Welcome to the
1999 Stratus
(RHD and LHD)
Electronic Service Manual

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CHRYSLER

GROUP TAB LOCATOR

INTRODUCTION

CONTENTS

GENERAL INFORMATION

VEHICLE SAFETY CERTIFICATION LABEL

A vehicle safety certification label is attached to the left side B-pillar (Fig. 1). This label indicates date of manufacture (month and year), Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating (GAWR) front, Gross Axle Weight Rating (GAWR) rear and the Vehicle Identification Number (VIN). The Month, Day and Hour of manufacture is also included.

All communications or inquiries regarding the vehicle should include the Month-Day-Hour and Vehicle Identification Number.

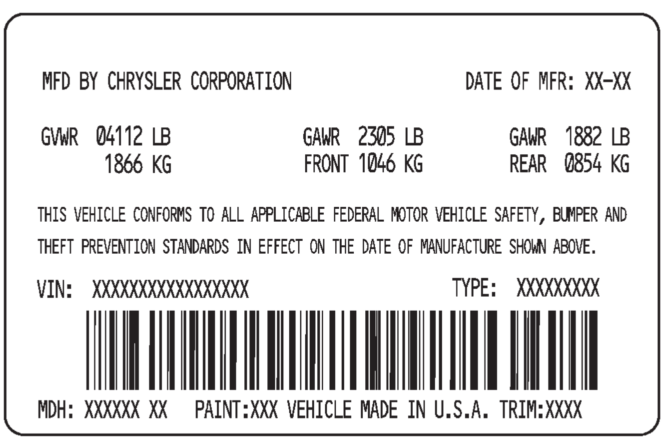

Fig. 1 Vehicle Safety Certification Label

VEHICLE IDENTIFICATION NUMBER

The Vehicle Identification Number (VIN) is located on the upper left corner of the instrument panel, near the left windshield pillar (Fig. 2). The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle. Refer to VIN Code Breakdown table for decoding information.

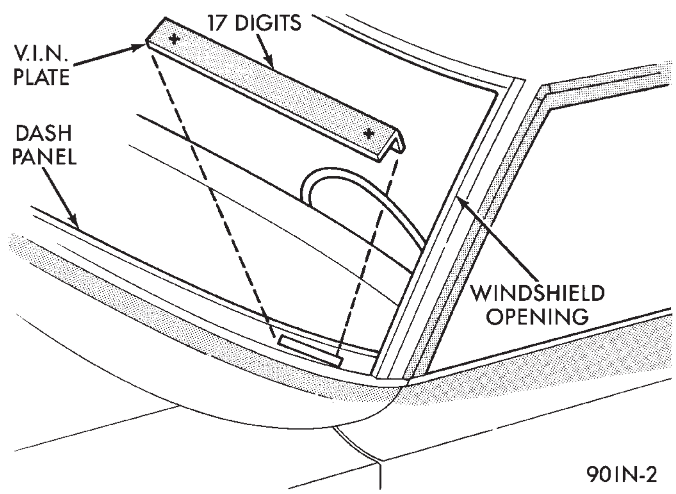

Fig. 2 Vehicle Identification Number (VIN Plate)

GENERAL INFORMATION (Continued)

VIN CODE BREAKDOWN

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = United States
2	Make	B = Dodge C = Chrysler P = Plymouth
3	Vehicle Type	3 = Passenger Car
4	Passenger Safety	E = Active Driver and Passenger Air Bags
5	Car Line	J = Chrysler, Cirrus J = Dodge, Stratus J = Plymouth, Breeze 2 = Chrysler, Breeze (sold in Mexico) 2 = Chrysler, Cirrus (sold in Mexico) 2 = Chrysler, Stratus (sold in Mexico)
6	Series	4 = High Line 5 = Premium 6 = Sport
7	Body Style	6 = 4 Door Sedan
8	Engine	C = 2.0L 4 Cyl 16V Gasoline SOHC H =2 .5L 6 Cyl Gasoline SOHC S =2.4L 4 Cyl 16 V DOHC Turbo (sold in Mexico) X = 2.4L 4 Cyl 16V Gasoline DOHC
9	Check Digit	0 through 9 or X
10	Model Year	X = 1999
11	Assembly Plant	N = Sterling Heights Assembly
12 through 17	Sequence Number	6 digit number assigned by assembly plant.

VIN CHECK DIGIT

To protect the consumer from theft and possible fraud the manufacturer is required to include a Check Digit at the ninth position of the Vehicle Identification Number. The check digit is used by the manufacturer and government agencies to verify the authenticity of the vehicle and official documentation. The formula to use the check digit is not released to the general public.

BODY CODE PLATE

LOCATION AND DECODING

The Body Code Plate (Fig. 3) is located in the engine compartment on the driver side strut tower. There are seven lines of information on the body code plate. Lines 4, 5, 6, and 7 are not used to define service information. Information reads from left to right, starting with line 3 in the center of the plate to line 1 at the bottom of the plate.

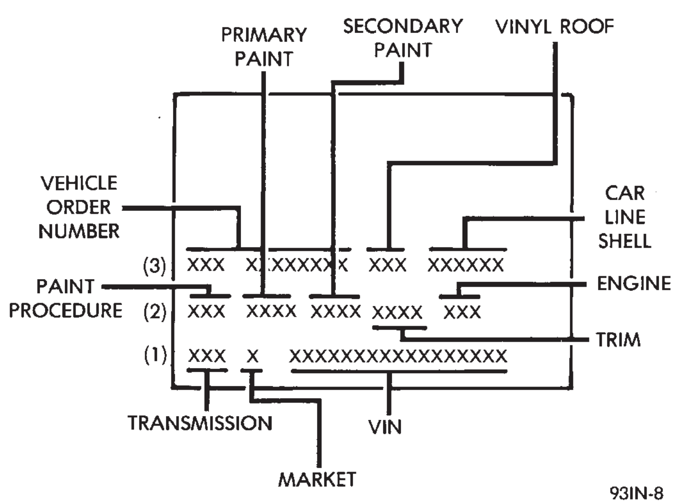

Fig. 3 Body Code Plate

GENERAL INFORMATION (Continued)

BODY CODE PLATE – LINE 3

DIGITS 1 THROUGH 12

Vehicle Order Number

DIGITS 13, THROUGH 15

Vinyl Roof Code

DIGITS 16 AND 17

Open space

DIGITS 18 AND 19

Vehicle Shell Line
- JA

DIGITS 20

Carline
- C = Chrysler
- D = Dodge
- H = Plymouth

DIGIT 21

Price Class
- E = Economy
- H = High Line
- L = Low Line
- M = Mid Line
- P = Premium
- S = Special/Sport
- X = Performance Image

DIGITS 22 AND 23

Body Type
- 41 = Four Door Sedan

BODY CODE PLATE LINE 2

DIGITS 1, 2, AND 3

Paint procedure

DIGIT 4

Open Space

DIGITS 5 THROUGH 7

Primary paint
See Group 23, Body for color codes.

DIGIT 8 AND 9

Open Space

DIGITS 10 THROUGH 12

Secondary Paint

DIGIT 13 AND 14

Open Space

DIGITS 15 THROUGH 18

Interior Trim Code

DIGIT 19

Open Space

DIGITS 20, 21, AND 22

Engine Code
- ECB = 2.0L Four Cylinder SOHC Gasoline
- EEB = 2.5L Six Cylinder SOHC Gasoline
- EDZ = 2.4L Four Cylinder DOHC Gasoline

DIGIT 23

Open Space

BODY CODE PLATE LINE 1

DIGITS 1, 2, AND 3

Transaxle Codes
- DGL = 41TE 4-speed Electronic Automatic Transaxle
- DD5 = NV T350 5-Speed Manual Transaxle

DIGIT 4

Open Space

DIGIT 5

Market Code
- C = Canada
- B = International
- M = Mexico
- U = United States

DIGIT 6

Open Space

DIGITS 7 THROUGH 23

Vehicle Identification Number
- Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

IF TWO BODY CODE PLATES ARE REQUIRED

The last code shown on either plate will be followed by END. When two plates are required, the last code space on the first plate will indicate (CTD)

When a second plate is required, the first four spaces of each line will not be used due to overlap of the plates.

GENERAL INFORMATION (Continued)

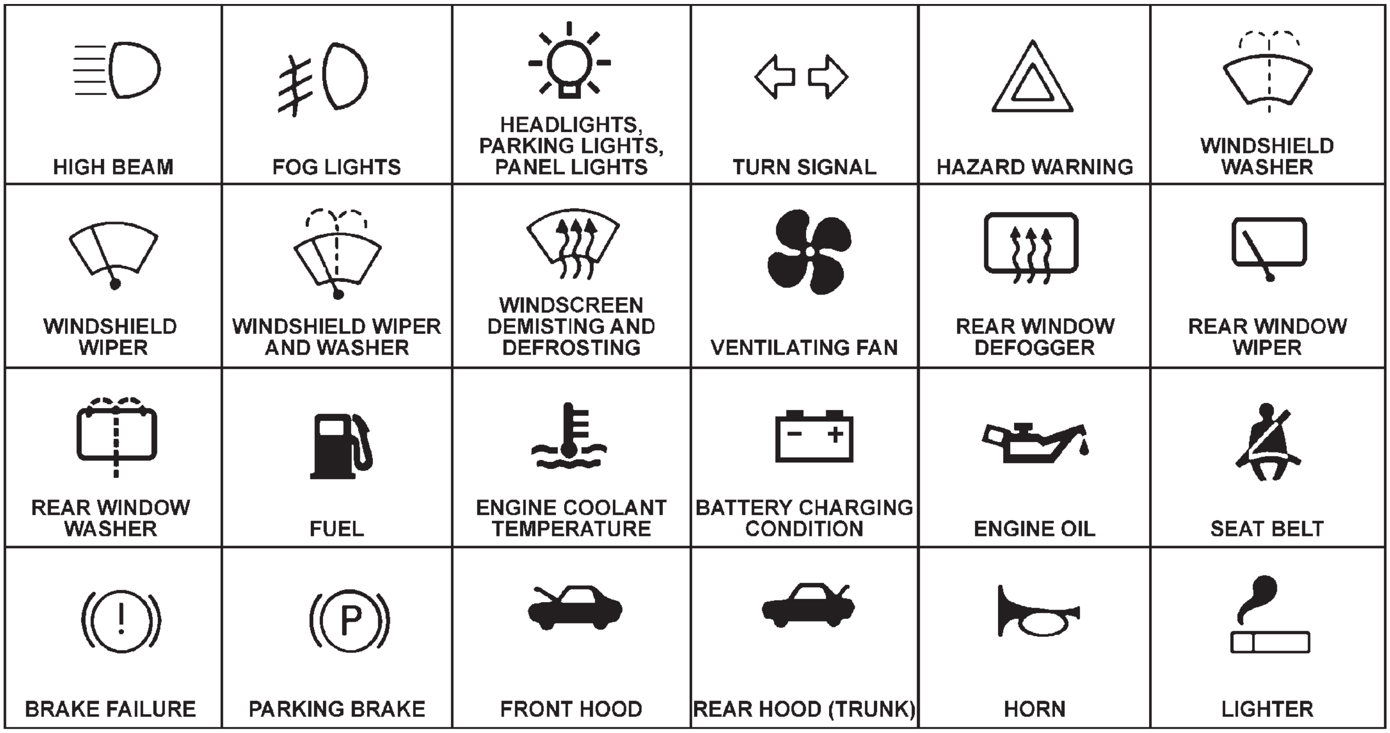

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Fig. 4 International Control and Display Symbols

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

The graphic symbols illustrated in the following International Control and Display Symbols chart (Fig. 4) are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

FASTENER IDENTIFICATION

THREAD IDENTIFICATION

SAE and metric bolt/nut threads are not the same. The difference is described in the Thread Notation chart (Fig. 5).

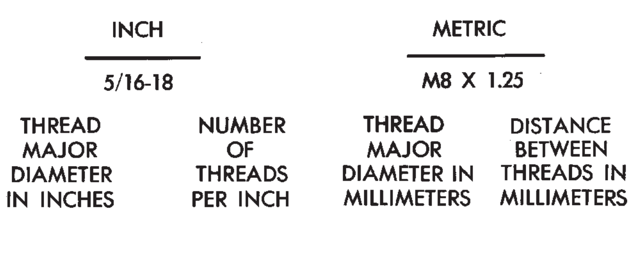

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Fig. 5 Thread Notation Chart – SAE and Metric

GRADE/CLASS IDENTIFICATION

The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 12.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

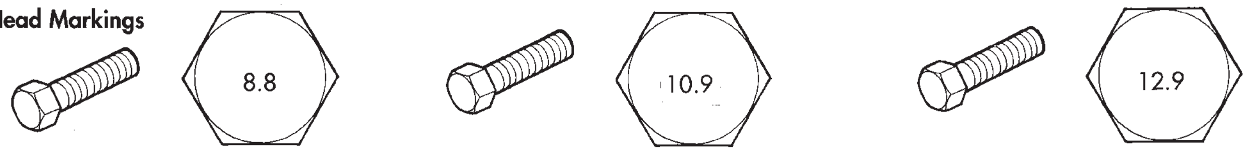
GENERAL INFORMATION (Continued)

FASTENER IDENTIFICATION

Bolt Markings and Torque - Metric

Commercial Steel Class — 8.8, 10.9, 12.9

Bolt Head Markings

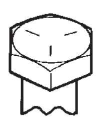


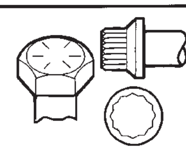
Body Size Diam. mm	8.8 Torque Cast Iron N•m	8.8 Cast Iron ft-lb	8.8 Aluminum N•m	8.8 Aluminum ft-lb	10.9 Torque Cast Iron N•m	10.9 Cast Iron ft-lb	10.9 Aluminum N•m	10.9 Aluminum ft-lb	12.9 Torque Cast Iron N•m	12.9 Cast Iron ft-lb	12.9 Aluminum N•m	12.9 Aluminum ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35	70	50	55	40
12	70	55	55	40	105	75	80	60	125	95	100	75
14	115	85	90	65	160	120	125	95	195	145	150	110
16	180	130	140	100	240	175	190	135	290	210	220	165
18	230	170	180	135	320	240	250	185	400	290	310	230

Bolt Markings and Torque Values - U.S. Customary

SAE Grade Number — 5, 8

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





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

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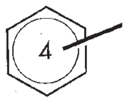
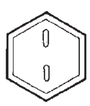
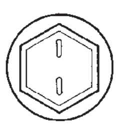
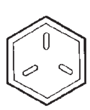
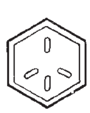
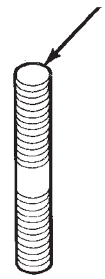
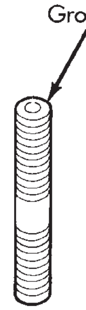
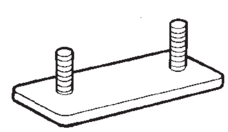
GENERAL INFORMATION (Continued)

FASTENER STRENGTH

HOW TO DETERMINE BOLT STRENGTH

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

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

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GENERAL INFORMATION (Continued)

FASTENER USAGE

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

Figure art, specifications and tightening torque references in this manual are identified in metric and SAE format.

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

THREADED HOLE REPAIR

Most stripped threaded holes can be repaired using a Helicoil®. Follow the manufacture recommendation for application and repair procedures.

METRIC SYSTEM

The metric system is based on quantities of one, ten, one hundred, one thousand and one million (Fig. 6).

Mega	-	(M) Million	Deci	-	(D) Tenth
Kilo	-	(K) Thousand	Centi	-	(C) Hundreth
Milli	-	(m) Thousandth			

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Fig. 6 Metric Prefixes

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

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

TORQUE REFERENCES

Individual Torque Charts appear at the end of many Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts.

CONVERSION FORMULAS AND EQUIVALENT VALUES

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

COMMON METRIC EQUIVALENTS

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

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GENERAL INFORMATION (Continued)

METRIC CONVERSION

in-lbs to N•m

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

N•m to in-lbs

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

ft-lbs to N•m

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

N•m to ft-lbs

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

in. to mm

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

mm to in.

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

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GENERAL INFORMATION (Continued)

TORQUE SPECIFICATIONS

SPECIFIED TORQUE FOR STANDARD BOLTS

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

INTRODUCTION

CONTENTS

GENERAL INFORMATION

E-MARK LABEL

An E-mark Label (Fig. 1) is located on the rear shut face of the driver's door. The label contains the following information:

- Date of Manufacture
- Month-Day-Hour (MDH)
- Vehicle Identification Number (VIN)
- Country Codes
- Regulation Number
- Regulation Amendment Number
- Approval Number

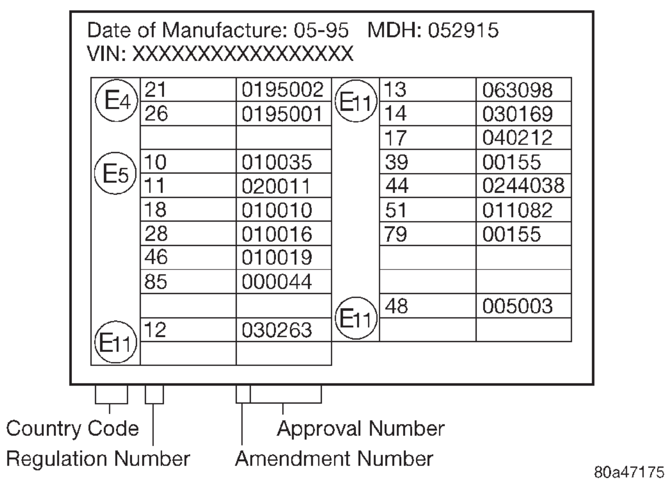


Fig. 1 E-Mark Label

VEHICLE IDENTIFICATION NUMBER

The Vehicle Identification Number (VIN) is located on the upper left corner of the instrument panel, near the left windshield pillar (Fig. 2). The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle. Refer to VIN Code Breakdown table for decoding information.

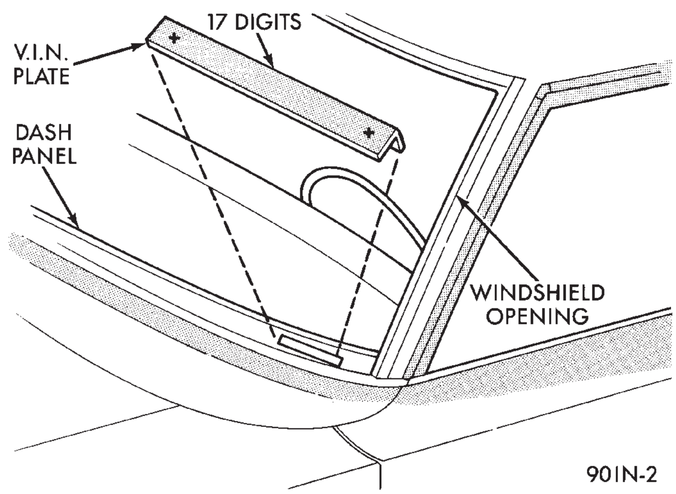


Fig. 2 Vehicle Identification Number (VIN Plate)

VIN CODE BREAKDOWN

GENERAL INFORMATION (Continued)

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = United States
2	Make	B = Dodge C = Chrysler P = Plymouth
3	Vehicle Type	3 = Passenger Car
4	Passenger Safety	E = Active Driver and Passenger Air Bags
5		J = Chrysler, Cirrus J = Dodge, Stratus J = Plymouth, Breeze
6	Series	4 = High Line 5 = Premium 6 = Sport
7	Body Style	6 = 4 Door Sedan
8	Engine	C = 2.0L 4 Cyl 16V Gasoline SOHC H = 2 .5L 6 Cyl Gasoline SOHC X = 2.4L 4 Cyl 16V Gasoline DOHC
9	Check Digit	See explanation in this section.
10	Model Year	X = 1999
11	Assembly Plant	N = Sterling Heights Assembly
12 through 17	Sequence Number	6 digit number assigned by assembly plant.

BODY CODE PLATE

LOCATION AND DECODING

The Body Code Plate (Fig. 3) is located in the engine compartment on the driver side strut tower. There are seven lines of information on the body code plate. Lines 4, 5, 6, and 7 are not used to define service information. Information reads from left to right, starting with line 3 in the center of the plate to line 1 at the bottom of the plate.

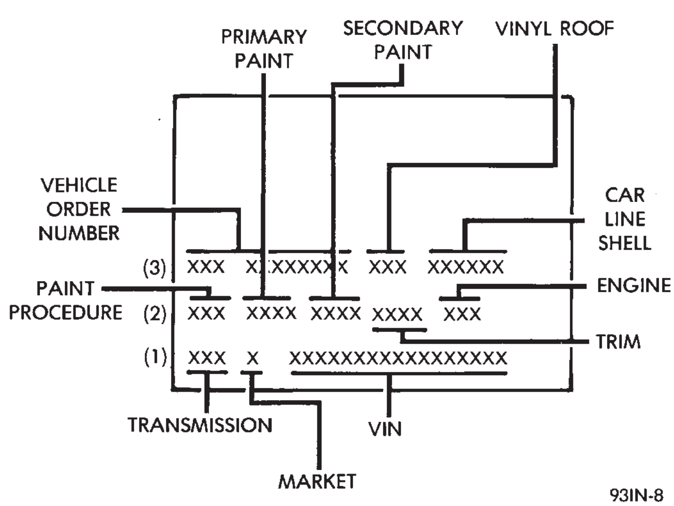


Fig. 3 Body Code Plate

GENERAL INFORMATION (Continued)

BODY CODE PLATE – LINE 3

DIGITS 1 THROUGH 12

Vehicle Order Number

DIGITS 13, THROUGH 15

Vinyl Roof Code

DIGITS 16 AND 17

Open space

DIGITS 18 AND 19

Vehicle Shell Line
- JA

DIGITS 20

Carline
- C = Chrysler
- D = Dodge
- H = Plymouth

DIGIT 21

Price Class
- E = Economy
- H = High Line
- L = Low Line
- M = Mid Line
- P = Premium
- S = Special/Sport
- X = Performance Image

DIGITS 22 AND 23

Body Type
- 41 = Four Door Sedan

BODY CODE PLATE LINE 2

DIGITS 1, 2, AND 3

Paint procedure

DIGIT 4

Open Space

DIGITS 5 THROUGH 7

Primary paint

See Group 23, Body for color codes.

DIGIT 8 AND 9

Open Space

DIGITS 10 THROUGH 12

Secondary Paint

DIGIT 13 AND 14

Open Space

DIGITS 15 THROUGH 18

Interior Trim Code

DIGIT 19

Open Space

DIGITS 20, 21, AND 22

Engine Code
- ECB = 2.0L Four Cylinder SOHC Gasoline
- EEB = 2.5L Six Cylinder SOHC Gasoline
- EDZ = 2.4L Four Cylinder DOHC Gasoline

DIGIT 23

Open Space

BODY CODE PLATE LINE 1

DIGITS 1, 2, AND 3

Transaxle Codes
- DGL = 41TE 4-speed Electronic Automatic Transaxle
- DD5 = NV T350 5-Speed Manual Transaxle

DIGIT 4

Open Space

DIGIT 5

Market Code
- B = International

DIGIT 6

Open Space

DIGITS 7 THROUGH 23

Vehicle Identification Number
- Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

IF TWO BODY CODE PLATES ARE REQUIRED

The last code shown on either plate will be followed by END. When two plates are required, the last code space on the first plate will indicate (CTD)

When a second plate is required, the first four spaces of each line will not be used due to overlap of the plates.

GENERAL INFORMATION (Continued)

MANUFACTURER PLATE

The Manufacturer Plate (Fig. 4) is located in the engine compartment on the passenger side strut tower. The plate contains five lines of information:

1. Vehicle Identification Number (VIN)
2. Gross Vehicle Mass (GVM)
3. Gross Train Mass (GTM)
4. Gross Front Axle Rating (GFAR)
5. Gross Rear Axle Rating (GRAR)

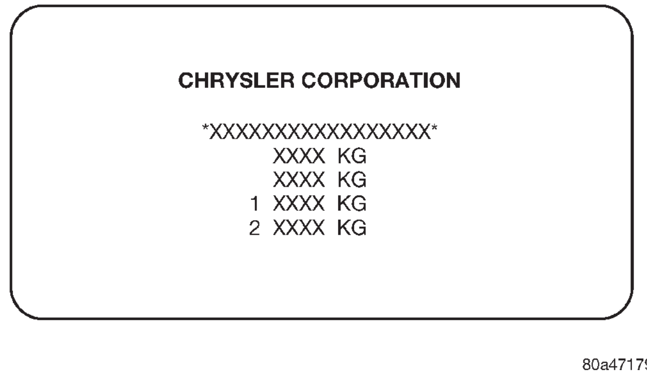


Fig. 4 Manufacturer Plate

LUBRICATION AND MAINTENANCE

CONTENTS

LUBRICANTS

INDEX

DESCRIPTION AND OPERATION

PARTS AND LUBRICANT RECOMMENDATIONS

DESCRIPTION

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

CLASSIFICATION OF LUBRICANTS

DESCRIPTION

Only lubricants bearing designations defined by the following organization should be used to service a Chrysler Corporation vehicle.

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API) (Fig. 1)
- National Lubricating Grease Institute (NLGI) (Fig. 2)

SAE VISCOSITY RATING

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 30 specifies a single viscosity engine oil. Engine oils also have multiple viscosities. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range.

- SAE 30 = single grade engine oil.
- SAE 10W-30 = multiple grade engine oil.

Chrysler Corporation only recommends multiple grade engine oils.

API QUALITY CLASSIFICATION

This symbol (Fig. 1) on the front of an oil container means that the oil has been certified by the American Petroleum Institute (API) to meet all the lubrication requirements specified by Chrysler Corporation.

Refer to Group 9, Engine for gasoline engine oil specification.

9400-9

Fig. 1 API Symbol

DESCRIPTION AND OPERATION (Continued)

GEAR LUBRICANTS

SAE ratings also apply to multiple grade gear lubricants. In addition, API classification defines the lubricants usage.

LUBRICANTS AND GREASES

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

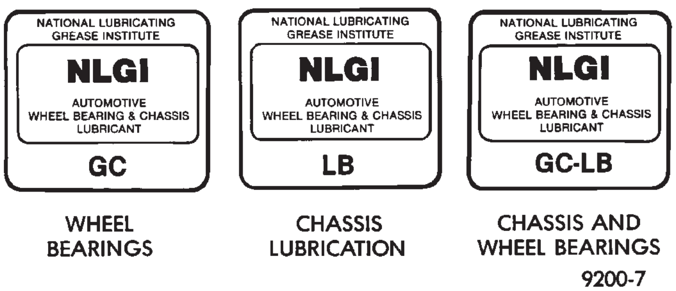


Fig. 2 NLGI Symbol

INTERNATIONAL SYMBOLS

DESCRIPTION

Chrysler Corporation uses international symbols to identify engine compartment lubricant and fluid check and fill locations (Fig. 3).

FLUID FILL/CHECK LOCATIONS

DESCRIPTION

Fluid fill/check locations are located in each applicable group.

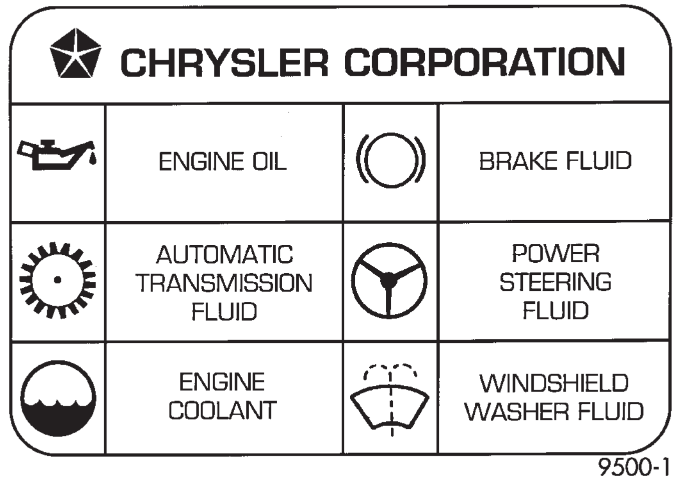


Fig. 3 International Symbols

LUBRICATION POINT LOCATIONS

DESCRIPTION

Lubrication point locations are located in each applicable group.

SPECIFICATIONS

FLUID CAPACITIES

Fuel Tank . . . . 60.5 L (16.0 gal.)
Engine Oil With Filter – 2.0 L, 2.5 L V6 . . . . 4.25 L (4.5 qts.)
Engine Oil With Filter – 2.4 L . . . . . 4.7 L (5.0 qts.)
Engine Oil Without Filter – 2.0 L, 2.5 L V6 . . . 3.8 L (4.0 qts.)
Engine Oil Without Filter – 2.4 L . . . 4.3 L (4.5 qts.)
Cooling System – 2.0 L . . . . 8.1 L (8.5 qts.)
Cooling System – 2.4 L . . . . 8.5 L (9.0 qts.)
Cooling System – 2.5 L . . . . 9.9 L (10.5 qts.)
Automatic Transaxle - Estimated Service Fill . . . . 3.8 L (4.0 qts.)
Automatic Transaxle - Overhaul Fill Capacity with Torque Converter Empty . . . . 8.6 L (9.1 qts.)
Manual transaxle . . . . 2.1 L (2.2 qt.)
Differential . . . . 0.95 L (1 qt.)

MAINTENANCE SCHEDULES

INDEX

DESCRIPTION AND OPERATION

MAINTENANCE SCHEDULES

There are two maintenance schedules that show proper service for the vehicle.

Schedule **"A"**. It lists all the scheduled maintenance to be performed under "normal" operating conditions.

Schedule**"B"**. It is a schedule for vehicles that are operated under the conditions listed at the beginning of the chart labeled Schedule "B".

SPECIFICATIONS

UNSCHEDULE INSPECTION

At Each Stop For Fuel

- Check engine oil level and add as required.
- Check windshield washer solvent and add as required.

Once A Month

- Check tire pressure and look for unusual wear or damage.
- Check fluid levels of coolant reservoir, brake master cylinder, power steering and automatic transmission. Add fluid as required.
- Check all lights and all other electrical items for correct operation.

At Each Oil Change

- Inspect the exhaust system.
- Inspect brake hoses.
- Inspect the CV joints and front suspension component boots and seals.
- Rotate the tires.
- Check the engine coolant level, hoses, and clamps.

If vehicle mileage is less than 7,500 miles (12 000 km) yearly, replace the engine oil filter at each oil change.

EMISSION CONTROL SYSTEM MAINTENANCE

The scheduled emission maintenance listed in **bold type** on the Maintenance Schedules, must be done at the mileage specified to assure the continued proper functioning of the emission control system. These, and all other maintenance services included in this manual, should be done to provide the best vehicle performance and reliability. More frequent maintenance may be needed for vehicles in severe operating conditions such as dusty areas and very short trip driving.

FLUID FILL POINTS AND LUBRICATION LOCATIONS

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

SCHEDULE – A

7,500 miles (12 000 km) or at 6 months

- Change engine oil.
- Change engine oil filter on 2.0 liter and 2.4 liter engines.

15,000 miles (24 000 km) or at 12 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Adjust drive belt tension.

22,500 Miles (36 000 km) or at 18 months

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Inspect the front brake pads and rear brake linings.

30,000 Miles (48 000 km) or at 24 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Lubricate front and rear suspension upper ball joints.
- Adjust drive belt tension.

SPECIFICATIONS (Continued)

- Replace the **engine air cleaner element (filter)**.
- Replace the **spark plugs** on 2.0 liter and 2.4 liter engines.
- Change the automatic transmission fluid.

37,500 Miles (60 000 km) or at 30 months

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

45,000 Miles (72 000 km) or at 36 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads and rear brake linings.
- Adjust drive belt tension.
- Flush and replace engine coolant at 36 months, regardless of mileage.

52,500 Miles (84 000 km) or at 42 months

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

60,000 Miles (96 000 km) or at 48 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Check and replace, if necessary, the **PCV valve**. See note #1 after schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Replace drive belts.
- Replace **engine air cleaner element (filter)**.
- Replace **ignition cables** on 2.0 liter and 2.4 liter engines.
- Replace **spark plugs** on 2.0 liter and 2.4 liter engines.
- Check and adjust if necessary the **ignition timing** on 2.5 liter engines.
- Change the automatic transmission fluid.

67,500 Miles (108 000 km) or at 54 months

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Inspect front brake pads, rear brake linings and rotors.

75,000 Miles (120 000 km) or at 60 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Flush and replace engine coolant.
- Adjust drive belt tension.

82,500 Miles (132 000 km) or at 66 months

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

90,000 Miles (144 000 km) or at 72 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Check and replace, if necessary, the **PCV valve**. See notes #1 and #2 after Schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Inspect front brake pads, rear brake linings and rotors.
- Adjust drive belt tension.
- Replace **engine air cleaner element (filter).**
- Replace **spark plugs** on 2.0 liter and 2.4 liter engines.
- Change the automatic transmission fluid.

97,500 Miles (156 000 km) or at 78 months

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

100,000 Miles (160 000 km) or at 80 months

- Replace **spark plugs and ignition cables** on 2.5 liter engines.
- Replace the engine timing belt on vehicles with 2.0 liter and 2.4 liter engines and Federal emissions package

105,000 Miles (168 000 km) or at 84 months

- Change engine oil.
- Replace engine oil filter on all engines.
- Flush and replace engine coolant.
- Replace **engine timing belt** on 2.0 liter and 2.4 liter engines and California emissions package.

SCHEDULE – B

Follow this schedule if the vehicle usually operates under one or more of the following conditions. Change the automatic transmission fluid and filter every 15,000 miles (24 000 km) if vehicle usually operates under one of the conditions marked with an *.

- Day and night temperatures are below freezing.
- Frequent stop and go driving.*
- Frequent long periods of engine idling.*
- Frequent driving in dusty conditions.
- Frequent short trips of less than 5 miles.
- Frequent operation at sustained high speeds during hot weather, above 90°F (32°C).*
- Frequent trailer towing.*
- Taxi, police or delivery service.*

If vehicle mileage is less than 7,500 miles (12 000 km) yearly, replace the engine oil filter at each oil change.

SPECIFICATIONS (Continued)

3,000 Miles (5 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

6,000 Miles (10 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

9,000 Miles (14 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

12,000 Miles (19 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads, rear brake linings and rotors.

15,000 Miles (24 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Adjust drive belt tension.
- Replace **engine air cleaner element (filter).** See note #1 after Schedule “B”.
- Change automatic transaxle fluid and filter.*

18,000 Miles (29 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

21,000 Miles (34 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

24,000 Miles (38 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads, rear brake linings and rotors.

27,000 Miles (43 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

30,000 Miles (48 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Check and replace, if necessary, the **PCV valve.** See note #1 after Schedule “B”.
- Lubricate front and rear suspension upper ball joints.
- Adjust drive belt tension.
- Replace **engine air cleaner element (filter)** .
- Replace **spark plugs** on 2.0 liter and 2.4 liter engines.
- Change automatic transmission fluid and filter.

33,000 Miles (53 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

36,000 Miles (58 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Flush and replace engine coolant.
- Inspect front brake pads, rear brake linings and rotors.

39,000 Miles (62 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

42,000 Miles (67 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

45,000 Miles (72 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Adjust drive belt tension.
- Inspect and replace, if required **engine air cleaner element (filter)** See note #1 after Schedule “B”.
- Change automatic transaxle fluid and filter.*

48,000 Miles (77 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads, rear brake linings and rotors.

51,000 Miles (82 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

54,000 Miles (86 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

57,000 Miles (91 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

SPECIFICATIONS (Continued)

60,000 Miles (96 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Check and replace, if necessary, the **PCV valve.** See notes #1 and #2 after Schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Replace drive belts.
- Replace the **engine air cleaner element (filter)**.
- Replace the **ignition cables** on 2.0 liter and 2.4 liter engines.
- Replace the **spark plugs** on 2.0 liter and 2.4 liter engines.
- Check and adjust if necessary the **ignition timing** on 2.5 liter engines.
- Change automatic transaxle fluid and filter.
- Inspect front brake pads, rear brake linings and rotors.

63,000 Miles (101 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

66,000 Miles (106 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

69,000 Miles (110 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

72,000 Miles (115 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads, rear brake linings and rotors.

75,000 Miles (120 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Adjust drive belt tension.
- Inspect and replace if required the **engine air cleaner element (filter).** See note #1 after Schedule "B".
- Replace the **spark plugs and ignition cables** on 2.5 liter engines.
- Change automatic transaxle fluid and filter.*

78,000 Miles (125 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

81,000 Miles (130 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Flush and replace the engine coolant.

84,000 Miles (134 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads, rear brake linings and rotors.

87,000 Miles (139 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

90,000 Miles (144 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Check and replace, if necessary, the **PCV valve.** See notes #1 and #2 after Schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Adjust drive belt tension.
- Replace the **engine air cleaner element (filter)**.
- Change automatic transaxle fluid and filter.
- Replace the **spark plugs** on 2.0 liter and 2.4 liter engines.

93,000 Miles (149 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

96,000 Miles (154 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.
- Inspect front brake pads, rear brake linings and rotors.

99,000 Miles (158 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.
- Replace the engine timing belt on 2.0 liter and 2.4 liter engines (Federal emissions package.)

102,000 Miles (163 000 km)

- Change engine oil.
- Replace engine oil filter on all engines.

105,000 Miles (168 000 km)

- Change engine oil.
- Replace engine oil filter on 2.0 liter and 2.4 liter engines.

SPECIFICATIONS (Continued)

- Adjust drive belt tension.
- Inspect and replace, if required, the **engine air cleaner element (filter)**.
- Replace the **engine timing belt** on 2.0 liter 2.4 liter engines (California emissions package.)
- Change automatic transaxle fluid and filter.*

NOTE: #1 This maintenance is recommended by Chrysler Corporation to the owner but is not required to maintain the emissions warranty.

NOTE: #2 This maintenance is not required if previously replaced.

JUMP STARTING, TOWING, AND HOISTING

INDEX

SERVICE PROCEDURES

JUMP STARTING PROCEDURE

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

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

TO JUMP START A DISABLED VEHICLE:

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

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

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

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

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

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

(5) On disabled vehicle, connect RED jumper cable clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground as close to the ground cable attaching point as possible (Fig. 1).

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

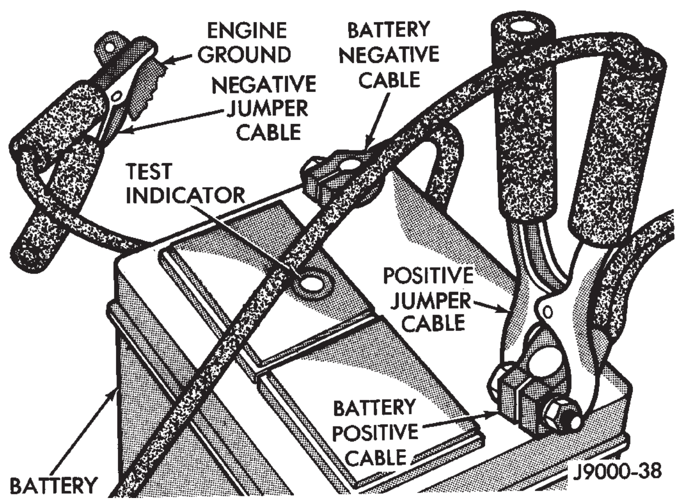


Fig. 1 Jumper Cable Clamp Connections

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

(7) Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 sec-

SERVICE PROCEDURES (Continued)

onds, stop cranking engine and allow starter to cool (15 minutes), before cranking again.

DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp from engine ground on disabled vehicle.
- When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal. Disconnect RED cable clamp from battery positive terminal.
- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

TOWING RECOMMENDATIONS

RECOMMENDED TOWING EQUIPMENT

To avoid damage to bumper fascia and air dams use of a flat bed towing device or wheel lift (Fig. 2) is recommended. When using a wheel lift towing device, be sure the unlifted end of disabled vehicle has at least 100 mm (4 in.) ground clearance. If minimum ground clearance cannot be reached, use a towing dolly. If a flat bed device is used, the approach angle should not exceed 15 degrees.

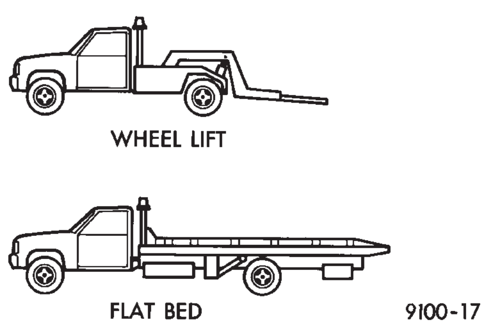


Fig. 2 Recommended Towing Equipment

GROUND CLEARANCE

CAUTION: If vehicle is towed with wheels removed, install lug nuts to retain brake drums or rotors.

A towed vehicle should be raised until the lifted wheels are a minimum 100 mm (4 in.) from the ground. Be sure there is at least 100 mm (4 in.) clearance between the tail pipe and the ground. If necessary, remove the wheels from the lifted end of the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the rear of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums or rotors.

LOCKED VEHICLE TOWING

When a locked vehicle must be towed with the front wheels on the ground, use a towing dolly or flat bed hauler.

FLAT TOWING WITH TOW BAR

- 3-speed automatic transaxle vehicles can be flat towed at speeds not to exceed 40 km/h (25 mph) for not more than 25 km (15 miles). The steering column must be unlocked and gear selector in neutral.
- 5-speed manual transaxle vehicles can be flat towed at any legal highway speed for extended distances. The gear selector must be in the neutral position.

WARNINGS AND PRECAUTIONS

WARNING: DO NOT ALLOW TOWING ATTACHMENT DEVICES TO CONTACT THE FUEL TANK OR LINES, FUEL LEAK CAN RESULT. DO NOT LIFT OR TOW VEHICLE BY FRONT OR REAR BUMPER, OR BUMPER ENERGY ABSORBER UNITS. DO NOT VENTURE UNDER A LIFTED VEHICLE IF NOT SUPPORTED PROPERLY ON SAFETY STANDS. DO NOT ALLOW PASSENGERS TO RIDE IN A TOWED VEHICLE. USE A SAFETY CHAIN THAT IS INDEPENDENT FROM THE TOWING ATTACHMENT DEVICE.

CAUTION: Do not damage brake lines, exhaust system, shock absorbers, sway bars, or any other under vehicle components when attaching towing device to vehicle. Do not attach towing device to front or rear suspension components. Do not secure vehicle to towing device by the use of front or rear suspension or steering components. Remove or secure loose or protruding objects from a damaged vehicle before towing. Refer to state and local rules and regulations before towing a vehicle. Do not allow weight of towed vehicle to bear on lower fascia, air dams, or spoilers.

FLAT BED TOWING TIE DOWNS

CAUTION: Do not tie vehicle down by attaching chains or cables to suspension components or engine mounts, damage to vehicle can result.

JA vehicles can be tied to a flat bed device using the reinforced loops located under the front and rear bumpers on the drivers side of the vehicle. There are also four reinforced elongated holes for T or R-hooks located on the bottom of the front frame rail torque boxes behind the front wheels and forward of the rear wheels inboard of the rocker panel weld seam.

TOWING—FRONT WHEEL LIFT

Chrysler Corporation recommends that a vehicle be towed with the front end lifted, whenever possible. A 90 cm (36 in.) length of 4x4 wood beam can be placed between the wheel lift device and the bottom of the

SERVICE PROCEDURES (Continued)

fascia to prevent damage to vehicle during the lifting operation. The beam can removed after lifting the front of the vehicle.

TOWING—REAR WHEEL LIFT

If a vehicle cannot be towed with the front wheels lifted, the rear wheels can be lifted provided the following guide lines are observed.

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

- Unlock steering column and secure steering wheel in straight ahead position with a clamp device designed for towing.
- Place front wheels on a towing dolly.

HOISTING RECOMMENDATIONS

Refer to Owner's Manual provided with vehicle for proper emergency jacking procedures.

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

CAUTION: Do not position hoisting device on suspension components, damage to vehicle can result.

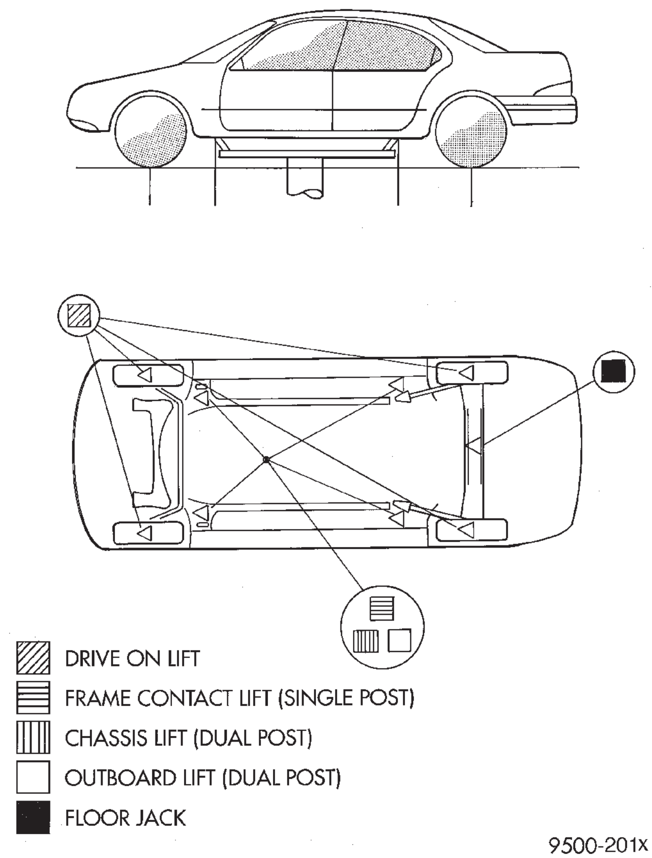


Fig. 3 Hoisting And Jacking Points

SUSPENSION

CONTENTS

WHEEL ALIGNMENT

INDEX

DESCRIPTION AND OPERATION

WHEEL ALIGNMENT

Vehicle wheel alignment is the proper adjustment of all interrelated front and rear suspension angles. These angles are what affects the handling and steering of the vehicle when it is in motion.

The method of checking a vehicle's front and rear wheel alignment will vary depending on the type and manufacturer of the equipment being used. Instructions furnished by the manufacturer of the equipment being used should always be followed to ensure accuracy of the alignment, except when alignment specifications recommended by Chrysler Corporation differ.

Typical wheel alignment angles and measurements are camber, caster, toe, and thrust angle.

- Camber is the number of degrees the top of the tire and wheel are tilted either inward or outward (Fig. 1). Camber is a tire wearing angle. Excessive negative camber will cause tread wear at the inside of the tire, while excessive positive camber will cause outside tire wear.
- Caster is the number of degrees of forward or rearward tilt of the steering knuckle. Forward tilt provides a negative caster angle, while rearward tilt provides a positive caster angle. Caster is not adjustable on this vehicle.
- Cross Camber is the difference between left and right camber. The right side camber is to be subtracted from the left, resulting in the cross camber reading. For example, if the left camber is +0.3° and the right camber is 0.0°, the cross camber would be +0.3°.
- Toe is measured in degrees or inches and is the difference in width between the centered leading and trailing edges of the tires on the same axle (Fig. 1). Toe-in means that the front width is more narrow than the rear. Toe-out means that the front width is wider than the rear.
- Thrust Angle is defined as the average of the toe settings on each rear wheel. If this measurement is out of specification, readjust the rear wheel toe so that each wheel has 1/2 of the total toe measurement. When readjusting, do not exceed the total toe specification.

Wheel alignment on this vehicle is to be checked and all alignment adjustments made with the vehicle at its curb height specification. Curb height is the riding height of the vehicle measured from a certain point on the vehicle to the ground while the vehicle is setting on a flat, level surface.

DESCRIPTION AND OPERATION (Continued)

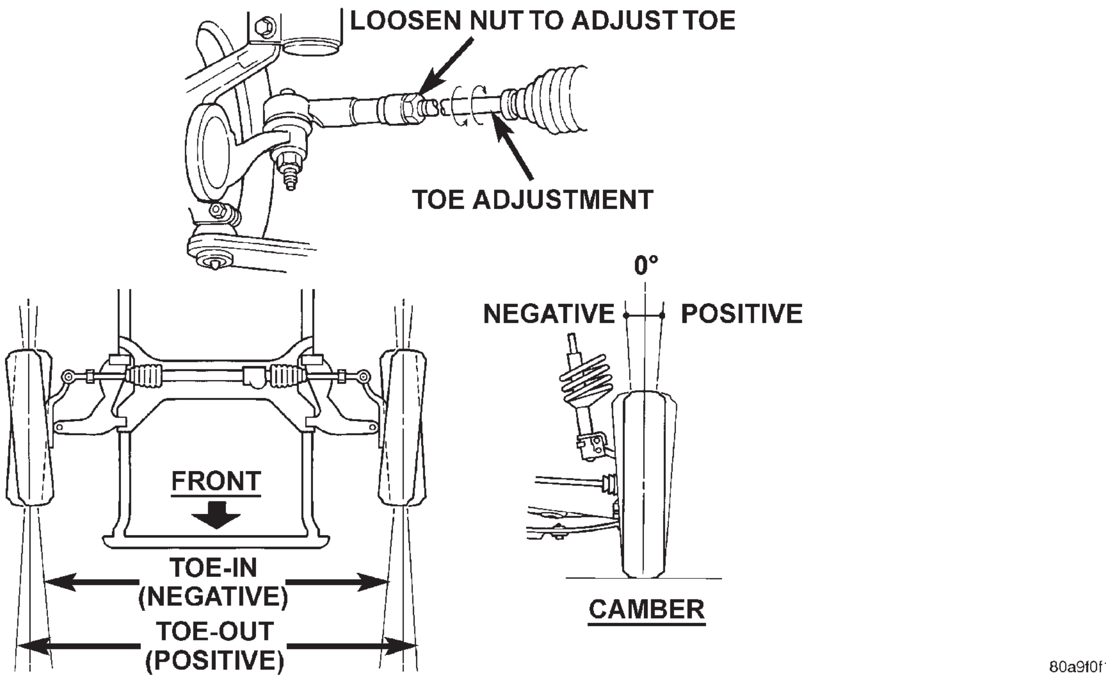


Fig. 1 Alignment Camber And Toe

DIAGNOSIS AND TESTING

SUSPENSION AND STEERING DIAGNOSIS

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
Front End Whine On Turns	1. Defective Wheel Bearing	1. Replace Wheel Bearing
	2. Incorrect Wheel Alignment	2. Check And Reset Wheel Alignment
	3. Worn Tires	3. Replace Tires
Front End Growl Or Grinding On Turns	1. Defective Wheel Bearing	1. Replace Wheel Bearing
	2. Engine Mount Grounding Against Frame Or Body Of Vehicle.	2. Check For Motor Mount Hitting Frame Rail And Reposition Engine As Required
	3. Worn Or Broken C/V Joint	3. Replace C/V Joint
	4. Loose Wheel Lug Nuts	4. Verify Wheel Lug Nut Torque
	5. Incorrect Wheel Alignment	5. Check And Reset Wheel Alignment
	6. Worn Tires	6. Replace Tires
Front End Clunk Or Snap On Turns	1. Loose Wheel Lug Nuts	1. Verify Wheel Lug Nut Torque
	2. Worn Or Broken C/V Joint	2. Replace C/V Joint
	3. Worn Or Loose Tie Rod Or Ball Joint	3. Tighten Or Replace Tie Rod End Or Ball Joint
	4. Worn Control Arm Bushing	4. Replace Control Arm Bushing
	5. Loose Sway Bar Or Upper Strut Attachment	5. Tighten Sway Bar Or Upper Strut Attachment To Specified Torque

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
Front End Whine With Vehicle Going Straight At A Constant Speed	1. Defective Wheel Bearing	1. Replace Wheel Bearing
	2. Incorrect Wheel Alignment	2. Check And Reset Wheel Alignment
	3. Worn Tires	3. Replace Tires
Front End Growl Or Grinding With Vehicle Going Straight At A Constant Speed	1. Engine Mount Grounding	1. Reposition Engine As Required
	2. Worn Or Broken C/V Joint	2. Replace C/V Joint
Front End Whine When Accelerating Or Decelerating	1. Worn Or Defective Transaxle Gears Or Bearings	1. Replace Transaxle Gears Or Bearings
Front End Clunk When Accelerating Or Decelerating	1. Worn Or Broken Engine Mount	1. Replace Engine Mount
	2. Worn Or Defective Transaxle Gears Or Bearings	2. Replace Transaxle Gears Or Bearings
	3. Loose Wheel Lug Nuts	3. Verify Wheel Lug Nut Torque
	4. Worn Or Broken C/V Joint	4. Replace C/V Joint
	5. Worn Or Loose Ball Joint	5. Tighten Or Replace Ball Joint
	6. Worn Or Loose Control Arm Bushing	6. Tighten To Specified Torque Or Replace Control Arm Bushing
	7. Loose Crossmember Bolts	7. Tighten Crossmember Bolts To Specified Torque
Road Wander	1. Incorrect Tire Pressure	1. Inflate Tires To Rcommended Pressure
	2. Incorrect Front Or Rear Wheel Toe	2. Check And Reset Front Wheel Toe
	3. Worn Wheel Bearings	3. Replace Wheel Bearing
	4. Worn Control Arm Bushings	4. Replace Control Arm Bushing
	5. Excessive Friction In Steering Gear	5. Replace Steering Gear
	6. Excessive Friction In Steering Shaft Coupling	6. Replace Steering Coupler
	7. Excessive Friction In Strut Upper Bearing	7. Replace Strut Bearing
Lateral Pull	1. Unequal Tire Pressure	1. Inflate All Tires To Recommended Pressure
	2. Radial Tire Lead	2. Perform Lead Correction Procedure
	3. Incorrect Front Wheel Camber	3. Check And Reset Front Wheel Camber
	4. Power Steering Gear Imbalance	4. Replace Power Steering Gear
	5. Wheel Braking	5. Correct Braking Condition Causing Lateral Pull

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
Excessive Steering Free Play	1. Incorrect Steering Gear Adjustment	1. Adjust Or Replace Steering Gear
	2. Worn Or Loose Tie Rod Ends	2. Replace Or Tighten Tie Rod Ends
	3. Loose Steering Gear Mounting Bolts	3. Tighten Steering Gear Bolts To The Specified Torque
	4. Loose Or Worn Steering Shaft Coupler	4. Replace Steering Shaft Coupler
Excessive Steering Effort	1. Low Tire Pressure	1. Inflate All Tires To Recommended Pressure
	2. Lack Of Lubricant In Steering Gear	2. Replace Steering Gear
	3. Low Power Steering Fluid Level	3. Fill Power Steering Fluid Reservoir To Correct Level
	4. Loose Power Steering Pump Belt	4. Correctly Adjust Power Steering Pump Drive Belt
	5. Lack Of Lubricant In Steering Ball Joints	5. Lubricate Or Replace Steering Ball Joints
	6. Steering Gear Malfunction	6. Replace Steering Gear
	7. Lack Of Lubricant In Steering Coupler	7. Replace Steering Coupler

SERVICE PROCEDURES

PRE-WHEEL ALIGNMENT INSPECTION

Before any attempt is made to change or correct the wheel alignment, the following inspection and necessary corrections must be made to the vehicle to ensure proper alignment.

(1) Be sure the fuel tank is full of fuel. If the fuel tank is not full, the reduction in weight will affect the curb height of the vehicle and the alignment specifications.

(2) The passenger and luggage compartments of the vehicle should be free of any load that is not factory equipment.

(3) Check the tires on the vehicle. The tires are to be inflated to the recommended air pressure. All tires must be the same size and in good condition with approximately the same tread wear.

(4) Check the front tire and wheel assemblies for excessive radial runout.

(5) Inspect all suspension component fasteners for looseness and torque.

(6) Inspect the lower front ball joints and all steering linkage for looseness and any sign of wear or damage.

(7) Inspect the rubber bushings on all the suspension components for signs of wear or deterioration. If any bushings show signs of wear or deterioration, they should be replaced prior to aligning the vehicle.

(8) Check vehicle curb height to verify it is within specifications. Refer to CURB HEIGHT MEASUREMENT in this section. If curb height is out of specifications, check for broken or sagged springs.

CURB HEIGHT MEASUREMENT

The wheel alignment is to be checked and all alignment adjustments made with the vehicle at its required curb height specification.

Vehicle height is to be checked with the vehicle on a flat, level surface, preferably a vehicle alignment rack. The tires are to be inflated to the recommended pressure. All tires are to be the same size as standard equipment. Vehicle height is checked with the fuel tank full of fuel, and no passenger or luggage compartment load.

Vehicle height is not adjustable. If measurement is not within specifications, inspect vehicle for bent or weak suspension components. Compare parts tag on suspect coil spring(s) to parts book and vehicle sales code, checking for a match. Once removed from vehicle, compare coil spring height to a correct new or known good coil spring. The heights should vary if the suspect spring is weak.

(1) Measure from the inboard edge of the wheel opening fender lip directly above the wheel center (spindle), to the floor or alignment rack surface.

(2) When measuring, maximum left-to-right differential is not to exceed 20 mm (0.79 in.).

(3) Compare measurements to specifications listed in the following chart.

SERVICE PROCEDURES (Continued)

CURB HEIGHT SPECIFICATIONS

VEHICLE	FRONT	REAR
ALL	694 mm ± 20 mm 27.32 in. ± 0.79 in.	693 mm ± 20 mm 27.28 in. ± 0.79 in.

WHEEL ALIGNMENT

(1) Position the vehicle on an alignment rack.

(2) Perform the PRE-WHEEL ALIGNMENT INSPECTION. It can be found elsewhere in this section.

(3) Install all required alignment equipment on the vehicle per the alignment equipment manufacturer's instructions. On this vehicle, a four-wheel alignment is recommended.

NOTE: Prior to reading the vehicle's alignment readouts, the front and rear of vehicle should be jounced. Induce jounce (rear first, then front) by grasping the center of the bumper and jouncing each end of vehicle an equal number of times. The bumper should always be released when vehicle is at the bottom of the jounce cycle.

(4) Read the vehicle's current front and rear alignment settings. Compare the vehicle's current alignment settings to the vehicle specifications for camber, caster and toe-in. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this section of this service manual group.

NOTE: Set the rear wheel alignment first before proceeding to the front to set the front wheel alignment.

(5) If rear camber or toe is not within specifications, proceed to REAR CAMBER AND TOE below. If rear camber and toe are within specifications, but front camber and caster are not, proceed to FRONT CAMBER AND CASTER which can be found following REAR CAMBER AND TOE. If rear camber and toe, and front camber and caster are within specifications, proceed to FRONT TOE.

Rear Caster on this vehicle is not adjustable and is not shown as an alignment specification.

CAUTION: Do not attempt to adjust the vehicle's wheel alignment by heating, bending or modifying any component of the suspension.

REAR CAMBER AND TOE

Rear Camber on this vehicle is adjustable. The rear camber on this vehicle is adjusted using the adjusting screw located in the forward and rear lateral links of the vehicles rear suspension (Fig. 2).

CAUTION: When checking the rear alignment on this vehicle, the alignment rack must be equipped with rear skid plates.

(1) For either rear wheel needing alignment, loosen the adjusting screw jam nuts (Fig. 2) on both the front and the rear lateral links.

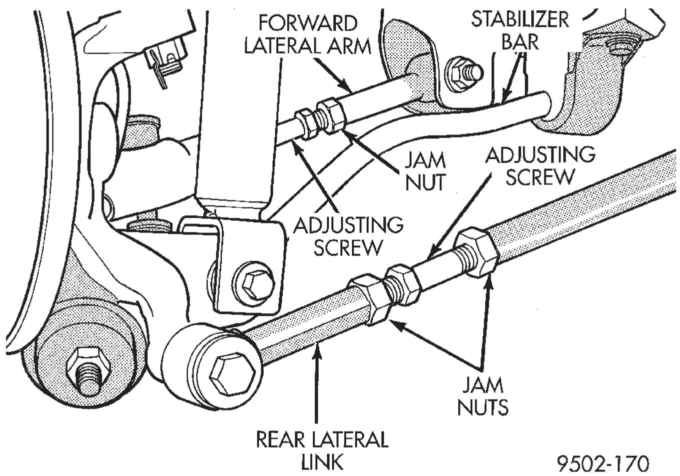


Fig. 2 Lateral Link Adjusting Screw Jam Nuts

CAUTION: Do not attempt to move the adjusting screws without properly loosening the jam nuts. Note that each adjusting screw has one right-handed nut and one left-handed nut.

CAUTION: When setting rear camber and toe on the vehicle, the maximum lengths of the adjustable lateral link at the locations shown (Fig. 3) must not be exceeded. If these maximum lengths are exceeded, inadequate retention of adjustment link to the inner and outer link may result.

(2) Rough-in the rear camber setting as close as possible to the preferred specification by mainly adjusting the rear lateral link adjusting screw (Fig. 2). Some adjustment of the forward lateral link adjusting screw will also be required to get the rear camber setting to the preferred specification. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group for the specification.

SERVICE PROCEDURES (Continued)

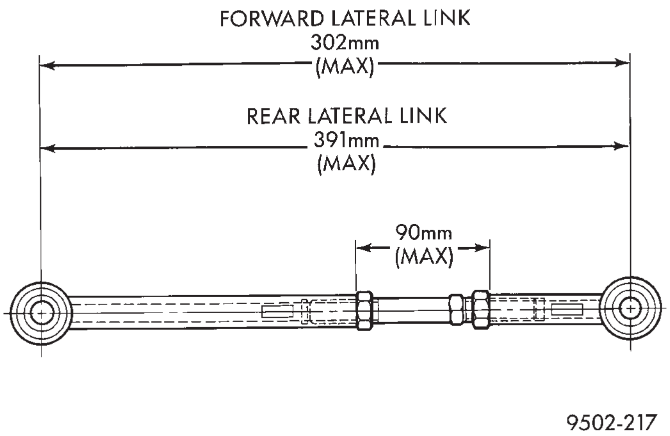


Fig. 3 Rear Lateral Link Maximum Length Dimensions

(3) Adjust the forward lateral link adjusting screw (Fig. 2) to set rear toe to the preferred specification. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group for the specification.

NOTE: Adjusting toe will cause a slight change in the camber setting. If during the setting of toe, camber is no longer at the preferred specification, continue to adjust camber and toe until both are at their preferred specifications.

(4) While holding adjustment screws from turning, use a crow foot and torque wrench, and tighten all lateral link adjusting screw jam nuts to a torque of 65 N·m (48 ft. lbs.). This will securely hold the adjusting screws from turning.

(5) Proceed to FRONT CASTER AND CAMBER, or FRONT TOE if front caster and camber are within specifications.

FRONT CAMBER AND CASTER

Camber and caster settings on this vehicle are determined at the time the vehicle is designed, by the location of the vehicle's suspension components. This is referred to as NET BUILD. The result is no required adjustment of camber and caster after the vehicle is built or when servicing the suspension components. Thus, when performing a wheel alignment, caster and camber are not normally considered adjustable angles. Camber and caster should be checked to ensure they meet vehicle specifications. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group of the service manual for the specifications.

If front camber is found not to meet alignment specifications, it can be adjusted using a procedure listed here. Before performing the camber adjustment procedure, inspect the suspension components for any signs of damage or bending.

CAMBER ADJUSTMENT PROCEDURE

(1) Open the hood and mark the position of all four shock assembly mounting bolts on the shock tower (Fig. 4) on the side of the vehicle requiring front camber adjustment.

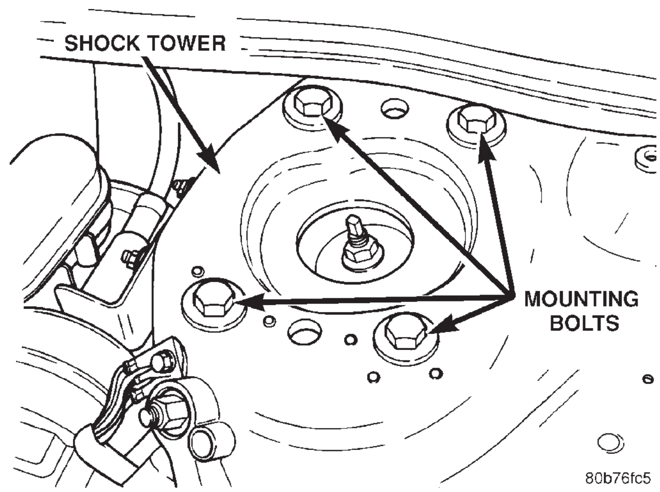


Fig. 4 Shock Assembly Mounting Bolts

(2) Raise the vehicle by the frame until the tires and front suspension are not supporting the weight of the vehicle.

(3) Loosen the shock assembly mounting bolts on the side marked in step 1. Loosen the bolts enough to allow adequate space for removal of the plastic locating pins that align the upper mounting bracket with the shock tower.

(4) Remove and discard both plastic locating pins from the shock assembly upper mounting bracket using a punch or pliers.

NOTE: Do not leave the plastic locating pins in the cavity of the shock tower or mount. Objectionable noise may result.

(5) Position the shock assembly inboard or outboard as required to adjust the camber. Make sure the fore and aft position is in the same as indicated by the marks made prior to adjustment, and also the forward and rearward bolts are moved equal amounts inward or outward.

NOTE: Do not attempt to enlarge any existing holes to increase adjustment range.

(6) Torque the upper shock assembly mounting bolts to 90 N·m (68 ft. lbs.)

(7) Lower the vehicle. Jounce the front and rear of vehicle an equal amount of times.

SERVICE PROCEDURES (Continued)

(8) Check and adjust the front camber as necessary. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group of the service manual for preferred specification.

(9) If toe readings obtained are not within the required specification range, adjust toe to meet the preferred specification setting. Toe is adjustable using the following procedure.

FRONT TOE

(1) Center the steering wheel and lock in place using a steering wheel clamp.

CAUTION: Do not twist front inner tie rod to steering gear rubber boots during front wheel Toe adjustment.

(2) Loosen front inner to outer tie rod end jam nuts (Fig. 5). Grasp inner tie rods at serrations and rotate inner tie rods of steering gear to set front toe to the preferred toe specification. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group of the service manual for preferred specification.

(3) Tighten tie rod jam nuts (Fig. 5) to 61 N·m (45 ft. lbs.) torque.

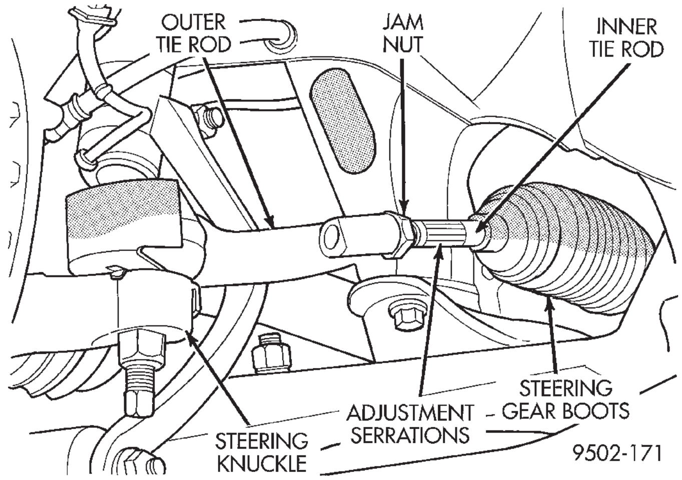


Fig. 5 Front Wheel Toe Adjustment

(4) Adjust steering gear to tie rod boots at the inner tie rod.

(5) Remove steering wheel clamp.

(6) Remove the alignment equipment.

(7) Road test the vehicle to verify the steering wheel is straight and the vehicle does not wander or pull.

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

NOTE: All specifications are given in degrees.

NOTE: All wheel alignments are to be set with the vehicle at its proper curb height. Refer to CURB HEIGHT MEASUREMENT in SERVICE PROCEDURES.

FRONT WHEEL ALIGNMENT	ACCEPTABLE RANGE	PREFERRED SETTING
CAMBER Cross Camber	-0.6° to +0.6° 0.7 degrees or less	0.0° 0.0
TOE— RIGHT/LEFT	0.05°out to 0.15° in	0.05° in
TOTAL TOE Specified In Degrees (See Note)	0.1°out to 0.3°in	0.1° in
CASTER* *Side To Side Caster Difference Not To Exceed	+2.3° to +4.3° 1.0° or less	+3.3° 0.0°
REAR WHEEL ALIGNMENT	ACCEPTABLE ALIGNMENT RANGE AT CURB HEIGHT	PREFERRED SETTING
CAMBER	-0.6° to +0.2°	-0.2°
TOE— RIGHT/LEFT	0.05° out to 0.15° in	0.05° in
TOTAL TOE Specified In Degrees (See Note) TOE OUT When Backed On Alignment Rack Is TOE IN When Driving	0.1° out to 0.3° in	0.1° in
THRUST ANGLE	+ or - 0.15°	0.0°
Note: Total toe is the sum of the left and right wheel toe settings. Positive is toe-in, negative is toe-out. Total toe must be equally split between each front wheel to ensure the steering wheel is centered after setting toe. Left and right toe must be equal to within 0.02 degrees for proper alignment.		

FRONT SUSPENSION

INDEX

DESCRIPTION AND OPERATION

FRONT SUSPENSION SYSTEM

This vehicle's front suspension is a short long arm design used in conjunction with a gas pressurized shock absorber and coil spring assembly.

The upper control arm of the vehicle is mounted using rubber isolation bushings to an aluminum casting which is attached to the shock tower using 4 mounting bolts. This aluminum casting is also used as the upper mount for the front shock/coil spring assembly. The shock absorber assembly is also isolated from the aluminum bracket using a 2 piece rubber bushing design. The lower control arm is mounted to the vehicle's front suspension crossmember using 2 through bolts per control arm. The lower control arm is also isolated from the vehicle using 2 rubber bushings of unique design for the front and rear mounting location. The bottom of the shock absorber is mounted to the lower control arm by a clevis bracket which is part of the shock absorber assembly. The clevis bracket is mounted to and isolated from the lower control arm using a rubber isolation bushing and a through-bolt. The front steering knuckle is mounted to the vehicle by a ball joint located in the upper and lower control arms. Steering of the vehicle is provided by a rack and pinion steering gear which is connected directly to the steering knuckle by an outer tie rod.

The front shock absorber assembly includes the following components: A rubber isolated top mount, an upper spring seat, upper control arm/shock absorber bracket, jounce bumper, dust shield, coil spring, lower spring seat and the shock absorber clevis bracket.

A sealed for life front hub and bearing assembly is attached to the front steering knuckle. The outer C/V joint assembly is splined to the front hub and bearing assembly and is retained by a nut, nut retainer and cotter pin.

SHOCK ASSEMBLY (FRONT)

The front shock assembly and suspension of the vehicle is supported by coil springs positioned around shock absorbers. The springs are contained between an upper seat located in the upper mounting bracket and a lower spring seat on the shock absorber.

DESCRIPTION AND OPERATION (Continued)

The shock absorber cushions the ride of the vehicle, controlling vibration, and jounce and rebound of the suspension.

The top of each shock absorber is bolted to a cast shock absorber/upper control arm bracket which is bolted to the shock tower of the vehicle using 4 mounting bolts.

The bottom of the shock absorber attaches to a clevis bracket using a pinch bolt. The clevis bracket attaches to the lower control arm of the vehicle using a thru-bolt and prevailing torque nut.

The shock absorber/upper control arm bracket also provides a pivotal mounting point for the upper control arm.

The components of the shock assembly listed below are serviceable if found to be defective.

- Upper mounting bracket
- Upper control arm
- Upper spring isolator
- Dust shield
- Cup
- Jounce bumper
- Coil spring
- Shock absorber
- Lower spring isolator

COIL SPRING

Coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. If the coil springs require replacement, be sure that the springs needing replacement, are replaced with springs meeting the correct load rating and spring rate for the vehicle and its specific options.

STEERING KNUCKLE

The steering knuckle is a single casting with legs machined for attachment to the vehicle's upper and lower control arm ball joints. The steering knuckle also has machined abutments on the casting to support and align the front brake caliper assembly. The knuckle also holds the front drive shaft outer C/V joint hub and bearing assembly. The hub is positioned through the bearing and knuckle, with the constant velocity stub shaft splined through the hub. The outer C/V joint is retained to the hub and bearing assembly using a nut, nut lock and cotter pin.

HUB AND BEARING (FRONT)

The bearing used on the front hub of this vehicle is the combined hub and bearing unit type assembly. This unit combines the front wheel mounting hub (flange) and the front wheel bearing into a one piece unit. The hub and bearing assembly is mounted to the steering knuckle and is retained by three mounting bolts accessible from the back of the steering knuckle. The hub and bearing unit is not serviceable and must be replaced as an assembly if the bearing or the hub is determined to be defective. The wheel mounting studs used to mount the tire and wheel to the vehicle are the only replaceable components of the hub and bearing assembly.

UPPER CONTROL ARM (FRONT)

The upper control arm is a high strength steel stamping. The upper control arm uses the 2 rubber bushings of the upper control arm/shock absorber mounting bracket to isolate it from the mounting bracket and the body of the vehicle. The isolator bushings used in the upper control arm are a metal encased rubber isolated pivot bushing. The bushings isolate the upper control arm from the body of the vehicle yet allows for the up and down movement of the control arm during the jounce and rebound travel of the vehicle suspension. The upper control arm is bolted to the top of the steering knuckle through the upper ball joint.

BALL JOINT (FRONT UPPER)

The ball joint is pressed into the upper control arm and has a tapered stud for attachment to the steering knuckle. The ball joint stud is attached and locked into the steering knuckle using a castle nut and cotter pin. The ball joint is not serviceable as a separate component of the upper control arm. If the ball joint is defective it will require replacement of the entire upper control arm.

LOWER CONTROL ARM

The lower control arm is a ductile iron casting using 2 rubber bushings to isolate it from the front suspension crossmember and body of the vehicle. The isolator bushings consist of 2 metal encased rubber isolated pivot bushings. The front of the lower control arm is bolted to the front crossmember using a bolt through the center of the rubber pivot bushing. The rear of the lower control arm is mounted to the front suspension crossmember using a thru-bolt. The lower control arms are inter-connected through a linked rubber isolated sway bar.

BALL JOINT (LOWER)

The ball joint used in the lower control arm of this vehicle is a sealed for life ball joint. The ball joint can not be replaced as a separate component of the lower control arm assembly. If the ball joint is determined to be defective it will require replacement of the complete lower control arm assembly.

The lower ball joint connection to the steering knuckle is achieved by an interference fit created by the tapered stud of the ball joint and a tapered hole in the steering knuckle. The ball joint stud is

DESCRIPTION AND OPERATION (Continued)

retained in the steering knuckle using a castle nut and a cotter pin. The cotter pin is used for positive retention of the castle nut.

The lower ball joint is lubricated for life at the time it is assembled in the lower control arm.

NOTE: The ball joint does not require any type of additional lubrication for the life of the vehicle. No attempt should be made to ever add any lubrication to the lower ball joint.

STABILIZER BAR (FRONT)

The stabilizer bar interconnects both front lower control arms of the vehicle and is attached to the front suspension cradle and the underbody of the vehicle.

Jounce and rebound movements affecting one wheel are partially transmitted to the opposite wheel of the vehicle to stabilize body roll.

Attachment of the stabilizer bar to the front suspension cradle is through 2 rubber-isolator bushings and bushing retainers. The stabilizer bar to lower control arm attachment is done utilizing a ball joint type, stabilizer bar attaching link. All parts of the stabilizer bar are replaceable as individual components, and the bushings attaching the stabilizer bar to crossmember are split for easy removal and installation.

DIAGNOSIS AND TESTING

SHOCK ASSEMBLY (FRONT)

(1) Inspect for damaged or broken coil springs (Fig. 1).

(2) Inspect for torn or damaged shock absorber dust boots (Fig. 1).

(3) Lift the dust boot and inspect the shock absorber for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off the lower end of the shock absorber). A slight amount of seepage between the shock absorber rod and the seal is not unusual and does not affect performance of the shock absorber. Also inspect jounce bumpers for signs of damage or deterioration (Fig. 1).

STEERING KNUCKLE

The front suspension steering knuckle is not a repairable component of the front suspension. It must be replaced if found to be damaged in any way. If it is determined that the steering knuckle is bent when servicing the vehicle, no attempt is to be made to straighten the steering knuckle.

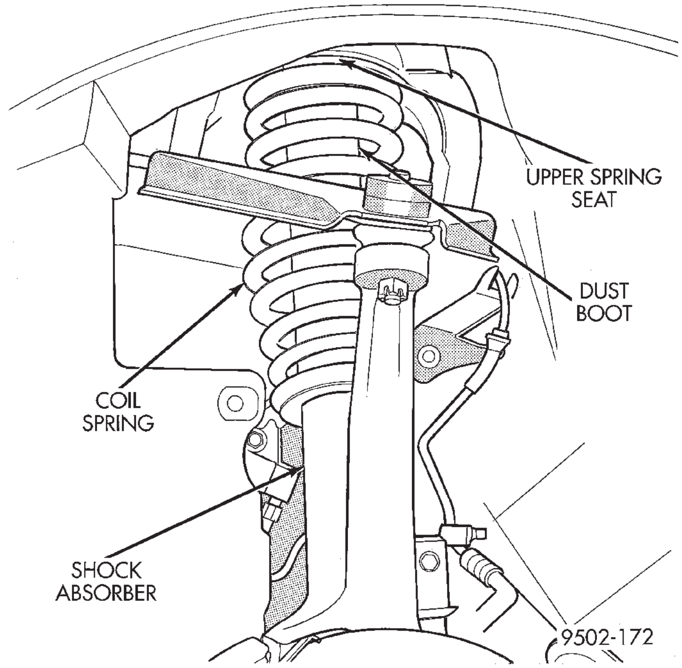


Fig. 1 On Vehicle Inspection

HUB AND BEARING (FRONT)

The hub and bearing is designed for the life of the vehicle and requires no type of periodic maintenance. The following procedure may be used for diagnosing the condition of the wheel bearing and hub.

With the wheel, disc brake caliper, and brake rotor removed, rotate the wheel hub. Any roughness or resistance to rotation may indicate dirt intrusion or a failed hub bearing. If the bearing exhibits any of these conditions during diagnosis, the hub bearing will require replacement. The bearing is not serviceable.

Damaged bearing seals and the resulting excessive grease loss may also require bearing replacement. Moderate grease weapage from the bearing is considered normal and should not require replacement of the wheel bearing.

To diagnose a bent hub, refer to BRAKE ROTOR in the DIAGNOSIS AND TESTING section in the BRAKES service manual group for the procedure on measuring hub runout.

UPPER CONTROL ARM (FRONT)

If damaged, the upper control arm is serviced only as a complete component. Inspect the upper control arm for any signs of damage. If control arm shows any sign of damage the upper control arm must be replaced. Do not attempt to repair or straighten a broken or bent upper control arm.

The only serviceable component of the upper control arm is the ball joint grease seal. No other repair or replacement procedure should be attempted on any component of the upper control arm. Service pro-

DIAGNOSIS AND TESTING (Continued)

cedures to replace the serviceable components are detailed in the specific component sections of this group.

BALL JOINT (FRONT UPPER)

With the weight of the vehicle resting on the road wheels, grasp the grease fitting and with no mechanical assistance or added force, attempt to move the grease fitting.

If the ball joint is worn the grease fitting will move easily. If movement is noted, replacement of the upper control arm is required.

LOWER CONTROL ARM

If damaged, the lower control arm casting is serviced only as a complete component. Inspect lower control arm for signs of damage from contact with the ground or road debris. If lower control arm shows any sign of damage, inspect lower control arm for distortion. **Do not attempt to repair or straighten a broken or bent lower control arm.**

The replaceable components of the lower control arm are: the ball joint grease seal and the control arm bushings. Inspect both control arm bushings for severe deterioration, and replace if required.

Inspect the lower ball joint for wear. Use the wear inspection procedure in the diagnosis and testing section in this group of service manual to determine if the wear is excessive and ball joint (lower control arm) replacement is required.

Service procedures to replace these components are detailed in the specific component removal and installation sections in this group of the service manual.

BALL JOINT (LOWER)

(1) Raise the vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Install a dial indicator on the vehicle so it is contacting the top surface of the steering knuckle near the lower ball joint stud castle nut.

(3) Grab wheel and tire assembly and push it up and down firmly.

(4) Record the amount of up and down movement of the steering knuckle recorded on the dial indicator.

(5) Replace lower control arm if the movement in the lower control arm exceeds 1.5 mm (.059 in.).

STABILIZER BAR (FRONT)

Inspect for broken or distorted stabilizer bar bushings, bushing retainers, and worn or damaged stabilizer bar to control arm attaching links.

SERVICE PROCEDURES

LUBRICATION

The only serviceable lubrication points on the suspension are the upper ball joints (Fig. 2). All other joints are sealed for life. Lubricate the upper ball joints until a slight swelling is noticed in the ball joint seal boots. Do not overfill the seal boots. Follow the vehicles maintenance schedule.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

WARNING: DO NOT REMOVE A SHOCK ROD NUT WHILE THE SHOCK ASSEMBLY IS INSTALLED IN VEHICLE, OR BEFORE THE SHOCK ASSEMBLY SPRING IS COMPRESSED.

CAUTION: Only frame contact hoisting equipment can be used on this vehicle. All vehicles have a fully independent rear suspension. The vehicles can not be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used, damage to rear suspension components will occur.

CAUTION: At no time when servicing a vehicle, can a sheet metal screw, bolt or other metal fastener be installed in the shock tower to take the place of an original plastic clip. Also, NO holes can be drilled into the front shock tower in the area shown in (Fig. 3), for the installation of any metal fasteners into the shock tower. Because of the minimum clearance in this area installation of metal fasteners could damage the coil spring coating and lead to a corrosion failure of the spring.

NOTE: If a suspension component becomes bent, damaged or fails, no attempt should be made to straighten or repair it. Always replace it with a new component.

SHOCK ASSEMBLY (FRONT)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS in this section.

REMOVAL

(1) Loosen wheel nuts.

(2) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubri-

REMOVAL AND INSTALLATION (Continued)

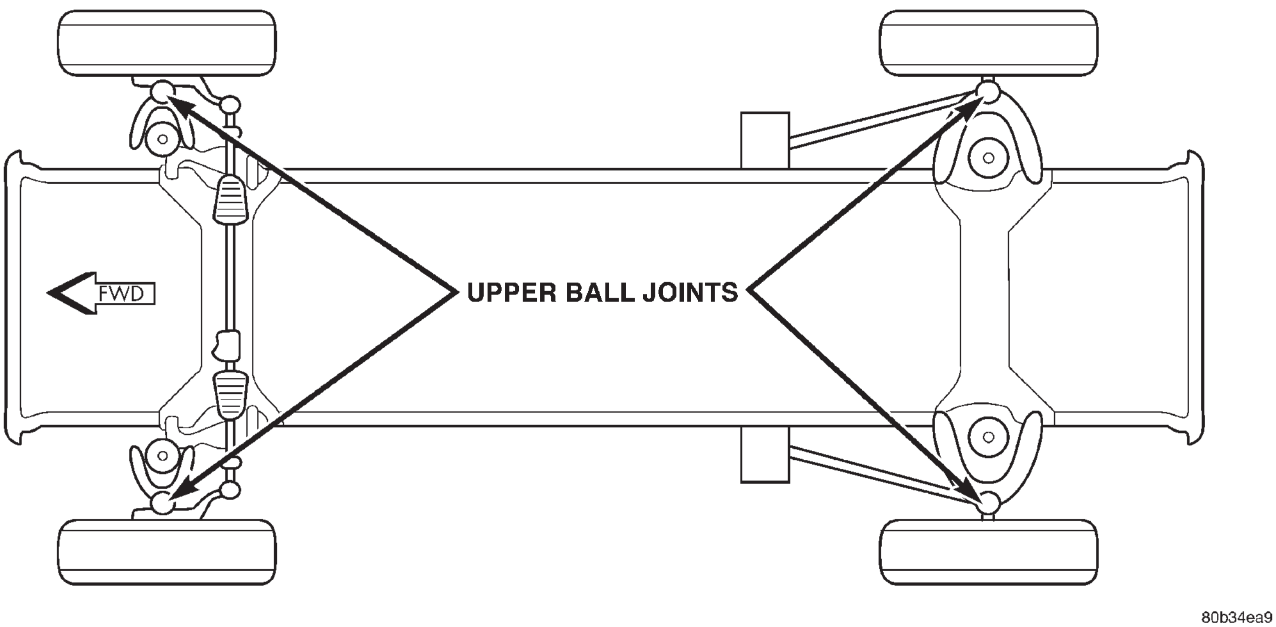


Fig. 2 Lubrication Points

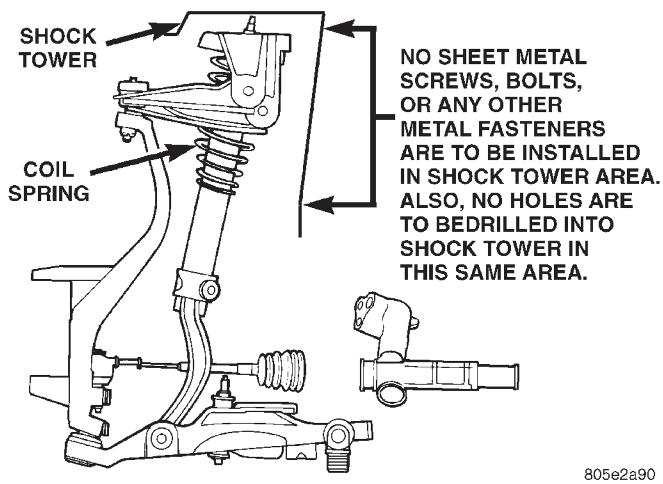


Fig. 3 Shock Tower To Spring Minimum Clearance Area

cation and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(3) Remove wheel and tire assembly from location on front of vehicle requiring strut removal.

(4) If both shock absorbers are removed, mark the shock absorbers right and left according to which side of the vehicle they were removed from.

(5) Remove the wheel speed sensor cable routing bracket (Fig. 4) from the steering knuckle.

(6) Remove the cotter pin and castle nut (Fig. 5) from the upper ball joint stud.

(7) Remove the upper ball joint stud from the steering knuckle using Puller, Special Tool, C-3894-A

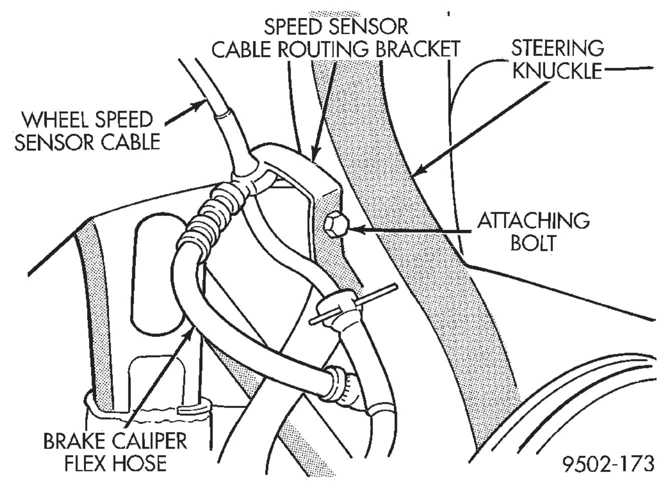


Fig. 4 Wheel Speed Sensor Cable Routing Bracket

(Fig. 6). Pull steering knuckle outward and position toward the rear of the front wheel opening.

(8) Remove pinch bolt attaching shock absorber clevis to shock absorber (Fig. 7).

(9) Remove the thru-bolt (Fig. 8) attaching the shock absorber clevis to the lower control arm.

(10) Remove the clevis from the shock absorber by carefully tapping the clevis off the shock absorber using a soft (brass) drift.

(11) Remove the 4 bolts attaching the shock absorber/upper control arm mounting bracket to the shock tower of the vehicle (Fig. 9).

(12) Remove the shock assembly from the vehicle. The shock assembly is removed out through the front area of the front wheel well.

REMOVAL AND INSTALLATION (Continued)

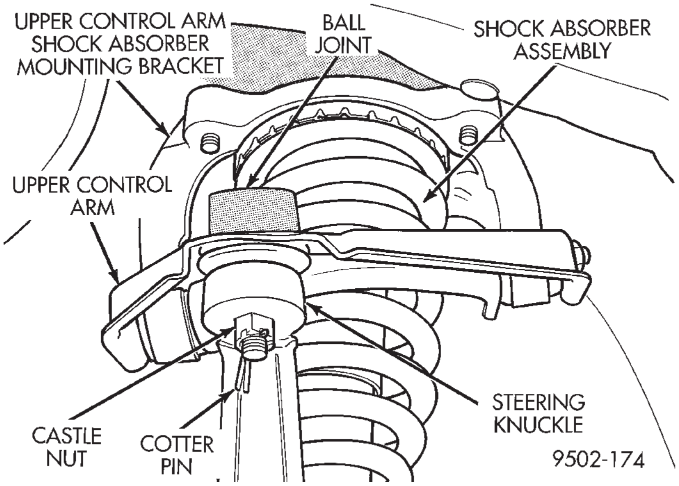


Fig. 5 Ball Joint Attachment To Steering Knuckle

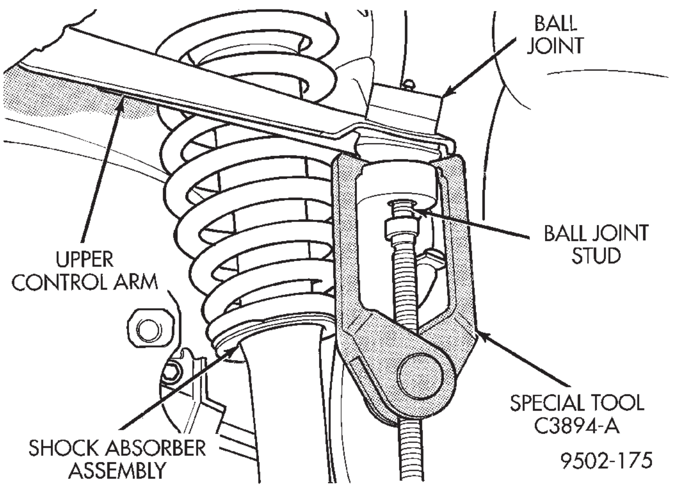


Fig. 6 Ball Joint Stud Removal From Steering Knuckle

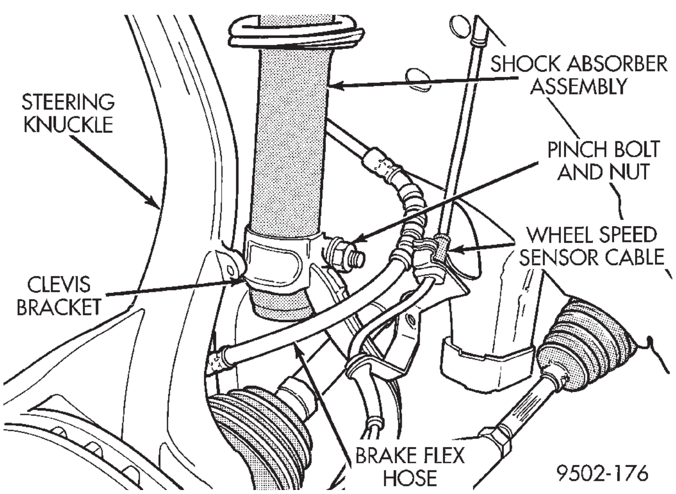


Fig. 7 Shock Absorber Clevis Bracket Pinch Bolt

(13) For disassembly and assembly of the shock assembly, refer to DISASSEMBLY AND ASSEMBLY in this section of this group.

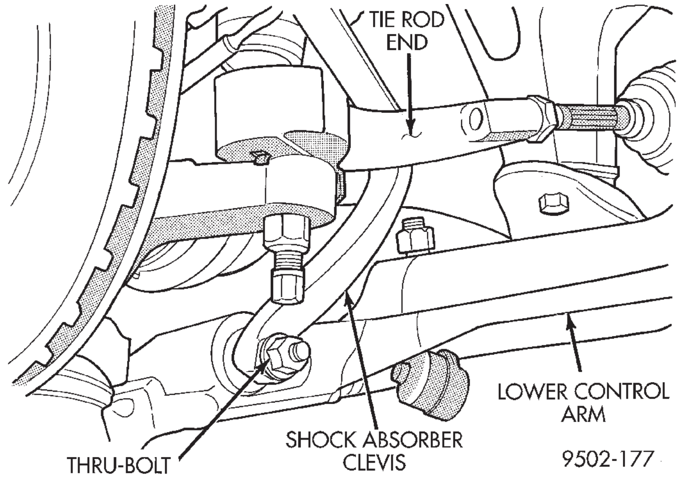


Fig. 8 Clevis To Lower Control Arm Attaching Bolt

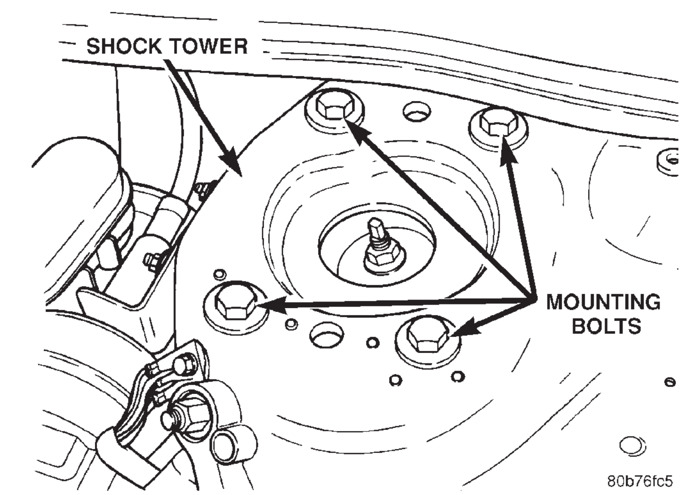


Fig. 9 Shock Assembly Attachment To Shock Tower

INSTALLATION

(1) Install the shock assembly, with the clevis removed, into shock tower. Aligning the 2 locating pins and the 4 mounting holes on the upper control arm shock absorber mount with the 4 holes in shock tower. Install the 4 upper control arm mount to shock tower mounting bolts (Fig. 9). Tighten the 4 bolts to a torque of 90 N·m (68 ft. lbs.).

(2) Install the clevis on the shock absorber. Clevis is installed by tapping it onto the fluid reservoir of the shock absorber using a soft (brass) drift until fully seated against locating tab on shock absorber (Fig. 10). Orientation tab on locating tab (Fig. 10) must be positioned in the split of the clevis.

(3) Install the clevis bracket to lower control arm thru-bolt (Fig. 8). Do not tighten or torque the thru-bolt at this time.

(4) Install upper ball joint into steering knuckle. Install castle nut on ball joint stud. Tighten castle nut to a torque of 62 N·m (45 ft. lbs.). Install cotter pin in stud of ball joint (Fig. 5).

REMOVAL AND INSTALLATION (Continued)

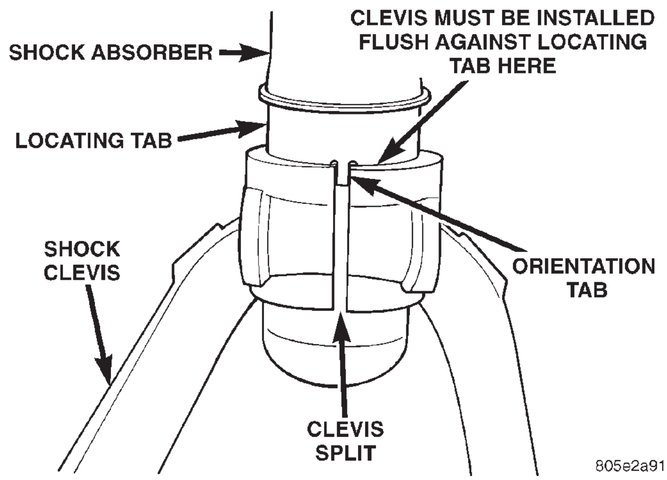


Fig. 10 Clevis Correctly Installed On Shock Absorber

(5) Install the routing bracket for the speed control cable (Fig. 4) on the steering knuckle. Install and securely tighten the routing bracket attaching bolt (Fig. 4).

CAUTION: When supporting lower control arm with jack stand, do not position jack stand under the ball joint cap on the lower control arm. Position in area of lower control arm shown in (Fig. 11).

(6) Lower vehicle to the ground with a jack stand positioned under the lower control arm (Fig. 11). Continue to lower vehicle so the total weight of the vehicle is supported by the jack stand and lower control arm.

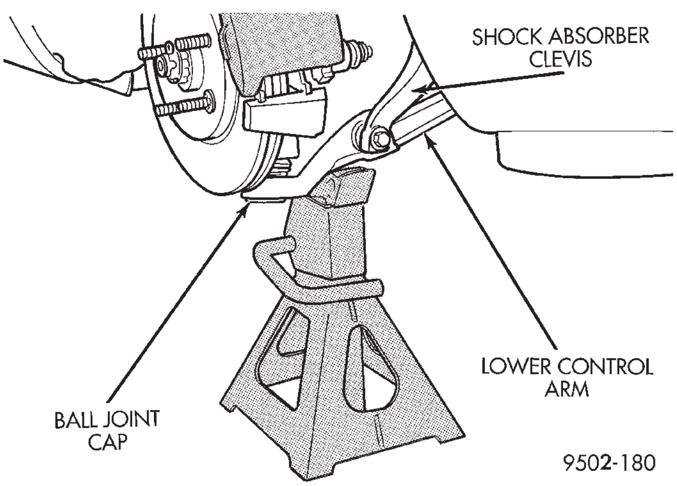


Fig. 11 Lower Control Arm Correctly Supported By Jack Stand

(7) Tighten the shock absorber clevis to lower control arm bushing thru-bolt to a torque of 95 N·m (70 ft. lbs.).

(8) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

STEERING KNUCKLE

REMOVE

(1) Remove cotter pin, nut lock, and spring washer (Fig. 12) from the front stub axle.

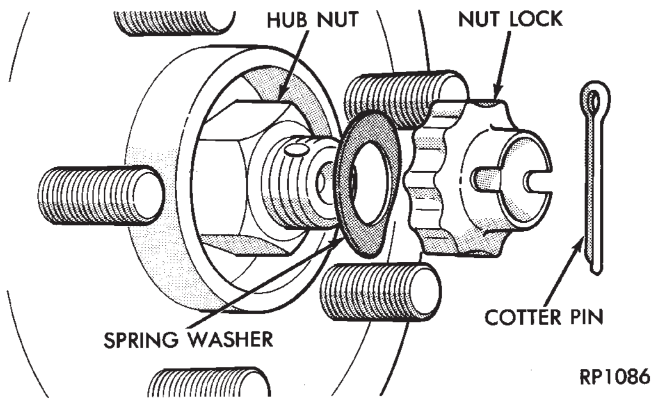


Fig. 12 Cotter Pin, Nut Lock

CAUTION: Wheel bearing damage will result if after loosening hub nut, vehicle is rolled on the ground or the weight of the vehicle is allowed to be supported by the tires.

(2) Loosen hub nut while vehicle is on the floor with the brakes applied (Fig. 13). **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

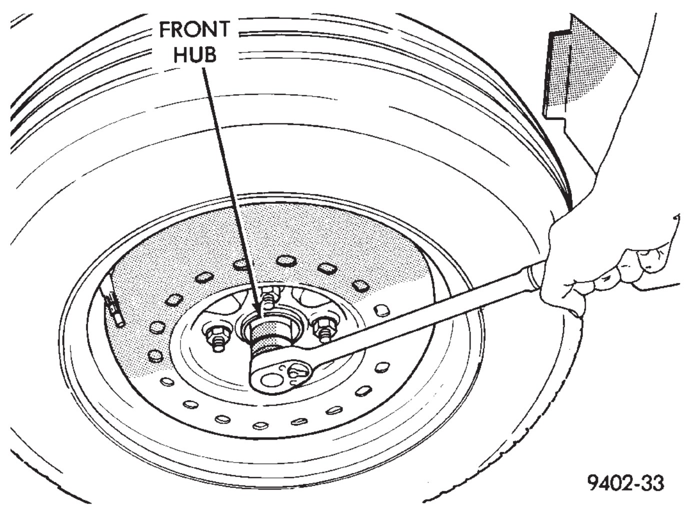


Fig. 13 Loosening Front Hub Nut

(3) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(4) Remove front tire and wheel assembly from the hub.

REMOVAL AND INSTALLATION (Continued)

(5) Remove front disc brake caliper to steering knuckle guide pin attaching bolts (Fig. 14).

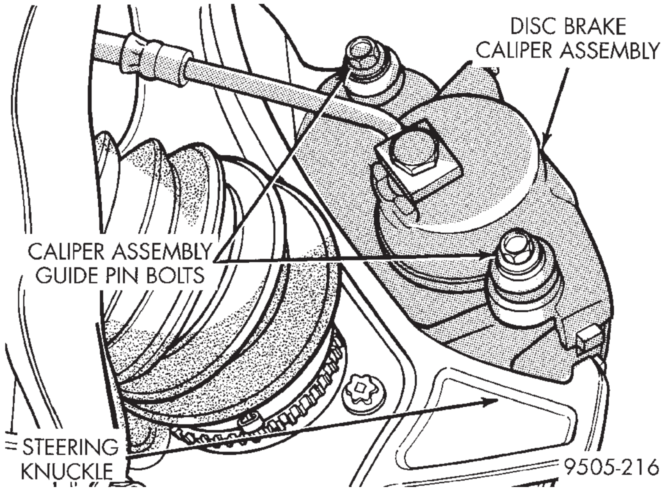


Fig. 14 Front Disc Brake Caliper Mounting

(6) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 15).

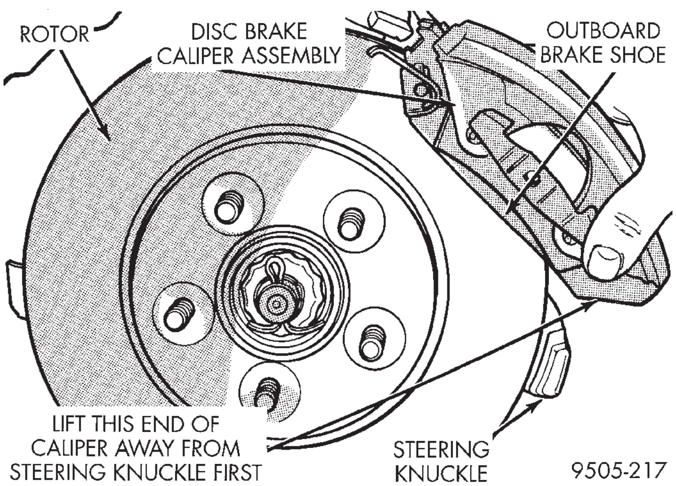


Fig. 15 Disc Brake Caliper Removal/ Installation On Steering Knuckle

(7) Support brake caliper/adapter assembly using a wire hook (Fig. 16) and not by hydraulic hose.

(8) Remove the braking disc from the front hub/ bearing assembly.

(9) If vehicle is equipped with 15 inch wheels, remove lower ball joint heat shield (Fig. 17) from lower control arm. **Heat shield must be removed before attempting to separating ball joint stud from steering knuckle.**

(10) Remove nut attaching outer tie rod end to the steering knuckle (Fig. 18). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench (Fig. 18).**

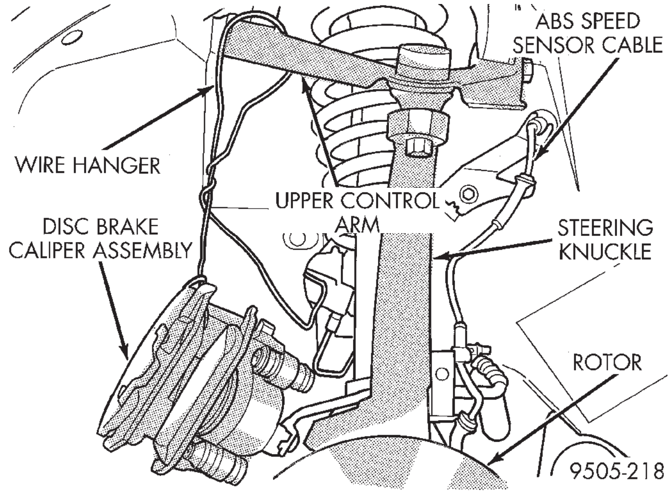


Fig. 16 Correctly Supported Front Disc Brake Caliper

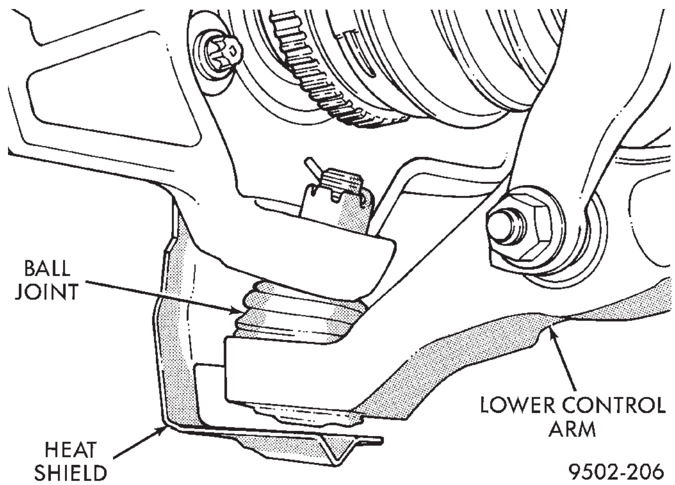


Fig. 17 Ball Joint Heat Shield With 15 Inch Wheels

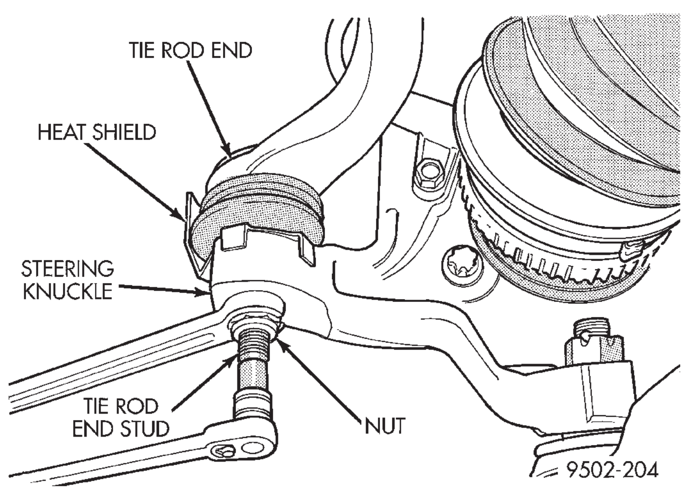


Fig. 18 Tie Rod End Attaching Nut

REMOVAL AND INSTALLATION (Continued)

(11) Remove the tie rod end from steering knuckle arm, using Remover, Special Tool MB-991113 (Fig. 19).

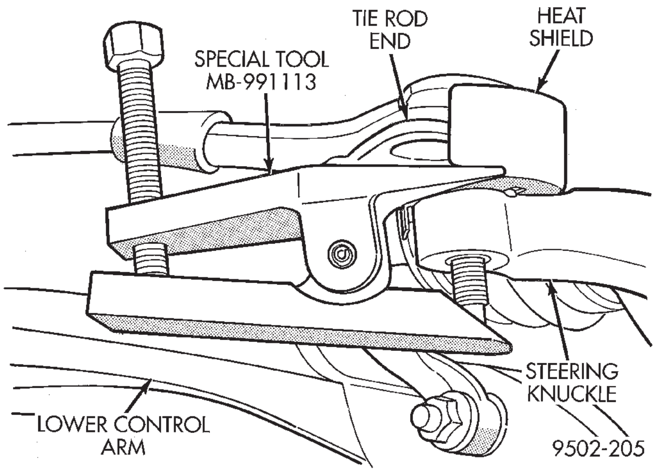


Fig. 19 Tie Rod End Removal From Steering Knuckle

(12) If equipped with antilock brakes remove the speed sensor cable routing bracket (Fig. 20) from the steering knuckle.

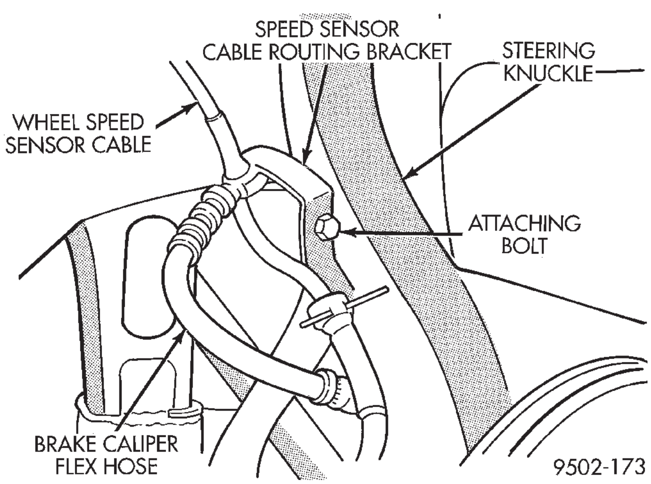


Fig. 20 Speed Sensor Cable Routing Bracket

(13) Remove cotter pin and castle nut (Fig. 21) from stud of lower ball joint at the steering knuckle.

CAUTION: No tool is to be inserted between the steering knuckle and the lower ball joint to separate stud of lower ball joint from the steering knuckle. The steering knuckle is to be separated from the stud of the ball joint only using the procedure as described in step Step 14 below.

(14) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel well as possible. Using a hammer strike the boss on the steering knuckle, (Fig. 22) until steering knuckle separates from stud of lower ball joint.

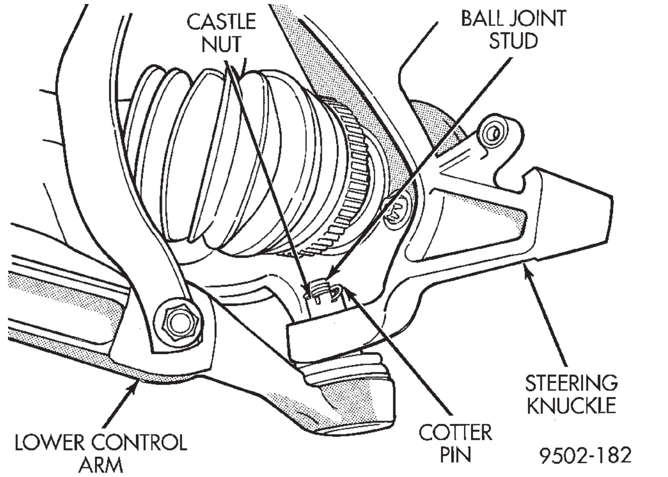


Fig. 21 Lower Ball Joint Attachment To Steering Knuckle

When striking steering knuckle care MUST be taken not to hit lower control arm or ball joint grease seal.

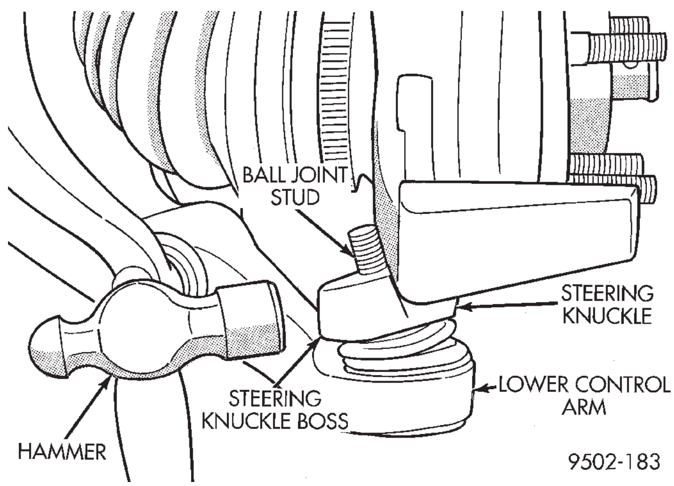


Fig. 22 Separating Ball Joint Stud From Steering Knuckle

CAUTION: Pulling steering knuckle out from vehicle after releasing from ball joint can separate inner C/V joint. See Driveshafts.

(15) Lift up on steering knuckle separating it from the lower ball joint stud. **Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.**

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(16) Separate the steering knuckle from the outer C/V joint. Separate steering knuckle from outer C/V joint, by supporting the driveshaft while pulling

REMOVAL AND INSTALLATION (Continued)

steering knuckle away from the outer C/V joint (Fig. 23).

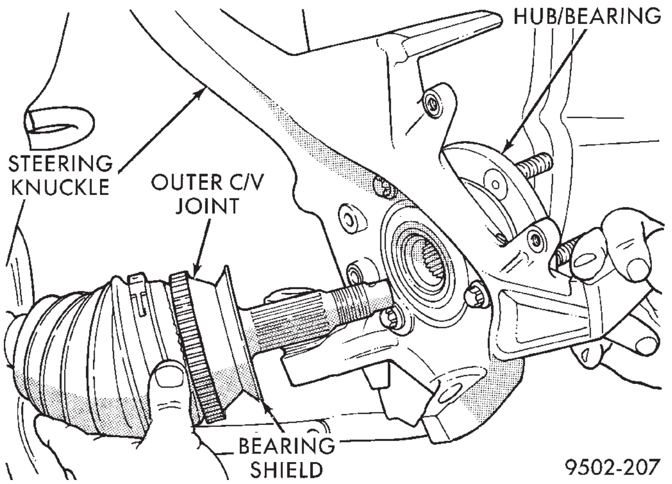


Fig. 23 Separating Steering Knuckle From Outer C/V Joint

(17) Remove the cotter pin and nut (Fig. 24) from the upper ball joint stud to steering knuckle attachment.

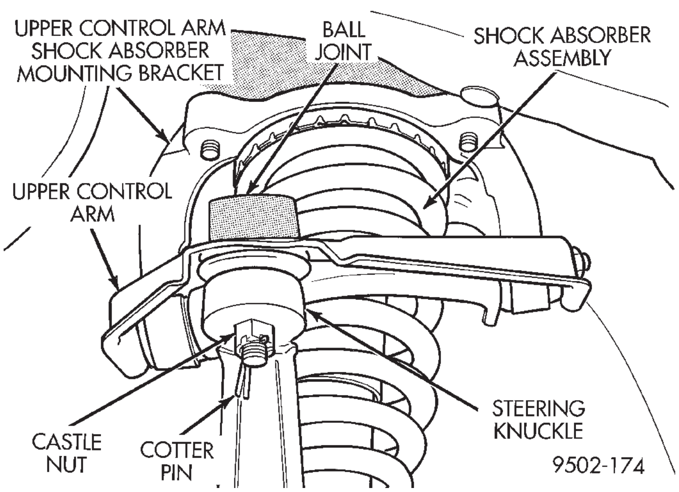


Fig. 24 Upper Ball Joint Attachment To Steering Knuckle

(18) Remove the upper ball joint stud from the steering knuckle using Puller, Special Tool, C-3894-A (Fig. 25).

(19) Remove steering knuckle from vehicle.

(20) **The bolt in type front wheel bearing used on the vehicle is transferable to the replacement steering knuckle if bearing is found to be in usable condition.** Refer to Hub And Bearing Service in this section of the service manual for proper wheel bearing removal and installation procedure.

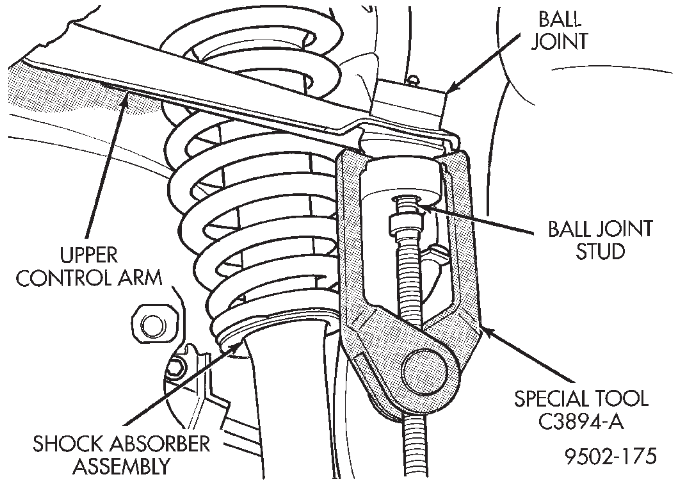


Fig. 25 Ball Joint Stud Removal From Steering Knuckle

INSTALL

(1) If required install a hub/bearing assembly into the steering knuckle before installing steering knuckle on vehicle. Refer to Hub And Bearing Service in this section of the service manual for proper wheel bearing removal and installation procedure.

(2) Slide drive shaft back into front hub/bearing assembly. Then install steering knuckle onto the ball joint stud in lower control arm.

(3) Install the steering knuckle to lower ball joint stud castle nut.

(4) Install upper ball joint in steering knuckle. Install the steering knuckle to upper ball joint nut. Tighten the upper ball joint castle nut (Fig. 24) to a torque of 62 N·m (45 ft. lbs.). Then, using a crowfoot and torque wrench, tighten the lower ball joint nut (Fig. 21) to a torque of 75 N·m (55 ft. lbs.). Install cotter pins in upper and lower ball joint studs.

(5) If equipped with antilock brakes install the speed sensor cable routing bracket on the steering knuckle (Fig. 20) and securely tighten the attaching bolt.

CAUTION: When installing tie rod on steering knuckle the heat shield (Fig. 26) must be installed. If heat shield is not installed, tie rod seal boot can fail due to excessive heat from brake rotor.

(6) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 17). Then using a crowfoot and 11/32 socket tighten the attaching nut to a torque of 61 N·m (45 ft. lbs.) (Fig. 26).

REMOVAL AND INSTALLATION (Continued)

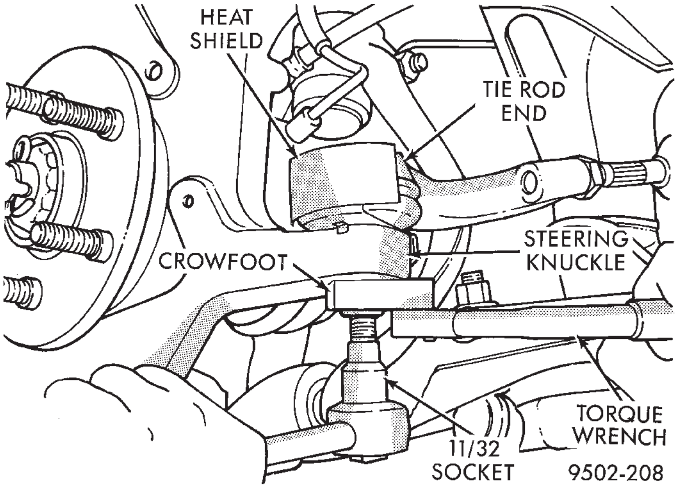


Fig. 26 Torquing Tie Rod End Attaching Nut

CAUTION: The ball joint seal boot heat shield (Fig. 17) must be installed. If heat shield is not installed, ball joint seal boot can fail due to excessive heat from brake rotor.

(7) Install the lower ball joint heat shield (Fig. 17) on the steering knuckle.

(8) Install braking disc back on hub and bearing assembly.

(9) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 15).

(10) Install disc brake caliper assembly to steering knuckle guide pin bolts (Fig. 14). Tighten caliper assembly guide pin bolts to a torque of 22 N·m (16 ft. lbs.).

(11) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install washer and hub nut (Fig. 27) onto stub axle and tighten nut.

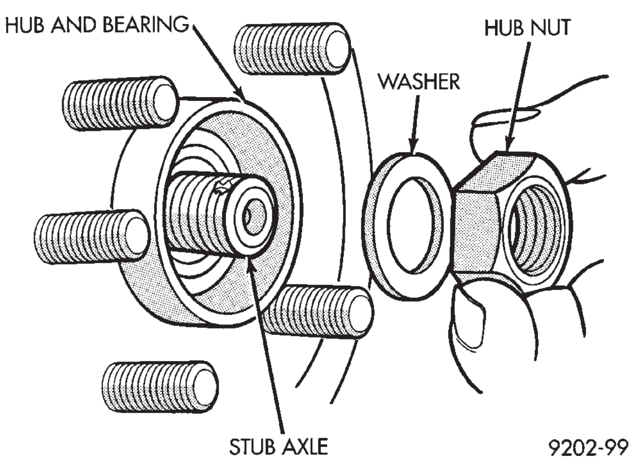


Fig. 27 Front Stub Axle Nut And Washer

(12) With vehicle brakes applied to keep braking disc from turning, tighten hub nut to 244 N·m (180 ft. lbs.) of torque (Fig. 28).

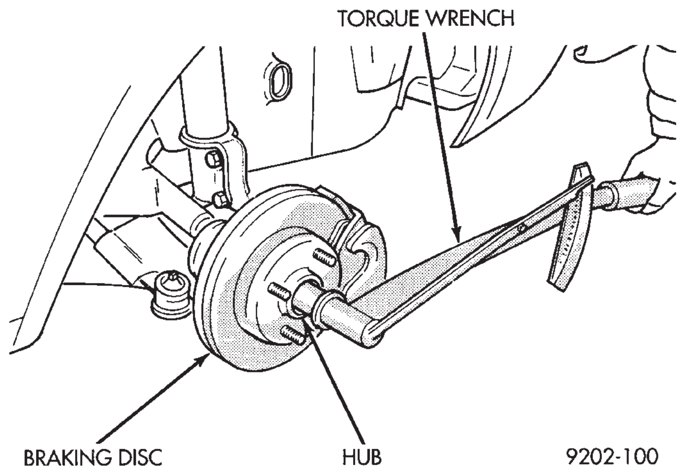


Fig. 28 Torquing Front Hub Nut

(13) Install the spring washer, hub nut lock, and new cotter pin. Wrap cotter pin prongs tightly around the hub nut lock (Fig. 29).

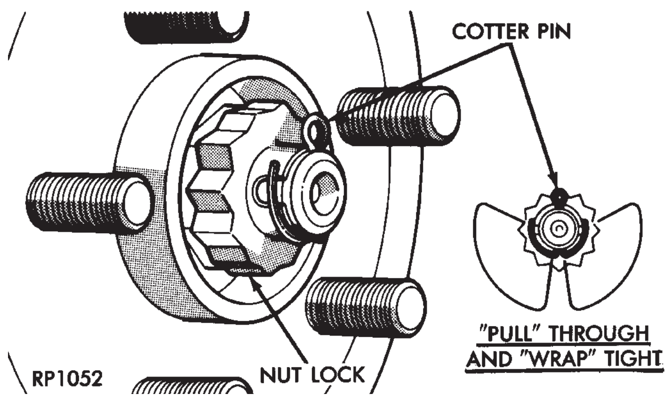


Fig. 29 Installing Spring Washer, Nut Lock And Cotter Pin

(14) Install front wheel and tire assembly. Install front wheel lug nuts and tighten in correct sequence. Then tighten to a torque of 129 N·m (95 ft. lbs.).

(15) Lower vehicle.

(16) Set front Toe on vehicle to required specification. Use procedure listed under Wheel Alignment, in the Front Suspension Service Procedures section of this service manual.

HUB AND BEARING (FRONT)

Removal and installation of the hub and bearing assembly from the steering knuckle must be done with the steering knuckle removed from the vehicle. This is required due to the tool clearance to the ABS tone wheel when removing the retaining bolts. Removing the retaining bolts with the steering

REMOVAL AND INSTALLATION (Continued)

knuckle installed can result in damage to the tone wheel teeth requiring replacement of the driveshaft.

REMOVAL

(1) Remove cotter pin, nut lock, and spring washer (Fig. 30) from the front stub axle.

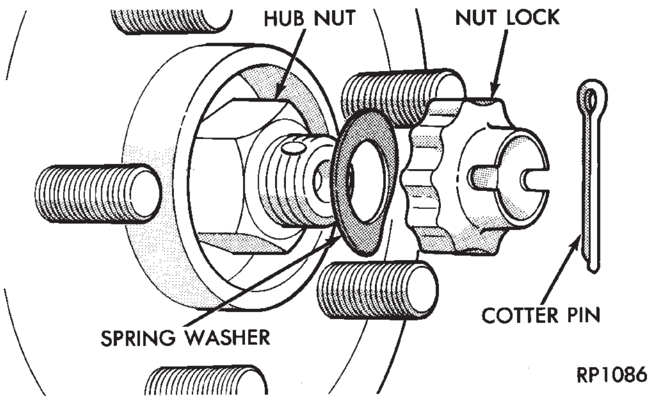


Fig. 30 Cotter Pin, Nut Lock

CAUTION: Wheel bearing damage will result if after loosening hub nut, vehicle is rolled on the ground or the weight of the vehicle is allowed to be supported by the tires.

(2) Loosen hub nut while vehicle is on the floor with the brakes applied (Fig. 31). **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

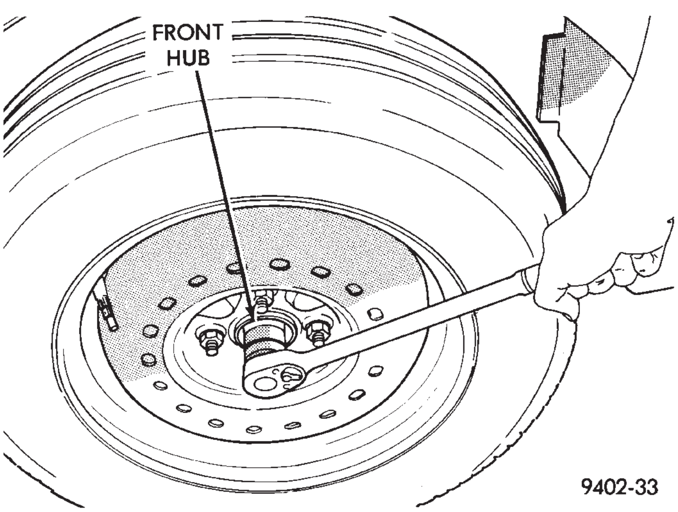


Fig. 31 Loosening Front Hub Nut

(3) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(4) Remove front tire and wheel assembly from the hub.

(5) Remove front disc brake caliper to steering knuckle guide pin attaching bolts (Fig. 32).

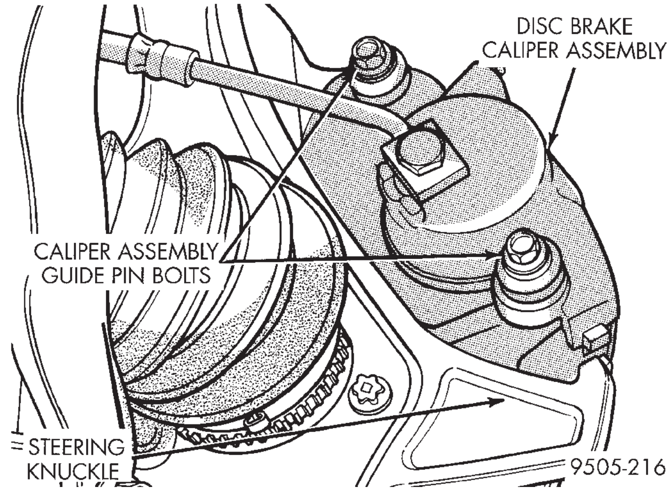


Fig. 32 Front Disc Brake Caliper Mounting

(6) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 33).

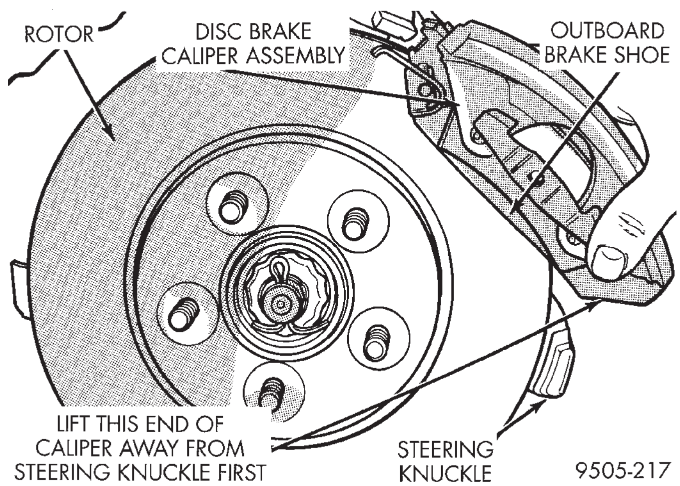


Fig. 33 Caliper Removal From Steering Knuckle

(7) Support brake caliper/adapter assembly using a wire hook (Fig. 34) and not by hydraulic hose.

(8) Remove the braking disc from the front hub/bearing assembly.

(9) If vehicle is equipped with 15 inch wheels, remove lower ball joint heat shield (Fig. 35) from lower control arm. **Heat shield must be removed before attempting to separating ball joint stud from steering knuckle.**

(10) Remove nut attaching the outer tie rod end to the steering knuckle (Fig. 36). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32**

REMOVAL AND INSTALLATION (Continued)

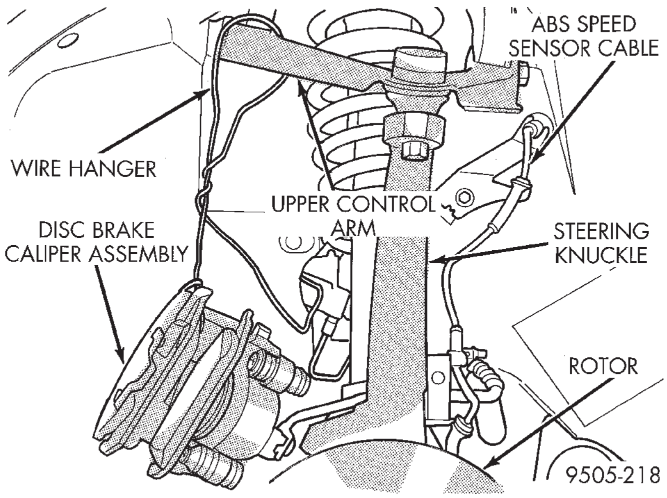


Fig. 34 Correctly Supported Front Disc Brake Caliper

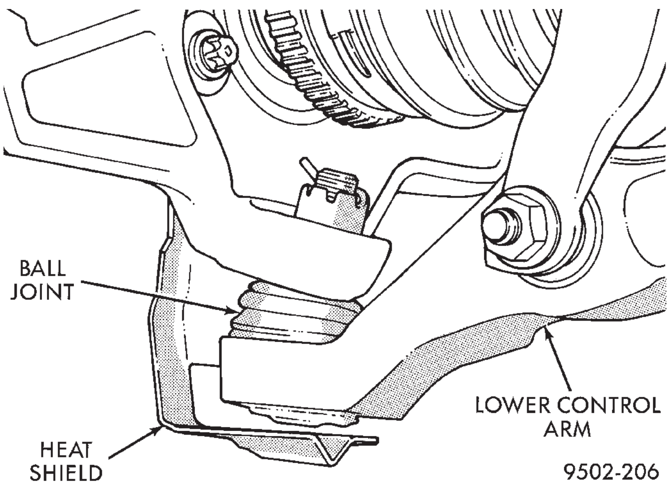


Fig. 35 Ball Joint Heat Shield With 15 Inch Wheels

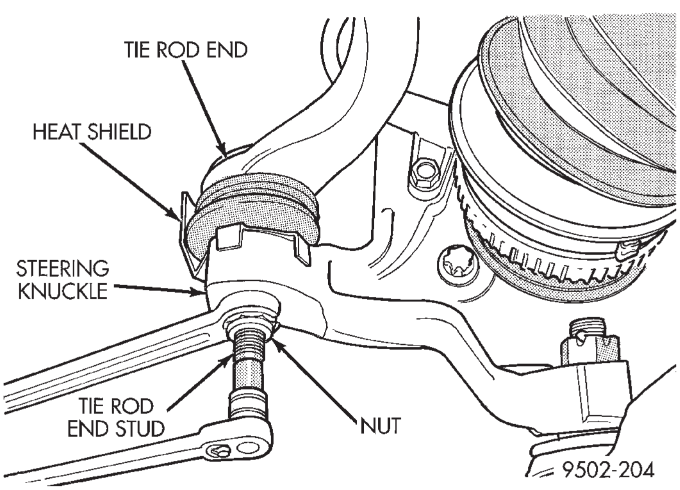


Fig. 36 Removing Tie Rod End Attaching Nut

socket while loosening and removing nut with wrench (Fig. 36).

(11) Remove the tie rod end from steering knuckle arm, using Remover, Special Tool MB-991113 (Fig. 37).

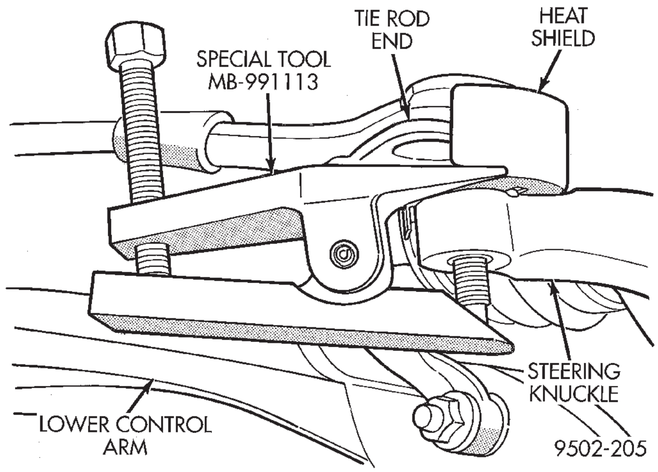


Fig. 37 Tie Rod End Removal From Steering Knuckle

(12) If equipped with antilock brakes remove the speed sensor cable routing bracket (Fig. 38) from the steering knuckle.

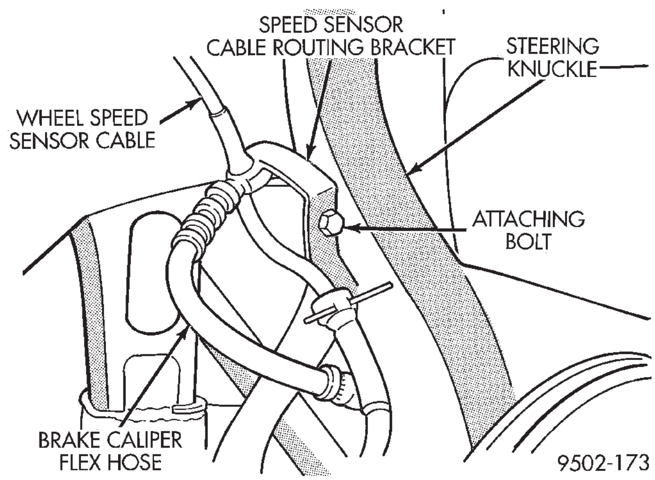


Fig. 38 Speed Sensor Cable Routing Bracket

(13) Remove cotter pin and castle nut (Fig. 39) from the stud of the lower ball joint.

CAUTION: No tool is to be inserted between the steering knuckle and the lower ball joint to separate stud of lower ball joint from the steering knuckle. The steering knuckle is to be separated from the stud of the ball joint only using the procedure as described in step Step 14 below.

(14) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel well as possible. Using a hammer strike the boss on the steering knuckle, (Fig. 40) until steering knuckle separates from stud of lower ball joint.

REMOVAL AND INSTALLATION (Continued)

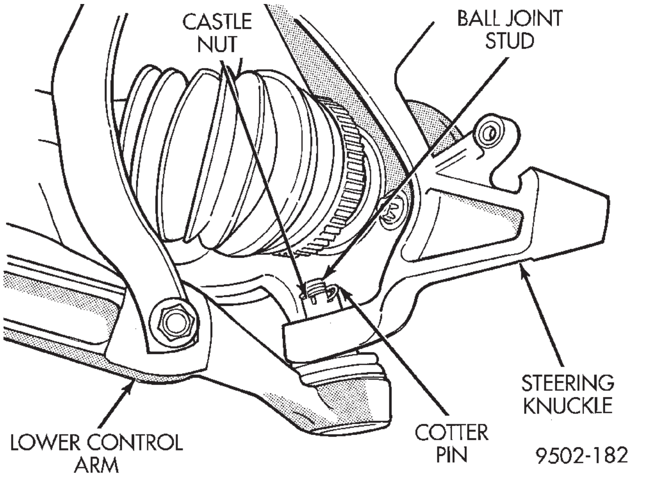


Fig. 39 Lower Ball Joint Attachment To Steering Knuckle

When striking steering knuckle, care MUST be taken not to hit lower control arm or ball joint grease seal.

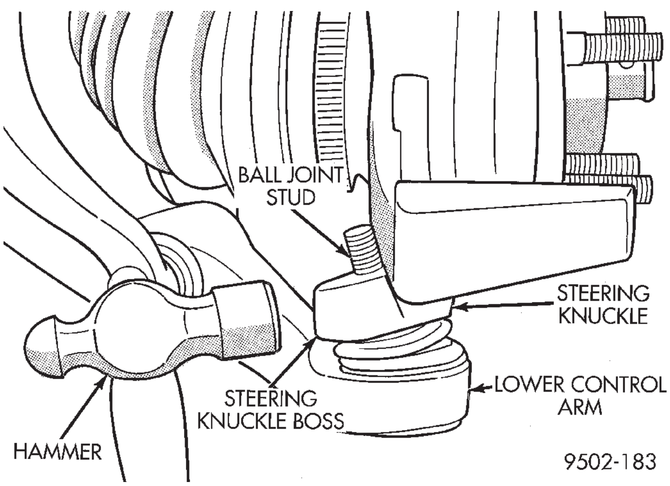


Fig. 40 Separating Ball Joint Stud From Steering Knuckle

CAUTION: Pulling steering knuckle out from vehicle after releasing from ball joint can separate inner C/V joint. See Driveshafts.

(15) Lift up on steering knuckle separating it from the lower ball joint stud. **Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.**

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(16) Separate the steering knuckle from the outer C/V joint. Separate steering knuckle from outer C/V joint, by supporting the driveshaft while pulling steering knuckle away from the outer C/V joint (Fig. 41).

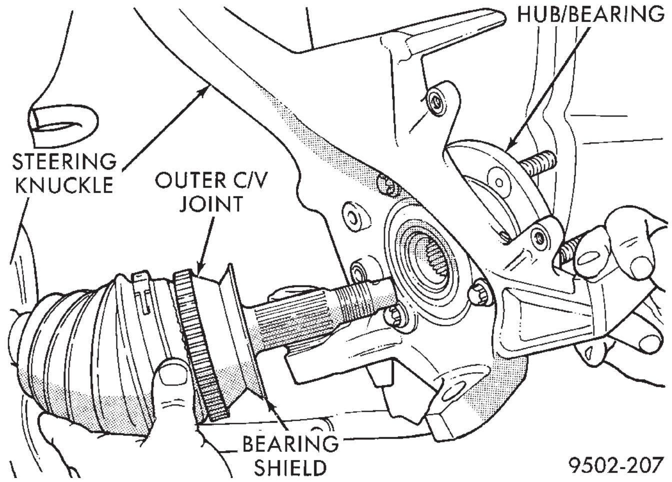


Fig. 41 Separating Steering Knuckle From Outer C/V Joint

(17) Remove the cotter pin and nut (Fig. 42) from the upper ball joint stud to steering knuckle attachment.

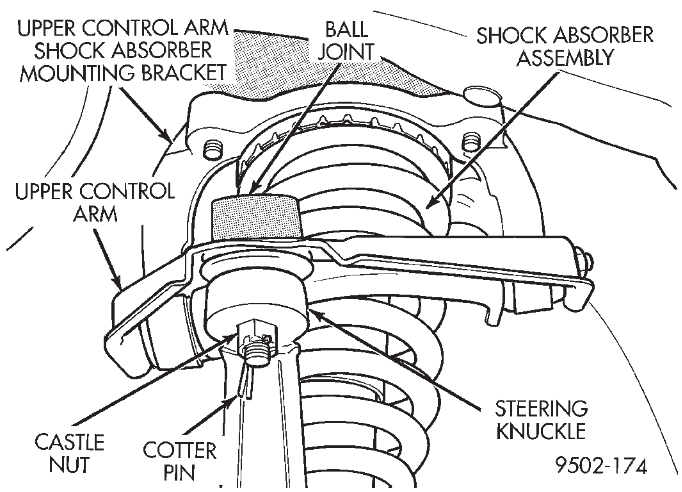


Fig. 42 Upper Ball Joint Attachment To Steering Knuckle

(18) Remove the upper ball joint stud from the steering knuckle using Puller, Special Tool, C3894-A (Fig. 43).

(19) Remove steering knuckle from vehicle.

(20) Mount steering knuckle securely in a vise.

(21) Remove the 3 bolts (Fig. 44) attaching the hub/bearing assembly to the steering knuckle.

(22) Remove the hub/bearing assembly out from the front of the steering knuckle. If bearing will not come out of steering knuckle, it can be tapped out using a soft faced hammer.

(23) Thoroughly clean all hub/bearing assembly mounting surfaces on steering knuckle.

REMOVAL AND INSTALLATION (Continued)

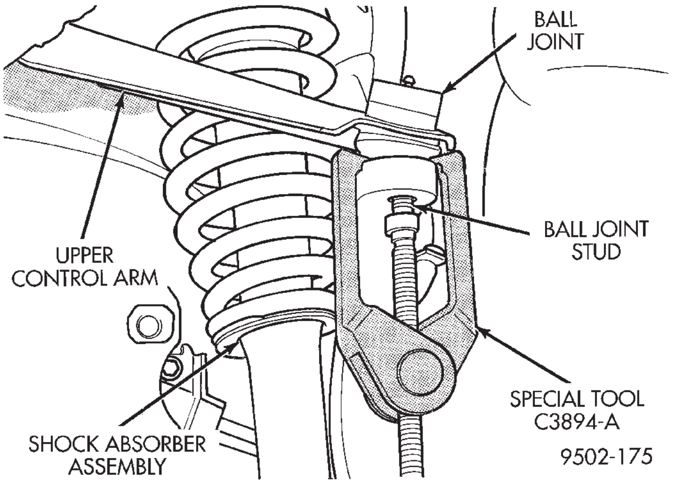


Fig. 43 Ball Joint Stud Removal From Steering Knuckle

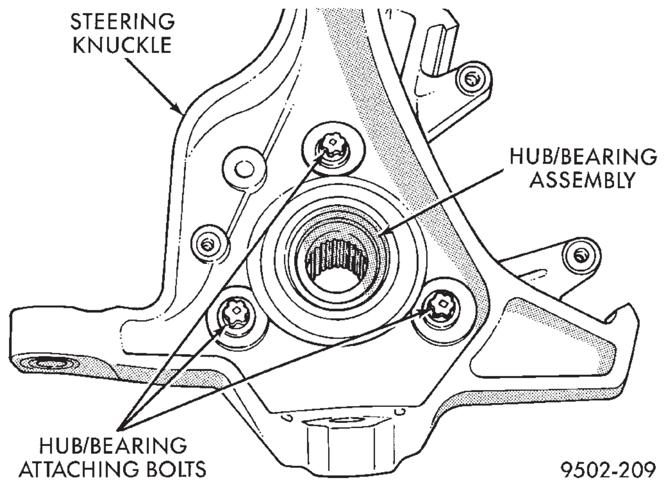


Fig. 44 Hub/Bearing Attaching Bolts

(24) Install the replacement hub/bearing assembly in steering knuckle aligning bolt boles in bearing flange with holes in steering knuckle.

(25) Install the 3 mounting bolts (Fig. 44) and tighten evenly to ensure bearing is square to face of steering knuckle. The tighten the 3 mounting bolts (Fig. 44) to a torque of 110 N·m (80 ft. lbs.).

INSTALLATION

(1) Slide drive shaft back into front hub/bearing assembly. Then install steering knuckle onto the ball joint stud in lower control arm.

(2) Install the steering knuckle to lower ball joint stud castle nut.

(3) Install upper ball joint stud in steering knuckle. Install the steering knuckle to upper ball joint stud castle nut. Using a crow foot and torque wrench, tighten the upper and lower ball joint castle nuts to the following torque specifications.

- Lower ball joint castle nut 74 N·m (55 ft. lbs.).
- Upper ball joint castle nut 62 N·m (45 ft. lbs.).

(4) If equipped with antilock brakes install the speed sensor cable routing bracket on the steering knuckle (Fig. 38) and securely tighten attaching bolt.

CAUTION: When installing tie rod on steering knuckle the heat shield (Fig. 45) must be installed. If heat shield is not installed, tie rod seal boot can fail due to excessive heat from brake rotor.

(5) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding the stud of the tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 36). Then using a crowfoot and 11/32 socket tighten the attaching nut to a torque of 61 N·m (45 ft. lbs.) (Fig. 45).

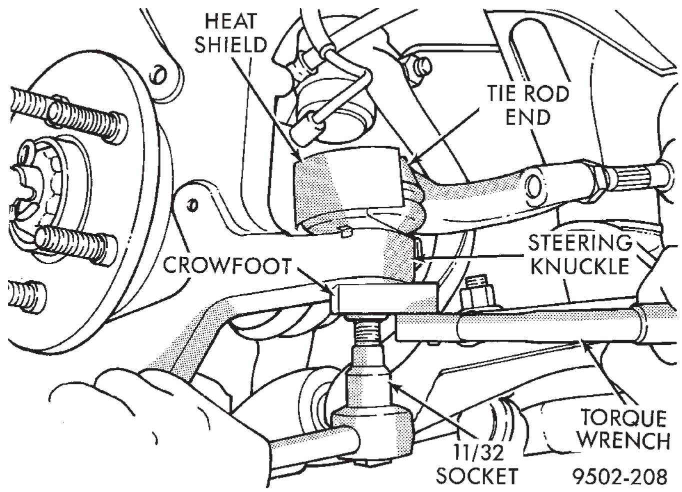


Fig. 45 Torquing Tie Rod End Attaching Nut

(6) Install braking disc back on hub and bearing assembly.

(7) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 33).

(8) Install disc brake caliper assembly to steering knuckle guide pin bolts (Fig. 32). Tighten caliper assembly guide pin bolts to a torque of 22 N·m (16 ft. lbs.).

(9) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install the washer and hub nut (Fig. 46) onto the stub axle and tighten nut.

(10) With vehicle brakes applied to keep stub axle from turning, tighten hub nut to a torque of 244 N·m (180 ft. lbs.) of torque (Fig. 47).

(11) Install the spring washer, hub nut lock, and a **new** cotter pin. Wrap cotter pin prongs tightly around the hub nut lock (Fig. 48).

(12) Install front wheel and tire assembly. Install front wheel lug nuts and tighten in correct sequence. Then tighten to a torque of 129 N·m (95 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

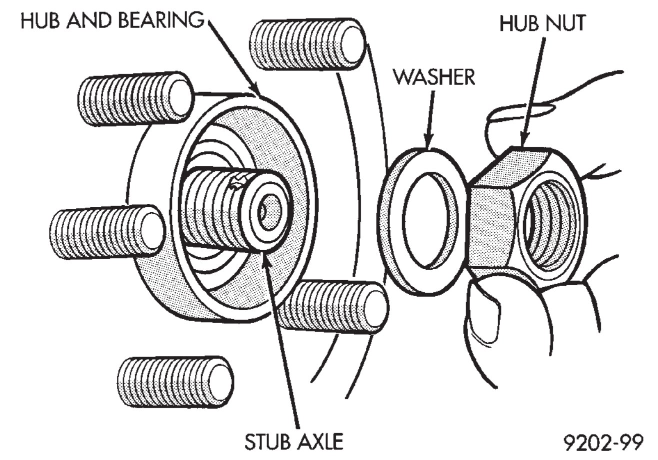


Fig. 46 Front Stub Axle Nut And Washer

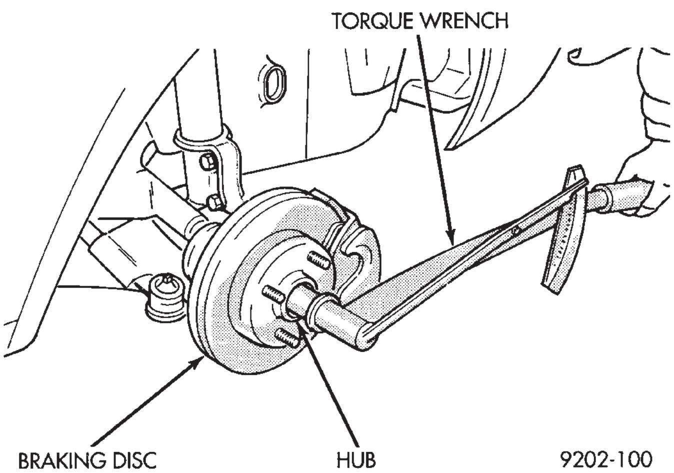


Fig. 47 Torquing Front Hub Nut

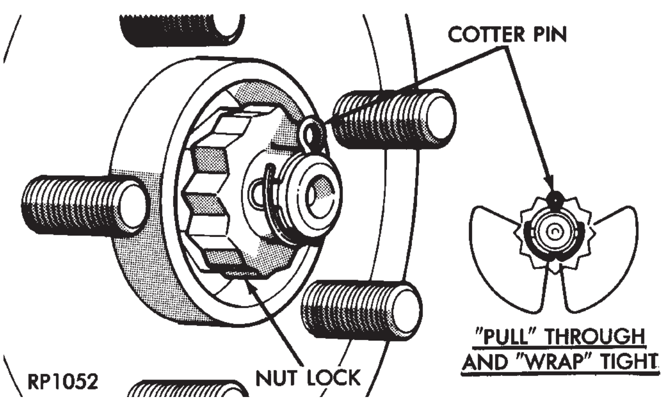


Fig. 48 Installing Spring Washer, Nut Lock And Cotter Pin

(13) Lower vehicle.

(14) Set front Toe on vehicle to required specification. Use procedure listed under Wheel Alignment, in the Front Suspension Service Procedures section of this service manual.

UPPER CONTROL ARM (FRONT)

REMOVAL

(1) Remove the front shock assembly from the vehicle. Refer to SHOCK ASSEMBLY (FRONT) in this section for the required procedure.

(2) Disassemble the shock assembly until the upper (shock absorber/upper control arm) mounting bracket is removed from the coil spring. Refer to SHOCK ASSEMBLY (FRONT) in the DISASSEMBLY AND ASSEMBLY section of this group for the required procedure.

(3) Remove the 2 bolts attaching the upper control arm to the bushings in the upper mounting bracket (Fig. 49).

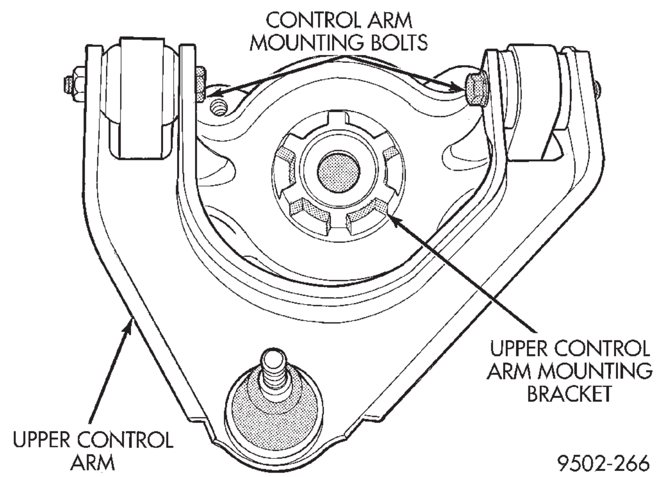


Fig. 49 Upper Control Arm To Mounting Bracket Attachment

(4) Remove the upper control arm from the mounting bracket.

INSTALLATION

(1) Install the upper control arm on the upper (shock absorber/upper control arm) mounting bracket.

(2) Install the 2 bolts attaching the upper control arm to the bushings in the mounting bracket (Fig. 49). The bolts must be installed from center, so the heads are toward the coil spring when it is installed. **Bolts MUST be installed so the head of the bolt will be toward the coil spring when the mounting bracket is installed on shock absorber (Fig. 49).**

CAUTION: For clearance reasons the control arm mounting bolts must be installed from center, so the heads are toward the coil spring when it is installed. Otherwise the bolts may rub the coil spring, damaging it.

REMOVAL AND INSTALLATION (Continued)

(3) Install the control arm mounting bolt nuts. Position the control arm at a 90 degree angle to the mounting bracket and tighten the bolts to a torque of 90 N·m (66 ft. lbs.).

(4) Reinstall the upper mounting bracket and control arm on the coil spring. Reassemble the front shock assembly. Refer to SHOCK ASSEMBLY (FRONT) in the DISASSEMBLY AND ASSEMBLY section of this group for the required procedure.

(5) Reinstall the front shock assembly on the vehicle. Refer to SHOCK ASSEMBLY (FRONT) in this section for the required installation procedure.

LOWER CONTROL ARM

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) **If the vehicle is equipped with 15 inch wheels the heat shield (Fig. 50) will need to be removed before the lower control arm can be separated from the steering knuckle. Use the following procedure to remove the heat shield.**

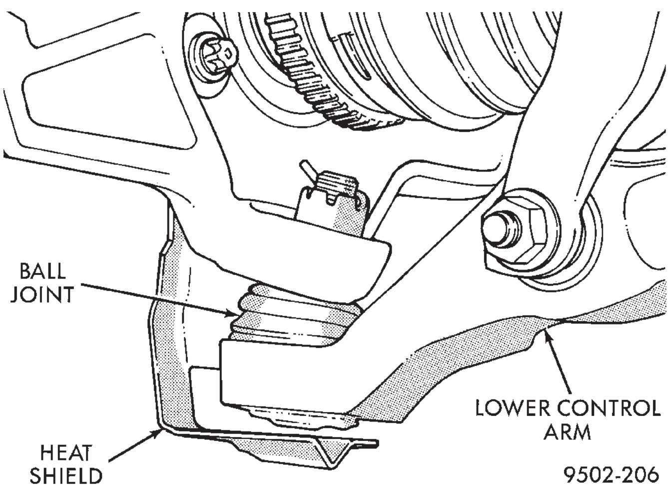


Fig. 50 Lower Ball Joint Heat Shield With 15 Inch Wheel

(4) Remove the 2 bolts attaching the disc brake caliper to the steering knuckle (Fig. 51). Remove the disc brake caliper from the steering knuckle. Using wire or an equivalent, hang caliper from upper control arm so weight of caliper is not supported by the brake flex hose (Fig. 52).

(5) Remove the 2 bolts attaching the heat shield (Fig. 50) to the steering knuckle. Remove heat shield from steering knuckle.

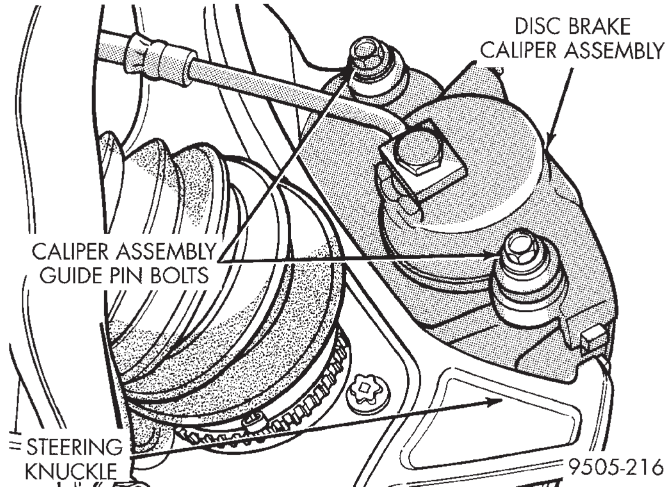


Fig. 51 Disc Brake Caliper Mounting

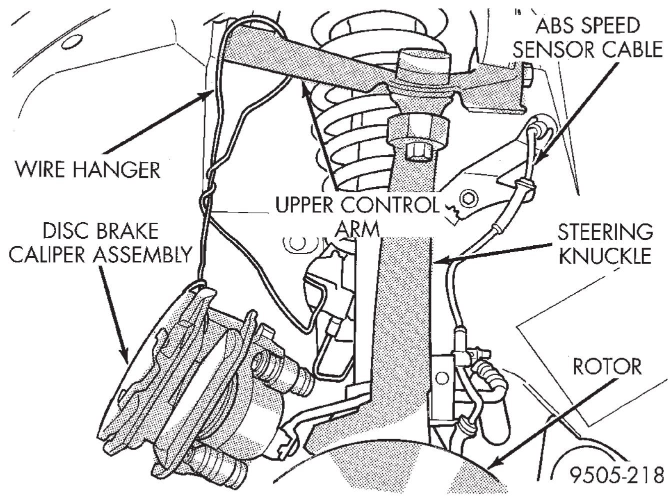


Fig. 52 Stored Disc Brake Caliper

(6) Remove brake rotor from front hub/bearing assembly.

(7) Remove cotter pin and castle nut (Fig. 53) from stud of lower ball joint.

CAUTION: No tool is to be inserted between the steering knuckle and the lower ball joint to separate the lower ball joint from the steering knuckle. The steering knuckle is to be separated from the ball joint only using the procedure as described in step Step 8 below.

(8) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel opening as possible (Fig. 54). Using a hammer strike steering knuckle boss (Fig. 54) until steering knuckle separates from the lower ball joint. **When striking steering knuckle care MUST be taken not to hit lower control arm or ball joint grease seal.**

REMOVAL AND INSTALLATION (Continued)

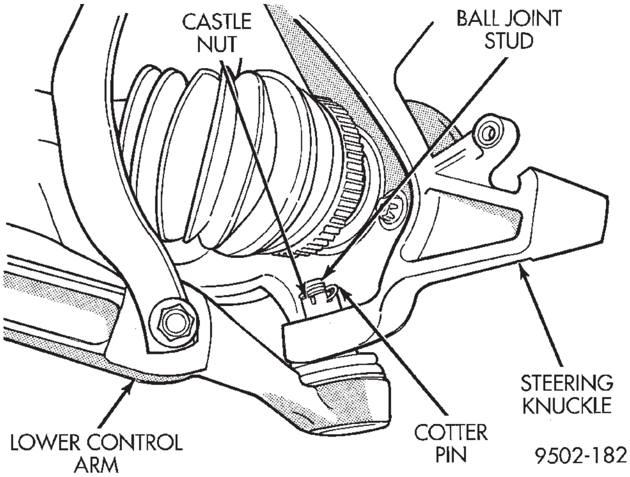


Fig. 53 Lower Ball Joint To Steering Knuckle Attachment

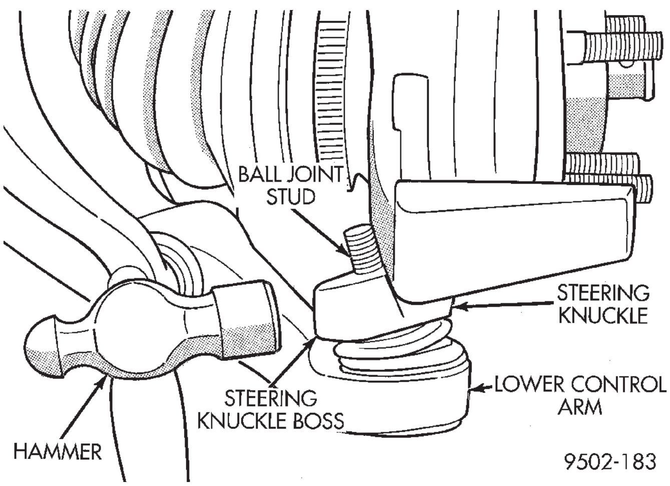


Fig. 54 Separating Lower Ball Joint Stud From Steering Knuckle

CAUTION: Pulling the steering knuckle outward from the vehicle after releasing it from the ball joint, can separate inner C/V joint. See Driveshafts.

(9) Remove the shock absorber clevis to lower control arm bushing thru-bolt. Separate clevis from lower control arm (Fig. 55).

(10) Remove nut attaching stabilizer bar link to lower control arm (Fig. 56). When removing nut, hold stud of stabilizer bar link from turning by inserting an allen wrench in the end of the stud (Fig. 56).

(11) Remove the bolts (Fig. 57) attaching one stabilizer bar bushing clamp to the front suspension crossmember and the body of the vehicle.

(12) Lower the one side of the stabilizer bar away from the lower control arm and body of vehicle.

(13) Remove the nut and bolt (Fig. 58) attaching the lower control arm to the front suspension crossmember.

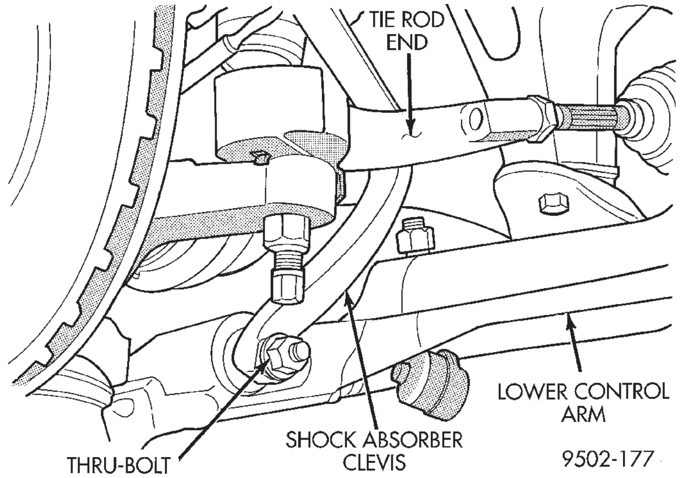


Fig. 55 Clevis To Lower Control Arm Attachment

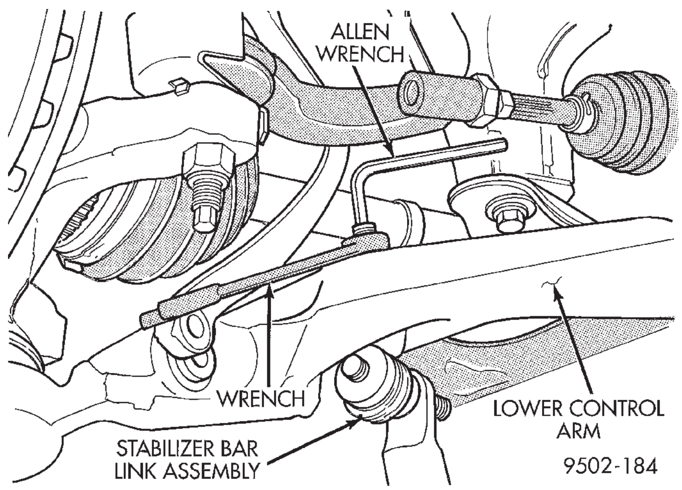


Fig. 56 Removing/ Installing Nut From Stud Of Stabilizer Link

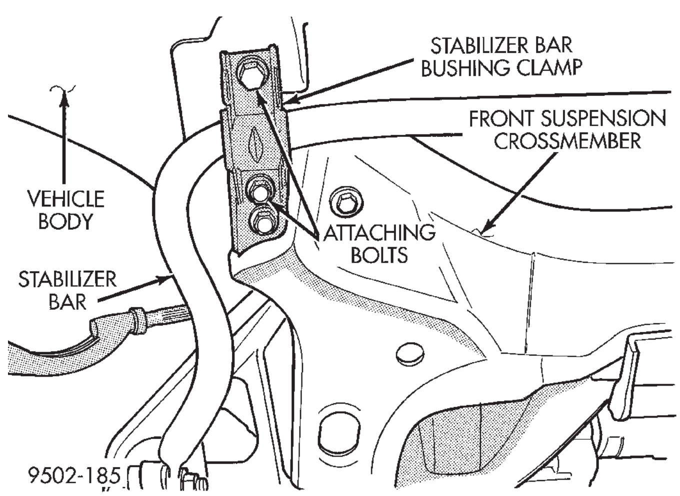


Fig. 57 Stabilizer Bar Bushing Clamp Attachment To Vehicle

REMOVAL AND INSTALLATION (Continued)

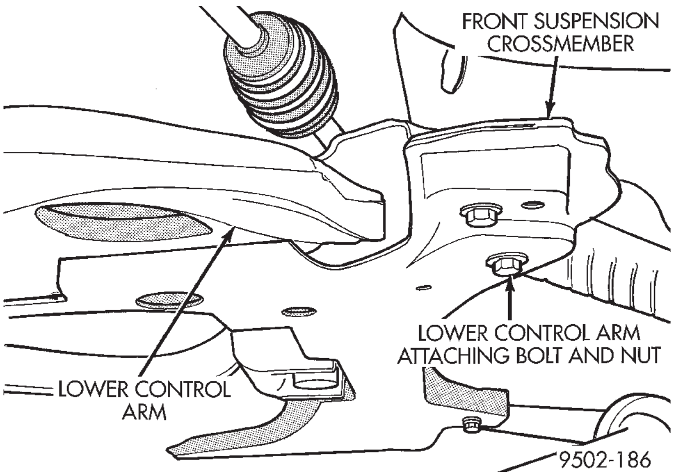


Fig. 58 Lower Control Arm Attachment To Front Suspension Crossmember

(14) Remove nut and bolt attaching the front of the lower control arm to the front suspension crossmember (Fig. 59).

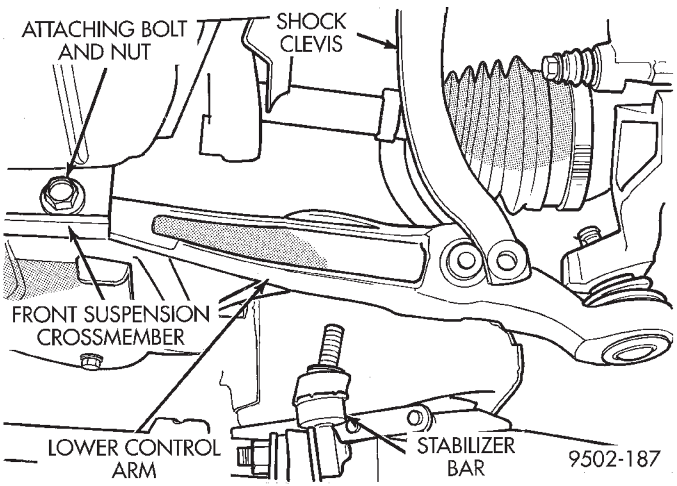


Fig. 59 Attaching Front Of Lower Control Arm To Suspension Crossmember

CAUTION: When removing lower control arm from crossmember care must be taken to prevent hitting lower ball joint seal against steering knuckle, causing damage to the ball joint seal.

(15) Remove the front of the lower control arm from the front suspension crossmember first.

(16) Then, remove the rear of the lower control arm from the front suspension crossmember. When removing rear of lower control arm from crossmember, keep control arm as level as possible. This will keep rear bushing from binding on crossmember making it easier to remove control arm from crossmember.

INSTALL

(1) Position rear of lower control arm into front suspension crossmember first. Then install front of lower control arm in front suspension crossmember. Install bolts and nuts (Fig. 58) and (Fig. 59) attaching the front and rear of lower control arm to front suspension crossmember. **Do not tighten front attaching bolt at this time**.

(2) Tighten rear lower control arm nut and bolt (Fig. 58) to a torque of 115 N·m (85 ft. lbs.).

(3) Install lower control arm ball joint stud into steering knuckle. Install steering knuckle to ball joint stud castle nut (Fig. 53). Torque castle nut to 74 N·m (55 ft. lbs.). Install cotter pin (Fig. 53) in ball joint.

(4) Position sway bar link into its lower control arm mounting hole.

(5) Align sway bar bushing clamp with mounting holes in front suspension crossmember and body of vehicle. Install and tighten the bushing clamp mounting bolts (Fig. 57) to a torque of 61 N·m (45 ft. lbs.).

NOTE: When tightening and torquing the attaching nut, hold stud of attaching link from turning by holding it with an allen wrench (Fig. 56).

(6) Install the stabilizer bar attaching link to lower control arm attaching nut. Tighten the attaching nut to a torque of 105 N·m (77 ft. lbs.).

(7) Install the clevis on the lower control arm. Loosely install the clevis to bushing thru-bolt (Fig. 55).

CAUTION: When supporting lower control arm with jack stand, do not position jack stand under the ball joint cap on the lower control arm. Position in area of lower control arm shown in (Fig. 60).

(8) Lower vehicle until jack stand positioned under lower control arm (Fig. 60) is supporting the vehicle. Continue to lower vehicle until the total weight of the vehicle is supported by the jack stand on the side of the vehicle with the tire removed and by the tire on the opposite side of the vehicle.

(9) **With the vehicle's suspension at curb height,** tighten the clevis to lower control arm bushing thru-bolt (Fig. 55) to a torque of 88 N·m (65 ft. lbs.).

(10) Tighten front lower control arm nut and bolt (Fig. 59) to a torque of 182 N·m (135 ft. lbs.).

(11) **If vehicle is equipped with 15 inch wheels the heat shield (Fig. 50) MUST be installed on steering knuckle and mounting bolts securely tighten before rotor and caliper is installed on steering knuckle.**

(12) Install rotor on hub/bearing assembly.

REMOVAL AND INSTALLATION (Continued)

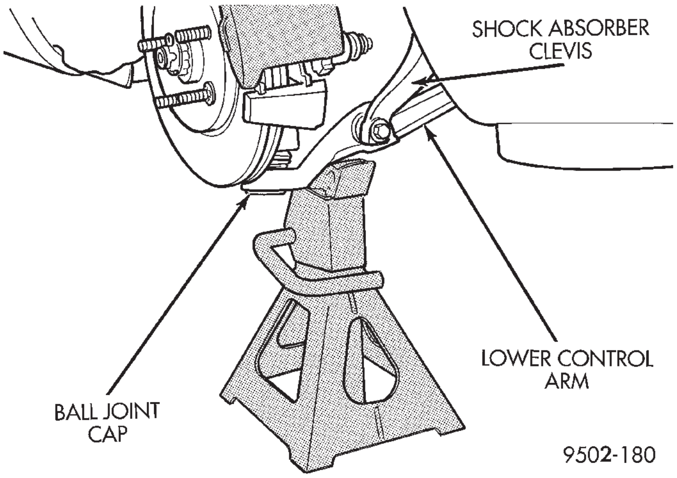


Fig. 60 Supporting Lower Control Arm With Jack Stand

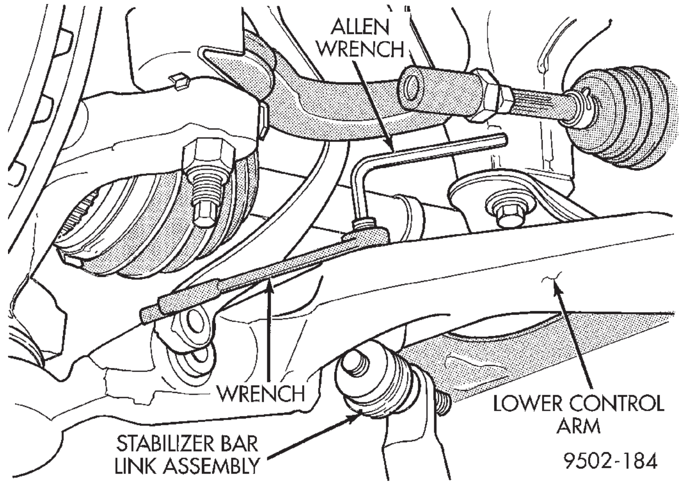


Fig. 61 Stabilizer Bar Attaching Link Nut Removal

(13) Install disc brake caliper on steering knuckle. Install and tighten the disc brake caliper mounting bolts (Fig. 51) to a torque of 22 N·m (16 ft. lbs.).

(14) Install wheel and tire assembly.

(15) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(16) Remove jack stand from under lower control arm and lower vehicle to the ground.

(17) Check the vehicles alignment specifications and set front Toe to preferred specifications.

STABILIZER BAR (FRONT)

REMOVAL

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove nuts and stabilizer bar attaching link assemblies from the front lower control arms (Fig. 61). When removing attaching link nut, keep stud from turning by installing a hex wrench in the end of the stud (Fig. 61).

(3) Remove the 4 bolts attaching the stabilizer bar bushing retainers to the front suspension crossmember and body (Fig. 62). Then remove the stabilizer bar assembly from the vehicle.

STABILIZER BAR INSPECTION

Inspect for broken or distorted stabilizer bar bushings, clamps and attaching links. If stabilizer bar to front crossmember bushing replacement is required, bushing can be removed using following procedure.

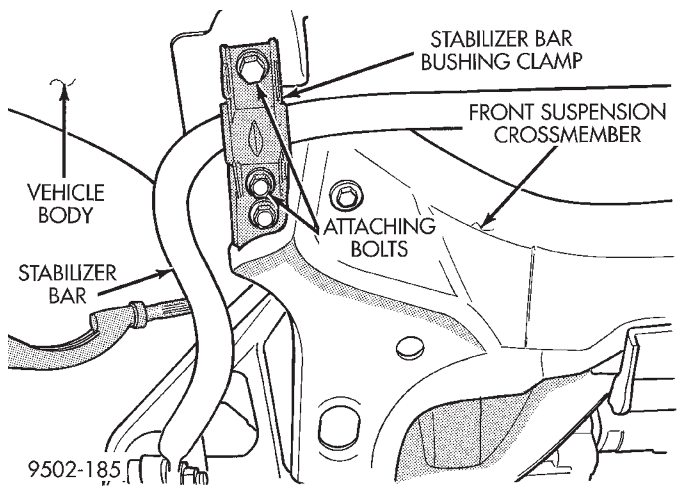


Fig. 62 Stabilizer Bar Bushing Retainer Attaching Bolts

If inspection determines that replacement of a stabilizer bar to lower control arm attachment link is required, replace the link before installing stabilizer bar.

INSTALLATION

(1) Position stabilizer bar and bushings as an assembly into front crossmember. Install the stabilizer bar bushing retainer to crossmember and body attaching bolts (Fig. 62). Tighten the retainer bolts going through the crossmember to 163 N·m (120 ft. lbs.). Tighten the retainer bolts going to the body to 61 N·m (45 ft. lbs.).

(2) Align stabilizer bar attaching link assemblies with attaching link mounting holes in the lower control arms. Install stabilizer bar attaching links into both lower control arms. Install the attaching link to lower control arm retaining nuts. Torque the stabilizer bar attaching link nuts to 105 N·m (78 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

WHEEL MOUNTING STUDS (FRONT)

CAUTION: If a wheel mounting stud needs to be replaced in the hub and bearing assembly, DO NOT hammer the studs out of the hub flange. If a stud is removed by hammering it out of the bearing flange, damage to the hub and bearing assembly will occur leading to premature bearing failure.

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the front wheel and tire assembly from the vehicle.

(3) Remove front disc brake caliper to steering knuckle attaching bolts (Fig. 63).

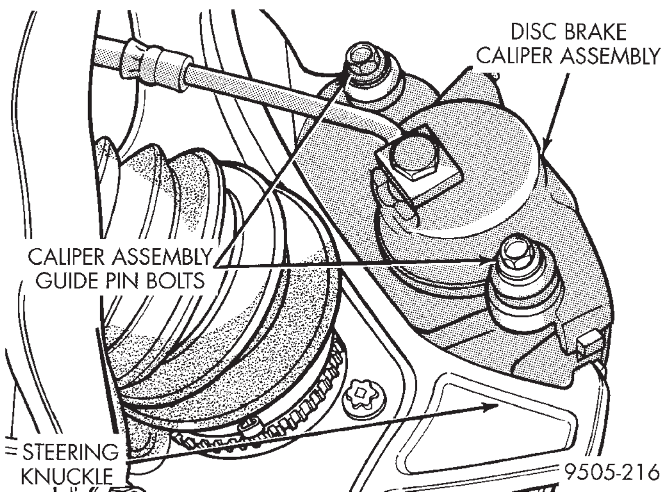


Fig. 63 Brake Caliper Attaching Bolts

(4) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 64).

(5) Support brake caliper/adapter assembly using a wire hook and not by hydraulic hose (Fig. 65).

(6) Remove braking disc from front hub (Fig. 66).

(7) Install a lug nut on wheel stud to be removed from hub and bearing assembly, (Fig. 67) so threads on stud are even with end of lug nut. Rotate hub so stud requiring removal is aligned with notch cast into front of steering knuckle. Install Remover, Special Tool C-4150 on hub and bearing assembly flange and wheel stud (Fig. 67).

(8) Tighten down on special tool, this will push the wheel stud out of the hub and bearing flange.

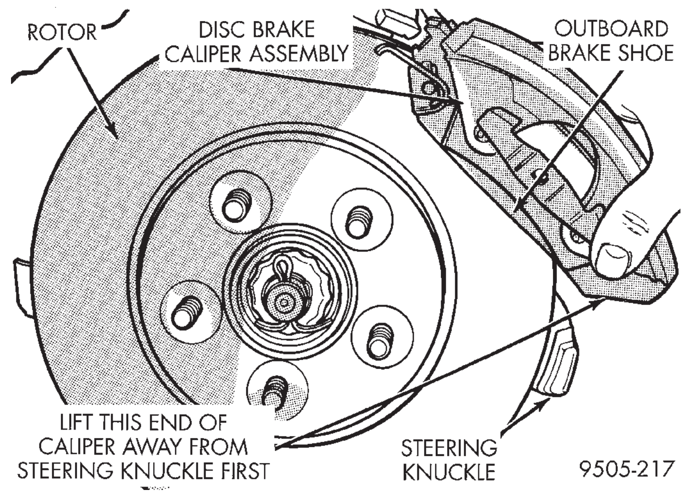


Fig. 64 Brake Caliper Assembly Removal And Installation

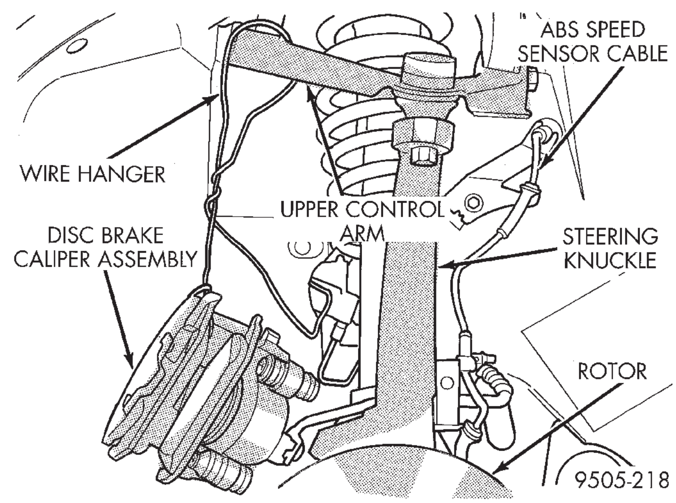


Fig. 65 Supporting Brake Caliper

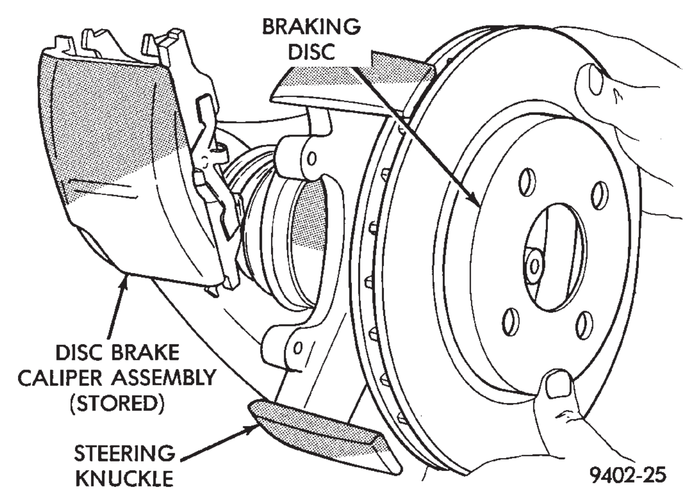


Fig. 66 Removing/Installing Front Braking Disc

REMOVAL AND INSTALLATION (Continued)

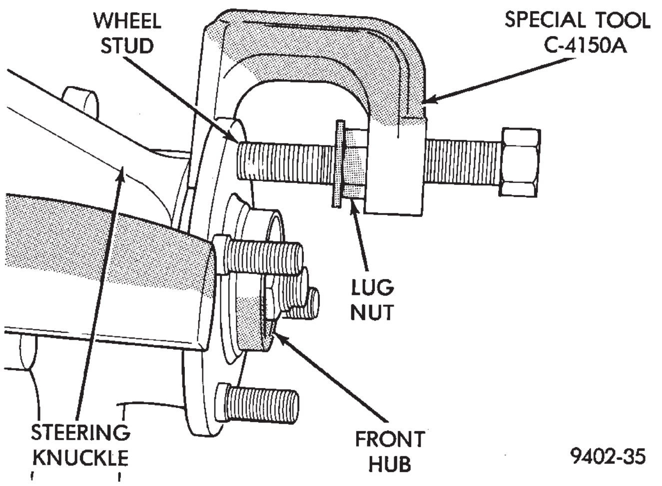


Fig. 67 Removing Wheel Stud From Hub And Bearing

INSTALLATION

(1) Install replacement wheel stud into flange of hub and bearing assembly. Install washers on wheel stud, then install a wheel lug nut on stud with flat side of lug nut against washers (Fig. 68).

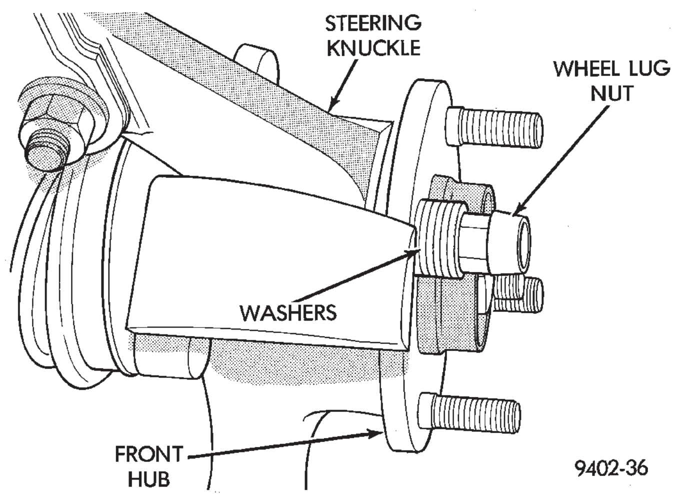


Fig. 68 Installing Wheel Stud Into Hub

(2) Tighten the wheel lug nut, pulling the wheel stud into the flange of the hub and bearing assembly. When the head of the stud is fully seated against the bearing flange, remove lug nut and washers from wheel stud.

(3) Install braking disk back on front hub (Fig. 66).

(4) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 64).

(5) Install disc brake caliper assembly to steering knuckle attaching bolts (Fig. 63) and torque to 31 N·m (23 ft. lbs.).

(6) Install front wheel and tire assembly. Install front wheel lug nuts and torque to 129 N·m (95 ft.lbs.).

(7) Lower vehicle.

DISASSEMBLY AND ASSEMBLY

SHOCK ASSEMBLY (FRONT)

The shock assembly must be removed from the vehicle for it to be disassembled and assembled. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

For the disassembly and assembly of the shock assembly, use strut spring compressor Pentastar Service Equipment (PSE) tool W-7200, or the equivalent, to compress the coil spring. Follow the manufacturer's instructions closely.

DISASSEMBLY

(1) If both shocks are being serviced at the same time, mark the coil spring and shock assembly according to which side of the vehicle the shock was removed from, and which shock the coil spring was removed from.

(2) Position the shock assembly in the strut coil spring compressor following the manufacturer's instructions. Set the lower hooks and install the clamp on the lower end of the coil spring, so the shock is held in place once the shock shaft nut is removed (Fig. 69). Rotate the shock assembly so the upper control arm ball joint sits directly below the front upper hook as shown (Fig. 70). Position the upper hooks on top of the upper mounting bracket (Fig. 70).

WARNING: DO NOT REMOVE THE SHOCK ROD NUT BEFORE THE COIL SPRING IS COMPRESSED. THE COIL SPRING IS HELD UNDER PRESSURE AND MUST BE COMPRESSED, REMOVING SPRING TENSION FROM THE UPPER MOUNTING BRACKET BEFORE THE ROD NUT IS REMOVED.

(3) Compress the coil spring until all coil spring tension is removed from the upper mounting bracket.

(4) Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and remove the retainer nut (Fig. 71).

(5) Remove the upper bushing retainer washer (Fig. 72) from the shock absorber rod.

(6) Remove the clamp from the bottom of the coil spring and remove the shock absorber, lower spring isolator, jounce bumper, cup, dust boot, and lower

DISASSEMBLY AND ASSEMBLY (Continued)

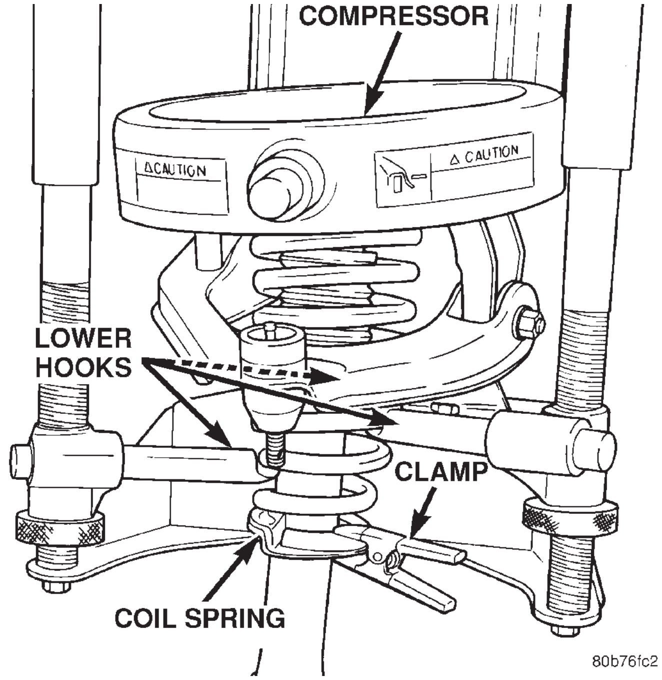


Fig. 69 Lower Hooks And Clamp

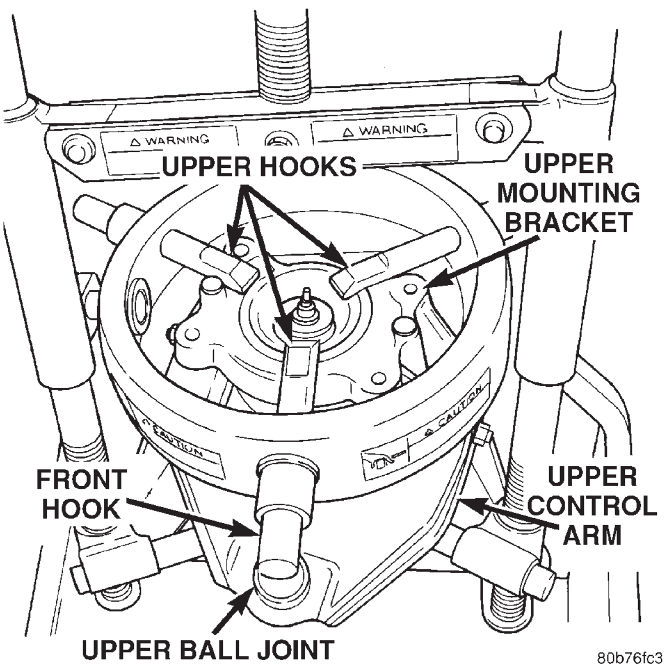


Fig. 70 Upper Hooks Positioned

bushing retainer washer out through the bottom of the coil spring.

NOTE: If the coil spring, upper mounting bracket, rod bushings, upper coil spring isolator, or upper control arm need to be serviced, proceed with the next step, otherwise, proceed with step 11.

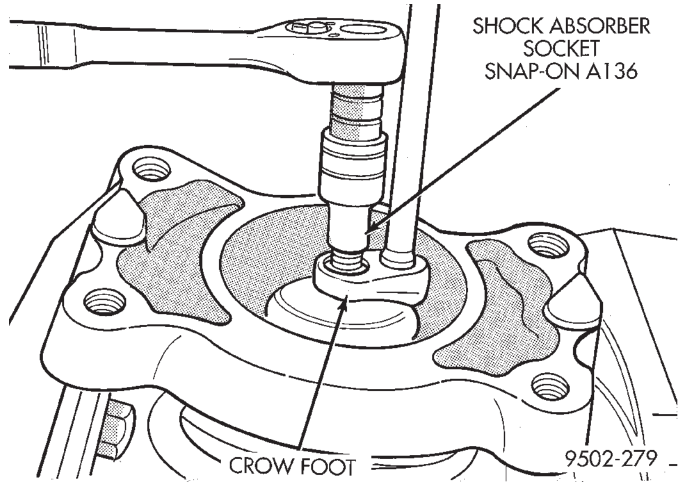


Fig. 71 Retainer Nut Removal/Installation

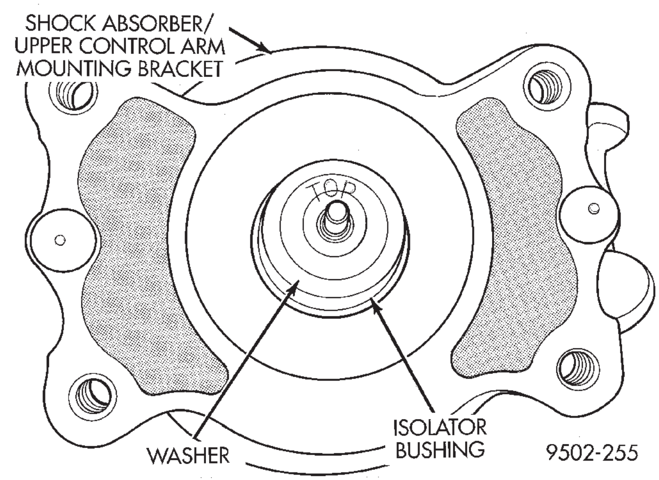


Fig. 72 Washer

NOTE: Before removing the coil spring from the spring compressor, note the position of the lower coil spring end to the spring compressor. The coil spring will need to be in this position on reassembly for proper coil spring-to-shock absorber and upper mounting bracket orientation.

(7) Release the tension from the coil spring by backing off the compressor drive fully. Push back the compressor upper hooks and remove the upper mounting bracket and upper control arm from the coil spring.

(8) Note the position of the coil spring in the spring compressor as listed in the above note before removal. This is necessary for proper alignment of the shock assembly components when reassembly is made. Remove the coil spring from the spring compressor.

(9) Remove the shock absorber rod upper isolator bushing from the upper (shock absorber/upper control arm) mounting bracket (Fig. 73).

DISASSEMBLY AND ASSEMBLY (Continued)

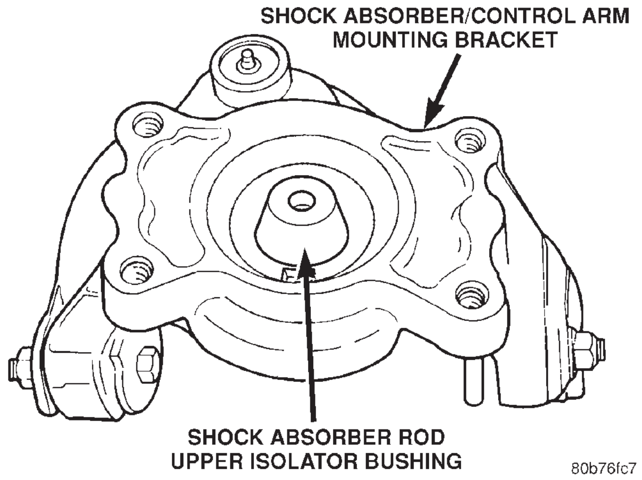


Fig. 73 Shock Absorber Rod Upper Isolator Bushing

(10) Remove the shock absorber rod lower isolator bushing and sleeve from the upper (shock absorber/ upper control arm) mounting bracket (Fig. 74). Remove upper coil spring isolator from mounting bracket.

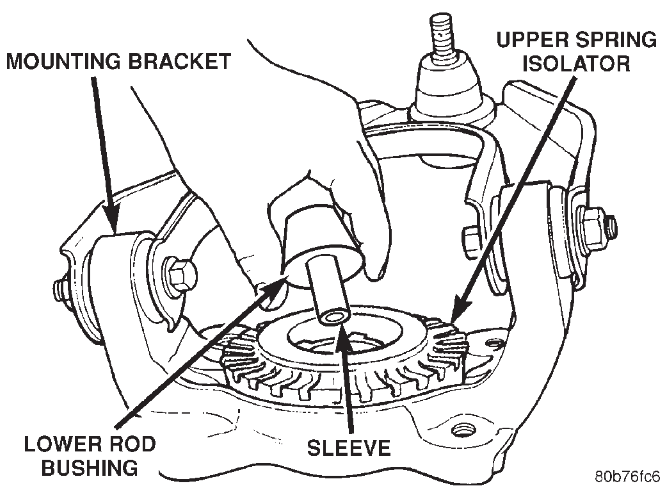


Fig. 74 Shock Absorber Rod Lower Isolator Bushing

NOTE: If removal of the upper control arm is necessary, refer to UPPER CONTROL ARM in the REMOVAL AND INSTALLATION section of this group.

(11) Remove the lower shock rod bushing retainer washer from the shock absorber rod (Fig. 75).

(12) Remove the dust shield and cup as an assembly from the shock absorber rod by pulling both straight up and off the shock rod (Fig. 75). The jounce bumper may come off at the same time. Remove the jounce bumper and metal collar.

(13) Remove the lower spring isolator (Fig. 75) from the lower spring seat on the shock absorber.

(14) Inspect the shock assembly components for the following and replace as necessary:

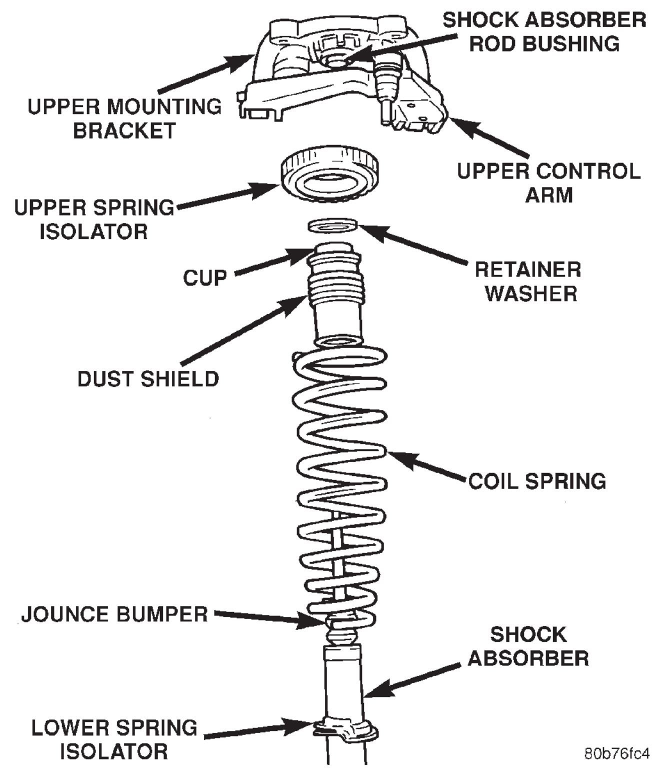


Fig. 75 Shock Assembly Components

- Inspect the shock for any condition of rod binding over the full stroke of the shaft.
- Check the upper mounting bracket for cracks, distortion and any sign of damage.
- Inspect the upper mounting bracket-upper control bushings for deterioration of the rubber.
- Check the upper and lower shock rod isolator bushings for severe deterioration of the rubber.
- Check the upper and lower spring isolators for severe deterioration of the rubber.
- Inspect the dust shield for rips and deterioration.
- Inspect the jounce bumper for cracks and signs of deterioration.
- Inspect the coil spring for any sign of damage to the coating.

ASSEMBLY

NOTE: If the coil spring, upper mounting bracket, rod bushings, upper coil spring isolator, and upper control arm have been removed from the spring compressor, proceed with the next step, otherwise, proceed with step 7.

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: If installation of the upper control arm on the upper mounting bracket is necessary, refer to UPPER CONTROL ARM in the REMOVAL AND INSTALLATION section of this group to reinstall the upper control arm on the upper mounting bracket before proceeding.

(1) Install the upper coil spring isolator on the upper (shock absorber/upper control arm) mounting bracket.

(2) Install the sleeve into the lower shock absorber rod isolator bushing (both upper and lower rod bushings are identical) (Fig. 74). The smaller end end of each bushing is to face away from the upper mounting bracket. Install the shock absorber rod lower isolator bushing and sleeve in the bottom of the upper (shock absorber/upper control arm) mounting bracket as shown (Fig. 74). From the top, install the shock absorber rod upper isolator bushing into the center of the upper mounting bracket over the sleeve protruding from the lower isolator bushing (Fig. 73).

(3) Place the lower end (smaller diameter) of the coil spring in the spring compressor supported by the lower hooks, following the manufacturer's instructions. Position the coil spring lower end tip at the position it was at before coil spring removal from the compressor as noted in step of DISASSEMBLY. Proper orientation of the spring in the compressor is necessary for proper alignment of all shock assembly components.

(4) Install the upper (shock absorber/upper control arm) mounting bracket on top of the coil spring matching the coil spring to its isolator on the upper mounting bracket. Position the upper control arm ball joint so it lies directly below the front upper hook as shown (Fig. 70).

(5) Position the upper hooks on top of the upper mounting bracket as shown (Fig. 70).

(6) Compress the coil spring.

(7) Install the lower spring isolator on the lower spring seat of the shock absorber (Fig. 75). When installing the spring isolator, be sure the isolator sets in the notch made for the lower coil spring end.

(8) Install the jounce bumper on the shock rod (Fig. 76). Install the jounce bumper with the pointed end pointing downward.

(9) Install the collar, undercut side facing down, on the rod of the shock absorber (Fig. 77). Be sure the collar is positioned squarely on the step of the shock absorber rod.

(10) Install the dust shield and cup (Fig. 75) onto the shock rod until the cup contacts the collar just installed. The dust boot will snap over the jounce bumper. Install the lower shock rod bushing retainer washer.

(11) Install the shock through the bottom of the coil spring until the lower spring seat contacts the lower end of the coil spring. The lower coil spring end should set into the notch of the shock absorber lower seat and isolator. Install the clamp temporarily securing the shock absorber to the coil spring (Fig. 69).

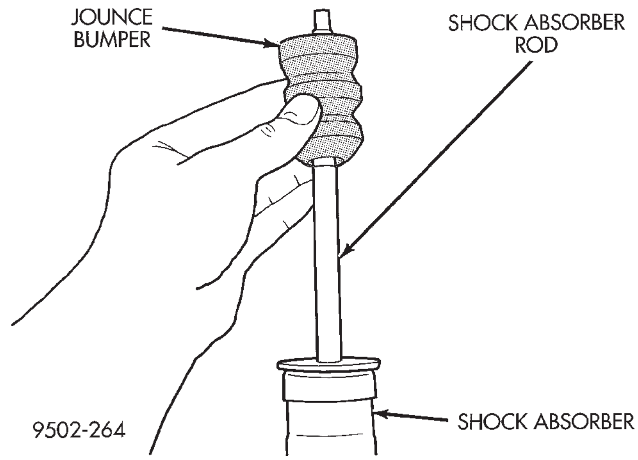


Fig. 76 Jounce Bumper Installation

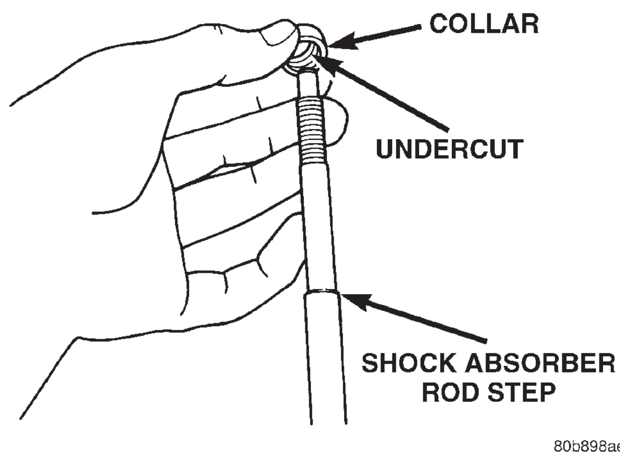


Fig. 77 Shock Absorber Rod Collar Installation

(12) Install the upper shock rod bushing retainer washer. Make sure the concave side is facing up.

(13) Install the shock assembly retainer nut. Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and tighten the retainer nut using a crow foot wrench (on the end of a torque wrench and extension) to a torque of 45 N·m (33 ft. lbs.) (Fig. 71).

(14) Slowly release the tension from the coil spring by backing off the compressor drive fully. As the tension is relieved, make sure the upper mounting bracket, isolator, and coil spring align properly. Remove the clamp from the lower end of the coil spring and shock. Push back the spring compressor upper and lower hooks, then remove the shock assembly from the spring compressor.

DISASSEMBLY AND ASSEMBLY (Continued)

(15) Install shock assembly on the vehicle. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

BALL JOINT SEAL BOOT (FRONT UPPER)

(1) Using a screw driver or other suitable tool, pry seal boot off of the ball joint assembly (Fig. 78).

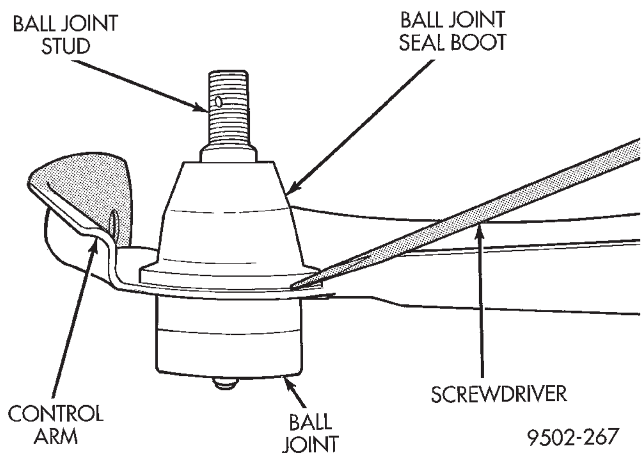


Fig. 78 Seal Boot Removal From Ball Joint

(2) Install a **NEW** ball joint assembly sealing boot on ball joint assembly. Install sealing boot as far as possible on ball joint assembly.

CAUTION: Do not use an arbor press to install the sealing boot on the upper control arm ball joint assembly. Damage to the sealing boot can occur do to excessive pressure applied to sealing boot when being installed.

(3) Position Receiving Cup, Special Tool 6758 over sealing boot so it is aligned properly with bottom edge of sealing boot (Fig. 79). Apply pressure **BY HAND** to special tool 6758, until sealing boot is pressed squarely against surface of upper control arm.

(4) Properly lubricate the upper ball joint assembly using only Mopar Multi-Mileage Lube or an equivalent.

BALL JOINT SEAL BOOT (LOWER)

CAUTION: The replacement of the lower ball joint seal boot can only be done in the event that the seal boot is damaged while performing a service procedure on the vehicle.

CAUTION: Under no circumstances can a lower ball joint seal boot be replaced if it is determined that the vehicle had been driven with the seal boot damaged. If the vehicle has been driven with a damaged

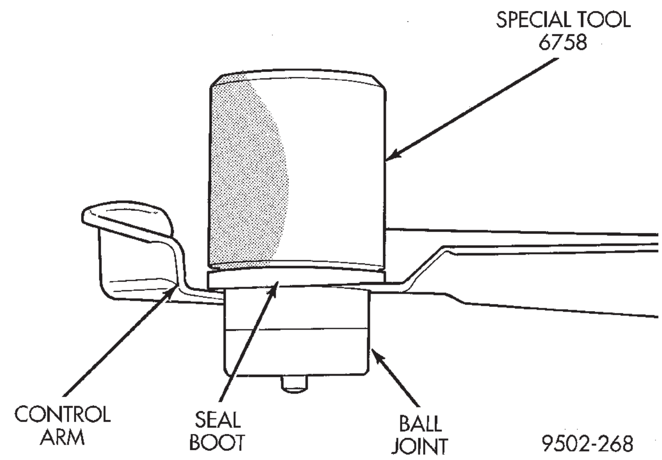


Fig. 79 Seal Boot Installation On Ball Joint

seal boot contamination of the ball joint has occurred. When contamination of the ball joint has occurred the lower control arm must be replaced. This is to ensure excessive wear of the ball joint does not occur from the contamination present in the ball joint.

CAUTION: Excessive wear in the ball joint can lead to a separation of the ball joint from the lower control arm.

CAUTION: The procedure below must be carefully followed when replacing the ball joint seal in the event it is damaged while servicing a vehicle.

CAUTION: The ball joint used in the lower control arm of this vehicle is a lubricated for life ball joint. This ball joint does not required any additional lubrication for the life of the vehicle. Do not alter the lower control arm or ball joint in an attempt to lubricate the lower control arm ball joint. If it is determined that the ball joint is lacking proper lubrication, the lower control arm will need to be replaced.

DISASSEMBLE

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

(2) Wrap a shop towel around the ball joint and seal boot. This is to prevent dirt and cleaning solvent to enter ball joint when cleaning area around ball joint.

(3) Using **ONLY** a solvent such as Mopar Foamy Engine Degreaser or an equivalent, thoroughly clean

DISASSEMBLY AND ASSEMBLY (Continued)

lower control arm in area around ball joint and seal. Then using a shop towel saturated with the engine degreaser, carefully wipe off the ball joint seal boot.

(4) Using 2 screwdrivers (Fig. 80) remove the ball joint seal retaining ring from the bottom of the ball joint seal.

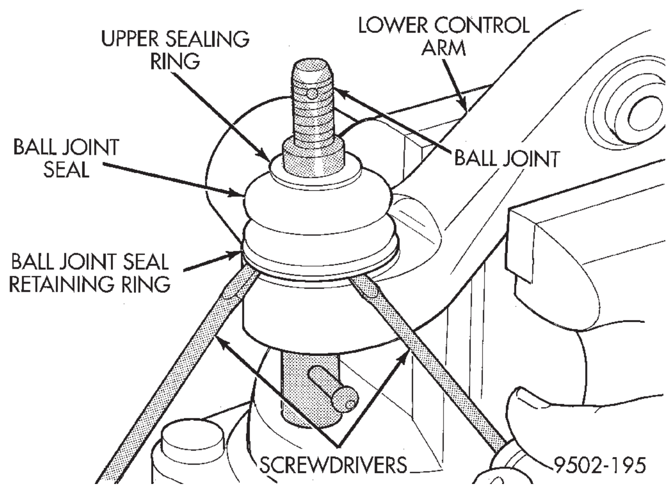


Fig. 80 Removing Ball Joint Seal Retaining Ring

(5) Remove ball joint seal from ball joint.

ASSEMBLE

CAUTION: When replacing ball joint seal, do not use any other type of grease to lubricate ball joint other than the lubricant provided in the Mopar Ball Joint Seal service kit.

(1) Apply grease from the ball joint seal kit, to the specified areas of the ball joint stud and seal (Fig. 81). Be sure no grease is present on the seal boot installation section of the seal boot or lower control arm (Fig. 81).

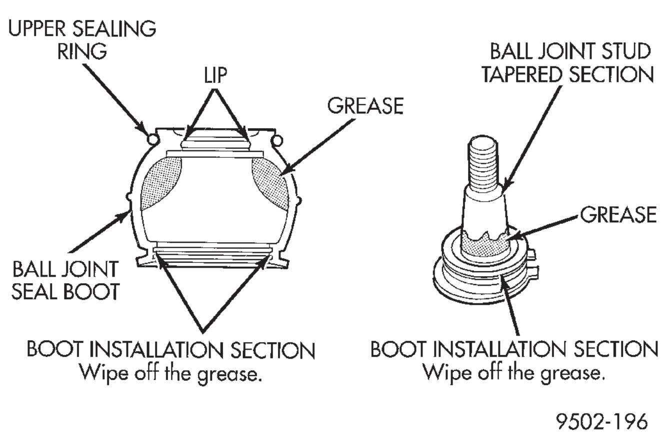


Fig. 81 Grease Correctly Applied To Ball Joint Stud And Seal Boot

(2) Slide ball joint seal boot with upper seal ring installed, (Fig. 81) down tapered section of ball joint stud (Fig. 81). Seal boot is to be installed on stud of ball joint until seal boot is sitting on seal groove in lower control arm.

(3) Carefully position ball joint seal boot in seal retaining groove on lower control arm. After installing seal boot in retaining groove, carefully bleed air out of sealing boot without getting grease pushed into seal boot retaining groove in lower control arm.

(4) Place Retaining Ring Installer, Special Tool, 6875-1 over ball joint seal boot (Fig. 82). Using adjusting knob, adjust tool so bottom edge of tool is even with top of retaining ring groove in seal boot (Fig. 82).

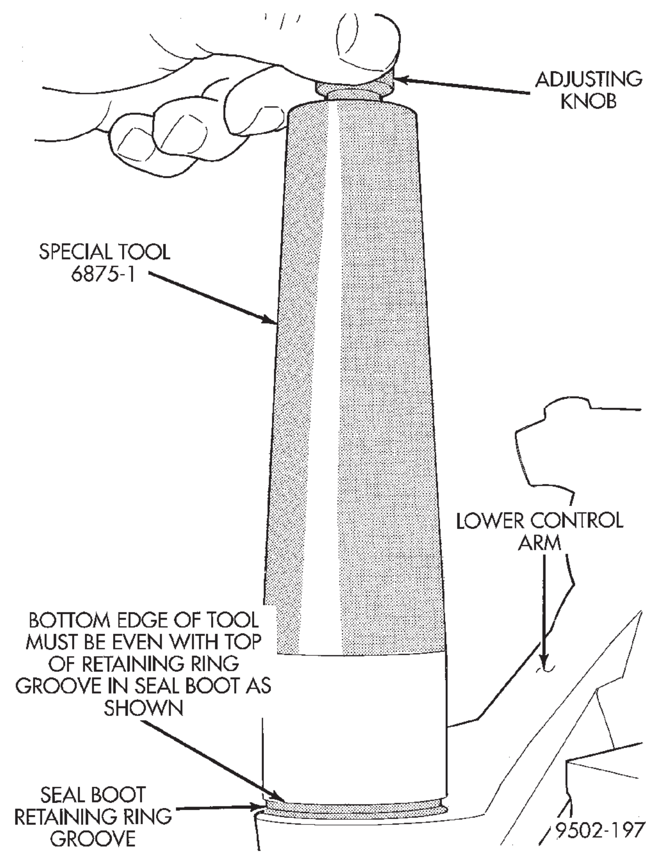


Fig. 82 Correctly Installed Ball Joint Seal Retaining Ring Tool

(5) Place seal boot retaining ring on Installer, Special Tool, 6875- 1 (Fig. 83). Then place expandable collar from Installer, Special Tool, 6875 over tapered cone of the special tool (Fig. 83).

(6) Using the expandable collar of Installer, Special Tool, 6875 (Fig. 84) push the seal boot retaining ring down the cone of Installer, Special Tool, 6875.

(7) Continue pushing retaining ring down Installer, Special Tool, 6875, until it is installed in the retaining ring groove of the seal boot (Fig. 85).

DISASSEMBLY AND ASSEMBLY (Continued)

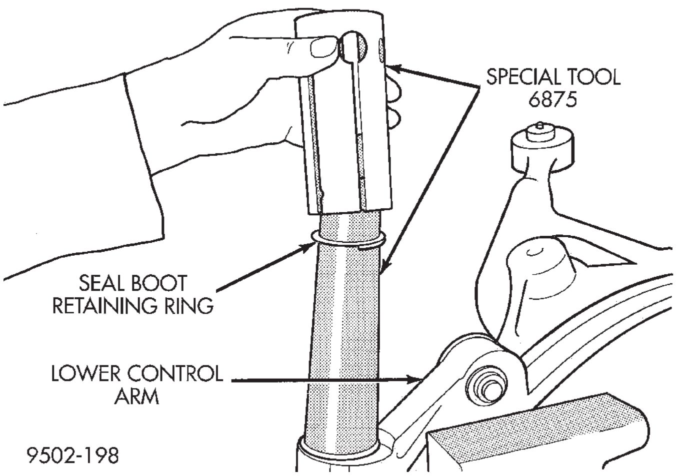


Fig. 83 Retaining Ring And Expandable Collar Installed On Tool

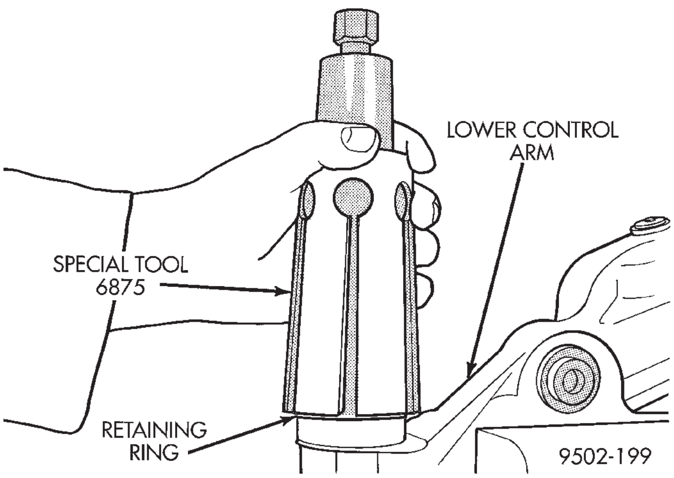


Fig. 84 Installing Seal Boot Retaining Ring

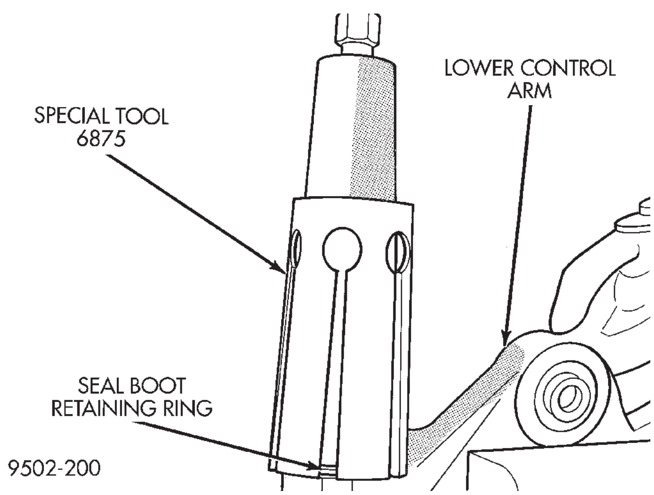


Fig. 85 Retaining Ring Installed In Ball Joint Seal Boot

(8) Remove Installer, Special Tool, 6875 from the ball joint seal boot. **When removing tool from seal boot be careful not to damage the seal boot with the tool.**

(9) Check retaining ring installation on seal boot to ensure it is fully seated in seal boot groove and the ends are not twisted (Fig. 86). Also, make sure upper sealing ring is on seal boot and correctly installed (Fig. 86). Check seal boot for damage before installing back on car.

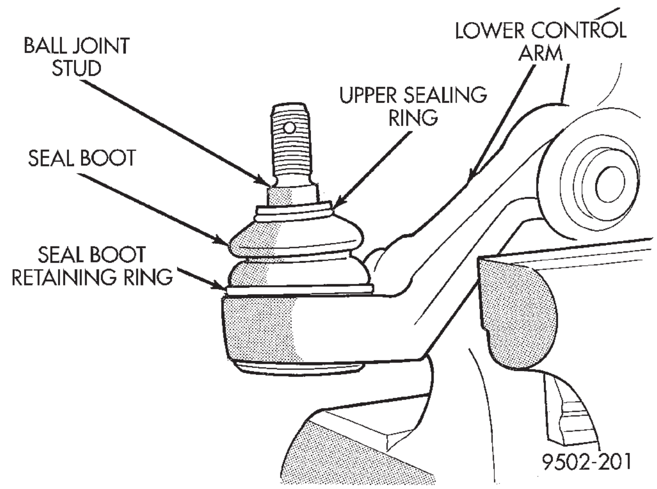


Fig. 86 Properly Installed Ball Joint Seal Boot

(10) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

LOWER CONTROL ARM FRONT ISOLATOR BUSHING

To perform removal and replacement of the lower control arm isolator bushings, the lower control arm must be removed from the vehicle.

DISASSEMBLY

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

(2) Install Bushing Remover, Special Tool 6602-5 and Bushing Receiver, Special Tool MB-990799 on Special Tool C-4212-F.

(3) Install lower control arm on Special Tools assembled for removal of the front isolator bushing. Be sure Special Tool MB-990799 is square on lower control arm and Special Tool 6602-5 is positioned correctly on isolator bushing (Fig. 87).

(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press front bushing out of lower control arm.

DISASSEMBLY AND ASSEMBLY (Continued)

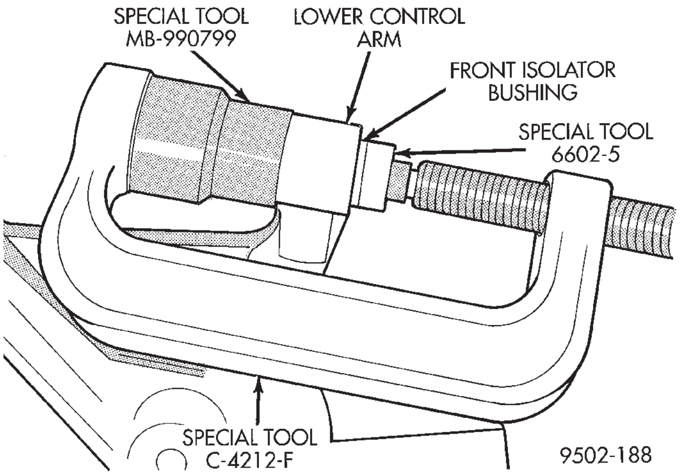


Fig. 87 Removing Front Bushing From Lower Control Arm

ASSEMBLY

(1) Mount Bushing Installer, Special Tool 6876 on screw portion of Remover/Installer Special Tool C-4212-F (Fig. 88).

(2) Start front bushing into lower control arm **by hand, making sure it is square with its mounting hole in the lower control arm.** Bushing is to be installed in lower control arm from the machined surface side of lower control arm bushing hole.

(3) Install lower control arm on Special Tools assembled for installation of front isolator bushing into lower control arm (Fig. 88). Be sure Special Tool 6758 is square on lower control arm and Special Tool 6876 is positioned correctly on isolator bushing.

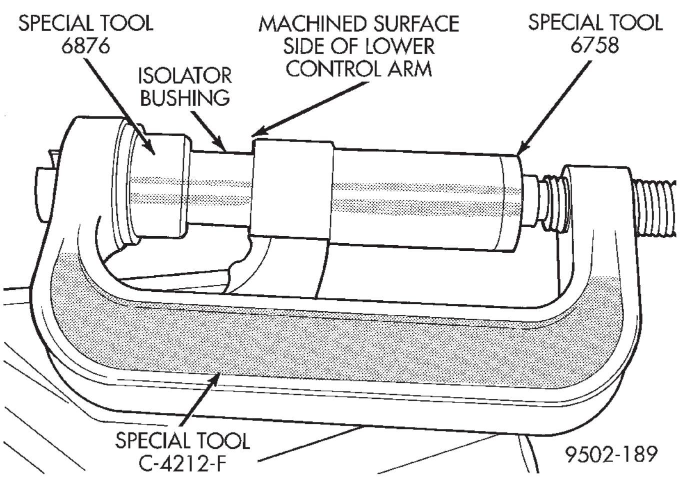


Fig. 88 Installing Front Bushing In Lower Control Arm

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing front bushing into lower control arm. Continue pressing front bushing into lower control arm until bushing is sitting flush on the machined surface of the lower control arm. This will correctly position front bushing in lower control arm.

(5) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

LOWER CONTROL ARM REAR ISOLATOR BUSHING

To perform removal and replacement of the lower control arm isolator bushings, the lower control arm must be removed from the vehicle.

DISASSEMBLY

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

(2) Install Bushing Remover, Special Tool 6756 and Bushing Receiver, Special Tool C-4366-2 on Special Tool C-4212-F (Fig. 89).

(3) Install Special Tools assembled for removal of the rear isolator bushing on the lower control arm. Be sure Special Tool C-4366-2 is square on lower control arm and Special Tool 6756 is positioned correctly on isolator bushing (Fig. 89).

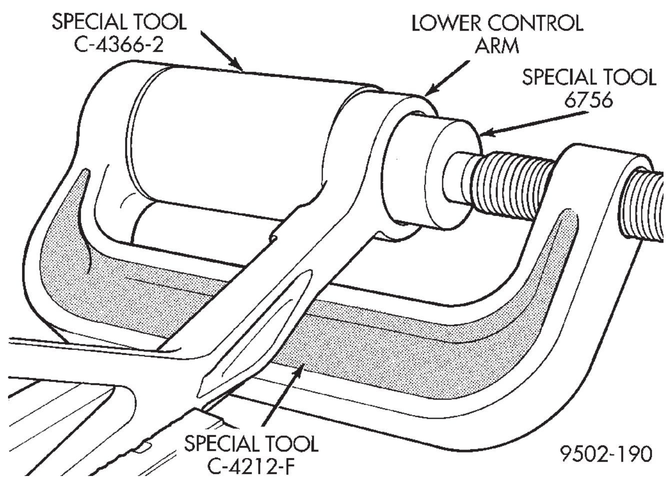


Fig. 89 Removing Lower Control Arm Rear Bushing

(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press rear bushing out of lower control arm.

ASSEMBLY

(1) Start rear bushing into lower control arm **by hand, making sure it is square with its mounting hole in the lower control arm.** Bushing is to be installed from the machined surface side of lower control arm bushing hole, with the void in rubber portion of bushing facing away from ball joint (Fig. 90).

DISASSEMBLY AND ASSEMBLY (Continued)

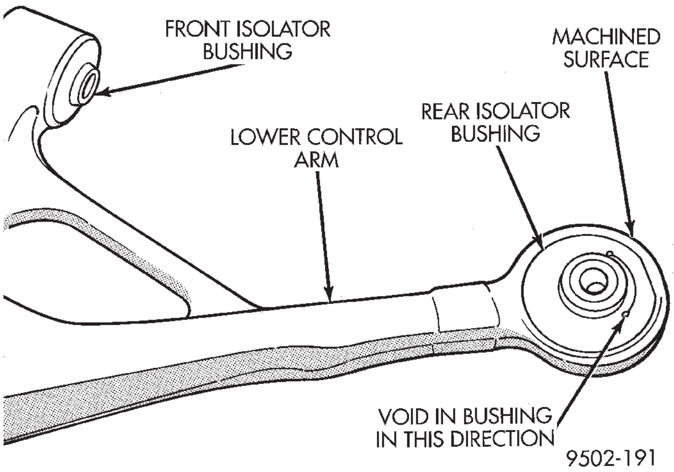


Fig. 90 Correctly Positioned Rear Isolator Bushing In Control Arm

(2) Mount Bushing Installer, Special Tool 6760 on screw portion of Remover/Installer Special Tool C-4212-F (Fig. 91).

(3) Install Special Tools assembled for installation of rear isolator bushing into lower control arm on the lower control arm. Be sure Special Tool 6756 is square on lower control arm and Special Tool 6760 is positioned correctly on isolator bushing (Fig. 91).

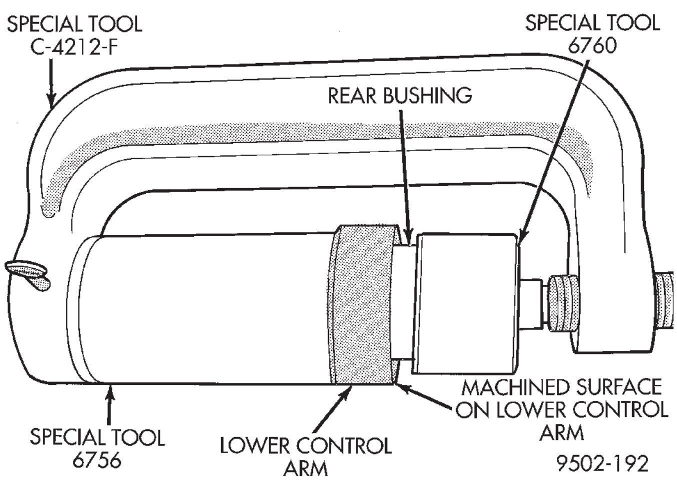


Fig. 91 Installing Rear Bushing In Lower Control Arm

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing rear bushing into lower control arm. Continue pressing rear bushing into lower control arm until bushing is sitting flush on the machined surface (Fig. 91) of the lower control arm. This will correctly position rear bushing in lower control arm.

(5) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

CONTROL ARM CLEVIS BUSHING

To perform removal and replacement of the lower control arm clevis bushing, the lower control arm must be removed from the vehicle.

DISASSEMBLE

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

(2) Install Bushing Remover, Special Tool 6877 and Bushing Receiver, Special Tool 6876 on Special Tool C-4212-F.

(3) Install lower control arm on Special Tools assembled for removal of the clevis isolator bushing. Be sure Special Tool 6876 is square on lower control arm and Special Tool 6877 is positioned correctly on clevis bushing (Fig. 92).

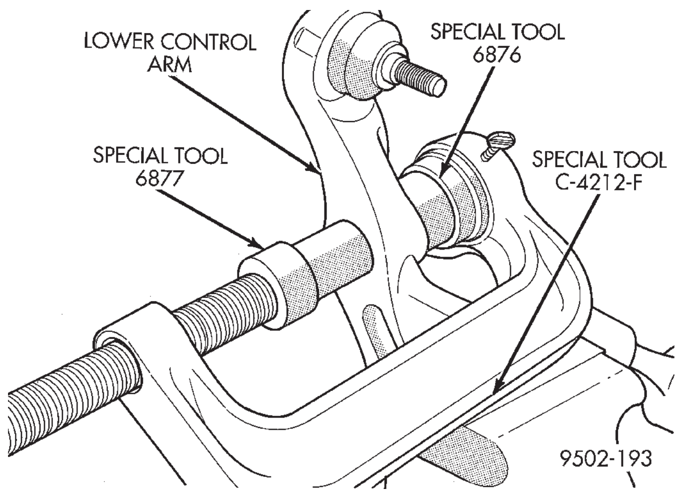


Fig. 92 Removing Clevis Bushing From Lower Control Arm

(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press clevis bushing out of lower control arm.

ASSEMBLE

(1) Start clevis bushing into lower control arm **by hand, making sure it is square with its mounting hole in the lower control arm.** Bushing is to be installed in lower control arm from the machined surface side of lower control arm bushing hole.

(2) Mount Bushing Installer, Special Tool 6877 on screw portion of Remover/Installer Special Tool C-4212-F as shown in (Fig. 93).

(3) Install the assembled special tools for installing the clevis bushing into the lower control arm, on the lower control arm and clevis bushing (Fig. 93). Be sure Special Tool 6876 is square on lower control arm and Special Tool 6877 is positioned correctly on clevis bushing (Fig. 93).

DISASSEMBLY AND ASSEMBLY (Continued)

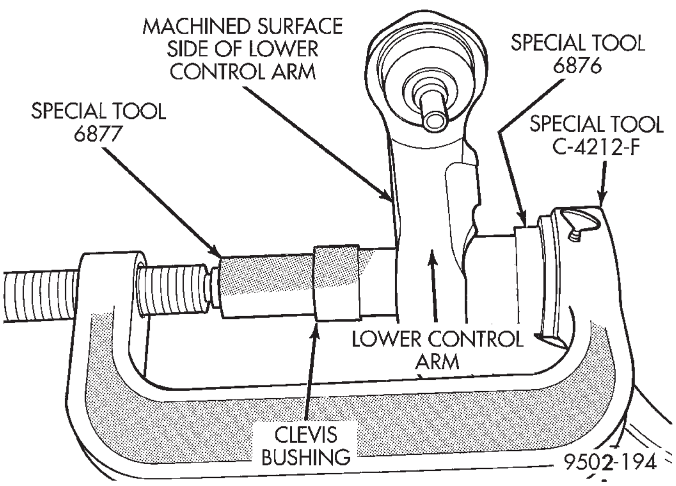


Fig. 93 Installing Clevis Bushing In Lower Control Arm

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing clevis bushing into lower control arm. Continue pressing clevis bushing into lower control arm until bushing is sitting flush with the machined surface of the lower control arm. This will correctly position the clevis bushing in the lower control arm.

(5) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

STABILIZER BAR BUSHING (FRONT)

(1) Bend back the 4 crimp locations on the stabilizer bar bushing retainer (Fig. 94).

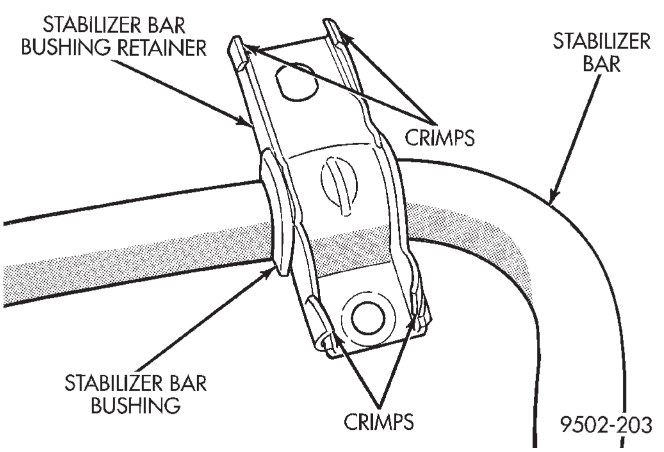


Fig. 94 Stabilizer Bar Bushing Retainer

(2) Separate the stabilizer bar bushing retainer.

(3) Stabilizer bar bushings are removed by opening slit and peeling bushing off stabilizer bar.

(4) Install new stabilizer bar bushings on the stabilizer bar. **Bushings must be installed on sway bar with slit in bushing facing front of vehicle when sway bar is installed.**

(5) Install bushing retainers back on stabilizer bar bushings.

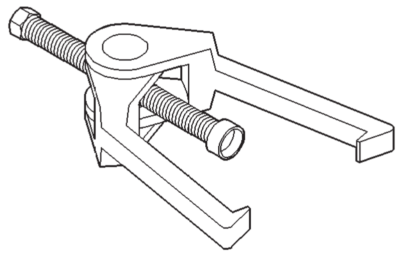
SPECIFICATIONS

FRONT SUSPENSION FASTENER TORQUE SPECIFICATIONS

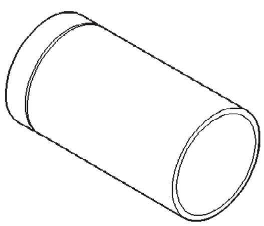
DESCRIPTION	TORQUE
Shock Assembly:	
Shock Tower Bolts	90 N·m (68 ft. lbs.)
Clevis Pinch Bolt	95 N·m (70 ft. lbs.)
Clevis To Control Arm Bolt	90 N·m (68 ft. lbs.)
Shock Rod Upper Mount Nut	45 N·m (33 ft. lbs.)
Upper Control Arm:	
Ball Joint Stud Castle Nut	61 N·m (45 ft. lbs.)
Upper Shock Bracket Bolts	90 N·m (66 ft. lbs.)
Lower Control Arm:	
Ball Joint Stud Castle Nut	74 N·m (55 ft. lbs.)
Crossmember Pivot Bolt (Front)	182 N·m (135 ft. lbs.)
Crossmember Rear Bolt	115 N·m (85 ft. lbs.)
Steering Knuckle:	
Disc Brake Caliper Bolts	22 N·m (16 ft. lbs.)
Tie Rod Nut	61 N·m (45 ft. lbs.)
Tie Rod End Adjustment Jam Nuts	61 N·m (45 ft. lbs.)
Hub And Bearing:	
Mounting Bolts	110 N.m (80 ft. lbs.)
Stub Axle Retaining Nut	244 N·m (180 ft. lbs.)
Wheel Mounting Nut	109-150 N.m (80-110 ft. lbs.)
Stabilizer Bar:	
Bushing Clamp Bolts	61 N·m (45 ft. lbs.)
Link Nuts (All)	105 N·m (78 ft. lbs.)
Front Suspension Crossmember:	
Body Mounting Bolts	163 N·m (120 ft. lbs.)
Steering Gear Mounting Bolts	68 N·m (50 ft. lbs.)

SPECIAL TOOLS

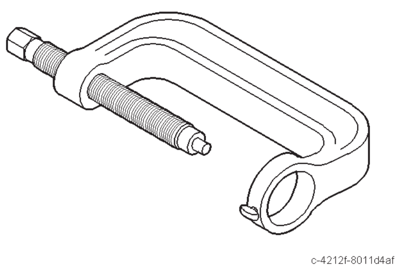
FRONT SUSPENSION



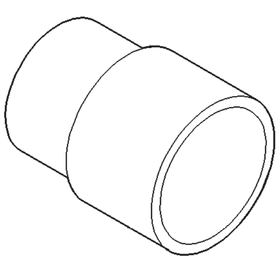
Puller C-3894-A



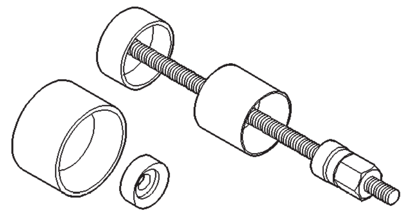
Installer, Ball Joint 6758



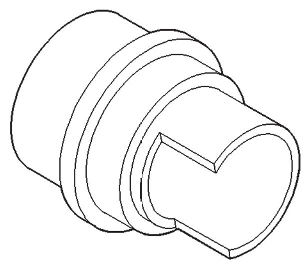
Press, Ball Joint Remover Installer C-4212F



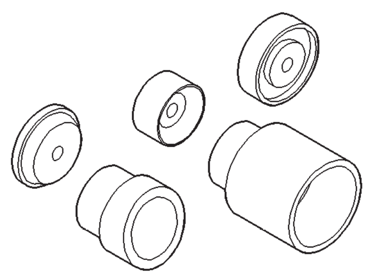
Remover, Ball Joint MB-990799



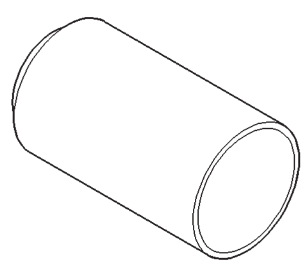
Remover/Installer Control Arm Bushing 6602–5 (In Tool Kit 6602)



Installer/Receiver, Control Arm Bushing 6876

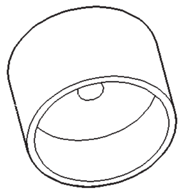


Remover / Installer C-4366-2 (In Tool Kit C-4366)

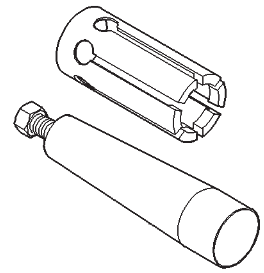


Receiver, Ball Joint 6756

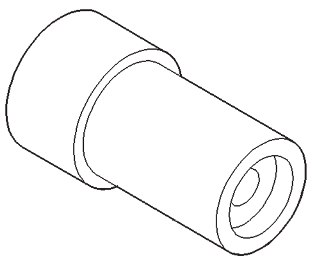
SPECIAL TOOLS (Continued)



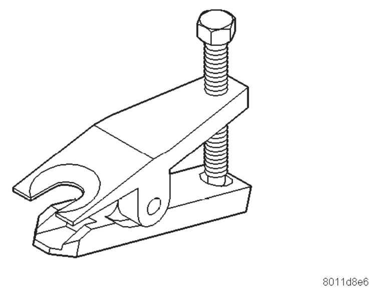
Installer, Bushing 6760



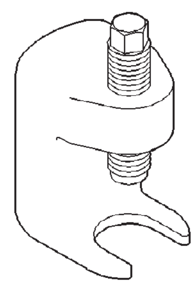
Installer, Ball Joint Seal Boot Retainer 6875



Remover/Installer Control Arm Clevis Bushing 6877



Remover, Tie Rod End MB-991113 or MB-990635



Remover, Lower Ball Joint C-4150A

REAR SUSPENSION

INDEX

DESCRIPTION AND OPERATION

REAR SUSPENSION SYSTEM

The rear suspension used on this vehicle is a fully independent short and long arm style suspension (Fig. 1).

SHOCK ASSEMBLY (REAR)

The rear shock absorber assemblies support the weight of the vehicle using coil springs positioned around the shock absorbers. The coil springs are contained between the upper mount of the shock absorber and a lower spring seat on the body of the shock absorber.

The top of each shock absorber assembly is bolted to the top of the inner fender through a rubber isolated mount.

The bottom of the shock absorber assembly attaches to the rear knuckle using a thru-bolt.

The components of the shock assembly listed below are servicable:

- Shock rod nut
- Shock mount
- Shock rod bushings
- Upper spring isolator
- Dust shield
- Cup
- Jounce bumper
- Lower spring isolator
- Coil spring
- Strut

COIL SPRING

Rear coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. Coil springs come in a various rates; be sure the correct spring is in use.

KNUCKLE (REAR)

A cast iron rear knuckle is attached to the upper control arm by the upper ball joint and to the rear shock absorber assembly. The lateral movement of the rear knuckle is controlled using two lateral arms attached to the bottom of the knuckle and by the upper control arm attached to the top of the knuckle. The outboard ends of the two lateral arms are mounted forward and rearward of the knuckle centerline, and the inboard ends are mounted to the rear suspension crossmember. Fore and aft movement of the knuckle is controlled by the trailing link.

DESCRIPTION AND OPERATION (Continued)

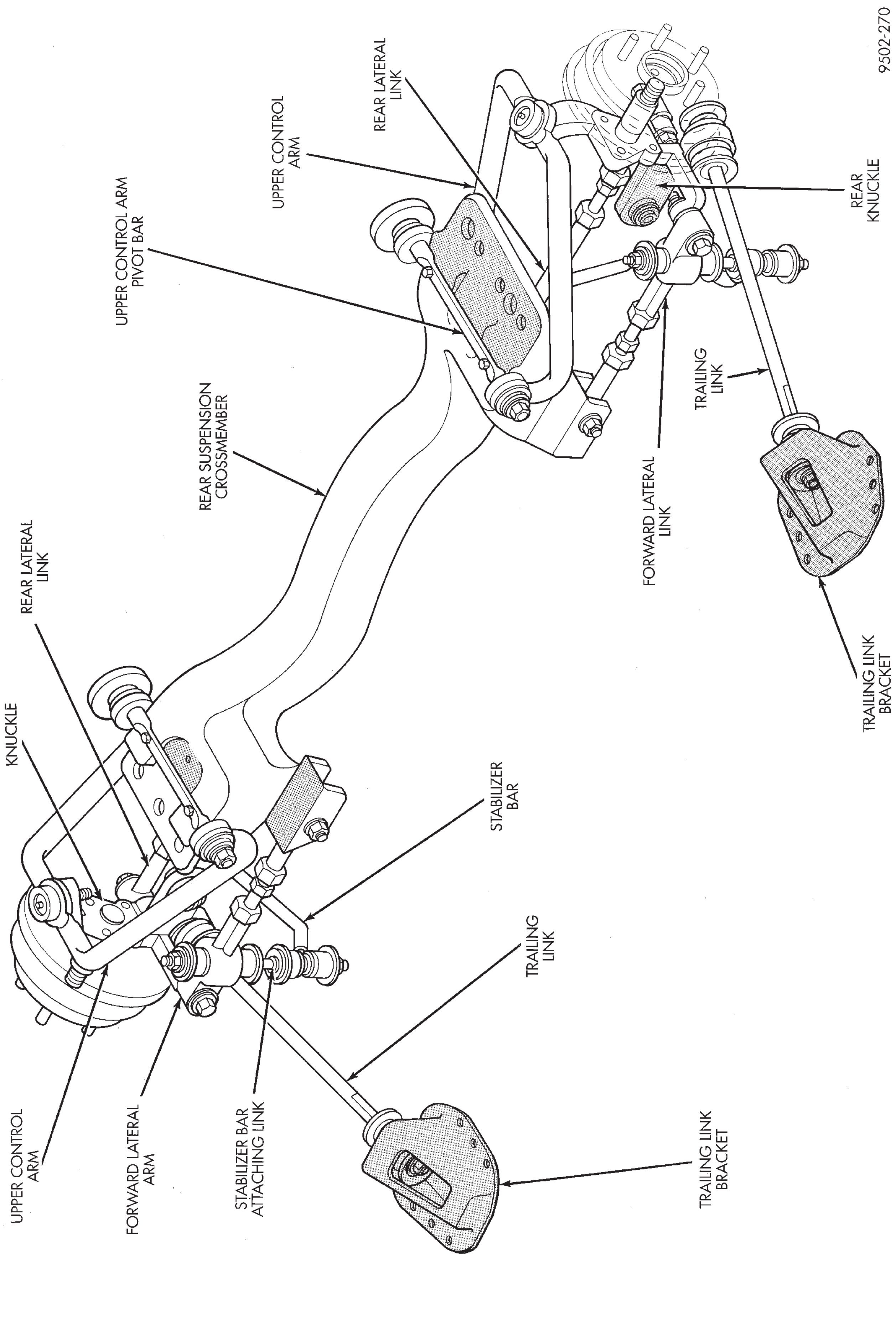


Fig. 1 Fully Independent Rear Suspension

DESCRIPTION AND OPERATION (Continued)

HUB AND BEARING (REAR)

The hub and bearing is a combined rear wheel hub and wheel bearing unit. All vehicles are equipped with permanently lubricated and sealed for life rear hub and bearing assemblies. There is no periodic lubrication or maintenance recommended for these units.

The hub and bearing is mounted to the rear knuckle's spindle using a retaining nut. The tire and wheel assembly, and rear brake drum or disc attaches to the studs protruding from the hub flange with wheel mounting studs.

UPPER CONTROL ARM (REAR)

An upper control arm is attached to the top of each rear knuckle, connecting the knuckle to the rear suspension crossmember. The attachment of the upper control arm to the knuckle is achieved through a ball joint in the upper control arm. The ball joint is pressed into the upper control arm and is attached to the knuckle using a tapered stud and a castle nut.

The upper control arm is bolted to the rear suspension crossmember using a pivot bar which is rubber isolated from the upper control arm.

LATERAL LINKS

The lateral movement of the rear knuckle is controlled by the lateral links connecting the front and rear of the knuckle to the rear suspension crossmember.

The lateral links have rubber isolator bushings at each end to isolate suspension noise from the body of the vehicle. The metal sleeves of the links are adjustable for setting rear alignment. The forward link allows for stabilizer bar attachment through stabilizer bar attachment links.

TRAILING LINK

Fore and aft movement of the knuckle is controlled by a trailing link. The trailing link bolts to the bottom of the knuckle and to a bracket attached to the floor pan of the vehicle.

The trailing link is steel and has rubber isolator bushings, retainer washers and nuts at each end to isolate suspension noise from the body of the vehicle.

STABILIZER BAR (REAR)

The stabilizer bar interconnects the forward lateral links of the vehicle's rear suspension and is attached to the rear suspension crossmember of the vehicle.

Jounce and rebound movements affecting one rear wheel of the vehicle are partially transmitted to the opposite wheel of the vehicle to stabilize body roll.

Attachment of the stabilizer bar to the rear crossmember of the vehicle is through 2 rubber-isolator bushings and bushing retainers. The stabilizer bar to lateral link attachment is done utilizing a rubber isolated stabilizer bar attaching link . All parts of the stabilizer bar are serviceable, and the stabilizer bar to rear suspension isolator bushings are split for easy removal and installation. The split in the stabilizer bar to crossmember bushing must be positioned toward the front of the vehicle, when the stabilizer bar is installed on the vehicle.

DIAGNOSIS AND TESTING

SHOCK ASSEMBLY (REAR)

(1) Inspect for damaged or broken coil springs.

(2) Inspect for torn or damaged shock absorber dust shield.

(3) Inspect for damaged lower spring isolator.

(4) Lift dust boot and inspect shock absorber for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off lower end of unit). A slight amount of seepage between the shock absorber rod and shock absorber rod seal is not unusual and does not affect performance of the shock absorber. Also inspect jounce bumpers for signs of damage or deterioration.

KNUCKLE (REAR)

Inspect the knuckle for physical damage. If it is determined that the knuckle is cracked, bent or broken when servicing the vehicle, no attempt is to be made to repair or to straighten the knuckle. The rear knuckle is not a repairable component of the rear suspension and must be replaced if found to be damaged in any way.

HUB AND BEARING (REAR)

The rear hub and bearing assembly is designed for the life of the vehicle and should require no maintenance. The following procedure may be used for evaluation of bearing condition.

With wheel and brake drum removed, rotate flanged outer ring of hub. Excessive roughness, lateral play or resistance to rotation may indicate dirt intrusion or bearing failure. If the rear wheel bearings exhibit these conditions during inspection, the hub and bearing assembly should be replaced.

Damaged bearing seals and resulting excessive grease loss may also require bearing replacement. Moderate grease loss from bearing is considered normal and should not require replacement of the hub and bearing assembly.

UPPER CONTROL ARM (REAR)

Inspect the control arm for physical damage. If it is determined that the upper control arm is broken or

DIAGNOSIS AND TESTING (Continued)

bent, the upper control arm must be replaced. The rear suspension upper control arm is not a repairable component and no attempt is to be made to repair or to straighten it. The upper control arm must be replaced if found to be damaged in any way.

Inspect the control arm pivot bushings for deterioration. If found to need replacement, the upper control arm is to be replaced.

The rear control arm, control arm bushings, and pivot bar are serviced as a complete assembly on this vehicle. Do not attempt to disassemble the control arm from the pivot bar to service the rear control arm bushings.

The only component on the upper control arm that is servicable is the rear upper ball joint and its seal.

BALL JOINT (REAR UPPER)

With the weight of the vehicle resting on the road wheels, grasp the grease fitting and with no mechanical assistance or added force, attempt to move the grease fitting.

If the ball joint is worn, the grease fitting will move easily. If movement is noted, replacement of the ball joint is required.

LATERAL LINKS

Inspect the lateral link isolator bushings and sleeves for signs of damage or deterioration. If the lateral link isolator bushings or sleeves are damaged or are deteriorated, replacement of the lateral link assembly will be required. The isolator bushings are not serviceable as a separate component of the lateral link assembly.

Inspect the lateral links for signs of contact with the ground or road debris which has bent or caused other damage to the lateral link. If the lateral link is bent or damaged, the lateral link will require replacement. **Do not attempt to repair or straighten a lateral link.**

CAUTION: Do not apply heat to the lateral link adjusting screws or to the jam nuts, when loosening or adjusting the lateral links.

TRAILING LINK

Inspect the trailing link bushings and retainers for signs of deterioration or damage. If the trailing link bushings are deteriorated or the retainers are damaged, replacement of the trailing link bushings and or the retainers will be required. The bushings and retainers are serviceable as separate components of the trailing link.

Inspect the trailing link for signs of contact with the ground or road debris which has bent or caused other damage to the trailing link. If the trailing link is bent or damaged the trailing link will require replacement. Do not ever attempt to repair or straighten a trailing link.

STABILIZER BAR (REAR)

Inspect the stabilizer bar for damage or bending.

Inspect for broken or distorted stabilizer bar bushings, and bushing retainers. When inspecting the stabilizer bar bushings, be sure that the slit in the bushings are positioned so that it is facing toward the front of the vehicle.

Inspect the bushings and sleeves in the stabilizer bar attaching links for damage or deterioration. Inspect the stabilizer bar attaching link to ensure it is not bent or broken. If any of these conditions are present when inspecting the attaching links, replacement of the attaching link is required.

SERVICE PROCEDURES

LUBRICATION

The only serviceable lubrication points on the suspension are the upper ball joints (Fig. 2). All other joints are sealed for life. Lubricate the upper ball joints until a slight swelling is noticed in the ball joint seal boots. Do not overfill the seal boots. Follow the vehicles maintenance schedule.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

WARNING: DO NOT REMOVE A SHOCK ROD NUT WHILE THE SHOCK ASSEMBLY IS INSTALLED IN VEHICLE, OR BEFORE THE SHOCK ASSEMBLY SPRING IS COMPRESSED.

CAUTION: Only frame contact or wheel lift hoisting equipment can be used on vehicles having a fully independent rear suspension. Vehicles with independent rear suspension can not be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used damage to rear suspension components will occur.

NOTE: If a rear suspension component becomes bent, damaged or fails, no attempt should be made to straighten or repair it. Always replace it with a new component.

REMOVAL AND INSTALLATION (Continued)

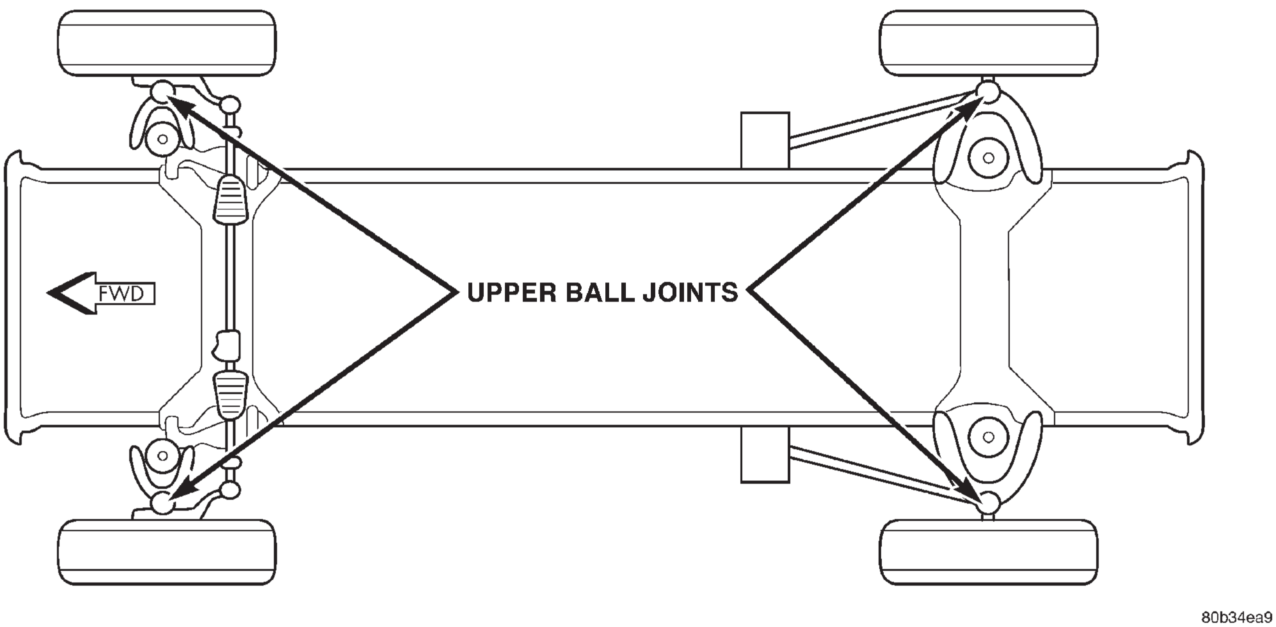


Fig. 2 Lubrication Points

SHOCK ASSEMBLY (REAR)

NOTE: Access for the nuts attaching the rear shock assembly upper mount to the vehicle is through the inside of the trunk.

REMOVAL

(1) Roll back carpeting on top of the rear shock tower to access shock mounting nuts.

(2) Remove the plastic cover from the top of the shock tower (Fig. 3).

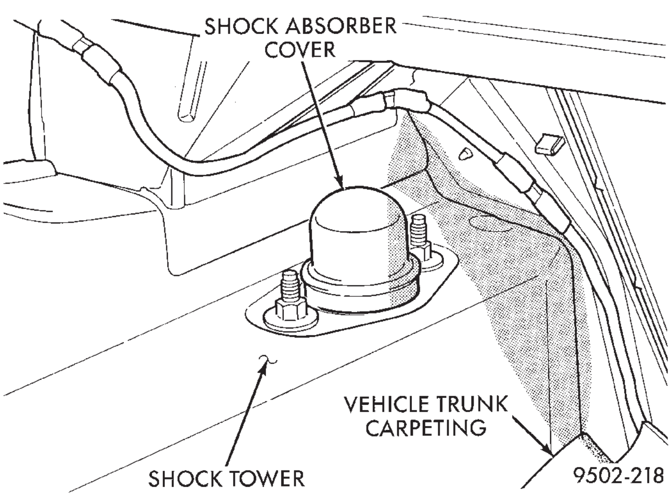


Fig. 3 Shock Assembly Cover

(3) Remove the 2 nuts (Fig. 4) attaching the shock assembly upper mount/spring seat to the shock tower.

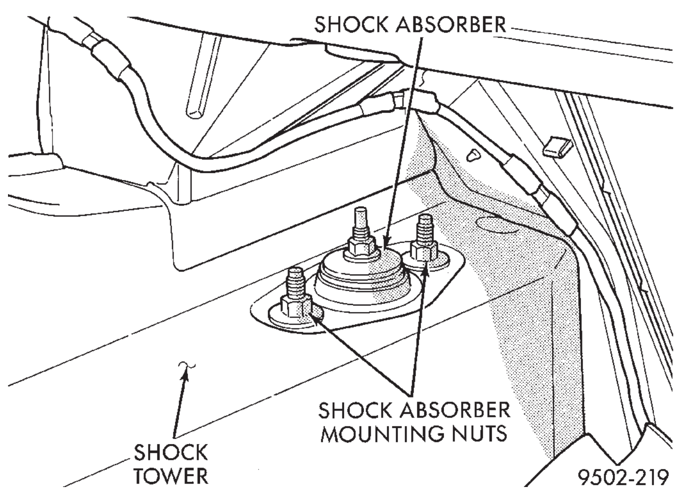


Fig. 4 Shock Upper Mount Attaching Nuts

(4) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(5) Remove the rear wheel and tire assembly from the vehicle.

(6) Remove bolt attaching shock absorber to rear knuckle (Fig. 5).

(7) Remove the shock absorber from the rear knuckle first, when removing the shock absorber from vehicle by pushing down on the rear suspension.

(8) Move shock assembly downward and tilt top of shock outward. Then remove shock assembly from vehicle through top of wheel opening (Fig. 6).

REMOVAL AND INSTALLATION (Continued)

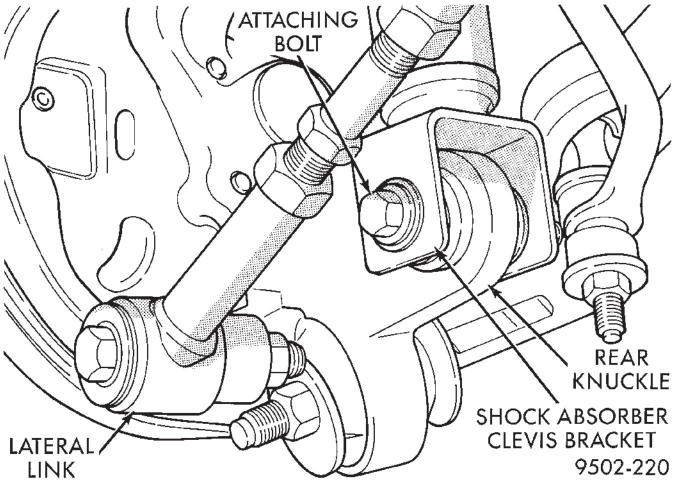


Fig. 5 Shock Absorber Attachment To Knuckle

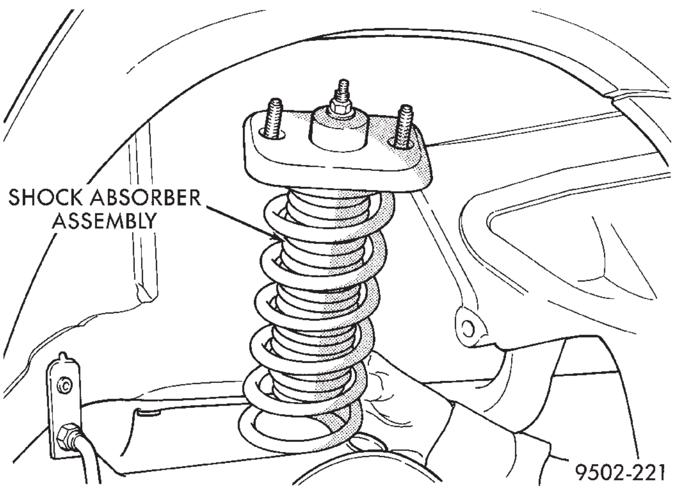


Fig. 6 Shock Assembly Removal/Installation

INSTALLATION

(1) Install shock assembly back in vehicle using the reverse sequence of removal (Fig. 6).

(2) Install upper shock mount into the mounting holes in rear shock tower.

(3) Push down on rear knuckle to obtain clearance and then install shock absorber clevis bracket on rear knuckle.

(4) Align clevis bracket on shock absorber with bushing in knuckle. Install and tighten bolt (Fig. 5) to a torque of 95 N·m (70 ft. lbs.).

(5) Lower vehicle far enough to gain access to the trunk.

(6) Install and tighten the 2 shock absorber mounting bracket attaching nuts (Fig. 4) to a torque of 54 N·m (40 ft. lbs.).

(7) Install plastic cover on shock tower (Fig. 3).

(8) Install carpeting back on shock tower.

(9) Install wheel and tire assembly on vehicle. Then torque all wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat tightening sequence to full specified torque of 129 N·m (95 ft. lbs.).

(10) Lower vehicle to the ground.

KNUCKLE (REAR)

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the rear wheel and tire assembly from the vehicle.

(3) Remove rear brake drum from rear hub and bearing assembly.

(4) If vehicle is equipped with antilock brakes remove the rear wheel speed sensor from the brake support plate and brake flex hose routing bracket (Fig. 7).

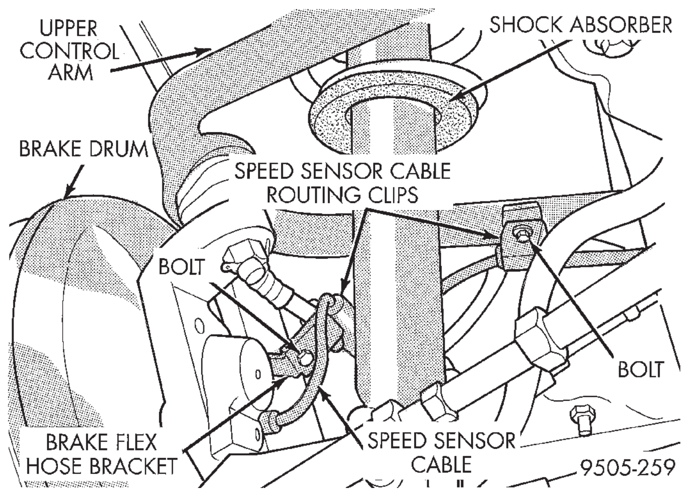


Fig. 7 Rear Wheel Speed Cable Routing And Attachment

(5) Remove the park brake cable from the park brake actuating lever (Fig. 8). Then remove the park brake cable from the rear brake support plate (Fig. 9). Park brake cable is removed from brake support plate using this procedure. Position a 1/2 inch box end wrench over cable retainer (Fig. 9) to collapse retaining tabs. Then pull bear brake cable from brake support plate.

(6) Remove the rear hub/bearing assembly retaining nut (Fig. 10). Then remove the washer and the hub/bearing assembly from the knuckle.

(7) Remove the 4 bolts (Fig. 11) attaching rear brake support plate to knuckle. Then remove brake support plate, brake shoes and wheel cylinder as an assembly from rear knuckle. **It is not necessary to remove brake flex hose from wheel cylinder when removing support plate.** Brake support

REMOVAL AND INSTALLATION (Continued)

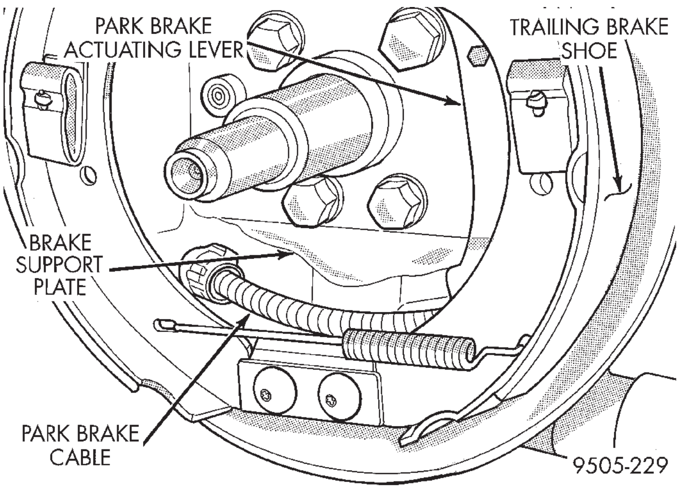


Fig. 8 Park Brake Cable Attachment To Actuating Lever

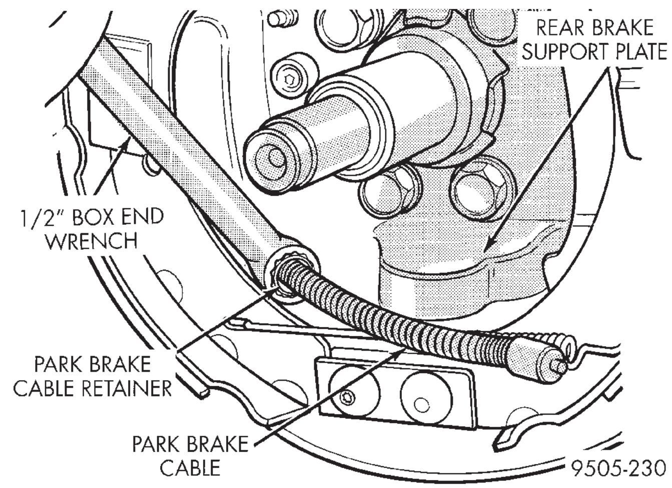


Fig. 9 Park Brake Cable Removal From Brake Support Plate

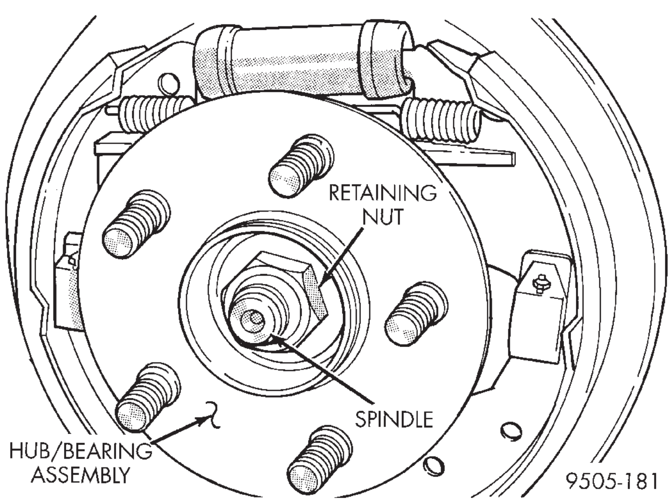


Fig. 10 Hub/Bearing Assembly Retaining Nut

plate when removed, must be supported using mechanics wire as shown in (Fig. 12).

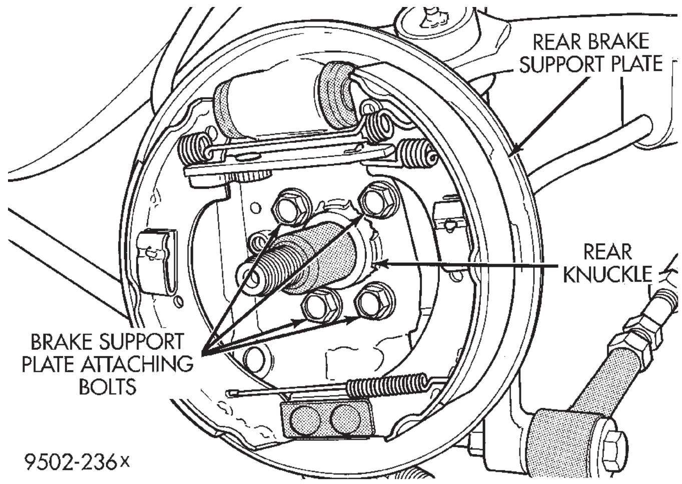


Fig. 11 Rear Brake Support Plate Mounting Bolts

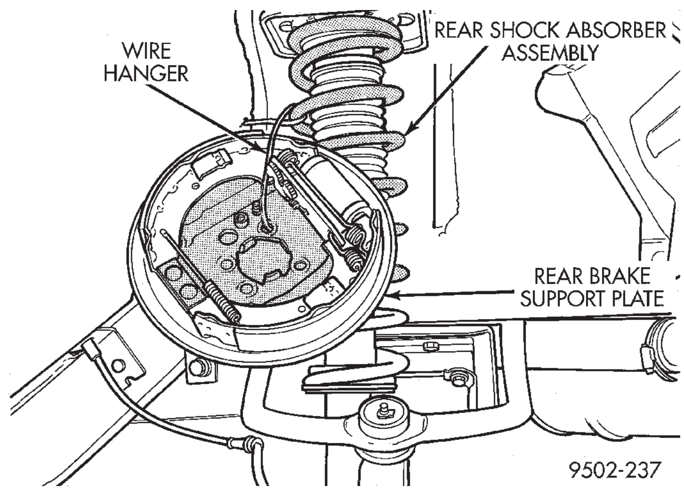


Fig. 12 Correctly Stored Rear Brake Support Plate

(8) Remove the nuts and bolts attaching the forward and rear lateral links (Fig. 13) to the rear knuckle.

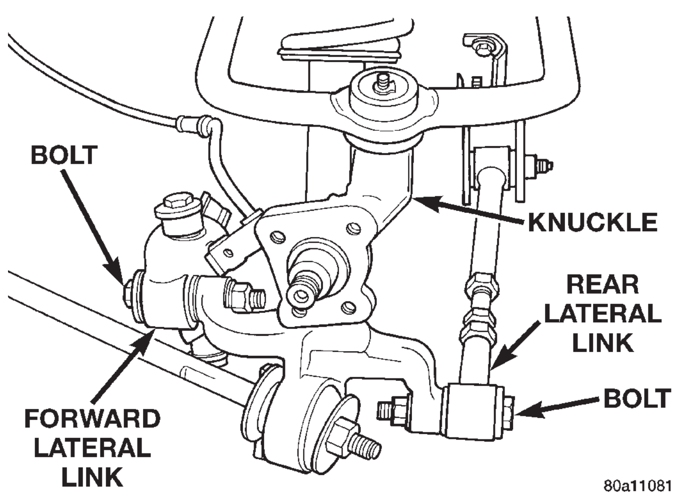


Fig. 13 Lateral Link Attachment To Rear Knuckle

REMOVAL AND INSTALLATION (Continued)

(9) Remove cotter pin and castle nut attaching upper control arm ball joint to knuckle.

(10) Remove ball joint stud from knuckle using Puller, Special Tool, CT-1106 (Fig. 14). When using puller, install castle nut on ball joint stud (Fig. 14) to protect threads from damage.

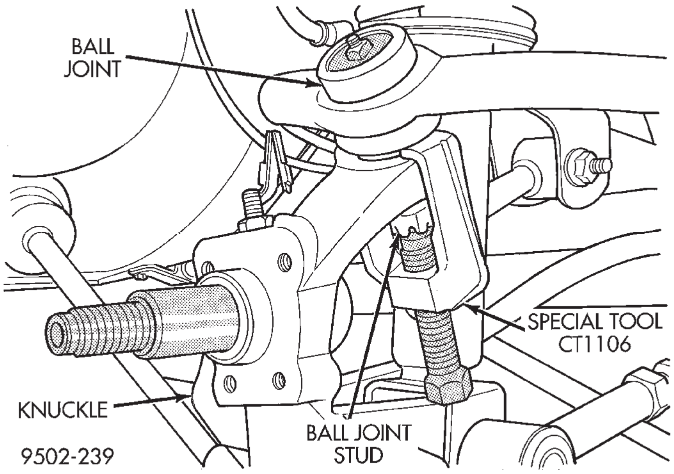


Fig. 14 Removing Ball Joint Stud From Knuckle

CAUTION: The installation position of the bushings and retainers on the trailing link is important. When separating the trailing link from the knuckle note the position and orientation of the bushings and the retainers to ensure the are installed correctly at assembly.

(11) Remove the nut and washer attaching the trailing link to the rear knuckle. Use a wrench on the flat of the trailing link to keep it from turning when removing nut (Fig. 15).

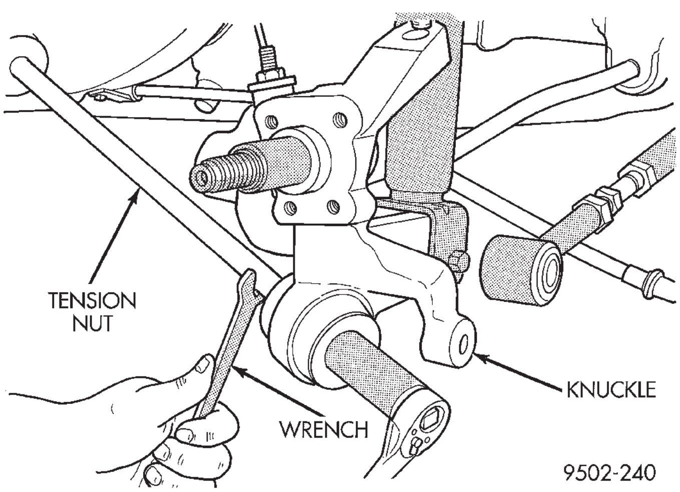


Fig. 15 Trailing Link Attachment To Rear Knuckle

(12) Remove the shock absorber clevis bracket to knuckle attaching nut and bolt (Fig. 16).

(13) Remove the knuckle assembly from the vehicle.

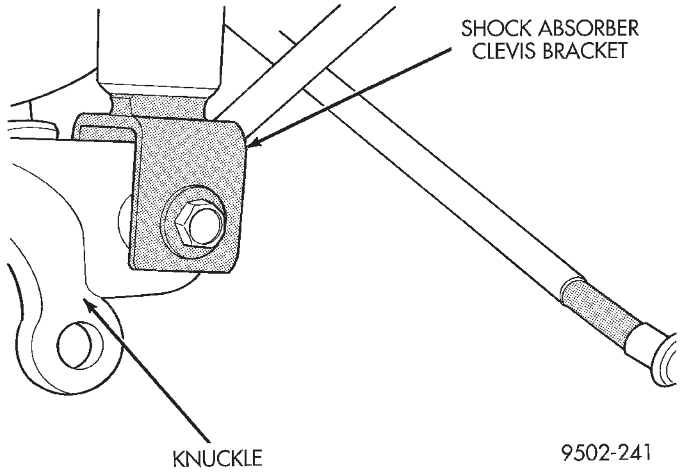


Fig. 16 Shock Absorber Attachment To Knuckle

INSTALLATION

(1) Install knuckle on clevis bracket of rear shock absorber. Then install clevis bracket to shock absorber attaching bolt with head of bolt facing rear of vehicle (Fig. 16).

CAUTION: The inner and outer bushing location on the trailing link to rear knuckle attachment is important. Do not interchange the inner and outer bushing location when installing knuckle back on trailing link. Also, when installing trailing link bushing retainers, the retainers must be installed with cupped side of retainer facing away from bushing and knuckle (Fig. 17).

(2) Install knuckle on trailing link. Then install the outer trailing link bushing, bushing retainer and retaining nut on trailing link (Fig. 17). Using a large adjustable wrench, to keep trailing link from rotating securely tighten the trailing link retaining nut (Fig. 17) to a torque of 95 N·m (70 ft. lbs.).

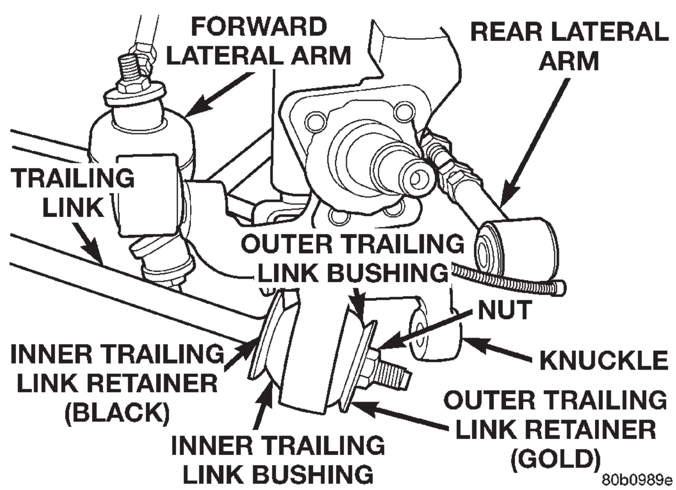


Fig. 17 Trailing Link Bushing And Retainer Installation

REMOVAL AND INSTALLATION (Continued)

(3) Install upper ball joint stud in knuckle. Install and tighten the ball joint stud castle nut to a torque of 67 N·m (50 ft. lbs.). Install cotter pin in ball joint stud.

(4) Install the front and rear lateral links and attaching nuts and bolts on the knuckle (Fig. 13) Tighten the lateral links to knuckle attaching bolts and nuts to 95 N·m (70 ft. lbs.).

(5) Install rear brake support plate assembly onto the knuckle. Install the 4 bolts (Fig. 11) attaching rear brake support plate to rear knuckle. Tighten the attaching bolts to a torque of 61 N·m (45 ft. lbs.).

(6) If vehicle is equipped with ABS brakes, install speed sensor head into rear brake support plate (Fig. 18). Torque speed sensor head mounting bolt to 7 N·m (60 in. lbs.).

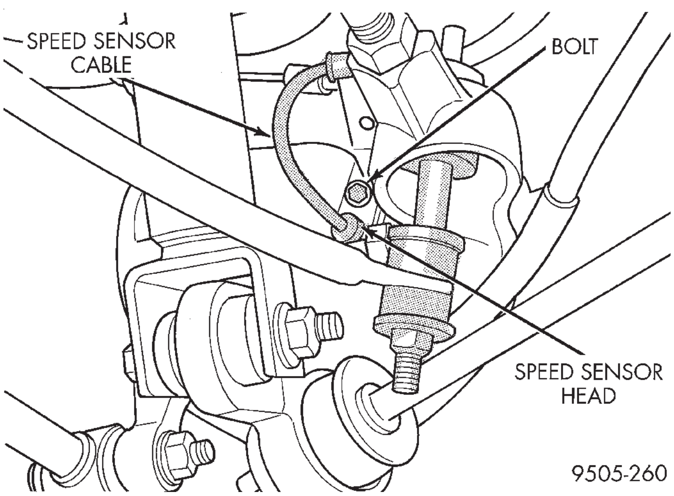


Fig. 18 Speed Sensor Head Attachment To Brake Support Plate

(7) Attach routing bracket for speed sensor cable to brake flex hose bracket and securely tighten attaching bolt (Fig. 7).

(8) Install park brake cable into brake support plate. Ensure cable retainer is securely holding cable to support plate. Then connect park brake cable to park brake lever on brake shoe.

(9) Install rear hub and bearing assembly on knuckle and install hub and bearing assembly retaining nut. Tighten retaining nut to a torque of 250 N·m (185 ft. lbs.).

(10) Install the brake drum on the hub/bearing assembly.

(11) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(12) Lower vehicle.

(13) Check and reset rear wheel alignment to specifications if required. Refer to Front And Rear Toe Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required alignment setting procedure.

HUB AND BEARING (REAR)

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(2) Remove rear wheel and tire assembly.

(3) If equipped with rear drum brakes, remove brake drum (Fig. 19) from rear hub and bearing assembly by removing the clips, then pulling the drum straight off the wheel mounting studs. If equipped with rear disc brakes, remove the rear caliper following the procedure found in REMOVAL AND INSTALLATION of the BASE BRAKE SYSTEM section of the group BRAKES. Remove the brake rotor by pulling the rotor straight off the wheel mounting studs.

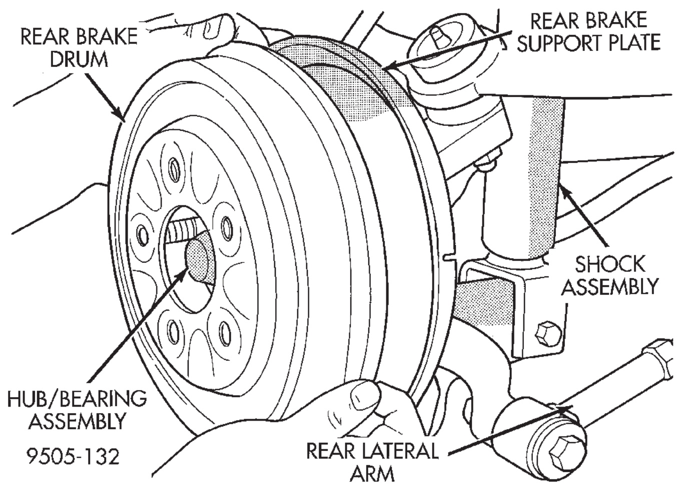


Fig. 19 Rear Brake Drum Removal

(4) Remove dust cap from rear hub and bearing assembly by prying it off.

(5) Remove hub and bearing assembly to rear spindle retaining nut (Fig. 20).

(6) Remove rear hub and bearing from the spindle by pulling it straight off the spindle by hand.

INSTALLATION

(1) Install the hub and bearing assembly on the knuckle spindle. Install a NEW retaining nut (Fig. 20). Tighten the retaining nut to a torque of 250 N·m (185 ft. lbs.).

(2) Install the hub and bearing dust cap using a soft faced hammer.

REMOVAL AND INSTALLATION (Continued)

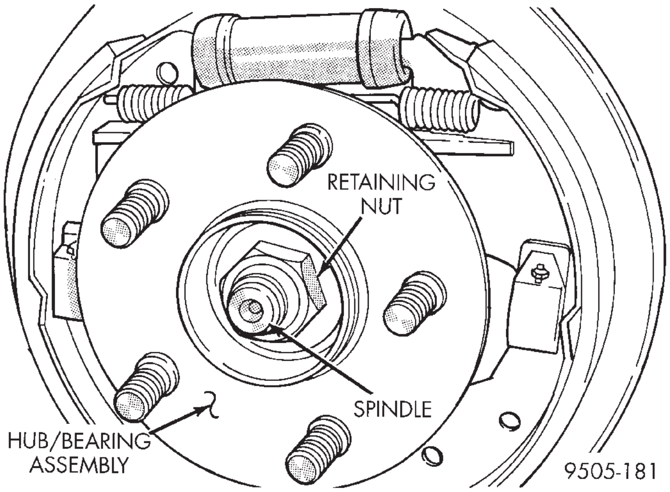


Fig. 20 Hub/Bearing Assembly Retaining Nut

(3) Install the brake drum or brake rotor on the hub and bearing.

(4) If equipped with rear disc brakes, install the rear caliper following the procedure found in REMOVAL AND INSTALLATION of the BASE BRAKE SYSTEM section of the group BRAKES.

(5) Install the rear tire and wheel assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half the specified torque. Then repeat pattern, fully tightening the stud nuts to a torque of 129 N·m (95 ft. lbs.).

(6) Lower the vehicle.

UPPER CONTROL ARM (REAR)

NOTE: The rear control arm, control arm bushings, and pivot bar are serviced as a complete assembly on this vehicle. Do not attempt to disassemble the control arm from the pivot bar to service the rear control arm bushings. The ball joint and ball joint seal are to be replaced with the control arm removed from the vehicle.

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove both rear wheel and tire assemblies from the vehicle.

(3) Remove the shock absorber clevis bracket to rear knuckle attaching bolt and nut (Fig. 21) on both sides of the vehicle.

(4) Remove muffler support bracket from rear frame rail (Fig. 22).

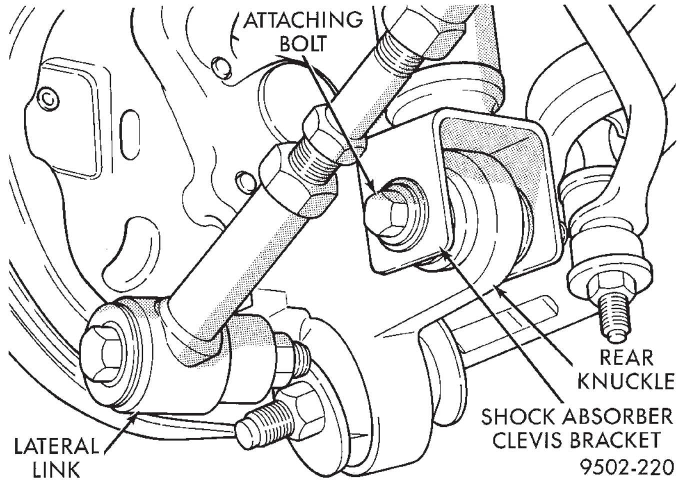


Fig. 21 Shock Absorber To Knuckle Attaching

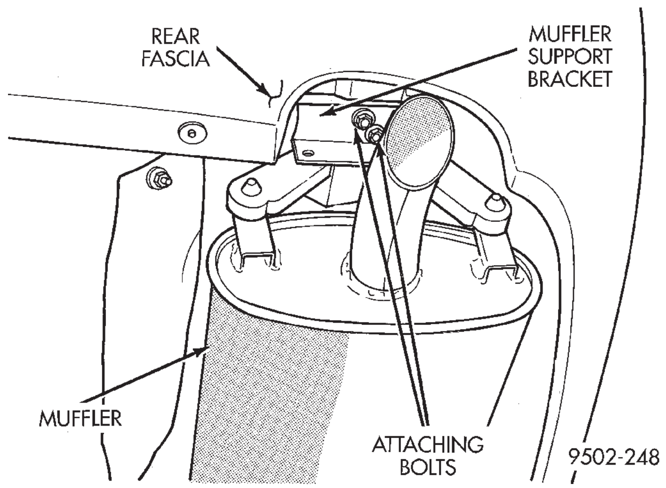


Fig. 22 Muffler Support Bracket

(5) Remove the rear exhaust pipe hanger bracket from the rear suspension crossmember (Fig. 23). Let exhaust system drop down as far as possible.

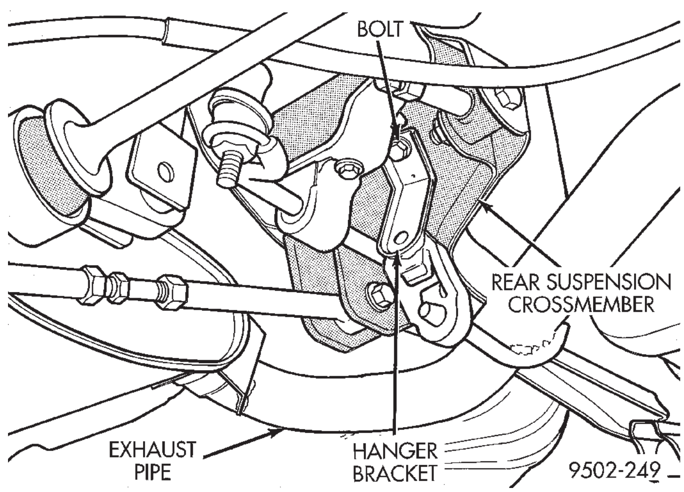


Fig. 23 Exhaust Pipe Hanger At Rear Suspension Crossmember

REMOVAL AND INSTALLATION (Continued)

(6) On only the side of the vehicle requiring control arm removal, separate the control arm ball joint from the rear knuckle using following procedure.

• Remove cotter pin and castle nut attaching upper control arm ball joint to knuckle.

• Remove ball joint stud from knuckle using Puller, Special Tool, CT- 1106 (Fig. 24). When using puller, install castle nut on ball joint stud to protect threads from damage.

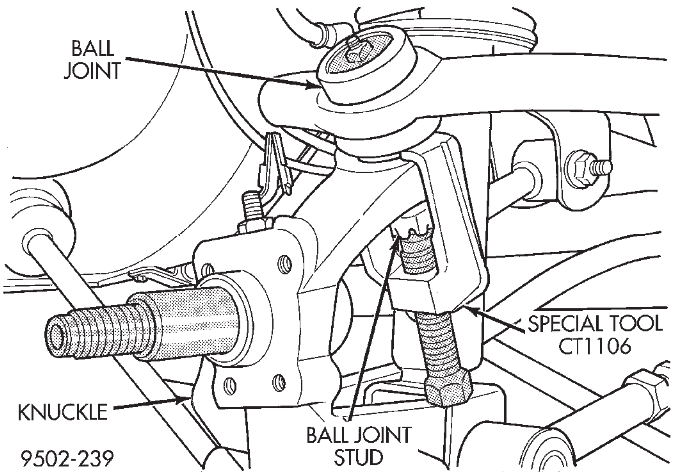


Fig. 24 Ball Joint Stud Removal From Knuckle

(7) Position a transmission jack and wooden block under the center of the rear suspension crossmember to support and lower crossmember during removal (Fig. 25).

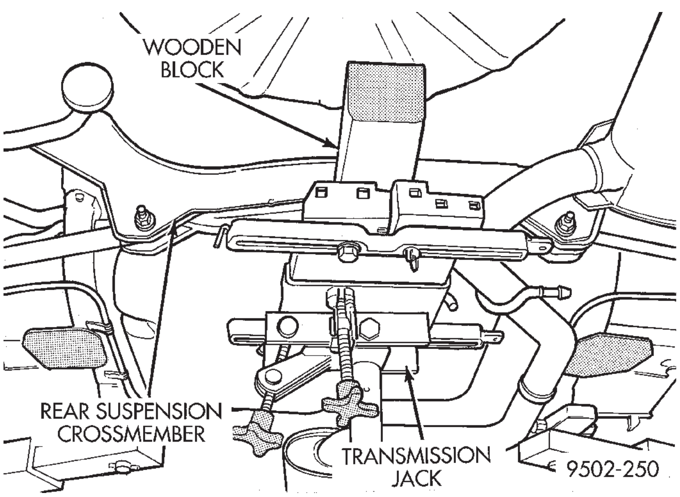


Fig. 25 Lowering And Supporting Rear Suspension Crossmember

(8) If vehicle is equipped with antilock brakes, remove routing clips for wheel speed sensor cable from brackets on both upper control arms (Fig. 26).

(9) Remove the 4 bolts (Fig. 27) attaching rear suspension crossmember to rear frame rails.

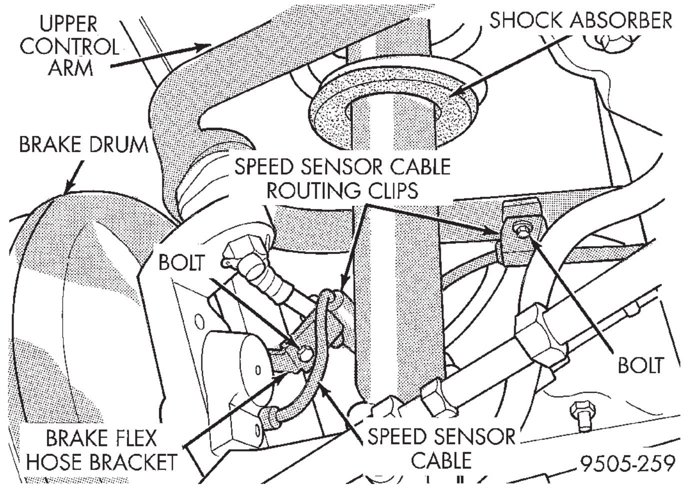


Fig. 26 Speed Sensor Cable Attachment To Control Arm

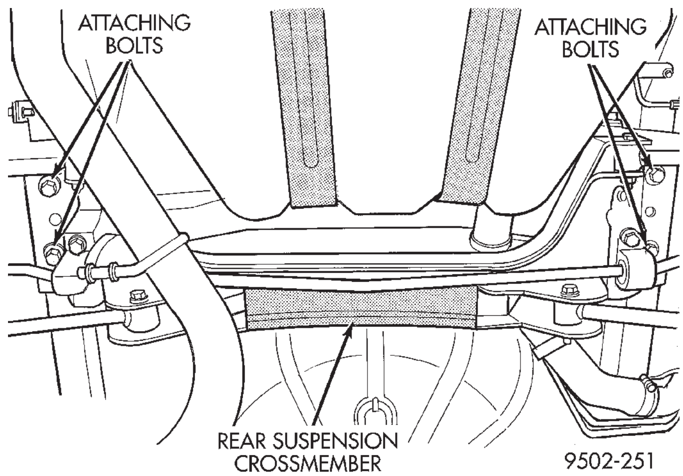


Fig. 27 Crossmember Attachment To Frame Rails

CAUTION: When lowering rear suspension crossmember do not put a strain on the rear brake flex hoses.

(10) Lower the rear suspension crossmember far enough to access the upper control arm pivot bar to crossmember attaching bolts. Remove the 2 bolts (Fig. 28) attaching the upper control arm to the rear suspension crossmember.

(11) Remove the upper control arm from the vehicle.

(12) Transfer any required components to the replacement control arm.

INSTALLATION

(1) Align the upper control arm pivot bar with the mounting holes in the rear suspension crossmember. Install and tighten the 2 pivot bar to crossmember attaching bolts (Fig. 28) to a torque of 107 N·m (79 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

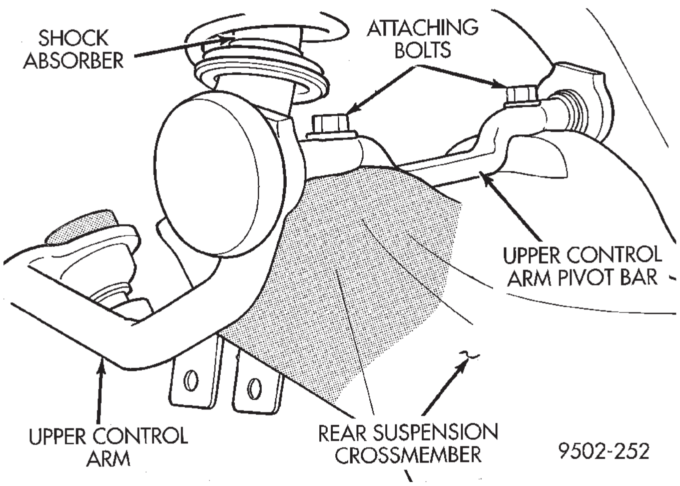


Fig. 28 Upper Control Arm Attachment To Crossmember

(2) Using transmission jack, raise rear suspension crossmember up to the rear frame rails and loosely install the 4 attaching bolts (Fig. 27).

(3) Position an appropriate size drift into the positioning hole in each side of rear suspension crossmember and crossmember locating holes in frame rails of the vehicle (Fig. 29). This is required to properly position rear suspension crossmember in the body of the vehicle. Then tighten the 4 crossmember to frame rail attaching bolts to 95 N·m (70 ft. lbs.). Remove drifts from rear suspension crossmember.

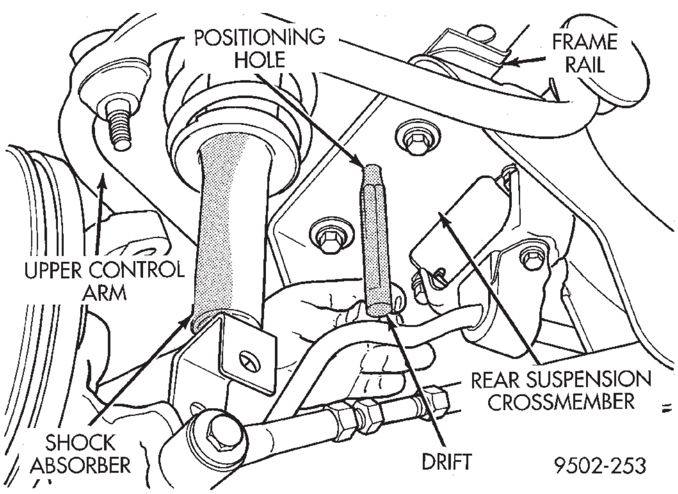


Fig. 29 Locating Rear Suspension Crossmember In Vehicle

(4) Install upper ball joint stud in knuckle. Install and tighten the ball joint stud castle nut to a torque of 67 N·m (50 ft. lbs.). Install cotter pin in ball joint stud.

(5) Remove transmission jack supporting rear suspension crossmember.

(6) Install muffler support bracket on rear frame rail (Fig. 22). Install rear exhaust pipe hanger on rear suspension crossmember (Fig. 23).

(7) If vehicle is equipped with antilock brakes, install the wheel speed sensor cable routing clip on upper control arm mounting bracket. Install and securely tighten attaching bolt (Fig. 26).

(8) Install the shock absorber clevis brackets (Fig. 21) on the rear knuckles. Install the shock absorber to knuckle mounting bolts. Tighten the mounting bolts to a torque of 95 N·m (70 ft. lbs.).

(9) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(10) Lower vehicle to the ground.

(11) Check and reset if required, rear wheel Camber and Toe to preferred specifications.

LATERAL LINKS

The rear suspension lateral links (Fig. 30) are only serviced as complete assemblies. The isolator bushings used in the lateral links are not serviced as separate components.

CAUTION: Do not attempt to straighten or repair a lateral link. Do not apply heat to the lateral link adjusting screws or to the jam nuts, when loosening or adjusting the lateral links.

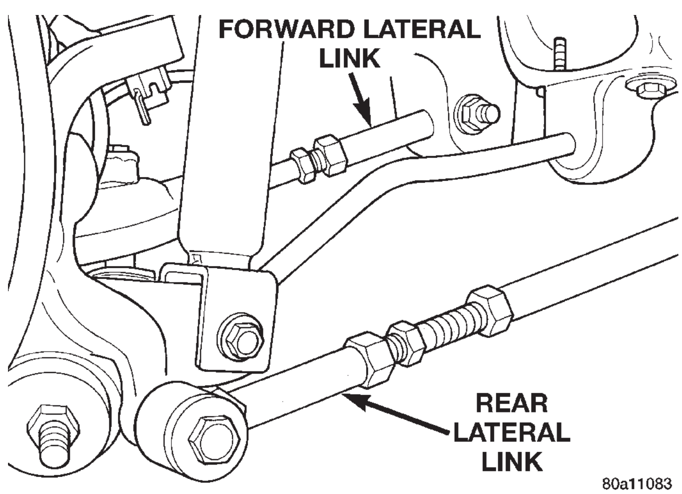


Fig. 30 Rear Suspension Lateral Links

FORWARD LATERAL LINK

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

REMOVAL AND INSTALLATION (Continued)

(2) Remove the rear wheel and tire assembly from the side of the vehicle requiring lateral link removal.

(3) Remove the rear stabilizer bar attaching link from the forward lateral link (Fig. 31).

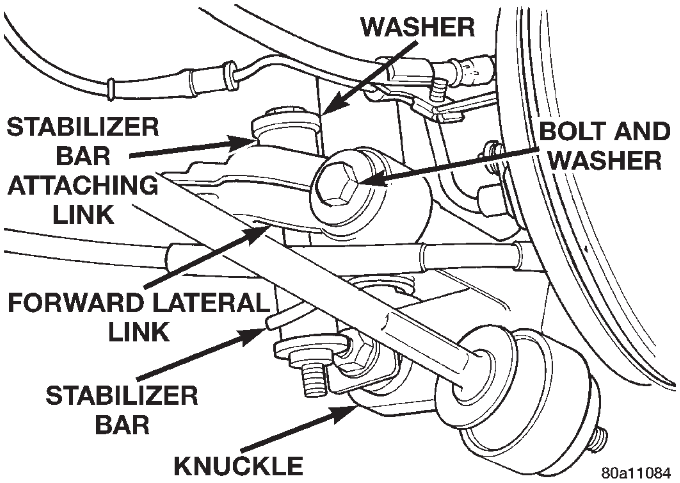


Fig. 31 Stabilizer Bar To Lateral Link Attachment

(4) Remove the nut, bolt and washer (Fig. 31) attaching the forward lateral link to the knuckle.

(5) Remove nut, bolt and washer, attaching the lateral link to the rear suspension crossmember (Fig. 32).

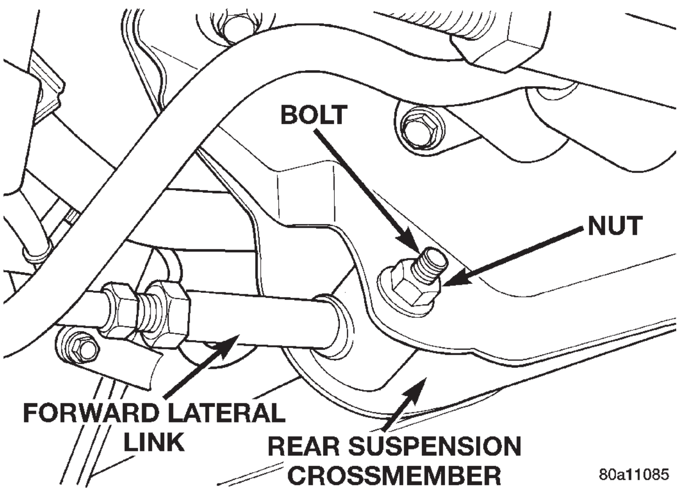


Fig. 32 Lateral Link Attachment To Rear Suspension Crossmember

(6) Remove the forward lateral link from the vehicle.

INSTALL

(1) Install the lateral link and the attaching nut and bolt at rear suspension crossmember (Fig. 32). **The forward lateral link is to be installed with the cup in cast portion facing down and toward rear knuckle (Fig. 31).**

(2) Install the lateral link and attaching nut and bolt at rear knuckle (Fig. 31).

(3) Torque both lateral link attaching bolts to 95 N·m (70 ft. lbs.).

(4) Install rear stabilizer bar attaching link, isolator bushings and attaching nut on forward lateral link (Fig. 31). Tighten the stabilizer bar attaching link to a torque of 32 N·m (24 ft. lbs.).

(5) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(6) Lower vehicle to the ground.

(7) Check and reset rear wheel Camber and Toe to specifications if required. Refer to Front And Rear Toe Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required Toe setting procedure.

REAR LATERAL LINK

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the rear wheel and tire assembly from the side of the vehicle requiring lateral link removal.

(3) Remove the nut, bolt and washer attaching the lateral link to the knuckle (Fig. 33).

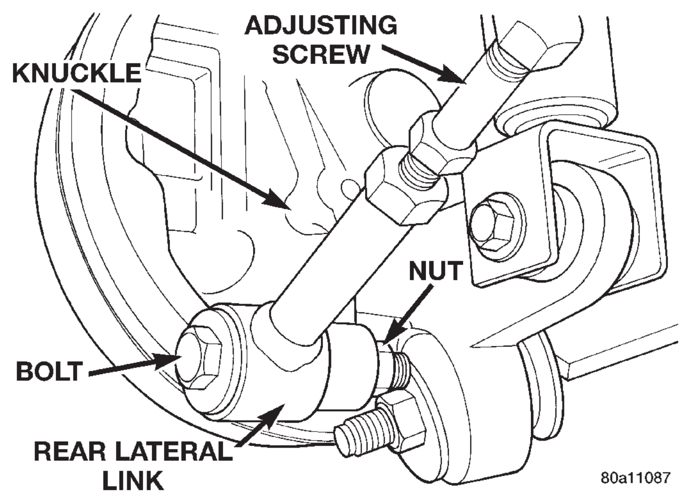


Fig. 33 Rear Lateral Link Attachment To Knuckle

(4) Remove the bolt (Fig. 34) and nut attaching the lateral link to the rear suspension crossmember.

(5) Remove rear lateral link from vehicle.

INSTALL

(1) Install the lateral link and the attaching nut and bolt at rear suspension crossmember (Fig. 34). **The rear lateral link is to be installed with the**

REMOVAL AND INSTALLATION (Continued)

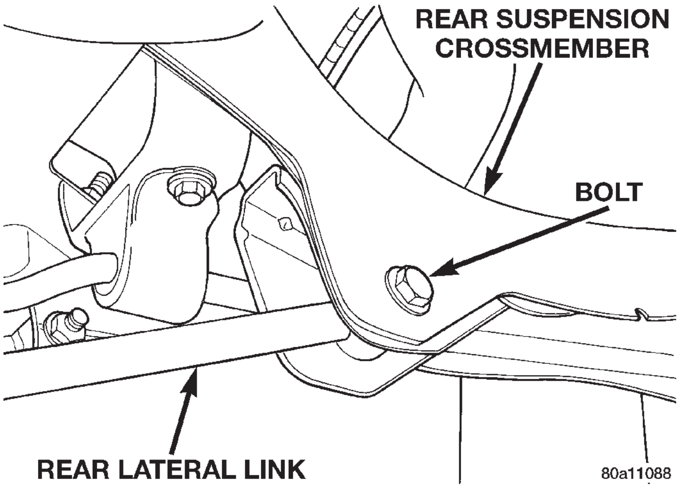


Fig. 34 Lateral Link Attachment To Rear Suspension Crossmember

adjusting screw toward rear knuckle not rear suspension crossmember (Fig. 33).

(2) Install the lateral link and the attaching bolt nut and washer at rear knuckle (Fig. 33).

(3) Torque both lateral link attaching bolts to 95 N·m (70 ft. lbs.).

(4) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification . Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(5) Lower vehicle to the ground.

(6) Check and reset rear wheel Camber and Toe to specifications if required. Refer to Front And Rear Toe Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required Toe setting procedure.

TRAILING LINK

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove rear wheel and tire assembly from the vehicle.

(3) At the knuckle, remove the nut, bushing retainer and outer trailing link bushing (Fig. 35) from the trailing link.

(4) Remove the 4 bolts (Fig. 36) attaching the trailing link hanger bracket to the floor pan and frame rail.

(5) Remove the trailing link and mounting bracket as an assembly from the vehicle.

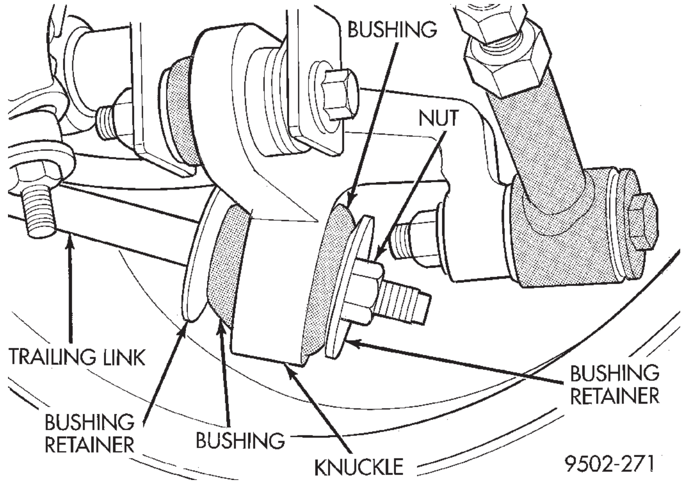


Fig. 35 Trailing Link To Knuckle Attachment

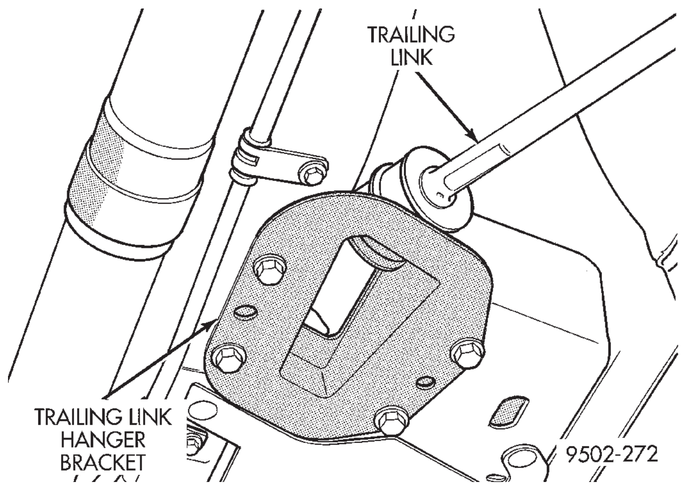


Fig. 36 Trailing Link Hanger Bracket Attachment To Vehicle

CAUTION: The installation position of the bushings and retainers on the trailing link is important. When separating the trailing link from the hanger bracket, note the position and orientation on the bushings and retainers to ensure they are re-installed correctly.

(6) Separate the trailing link from the hanger bracket. To separate trailing link from hanger bracket, use a large adjustable wrench on flat of trailing link to turn link while holding nut stationary (Fig. 37).

REMOVAL AND INSTALLATION (Continued)

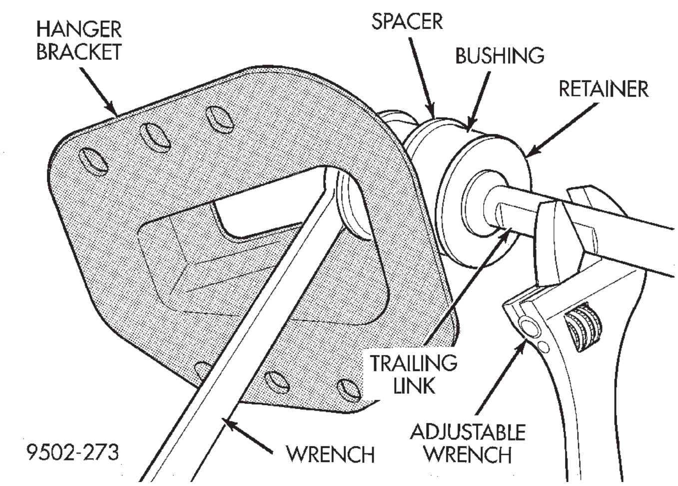


Fig. 37 Separating Trailing Link From Hanger Bracket

INSTALLATION

CAUTION: The inner and outer trailing link to hanger bracket bushings and retainers must be installed in their correct position on the trailing link. Do not reverse the position of the inner and outer trailing link bushing or retainers on the trailing link.

(1) Install the black inner bushing retainer, and inner bushing (Fig. 38) on the trailing link. Install the trailing link, retainer and bushing on the hanger bracket (Fig. 38). Then install the outer bushing, gold outer bushing retainer and nut (Fig. 38) on the trailing link. Using a large adjustable wrench on the flat of the trailing link to keep it from rotating, tighten the trailing link retaining nut to a torque of 99 N·m (73 ft. lbs.).

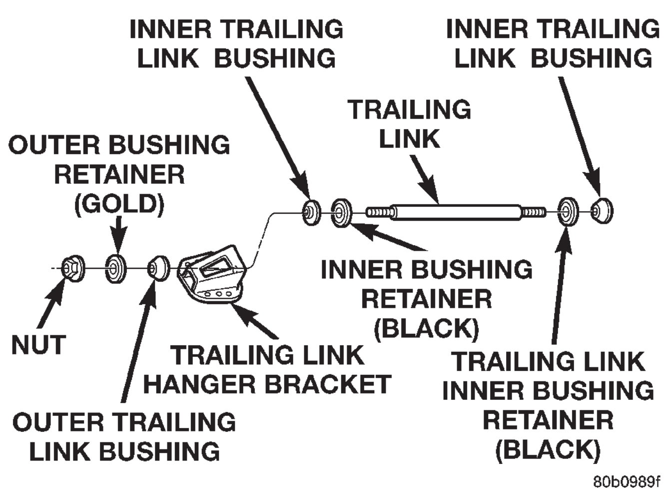


Fig. 38 Trailing Link Bushing Installation

(2) Install the (black) inner bushing retainer, and inner bushing (Fig. 38) on the trailing link.

(3) Install knuckle end of trailing link in rear knuckle.

CAUTION: It is important that the following procedure be done when installing the trailing arm hanger bracket to the body of the vehicle. This procedure will ensure that the hanger bracket is installed in the correct position on the vehicle.

(4) Install trailing link hanger bracket on vehicle and loosely install the 4 attaching bolts (Fig. 39). Then install 2 drift pins of appropriate size in positioning holes on hanger bracket and into locating holes in body (Fig. 39). With hanger bracket correctly positioned on vehicle tighten the 4 hanger bracket mounting bolts to a torque of 28 N·m (250 in. lbs.).

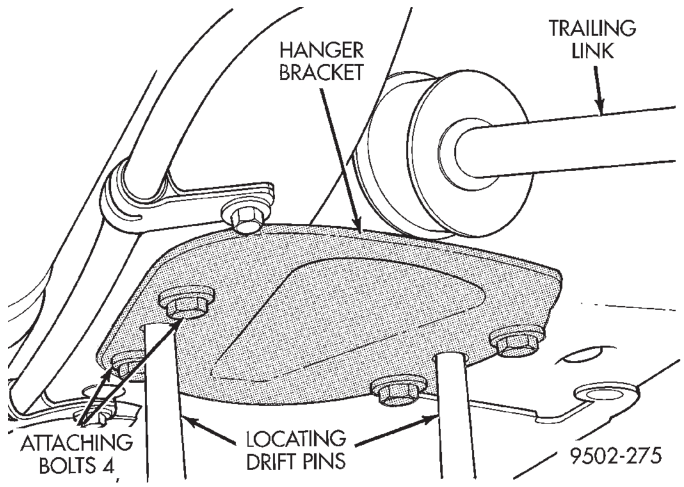


Fig. 39 Trailing Link Hanger Bracket Installation

CAUTION: When installing trailing link bushing retainers, the retainers must be installed with cupped side of retainer facing away from bushing and knuckle (Fig. 35).

(5) Install the outer bushing and the (gold) bushing retainer on the trailing link (Fig. 35). Install the retaining nut (Fig. 35) on trailing link . Using a large adjustable wrench on the flat of the trailing link to keep it from rotating tighten the trailing link retaining nut (Fig. 35) to a torque of 95 N·m (70 ft. lbs.).

STABILIZER BAR (REAR)

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove both rear wheel and tire assemblies from the vehicle.

(3) Remove the nuts (Fig. 40) attaching the stabilizer links/isolator bushings to the stabilizer bar.

REMOVAL AND INSTALLATION (Continued)

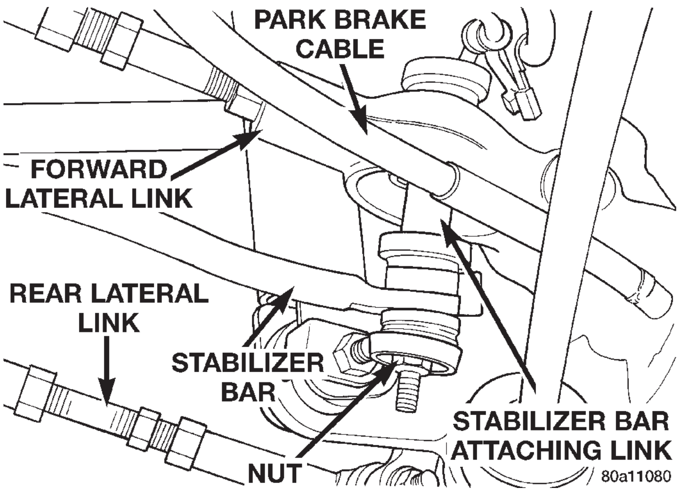


Fig. 40 Stabilizer Bar Attaching Link

(4) Remove the 4 bolts attaching the stabilizer bar bushing clamps to the rear suspension crossmember (Fig. 41).

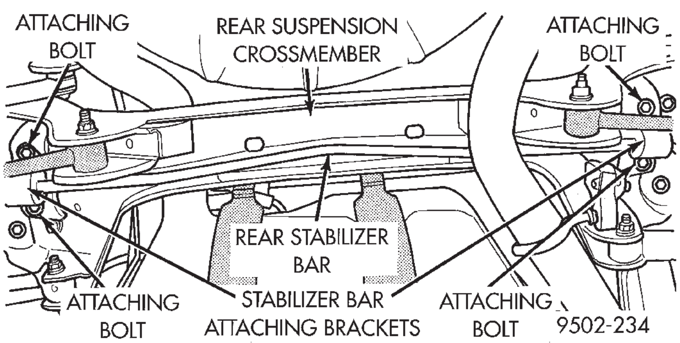


Fig. 41 Stabilizer Bar Attachment To Rear Suspension

(5) Remove the rear stabilizer bar to crossmember bushing clamps and bushings from the stabilizer bar.

(6) Remove stabilizer bar from vehicle. Stabilizer bar will come out of vehicle between the exhaust pipe and the rear suspension crossmember.

STABILIZER BAR BUSHING INSPECTION

Inspect for broken or distorted retainers and bushings. If bushing replacement is required, bushings can be removed by opening slit in bushing and removing bushing from around stabilizer bar.

INSTALLATION

(1) Install stabilizer bar back in vehicle with the bushings removed using the reverse sequence of removal.

(2) When stabilizer bar is installed in vehicle, it must be installed with the bend in the end of the stabilizer bar positioned up in vehicle when viewed from the side (Fig. 42).

(3) Install the stabilizer bar onto the stabilizer bar attaching links on the forward lateral links. Install

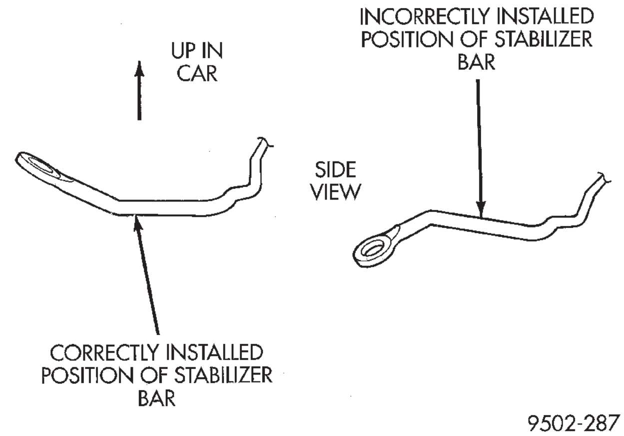


Fig. 42 Installed Position Of Stabilizer Bar In Vehicle

the stabilizer bar to attaching link bushings on attaching links. Tighten the bushing retaining nuts to a torque of 32 N·m (24 ft. lbs.).

NOTE: Prior to installing the bushing clamps, be sure that the stabilizer bar bushings are installed on the stabilizer bar with the slits in the bushings positioned toward the front of the vehicle.

(4) Loosely install the stabilizer bar bushing clamps on the rear suspension crossmember.

(5) Position stabilizer bar so it is centered in the vehicle and does not contact other suspension components or vehicle body.

(6) Tighten bolts attaching stabilizer bar bushing clamps to the rear crossmember to a torque of 28 N·m (250 in. lbs.) (Fig. 41).

(7) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(8) Lower vehicle to the ground.

DISASSEMBLY AND ASSEMBLY

SHOCK ASSEMBLY (REAR)

The shock assembly must be removed from the vehicle for it to be disassembled and assembled. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

For the disassembly and assembly of the shock assembly, use strut spring compressor Pentastar Service Equipment (PSE) tool W-7200, or the equivalent, to compress the coil spring. Follow the manufacturer's instructions closely.

DISASSEMBLY AND ASSEMBLY (Continued)

DISASSEMBLY

(1) If both shocks are being serviced at the same time, mark the coil spring and shock assembly according to which side of the vehicle the shock was removed from, and which shock the coil spring was removed from.

(2) Position the shock assembly in the strut coil spring compressor following the manufacturer's instructions. Set the lower hooks and install the clamp on the lower end of the coil spring, so the shock is held in place once the shock shaft nut is removed (Fig. 43). Lower the upper hooks and position them on the coil spring near the top (Fig. 44).

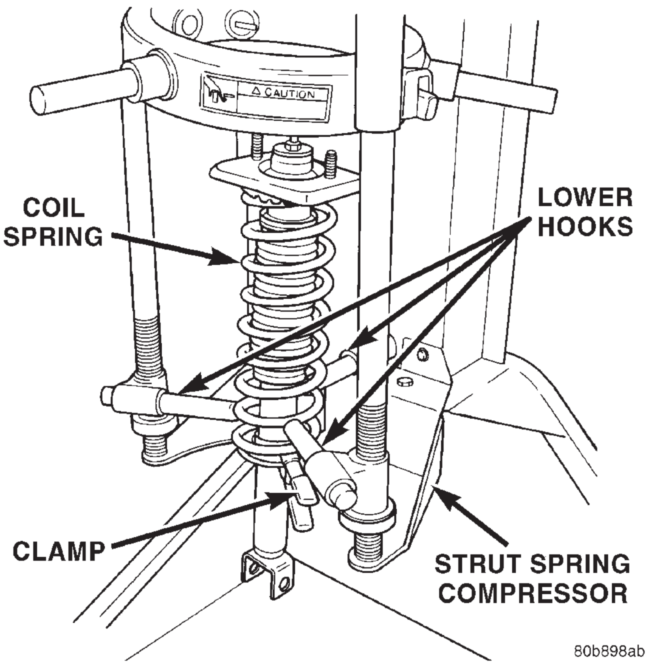


Fig. 43 Lower Hooks And Clamp

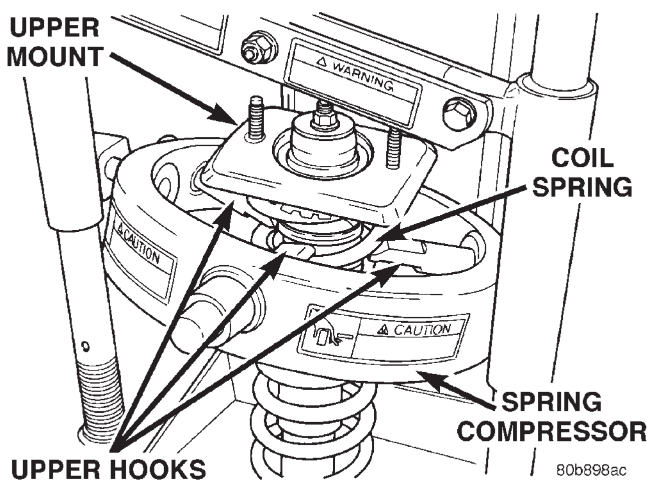


Fig. 44 Upper Hooks Positioned

WARNING: DO NOT REMOVE THE SHOCK ROD NUT BEFORE THE COIL SPRING IS COMPRESSED. THE COIL SPRING IS HELD UNDER PRESSURE AND MUST BE COMPRESSED, REMOVING SPRING TENSION FROM THE UPPER MOUNTING BRACKET BEFORE THE ROD NUT IS REMOVED.

(3) Compress the coil spring until all coil spring tension is removed from the upper mounting bracket.

(4) Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and remove the retainer nut (Fig. 45).

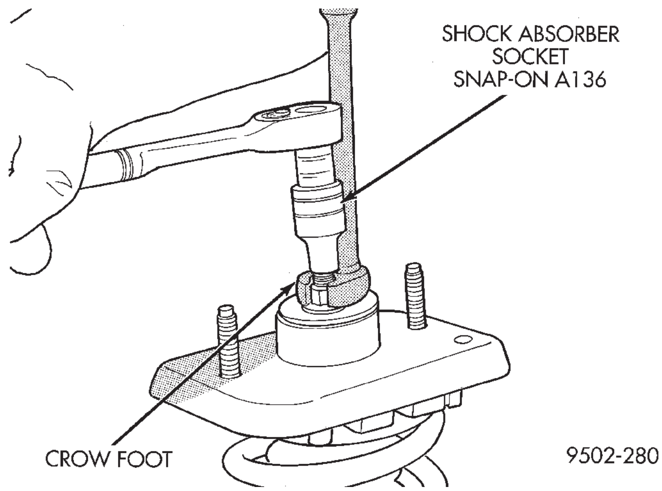


Fig. 45 Retainer Nut Removal/Installation

(5) Remove the upper shock rod bushing retainer washer from the shock rod.

(6) Remove the upper shock mount and the rod isolator bushings as an assembly from the rod of the shock absorber.

(7) Remove the upper coil spring isolator from the top of the coil spring (Fig. 46).

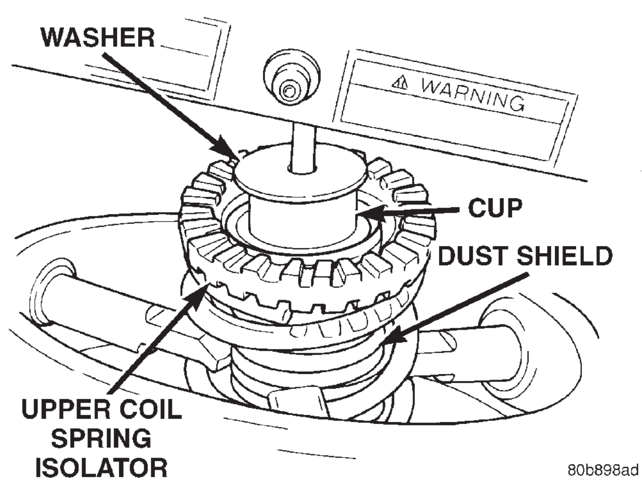


Fig. 46 Upper Coil Spring Isolator, Washer And Dust Boot

DISASSEMBLY AND ASSEMBLY (Continued)

(8) Remove the lower shock rod bushing washer from the top of the dust boot and shock absorber rod (Fig. 46).

(9) Remove the dust shield and cup as an assembly from the shock absorber rod by pulling both straight up and off the shock rod (Fig. 46).

(10) Remove the clamp from the bottom of the coil spring and remove the shock absorber, lower spring isolator, jounce bumper, and collar out through the bottom of the coil spring.

(11) Remove the jounce bumper and the collar (Fig. 47) from the rod of the shock absorber.

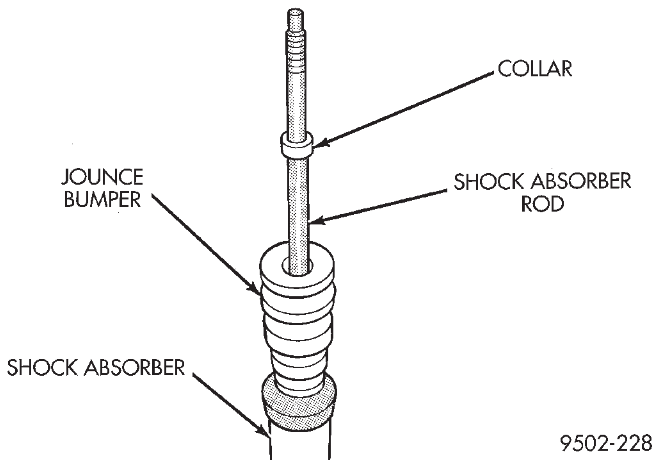


Fig. 47 Shock Absorber Jounce Bumper And Collar

(12) Remove the lower coil spring isolator (Fig. 48) from the lower spring seat on the shock absorber.

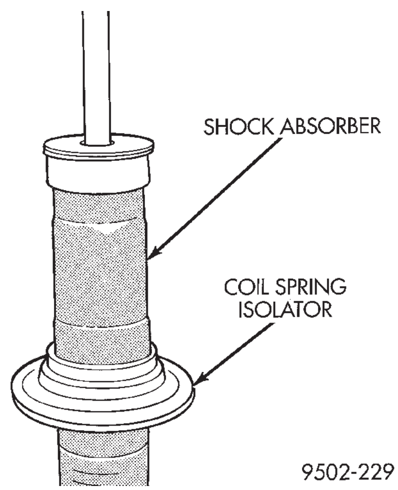


Fig. 48 Lower Coil Spring Isolator

(13) Remove the upper shock rod isolator bushing and sleeve from the upper shock mount (Fig. 49).

(14) Remove the lower shock rod isolator bushing from the upper shock mount (Fig. 50).

(15) Inspect the shock assembly components for the following and replace as necessary:

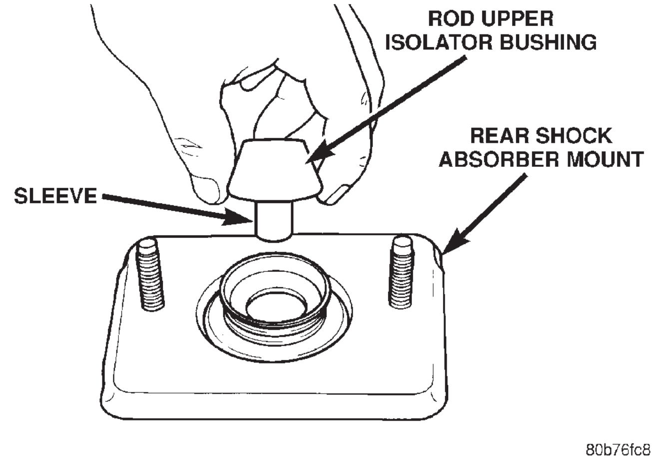


Fig. 49 Shock Rod Upper Isolator Bushing

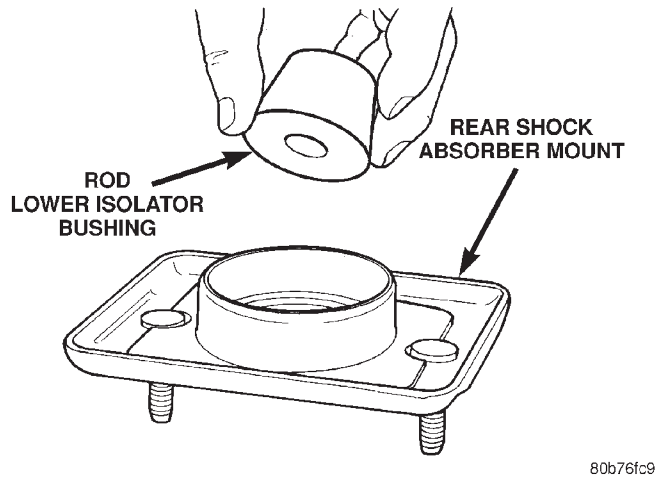


Fig. 50 Shock Rod Lower Isolator Bushing

- Inspect the shock for any condition of rod binding over the full stroke of the shaft.
- Check the upper shock mount for cracks and distortion, and locating studs for any sign of damage.
- Check the upper and lower shock rod isolator bushings for severe deterioration of the rubber.
- Check the upper and lower coil spring isolators for severe deterioration of the rubber.
- Inspect the dust shield for rips and deterioration.
- Inspect the jounce bumper for cracks and signs of deterioration.
- Inspect the coil spring for any sign of damage to the coating.

(16) If the coil spring needs to be serviced, release the tension from the coil spring by backing off the compressor drive fully. Push back the compressor upper hooks and remove the coil spring from the compressor.

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

(1) If the coil spring has been removed from the compressor, place the lower end (smaller diameter) of the coil spring in the spring compressor supported by the lower hooks at the same position as in disassembly (Fig. 43), following the manufacturer's instructions.

(2) Position the upper hooks of the spring compressor on the coil spring near the top as in disassembly (Fig. 44).

(3) Compress the coil spring enough to reinstall the shock absorber and upper mount.

(4) Install the lower shock rod isolator bushing in the bottom of the upper shock mount (Fig. 50). The smaller end is to be pointed away form the mount.

(5) Install the upper shock rod isolator bushing and sleeve in the upper shock mount until seated into lower bushing (Fig. 49). The smaller end of the bushing is to be pointed away from the mount when installed.

(6) Install the lower coil spring isolator (Fig. 48) on the lower spring seat of the shock absorber.

(7) Install the jounce bumper as shown on the rod of the shock absorber (Fig. 51).

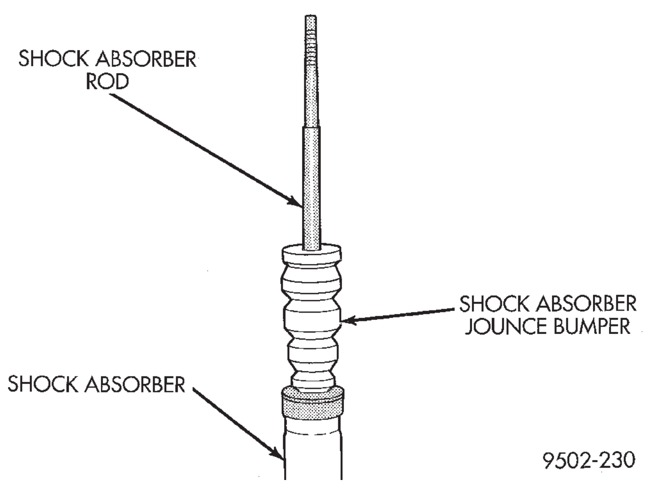


Fig. 51 Jounce Bumper Installed

(8) Install the collar on the rod of the shock absorber assembly with the undercut side of sleeve facing down (Fig. 52). Push the collar down until seated on the step of the shock absorber rod.

(9) Install the shock through the bottom of the coil spring until the lower spring seat contacts the lower end of the coil spring. Install the clamp temporarily securing the shock absorber to the coil spring (Fig. 44).

(10) Install dust shield and cup over the jounce bumper and onto the rod of the shock absorber.

(11) Install the lower shock rod bushing retainer washer on the shock absorber rod.

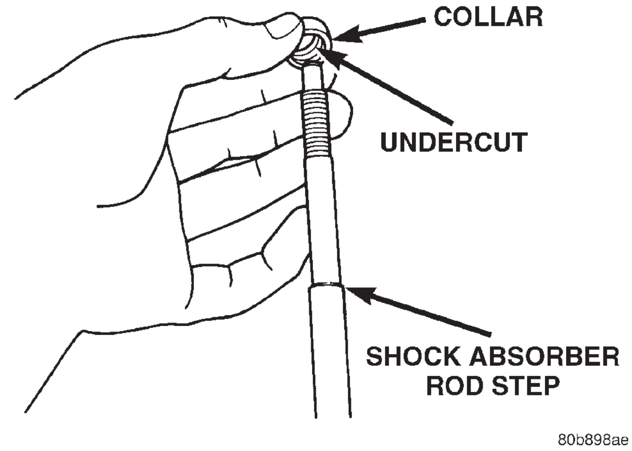


Fig. 52 Installing Collar On Shock Absorber Rod

(12) Install the upper spring isolator on the top of the coil spring. The bottom of the isolator is contoured to fit around the inside diameter of the coil spring (Fig. 46).

(13) Install the upper shock mount bracket and rod isolator bushings as an assembly on the top of the rod of the shock absorber (Fig. 44).

(14) Install the upper shock rod bushing retainer washer. Make sure the concave side is facing up.

(15) Install the shock assembly retainer nut. Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and tighten the retainer nut using a crow foot wrench (on the end of a torque wrench and extension) to a torque of 45 N·m (33 ft. lbs.) (Fig. 45).

(16) Position the upper shock mount so it's studs are in line with the bolt hole in the shock absorber lower bracket (Fig. 44).

(17) Slowly release the tension from the coil spring by backing off the compressor drive fully. As the tension is relieved, make sure the upper mount, isolator, and coil spring align properly. Remove the clamp from the lower end of the coil spring and shock. Push back the spring compressor upper and lower hooks, then remove the shock assembly from the spring compressor.

(18) Install shock assembly on the vehicle. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

BALL JOINT (REAR UPPER)

The rear upper control arm must be removed from the vehicle for replacement of the ball joint. Refer to CONTROL ARM (REAR UPPER) in the REMOVAL AND INSTALLATION section of this service manual group for the required procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

REMOVAL

(1) Using a screw driver or other suitable tool, pry seal boot up and off of ball joint assembly (Fig. 53).

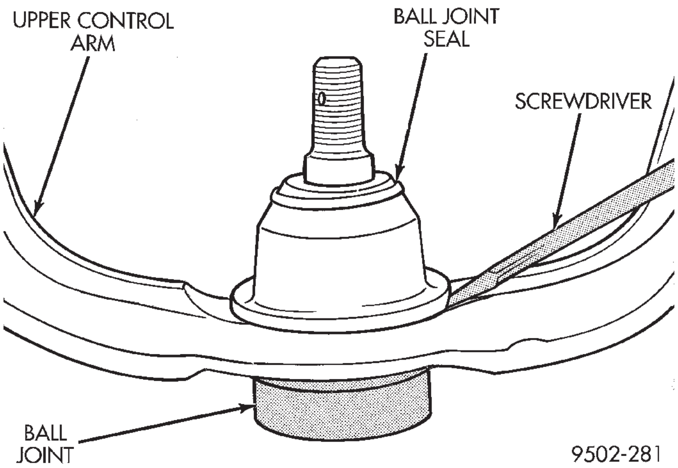


Fig. 53 Ball Joint Seal Boot Removal

(2) Position Receiving Cup, Special Tool 6758 to support control arm when removing ball joint assembly (Fig. 54). Install Remover/Installer, Special Tool 6804 on top of ball joint assembly (Fig. 54).

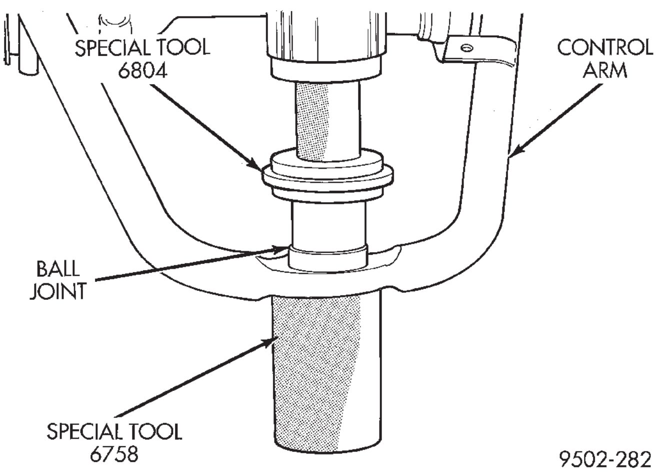


Fig. 54 Removing Ball Joint From Upper Control Arm

(3) Using an arbor press, press the ball joint assembly out of the control arm.

INSTALLATION

(1) By hand, position ball joint assembly into ball joint bore of control arm. Be sure ball joint assembly is not cocked in the bore of the control arm, this will cause binding of the ball joint assembly, when being pressed into lower control arm.

(2) Position assembly in an arbor press with Receiving Cup, Special Tool 6758 supporting lower control arm (Fig. 55). Then install Remover/Installer, Special Tool 6804 on the top of the ball joint assembly (Fig. 55).

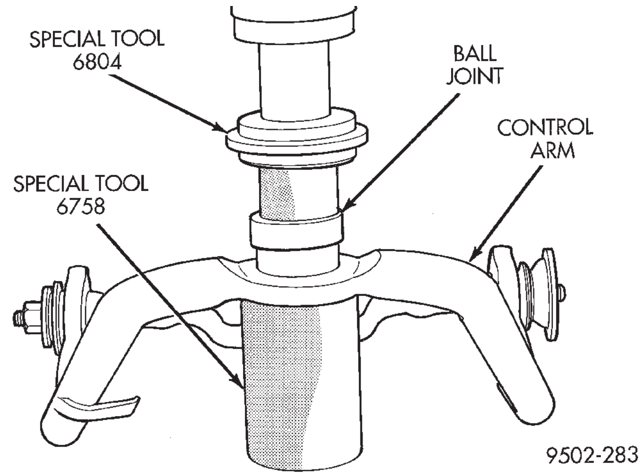


Fig. 55 Installing Ball Joint In Upper Control Arm

CAUTION: When installing the ball joint in the upper control arm, do not press the ball joint into the control arm all the way. The lip on the ball joint must not touch the surface of the control arm. Refer to Step 3 below when installing the ball joint.

(3) Carefully align all pieces. Using the arbor press, press the ball joint into the control arm until a gap of 3mm (1/8 inch) is between lip on ball joint and surface of lower control arm.

(4) Install a **NEW** ball joint assembly sealing boot on ball joint assembly.

CAUTION: Do not use an arbor press to install the sealing boot on the lower control arm ball joint assembly. Damage to the sealing boot can occur due to excessive pressure applied to sealing boot when being installed.

(5) Position Receiving Cup, Special Tool 6758 over sealing boot so it is aligned properly with bottom edge of sealing boot (Fig. 56). Apply pressure **BY HAND** to special tool 6758, until sealing boot is pressed squarely against surface of control arm.

(6) Reinstall the control arm on the vehicle. Refer to CONTROL ARM (REAR UPPER) in the REMOVAL AND INSTALLATION section of this service manual group for the required procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

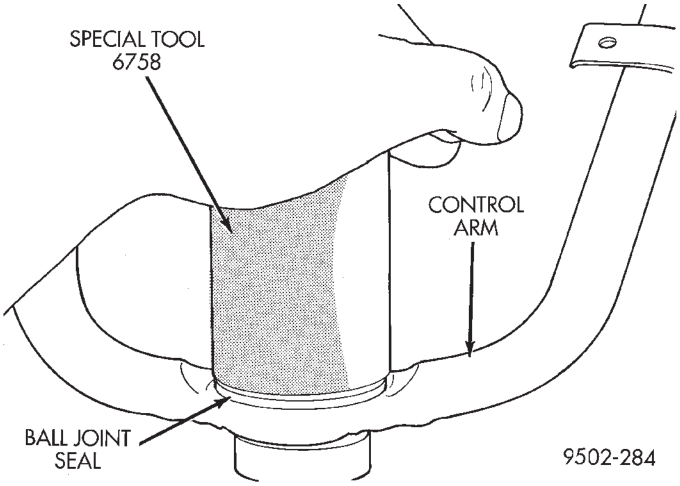


Fig. 56 Ball Joint Seal Boot Installation

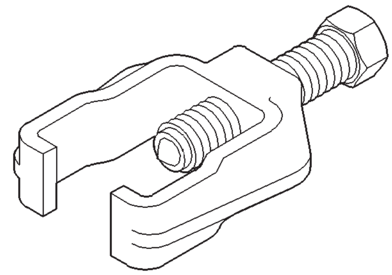
SPECIFICATIONS

REAR SUSPENSION FASTENER TORQUE SPECIFICATIONS

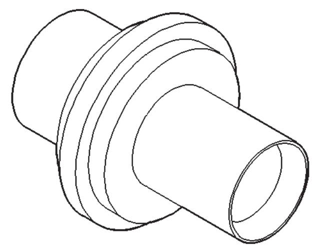
DESCRIPTION	TORQUE
Shock Assembly:	
Upper Mount To Body Nuts	54 N·m (40 ft. lbs.)
Knuckle Bolt/Nut	95 N·m (70 ft. lbs.)
Shock Rod retainer Nut	45 N·m (33 ft. lbs.)
Knuckle:	
Brake Support Plate Mounting Bolts	61 N·m (45 ft. lbs.)
Hub And Bearing:	
Retaining Nut	250 N·m (185 ft. lbs.)
Wheel Mounting Nuts	109-150 N·m (80-110 ft. lbs.)
Upper Control Arm:	
Pivot Bar Bolts	107 N·m 80 ft. lbs.)
Ball Joint Castle Nut	67 N·m (50 ft. lbs.)
Lateral Links:	
Knuckle Bolts	95 N·m (70 ft. lbs.)
Suspension Crossmember Bolts	95 N·m (70 ft. lbs.)
Adjustment Jam Nuts	65 N·m (48 ft. lbs.)
Trailing Link:	
Shaft Nuts (Front And Rear)	95 N·m (70 ft. lbs.)
Bracket To Body Mounting Bolts	28 N·m (21 ft. lbs.)
Stabilizer Bar:	
Isolator Bushing Retainer Bolt	28 N·m (20 ft. lbs.)
Link Nut	32 N·m (24 ft. lbs.)
Rear Suspension Crossmember:	
Body Attaching Bolts	95 N·m 70 ft. lbs.)

SPECIAL TOOLS

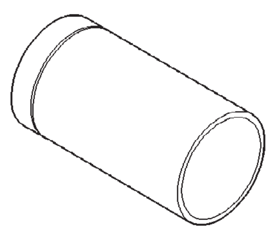
REAR SUSPENSION



Puller, Pitman Arm CT-1106



Remover, Suspension Arm Bushing And Ball Joint 6804



Installer, Ball Joint 6758

DIFFERENTIAL AND DRIVELINE

CONTENTS

GENERAL INFORMATION

FRONT DRIVESHAFTS

Vehicles equipped with either an automatic or manual transmission uses an unequal length driveshaft system.

Vehicles equipped with automatic transaxles use a solid short interconnecting shaft on the left side. The right side of the vehicle uses a longer solid interconnecting shaft.

Driveshafts used on both the right and left sides of the vehicle use a tuned rubber damper weight. The damper weight on the right side is a single clamp style damper. The damper weight on the left side is a double clamp style damper. When replacing a driveshaft, be sure the replacement driveshaft has the same damper weight as the original.

Both driveshaft assemblies use the same type of inner and outer joints. The inner joint of both driveshaft assemblies is a tripod joint, and the outer joint of both driveshaft assemblies is a Rzeppa joint. Both tripod joints and Rzeppa joints are true constant velocity (C/V) joint assemblies. The inner tripod joint allows for the changes in driveshaft length through the jounce and rebound travel of the front suspension.

On vehicles equipped with ABS brakes, the outer C/V joint is equipped with a tone wheel used to determine vehicle speed for ABS brake operation.

The inner tripod joint of both driveshafts is splined into the transaxle side gears. The inner tripod joints are retained in the side gears of the transaxle using a snap ring located in the stub shaft of the tripod joint. The outer C/V joint has a stub shaft that is splined into the wheel hub and retained by a hub nut using a nut lock and cotter pin, hub nut retention system.

NOTE: This vehicle does not use a rubber lip bearing seal as on past front wheel drive cars, to prevent contamination of the front wheel bearing. On these vehicles, the face of the outer C/V joint has a metal bearing shield which is pressed onto the end of the outer C/V joint housing. This design deters direct water splash on bearing seal while allowing any water that gets in, to run out the bottom of the bearing shield. It is important though to thoroughly clean the outer C/V joint and the wheel bearing area in the steering knuckle before it is assembled after servicing.

DIAGNOSIS AND TESTING

DRIVESHAFT DIAGNOSIS

VEHICLE INSPECTION

(1) Check for grease in the vicinity of the inboard tripod joint and outboard C/V joint; this is a sign of inner or outer joint seal boot or seal boot clamp damage.

(2) A light film of grease may appear on the right inner tripod joint seal boot; this is considered normal and should not require replacement of the seal boot.

NOISE AND/OR VIBRATION IN TURNS

A clicking noise and/or a vibration in turns could be caused by one of the following conditions:

(1) Damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss and/or contamination of the joint grease, resulting in inadequate lubrication of the joint.

(2) Noise may also be caused by another component of the vehicle coming in contact with the driveshafts.

DIAGNOSIS AND TESTING (Continued)

CLUNKING NOISE DURING ACCELERATION

This noise may be a result of one of the following conditions:

(1) A torn seal boot on the inner or outer joint of the driveshaft assembly.

(2) A loose or missing clamp on the inner or outer joint of the driveshaft assembly.

(3) A damaged or worn driveshaft C/V joint.

SHUDDER OR VIBRATION DURING ACCELERATION

This problem could be a result of:

(1) A worn or damaged driveshaft inner tripod joint.

(2) A sticking tripod joint spider assembly (inner tripod joint only).

(3) Improper wheel alignment. See Wheel Alignment in this group for alignment checking and setting procedures and specifications.

VIBRATION AT HIGHWAY SPEEDS

This problem could be a result of:

(1) Foreign material (mud, etc.) packed on the backside of the wheel(s).

(2) Out of balance front tires or wheels. See Group 22, Wheels And Tires for the required balancing procedure.

(3) Improper tire and/or wheel runout. See Group 22, Wheels And Tires for the required runout checking procedure.

REMOVAL AND INSTALLATION

FRONT DRIVESHAFTS

REMOVAL

CAUTION: The driveshaft, when installed, acts as a bolt and secures the front hub/bearing assembly. If vehicle is to be supported or moved on its wheels with a driveshaft removed, install a PROPER–SIZED BOLT AND NUT through front hub. Tighten bolt and nut to 244 N·m (180 ft. lbs.). This will ensure that the hub bearing cannot loosen.

(1) Remove cotter pin, nut lock, and spring washer from the end of the outer C/V joint stub axle (Fig. 1).

(2) Loosen (but do not remove) stub axle to hub/bearing retaining nut. Loosen hub nut while vehicle is on the floor with the brakes applied (Fig. 2). The front hub and driveshaft are splined together and retained by the hub nut.

(3) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting, in the Lubrication and Maintenance section, for required lifting procedure to be used for this vehicle.

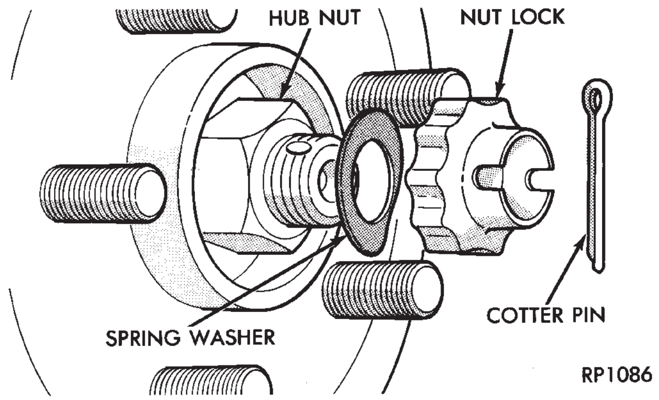


Fig. 1 Cotter Pin, Nut Lock and Spring Washer

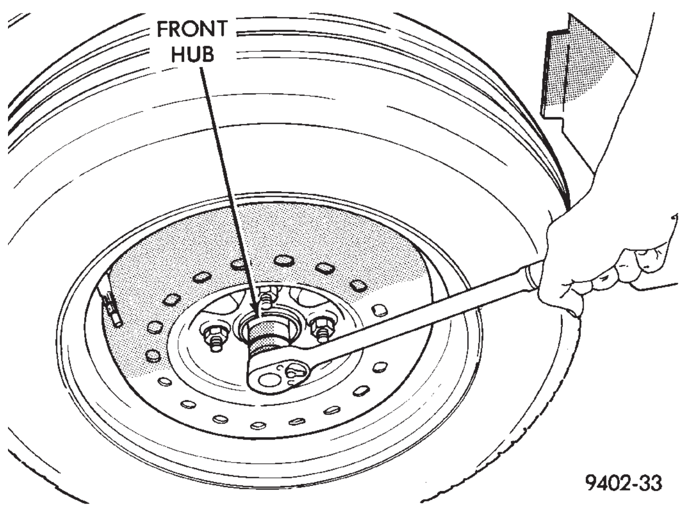


Fig. 2 Loosening Front Hub Retaining Nut

(4) Remove front tire and wheel assembly from the hub.

(5) Remove front disc brake caliper assembly to steering knuckle guide pin attaching bolts (Fig. 3).

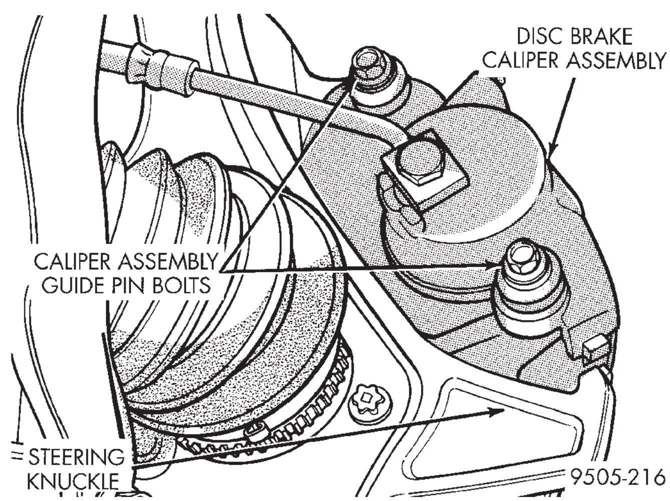


Fig. 3 Caliper Guide Pin Attaching Bolts

REMOVAL AND INSTALLATION (Continued)

(6) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 4).

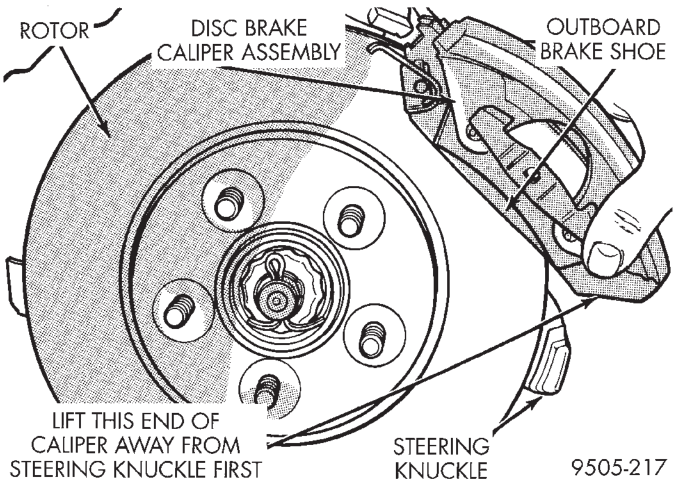


Fig. 4 Removing Disc Brake Caliper

(7) Support brake caliper/adapter assembly using a wire hook (Fig. 5). **Do not support assembly by the brake flex hose.**

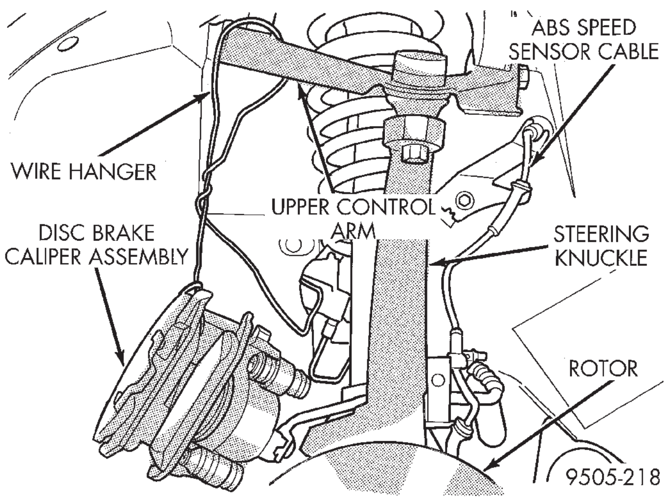


Fig. 5 Correctly Supported Brake Caliper

(8) Remove braking disc from front hub.

(9) Remove nut attaching outer tie rod end to steering knuckle. **Remove nut from tie rod end by holding tie rod end stud with a 11/32 socket and loosen and remove nut (Fig. 6).**

(10) Remove the tie rod end stud from steering knuckle arm, using remover, Special Tool MB-990635 (Fig. 7).

(11) If equipped with antilock brakes, remove the speed sensor cable routing bracket from the steering knuckle (Fig. 8).

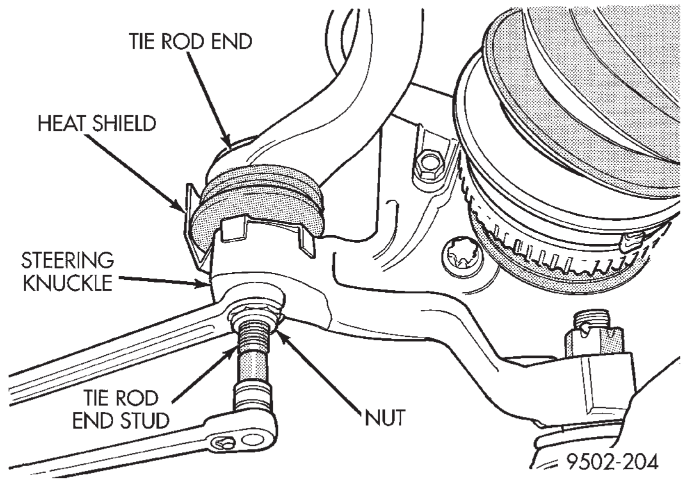


Fig. 6 Removing Tie Rod End Attaching Nut

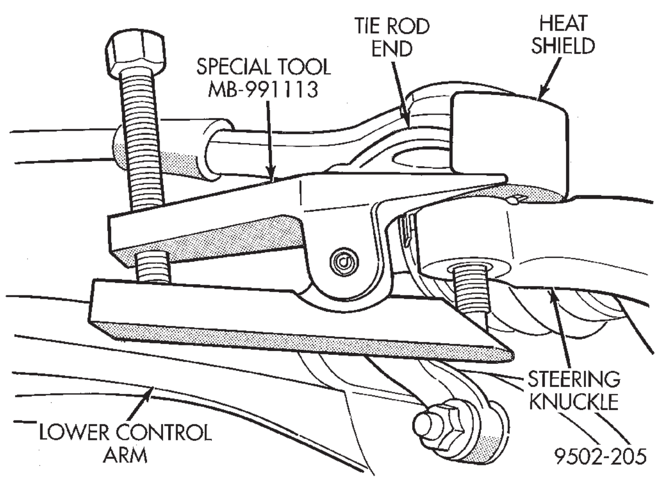


Fig. 7 Tie Rod End Removal from Steering Knuckle

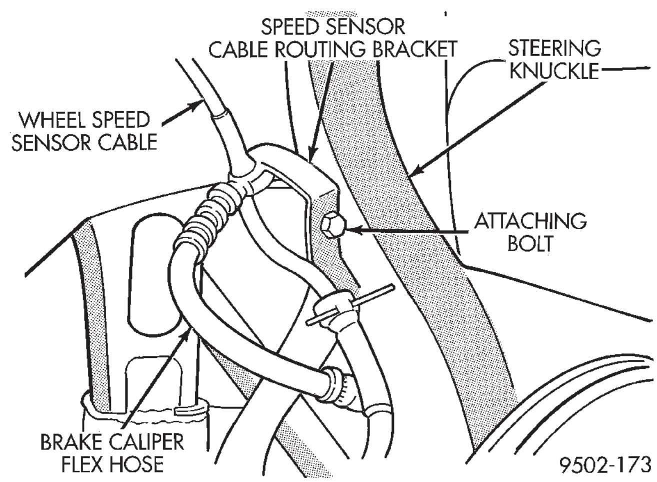


Fig. 8 Wheel Speed Sensor Cable Routing Bracket

REMOVAL AND INSTALLATION (Continued)

(12) Remove cotter pin and castle nut (Fig. 9) from stud of lower ball joint at the steering knuckle.

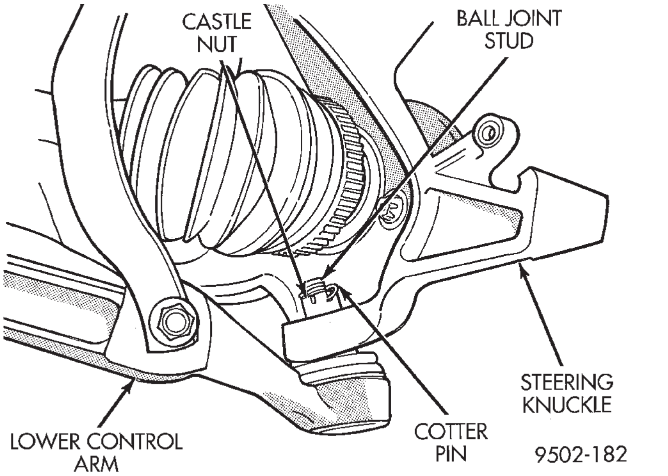


Fig. 9 Lower Ball Joint to Steering Knuckle Attachment

CAUTION: No tool is to be inserted between the steering knuckle and the lower ball joint to separate stud of lower ball joint from the steering knuckle. The steering knuckle is to be separated from the stud of the ball joint only using the procedure as described in Step 13.

(13) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel well as possible. Using a hammer strike steering knuckle boss until steering knuckle separates from stud of lower ball joint (Fig. 10). **When striking steering knuckle, care MUST be taken not to hit lower control arm or ball joint grease seal.**

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint. Driveshaft must be supported.

(14) Pull steering knuckle assembly out and away from outer C/V joint of the driveshaft assembly (Fig. 11).

CAUTION: When inserting pry bar between inner tripod joint and transaxle case, care must be used to ensure no damage occurs to oil seal in transaxle case.

(15) Support the outer end of the driveshaft assembly. Insert a pry bar between inner tripod joint and transaxle case (Fig. 12). Pry against inner tripod joint, until tripod joint retaining snap ring is disengaged from transaxle side gear.

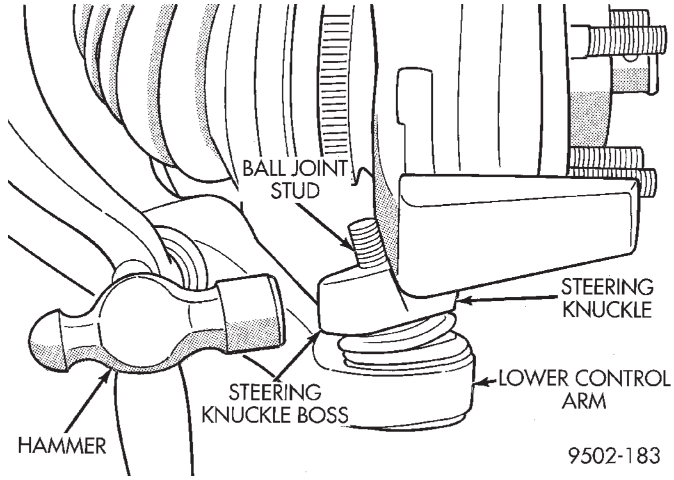


Fig. 10 Separating Ball Joint Stud from Steering Knuckle

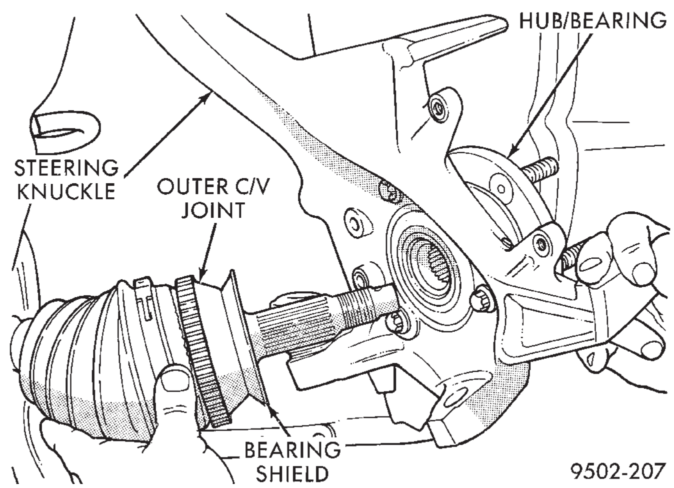


Fig. 11 Separating Steering Knuckle from Outer C/V Joint

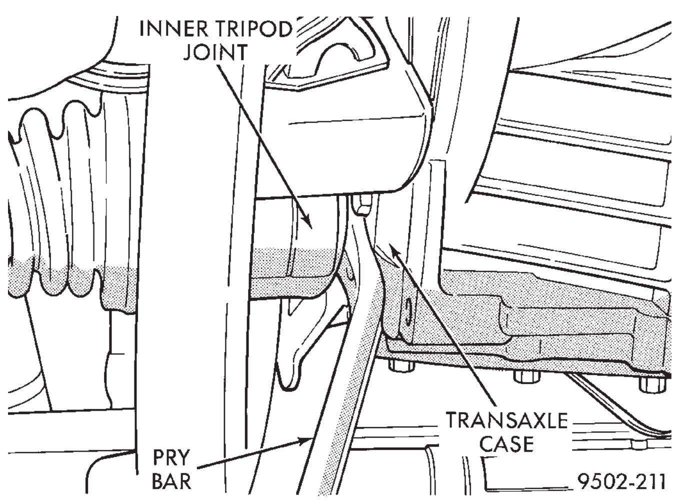


Fig. 12 Disengaging Inner Tripod Joint From Transaxle

REMOVAL AND INSTALLATION (Continued)

(16) Hold inner tripod joint and interconnecting shaft of driveshaft assembly. Remove inner tripod joint from transaxle, by pulling it straight out of transaxle side gear and transaxle oil seal (Fig. 13). **When removing tripod joint, do not let spline or snap ring drag across sealing lip of the transaxle to tripod joint oil seal.**

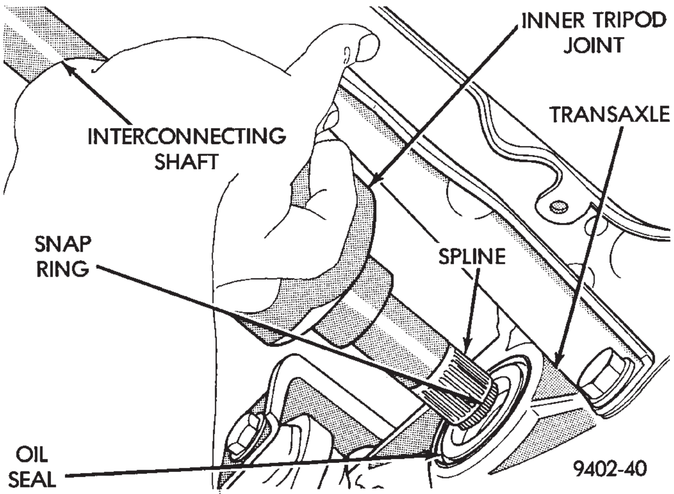


Fig. 13 Tripod Joint Removal from Transaxle

CAUTION: The driveshaft, when installed, acts as a bolt and secures the front hub/bearing assembly. If vehicle is to be supported or moved on its wheels with a driveshaft removed, install a PROPER–SIZED BOLT AND NUT through front hub. Tighten bolt and nut to 244 N·m (180 ft. lbs.). This will ensure that the hub bearing cannot loosen.

INSTALLATION

(1) Thoroughly clean spline and oil seal sealing surface, on tripod joint. Lightly lubricate oil seal sealing surface on tripod joint with fresh clean transmission lubricant.

(2) Holding driveshaft assembly by tripod joint and interconnecting shaft, install tripod joint into transaxle side gear as far as possible by hand (Fig. 13).

(3) Grasp inner tripod joint an interconnecting shaft. Forcefully push the tripod joint into side gear of transaxle, until snap ring is engaged with transaxle side gear. **Test that snap ring is fully engaged with side gear by attempting to remove tripod joint from transaxle by hand. If snap ring is fully engaged with side gear, tripod joint will not be removable by hand.**

(4) Clean all debris and moisture out of steering knuckle, in the area were outer C/V joint will be installed into steering knuckle.

(5) Ensure that front of outer C/V joint which fits against the face of the hub and bearing is free of debris and moisture before installing outer C/V joint into hub and bearing assembly (Fig. 14).

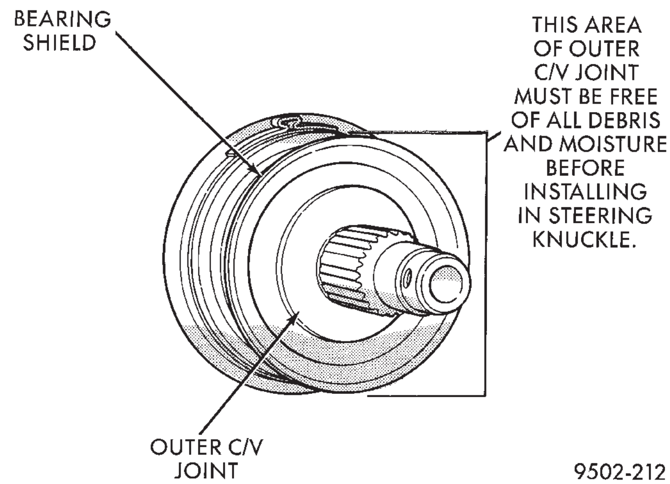


Fig. 14 Outer C/V Joint Inspection

(6) Slide driveshaft back into front hub (Fig. 15). Then install steering knuckle onto the lower control arm ball joint stud.

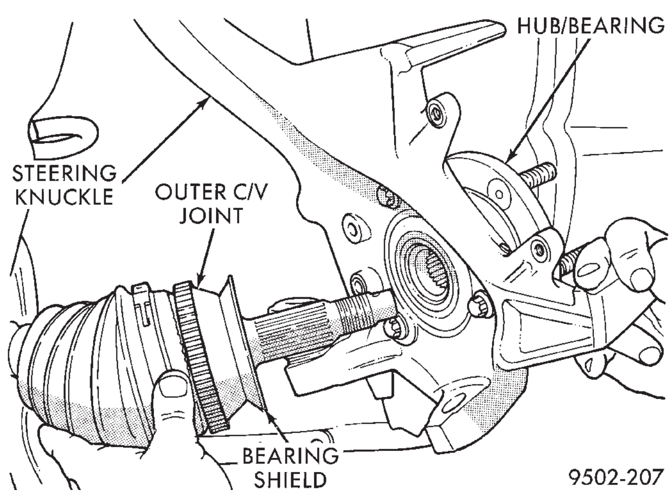


Fig. 15 Steering Knuckle Installation on Outer C/V Joint

REMOVAL AND INSTALLATION (Continued)

(7) Install the steering knuckle to ball joint stud castle nut (Fig. 16). Tighten the castle nut to 95 N·m (70 ft. lbs.).

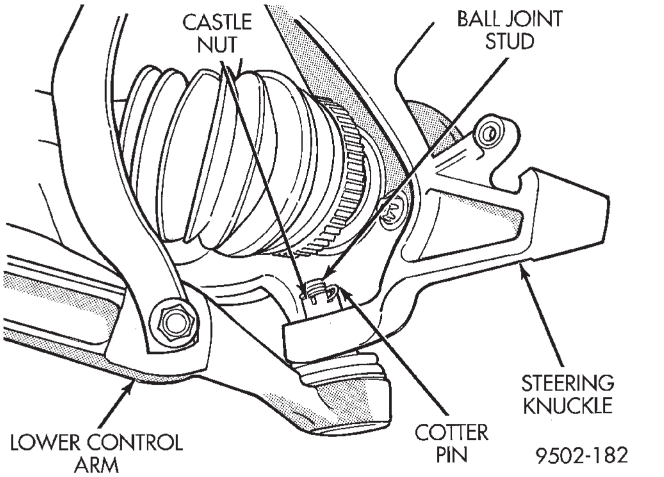


Fig. 16 Lower Ball Joint to Steering Knuckle Attachment

(8) If equipped with antilock brakes, install the speed sensor cable on the steering knuckle and securely tighten bolt (Fig. 17).

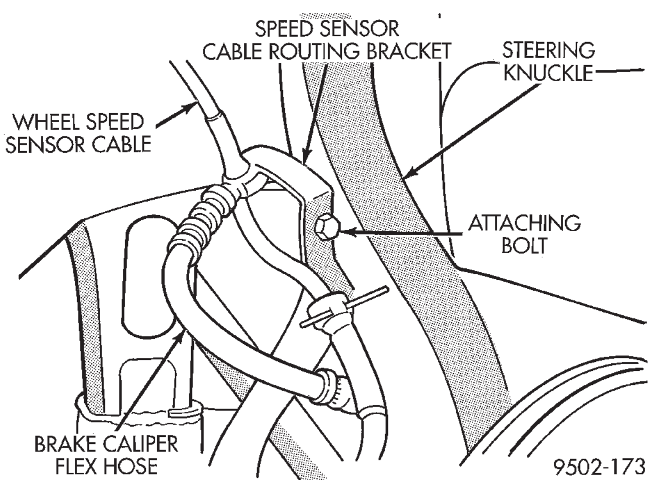


Fig. 17 Wheel Speed Sensor Cable Routing Bracket

(9) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle nut onto stud of tie rod end. While holding stud of tie rod end stationary (Fig. 18), tighten tie rod end to steering knuckle nut. Using a crowfoot and 11/32 socket, tighten the nut to 61 N·m (45 ft. lbs.) (Fig. 19).

(10) Install braking disc back on hub and bearing assembly.

(11) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 20).

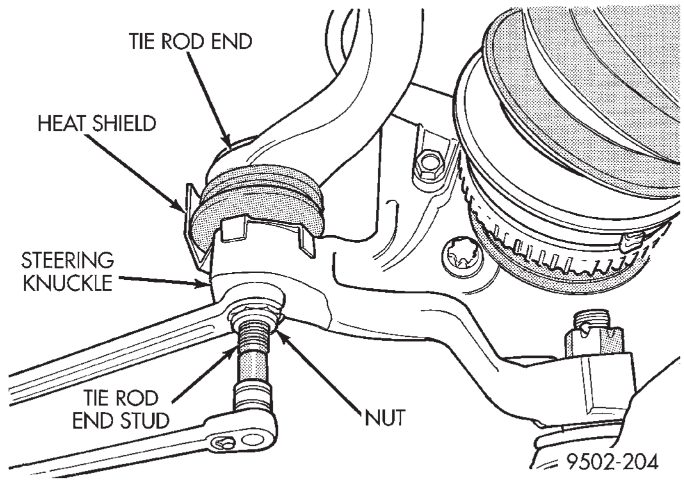


Fig. 18 Installing Tie Rod End Nut

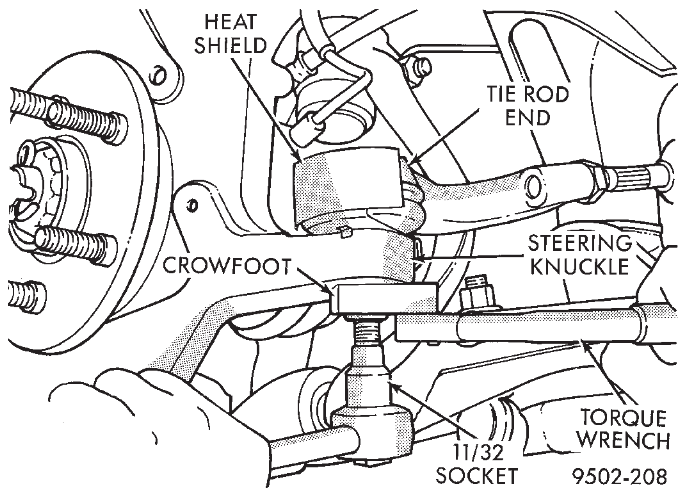


Fig. 19 Torquing Tie Rod End Nut

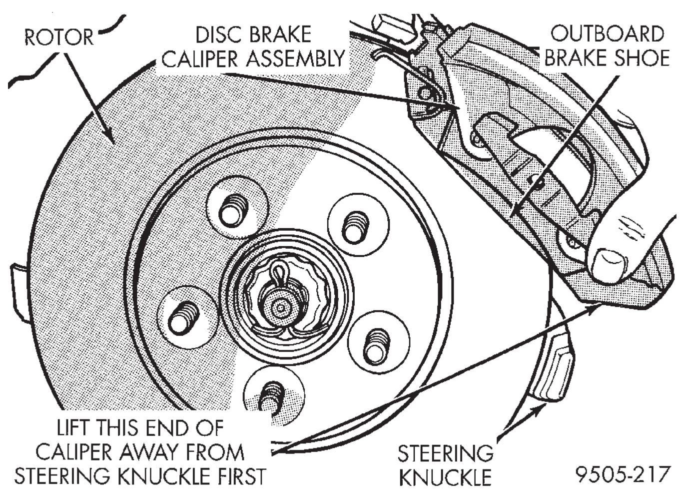


Fig. 20 Disc Brake Caliper Assembly Installation

(12) Install caliper assembly to steering knuckle guide pin bolts (Fig. 21). Tighten caliper assembly bolts to 31 N·m (23 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

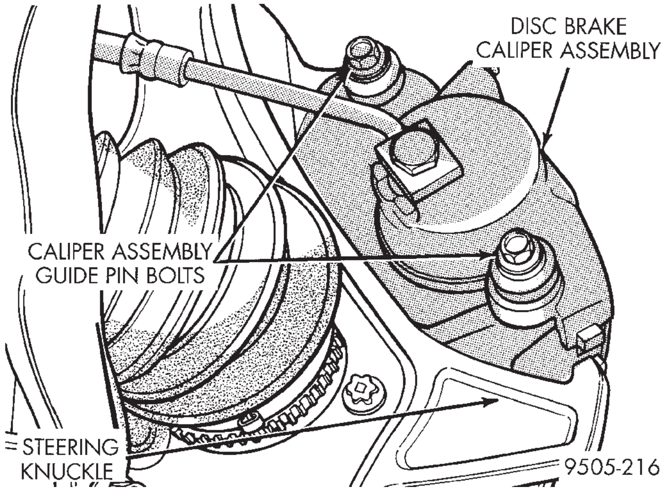


Fig. 21 Disc Brake Caliper Bolts

(13) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install hub nut onto threads of stub axle and tighten nut. (Fig. 22).

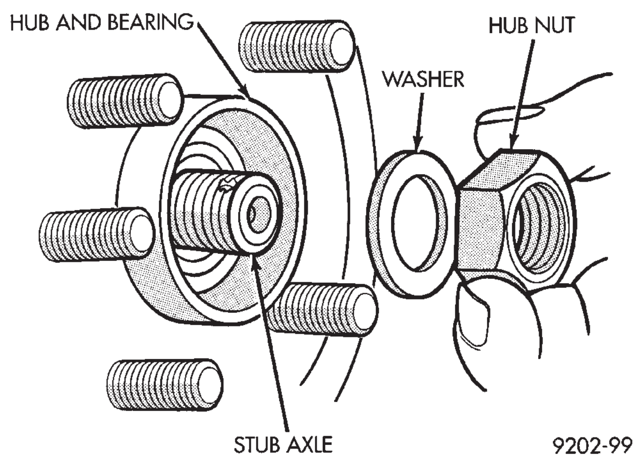


Fig. 22 Install Washer and Hub Nut

(14) With vehicle brakes applied to keep braking disc from turning, tighten hub nut to 244 N·m (180 ft. lbs.) (Fig. 23).

(15) Install the spring washer, hub nut lock, and new cotter pin on end of stub axle. Wrap cotter pin prongs tightly around the hub nut lock (Fig. 24).

(16) Install front wheel and tire assembly. Install front wheel lug nuts and tighten in the correct sequence (Fig. 25). Tighten lug nuts to 135 N·m (100 ft. lbs.).

(17) Lower vehicle.

(18) Check for correct fluid level in transaxle assembly. Refer to Group 21, Transaxle for the correct fluid level checking procedure for the type of transaxle being checked.

(19) Set front toe on vehicle to required specification.

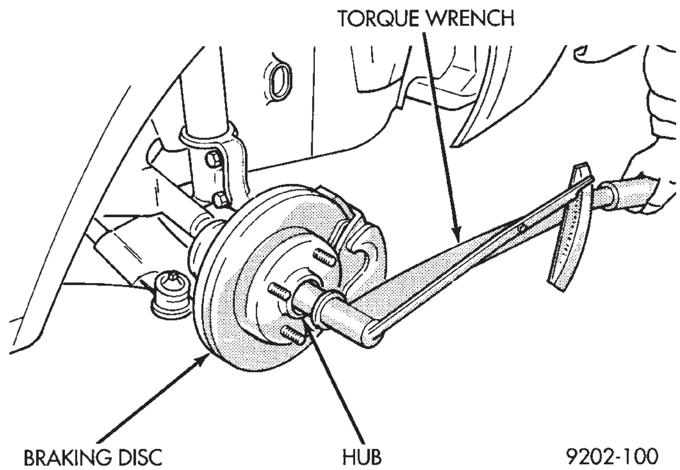


Fig. 23 Torquing Front Hub Nut

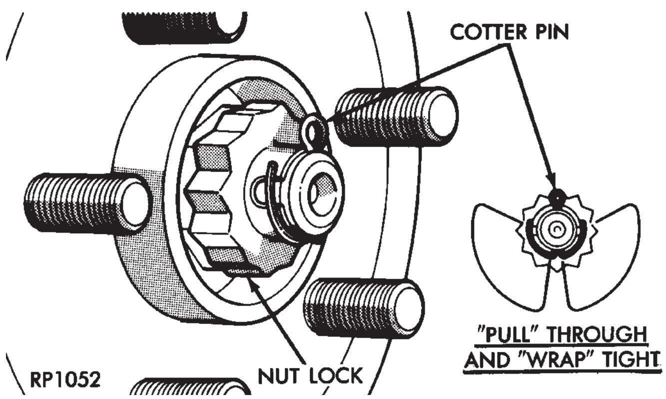


Fig. 24 Spring Washer, Nut Lock and Cotter Pin Installation

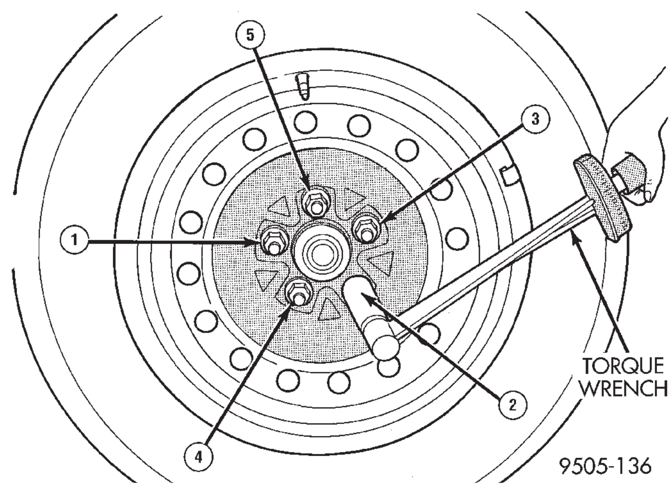


Fig. 25 Wheel Lug Torquing Sequence

DISASSEMBLY AND ASSEMBLY

INNER TRIPOD JOINT SEAL BOOT

REMOVAL

To remove sealing boots from driveshafts, the driveshaft assemblies must be removed from the vehicle. See Servicing Driveshaft for the required driveshaft removal and replacement procedure.

The inner tripod joints use no internal retention in the tripod housing to keep the spider assembly in the housing. Therefore, do not pull on the interconnecting shaft to disengage tripod housing from transmission stub shaft. Removal in this manner will cause damage to the inboard joint sealing boots.

(1) Remove the driveshaft requiring boot replacement from the vehicle. See Servicing Driveshaft for the required driveshaft removal procedure.

(2) Remove large boot clamp which retains inner tripod joint sealing boot to tripod joint housing and discard. Remove small clamp which retains inner tripod joint sealing boot to interconnecting shaft and discard. Remove the sealing boot from the tripod housing and slide it down the interconnecting shaft.

CAUTION: When removing the tripod joint housing from the spider assembly, hold the bearings in place on the spider trunions to prevent the bearings from falling away.

(3) Slide the tripod joint housing off the spider assembly and the interconnecting shaft (Fig. 26).

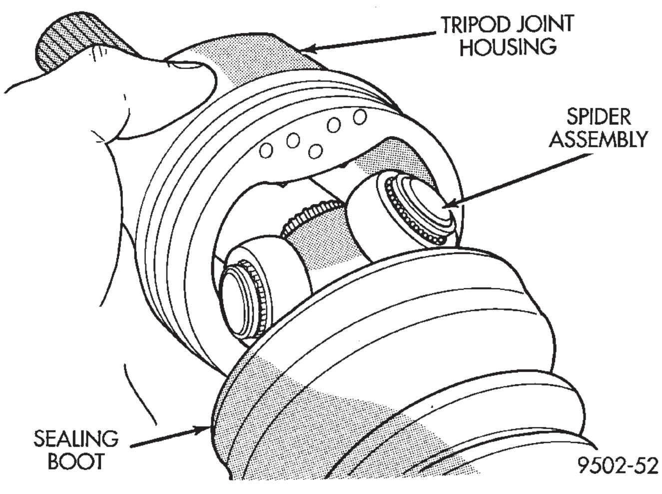


Fig. 26 Spider Assembly Removal from Tripod Joint Housing

(4) Remove snap ring which retains spider assembly to interconnecting shaft (Fig. 27). Remove the spider assembly from interconnecting shaft. If spider assembly will not come off interconnecting shaft by hand, it can be removed by tapping spider assembly with a brass drift (Fig. 28). **Do not hit the outer tripod bearings in an attempt to remove spider assembly from interconnecting shaft.**

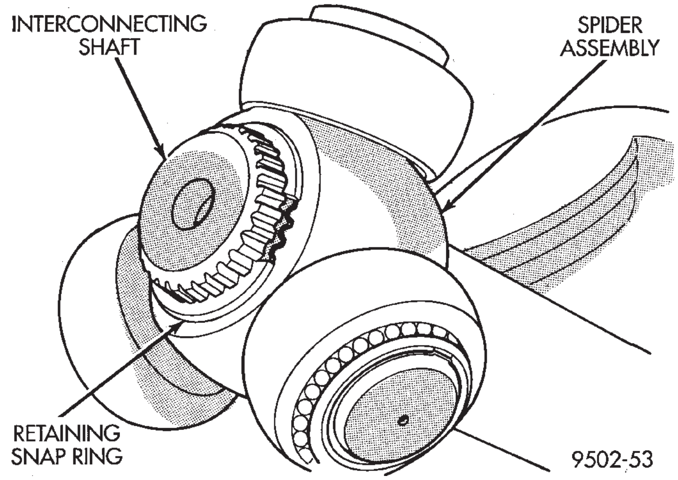


Fig. 27 Spider Assembly Retaining Snap Ring

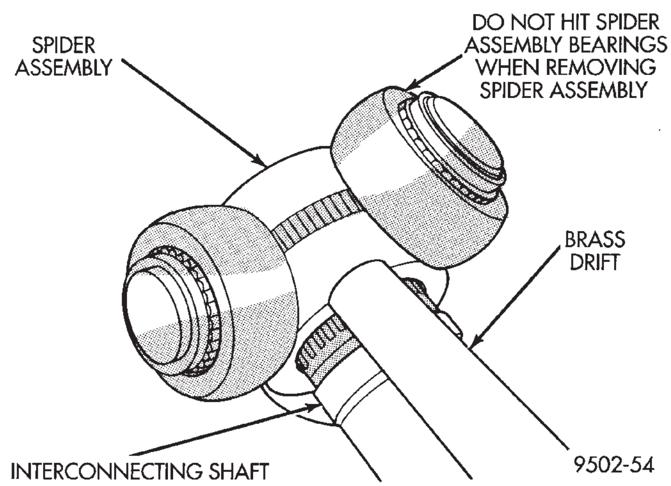


Fig. 28 Spider Assembly Removal from Interconnecting Shaft

(5) Slide sealing boot off interconnecting shaft.

(6) Thoroughly clean and inspect spider assembly, tripod joint housing, and interconnecting shaft for any signs of excessive wear. **If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.**

DISASSEMBLY AND ASSEMBLY (Continued)

INSTALLATION

NOTE: The inner tripod joint sealing boots are made from two different types of material. High temperature applications use silicone rubber where as standard temperature applications use hytrel plastic. The silicone sealing boots are soft and pliable. The Hytrel sealing boots are stiff and rigid. The replacement sealing boot MUST BE the same type of material as the sealing boot which was removed.

(1) Slide inner tripod joint seal boot retaining clamp, onto interconnecting shaft. Then, slide the replacement inner tripod joint sealing boot onto the interconnecting shaft. **Inner tripod joint seal boot MUST be positioned on interconnecting shaft, so the raised bead on the inside of the seal boot is in groove on interconnecting shaft (Fig. 29).**

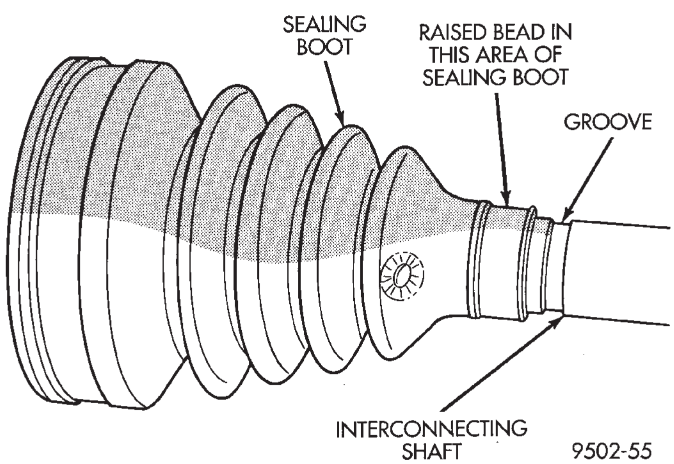


Fig. 29 Sealing Boot Installation on Interconnecting Shaft

(2) Install spider assembly onto interconnecting shaft (Fig. 30). Spider assembly must be installed on interconnecting shaft far enough to fully install spider retaining snap ring. If spider assembly will not fully install on interconnecting shaft by hand, it can be installed by tapping the spider body with a brass drift (Fig. 31). **Do not hit the outer tripod bearings in an attempt to install spider assembly on interconnecting shaft.**

(3) Install the spider assembly to interconnecting shaft retaining snap ring into groove on end of interconnecting shaft (Fig. 32). Be sure the snap ring is fully seated into groove on interconnecting shaft.

(4) Distribute 1/2 the amount of grease provided in the seal boot service package (DO NOT USE ANY OTHER TYPE OF GREASE) into tripod housing. Put the remaining amount into the sealing boot.

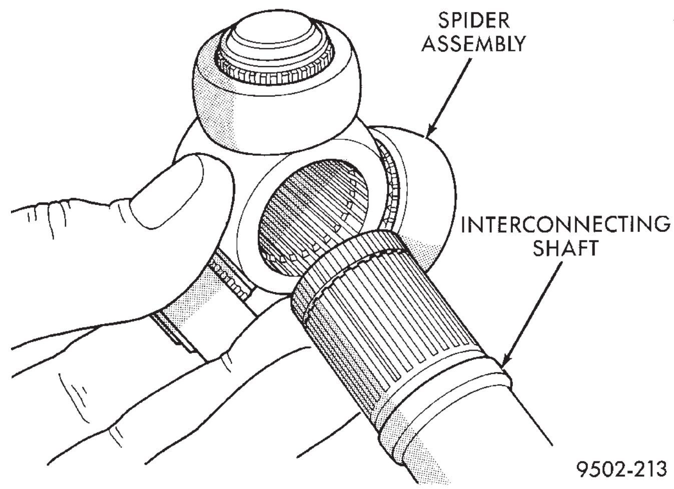


Fig. 30 Spider Assembly Installation on Interconnecting Shaft

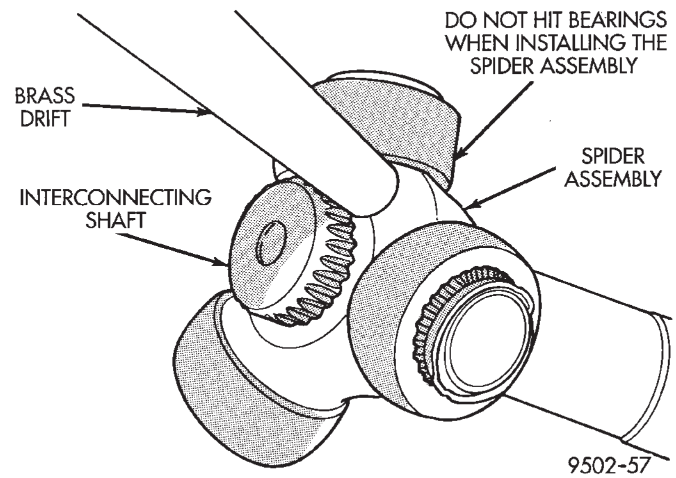


Fig. 31 Installing Spider Assembly on Interconnecting Shaft

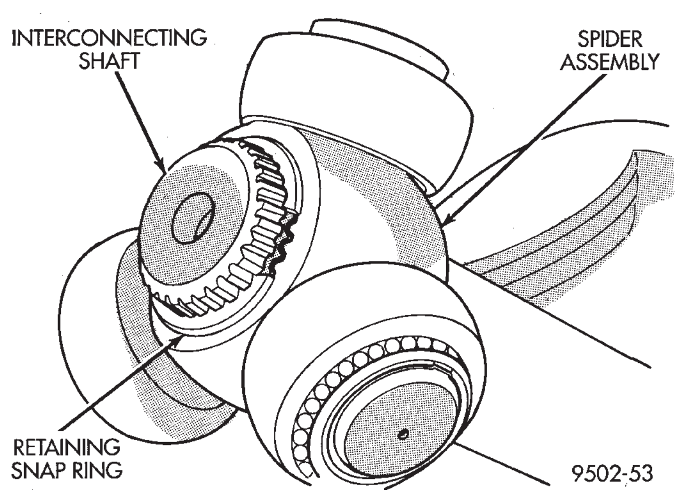


Fig. 32 Spider Assembly Retaining Snap Ring Installed

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Align tripod housing with spider assembly and then slide tripod housing over spider assembly and interconnecting shaft (Fig. 33).

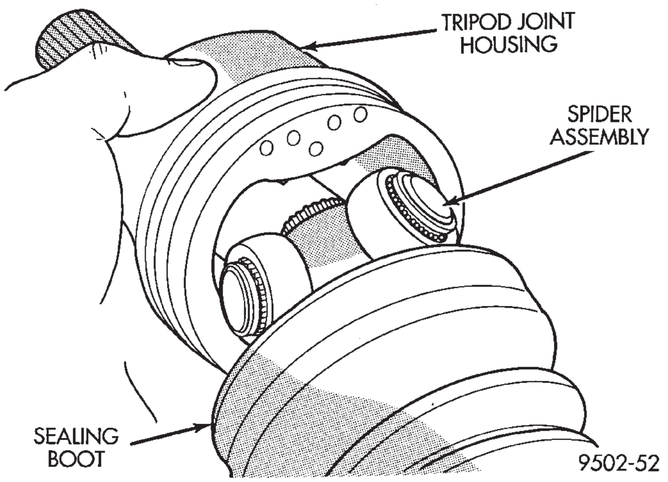


Fig. 33 Installing Tripod Housing on Spider Assembly

(6) Install inner tripod joint seal boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C- 4975-A over bridge of clamp (Fig. 34). Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 35).

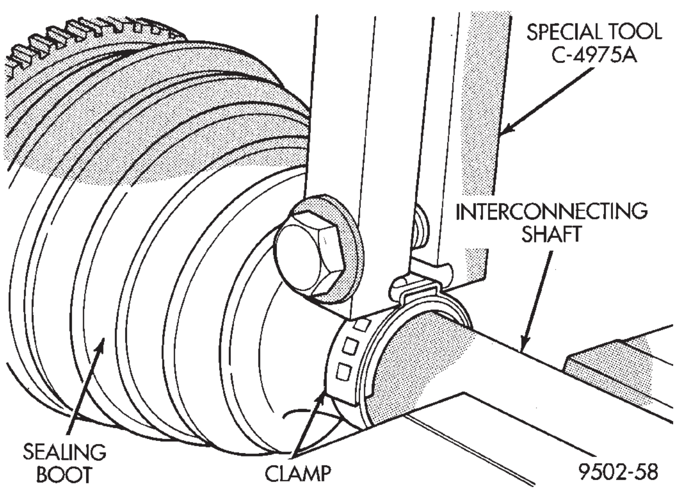


Fig. 34 Crimping Tool Installed on Sealing Boot Clamp

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

(8) Position sealing boot into the tripod housing retaining groove. Install seal boot retaining clamp evenly on sealing boot.

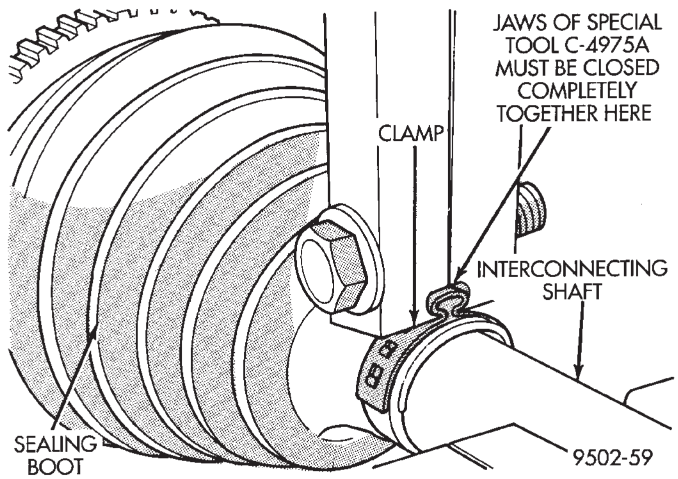


Fig. 35 Sealing Boot Retaining Clamp Installed

CAUTION: The following positioning procedure determines the correct air pressure inside the inner tripod joint assembly prior to clamping the sealing boot to inner tripod joint housing. If this procedure is not done prior to clamping sealing boot to tripod joint housing sealing boot durability can be adversely affected.

CAUTION: When venting the inner tripod joint assembly, use care so inner tripod sealing boot does not get punctured, or in any other way damaged. If sealing boot is punctured, or damaged in any way while being vented, the sealing boot can not be used.

(9) Insert a trim stick between the tripod joint and the sealing boot to vent inner tripod joint assembly (Fig. 36). **When inserting trim stick between tripod housing and sealing boot ensure trim stick is held flat and firmly against the tripod housing. If this is not done damage to the sealing boot can occur.** If inner tripod joint has a Hytrel (hard plastic) sealing boot, be sure trim stick is inserted between soft rubber insert and tripod housing not the hard plastic sealing boot and soft rubber insert.

(10) With trim stick inserted between sealing boot and tripod joint housing, position the interconnecting shaft so it is at the center of its travel in the tripod joint housing. Remove the trim stick from between the sealing boot and the tripod joint housing. **This procedure will equalize the air pressure in the tripod joint, preventing premature sealing boot failure.**

(11) Position trilobal boot to interface with the tripod housing. The lobes of the boot must be properly aligned with the recess's of the tripod housing.

DISASSEMBLY AND ASSEMBLY (Continued)

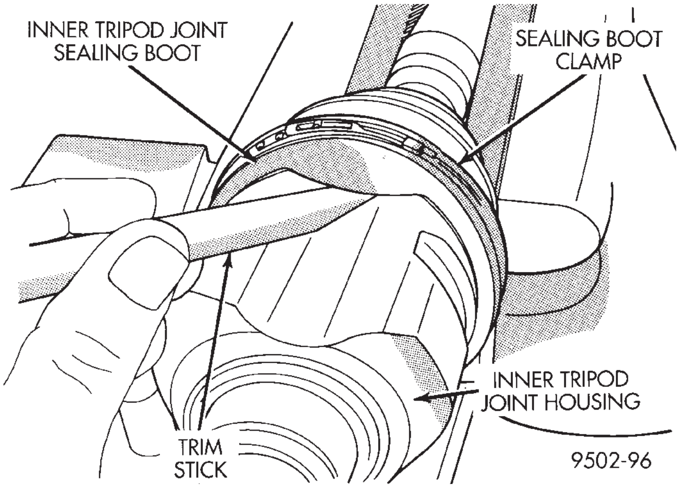


Fig. 36 Trim Stick Inserted for Venting Tripod Joint

(12) Clamp tripod joint sealing boot to tripod joint, using required procedure for type of boot clamp application.

CRIMP TYPE BOOT CLAMP

If seal boot uses crimp type boot clamp:

• Clamp sealing boot onto tripod housing using Crimper, Special Tool C-4975-A.

• Place crimping tool C- 4975-A over bridge of clamp (Fig. 37).

• Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 38).

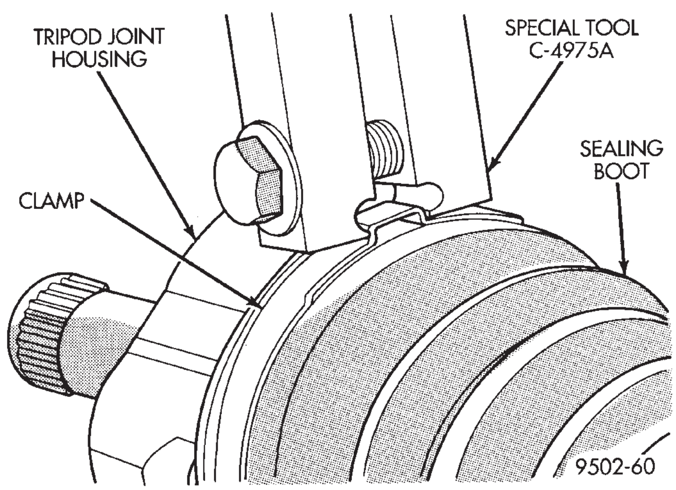


Fig. 37 Crimping Tool Installed on Sealing Boot Clamp

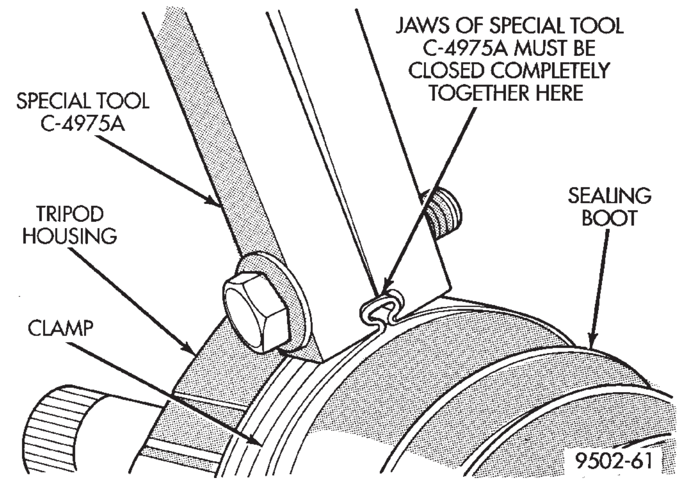


Fig. 38 Sealing Boot Retaining Clamp Installed

LATCHING TYPE BOOT CLAMP

If seal boot uses low profile latching type boot clamp:

• Clamp sealing boot onto tripod housing using clamp locking tool, Snap-On YA3050 or an equivalent.

• Place prongs of clamp locking tool in the holes of the clamp (Fig. 39).

• Squeeze tool together until top band of clamp is latched behind the two tabs on lower band of clamp (Fig. 40).

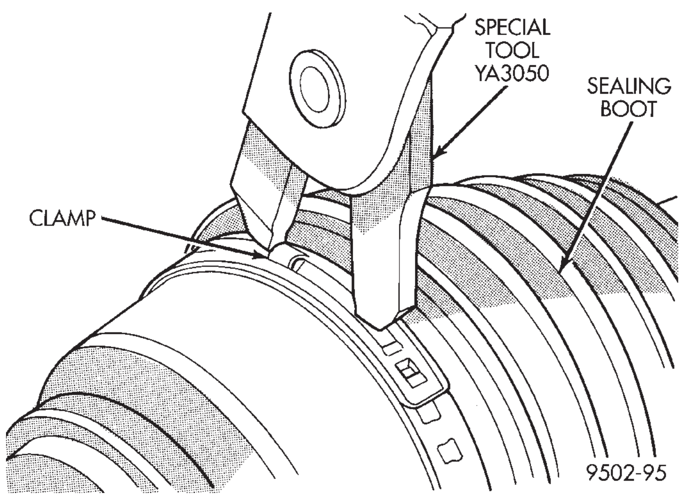


Fig. 39 Clamping Tool Installed on Sealing Boot Clamp

DISASSEMBLY AND ASSEMBLY (Continued)

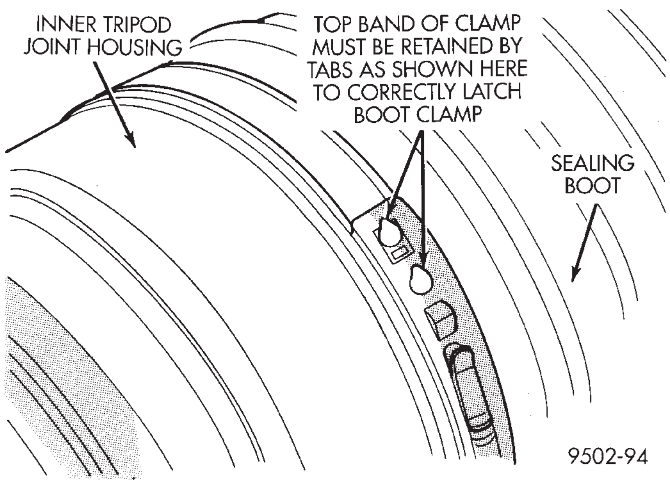


Fig. 40 Sealing Boot Clamp Correctly Installed

(13) Install the driveshaft back on the vehicle. See Servicing Driveshaft, for the required driveshaft installation procedure.

OUTER C/V JOINT SEAL BOOT

REMOVAL

To remove outer C/V joint sealing boot from a driveshaft for replacement, the driveshaft assembly must be removed from the vehicle. See Servicing Driveshaft in this section for the required driveshaft removal and replacement procedure.

(1) Remove driveshaft assembly requiring boot replacement from vehicle. See Servicing Driveshaft in this section for the required driveshaft removal procedure.

(2) Remove large boot clamp retaining C/V joint sealing boot to C/V joint housing (Fig. 41) and discard. Remove small clamp that retains outer C/V joint sealing boot to interconnecting shaft and discard. Remove sealing boot from outer C/V joint housing and slide it down interconnecting shaft.

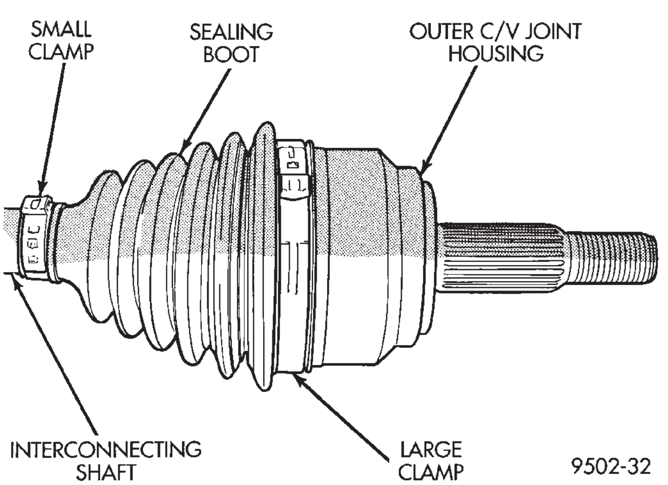


Fig. 41 Outer C/V Joint Seal Boot Clamps

(3) Wipe away grease to expose outer C/V joint and interconnecting shaft.

(4) Remove outer C/V joint from interconnecting shaft using the following procedure: Support interconnecting shaft in a vise **equipped with protective caps on jaws of vise to prevent damage to interconnecting shaft.** Then, using a **soft–faced hammer,** sharply hit the end of the C/V joint housing to dislodge housing from internal circlip on interconnecting shaft (Fig. 42). Then slide outer C/V joint off end of interconnecting shaft, joint may have to be tapped off shaft using a **soft–faced** hammer.

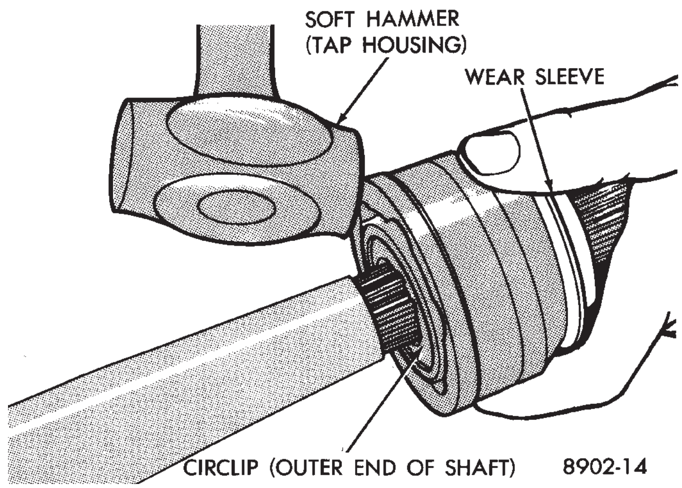


Fig. 42 Outer C/V Joint Removal from Interconnecting Shaft

(5) Remove large circlip (Fig. 43) from the interconnecting shaft before attempting to remove outer C/V joint sealing boot.

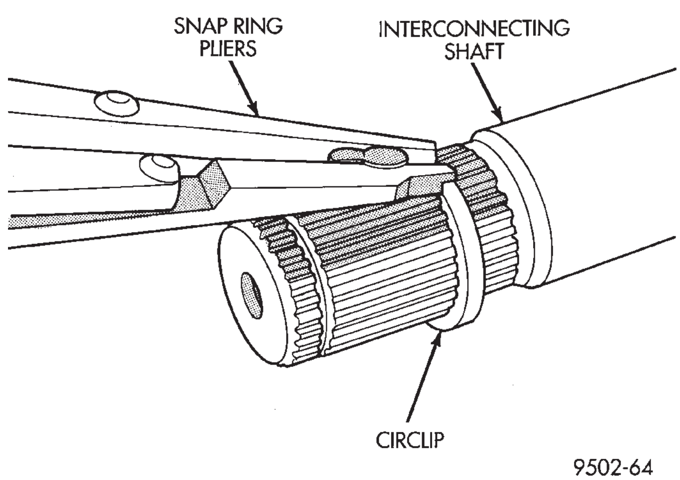


Fig. 43 Circlip Removal from Interconnecting Shaft

(6) Slide failed sealing boot off interconnecting shaft.

(7) Thoroughly clean and inspect outer C/V joint assembly and interconnecting joint for any signs of excessive wear. **If any parts show signs of exces-**

DISASSEMBLY AND ASSEMBLY (Continued)

sive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.

INSTALLATION

(1) Slide new sealing boot to interconnecting shaft retaining clamp onto interconnecting shaft. Slide the outer C/V joint assembly sealing boot onto the interconnecting shaft (Fig. 44). **Seal boot MUST be positioned on interconnecting shaft so the raised bead on the inside of the seal boot is in groove on interconnecting shaft.**

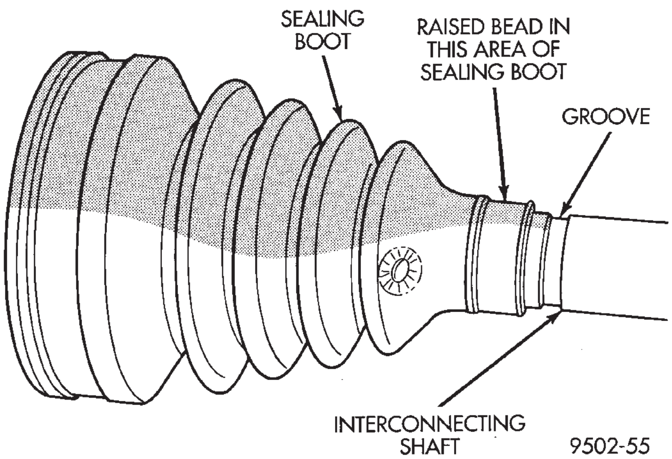


Fig. 44 Sealing Boot Installation on Interconnecting Shaft

(2) Align splines on interconnecting shaft with splines on cross of outer C/V joint assembly and start outer C/V joint onto interconnecting shaft.

(3) Install outer C/V joint assembly onto interconnecting shaft by using a **soft–faced** hammer and tapping end of stub axle (with nut installed) until outer C/V joint is fully seated on interconnecting shaft (Fig. 45).

(4) Outer C/V joint assembly must be installed on interconnecting shaft until cross of outer C/V joint assembly is seated against circlip on interconnecting shaft (Fig. 46).

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

(6) Install outer C/V joint sealing boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C- 4975-A over bridge of clamp (Fig. 47). Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 48).

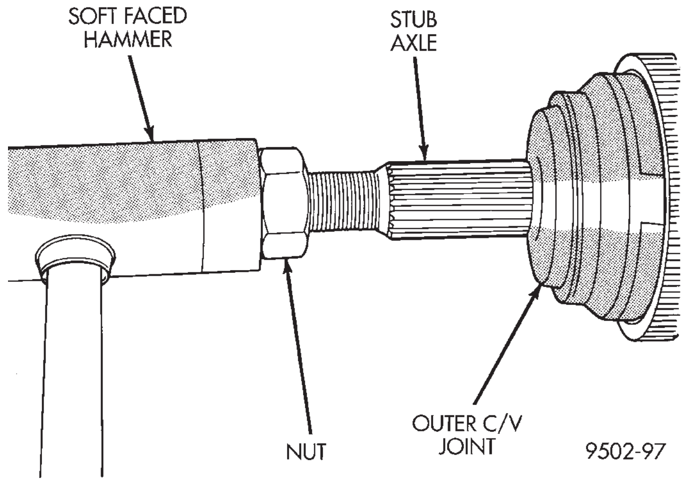


Fig. 45 Outer C/V Joint Installation on Interconnecting Shaft

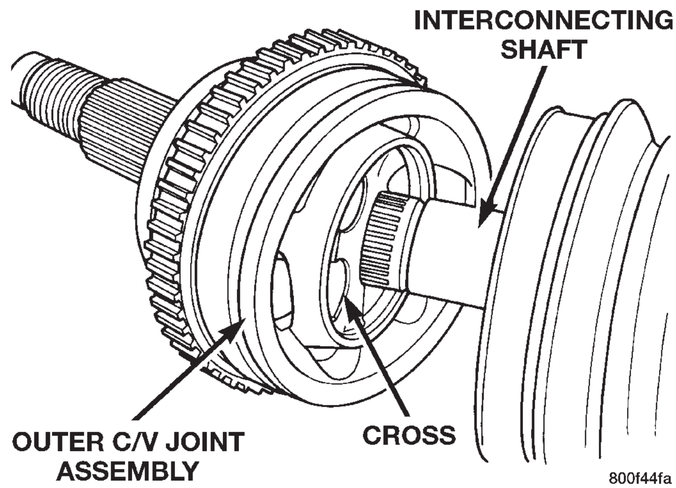


Fig. 46 Outer C/V Joint Correctly Installed on Interconnecting Shaft

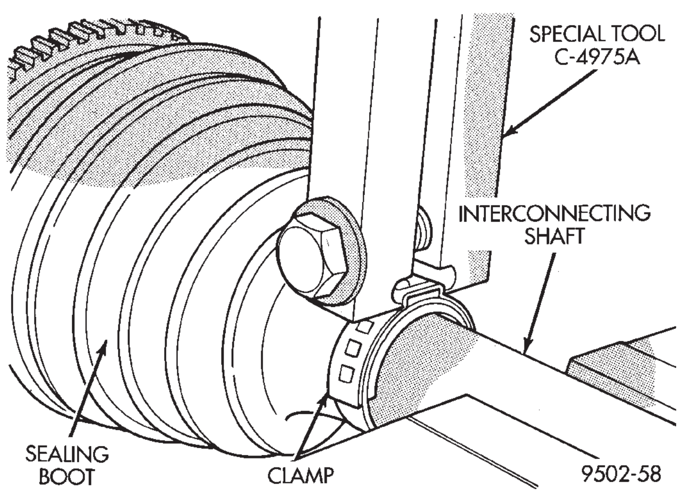


Fig. 47 Crimping Tool Installed on Sealing Boot Clamp

DISASSEMBLY AND ASSEMBLY (Continued)

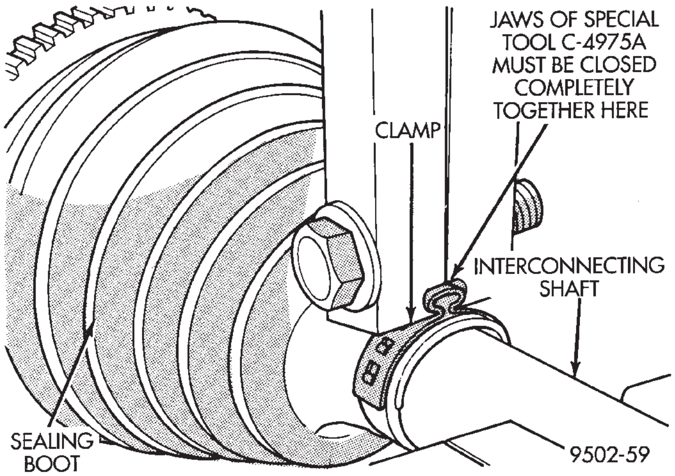


Fig. 48 Sealing Boot Retaining Clamp Installed

CAUTION: Seal must not be dimpled, stretched, or out–of–shape in any way. If seal is NOT shaped correctly, equalize pressure in seal and shape it by hand.

(8) Position outer C/V joint sealing boot into its retaining groove on outer C/V joint housing. Install sealing boot to outer C/V joint retaining clamp evenly on sealing boot.

(9) Clamp sealing boot onto outer C/V joint housing using Crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C- 4975-A over bridge of clamp (Fig. 49). Tighten nut on crimping tool C- 4975-A until jaws on tool are closed completely together, face to face (Fig. 50).

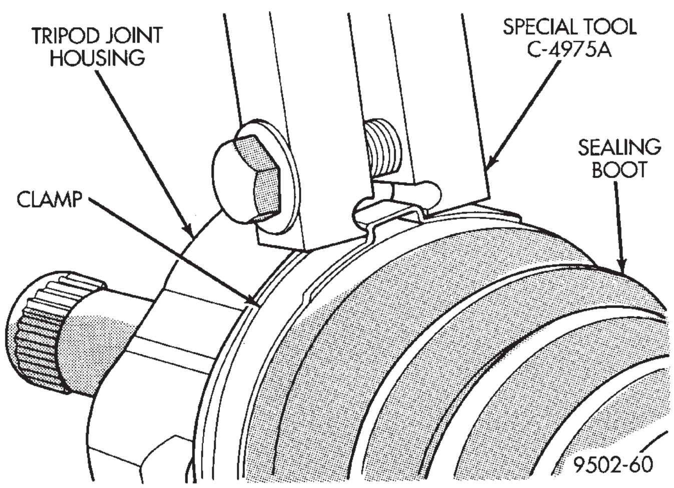


Fig. 49 Crimping Tool Installed on Sealing Boot Clamp

(10) Install the driveshaft requiring boot replacement back on the vehicle. See Servicing Driveshaft in this section for the required driveshaft installation procedure.

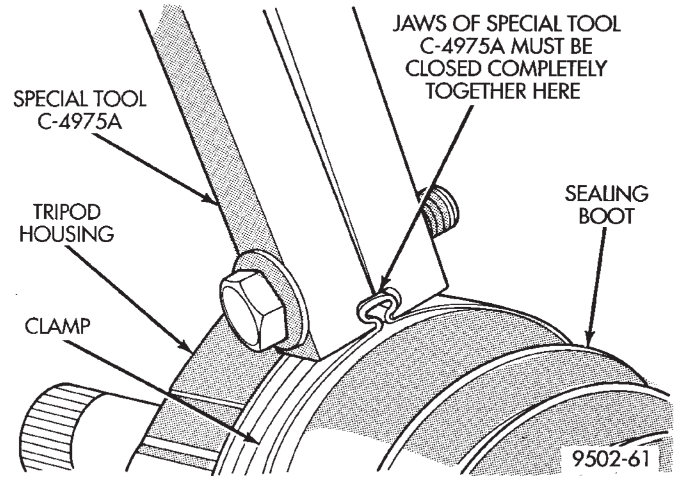


Fig. 50 Sealing Boot Retaining Clamp Installed

OUTER C/V JOINT BEARING SHIELD SERVICE

The front hub/bearing shield on the outer C/V joint is a serviceable component of the outer C/V. If it is damaged in use on a vehicle or during servicing of a driveshaft it can be replaced using the following procedure.

To remove the bearing shield from the outer C/V joint, the driveshaft assemblies must be removed from the vehicle. See Servicing Driveshaft, for the required driveshaft removal and replacement procedure.

BEARING SHIELD REMOVAL FROM OUTER C/V JOINT

(1) Clamp driveshaft in a vise by the interconnecting shaft.

(2) Using a drift (Fig. 51) tap around the entire edge of the bearing shield until it is removed from the outer C/V Joint.

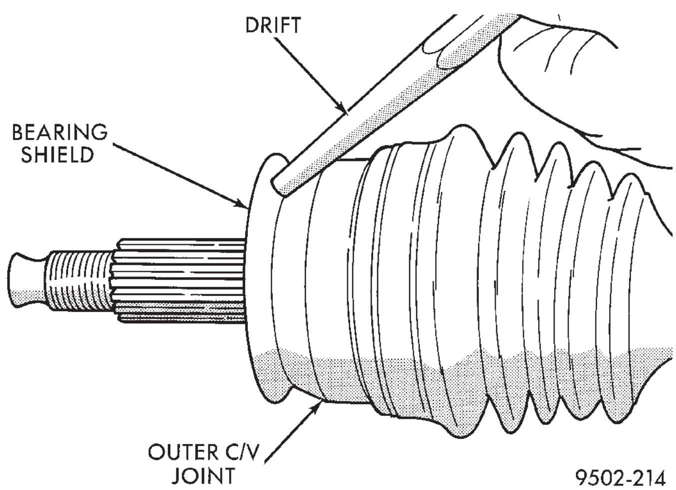


Fig. 51 Removing Bearing Shield from Outer C/V Joint

DISASSEMBLY AND ASSEMBLY (Continued)

BEARING SHIELD INSTALLATION ON OUTER C/V JOINT

(1) Install bearing shield by hand on outer C/V Joint so that it is installed squarely on the C/V joint.

(2) Position installer, Special Tool, C-4698-2 and handle, Special Tool, C-4698-1 on face of bearing shield (Fig. 52).

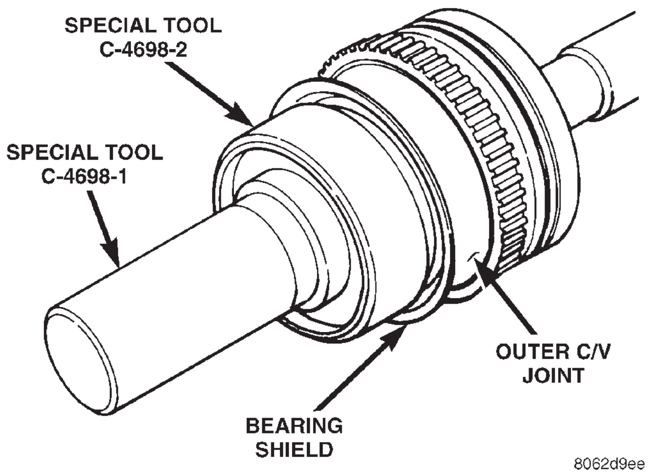


Fig. 52 Special Tools for Installing Bearing Shield

CAUTION: If bearing shield is not installed flush against the face of the outer C/V joint, interference with steering knuckle will occur when driveshaft is installed.

(3) Using a hammer, drive the bearing shield on the outer C/V joint until it is flush against the front of the outer C/V joint (Fig. 53).

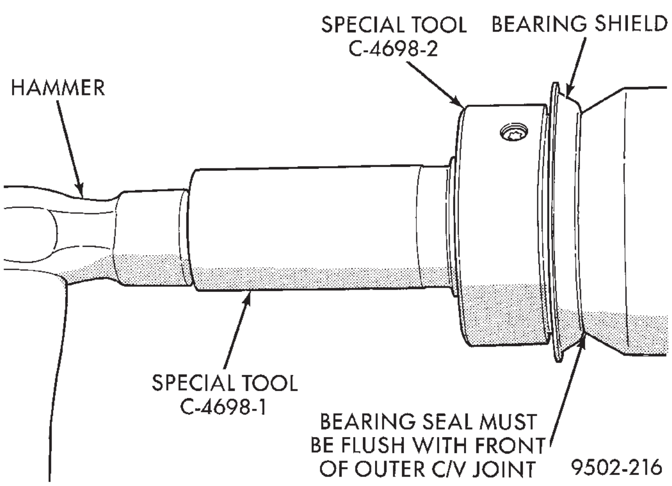


Fig. 53 Correctly Installed Bearing Shield

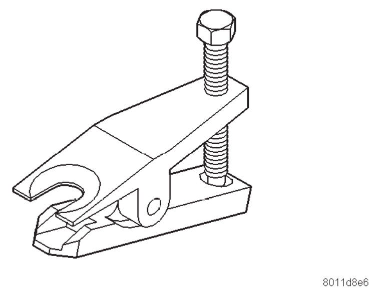
SPECIFICATIONS

TORQUE SPECIFICATIONS

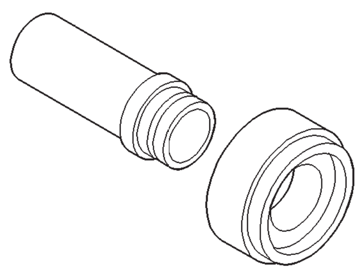
DESCRIPTION	TORQUE
Caliper To Knuckle Bolts	31 N·m (23 ft. lbs.)
Driveshaft Nut	244 N·m (180 ft. lbs.)
Front Wheel Lug Nuts	135 N·m (100 ft. lbs.)
Knuckle To Ball Stud Nut	95 N·m (70 ft. lbs.)
Tie Rod End To Knuckle	61 N·m (45 ft. lbs.)

SPECIAL TOOLS

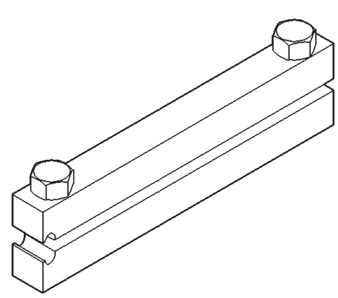
DRIVESHAFT



Tie Rod Remover MB-990635



Bearing Shield Installer C-4698



Boot Clamp Installer C-4975A

BRAKES

CONTENTS

BASE BRAKE SYSTEM

INDEX

DESCRIPTION AND OPERATION

BASE BRAKE SYSTEM OPERATION

When a vehicle needs to be stopped, the driver applies the brake pedal. The brake pedal pushes the input rod of the power brake booster into the booster. The booster uses vacuum to ease pedal effort as force is transferred through the booster to the master cylinder. The booster's output rod pushes in the master cylinder's primary and secondary pistons applying hydraulic pressure through the chassis brake tubes and proportioning valves to the brakes at each tire and wheel assembly.

Front disc brakes control the braking of the front wheels; rear braking is controlled by rear drum brakes as standard equipment. Rear disc brakes are optional.

The hydraulic brake system is diagonally split on both the non-antilock and antilock braking systems. This means the left front and right rear brakes are on one hydraulic circuit and the right front and left rear are on the other.

Vehicles equipped with the optional antilock brake system (ABS) use a system designated Mark 20, which is supplied by ITT Teves. This system shares most base brake hardware used on vehicles without ABS. A vehicle equipped with ABS, however, uses a different power brake booster, master cylinder, and brake tubes. Also included in the ABS system is an integrated control unit (ICU), four wheel speed sensors, and an electronic controller referred to as the controller antilock brake (CAB). These components are described in detail in the ANTILOCK BRAKE SYSTEM section in this group of the service manual.

The parking brakes are hand-operated. When applied, the parking brake lever pulls on cables that actuate brake shoes at each rear wheel. The parking brake lever has an automatic adjusting feature that takes up any excessive slack in the parking brake system.

MASTER CYLINDER

This vehicle uses 2 differently designed master cylinder assemblies depending on whether the vehicle is or is not equipped with antilock brakes.

Vehicles not equipped with ABS use a standard compensating port master cylinder design, while vehicles equipped with ABS use a center valve design master cylinder.

On vehicles equipped with ABS brakes, the master cylinder is a two outlet design. On vehicles not equipped with ABS brakes, the master cylinder is a 4 outlet design. All vehicles are equipped with a master cylinder having a bore diameter of 22.2 mm.

The master cylinder assembly (Fig. 1) consists of the following components. The body of the master cylinder is an anodized aluminum casting. It has a machined bore to accept the master cylinder piston and threaded ports with seats for hydraulic brake line connections. The brake fluid reservoir of the master cylinder assembly is made of a see through polypropelene type plastic.

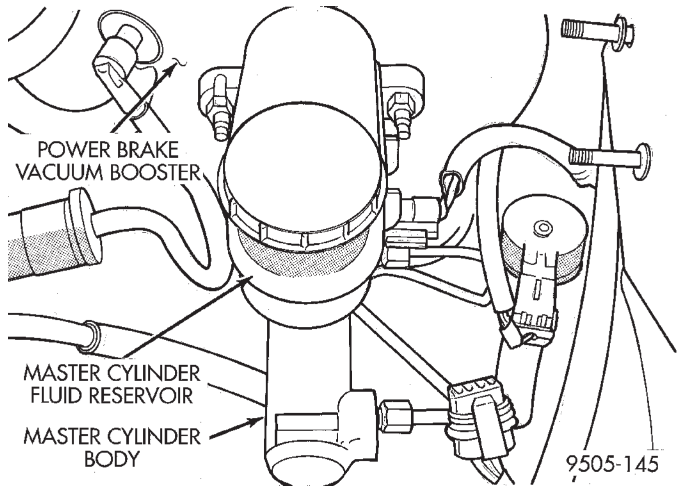


Fig. 1 Master Cylinder

On Non-ABS master cylinders, the primary outlet ports (Fig. 2) supply hydraulic pressure to the right front and left rear brakes. The secondary outlet ports (Fig. 2) supply hydraulic pressure to the left front and right rear brakes.

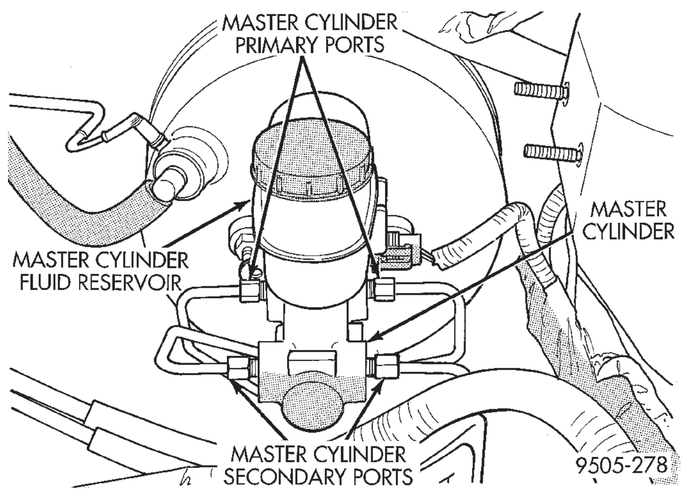


Fig. 2 Primary And Secondary Ports Without ABS

On ABS master cylinders, the primary outlet port (Fig. 3) supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port (Fig. 3) supplies hydraulic pressure to the left front and right rear brakes.

POWER BRAKE BOOSTER

All vehicles use a 205 mm tandem diaphragm power brake vacuum booster. The power brake vacuum booster though, may be unique for the type of

DESCRIPTION AND OPERATION (Continued)

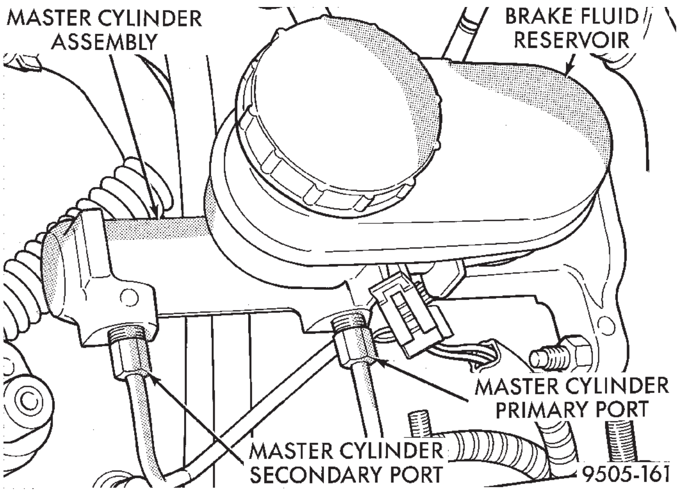


Fig. 3 Primary And Secondary Ports With ABS

brake system the vehicle is equipped with. For this reason, if the power brake vacuum booster requires replacement, be sure it is replaced with the correct part for the type of brake system that the vehicle is equipped with.

The power brake booster can be identified by the tag attached to the body of the booster assembly (Fig. 4). This tag contains the following information: The production part number of the power booster assembly, the date it was built, who manufactured it, and brake sales code.

NOTE: The power brake booster assembly is not a repairable part and must be replaced as a complete unit if it is found to be faulty in any way. The power booster vacuum check valve is not repairable but can be replaced as an assembly.

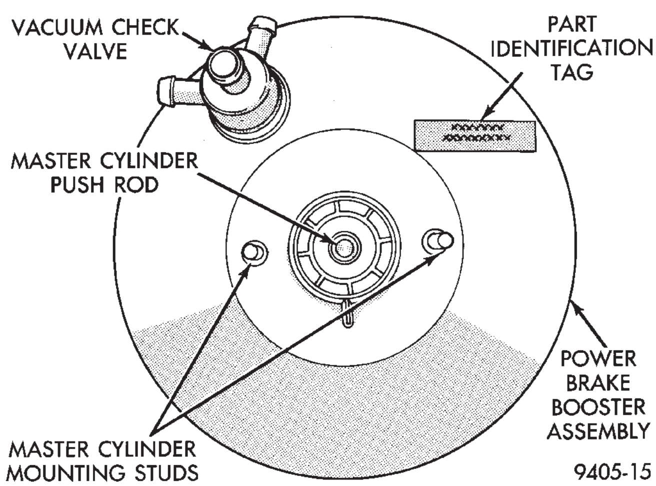


Fig. 4 Power Brake Booster Identification

The power brake booster reduces amount of force required by the driver to obtain the necessary hydraulic pressure to stop vehicle.

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 4).

As the brake pedal is depressed, the power boosters input rod moves forward (Fig. 5). This opens and closes valves in the power booster, allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the power booster (Fig. 5) out against the primary piston of the master cylinder. As the pistons in the master cylinder move forward this creates the hydraulic pressure in the brake system.

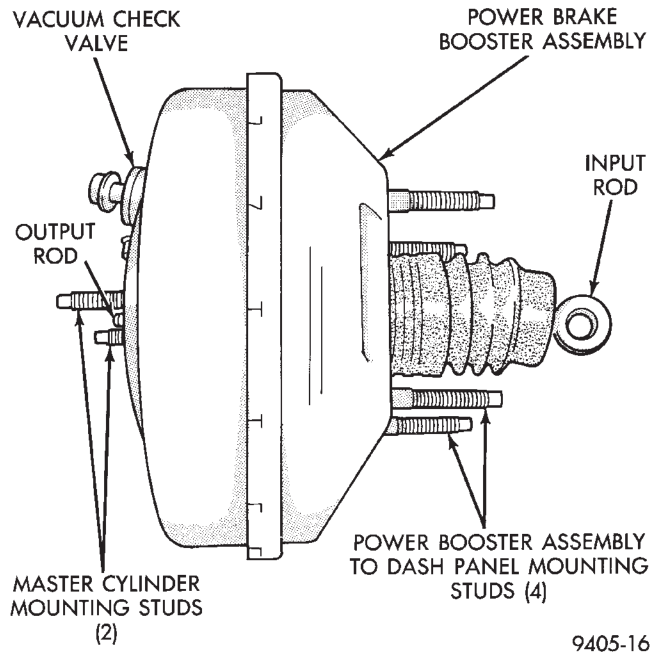


Fig. 5 Power Brake Booster Assembly

Different systems and engine combinations require different vacuum hose routings.

The power brake vacuum booster assembly mounts on the engine side of the dash panel. It is connected to the brake pedal by the input push rod (Fig. 5). A vacuum line connects the power booster to the intake manifold. The master cylinder is bolted to the front of the power brake vacuum booster assembly.

BRAKE TUBES AND HOSES

The purpose of the chassis brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the wheel brakes of the vehicle. The chassis tubes are steel with a corrosion resistant coating applied to the external surfaces and the flex hoses are made of reinforced rubber. The rubber flex hoses allow for the movement of the vehicles suspension.

DESCRIPTION AND OPERATION (Continued)

PROPORTIONING VALVE

This vehicle uses screw-in proportioning valves in-line with the rear brake tubes. The chassis brake tubes connect directly from the master cylinder or HCU (on ABS vehicles) to the brake flex hose. The brake system uses two proportioning valves in-line with each of the rear wheel chassis brake tubes. The non-ABS equipped proportioning valves are located on the front suspension crossmember in the same area where the integrated control unit mounts on ABS equipped vehicles (Fig. 6).

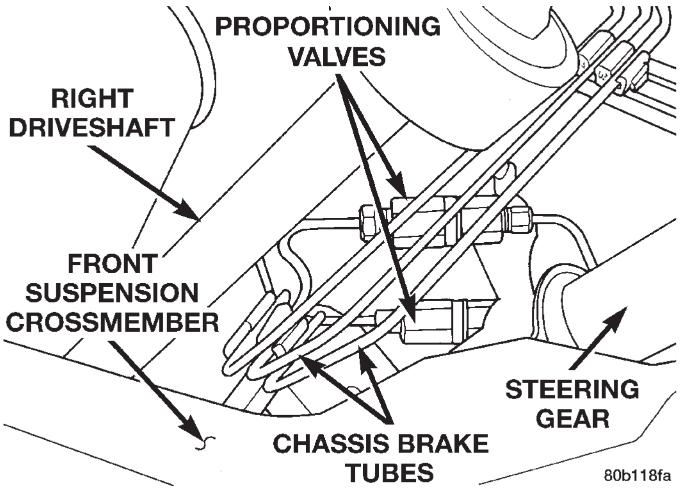


Fig. 6 Proportioning Valves For Non ABS Equipped Vehicles

On vehicles equipped with antilock brakes, the proportioning valves are located at the rear of the vehicle (Fig. 7). Each proportioning valve mounts directly to the flex hose for the rear wheel brakes and has the chassis brake tube for each rear brake connected directly to it (Fig. 7).

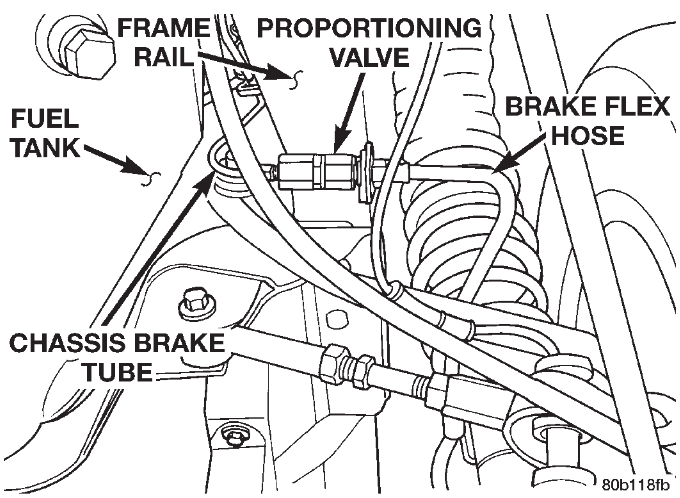


Fig. 7 Proportioning Valve Location For ABS Equipped Vehicles

Proportioning valves balance front to rear braking by controlling at a given ratio, to increase the rear brake system hydraulic pressure above a preset level (split point). Under light pedal application, the proportioning valve allows full hydraulic pressure to be applied to the rear brakes.

There are two proportioning valve assemblies used in each vehicle. Due to differences in thread sizes, each proportioning valve has a different part number. During any service procedures identify valve assemblies by supplier part number and or the bar code label and stamp identification band (Fig. 8). All vehicle brake systems use a common calibration for the proportioning valve. The split point is 500 psi and the slope is 0.43 on rear drum brake vehicles. Vehicles with rear disc brakes have a split point of 400 psi and a slope of 0.34.

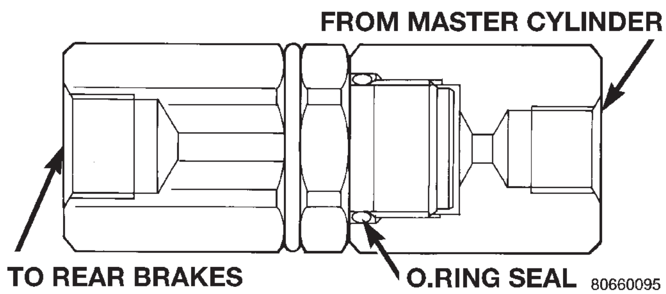


Fig. 8 Proportioning Valve Identification

DISC BRAKES (FRONT)

The front disc brakes (Fig. 9) and (Fig. 10) consists of the following components:

- Braking disc (brake rotor)
- Caliper assembly - single piston, floating type
- Brake pads and linings

The front disc brakes used on this vehicle are double pin floating calipers.

The front disc brake double pin calipers are mounted directly to the steering knuckles and use no adapter. The caliper is mounted to the steering knuckle using bushings, sleeves and 2 guide pin bolts

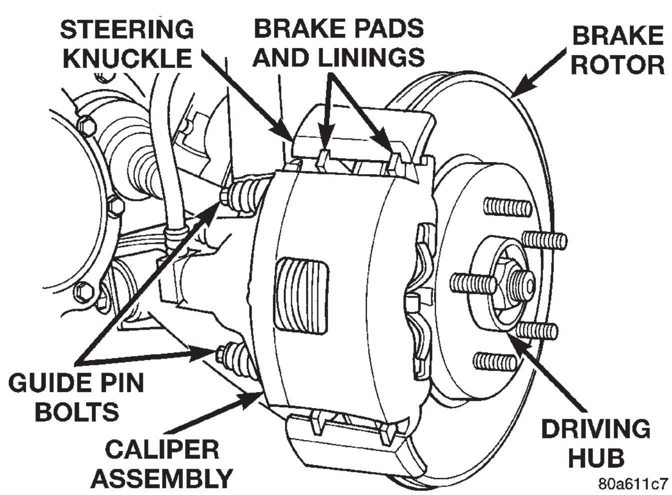


Fig. 9 Front Disc Brake Components

DESCRIPTION AND OPERATION (Continued)

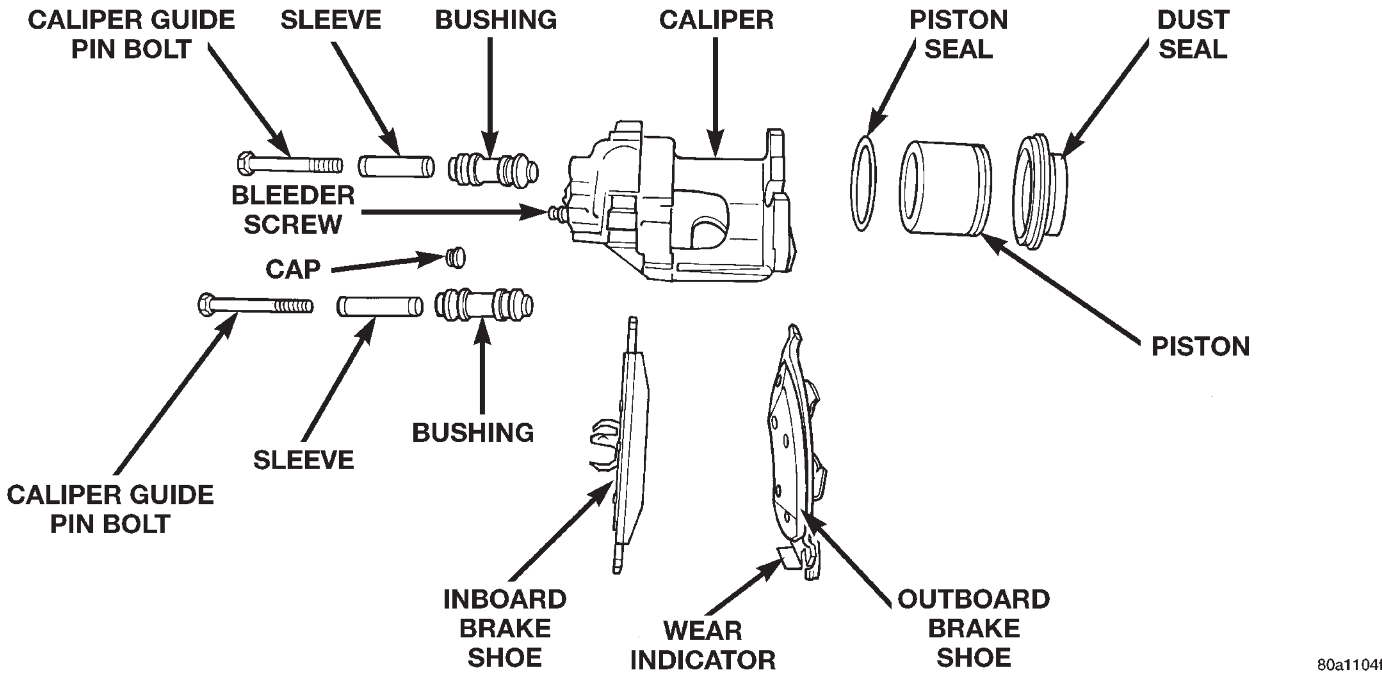


Fig. 10 Front Disc Brake Caliper (Exploded View)

which thread directly into bosses on the steering knuckle (Fig. 9), (Fig. 10) and (Fig. 11).

Two machined abutments on the steering knuckle position the caliper. The guide pin bolts, sleeves and bushings control the side to side movement of the caliper. The piston seal is designed to pull the piston back into the bore of the caliper when the brake pedal is released. This maintains the proper brake shoe to rotor clearance (Fig. 12).

All the front brake forces generated during braking of the vehicle are taken up directly by the steering knuckles of the vehicle.

The caliper is a one piece casting with the inboard side containing a single piston cylinder bore.

The front disc brake caliper piston (Fig. 10), is manufactured from a phenolic compound. The outside diameter of the caliper piston is 54 mm.

A square cut rubber piston seal is located in a machined groove in the caliper cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 12).

A rubber dust boot is installed in the cylinder bore opening and in a groove in the piston (Fig. 12). This prevents contamination in the bore area.

As front disc brake linings wear, master cylinder reservoir brake fluid level will drop. Fluid level should be checked after replacing linings.

Front disc brakes are equipped with an audible wear sensor (Fig. 10) on the outboard brake pad. This sensor emits a sound when the brake lining may need inspection and/or replacement.

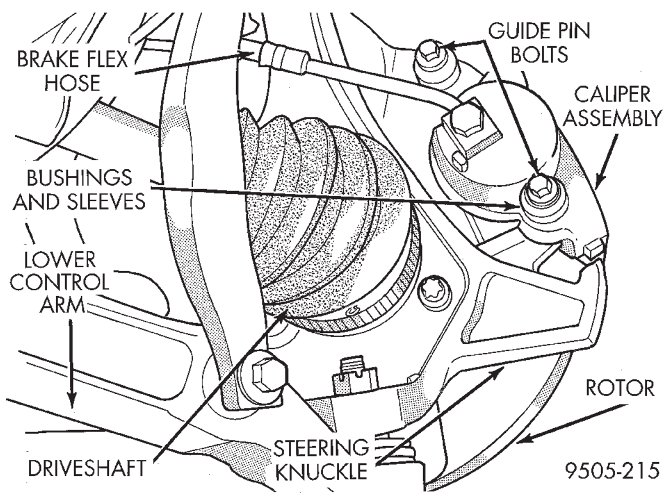


Fig. 11 Front Disc Brake Caliper Mounting

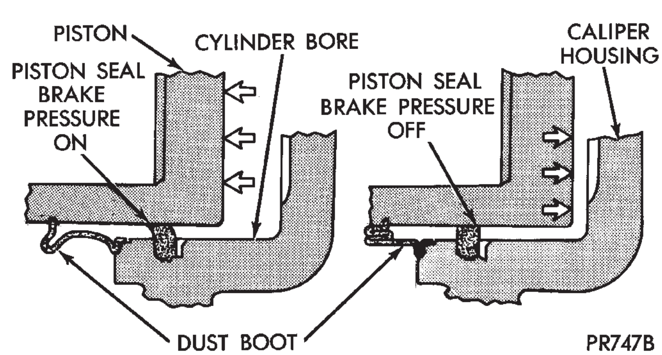


Fig. 12 Piston Seal Function for Automatic Adjustment

DESCRIPTION AND OPERATION (Continued)

DISC BRAKES (REAR)

The rear disc brakes are similar to the front disc brakes, however, there are several distinctive features that require different service procedures. The single piston, floating caliper rear disc brake assembly includes a hub and bearing assembly, adapter, brake rotor, caliper, brake pads/linings. The parking brake system on all vehicles equipped with rear disc brakes consists of a small duo-servo drum brake mounted to the caliper adapter. The drum brake shoes expand out against a braking surface (hat section) on the inside area of the rotor.

Vehicles are equipped with a caliper assembly that has a 33.4 mm (1.31 in.) piston and uses a solid non-vented rotor.

The caliper assembly on all applications float on rubber bushings using internal metal sleeves which are attached to the adapter using threaded guide pin bolts.

The adapter and rotor shield are mounted to the rear suspension knuckles of vehicle. The adapter is used to mount the brake shoes and actuating cables for the parking brake system. The adapter also mounts the rear caliper assembly to the vehicle. The adapter has two machined abutments which are used to position and align the caliper and brake pads for movement inboard and outboard (Fig. 13).

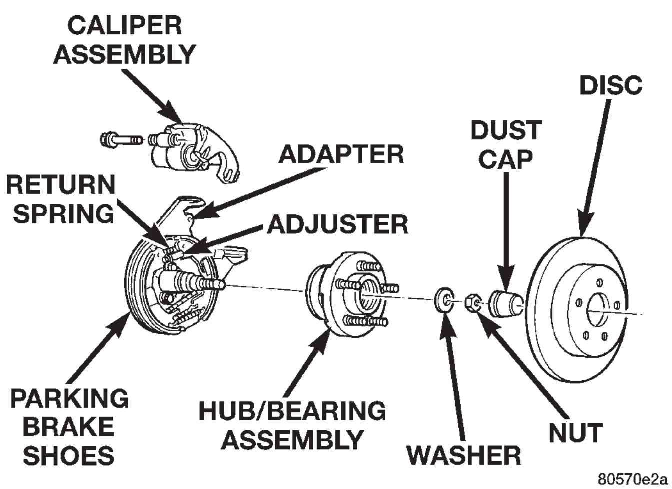


Fig. 13 Rear Disc Brake Exploded View

DRUM BRAKES (REAR)

This vehicles rear wheel drum brakes are a two shoe leading/trailing internal expanding type, with an automatic self adjuster mechanism. The automatic self adjuster mechanism used on this vehicle is a new design and functions differently than the screw type adjusters used in the past. This new self adjuster is still actuated each time the vehicles service brakes are applied. This new automatic adjuster mechanism is located directly below the rear wheel cylinder in the area where the screw adjuster was located.

The original equipment rear drum brake assemblies used on this vehicle are supplied by Varga N.A. Inc. (Fig. 14).

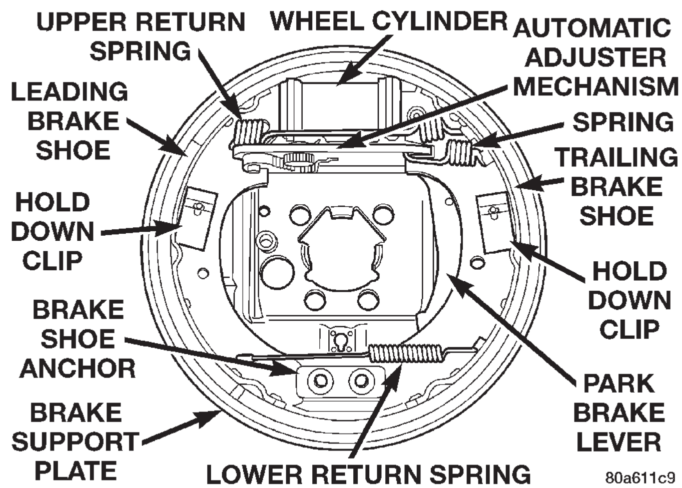


Fig. 14 Varga Rear Wheel Brake Assembly (Left Side Shown)

PARKING BRAKES

All vehicles are equipped with a center mounted, hand operated park brake lever (Fig. 15). The park brake lever is located in the vehicle, between the driver and passenger seat, and mounted to the console bracket which is welded to the floor pan.

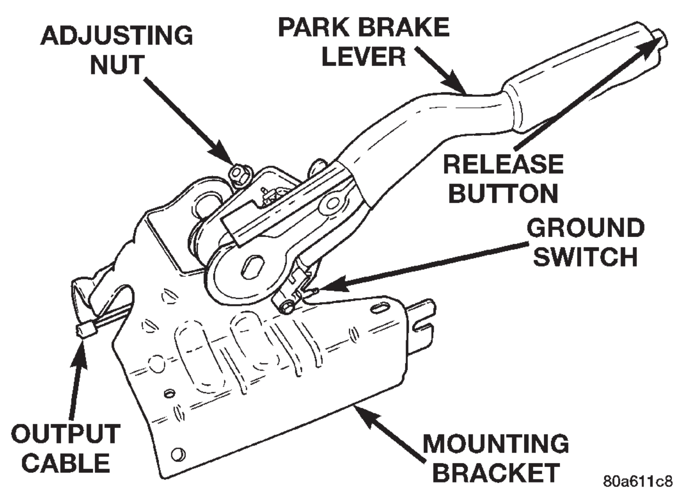


Fig. 15 Park Brake Hand Lever

On vehicles equipped with rear drum brakes, the rear wheel service brakes also act as the vehicle's parking brakes. The rear drum brake shoes, when acting as parking brakes, are mechanically operated using an internal actuating lever and strut which is connected to a flexible steel cable. There is an individual park brake cable for each rear wheel, which are joined using a park cable equalizer before termi-

DESCRIPTION AND OPERATION (Continued)

nating at the floor mounted, hand operated park brake lever.

On vehicles equipped with rear disc brakes, the rear parking brakes have their own set of cable operated brake shoes located behind the rear disc brake rotor. The interior or the rear disc brake rotor acts as the parking brake drum. There is an individual flexible steel parking brake cable for each rear wheel, which are joined using a park cable equalizer before terminating at the floor mounted, hand operated park brake lever.

On this vehicle, the parking brake lever output cable is not replaceable as a separate component of the parking brake lever (Fig. 15). Never attempt to repair the parking brake output cable in any manner.

This vehicle uses a bent nail type park brake cable tension equalizer (Fig. 16). The bent nail tension equalizer is to be used only one time to set the park brake cable tension. If the park brake cables require adjustment during the life of the vehicle, a **NEW** tension equalizer **MUST** be installed before doing the park cable adjustment procedure.

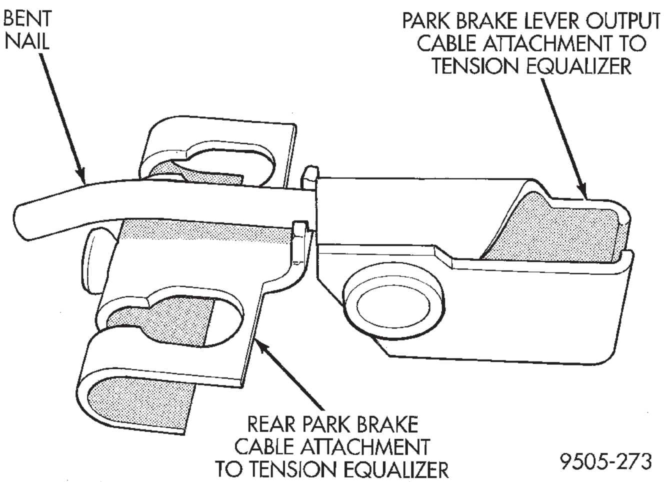


Fig. 16 Bent Nail Park Brake Cable Tension Equalizer

RED BRAKE WARNING LAMP

The red Brake warning lamp is located in the instrument panel cluster and is used to indicate a low brake fluid condition, the parking brake is applied or that the antilock brake system has a fault but could not turn on the yellow ABS warning lamp. In addition, the brake warning lamp is turned on as a bulb check by the ignition switch when the ignition switch is placed in the crank position. Problems with this system will generally be of the type where the warning lamp fails to turn on when it should, or remains on when it should not.

The warning lamp bulb is supplied a 12 volt ignition feed anytime the ignition switch is on. The bulb is then illuminated by completing the ground circuit either through the park brake switch, the fluid level sensor in the master cylinder reservoir, the ignition switch in the crank position or the ABS CAB.

The Brake Fluid Level sensor is located in the brake fluid reservoir of the master cylinder assembly (Fig. 17). The purpose of the sensor is to provide the driver with an early warning that brake fluid level in master cylinder reservoir has dropped to below normal. This may indicate an abnormal loss of brake fluid in the master cylinder fluid reservoir resulting from a leak in the hydraulic system.

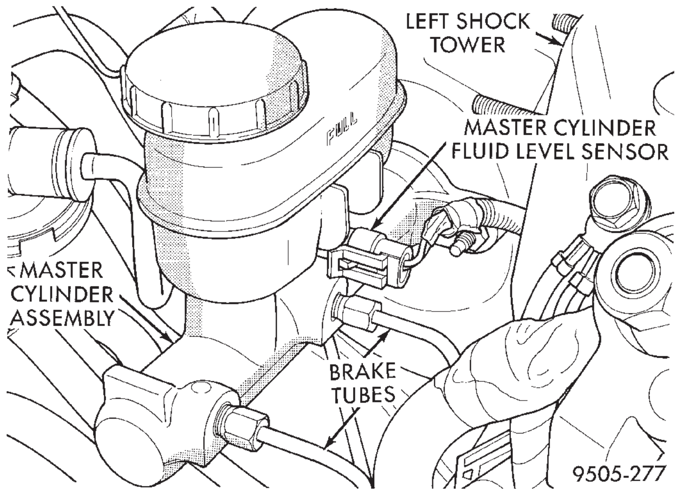


Fig. 17 Master Cylinder Fluid Level Sensor

As the fluid drops below the minimum level, the fluid level sensor closes the brake warning light circuit. This will turn on the red brake warning light. At this time, master cylinder fluid reservoir should be checked and filled to the full mark with DOT 3 brake fluid. **If brake fluid level has dropped in master cylinder fluid reservoir, the entire brake hydraulic system should be checked for evidence of a leak.**

STOP LAMP SWITCH

The stop lamp switch controls operation of the vehicles stop lamps. Also, if the vehicle is equipped with speed control, the stop lamp switch will deactivate speed control when the brake pedal is depressed.

The stop lamp switch controls operation of the right and left tail, stop and turn signal lamp and CHMSL lamp, by supplying battery current to these lamps.

The stop lamp switch controls the lamp operation by opening and closing the electrical circuit to the stop lamps.

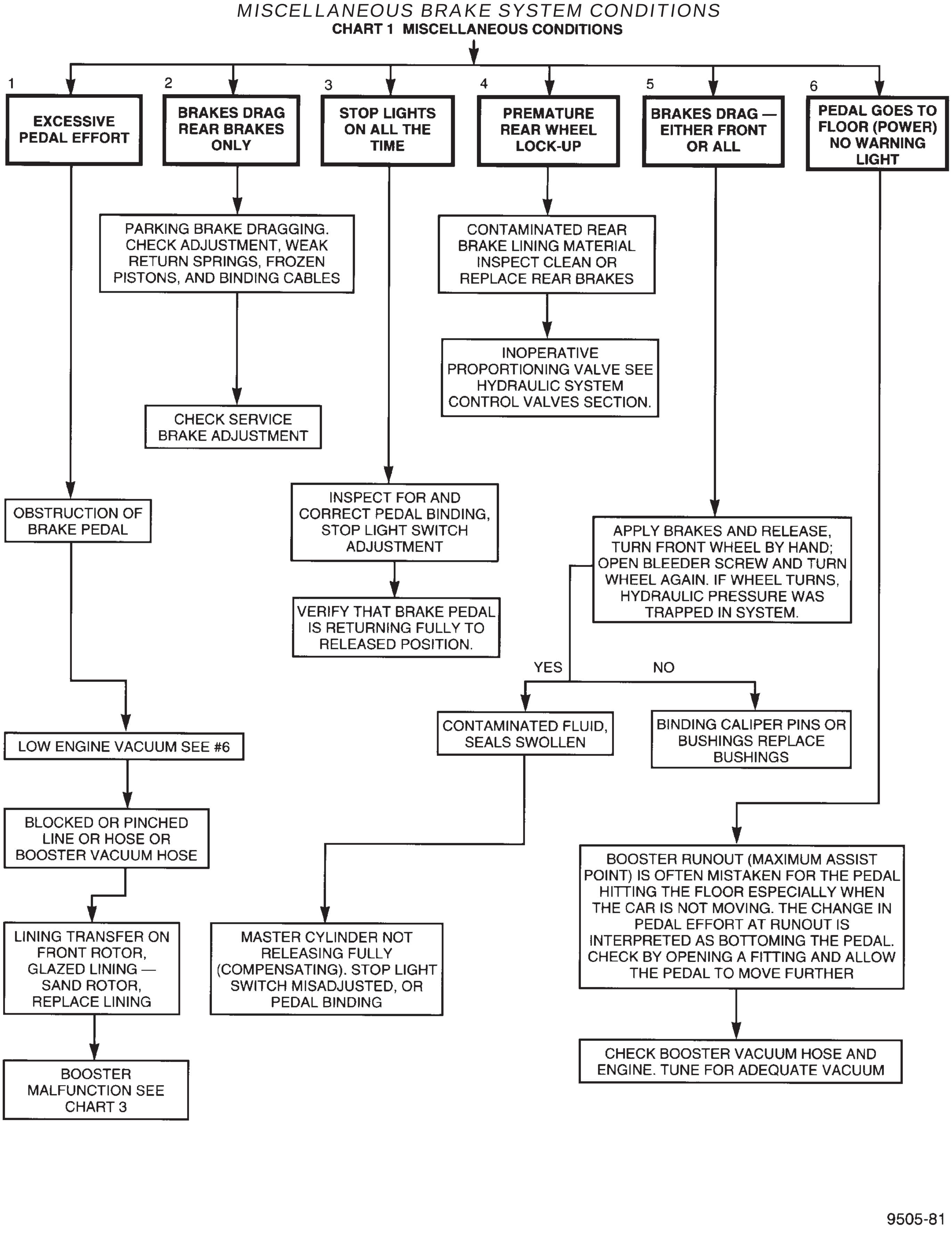
DIAGNOSIS AND TESTING

BRAKE SYSTEM DIAGNOSIS CHART GUIDE

SYMPTOM	CHART 1 MISC. COND.	CHART 2 WARNING LIGHT	CHART 3 POWER BRAKES	CHART 4 BRAKE NOISE	CHART 5 WHEEL BRAKES
Brake Warning Light On		X	NO	NO	
Excessive Pedal Travel	6	X	NO		O
Pedal Goes To The Floor	6	X			
Stop Light On Without Brakes	3				
All Brakes Drag	5				
Rear Brakes Drag	2	NO	NO		
Grabby Brakes			O		X
Spongy Brake Pedal		X	NO		
Premature Rear Brake Lockup	4	NO	NO		O
Excessive Pedal Effort	1		O		
Rough Engine Idle		NO	O		
Brake Chatter (Rough)		NO	NO		X
Surge During Braking		NO	NO		X
Noise During Braking		NO	NO	X	
Rattle Or Clunking Noise		NO	NO	X	
Pedal Pulsates During Braking		NO	NO		X
Pull To Right Or Left		NO	NO		X
No: Not A Possible Cause		X: Most Likely Cause		O: Possible Cause	

DIAGNOSIS AND TESTING (Continued)

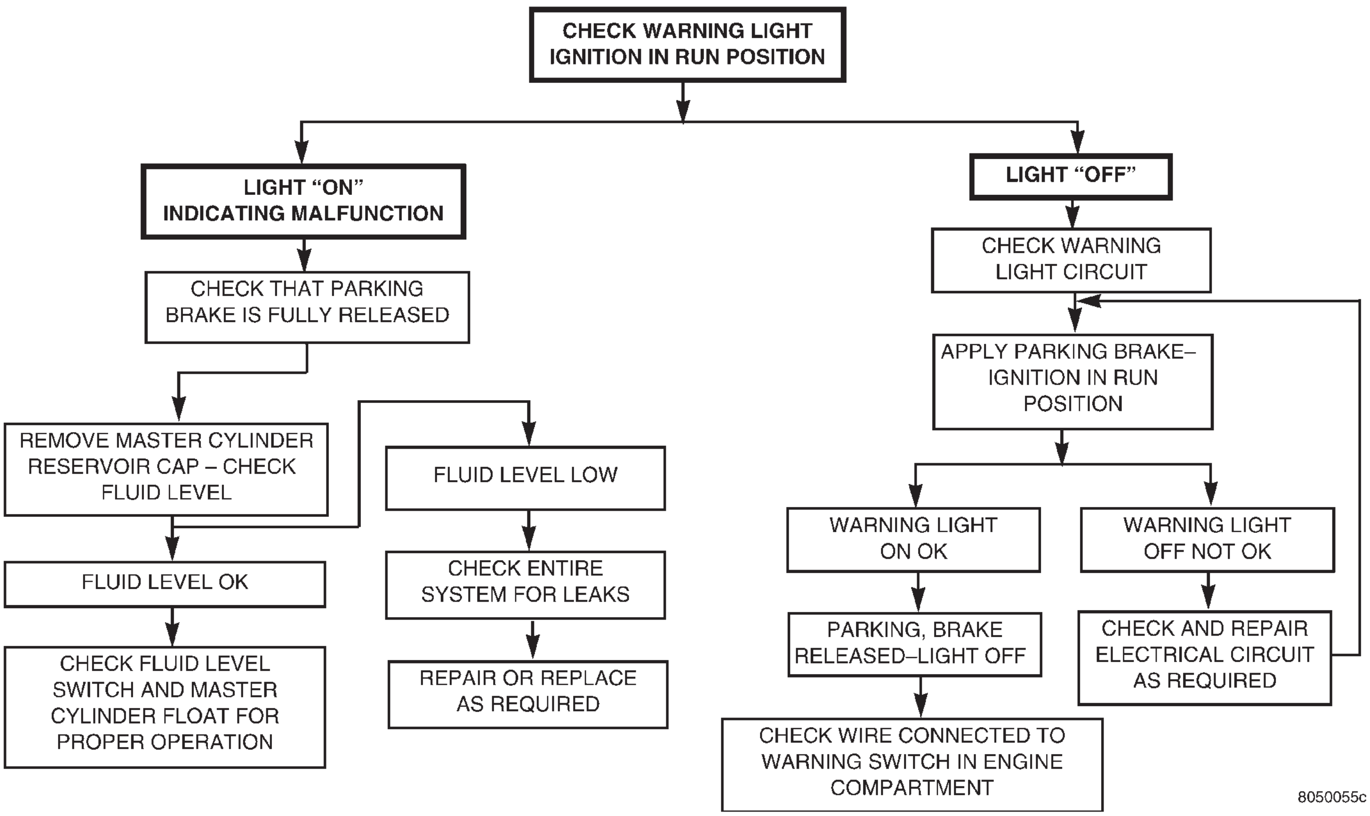
BRAKE SYSTEM DIAGNOSIS CHARTS



DIAGNOSIS AND TESTING (Continued)

RED BRAKE WARNING LAMP FUNCTION

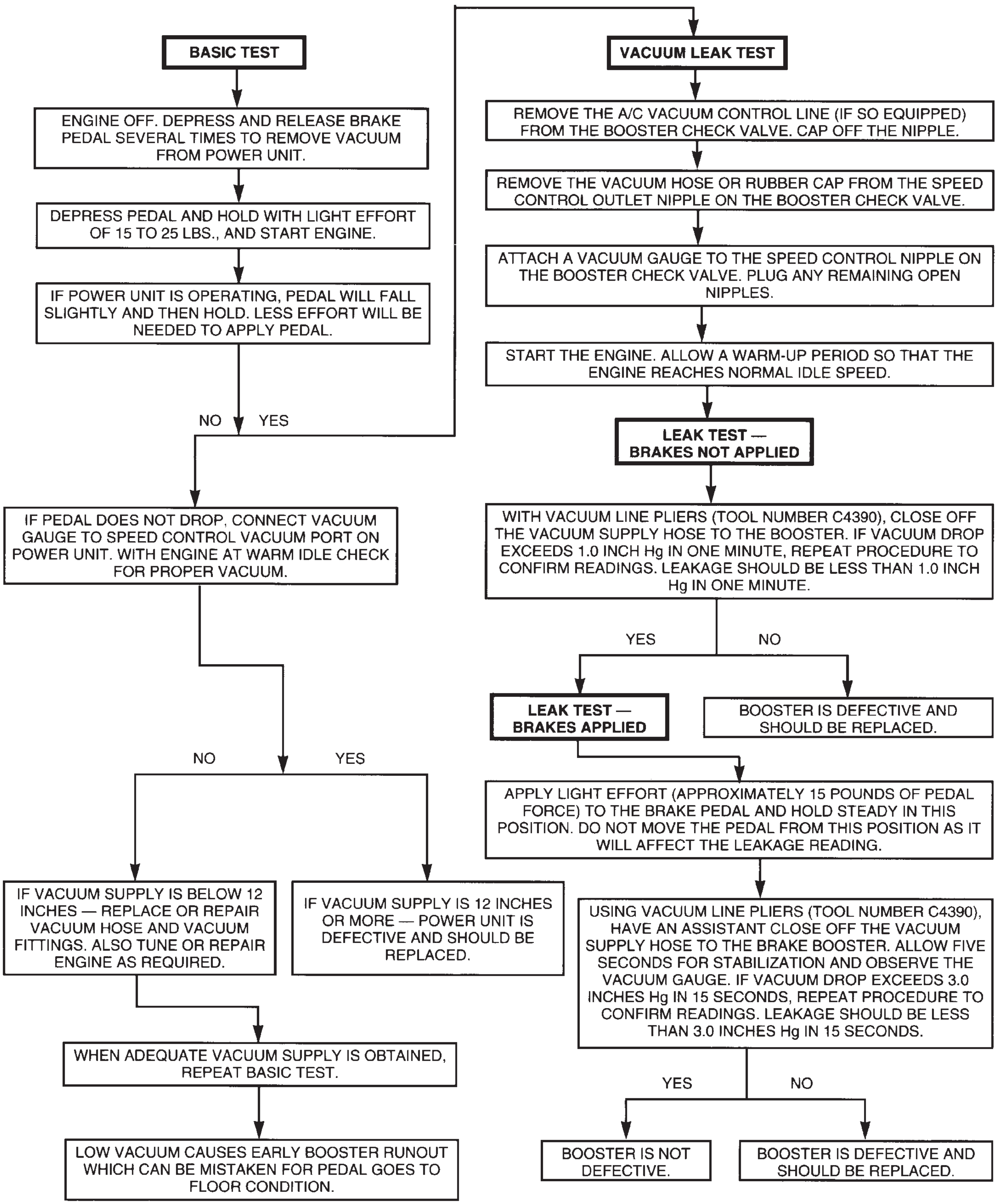
CHART 2 WARNING LAMP FUNCTION



DIAGNOSIS AND TESTING (Continued)

POWER BRAKE SYSTEM DIAGNOSTICS

CHART 3 POWER BRAKES



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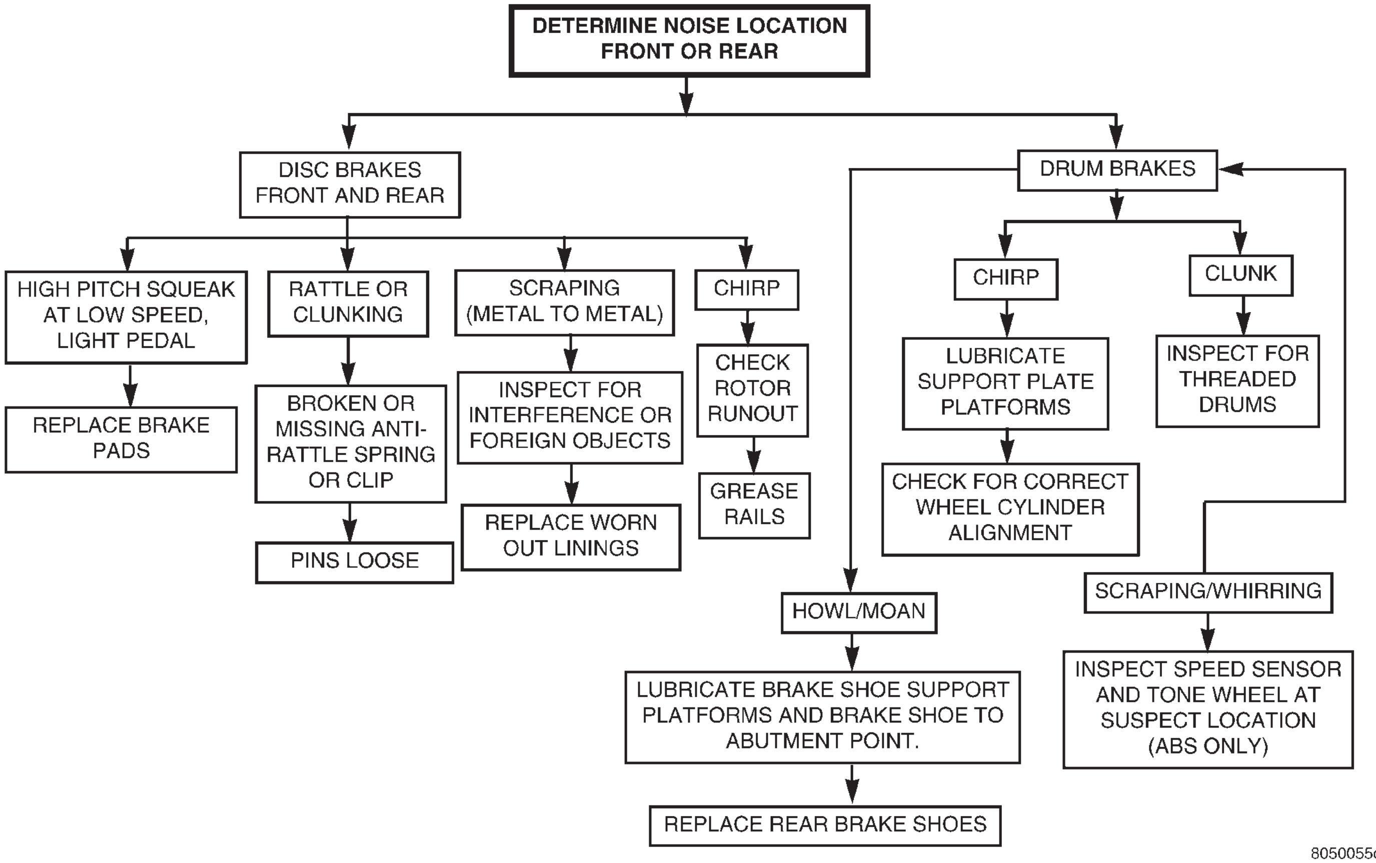
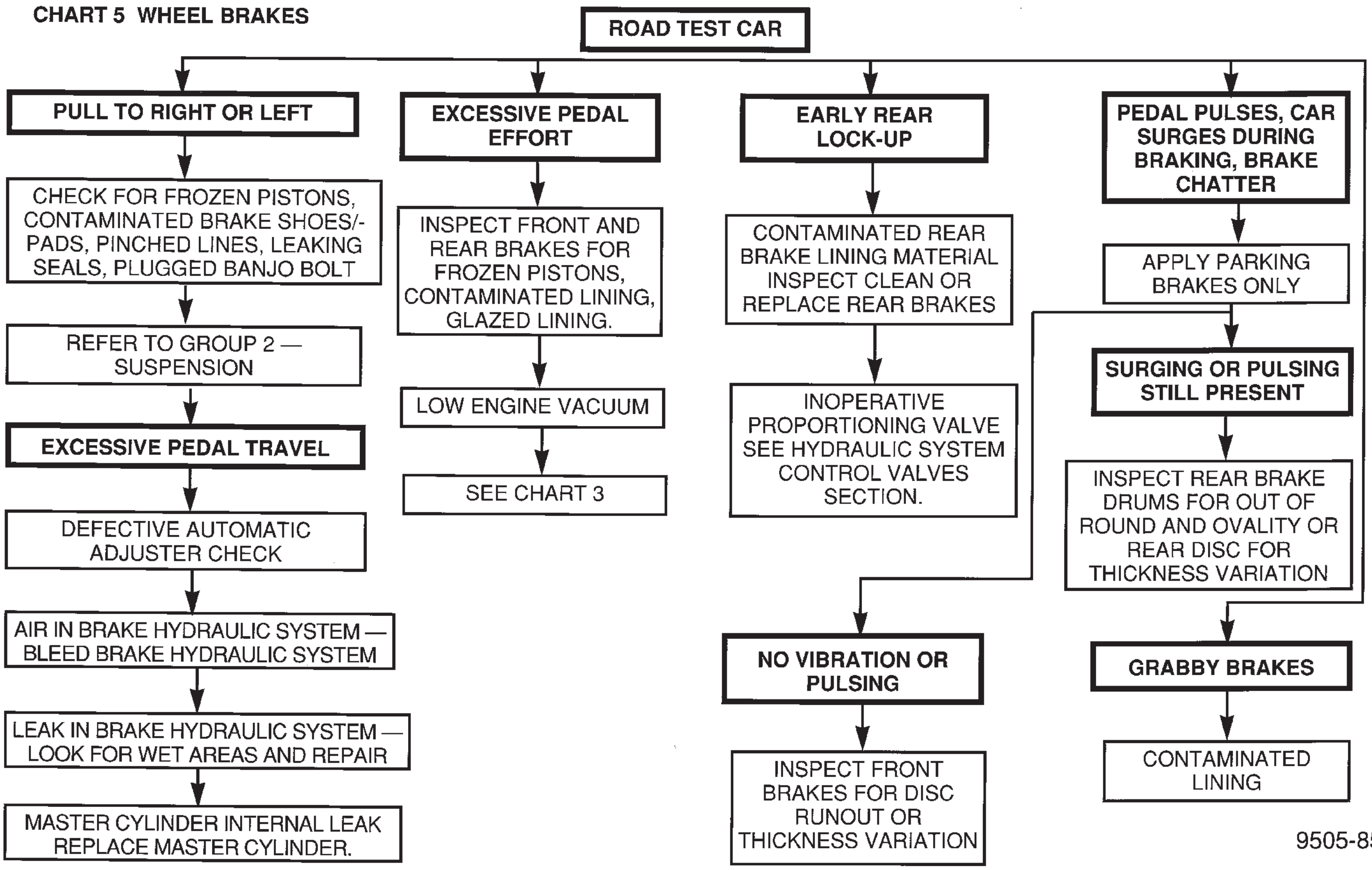
DIAGNOSIS AND TESTING (Continued)

BRAKE NOISE



DIAGNOSIS AND TESTING (Continued)

VEHICLE ROAD TEST



PROPORTIONING VALVE

NOTE: The following procedure is for the diagnosis and testing of the proportioning valve(s) on a vehicle without ABS. For diagnosis and testing of proportioning valves on a vehicle equipped with ABS, Refer to the ANTILOCK BRAKE SYSTEM section in this group.

If a condition of premature rear wheel skid occurs on a vehicle, the proportioning valve should always be tested prior to it being replaced. This is due to the fact that there are conditions other then a faulty proportioning valve which can cause a premature rear wheel skid.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 18). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which slides first is determined, use the following procedure to diagnose the proportioning valve.

The test procedure for a premature rear wheel skid is the same for both rear wheel proportioning valves. After road testing vehicle to determine which wheel skids first, the proper test fittings required will have to be determined. Then follow the procedure below for testing the required proportioning valve.

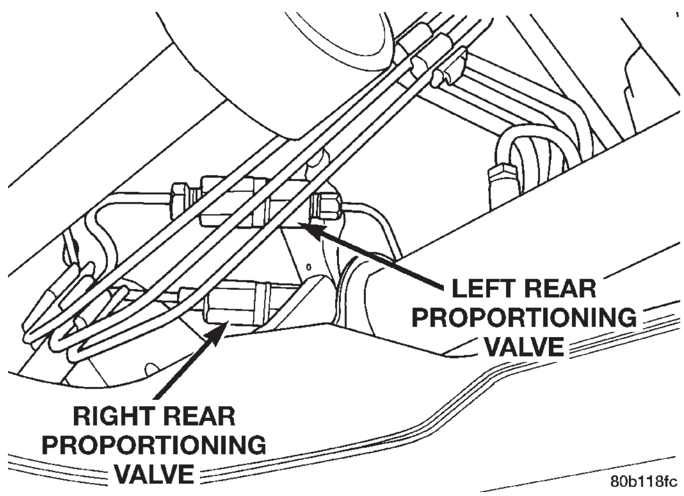


Fig. 18 Non-ABS Brake Proportioning Valve Location

(1) Road test the vehicle. Determine which rear wheel exhibits premature rear wheel skid, then refer to the figure (Fig. 18) to determine which proportioning valve needs to be tested.

DIAGNOSIS AND TESTING (Continued)

(2) Remove hydraulic brake line (Fig. 18) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(3) Remove the proportioning valve from the rear brake chassis tube.

CAUTION: Be sure the pressure test fittings being installed into proportioning valve, have the correct thread sizes for installation into the proportioning valve and installation of rear brake line tube nut.

(4) Install Pressure Test Fitting, Special Tool 8187 in the inlet port of the proportioning valve (Fig. 19). Install Pressure Test Fitting, Special Tool 8187–2 in the outlet port of the proportioning valve (Fig. 19). Tighten tube nuts to a torque of 17 N·m (145 in. lbs.)

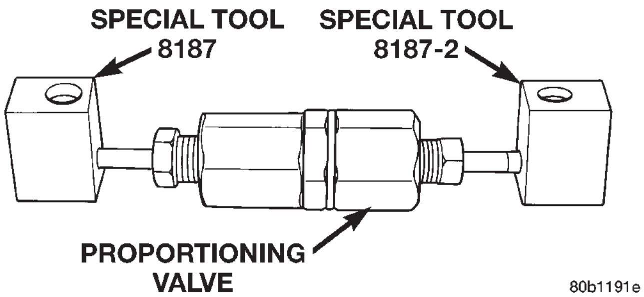


Fig. 19 Pressure Test Fitting Installed In Proportioning Valve

(5) Install the proportioning valve with the pressure test fittings installed, in the chassis brake tube (Fig. 20). Tighten both tube nuts to a torque of 17 N·m (145 in. lbs.).

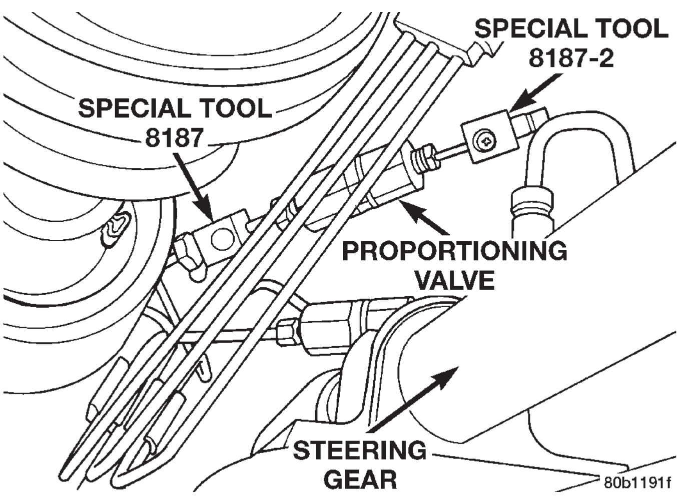


Fig. 20 Proportioning Valve With Pressure Test Fittings Installed

(6) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 21). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air. hose.

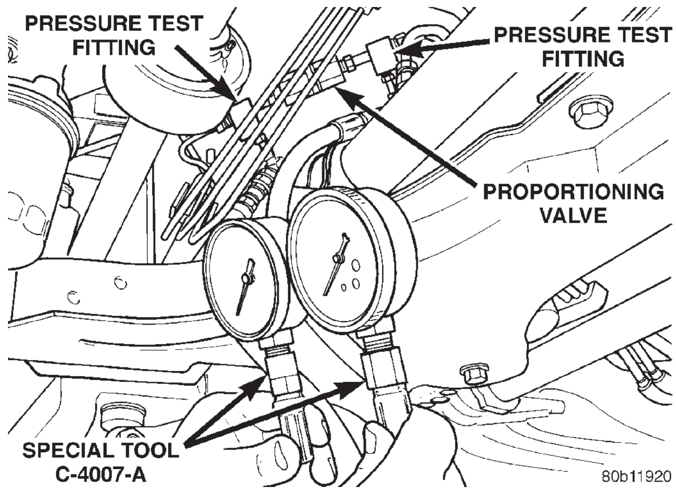


Fig. 21 Pressure Gauges Installed On Pressure Test Fittings

(7) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart, PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(8) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

(9) Install proportioning valve in rear brake line and hand tighten both tube nuts until they are fully seated in proportioning valve.

(10) Tighten both brake line tube nuts at the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(11) Bleed the affected brake line. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section.

DIAGNOSIS AND TESTING (Continued)

PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS

Sales Code	Brake System Type	Split Point	Slope	Identification	Inlet Pressure	Outlet Pressure
BRA	14″ Disc/Drum	500 psi	0.43	Bar Code Label	1000 psi	600-700 psi
BRJ	14″ Disc/Drum W/ABS	500 psi	0.43	Bar Code Label	1000 psi	600-700 psi
BRF	14″ Disc/Disc W/ABS	400 psi	0.34	Bar Code Label	1000 psi	600-700 psi

BRAKE ROTOR

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

Excessive runout or wobble in a rotor can increase pedal travel due to piston knock-back. This increases guide pin sleeve wear due to the tendency of the caliper to follow the rotor wobble.

When diagnosing a brake noise or pulsation, the machined disc braking surface should be checked and inspected.

BRAKING SURFACE INSPECTION

Light braking surface scoring and wear is acceptable. If heavy scoring or warping is evident, the rotor must be refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

Excessive wear and scoring of the rotor can cause improper lining contact on the rotor's braking surface. If the ridges on the rotor are not removed before new brake shoes are installed, improper wear of the shoes will result.

If a vehicle has not been driven for a period of time, the rotor's braking surface will rust in the areas not covered by the brake shoes at that time. Once the vehicle is driven, noise and chatter from the disc brakes can result when the brakes are applied.

Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced. If cracks or burned spots are evident, the rotor must be replaced.

ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if it is worn below minimum thickness or if machining the rotor will cause its thickness to fall below specifications.

CAUTION: Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Minimum thickness specifications are cast on the rotor's unmachined surface (Fig. 22). Limits can also be found in the table at the end of this brake rotor information.

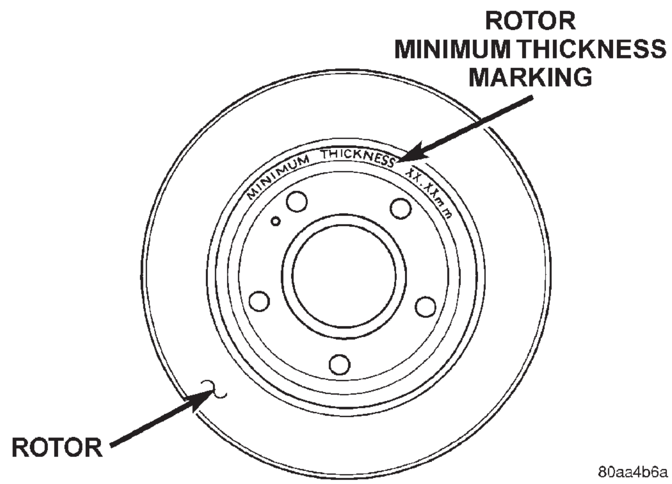


Fig. 22 Minimum Brake Rotor Thickness Markings (Typical)

ROTOR THICKNESS VARIATION

Thickness variation in a rotor's braking surface can result in pedal pulsation, chatter and surge. This can also be caused by excessive runout in the rotor or the hub.

Rotor thickness variation measurements should be made in conjunction with measuring runout. Measure thickness of the brake rotor at 12 equal points around the rotor braking surface with a micrometer at a radius approximately 25 mm (1 inch) from edge of rotor (Fig. 23). If thickness measurements vary by more than 0.013 mm (0.0005 inch), the rotor should refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

ROTOR RUNOUT

On-vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable). To measure rotor runout on the vehicle, first remove

DIAGNOSIS AND TESTING (Continued)

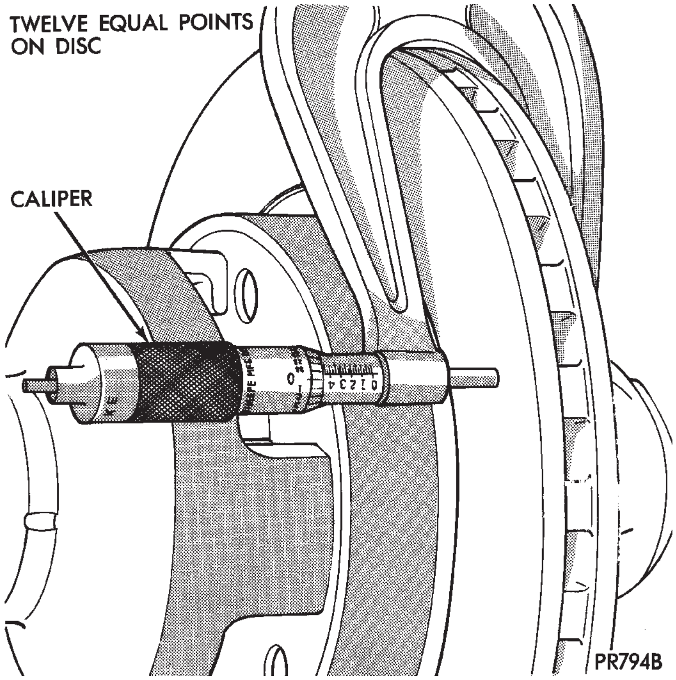


Fig. 23 Checking Rotor For Thickness

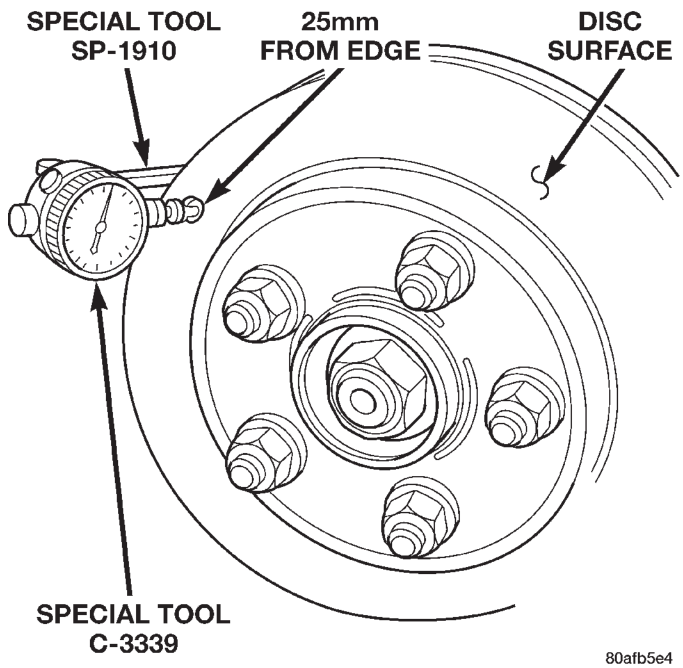


Fig. 24 Checking Rotor Runout

the tire and wheel assembly. Reinstall the wheel mounting nuts on the studs, tightening the rotor to the hub. Mount the Dial Indicator, Special Tool C-3339, with Mounting Adaptor, Special Tool SP-1910 on steering arm. The dial indicator plunger should contact braking surface of rotor approximately 25 mm (one inch) from outer edge of rotor (Fig. 24). Check lateral runout on both sides of the rotor, marking the low and high spots on both. Runout limits can be found in the table at the end of this brake rotor information.

If runout is in excess of the specification, check the lateral runout of the hub face. Before removing the rotor from the hub, place a chalk mark across both the rotor and the one wheel stud closest to where the high runout measurement was taken. This way, the original mounting spot of the rotor on the hub is indexed (Fig. 25).

Remove the rotor from the hub.

NOTE: Clean the hub face surface before checking runout. This provides a clean surface to get an accurate indicator reading.

Mount Dial Indicator, Special Tool C-3339, and Mounting Adaptor, Special Tool SP-1910, to the steering knuckle. Position the indicator stem so it contacts the hub face near the outer diameter. Care must be taken to position stem outside of the stud circle, but inside of the chamfer on the hub rim (Fig. 26).

Hub runout should not exceed 0.08 mm (0.003 inch). If runout exceeds this specification, the hub must be replaced. Refer to the SUSPENSION group

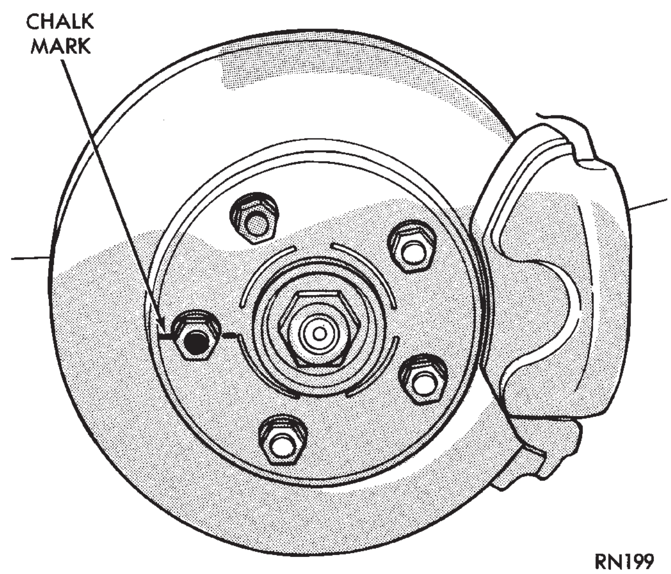


Fig. 25 Marking Rotor and Wheel Stud

in this service manual for the hub and bearing removal and installation procedure.

If the hub runout does not exceed this specification, install the rotor back on the hub, aligning the chalk marks on the rotor with a wheel mounting stud, two studs apart from the original stud (Fig. 27). Tighten nuts in the proper sequence and torque to specifications.

Recheck brake rotor runout to see if the runout is now within specifications.

If runout is not within specifications, reface or replace the brake rotor. Refer to SERVICE PROCE-

DIAGNOSIS AND TESTING (Continued)

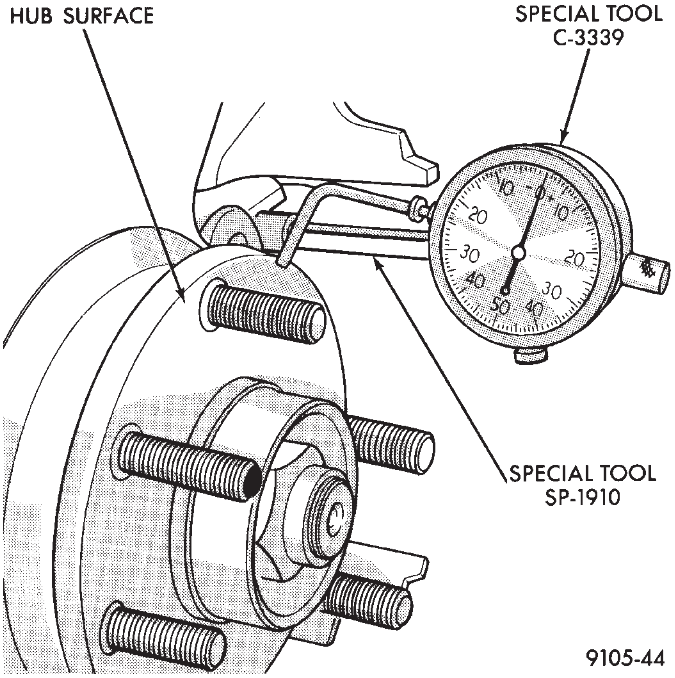


Fig. 26 Checking Hub Runout

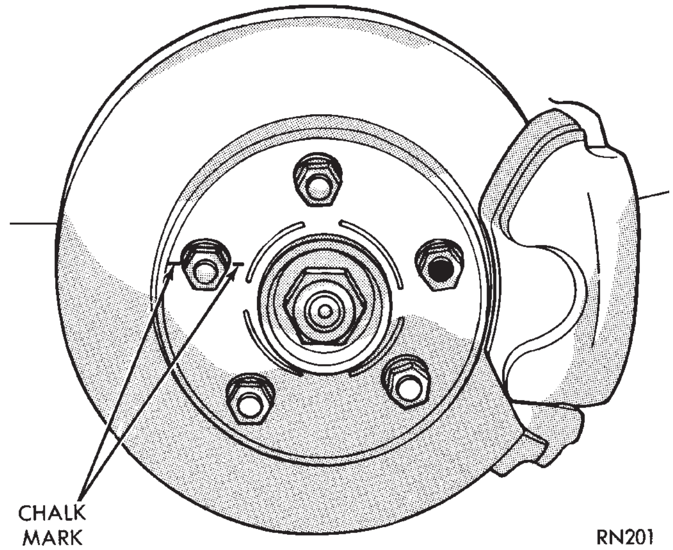


Fig. 27 Index Rotor And Wheel Stud

DURES in this section of this group for information on brake rotor machining.

BRAKE ROTOR LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Runout*	Rotor Micro Finish
Front Rotor	22.87–23.13 mm 0.900-0.911 in.	21.4 mm 0.843 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
Rear Rotor	8.87–9.13 mm 0.350-0.360 in.	7.25 mm 0.285 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

BRAKE DRUM

With the drum off the vehicle, measure the drum for diameter variation (oval shape). The diameter variation of the drum braking surface must not exceed either 0.0635 mm (0.0025 inch) in 30° or 0.0889 mm (0.0035 inch) in 360°.

Measure brake drum runout. Brake drum runout should be checked with the drum mounted on a brake lathe. Brake drum runout should not exceed 0.1524 mm (0.006 inch).

If either of these measurements are not within specification, reface or replace the drum. Refer to BRAKE DRUM MACHINING in the SERVICE PROCEDURES section of this service manual group for refacing procedures.

Always replace the drum if machining will cause the diameter to exceed drum maximum diameter. All brake drums are marked with the maximum allowable brake drum diameter (Fig. 28).

DRUM BRAKE AUTOMATIC ADJUSTER

Place the vehicle on a frame contact hoist with a helper in the driver's seat to apply the brakes. Raise the vehicle. Remove the adjuster access plug from the rear brake support plate automatic adjuster access hole (Fig. 29). This will allow access to the adjuster quadrant (Fig. 30) on the automatic adjuster mechanism. Then, to eliminate the possibility of maximum adjustment, insert a small screwdriver through the access hole in the support plate (Fig. 29)

DIAGNOSIS AND TESTING (Continued)

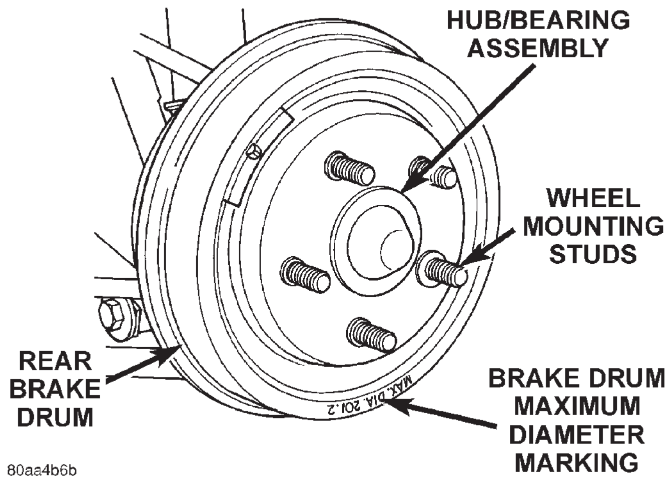


Fig. 28 Brake Drum Maximum Diameter Identification

and back off adjuster quadrant approximately 4 to 5 notches.

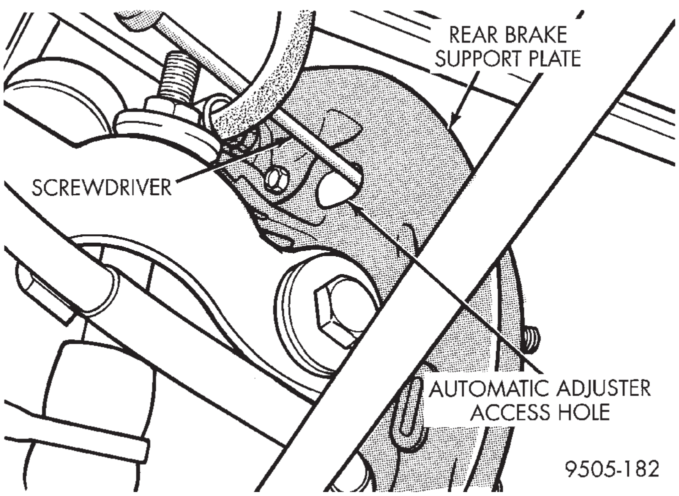


Fig. 29 Accessing The Automatic Adjuster Quadrant

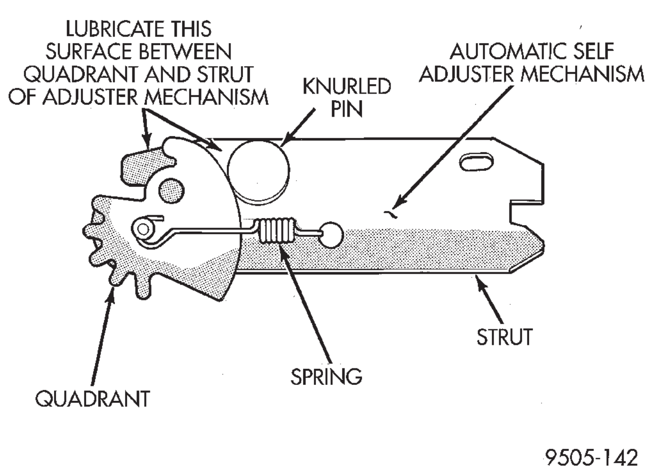


Fig. 30 Automatic Adjuster Quadrant

Fully apply the brake pedal which will cause the brake shoes to leave the anchor. Upon application of the brake pedal, the adjuster quadrant should move. Thus, a definite rotation of the adjuster quadrant can be observed if the automatic adjuster is working properly. If one or more adjusters do not function properly, the respective drum must be removed for adjuster mechanism servicing.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

RED BRAKE WARNING LAMP

For diagnosis of specific problems with the red BRAKE warning lamp system, refer to BRAKE SYSTEM DIAGNOSIS CHART GUIDE, and CHARTS located in the DIAGNOSIS AND TESTING section of this service manual group.

STOP LAMP SWITCH

The required procedure for testing the stop lamp switch is covered in GROUP 8H - VEHICLE SPEED CONTROL SYSTEM in this service manual. The electrical circuit for stop lamps is covered in GROUP 8W - REAR LIGHTING in this service manual.

SERVICE PROCEDURES

BRAKE FLUID LEVEL CHECKING

Brake fluid level should be checked a minimum of twice a year.

Master cylinder reservoirs are marked, FULL and MIN, indicating the allowable brake fluid level range in the master cylinder brake fluid reservoir (Fig. 31).

CAUTION: Use only Mopar® brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

Although there is a range, the preferred level is FULL. If necessary, adjust the brake fluid level,

SERVICE PROCEDURES (Continued)

bringing it to the FULL mark on the side of the master cylinder brake fluid reservoir.

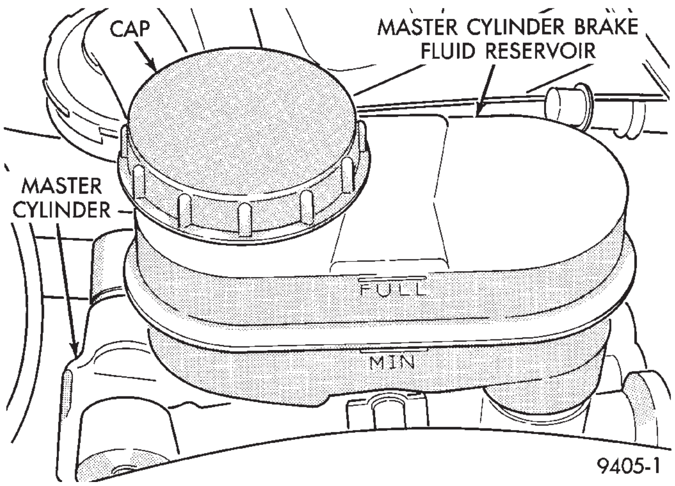


Fig. 31 Master Cylinder Fluid Level

BASE BRAKE BLEEDING

NOTE: For bleeding the ABS hydraulic system, refer to ANTILOCK BRAKE SYSTEM BLEEDING in the ANTILOCK BRAKE SYSTEM section of this service manual group.

CAUTION: Before removing the master cylinder cap, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder reservoir.

CAUTION: Use only Mopar® brake fluid or an equivalent from a fresh, tightly sealed container. Brake fluid must conform to DOT 3 specifications.

Do not pump the brake pedal at any time while having a bleeder screw open during the bleeding process. This will only increase the amount of air in the system and make additional bleeding necessary.

Do not allow the master cylinder reservoir to run out of brake fluid while bleeding the system. An empty reservoir will allow additional air into the brake system. Check the fluid level frequently and add fluid as needed.

The following wheel circuit sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

MANUAL BLEEDING

NOTE: To bleed the brakes manually, the aid of a helper will be required.

(1) Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 32).

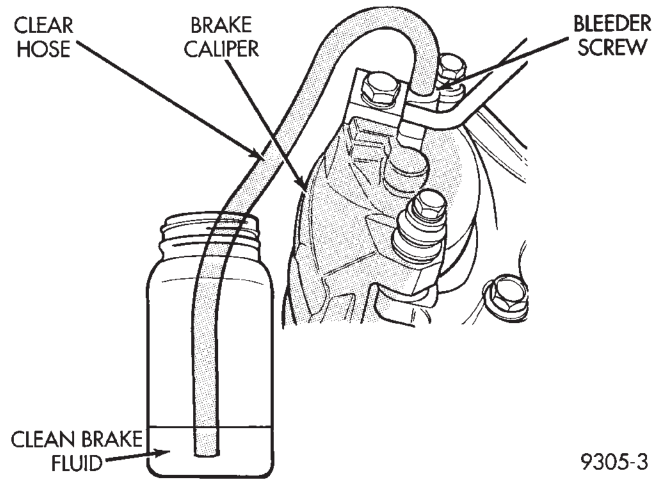


Fig. 32 Proper Method for Purging Air From Brake System (Typical)

(2) Have a helper pump the brake pedal three or four times and hold it in the down position.

(3) With the pedal in the down position, open the bleeder screw at least 1 full turn.

(4) Once the brake pedal has dropped, close the bleeder screw. After the bleeder screw is closed, release the brake pedal.

(5) Repeat the above steps until all trapped air is removed from that wheel circuit (usually four or five times).

(6) Bleed the remaining wheel circuits in the same manner until all air is removed from the brake system. Monitor the fluid level in the master cylinder reservoir to make sure it does not go dry.

(7) Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Rebleed the brakes as necessary.

(8) Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

PRESSURE BLEEDING

NOTE: Follow pressure bleeder manufacturer's instructions for use of pressure bleeding equipment.

SERVICE PROCEDURES (Continued)

Use bleeder tank, Special Tool C-3496-B, with master cylinder reservoir adapter, Special Tool 8224, to pressurize the hydraulic system for bleeding.

Following the same wheel circuit sequence as prescribed for manual bleeding.

(1) Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 32).

(2) Open the bleeder screw at least one full turn or more to obtain a steady stream of brake fluid.

(3) After approximately 4–8 ounces of fluid have been bled through the brake circuit and an air-free flow is maintained in the clear plastic hose and jar, close the bleeder screw.

(4) Repeat this procedure at all the remaining bleeder screws.

(5) Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Rebleed the brakes as necessary.

(6) Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

MASTER CYLINDER BLEEDING

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder outlet ports (Fig. 33) or (Fig. 34). Position bleeding tubes so the outlets of the bleeding tubes will be below the surface of the brake fluid when reservoir is filled to proper level.

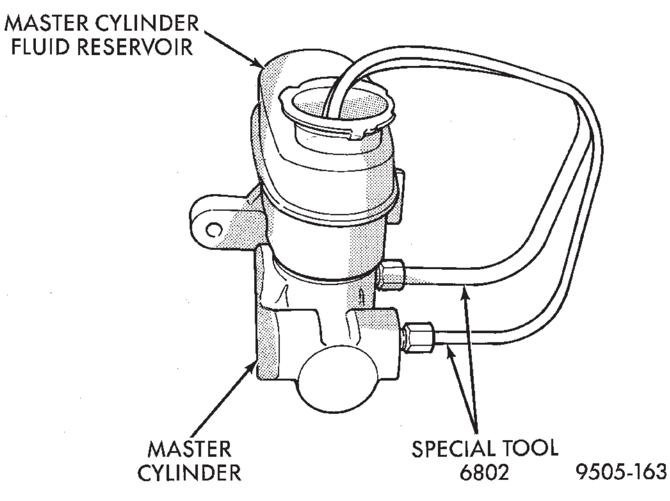


Fig. 33 Bleeding Tubes Attached To Master Cylinder With ABS

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 35). Depress push rod slowly, and then allow pistons to return to the released position. Continue to repeat this step several times after no more air bubbles are expelled from bleed tubes to ensure all air is bled from the master cylinder.

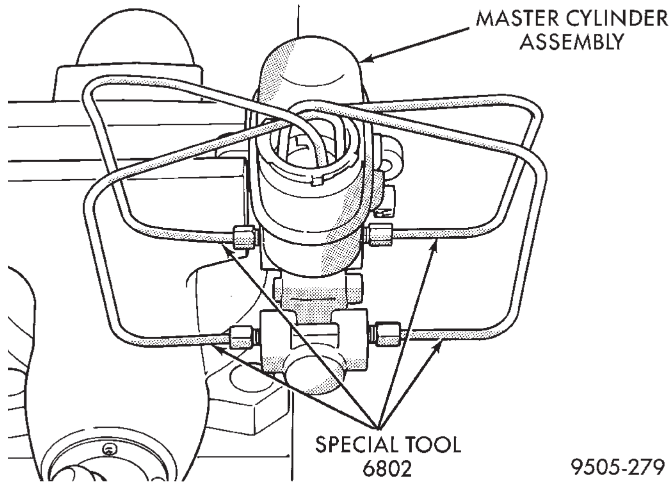


Fig. 34 Bleeding Tubes Attached to Master Cylinder With Out ABS

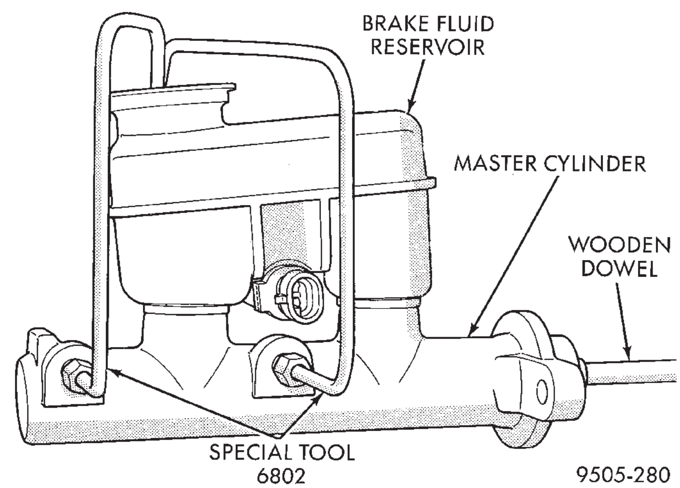


Fig. 35 Bleeding Master Cylinder

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

NOTE: It is not necessary to bleed the brakes entire hydraulic system after replacing the master cylinder. However, the master cylinder must have been thoroughly bled and filled to the proper level upon installation on the power brake vacuum booster.

BRAKE TUBE REPAIR

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZN-AL alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

SERVICE PROCEDURES (Continued)

Care should be taken when repairing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 36). Ream out any burrs or rough edges showing on inside of tubing (Fig. 37). This will make the ends of tubing square (Fig. 37) and ensure better seating of flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**

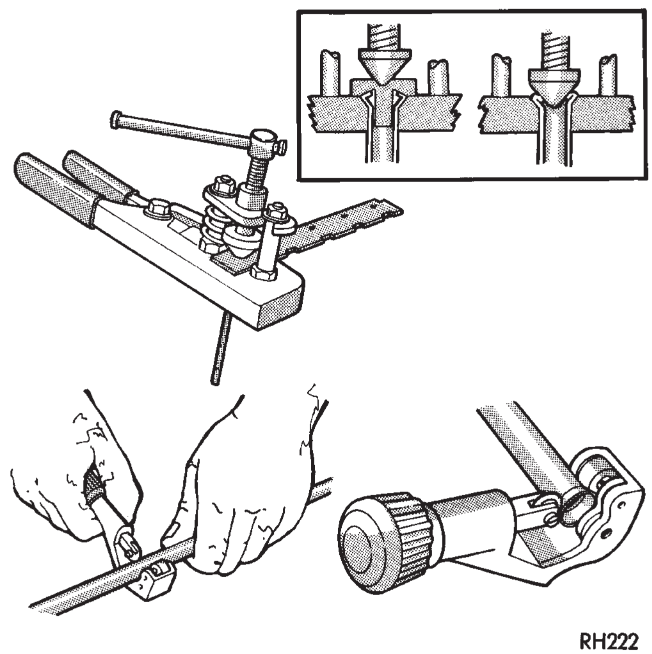


Fig. 36 Cutting And Flaring Of Brake Fluid Tubing

DOUBLE INVERTED TUBING FLARES

To make a double inverted tubing flare (Fig. 38) and (Fig. 39). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the tubing size. Squeeze handles of flaring tool and lock tubing in place. Place 3/16 inch plug of gauge (A) down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect

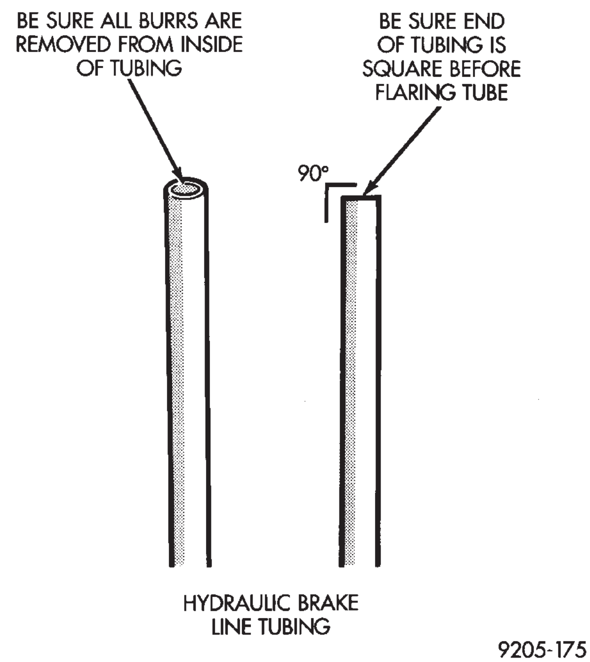


Fig. 37 Brake Fluid Tube Preparation For Flaring

seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.

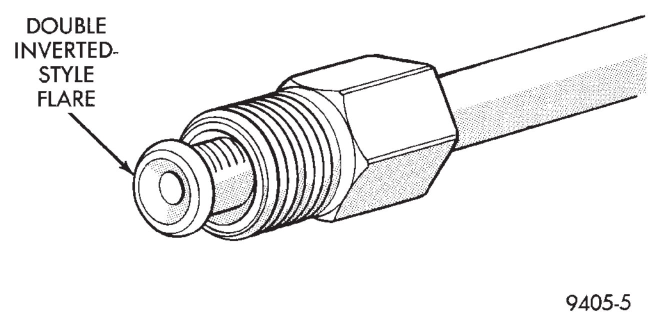


Fig. 38 Double Inverted Brake Line Tubing Flare

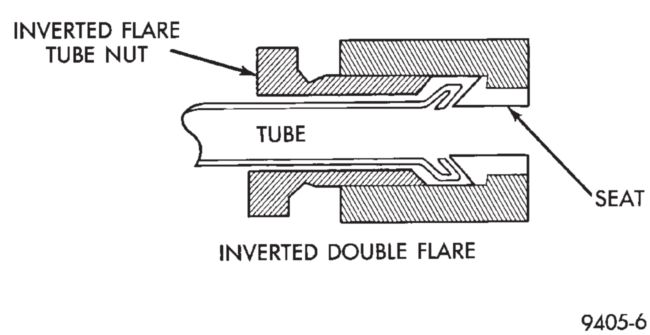


Fig. 39 Double Wall Inverted Flare Connection

SERVICE PROCEDURES (Continued)

BRAKE ROTOR MACHINING

NOTE: Refacing the rotor is not required each time the brake pads are replaced, only when the need is foreseen.

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or brake pedal pulsation, the rotor should be refaced using a hub-mounted on-car brake lathe (Fig. 40), or replaced.

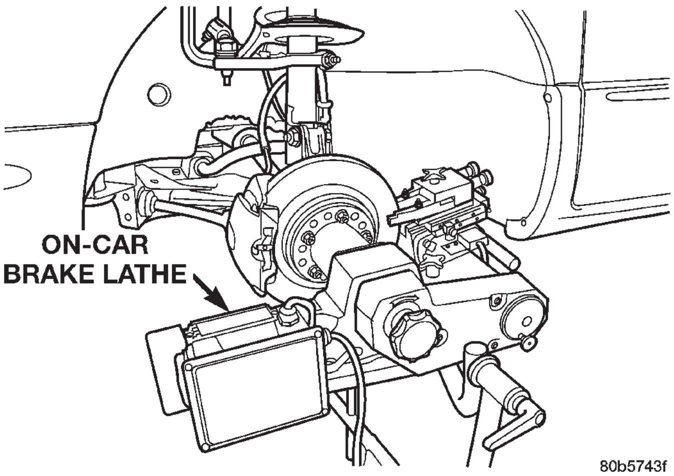


Fig. 40 On-Car Brake Lathe

The use of a hub-mounted on-car brake lathe is highly recommended to eliminate the possibility of excessive runout. It trues the brake rotor to the vehicle's hub and bearing.

NOTE: All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 41).

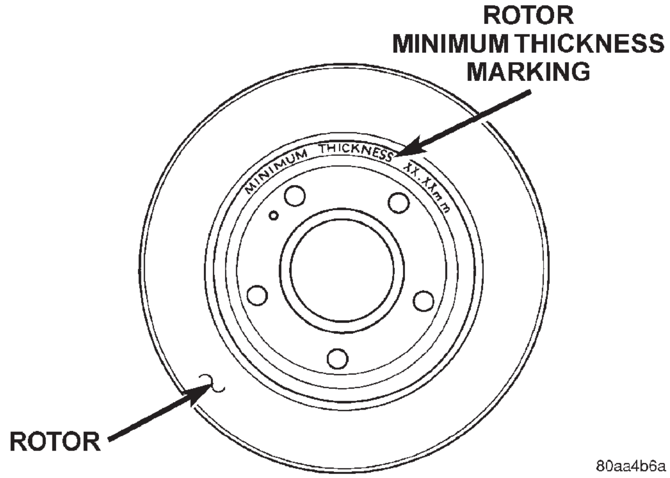


Fig. 41 Minimum Brake Rotor Thickness Markings (Typical)

Minimum allowable thickness is the minimum thickness which the brake rotor machined surface may be cut to.

CAUTION: Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Before installation, verify the brake rotor face and the hub adapters are free of any chips, rust, or contamination.

When mounting and using the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

Machine both sides of the brake rotor at the same time. Cutting both sides at the same time minimizes the possibility of a tapered or uneven cut.

SPECIFICATIONS AND LIMITS

When refacing a rotor, the required TIR (Total Indicator Reading) and thickness variation limits MUST BE MAINTAINED. Extreme care in the operation of rotor turning equipment is required.

BRAKE ROTOR REFINISHING LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Run Out*	Rotor Micro Finish
Front Rotor	22.87–23.13 mm 0.900-0.911 in.	21.4 mm 0.843 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
Rear Rotor	8.87–9.13 mm 0.350-0.360 in.	7.25 mm 0.285 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

SERVICE PROCEDURES (Continued)

BRAKE DRUM MACHINING

If a brake drum is deeply scored or warped, it can be machined on a brake lathe equipped to machine brake drums. Follow the manufacturers instructions on the machining procedure.

Measure the brake drum diameter before machining. Refer to BRAKE DRUM in DIAGNOSIS AND TESTING in this section for further information. If machining the drum will cause the drum to exceed maximum diameter, do not machine the brake drum. It needs to be replaced.

All brake drums are marked with the maximum allowable brake drum diameter (Fig. 42).

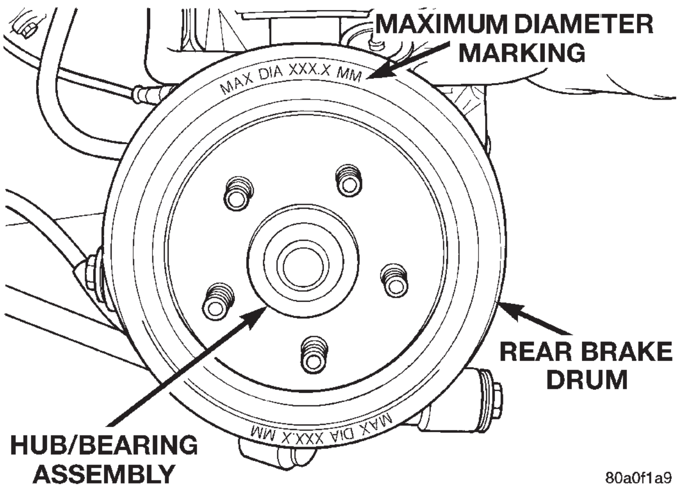


Fig. 42 Brake Drum Maximum Diameter Identification

When machining, make sure the final finish feed cut is fine in order to avoid a screw effect on the brake shoes when the brakes are applied. This final feed cut specification varies from lathe manufacturer to lathe manufacturer.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

WARNING: ALTHOUGH FACTORY INSTALLED BRAKE SHOE LININGS ARE MADE FROM ASBESTOS-FREE MATERIALS, SOME AFTERMARKET BRAKE SHOE LININGS MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM. IT IS POSSIBLE THAT AFTERMARKET BRAKE SHOES MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS; ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR; USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER-DAMPENED SHOP TOWELS. DO NOT CREATE BRAKE LINING DUST BY SANDING THE BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS. USE ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSING OF PRODUCTS CONTAINING ASBESTOS.

CAUTION: Use only Mopar® brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash it off immediately with water.

CAUTION: During service procedures, grease or any other foreign material must be kept off the caliper assembly, surfaces of the brake rotor and external surfaces of the hub. Avoid deformation, scratching or nicking of the brake rotor and brake shoe linings.

CAUTION: When handling the brake rotor and caliper, be careful to avoid damaging the rotor and caliper, and scratching or nicking the brake shoe lining.

MASTER CYLINDER

REMOVE

(1) Remove vehicle wiring harness connector from brake fluid level sensor, in master cylinder brake fluid reservoir (Fig. 43).

(2) Disconnect the primary and secondary brake tubes from master cylinder outlet ports (Fig. 44) and (Fig. 45). Install plugs at all open brake tube outlets on master cylinder assembly.

(3) Using Mopar, Brake Parts Cleaner or an equivalent, clean area where master cylinder attaches to booster.

(4) Remove the 2 nuts (Fig. 46) attaching master cylinder assembly to power brake vacuum booster.

REMOVAL AND INSTALLATION (Continued)

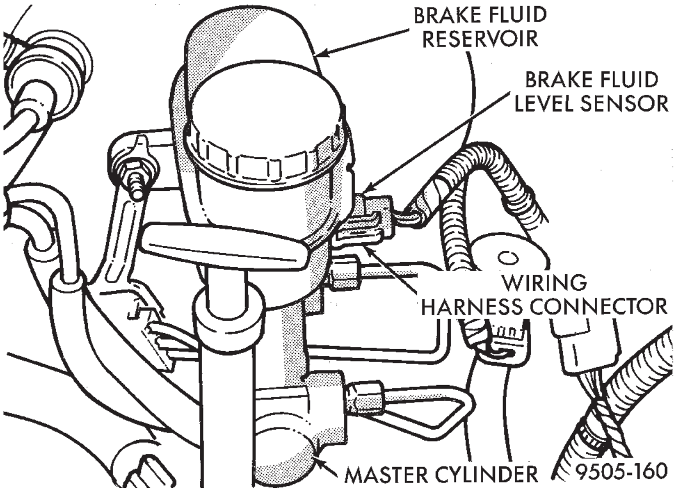


Fig. 43 Master Cylinder Fluid Level Sensor

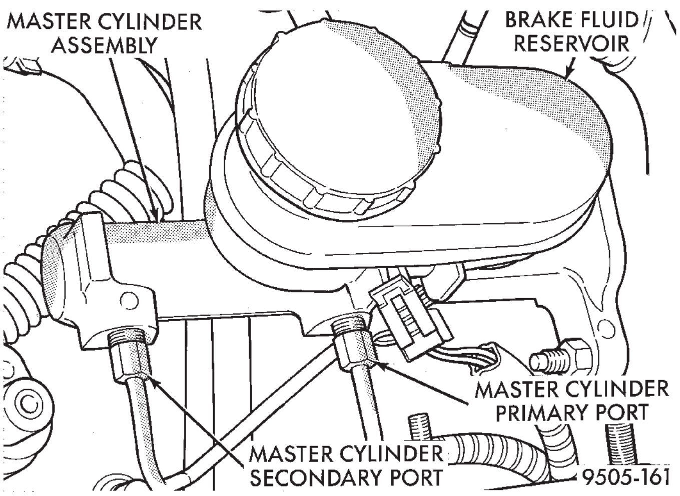


Fig. 44 Master Cylinder Primary And Secondary Ports With ABS

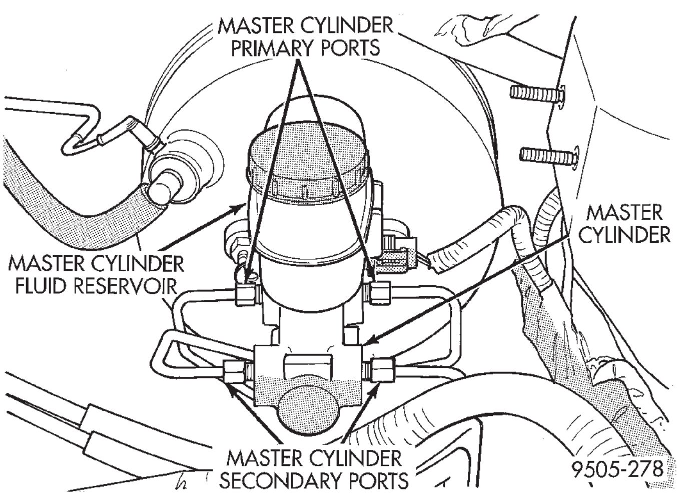


Fig. 45 Master Cylinder Primary And Secondary Ports With Out ABS

(5) Slide master cylinder assembly straight off its mounting studs on power brake vacuum booster.

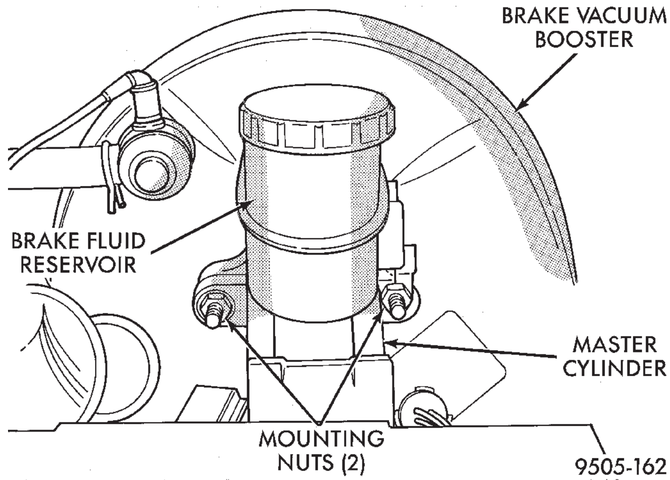


Fig. 46 Master Cylinder Mounting To Vacuum Booster

BLEEDING MASTER CYLINDER

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder outlet ports (Fig. 47) or (Fig. 48). Position tubes so outlets of Bleeding Tubes will be below surface of brake fluid when reservoir is filled to proper level.

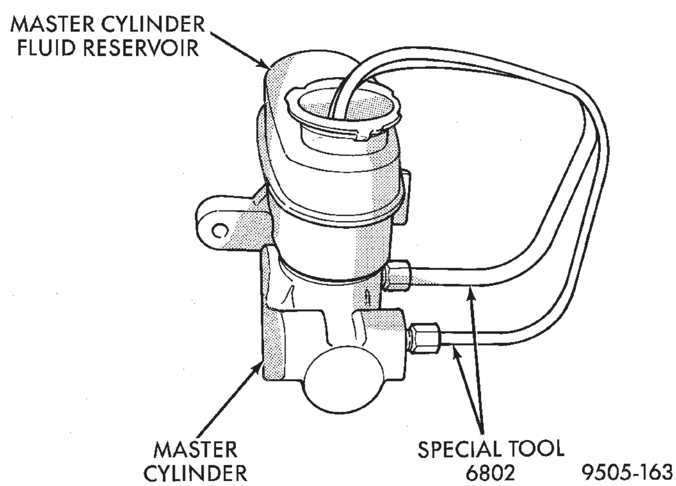


Fig. 47 Bleeding Tubes Attached to Master Cylinder With ABS

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 49), depress push rod slowly, and then allow pistons to return to released position. Continue to repeat this step several times after no more air bubbles are expelled from bleed tubes to ensure all air is bled from master cylinder.

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

REMOVAL AND INSTALLATION (Continued)

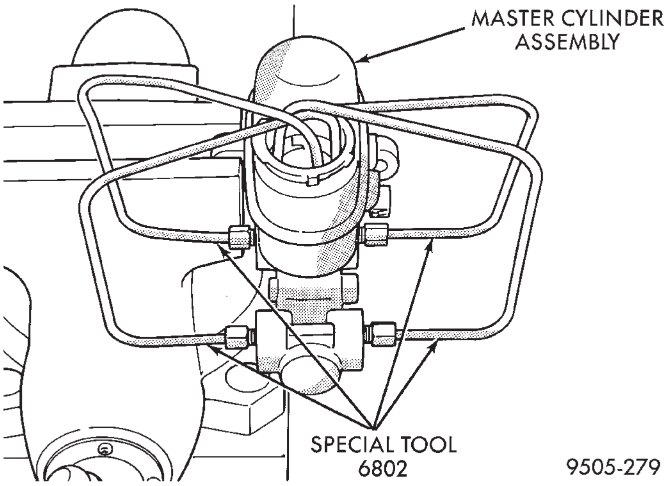


Fig. 48 Bleeding Tubes Attached to Master Cylinder With Out ABS

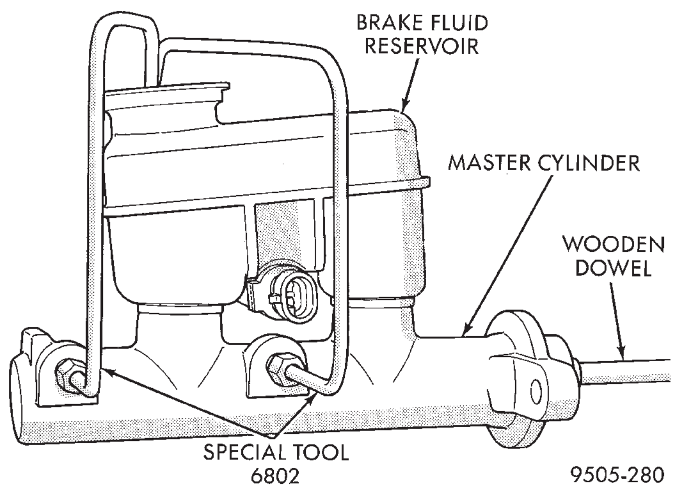


Fig. 49 Bleeding Master Cylinder

NOTE: It is not necessary to bleed the entire hydraulic system after replacing the master cylinder. However, the master cylinder must have been bled and filled upon installation.

INSTALL

(1) Position master cylinder assembly on studs of power brake unit, aligning push rod on power brake vacuum booster with piston of master cylinder.

(2) Install the 2 master cylinder to power brake vacuum booster mounting nuts (Fig. 46). Tighten both nuts to a torque of 28 N·m (250 in. lbs.).

(3) Connect brake tubes to master cylinder primary and secondary ports (Fig. 47) or (Fig. 48). Then tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

BRAKE FLUID LEVEL SWITCH

The master cylinder or brake fluid reservoir does not have to be removed from the vehicle for replacement of the brake fluid level sensor.

(1) Remove wiring harness connector from brake fluid reservoir level sensor (Fig. 50).

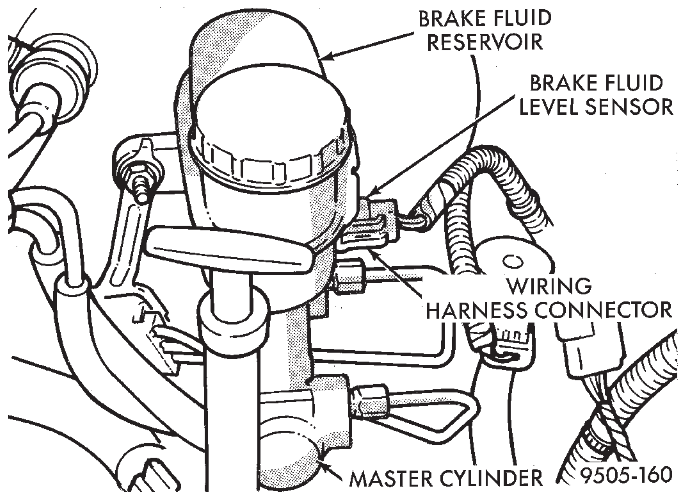


Fig. 50 Master Cylinder Fluid Level Sensor

(2) Compress the retaining tabs (Fig. 51) on the end of the brake fluid level sensor.

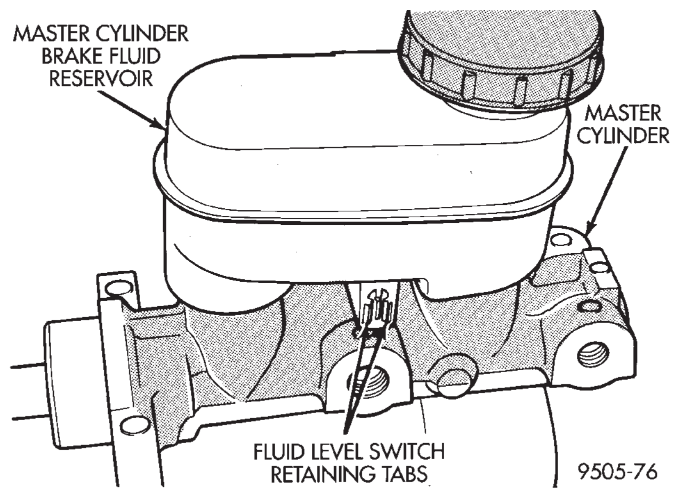


Fig. 51 Brake Fluid Level Switch Retaining Tabs

(3) While compressing retaining tabs, grasp opposite end of brake fluid level sensor and pull it out of master cylinder fluid reservoir (Fig. 52).

POWER BRAKE BOOSTER (2.0L/2.4L ENGINE)

REMOVAL

(1) Remove the remote ground cable from the ground stud located on the left strut tower (Fig. 53).

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 54).

REMOVAL AND INSTALLATION (Continued)

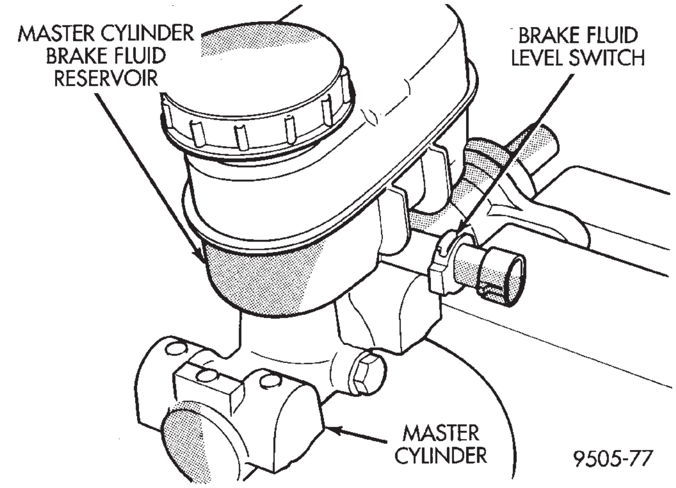


Fig. 52 Removing Fluid Level Switch From Reservoir

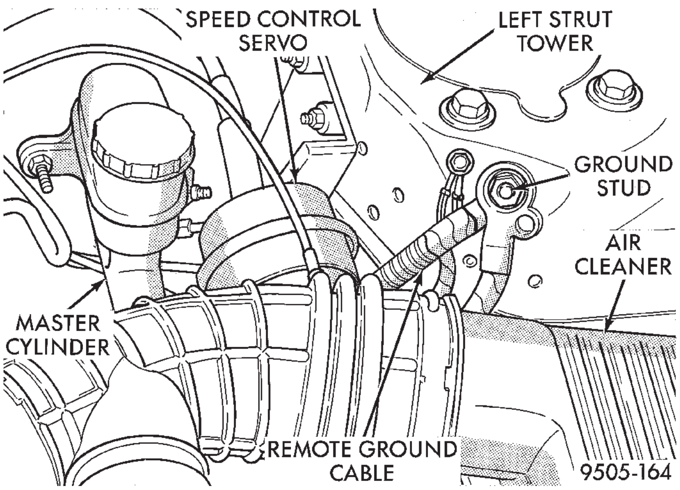


Fig. 53 Ground Cable Attachment At Strut Tower

This will prevent accidental grounding of the remote ground cable.

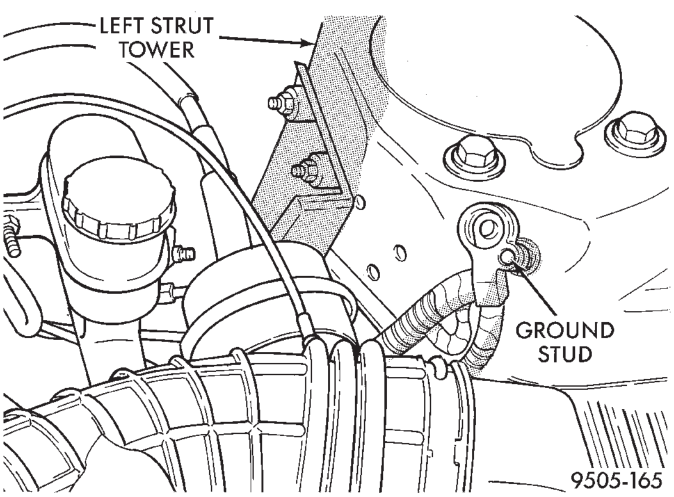


Fig. 54 Correctly Isolated Remote Ground Cable

(3) If equipped, remove the vehicle's wiring harness connector from the speed control servo. Remove the 2 speed control servo mounting bracket to strut tower attaching nuts (Fig. 55). Without removing speed control cable from servo, move speed control servo out of the way.

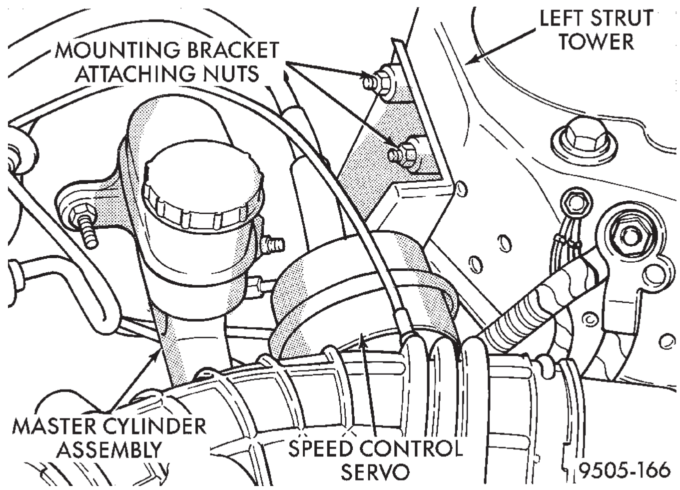


Fig. 55 Speed Control Servo Attachment

(4) Remove the vacuum harness connector and electrical connector from the purge solenoid (Fig. 56). Remove purge solenoid from vehicle.

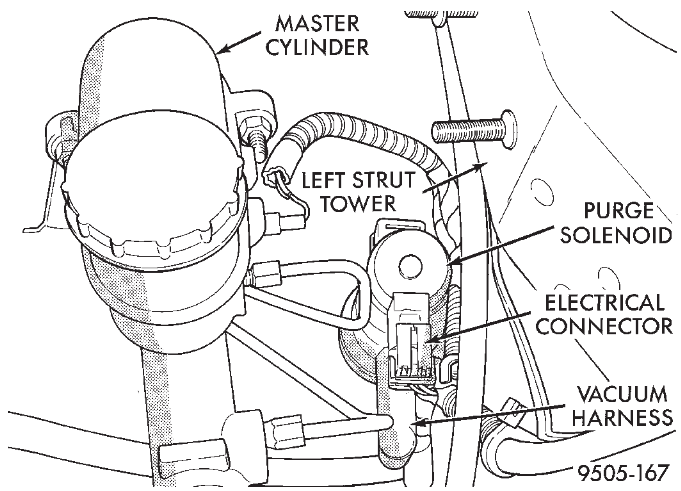


Fig. 56 Purge Control Solenoid

(5) Remove the vacuum hoses (Fig. 57) from the check valve located on the power brake vacuum booster.

(6) Remove EGR valve transducer assembly and vacuum hoses (Fig. 58) from the EGR valve. **Valve removal is necessary for required clearance to remove power brake vacuum booster from vehicle and not damage transducer during removal.**

(7) Remove the vehicle's wiring harness connector from the master cylinder brake fluid level sensor (Fig. 59).

REMOVAL AND INSTALLATION (Continued)

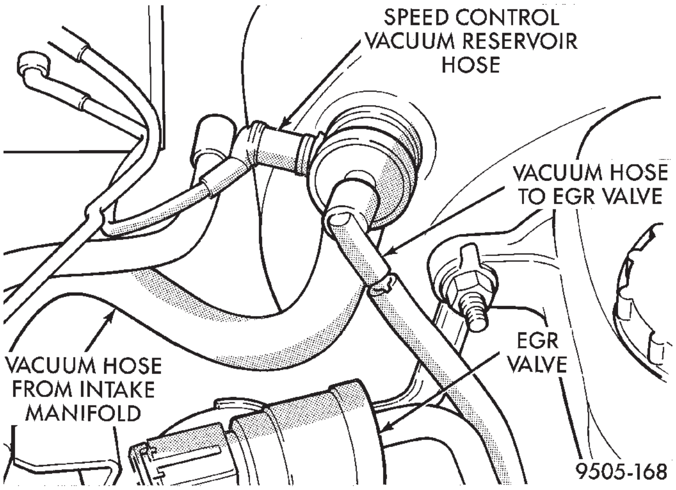


Fig. 57 Vacuum Hose Attachment To Check Valve

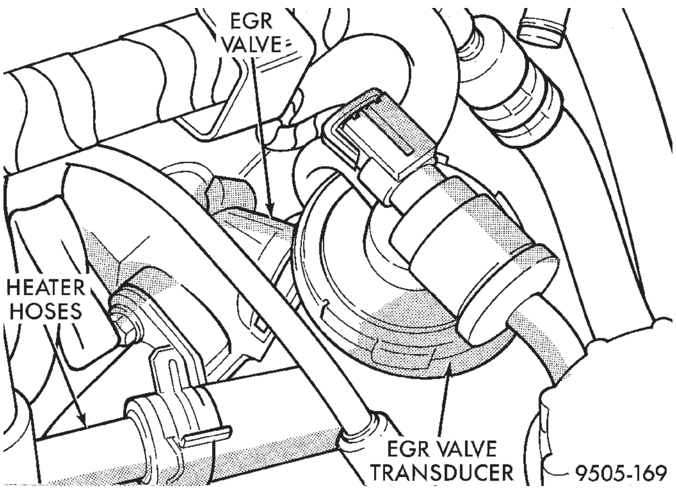


Fig. 58 EGR Valve Transducer Assembly

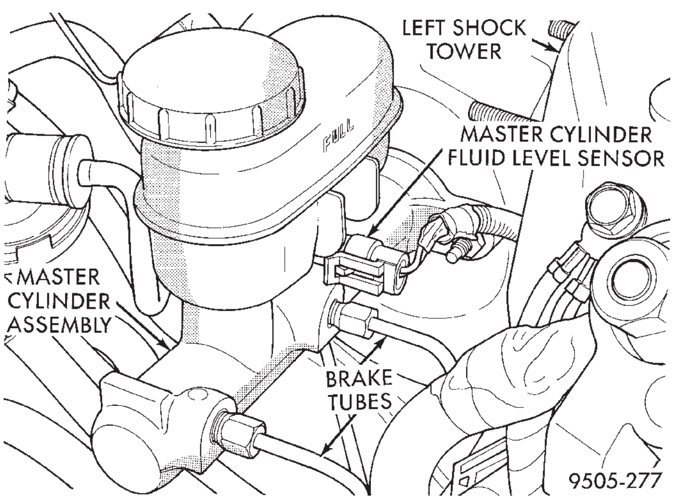


Fig. 59 Master Cylinder Brake Fluid Level Sensor

(8) Remove the 2 nuts (Fig. 60) attaching the master cylinder assembly to the power brake vacuum booster.

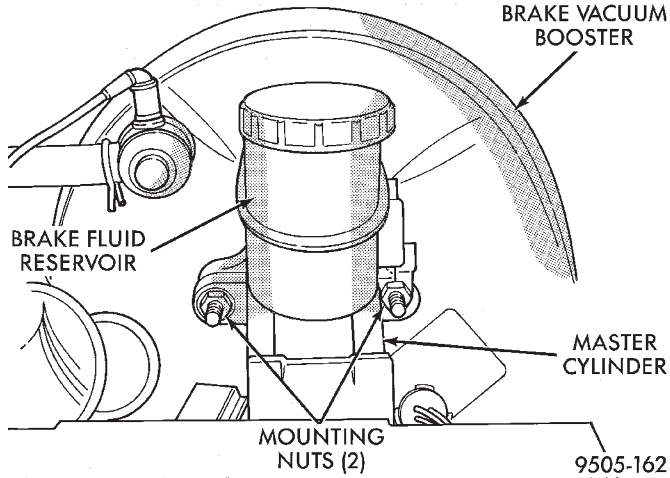


Fig. 60 Master Cylinder Mounting

(9) Without removing the brake tubes from master cylinder, remove it from the power brake vacuum booster. Then carefully lower master cylinder and brake tubes as an assembly until it is positioned on top of the transaxle (Fig. 61).

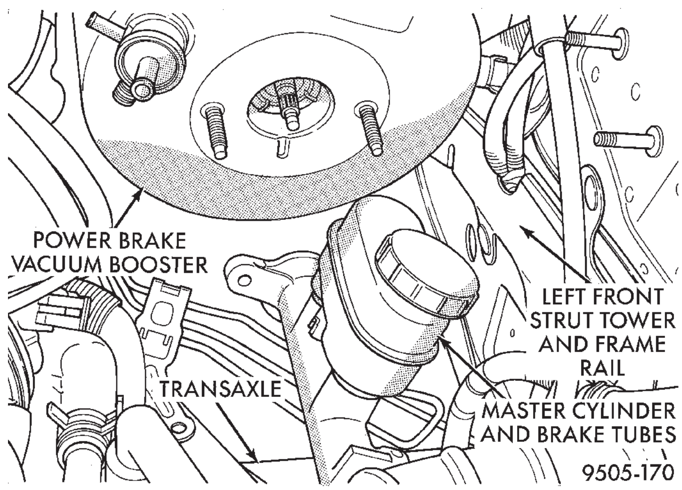


Fig. 61 Master Cylinder Assembly Positioned For Booster Removal

(10) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 62). Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. Replace only with a new retaining clip when assembled.**

(11) Remove the 4 nuts attaching power brake vacuum booster to dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly (Fig. 63).

REMOVAL AND INSTALLATION (Continued)

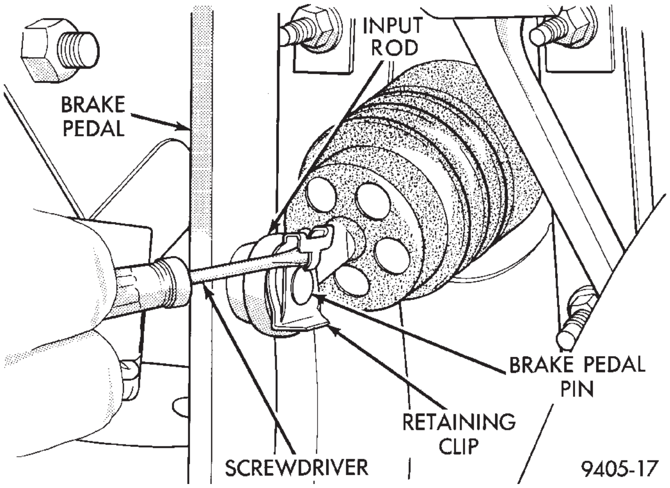


Fig. 62 Input Rod Retaining Pin

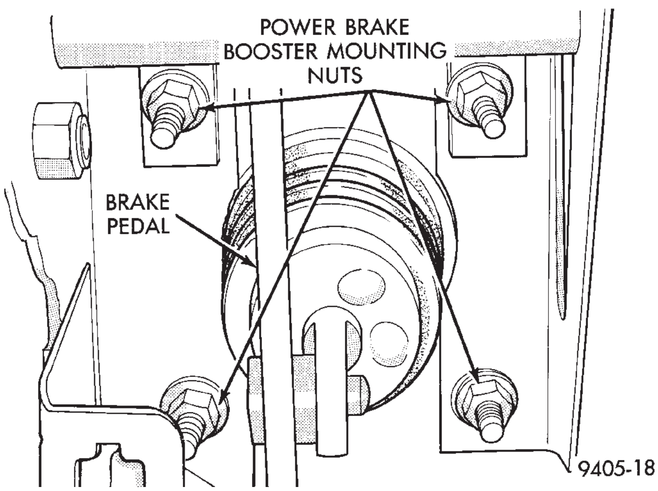


Fig. 63 Power Brake Vacuum Booster Mounting

(12) Slide power brake vacuum booster forward until mounting studs clear dash panel and then tilt up and rotate toward center of vehicle to remove (Fig. 64).

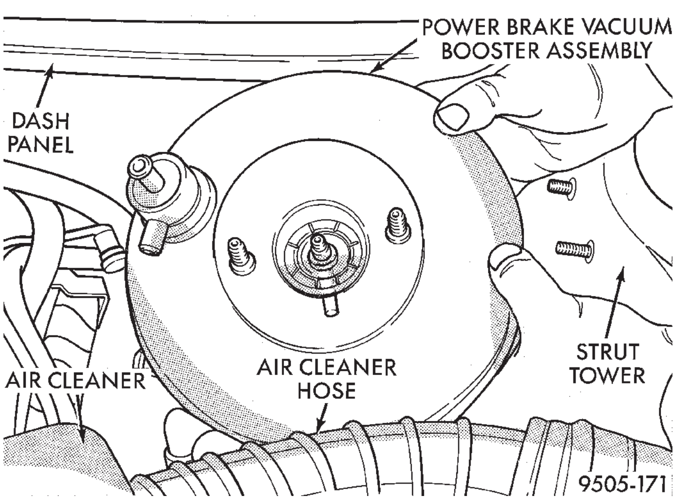


Fig. 64 Power Brake Vacuum Booster

CAUTION: Do not attempt to disassemble the power brake vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALLATION

(1) Position power brake booster onto dash panel.

(2) Install and torque the 4 power brake vacuum booster mounting nuts (Fig. 63) to 29 N·m (250 in. lbs.) torque.

(3) Using lubriplate, or an equivalent, coat the surfaces of the brake pedal pin that contact the power brake vacuum booster input rod.

(4) Connect power brake vacuum booster input rod to brake pedal pin and install a NEW retaining clip. **Use only a new retainer clip DO NOT USE the old clip.**

(5) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

(6) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 60). Tighten the 2 mounting nuts to a torque of 28 N·m (250 in. lbs.).

(7) Install the vehicle's wiring harness connector on the master cylinder brake fluid level sensor (Fig. 59).

(8) Install the purge control solenoid (Fig. 56) on the left front frame rail. Tighten the purge control solenoid mounting bolt.

(9) Install the EGR transducer assembly on the EGR valve (Fig. 58). Install the vehicle wiring harness connector (Fig. 58) on the EGR transducer, ensuring the retaining clip is fully engaged with transducer.

(10) Connect all previously removed vacuum hoses onto the power brake vacuum booster check valve (Fig. 57).

(11) If equipped, install speed control servo on the mounting studs in the left strut tower (Fig. 55). Install the 2 speed control servo bracket mounting nuts (Fig. 55). Tighten the 2 mounting nuts to a torque of 6 N·m (55 in. lbs.).

(12) Check brake light switch for correct adjustment. If required, adjust stop lamp switch as necessary. See required procedure in the Service Adjustments Section in this group of the service manual.

(13) Road test vehicle to ensure proper operation of the vehicles brake system.

POWER BRAKE BOOSTER (2.5L ENGINE)

REMOVAL

(1) Remove the remote ground cable from the ground stud located on the left shock tower (Fig. 65).

REMOVAL AND INSTALLATION (Continued)

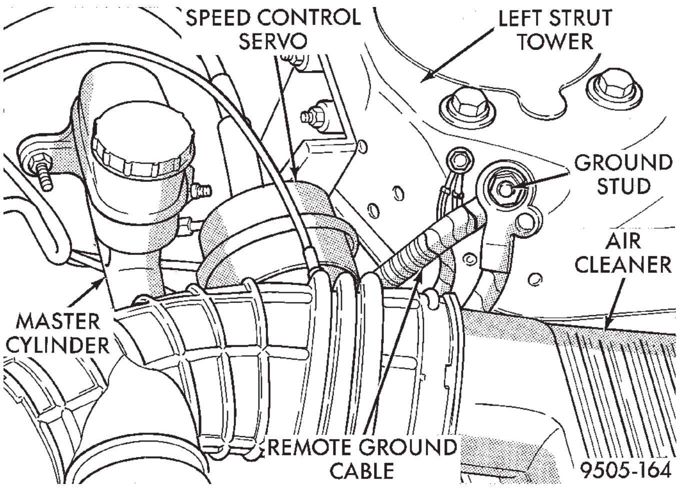


Fig. 65 Ground Cable Attachment To Strut Tower

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 66). **This will prevent accidental grounding of the remote ground cable.**

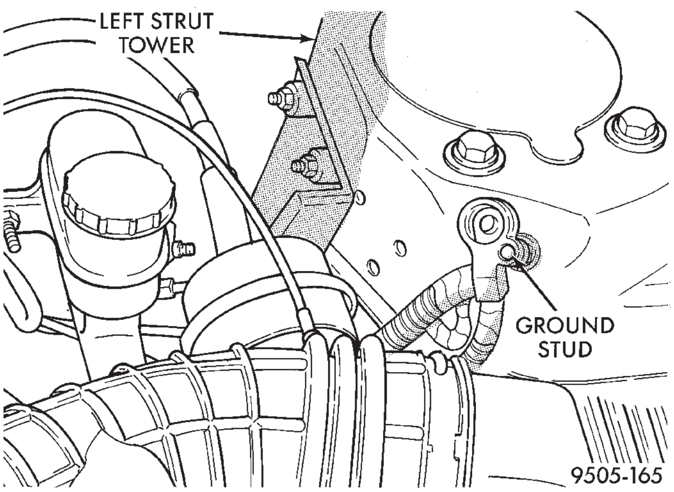


Fig. 66 Correctly Isolated Remote Ground Cable

(3) Remove the PCV hose (Fig. 67) from the air chamber located on the front of the intake manifold. Remove bolt (Fig. 67) attaching the air chamber to the intake manifold. Then unlatch lid of air cleaner from air cleaner housing and loosen clamp attaching air inlet hose to throttle body (Fig. 67). Remove the air cleaner lid, air inlet hose and air chamber (Fig. 67) as an assembly from the engine.

(4) Remove the throttle cable and if equipped the speed control cable from the throttle body (Fig. 68). Remove the vacuum hose (Fig. 68) from the throttle body. Remove the wiring harness connectors from AIS motor and the Throttle Position Sensor (Fig. 68) on the throttle body. Then, remove the 4 bolts (Fig. 68) attaching the throttle body to the intake manifold and remove it from intake manifold.

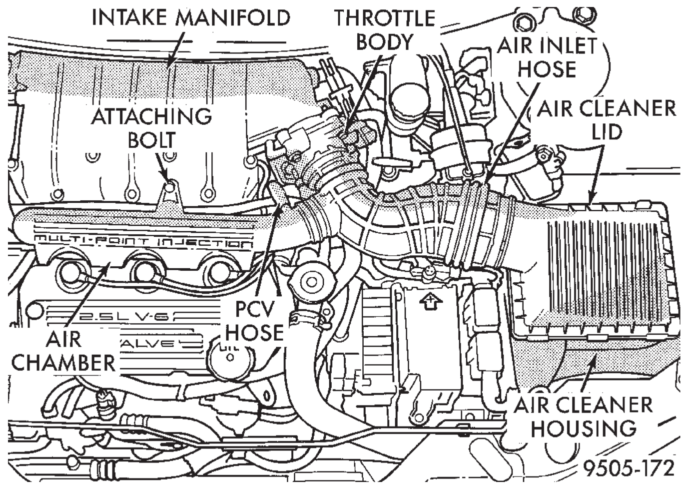


Fig. 67 Engine Air Intake System Components

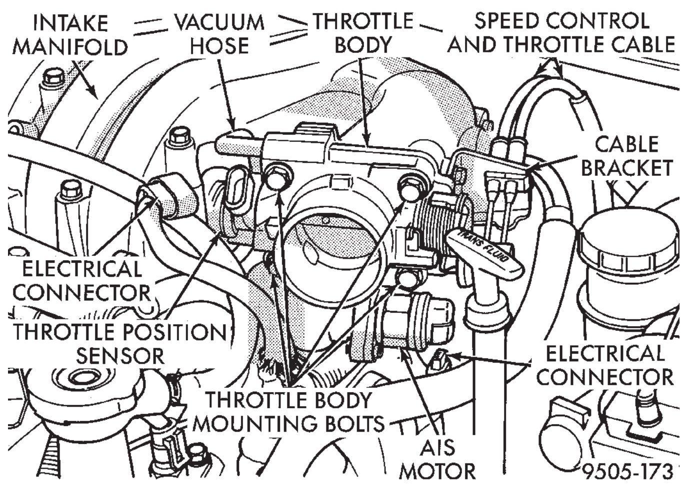


Fig. 68 Throttle Body Attachment To Intake Manifold

(5) Without removing cables from bracket, remove the throttle and speed control cable mounting bracket (Fig. 68) from the intake manifold.

(6) Remove the EGR tube (Fig. 69) from the intake manifold and EGR valve.

(7) If equipped, remove the vehicle's wiring harness connector from the speed control servo. Remove the 2 speed control servo mounting bracket to strut tower attaching nuts (Fig. 70). Without removing speed control cable from servo, move speed control servo out of the way.

(8) Remove the primary and secondary brake tubes (Fig. 71) and (Fig. 72) from the master cylinder assembly.

(9) Remove the vehicle's wiring harness connector from the master cylinder brake fluid level sensor (Fig. 73).

(10) Remove the 2 nuts (Fig. 74) attaching the master cylinder assembly to the power brake vacuum booster. Then remove the master cylinder assembly from the power brake vacuum booster.

REMOVAL AND INSTALLATION (Continued)

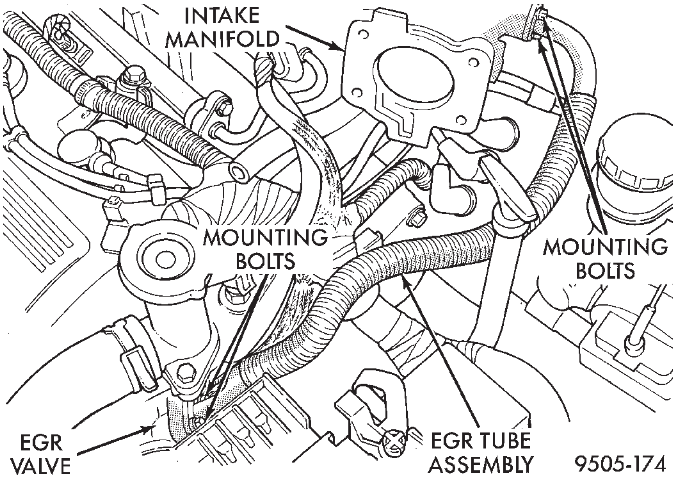


Fig. 69 EGR Tube Attachment To Intake Manifold And EGR Valve

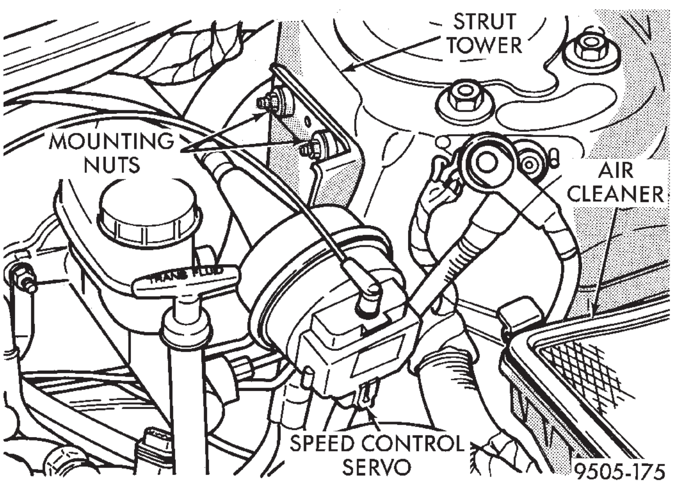


Fig. 70 Speed Control Servo Attachment To Strut Tower

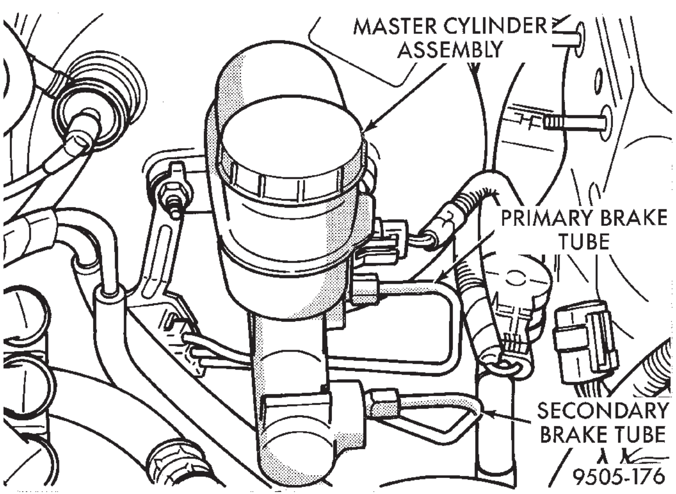


Fig. 71 Primary And Secondary Brake Tubes With Antilock Brakes

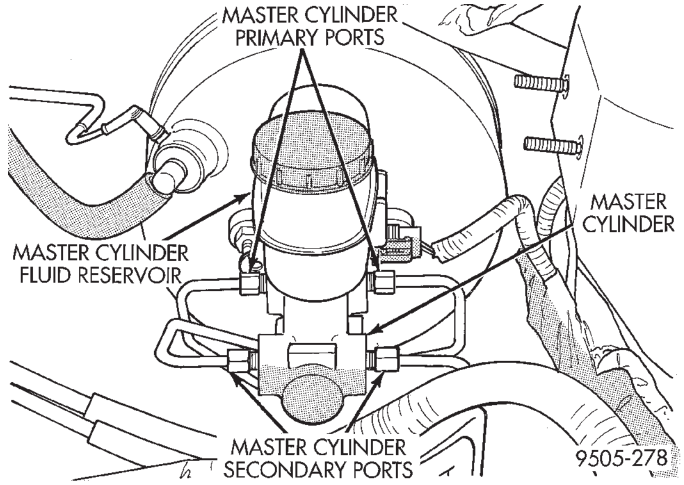


Fig. 72 Primary And Secondary Brake Tubes Without Antilock Brakes

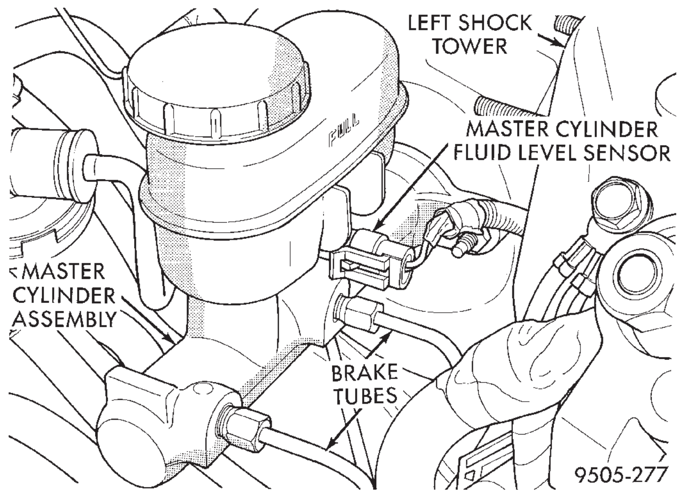


Fig. 73 Master Cylinder Brake Fluid Level Sensor

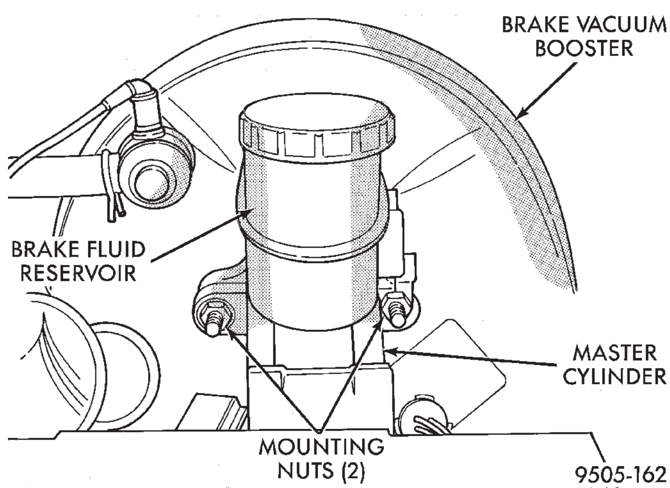


Fig. 74 Master Cylinder Mounting To Vacuum Booster

(11) Remove the vacuum harness connector and electrical connector from the purge solenoid (Fig. 75).

REMOVAL AND INSTALLATION (Continued)

Remove bracket and purge solenoid as an assembly from the vehicle.

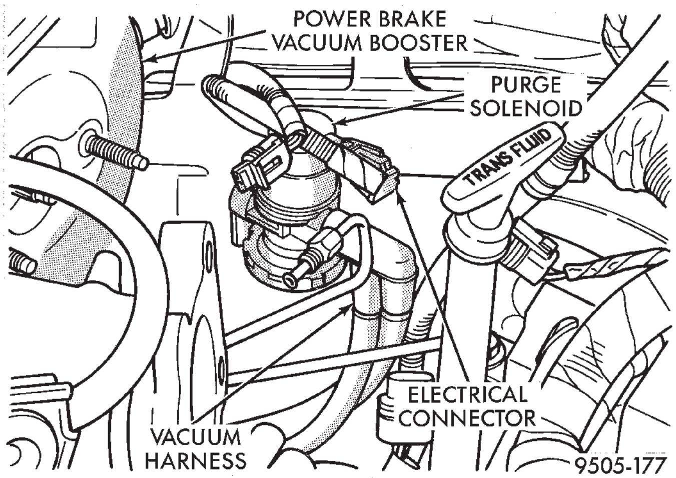


Fig. 75 Purge Control Solenoid

(12) Remove dipstick tube attaching bolt (Fig. 76). Then remove the dipstick tube and dipstick (Fig. 76) as an assembly from the transaxle.

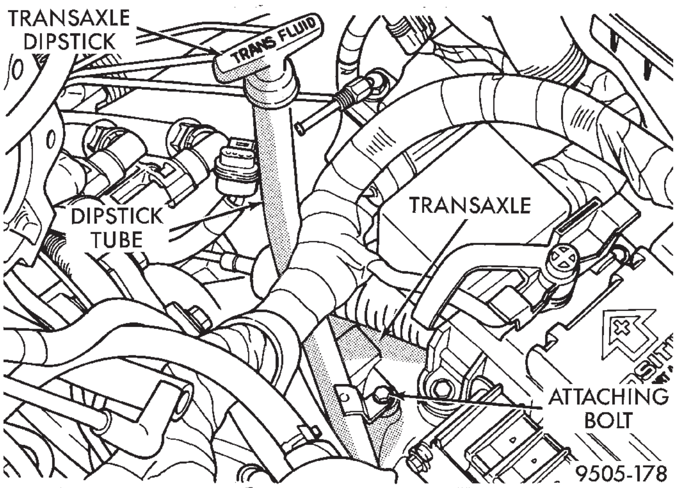


Fig. 76 Transaxle Dipstick Tube

(13) Remove the vacuum hoses from the check valve located on the power brake vacuum booster.

(14) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 77). Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. Replace only with a new retaining clip when assembled.**

(15) Remove the 4 nuts attaching power brake vacuum booster to dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly (Fig. 78).

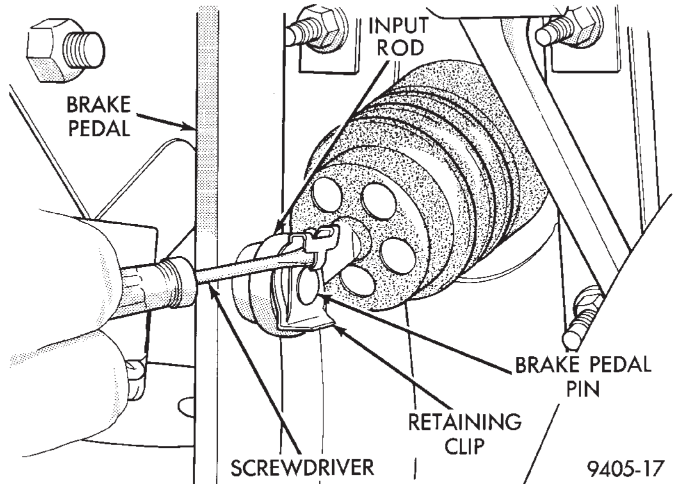


Fig. 77 Input Rod Retaining Pin

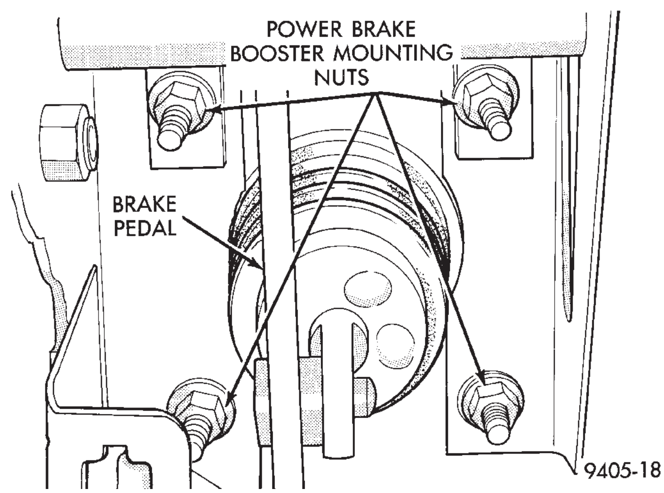


Fig. 78 Power Brake Vacuum Booster Mounting

(16) Slide power brake vacuum booster straight forward until mounting studs clear dash panel. Then lift power brake vacuum booster strait up to remove it from the vehicle (Fig. 79).

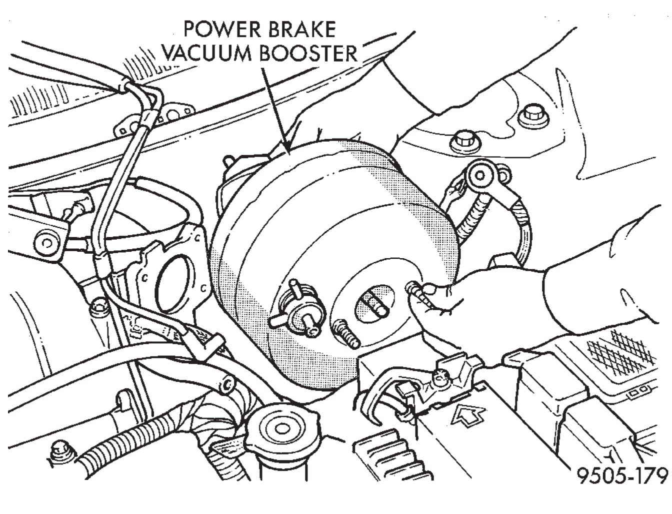


Fig. 79 Power Brake Vacuum Booster Removal

REMOVAL AND INSTALLATION (Continued)

CAUTION: Do not attempt to disassemble the power brake vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALLATION

(1) Position power brake booster onto dash panel.

(2) Install and torque the 4 power brake vacuum booster mounting nuts (Fig. 78) to 29 N·m (250 in. lbs.) torque.

(3) Using lubriplate, or an equivalent, coat the surfaces of the brake pedal pin that contact the power brake vacuum booster input rod.

(4) Connect power brake vacuum booster input rod to brake pedal pin and install a NEW retaining clip. **Use only a new retainer clip DO NOT USE the old clip.**

(5) Install the dipstick tube in transaxle (Fig. 76). Install dipstick tube attaching bolt and securely tighten (Fig. 76).

(6) Install the vacuum hoses on the check valve in the power brake vacuum booster.

(7) Position purge control solenoid (Fig. 75) on left front strut tower and install and securely tighten attaching bolt. Then correctly route and install the vacuum harness connector and electrical connector (Fig. 75) on the purge control solenoid.

(8) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

(9) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 74). Tighten the 2 mounting nuts to a torque of 28 N·m (250 in. lbs.).

(10) Install the primary and secondary brake tubes (Fig. 71) and (Fig. 72) in the master cylinder assembly outlet ports. Tighten all tube nuts to a torque of 17 N·m (145 in. lbs.).

(11) Install the vehicle's wiring harness connector on the master cylinder brake fluid level sensor (Fig. 73).

(12) If equipped, install speed control servo on the mounting studs in the left strut tower (Fig. 70). Install the 2 speed control servo bracket mounting nuts (Fig. 70). Tighten the 2 mounting nuts to a torque of 6 N·m (55 in. lbs.). Install electrical connector on speed control servo.

(13) Install the EGR tube with **NEW** gaskets on the intake manifold and EGR valve (Fig. 69). Install the 4 mounting bolts and tighten to a torque of 11 N·m (95 in. lbs.).

(14) Install the throttle body and a **NEW** gasket on the intake manifold. Install the 4 throttle body attaching bolts (Fig. 68) and tighten to a torque of 22 N·m (200 in. lbs.).

(15) Install the vacuum hose (Fig. 68) on the throttle body. Install the wiring harness connectors on the AIS motor and the Throttle Position Sensor (Fig. 68) located on the throttle body.

(16) Install the mounting bracket for the throttle cable and speed control cable onto the intake manifold and securely tighten the mounting bolts.

(17) Install the throttle cable, and if equipped, the speed control cable on the cam of the throttle body assembly.

(18) Install the air cleaner lid, air inlet hose and air chamber (Fig. 67) as an assembly on the engine. Latch lid of air cleaner to air cleaner housing. Securely tighten the clamp attaching the air inlet hose to the throttle body (Fig. 67). Install and securely tighten the bolt attaching the air chamber to the intake manifold (Fig. 67).

(19) Install the remote ground cable (Fig. 65) on the ground stud located on the left strut tower (Fig. 65). Install and securely tighten the ground cable attaching nut.

(20) Check brake light switch for correct adjustment. If required, adjust stop lamp switch as necessary. See required procedure in the Service Adjustments Section in this group of the service manual.

(21) Road test vehicle to ensure proper operation of the vehicles brake system.

BRAKE TUBES AND HOSES

NOTE: Brake hoses for each brake are unique and are not interchangeable.

Always use Mopar replacement brake hoses to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks and burrs.

Use new copper seal washers on all connections using banjo bolts and tighten all the fittings to their specified torques.

The flexible front hydraulic brake hose should always be installed on the vehicle by first attaching the banjo connector to the caliper assembly. Then bolt the intermediate hose bracket to the strut assembly allowing the bracket to position the hose to prevent twisting. Attach the hose to the brake tubing before attaching it to the front frame rail. Tighten all brake line fittings to the specified torque.

On vehicles equipped with rear drum brakes, install the rear brake hoses first to the wheel cylinders and then attach the hose bracket to the body. On vehicles equipped with rear disc brakes, attach the brake hoses to the caliper first and then attach the brake hose bracket to the body. Following this procedure will reduce the potential for twisting the brake hose during installation.

REMOVAL AND INSTALLATION (Continued)

Only double wall 4.75mm (3/16 in.) steel brake line tubing with Al- Rich/ZN-AL alloy coating should be used for replacement. Care must be taken when replacing brake tubing; to be sure, use the proper bending and flaring tools, and procedures to avoid kinking. Do not route the tubes against sharp edges, moving components, or into hot areas. All tubes should be properly attached with the recommended retaining clips.

PROPORTIONING VALVE

NOTE: The following procedure is for removal and installation of the proportioning valve(s) on vehicles without antilock brakes. For the procedure to remove and install the proportioning valve(s) on vehicles with antilock brakes refer to ANTILOCK BRAKE SYSTEM in this group.

REMOVAL

(1) Remove hydraulic brake line (Fig. 80) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(2) Then remove the proportioning valve from the rear brake line.

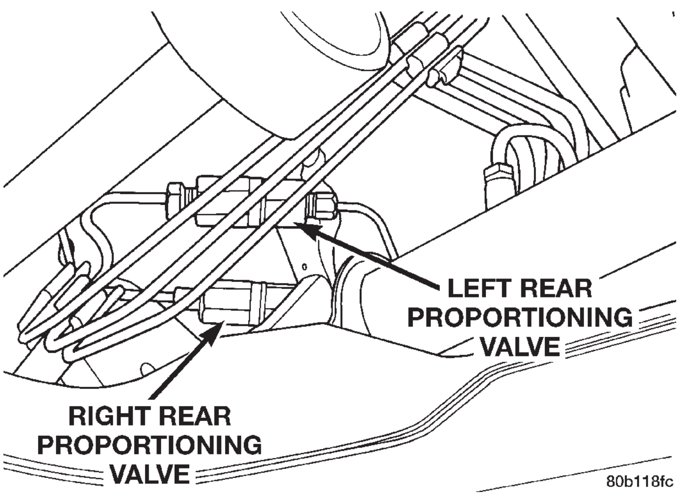


Fig. 80 Non-ABS Brake Proportioning Valve Location

INSTALLATION

(1) Install proportioning valve in rear brake line and hand tighten both tube nuts until they are fully seated in proportioning valve (Fig. 80).

(2) Tighten both brake line tube nuts at the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(3) Bleed the affected brake line. Refer to BASE BRAKE BLEEDING in SERVICE PROCEDURES in this section.

DISC BRAKE CALIPER (FRONT)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove front wheel and tire assemblies from vehicle.

(3) Remove the 2 caliper to steering knuckle guide pin bolts (Fig. 81).

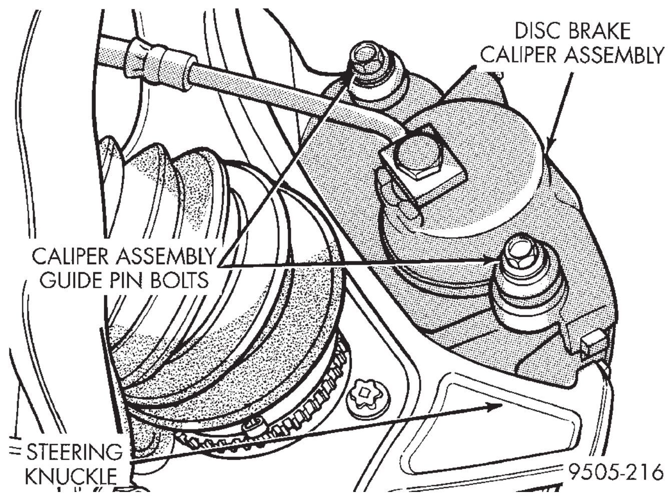


Fig. 81 Removing Caliper Guide Pin Bolts

(4) Remove brake caliper from steering knuckle, by first rotating bottom end of caliper away from steering knuckle. Then slide top of caliper down from the machined abutment on steering knuckle (Fig. 82).

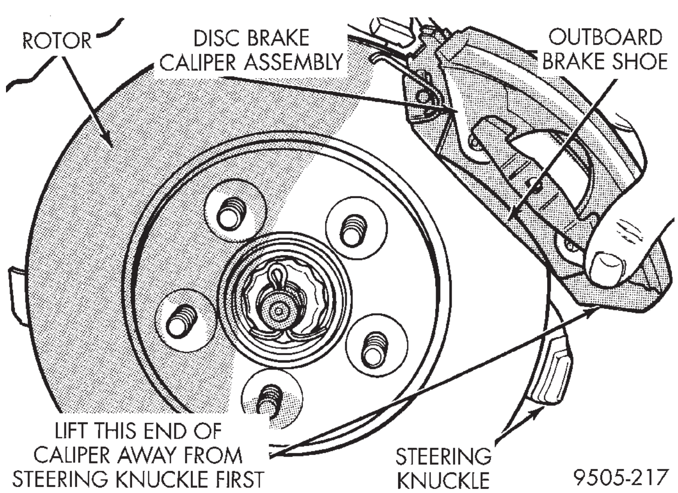


Fig. 82 Removing / Installing Brake Caliper

(5) **Support caliper from upper control arm to prevent weight of caliper from being supported**

REMOVAL AND INSTALLATION (Continued)

by brake flex hose. Supporting disc brake caliper from flex hose can damage the hose (Fig. 83).

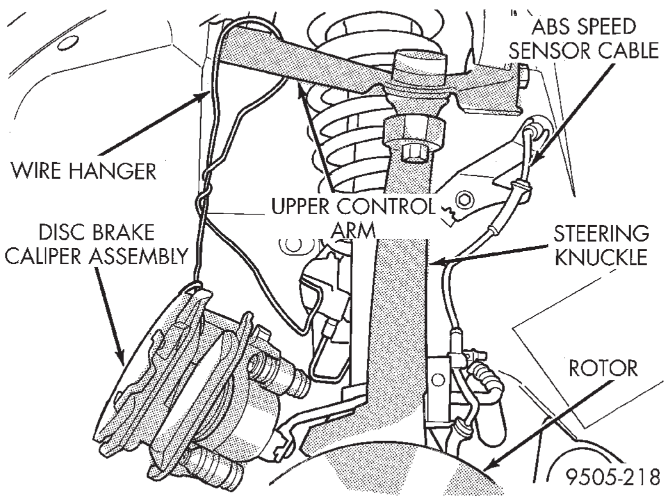


Fig. 83 Storing Caliper

INSTALLATION

(1) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(2) If removed, install the front rotor on the hub, making sure it is squarely seated on face of hub.

CAUTION: Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(3) Carefully position caliper and brake shoe assemblies over brake rotor by first hooking top of brake shoes on the machined abutment on upper steering knuckle (Fig. 82). Then rotate the bottom of the brake caliper into position on the steering knuckle. **Make sure that caliper guide pin bolts, bushings and sleeves are clear of the steering knuckle bosses.**

NOTE: When being installed, extreme caution must be taken not to cross thread the caliper guide pin bolts.

(4) Install the brake caliper guide pin bolts (Fig. 81). Then tighten the guide pin bolts to a torque of 22 N·m (16 ft. lbs.).

(5) Install the wheel and tire assembly.

(6) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(7) Remove jackstands or lower hoist.

(8) Check and adjust brake fluid level as necessary.

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoes.

DISC BRAKE SHOES (FRONT)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove front wheel and tire assemblies from vehicle.

CAUTION: When prying the piston back into the bore of the caliper do not use a hard pry bar. The use of a hard pry bar will damage the braking surface of the rotor.

(3) Slightly pry the piston back into the bore of the disc brake caliper. The piston is to be pryed back by inserting a soft tool (such as a trim stick) between the inboard brake shoe and the rotor and prying against the inboard brake shoe. This will force the piston back into the caliper.

(4) Remove the 2 brake caliper to steering knuckle guide pin bolts (Fig. 84).

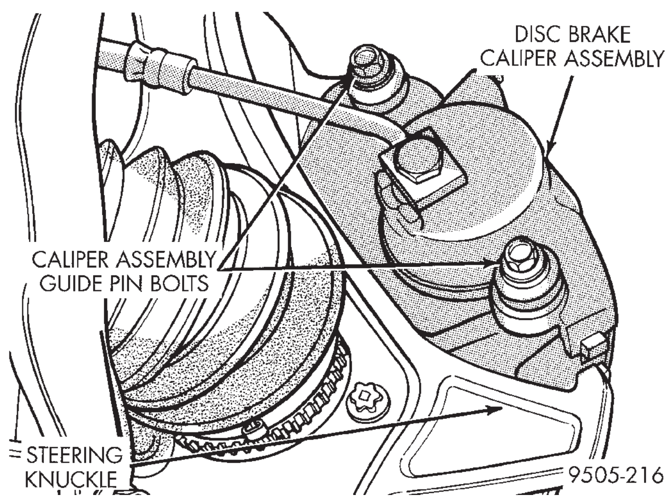


Fig. 84 Removing Caliper Guide Pin Bolts

(5) Remove brake caliper from steering knuckle, by first rotating bottom of brake caliper away from the steering knuckle. Then slide top of brake shoes down

REMOVAL AND INSTALLATION (Continued)

and out from the top machined abutment on steering knuckle (Fig. 85).

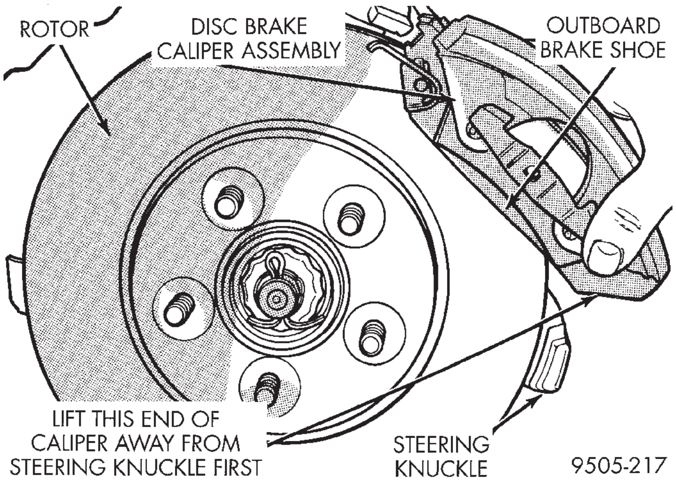


Fig. 85 Removing Brake Caliper

(6) **Support brake caliper from upper control arm to prevent weight of caliper from being supported by brake flex hose. Supporting disc brake caliper from flex hose can damage the hose (Fig. 86).**

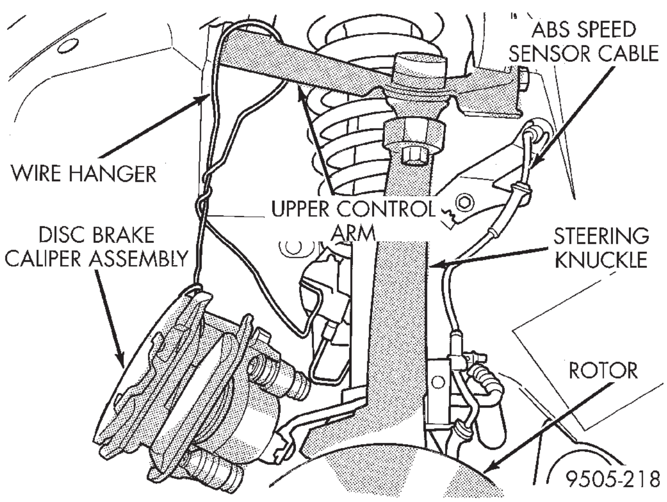


Fig. 86 Storing Caliper

(7) Remove the brake rotor from the front hub (Fig. 87).

(8) Remove outboard brake shoe by pushing the brake shoe inward until retaining pins on brake shoe can be removed from holes in caliper (Fig. 88). Then slide the brake shoe off the caliper.

(9) Pull inboard brake shoe away from piston until retaining clip is free from cavity in piston (Fig. 89).

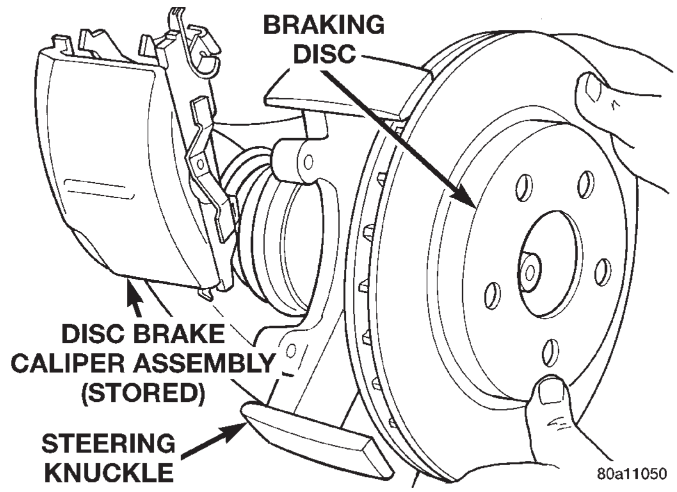


Fig. 87 Removing / Installing Brake Rotor

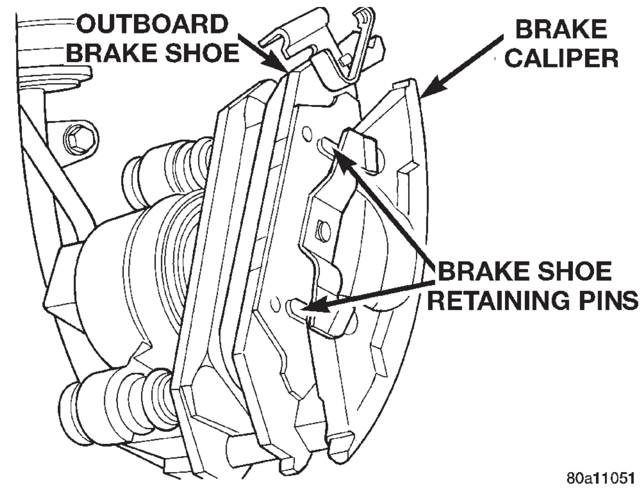


Fig. 88 Removing / Installing Outboard Brake Shoe

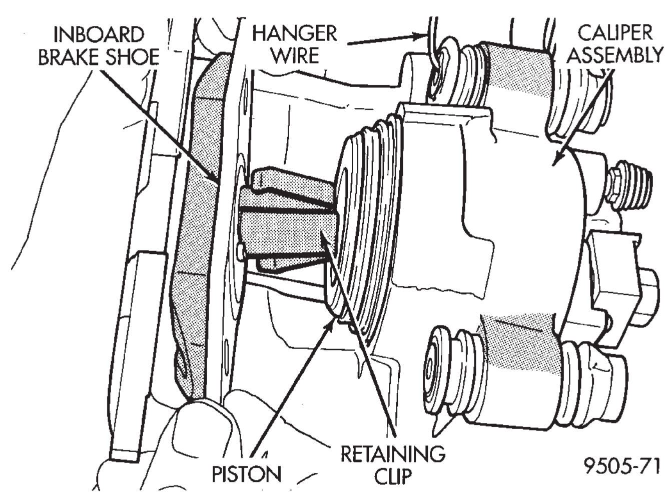


Fig. 89 Removing Inboard Brake Shoe

CALIPER INSPECTION

Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

REMOVAL AND INSTALLATION (Continued)

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

INSTALLATION

(1) Completely retract caliper piston back into piston bore of caliper assembly. This is required for caliper installation with new brake shoe assemblies.

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install the front rotor on the hub, making sure it is squarely seated on face of hub (Fig. 87).

(4) Remove the protective paper from the noise suppression gasket on both the inner and outer brake shoe assemblies (if equipped).

NOTE: Note: The inboard and outboard brake shoes are not common (Fig. 90). Be sure the correct outer brake shoe is installed in the correct caliper. The left and right outer brake shoes are different and must be installed correctly. The wear sensor (Fig. 90) and the hold down clip must be on the upper end of the caliper when the caliper and brake shoes are installed on the steering knuckle.

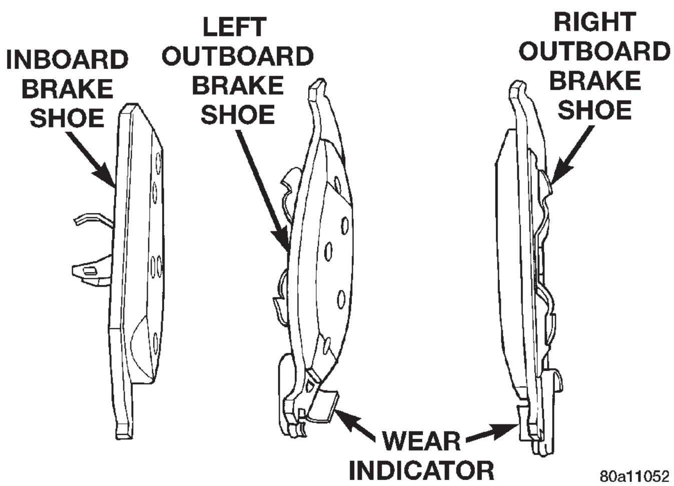


Fig. 90 Front Brake Shoe Assembly Identification

(5) Install the new inboard brake shoe assembly into the caliper piston by firmly pressing into piston bore (Fig. 91). Be sure inboard brake shoe assembly is positioned squarely against face of caliper piston.

(6) Slide the new outboard brake shoe assembly onto the caliper assembly (Fig. 88).

CAUTION: Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses. Also, make sure that caliper guide pin bushings and sleeves are clear of the steering knuckle bosses

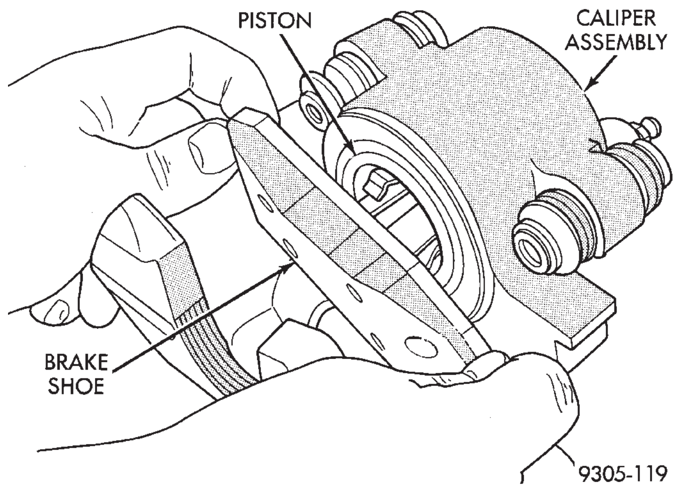


Fig. 91 Installing Inboard Brake Shoe Assembly

(7) Carefully position brake caliper and brake shoes over brake rotor by first hooking top of brake shoes onto upper abutment on steering knuckle (Fig. 92). Then rotate caliper into position at bottom of steering knuckle.

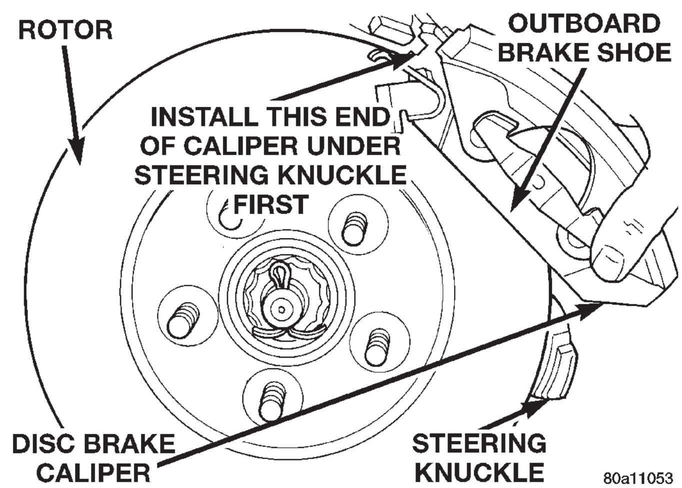


Fig. 92 Installing Brake Caliper

NOTE: When installing guide pin bolts, extreme caution should be taken not to cross thread the caliper guide pin bolts.

(8) Install the caliper guide pin bolts (Fig. 84) and tighten to a torque of 22 N·m (16 ft. lbs.).

(9) Install the wheel and tire assembly.

(10) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jackstands or lower hoist.

(12) Check brake fluid level.

REMOVAL AND INSTALLATION (Continued)

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(13) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoes.

DISC BRAKE CALIPER (REAR)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheels and tires from vehicle.

(3) Remove the 2 guide pin bolts mounting the caliper to the adapter (Fig. 93).

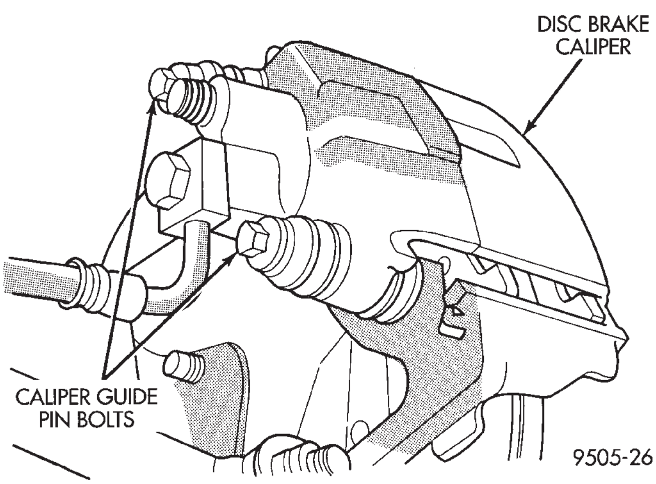


Fig. 93 Caliper Guide Pin Bolts

(4) Remove caliper from adapter and rotor by first rotating top of caliper away from the adapter, and then lifting the caliper off lower machined abutment on adapter (Fig. 94).

(5) Support the caliper from the rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 95).

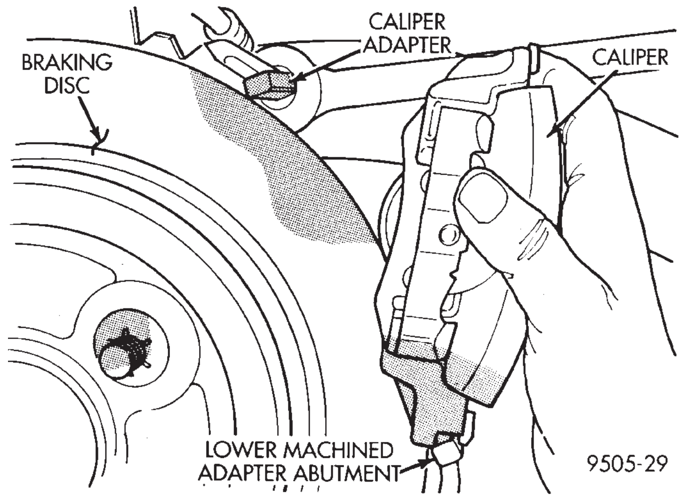


Fig. 94 Removing Caliper From Adapter

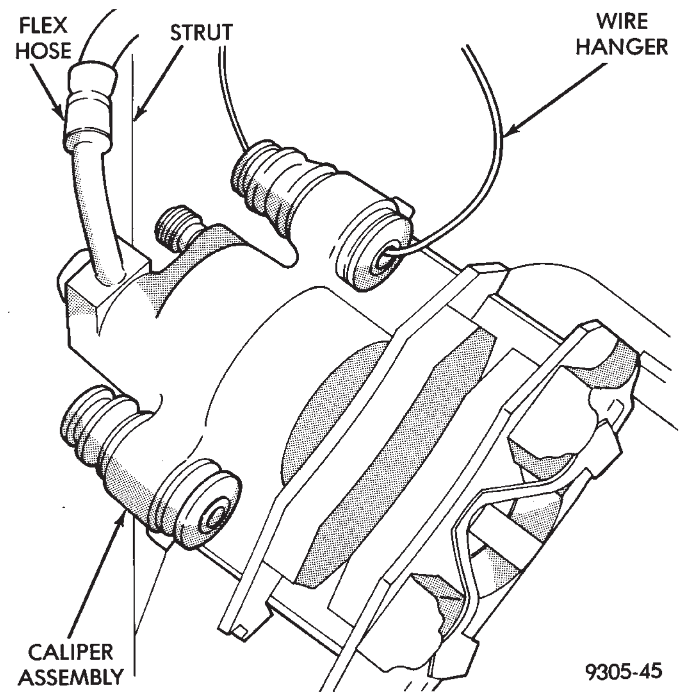


Fig. 95 Storing Caliper

INSTALLATION

NOTE: Step 1 below is only required when installing the disc brake caliper, after new brake shoes have been installed.

(1) Completely retract caliper piston back into piston bore of caliper assembly.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the rotor on the hub making sure it is squarely seated on the face of the hub (Fig. 96).

CAUTION: Use care when installing caliper assembly onto adapter so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(4) Carefully lower caliper and brake shoes over rotor reversing the removal procedure (Fig. 94).

REMOVAL AND INSTALLATION (Continued)

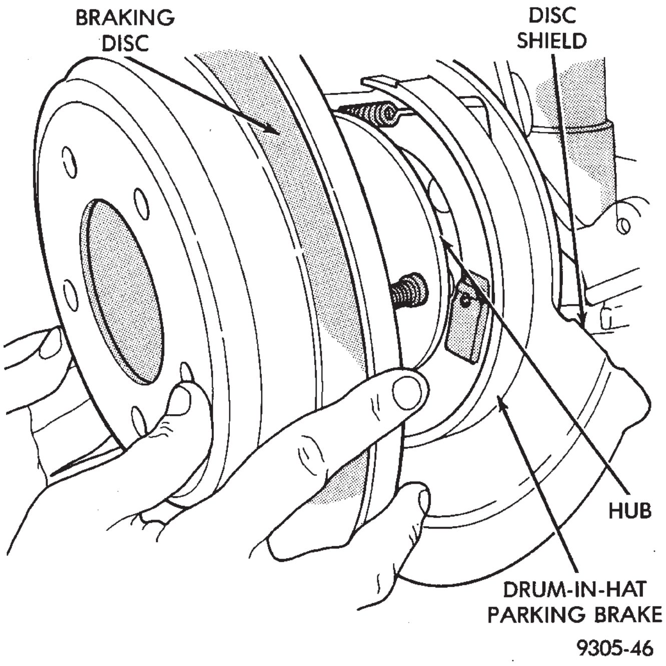


Fig. 96 Installing Rear Rotor

Make sure that the caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(5) Install the caliper guide pin bolts (Fig. 93). Tighten the caliper guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(6) Install wheels and tires.

(7) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(8) Remove jackstands or lower hoist.

(9) Check brake fluid level.

NOTE: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(10) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

DISC BRAKE SHOES (REAR)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheels and tires from vehicle.

(3) Remove the 2 guide pin bolts mounting the caliper to the adapter (Fig. 97).

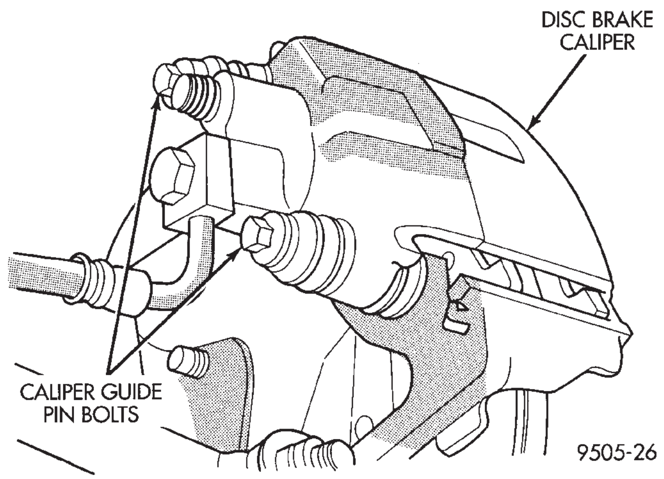


Fig. 97 Caliper Guide Pin Bolts

(4) Remove caliper from adapter and rotor by first rotating the top of the caliper away from adapter, and then lifting the caliper off the lower machined abutment on adapter (Fig. 98).

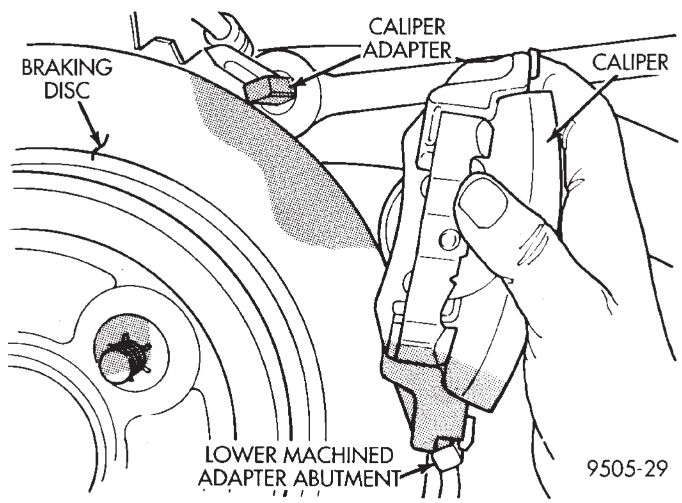


Fig. 98 Caliper Removal/Installation

(5) Support caliper from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 99).

(6) Remove rear rotor from hub/bearing (Fig. 100). Then inspect drum-in-hat parking brake shoes and parking brake braking surface on rotor for any signs of excessive wear or damage. Replace parking brake shoes if required.

REMOVAL AND INSTALLATION (Continued)

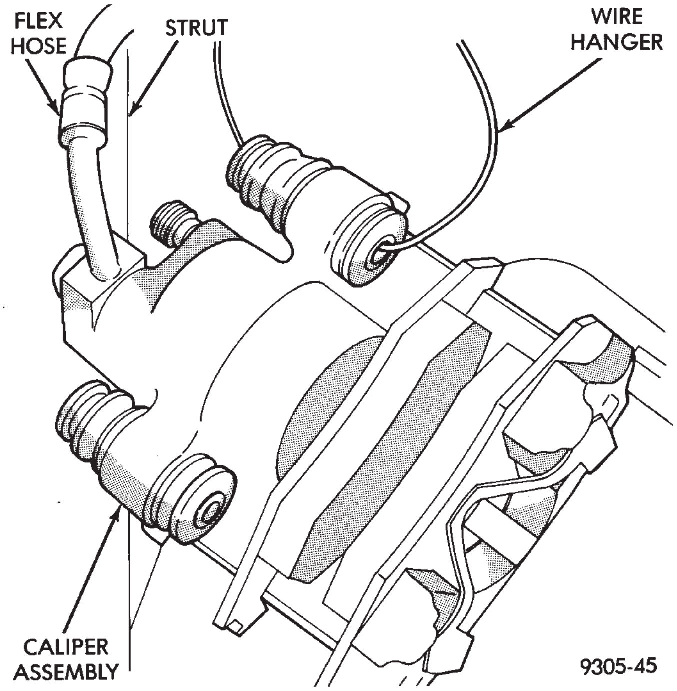


Fig. 99 Storing Caliper

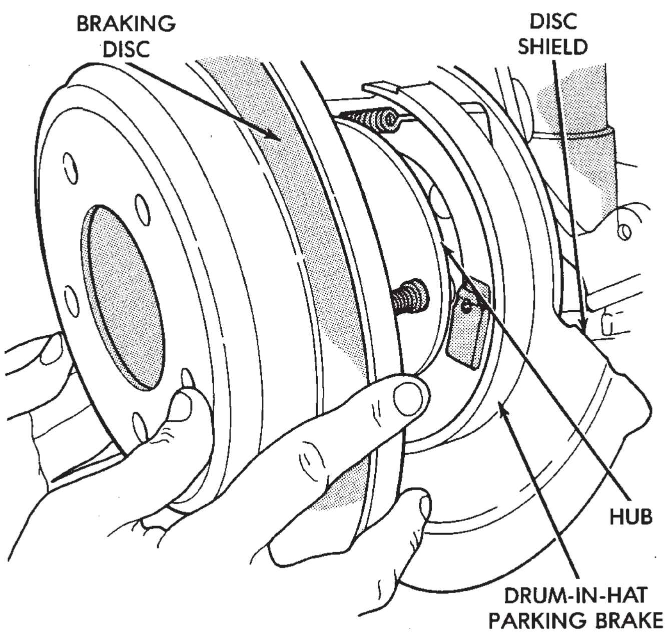


Fig. 100 Rear Brake Rotor

(7) Remove outboard brake pad from caliper by prying brake pad retaining clip over raised area on caliper. Then slide brake pad down and off the caliper (Fig. 101).

(8) Pull inboard brake pad away from caliper piston, until retaining clip is free from cavity in piston. (Fig. 102).

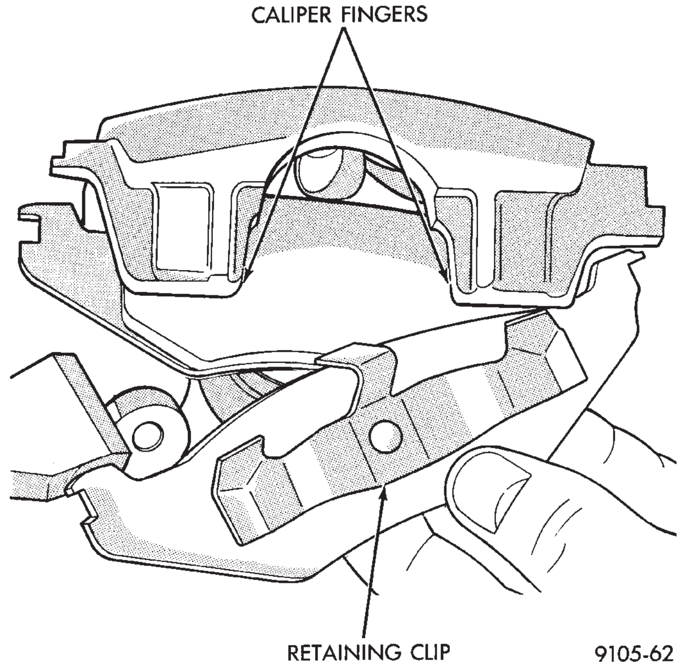


Fig. 101 Removing Outboard Brake Pad

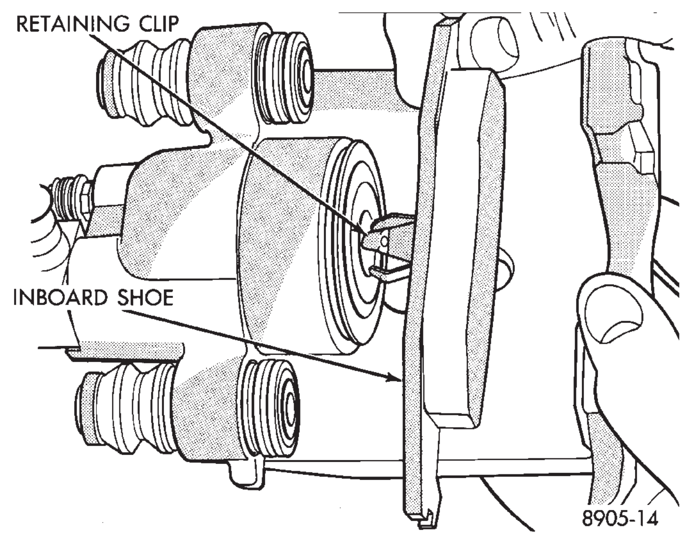


Fig. 102 Removing Inboard Brake Pad

CALIPER INSPECTION

Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Completely retract the caliper piston back into the piston bore of the caliper. This is required for caliper installation when new brake pad assemblies are installed on caliper.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install rear rotor on hub making sure it is squarely seated on face of hub (Fig. 100).

(4) Remove protective paper from noise suppression gasket on both inner and outer brake pad assemblies (if equipped).

(5) Install new inboard brake pad into caliper piston by firmly pressing it into bore of piston using thumbs (Fig. 101). **Be sure inboard brake shoe is positioned squarely against face of piston.**

(6) Slide new outboard brake pad onto the caliper (Fig. 101). Be sure retaining clip is squarely seated in the depressed areas on the caliper.

CAUTION: Use care when installing caliper assembly onto adapter, so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(7) Carefully lower caliper and brake shoes over rotor reversing the required removal procedure (Fig. 98). Make sure that caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(8) Install caliper guide pin bolts into adapter. (Fig. 97). Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(9) Install the wheels and tires.

(10) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jackstands or lower hoist.

(12) Check brake fluid level.

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(13) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

DRUM BRAKE WHEEL CYLINDER (REAR)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

(1) In case of a leak, remove brake shoes (replace if soaked with grease or brake fluid.)

(2) Disconnect rear brake flex hose tube from wheel cylinder and remove the flex hose routing bracket from the brake support plate (Fig. 103).

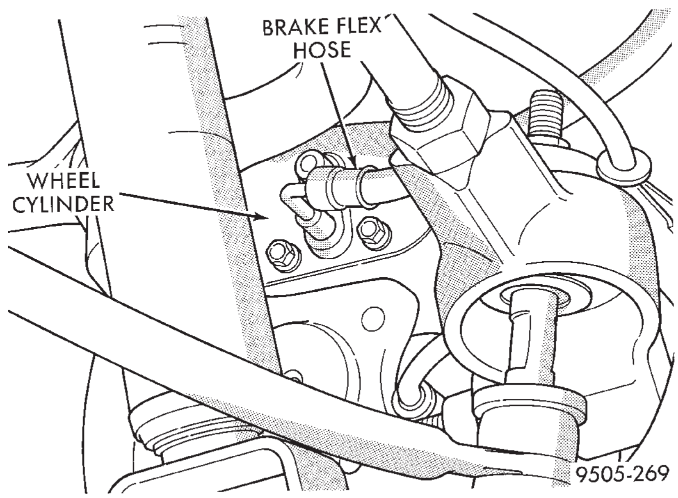


Fig. 103 Brake Flex Hose At Wheel Cylinder

(3) Remove rear wheel cylinder attaching bolts (Fig. 104). Then pull wheel cylinder assembly off brake support plate.

INSTALLATION

(1) Apply a small bead of silicone sealer around the mating surface of the wheel cylinder to brake support plate.

(2) Install wheel cylinder onto brake support plate. Tighten the attaching bolts (Fig. 104) to a torque of 11 N·m (97 in. lbs.).

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder (Fig. 103). Tighten the tube nut to a torque of 17 N·m (145 in. lbs.).

(4) Install brake shoes on support plate. Follow procedure for Installing Brake Shoe Assemblies in this section of the service manual.

(5) Install rear brake drum onto rear hub.

(6) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence

REMOVAL AND INSTALLATION (Continued)

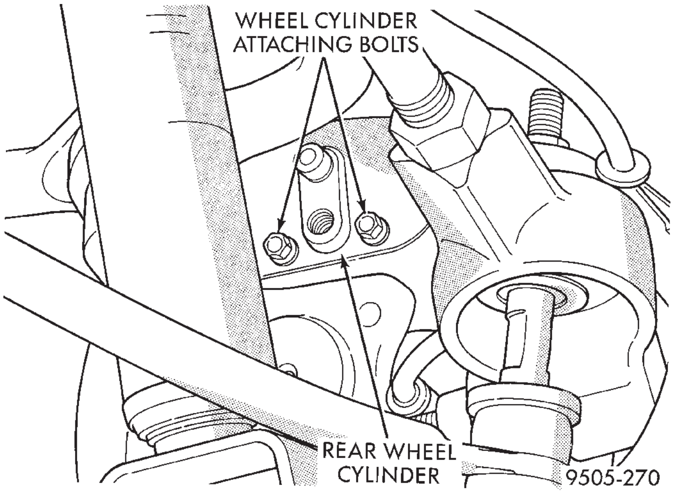


Fig. 104 Wheel Cylinder Attaching Bolts

until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(7) Bleed the entire brake system. See Bleeding Brake System in Service Adjustments section in this group of the service manual.

(8) Adjust the rear brakes. See Adjusting Service Brakes in Service Adjustments section in this group of the service manual.

DRUM BRAKE SHOES (REAR)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

NOTE: If the vehicle has high mileage, the brake drums may have a ridge worn in them by the brake shoes. This ridge causes the brake drum to interfere with the brake shoes, not allowing the brake drum to be removed. Further clearance can be obtained by fully backing off the brakes automatic self adjuster mechanism, using the following procedure.

(3) Remove the rubber plug (Fig. 105) from the top of brake support plate.

(4) Insert a screwdriver, through the automatic adjuster access hole, in the rear brake support plate (Fig. 106). Engage screwdriver with the teeth on the adjuster mechanism quadrant. Then rotate quadrant

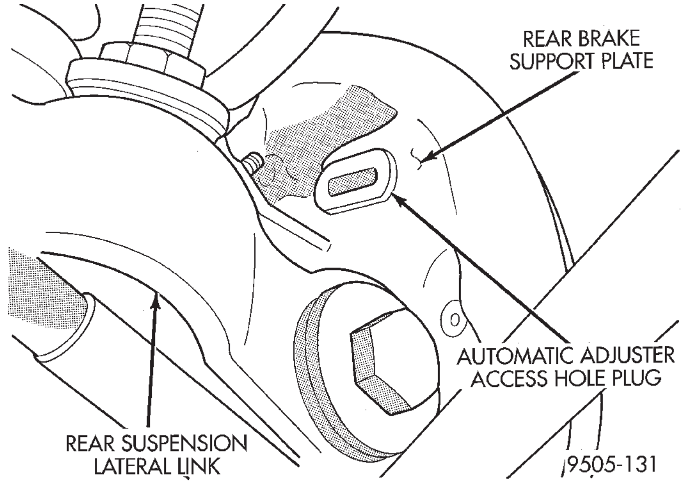


Fig. 105 Adjuster Access Hole Plug

so that teeth on quadrant, are moved toward the front of the vehicle. Continue moving quadrant toward front of vehicle until it stops moving. This will fully back off the adjustment of the rear brake shoes allowing brake drum to be removed.

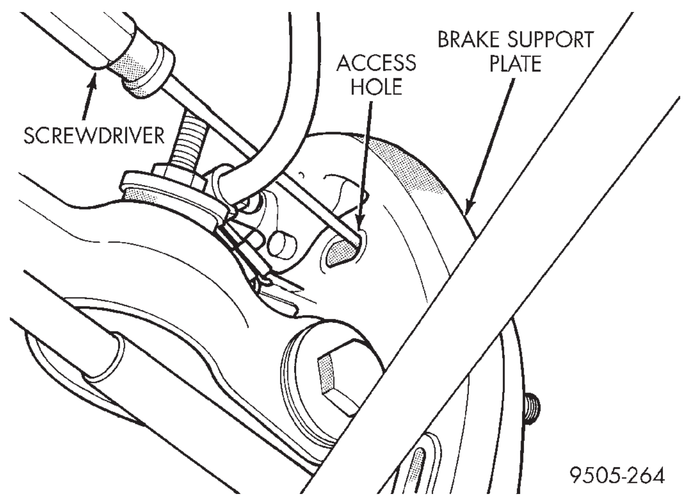


Fig. 106 Backing Off Rear Brake Shoe Adjustment

(5) Remove rear brake drum to hub/bearing retaining nuts (if equipped). Then remove rear brake drum from hub and bearing assembly (Fig. 107).

(6) Remove the actuating spring (Fig. 108) from the automatic adjuster mechanism and the trailing brake shoe.

(7) Remove the upper return spring from the leading and trailing brake shoe assembly (Fig. 109).

(8) Remove the lower return spring from the leading and trailing brake shoe assembly (Fig. 110).

(9) Remove the brake shoe retainer and pin (Fig. 111) from the leading brake shoe assembly.

(10) Remove the leading brake shoe and the adjuster mechanism as an assembly, (Fig. 112) from the rear brake support plate. **The adjuster mechanism can not be separated from the leading**

REMOVAL AND INSTALLATION (Continued)

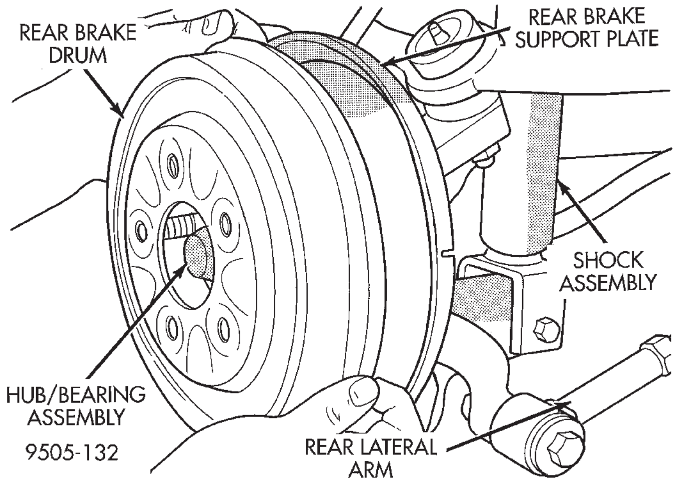


Fig. 107 Rear Brake Drum Assembly

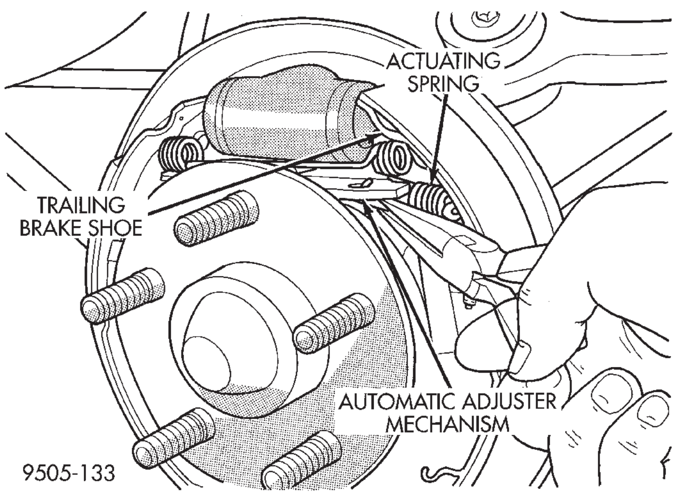


Fig. 108 Adjuster Mechanism Actuating Spring

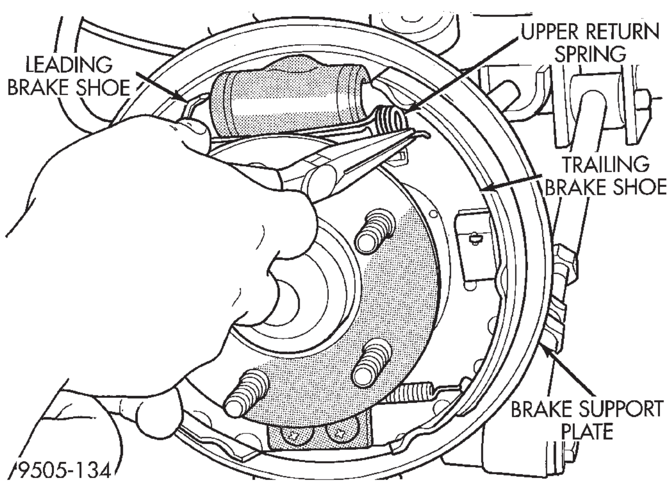


Fig. 109 Upper Brake Shoe Return Spring

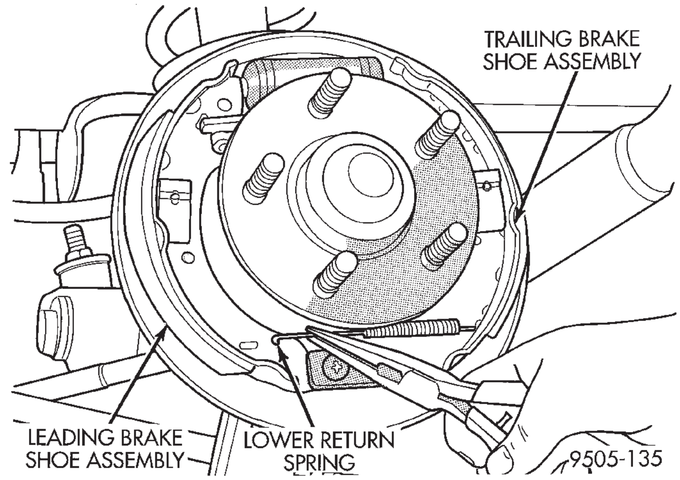


Fig. 110 Lower Brake Shoe Return Spring

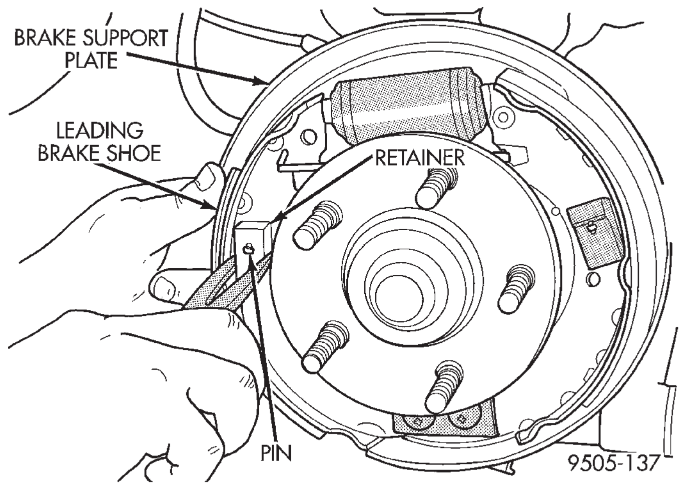


Fig. 111 Leading Brake Shoe Retainer

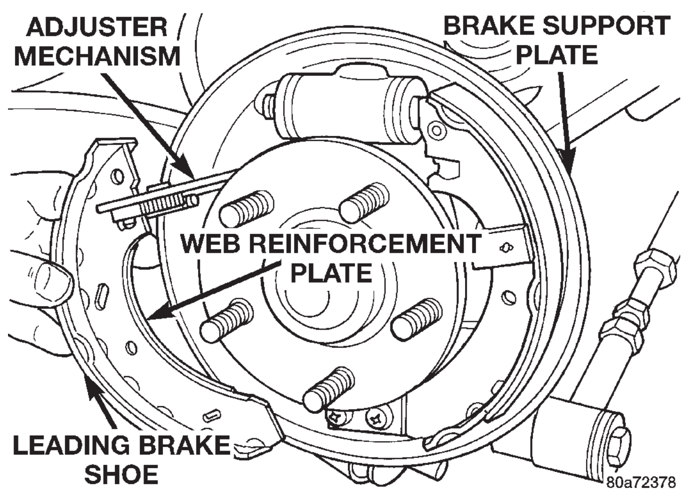


Fig. 112 Leading Brake Shoe And Adjuster Mechanism

brake shoe until the brake shoe and adjuster mechanism is removed from the support plate.

(11) Remove the brake shoe retainer and pin, (Fig. 113) from the trailing brake shoe.

(12) Remove the trailing brake shoe assembly from the brake support plate.

REMOVAL AND INSTALLATION (Continued)

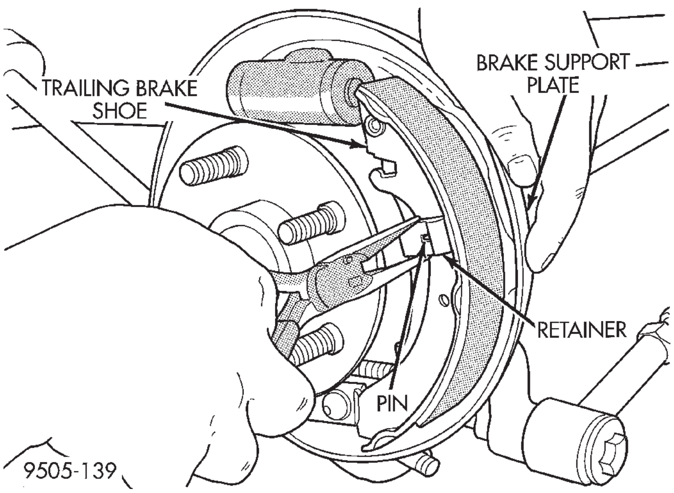


Fig. 113 Trailing Brake Shoe To Support Plate Retainer

CAUTION: On this vehicle, the park brake actuating lever is permanently attached to the trailing brake shoe assembly. Do not attempt to remove it from the original brake shoe assembly or reuse the original actuating lever on a replacement brake shoe assembly. All replacement brake shoe assemblies for this vehicle must have the actuating lever as part of the trailing brake shoe assembly.

(13) Remove the park brake cable from the park brake actuating lever, (Fig. 114) attached to the trailing brake shoe assembly. Do not attempt to remove actuating lever from brake shoe assembly.

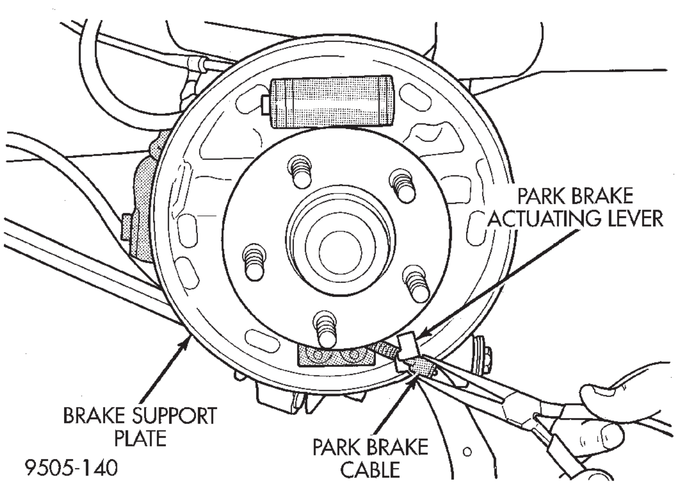


Fig. 114 Park Brake Cable To Actuator Lever Attachment

(14) Remove the automatic adjuster mechanism from the original leading brake shoe assembly for installation on the replacement brake shoe, using the following procedure. Fully extend the adjuster mechanism in the direction shown in (Fig. 115). Then, with adjuster mechanism fully extended, rotate the adjuster mechanism in the direction shown in (Fig. 115) to separate adjuster mechanism from leading brake shoe.

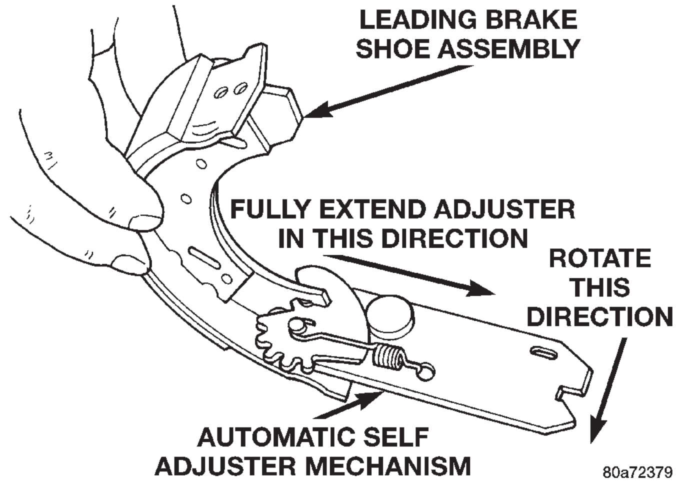


Fig. 115 Removing Adjuster Mechanism From Leading Brake Shoe

CLEANING AND INSPECTION

Clean metal portion of brake shoes. Check to see if shoes are bent.

Lining should show contact across entire width and from heel to toe, otherwise replace.

Shoes with lack of contact at toe or heel may be improperly ground.

Clean and inspect the brake support plate and the automatic self adjusting mechanism.

Visually examine the adjuster assembly to ensure it is functioning correctly by checking for the following operation.

- Be sure the quadrant (Fig. 116) is free to rotate throughout its entire tooth contact range.
- Ensure that the quadrant is free to slide the full length of its mounting slot in the adjuster mechanism.
- Inspect the quadrant spring (Fig. 116) for any signs of excessive wear or damage.
- Ensure that the knurled pin (Fig. 116) is securely attached to the adjuster mechanism and that its teeth are not damaged.
- Overall, examine the adjuster mechanism for excessive wear or damage and replace if necessary.

If the adjuster mechanism is re-useable, apply a light coat of Mopar Multi-Purpose Lubricant or equivalent, between the quadrant and the strut of the adjuster mechanism (Fig. 116).

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

REMOVAL AND INSTALLATION (Continued)

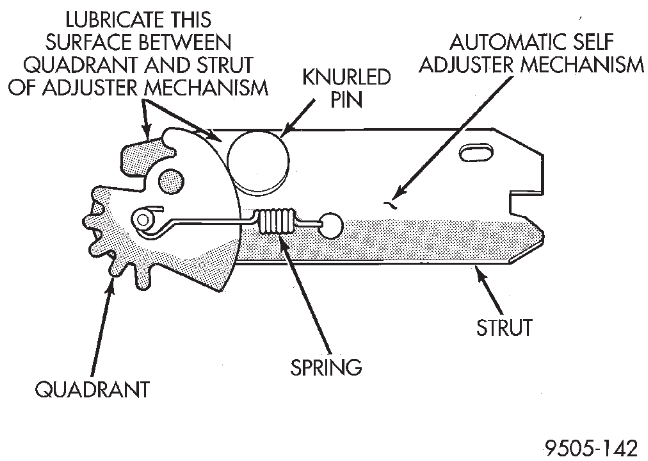


Fig. 116 Automatic Self Adjuster Mechanism

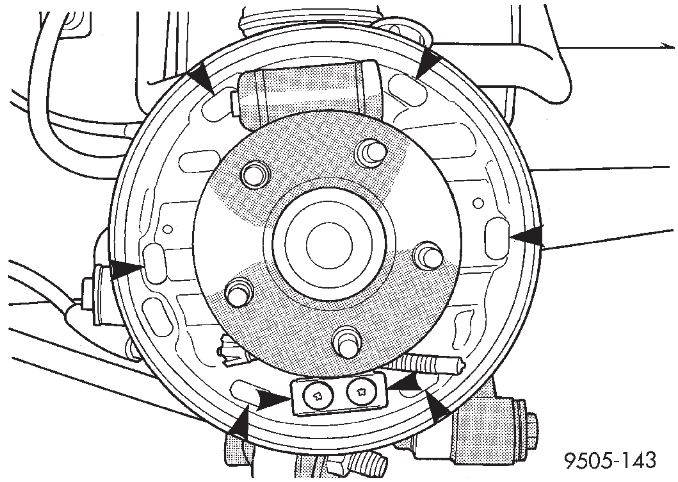


Fig. 118 Shoe Contact Areas on Support Plate

INSTALLATION

NOTE: The leading rear brake shoes on this vehicle are designated for which side of the vehicle they are to be installed on. When correctly installed, the web reinforcement plate on the brake shoes (Fig. 117) will be facing toward the brake support plate (Fig. 112).

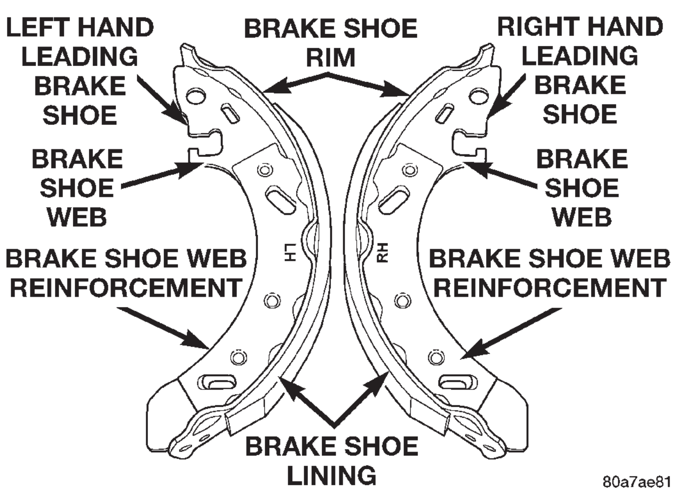


Fig. 117 Leading Brake Shoes

(1) Lubricate the eight brake shoe contact areas (indicated by arrows) on the support plate and anchor using Mopar Multi-Purpose Lubricant or equivalent (Fig. 118).

(2) Install the park brake cable on the park brake actuating lever of the trailing brake shoe (Fig. 114).

CAUTION: The leading and trailing brake shoes used on the rear brakes of this vehicle are unique (handed) for the left and right side of the vehicle. Care must be taken to ensure the brake shoes are properly installed on the vehicle. When the trailing brake shoes are properly installed on the correct side of the vehicle, the park brake actuating lever will be positioned behind the brake shoe web (Fig. 113).

(3) Install the correctly handed trailing brake shoe on the support plate so it is squarely seated on the shoe contact areas. Then install the brake retainer on the retainer pin (Fig. 113).

(4) Install the automatic self adjuster mechanism on the correct leading brake shoe assembly using the reverse procedure as indicated in step Step 14 of the brake shoe removal procedure. Refer to (Fig. 119) for the correct installation of the adjuster mechanism on the leading brake shoe.

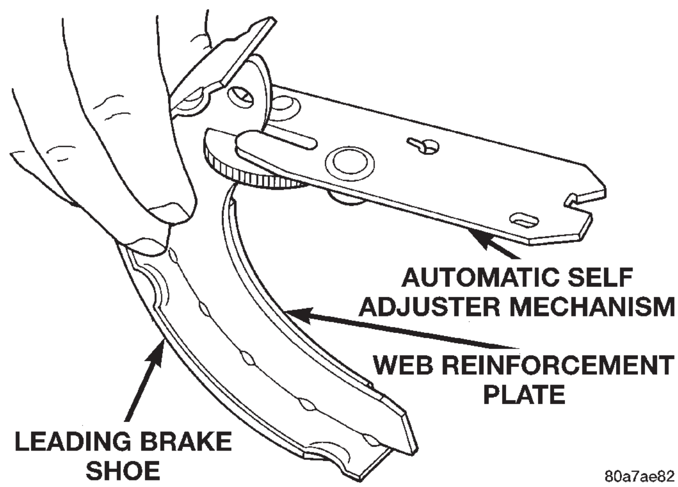


Fig. 119 Adjuster Mechanism Correctly Installed On Correct Leading Brake Shoe

NOTE: When installing the leading brake shoe, the web support plate (Fig. 112) must be facing the brake support plate.

(5) Install the leading brake shoe and the adjuster mechanism as an assembly (Fig. 112) on the brake support plate.

REMOVAL AND INSTALLATION (Continued)

(6) Be sure leading brake shoe assembly is squarely seated on the brake support plate shoe contact areas. Then install the brake retainer on the retainer pin (Fig. 111).

(7) Install the lower return spring onto the leading and trailing brake shoe assembly (Fig. 110).

CAUTION: The upper brake shoe return spring and adjuster mechanism actuating spring are unique for the side of the vehicle they are used on. The springs are colored for identification of which side of the vehicle they are to be used on. The left side springs are colored green and the right side springs are blue.

(8) Install the upper return spring (blue right side, green left side) on the leading brake shoe first, then on the trailing brake shoe (Fig. 109).

(9) Install the automatic adjuster actuation spring first on the trailing brake shoe and then hook it onto the adjuster mechanism (Fig. 108).

(10) Install the rear brake drums on the hubs.

(11) Install the wheel and tire assemblies.

(12) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(13) Lower vehicle

(14) Adjust rear brake shoes. **Brake shoes will adjust by fully depressing the brake pedal 2 to 3 times. Brake shoes should now be correctly adjusted and will not require any type of manual adjustment.**

(15) Road test vehicle.

BRAKE DRUM

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

If the vehicle has high mileage, the brake drums may have a ridge worn in them by the brake shoes. This ridge causes the brake drum to interfere with the brake shoes thus, not allowing the brake drum to be removed. Further clearance can be obtained by backing off the brakes automatic self adjuster mechanism, using the following procedure.

(1) Remove the rubber plug (Fig. 120) from the brake support plate.

(2) Insert a screwdriver, through the automatic adjuster access hole, in the rear brake support plate (Fig. 121). Engage screwdriver with the teeth on the adjuster mechanism quadrant. Then rotate quadrant so that the teeth on the quadrant are moved toward

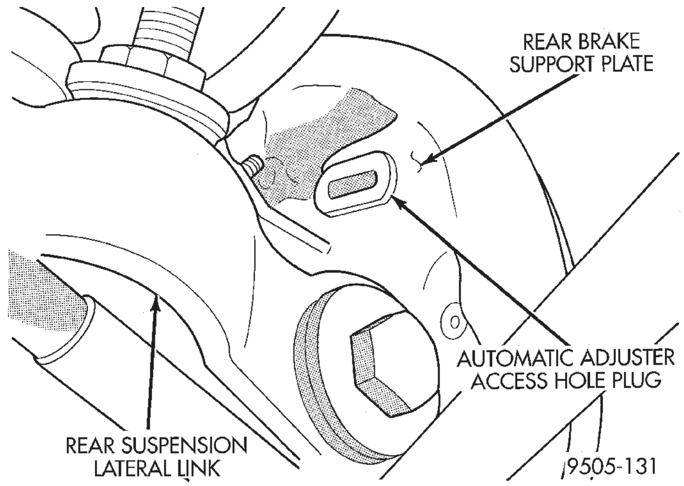


Fig. 120 Automatic Adjuster Access Hole Plug

the front of the vehicle (Fig. 121). This will back off the adjustment of the rear brake shoes.

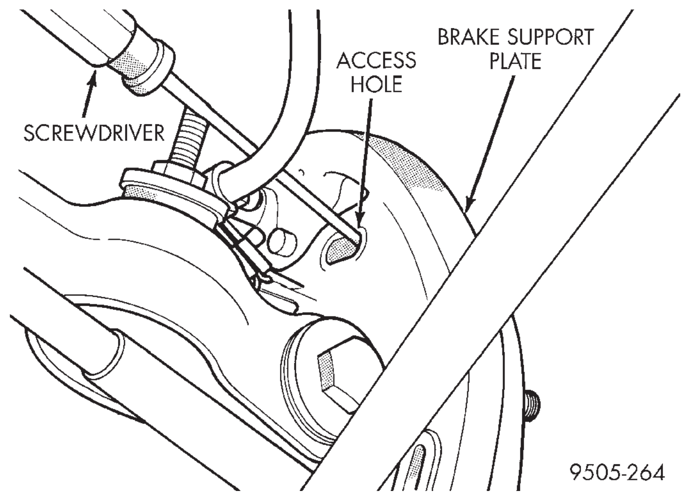


Fig. 121 Backing Off Rear Brake Shoe Adjustment

(3) Remove rear brake drum from the rear hub and bearing assembly (Fig. 122).

INSTALLATION

(1) Install rear brake drum on rear hub and bearing assembly.

(2) Install the wheel and tire assembly.

(3) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(4) Adjust rear brakes. The rear brakes on this vehicle are adjusted by depressing the brake pedal as far as possible 2 or 3 times.

REMOVAL AND INSTALLATION (Continued)

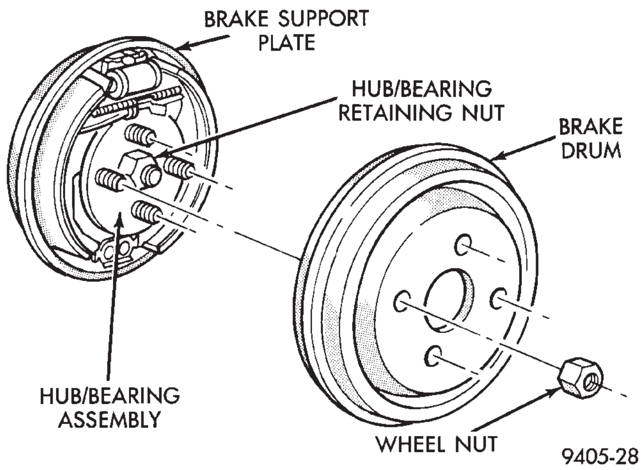


Fig. 122 Brake Drum And Hub And Bearing Assembly

DRUM BRAKE SUPPORT PLATE (REAR)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear tire and wheel assembly from vehicle.

(3) Remove the dust cap from the rear hub and bearing assembly (Fig. 123).

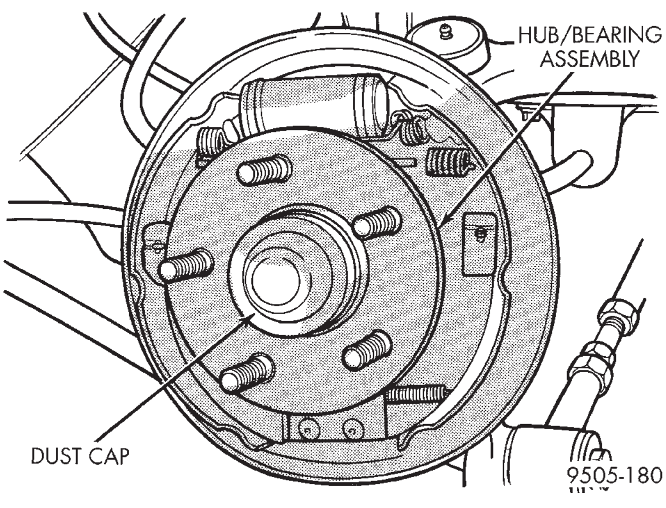


Fig. 123 Hub And Bearing Dust Cap

(4) Remove the rear hub and bearing assembly retaining nut (Fig. 124). Then remove the hub and bearing assembly from the rear spindle.

(5) Remove rear brake shoe assemblies from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly removal procedure.

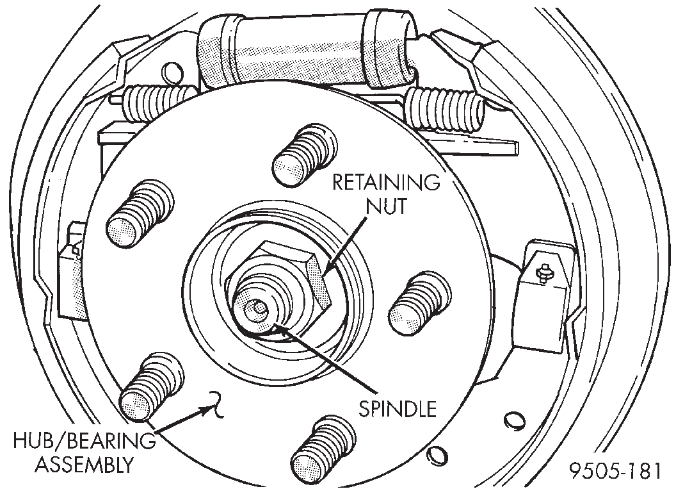


Fig. 124 Hub And Bearing Retaining Nut

(6) Disconnect rear brake flex hose tube from wheel cylinder and remove the brake flex hose bracket from the brake support plate (Fig. 125).

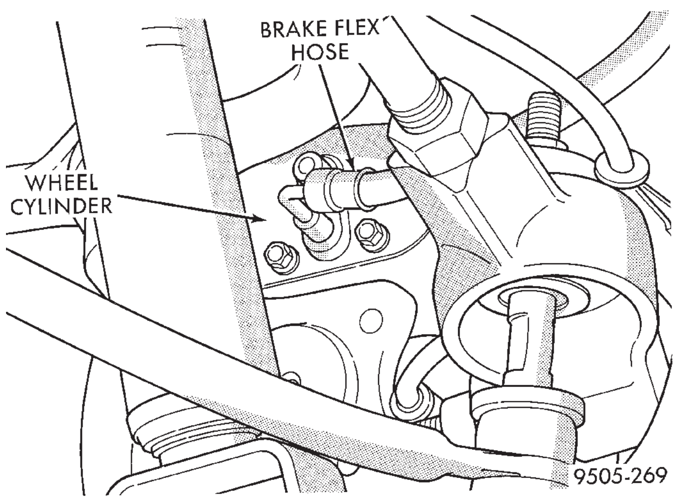


Fig. 125 Brake Flex Hose Tube At Wheel Cylinder

(7) Position a 1/2 wrench over the retainer fingers on the end of the parking brake cable (Fig. 126). Compress cable housing retaining fingers and start cable housing out of support plate (Fig. 126). Remove wrench when retainer is free from the park brake cable mounting hole in the rear brake support plate. Alternate method is to use a aircraft type hose clamp over cable housing end fitting compressing the three fingers.

(8) Remove the 4 brake support plate to knuckle attaching bolts and washer assemblies. Separate brake support plate from rear suspension knuckle.

REMOVAL AND INSTALLATION (Continued)

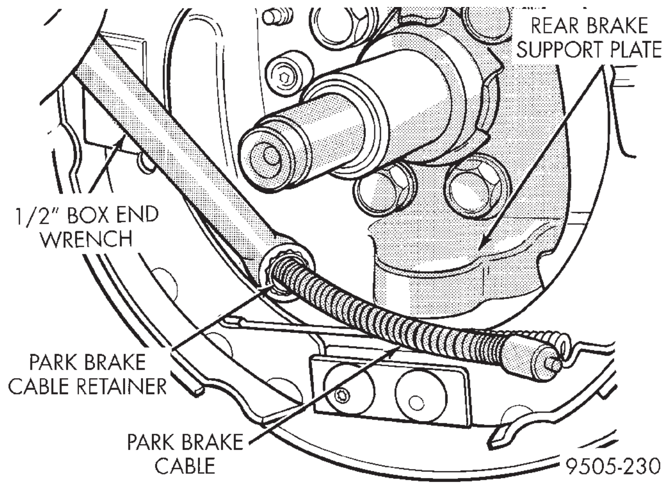


Fig. 126 Removing Park Brake Cable From Support Plate

INSTALLATION

(1) Install gasket and brake support plate on rear spindle. Tighten the support plate-to-spindle attaching bolts to a torque of 63 N·m (46 ft. lbs).

(2) Insert parking brake cable end fitting into brake support plate.

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder. Tighten tube nut to a torque of 17 N·m (145 in. lbs.).

(4) Install rear brake shoe assemblies on the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly installation procedure.

(5) Install the rear hub and bearing on the rear spindle. Install a **NEW** hub and bearing assembly retaining nut (Fig. 124).

(6) Tighten the hub and bearing assembly retaining nut to a torque of 250 N·m (185 ft. lbs.). Install dust cap.

(7) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(8) Install brake drum on rear hub/bearing assembly.

(9) Bleed the vehicle's base brakes hydraulic system.

(10) After brake drums are installed, pump brake pedal several times to do final adjustment of the brake shoe assemblies.

(11) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

PARKING BRAKE LEVER

REMOVAL

(1) Remove the 2 screws (Fig. 127) attaching rear of center console assembly to console bracket.

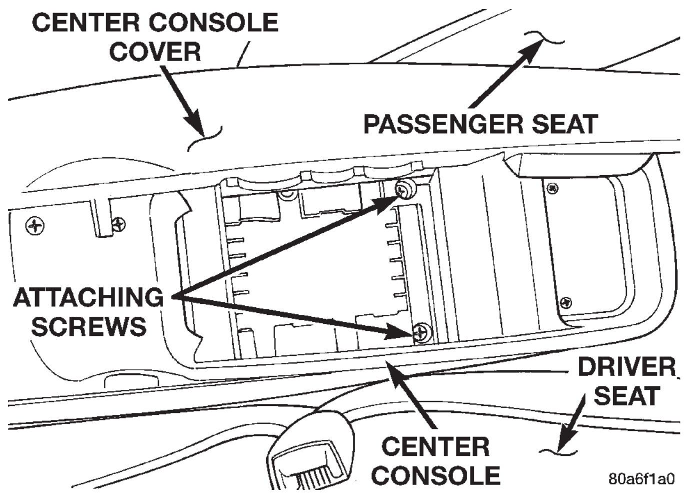


Fig. 127 Center Console Rear Attaching Screws

(2) If vehicle is equipped with an automatic transmission remove the shift knob from the shifter. The gear shift knob is attached to the shifter using a set screw (Fig. 128). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench (Fig. 128).

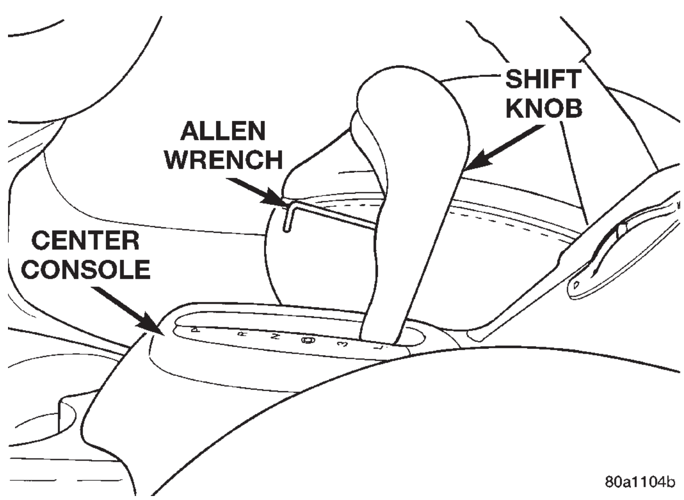


Fig. 128 Shift Knob Retaining Screw

(3) If the vehicle is equipped with a manual transmission remove the gearshift knob and shifter boot using the following procedure.

- Push shifter boot down to expose clips on gearshift knob and roll pin on shifter handle (Fig. 129).
- Pry the clips on the shifter knob away from the roll pin in the shifter handle using a flat blade pry tool (Fig. 129).
- Remove the shifter knob from the shifter handle, by pulling the shifter knob straight up (Fig. 130).

REMOVAL AND INSTALLATION (Continued)

• Remove the shifter boot from the center console. Shifter boot is removed by squeezing the bezel together at the base of the shifter boot and pulling upward on the boot (Fig. 131).

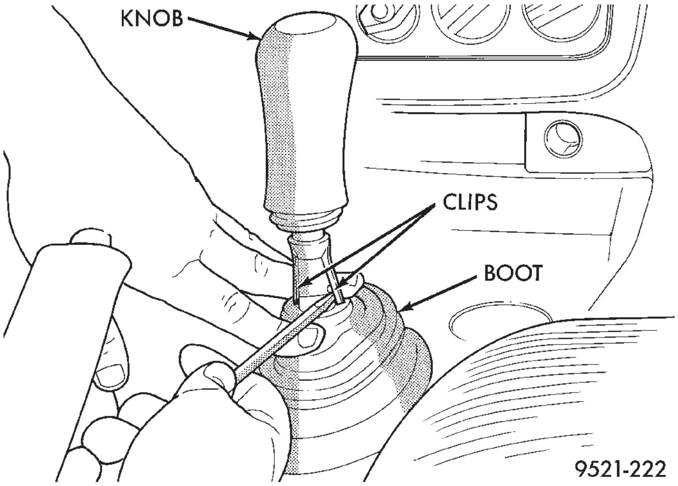


Fig. 129 Gearshift Knob

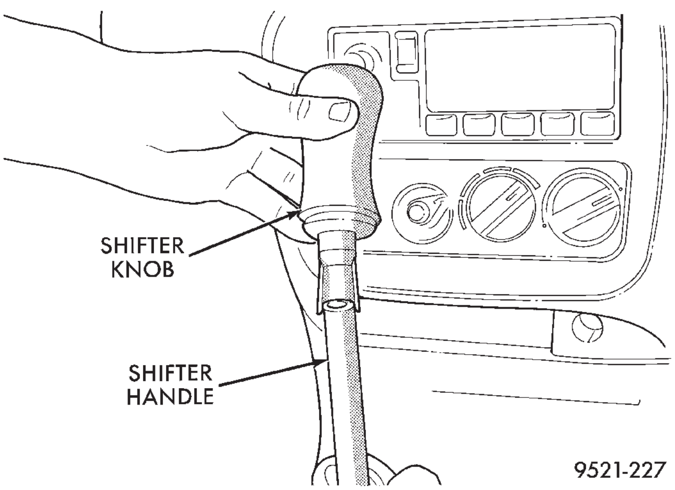


Fig. 130 Gearshift Knob Removal

(4) Remove the 2 screws attaching the front of the center console to the gear selector or shifter (Fig. 132) or (Fig. 133).

(5) Raise the park brake hand lever to approximately the half way point of its total travel. This will allow for the required clearance to remove the center console.

(6) Remove the center console/arm rest from the vehicle.

(7) Lower park brake lever handle.

(8) Loosen adjusting nut (Fig. 134) on park brake lever output cable. This will take tension off output cable, allowing it to be easily removed from tension equalizer.

CAUTION: Discard output cable retaining clip after removing it from park brake cable tension equalizer. Retainer is not to be re-used, a new retainer is to be installed when attaching output cable to tension equalizer.

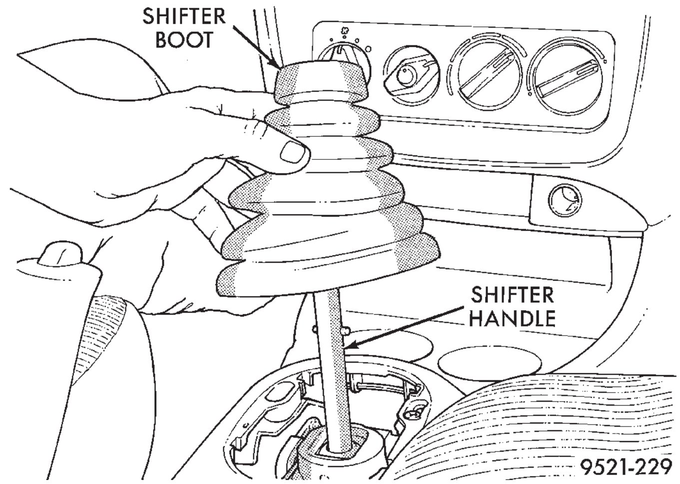


Fig. 131 Boot Removal

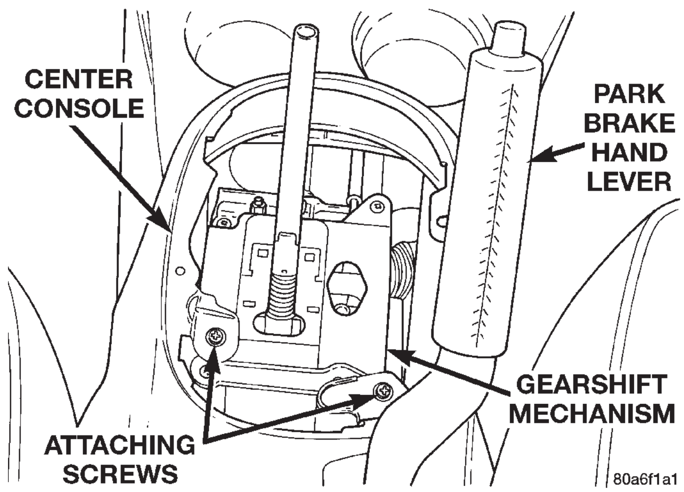


Fig. 132 Center Console Front Attaching Screws (Automatic)

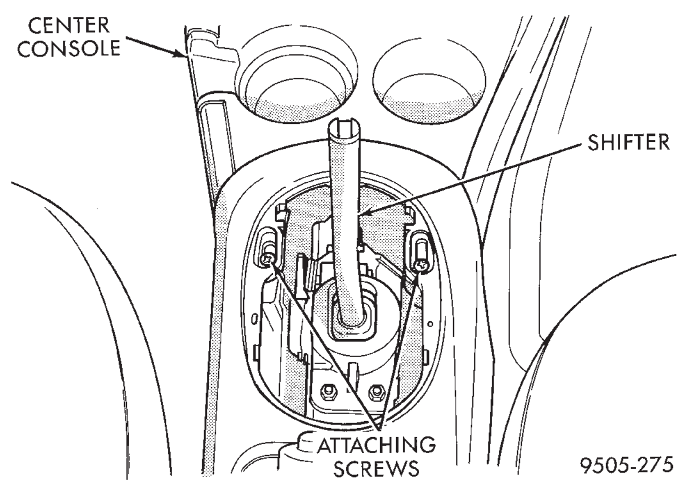


Fig. 133 Center Console Front Attaching Screws (Manual)

REMOVAL AND INSTALLATION (Continued)

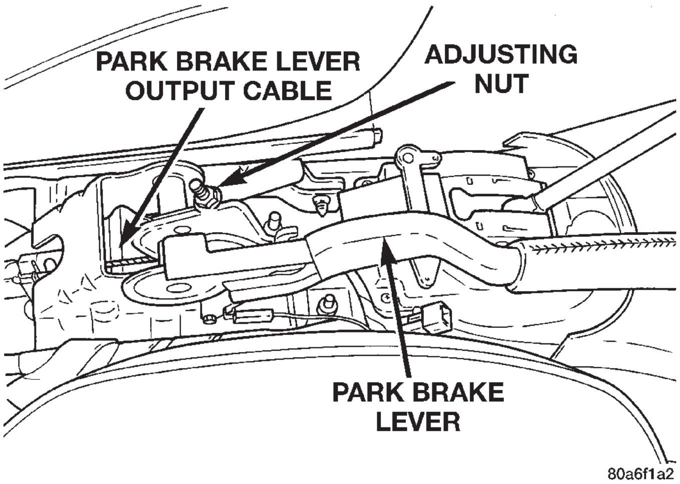


Fig. 134 Park Brake Lever Output Cable Adjustment Nut

(9) Using a screwdriver (Fig. 135) unlatch the park brake output cable retainer. Then remove cable retainer from park brake cable tension equalizer.

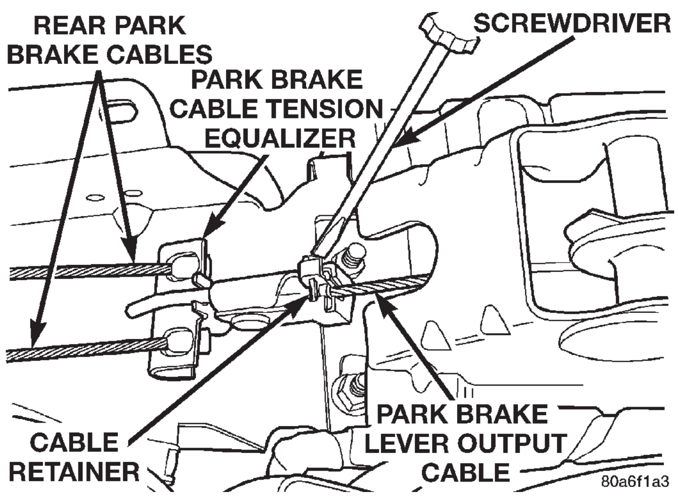


Fig. 135 Output Cable To Equalizer Retaining Clip

(10) Remove the park brake cable tension equalizer from the park brake lever output cable.

(11) Remove the electrical connector (Fig. 136) from the ground switch on the park brake lever mechanism

(12) Unclip the wiring harness (Fig. 137) from the park brake mechanism bracket. Wiring harness is attached to bracket using 2 routing clips pushed through holes in the top of the bracket.

(13) Remove the 4 bolts (Fig. 138) attaching the park brake mechanism bracket.

(14) Remove the park brake mechanism from the vehicle.

INSTALLATION

(1) Place the park brake mechanism on the console bracket. Install the 4 bolts (Fig. 138) mounting the park brake mechanism to the console bracket. Tighten the 4 mounting bolts to a torque of 28 N·m (250 in. lbs.).

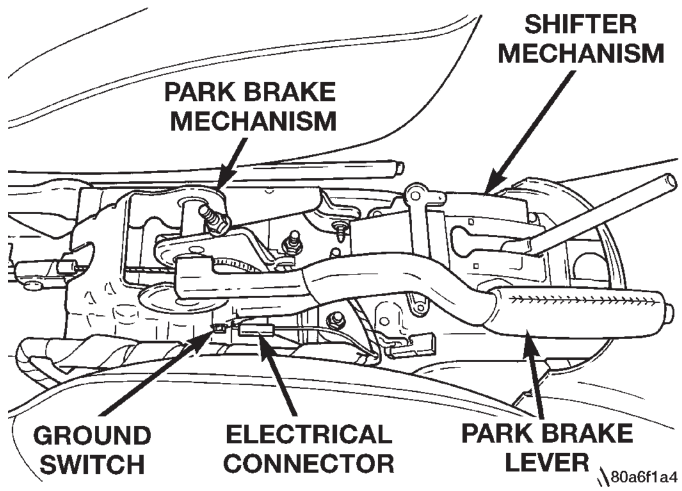


Fig. 136 Wiring Harness Connection To Ground Switch

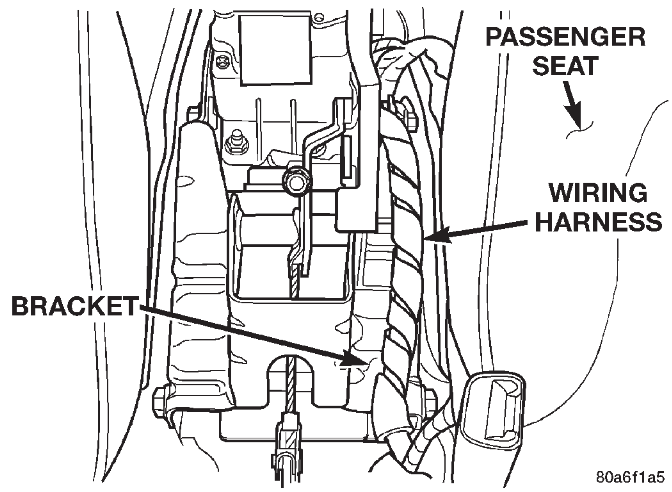


Fig. 137 Wiring Harness

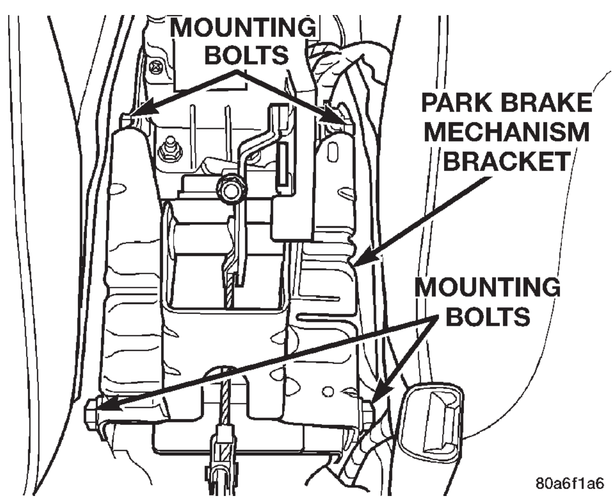


Fig. 138 Park Brake Lever Bracket Mounting

REMOVAL AND INSTALLATION (Continued)

(2) Install the wiring harness (Fig. 137) on the park brake mechanism bracket.

(3) Install the electrical connector on the ground switch of the park brake lever mechanism (Fig. 136).

CAUTION: A new cable tension equalizer must be installed when replacing the park brake mechanism. The new cable tension equalizer is required to correctly adjust park brake cable tension after installing park brake mechanism.

(4) Install a **NEW** park brake cable tension equalizer on the park brake lever output cable and rear park brake cables (Fig. 139).

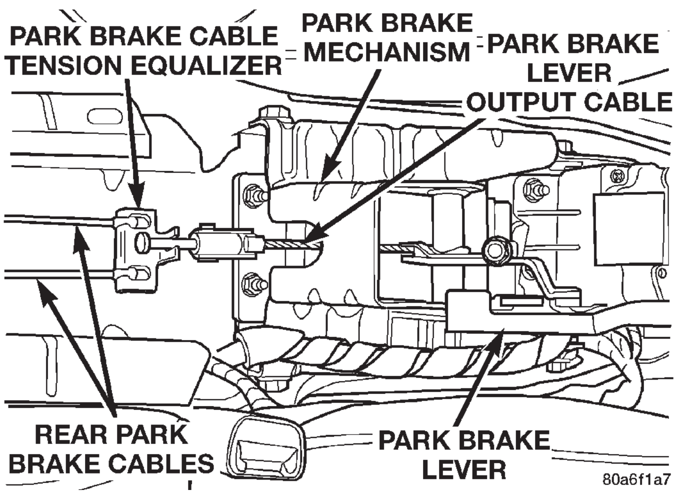


Fig. 139 Park Brake Cable Tension Equalizer

CAUTION: A new park brake lever output cable retainer must be used when installing output cable on cable tension equalizer. Cable retainer usage is required to ensure output cable can not separate from tension equalizer.

(5) Install a **new** parking brake lever output cable to tension equalizer retaining clip (Fig. 140) on tension equalizer. The cable retainer (Fig. 140) must be closed and securely latched.

(6) Adjust cable tension for the parking brake system using the following steps.

- Position park brake lever so it is in the fully released position.
- On vehicles with REAR DRUM BRAKES, tighten the adjusting nut on the parking brake lever output cable until 12 mm millimeters of thread is out past top edge of adjustment nut (Fig. 141).
- On vehicles with REAR DISC BRAKES, tighten the adjusting nut on the parking brake lever output cable until 26 mm millimeters of thread is out past top edge of adjustment nut (Fig. 142).
- Actuate the parking brake lever to its fully applied position (22 clicks) 1 time and then reposition the lever to its fully released position.

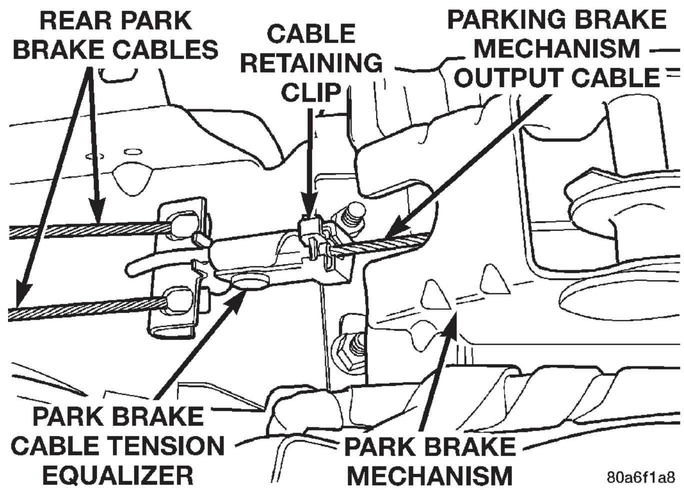


Fig. 140 Cable Retainer Installed On Tension Equalizer

NOTE: Actuating the parking brake lever to its fully applied position one time after tightening the adjustment nut will yield (stretch) the bent nail portion of the tension equalizer approximately 1/4 inch. This process will correctly set the parking brake cable tension.

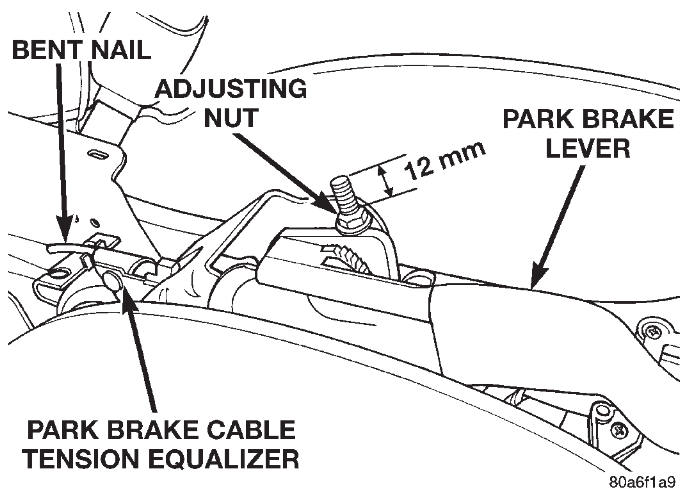


Fig. 141 Parking Brake Adjustment (Rear Drum Brakes)

(7) Check the rear wheels of the vehicle with the park brake lever fully released, they should rotate freely without dragging.

(8) After the park brake cable tension has been properly adjusted, check for free play in park brake lever. Park brake hand lever should feel firm at all clicks, with a maximum of 22 clicks of lever travel possible.

(9) Install the center console back in the vehicle.

(10) Install the 2 screws attaching the front of the center console to the forward console (Fig. 132) (Fig. 133).

REMOVAL AND INSTALLATION (Continued)

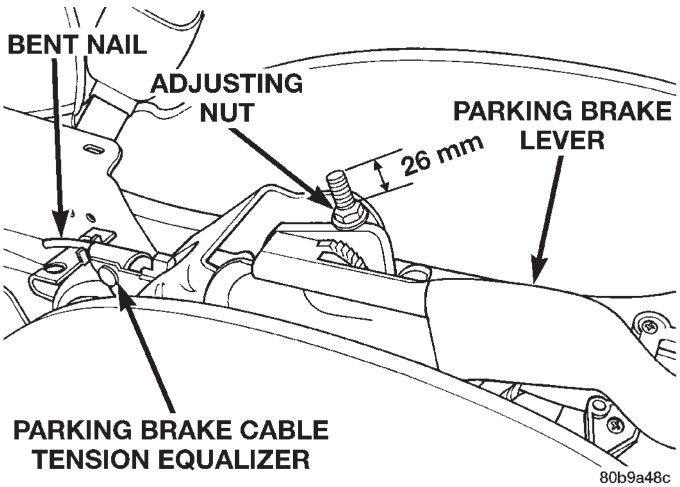


Fig. 142 Parking Brake Adjustment (Rear Disc Brakes)

(11) Install screws attaching rear of center console assembly to console bracket (Fig. 127).

(12) Install the shifter boot or PRNDL plate back in the center console.

(13) Install the shift knob on the shifter (Fig. 128) or (Fig. 130).

PARKING BRAKE CABLE (REAR)

For servicing of either the left or right rear parking brake cable, follow the procedure as listed below.

REMOVAL

(1) Remove the 2 screws (Fig. 143) attaching rear of center console assembly to console bracket.

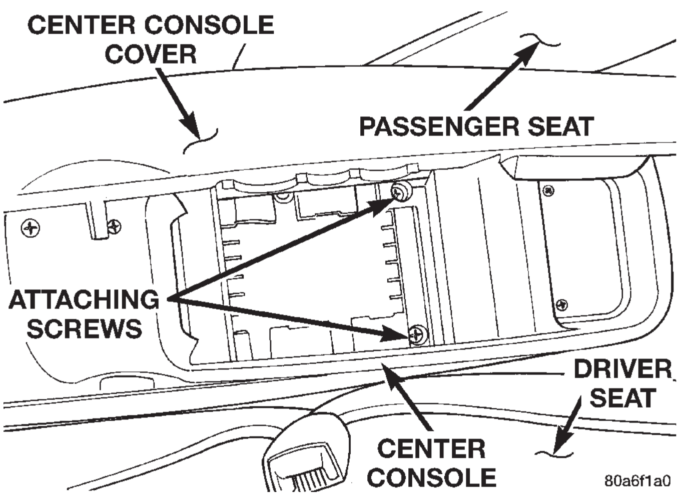


Fig. 143 Center Console Rear Attaching Screws

(2) If vehicle is equipped with an automatic transmission remove the shift knob from the shifter. The gear shift knob is attached to the shifter using a set screw (Fig. 144). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench (Fig. 144).

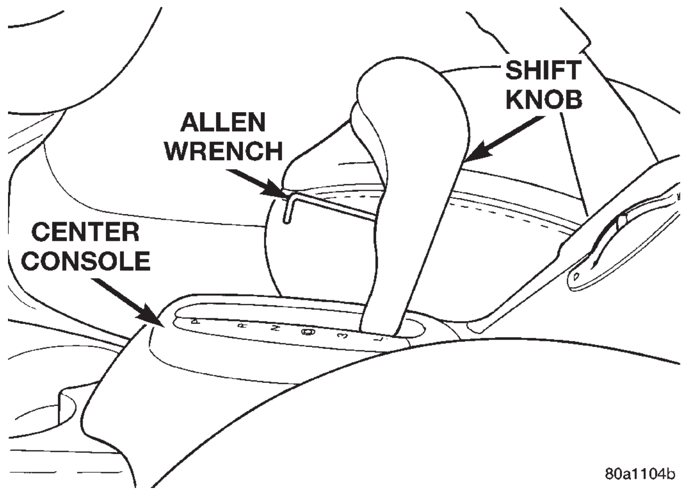


Fig. 144 Shift Knob Retaining Screw

(3) If the vehicle is equipped with a manual transmission remove the gearshift knob and shifter boot using the following procedure.

- Push shifter boot down to expose clips on gearshift knob and roll pin on shifter handle (Fig. 145).
- Pry the clips on the shifter knob away from the roll pin in the shifter handle using a flat blade pry tool (Fig. 145).
- Remove the shifter knob from the shifter handle, by pulling the shifter knob straight up (Fig. 146).
- Remove the shifter boot from the center console. Shifter boot is removed by squeezing the bezel together at the base of the shifter boot and pulling upward on the boot (Fig. 147).

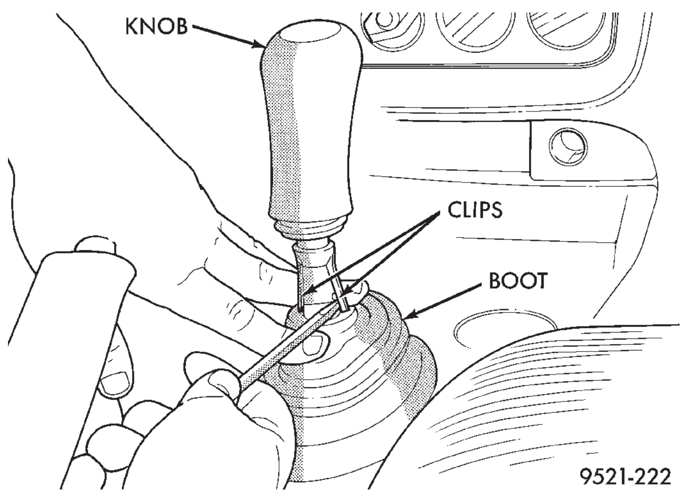


Fig. 145 Gearshift Knob

(4) Remove the 2 screws attaching the front of the center console to the gear selector or shifter (Fig. 148) or (Fig. 149).

(5) Raise park brake hand lever to the mid-position of its travel. This will allow for the required clearance to remove center console.

(6) Remove center console/arm rest from vehicle.

REMOVAL AND INSTALLATION (Continued)

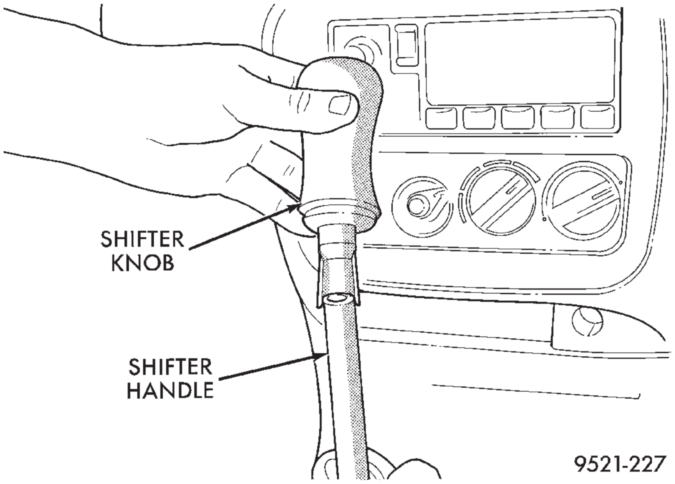


Fig. 146 Gearshift Knob Removal

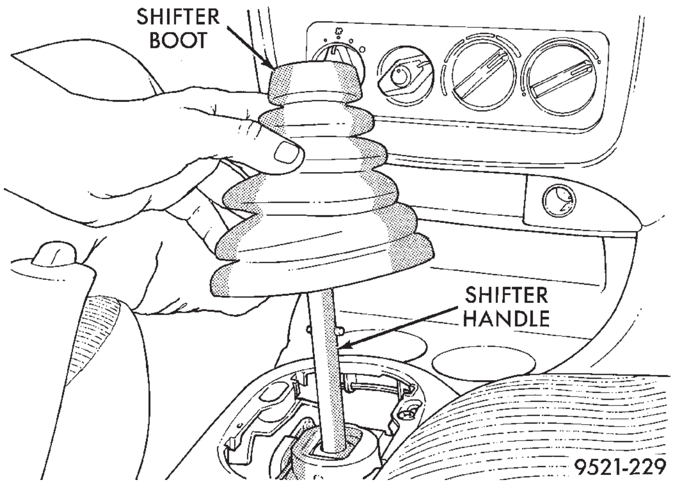


Fig. 147 Boot Removal

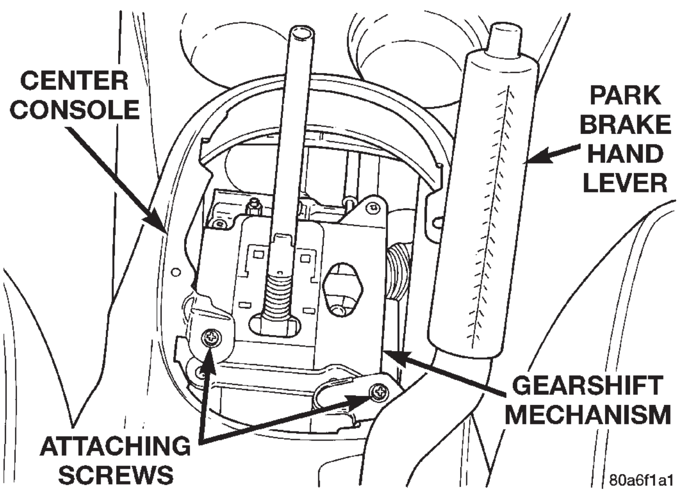


Fig. 148 Center Console Front Attaching Screws (Automatic)

(7) Lower park brake lever handle.

(8) Loosen adjusting nut (Fig. 150) on park brake cable output cable. This will take tension off park brake cables, allowing rear park brake cables to be easily removed from tension equalizer.

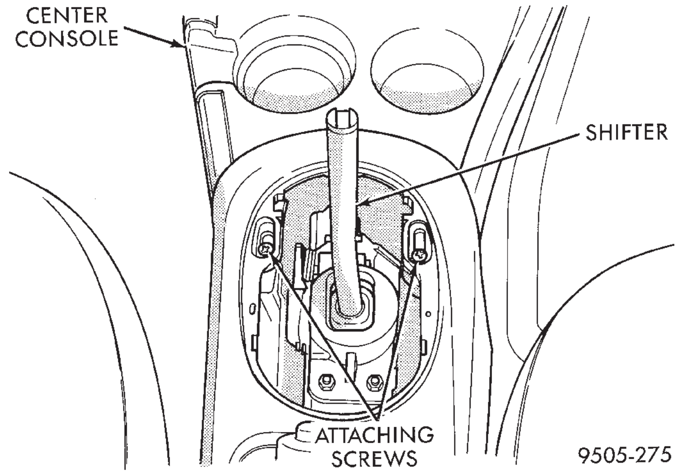


Fig. 149 Center Console Front Attaching Screws (Manual)

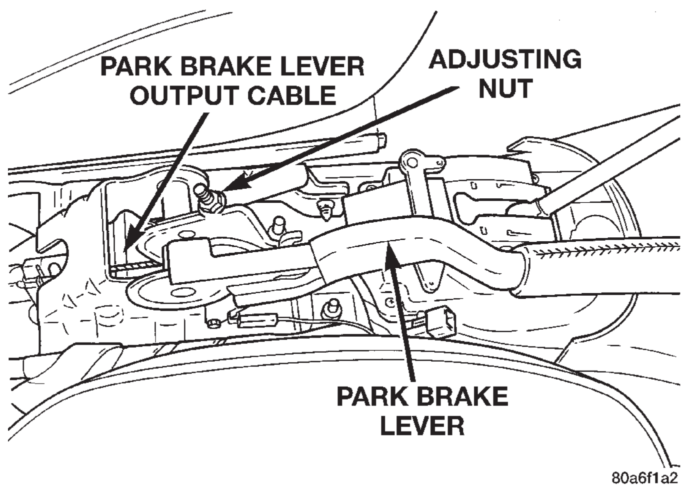


Fig. 150 Park Brake Lever Output Cable Adjustment Nut

(9) Remove the rear park brake cable requiring service, from the park brake cable tension equalizer (Fig. 151).

(10) Remove rear seat cushion from vehicle.

(11) Remove scuff plates from right and left rear door sills. Scuff plates are attached to door sills using clips on bottom of scuff plates. Remove by carefully prying scuff plate retaining clips out of door sills.

(12) Fold rear carpeting forward to expose park brake cables.

(13) Remove the routing clip (Fig. 152) attaching the rear park brake cables to the floor pan of the vehicle.

(14) Install the box end of a 1/2 in. wrench over the park brake cable retainer as indicated in (Fig. 153). This will compress tabs on park brake cable retainer, allowing cable to be removed from console bracket. From under carpet, grasp park brake cable

REMOVAL AND INSTALLATION (Continued)

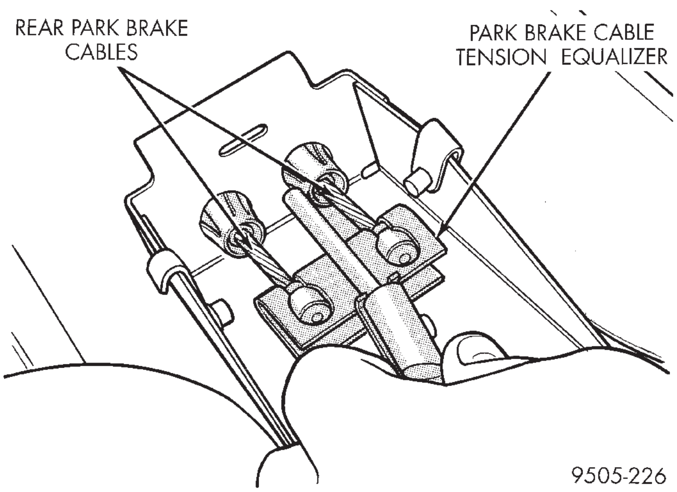


Fig. 151 Rear Park Brake Cables At Tension

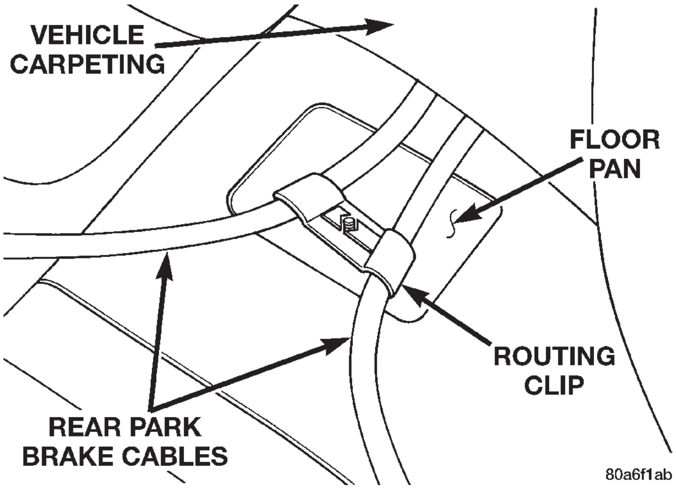


Fig. 152 Park Brake Cable Attachment To Floor Pan

housing and pull cable straight out of console bracket.

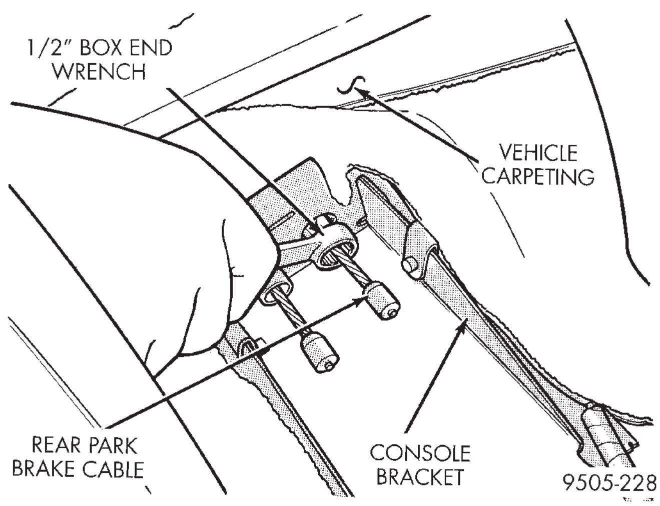


Fig. 153 Compressing Park Brake Cable Retaining Tabs

(15) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(16) Remove rear wheel and tire assembly from the side of the vehicle requiring park brake cable service.

(17) Remove the rear brake drum (Fig. 154) from the rear hub/bearing assembly.

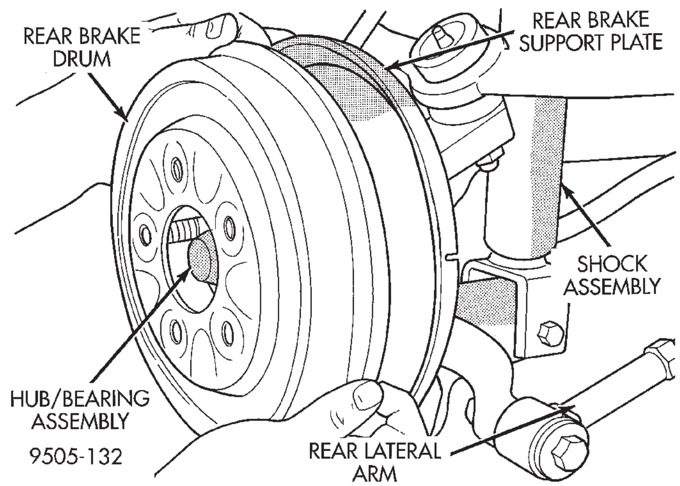


Fig. 154 Rear Brake Drum

(18) Remove dust cap (Fig. 155) from rear hub/bearing assembly.

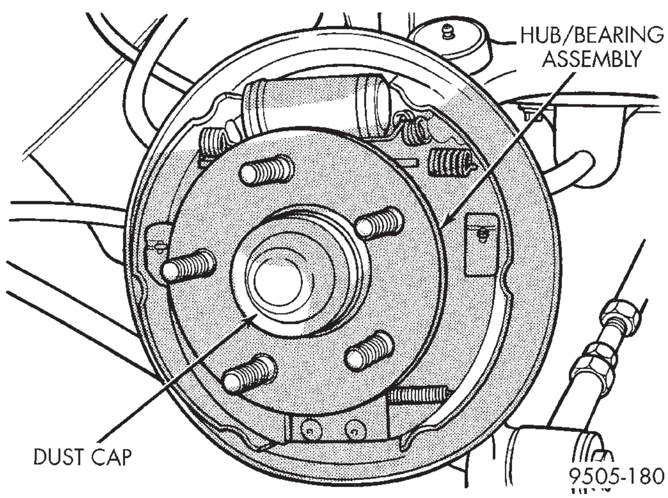


Fig. 155 Rear Hub/Bearing Dust Cap

(19) Remove the rear hub/bearing assembly retaining nut (Fig. 156).

(20) Remove the rear hub/bearing assembly from the rear spindle.

(21) Remove the park brake cable from the park brake actuating lever on the trailing brake shoe (Fig. 157).

(22) Remove park brake cable (Fig. 158) from rear brake support plate. Park brake cable is removed

REMOVAL AND INSTALLATION (Continued)

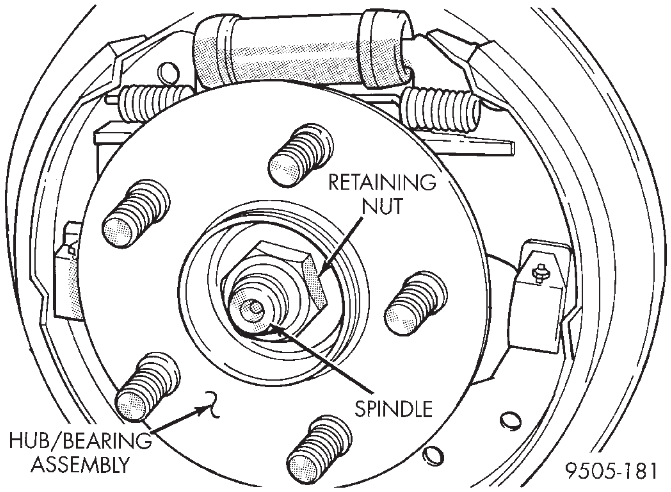


Fig. 156 Hub/Bearing Assembly Retaining Nut

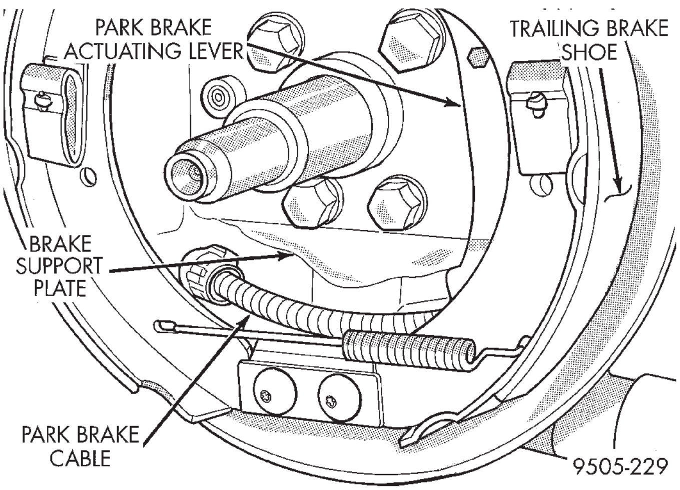


Fig. 157 Park Brake Cable At Actuating Lever

from brake support plate using a 1/2 in. wrench as shown in (Fig. 158) to compress locking tabs on park brake cable retainer.

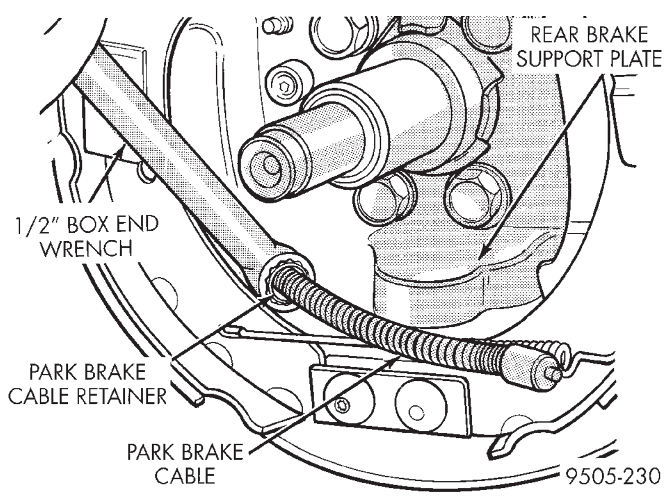


Fig. 158 Park Brake Cable Removal From Brake Support Plate

(23) Raise vehicle.

NOTE: The park brake cable routing and routing brackets are different on the right and left side of the vehicle.

(24) Remove the 2 routing brackets attaching the right hand side (Fig. 159) or left hand side (Fig. 160) park brake cable to the frame rail.

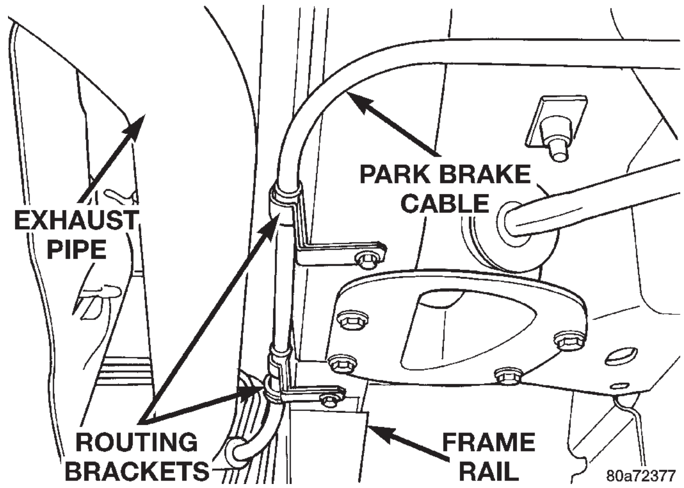


Fig. 159 Park Brake Cable Routing Brackets (Right Side)

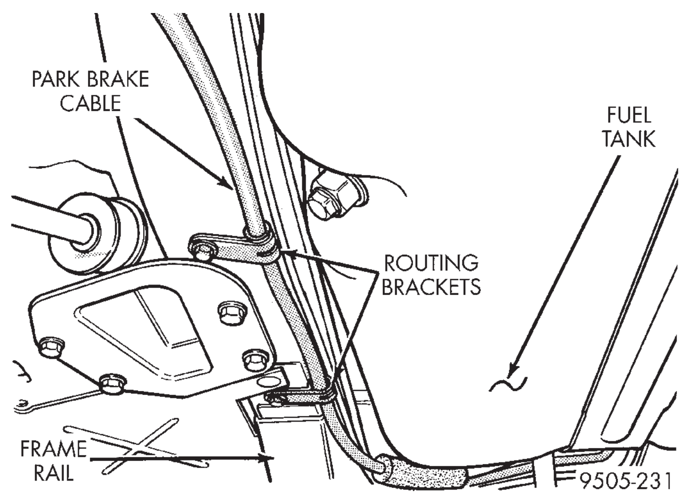


Fig. 160 Park Brake Cable Routing Brackets (Left Side)

(25) Remove the park brake cable and sealing grommet (Fig. 161) from the floor pan of the vehicle.

INSTALLATION

(1) Install parking brake cable into floor pan of vehicle making sure sealing grommet (Fig. 161) is installed in floor pan as far as possible to insure a proper seal.

(2) Install park brake cable into the rear brake support plate. Be sure locking tabs on cable retainer

REMOVAL AND INSTALLATION (Continued)

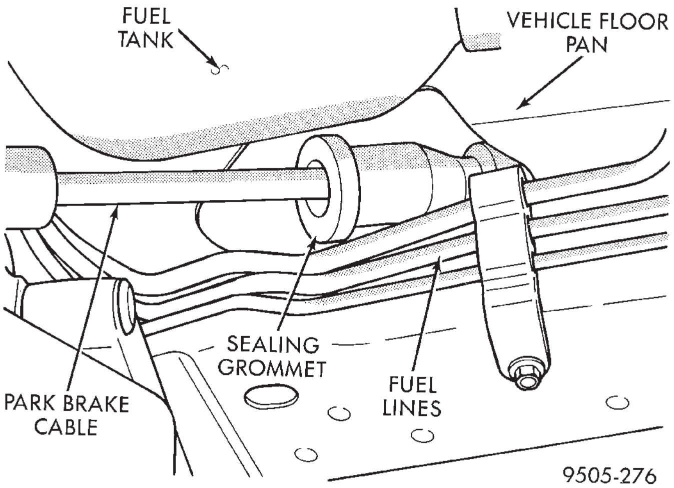


Fig. 161 Park Brake Cable Removal / Installation At Floor Pan

are expanded to ensure park brake cable is securely held in the support plate.

NOTE: The park brake cable routing and routing brackets are different on the right and left side of the vehicle. Be sure the correct routing brackets are installed on the correct side of the vehicle. The routing brackets will ensure the correct routing of the park brake cable for the side of the vehicle it is installed on.

(3) Install the 2 park brake cable routing brackets (Fig. 159) or (Fig. 160) on the right or left side rear frame rail. Install and securely tighten routing bracket attaching bolts.

(4) Install the park brake cable on the park brake actuating lever of the trailing brake shoe (Fig. 157).

(5) Install hub/bearing assembly on rear spindle. Then install **a new** rear hub/bearing assembly retaining nut (Fig. 156). Torque hub/bearing assembly to spindle retaining nut to 250 N·m (185 ft. lbs.).

(6) Install hub/bearing assembly dust cap, (Fig. 155) using a soft faced hammer.

(7) Install rear brake drum on hub/bearing assembly (Fig. 154).

(8) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in crisscross pattern to one-half specified torque. Then repeat pattern, fully tightening stud nuts to 129 N·m (95 ft. lbs.).

(9) Lower vehicle.

(10) Grasp park brake cable to floor pan seal grommet by hand, and pull it into floor pan to ensure seal grommet is fully seated into floor pan.

(11) Route park brake cable under carpeting and up to park brake cable hole in console bracket on floor pan. Then install park brake cable into console bracket (Fig. 162). Be sure tabs (Fig. 162) on park brake cable retainer, have expanded out to hold park brake cable in console bracket.

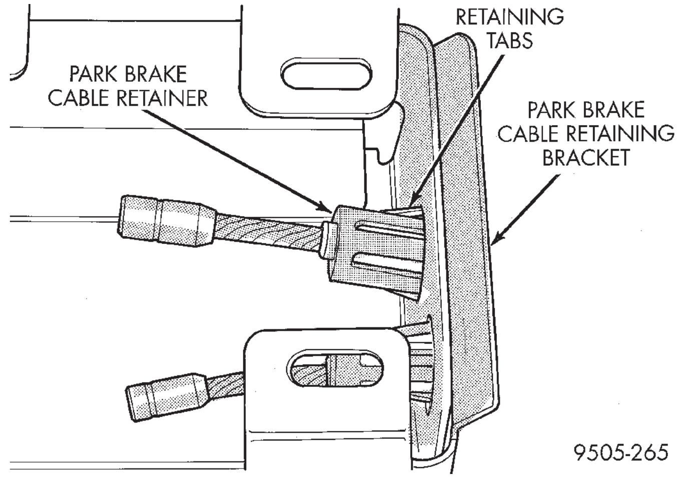


Fig. 162 Park Brake Cable Installed In Console Bracket

(12) Install the routing bracket holding park brake cables to the floor pan of the vehicle (Fig. 152).

CAUTION: Discard output cable retaining clip and tension equalizer after removing it from the park brake output cable. A new tension equalizer and retaining clip is to be used when installing a new rear park brake cable.

(13) Using a screwdriver (Fig. 163) unlatch the park brake output cable retainer. Then remove cable retainer and park brake cable tension equalizer from park brake lever output cable **and discard components.**

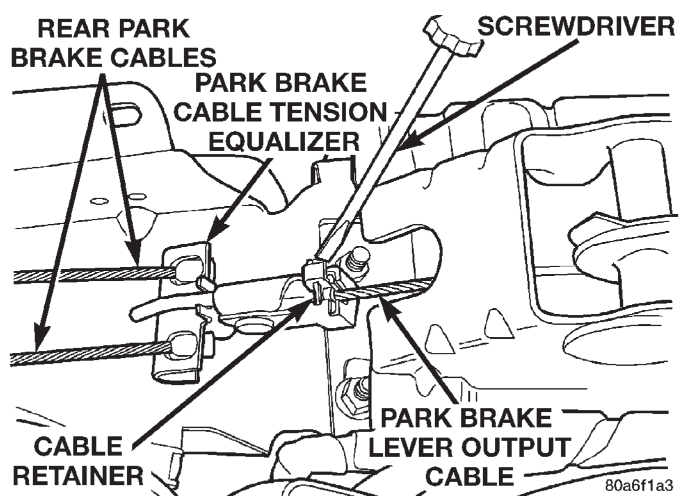


Fig. 163 Output Cable To Equalizer Retaining Clip

REMOVAL AND INSTALLATION (Continued)

CAUTION: A new cable tension equalizer must be installed when replacing a rear park brake cable . The new cable tension equalizer is required to correctly adjust park brake cable tension after installing a new rear park brake cable.

(14) Install a **NEW** park brake cable tension equalizer on the park brake lever output cable and rear park brake cables (Fig. 164).

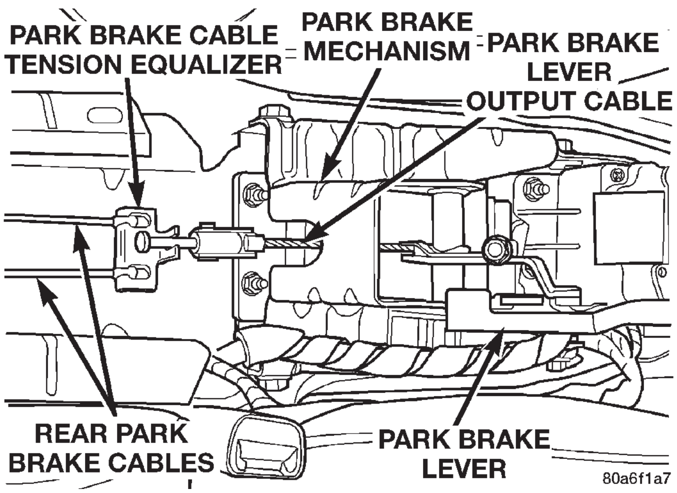


Fig. 164 Park Brake Cable Tension Equalizer

CAUTION: A new retainer (Fig. 165) must be used when installing the park brake mechanism output cable on the cable tension equalizer. Cable retainer usage is required to ensure output cable can not separate from tension equalizer.

(15) Install a **new** park brake lever output cable to tension equalizer retaining clip (Fig. 165) on tension equalizer. The cable retainer (Fig. 165) must be closed and securely latched.

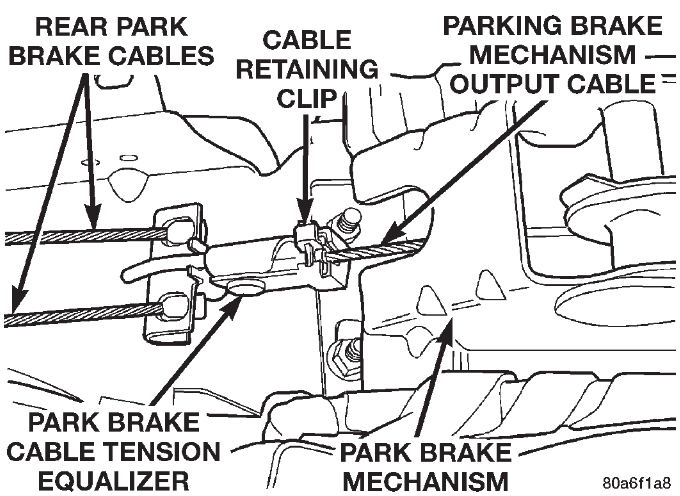


Fig. 165 Cable Retainer Installed On Tension Equalizer

(16) Adjust cable tension for the parking brake system using the following steps.

- Position parking brake lever so it is in the fully released position.
- On vehicles with REAR DRUM BRAKES, tighten the adjusting nut on the parking brake lever output cable until 12 mm millimeters of thread is out past top edge of adjustment nut (Fig. 166).
- On vehicles with REAR DISC BRAKES, tighten the adjusting nut on the parking brake lever output cable until 26 mm millimeters of thread is out past top edge of adjustment nut (Fig. 167).
- Actuate the parking brake lever to its fully applied position (22 clicks) 1 time and then reposition the lever to its fully released position.

NOTE: Actuating the parking brake lever to its fully applied position one time after tightening the adjustment nut will yield (stretch) the bent nail portion of the tension equalizer approximately 1/4 inch. This process will correctly set the parking brake cable tension.

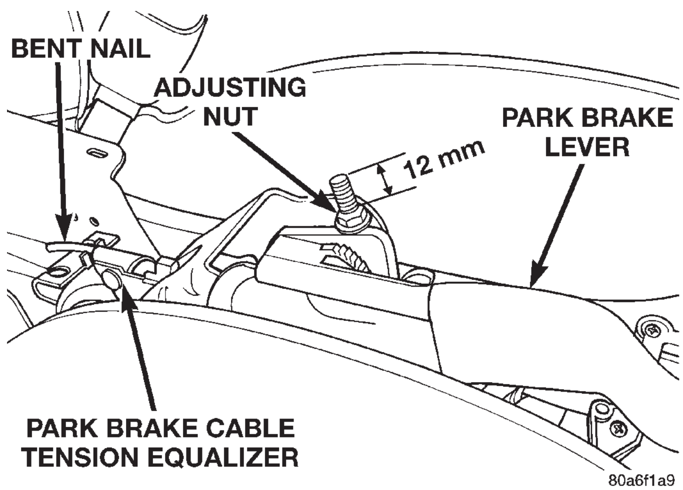


Fig. 166 Parking Brake Adjustment (Rear Drum Brakes)

(17) Check the rear wheels of the vehicle with the park brake lever fully released, they should rotate freely without dragging.

(18) After the park brake cable tension has been properly adjusted, check for free play in park brake lever. Park brake hand lever should feel firm at all clicks, with a maximum of 21 clicks of lever travel possible.

(19) Install the center console back in the vehicle.

(20) Install the 2 screws attaching the front of the center console (Fig. 148) or (Fig. 149).

(21) Install screws attaching rear of center console assembly to console bracket (Fig. 143).

(22) Install the shifter boot or PRNDL plate back in the center console.

REMOVAL AND INSTALLATION (Continued)

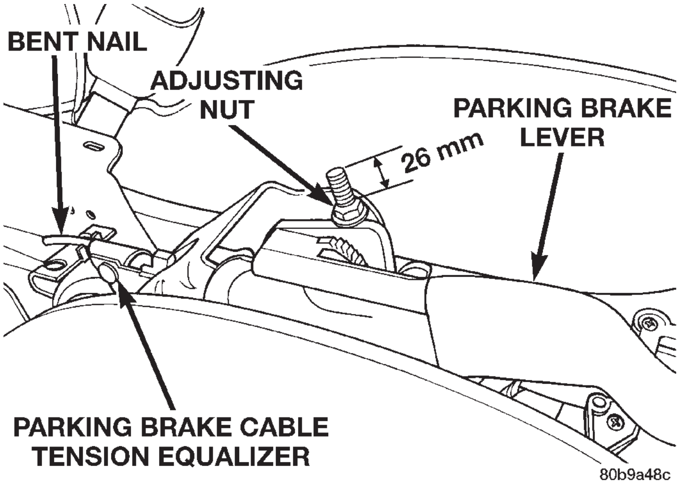


Fig. 167 Parking Brake Adjustment (Rear Disc Brakes)

(23) Install the shift knob on the shifter (Fig. 144) or (Fig. 146).

(24) Install rear carpeting.

(25) Install both rear door sill plate scuff moldings, by snapping them onto rear door sills.

(26) Install lower rear seat cushion. Be sure lower seat cushion is fully installed in retainers on floor pan of vehicle.

PARKING BRAKE SHOES (WITH REAR DISC BRAKES)

REMOVAL

(1) Remove disc brake caliper from adapter and rotor (See Disc Brake Shoe Removal).

(2) Remove rotor from hub/bearing.

(3) Remove dust cap from hub/bearing.

(4) Remove hub/bearing rear retaining nut and washer.

(5) Remove hub/bearing from knuckle.

(6) Remove hold down clip from rear park brake shoe (Fig. 168).

(7) Turn park brake shoe adjuster wheel until adjuster is at its shortest length.

(8) Remove the park brake shoe adjuster from the park brake shoes (Fig. 169).

(9) Remove the lower return spring (Fig. 170) between the park brake shoes.

(10) Pull the rear park brake shoe away from the caliper adapter (Fig. 171). Remove the upper return spring (Fig. 171) from between the park brake shoes.

(11) Remove the hold-down clip from the front park brake shoe (Fig. 172). Then remove front park brake shoe.

INSTALLATION

(1) Install front brake shoe and hold down clip (Fig. 172).

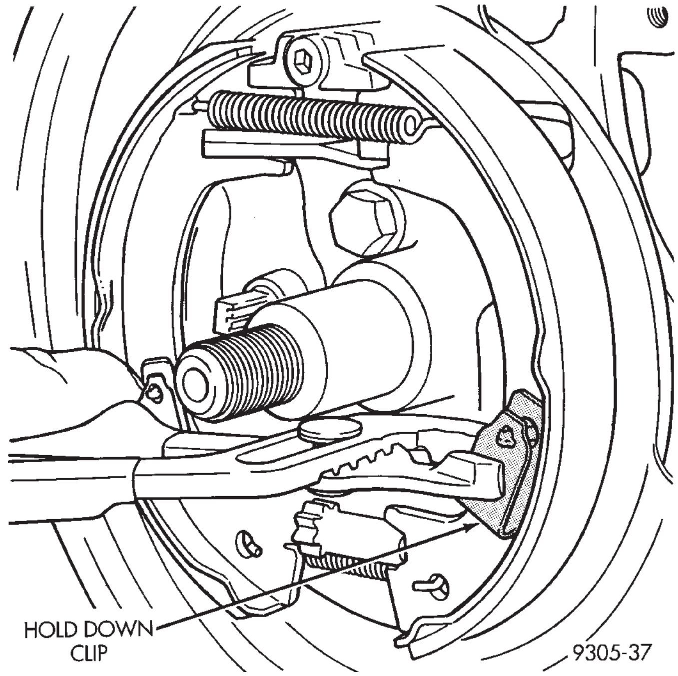


Fig. 168 Rear Park Brake Shoe Hold-Down Clip

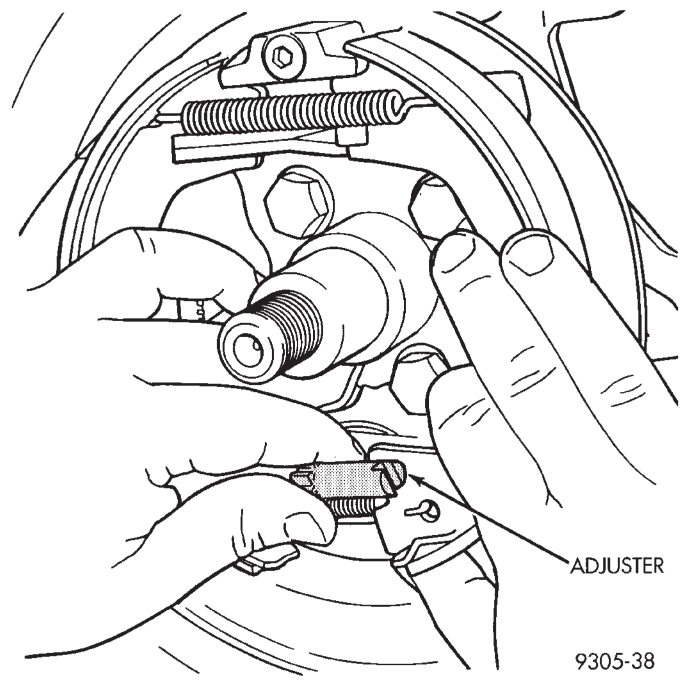


Fig. 169 Park Brake Shoe Adjuster

(2) Install the rear park brake shoe and the park brake shoe upper return spring (Fig. 171).

(3) Pull rear brake shoe over anchor block until properly located on adapter.

(4) Install the park brake lower return spring (Fig. 170).

(5) Install the adjuster between the park brake shoes. Adjuster must be installed with the star wheel toward the rear of the vehicle (Fig. 169).

REMOVAL AND INSTALLATION (Continued)

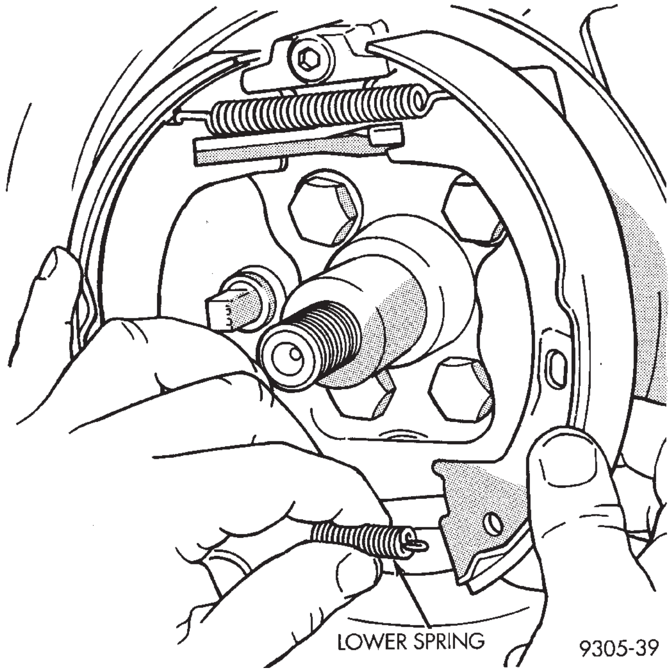


Fig. 170 Brake Shoe Lower Return Spring

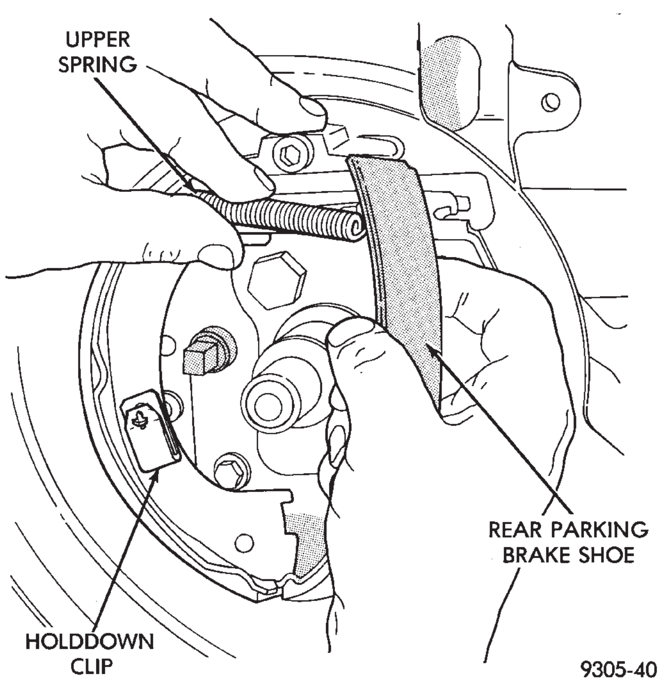


Fig. 171 Brake Shoe and Upper Spring

(6) Install hold down clip on rear park brake shoe (Fig. 168).

(7) Adjust park brake shoes to an outside diameter of 171 mm (6.75 inch).

(8) Install hub/bearing on knuckle.

(9) Install **A NEW** hub/bearing retaining nut. Tighten the hub/ bearing retaining nut to a torque of 250 N·m (185 ft. lbs.).

(10) Install dust cap on hub/bearing.

(11) Install rotor.

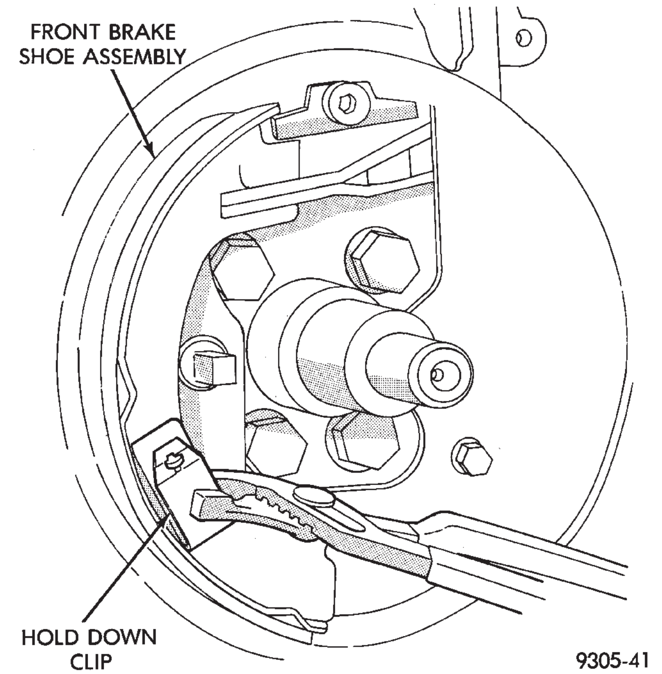


Fig. 172 Front Park Brake Shoe Hold Down Clip

(12) Install rear disc brake caliper on adapter (See Brake Shoe Removal).

(13) Install wheel and tire.

(14) Tighten wheel stud nuts to 129 N·m (95 ft.lbs.).

STOP LAMP SWITCH

REMOVAL

(1) Depress and hold the brake pedal while rotating the stop lamp switch (Fig. 173) in a counter-clockwise direction approximately 30 degrees.

(2) Pull the switch rearward and remove it from its mounting bracket.

(3) Disconnect the wiring harness connector from the stop lamp switch.

INSTALLATION

NOTE: Prior to installing stop lamp switch into bracket, the plunger must be moved to its fully extended position using the procedure in Step 1.

(1) Hold the stop lamp switch firmly in one hand. Then using the other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(2) Connect the wiring harness connector to the stop lamp switch.

(3) Mount the stop lamp switch into the bracket using the following procedure:

- Depress the brake pedal as far down as possible.

REMOVAL AND INSTALLATION (Continued)

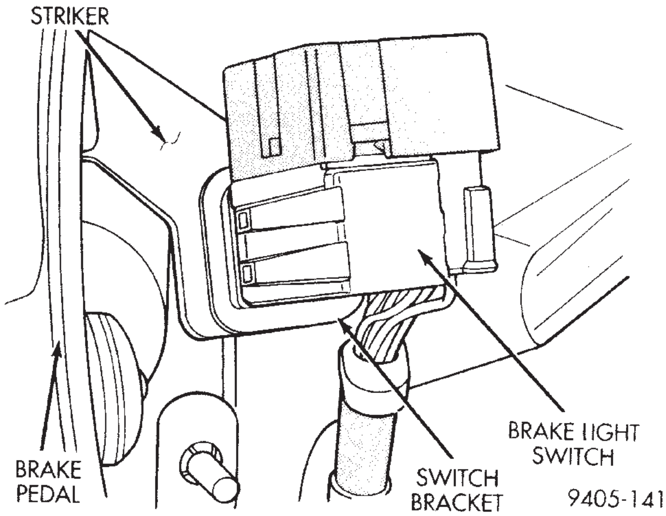


Fig. 173 Stop Lamp Switch

• Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.

• When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place.

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the stop lamp switch. If too much force is used, the stop lamp switch or striker can be damaged.

(4) Gently pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(5) Check the stop lamps to verify they are operating properly and not staying on when the pedal is in the released position.

DISASSEMBLY AND ASSEMBLY

MASTER CYLINDER BRAKE FLUID RESERVOIR

NOTE: To replace the master cylinder brake fluid reservoir on this vehicle, it is not necessary to remove the master cylinder from the power brake booster.

DISASSEMBLY

(1) Remove master cylinder from vehicle. Refer to REMOVAL AND INSTALLATION in this section.

(2) Using Mopar, Brake Parts Cleaner or an equivalent, thoroughly clean the master cylinder and brake fluid reservoir.

(3) Remove the brake fluid reservoir filler cap.

(4) Using a syringe or equivalent type tool, empty as much brake fluid as possible from the reservoir.

CAUTION: Do not pry fluid reservoir off master cylinder using a tool, damage to the reservoir or master cylinder can result.

(5) Remove brake fluid reservoir from master cylinder by rocking the reservoir from side to side while pulling upward on the fluid reservoir.

(6) Remove master cylinder housing to brake fluid reservoir sealing grommets (Fig. 174).

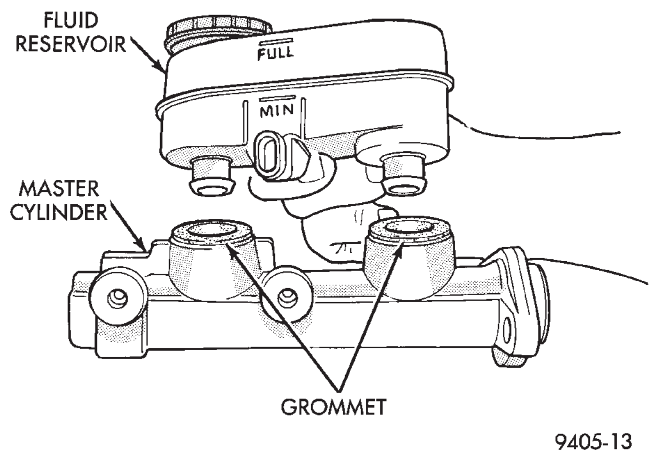


Fig. 174 Removing Fluid Reservoir From Master Cylinder

ASSEMBLY

CAUTION: To ensure a leak proof seal when installing a fluid reservoir, never reuse the original fluid reservoir to master cylinder sealing grommets.

(1) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 174) in master cylinder housing.

(2) Lubricate reservoir mounting area with fresh clean brake fluid. Place reservoir in position over grommets. Seat reservoir into grommets using a rocking motion while firmly pressing down on fluid reservoir.

(3) Be sure reservoir is positioned properly.

(4) Make sure bottom of fluid reservoir touches top of both sealing grommets.

(5) Reinstall the master cylinder on the vehicle. Refer to REMOVAL AND INSTALLATION in this section.

DISC BRAKE CALIPER (FRONT AND REAR)

Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING AND INSPECTION in this section of this service manual group.

DISASSEMBLY AND ASSEMBLY (Continued)

CALIPER GUIDE PIN BUSHING

REMOVAL

(1) With one hand, push the guide pin bushing sleeve towards the back of the caliper, and at the same time, pull the sleeve out the back of the caliper and bushing (Fig. 175).

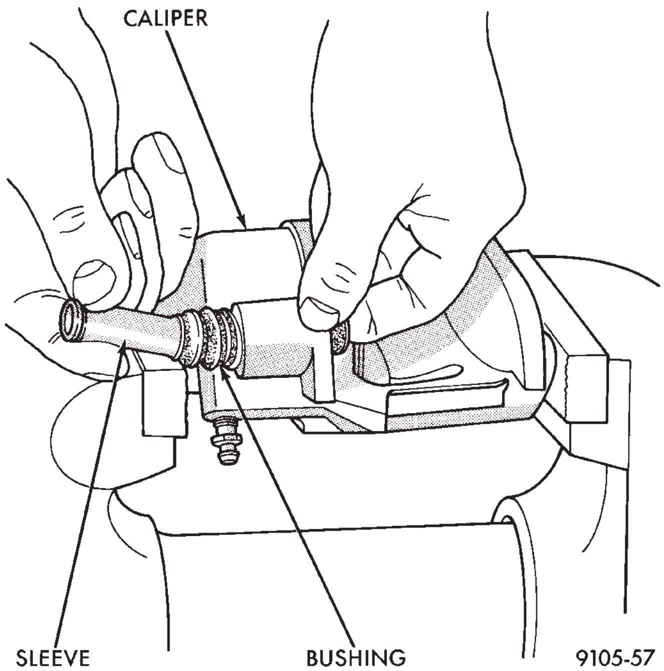


Fig. 175 Removing Sleeve From Bushing

(2) Using your fingers, collapse one side of the rubber guide pin bushing. Pull the guide pin bushing out the other side of the brake caliper mounting boss (Fig. 176).

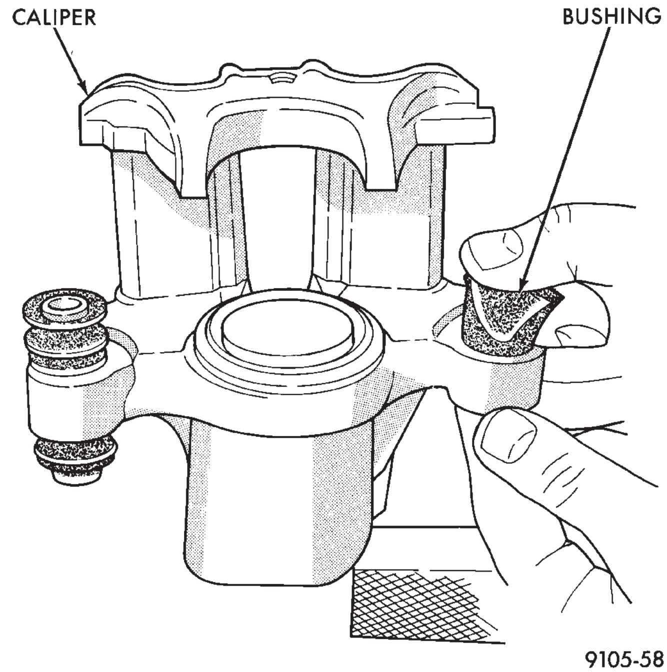


Fig. 176 Removing Bushing From Caliper

INSTALLATION

(1) Fold the guide pin bushing in half lengthwise at the solid middle section (Fig. 177).

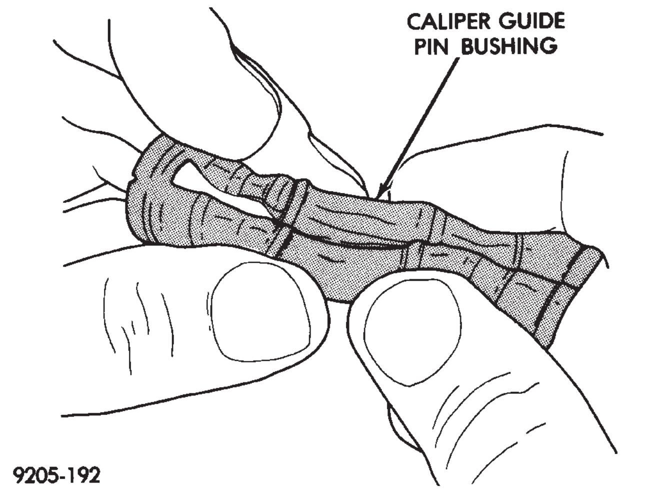


Fig. 177 Folded Caliper Guide Pin Bushing

NOTE: To avoid damage to the bushing, do not use a sharp object to install the guide pin bushing.

(2) Insert the folded bushing into the caliper mounting boss using your fingers (Fig. 178).

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper housing. The bushing flanges should be seated evenly on both sides of the bushing hole (Fig. 179).

(4) Lubricate the inside surfaces of the bushing using Mopar Dielectric Grease or an equivalent.

(5) Install the guide pin sleeve into one end of bushing until the seal area of bushing is past the seal groove in the sleeve (Fig. 180).

(6) Holding the convoluted boot on the opposite end of the bushing, push the steel sleeve through the bushing until the bushing boot is fully seated into the seal groove on that end of sleeve (Fig. 180). Install the other end bushing boot into the groove on that end of the bushing sleeve.

(7) Verify both ends of the bushing are seated in the sleeve groves (Fig. 181). When the sleeve is seated properly into the bushing, the sleeve/bushing can be held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

DISASSEMBLY AND ASSEMBLY (Continued)

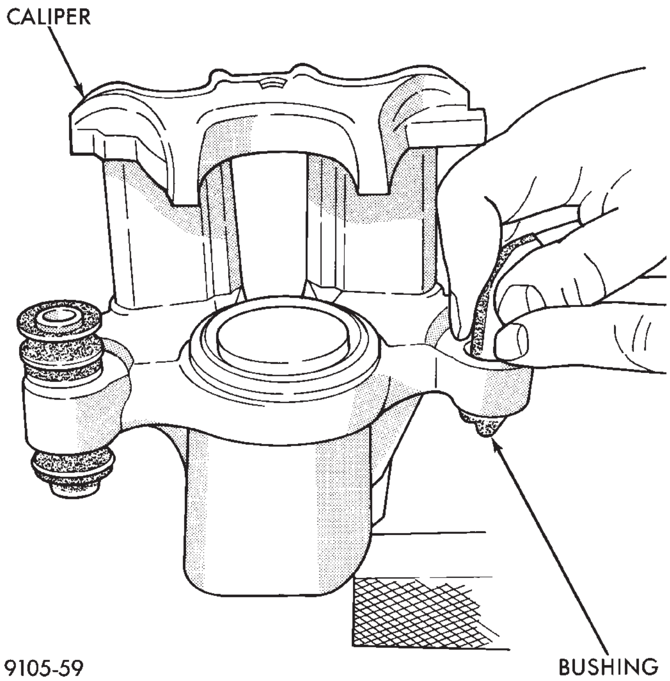


Fig. 178 Installing Caliper Guide Pin Bushing

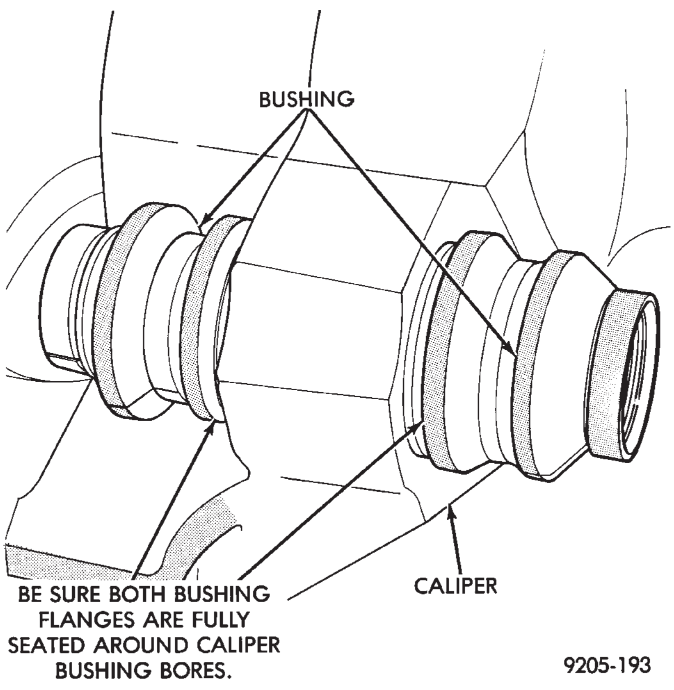


Fig. 179 Bushing Correctly Installed In Caliper

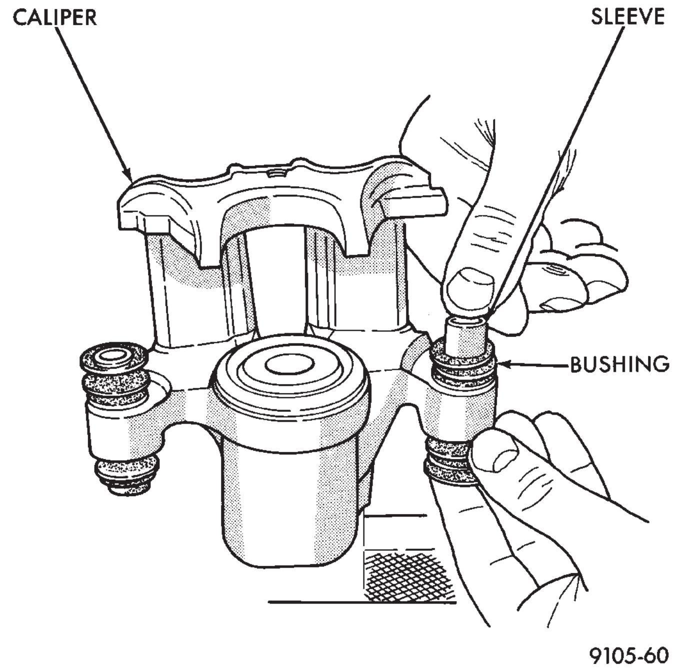


Fig. 180 Installing Sleeve In Bushing

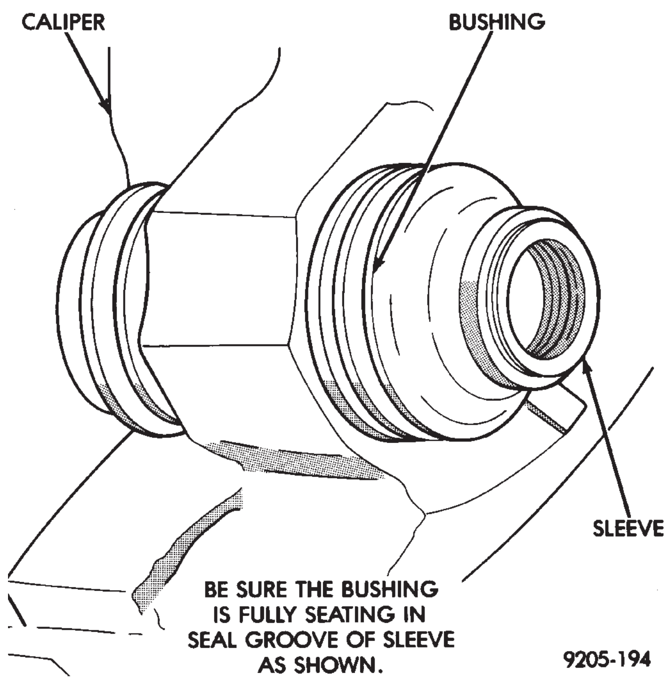


Fig. 181 Correctly Installed Guide Pin Sleeve And Bushing

CALIPER PISTON AND SEALS

CALIPER PISTON REMOVAL

WARNING: UNDER NO CONDITION SHOULD HIGH PRESSURE AIR EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

NOTE: The safest way to remove the piston from the caliper bore is to use the hydraulic pressure of the vehicle's brake system.

(1) Following the removal procedure in DISC BRAKE SHOES found in this section, remove the caliper from the brake rotor and hang the assembly on a wire hook away from rotor and body of the vehicle so brake fluid cannot get on these components.

DISASSEMBLY AND ASSEMBLY (Continued)

Remove the brake shoes, and place a small piece of wood between the piston and caliper fingers.

(2) Carefully depress the brake pedal to hydraulically push piston out of its bore. Once completed, apply and hold down the brake pedal to any position beyond the first inch of pedal travel using a brake pedal holding tool. This will prevent the fluid in the master cylinder reservoir from completely draining out.

(3) Disconnect the brake fluid flex hose from the caliper assembly and remove it from the vehicle.

CALIPER SEAL REMOVAL

CAUTION: Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion.

(1) To disassemble the caliper, mount it in a vise equipped with protective jaws.

(2) Remove the piston dust boot from the caliper and discard (Fig. 182).

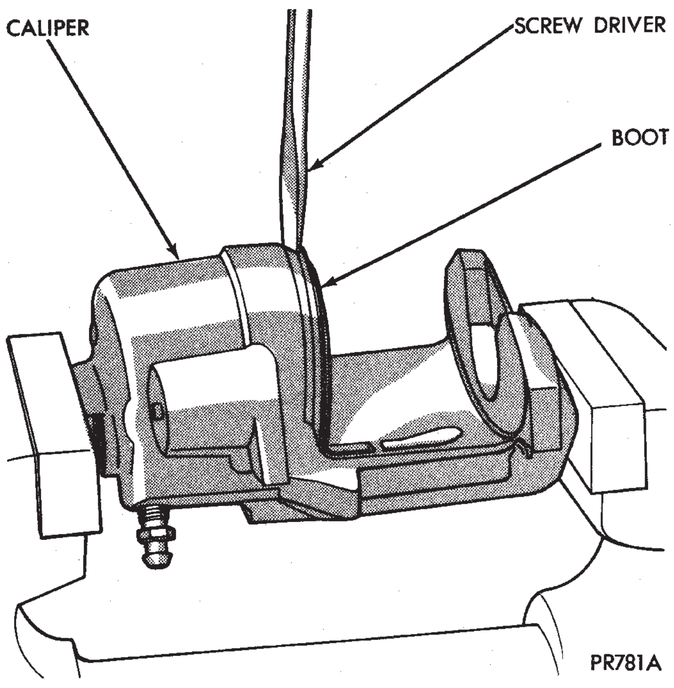


Fig. 182 Removing Caliper/Piston Dust Boot

NOTE: Do not use a screw driver or other metal tool for seal removal. Using such tools can scratch the bore or leave burrs on the seal groove edges.

(3) Using a soft tool such as a plastic trim stick, work the piston seal out of its groove in caliper piston bore (Fig. 183). Discard the old seal.

(4) Clean the piston bore and drilled passage ways using alcohol or a suitable solvent. Wipe it dry using only a lint-free cloth.

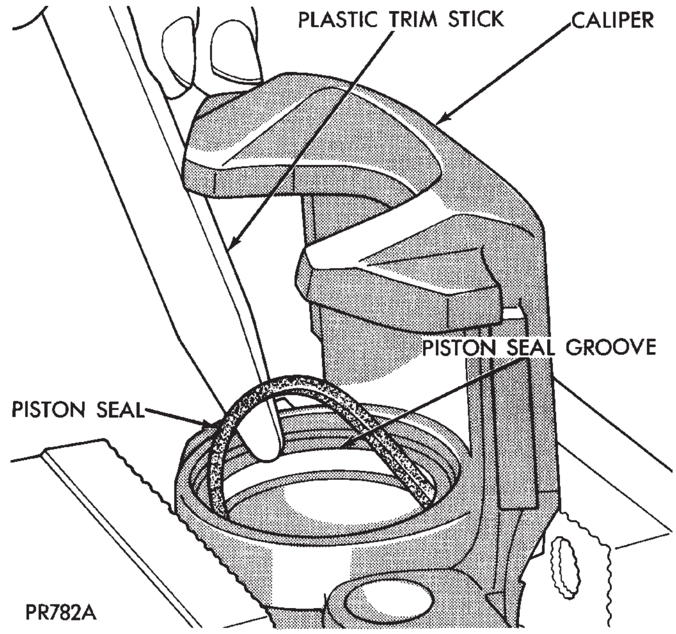


Fig. 183 Removing Piston Seal

(5) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095, or the equivalent to hone the bore. Do not over-hone the bore. Don not increase the diameter of the bore more than 0.0254 mm (0.001 inch) (Fig. 184). If the bore does not clean up within this specification, a new caliper housing should be installed.

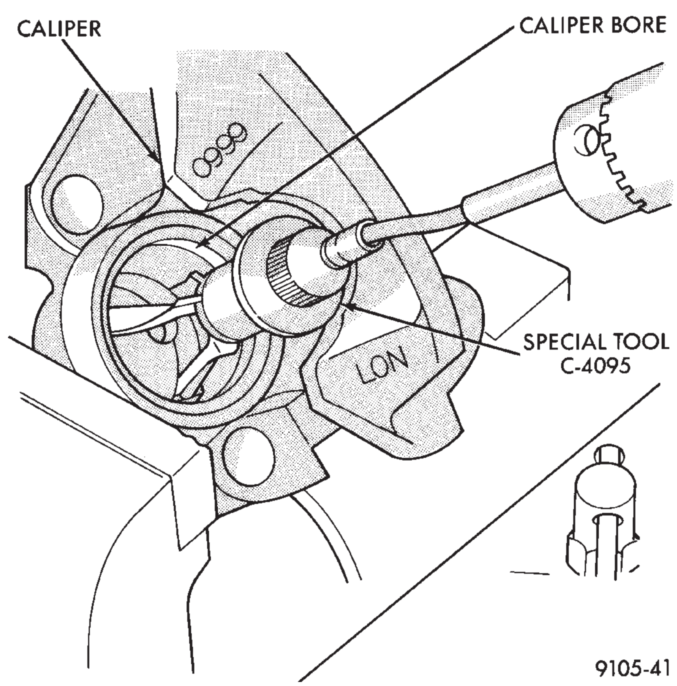


Fig. 184 Honing Brake Caliper Piston Bore

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: During the honing procedure, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush. Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper bore with fresh clean brake fluid; wipe it dry with a clean, lint free cloth and then clean it a second time.

(6) Inspect the caliper piston for pitting, scratches, or any physical damage. Replace the piston if there is evidence of scratches, pitting or physical damage.

CALIPER SEAL AND PISTON INSTALLATION

NOTE: Never use an old piston seal.

(1) Dip the new piston seal in clean brake fluid and install it in the groove of the caliper bore. The seal should be started at one area of the groove and gently worked around and into the groove (Fig. 185) using only your clean fingers to seat it.

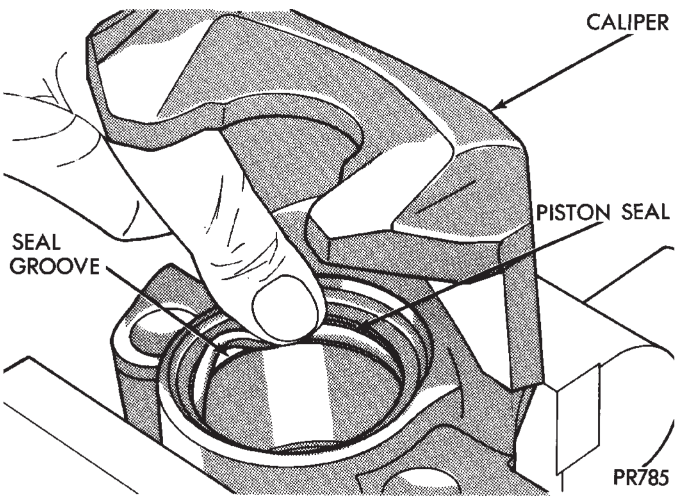


Fig. 185 Installing New Piston Seal

(2) Coat the new piston boot with clean brake fluid leaving a generous amount inside the boot.

(3) Position the dust boot over the piston after coating it with brake fluid.

CAUTION: Force applied to the piston to seat it in the bore must be applied uniformly to avoid cocking and binding of the piston.

(4) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 186).

(5) Position the dust boot into the counterbore of the caliper assembly piston bore.

(6) Using a hammer and Installer, Special Tool C-4689, and Handle, Special Tool C-4171, drive the boot into the counterbore of the caliper (Fig. 187).

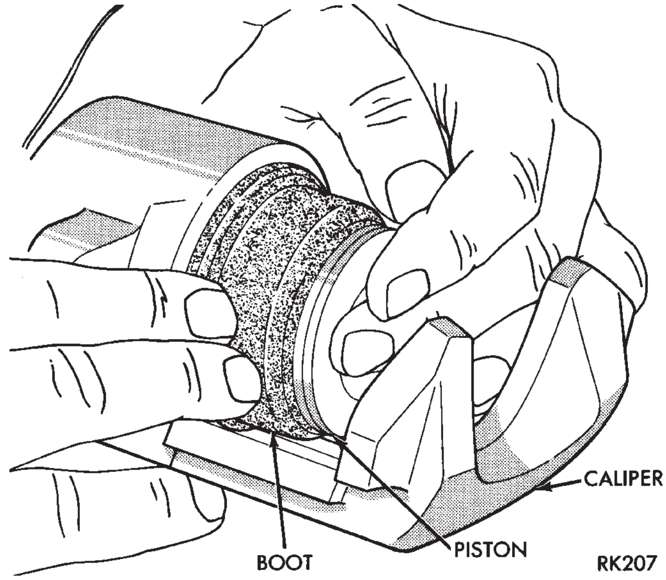


Fig. 186 Installing Piston Into Caliper Bore

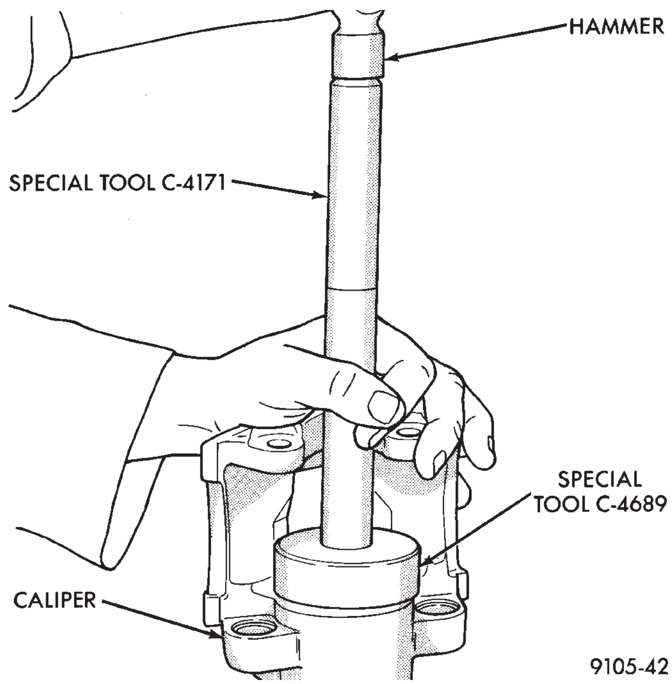


Fig. 187 Installing Dust Boot In Caliper Counterbore

(7) Install the brake shoes.

(8) Reinstall the caliper on the vehicle and bleed the brakes as necessary. Follow the installation procedure found in DISC BRAKE CALIPER in the REMOVAL AND INSTALLATION section in this section of this service manual group.

DRUM BRAKE WHEEL CYLINDER (REAR)

DISASSEMBLY

To disassemble the wheel cylinders, proceed as follows:

DISASSEMBLY AND ASSEMBLY (Continued)

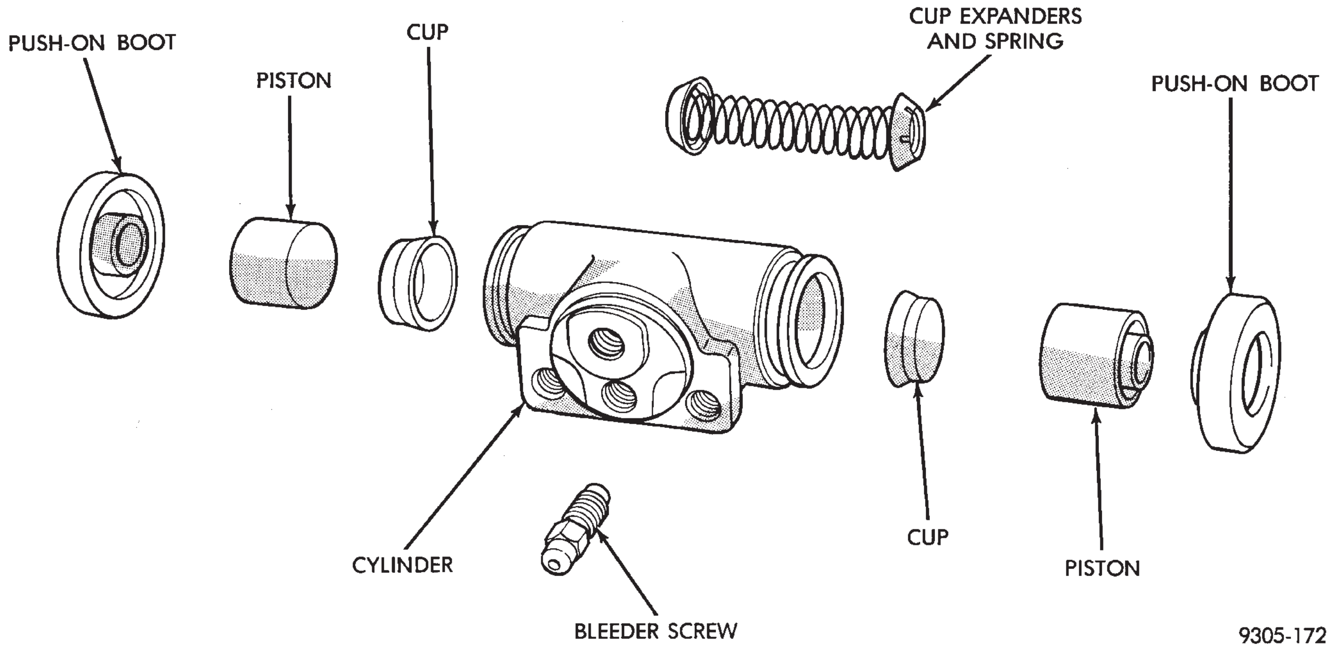


Fig. 188 Rear Wheel Cylinder (Exploded View)

(1) Pry boots away from cylinders and remove (Fig. 188).

(2) Press **IN** on one piston to force out opposite piston, cup and spring (Fig. 188). Then using a soft tool such as a dowel rod, press out the cup and piston that remain in the wheel cylinder.

(3) Wash wheel cylinder, pistons, and spring (Fig. 188) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

ASSEMBLY

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with Mopar Protect-A-Cup Lubricant.

(3) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 188).

(4) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 188).

(5) Install a boot over each end of cylinder (Fig. 188). **Be careful not to damage boot during installation.**

CLEANING AND INSPECTION

DISC BRAKES (FRONT)

BRAKE SHOE (PAD) LINING WEAR

If a visual inspection does not adequately determine the condition of the front disc brake shoe lining, a physical check will be necessary. To check the amount of brake shoe lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the front brake shoes. (See Brake Shoe Removal paragraph).

Combined front brake shoe thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 9.0 mm (3/8 inch) they should be replaced.

Replace both brake shoes (inboard and outboard) on both front sides of the vehicle.

If the front disc brake shoes do not require replacement, reinstall, the brake shoes making sure each brake shoe is returned to the original position on the vehicle it was removed from. (See Brake Pad Installation).

CLEANING AND INSPECTION (Continued)

CALIPER INSPECTION

Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

DISC BRAKES (REAR)

BRAKE SHOE (PAD) LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the rear disc brake shoes. Refer to Disc Brake Shoes in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.0 mm (9/32 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** rear wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Rear Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

DRUM BRAKES (REAR)

Clean the metal portion of brake shoes. Check to see if shoes are bent.

Lining should show contact across entire width and from heel to toe, otherwise replace.

Measure the combined thickness of the leading and trailing brake shoe and lining (Fig. 189). The lining used on the leading and trailing brake shoes of this vehicle are of different thicknesses. Therefore, the minimum thickness measurement for the replacement of the leading and trailing brake shoes are different. When measuring the thickness, the measurement is the combined thickness of the brake shoe rim and the brake shoe lining (Fig. 189). The minimum combined leading brake shoe rim and lining thickness specification for replacement is 3.0 mm (Fig. 189). The minimum combined trailing brake shoe rim and lining thickness specification for replacement is 2.8 mm or less (Fig. 189).

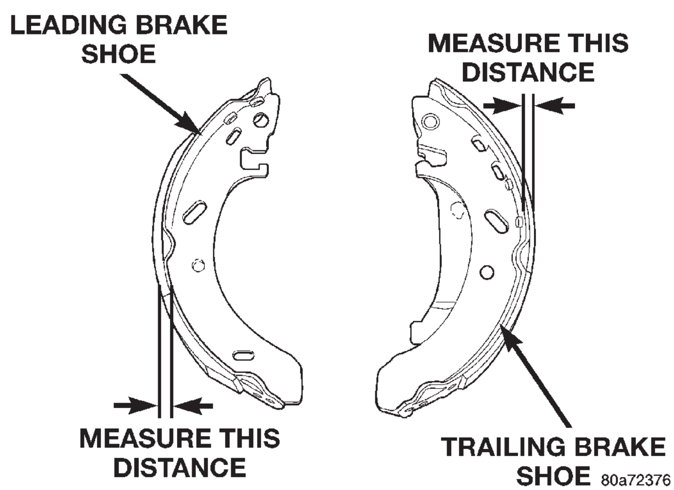


Fig. 189 Brake Shoe Lining Thickness Measurement

Shoes with lack of contact at toe or heel may be improperly ground.

Clean and inspect the brake support plate and the automatic self adjusting mechanism.

Visually examine the adjuster assembly to ensure it is functioning correctly by checking for the following operation.

- Be sure the quadrant (Fig. 190) is free to rotate throughout its entire tooth contact range.
- Ensure that the quadrant is free to slide the full length of its mounting slot in the adjuster mechanism.
- Inspect the quadrant spring (Fig. 190) for any signs of excessive wear or damage.

CLEANING AND INSPECTION (Continued)

• Ensure that the knurled pin (Fig. 190) is securely attached to the adjuster mechanism and that its teeth are not damaged.

• Overall, examine the adjuster mechanism for excessive wear or damage and replace if necessary.

If the adjuster mechanism is reusable, apply a light coat of Mopar Multi-Purpose Lubricant or equivalent, between the quadrant and the strut of the adjuster mechanism (Fig. 190).

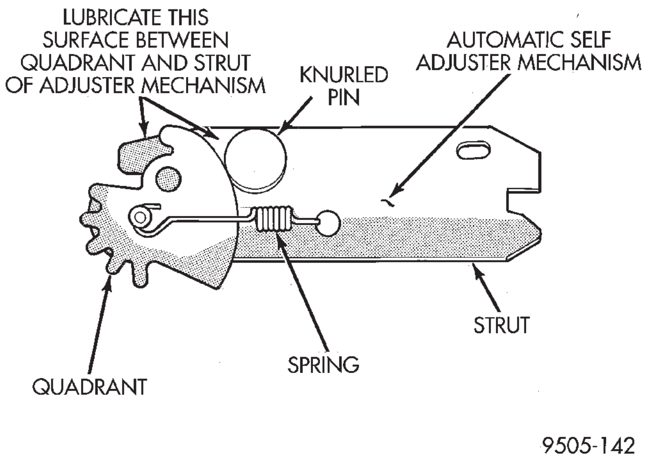


Fig. 190 Automatic Self Adjuster Mechanism

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

DRUM BRAKE WHEEL CYLINDER

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

BRAKE TUBES AND HOSES

Flexible rubber hose is used at both front and rear brakes. Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for severe surface cracking, scuffing, worn spots or physical damage. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

The steel brake tubing should be inspected periodically for evidence of corrosion, physical damage or contact with moving or hot components of the vehicle.

ADJUSTMENTS

DRUM BRAKE SHOES

NOTE: Unique to this vehicle is a new fully automatic adjusting mechanism (Fig. 191) for the rear drum brakes. The rear drum brakes used on this vehicle have no provisions to be manually adjusted and should not require manual brake shoe adjustment for the life of the linings. Although in the event of a brake reline, it will require the automatic adjuster to be reset. After resetting the automatic adjuster the initial adjustment procedure must be done prior to driving the vehicle.

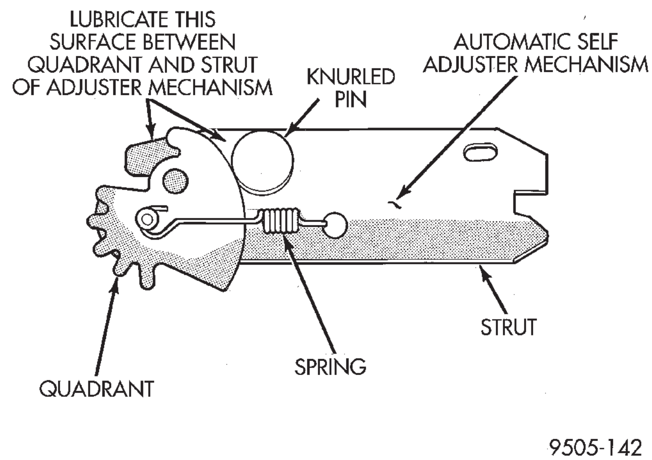


Fig. 191 Rear Drum Brake Automatic Self Adjuster Mechanism

REAR DRUM BRAKE INITIAL ADJUSTMENT PROCEDURE

(1) **Be sure parking brake lever is fully released.**

(2) Fully apply the vehicles service brakes 2 to 3 times by depressing the brake pedal as far as possible. This will cause the automatic adjuster mechanism to correctly adjust the rear drum brakes.

(3) Apply and release the park brake lever one time after the service brakes have been correctly adjusted.

(4) This procedure has correctly adjusted the vehicle's rear service brakes.

PARKING BRAKE

This vehicle uses a bent nail type park brake cable tension equalizer (Fig. 192). The bent nail tension equalizer it to be used only one time to set the park

ADJUSTMENTS (Continued)

brake cable tension. If the park brake cables require adjustment during the life of the vehicle, a **NEW** tension equalizer **MUST** be installed before doing the park cable adjustment procedure.

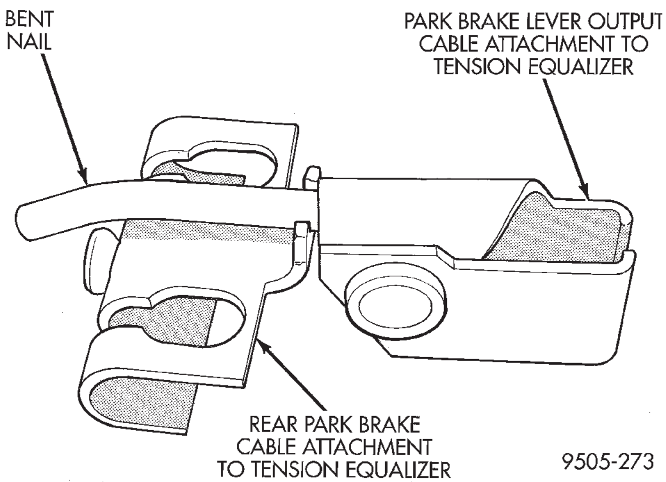


Fig. 192 Bent Nail Park Brake Cable Tension Equalizer

(1) Remove the 3 screws (Fig. 193) attaching the rear of the center console.

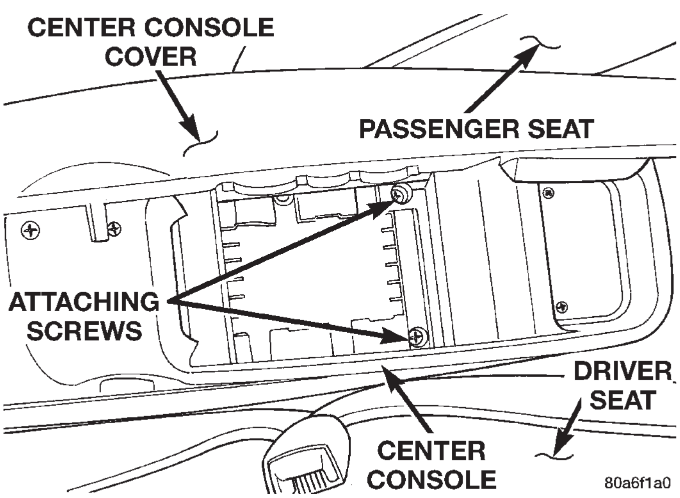


Fig. 193 Center Console Rear Attaching Screws

(2) If vehicle is equipped with an automatic transmission remove the shift knob from the shifter. The gear shift knob is attached to the shifter using a set screw (Fig. 194). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench (Fig. 194).

(3) If the vehicle is equipped with a manual transmission remove the gearshift knob and shifter boot using the following procedure.

• Push shifter boot down to expose clips on gearshift knob and roll pin on shifter handle (Fig. 195).

• Pry the clips on the shifter knob away from the roll pin in the shifter handle using a flat blade pry tool (Fig. 195).

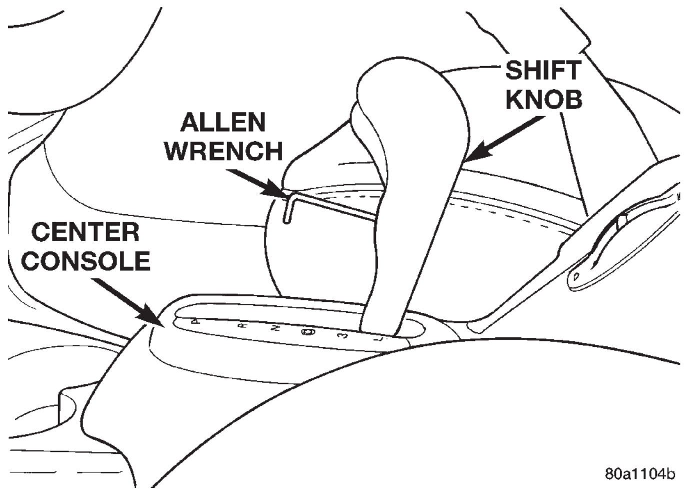


Fig. 194 Shift Knob Retaining Screw

• Remove the shifter knob from the shifter handle, by pulling the shifter knob straight up (Fig. 196).

• Remove the shifter boot from the center console. Shifter boot is removed by squeezing the bezel together at the base of the shifter boot and pulling upward on the boot (Fig. 197).

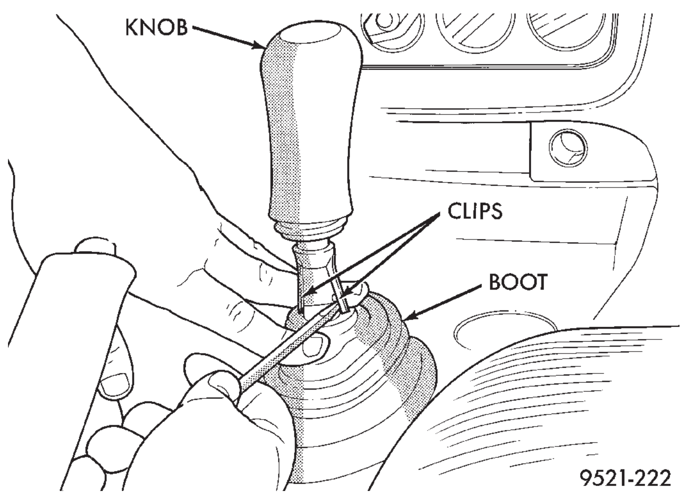


Fig. 195 Gearshift Knob

(4) Remove the 2 screws attaching the front of the center console to the gear selector or shifter (Fig. 198) or (Fig. 199).

(5) Raise the park brake hand lever to approximately the half way point or its travel. This will provide the required clearance to remove center console.

(6) Remove center console/arm rest from vehicle.

(7) Lower park brake lever handle.

(8) Loosen adjusting nut (Fig. 200) on park brake cable output cable. This will take tension off output cable, allowing it to be easily removed from tension equalizer.

ADJUSTMENTS (Continued)

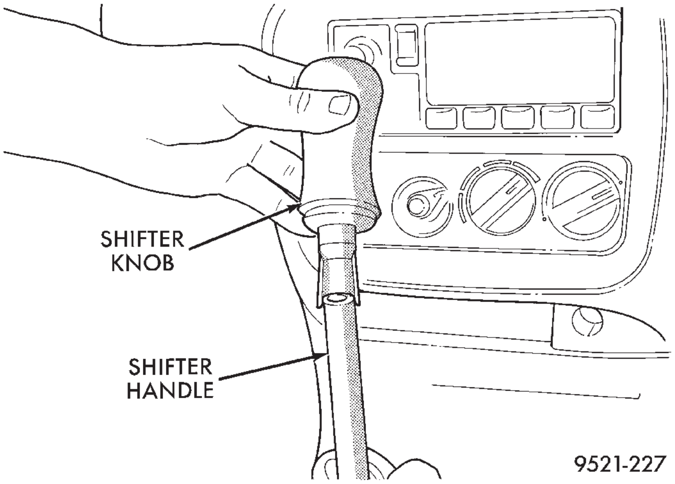


Fig. 196 Gearshift Knob Removal

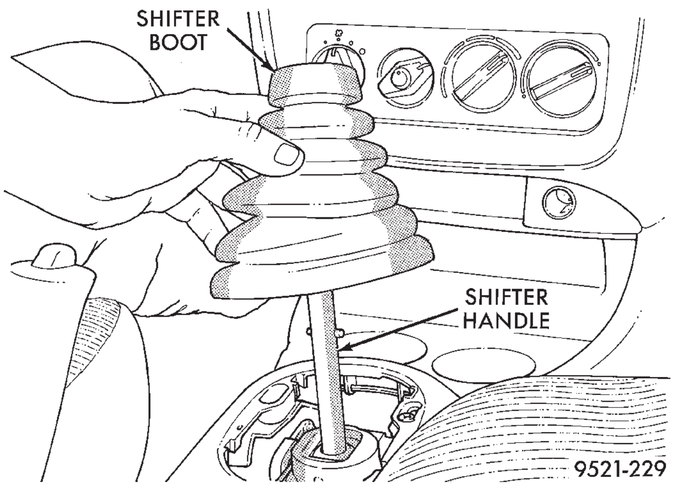


Fig. 197 Boot Removal

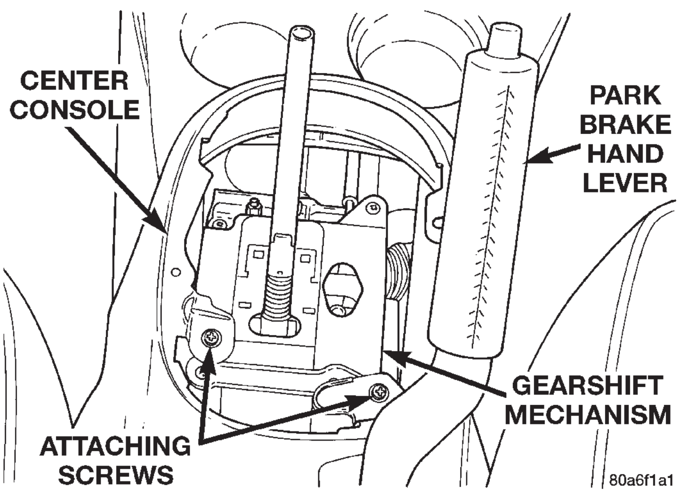


Fig. 198 Center Console Front Attaching Screws (Automatic)

CAUTION: Discard output cable retaining clip after removing it from park brake cable tension equalizer. Retainer is not to be re-used, a new retainer is to be installed when attaching output cable to tension equalizer.

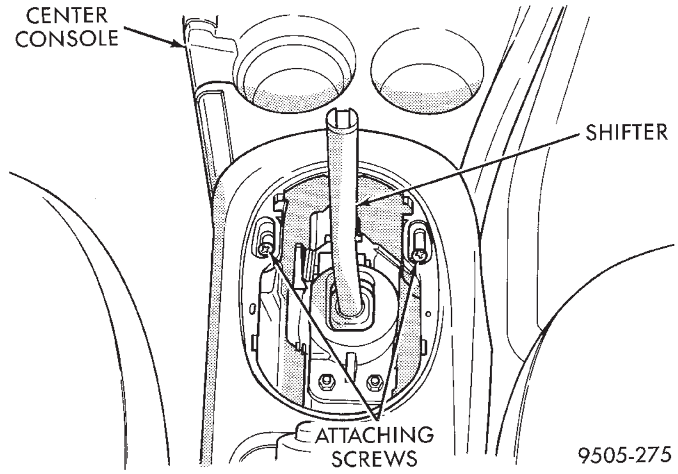


Fig. 199 Center Console Front Attaching Screws (Manual)

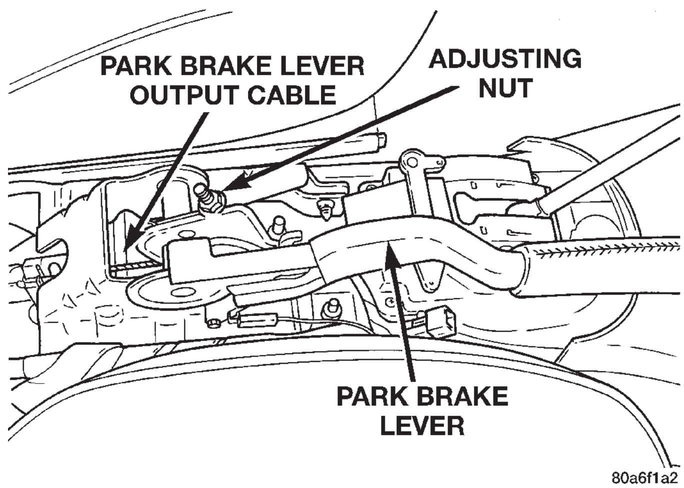


Fig. 200 Park Brake Lever Output Cable Adjustment Nut

(9) Using a screwdriver (Fig. 201) unlatch the park brake output cable retainer. Then remove cable retainer from park brake cable tension equalizer.

(10) Remove the park brake cable tension equalizer from the park brake lever output cable and the rear park brake cables (Fig. 202).

CAUTION: A new cable tension equalizer must be installed when adjusting park brake cable tension.

(11) Install a **NEW** park brake cable tension equalizer on the park brake lever output cable and rear park brake cables (Fig. 202).

ADJUSTMENTS (Continued)

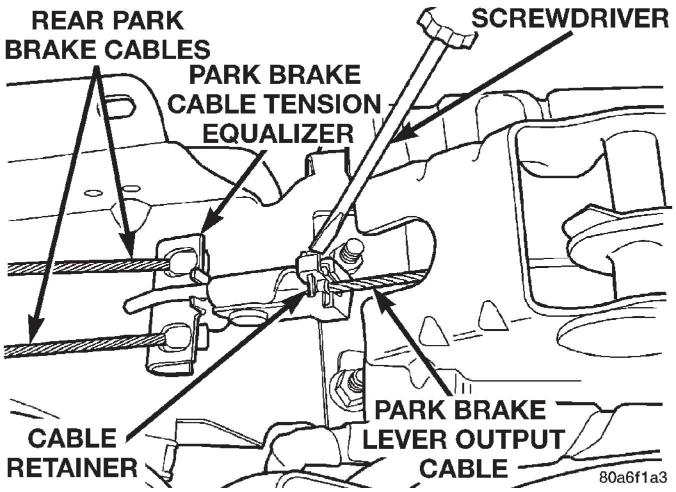


Fig. 201 Output Cable To Equalizer Retaining Clip

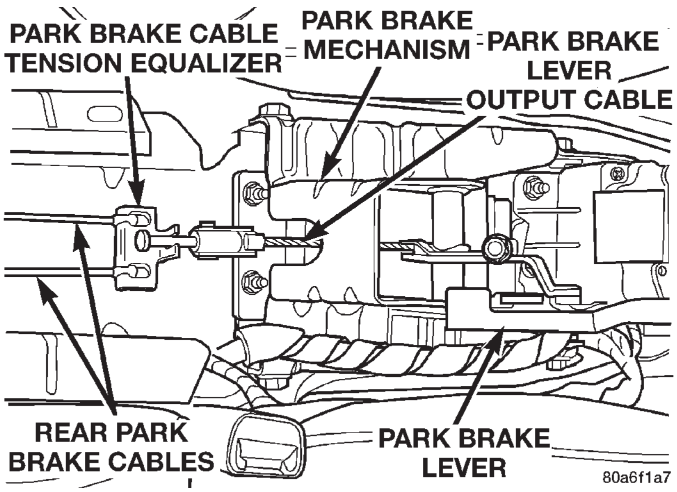


Fig. 202 Park Brake Cable Tension Equalizer

CAUTION: A new park brake lever output cable retainer must be used when installing output cable on cable tension equalizer. Cable retainer usage is required to ensure output cable can not separate from tension equalizer.

(12) Install a **new** park brake lever output cable to tension equalizer retaining clip (Fig. 203) on tension equalizer. The cable retainer (Fig. 203) must be closed and securely latched.

(13) Adjust cable tension for the parking brake system using the following steps.

• Position park brake lever so it is in the fully released position.

• On vehicles with REAR DRUM BRAKES, tighten the adjusting nut on the parking brake lever output cable until 12 mm millimeters of thread is out past top edge of adjustment nut (Fig. 204).

• On vehicles with REAR DISC BRAKES, tighten the adjusting nut on the parking brake lever output cable until 26 mm millimeters of thread is out past top edge of adjustment nut (Fig. 205).

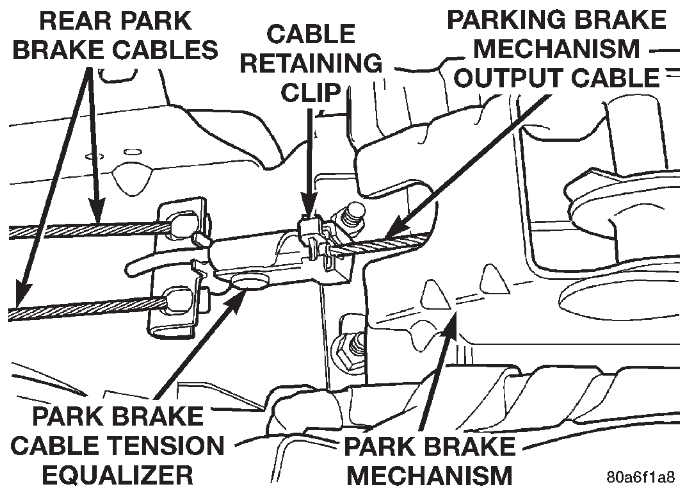


Fig. 203 Cable Retainer Installed On Tension Equalizer

• Actuate the parking brake lever to its fully applied position (22 clicks) 1 time and then reposition the lever to its fully released position.

NOTE: Actuating the parking brake lever to its fully applied position one time after tightening the adjustment nut will yield (stretch) the bent nail portion of the tension equalizer approximately 1/4 inch. This process will correctly set the parking brake cable tension.

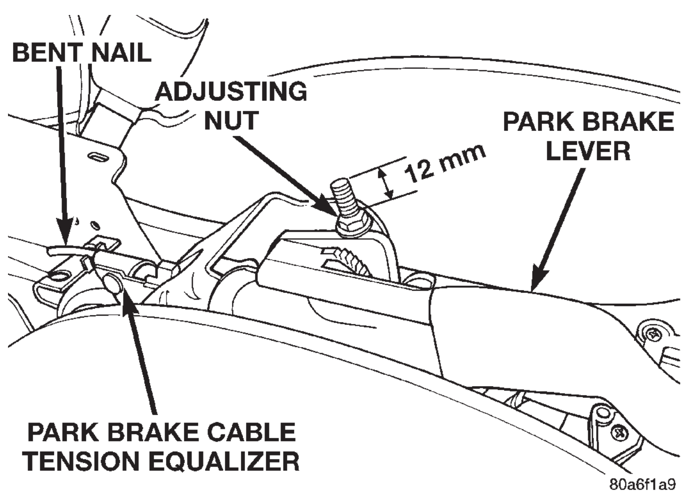


Fig. 204 Parking Brake Adjustment (Rear Drum Brakes)

(14) Check the rear wheels of the vehicle; they should rotate freely without dragging.

(15) After the park brake cable tension has been properly adjusted, check for free play in park brake lever. Park brake hand lever should feel firm at all clicks, with a maximum of 21 clicks of lever travel possible.

(16) Install the 2 screws attaching the front of the center console (Fig. 198) or (Fig. 199).

ADJUSTMENTS (Continued)

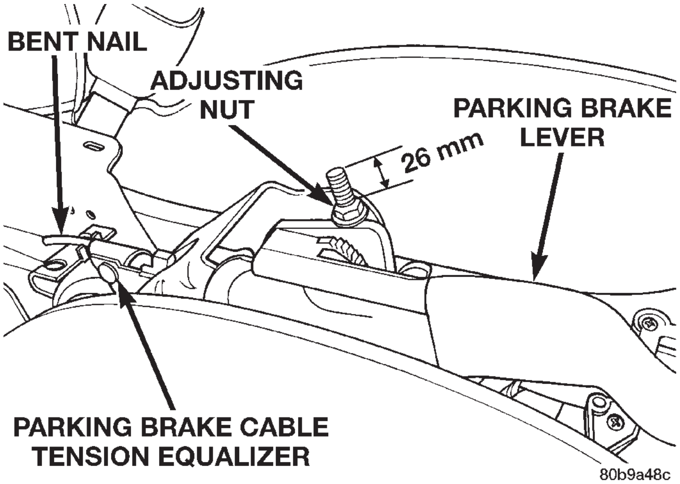


Fig. 205 Parking Brake Adjustment (Rear Disc Brakes)

(17) Install screws attaching rear of center console assembly to console bracket.

(18) Install the shifter boot or PRNDL plate back in the center console.

(19) Install the shift knob on the shifter (Fig. 194) or (Fig. 196).

STOP LAMP SWITCH

(1) Remove stop lamp switch from its bracket by rotating it approximately 30° in a counter-clockwise direction.

(2) Disconnect wiring harness connector from stop lamp switch.

(3) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(4) Install the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then while keeping the brake pedal depressed, install the stop lamp switch into the bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in the square hole of the bracket, rotate switch clockwise approximately 30° to lock the switch into the bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If too much force is used, damage to the vacuum booster, stop lamp switch or striker (Fig. 206) can result.

(5) Connect the wiring harness connector to the stop lamp switch.

(6) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger (Fig. 206) to ratchet backward to the correct position.

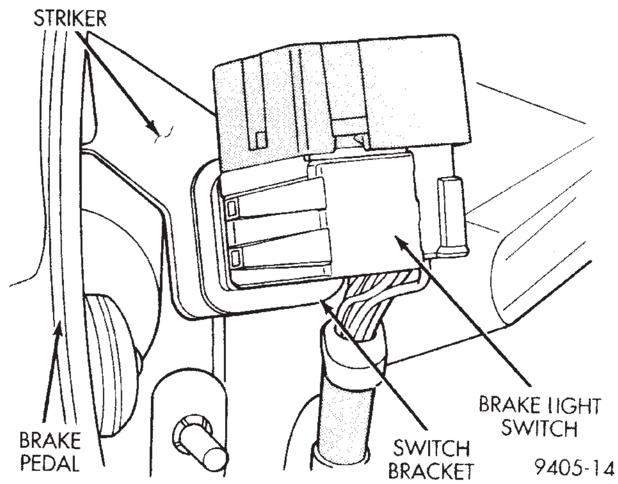


Fig. 206 Stop Light Switch Location In Vehicle

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

SPECIFICATIONS (Continued)

BRAKE ACTUATING SYSTEM

ACTUATION:
Vacuum Operated Power Brakes . . . . Standard
Hydraulic System . . . . Dual-Diagonally Split
MASTER CYLINDER ASSEMBLY:
Type . . . . Bosch
Body Material . . . . Anodized Aluminum
Reservoir Material . . . . Polypropelene
MASTER CYLINDER BORE / STROKE AND SPLIT:
Non ABS . . 22.2 mm x 33.4 mm (.874 in. x 1.32 in.)
ABS . . . . . 22.2 mm x 33.4 mm (.874 in. x 1.32 in.)
Displacement Split . . . . 50 / 50
MASTER CYLINDER FLUID OUTLET PORTS:
ABS . . . . Primary 3/8–24 Secondary 7/16–24
Non ABS . . . . Primary Inboard And Outboard 7/16–24
Non ABS . . . . Secondary Inboard And Outboard 3/8–23
Outlet Fitting Type . . . . Double Wall Inverted Flare
ABS HYDRAULIC CONTROL UNIT:
Hydraulic Tube Fitting Type . . . . Double Wall Inverted Flare
BOOSTER:
Make/Type . . . . Bosch Vacuum W/&W/O ABS
Mounting Studs . . . . M8 x 1.25
Type . . . . 205 mm Tandem
Boost At 20 inches Of Manifold Vacuum . . . . 4690 All
SCREW IN PROPORTIONING VALVE:
Material . . . . Aluminum
Function . . . . Hydraulic Pressure Proportioning
BRAKE PEDAL
Pedal Ratio 3.32

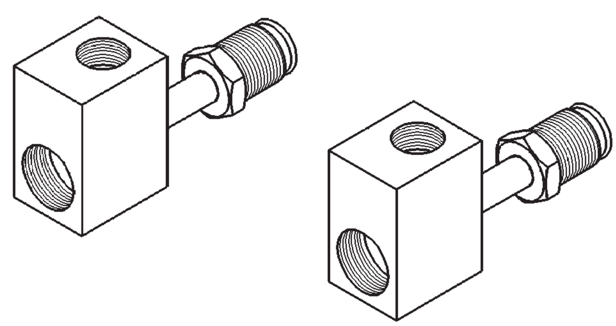
BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION **TORQUE**
MASTER CYLINDER:
Mounting Nuts . . . . 28 N·m (250 in. lbs.)
POWER BRAKE BOOSTER:
Dash Panel Mounting Nuts . . . . 28 N·m (250 in. lbs.)
BRAKE TUBES:
Tube Nuts . . . . 17 N·m (145 in. lbs.)
BRAKE HOSES:
Caliper Banjo Bolt . . . . 48 N·m (35 ft. lbs.)
Intermediate Bracket Bolt . . . 23 N·m (17 ft. lbs.)
DISC BRAKE CALIPER (ALL):
Guide Pin Bolts . . . . 22 N·m (192 in. lbs.)
Bleeder Screw . . . . 15 N·m (125 in. lbs.)
REAR WHEEL CYLINDER:
Mounting Bolts . . . . 11 N·m (97 in. lbs.)

DESCRIPTION **TORQUE**
Bleeder Screw . . . . 10 N·m (80 in. lbs.)
INTEGRATED CONTROL UNIT:
Mounting Bolts To Bracket . . . 11 N·m (97 in. lbs.)
Bracket To Crossmember Bolts . . . . 28 N·m (250 in. lbs.)
CAB Mounting bolts . . . . 2 N·m (17 in. lbs.)
REAR BRAKE SHOE SUPPORT PLATE:
Mounting Bolts . . . . 63 N·m (46 ft. lbs.)
REAR DISC BRAKE ADAPTER:
Mounting Bolts . . . . 63 N·m (46 ft. lbs.)
PARKING BRAKE:
Lever Mounting Nuts . . . . . . 28 N·m (250 in. lbs.)
REAR HUB AND BEARING:
Retaining Nut . . . . 250 N·m (185 ft. lbs.)
WHEEL SPEED SENSOR:
Head Mounting bolt . . . . 7 N·m (60 in. lbs.)
TIRE AND WHEEL:
Wheel Mounting Nut . . . . 109–150 N·m (80–110 ft. lbs.)

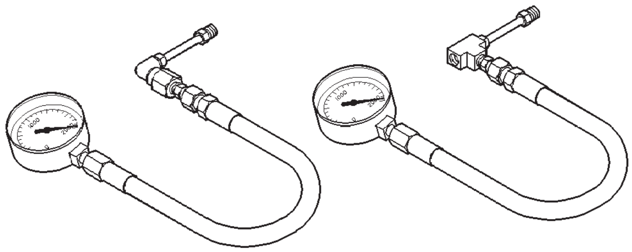
SPECIAL TOOLS

BASE BRAKE SYSTEM

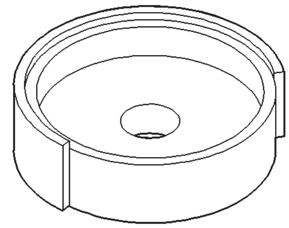


Adapters, Brake Pressure Test 8187

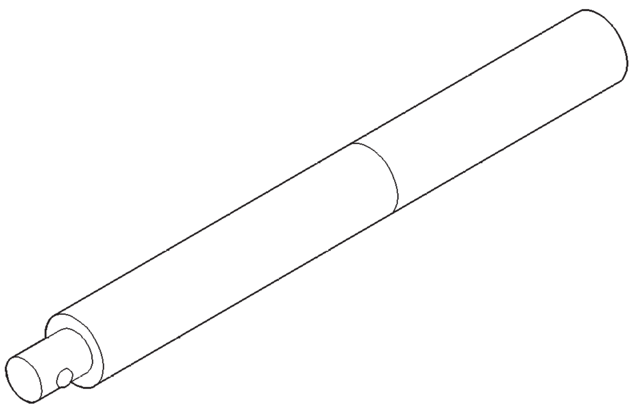
SPECIAL TOOLS (Continued)



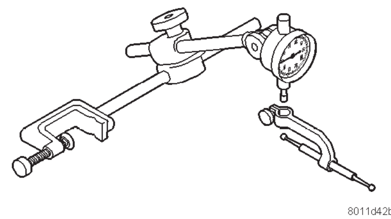
Gauge Set C-4007-A



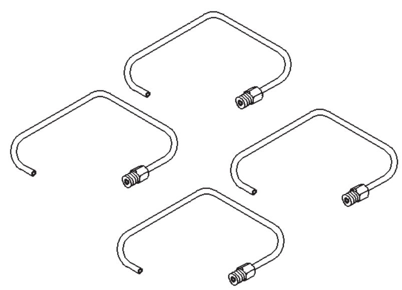
Installer, Dust Boot C-4689



Handle, Universal C-4171



Dial Indicator C-3339



Tubes, Master Cylinder Bleeding 6802

ANTILOCK BRAKE SYSTEM

INDEX

DESCRIPTION AND OPERATION

ANTILOCK BRAKE SYSTEM OPERATION

This section covers the physical and operational descriptions and the on-car service procedures for the ITT Teves Mark 20 Antilock Brake System.

The purpose of the antilock brake system (ABS) is to prevent wheel lockup under braking conditions on virtually any type of road surface. Antilock braking is desirable because a vehicle that is stopped without locking the wheels retains directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking.

There are a few performance characteristics of the ITT Teves Mark 20 Antilock Brake System that may at first seem abnormal, but in fact are normal. These characteristics are described below.

NORMAL BRAKING

Under normal braking conditions, the ABS functions the same as a standard base brake system with a diagonally split master cylinder and conventional vacuum assist.

ABS BRAKING

ABS operation is available at all vehicle speeds above 3–5 mph. If a wheel locking tendency is detected during a brake application, the brake system enters the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

During an ABS stop, the brakes hydraulic system is still diagonally split. However, the brake system pressure is further split into four control channels. During antilock operation of the vehicle's brake system, the front wheels are controlled independently and are on two separate control channels, and the rear wheels of the vehicle are controlled together.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the controller antilock brake (CAB).

NOISE AND BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping, or groaning noises heard by the driver. This is normal and is due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

DESCRIPTION AND OPERATION (Continued)

At the end of an ABS stop, ABS is turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less than 3 mph or during an ABS stop where ABS is no longer required. These conditions exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel, or sand on it. Also, stopping a vehicle on a bumpy road surface activates ABS because of the wheel hop caused by the bumps.

TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lockup, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows: 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25–30 percent. This means that the wheel rolling velocity is 25–30 percent less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lockup.

Complete wheel lockup normally leaves black tire marks on dry pavement. The ABS will not leave dark black tire marks since the wheel never reaches a fully locked condition. However, tire marks may be noticeable as light patched marks.

START-UP CYCLE

When the ignition is turned on, a popping sound and a slight brake pedal movement may be noticed. The ABS warning lamp will also be on for up to 5 seconds after the ignition is turned on. When the vehicle is first driven off, a humming may be heard or felt by the driver at approximately 20–40 kph (12–25 mph). All of these conditions are a normal function of ABS as the system is performing a diagnosis check.

PREMATURE ABS CYCLING

Symptoms of premature ABS cycling include: clicking sounds from the solenoid valves; pump/motor running; and pulsations in the brake pedal. Premature ABS cycling can occur at any braking rate of the vehicle and on any type of road surface. Neither the red BRAKE warning lamp, nor the amber ABS warning lamp, illuminate and no fault codes are stored in the CAB.

Premature ABS cycling is a condition that needs to be correctly assessed when diagnosing problems with the antilock brake system. It may be necessary to use a DRB scan tool to detect and verify premature ABS cycling.

Check the following common causes when diagnosing premature ABS cycling: damaged tone wheels; incorrect tone wheels; damaged steering knuckle wheel speed sensor mounting bosses; loose wheel speed sensor mounting bolts; excessive tone wheel runout; or an excessively large tone wheel-to-wheel speed sensor air gap. Give special attention to these components when diagnosing a vehicle exhibiting premature ABS cycling.

After diagnosing the defective component, repair or replace it as required. When the component repair or replacement is completed, test drive the vehicle to verify that premature ABS cycling has been corrected.

ANTILOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the antilock brake system components. For information on servicing base brake system components used in conjunction with these components, see the BASE BRAKE SYSTEM found at the beginning of this service manual group.

MASTER CYLINDER

A vehicle equipped with ABS uses a different master cylinder (Fig. 1) than a vehicle that is not equipped with ABS. Vehicles equipped with ABS use a center port master cylinder while vehicles not equipped with ABS use a compensating port master cylinder.

The brake tubes from the primary and secondary outlet ports on the master cylinder go directly to the hydraulic control unit (HCU).

Refer to the BASE BRAKE SYSTEM at the beginning of this service manual group for further information and service procedures on master cylinders.

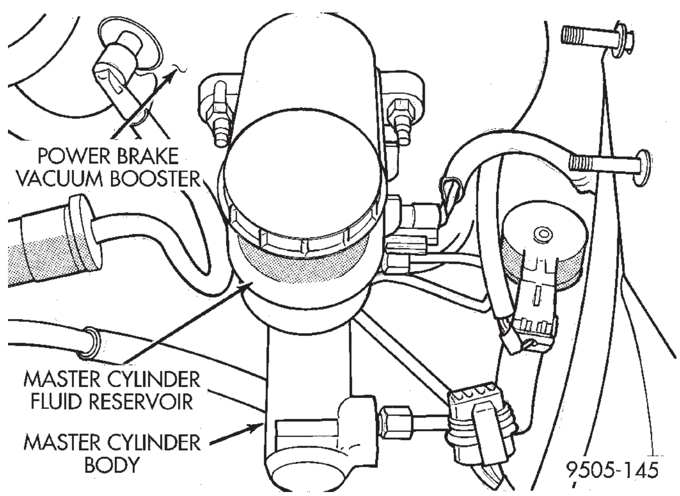


Fig. 1 Master Cylinder

DESCRIPTION AND OPERATION (Continued)

INTEGRATED CONTROL UNIT (ICU)

The hydraulic control unit (HCU) and the controller antilock brake (CAB) used with this antilock brake system are combined (integrated) into one unit, which is called the integrated control unit (ICU) (Fig. 2). The ICU is located on the passenger's side of the vehicle, and is mounted on top of the front suspension crossmember (Fig. 3). It can be accessed from under the vehicle.

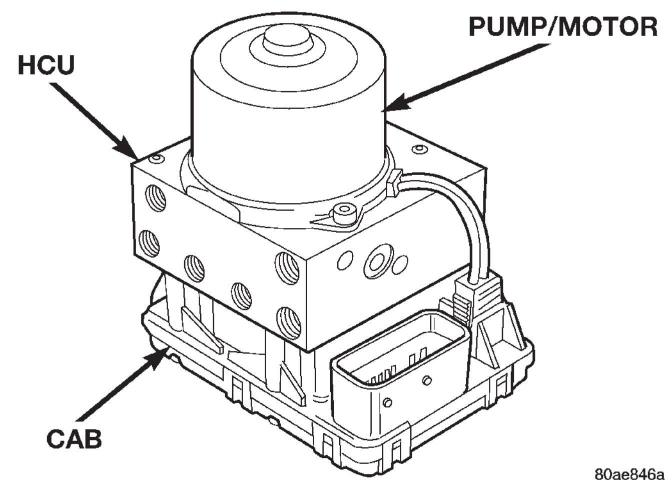


Fig. 2 Integrated Control Unit (ICU)

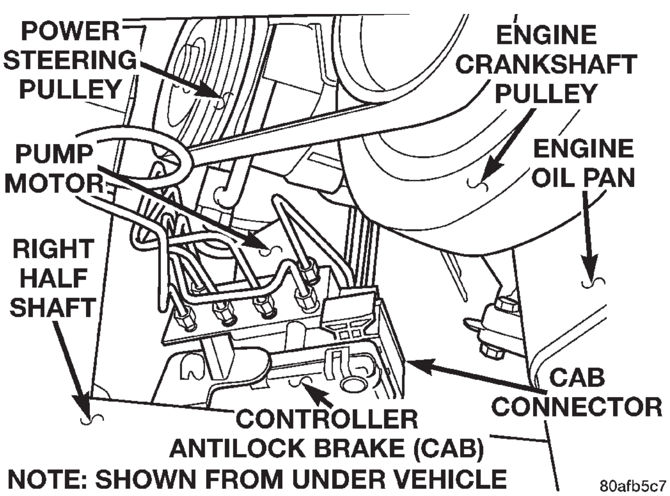


Fig. 3 ICU Mounting Location

The ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), valve block, fluid accumulators, a pump, and an electric motor.

The replaceable components of the ICU are the HCU and the CAB. No attempt should be made to service any individual components of the HCU or CAB.

CONTROLLER ANTILOCK BRAKE (CAB)

The controller antilock brake (CAB) is a microprocessor-based device which monitors the ABS system during normal braking and controls it when the vehicle is in an ABS stop. The CAB is mounted to the bottom of the HCU (Fig. 2). The CAB uses a 25-way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the RUN or ON position. The CAB is on the CCD bus.

The primary functions of the CAB are to:

(1) monitor the antilock brake system for proper operation.

(2) detect wheel locking or wheel slipping tendencies by monitoring the speed of all four wheels of the vehicle.

(3) control fluid modulation to the wheel brakes while the system is in an ABS mode.

(4) store diagnostic information.

(5) provide communication to the DRB scan tool while in diagnostic mode.

The CAB constantly monitors the antilock brake system for proper operation. If the CAB detects a fault, it will turn on the amber ABS warning lamp and disable the antilock braking system. The normal base braking system will remain operational.

The CAB continuously monitors the speed of each wheel through the signals generated by the wheel speed sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the CAB commands the CAB command coils to actuate. The CAB command coils then open and close the valves in the HCU that modulate brake fluid pressure in some or all of the hydraulic circuits. The CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The CAB contains a self-diagnostic program that monitors the antilock brake system for system faults. When a fault is detected, the amber ABS warning lamp is turned on and the fault diagnostic trouble code (DTC) is then stored in a diagnostic program memory. These DTC's will remain in the CAB memory even after the ignition has been turned off. The DTC's can be read and cleared from the CAB memory by a technician using the DRB scan tool. If not cleared with a DRB scan tool, the fault occurrence and DTC will be automatically cleared from the CAB memory after the identical fault has not been seen during the next 3,500 miles.

CONTROLLER ANTILOCK BRAKE INPUTS

- wheel speed sensors (four)
- stop lamp switch
- ignition switch
- system voltage
- ground
- diagnostic communication (CCD)

DESCRIPTION AND OPERATION (Continued)

CONTROLLER ANTILOCK BRAKE OUTPUTS

- amber ABS warning lamp actuation
- instrument cluster (MIC)
- diagnostic communication (CCD)

HYDRAULIC CONTROL UNIT (HCU)

The hydraulic control unit (HCU) is mounted to the CAB as part of the ICU (Fig. 4). The ICU is located on the passenger's side of the vehicle, and is mounted on top of the front suspension crossmember (Fig. 3). It can be accessed from under the vehicle. The HCU controls the flow of brake fluid to the brakes using a series of valves and accumulators. A pump/motor is mounted on the HCU to supply build pressure to the brakes during an ABS stop.

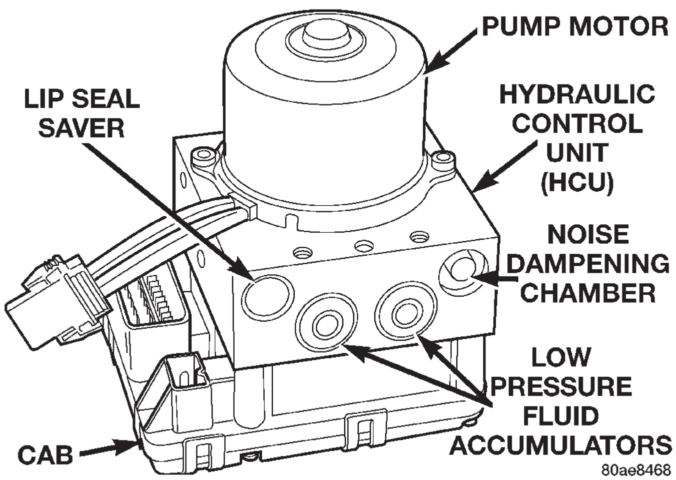


Fig. 4 Integrated Control Unit (ICU)

For more information, see INTEGRATED CONTROL UNIT in this section.

VALVES AND SOLENOIDS

The valve block contains four inlet valves and four outlet valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring-loaded in the closed position during normal braking. The fluid is allowed to flow from the master cylinder to the wheel brakes.

During an ABS stop, these valves cycle to maintain the proper slip ratio for each wheel. The inlet valve closes preventing further pressure increase and the outlet valve opens to provide a path from the wheel brake to the HCU accumulators and pump/motor. This releases (decays) pressure from the wheel brake, thus releasing the wheel from excessive slippage. Once the wheel is no longer slipping, the outlet valve is closed and the inlet valve is opened to reapply (build) pressure.

BRAKE FLUID ACCUMULATORS

There are two fluid accumulators in the HCU–one for the primary hydraulic circuit and one for the secondary hydraulic circuit (Fig. 4). Each hydraulic circuit uses a 5 cc accumulator.

The fluid accumulators temporarily store brake fluid that is removed from the wheel brakes during an ABS cycle. This stored fluid is used by the pump/motor to provide build pressure for the brake hydraulic system. When the antilock stop is complete, the accumulators are drained by the pump/motor.

On ABS-only vehicles, there is a mini-accumulator on the secondary hydraulic circuit that protects the master cylinder seals during an ABS stop, and there is a noise dampening chamber on the primary circuit.

PUMP/MOTOR

There are two pump assemblies in the HCU–one for the primary hydraulic circuit and one for the secondary hydraulic circuit. Both pumps are driven by a common electric motor (Fig. 4). This DC-type motor is integral to the HCU and is controlled by the CAB.

The pump/motor provides the extra amount of brake fluid needed during antilock braking. Brake fluid is released to the accumulators when the outlet valve is opened during an antilock stop. The pump mechanism consists of two opposing pistons operated by an eccentric camshaft. In operation, one piston draws fluid from the accumulators, and the opposing piston pumps fluid to the master cylinder circuits. When the antilock stop is complete, the pump/motor drains the accumulators.

The CAB may turn on the pump/motor when an antilock stop is detected. The pump/motor continues to run during the antilock stop and is turned off after the stop is complete. Under some conditions, the pump/motor runs to drain the accumulators during the next drive-off.

The pump/motor is not a serviceable item; if it requires replacement, the HCU must be replaced.

PROPORTIONING VALVE

There are two proportioning valves (Fig. 5) used in the antilock brake system. One proportioning valve is located in the chassis brake tube leading to each rear wheel brake hydraulic circuit (Fig. 6). The proportioning valve can be identified by its bar code label and stamp. Be sure a replacement proportioning valve has the same stamp as the proportioning valve being replaced.

The ABS proportioning valves function the same as the proportioning valves in the base brake system.

ABS FUSES

The ABS fuses and the ABS pump/motor fuse are located in the power distribution center (PDC). Refer to the sticker on the inside of the PDC cover for the location of these fuses or use the following figure (Fig. 7). The PDC is located on the driver's side of

DESCRIPTION AND OPERATION (Continued)

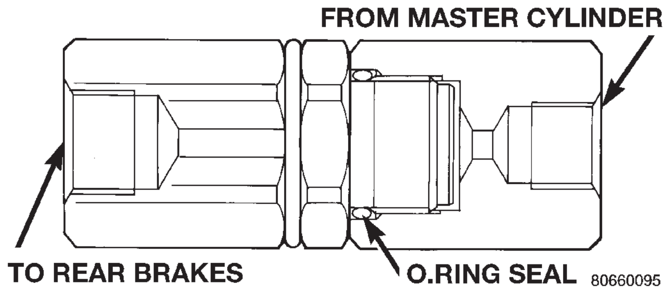


Fig. 5 Proportioning Valve

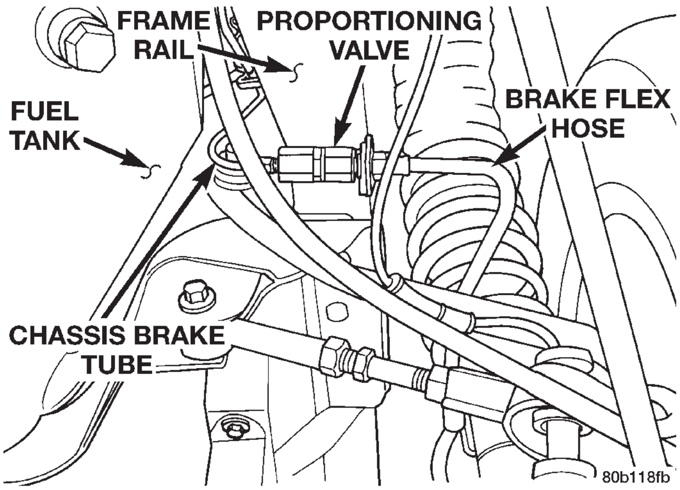


Fig. 6 Proportioning Valve Location In Vehicle

the engine compartment between the radiator and the brake master cylinder.

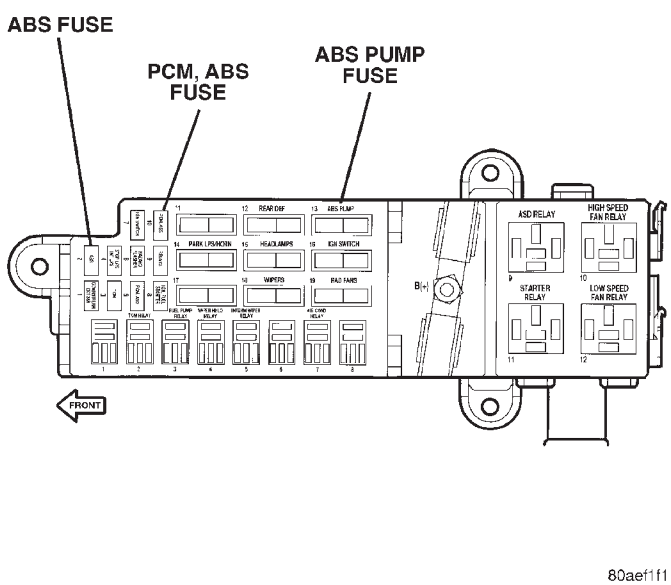


Fig. 7 Fuse Location

ABS RELAYS (SOLID STATE)

Two internal relays (drivers) are used to control the antilock brake system. The two relays are the pump/motor relay and the system relay. The pump/motor relay and the system relay are located in the CAB. If either the pump/motor relay or the system relay is diagnosed as not functioning properly, the CAB must be replaced. Refer to INTEGRATED CONTROL UNIT in the DISASSEMBLY AND ASSEMBLY section in this section of this service manual group for the procedure to remove the CAB from the HCU.

AMBER ABS WARNING LAMP

The amber ABS warning lamp is located on the left side of the instrument cluster. The purpose of the warning lamp is discussed in detail below.

When the ignition key is turned to the ON position, the amber ABS warning lamp is lit until the CAB completes its self-tests and turns off the lamp (approximately 4 seconds). The amber ABS warning lamp will illuminate when the CAB detects a condition that results in the shutdown of ABS function or when the body control module (BCM) does not receive messages from the CAB. The CAB turns on the amber ABS warning lamp by grounding the circuit.

Under most conditions, when the amber ABS warning lamp is on, only the ABS function of the brake system is affected; the base brake system and the ability to stop the vehicle are not affected.

WHEEL SPEED SENSOR (WSS) AND TONE WHEEL

One wheel speed sensor (WSS) and one tone wheel are located at each front (Fig. 8) and rear (Fig. 9) (Fig. 10) wheel. Each front wheel speed sensor is attached to a boss in the steering knuckle. The front tone wheel is part of the outboard constant velocity joint. The rear wheel speed sensor on rear drum brake applications is mounted to the brake support plate. The rear wheel speed sensor on rear disc brake applications is mounted to the rear disc brake adapter. The rear tone wheel is an integral part of the rear wheel hub and bearing.

The wheel speed sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction created when a toothed sensor ring (tone wheel) (Fig. 8) (Fig. 9) (Fig. 10) passes the stationary magnetic wheel speed sensor. The CAB converts the AC signal into a digital signal. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

Correct ABS operation is dependent on accurate wheel speed signals. The vehicle's tires and wheels all must be the same size and type to generate accurate signals. Variations in tire and wheel size can produce inaccurate wheel speed signals.

Improper speed sensor-to-tone wheel clearance can cause erratic speed sensor signals. The speed sensor air gap is not adjustable, but should be checked when

DESCRIPTION AND OPERATION (Continued)

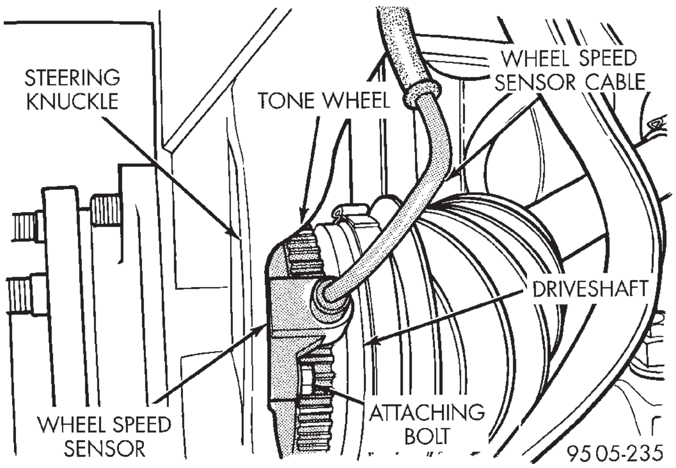


Fig. 8 Front Wheel Speed Sensor

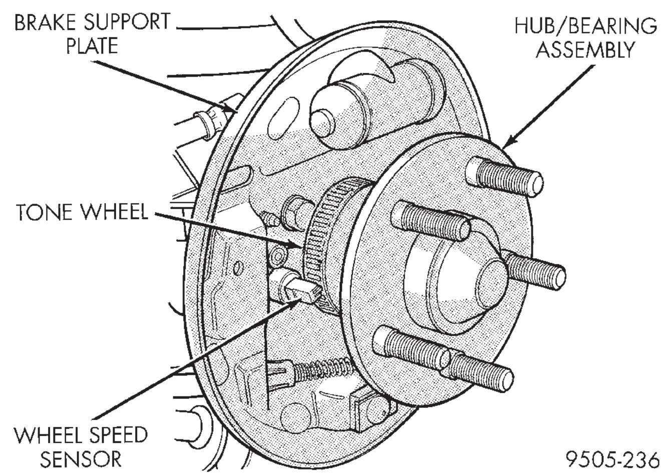


Fig. 9 Rear Wheel Speed Sensor With Drum Brakes

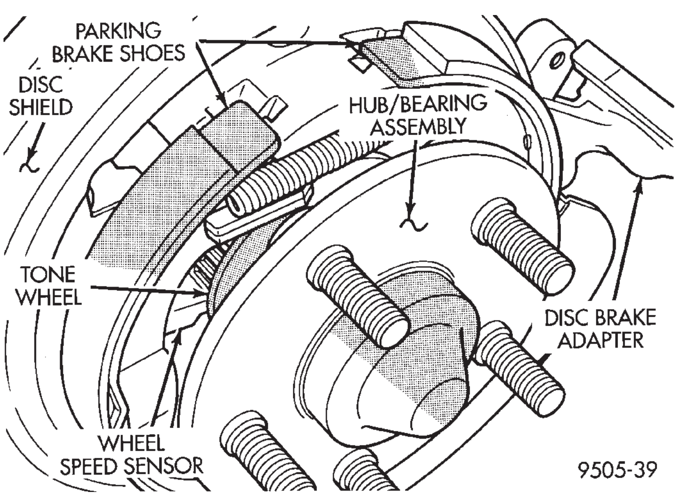


Fig. 10 Rear Wheel Speed Sensor With Disc Brakes

applicable. Wheel speed sensor-to-tone wheel clearance specifications can be found in the SPECIFICATIONS section in this section of this service manual group.

HYDRAULIC CIRCUITS AND VALVE OPERATION

The hydraulic fluid control valves control the flow of pressurized brake fluid to the wheel brakes during the different modes of ABS braking. The following paragraphs explain how this works. For purposes of explanation only, it is assumed that only the right front wheel is experiencing antilock braking; the following diagrams show only the right front wheel in an antilock braking operation.

NORMAL BRAKING HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION

The hydraulic diagram (Fig. 11) shows the vehicle in the normal braking mode of the base brake hydraulic system. The diagram shows no wheel spin or slip occurring relative to the speed of the vehicle. The driver is applying the brake pedal; this builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle.

ABS HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION

The hydraulic diagram (Fig. 12) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.
- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.
- The brake fluid is routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

DESCRIPTION AND OPERATION (Continued)

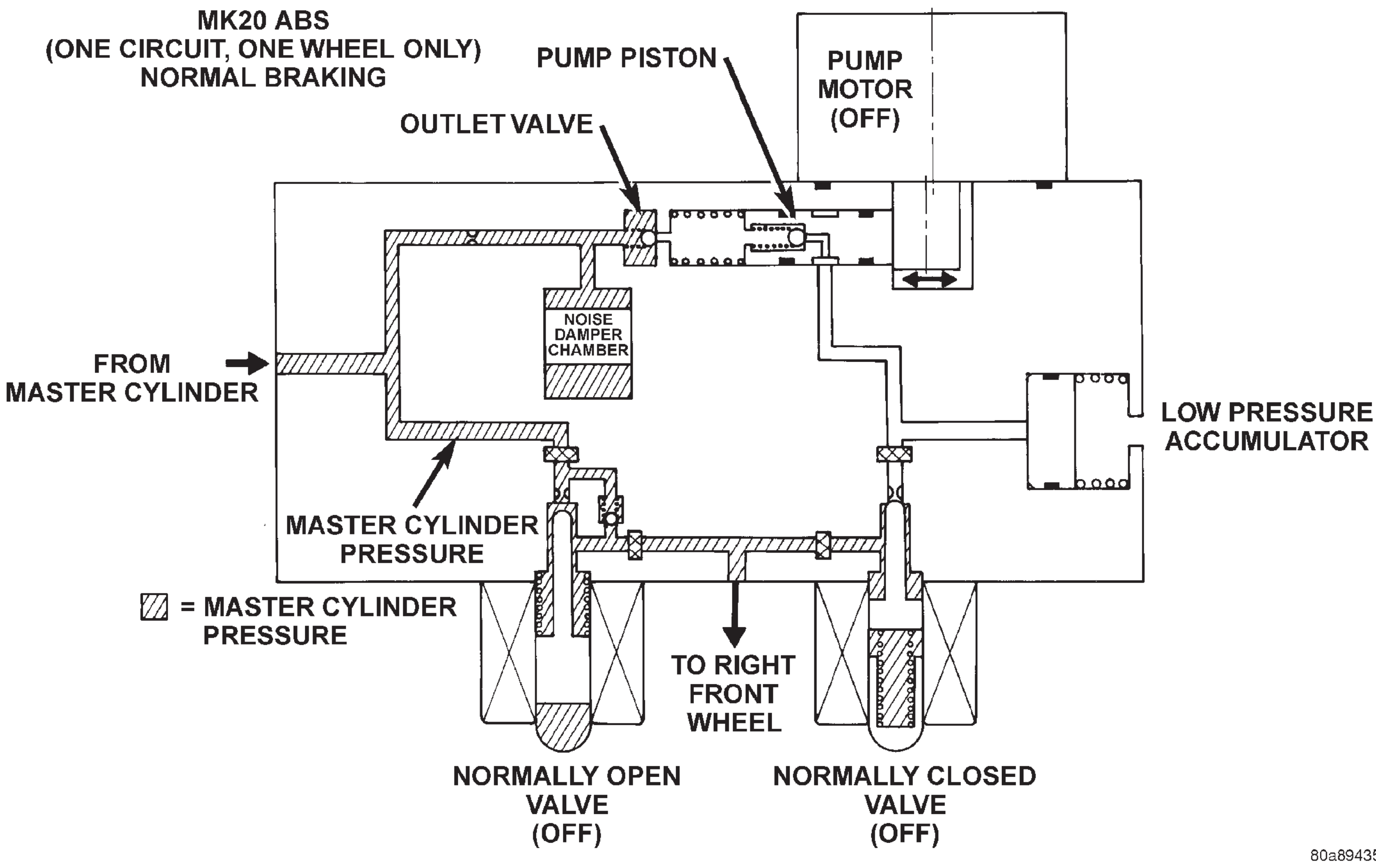


Fig. 11 Normal Braking Hydraulic Circuit

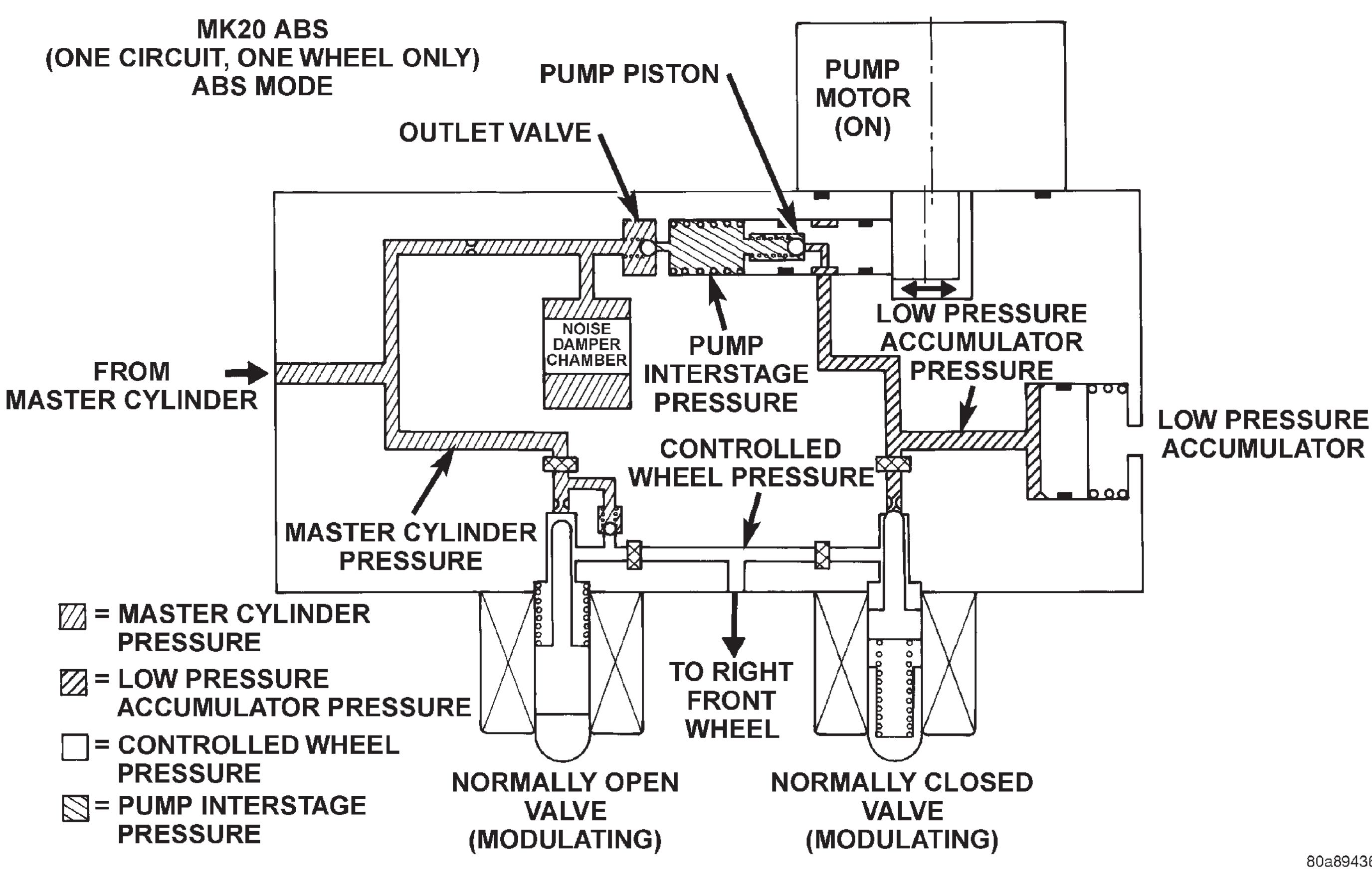


Fig. 12 ABS Without Traction Control - Hydraulic Circuit

DIAGNOSIS AND TESTING

SERVICE WARNINGS AND CAUTIONS

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits.

CAUTION: In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.

CAUTION: These circuits should only be tested using a high impedance multi-meter or the DRB scan tool as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, etc.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

ABS GENERAL DIAGNOSTICS INFORMATION

This section contains information necessary to diagnose the antilock brake system. Specifically, this section should be used to help diagnose conditions which result in any of the following:

(1) amber ABS warning lamp turned on.

(2) brakes lock-up on hard application.

Diagnosis of base brake conditions that are obviously mechanical in nature should be directed to BASE BRAKE SYSTEM at the beginning of this group.

Many ABS conditions judged to be a problem by the driver may be normal operating conditions. See ABS OPERATION in the DESCRIPTION AND OPERATION section of this group to become familiarized with the normal characteristics of this antilock brake system.

ABS WIRING DIAGRAM INFORMATION

During the diagnosis and testing of the antilock brake system it may become necessary to reference the wiring diagrams covering the antilock brake system and its components. For wiring diagrams refer to GROUP 8W of this service manual. It will provide you with the wiring diagrams and the circuit description and operation information covering the antilock brake system.

ABS VEHICLE TEST DRIVE

Most ABS complaints will require a test drive to properly duplicate and diagnose the condition.

WARNING: CONDITIONS THAT RESULT IN TURNING ON THE RED BRAKE WARNING LAMP MAY INDICATE REDUCED BRAKING ABILITY.

Before test driving a brake complaint vehicle, note whether the red BRAKE or amber ABS warning lamp is turned on. If it is the red BRAKE warning lamp, there is a brake hydraulic problem that must be corrected before driving the vehicle. Refer to the BASE BRAKE SYSTEM for diagnosis of the red BRAKE warning lamp. If the amber ABS warning lamp is on, test drive the vehicle as described below. While the amber ABS warning lamp is on, the ABS is not functional. The ability to stop the car using the base brake system should not be affected.

If a functional problem of the ABS is determined while test driving the vehicle, refer to the ITT Teves Mark 20 Antilock Brake System diagnostic manual.

(1) Turn the key to the OFF position and then back to the ON position. Note whether the amber ABS warning lamp continues to stay on. If it does, refer to the diagnostic manual.

(2) If the amber ABS warning lamp goes out, shift into gear and drive the car to a speed of 20 kph (12 mph) to complete the ABS start-up and drive-off cycles (see ABS ELECTRONIC DIAGNOSIS). If at this time the amber ABS warning lamp comes on, refer to the diagnostic manual.

(3) If the amber ABS warning lamp remains out, drive the vehicle a short distance. Accelerate the vehicle to a speed of at least 40 mph. Bring the vehicle to a complete stop, braking hard enough to cause the ABS to cycle. Again accelerate the vehicle past 25 mph. Refer to the diagnostic manual for further testing of the antilock brake system.

ABS ELECTRONIC DIAGNOSIS

The following information is presented to give the technician a general background on the diagnostic capabilities of the ABS system. Complete electronic diagnosis of the ABS system used on this vehicle is covered in the ITT Teves Mark 20 Antilock Brake System diagnostics manual.

Electronic diagnosis of the ABS used on this vehicle is performed using the DRB scan tool. The vehicle's scan tool diagnostic connector is located under the instrument panel, directly next to the left side kick panel (Fig. 13).

DIAGNOSIS AND TESTING (Continued)

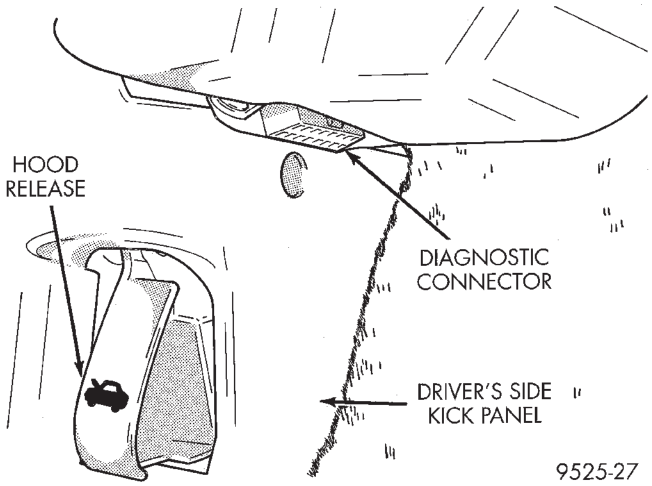


Fig. 13 ABS System Diagnostic Connector Location

ABS SELF-DIAGNOSIS

The ABS system is equipped with a self-diagnosis capability, which may be used to assist in the isolation of ABS faults. The features are described below.

START-UP CYCLE

The self-diagnosis ABS start-up cycle begins when the ignition switch is turned to the ON position. Electrical checks are completed on ABS components, including the CAB, system power, wiring and wheel speed sensors. During this check the amber ABS warning lamp is turned on for approximately 5 seconds and the brake pedal may emit a popping sound, moving slightly when the solenoid valves are checked.

DRIVE-OFF CYCLE

The first time the vehicle is set in motion after an ignition off/on cycle, the drive-off cycle occurs. This cycle is performed when the vehicle reaches a speed of approximately 20 kph (12 mph.).

- The pump/motor is briefly activated to verify function. When the pump/motor is briefly activated, a whirling or buzzing sound may be heard by the driver. This sound is normal, indicating the pump/motor is running.
- The wheel speed sensor output correct operating range is verified.

ONGOING TESTS

While the system is operating, these tests are performed on a continuous basis:

- solenoid continuity
- wheel speed sensor continuity
- wheel speed sensor output
- system voltage
- CAB self-diagnosis
- CCD monitor

DIAGNOSTIC TROUBLE CODES (DTC's)

Diagnostic trouble codes (DTC's) are kept in the controller's memory until either erased by the technician using the DRB, or erased automatically after 3500 miles. DTC's are retained by the controller even if the ignition is turned off or the battery is disconnected. More than one DTC can be stored at a time. When accessed, the number of occurrences and the DTC that is stored are displayed. Most functions of the CAB and the ABS system can be accessed by the technician for testing and diagnostic purposes using the DRB.

LATCHING VERSUS NON-LATCHING DIAGNOSTIC TROUBLE CODES

Some DTC's detected by the CAB are "latching" codes. The DTC is latched and ABS braking is disabled until the ignition switch is reset. Thus, ABS braking is non-operational even if the original DTC has disappeared. Other DTC's are non-latching. Any warning lamps that are turned on are only turned on as long as the DTC condition exists; as soon as the condition goes away, the amber ABS warning lamp is turned off, although, in most cases, a DTC is set.

INTERMITTENT DIAGNOSTIC TROUBLE CODES

As with virtually any electronic system, intermittent electrical problems in the ABS system may be difficult to accurately diagnose. Most intermittent electrical problems are caused by faulty electrical connections or wiring. A visual inspection should be done before trying to diagnose or service the antilock brake system; this will eliminate unnecessary diagnosis and testing time. Perform a visual inspection for loose, disconnected, damaged, or misrouted wires or connectors; include the following components and areas of the vehicle in the inspection.

(1) Inspect fuses in the power distribution center (PDC) and the wiring junction block. Verify that all fuses are fully inserted into the PDC and wiring junction block. A label on the underside of the PDC cover identifies the locations of the ABS fuses.

(2) Inspect the 25-way electrical connector at the CAB for damaged, spread, or backed-out wiring terminals. Verify that the 25-way connector is fully inserted in the socket of the CAB. Be sure that wires are not stretched tight or pulled out of the connector.

(3) Verify that all the wheel speed sensor connections are secure.

(4) Look for poor mating of connector halves or terminals not fully seated in the connector body.

(5) Check for improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

DIAGNOSIS AND TESTING (Continued)

(6) Look for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it.

(7) Verify pin presence in the connector assembly

(8) Check for proper ground connections. Check all ground connections for signs of corrosion, loose fasteners, or other potential defects. Refer to the wiring diagrams for ground locations.

(9) Look for problems with the main power sources of the vehicle. Inspect the battery, generator, ignition circuits and related relays and fuses.

If a visual check does not find the cause of the problem, operate the car in an attempt to duplicate the condition and record any trouble codes.

Most failures of the ABS disable the ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, that allow ABS operation to resume during the ignition cycle in which the trouble occurred even if the trouble conditions are no longer present.

The following trouble conditions may result in intermittent illumination of the amber ABS warning lamp.

- Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the Amber ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

Additional possible causes that may result in the illumination of the amber ABS warning lamp are as follows:

- High system voltage. If high system voltage is detected by the CAB, the CAB will turn on the Amber ABS Warning Lamp. If the ignition key is cycled and normal voltage is again detected by the CAB, normal ABS operation resumes and the lamp remains off.
- Any condition that interrupts electrical current to the CAB may cause the amber ABS warning lamp to turn on intermittently.
- If CCD communication between the body controller and the CAB is interrupted, the body controller can turn on the amber ABS warning lamp.

TONE WHEEL

Tone wheels can cause erratic wheel speed sensor signals. Inspect tone wheels for the following possible causes.

- missing, chipped, or broken teeth
- contact with the wheel speed sensor
- wheel speed sensor to tone wheel alignment
- wheel speed sensor to tone wheel clearance
- excessive tone wheel runout
- tone wheel loose on its mounting surface
- incorrect model year tone wheel (driveshaft) installed

If a front tone wheel is found to need replacement, the drive shaft must be replaced. No attempt should be made to replace just the tone wheel. Refer to the DIFFERENTIAL AND DRIVELINE group in this service manual for removal and installation.

If a rear tone wheel is found to need replacement, the rear hub and bearing must be replaced. No attempt should be made to replace just the tone wheel. Refer to the SUSPENSION group in this service manual for removal and installation.

If wheel speed sensor to tone wheel contact is evident, determine the cause and correct it before replacing the wheel speed sensor or tone wheel.

Check the gap between the speed sensor head and the tone wheel to ensure it is within specifications. Refer to SPECIFICATIONS in this section of the service manual for the minimum and maximum wheel speed sensor to tone wheel clearance.

Excessive wheel speed sensor runout can cause erratic wheel speed sensor signals. Refer to SPECIFICATIONS in this section of the service manual for the maximum allowed tone wheel runout. If tone wheel runout is excessive, determine if it is caused by a defect in the driveshaft assembly or hub and bearing. Replace as necessary.

Tone wheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface. Replacement of the front driveshaft or rear hub and bearing is necessary.

Pre-1998 models of this vehicle used a different antilock brake system which used a different tone wheel. Although the driveshafts may be interchangeable, the tone wheels are not. Do not use a pre-1998 driveshaft or rear hub and bearing on this model year vehicle, or vice-versa.

PROPORTIONING VALVE

NOTE: The following procedure is for the diagnosis and testing of the proportioning valve(s) on a vehicle equipped with ABS. For diagnosis and testing of proportioning valves on a vehicle without ABS, Refer to the BASE BRAKE SYSTEM section in this group.

If a condition of premature rear wheel skid occurs on a vehicle, the proportioning valve should always be tested prior to it being replaced. This is due to the fact that there are conditions other then a faulty proportioning valve which can cause a premature rear wheel skid.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 14). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which is skidding first is determined,

DIAGNOSIS AND TESTING (Continued)

use the following procedure to diagnose the proportioning valve.

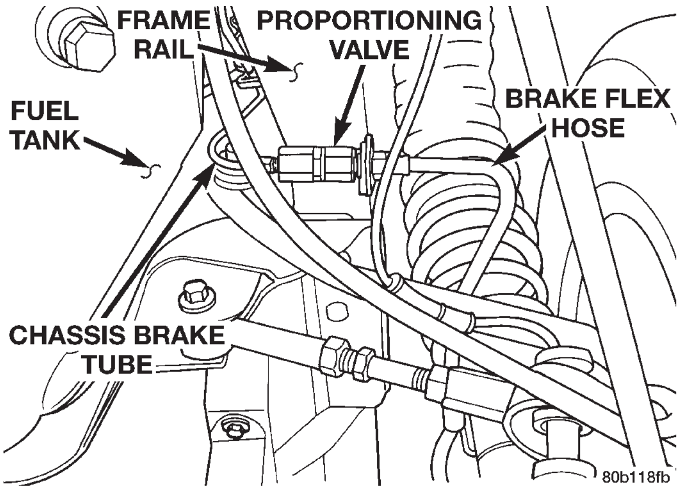


Fig. 14 Proportioning Valve Location

The test procedure is the same for both rear wheel proportioning valves. After road testing vehicle to determine which wheel skids first, follow the procedure below for testing the required proportioning valve.

(1) Remove the chassis brake tube (Fig. 14) from the proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

CAUTION: When removing proportioning valve from flex hose place wrench on proportioning valve (Fig. 15) not adapter fitting. The adapter fitting (Fig. 15) is not to be removed from the proportioning valve.

(2) Remove proportioning valve from brake flex hose (Fig. 15).

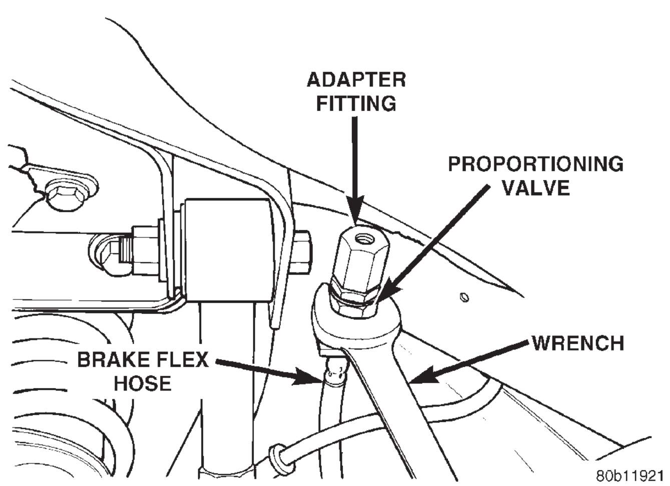


Fig. 15 Proportioning Valve Removal

(3) Remove the brake flex hose mounting bracket (Fig. 16) from the frame rail.

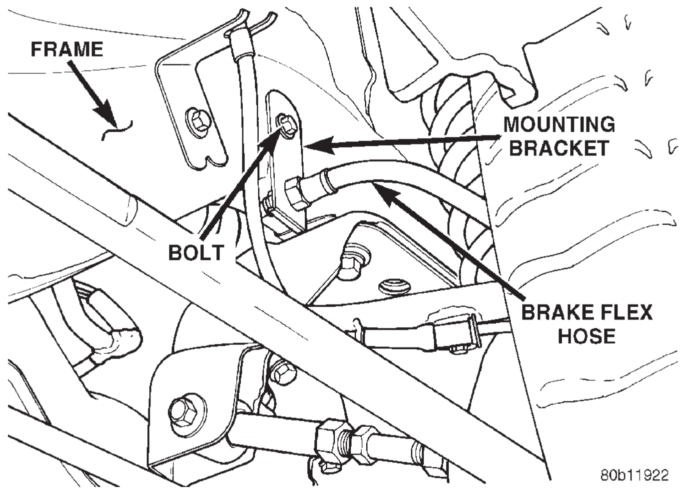


Fig. 16 Brake Flex Hose Mounting Bracket

CAUTION: Be sure the pressure test fittings being installed into the proportioning valve have the correct thread sizes and flares for installation into the proportioning valve and for installation of the chassis brake tubes.

(4) Install Pressure Test Fitting, Special Tool 6833–1 in the inlet port of the proportioning valve (Fig. 17). Install Pressure Test Fitting, Special Tool 8187–2 in the outlet port of the proportioning valve (Fig. 17). Tighten tube nuts to a torque of 17 N·m (145 in. lbs.)

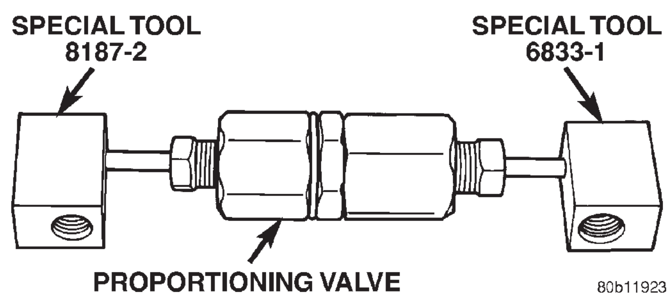


Fig. 17 Pressure Test Fittings Installed On Proportioning Valve

(5) Install proportioning valve Pressure Test Fitting, Special Tool 8187–2 on brake flex hose (Fig. 18) and securely tighten. Install the chassis brake tube (Fig. 18) in Pressure Test Fitting, Special Tool 6833–1. Tighten tube nut to a torque of 17 N·m (145 in. lbs.)

(6) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 19). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air.

(7) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following

DIAGNOSIS AND TESTING (Continued)

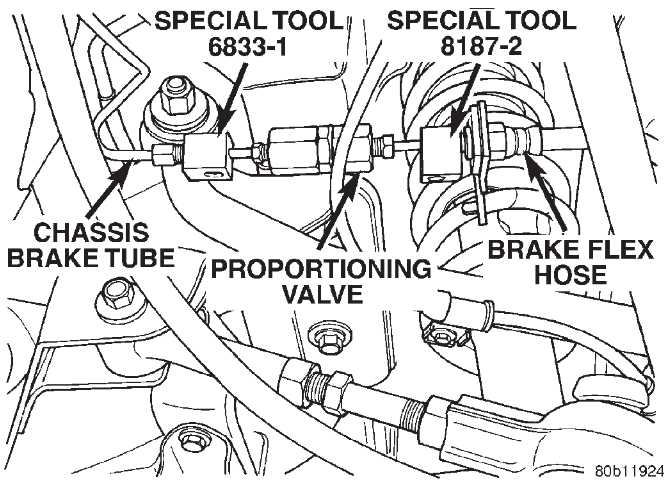


Fig. 18 Proportioning Valve With Pressure Test Fittings Installed

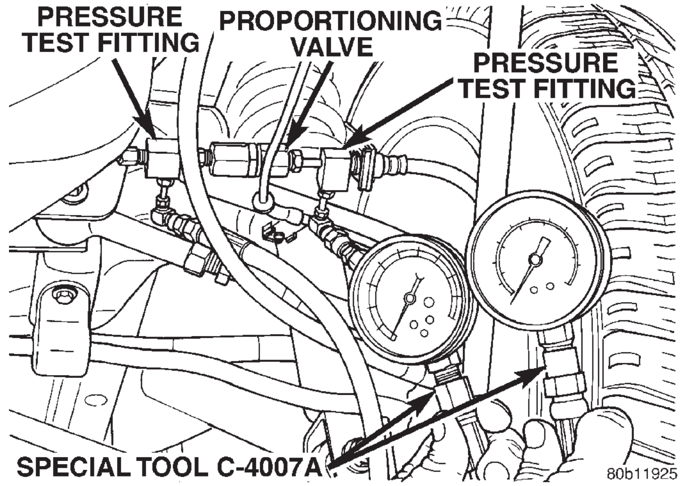


Fig. 19 Pressure Gauges Installed On Pressure Test Fittings

chart, PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(8) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

(9) Install proportioning valve on end of brake flex hose. Tighten the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(10) Install brake tube on proportioning valve. Torque tube nut to 17 N·m (145 in. lbs.) torque.

(11) Bleed the affected brake line. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section.

PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS

Sales Code	Brake System Type	Split Point	Slope	Identification	Inlet Pressure	Outlet Pressure
BRA	14″ Disc/Drum	500 psi	0.43	Bar Code Label	1000 psi	600-700 psi
BRJ	14″ Disc/Drum W/ABS	500 psi	0.43	Bar Code Label	1000 psi	600-700 psi
BRF	14″ Disc/Disc W/ABS	400 psi	0.34	Bar Code Label	1000 psi	600-700 psi

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts. Swelling indicates the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If the fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If the brake fluid is contaminated, drain and thoroughly flush the brake system. Replace all the rubber parts or components containing rubber coming into contact with the brake fluid including: the master cylinder; proportioning valves; caliper seals; wheel cylinder seals; ABS hydraulic control unit; and all hydraulic fluid hoses.

SERVICE PROCEDURES

BRAKE FLUID LEVEL CHECKING

CAUTION: Use only Mopar brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

SERVICE PROCEDURES (Continued)

Refer to SERVICE PROCEDURES in the BASE BRAKE SYSTEM section in this group for the proper procedure to check and adjust the brake fluid level in the master cylinder fluid reservoir.

ANTILOCK BRAKE SYSTEM BLEEDING

The base brake's hydraulic system must be bled anytime air enters the hydraulic system. The ABS though, particularly the ICU (HCU), should only be bled when the HCU is replaced or removed from the vehicle. The ABS must always be bled anytime it is suspected that the HCU has ingested air. Under most circumstances that require the bleeding of the brakes hydraulic system, only the base brake hydraulic system needs to be bled.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During the brake bleeding procedure, be sure the brake fluid level remains close to the FULL level in the master cylinder fluid reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The ABS must be bled as two independent braking systems. The non-ABS portion of the brake system with ABS is to be bled the same as any non-ABS system.

The ABS portion of the brake system must be bled separately. Use the following procedure to properly bleed the brake hydraulic system including the ABS.

BLEEDING

When bleeding the ABS system, the following bleeding sequence must be followed to insure complete and adequate bleeding.

(1) Make sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB scan tool to the diagnostics connector. The diagnostic connector is located under the lower steering column cover to the left of the steering column.

(3) Using the DRB, check to make sure the CAB does not have any fault codes stored. If it does, clear them using the DRB.

WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM YOURSELF AND THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in SERVICE PROCEDURES in the BASE BRAKE SYSTEM section at the beginning of this group.

(5) Using the DRB, select ANTILOCK BRAKES, followed by MISCELLANEOUS, then BLEED BRAKES. Follow the instructions displayed. When the scan tool displays TEST COMPLETED, disconnect the scan tool and proceed.

(6) Bleed the base brake system a second time. Check brake fluid level in the reservoir periodically to prevent emptying, causing air to enter the hydraulic system.

(7) Fill the master cylinder reservoir to the full level.

(8) Test drive the vehicle to be sure the brakes are operating correctly and that the brake pedal does not feel spongy.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

Review this entire section prior to performing any mechanical work on a vehicle equipped with ABS. This section contains information on precautions pertaining to potential component damage, vehicle damage and personal injury which could result when servicing an ABS equipped vehicle.

CAUTION: Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

CAUTION: An attempt to remove or disconnect certain system components may result in improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

REMOVAL AND INSTALLATION (Continued)

CAUTION: When performing any service procedure on a vehicle equipped with ABS do not apply a 12-volt power source to the ground circuit of the pump motor in the HCU. Doing this will damage the pump motor and will require replacement of the entire HCU.

CAUTION: If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

CAUTION: The CAB 25-way connector should never be connected or disconnected with the ignition switch in the ON position.

Many components of the ABS System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

INTEGRATED CONTROL UNIT (HCU and CAB)

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of this REMOVAL AND INSTALLATION section.

REMOVAL

(1) Remove the remote ground cable from the ground stud on the left strut tower (Fig. 20).

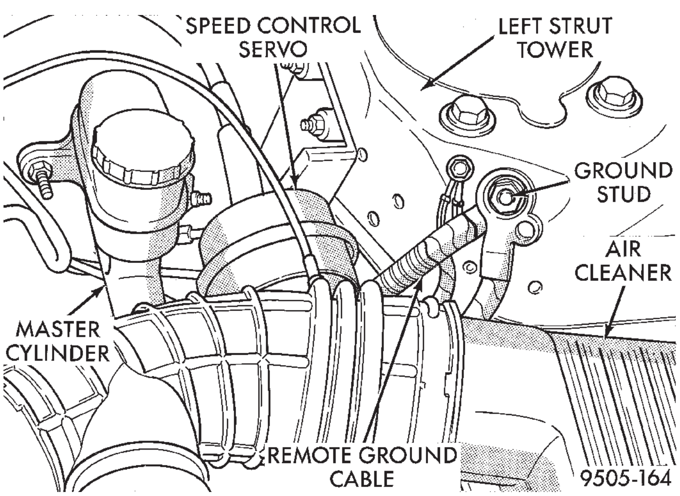


Fig. 20 Remote Ground Cable Attachment To Strut Tower

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown in (Fig. 21) and installing the nut on the stud. **This will prevent accidental grounding of the remote ground cable.**

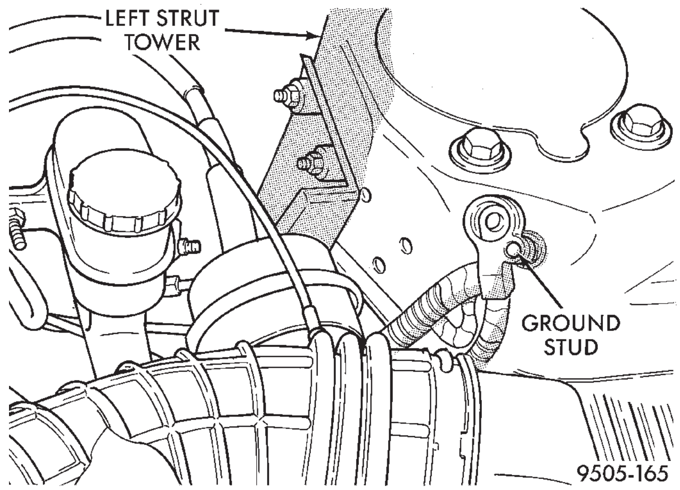


Fig. 21 Correctly Isolated Remote Ground Cable

(3) Using a brake pedal positioning tool such as shown in (Fig. 22) depress brake pedal past its first 1 inch of travel and hold in this position. This will isolate the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

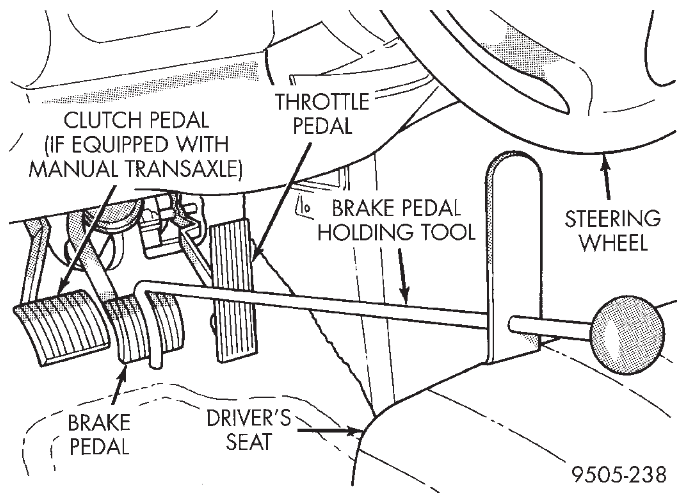


Fig. 22 Brake Pedal Holding Tool Installed

(4) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the splash shield (Fig. 23) from the right side of the engine compartment.

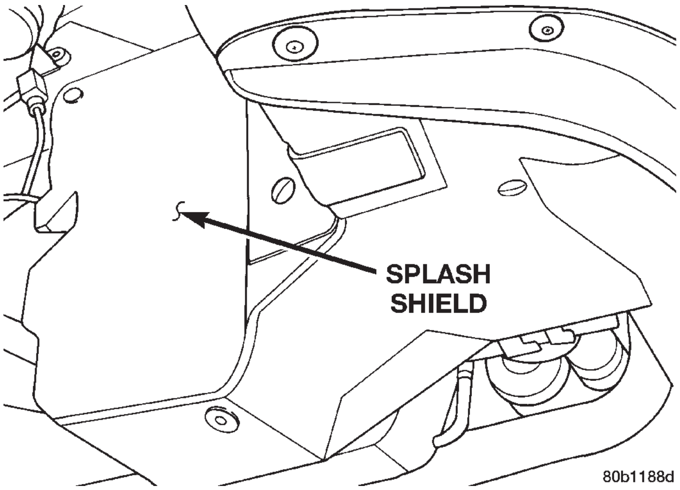


Fig. 23 Right Side Splash Shield

(6) Remove entire exhaust system from the vehicle as a complete assembly using the following steps.

(a) Disconnect the oxygen sensor wiring harnesses from the vehicle wiring harness.

(b) Remove the ground strap between the frame and muffler at the muffler bracket.

(c) Remove attaching bolts from exhaust pipe at exhaust manifold on engine (Fig. 24).

(d) Remove all exhaust system support/isolators from the vehicle's exhaust system (Fig. 25). Remove support/isolators from brackets on exhaust system components and leave attached to body of vehicle.

(e) Lower exhaust system as a complete assembly away from the underbody of the vehicle.

(7) Remove the heat shield for the HCU from the HCU mounting bracket (Fig. 26).

(8) Using Mopar, Brake Parts Cleaner or an equivalent, thoroughly clean all surfaces of the HCU. Also, thoroughly clean all brake tube to HCU connections.

(9) Remove the 4 chassis brake tubes from the outlet ports on the HCU (Fig. 27).

(10) Remove the primary and secondary brake tubes coming from the master cylinder from the HCU inlet ports (Fig. 28).

(11) Remove the bolt (Fig. 29) attaching the front leg of the HCU mounting bracket to the front suspension crossmember.

(12) Remove the 2 bolts (Fig. 30) attaching the back legs of the HCU mounting bracket to the front suspension crossmember.

(13) Remove bolt (Fig. 31) attaching the side of the HCU to the mounting bracket.

(14) Remove the 2 bolts (Fig. 32) attaching the top of the HCU to the mounting bracket.

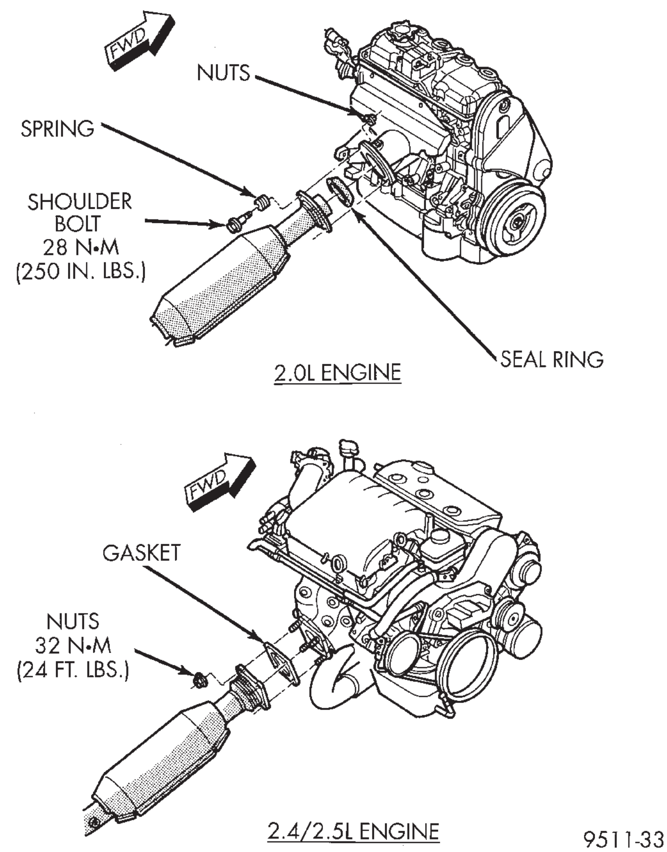


Fig. 24 Exhaust Pipe Mounting To Exhaust Manifold

CAUTION: Do not apply a 12–volt power source to any terminals of the 25 HCU connector when disconnected from the CAB.

(15) Disconnect the 25 way wiring harness connector from the CAB using the following procedure. Grasp the lock on the 25 way connector and pull it out from the connector as far as possible (Fig. 33). This will unlock and raise the 25 way connector out of the socket on the CAB.

(16) Remove the ICU from its mounting bracket. Then remove the ICU from the vehicle by pulling it out through the area between the right drive shaft and frame rail (Fig. 34).

(17) Refer to INTEGRATED CONTROL UNIT in DISASSEMBLY AND ASSEMBLY within this section to separated the CAB from the HCU.

INSTALLATION

(1) Install the ICU back in the vehicle and on its mounting bracket using the reverse order of its removal.

(2) Install isolators, washers and attaching bolts, mounting the ICU to its mounting bracket (Fig. 31) and (Fig. 32).

(3) Tighten the 3 HCU mounting bolts to a torque of 11 N·m (97 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

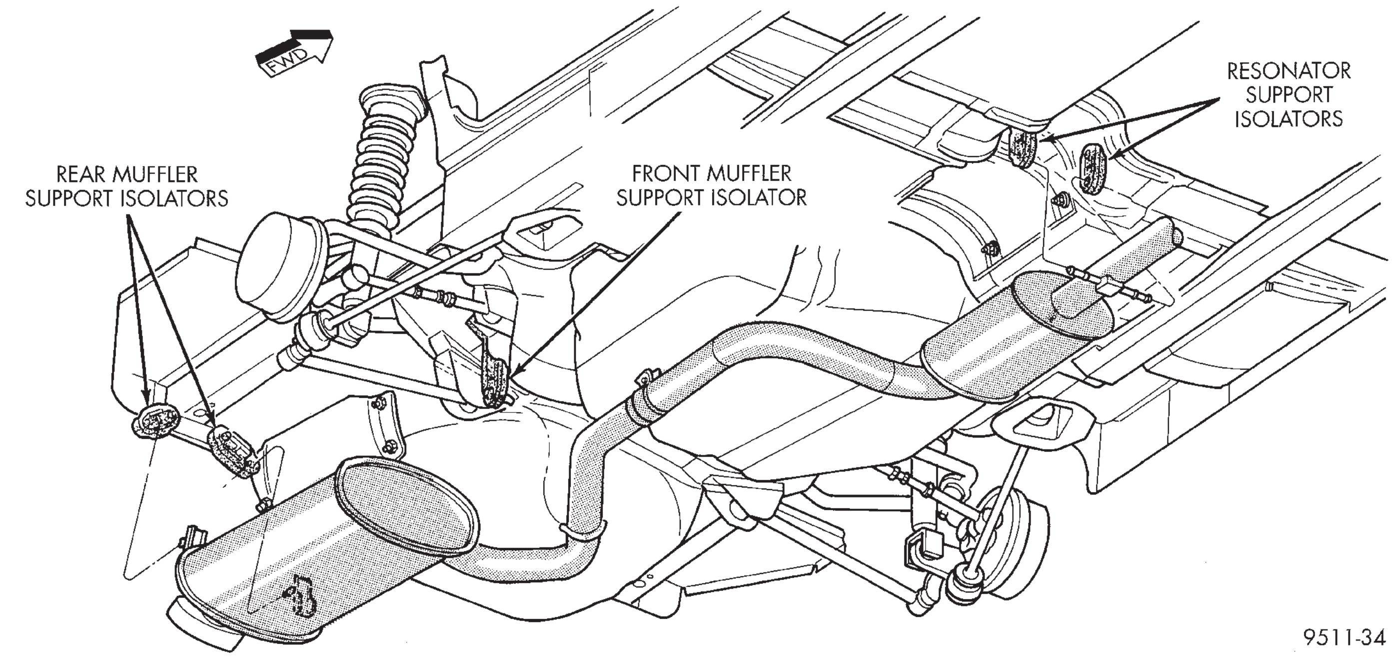


Fig. 25 Exhaust System Support/Isolator Locations

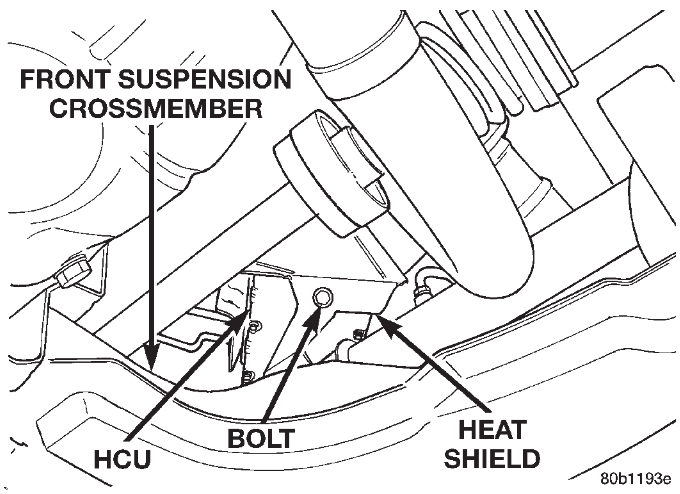


Fig. 26 HCU Heat Shield

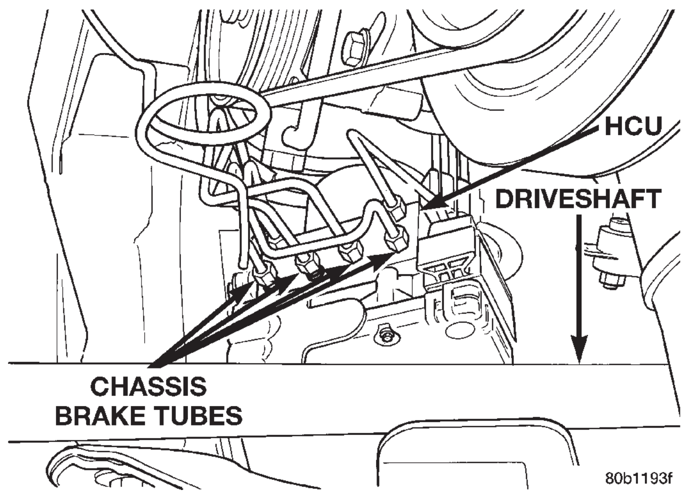


Fig. 27 Chassis Brake Tube Connections To HCU

CAUTION: Before installing the 25 way connector in the CAB be sure that the seal is properly installed in the connector.

(4) Install the 25 way connector into the socket on the CAB. The connector is installed using the following procedure. Position the 25 way connector in the socket on the CAB and carefully push it down as far as it will go. When connector is fully seated into the CAB socket push in the connector lock (Fig. 33) as far as it will go. This will pull the 25 connector into the socket on the CAB and lock it in the installed position.

(5) Install the 2 bolts (Fig. 30) attaching the back legs of the HCU mounting bracket to the front suspension crossmember.

(6) Install the bolt (Fig. 29) attaching the front leg of the HCU mounting bracket to the front suspension crossmember.

(7) Tighten the 3 bolts mounting the HCU mounting to the front suspension crossmember to a torque of 28 N·m (250 in. lbs.).

(8) Install the primary and secondary brake tubes coming from the master cylinder in the HCU inlet ports (Fig. 28).

(9) Install the 4 chassis brake tubes in the outlet ports on the HCU (Fig. 27).

(10) Using a crow foot (Fig. 35) and (Fig. 36) tighten all of the brake tube nuts to a torque of 17 N·m (145 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

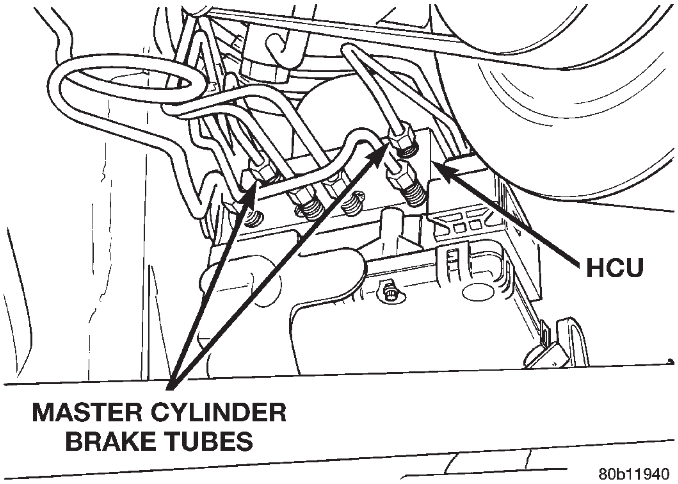


Fig. 28 Master Cylinder Brake Tube Connections To HCU

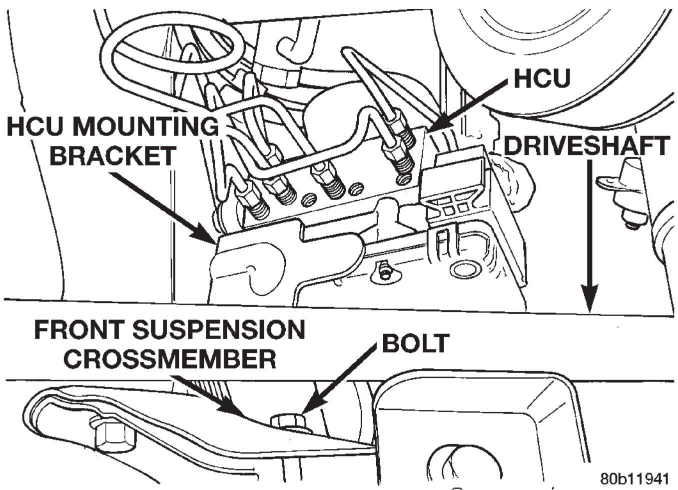


Fig. 29 HCU Mounting Bracket Front Bolt

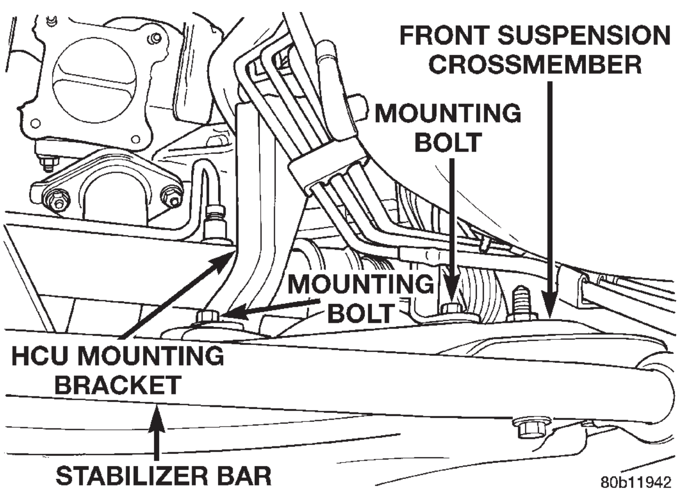


Fig. 30 HCU Mounting Bracket Rear Bolts

(11) Install the HCU heat shield (Fig. 26) on the HCU mounting bracket. Install and securely tighten the attaching bolt.

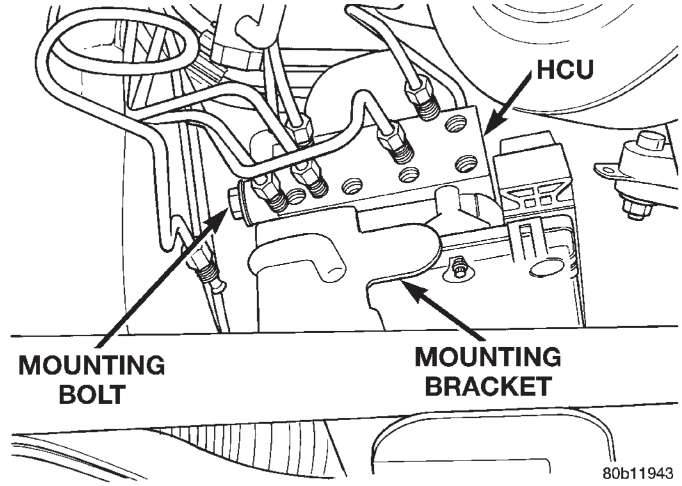


Fig. 31 HCU To Bracket Mounting Bolt

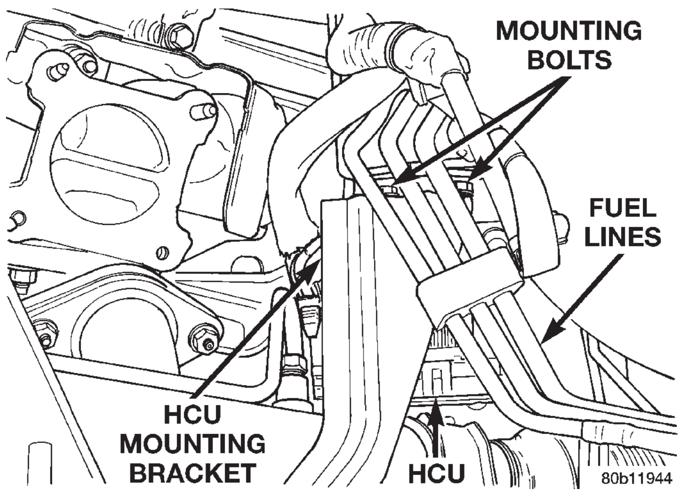


Fig. 32 HCU To Bracket Mounting Bolt

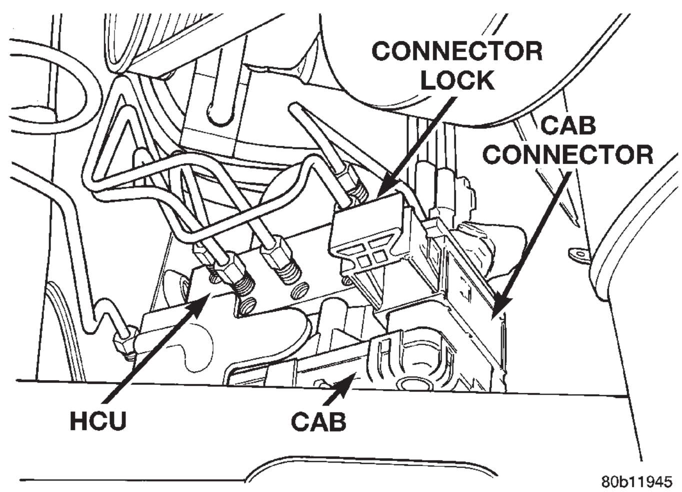


Fig. 33 Unlocked CAB Connector

(12) Install exhaust system in vehicle using the reverse steps of its removal.

(13) Install right side engine compartment splash shield (Fig. 23) back on the vehicle.

REMOVAL AND INSTALLATION (Continued)

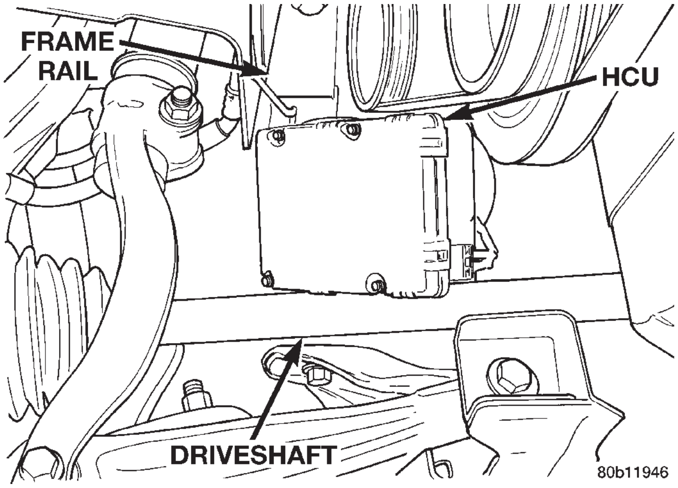


Fig. 34 ICU Remove And Install

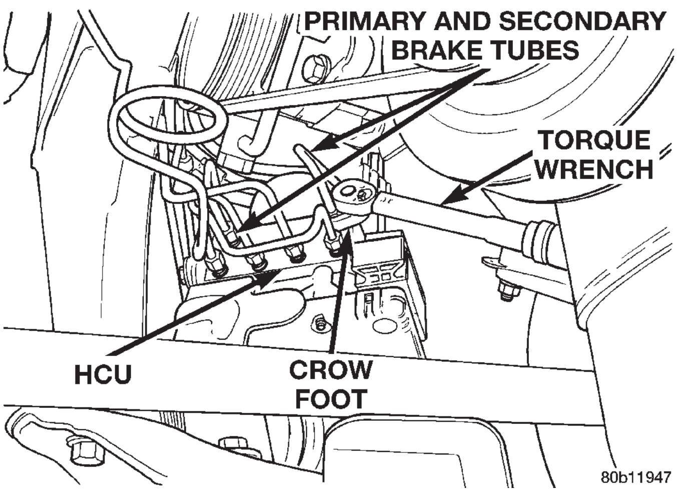


Fig. 35 Torquing Primary And Secondary Brake Tube Nut

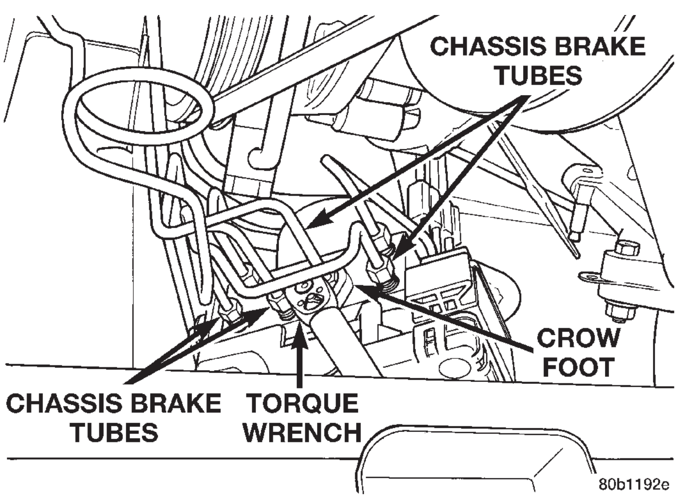


Fig. 36 Torquing Chassis Brake Tube Nuts

(14) Lower vehicle.
(15) Remove brake pedal holding tool.

(16) Install the remote ground cable onto the ground stud located on left shock tower (Fig. 20). Install the remote ground cable attaching nut and tighten to a torque of 28 N·m (250 in. lbs.).

(17) Bleed the base brakes and the ABS brakes hydraulic system. Refer to the Bleeding ABS System in this section of the manual for the proper bleeding procedure.

(18) Road test vehicle to ensure proper operation of the base and ABS systems.

PROPORTIONING VALVE

NOTE: Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of this REMOVAL AND INSTALLATION section.

CAUTION: Proportioning valves should never be disassembled.

This procedure is for removal and installation of one of the two proportioning valves mounted on this vehicle equipped with ABS.

REMOVAL

(1) Remove chassis brake (Fig. 37) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

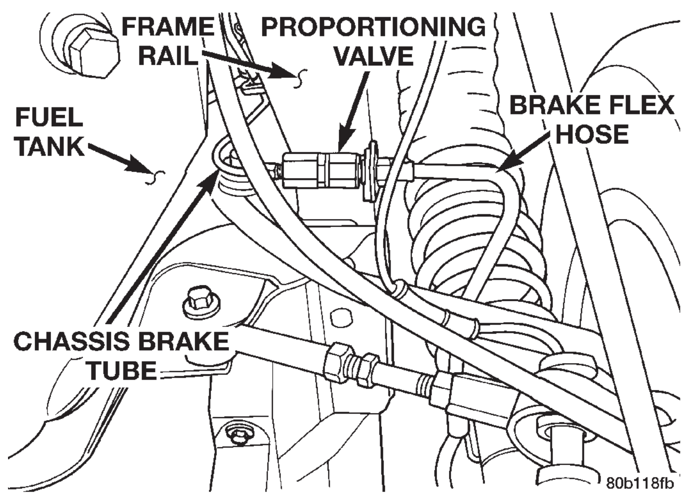


Fig. 37 Proportioning Valve Location

CAUTION: When removing proportioning valve from flex hose place wrench on proportioning valve (Fig. 38) not adapter fitting. The adapter fitting (Fig. 38) is not to be removed from the proportioning valve.

(2) Remove proportioning valve from brake flex hose (Fig. 38).

REMOVAL AND INSTALLATION (Continued)

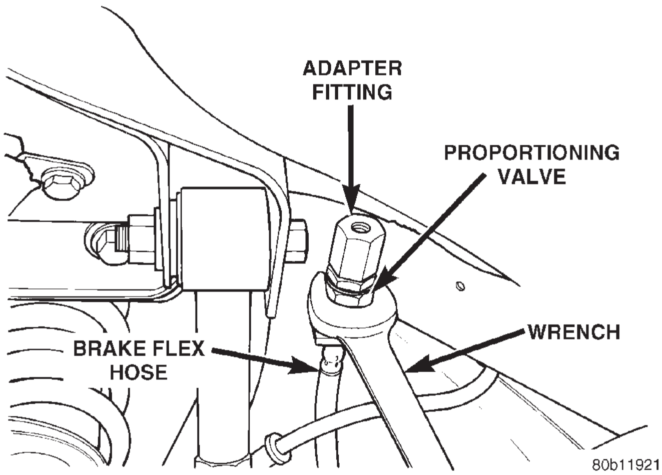


Fig. 38 Proportioning Valve Removal

INSTALLATION

(1) Install proportioning valve on brake flex hose (Fig. 38). Tighten proportioning valve to a torque of 17 N·m (145 in. lbs.)

(2) Install brake tube on proportioning valve (Fig. 37). Tighten tube nuts to 17 N·m (145 in. lbs.) torque.

(3) Bleed the affected brake line. See Bleeding Brake System in the Service Procedures section of the manual for proper bleeding procedure.

WHEEL SPEED SENSOR (FRONT)

This procedure is for the removal and installation of one of the two rear wheel speed sensors.

REMOVAL

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) Remove the speed sensor cable routing bracket (Fig. 39) from the steering knuckle. Remove the wiring harness sealing grommet retainer and speed sensor routing bracket from the inner fender.

(4) Remove speed sensor sealing grommet from the inner fender (Fig. 40). Then unplug the speed sensor cable from the vehicle wiring harness (Fig. 40).

(5) Remove bolt (Fig. 41) attaching speed sensor to steering knuckle. Then remove speed sensor head from steering knuckle

CAUTION: If speed sensor head locating pin has seized to the steering knuckle, do not attempt to remove speed sensor head by grasping with pliers and turning. This will damage the speed sensor head. Use only the following procedure.

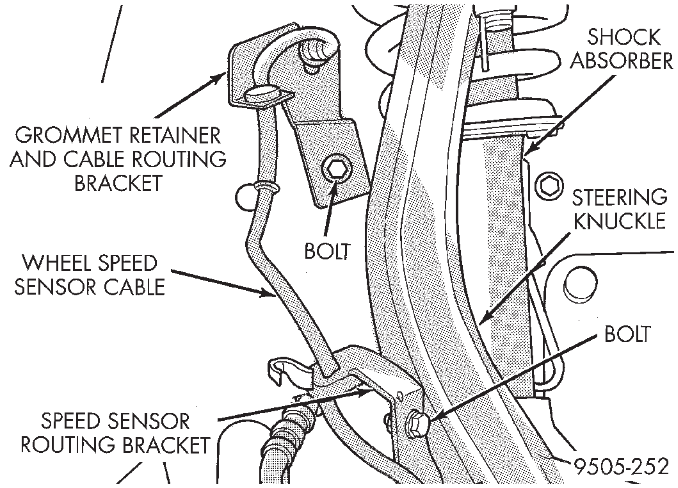


Fig. 39 Speed Sensor Cable Routing Brackets

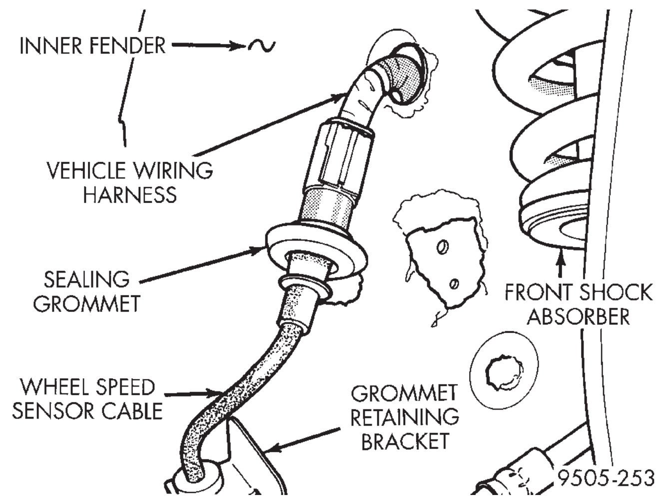


Fig. 40 Wheel Speed Sensor Connection To Vehicle Wiring Harness

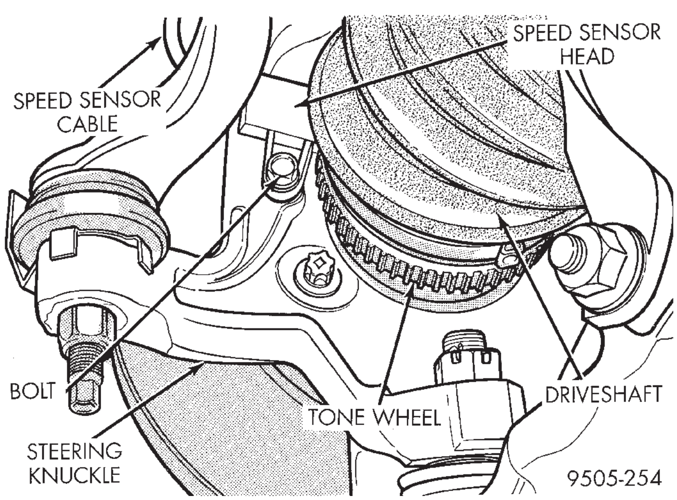


Fig. 41 Speed Sensor Head Attachment To Steering Knuckle

(6) If speed sensor head can not be removed from steering knuckle by hand, the locating pin on the

REMOVAL AND INSTALLATION (Continued)

speed sensor head has seized to the steering knuckle do to corrosion. Remove speed sensor head from steering knuckle using the following procedure. Remove disc brake caliper from steering knuckle, and remove brake rotor from hub/bearing assembly. Then insert a pin punch through hole in front steering knuckle (Fig. 42) and tap speed sensor head locating pin out of steering knuckle.

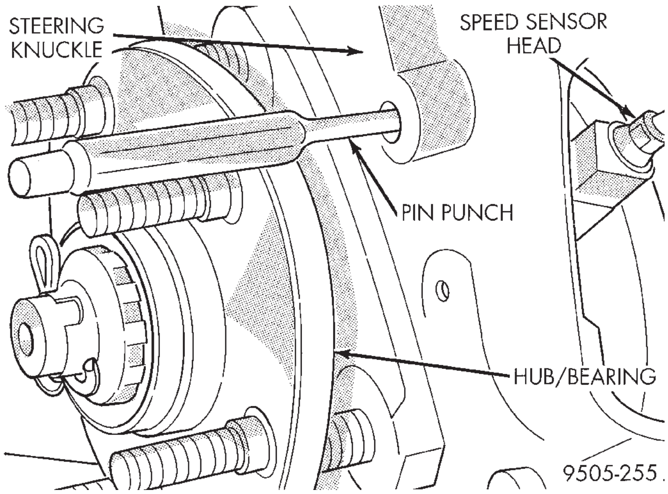


Fig. 42 Speed Sensor Head Removal From Steering Knuckle

INSTALLATION

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Connect the wheel speed sensor cable connector to the vehicle wiring harness (Fig. 40).

(2) Install the speed sensor cable assembly grommet into the front inner fender (Fig. 40). Install speed sensor cable grommet retainer/routing bracket on the inner fender of the vehicle and install and securely tighten attaching bolt (Fig. 39).

CAUTION: When installing the wheel speed sensor cable routing bracket on the steering knuckle, (Fig. 39) the speed sensor cable must be looped toward the shock absorber as shown in (Fig. 43). If speed sensor cable is not routed in this direction it will rub against the tire or wheel, damaging the speed sensor cable.

(3) Install the speed sensor cable routing bracket on the steering knuckle. Install and tighten routing bracket mounting bolt to a torque of 12 N·m (105 in. lbs.)

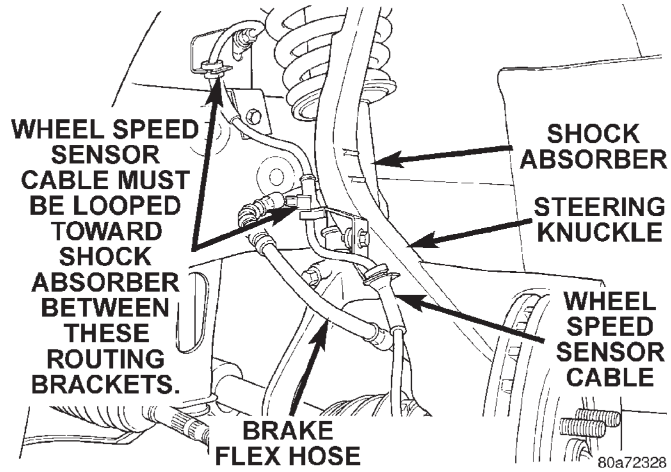


Fig. 43 Correct Front Wheel Speed Sensor Cable Routing

(4) Install speed sensor head on steering knuckle (Fig. 44). When installing speed sensor head on steering knuckle, apply a small amount of grease on speed sensor locating pin (Fig. 44). Use Mopar, Multi-Purpose Grease or an equivalent on speed sensor head locating pin. Install the speed sensor head attaching screw and tighten to a torque of 6 N·m (55 in. lbs.).

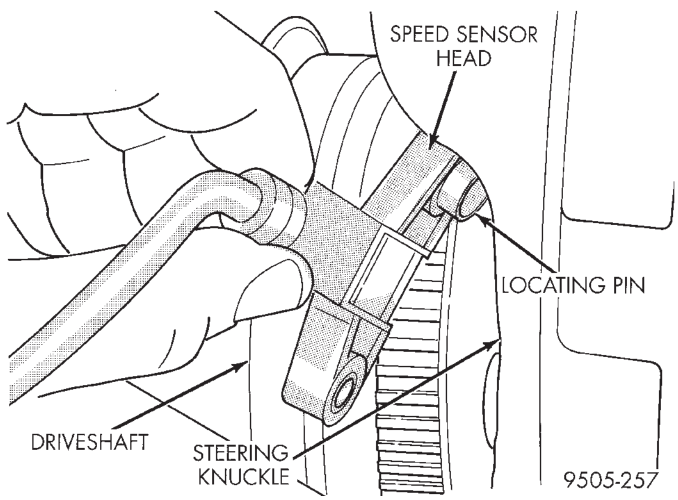


Fig. 44 Installing Speed Sensor Head In Steering Knuckle

(5) Install the wheel and tire assembly on vehicle.

(6) Road test vehicle to ensure proper operation of the base and ABS systems.

WHEEL SPEED SENSOR (REAR)

This procedure is for the removal and installation of one of the two rear wheel speed sensors.

REMOVAL

(1) Unplug the speed sensor cable connector from the vehicle wiring harness (Fig. 45). **Access for**

REMOVAL AND INSTALLATION (Continued)

speed sensor cable to vehicle wiring harness connection is in the trunk of the vehicle.

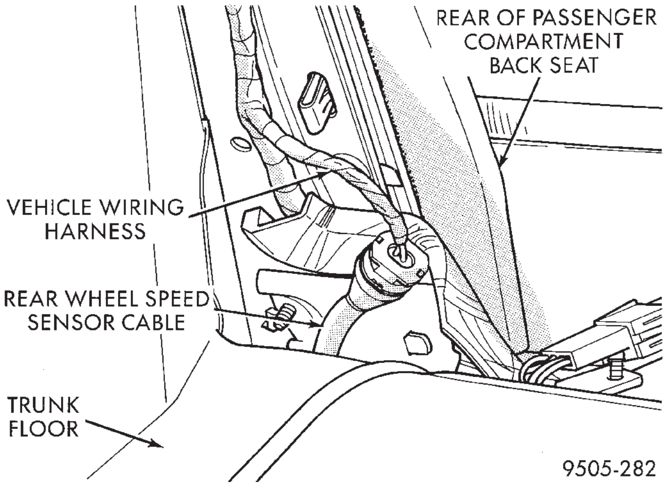


Fig. 45 Rear Speed Sensor Cable Connection To Vehicle Wiring Harness

(2) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(3) Remove the rear tire and wheel assembly from the vehicle.

(4) Remove speed sensor cable sealing grommet retainer (Fig. 46) from the rear frame rail of the vehicle. Then remove speed sensor cable sealing grommet and cable from hole in body of vehicle.

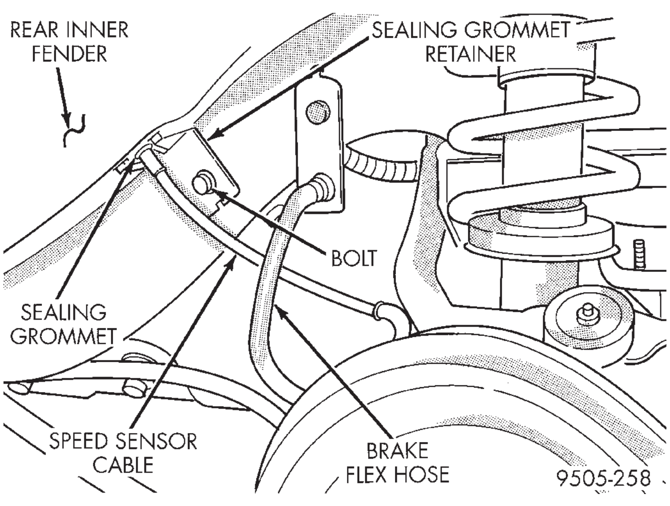


Fig. 46 Rear Speed Senor Cable Attachment To Body

(5) Remove speed sensor routing clips from the rear upper control arm and brake flex hose routing bracket (Fig. 47).

(6) Remove the rear speed sensor from the rear brake support plate (Fig. 48).

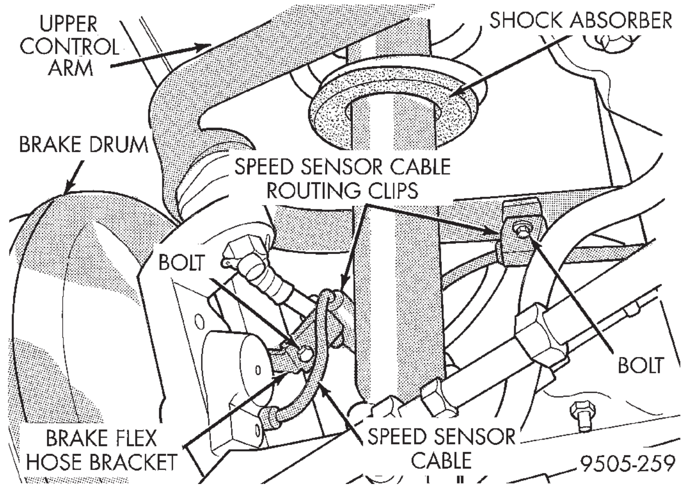


Fig. 47 Speed Sensor Cable Attachment To Rear Suspension

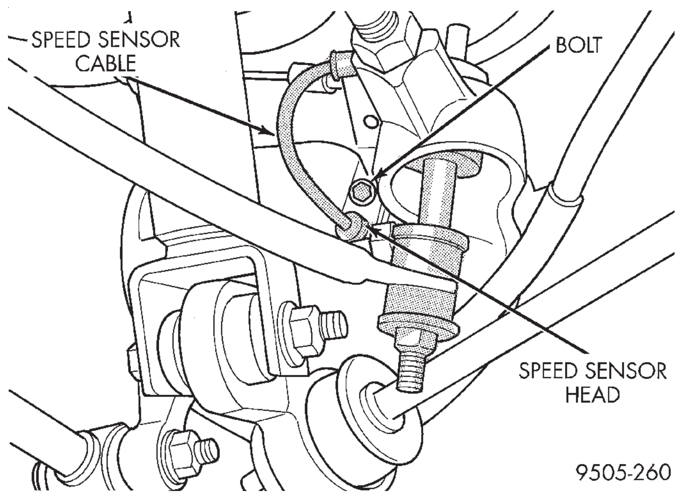


Fig. 48 Rear Speed Sensor Head Attachment To Brake Support Plate

INSTALLATION

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Install speed sensor head into brake support plate (Fig. 48).

(2) Install wheel speed sensor attaching bolt (Fig. 48). Tighten the speed sensor head attaching bolt to 8 N·m (75 in. lbs.)

(3) Install speed sensor cable routing clips (Fig. 47) on the brake flex hose bracket and the bracket on the upper control arm. Install and securely tighten the routing clip attaching bolts.

REMOVAL AND INSTALLATION (Continued)

(4) Install connector end of speed sensor cable through hole in inner fender and into trunk of vehicle.

(5) Install speed control sealing grommet into hole in inner fender. Install the sealing grommet retainer and attaching bolt (Fig. 46) on rear frame rail. Securely tighten retainer attaching bolt.

(6) Install the tire and wheel assembly on vehicle.

(7) Lower vehicle.

(8) Plug speed sensor cable connector into vehicle wiring harness (Fig. 45). **Install foam sleeve back over the speed sensor cable to vehicle wiring harness connection to prevent connector from rattling against body of vehicle.**

(9) Road test vehicle to ensure proper operation of the base and ABS systems.

DISASSEMBLY AND ASSEMBLY

INTEGRATED CONTROL UNIT (HCU AND CAB)

REMOVAL

NOTE: To replace the hydraulic control unit (HCU) or the controller antilock brake (CAB) on this vehicle, the entire integrated control unit (ICU) needs to be removed from the vehicle. The CAB can then be separated from the HCU. Do not attempt to replace the CAB with the ICU mounted in the vehicle.

(1) Remove the ICU from the vehicle. Refer INTEGRATED CONTROL UNIT in the REMOVAL AND INSTALLATION section in this section of the service manual.

(2) Disconnect the pump/motor wiring harness (Fig. 49) from the CAB.

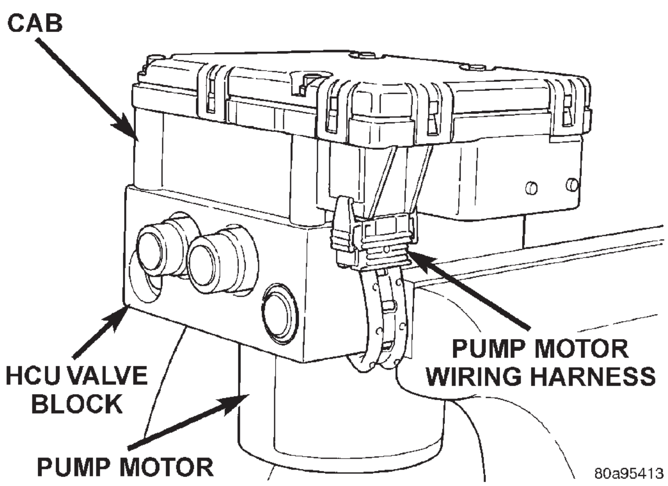


Fig. 49 Pump/Motor To CAB Wiring Harness

(3) Remove the 4 bolts (Fig. 50) attaching the CAB to the HCU.

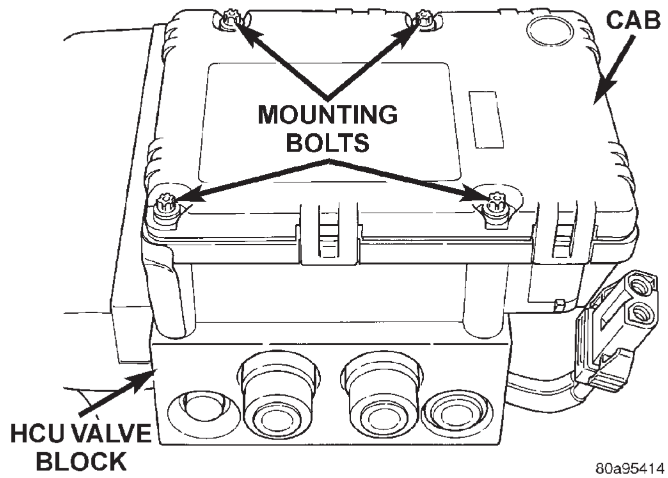


Fig. 50 CAB Attaching Bolts

(4) Remove the CAB from the HCU (Fig. 51).

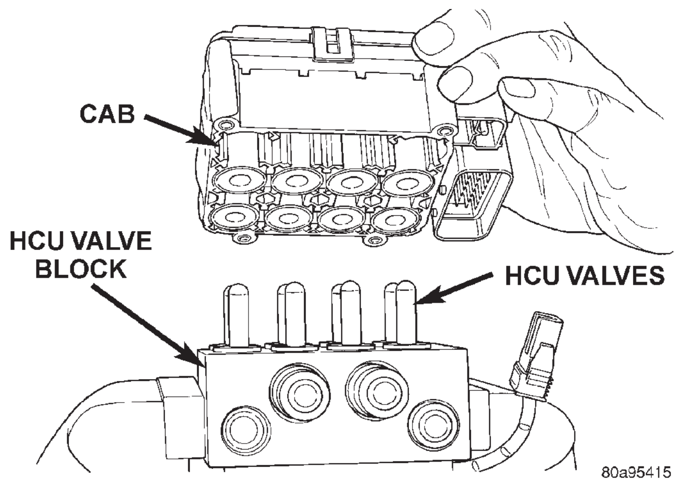


Fig. 51 Remove/Install CAB

INSTALLATION

(1) Install the CAB (Fig. 51) on the HCU.

(2) Install the 4 bolts mounting the CAB (Fig. 50) to the HCU. Tighten the CAB mounting bolts to a torque of 2 N·m (17 in. lbs.).

(3) Plug the pump/motor wiring harness into the CAB (Fig. 49).

(4) Install the ICU in the vehicle.

(5) Bleed the base and ABS hydraulic systems. Refer to ANTILOCK BRAKE SYSTEM BLEEDING in this section of this service manual group.

(6) Road test the vehicle to ensure proper operation of the base brakes and ABS.

SPECIFICATIONS

TONE WHEEL RUNOUT

FRONT TONE WHEEL:
Maximum Runout . . . . 0.25 mm (0.009 in.)
REAR TONE WHEEL:
Maximum Runout . . . . 0.25 mm (0.009 in.)

WHEEL SPEED SENSOR-TO-TONE WHEEL CLEARANCE

FRONT WHEEL:
Minimum Clearance . . . . 0.17 mm (0.007 in.)
Maximum Clearance . . . . 1.80 mm (0.072 in.)
REAR WHEEL:
Minimum Clearance . . . . 0.37 mm (0.015 in.)
Maximum Clearance . . . . 1.50 mm (0.059 in.)

WHEEL SPEED SENSOR RESISTANCE

ALL:
Allowable Resistance . . . . 2160 - 2640 ohms

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION **TORQUE**
MASTER CYLINDER:
Mounting Nuts . . . . 28 N·m (250 in. lbs.)
POWER BRAKE BOOSTER:
Dash Panel Mounting Nuts . . . . 28 N·m (250 in. lbs.)
BRAKE TUBES:
Tube Nuts . . . . 17 N·m (145 in. lbs.)
BRAKE HOSES:
Caliper Banjo Bolt . . . . 48 N·m (35 ft. lbs.)
Intermediate Bracket Bolt . . . 23 N·m (17 ft. lbs.)
DISC BRAKE CALIPER (ALL):
Guide Pin Bolts . . . . 22 N·m (192 in. lbs.)
Bleeder Screw . . . . 15 N·m (125 in. lbs.)
REAR WHEEL CYLINDER:
Mounting Bolts . . . . 11 N·m (97 in. lbs.)
Bleeder Screw . . . . 10 N·m (80 in. lbs.)
INTEGRATED CONTROL UNIT:
Mounting Bolts To Bracket . . . 11 N·m (97 in. lbs.)
Bracket To Crossmember Bolts . . . . 28 N·m (250 in. lbs.)
CAB Mounting bolts . . . . 2 N·m (17 in. lbs.)
REAR BRAKE SHOE SUPPORT PLATE:
Mounting Bolts . . . . 63 N·m (46 ft. lbs.)
REAR DISC BRAKE ADAPTER:
Mounting Bolts . . . . 63 N·m (46 ft. lbs.)
PARKING BRAKE:
Lever Mounting Nuts . . . . . . 28 N·m (250 in. lbs.)
REAR HUB AND BEARING:
Retaining Nut . . . . 250 N·m (185 ft. lbs.)
WHEEL SPEED SENSOR:
Head Mounting bolt . . . . 7 N·m (60 in. lbs.)
TIRE AND WHEEL:
Wheel Mounting Nut . . . . 109–150 N·m (80–110 ft. lbs.)

CLUTCH

CONTENTS

GENERAL INFORMATION

CLUTCH COMPONENTS

The modular clutch assembly used in this vehicle consists of a single, dry-type clutch disc and a diaphragm style clutch cover. The clutch unit is serviced as an assembly. No disassembly is possible.

The clutch disc has cushion springs riveted to the disc hub assembly. The clutch disc facings are riveted to the cushion springs. The facings are made from a non-asbestos material.

The clutch cover pressure plate assembly is a diaphragm type unit with a one-piece diaphragm spring with multiple release fingers. The pressure plate release fingers are preset during manufacture and are not adjustable.

A sleeve-type release bearing is used to engage and disengage the clutch cover pressure plate. The bearing is prelubed during manufacture and is a sealed unit.

The release bearing is operated by a pivoting release fork in the clutch housing. The fork pivots on a ball stud within the housing. The release fork is actuated by a self-adjusting clutch cable.

The clutch cable has a unique self-adjuster mechanism built into the cable which compensates for clutch disc wear. The cable requires no maintenance or lubrication. There are no serviceable components on the cable assembly.

The clutch pedal is connected to the cable through a plastic spacer. The upper end of the clutch pedal pivots in the pedal bracket on two nylon bushings and a shaft (Fig. 1). These bushings do not require periodic lubrication.

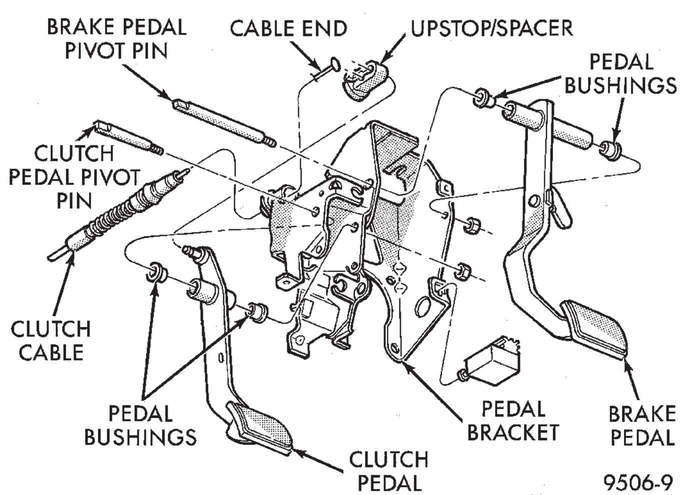


Fig. 1 Clutch Pedal Components

CLUTCH DISC AND COVER APPLICATION

The 2.0 single overhead cam engine uses a 228 mm (9.0 in.) clutch disc. The manual transaxle is available only with the 2.0 liter engine.

CLUTCH REPLACEMENT

The transaxle must be removed to service the modular clutch disc assembly and lever.

DESCRIPTION AND OPERATION

CLUTCH CABLE

The manual transaxle clutch release system has a unique self-adjusting mechanism to compensate for clutch disc wear (Fig. 2). This adjuster mechanism is located within the clutch cable assembly. The preload spring maintains tension on the cable. This tension keeps the clutch release bearing continuously loaded against the fingers of the clutch cover assembly.

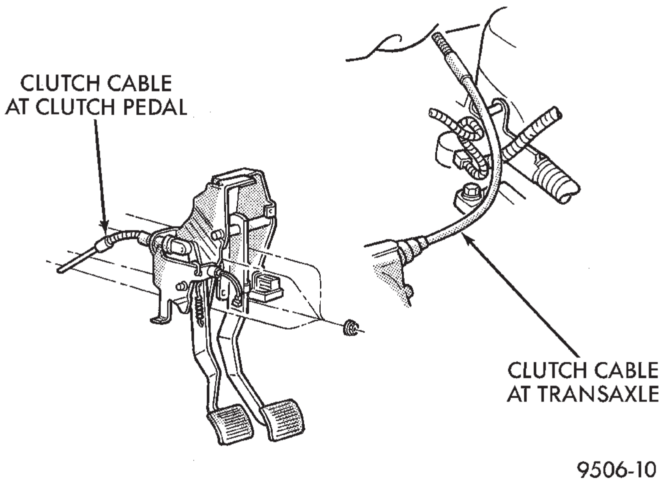


Fig. 2 Clutch Cable Routing

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch functions as a safety interlock device. It prevents possible engine cranking with the clutch engaged.

The clutch pedal position switch is wired in series between the starter relay coil and the ignition switch.

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 3).

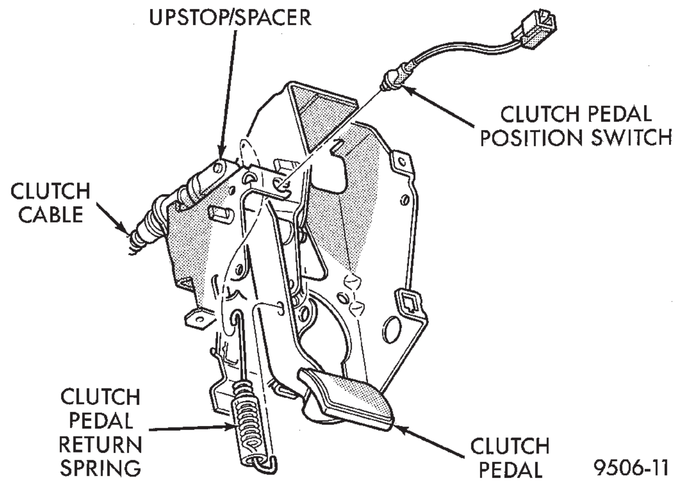


Fig. 3 Clutch Pedal Position Switch and Components

DIAGNOSIS AND TESTING

CLUTCH PEDAL POSITION SWITCH

CLUTCH PEDAL POSITION SWITCH–ELECTRICAL TEST

Disconnect clutch pedal position switch harness from instrument panel wiring harness. Using an ohmmeter, check for continuity between the two terminals in the connector on the switch harness. There should be no continuity between the terminals when the switch is in its normal (fully extended) position. When the switch is depressed more than 1.25 mm (0.050), the ohmmeter should show continuity (zero ohms).

If ohmmeter readings do not fall within these ranges, the switch is defective, and must be replaced.

CLUTCH PEDAL POSITION SWITCH–MECHANICAL TEST

With the park brake set and the vehicle **IN NEUTRAL,** turn the key to the start position. The vehicle should not crank. If the vehicle cranks, the switch is defective (shorted out) and must be replaced. If the vehicle does not crank proceed to the next step.

WARNING: BEFORE PERFORMING THIS STEP, BE SURE THAT THE AREA IN FRONT OF THE VEHICLE IS CLEAR OF OBSTRUCTIONS AND PEOPLE. VEHICLE MAY MOVE WHEN PERFORMING THIS TEST.

With the park brake set and the vehicle **IN GEAR,** turn the key to the start position and hold it there.

Slowly depress the clutch pedal and feel for any vehicle motion when the starter is energized. If there is no motion the switch is working properly.

If motion is felt, check to see if the switch is making contact when the pedal is between 25 mm (1.0 in.) and 6 mm (0.25 in.) from the floor. If this condition is met, then the problem is either the clutch or the self-adjusting cable (See “Clutch Will Not Disengage Properly”). If this condition is not met, then the switch mounting tab on the brake bracket is bent, and the brake bracket must be replaced.

If vehicle will not crank, even with clutch pedal pressed to the floor, refer to “Service Diagnosis-Clutch Pedal Position Switch” chart in this section.

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS–CLUTCH PEDAL POSITION SWITCH

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WON'T CRANK WHEN CLUTCH PEDAL IS PRESSED TO THE FLOOR	Switch does not have continuity when plunger is depressed 1.25 mm	Defective switch. Replace switch.
	Switch plunger is not depressed when clutch pedal is pushed to the floor	Floor mat interferes with clutch pedal movement. Move floor mat out of the way.
	Problem is related to other components in the starting circuit	Check other components in the starting circuit. Refer to Section 8A, Battery/Starting/Charging System.

CLUTCH DIAGNOSIS

Problem diagnosis will generally require a road test to determine the type of fault. Component inspection will then determine the problem after road testing.

Drive the vehicle at normal speeds during road test. Shift the transaxle through all gear ranges and observe clutch action. If chatter, grab, slip, or improper release is experienced, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed. The transaxle or other driveline components may actually be at fault.

SERVICE DIAGNOSIS—CLUTCH GRAB/CHATTER

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC FACING COVERED WITH OIL OR GREASE	Oil leak at engine rear main or transaxle input shaft seal	Correct leak and replace modular clutch assembly
	Too much grease applied to splines of disc and input shaft	Apply lighter coating of grease to splines
NO FAULT FOUND WITH CLUTCH COMPONENTS	Problem actually related to suspension or driveline component	Further diagnosis required. Check engine/transmission mounts, suspension attaching parts and other driveline components as needed.
	Engine related problems	Check EFI and ignition systems
PARTIAL ENGAGEMENT OF CLUTCH DISC	Clutch cover, spring, or release fingers bent, distorted (rough handling, improper assembly)	Replace modular clutch assembly
	Clutch disc damaged or distorted	Replace modular clutch assembly
	Clutch misalignment	Check alignment and runout of flywheel, disc, or cover. Check clutch housing to engine dowels and dowel holes for damage. Correct as necessary.

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—CLUTCH SLIPS

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC FACING WORN OUT	Normal wear.	Replace modular clutch assembly.
	Driver frequently rides (slips) clutch, results in rapid wear overheating.	Replace modular clutch assembly
	Insufficient clutch cover diaphragm spring tension	Replace modular clutch assembly
CLUTCH DISC FACING CONTAMINATED WITH OIL OR GREASE	Leak at rear main oil seal or transaxle input shaft seal	Replace leaking seals. Replace modular clutch assembly.
	Excessive amount of grease applied to input shaft splines	Apply less grease to input shaft. Replace modular clutch assembly
	Road splash, water entering housing	Seal housing. Inspect modular clutch assembly.
CLUTCH IS RUNNING PARTIALLY DISENGAGED	Release bearing sticking or binding, does not return to normal running position.	Verify that bearing is actually binding. Then, replace bearing and transmission front bearing retainer if sleeve surface is damaged.
	Cable self-adjuster mechanism sticking or binding causing high preload	Verify that self-adjuster is free to move
CLUTCH DISC FACINGS HAVE FRACTURED INTO SMALL PIECES	Driver performs a 5-1 downshift at vehicle speed in excess of 60 miles per hour	Alert driver to problem cause. Replace modular clutch assembly.
	Leak at rear main or transaxle input shaft seal	Replace modular clutch assembly. Replace seal.
	Excessive heat from slippage	Replace modular clutch assembly

SERVICE DIAGNOSIS—IMPROPER CLUTCH RELEASE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC BINDS ON INPUT SHAFT SPLINES	Clutch disc hub splines damaged during installation	Clean, smooth, and lubricate disc and shaft splines. Replace modular clutch assembly and/or input shaft if splines are severely damaged.
	Input shaft splines rough, damaged.	Clean input shaft splines. Then lube.
	Corrosion or rust formations on splines of input shaft and disc	Clean input shaft splines and disc splines, then lube
CLUTCH DISC RUSTED TO FLYWHEEL AND/OR PRESSURE PLATE	Occurs in vehicles stored or not driven for extended period of time. Also occurs after steam cleaning if vehicle is not used for extended period.	Replace modular clutch assembly
CLUTCH WILL NOT DISENGAGE PROPERLY	Disc bent, distorted during transaxle installation	Replace modular clutch assembly
	Clutch cover diaphragm spring damaged during transaxle installation	Replace modular clutch assembly
	Release fork bent, loose, or damaged	Replace fork if worn or damaged

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	Clutch cable binding or routed incorrectly	Check and correct cable routing
	Self-adjuster in cable not functioning properly, resulting in excess cable slack	Pull on cable conduit at transaxle (as if disconnecting cable) to check adjuster operation

SERVICE DIAGNOSIS–CLUTCH PEDAL NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH PEDAL MAKES REPEATED ″POP″ NOISE IN THE FIRST INCH OF TRAVEL	Self-adjusting mechanism in cable defective	Replace clutch cable
CLUTCH PEDAL SQUEAKS WHEN DEPRESSED TO FLOOR	Pedal bushings worn out or inadequate lubrication	Replace or lubricate bushings
	Clutch pedal return spring worn out	Replace return spring

DRIVE PLATE MISALIGNMENT

Common causes of misalignment are:

- Heat warping
- Mounting drive plate on a dirty crankshaft flange
- Incorrect bolt tightening
- Improper seating on the crankshaft shoulder
- Loose crankshaft bolts

Clean the crankshaft flange before mounting the drive plate. Dirt and grease on the flange surface may misalign the flywheel, causing excessive runout. Use new bolts when mounting drive plate to crankshaft. Tighten drive plate bolts to specified torque only. Over-tightening can distort the drive plate hub causing excessive runout.

CLUTCH COVER AND DISC RUNOUT

Check condition of the clutch cover before installation. A warped cover or diaphragm spring will cause grab and/or incomplete release or engagement. Use care when handling the clutch assembly. Impact can distort the cover, diaphragm spring, and release fingers.

CLUTCH CHATTER COMPLAINTS

For all clutch chatter complaints, do the following:

(1) Check for loose, misaligned, or broken engine and transmission mounts. If present, they should be corrected at this time. Test vehicle for chatter. If chatter is gone, there is no need to go any further. If chatter persists:

(2) Check to see if clutch cable routing is correct and operates smoothly.

(3) Check for loose connections in drive train. Correct any problems and determine if clutch chatter complaints have been satisfied. If not:

(4) Remove transaxle. See Group 21, Manual Transaxle for procedure.

(5) Check to see if the release bearing is sticky or binding. Replace bearing, if needed.

(6) Check linkage for excessive wear on the pivot stud and fork fingers. Replace all worn parts.

(7) Check clutch assembly for contamination (dirt, oil). Replace clutch assembly, if required.

(8) Check to see if the clutch disc hub splines are damaged. Replace with new clutch assembly, if necessary.

(9) Check input shaft splines for damage. Replace, if necessary.

(10) Check for uneven wear on clutch fingers.

(11) Check for broken clutch cover diaphragm spring fingers. Replace with new clutch assembly, if necessary.

CLASH–INTO–REVERSE COMPLAINTS

All JA NV T350 (A-578) manual transaxles are equipped with a reverse brake. It prevents clash when shifting into reverse, but only if the vehicle is not moving. See Group 21, Transaxle for further diagnosis.

(1) Depress clutch pedal to floor and hold. After three seconds, shift to reverse. If clash is present, clutch has excessive spin time, and the reverse brake may not be functioning.

(2) Remove transaxle. See Group 21, Manual Transaxle for procedure.

DIAGNOSIS AND TESTING (Continued)

(3) Check the input shaft spline, clutch disc splines, and release bearing for dry rust. If present, clean rust off and apply a light coat of bearing grease to the input shaft splines. Apply grease on the input shaft splines only where the clutch disc slides. Verify that the clutch disc slides freely along the input shaft spline.

(4) Check to see if the clutch disc hub splines are damaged, and replace with new clutch assembly if required.

(5) Check the input shaft for damaged splines. Replace as necessary.

(6) Check for broken clutch cover diaphragm spring fingers.

(7) Install clutch assembly and transaxle.

REMOVAL AND INSTALLATION

CLUTCH CABLE

REMOVAL

(1) Pull up and remove Power Distribution Center.

(2) Remove clutch cable inspection cover.

(3) Pull back on clutch cable housing and disengage cable from housing (Fig. 4).

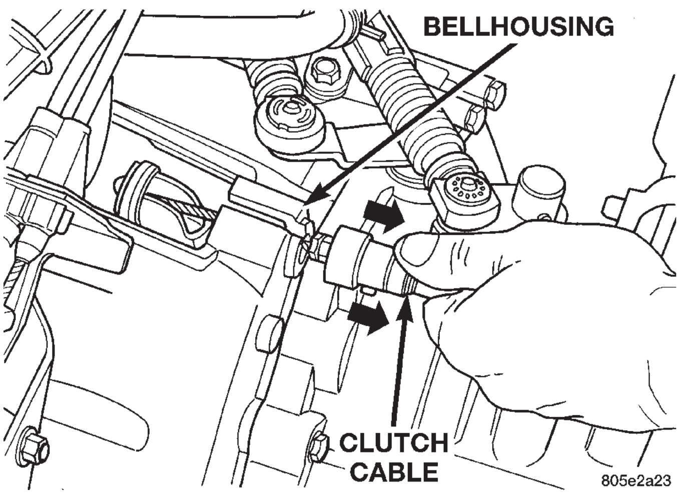


Fig. 4 Cable at Transaxle

(4) Guide cable through slot in transaxle and disconnect cable from release lever.

(5) Disconnect clutch cable up-stop/spacer with cable strand from clutch pedal (Fig. 5).

NOTE: Depressing the clutch pedal provides access to the clutch cable strand. Disconnect the cable up-stop/spacer from the pedal pivot pin by removing the retaining clip at the top of the clutch pedal. Wedge a flat–blade pry tool between the pin and the retaining tab. While holding the tab slightly separated from the pin, pull the upstop/spacer off the pedal. Now remove the cable end from the upstop/spacer.

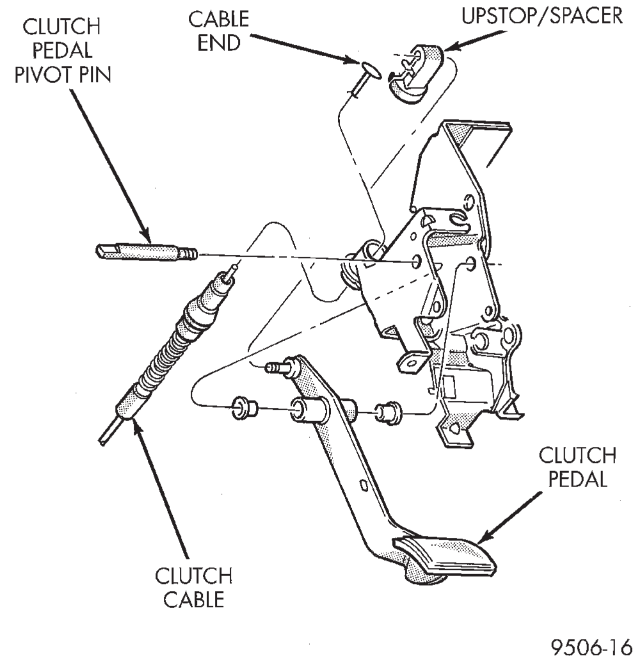


Fig. 5 Cable End Removal

CAUTION: Do not pull on the clutch cable to remove it from the dash panel. Damage to the cable self-adjuster may occur.

(6) Use a slight twisting motion while grasping the grommet and body to remove the cable from the dash panel and clutch bracket.

(7) A screwdriver may be required to dislodge the cable grommet from the dash panel. Use caution to avoid damage to the cable grommet.

INSTALLATION

(1) Using a slight twisting motion, insert the self––adjuster mechanism end of the clutch cable through the dash panel hole and into the bracket.

(2) Seat the cylindrical part of the cable grommet in the dash panel. Be sure the self–adjuster is firmly seated against the clutch bracket to ensure proper adjuster mechanism function.

(3) Connect the clutch cable to the up-stop/spacer.

(4) Connect the up-stop/spacer to the clutch pedal.

(5) Perform the Adjuster Mechanism Function Check before finishing installation.

ADJUSTER MECHANISM FUNCTION CHECK

(1) With slight pressure, pull the clutch release lever end of the cable to draw the cable taut. Push the clutch cable housing toward the dash panel (With less than 25 lbs. of effort, the cable housing should move 30-50mm.). This indicates proper adjuster mechanism function. If the cable does not adjust,

REMOVAL AND INSTALLATION (Continued)

determine if the mechanism is properly seated on the bracket.

(2) If the adjust mechanism functions properly, guide the cable through the slot in the transaxle housing. Connect cable to release lever, seating the cupped washer securely on lever tangs.

(3) Pull back on clutch cable housing and insert into transaxle housing (Fig. 4).

(4) Reinstall cable inspection cover and PDC. Check clutch pedal position switch operation.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 6).

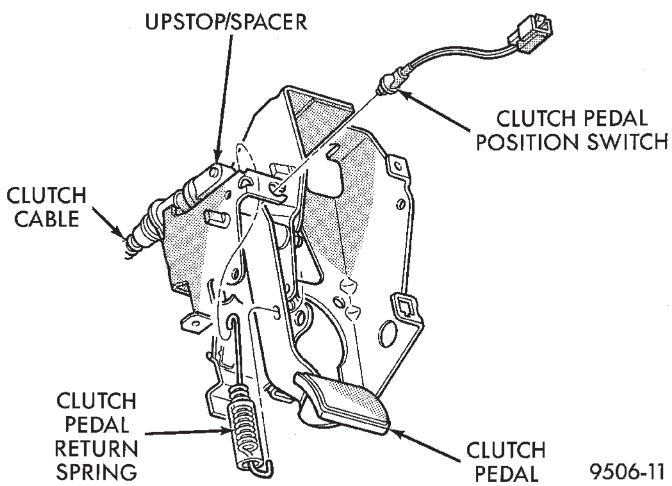


Fig. 6 Clutch Pedal Position Switch and Components

REMOVAL

(1) Disconnect electrical harness to switch connector.

(2) Depress wing tabs on switch and push switch out of mounting bracket. Then slide wires through slot in bracket.

INSTALLATION

(1) Slide switch wires through slot in switch bracket.

(2) Line up switch tab with slot in switch bracket and push switch into position. Do not pull on the switch wires to seat switch into bracket, switch damage may occur.

(3) Attach switch wiring harness to vehicle wiring harness.

(4) After installation, the switch must be checked for proper operation. Refer to Diagnosis and Testing section for proper testing procedures.

CLUTCH ASSEMBLY

The transaxle must be removed to service the modular clutch disc assembly and lever.

REMOVAL

(1) Remove the starter wiring. Remove the starter assembly.

(2) Remove the rear transaxle support bracket.

(3) Remove the front transaxle support bracket.

(4) Remove modular clutch retaining bolts.

(5) Remove transaxle. See Group 21, Manual Transaxle, for procedure.

(6) The transaxle and modular clutch come out as an assembly.

(7) Remove the modular clutch assembly from the transaxle input shaft (Fig. 7). Handle carefully to avoid contaminating the friction surfaces.

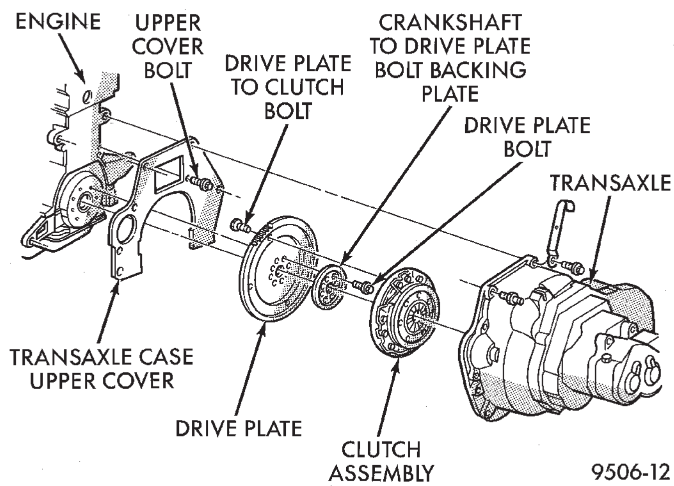


Fig. 7 Clutch Components

INSPECTION

(1) Inspect for oil leakage through engine rear main bearing oil seal and transaxle input shaft seal. If leakage is noted, it should be corrected at this time.

INSTALLATION

(1) Mount modular clutch assembly onto input shaft.

(2) Install transaxle. See Group 21, Manual Transaxle, for procedure.

NOTE: Use new bolts when mounting modular clutch assembly to drive plate.

(3) To avoid distortion of the drive plate, bolts should be tightened a few turns at a time. Use a crisscross pattern, until all bolts are seated. Tighten bolts to 75 N·m (55 ft. lbs.) following a crisscross pattern sequence.

(4) Install clutch inspection cover.

(5) Install transaxle lower support brackets.

(6) Install starter assembly.

RELEASE BEARING AND FORK

Remove the transaxle from the vehicle. See Group 21, Transaxle for removal and installation procedures.

REMOVAL

(1) Move the lever and bearing assembly to a vertical in-line position. Grasp the release lever with two hands in the pivot stud socket area. Pull with even pressure and the lever will pop off the pivot–stud. Do not use a screwdriver or pry bar to pop off the lever. This may damage the spring clip on the lever.

(2) As a unit, remove the fork from the bearing thrust plate. Be careful not to damage retention tabs on bearing.

(3) Examine the condition of the bearing. **It is pre-lubricated and sealed and should not be immersed in oil or solvent.**

(4) The bearing should turn smoothly when held in the hand under a light thrust load. A light drag caused by the lubricant fill is normal. If the bearing is noisy, rough, or dry, replace the complete bearing assembly with a new bearing.

(5) Check the condition of the pivot stud spring clips on back side of clutch fork. If the clips are broken or distorted, replace the clutch fork.

INSTALLATION

(1) The pivot ball pocket in the fork is Teflon coated and should be installed WITHOUT any lubricant such as grease. Using grease will break down the Teflon coating. Be sure the ball stud and fork pocket are clean of contamination and dirt.

(2) Assemble the fork to the bearing. The small pegs on the bearing must go over the fork arms.

(3) Slide the bearing and fork assembly onto the input shaft bearing retainer, as a unit.

(4) Snap the clutch fork onto the pivot ball.

(5) Reinstall transaxle assembly. Refer to Group 21, Transaxle for further information.

CLEANING AND INSPECTION

CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, grease, water, or other fluids on the clutch contact surfaces will cause faulty operation.

During inspection, note if any components are contaminated. Look for evidence of oil, grease, or water/road splash on clutch components.

OIL CONTAMINATION

Oil contamination indicates a leak at the rear main seal and/or transaxle input shaft. Oil leaks produce a residue of oil on the transaxle housing interior, clutch cover and flywheel. Heat buildup caused by slippage can bake the oil residue onto the components. This glaze-like residue ranges in color from amber to black.

GREASE CONTAMINATION

Grease contamination is usually a product of overlubrication. During clutch service, apply only a small amount of grease to the input shaft splines. Excess grease may be thrown off during operation, contaminating the disc.

ROAD SPLASH/WATER CONTAMINATION

Road splash contamination is usually caused by driving the vehicle through deep water puddles. Water can be forced into the clutch housing, causing clutch components to become contaminated. Facing of disc will absorb moisture and bond to the flywheel and/or, pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, replacement of clutch assembly may be required. Drive the vehicle until normal clutch operating temperature has been obtained. This will dry off disc assembly, pressure plate, and flywheel.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. Facing of disc will absorb moisture and will bond to flywheel and/or pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, it may require replacement of clutch assembly. After cleaning, drive the vehicle to its normal clutch operating temperature. This will dry off disc assembly, pressure plate, and flywheel.

ADJUSTMENTS

CLUTCH CABLE

The manual transaxle clutch release system has a unique self-adjusting mechanism to compensate for clutch disc wear (Fig. 8). This adjuster mechanism is located within the clutch cable assembly. The preload spring maintains tension on the cable. This tension keeps the clutch release bearing continuously loaded against the fingers of the clutch cover assembly.

ADJUSTER MECHANISM FUNCTION CHECK

(1) With slight pressure, pull the clutch release lever end of the cable to draw the cable taut. Push

ADJUSTMENTS (Continued)

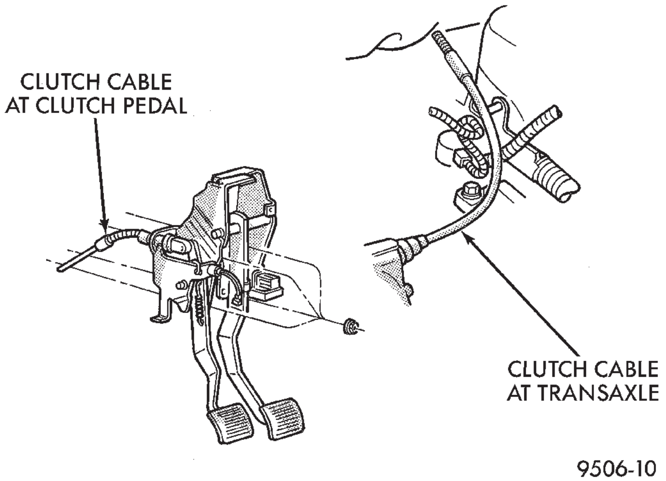


Fig. 8 Clutch Cable Routing

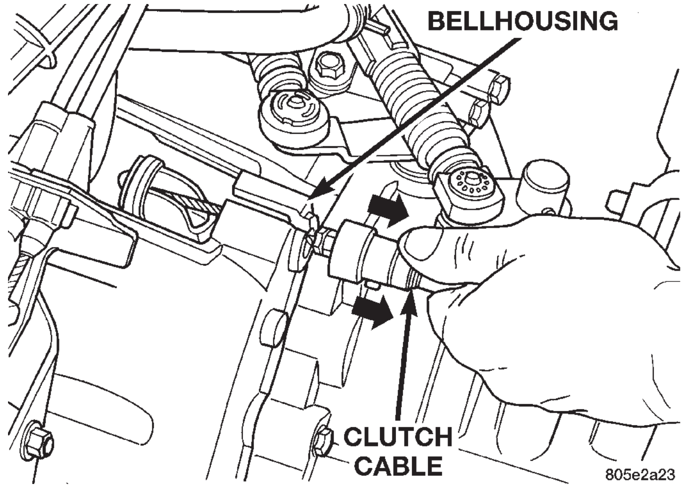


Fig. 9 Cable at Transaxle

the clutch cable housing toward the dash panel. With less than 25 lbs. of effort the cable housing should move 30-50mm. This indicates proper adjuster mechanism function. If the cable does not adjust, determine if the mechanism is properly seated on the bracket.

(2) If the adjust mechanism functions properly, guide the cable through the slot in the transaxle housing. Connect cable to release lever, seating the cupped washer securely on lever tangs.

(3) Pull back on clutch cable housing and insert into transaxle housing (Fig. 9).

(4) Reinstall cable inspection cover and air cleaner assembly. Check clutch pedal position switch operation.

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted to a bracket located behind the clutch pedal. The switch is held in place by four plastic wing tabs.

The clutch pedal position switch IS NOT adjustable. The pedal blade contacts the switch in the down position (Fig. 10).

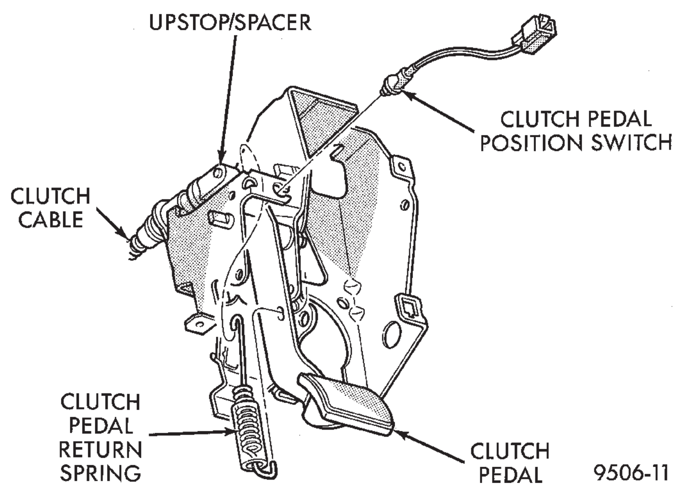


Fig. 10 Clutch Pedal Position Switch and Components

SPECIFICATIONS

NV T350 (A-578) CLUTCH TIGHTENING REFERENCE

DESCRIPTION	TORQUE
Drive Plate To Clutch Bolts	75 N·m (55 ft. lbs.)
Drive Plate To Crankshaft Bolts	95 N·m (70 ft. lbs.)
Clutch Pedal Pivot Shaft Nut	41 N·m (30 ft. lbs.)

COOLING SYSTEM

CONTENTS

GENERAL INFORMATION

COOLING SYSTEM

The cooling system consists of an engine cooling module, thermostat, coolant, a water pump to circulate the coolant. The engine cooling module may consist of a radiator, electric fan motor, shroud, radiator pressure cap, coolant reserve system, transmission oil cooler and lines, hoses, clamps, and air conditioning condenser.

- When Engine is cold: Thermostat is closed, cooling system has no flow through the radiator. The coolant bypass flows through the engine and heater core.
- When Engine is warm: Thermostat is open, cooling system has bypass flow and coolant flow through radiator and heater core.

The primary purpose of a cooling system is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also provides hot water (coolant) for heater performance and cooling for automatic transmission oil. It does this by transferring heat from engine metal to coolant, moving this heated coolant to the radiator, and then transferring this heat to the ambient air.

Coolant flow circuits for 2.0L and 2.4L engine equipped vehicles are shown in (Fig. 1). The 2.5L engine coolant flow circuit is shown in (Fig. 2).

WATER PIPES—2.5L

The 2.5L engine use metal piping beyond the lower radiator hose to route coolant to the suction side of water pump, located in the V of the cylinder banks.

The pipes are also provided with inlet nipples for thermostat bypass, heater return coolant hoses, and brackets for rigid engine attachment. The pipes employ O-rings for sealing at their interconnection and to the water pump (Fig. 3).

ACCESSORY DRIVE BELTS

The engines are equipped with 2 accessory drive belts. One belt drives the power steering pump, the other drives the generator and air conditioning (Fig. 4) or (Fig. 5).

COOLANT RECOVERY SYSTEM (CRS)

This system works in conjunction with the pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides a volume for expansion and contraction, provides a convenient and safe method for checking coolant level, and adjusting level at atmospheric pressure without removing the pressure cap. It also provides some reserve coolant to cover minor leaks and evaporation or boiling losses. All vehicles are equipped with this system (Fig. 6).

See Coolant Level Check Service, Deaeration and Pressure Cap sections for operation and service.

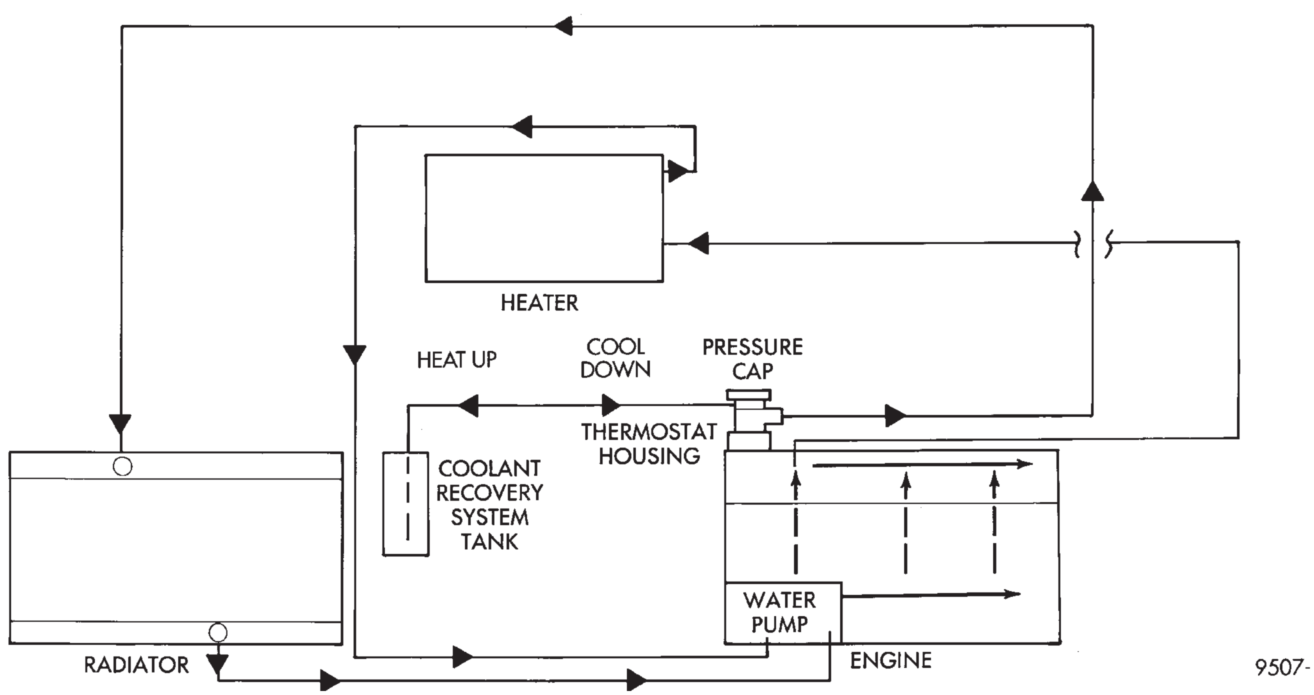


Fig. 1 Cooling System Operation—2.0L and 2.4L Engines

GENERAL INFORMATION (Continued)

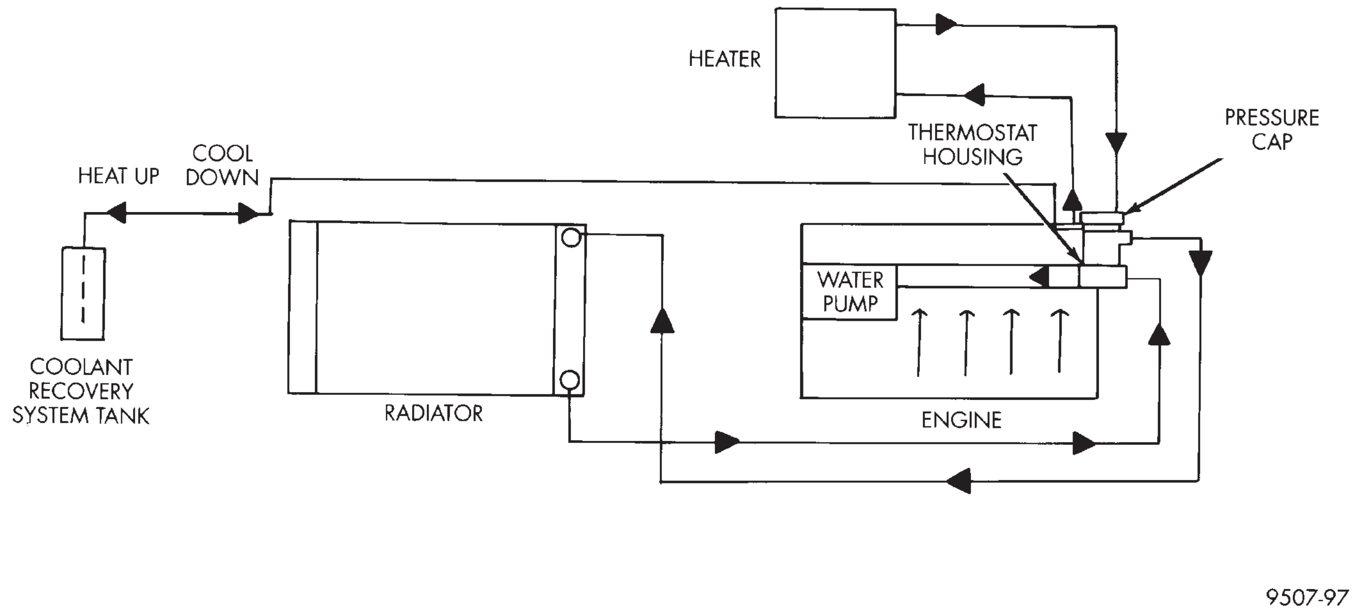


Fig. 2 Cooling System Operation—2.5L Engine

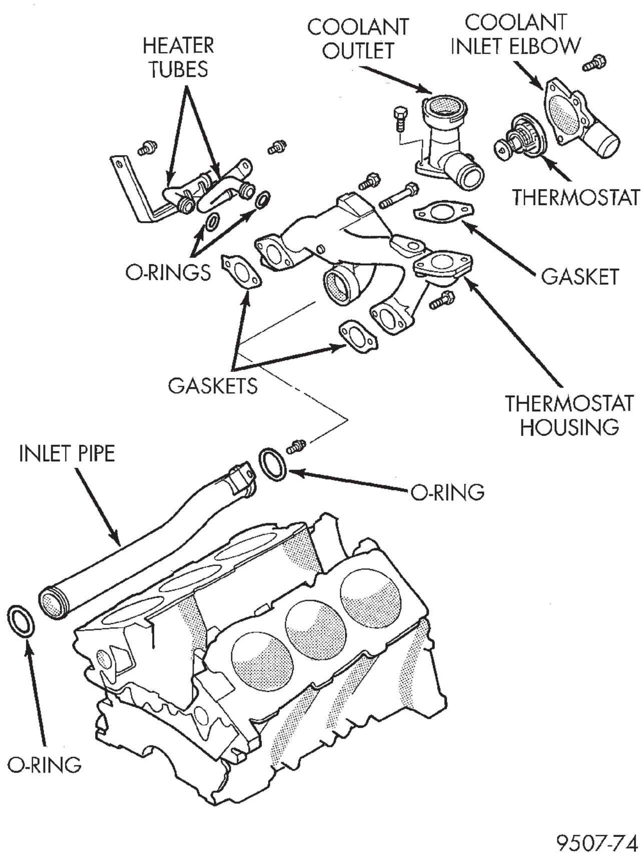


Fig. 3 Engine Inlet Coolant Pipes—2.5L Engine

ENGINE THERMOSTATS

The 2.0L and 2.4L engine thermostats are located on the front of the engine (radiator side) in the thermostat housing/engine outlet connector (Fig. 7) and (Fig. 8). The thermostat has a air bleed located in the flange and a O-ring with a locating dimple incorporate on it. There is a relief in the cylinder head for locating the air bleed.

The 2.5L engine thermostat is located in a thermostat housing, located below the throttle body. This thermostat has an air bleed valve, located in the thermostat flange (Fig. 9).

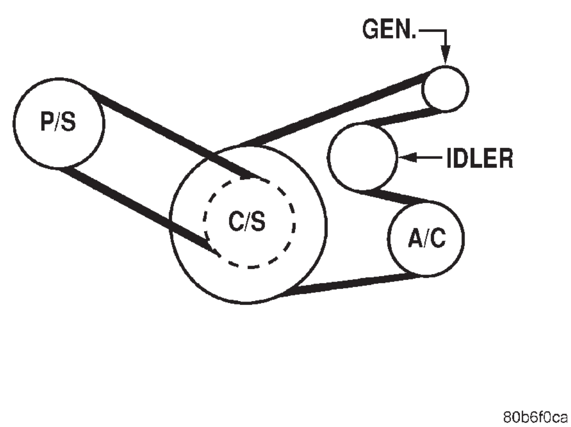


Fig. 4 Drive Belts—2.0/2.4L Engine

WATER PUMP—2.0/2.4L ENGINES

The water pump body is made of aluminum with a steel impeller. The water pump is bolted to the front of the block, and driven by the timing belt. The water pump is the heart of the cooling system, pumping the

GENERAL INFORMATION (Continued)

coolant through the engine block, cylinder head, heater core, and radiator.

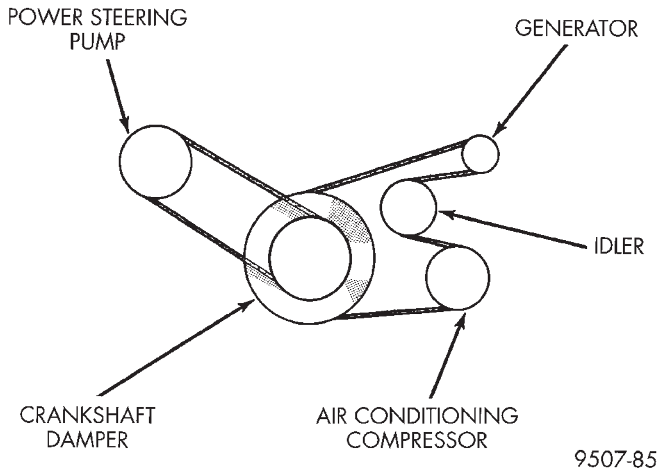


Fig. 5 Drive Belts—2.5L Engine

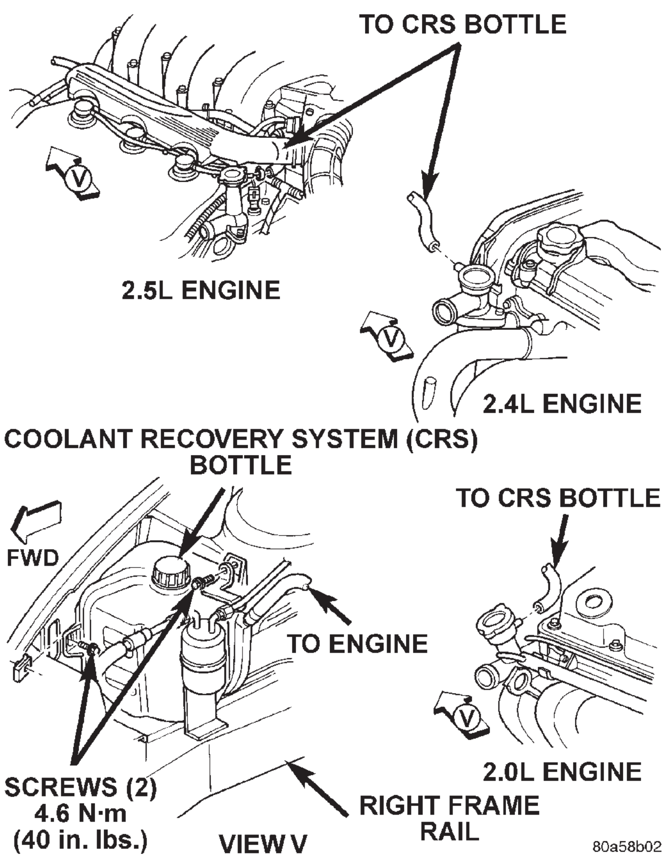


Fig. 6 Coolant Recovery System

NOTE: The water pump on all models can be replaced without discharging the air conditioning system.

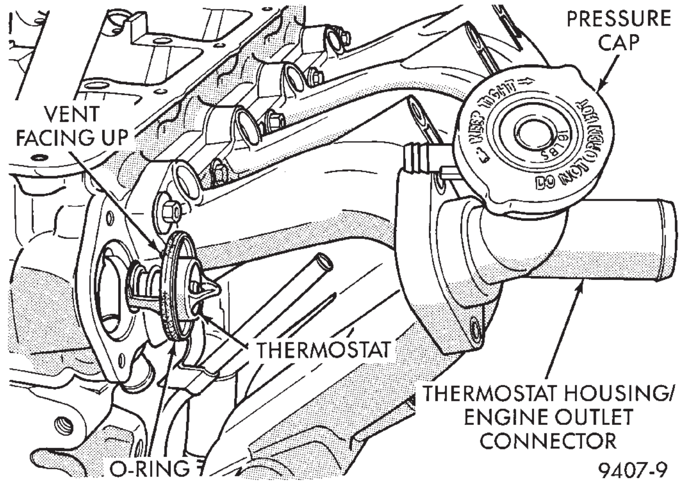


Fig. 7 Thermostat/Engine Outlet Connector—2.0L Engine

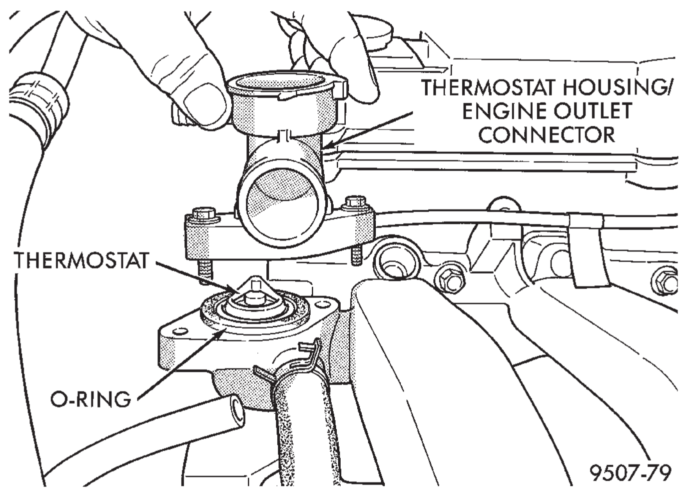


Fig. 8 Thermostat and Engine Outlet Connector—2.4L Engine

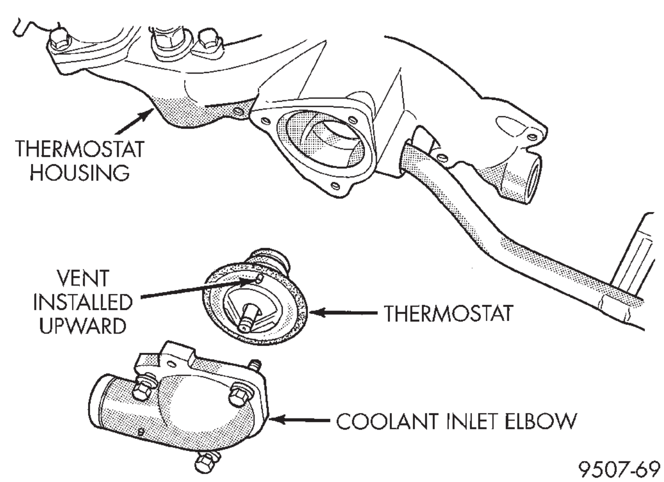


Fig. 9 Thermostat, Housing and Inlet Elbow—2.5L Engine

GENERAL INFORMATION (Continued)

WATER PUMP—2.5L ENGINE

The 2.5L pump bolts directly to the engine block uses a gasket for pump to block sealing (Fig. 10). The pump is serviced as an assembly.

The water pump is driven by the timing belt. See Timing Belt in Group 9, Engine for component removal providing access to water pump.

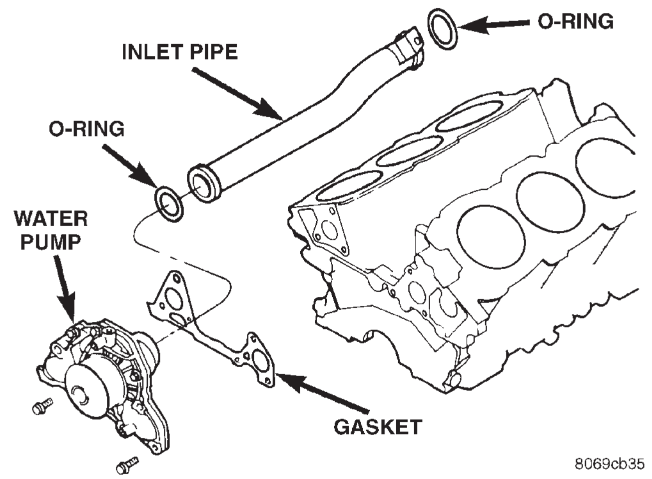


Fig. 10 Water Pump—2.5L Engine

WATER PUMP INLET TUBE—2.0/2.4L ENGINES

The inlet tube connects the water pump to the radiator and heater core. This tube is sealed by an O-ring and held in place by fasteners to the block.

COOLANT

The cooling system is designed around the coolant. The coolant must accept heat from engine block metal and in the cylinder head area near the exhaust valves. Then coolant carries this heat to the radiator where the tube/fin assemblies of these components can give off the heat to the air.

Mopar® Antifreeze or the equivalent is recommended for optimum cooling performance and corrosion protection when mixed to a freeze point of -37° C (-35° F).

COOLANT REPLACEMENT

Refer to Group 0, Lubrication and Maintenance for schedule.

COOLING SYSTEM PRESSURE CAP

The cooling system is equipped with a pressure cap that releases pressure at some point within a range of 97-124 kPa (14-18 psi) (Fig. 11).

The system will operate at higher than atmospheric pressure, which raises the coolant boiling point, allowing increased radiator cooling capacity.

There is a vent valve in the center of the cap that allows a small coolant flow to the CRS tank. **If the valve is stuck shut, the radiator hoses will collapse on cool-down. Clean the vent valve (Fig. 11) to ensure proper sealing when boiling point is reached.**

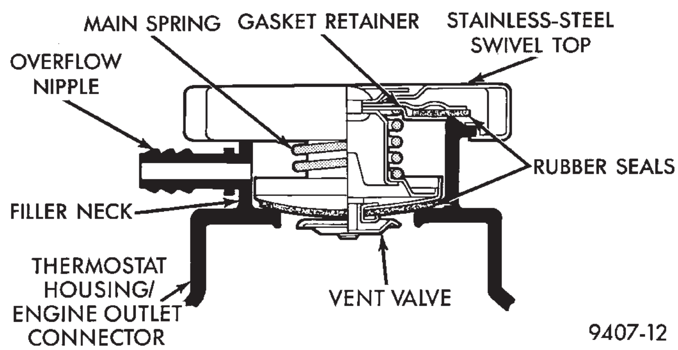


Fig. 11 Cooling System Pressure Cap to Filler Neck

There is a gasket in the cap that seals to the top of the filler neck so that vacuum is maintained to draw coolant back into the system from the coolant reserve system tank.

RADIATOR

The radiators are cross flow types (horizontal tubes) with design features that provide greater strength as well as sufficient heat transfer capabilities to keep the engine satisfactorily cooled (Fig. 12).

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches.

COOLING SYSTEM FANS

All models use electric motor driven, two speed cooling system fans. The fan modules include a motor support and shroud. The module is fastened to the radiator by bolts (Fig. 13).

NOTE: Attempts to reduce high temperature gauge reading by increasing engine speed, at the same vehicle speed, can increase high engine coolant temperature.

AUTOMATIC TRANSMISSION OIL COOLERS

Oil coolers are internal oil to coolant type, mounted in the radiator left tank (Fig. 14). Rubber oil lines feed the oil cooler and the automatic transmission. Use only approved transmission oil cooler hose. Since these hoses are molded to fit space available, replacement molded hoses are recommended. Tighten Oil Cooler Hose Clamps to 2 N·m (18 in. lbs.).

GENERAL INFORMATION (Continued)

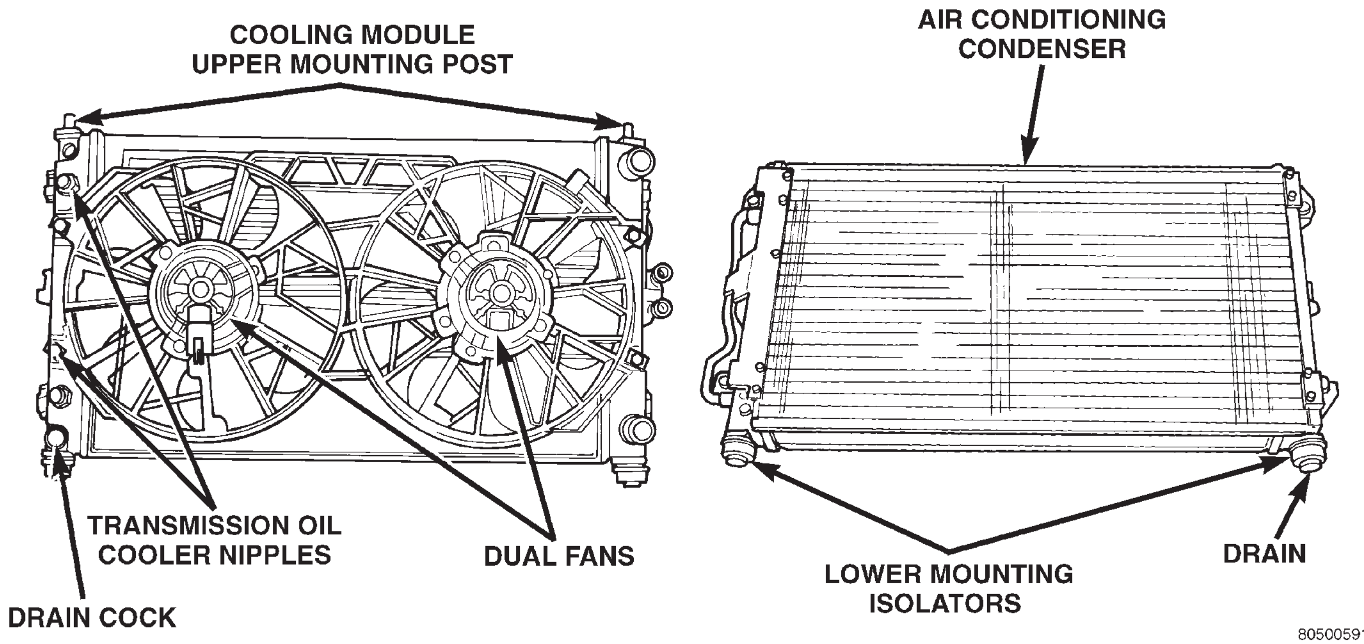


Fig. 12 Radiator Module

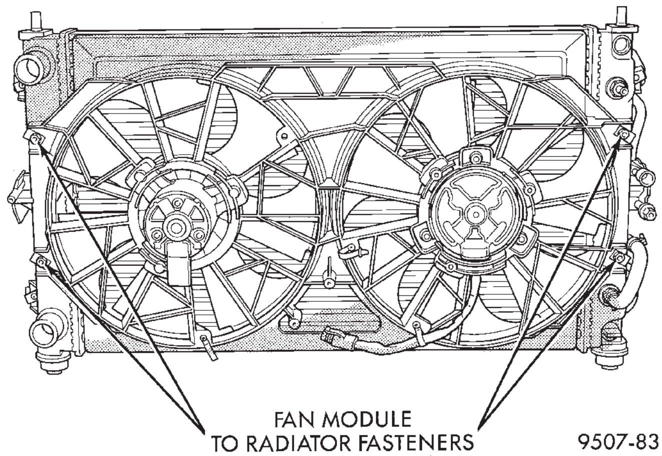


Fig. 13 Fan Module

EXTERNAL TRANSMISSION OIL COOLER

An external oil-to-air type transmission oil cooler is mounted ahead of the cooling module (Fig. 15) and (Fig. 16). This style of cooler uses steel tubes and rubber oil lines to feed oil from the internal (in radiator tank) cooler to the external cooler and then to the automatic transmission. Use only approved transmission oil cooler hose. Since these hoses are molded to fit space available, replacement molded hoses are recommended.

ENGINE BLOCK HEATER

On all models an engine block heater is available as an optional accessory. The heater, operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille.

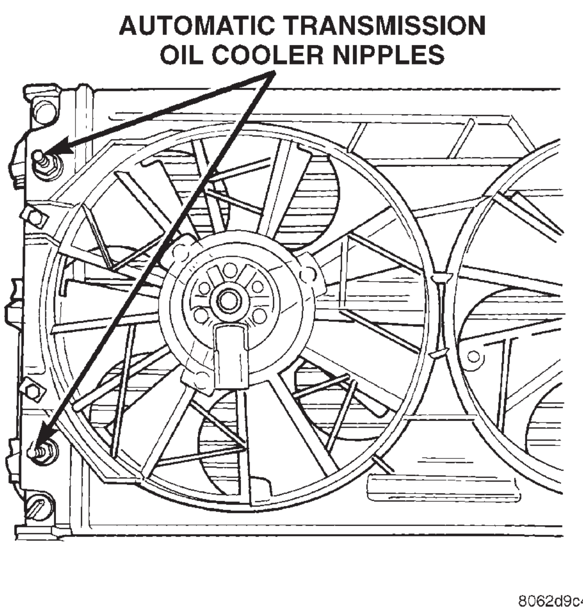


Fig. 14 Transmission Oil Cooler

Refer to Description and Operation in this section for more information.

DESCRIPTION AND OPERATION

THERMOSTAT

The engine cooling thermostats are wax pellet driven, reverse poppet choke type. They are designed to provide the fastest warm up possible by preventing leakage through them and to guarantee a minimum engine operating temperature of 88 to 93°C

DESCRIPTION AND OPERATION (Continued)

(192 to 199°F). They also automatically reach wide open so they do not restrict flow to the radiator as temperature of the coolant rises in hot weather to around 104°C (220°F). Above this temperature the coolant temperature is controlled by the radiator, fan, and ambient temperature, not the thermostat.

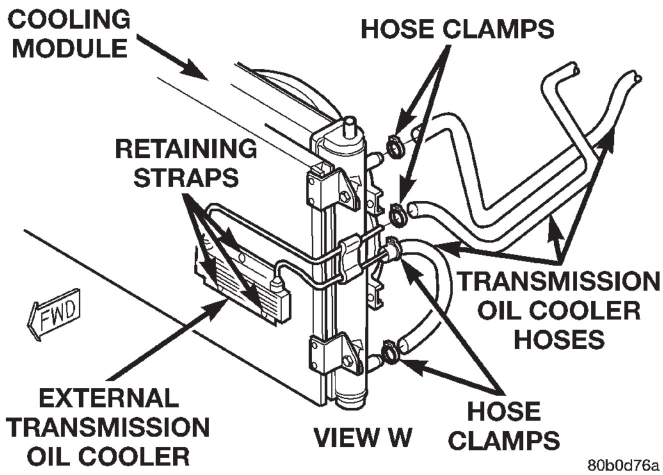


Fig. 15 Transmission Oil Cooler—2.0/2.4L Engines

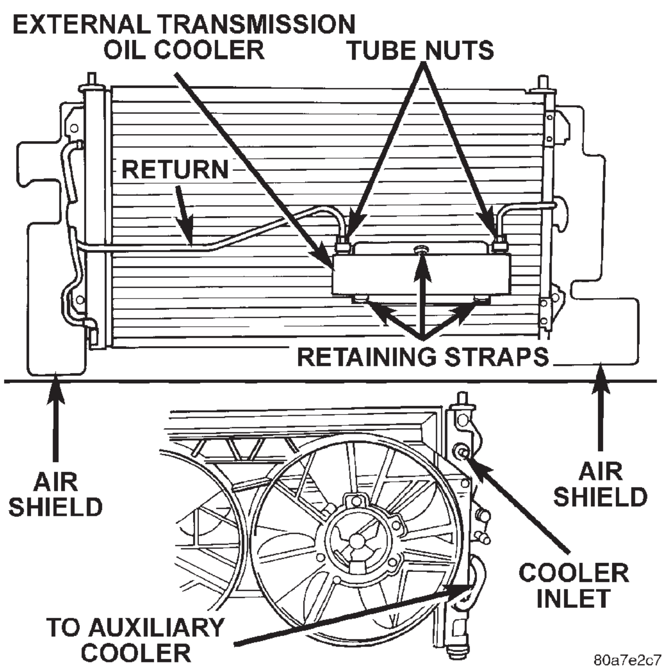


Fig. 16 Transmission Oil Cooler—2.5L Engine

The thermostat is operated by a wax filled container (pellet) which is sealed. When heated coolant reaches a predetermined temperature, the wax expands enough to overcome the closing spring and water pump pressure, which forces the valve to open.

Coolant leakage into the wax pellet will cause a thermostat to fail open. Do not attempt to free-up a stuck open thermostat.

COOLANT PERFORMANCE

Performance is measurable. For heat transfer, one pound of pure water absorbs 1 btu for each degree of temperature rise. This formula is altered when necessary additives to control boiling, freezing, and corrosion are added as follows:

- Pure Water (1 btu) boils at 100°C (212°F) and freezes at 0°C (32°F).
- 100 Percent ethylene glycol (.7 btu) can cause an engine to run hot, cause detonation, and will freeze at -22°C (-8°F).
- 50/50 Ethylene Glycol and Distilled Water (.82 btu) is the recommended combination that provides a freeze point of -37°C (-35°F). The radiator, water pump, engine water jacket, radiator pressure cap, thermostat, temperature gauge, coolant sensor and heater are all designed for 50/50 ethylene glycol.

Where required, a 56 percent glycol and 44 percent water mixture will provide a freeze point of -46°C (-50°F).

NOTE: Richer mixtures cannot be measured with field equipment and can lead to problems associated with 100 percent glycol. If there is doubt that the coolant mixture is to rich for field equipment to measure, put a sample in a clean container. Add exactly the same amount of water and retest. If the coolant in the vehicle is 100% antifreeze, the diluted sample will read 50% . If the coolant in the vehicle was 70% antifreeze and 30% water, the diluted sample will read as 35% , etc.

SELECTION AND ADDITIVES

The use of aluminum cylinder heads, intake manifolds, and water pumps requires special corrosion protection. Mopar® Antifreeze or the equivalent is recommended for optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-35°F) to -59°C (-50°F). If it looses color or becomes contaminated; drain, flush, and replace with fresh properly mixed solution.

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended.

COOLING SYSTEM PRESSURE CAP

The cooling system is equipped with a pressure cap that releases built up pressure, maintaining a range of 97-124 kPa (14-18 psi).

The cooling system will operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point thus, allowing increased radiator cooling capacity.

DESCRIPTION AND OPERATION (Continued)

There is also a vent valve in the center of the cap. This valve also opens when coolant is cooling and contracting allowing coolant to return to radiator from coolant reserve system tank by vacuum through connecting hose. **If valve is stuck shut, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 17) to ensure proper sealing when boiling point is reached.**

The gasket in the cap seals the filler neck, so that vacuum can be maintained, allowing coolant to be drawn back into the radiator from the reserve tank.

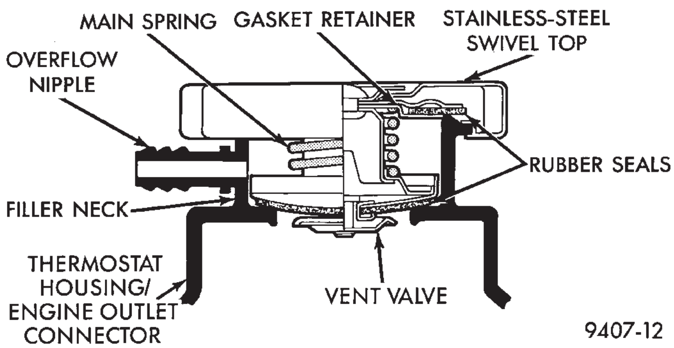


Fig. 17 Cooling System Pressure Cap

RADIATOR HOSES AND CLAMPS

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE WORKING ON VEHICLE. RELIEVE PRESSURE BY PLACING A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE IT COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING OUT COOLANT AND STEAM AND THE PRESSURE DROPS CONTINUE SERVICE.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 18).

The hose clamps are removed by using Special Tool 6094 or equivalent constant tension clamp pliers (Fig. 19) to compress hose clamp.

A hardened, cracked, swollen or restricted hose should be replaced. Do not damage radiator inlet and outlet when loosening hoses.

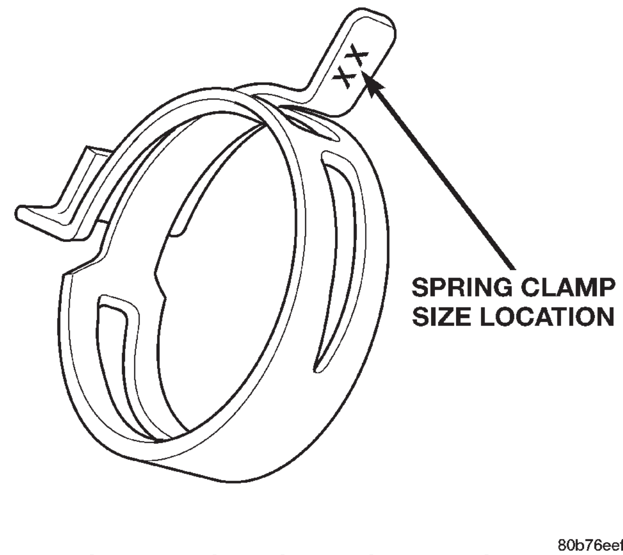


Fig. 18 Spring Clamp Size Location

Radiator hoses should be routed without any kinks and indexed as designed. The use of molded hoses is recommended.

Make sure hoses and connectors are clean and dry before installation. Do not lubricate hoses when installing.

Spring type hose clamps are used in all applications. If replacement is necessary, replace with the original Mopar® equipment spring type clamp.

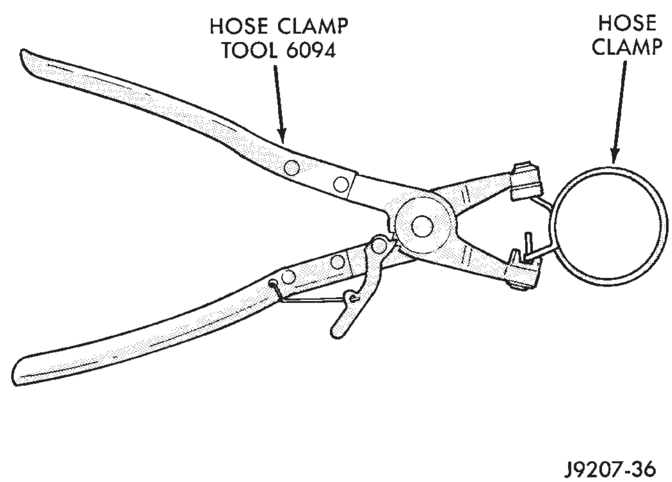


Fig. 19 Hose Clamp Tool

ENGINE BLOCK HEATER

The heater, operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille, provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant (Fig. 20). **The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or**

DESCRIPTION AND OPERATION (Continued)

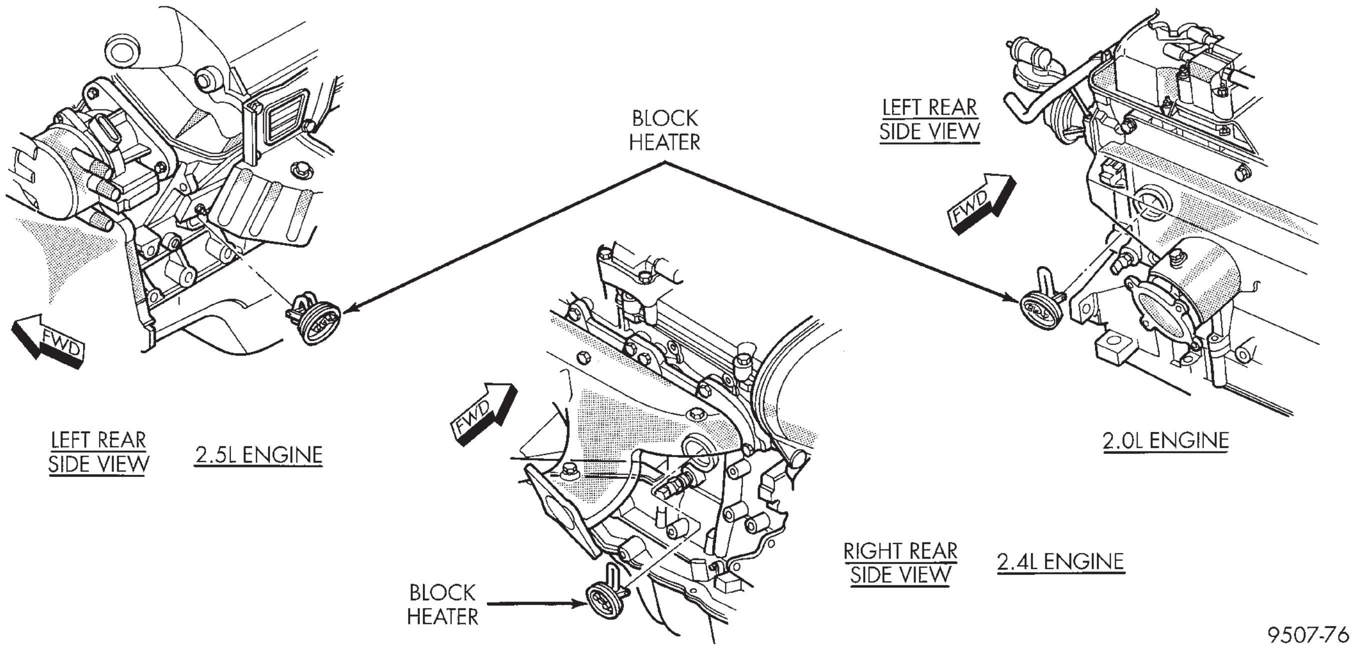


Fig. 20 Engine Block Heater

exhaust manifolds and become damaged. For removal procedures, refer to Removal and Installation in this section.

WATER PUMP—2.0/2.4L ENGINES

The water has a diecast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block (Fig. 21). Cylinder block to water pump sealing is provided by a rubber O-ring. The water pump is driven by the timing belt. Refer to Group 9, Engine section for component removal to access the water pump.

NOTE: The water pump on all models can be replaced without discharging the air conditioning system.

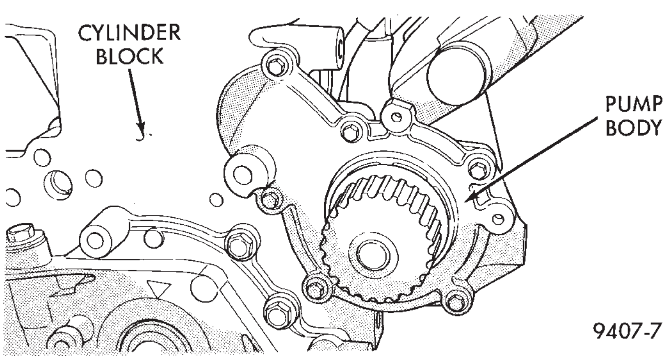


Fig. 21 Water Pump

WATER PUMP—2.5L ENGINE

The water pump has a aluminum body with a steel impeller. A gasket is used to seal the pump to the cylinder block. The water pump inlet is located at the rear of the pump, a inlet tube located between the cylinder heads connects the water pump with the thermostat housing (Fig. 22). The water pump is driven by the timing belt. Refer to Group 9, Engine for timing belt removal.

NOTE: The water pump can be replaced with out discharging the air conditioning system.

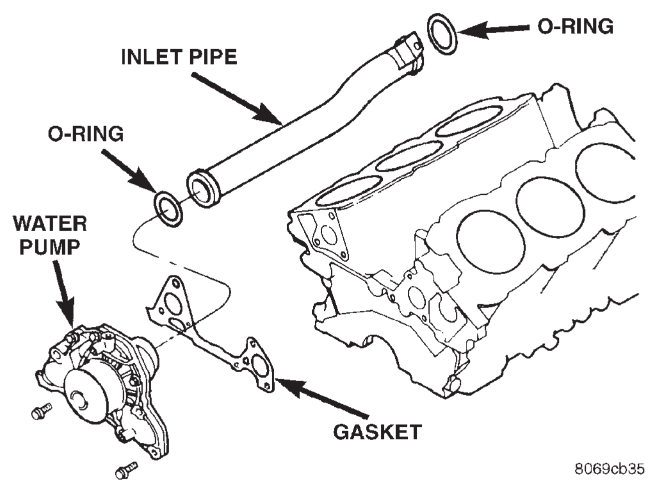


Fig. 22 Water Pump and Inlet Tube

DIAGNOSIS AND TESTING

COOLING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open engine thermostat?	1. Refer to On Board Diagnostic in Group 25. Replace thermostat, if necessary. If a (DTC) has not been set, the problem may be with the temperature gauge.
	2. Is the temperature gauge (if equipped) connected to the temperature gauge coolant sensor on the engine?	2. Check the connector at the engine coolant sensor. Refer to Group 8E. Repair as necessary.
	3. Is the temperature gauge (if equipped) operating OK?	3. Check Gauge operation. Refer to Group 8E. Repair as necessary.
	4. Coolant level low during cold ambient temperature, accompanied by poor heater performance.	4. Check coolant level in the coolant recovery/reserve container and the radiator. Inspect the system for leaks. Repair as necessary. Refer to WARNINGS in this section before removing pressure cap.
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	1. Trailer being towed, a steep hill being climbed, vehicle being operated in slow moving traffic, or engine idling during high ambient (outside) temperatures with air conditioning on. High altitudes Could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and drive the vehicle without any of the previous conditions. Observe the temperature gauge the gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause of the overheating and repair. Refer to POSSIBLE CAUSES in this section.
	2. Is temperature gauge (if equipped) reading correctly?	2. Check gauge. Refer to Group 8E. Repair as necessary.
	3. Is temperature warning lamp (if equipped) illuminating unnecessarily?	3. Check warning lamp operation. Refer to Group 8E. Repair as necessary.
	4. Coolant low in recovery/reserve container and radiator?	4. Check for coolant leaks and repair as necessary. Refer to Checking Cooling System for Leaks in this section.
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 6.	5. Tighten cap.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	6. Poor seals at radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator cap Inspection. Replace cap if necessary. (b) Check condition of filler neck . If neck is bent or damaged, replace neck.
	7. Coolant level low in radiator, but not in coolant recovery/reserve container. This indicates the radiator is not drawing coolant from the coolant recovery/reserve container as the engine cools. As the engine cools, a vacuum is formed inside the cooling system. If the radiator cap seals are defective, or the cooling system has a leak, a vacuum cannot be formed.	7. (a) Check condition of radiator cap and cap seals. Replace cap if necessary. (b) Check condition of filler neck. Replace if damaged. (c) Check condition of hose from filler neck to coolant container. It should be tight at both ends without any kinks or tears. Replace hose as necessary. (d) Check coolant recovery/reserve container and hose for blockage. Repair as necessary.
	8. Freeze point of coolant not correct. Mixture ratio may be too rich.	8. Check coolant concentration. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ration as required.
	9. Coolant not flowing through system.	9. Check for coolant flow at filler neck with some coolant removed, engine warm, and thermostat open. Coolant should be observed flowing through filler neck. If flow is not observed, determine reason for lack of flow and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Clean obstruction from fins.
	11. Radiator core is plugged or corroded.	11. Replace or re-core radiator.
	12. Fuel or ignition system problems.	12. Refer to Fuel and Ignition System groups for diagnosis. Also refer to the appropriate Powertrain Diagnostic Procedure manual.
	13. Dragging Brakes.	13. Inspect brake system and repair as necessary. Refer to Group 5, Brakes for diagnosis.
	14 Bug screen or other aftermarket accessory is being used causing reduced air flow.	14. Remove bug screen or accessory.
	15. Thermostat partially or completely closed. This is more prevalent on high mileage vehicles.	15. Check thermostat operation and replace as necessary. Refer to thermostat in this section for procedure.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	16. Electric cooling fan not operating properly.	16. Check electric fan operation and repair as necessary.
	17. Cylinder head gasket leaking.	17. Check cylinder head gasket for leaks. Refer to testing cooling system for leaks. For repairs, refer to Group 9, Engine.
	18. Heater core leaking.	18. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning and repair as necessary.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. The gauge may cycle up and down. This is due to the cycling of the electric radiator fan.	1. A normal condition. No correction is necessary. If gauge cycling is going into the hot zone, check electric fan operation and repair as necessary. Refer to procedure in this section.
	2. During cold weather operation with the heater blower in the high position, the gauge reading may drop slightly.	2. A normal condition. No correction is necessary.
	3. Temperature gauge or engine mounted gauge sensor is defective or shorted.	3. Check operation of gauge and repair as necessary. Refer to Group 8E, Instrument Panel and Gauges.
	4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).	4. A normal condition. No correction is necessary. The gauge should return to normal range after vehicle is driven.
	5. Gauge reading high after restarting a warmed-up (hot) engine.	5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	6. Check and correct coolant leaks. Refer to Testing Cooling System For Leaks in the section.
	7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system. This will cause thermostat to open late.	7. (a) Check for cylinder head gasket leaks with a commercially available Block Leak Tester. Repair as necessary. (b) Check for coolant in the engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary.
	8. Water pump impeller loose on shaft.	8. Check water pump and replace as necessary. Refer to Water Pump in this section.
	9. Loose drive belt (water pump slipping).	9. Check drive belt and correct as necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
	10. Air leak on the suction side of water pump allows air to build up in cooling system. This will cause the thermostat to open late.	10. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT FLOWING INTO RECOVERY CONTAINER. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL, BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN RECOVERY CONTAINER.	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and seals. Refer to Radiator Cap in this section. Replace as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT.	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. Refer to Testing Cooling System For Leaks in this section.
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH.	1. Engine overheating. 2. Freeze point of coolant not correct.	1. Check reason for overheating and repair as necessary. 2. Check the freeze point of the coolant. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ratio as required.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant recovery/reserve container system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this section. Replace as necessary. (b) Hose between coolant recovery/reserve container and radiator is kinked. Repair as necessary. (c) Vent at coolant recovery/reserve container is plugged. Clean vent and repair as necessary. (d) Recovery/reserve container is internally blocked or plugged. Check for blockage and repair as necessary.
ELECTRIC RADIATOR FAN OPERATES ALL THE TIME.	1. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective. 2. Check for low coolant level.	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary. 2. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ELECTRIC RADIATOR FAN WILL NOT OPERATE. GAUGE READING HIGH OR HOT	1. Fan motor defective.	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
	2. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective.	2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
	3. Blown fuse in power distribution center (PDC).	3. Determine reason for blown fuse and repair as necessary.
NOISY FAN	1. Fan blades loose.	1. Replace fan blade assembly. Refer to Cooling System Fans in this section.
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or A/C condenser.	3. Remove obstructions and/or clean debris from radiator and/or A/C condenser.
	4. Electric fan motor defective.	4. Refer to procedure in this section.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or air conditioning condenser is restricted, obstructed or dirty.	1. Remove restriction and/or clean as necessary.
	2. Electric radiator fan not operating when A/C is on.	2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
	3. Engine is overheating (heat may be transferred from radiator to A/C condenser). High underhood temperature due to engine overheating may also transfer heat to A/C components.	3. Correct overheating condition. Refer to this section.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
INADEQUATE HEATER PERFORMANCE.	1. Has a diagnostic trouble code (DTC) been set?	1. Refer to On-Board Diagnostic in Group 25, Emission Control Systems.
	2. Coolant level low.	2. Refer to testing cooling system for leaks in this section. Repair as necessary.
	3. Obstructions in heater hose fittings at engine.	3. Remove heater hoses at both ends and check for obstructions. Repair as necessary.
	4. Heater hose kinked.	4. Locate kinked area and repair as necessary.
	5. Water pump is not pumping coolant to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. The water pump drive belt may be slipping causing poor water pump operation.	5. Refer to water pump in this section. Repair as necessary.
HEAT ODOR	1. Various heat shields are used at certain driveline components. One or more of these shields may be missing.	1. Locate missing shields and replace or repair as necessary.
	2. Is temperature gauge reading above the normal range?	2. Refer to the previous Temperature Gauge Reads High in these Diagnostic Charts. Repair as necessary.
	3. Is cooling fan operating correctly?	3. Refer to Cooling System Fan in this section for diagnosis. Repair as necessary.
	4. Has undercoating been applied to any unnecessary component.	4. Clean undercoating as necessary.
	5. Engine may be running rich causing the catalytic converter to overheat.	5. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.
POOR DRIVEABILITY (THERMOSTAT POSSIBLY STUCK OPEN). GAUGE MAY BE READING LOW	1. For proper driveability, good vehicle emissions and for preventing build-up of engine oil sludge, the thermostat must be operating properly. Has a diagnostic trouble code (DTC) been set?	1. Refer to On-Board Diagnostics in Group 25, Emission Control Systems. DTC's may also be check using the DRB scan tool. Refer to the proper Powertrain Diagnostic Procedure manual for checking the thermostat if necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP, RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE.	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contact the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Check the freeze point of the coolant. Refer to Coolant Concentration in the section for procedure. Adjust the glycol-to-water ratio as required.
COOLANT LEVEL CHANGES IN COOLANT RECOVERY/RESERVE CONTAINER	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the container was between the FULL and ADD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

ENGINE THERMOSTAT TESTING

The thermostat is operated by a wax filled container (pellet) which is sealed. When heated coolant reaches a predetermined temperature the wax pellet expands enough to overcome the closing spring and water pump pressure, which forces the valve to open. Coolant leakage into the pellet will cause a thermostat to fail open. Do not attempt to free up a thermostat with a screwdriver.

The thermostat that opens too soon type failure mode is included in the on-board diagnosis. The check engine light will not be lit by an open too soon condition. If it has failed open, a diagnostic trouble code (DTC) will be set. Do not change a thermostat for lack of heater performance or temperature gauge position, unless a DTC is present. See Diagnosis for other probable causes. Thermostat failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will indicate this. Refer to Diagnosis in this section.

WATER PUMP DIAGNOSIS

A quick flow test to tell whether or not the pump is working is to see if the heater warms properly. A defective pump will not be able to circulate heated coolant through the long heater hose.

Another flow test to help determine pump operation, remove radiator cap.

WARNING: DO NOT remove radiator cap if the cooling system is hot or under pressure.

COOLING SYSTEM FLOW CHECK

To determine whether coolant is flowing through the cooling system, use the following procedures:

(1) If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Remove pressure cap when engine is cold, remove small amount of coolant Idle engine until thermostat opens, you should observe coolant flow while looking down the filler neck. Once flow is detected install the pressure cap.

DIAGNOSIS AND TESTING (Continued)

RADIATOR FAN CONTROL

Fan control is accomplished three ways. The fan runs when the air conditioning pressure reaches a set psi see charts below. In addition to this control, the fan is turned on by the temperature of the coolant which is sensed by the coolant temperature sensor which sends the message to the Powertrain Control Module (PCM). The PCM turns on the fan through a fan relay. On models equipped with automatic transmission, a transmission fluid thermister may have some influences on fan operation. See Wiring Diagrams Manual for circuity and diagnostics provided.

The Powertrain Control Module (PCM) provides fan control for the following conditions:

• The fan will not run during cranking until the engine starts no matter what the coolant temperature is.

• Fan will run when the air conditioning clutch is engaged, low pressure cutout switch is closed and once set compressor head pressure is reached. See charts.

• Fan will run according to the following information charts.

RADIATOR FAN OPERATION—2.0L ENGINE

Radiator Fan Control			**A/C Pressure**	
A/C Off	**Low**	**High**		
Fan On:	104°C (220°F)	110°C (230°F)		
Fan Off:	99°C (210°F)	104°C (220°F)		
A/C On	Low	High	Low	High
Fan On:	99°C (210°F)	110°C (230°F)	1,466 Kpa (209 psi)	1,717 Kpa (249 psi)
Fan Off:	93°C (200°F)	104°C (220°F)	1,172 Kpa (170 psi)	1,579 Kpa (229 psi)
EATX Fluid Temperature			**Low Speed**	**High Speed**
Fan On:			116°C (240°F)	120°C (248°F)
Fan Off:			109°C (228°F)	116°C (240°F)

ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

RADIATOR FAN OPERATION—2.4L ENGINE

Radiator Fan Control			**A/C Pressure**	
A/C Off	**Low**	**High**		
Fan On:	104°C (219°F)	110°C (230°F)		
Fan Off:	99°C (210°F)	105°C (221°F)		
A/C On	**Low**	**High**	**Low**	**High**
Fan On:	99°C (210°F)	110°C (230°F)	1,448 Kpa (210 psi)	1,718 Kpa (249 psi)
Fan Off:	93°C (199°F)	105°C (221°F)	1,207 Kpa (175 Psi)	1,585 Kpa (229 Psi)
EATX Fluid Temperature			**Low Speed**	**High Speed**
Fan On:			118°C (244°F)	122°C (252°F)
Fan Off:			116°C (240°F)	118°C (244°F)

RADIATOR FAN OPERATION—2.5L ENGINE

Radiator Fan Control			**A/C Pressure**	
A/C Off	**Low**	**High**		
Fan On:	104°C (220°F)	110°C (230°F)		
Fan Off:	98°C (208°F)	105°C (221°F)		
A/C On	Low	High	Low	High
Fan On:	99°C (210°F)	110°C (230°F)	1,448 Kpa (210 psi)	1,718 Kpa (249 psi)
Fan Off:	93°C (199°F)	105°C (221°F)	1,207 Kpa (175 psi)	1,585 kpa (229 psi)
EATX Fluid Temperature			**Low Speed**	**High Speed**
Fan On:			118°C (244°F)	122°C (252°F)
Fan Off:			116°C (240°F)	118°C (244°F)

DIAGNOSIS AND TESTING (Continued)

For wiring diagrams of the fan motor systems refer to Group, 8W Wiring Diagrams.

COOLANT CONCENTRATION TESTING

Coolant concentration should be checked when any additional coolant was added to system or after a coolant drain, flush and refill. The coolant mixture offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-34°F) to -59°C (-50°F). The use of a hydrometer or a refractometer can be used to test coolant concentration.

Hydrometers test the amount of glycol in a mixture by measuring the specific gravity of the mixture. The higher the concentration of ethylene glycol, the larger the number of balls that will float, and higher the freeze protection (up to a maximum of 70% by volume glycol).

Refractometers test the amount of glycol in a coolant mixture by measuring the amount a beam of light bends as it passes through the fluid.

Some coolant manufactures use other types of glycols into their coolant formulations. Propylene glycol is the most common new coolant. However, propylene glycol based coolants do not provide the same freezing protection and corrosion protection and is only recommended for limited usage. Refer to appropriate Technical Service Bulletin(s) regarding use of propylene glycol based coolants.

CAUTION: Do not mix types of coolant—corrosion protection will be severely reduced.

Because ethylene glycol and propylene glycol do not have the same specific gravities, the use of a hydrometer will be inaccurate. Therefore, Special Tool 8286 refractometer, must be used when testing coolant.

NOTE: A refractometer should be used if the glycol type is unknown, and to achieve an accurate reading of freeze protection.

TESTING SYSTEM FOR LEAKS

With engine not running, wipe the coolant filler neck sealing seat clean. The radiator should be full.

Attach a radiator pressure tester to the coolant filler neck, as shown in (Fig. 23) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 2 psi in 2 minutes inspect all points for external leaks.

All hoses, radiator and heater, should be moved while at 104 kPa (15 psi) since some leaks occur while driving due to engine rock, etc.

If there are no external leaks after the gauge dial shows a drop in pressure, detach the tester. Start engine and run the engine to normal operating temperature in order to open the thermostat and allow the coolant to expand. Reattach the tester. If the needle on the dial fluctuates, it indicates a combustion leak and is usually a head gasket leak.

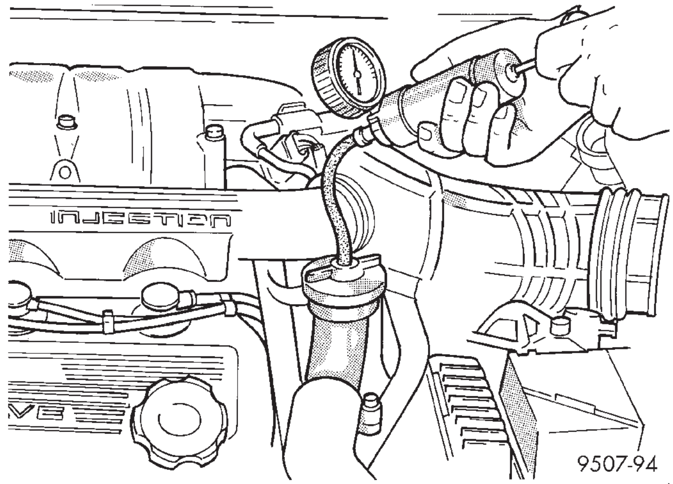


Fig. 23 Pressure Testing Cooling System—Typical

WARNING: WITH TOOL IN PLACE PRESSURE BUILDS UP FAST. ANY EXCESSIVE AMOUNT OF PRESSURE BUILT UP BY CONTINUOUS ENGINE OPERATION MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

If the needle on the dial does not fluctuate, race the engine a few times. If an abnormal amount of coolant or steam is emitted from the tailpipe, it may indicate a faulty head gasket, cracked engine block or cylinder head.

There may be internal leaks which can be determined by removing the oil dipstick. If water globules appear intermixed with the oil, it will indicate a internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

PRESSURE CAP TO FILLER NECK SEAL PRESSURE RELIEF CHECK

The pressure cap upper gasket (seal) pressure relief can be checked by removing the overflow hose at the radiator filler neck nipple (Fig. 24). Attach the radiator pressure tester to the **filler neck nipple,** and pump air into the system. The pressure cap upper gasket should relieve pressure at 69-124 kPa (10-18 psi), and hold pressure at 55 kPa (8 psi) minimum.

WARNING: THE WARNING WORDS DO NOT OPEN HOT ON THE PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, THE COOLING SYSTEM BUILDS UP PRESSURE. TO PREVENT SCALDING OR OTHER INJURY, THE PRESSURE CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT AND/OR UNDER PRESSURE.

DIAGNOSIS AND TESTING (Continued)

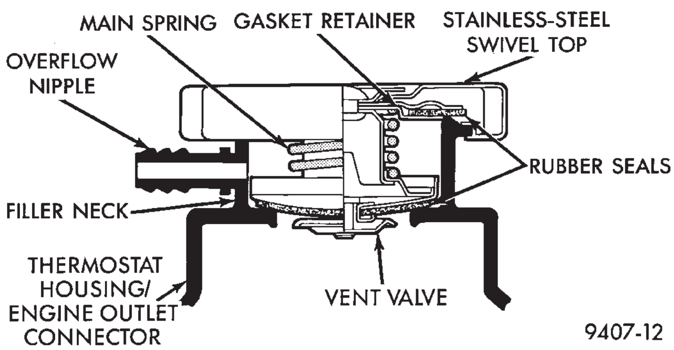


Fig. 24 Cooling System Pressure Cap to Filler Neck

There is no need to remove the pressure cap at any time **except** for the following purposes:

- Check and adjust coolant freeze point
- Refill system with new coolant
- Conducting service procedures
- Checking for leaks

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. PLACE A SHOP TOWEL OVER THE CAP, AND WITHOUT PUSHING DOWN, ROTATE IT COUNTER-CLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE. WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS, PUSH DOWN ON THE CAP AND REMOVE IT COMPLETELY. SQUEEZING THE RADIATOR INLET HOSE WITH A SHOP TOWEL (TO CHECK PRESSURE) BEFORE AND AFTER TURNING TO THE FIRST STOP IS RECOMMENDED.

PRESSURE TESTING COOLING SYSTEM PRESSURE CAP

Dip the pressure cap in water; clean off any deposits on the vent valve or its seat, and apply the cap to end of radiator pressure tester (Fig. 25). Working the plunger, increase the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi), replace the cap.

CAUTION: The radiator pressure tester is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn the tool upside down, and recheck the pressure cap to confirm that the cap is faulty.

If the pressure cap tests properly while positioned the on radiator pressure tester, but will not hold pressure or vacuum when positioned on the filler neck, inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

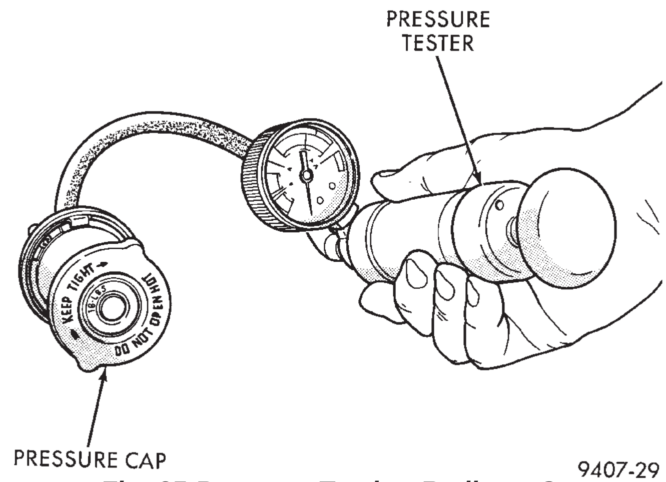


Fig. 25 Pressure Testing Radiator Cap

LOW COOLANT LEVEL AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine at running operating temperature the high pressure inlet tank runs full and the low pressure outlet tank drops. If this level drops below the top of the transmission oil cooler, air will be sucked into the water pump:

- Transmission oil will become hotter.
- High reading shown on the temperature gauge.
- Air in the coolant will also cause loss of flow through the heater.
- Exhaust gas leaks into the coolant can also cause the same problems.

DEAERATION

Air can only be removed from the system by gathering under the pressure cap. On the next heat up it will be pushed past the pressure cap into the CRS tank by thermal expansion of the coolant. It then escapes to the atmosphere in the CRS tank and is replaced with solid coolant on cool down.

TEMPERATURE GAUGE INDICATION

At idle the temperature gauge could rise slowly to about 1/2 gauge travel. The fan will come on and the gauge could drop to about 1/3 gauge travel, this is normal.

ACCESSORY DRIVE BELTS

Satisfactory performance of the belt driven accessories depends on belt condition and proper belt tension.

DIAGNOSIS AND TESTING (Continued)

ACCESSORY DRIVE BELT DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	1. Belt too loose. 2. Belt excessively glazed or worn.	1. Adjust belt tension. 2. Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	1. Belts too loose. 2. Belts glazed.	1. Adjust belt tension. 2. Replace belts.
BELT CHIRP AT IDLE	1. Belts too loose. 2. Foreign material imbedded in belt. 3. Non-uniform belt. 4. Misaligned pulley(s). 5. Non-uniform groove or eccentric pulley.	1. Adjust belt tension. 2. Replace belt. 3. Replace belt. 4. Align accessories. 5. Replace pulley(s).
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt. 2. Belt too loose, or too tight. 3. Misaligned pulleys. 4. Non-uniform grooves or eccentric pulley.	1. Replace belt. 2. Adjust belt tension. 3. Align accessories. 4. Replace pulley(s).

ENGINE BLOCK HEATER

If unit does not operate, trouble can be in either the power cord or the heater element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

SERVICE PROCEDURES

COOLANT LEVEL CHECK—ROUTINE

Do not remove radiator cap for routine coolant level inspections.

The coolant reserve system provides a quick visual method for determining the coolant level without removing the radiator cap. **With the engine cold and not running**, simply observe the level of the coolant in the reserve tank. The level should be between the minimum and maximum marks.

COOLANT—ADDING ADDITIONAL

NOTE: The radiator cap should not be removed.

When additional coolant is needed, it should be added to the coolant recovery/reserve container (Fig. 26), (Fig. 28), or (Fig. 27). Use only 50/50 concentration of ethylene glycol type antifreeze and water

COOLANT LEVEL—SERVICING

NOTE: The cooling system is closed and designed to maintain coolant level to the top of the radiator.

When servicing requires a coolant level check in the radiator, the engine must be **off** and **not** under pressure. Drain several ounces of coolant from the radiator drain cock while observing the Coolant Recovery Container. Coolant level in the container should drop slightly. Then remove the radiator cap, (Fig. 26), (Fig. 28), or (Fig. 27). The radiator should be full to the top. If not, and the coolant level in the recovery container is at the ADD mark there is a air leak in the recovery system. Check hose or hose connections to the recovery container, radiator filler neck or the pressure cap seal to the radiator filler neck for leaks.

SERVICE PROCEDURES (Continued)

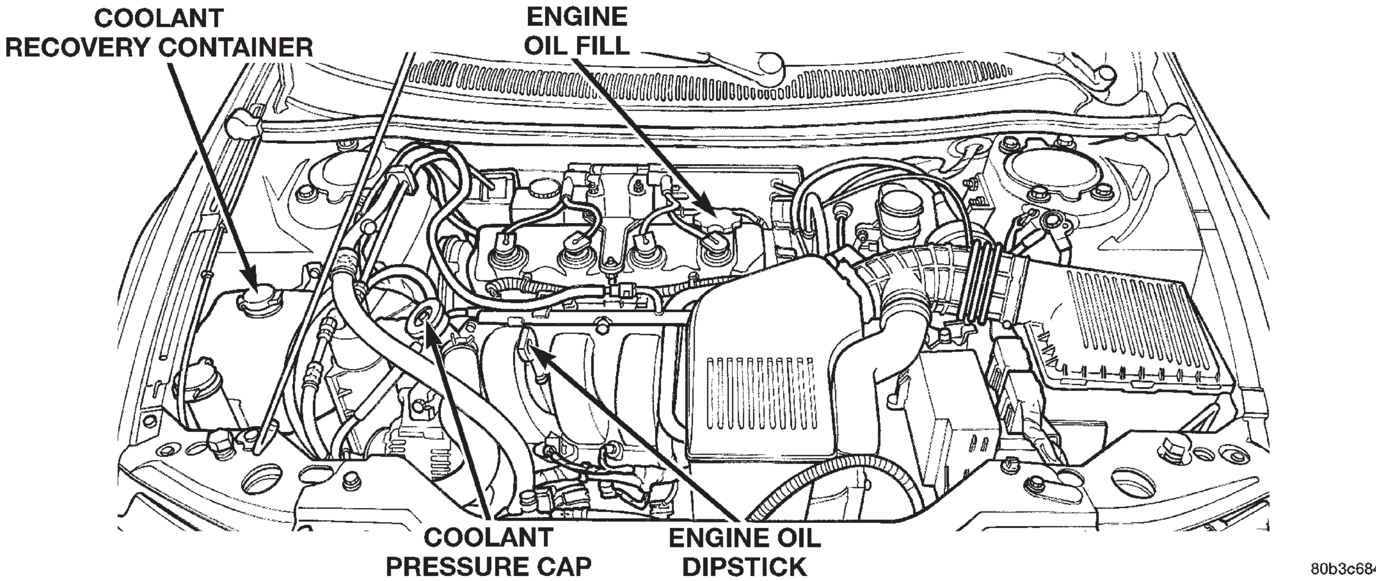


Fig. 26 Coolant Recovery Container and Pressure Cap Locations—2.0L Engine

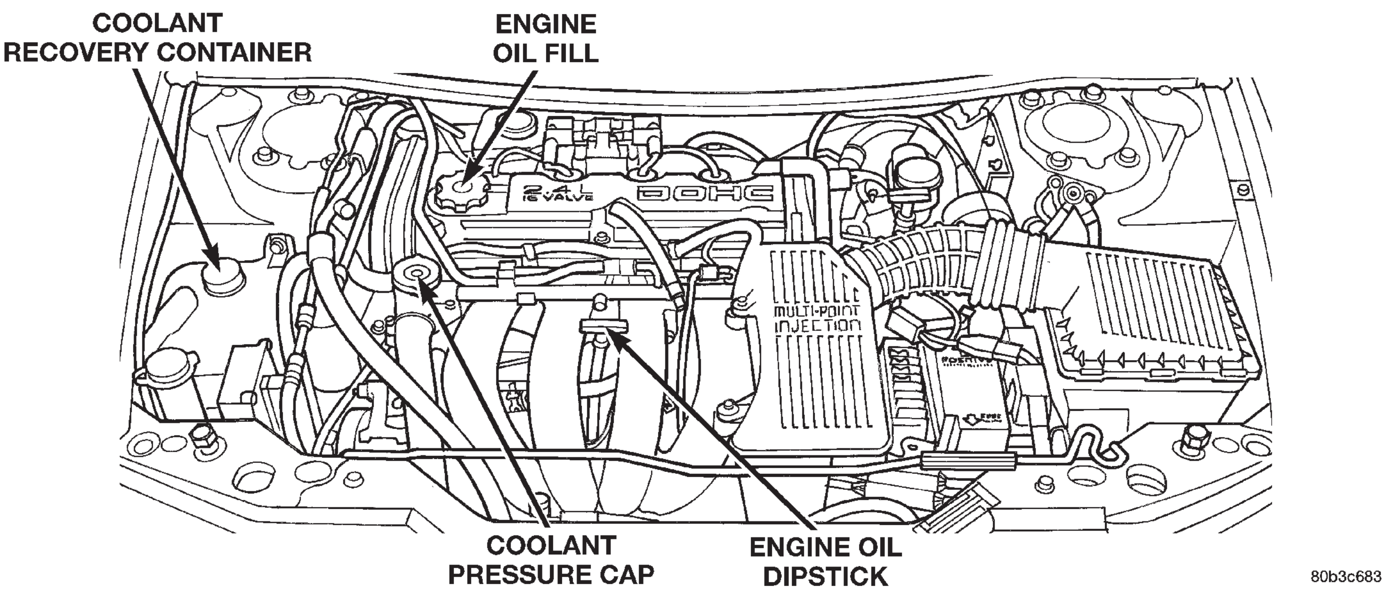


Fig. 27 Coolant Recovery Container and Pressure Cap Locations—2.4L Engine

COOLING SYSTEM—DRAINING

NOTE: Drain, flush, and fill the cooling system at the mileage or time intervals specified in the Maintenance Schedule in this Group. If the solution is dirty or rusty or contains a considerable amount of sediment, clean and flush with a reliable cooling system cleaner. Care should be taken in disposing of the used engine coolant from your vehicle. Check governmental regulations for disposal of used engine coolant.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP OR OPEN THE RADIATOR DRAINCOCK, WHEN SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

To drain cooling system move temperature selector for heater to full heat with engine running (to provide vacuum for actuation). **Without removing radiator pressure cap and with system not under pressure,** Shut engine off and open draincock (Fig. 29). The coolant reserve tank should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks).

NOTE: To open draincock on vehicle equipped with 2.5L engine, use a 3/8 inch drive extension 3” long, a 19mm socket with universal.

SERVICE PROCEDURES (Continued)

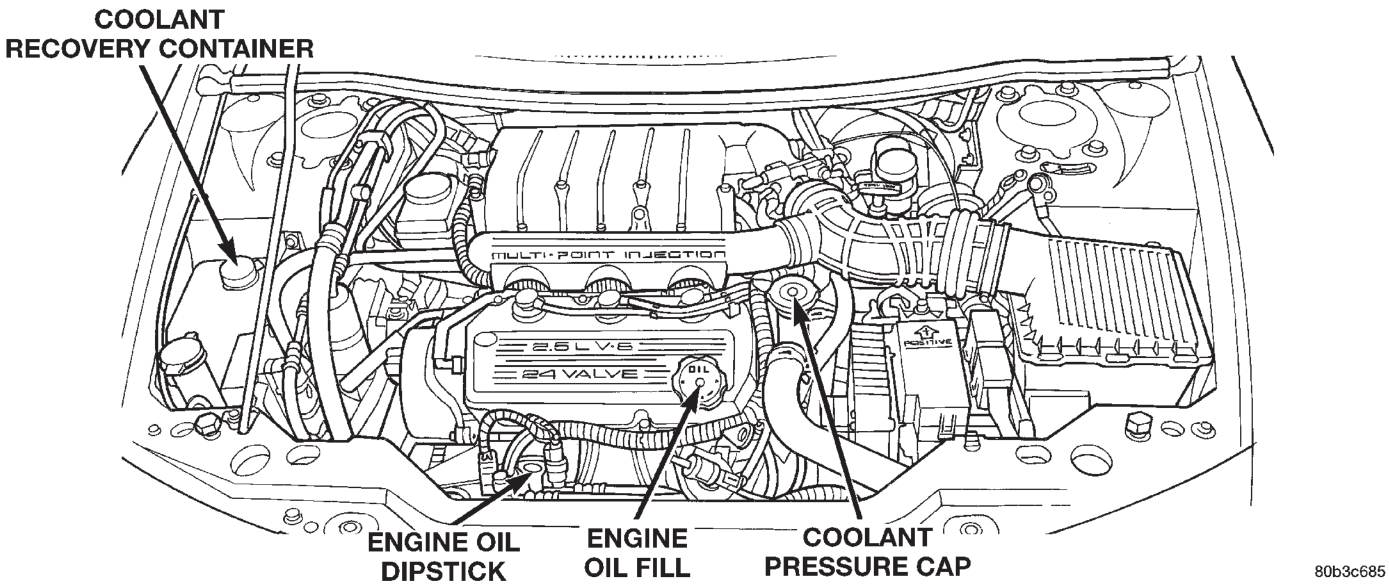


Fig. 28 Coolant Recovery Container and Pressure Cap Locations—2.5L Engine

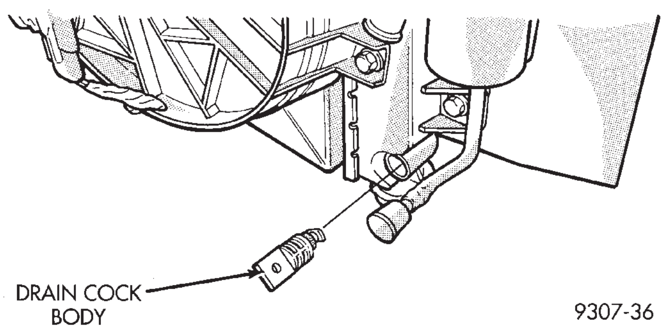


Fig. 29 Draincock—Typical

COOLING SYSTEM—REFILLING

First clean system to remove old glycol, see Cooling System Cleaning.

Fill system with 50/50 glycol/water mix. Use anti-freeze described in Coolant section. The thermostat in the these engines allow air to flow through them.

Continue filling system until full, this provides better heater performance. **Be careful not to spill coolant on drive belts or the generator.**

Fill coolant recovery/reserve container to at least the FULL HOT mark with 50/50 glycol/water mix, (Fig. 26), (Fig. 28), or (Fig. 27). It may be necessary to add coolant to the recovery/reserve container to maintain coolant level between the FULL HOT and ADD mark after three or four warm-up/cool down cycles and also, if any trapped air that has been removed from cooling system.

REMOVAL AND INSTALLATION

WATER PUMP—2.0/2.4L ENGINES

REMOVAL

(1) Raise vehicle on a hoist. Remove right inner splash shield.

(2) Remove accessory drive belts and power steering pump. Refer to Accessory Drive Belt service in this section.

(3) Drain cooling system. Refer to Cooling System Draining in this section.

(4) Support engine from the bottom and remove right engine mount.

(5) Remove right engine mount bracket.

(6) Remove timing belt, camshaft sprockets, and rear timing belt cover. Refer to Group 9, Engine for procedure.

(7) Remove water pump attaching screws to engine (Fig. 30).

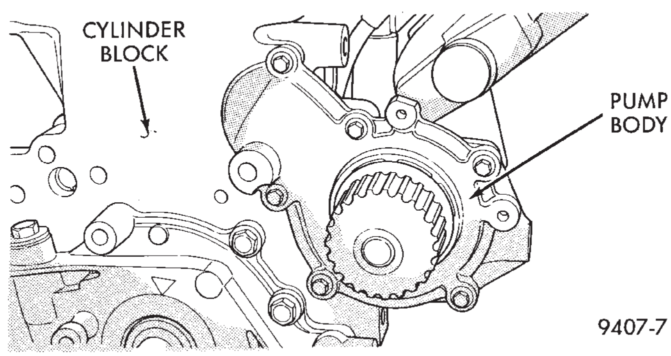


Fig. 30 Water Pump

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install new O-ring gasket in water pump body O-ring groove (Fig. 31).

CAUTION: Make sure O-ring is properly seated in water pump groove before tightening screws. An improperly located O-ring may cause damage to the O-ring and cause a coolant leak.

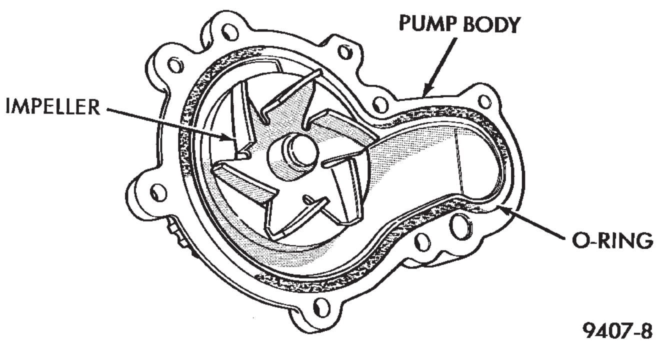


Fig. 31 Water Pump Body

(2) Assemble pump body to block and tighten screws to 12 N·m (105 in. lbs.) (Fig. 30). Pressurize cooling system to 15 psi with pressure tester and check water pump shaft seal and O-ring for leaks.

(3) Rotate pump by hand to check for freedom of movement.

(4) Install rear timing belt cover, camshaft sprockets, and timing belt. Refer to Group 9, Engine for procedures.

(5) Install right engine mount bracket and engine mount. Refer to Group 9, Engine for procedure.

(6) Fill cooling system. Refer to Cooling System Filling for procedure outlined in this section.

(7) Install power steering pump and accessory drive belts. Refer to Accessory Drive Belts, in this section.

WATER PUMP—2.5L ENGINE

REMOVAL

(1) Drain cooling system. Refer to Cooling System Draining in this section.

(2) Remove right engine mount and bracket. Refer to Group 9, Engine for procedure.

(3) Remove timing belt. Refer to Group 9, Engine for procedure.

(4) Remove water pump mounting bolts.

(5) Separate pump from water inlet pipe (Fig. 33) and remove pump (Fig. 32).

INSTALLATION

(1) Clean all gasket and O-ring surfaces on pump and water pipe inlet tube.

(2) Install new O-ring on water inlet pipe (Fig. 34). Wet the O-ring with water to facilitate assembly.

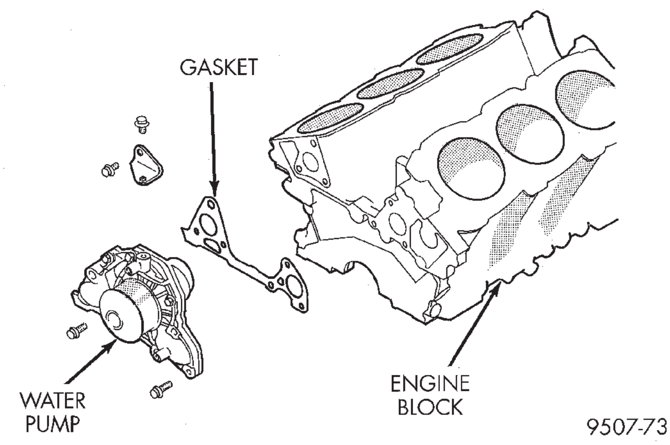


Fig. 32 Water Pump—2.5L Engine

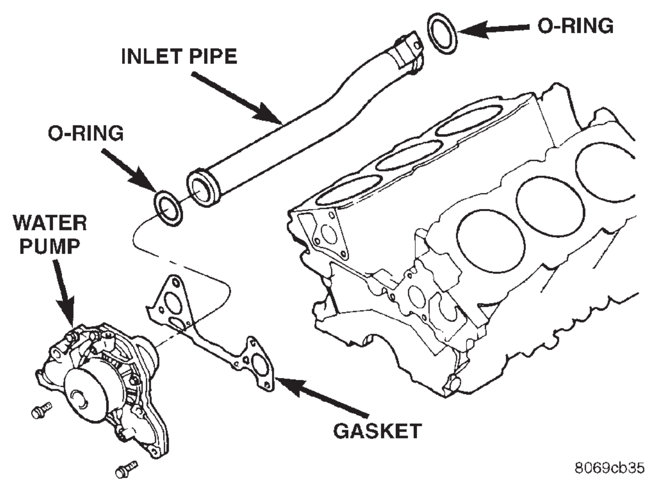


Fig. 33 Water Pump Inlet Tube

CAUTION: Keep the O-ring free of oil or grease.

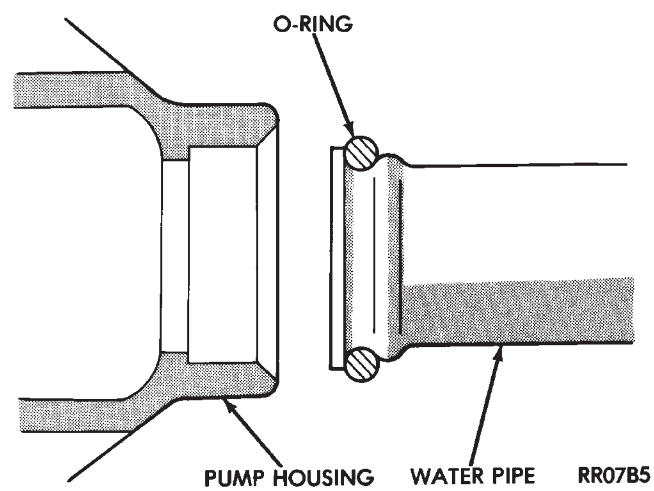


Fig. 34 Water Pipe O-Ring

(3) Install new gasket on water pump and install pump inlet opening over water pipe, press assembly to cause water pipe insertion into pump housing.

REMOVAL AND INSTALLATION (Continued)

(4) Install pump to block mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(5) Install timing belt and right engine mount bracket and mount. Refer to Group 9, Engine for procedure.

(6) Fill cooling system. See Cooling System Refilling.

(7) Install accessory drive belts. Refer to Accessory Drive Belts, in this section for procedure.

WATER PUMP INLET TUBE—2.0/2.4L ENGINES

REMOVAL

(1) Drain cooling system. Refer to procedure in this section.

(2) Remove upper radiator hose to access the hose connections at the inlet tube.

(3) Remove lower radiator hose and heater hose from the inlet tube (Fig. 35).

(4) Remove the 2 fasteners from that hold the inlet tube to the block.

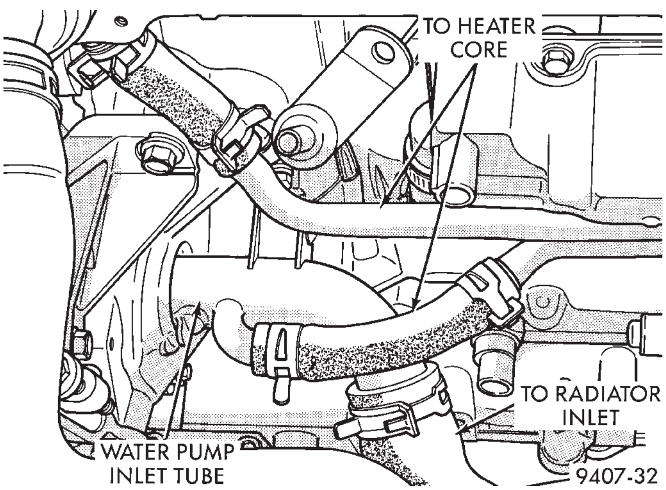


Fig. 35 Water Pump Inlet Tube Hose Connections

(5) Rotate inlet tube while removing from the engine block (Fig. 36).

INSTALLATION

(1) Inspect the O-ring for damage before installing the tube into the cylinder block (Fig. 36).

(2) Lube O-ring with coolant and install into the cylinder block opening.

(3) Install 2 fasteners and tighten to 12 N·m (105 in. lbs.).

(4) Connect lower radiator hose and heater hose to inlet tube (Fig. 35).

(5) Install upper radiator hose.

(6) Fill cooling system. Refer to procedure in this section.

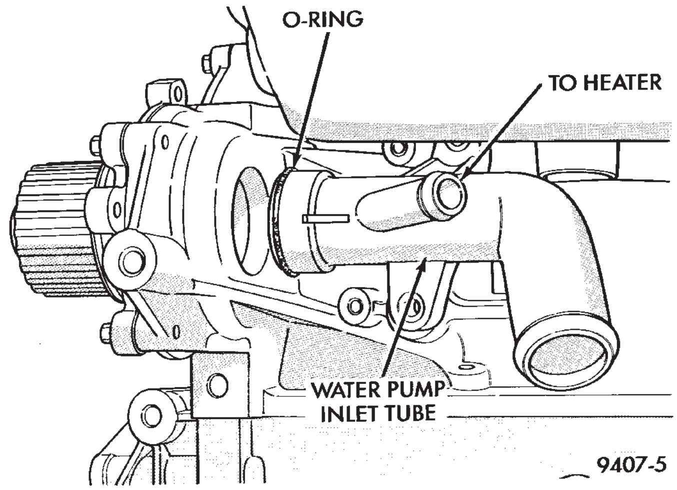


Fig. 36 Water Pump Inlet Tube—Service

THERMOSTAT

REMOVAL

(1) Drain cooling system to the thermostat level or below.

(2) Remove coolant recovery system (CRS) hose and thermostat/engine outlet connector bolts (Fig. 37) and (Fig. 38) 2.0/2.4L Engines. 2.5L engine remove inlet hose and coolant elbow from thermostat housing (Fig. 39).

(3) Remove thermostat assembly, and clean sealing surfaces.

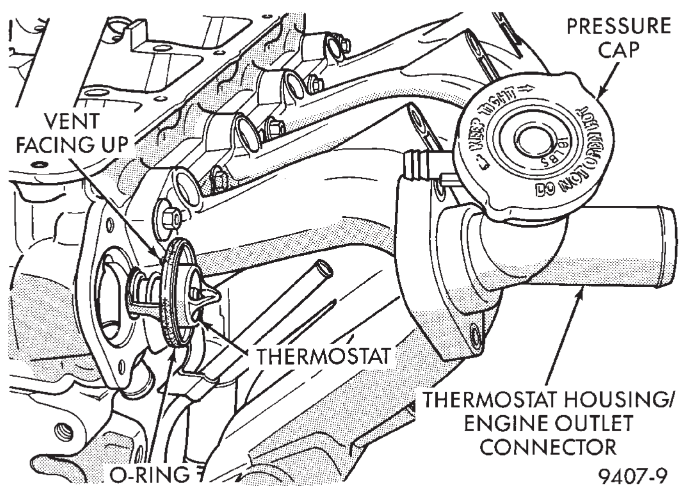


Fig. 37 Thermostat/Engine Outlet Connector—2.0L Engine

INSTALLATION—2.0/2.4L ENGINE

(1) Place the new thermostat assembly into the engine outlet connector. Align air bleed with notch on the cylinder head.

(2) Install engine outlet connector onto cylinder head and tighten bolts to 12.5 N·m (110 in. lbs.). Connect the coolant recovery system (CRS) hose.

REMOVAL AND INSTALLATION (Continued)

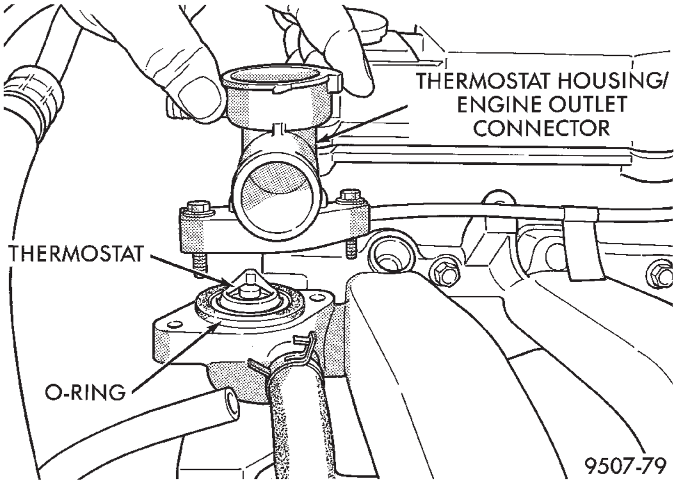


Fig. 38 Thermostat and Engine Outlet Connector—2.4L Engine

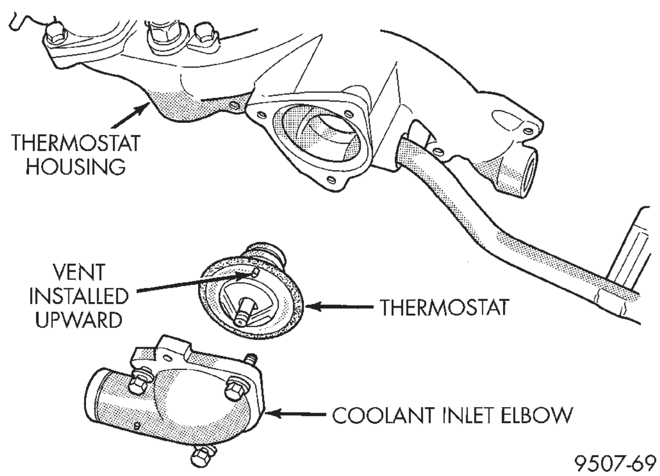


Fig. 39 Thermostat, Housing and Inlet Elbow—2.5L Engine

(3) Fill cooling system. Refer to Cooling System Refilling in this section.

INSTALLATION—2.5L ENGINE

(1) Install thermostat into the recess in the thermostat housing.

(2) Install inlet elbow and tighten the bolts to 19 N·m (168 in. lbs.) (Fig. 39).

(3) Fill cooling system. Refer to Cooling System Refilling in this section.

RADIATOR

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove air inlet resonator. Refer to Group 14, Fuel System for procedure.

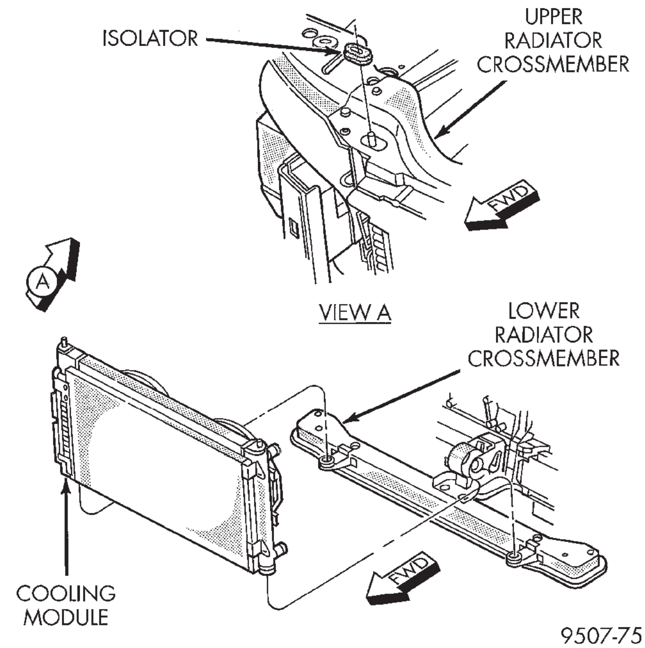


Fig. 40 Cooling Module Mounting

WARNING: DO NOT REMOVE THE CYLINDER BLOCK PLUG OR THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(3) Drain cooling system. Refer to Cooling System Draining in this section.

(4) Remove upper radiator crossmember (Fig. 40). Refer to Group 23, Body for procedure.

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches.

(5) Remove hose clamps and hoses from the radiator.

(6) Disconnect the fan wiring connector.

(7) Remove fan module.

(8) Disconnect automatic transmission hoses from cooler and plug off.

(9) Remove screw attaching support bracket for external transmission oil cooler lines to left side of radiator (if equipped).

(10) Disconnect the engine block heater wire, if equipped.

CAUTION: Avoid bending the condenser inlet tube. Care should be taken not to damage radiator or condenser cooling fins or water tubes during removal.

REMOVAL AND INSTALLATION (Continued)

(11) Remove screw attaching support bracket for air conditioning lines from right side of radiator. Remove support bracket.

(12) Remove the air conditioning condenser attaching screws located at the front of the radiator (Fig. 41), if equipped. It is not necessary to discharge the air conditioning system to remove radiator.

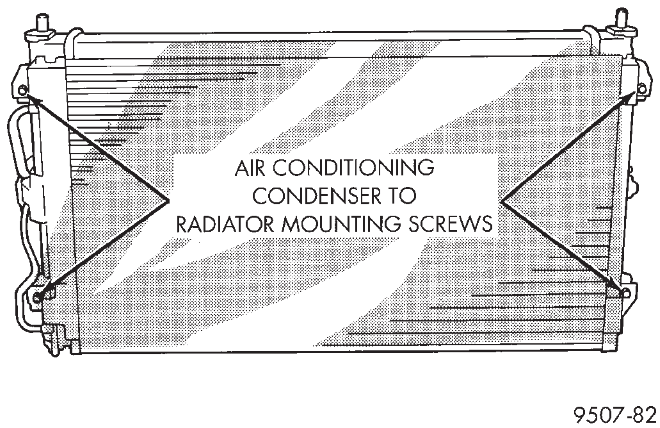


Fig. 41 A/C Condenser to Radiator Mounting Screws

(13) Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

INSTALLATION

(1) Slide radiator and fan module down into position, seat the radiator assembly lower rubber isolators in the mount holes provided.

(2) Attach air conditioning condenser to radiator, if equipped. Tighten mounting screws to 5 N·m (45 in. lbs.).

(3) Install air conditioning line support bracket and attaching screw to right side of radiator.

(4) Connect engine block heater wire, if equipped.

(5) Connect lower radiator hose and clamp.

(6) Install external transmission oil cooler line support bracket and attaching screw to left side of radiator (if equipped).

(7) Connect automatic transmission hoses; tighten hose clamps to 2.5 N·m (22 in. lbs.).

(8) Install fan module.

(9) Connect fan motor electrical connection.

(10) Install upper radiator hose. Align hose so it does not interfere with the accessory drive belt or engine. Position hose clamp so it will not interfere with the hood liner.

(11) Install upper radiator crossmember. Refer to Group 23, Body for procedure.

(12) Connect negative cable to auxiliary jumper terminal.

(13) Fill cooling system with coolant. Refer to Cooling System Refilling in this section.

(14) Operate engine until it reaches normal operating temperature. Check cooling system and automatic transmission for correct fluid levels.

RADIATOR DRAINCOCK

REMOVAL

CAUTION: Plastic tanks, while stronger then brass are subject to damage by impact, such as wrenches.

(1) Turn the draincock stem counterclockwise to unscrew the stem. When the stem is unscrewed to the end of the threads, pull the stem (Fig. 42) from the radiator tank.

NOTE: To open draincock on vehicle equipped with 2.5L engine, use a 3/8 inch drive extension 3" long, a 19mm socket with universal.

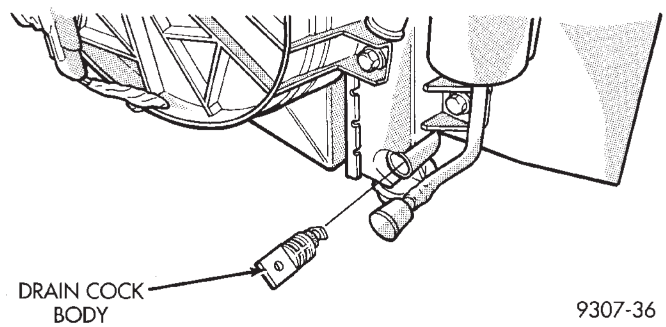


Fig. 42 Draincock—Typical

INSTALLATION

(1) Push the draincock assembly body into the tank opening until it snaps into place.

(2) Tighten the draincock stem by turning clockwise to 2.0-2.7 N·m (18-25 in. lbs.) torque.

RADIATOR FAN, MOTOR AND SHROUD

REMOVAL

(1) Remove upper radiator crossmember. Refer to Group 23, Body for procedure.

(2) Disconnect fan motor electrical connector.

(3) Remove fasteners attaching fan module to radiator (Fig. 44).

(4) Remove fan module.

FAN SERVICE

There are no repairs to be made to the fan. If the fan is warped, cracked, or otherwise damaged, it must be replaced with **only** the recommended part for adequate strength, performance and safety.

(1) To remove fan from motor shaft, bench support the motor and motor shaft while removing the fan

REMOVAL AND INSTALLATION (Continued)

retaining clip, so that the shaft and motor will not be damaged by excessive force. **Surface burr removal may be required to remove fan from motor shaft (Fig. 43).** Do not permit the fan blades to touch the bench.

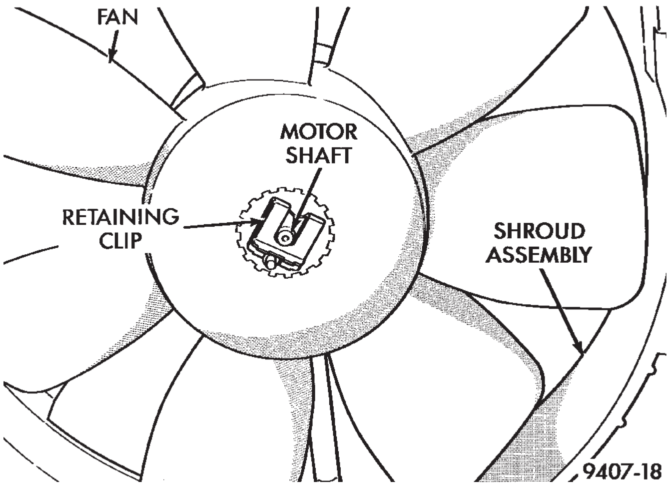


Fig. 43 Radiator Fan—Removal/Installation

(2) To install fan on motor shaft, slide the fan over the shaft. Support motor and shaft while installing fan retaining clip.

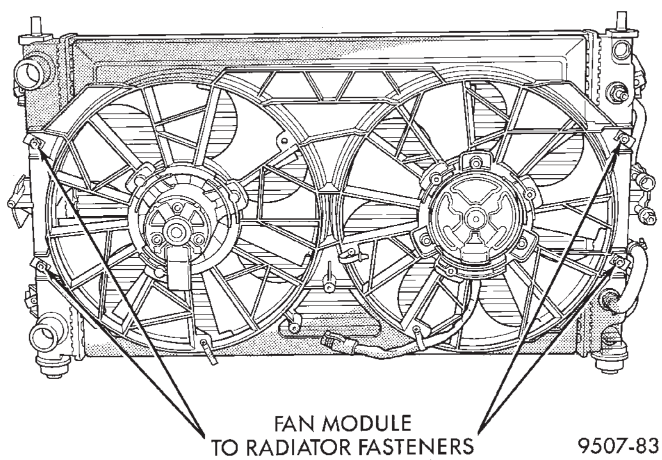


Fig. 44 Fan Module

FAN SHROUD

All vehicles have fan shrouds to improve fan air flow efficiency.

The shroud supports the electric fan motor and fan.

FAN MOTOR SERVICE

(1) Remove the motor fasteners from support. Remove motor from support.

(2) Reverse the above procedure for Installation. Tighten the short fan motor fasteners to 3 N·m (25 in. lbs.) and tighten the tall fan motor fasteners to 5 N·m (45 in. lbs.).

INSTALLATION

(1) Install fan module to radiator. Tighten shroud to radiator fasteners to 7.5 N·m (65 in. lbs.) (Fig. 44).

(2) Connect fan motor electrical connector. **For wiring diagrams of fan motor systems, refer to Group 8W, Wiring Diagrams**.

(3) Install upper radiator crossmember. Refer to Group 23, Body for procedure.

ENGINE BLOCK HEATER

REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Drain, Clean, Flush and Refill of this section for procedure.

(2) Detach power cord plug from heater.

(3) Loosen screw in center of heater. Remove heater assembly.

INSTALLATION

(1) Thoroughly clean core hole and heater seat (Fig. 45).

(2) Insert heater assembly with electrical connector position at the top of the core hole.

(3) With heater seated, tighten center screw securely to assure a positive seal.

(4) Fill cooling system with coolant to the proper level, vent air, and inspect for leaks. Pressurize system with Radiator Pressure Tool before looking for leaks.

The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.

ACCESSORY DRIVE BELTS—2.0/2.4L ENGINES

AIR CONDITIONING COMPRESSOR AND GENERATOR BELT

(1) Loosen T-Bolt locking nut A and pivot bolt B to remove and install Poly V belt and/or adjust belt tension (Fig. 46).

(2) Tighten adjusting bolt to adjust belt tension to specification shown in Belt Tension Chart.

(3) Tighten T-Bolt locking nut A and pivot bolt B to 54 N·m (40 ft. lbs.) (Fig. 46).

POWER STEERING PUMP BELT

(1) From the top of the vehicle loosen pivot bolt C.

(2) From under the vehicle loosen locking bolts D and E (Fig. 47).

(3) Install the belt. Adjust belt tension with 1/2 in. breaker bar installed in adjusting bracket. See Belt Tension Chart.

(4) Tighten locking bolt D to 54 N·m (40 ft. lbs.) (Fig. 47).

REMOVAL AND INSTALLATION (Continued)

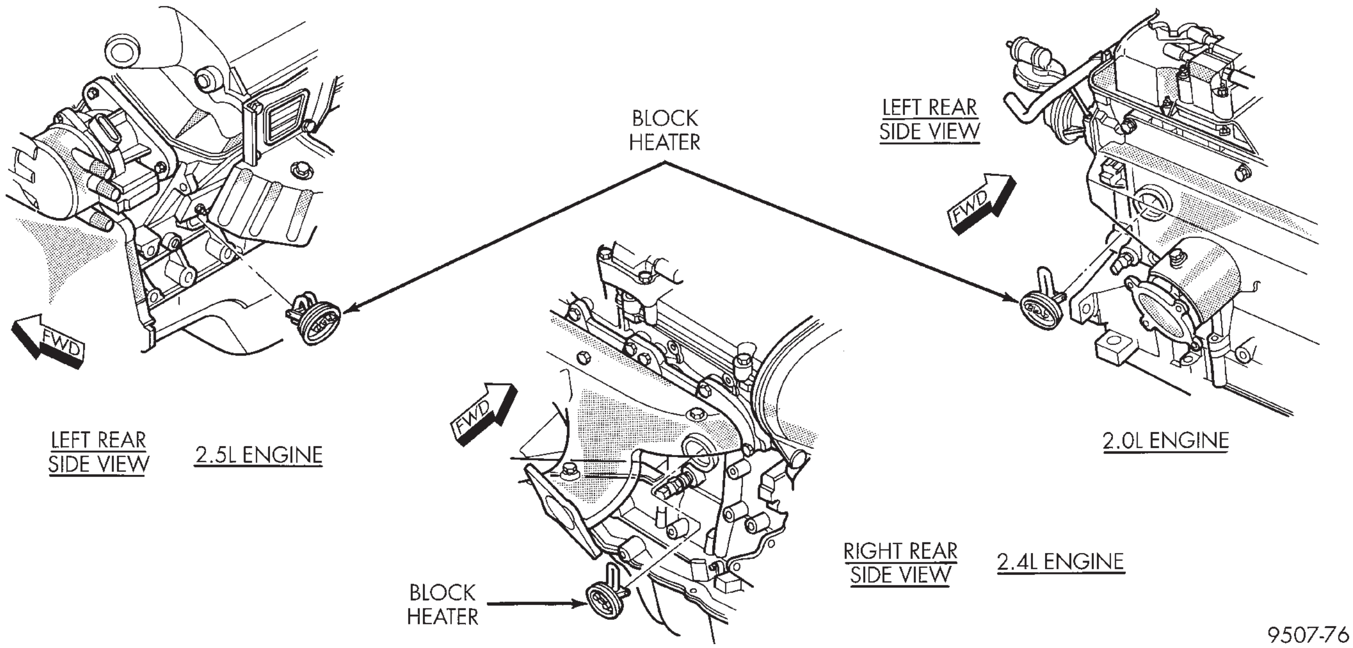
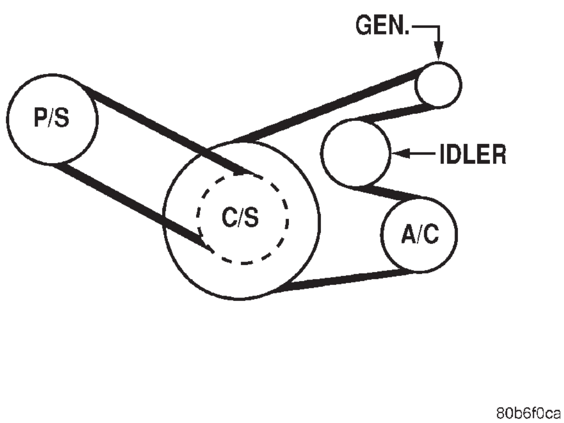


Fig. 45 Engine Block Heaters



Accessory Drive Belt System—2.0/2.4L Engines

(5) Tighten locking bolt E to 28 N·m (250 in. lbs.).
(6) Tighten pivot bolt C to 54 N·m (40 ft. lbs.).

ACCESSORY DRIVE BELTS—2.5L ENGINE

AIR CONDITIONING AND GENERATOR BELT

REMOVAL

(1) Remove power steering pump drive belt. Refer to procedure in this section.
(2) Loosen idler pulley locking bolt (Fig. 49).
(3) Loosen the adjusting screw to decrease the idler pulley tension (Fig. 49).
(4) Remove belt.

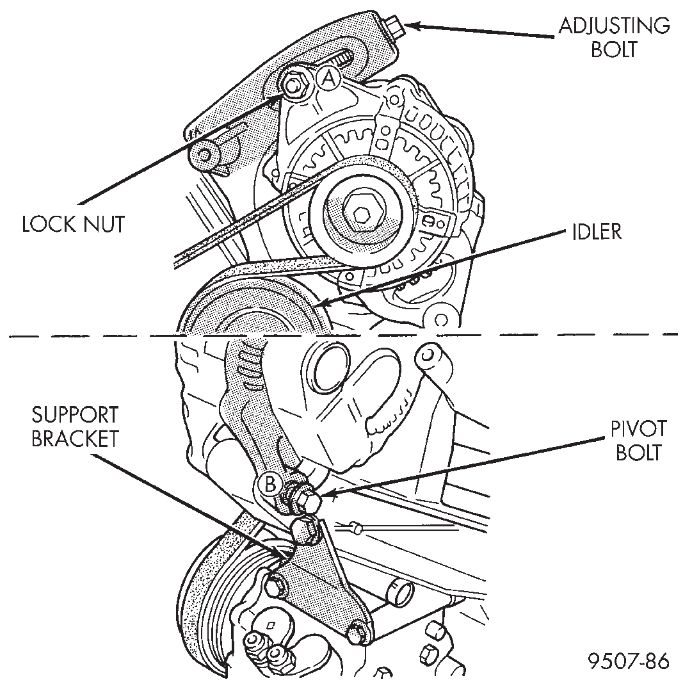


Fig. 46 Air Conditioning Compressor and Generator Belt Adjustment

INSTALLATION

(1) Refer to (Fig. 48) for belt routing.
(2) Install drive belt on pulleys.

NOTE: Use Special Tool 7198, Belt Tension Gauge to check belt for proper tension.

REMOVAL AND INSTALLATION (Continued)

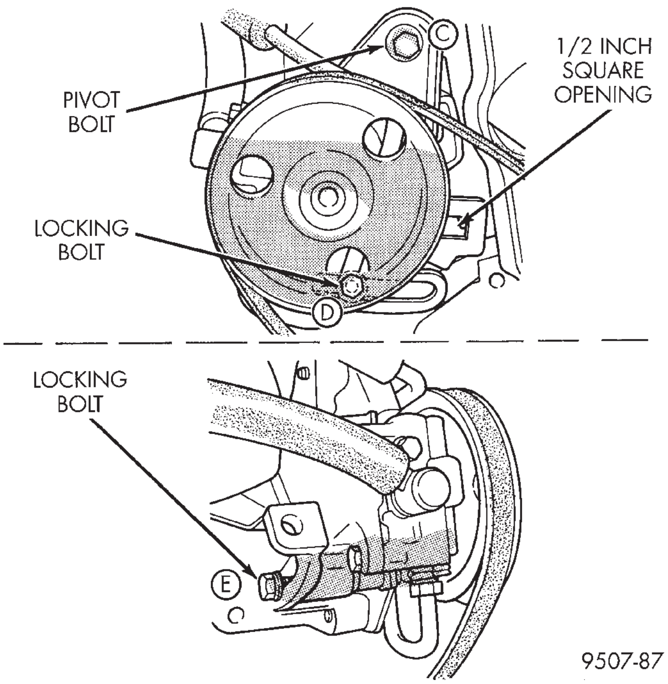


Fig. 47 Power Steering Belt Adjustment

BELT TENSION CHART

ACCESSORY DRIVE BELTS	GAUGE	
2.0/2.4L ENGINES		
Air Conditioning Compressor & Generator	New Belt:	667 N (150 lbs.)
	Used Belt:	356 N (80 lbs.)
Power Steering Pump	New Belt:	578 N (130 lbs.)
	Used Belt:	356 N (80 lbs.)

(3) Tighten the adjusting screw until belt is tensioned to specifications. Refer to Belt Tension Chart for specifications.

(4) Tighten idler pulley locking bolt to 54 N·m (40 ft. lbs.). Recheck belt for proper tension and adjust as necessary.

(5) Install power steering pump drive belt.

Air Conditioning and Generator Belt Tension Adjustment

To adjust the air conditioning and generator drive belt, loosen the idler pulley locking bolt and adjust belt tension by turning adjusting screw (Fig. 49). Use Belt Tension Gauge and refer to Belt Tension Chart for specification. Tighten pulley bolt to 54 N·m (40 ft. lbs.) after adjustment.

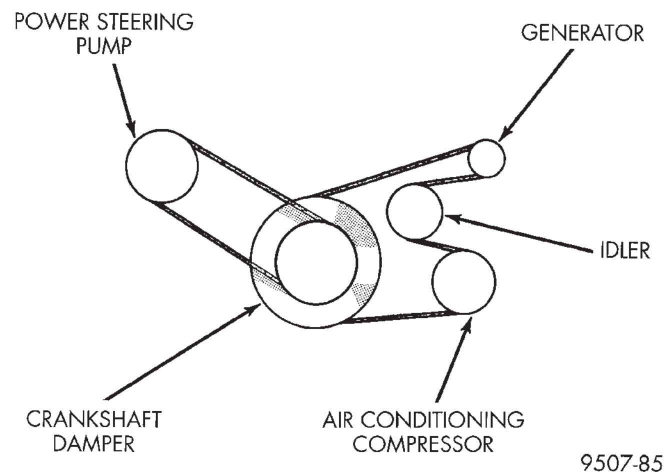


Fig. 48 Accessory Drive Belt Routing—2.5L Engine

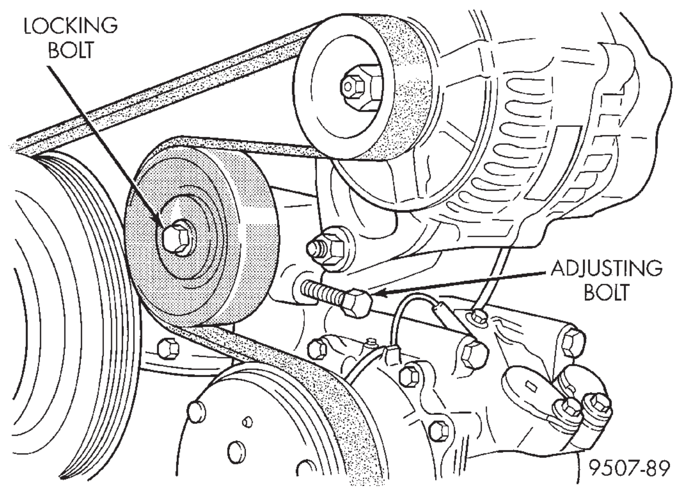


Fig. 49 Air Conditioning Compressor and Generator Belt Idler

POWER STEERING PUMP BELT

REMOVAL

(1) From the top of the vehicle loosen pivot bolt (Fig. 51).

(2) Hoist vehicle and remove splash shield (Fig. 50).

(3) From under the vehicle loosen the locking bolts F and G (Fig. 51).

INSTALLATION

(1) Install belt. Refer to (Fig. 48) for belt routing.

NOTE: Use Special Tool 7198, Belt Tension Gauge to check belt for proper tension.

(2) Adjust belt tension with 1/2 in. drive breaker bar installed in adjusting bracket (Fig. 51). Use belt tension gauge and refer to Belt Tension Chart for tension specification.

REMOVAL AND INSTALLATION (Continued)

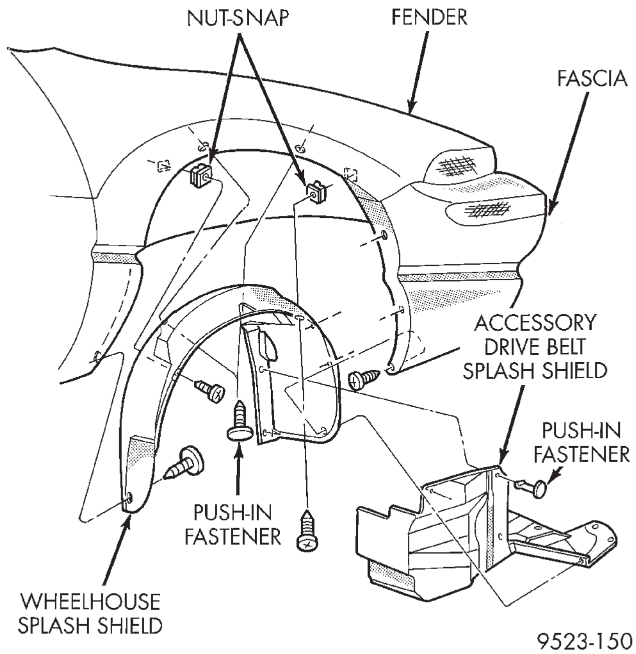


Fig. 50 Accessory Drive Belt Splash Shield

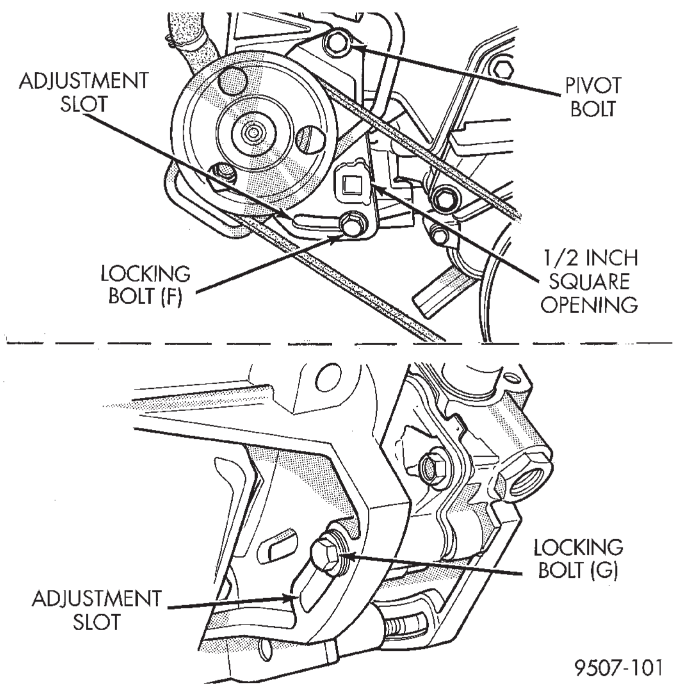


Fig. 51 Power Steering Belt Adjustment

(3) Tighten locking bolt G to 28 N·m (250 in. lbs.) (Fig. 51).

(4) Tighten locking bolt F and the pivot bolt to 54 N·m (40 ft. lbs.).

Power Steering Pump Belt Tension Adjustment

Refer to Power Steering Pump Belt installation procedures for belt tensioning procedures.

BELT TENSION CHART

ACCESSORY DRIVE BELTS	GAUGE	
2.5L ENGINE		
Air Conditioning Compressor & Generator Belt	New Belt:	667 N (150 lbs.)
	Used Belt:	356 N (80 lbs.)
Power Steering Pump Belt	New Belt:	578 N (130 lbs.)
	Used Belt:	356 N (80 lbs.)

CLEANING AND INSPECTION

WATER PUMP—2.0/2.4L ENGINES

Replace water pump body assembly if it has any of these defects:

(1) Cracks or damage on the body.

(2) Coolant leaks from the shaft seal, evident by coolant traces on the pump body.

(3) Loose or rough turning bearing.

(4) Impeller rubs either the pump body or the engine block.

(5) Impeller loose or damaged.

(6) Sprocket or sprocket flange loose or damaged.

WATER PUMP—2.5L ENGINE

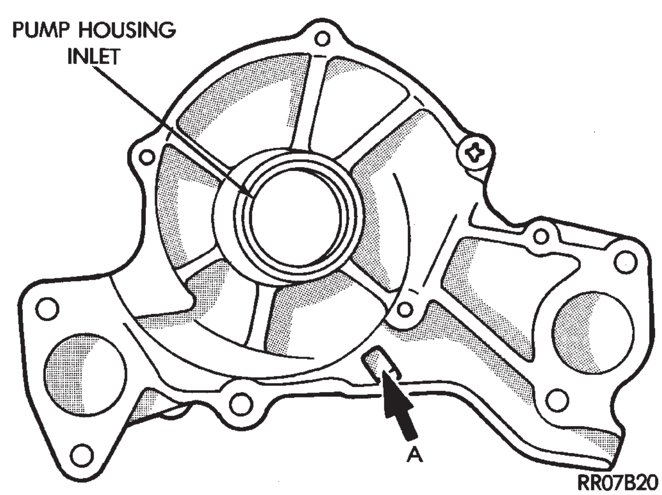


Fig. 52 Water Pump Inspection

Replace the water pump if it has any of the following defects:

- Damage or cracks on the pump body.

CLEANING AND INSPECTION (Continued)

- Coolant leaks, if the shaft seal is leaking, evident by traces of coolant leaks from vent hole A in (Fig. 52).
- Impeller rubs inside of pump.
- Excessively loose or rough turning bearing.

ACCESSORY DRIVE BELT INSPECTION

Belt replacement under any or all of the following conditions is required, excessive wear, frayed cords or severe glazing.

Poly-V Belt system may develop minor cracks across the ribbed side. These minor cracks are considered normal and acceptable. Cracks parallel are not (Fig. 53).

NOTE: Do not use any type of belt dressing or restorer on Poly-V Belts.

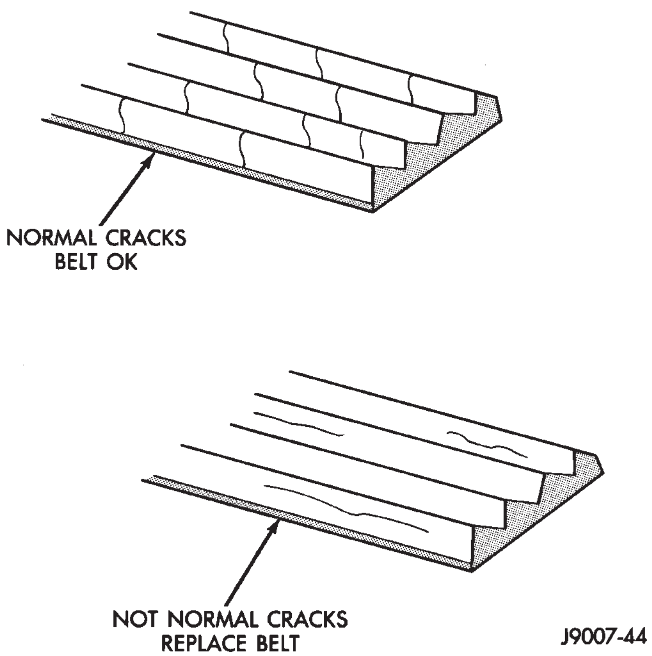


Fig. 53 Drive Belt Wear Pattern

COOLING SYSTEM CAP

Hold the cap in your hand, **right side up** (Fig. 54). The vent valve at the bottom of the cap should open. If the rubber gasket has swollen, preventing the valve from opening, replace the cap.

Hold the cleaned cap in your hand, **upside down.** If any light can be seen between vent valve and the rubber gasket, replace the cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

A replacement cap must be of the type designed for coolant reserve systems. This design ensures coolant return to the radiator.

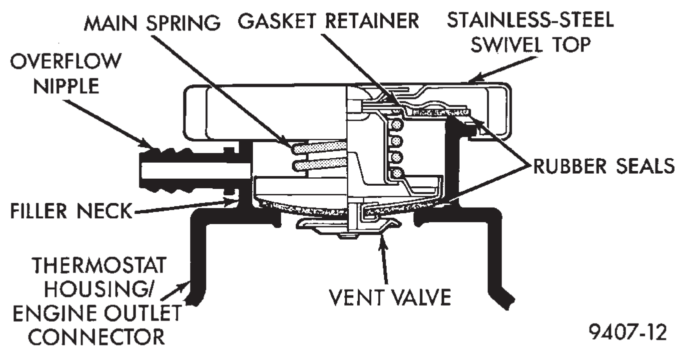


Fig. 54 Cooling System Pressure Cap

CLEANING COOLING SYSTEM

Drain cooling system (see: **Draining Cooling System**) and refill with clean water (see: **Refilling Cooling System**). Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill, run and drain the system again until water runs clear.

RADIATOR FLUSHING

Drain cooling system and remove radiator hoses from engine. Install suitable flushing gun in radiator lower hose. Fill radiator with clean water and turn on air in short blasts.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result. Continue this procedure until water runs clear.

ENGINE FLUSHING

Drain radiator (see: **Cooling System Draining**) and remove hoses from radiator. Remove engine thermostat and reinstall thermostat housing. A gasket may be needed to seal the housing to cylinder head because the seal is part of thermostat. Install suitable flushing gun to thermostat housing hose. Turn on water, and when engine is filled, turn on air, but no higher than 138 kPa (20 psi) in short blasts. Allow engine to fill between blasts of air. Continue this procedure until water runs clean. Install thermostat and fill cooling system. Refer to (**Cooling System Refilling**) for procedure.

REVERSE FLUSHING

Reverse flushing of the cooling system is the forcing of water through the cooling system, using air pressure in a direction opposite to that of the normal flow of water. This is only necessary with dirty systems and evidence of partial plugging.

CLEANING AND INSPECTION (Continued)

CHEMICAL CLEANING

One type of corrosion encountered with aluminum cylinder heads is aluminum hydroxide deposits. Corrosion products are carried to the radiator and deposited when cooled off. They appear as dark grey when wet and white when dry. This corrosion can be removed with a two part cleaner (oxalic acid and neutralizer) available in auto parts outlets. Follow manufacturers directions for use.

ADJUSTMENTS

BELT TENSION GAUGE METHOD

For conventional belts and Poly-V belts, use belt tensioning gauge Special Tool 7198 to obtain proper belt tension.

Adjust the belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart.

BELT TENSION CHART

ACCESSORY DRIVE BELTS	GAUGE	
2.0/2.4/2.5L ENGINES		
Air Conditioning Compressor & Generator	New Belt:	667 N (150 lbs.)
	Used Belt:	356 N (80 lbs.)
Power Steering Pump	New Belt:	578 N (130 lbs.)
	Used Belt:	356 N (80 lbs.)

SPECIFICATIONS

COOLING SYSTEM CAPACITY

COOLING SYSTEM CAPACITY CHART

Engine	2.0L	2.4L	2.5L
COOLANT CAPACITY*			
Liters	8.0	8.5	10.0
U.S. Qts.	8.5	9.0	10.5
*Includes Heater and Coolant Recovery System			

TORQUE

DESCRIPTION **TORQUE**

A/C Condenser to Radiator
Fasteners . . . . 5 N·m (45 in. lbs.)

Thermostat Housing 2.0/2.4L
Bolts . . . . 12.5 N·m (110 in. lbs.)

Thermostat Housing 2.5L
Bolts . . . . 19 N·m (168 in. lbs.)

Water Pump Mounting 2.0/2.4L
Bolts . . . . 12 N·m (105 in. lbs.)

Water Pump Mounting 2.5L
Bolts . . . . 24 N·m (205 in. lbs.)

Water Pump Inlet Tube to Block
Bolts . . . . 12 N·m (105 in. lbs.)

Water Pump Inlet Pipe to Cylinder Head 2.5L
Fasteners . . . . 14 N·m (123 in. lbs.)

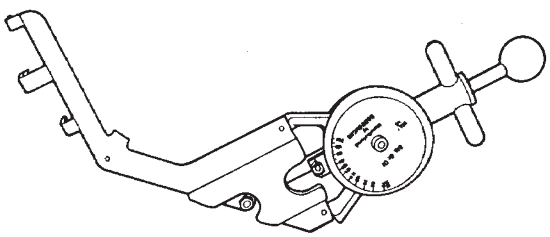
Fan Module to Radiator
Fasteners . . . . 7 N·m (65 in. lbs.)

Fan Motor to Shroud
Fasteners . . . . 5 N·m (45 in. lbs.)

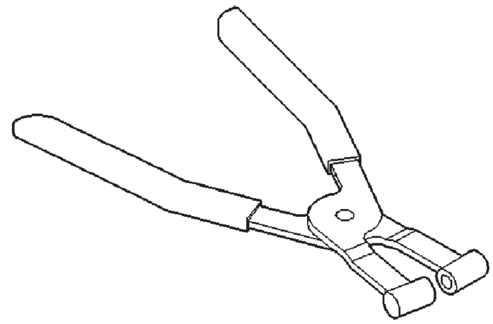
Transmission Oil Cooler Hose
Clamps . . . . 2 N·m (18 in. lbs.)

SPECIAL TOOLS

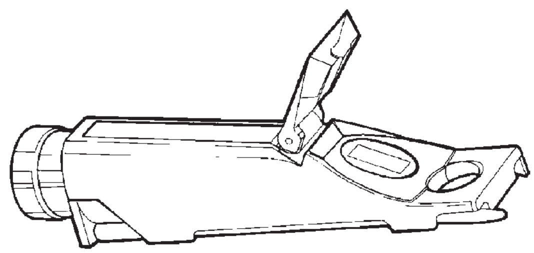
COOLING



Belt Tension Gauge 7198



Hose Clamp Pliers 6094



Coolant Refractometer 8286

BATTERY

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The battery stores, stabilizes, and delivers electrical current to operate various electrical systems in the vehicle. The determination of whether a battery is good or bad is made by its ability to accept a charge. It also must supply high-amperage current for a long enough period to be able to start the vehicle. The capability of the battery to store electrical current comes from a chemical reaction. This reaction takes place between the sulfuric acid solution (electrolyte) and the lead +/- plates in each cell of the battery. As the battery discharges, the plates react with the acid from the electrolyte. When the charging system charges the battery, the water is converted to sulfuric acid in the battery. The concentration of acid in the electrolyte is measured as specific gravity using a hydrometer. The specific gravity indicates the battery's state-of-charge. The OE battery is sealed and water cannot be added.

The battery is vented to release gases that are created when the battery is being charged and discharged.

The battery must be completely charged, and the battery side, posts, and cable terminals must be cleaned before diagnostic procedures are performed.

SAFETY PRECAUTIONS AND WARNINGS

WARNING: WEAR SAFETY GLASSES.

DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE.

DO NOT USE OPEN FLAME NEAR BATTERY.

REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.

WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW THE DISABLED VEHICLE'S BATTERY TO EXCEED 16 VOLTS. PERSONAL INJURY OR DAMAGE TO ELECTRICAL SYSTEM CAN RESULT.

TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

DESCRIPTION AND OPERATION

BATTERY BLANKET HEATER

The blanket heater is used with Alaska and Canada cold weather packages. The 110 volt A.C. blanket

DESCRIPTION AND OPERATION (Continued)

heater is used to improve the battery cold start ability. This vehicle has an electronic voltage regulator which controls battery charging. ONLY CHRYSLER approved battery blanket/block heater combination should be used. It is designed to provide optimum charging system performance in very cold ambient temperatures below -17.8°C (0°F). The addition of an aftermarket battery heater or engine block heater will adversely affect battery charging and will result in battery discharge or damage.

BATTERY IGNITION OFF DRAW (IOD)

A completely normal vehicle will have a small amount of current drain on the battery with the key out of the ignition. It can range from 15 to 30 milliamperes after all the modules time out. If a vehicle will not be operated for approximately a 20 days, the IOD fuse should be disconnected to eliminate the vehicle electrical drain on the battery. The IOD fuse is located in the Junction Block number 5. Removing this fuse will help prevent the battery from discharging during storage.

CHARGING TIME REQUIRED

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD -1°C (30°F) BATTERY. PERSONAL INJURY MAY RESULT.

The time required to charge a battery will vary depending upon the following factors.

SIZE OF BATTERY

A completely discharged large heavy-duty battery may require more recharging time than a completely discharged small capacity battery, refer to Battery Charging Timetable for charging times.

BATTERY CHARGING TIMETABLE

CHARGING AMPERAGE	5 AMPERES	10 AMPERES	20 AMPERES
OPEN CIRCUIT VOLTAGE	HOURS CHARGING AT 21° C (70° F)		
12.25 TO 12.49	6 HOURS	3 HOURS	1.5 HOURS
12.00 TO 12.24	10 HOURS	5 HOURS	2.5 HOURS
10.00 TO 11.99	14 HOURS	7 HOURS	3.5 HOURS
*BELOW 10.00	18 HOURS	9 HOURS	4.5 HOURS
*REFER TO CHARGING A COMPLETELY DISCHARGED BATTERY			

TEMPERATURE

A longer time will be needed to charge a battery at -18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, current accepted by battery will be very low at first. In time, the battery will accept a higher rate as battery temperature warms.

CHARGER CAPACITY

A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 20 amperes or more.

STATE OF CHARGE

A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current amperage will be low. As water is converted back to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise. Refer to Battery Charging procedures.

DIAGNOSIS AND TESTING

BATTERY BLANKET HEATER INSPECTION

(1) Remove battery. Refer to battery removal.
(2) Remove blanket heater from battery (Fig. 1).

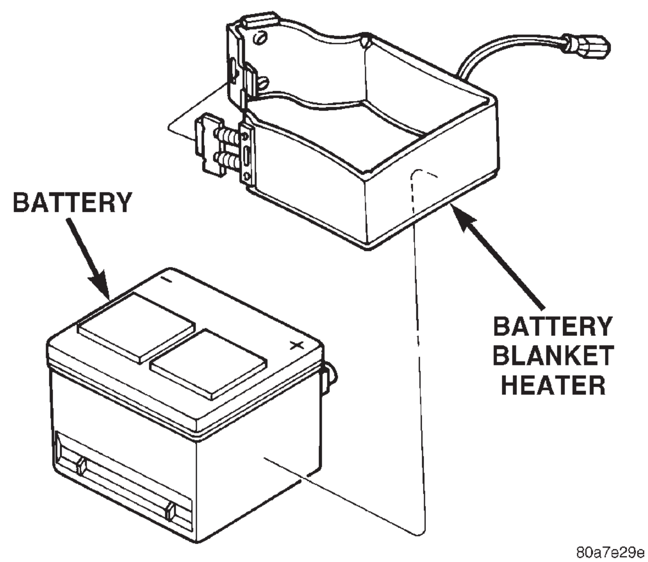


Fig. 1 Battery Blanket Heater

WARNING: SERIOUS PERSONAL INJURY AND/OR ELECTRICAL BURNS COULD RESULT IF THESE PROCEDURES ARE NOT FOLLOWED.

(3) Clean battery blanket heater vinyl cover with a baking soda solution and wipe dry.

DIAGNOSIS AND TESTING (Continued)

(4) Inspect blanket heater for cuts, abrasion or other damage. If heater is damaged replace. If OK, go to Step 5.

(5) Lay heater flat and connect heater to vehicle's connector.

(6) Connect the power cord to a 110 volt AC source for 3 minutes MAXIMUM.

(7) Disconnect voltage source from the power cord.

(8) Immediately feel the heater cover on the inside it should be warm to the touch. If warm, heater is OK. If not OK, go to Step 9.

(9) Using an Ohmmeter, connect a lead across the two terminals.

(10) Check for a resistance value of 220 to 280 Ohms. If within the resistance value range the blanket is OK. If not OK, replace blanket.

(11) Check extension cord to vehicle for voltage. If extension cord is OK, go to Step 12. If not OK, repair as necessary.

(12) Ensure heater receives voltage from extension cord and power cord. If OK, replace heater. If not OK, repair as necessary.

BATTERY DISCHARGING

CAUSES OF BATTERY DISCHARGING

It is normal to have up to a 30 milliamperes continuous electrical draw ON the battery. This draw will take place with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accessories that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period of approximately 20 days the IOD fuse should be disconnected. The IOD fuse is located in the Power Distribution Center and disconnection of this fuse will help prevent the battery from discharge during storage. Refer to Battery Diagnosis and Testing Table and to the proper procedures.

BATTERY DIAGNOSIS AND TESTING

STEPS	POSSIBLE CAUSE	CORRECTION
VISUAL INSPECTION Check for possible damage to battery and clean battery.	(1) Loose battery post, Cracked battery cover or case, Leaks or Any other physical (2) Battery OK.	(1) Replace Battery (2) Check state of charge. Perform Battery Open Circuit Voltage Test.
BATTERY OPEN CIRCUIT VOLTAGE TEST	(1) Battery is above 12.40 Volts (2) Battery is below 12.40 Volts.	(1) Perform the Battery Load Test. (2) Perform Battery Charging procedure
BATTERY CHARGED	(1) Battery accepted Charge. (2) Battery will not accept charge	(1) Perform Battery Open Circuit Voltage Test. (2) Perform Charging a Completely Discharged Battery procedure.
BATTERY LOAD TEST	(1) Acceptable minimum voltage. (2) Unacceptable minimum voltage	(1) Battery is OK to put in use, perform Battery Ignition Off Draw Test. (2) Replace Battery and perform Battery Ignition Off Draw Test.
CHARGING A COMPLETELY DISCHARGED BATTERY	(1) Battery accepted charge. (2) Battery will not accept charge.	(1)Perform Battery Open Circuit Voltage Test. (2) Replace Battery.
IGNITION OFF DRAW TEST	(1) IOD is 15-30 Milliamperes. (2) IOD Exceeds 30 Milliamperes.	(1) Vehicle is normal. (2) Eliminate excess IOD draw.

ABNORMAL BATTERY DISCHARGING

- Corroded battery posts, cables or terminals.
- Loose or worn generator drive belt.
- Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.
- Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.
- Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Ignition Off Draw (IOD).
- Defective charging system.

DIAGNOSIS AND TESTING (Continued)

- Defective battery.

IGNITION OFF DRAW TESTS (IOD)

High battery current draw when the ignition switch in the off position will discharge a battery. After a dead battery is serviced, the vehicle Ignition Off Draw (IOD) should be checked. To determine if a high current draw condition exists, check the vehicle with a Digital multimeter that has an ammeter range from at least 10 amps down to 10 milliamps (30) milliamps is allowable.

(1) Verify all electrical accessories are OFF:

- Remove key from ignition switch
- Turn off all lamps
- Trunk compartment lamp is disconnected or removed
- Glove box lamp goes off when the door is closed
- All doors are closed
- Sun visor vanity lamps are OFF

(2) Disconnect battery negative remote cable.

CAUTION: Do not operate any accessory that has a greater draw than the ammeter can measure.

(3) Using a Digital multi-meter, set to 10 amps and connect leads between the battery negative remote terminal and the battery negative remote cable stud.

(a) Remove the "EATX" (20 amp min) fuses from the PDC.

(b) Wait (1) minute.

(c) If the reading is greater than 30 milliamps, go to HIGH MILLIAMP READING.

(d) Reinstall the EATX fuse.

(e) If the draw increases, remove the fuse again and immediately reinstall the fuse. If the draw increases again, repeat the remove and install process (2) or (3) times. If the draw continues to increase, it will be necessary to wait for up to (20) minutes to see if the draw drops. If it does not, the problem will be in the EATX module or circuit.

(f) If the draw remains under (30) milliamps, there is not a problem with an "Ignition Off Draw".

NOTE: Each time the ammeter is disconnected and reconnected, all electronic timer functions will be reactivated

HIGH MILLIAMPERE READING

NOTE: Perform BATTERY IGNITION OFF DRAW TEST before proceeding.

If the IOD is high, there is either a short circuit or a fault in an electronic module. There are (6) other fuses in the Power Distribution Center and Junction Block that feed the modules with ignition off draw. Ensure that all electronic timer functions are timed out before testing any of the components.

IN THE POWER DISTRIBUTION CENTER

- Ignition Fuel Starter (20 Amp)
- Hazard Flasher (20 Amp)
- EATX (20 Amp min) (previously tested)
- Seat Belt (20 Amp max) (previously tested)
- Stop Lamp (20 Amp)

IN THE JUNCTION BLOCK:

- Daytime Running Lamps (DRL) (20 Amp)
- Horns-Cigar Lighter (20 Amp)
- Interior lamps (10 Amp) (IOD)
- Park/tail lamps-Instrument Cluster (20 Amp)

NOTE: Do not operate any accessory that has a greater draw than the installed ammeter can measure.

Replace fuses one at a time. The module should draw a few milliamps when the fuse is replaced. If it draws in excess of (20) milliamps (not including timed out functions) then the module should be replaced or wiring should be investigated. Refer to Group 8W-Wiring Diagrams. Check for faulty systems operations or module fault codes to help find wiring faults. Be sure you have double checked other possible IOD draws. Refer to IOD Draw Table

IOD DRAW TABLE

COMPONENT	AMPERAGE DRAW
STUCK RELAY	0.25 AMP
ILLUMINATED BULB	0.25 - 1 AMP
RADIO MEMORY	1 - 4 ma
BCM	6 ma (TIMED OUT)

To determine if a module draw is within acceptable range, refer to the Module Amperage Table for IOD readings.

DIAGNOSIS AND TESTING (Continued)

MODULE AMPERAGE TABLE

FUSE NO.	MODULE	INITIALIZER	TIMEOUT	DRAW DURING TIMEOUT	DRAW AFTER TIMEOUT
#4	BCM - LAMPS	RKE, DOOR AJAR, IGNITION KEY ON	0.5 MIN.	2.7 AMPS	0
#5 & #10	PCM	IGNITION KEY ON	0.5 MIN.	UP TO 4 AMPS	1.3 ma
#4	BCM - MICROPROCESSOR	DOOR AJAR, IGNITION KEY ON	1 MIN.	60 ma	7 ma
#3	EATX	IGNITION KEY ON	20 MIN.	60 ma	0.8 ma

BATTERY LOAD TEST

A fully charged battery must have cranking capacity. To provide the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking capability of the battery.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.

(1) Disconnect and isolate the battery negative remote cable first. Then disconnect and isolate the positive Jump Start cable.

(2) Use a suitable Volt/Ammeter/Load tester connected between remote battery terminals (Fig. 2) and (Fig. 3). Check the open circuit voltage of the battery. Voltage should be equal to or greater than 12.4 volts. If below 12.4 volts charge battery, perform the same test at the battery. Remove both battery cables the negative cable first. If the voltage is still below 12.4 perform Battery Charging procedures.

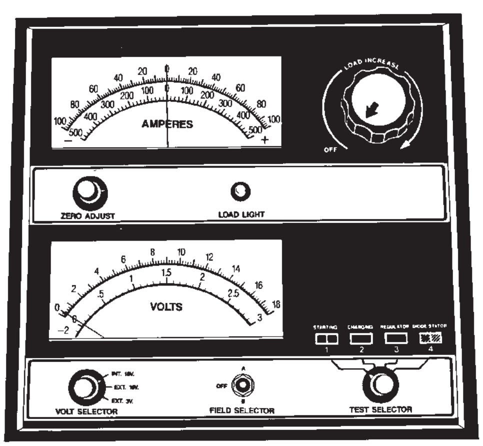


Fig. 2 Volt-Ammeter-Load Tester

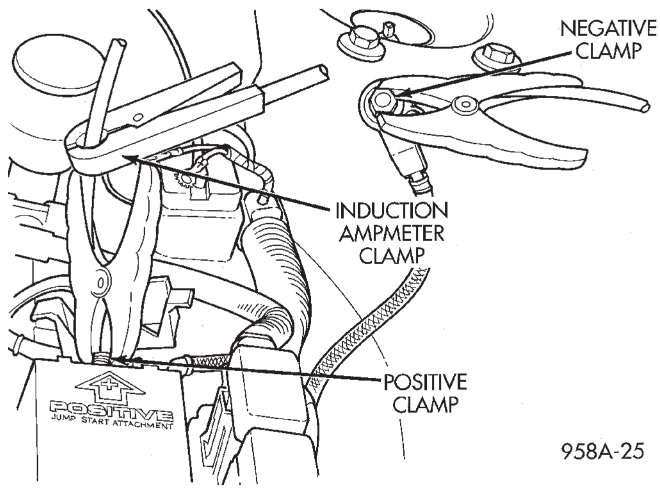


Fig. 3 Volt-Ammeter-Load Tester Connections

(3) Rotate the load control knob of the carbon pile rheostat to apply a 260 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 4).

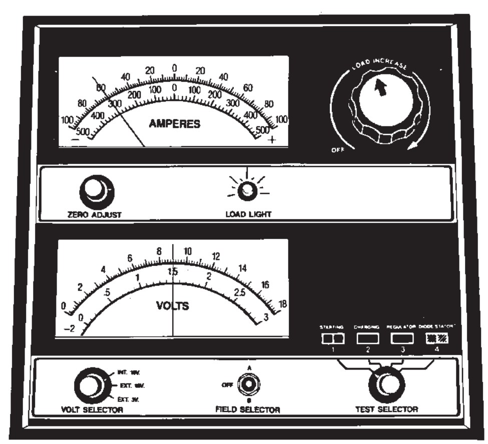


Fig. 4 Remove Surface Charge from Battery

(4) Allow the battery to stabilize for two minutes, and then verify open circuit voltage.

DIAGNOSIS AND TESTING (Continued)

(5) Rotate the load control knob on the tester to maintain 50% (260) of the battery cold crank rating for a minimum 15 seconds (Fig. 5).

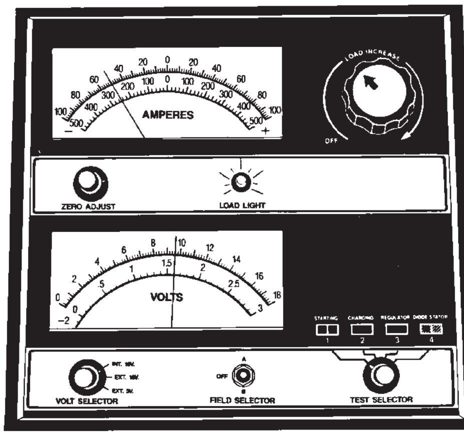


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Fig. 5 Load 50% Cold Crank Rating

(6) After 15 seconds, record the loaded voltage reading and return the load control to off.

(7) Voltage drop will vary according to battery temperature at the time of the load test. Battery temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged, boosted, or loaded a few minutes prior to the test, the battery would be slightly warmer. Refer to Battery Load Test Temperatures Table for proper loaded voltage reading.

BATTERY LOAD TEMPERATURE TABLE

Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(8) If battery passes load test, it is in good condition and further tests are not necessary. If it fails load test, it should be replaced.

BATTERY OPEN CIRCUIT VOLTAGE TEST

An open circuit voltage no load test shows the state of charge of a battery and whether it is ready for a load test at 50 percent of the battery's cold crank rating. Refer to Battery Load Test. If a battery has open circuit voltage reading of 12.4 volts or greater, and will not pass the load test, replace the battery because it is defective. To test open circuit voltage, perform the following operation.

(1) Remove both battery cables, negative cable first. Connect a Volt/Ammeter/Load tester (Fig. 6) to the battery posts (Fig. 7).

(2) Allow the battery to stabilize for 2 minutes, and then verify the open circuit voltage. Refer to Battery Open Circuit Voltage table.

(3) This voltage reading will approximate the state of charge of the battery. It will not reveal battery cranking capacity.

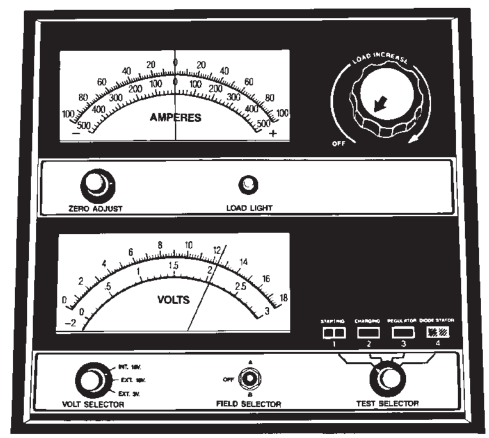

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Fig. 6 Testing Open Circuit Voltage

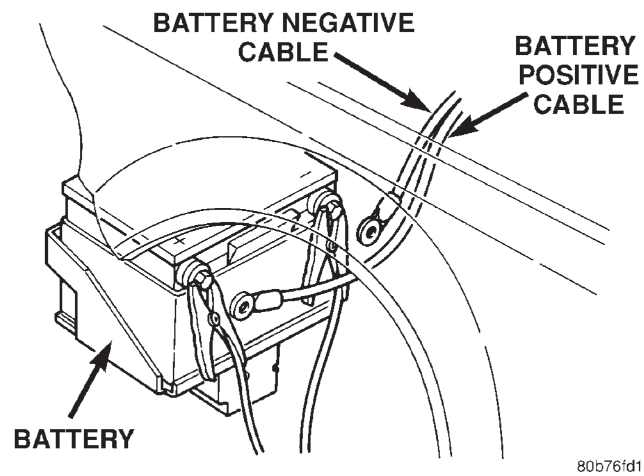

Fig. 7 Volt-Ammeter Load Tester Connections

SERVICE PROCEDURES

BATTERY CHARGING

A battery is considered fully charged when it will meet all the following requirements.

• It has an open circuit voltage charge of at least 12.4 volts (refer to Battery Open Circuit Voltage table).

SERVICE PROCEDURES (Continued)

BATTERY OPEN CIRCUIT VOLTAGE

Open Circuit Volts	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

• It passes the 15 second load test, refer to Battery Load Test Temperatures Table.

WARNING: DO NOT ASSIST BOOST OR CHARGE A FROZEN BATTERY.

EXPLOSIVE GASES FORM OVER THE BATTERY, DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY.

CAUTION: Disconnect the battery NEGATIVE cable first, before charging battery to avoid damage to electrical systems. Do not exceed 16.0 volts while charging battery. Refer to the instructions supplied with charging equipment.

Battery electrolyte will bubble inside of battery case while being charged properly. If the electrolyte boils violently, or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger. Evaluate battery condition. Battery damage may occur if charging is excessive.

Some battery chargers are equipped with polarity sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

CAUTION: Do not overcharge Battery. Refer to Battery Charging Rate table.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. Refer to Battery Load Test in this Group. If the battery will endure a load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service.

CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced. Refer to Battery Charging Rate table for correct charge times.

BATTERY CHARGING RATE

Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

(1) Measure the voltage at remote cable terminals with a voltmeter accurate to 1/10 volt (Fig. 8). If below 10 volts, charge current will be low, and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on amp meters built into many chargers.

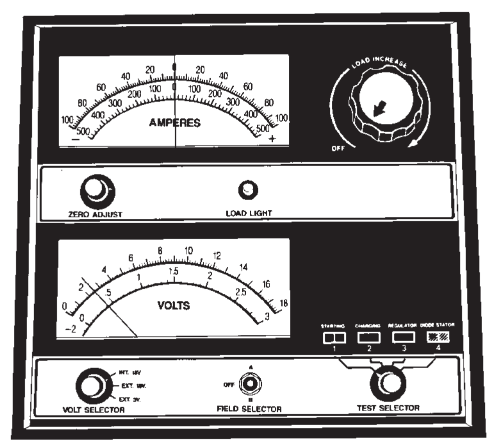

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Fig. 8 Voltmeter Accurate to 1/10 Volt (Connected)

(2) Connect charger leads to the remote cables. Some chargers feature polarity protection circuitry that prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry. This may happen even though the leads are connected properly.

(3) Battery chargers vary in the amount of voltage and current they provide. For the time required for the battery to accept measurable charger current at various voltages, refer to Battery Charging Rate table. If charge current is still not measurable after charging times, the battery should be replaced. If charge current is measurable during charging time,

SERVICE PROCEDURES (Continued)

the battery may be good, and charging should be completed in the normal manner.

VISUAL INSPECTION AND SERVICE

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(1) Clean battery with a solution of warm water and baking soda. Apply solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 9). Rinse with clear water and blot dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.

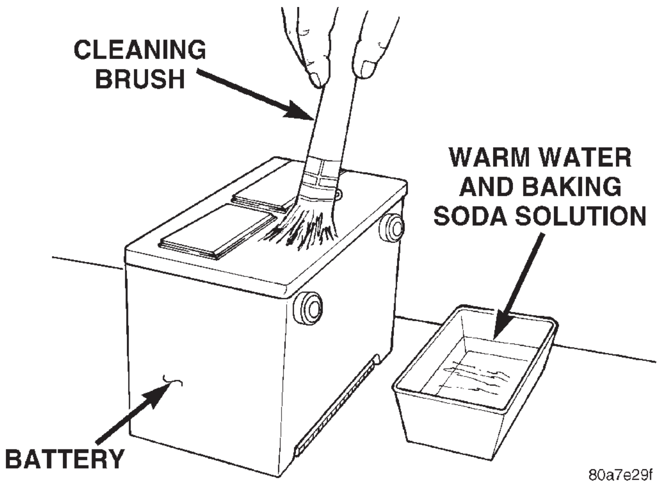


Fig. 9 Cleaning Battery

(2) Inspect battery case and cover for cracks or leakage. If leakage is present battery must be replaced.
(3) Inspect battery tray for damage caused by acid from battery. If acid damage is present, it will be necessary to clean area with:
- Baking soda solution
- Wire brush
- Scraper

(4) Clean battery terminals with baking soda and suitable cleaning tool.
(5) Inspect cables for damage and broken terminals. Replace damaged, frayed cables and broken terminal.
(6) Inspect battery for proper or damaged hold down ledge.

REMOVAL AND INSTALLATION

BATTERY

REMOVAL

The Battery is accessible without removing the Wheel and Tire assembly.

(1) Make sure ignition switch is in OFF UNLOCKED position and all accessories are OFF.

WARNING: NEVER GET UNDER A LIFTED VEHICLE IF NOT SUPPORTED PROPERLY ON SAFETY STANDS.

(2) Disconnect battery negative cable from remote negative terminal on left shock tower.
(3) Turn steering wheel to the **FULL LEFT** position.
(4) Twist the four plastic screws one quarter turn to release shield.
(5) Remove shield.
(6) Disconnect battery blanket heater cord, if equipped (Fig. 10).

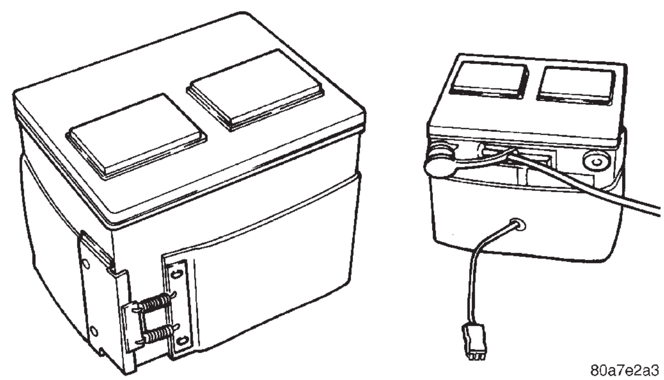


Fig. 10 Battery with Blanket Heater

(7) Remove battery negative cable followed by the battery positive cable.
(8) Remove bolt attaching the battery strap to the battery hold down bracket. Remove hold down bracket bolt.
(9) Slide battery to rear of tray and lift over lip. Use care not to tip battery so that the acid will not spill out.
(10) Remove battery.
(11) Remove battery blanket heater if equipped (Fig. 10).

INSTALLATION

For installation, reverse the above procedures. Tighten battery cables to 16 N·m (150 in. lbs.) torque.

BATTERY TRAY

REMOVAL

(1) Remove battery, refer to Battery Removal procedures above.
(2) Remove the battery tray attaching bolts (Fig. 11).
(3) Remove battery tray.
(4) Remove battery strap.

REMOVAL AND INSTALLATION (Continued)

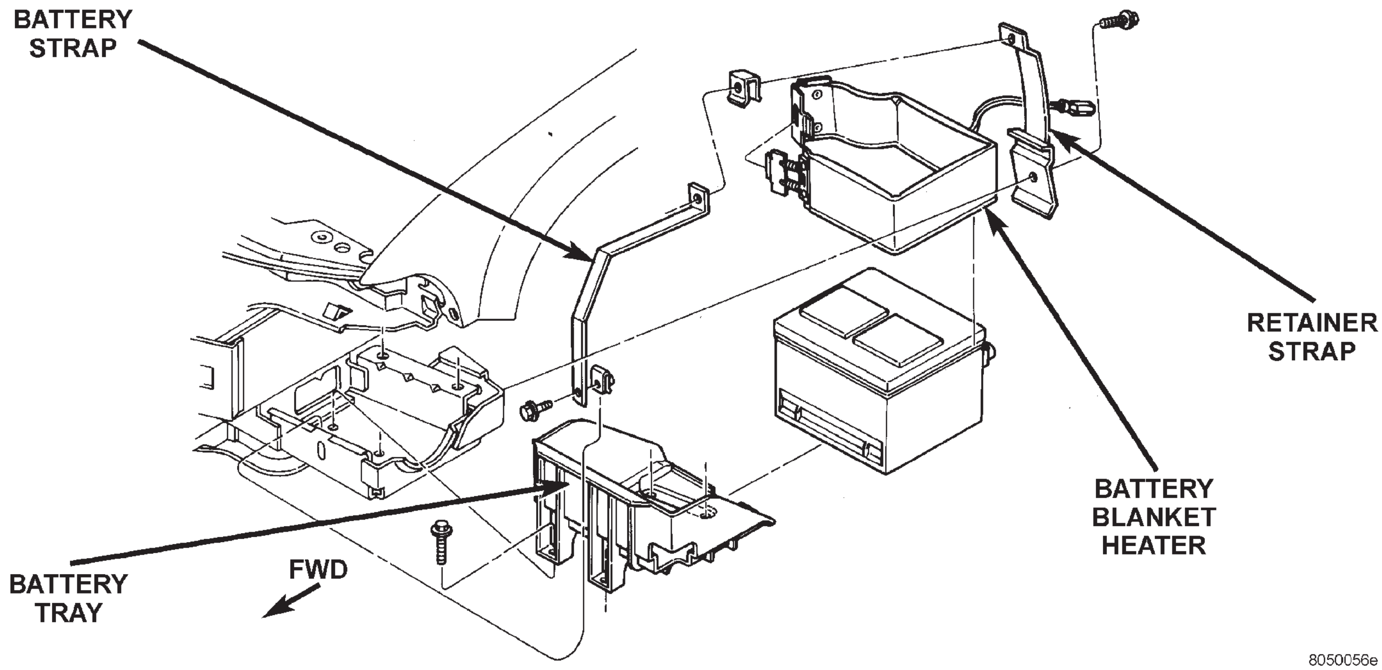


Fig. 11 Battery Tray Removal

INSTALLATION

For installation, reverse the above procedures.

SPECIFICATIONS

BATTERY SPECIFICATIONS

Load Test (Amps)	Cold Cranking Rating @ -18°C (0°F)	Reserve Capacity
260 Amp	510 Amp	110 Minutes

COLD CRANK RATING

The current battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at –18° C (0° F).

RESERVE CAPACITY RATING

The length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27°C (80°F).

TORQUE

DESCRIPTION	TORQUE
Battery Hold Down Bolt Clamp Bolt	14 N·m (160 in. lbs.)

1999 JA Cirrus, Stratus and Breeze
Publication No. 81-270-9121
TSB 26-09-98 September, 1998

STARTING SYSTEMS

CONTENTS

GENERAL INFORMATION

GENERAL INFORMATION

The starting system (Fig. 1) and (Fig. 2) has:

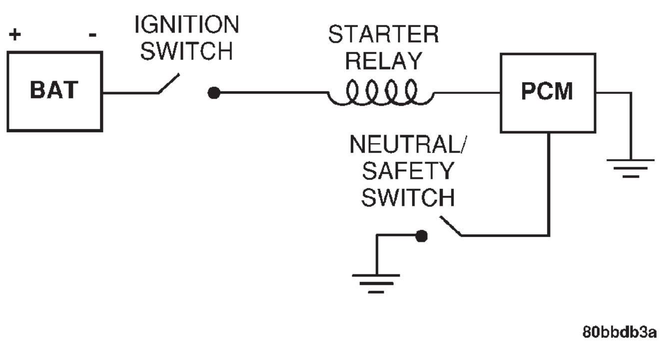


Fig. 1 Starting System Components - Automatic

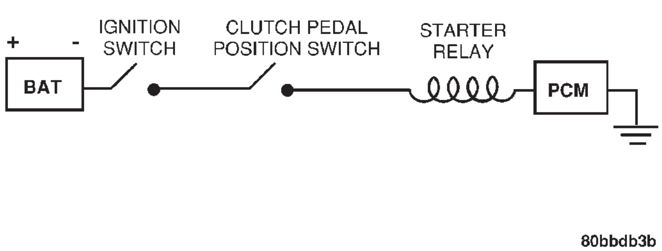


Fig. 2 Starting System Components - Manual

- Ignition switch
- Starter relay
- Transmission range sensor, or Park/Neutral Position switch with automatic transmissions
- Clutch Pedal Position Switch with manual transmissions
- Powertrain Control Module (PCM)
- Wiring harness
- Battery
- Starter motor with an integral solenoid

These components form two separate circuits. A high amperage circuit that feeds the starter motor up to 300+ amps, and a control circuit that operates on less than 20 amps.

The Powertrain Control Module (PCM) controls a double start over ride safety that does not allow the starter to be engaged if the engine is already running.

DESCRIPTION AND OPERATION

BOSCH AND MELCO STARTERS

The Bosch and Melco are permanent magnet starter motors. A planetary gear train transmits power between starter motor and pinion shaft. The fields have six permanent magnets. The Bosch is used on 2.0L engines and Melco is used on 2.5L engines.

NIPPONDENSO STARTER

The Nippondenso is a reduction gear-field coil starter motor and is available on 2.4L engine.

SUPPLY CIRCUIT AND CONTROL CIRCUIT

The starter system consists of two separate circuits:
- A high amperage supply to feed the starter motor.
- A low amperage circuit to control the starter solenoid.

DIAGNOSIS AND TESTING

CONTROL CIRCUIT TEST

The starter control circuit has:

- Starter solenoid
- Starter relay
- Transmission range sensor, or Park/Neutral Position switch with automatic transmissions
- Clutch Pedal Position Switch with manual transmissions
- Ignition switch
- Battery
- All related wiring and connections

CAUTION: Before performing any starter tests, the ignition and fuel systems must be disabled.

- To disable ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for the proper relay location.

STARTER SOLENOID

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION WITH THE PARKING BRAKE APPLIED

(1) Verify battery condition. Battery must be in good condition with a full charge before performing any starter tests. Refer to Battery Tests.

(2) Perform Starter Solenoid test BEFORE performing the starter relay test.

(3) Raise the vehicle.

(4) Perform a visual inspection of the starter/starter solenoid for corrosion, loose connections or faulty wiring.

(5) Lower the vehicle.

(6) Locate and remove the starter relay from the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location.

(7) Connect a remote starter switch or a jumper wire between the remote battery positive post and terminal 87 of the starter relay connector.

(a) If engine cranks, starter/starter solenoid is good. Go to the Starter Relay Test.

(b) If engine does not crank or solenoid chatters, check wiring and connectors from starter relay to starter solenoid for loose or corroded connections. Particularly at starter terminals.

(c) Repeat test. If engine still fails to crank properly, trouble is within starter or starter mounted solenoid, and replace starter.

STARTER RELAY

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION/NEUTRAL WITH THE PARKING BRAKE APPLIED

RELAY TEST

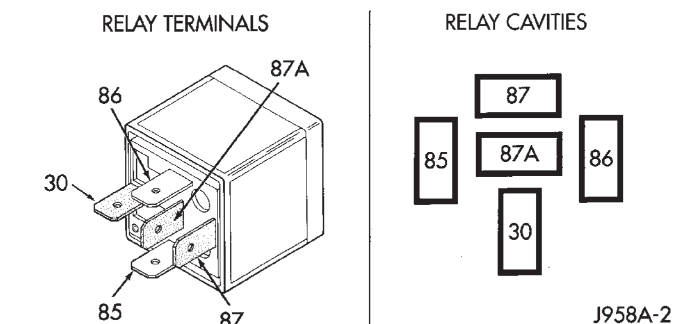
The starter relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

Remove the starter relay from the PDC as described in this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ±5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery B+ lead to terminals 86 and a ground lead to terminal 85 to energize the relay. The relay should click. Also test for continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to Relay Circuit Test procedure. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Starter Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the PDC fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coils. There should be

DIAGNOSIS AND TESTING (Continued)

continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open circuit to the starter solenoid as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. On vehicles with a manual transmission, the clutch pedal must be fully depressed for this test. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If not OK with an automatic transmission, check for an open or short circuit to the ignition switch and repair, if required. If the circuit to the ignition switch is OK, see the Ignition Switch Test procedure in this group. If not OK with a manual transmission, check the circuit between the relay and the clutch pedal position switch for an open or a short. If the circuit is OK, see the Clutch Pedal Position Switch Test procedure in this group.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. On vehicles with an automatic transmission, it is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. On vehicles with a manual transmission, it is grounded at all times. Check for continuity to ground at the cavity for relay terminal 85. If not OK with an automatic transmission, check for an open or short circuit to the park/neutral position switch and repair, if required. If the circuit is OK, see the Park/Neutral Position Switch Test procedure in this group. If not OK with a manual transmission, repair the circuit to ground as required.

SAFETY SWITCHES

For diagnostics,

• Clutch Pedal Position Switch, refer to Group 6, Clutch.

• Park/Neutral Position Switch, refer to Group 21, Transaxle

IGNITION SWITCH

After testing starter solenoid and relay, test ignition switch and wiring. Refer to Group 8D, Ignition Systems or Group 8W, Wiring Diagrams. Check all wiring for opens or shorts, and all connectors for being loose or corroded.

BATTERY

Refer to Group 8A, Battery for proper procedures.

ALL RELATED WIRING AND CONNECTORS

Refer to Group 8W, Wiring Diagrams,

FEED CIRCUIT RESISTANCE TEST

Before proceeding with this operation, review Starting System Test. The following operation will require a voltmeter, accurate to one tenth of a volt.

CAUTION: Before Performing any starter test, the Ignition and fuel systems must be disabled.

(1) To disable ignition and fuel systems disconnect the Automatic Shutdown Relay (ASD) in the Power Distribution Center (PDC).

(2) Check that all wiring harnesses and components properly connected. Connect negative lead of voltmeter to battery negative terminal, and positive lead to engine block near the battery cable attaching point (Fig. 2). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, clean or repair the poor contact at ground cable attaching points. If voltage reading is still above 0.2 volt after correcting poor contacts, replace ground cable.

(3) Connect the positive voltmeter lead to the battery positive terminal, and negative lead to battery positive cable terminal on starter solenoid (Fig. 3). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, clean or repair the poor contact at:

• Battery cable to solenoid connection
• Battery cable to remote terminal
• Battery cable to battery

If reading is still above 0.2 volt after correcting poor contacts, replace battery positive cable as necessary.

(4) If resistance tests do not detect feed circuit failures, replace starter motor.

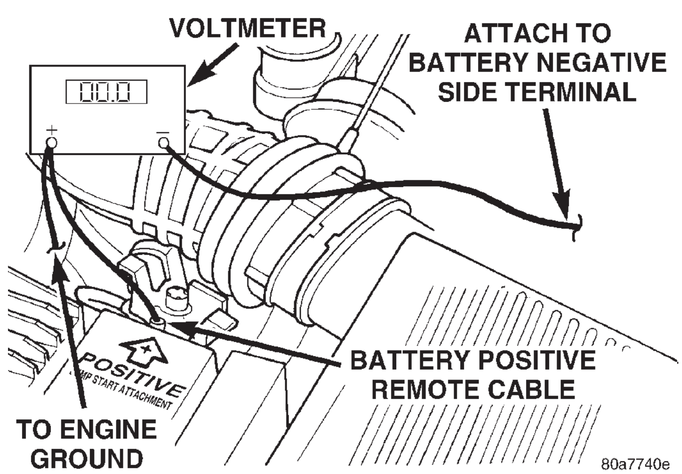


Fig. 2 Test Ground Circuit Resistance

FEED CIRCUIT TEST

The following procedure will require a suitable volt-ampere tester (Fig. 4).

DIAGNOSIS AND TESTING (Continued)

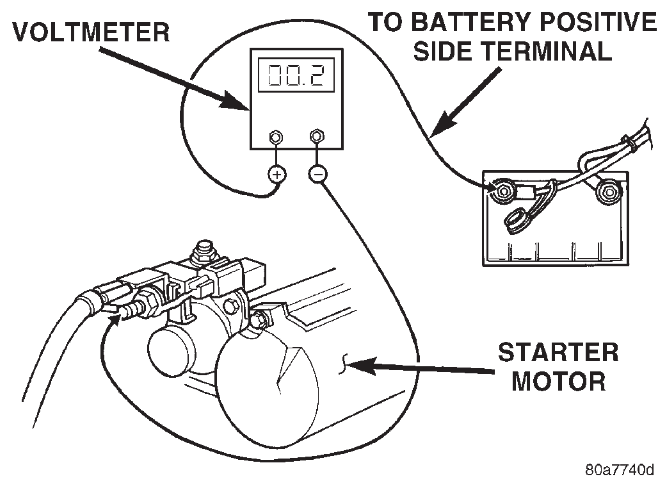


Fig. 3 Test Battery Positive Cable Resistance

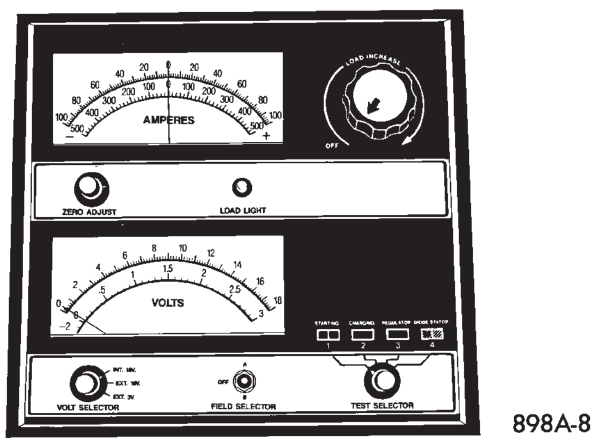


Fig. 4 Volt Ampere Tester

CAUTION: Before Performing any starter test, the Ignition and fuel systems must be disabled.

(1) Connect a volt-ampere tester (Fig. 4) to the remote battery terminals (Fig. 5). Refer to the operating instructions provided with the tester being used.

(2) To disable the ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD) in the Power Distribution Center (PDC). Refer to the PDC cover for the proper relay location.

(3) Verify that:

- All lamps and accessories are OFF
- Automatic transmission shift selector is in PARK
- Manual transmission clutch pedal depressed
- Set parking brake

(4) Rotate and hold the ignition switch in the START position. Observe the volt-ampere tester (Fig. 4).

- Voltage above 9.6 volts, and amperage draw above 280 amps, check for engine seizing or faulty starter.

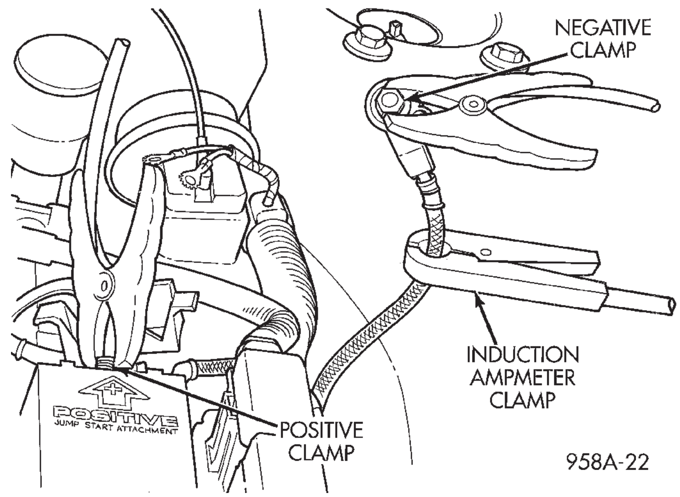


Fig. 5 Volt-Ampere Tester Connections

- Voltage above 12.4 volts and amperage reads 0 to 10 amps, check for corroded cables and/or bad connections.
- Voltage below 9.6 volts and amperage draw above 300 amps, the problem is the starter. Replace the starter refer to starter removal.

CAUTION: Do not overheat the starter motor or draw the battery voltage below 9.6 volts during cranking operations.

(5) After the starting system problems have been corrected, verify the battery state-of-charge and charge battery if necessary. Disconnect all testing equipment and connect ASD relay. Start the vehicle several times to assure the problem has been corrected.

STARTING SYSTEM TEST

For circuit descriptions and diagrams, refer to 8W-21, Starting System in Group 8W, Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

INSPECTION

Before removing any unit from the starting system for repair or diagnosis, perform the following inspections:

DIAGNOSIS AND TESTING (Continued)

• **Battery -** Visually inspect the battery for indications of physical damage and loose or corroded cable connections. Determine the state-of-charge and cranking capacity of the battery. Charge or replace the battery, if required. Refer to Group 8A, Battery for more information.

• **Ignition Switch -** Visually inspect the ignition switch for indications of physical damage and loose or corroded wire harness connections.

• **Clutch Pedal Position Switch -** Visually inspect the clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections.

• **Park/Neutral Position Switch -** Visually inspect the park/neutral position switch for indications of physical damage and loose or corroded wire harness connections.

• **Starter Relay -** Visually inspect the starter relay for indications of physical damage and loose or corroded wire harness connections.

• **Starter -** Visually inspect the starter for indications of physical damage and loose or corroded wire harness connections.

• **Starter Solenoid -** Visually inspect the starter solenoid for indications of physical damage and loose or corroded wire harness connections.

• **Wiring -** Visually inspect the wire harness for damage. Repair or replace any faulty wiring, as required.

STARTING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO ENGAGE.	1. BATTERY DISCHARGED OR FAULTY. 2. STARTING CIRCUIT WIRING FAULTY. 3. STARTER RELAY FAULTY. 4. IGNITION SWITCH FAULTY. 5. PARK/NEUTRAL POSITION SWITCH (AUTO TRANS) FAULTY OR MIS-ADJUSTED. 6. CLUTCH PEDAL POSITION SWITCH (MAN TRANS) FAULTY. 7. STARTER SOLENOID FAULTY. 8. STARTER ASSEMBLY FAULTY.	1. REFER TO GROUP 8A , BATTERY. CHARGE OR REPLACE BATTERY, IF REQUIRED. 2. REFER TO FEED CIRCUIT RESISTANCE TEST AND FEED CIRCUIT TEST IN THIS SECTION. 3. REFER TO RELAY TEST, IN THIS SECTION. REPLACE RELAY, IF NECESSARY. 4. REFER TO IGNITION SWITCH TEST, IN GROUP 8D IGNITION SYSTEM OR GROUP 8W, WIRING DIAGRAMS. REPLACE SWITCH, IF NECESSARY. 5. REFER PARK/NEUTRAL POSITION SWITCH TEST, IN GROUP 21, TRANSAXLE. REPLACE SWITCH, IF NECESSARY. 6. REFER TO CLUTCH PEDAL POSITION SWITCH TEST, IN GROUP 6, CLUTCH. REPLACE SWITCH, IF NECESSARY. 7. REFER TO SOLENOID TEST, IN THIS SECTION. REPLACE STARTER ASSEMBLY, IF NECESSARY. 8. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. BATTERY DISCHARGED OR FAULTY. 2. STARTING CIRCUIT WIRING FAULTY. 3. STARTER ASSEMBLY FAULTY. 4. ENGINE SEIZED.	1. REFER TO GROUP 8A, BATTERY. CHARGE OR REPLACE BATTERY AS NECESSARY. 2. REFER TO THE FEED CIRCUIT RESISTANCE TEST AND THE FEED CIRCUIT TEST IN THIS SECTION. REPAIR AS NECESSARY. 3. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY. 4. REFER TO GROUP 9 ENGINE, FOR DIAGNOSTIC AND SERVICE PROCEDURES.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. BROKEN TEETH ON STARTER RING GEAR. 2. STARTER ASSEMBLY FAULTY.	1. REMOVE STARTER. INSPECT RING GEAR AND REPLACE IF NECESSARY. 2. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER DOES NOT DISENGAGE.	1. STARTER IMPROPERLY INSTALLED. 2. STARTER RELAY FAULTY. 3. IGNITION SWITCH FAULTY. 4. STARTER ASSEMBLY FAULTY.	1. INSTALL STARTER. TIGHTEN STARTER MOUNTING HARDWARE TO CORRECT TORQUE SPECIFICATIONS. 2. REFER TO RELAY TEST, IN THIS SECTION. REPLACE RELAY, IF NECESSARY. 3. REFER TO IGNITION SWITCH TEST, IN GROUP 8D, IGNITION SYSTEM. REPLACE SWITCH, IF NECESSARY. 4. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.

REMOVAL AND INSTALLATION

SAFETY SWITCHES

For Removal and Installation of the:

- Clutch Position Switch, refer to Group 6, Clutch.
- Park/Neutral Switch, refer to Group 21, Transaxle.

STARTER

CAUTION: The generator output terminal must be connected to the battery positive terminal of the starter solenoid. For the charging and cranking systems to operate properly.

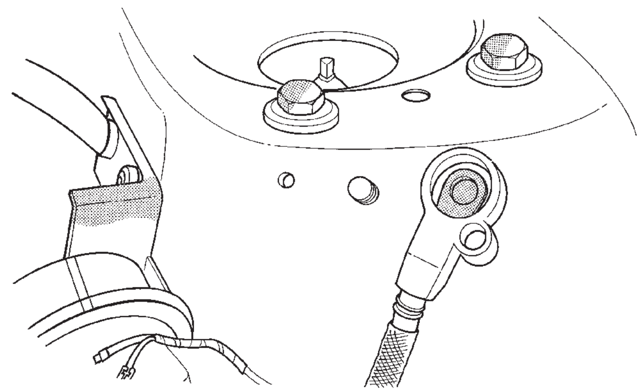


Fig. 6 Remove Remote Battery Cable at Shock Tower

2.0L ENGINE – WITH MANUAL TRANSAXLE

REMOVAL

(1) Disconnect the remote battery negative cable from the terminal on shock tower (Fig. 6).

(2) Remove air cleaner resonator, refer to Group 14, Fuel.

(3) Remove the battery positive cable nut from starter. Remove battery positive cable and generator output wire from starter (Fig. 7).

(4) Disconnect push on solenoid connector. Unlock the red locking tab and compress lock to release the connector.

(5) Remove two bolts attaching starter to transmission housing and remove starter from vehicle.

INSTALLATION

For installation, reverse the above procedures. Clean corrosion/dirt from wire terminals before installing wiring to the solenoid.

2.0L ENGINE WITH AUTOMATIC TRANSAXLE – 2.4L ENGINE

REMOVAL

(1) Disconnect battery negative cable from remote negative terminal on shock tower (Fig. 6).

(2) Remove air cleaner resonator, refer to Group 14, Fuel.

(3) Remove three Transmission Control Module (TCM) mounting screws. Move TCM to provide access to top starter mounting bolt. DO NOT disconnect TCM wiring.

(4) Remove top bolt attaching starter to transmission housing (Fig. 8).

(5) Raise vehicle.

(6) Remove battery positive cable nut from starter and remove cable.

(7) Disconnect push on solenoid connector. Unlock the red locking tab and compress lock to release the connector (2.0L only).

(8) Remove the bottom bolt attaching starter to transmission housing (Fig. 8).

(9) Remove starter from vehicle.

INSTALLATION

(1) With vehicle is raised, set starter face into transmission housing.

(2) Lower vehicle.

(3) Install top starter mounting bolt but do not tighten.

(4) Raise vehicle.

REMOVAL AND INSTALLATION (Continued)

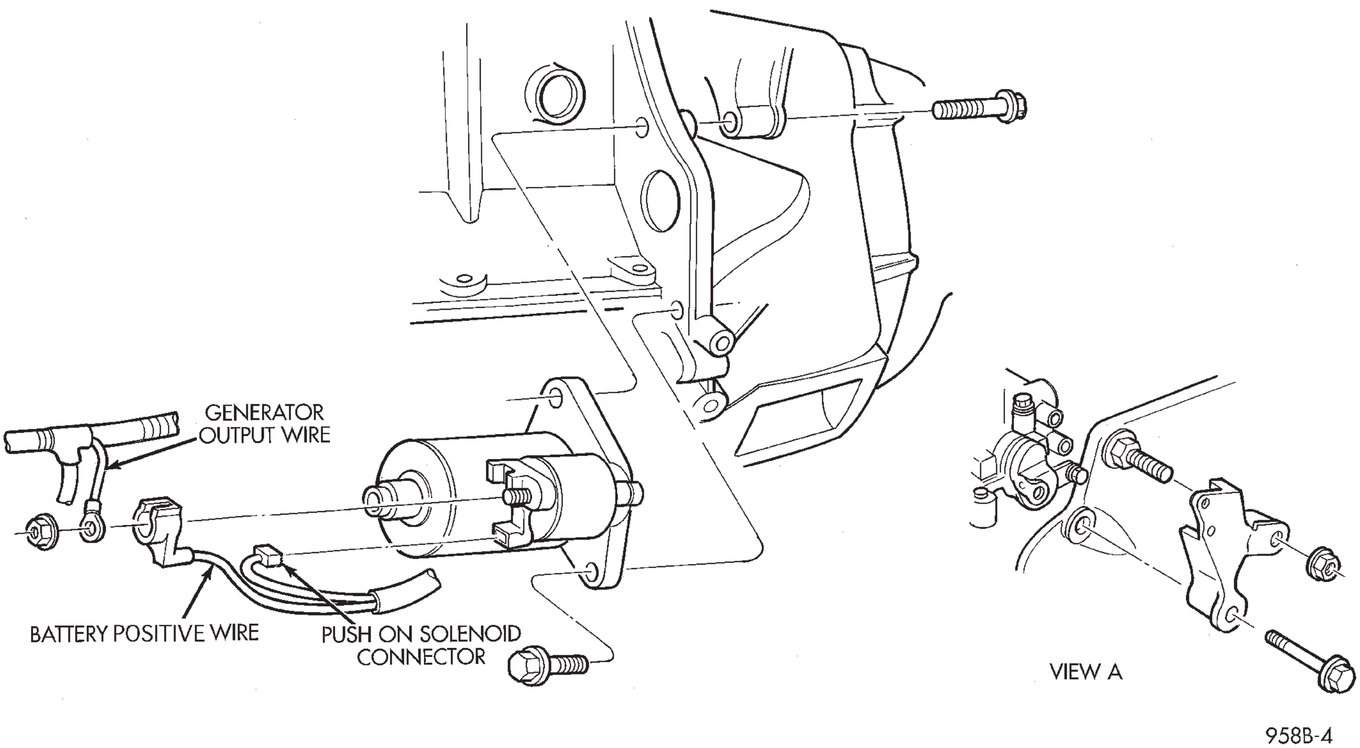


Fig. 7 Wire Terminal Connection – 2.0L Engine

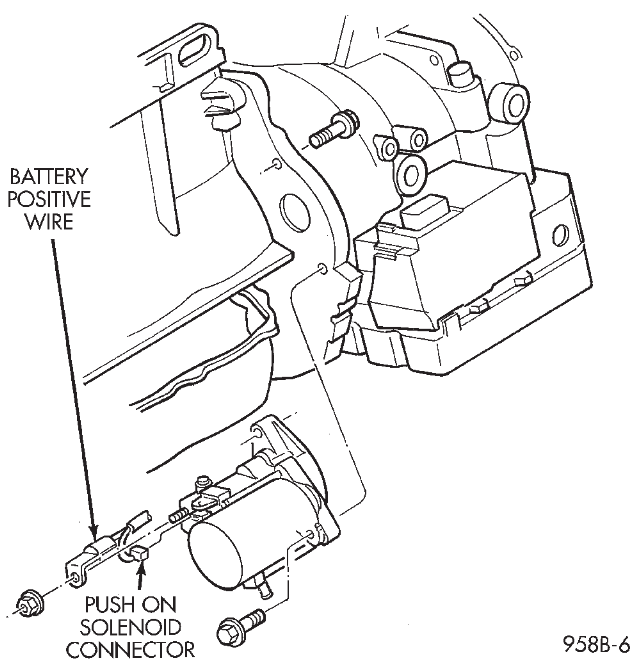


Fig. 8 Wire Terminal Connection

(5) Install bottom starter mounting bolt and tighten to 54 N·m (40 ft. lbs.) torque.

(6) Clean corrosion/dirt from wire terminals before installing wiring to the solenoid.

(7) Connect battery positive cable to solenoid post (Fig. 8).

(8) Connect the push-on solenoid connector.

(9) Lower vehicle.

(10) Tighten top starter bolt to 54 N·m (40 ft. lbs.) torque.

(11) Install TCM and the mounting screws.

(12) Install air cleaner resonator, refer to Group 14, Fuel.

(13) Connect battery remote cable to the remote terminal.

2.5L ENGINE

REMOVAL

(1) Disconnect battery negative cable from remote negative terminal on shock tower (Fig. 6).

(2) Raise vehicle.

(3) Remove oil filter.

(4) Remove battery positive cable nut from starter and remove cable (Fig. 9).

(5) Disconnect push on solenoid connector.

REMOVAL AND INSTALLATION (Continued)

(6) Remove three bolts attaching starter to transmission housing and remove starter from vehicle.

INSTALLATION

For installation, reverse the above procedures. Clean corrosion/dirt from wire terminals before installing wiring to the solenoid.

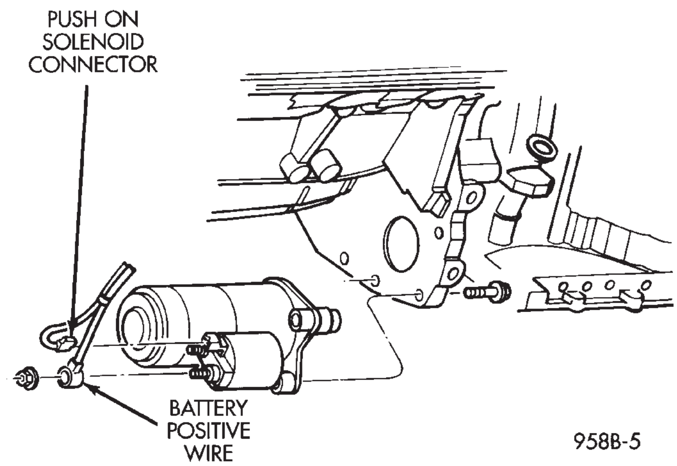


Fig. 9 Wire Terminal Connection – 2.5L Engine

STARTER RELAY

The relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for relay location.

SPECIFICATIONS

STARTER

Manufacturer	BOSCH	MELCO	NIPPONDENSO
Engine Application	2.0L	2.5L	2.4L
Power rating	0 .95 Kw	1.2 Kw	1.4 Kw
Voltage	12 VOLTS	12 VOLTS	12 VOLTS
Brushes	4	4	4
Drive	Planetary Gear Train	Planetary Gear Train	Offset Gear Reduced

Engine Amperage Draw Test ......150-280 Amps*

Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

TORQUE

DESCRIPTION	TORQUE
Starter Mounting Bolts	54 N·m (40 ft. lbs.)
Starter Solenoid Battery Nut . . .	10 N·m (90 in. lbs.)

CHARGING SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

CHARGING SYSTEM

DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to the Ignition System for information)
- Battery (refer to the Battery for information)
- Battery temperature sensor
- Voltmeter (refer to the Instrument Panel and Gauges for information)
- Wiring harness and connections (refer to the Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. When the ignition switch is turned to the ON position, battery voltage is applied to the generator rotor through one of the two field terminals to produce a magnetic field. The generator is driven by the engine through a serpentine belt and pulley arrangement.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry, contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

Temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly and to maintain the proper voltage depending on battery temperature.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including the EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects.

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicles electrical system through the generator, battery, and ground terminals.

Noise emitting from the generator may be caused by:

- Worn, loose or defective bearings
- Loose or defective drive pulley
- Incorrect, worn, damaged or misadjusted drive belt
- Loose mounting bolts

DESCRIPTION AND OPERATION (Continued)

- Misaligned drive pulley
- Defective stator or diode
- Damaged internal fins

BATTERY TEMPERATURE SENSOR

DESCRIPTION

The sensor is located on the rear side of the front bumper beam. (Fig. 1).

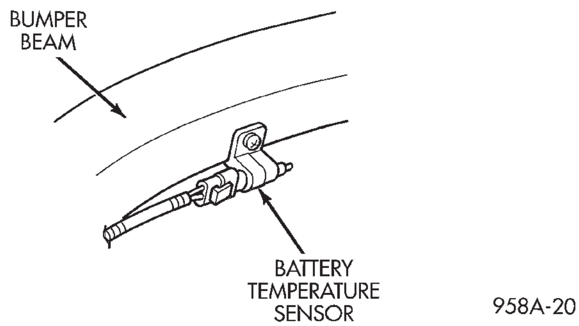


Fig. 1 Battery Temperature Sensor

OPERATION

The battery temperature sensor is used to determine the battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The battery temperature sensor is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled depending upon the battery temperature sensor input (example: disable purge and EGR, enable LDP). Most OBD II monitors are disabled below 20°F.

ELECTRONIC VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage and battery temperature (refer to Battery Temperature Sensor for more information). It then compensates and regulates generator current output accordingly. Also refer to Charging System Operation for additional information.

DIAGNOSIS AND TESTING

CHARGING SYSTEM

When the ignition switch is turned to the ON position, battery potential will register on the voltmeter. During engine cranking a lower voltage will appear on the meter. With the engine running, a voltage reading higher than the first reading (ignition in ON) should register.

The following are possible symptoms of a charging system fault:

- The voltmeter does not operate properly
- An undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- Accessories being left on with the engine not running
- A faulty or improperly adjusted switch that allows a lamp to stay on. See Ignition-Off Draw Test in the Battery section for more information.

The following procedures may be used to correct a problem diagnosed as a charging system fault.

INSPECTION

(1) Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.

(2) Inspect all fuses in the fuseblock module and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(3) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(4) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in the Cooling System.

(5) Inspect automatic belt tensioner (if equipped). Refer to the Cooling System for information.

(6) Inspect connections at generator field, battery output, and ground terminals. Also check ground connection at engine. They should all be clean and tight. Repair as required.

CHARGING SYSTEM RESISTANCE TESTS

These tests will show the amount of voltage drop across the generator output wire from the generator output (B+) terminal to the battery positive post.

DIAGNOSIS AND TESTING (Continued)

They will also show the amount of voltage drop from the ground (-) terminal on the generator (Fig. 2) or (Fig. 3) to the battery negative post.

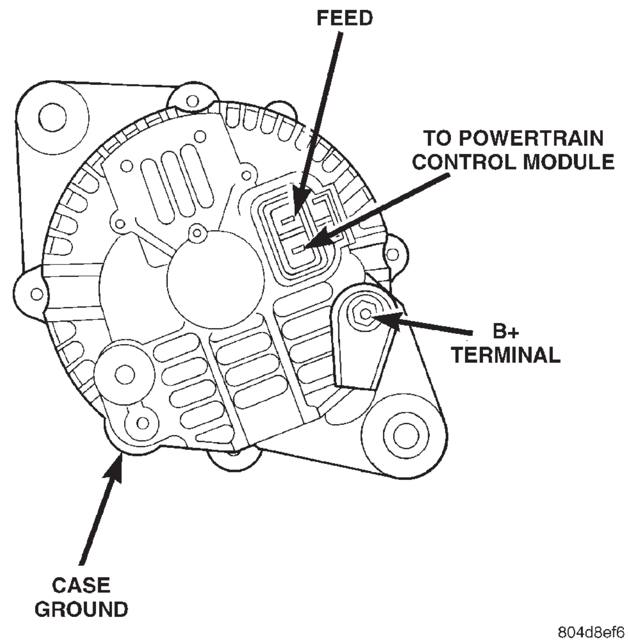


Fig. 2 Generator Terminals—2.5L

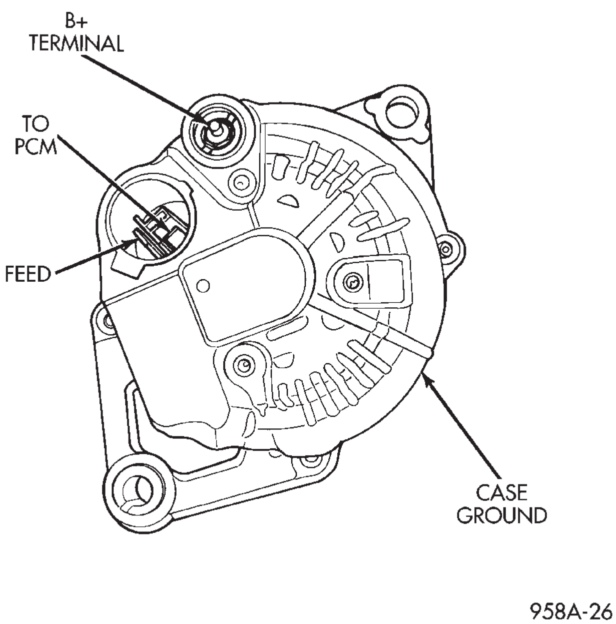


Fig. 3 Generator Terminals—2.0/2.4L

A voltmeter with a 0–18 volt DC scale should be used for these tests. By repositioning the voltmeter test leads, the point of high resistance (voltage drop) can easily be found.

Test points on the generator may be reached by either removing the air cleaner housing or below by raising the vehicle on a hoist.

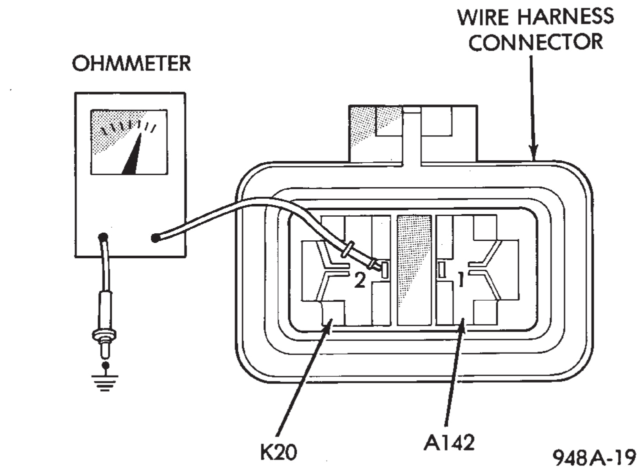


Fig. 4 Electrical Resistance Test

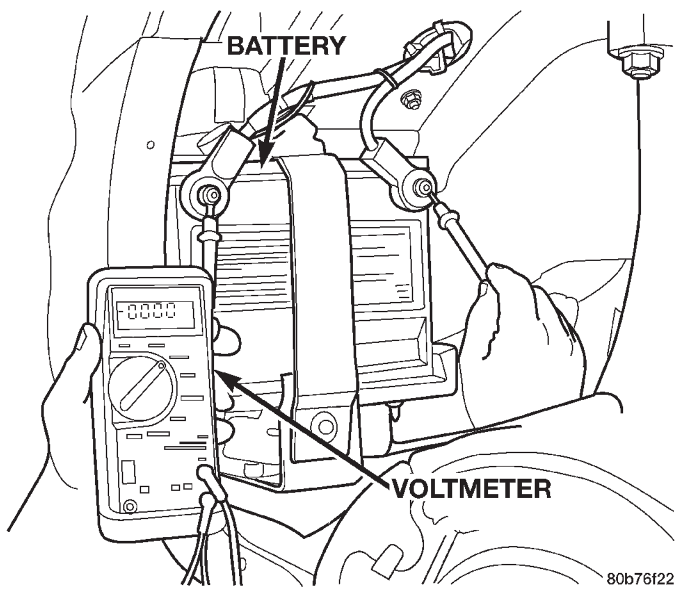


Fig. 5 Battery Voltage Test

PREPARATION

(1) Before starting test, make sure battery is in good condition and is fully-charged. See the Battery section for more information.

(2) Raise vehicle and support.

(3) Remove left front tire.

(4) Remove wheel well splash shield.

(5) Check condition of battery cables at battery. Clean if necessary.

(6) Start the engine and allow it to reach normal operating temperature.

(7) Shut engine off.

(8) Connect an engine tachometer.

(9) Fully engage the parking brake.

TEST

(1) Start engine.

(2) Place heater blower in high position.

DIAGNOSIS AND TESTING (Continued)

(3) Turn on headlamps and place in high-beam position.

(4) Turn vehicle interior lamps on.

(5) Bring engine speed up to 2400 rpm and hold.

(6) Testing (+ positive) circuitry:

(a) Touch the positive lead of voltmeter directly to battery positive **POST** (Fig. 5).

(b) Touch the negative lead of voltmeter to the B+ output terminal stud on the generator (not the terminal mounting nut). Voltage should be no higher than 0.6 volts. If voltage is higher than 0.6 volts, touch test lead to terminal mounting stud nut and then to the wiring connector. If voltage is now below 0.6 volts, look for dirty, loose or poor connection at this point. Also check condition of the generator output wire-to-battery bullet connector. Refer to Group 8, Wiring for connector location. A voltage drop test may be performed at each (-ground) connection in this circuit to locate the excessive resistance.

(7) Testing (- ground) circuitry:

(a) Touch the negative lead of voltmeter directly to battery negative **POST**.

(b) Touch the positive lead of voltmeter to the generator case. Voltage should be no higher than 0.3 volts. If voltage is higher than 0.3 volts, touch test lead to generator case and then to the engine block. If voltage is now below 0.3 volts, look for dirty, loose or poor connection at this point. A voltage drop test may be performed at each connection in this circuit to locate the excessive resistance. This test can also be performed between the generator case and the engine. If test voltage is higher than 0.3 volts, check for corrosion at generator mounting points or loose generator mounting.

(8) When finished with test, install splash shield and tire, then lower vehicle.

CURRENT OUTPUT TEST

The current output test will determine if the charging system can deliver its minimum test current (amperage) output. Refer to the Specifications section at the end of this group for minimum test current (amperage) requirements.

The first part of this test will determine the combined amperage output of both the generator and the Electronic Voltage Regulator (EVR) circuitry.

PREPARATION

(1) Determine if any Diagnostic Trouble Codes (DTC) exist. For repair, refer to the appropriate Powertrain Diagnostic Procedures manual.

(2) Before starting test, make sure battery is in good condition and is fully-charged. See the Battery section for more information.

(3) Check condition of battery cables at battery. Clean if necessary.

(4) Be sure the generator drive belt is properly tensioned. Refer to the Cooling System for information.

(5) A volt/amp tester equipped with both a battery load control (carbon pile rheostat) and an inductive-type pickup clamp (ammeter probe) will be used for this test. Refer to operating instructions supplied with tester. When using a tester equipped with an inductive-type clamp, removal of wiring at the generator will not be necessary.

(6) Start the engine and allow it to reach operating temperature.

(7) Shut engine off.

(8) Turn off all electrical accessories and all vehicle lighting.

(9) Connect the volt/amp tester leads to the battery post or jump start posts. Be sure the carbon pile rheostat control is in the OPEN or OFF position before connecting leads. See Load Test in the Battery section for more information. Also refer to the operating instructions supplied with test equipment.

(10) Connect the inductive clamp (ammeter probe). Refer to the operating instructions supplied with test equipment.

(11) If volt/amp tester is not equipped with an engine tachometer, connect a separate tachometer to the engine.

TEST

(1) Perform the previous test Preparation.

(2) Fully engage the parking brake.

(3) Start engine.

(4) Bring engine speed to 2500 rpm.

(5) With engine speed held at 2500 rpm, slowly adjust the rheostat control (load) on the tester to obtain the highest amperage reading. Do not allow voltage to drop below 12 volts. Record the reading. **This load test must be performed within 15 seconds to prevent damage to test equipment.** On certain brands of test equipment, this load will be applied automatically. Refer to the operating manual supplied with test equipment.

(6) The ammeter reading must meet the Minimum Test Amps specifications as displayed in the Generator Ratings chart. This can be found in the Specifications section. A label stating a part reference number is attached to the generator case. On some engines this label may be located on the bottom of the case. Compare this reference number to the Generator Ratings chart.

(7) Rotate the load control to the OFF position.

(8) Continue holding engine speed at 2500. If EVR circuitry is OK, amperage should drop below 15–20 amps. With all electrical accessories and vehicle

DIAGNOSIS AND TESTING (Continued)

lighting off, this could take several minutes of engine operation. If amperage did not drop, refer to the appropriate Powertrain Diagnostic Procedures manual for testing.

(9) Remove volt/amp tester.

If minimum amperage could not be met, refer to the appropriate Powertrain Diagnostic Procedures manual for testing.

BATTERY TEMPERATURE SENSOR

To perform a complete test of this sensor and its circuitry, refer to the appropriate Powertrain Diagnostic Procedures manual. To test the sensor only, refer to the following:

(1) Disconnect the sensor from the engine harness.

(2) Attach ohmmeter leads to the wire terminals of the sensor.

(3) At room temperature of 25° C (75–80° F), an ohmmeter reading of 9K to 11K ohms should be observed.

(4) If reading is above or below the specification, replace the sensor.

(5) Refer to the Removal and Installation section for procedures.

ON-BOARD DIAGNOSTIC SYSTEM TEST

GENERAL INFORMATION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the OBD system. Some circuits are checked continuously and some are checked only under certain conditions.

If the OBD system senses that a monitored circuit is bad, it will put a DTC into electronic memory. The DTC will stay in electronic memory as long as the circuit continues to be bad. The PCM is programmed to clear the memory after 50 engine starts if the problem does not occur again.

DIAGNOSTIC TROUBLE CODES

A DTC description can be read using the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for information.

A DTC does not identify which component in a circuit is bad. Thus, a DTC should be treated as a symptom, not as the cause for the problem. In some cases, because of the design of the diagnostic test procedure, a DTC can be the reason for another DTC to be set. Therefore, it is important that the test procedures be followed in sequence, to understand what caused a DTC to be set.

ERASING DIAGNOSTIC TROUBLE CODES

The DRB Scan Tool must be used to erase a DTC.

REMOVAL AND INSTALLATION

GENERATOR—2.0L (NIPPONDENSO)

REMOVAL

(1) Disconnect battery negative cable from remote negative terminal on shock tower (Fig. 6).

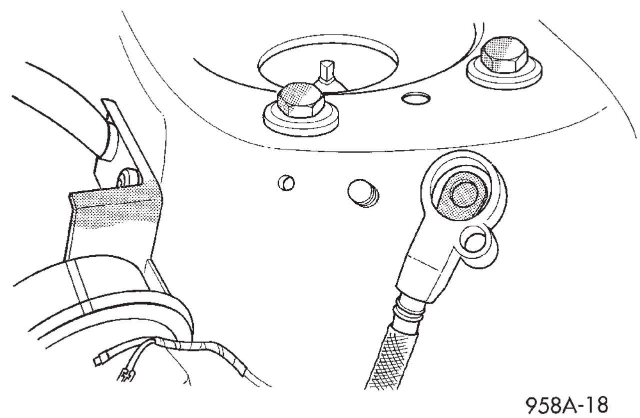


Fig. 6 Remove Battery Cable at Shock Tower

(2) Unplug field circuit from generator.

(3) Remove B+ terminal cover by spreading the cover with a small flat blade tool.

(4) Remove the B+ terminal nut and wire (Fig. 7).

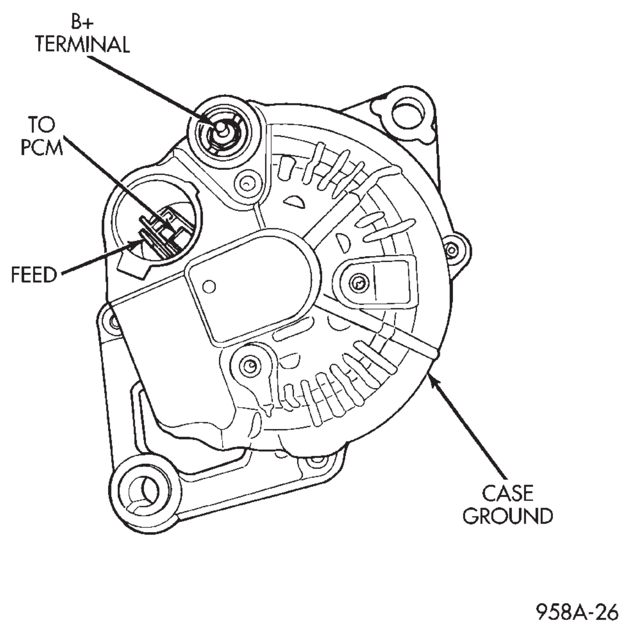


Fig. 7 Wiring Connections—2.0/2.4L

REMOVAL AND INSTALLATION (Continued)

(5) Loosen adjusting T-bolt, but do not remove (Fig. 8).

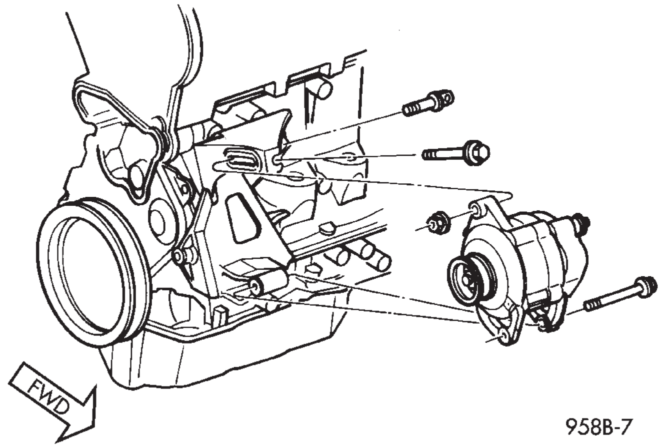


Fig. 8 Generator—2.0L Engine

(6) Loosen pivot bolt, but do not remove.
(7) Loosen adjusting bolt to allow removal of the generator drive belt. Refer to the Cooling System.
(8) Remove adjusting T-bolt.
(9) Remove pivot bolt, do not drop spacer.
(10) Release generator from mounting bracket and move it toward passenger head lamp bucket.
(11) Remove generator from head lamp bucket area.

INSTALLATION

(1) For installation, reverse above procedures. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart.

GENERATOR—2.4L (NIPPONDENSO)

REMOVAL

(1) Disconnect battery negative cable from remote negative terminal on shock tower (Fig. 9).
(2) Unplug field circuit from generator.
(3) Remove B+ terminal cover by spreading the cover with a small flat blade tool.
(4) Remove the B+ terminal nut and wire (Fig. 10).
(5) Loosen adjusting T-bolt, but do not remove (Fig. 10).
(6) Loosen pivot bolt, but do not remove.
(7) Loosen adjusting bolt to allow removal of the generator drive belt. Refer to the Cooling System.
(8) Remove adjusting T-bolt.
(9) Remove pivot bolt.
(10) Remove ABS braking unit by removing the two lower plate mounting bolts. Refer to the Brake section.

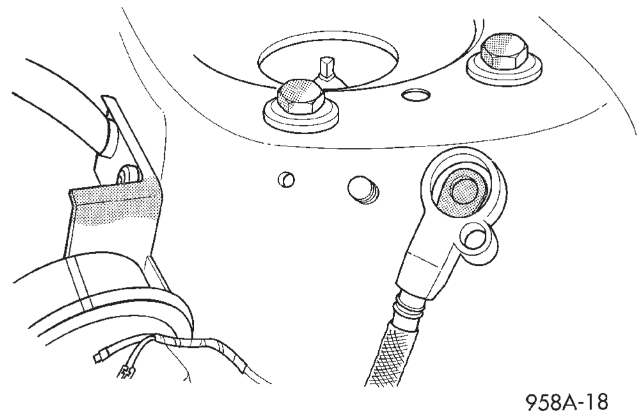


Fig. 9 Battery Cable at Shock Tower

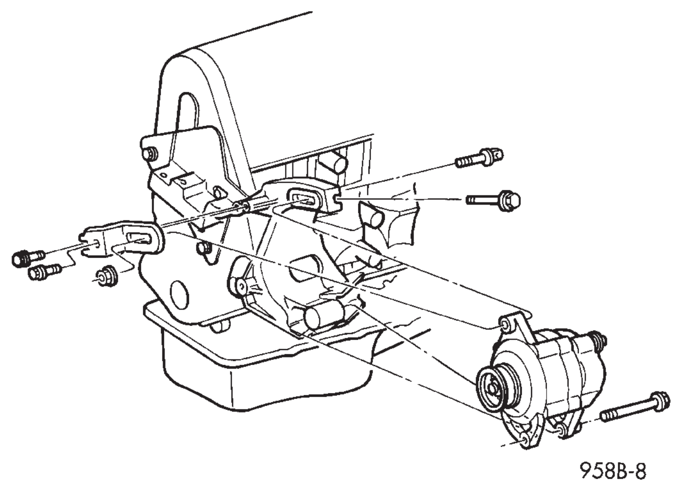


Fig. 10 Generator—2.4L Engine

(11) Remove Coolant Overflow bottle. Refer to the Cooling System.
(12) Remove by sliding alternator under the air conditioning lines towards passenger side of vehicle.
(13) Remove generator from vehicle.

INSTALLATION

(1) For installation, reverse above procedures. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart.

GENERATOR—2.5L

REMOVAL

(1) Disconnect battery negative cable from remote negative terminal on shock tower.
(2) Unplug field circuit from generator.
(3) Remove the B+ terminal nut and wire (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

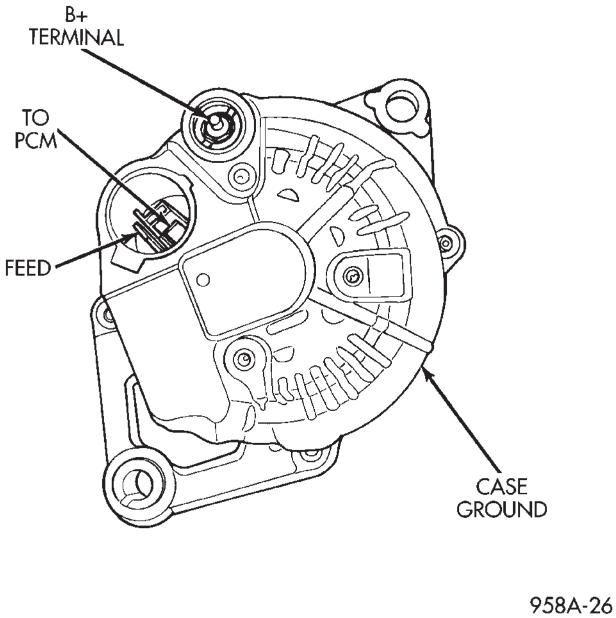


Fig. 11 Wiring Connections—2.5L

(4) Loosen top mounting ear bolt.

(5) Loosen pivot bolt, but do not remove. Be careful not to lose nut (Fig. 12).

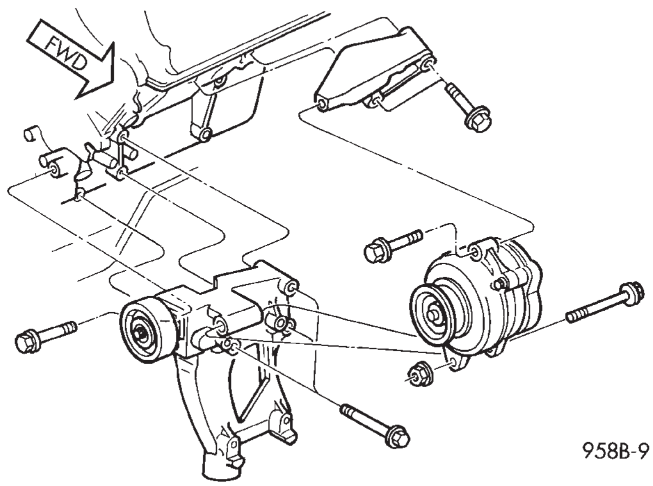


Fig. 12 Generator—2.5L Engine

(6) Loosen adjusting bolt on idler to allow removal of the generator drive belt. Refer to the Cooling System.

(7) Remove pivot bolt, do not drop spacer.

(8) Remove top mounting ear bolt.

(9) Remove upper generator bracket.

(10) Remove generator.

INSTALLATION

(1) For installation, reverse above procedures. Tighten all fasteners to the proper torque. Refer to the Torque Specifications chart.

BATTERY TEMPERATURE SENSOR

REMOVAL

(1) Raise vehicle on host.

(2) Remove screw from sensor.

(3) Disconnect electrical connector from sensor.

INSTALLATION

(1) Connect electrical connector to sensor.

(2) Install screw and tighten.

(3) Lower vehicle.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	ENGINES	MINIMUM TEST AMPS
DENSO	2.0L	74 amps
DENSO	2.4L	74 amps
MELCO	2.5L	74 amps
The Test Specifications are: 1. 2500 ±20 RPMS 2. Voltage Output 15V ±.3V 3. Field Current 5amps ±.1amp		

TORQUE

DESCRIPTION	TORQUE
Battery Terminal Nut	10 N·m (90 in. lbs.)
Battery Hold Down Clamp Bolt	10 N·m (90 in. lbs.)
Battery Negative Cable Nut at Shock Tower	10 N·m (90 in. lbs.)
Generator B+ Terminal	9 N·m (75 in. lbs.)
Generator Mounting Bolt	54 N·m (40 ft. lbs.)
Generator Pivot Bolt	54 N·m (40 ft. lbs.)

CHARGING SYSTEM

CONTENTS

page

SPECIFICATIONS

GENERATOR RATINGS

TYPE	ENGINES	MINIMUM TEST AMPS
DENSO	2.0L	74 amps
DENSO	2.4L	74 amps
DENSO	2.0 & 2.5 W/Heated Seat	90 amps
MELCO	2.5L	74 amps
The Test Specifications are: 1. 2500 ±20 RPMS 2. Voltage Output 15V ±.3V 3. Field Current 5amps ±.1amp		

IGNITION SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

IGNITION SYSTEM

DESCRIPTION

NOTE: The 2.0, 2.4, and 2.5L engines use a fixed ignition timing system. Basic ignition timing is not adjustable. All spark advance is determined by the Powertrain Control Module (PCM).

The distributorless ignition system used on 2.0/2.4L engines is referred to as the Direct Ignition System (DIS). **Basic ignition timing is not adjustable.** The system's three main components are the coil pack, crankshaft position sensor, and camshaft position sensor.

The 2.5L engine uses a distributor, crankshaft sensor and ignition coil. **Basic ignition timing is not adjustable.** The system's main components are the distributor, distributor pickup, camshaft signal, crankshaft signal and ignition coil.

OPERATION

The crankshaft position sensor and camshaft position sensor are hall effect devices. The camshaft position sensor and crankshaft position sensor generate pulses that are inputs to the PCM. The PCM determines crankshaft position from these sensors. The PCM calculates injector sequence and ignition timing from crankshaft position. For a description of both

DESCRIPTION AND OPERATION (Continued)

sensors, refer to Camshaft Position Sensor and Crankshaft Position Sensor in this section.

SPARK PLUGS—2.0/2.4L

DESCRIPTION

All engines use resistor spark plugs. They have resistance values ranging from 6,000 to 20,000 ohms when checked with at least a 1000 volt spark plug tester.

Do not use an ohm meter to check the resistance of the spark plugs. This will give an inaccurate reading.

Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. An isolated plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in the - Lubrication and Maintenance section.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled. Refer to the Spark Plug Condition section of this group. After cleaning, file the center electrode flat with a small flat point file or jewelers file. Adjust the gap between the electrodes (Fig. 2) to the dimensions specified in the chart at the end of this section.

Special care should be used when installing spark plugs in the 2.0/2.4L cylinder head spark plug wells. Be sure the plugs do not drop into the wells, damage to the electrodes can occur.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap. Overtightening can also damage the cylinder head. Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

SPARK PLUGS PLATINUM

DESCRIPTION

The engine utilize platinum spark plugs. Refer to the maintenance schedule.

All engines use resistor spark plugs. They have resistance values ranging from 6,000 to 20,000 ohms when checked with at least a 1000 volt spark plug tester.

Do not use an ohm meter to check the resistance of the spark plugs. This will give an inaccurate reading.

The spark plugs are double platinum and have a recommended service life of 100,000 miles for normal driving conditions per schedule A in this manual. The spark plugs have a recommended service life of 75,000 miles for severe driving conditions per schedule B in this manual. A thin platinum pad is welded to both electrode ends as show in (Fig. 1). Extreme care must be used to prevent spark plug cross threading, mis-gaping and ceramic insulator damage during plug removal and installation.

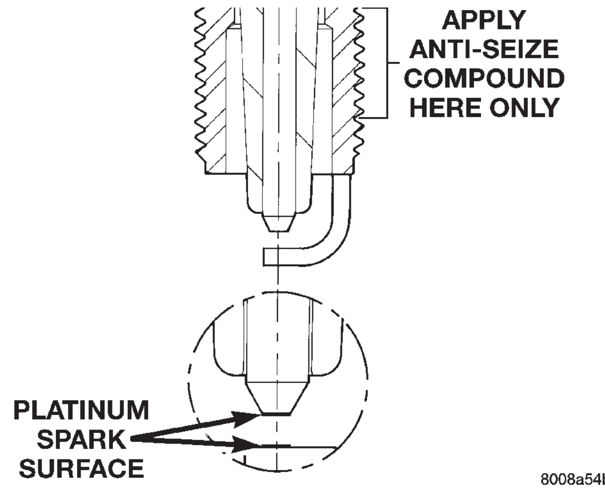


Fig. 1 Platinum Pads

CAUTION: Cleaning of the platinum plug may damage the platinum tip.

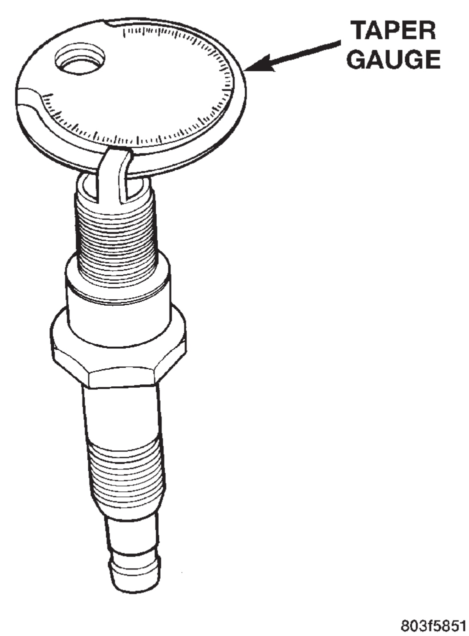


Fig. 2 Setting Spark Plug Electrode Gap

SPARK PLUG CABLES

DESCRIPTION

Spark Plug cables are sometimes referred to as secondary ignition wires. They transfer electrical current from the distributor (2.5L), coil pack (2.0/2.4L), to individual spark plugs at each cylinder. The resistor type, nonmetallic spark plug cables provide sup-

DESCRIPTION AND OPERATION (Continued)

pression of radio frequency emissions from the ignition system.

Check the spark plug cable connections for good contact at the coil and distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil and distributor cap towers and spark plug cover should fit tight around spark plug insulators. Loose cable connections can cause ignition malfunctions by permitting water to enter the towers, corroding, and increasing resistance. **To maintain proper sealing at the terminal connections, the connections should not be broken unless testing indicates high resistance, an open circuit or other damage.**

Clean high tension cables with a cloth moistened with a non-flammable solvent and wipe dry. Check for brittle or cracked insulation. Plastic clips in various locations protect the cables from damage. When the cables are replaced the clips must be used to prevent damage to the cables.

ELECTRONIC IGNITION COIL—2.0/2.4L

WARNING: THE DIRECT IGNITION SYSTEM GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

DESCRIPTION

The coil pack consists of 2 coils molded together. The coil pack is mounted on the valve cover (Fig. 3) and (Fig. 4).

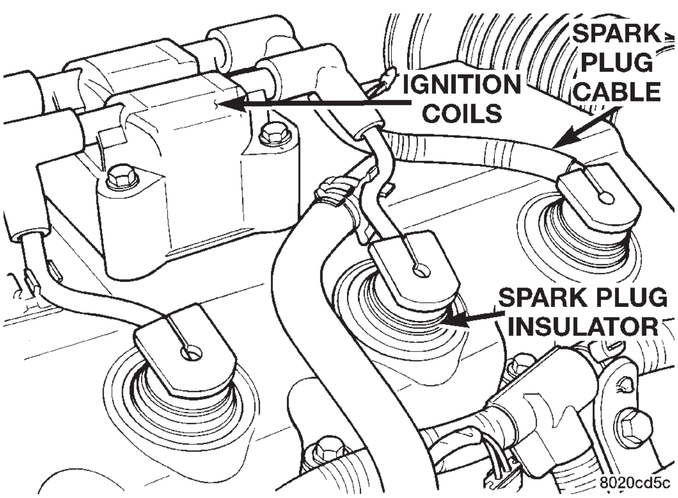


Fig. 3 Ignition Coil Pack—2.0L Engine

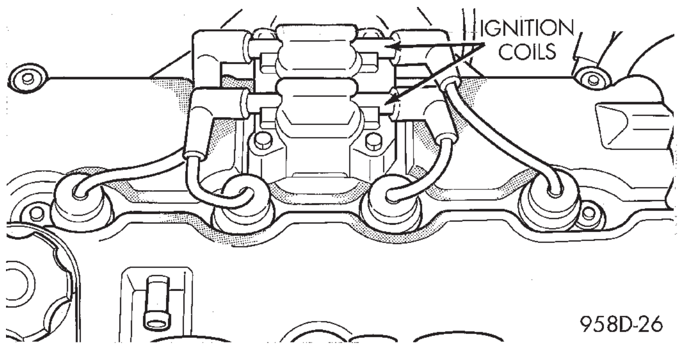


Fig. 4 Ignition Coil Pack—2.4L Engine

OPERATION

High tension leads route to each cylinder from the coil. The coil fires two spark plugs every power stroke. One plug is the cylinder under compression, the other cylinder fires on the exhaust stroke. Coil number one fires cylinders 1 and 4. Coil number two fires cylinders 2 and 3. The PCM determines which of the coils to charge and fire at the correct time.

The Auto Shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs. Refer to Auto Shutdown (ASD) Relay—PCM Output, in this section for relay operation.

IGNITION COIL—2.5L

DESCRIPTION

The ignition coil is located inside the distributor. The distributor is mounted to the right end of the engine block behind the thermostat housing (Fig. 5).

OPERATION

The 2.5L engine uses an epoxy type coil. The coils are not oil filled. The windings are embedded in a heat and vibration resistant epoxy compound.

On a 2.5L The PCM controls ignition timing by turning on and off the transistor in the distributor. By switching the ground path for the coil on and off, the PCM adjusts ignition timing to meet changing engine operating conditions.

The PCM operates the ignition coil through the Auto Shutdown (ASD) relay. When the relay is energized by the PCM, battery voltage is connected to the ignition coil positive terminal. The PCM will de-energize the ASD relay if it does not receive an input from the distributor pick-up. Refer to Auto Shutdown (ASD) Relay and Fuel Pump Relay in this section.

DESCRIPTION AND OPERATION (Continued)

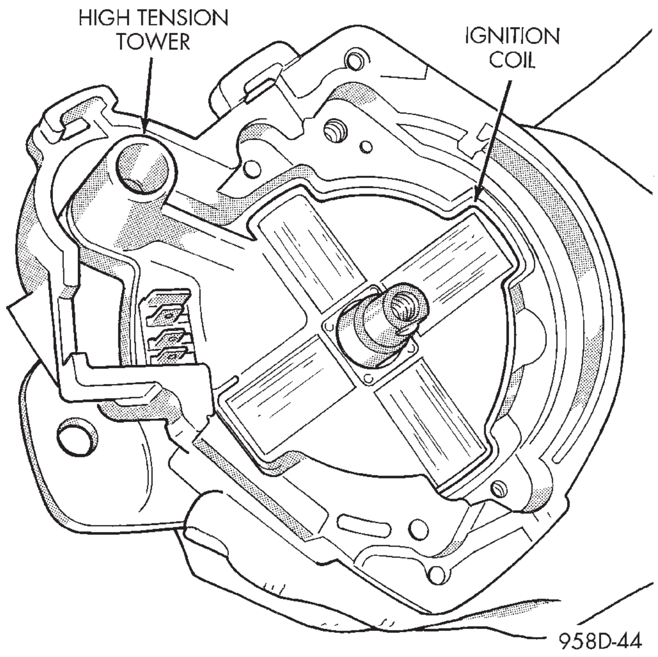


Fig. 5 Ignition Coil—2.5L Engine

AUTOMATIC SHUTDOWN RELAY

DESCRIPTION

The ASD relay is located in the PDC (Fig. 6). The inside top of the PDC cover has a label showing relay and fuse identification.

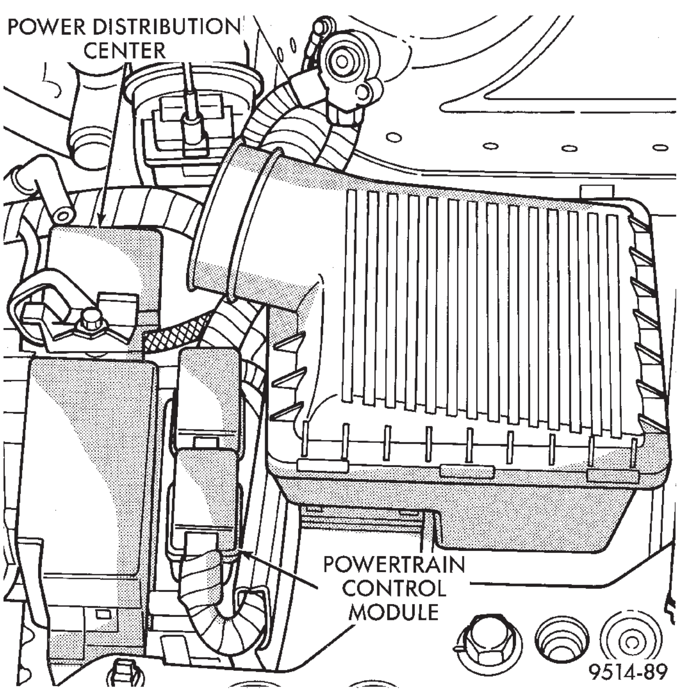


Fig. 6 Power Distribution Center (PDC)

OPERATION

The Automatic Shutdown (ASD) relay supplies battery voltage to the fuel injectors, generator field, electronic ignition coil and the heating elements in the oxygen sensors.

Refer to the Wiring Diagrams for circuit information.

The PCM controls the ASD relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position unless the O2 Heater Monitor test is being run. Refer to the On-Board Diagnostics in the Emission Control section. When the ignition switch is in On or Start, the PCM momentarily turns on the ASD relay. While the relay is on the PCM monitors the crankshaft and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive crankshaft and camshaft position sensor signals when the ignition switch is in the Run position, it will de-energize the ASD relay.

CRANKSHAFT POSITION SENSOR—2.0/2.4L

DESCRIPTION

The crankshaft position sensor mounts to the engine block behind the generator, just above the oil filter (Fig. 7).

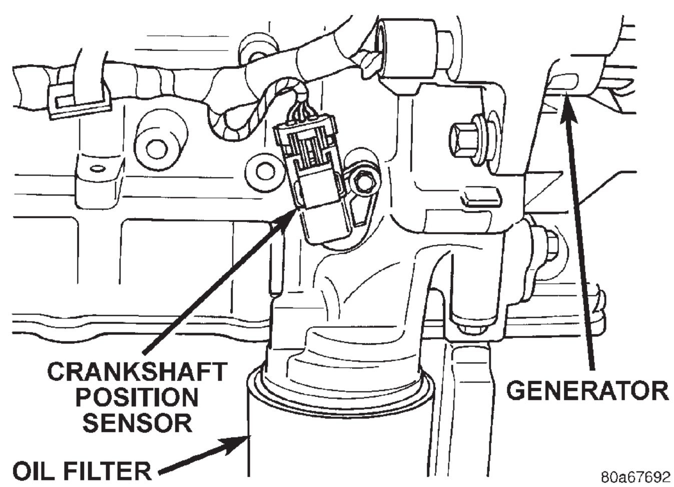


Fig. 7 Crankshaft Position Sensor

OPERATION

The PCM determines what cylinder to fire from the crankshaft position sensor input and the camshaft position sensor input. The second crankshaft counterweight has machined into it two sets of four timing reference notches including a 60 degree signature notch (Fig. 8). From the crankshaft position sensor input the PCM determines engine speed and crankshaft angle (position).

DESCRIPTION AND OPERATION (Continued)

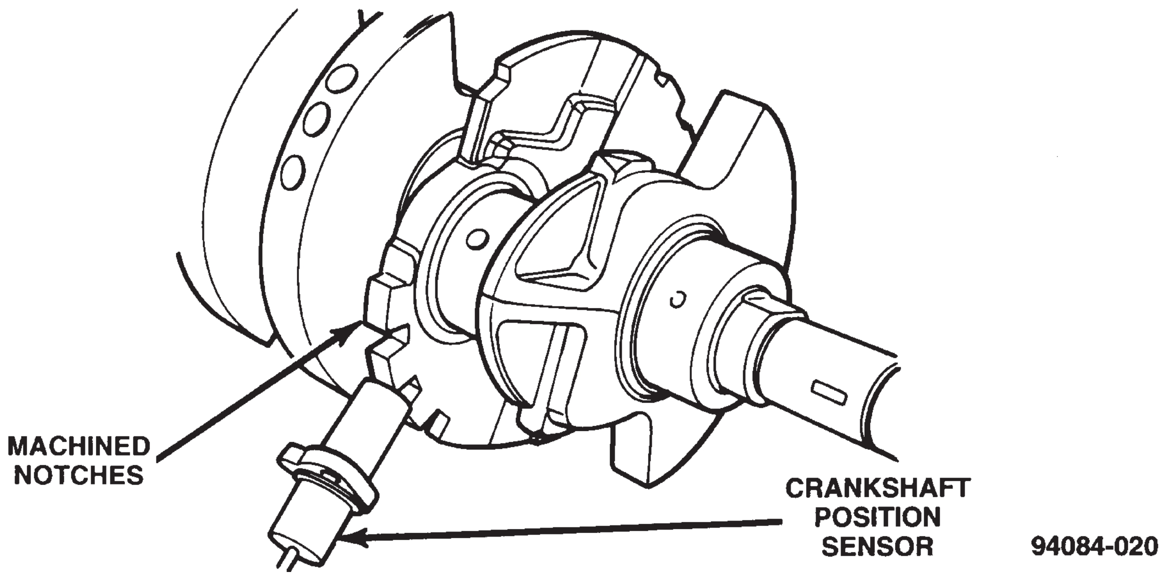


Fig. 8 Timing Reference Notches

The notches generate pulses from high to low in the crankshaft position sensor output voltage. When a metal portion of the counterweight aligns with the crankshaft position sensor, the sensor output voltage goes low (less than 0.5 volts). When a notch aligns with the sensor, voltage goes high (5.0 volts). As a group of notches pass under the sensor, the output voltage switches from low (metal) to high (notch) then back to low.

CRANKSHAFT POSITION SENSOR—2.5L

DESCRIPTION

The crankshaft sensor is located on the rear of the transmission housing, above the differential housing (Fig. 9). The sensor connector has a christmas tree attached to the heater tube bracket. The bottom of the sensor is positioned next to the drive plate.

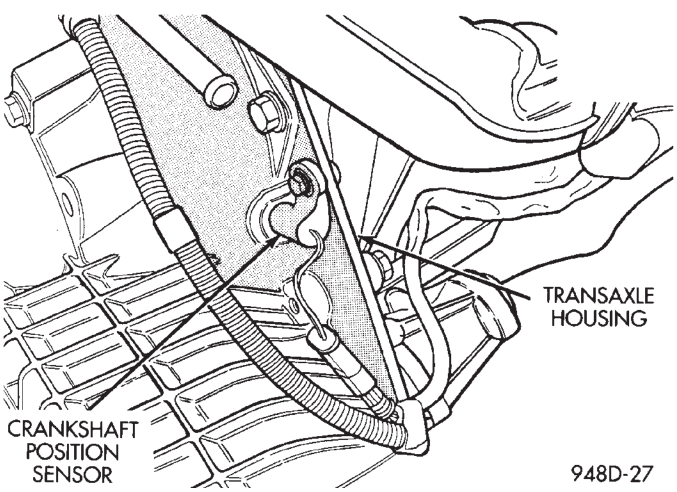


Fig. 9 Crankshaft Position Sensor Location—Typical

OPERATION

The crankshaft position sensor (Fig. 10) detects slots cut into the transmission driveplate extension. There are 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 11). Basic timing is set by the position of the last slot in each group. Once the Powertrain Control Module (PCM) senses the last slot, it determines crankshaft position (which piston will next be at TDC) from the camshaft position sensor input. The 4 pulses generated by the crankshaft position sensor represent the 69°, 49°, 29°, and 9° BTDC marks. It may take the PCM one engine revolution to determine crankshaft position.

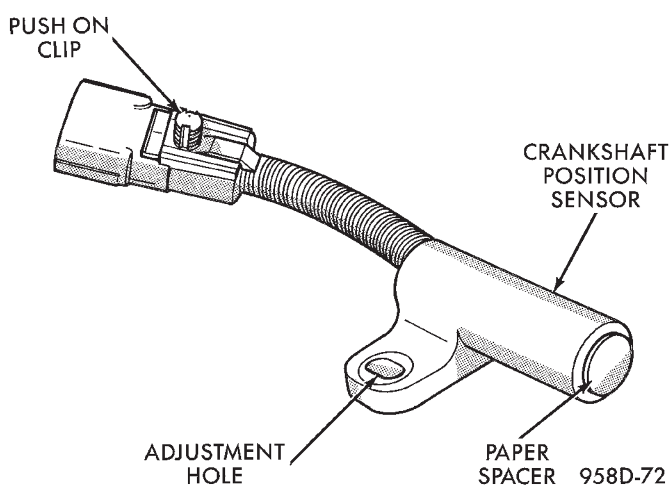


Fig. 10 Crankshaft Position Sensor—Adjustable

The PCM uses crankshaft position reference to determine injector sequence, ignition timing and the presence of misfire. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.

DESCRIPTION AND OPERATION (Continued)

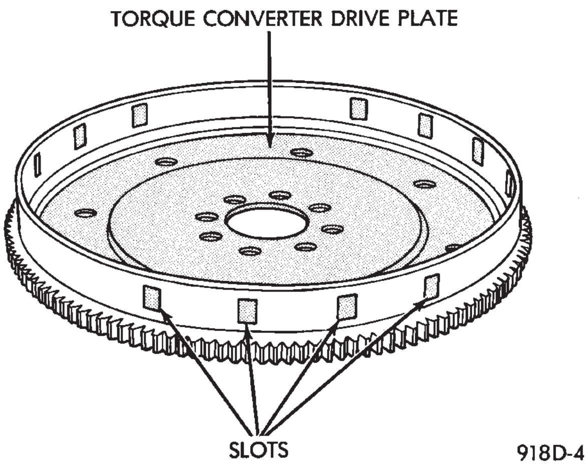


Fig. 11 Timing Slots

CAMSHAFT POSITION SENSOR—2.0/2.4L

DESCRIPTION

The camshaft position sensor is mounted to the rear of the cylinder head. The sensor also acts as a thrust plate to control camshaft endplay (Fig. 14).

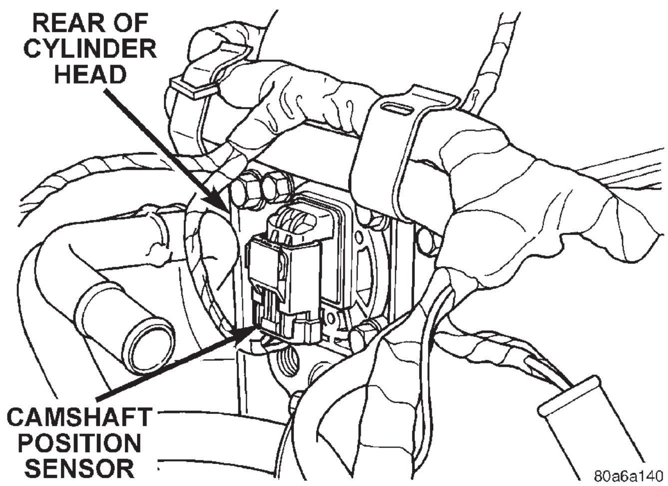


Fig. 12 Camshaft Position Sensor—2.0L SOHC

OPERATION

A target magnet attaches to the rear of the camshaft and indexes to the correct position. The target magnet has four different poles arranged in an asymmetrical pattern. As the target magnet rotates, the camshaft position sensor senses the change in polarity (Fig. 15).

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor (Fig. 12) and (Fig. 13) and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

The sensor input switches from high (5 volts) to low (0.30 volts) as the target magnet rotates. When

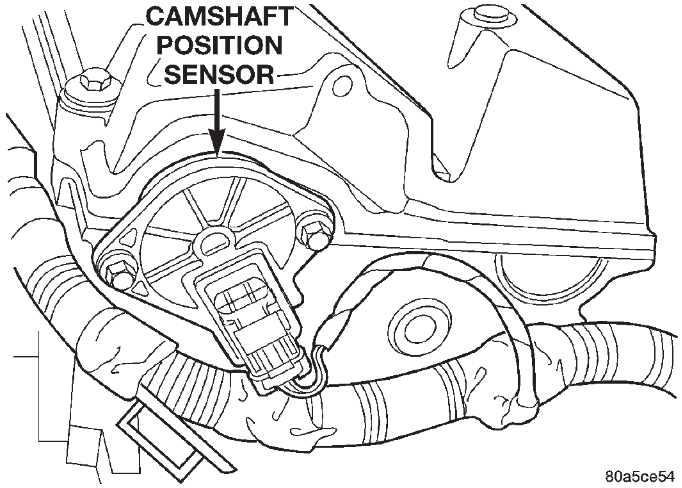


Fig. 13 Camshaft Position Sensor—2.4L DOHC

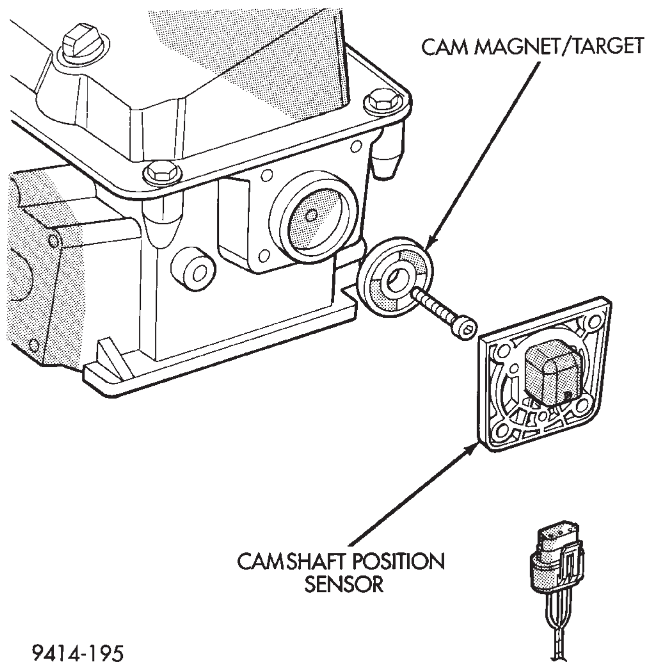


Fig. 14 Target Magnet—Typical

the north pole of the target magnet passes under the sensor, the output switches high. The sensor output switches low when the south pole of the target magnet passes underneath.

CAMSHAFT POSITION SENSOR—2.5L

DESCRIPTION

The 2.5L engine is equipped with a camshaft driven mechanical distributor, containing a shaft driven distributor rotor. The distributor is also equipped with an internal camshaft position (fuel sync) sensor (Fig. 16). This sensor provides fuel injection synchronization and cylinder identification to the PCM.

DESCRIPTION AND OPERATION (Continued)

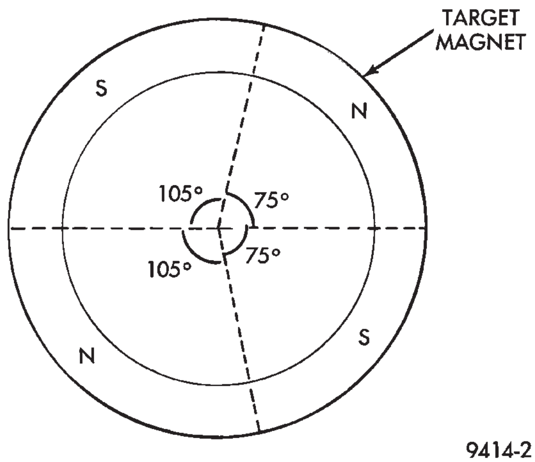


Fig. 15 Target Magnet Polarity

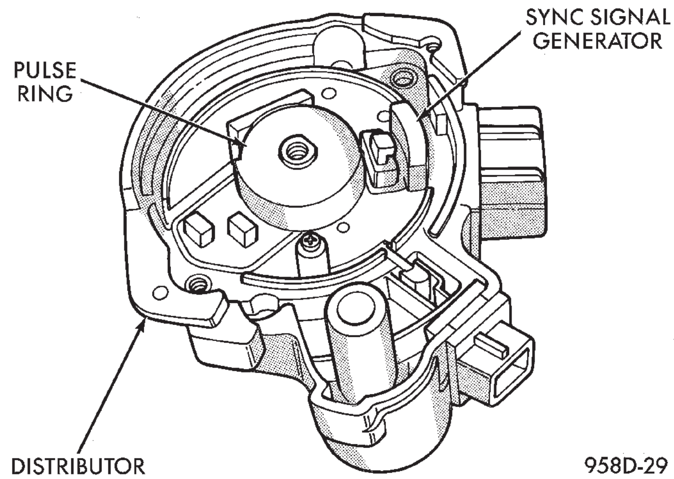


Fig. 16 Camshaft Position Sensor—2.5L Engine

OPERATION

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

The camshaft position sensor contains a hall effect device called a sync signal generator. This sync signal generator detects a rotating pulse ring (shutter) on the distributor shaft. The pulse ring rotates 180 through the sync signal generator. Its signal is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the shutter enters the sync signal generator, the interruption of magnetic field causes the voltage to switch high. This causes a sync signal of approximately 5 volts.

When the trailing edge of the shutter leaves the sync signal generator, the change of magnetic field causes the sync signal voltage to switch low to 0 volts.

Since the shutter rotates at half crankshaft speed, it may take 1 engine revolution during cranking for the PCM to determine the position of piston number 6.

KNOCK SENSOR

DESCRIPTION

The knock sensor threads into the cylinder block.

OPERATION

When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increases, the knock sensor output voltage also increases.

NOTE: Over or under tightening affects knock sensor performance, possibly causing improper spark control.

LOCK KEY CYLINDER

DESCRIPTION

The lock cylinder is inserted in the end of the housing opposite the ignition switch.

OPERATION

The ignition key rotates the cylinder to 5 different detents (Fig. 17):

- Accessory
- Off (lock)
- Unlock
- On/Run
- Start

IGNITION INTERLOCK

OPERATION

All vehicles equipped with automatic transaxles have an interlock system. The system prevents shifting the vehicle out of Park unless the ignition lock cylinder is in the Off, Run or Start position. In addition, the operator cannot rotate the key to the lock position unless the shifter is in the park position. On vehicles equipped with floor shift refer to the - Transaxle for Automatic Transmission Shifter/Ignition Interlock.

DIAGNOSIS AND TESTING (Continued)

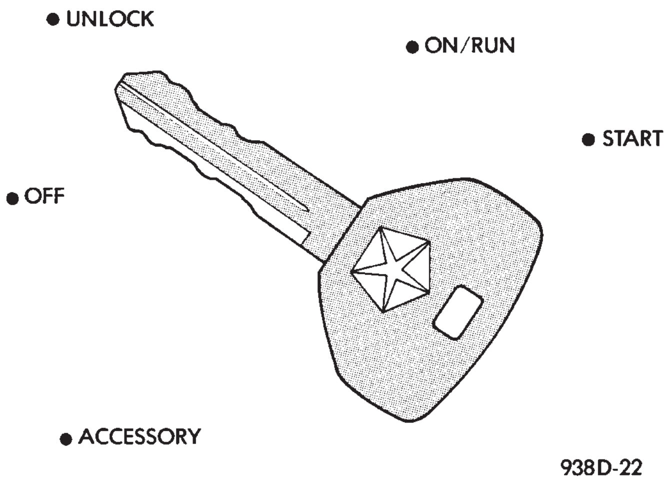


Fig. 17 Ignition Lock Cylinder Detents

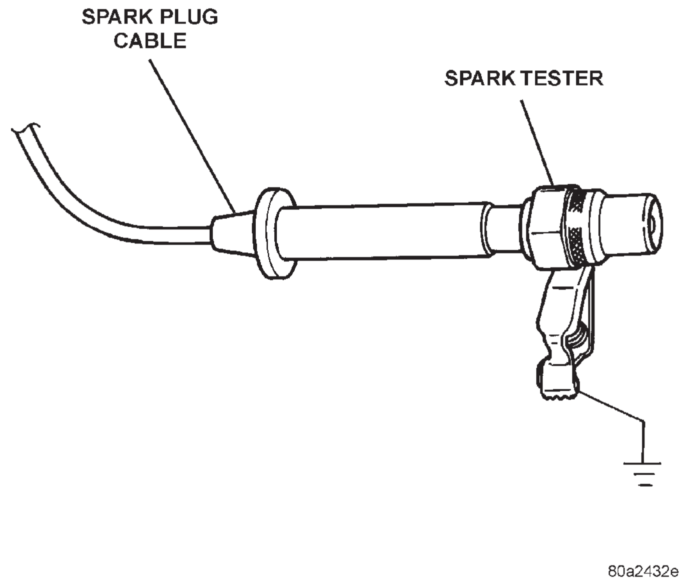


Fig. 18 Testing For Spark

DIAGNOSIS AND TESTING

TESTING FOR SPARK AT COIL—2.0/2.4L

WARNING: THE DIRECT IGNITION SYSTEMS GENERATES APPROXIMATELY 40,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

The coil pack contains independent coils. Each coil must be checked individually.

CAUTION: Spark plug wire damage may occur if the spark plug is moved more than 1/4 inch away from the engine ground.

CAUTION: Do not leave any one spark plug cable disconnected any longer than 30 seconds or possible heat damage to catalytic converter will occur.

CAUTION: Test must be performed at idle and in park only with the parking brake on.

NOTE: New isolated engine valve cover may not provide adequate ground. Use engine block as engine ground.

Use a new spark plug and spark plug cable for the following test.

(1) Insert a new spark plug into the new spark plug boot. Ground the plug to the engine (Fig. 18). Do not hold with your hand.

(2) Starting with coil insulator #1, remove it from the DIS coil.

(3) Plug the test spark plug cable onto #1 coil tower. Make sure a good connection is made; there should be a click sound.

(4) Crank the engine and look for spark across the electrodes of the spark plug.

CAUTION: Always install the cable back on the coil tower after testing to avoid damage to the coil and catalytic converter.

(5) Repeat the above test for the remaining coils. If there is no spark during all cylinder tests, proceed to the Failure To Start Test.

(6) If one or more tests indicate irregular, weak, or no spark, proceed to Check Coil Test.

TESTING FOR SPARK AT COIL—2.5L

WARNING: THE IGNITION SYSTEM GENERATES APPROXIMATELY 32,000 VOLTS. PERSONAL INJURY COULD RESULT FROM CONTACT WITH THIS SYSTEM.

CAUTION: Spark plug wire damage may occur if the spark plug is moved more than 1/4 inch away from the engine ground.

CAUTION: Do not leave any one spark plug cable disconnected any longer than necessary during test or possible heat damage to catalytic converter will occur. Total test time must not exceed 1 minute. Use a new spark plug and spark plug cable for the following test.

(1) Insert a new spark plug into the new spark plug boot. Ground the plug to the engine (Fig. 18).

(2) Remove distributor cap. Refer to Distributor Service in this section.

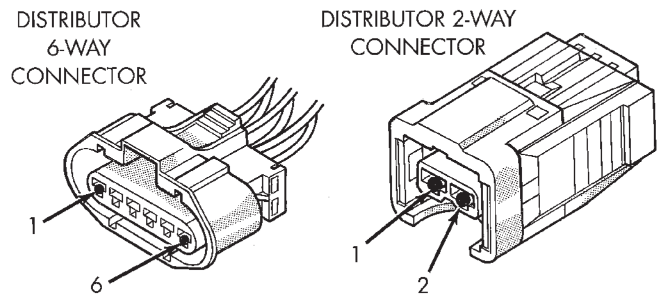
DIAGNOSIS AND TESTING (Continued)

(3) Plug test spark plug cable onto coil tower.

(4) Crank engine and look for spark across the electrodes of the spark plug. If there is no spark, check for: (Fig. 19)

- Continuity from PCM pin 11 to 6-way connector terminal 1
- Continuity between ground and 6-way connector terminal 2
- Continuity from PCM pin 6 to 2-way connector terminal 2
- Correct resistance in distributor cap, refer to Distributor Cap Resistance Test.

(5) If all circuits show continuity, replace distributor assembly.



CAV	COLOR	FUNCTION
1	BK/GY	IGNITION COIL DRIVER
2	BK	GROUND
4	TN/YL	CMP SENSOR SIGNAL
5	DB/WT	FUSED IGN SWITCH OUTPUT
6	BK/LB	SENSOR GROUND

CAV	COLOR	FUNCTION
2	BK/RD	ASD RELAY OUTPUT

Fig. 19 Distributor Connectors

CHECK COIL TEST—2.0/2.4L

Coil one fires cylinders 1 and 4, coil two fires cylinders 2 and 3. Each coil tower is labeled with the number of the corresponding cylinder.

(1) Remove ignition cables and measure the resistance of the cables. Resistance must be within the range shown in the Cable Resistance Chart in Specifications. Replace any cable not within tolerance.

(2) Disconnect the electrical connector from the coil pack.

(3) Measure the primary resistance of each coil. At the coil, connect an ohmmeter between the B+ pin and the pin corresponding to the cylinders in question (Fig. 20). Resistance on the primary side of each coil should be 0.45 - 0.65 ohm at (70° to 80° F). Replace the coil if resistance is not within tolerance.

(4) Remove ignition cables from the secondary towers of the coil. Measure the secondary resistance of the coil between the towers of each individual coil (Fig. 21). Secondary resistance should be 10,900 to 14,700 ohms. Replace the coil if resistance is not within tolerance.

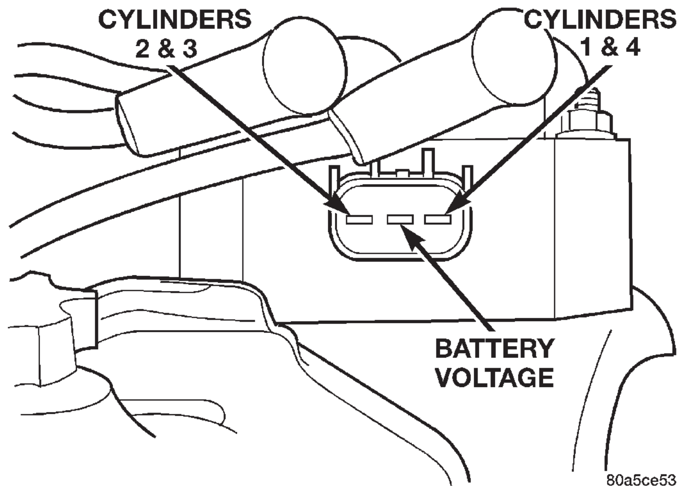


Fig. 20 Terminal Identification

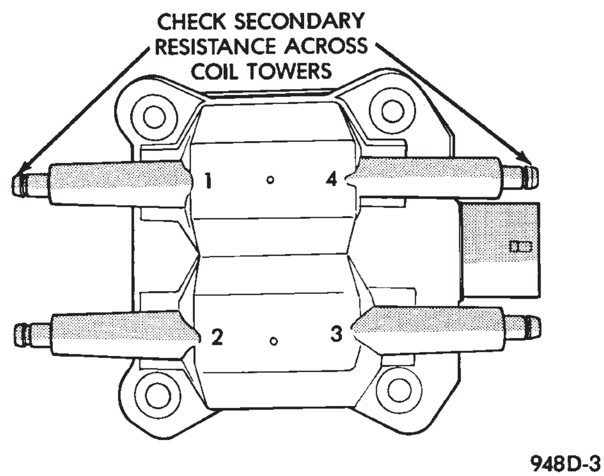


Fig. 21 Checking Ignition Coil Secondary Resistance

CHECK COIL TEST—2.5L

Measure primary coil resistance at the 2 pin distributor connector. Resistance should be between 0.6 and 0.8 ohms.

Measure secondary coil resistance between the coil tower and each terminal of the 2 pin distributor connector. Resistance should be 12k to 18k ohms.

FAILURE TO START TEST—2.0/2.4L

This no-start test checks the camshaft position sensor and crankshaft position sensor.

Use the DRB scan tool to test the camshaft position sensor and the sensor circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

The Powertrain Control Module (PCM) supplies 8 volts to the camshaft position sensor and crankshaft position sensor through one circuit. If the 8 volt sup-

DIAGNOSIS AND TESTING (Continued)

ply circuit shorts to ground, neither sensor will produce a signal (output voltage to the PCM).

When the ignition key is turned and left in the On position, the PCM automatically energizes the Auto Shutdown (ASD) relay. However, the controller de-energizes the relay within one second because it has not received a camshaft position sensor signal indicating engine rotation.

During cranking, the ASD relay will not energize until the PCM receives a camshaft position sensor signal. Secondly, the ASD relay remains energized only if the controller senses a crankshaft position sensor signal immediately after detecting the camshaft position sensor signal.

(1) Check battery voltage. Voltage should approximately 12.66 volts or higher to perform failure to start test.

(2) Disconnect the harness connector from the coil pack (Fig. 22).

(3) Connect a test light to the B+ (battery voltage) terminal of the coil electrical connector and ground. The B+ wire for the DIS coil is the center terminal. **Do not spread the terminal with the test light probe.**

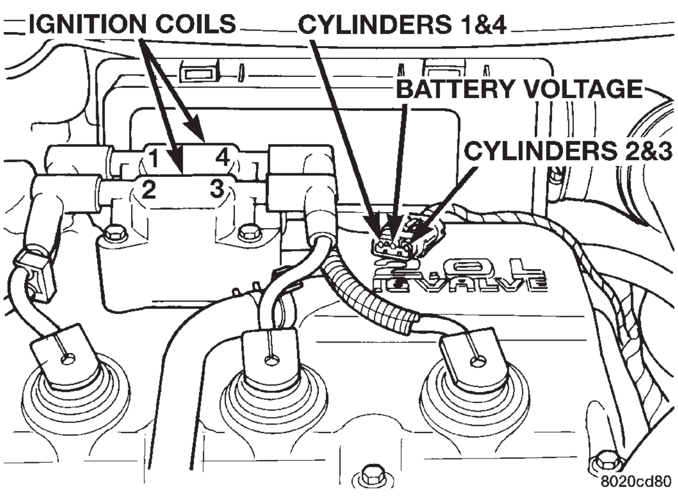


Fig. 22 Ignition Coil Engine Harness Connector

(4) Turn the ignition key to the **ON position.** The test light should flash On and then Off. **Do not turn the Key to off position, leave it in the On position** .

(a) If the test light flashes momentarily, the PCM grounded the ASD relay. Proceed to step 5.

(b) If the test light did not flash, the ASD relay did not energize. The cause is either the relay or one of the relay circuits. Use the DRB scan tool to test the ASD relay and circuits. Refer to the appropriate Powertrain Diagnostics Procedure Manual. Refer to the wiring diagrams section for circuit information.

(5) Crank the engine. (If the key was placed in the off position after step 4, place the key in the On position before cranking. Wait for the test light to flash once, then crank the engine.)

(6) If the test light momentarily flashes during cranking, the PCM is not receiving a crankshaft position sensor signal.

(7) If the test light did not flash during cranking, unplug the crankshaft position sensor connector. Turn the ignition key to the off position. Turn the key to the On position, wait for the test light to momentarily flash once, then crank the engine. If the test light momentarily flashes, the crankshaft position sensor is shorted and must be replaced. If the light did not flash, the cause of the no-start is in either the crankshaft position sensor/camshaft position sensor 8 volt supply circuit, or the camshaft position sensor output or ground circuits.

FAILURE TO START TEST—2.5L

NOTE: Before proceeding with this test make sure Testing For Spark At Coil has been performed. Failure to do this may lead to unnecessary diagnostic time and wrong test results.

Refer to the On-Board Diagnostic checks. Also, refer to the DRB scan tool and the appropriate Powertrain Diagnostic Procedures manual. These checks will help diagnose problems with the PCM and ASD relay.

IGNITION TIMING PROCEDURE

The engines for this vehicle, use a fixed ignition system. The PCM regulates ignition timing. Basic ignition timing is not adjustable.

CAMSHAFT POSITION SENSOR AND CRANKSHAFT POSITION SENSOR

The output voltage of a properly operating camshaft position sensor or crankshaft position sensor switches from high (5.0 volts) to low (0.3 volts). By connecting a Mopar Diagonostic System (MDS) and engine analyzer to the vehicle, technicians can view the square wave pattern.

DISTRIBUTOR CAP RESISTANCE TEST—2.5L

There is a resistor built into the distributor cap. Connect an ohmmeter between the center button and igntion coil terminal. Ohmmeter should read 5000 ohms.

SPARK PLUG CONDITION

Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. An isolated plug displaying an abnormal condition indicates

DIAGNOSIS AND TESTING (Continued)

that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in the - Lubrication and Maintenance section.

NORMAL OPERATING CONDITIONS

The few deposits present will be probably light tan or slightly gray in color with most grades of commercial gasoline (Fig. 23). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 1600 km (1000 miles) of operation for non platinum spark plugs. Non-platnium spark plugs that have normal wear can usually be cleaned, and then reinstalled.

CAUTION: Never attempt to file the electrodes or use a wire brush for cleaning platinum spark plugs. This would damage the platinum pads which would shorten spark plug life.

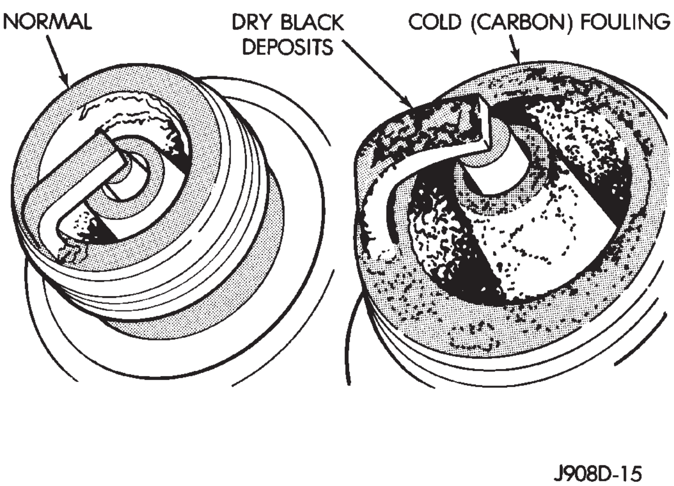


Fig. 23 Normal Operation and Cold (Carbon) Fouling

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT may coat the entire tip of the spark plug with a rust colored deposit. The rust color deposits can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance may be affected by MMT deposits.

COLD FOULING (CARBON FOULING)

Cold fouling is sometimes referred to as carbon fouling because the deposits that cause cold fouling are basically carbon (Fig. 23). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or misfire conditions. Cold (carbon) fouling of the entire set may be caused by a clogged air cleaner.

Cold fouling is normal after short operating periods. The spark plugs do not reach a high enough operating temperature during short operating periods. **Replace carbon fouled plugs with new spark plugs.**

FUEL FOULING

A spark plug that is coated with excessive wet fuel is called fuel fouled. This condition is normally observed during hard start periods.**Clean fuel fouled spark plugs with compressed air and reinstall them in the engine.**

OIL FOULING

A spark plug that is coated with excessive wet oil is oil fouled. In older engines, wet fouling can be caused by worn rings or excessive cylinder wear. Break-in fouling of new engines may occur before normal oil control is achieved. **Replace oil fouled spark plugs with new ones.**

OIL OR ASH ENCRUSTED

If one or more plugs are oil or ash encrusted, evaluate the engine for the cause of oil entering the combustion chambers (Fig. 24). Sometimes fuel additives can cause ash encrustation on an entire set of spark plugs. **Ash encrusted spark plugs can be cleaned and reused.**

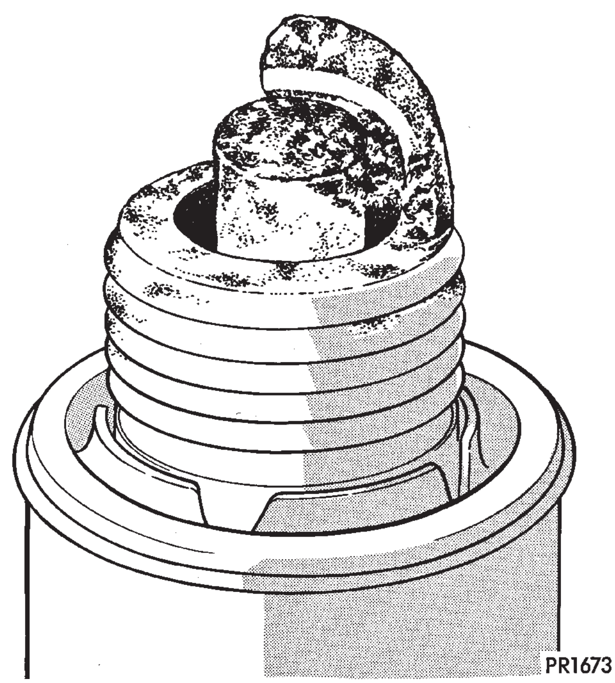


Fig. 24 Oil or Ash Encrusted

HIGH SPEED MISS

When replacing spark plugs because of a high speed miss condition;**wide open throttle operation should be avoided for approximately 80 km (50 miles) after installation of new plugs.** This will allow deposit shifting in the combustion chamber to take place gradually and avoid plug destroying splash fouling shortly after the plug change.

DIAGNOSIS AND TESTING (Continued)

ELECTRODE GAP BRIDGING

Loose deposits in the combustion chamber can cause electrode gap bridging. The deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, the deposits partially liquefy and bridge the gap between the electrodes (Fig. 25). This short circuits the electrodes. **Spark plugs with electrode gap bridging can be cleaned and reused.**

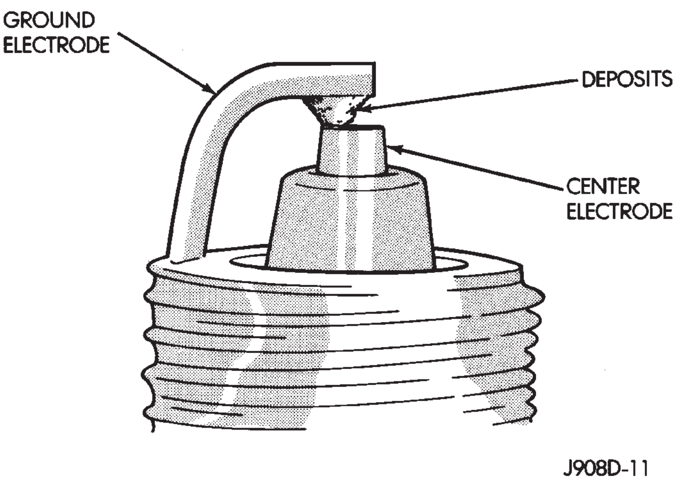


Fig. 25 Electrode Gap Bridging

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 26). They may appear to be harmful, but are a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy but the deposits are easily removed. **Spark plugs with scavenger deposits can be considered normal in condition, cleaned and reused.**

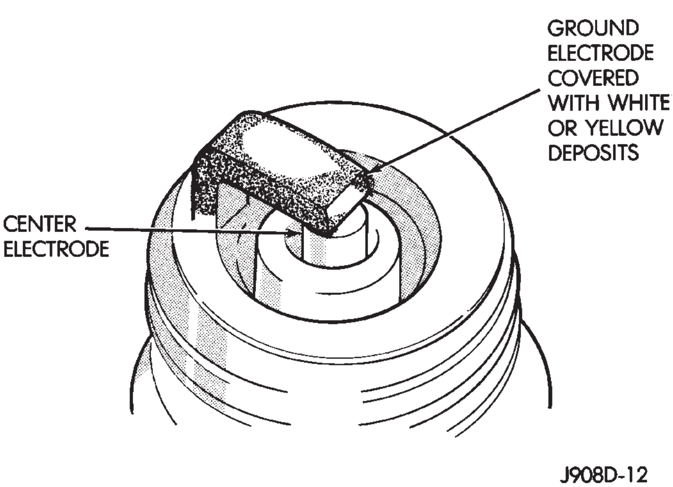


Fig. 26 Scavenger Deposits

CHIPPED ELECTRODE INSULATOR

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap. Under certain conditions, severe detonation also can separate the insulator from the center electrode (Fig. 27). **Spark plugs with chipped electrode insulators must be replaced.**

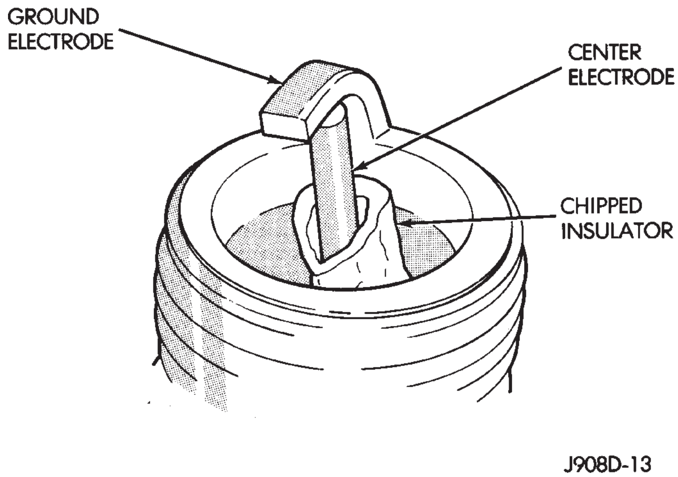


Fig. 27 Chipped Electrode Insulator

PREIGNITION DAMAGE

Excessive combustion chamber temperature can cause preignition damage. First, the center electrode dissolves and the ground electrode dissolves somewhat later (Fig. 28). Insulators appear relatively deposit free. Determine if the spark plugs are the correct type, as specified on the VECI label, or if other operating conditions are causing engine overheating.

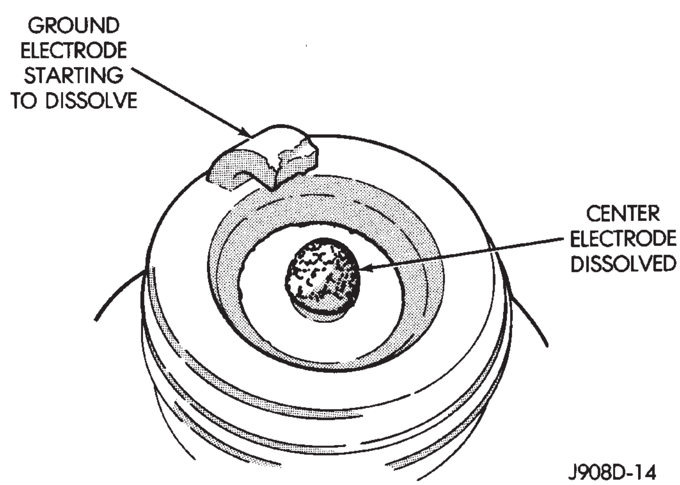


Fig. 28 Preignition Damage

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 29). The increase in electrode gap will be considerably in excess of 0.001 in per 1000 miles of operation.

DIAGNOSIS AND TESTING (Continued)

This suggests that a plug with a cooler heat range rating should be used. Over advanced ignition timing, detonation and cooling system malfunctions also can cause spark plug overheating.

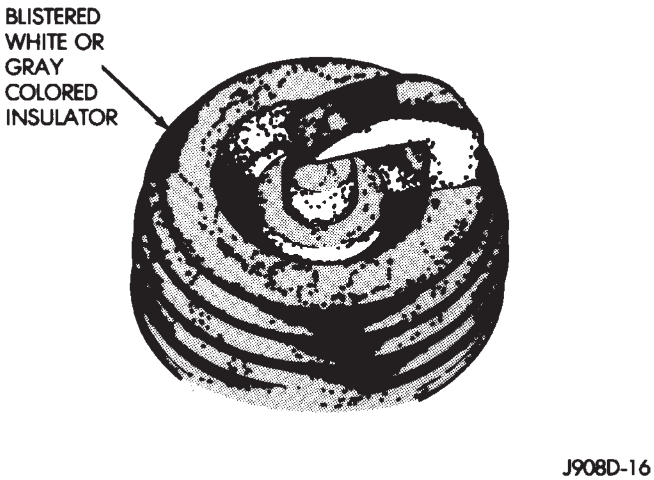


Fig. 29 Spark Plug Overheating

REMOVAL AND INSTALLATION

SPARK PLUG CABLES—2.0/2.4L

Clean high tension cables with a cloth moistened with a non- flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

Resistance cables are identified by the words **Electronic Suppression** .

REMOVAL

Disconnect the cable from the ignition coil first.

The cables insulate the spark plugs and cover the top of the spark plug tubes (Fig. 3). To remove the cables, lightly grasp the top of the cable. Rotate the insulator 90° and pull straight up. **Ensure the #1 and #4 cables run under the #2 and #3 ignition coil towers. Keep #4 cable away from the oil fill cap.**

INSTALLATION

Ensure the #1 and #4 cables run under the #2 and #3 ignition coil towers. Keep #4 cable away from the oil fill cap.

Rotate the insulator 90° and push straight down. Connect the cable to the ignition coil.

SPARK PLUG—2.0/2.4L

Failure to route the cables properly could cause the radio to reproduce ignition noise, cross ignition of the spark plugs or short circuit the cables to ground.

NOTE: REMOVE cables from coil first before removing spark plug insulator.

Special care should be used when installing spark plugs in the 2.0/2.4L cylinder head spark plug wells. Be sure the plugs do not drop into the wells, damage to the electrodes can occur.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap. Overtightening can also damage the cylinder head.

REMOVAL

Always remove the spark plug cable by grasping the top of the spark plug insulator, turning the boot 1/2 turn and pulling straight up in a steady motion.

(1) Remove the spark plug using a quality socket with a rubber or foam insert.

(2) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

INSTALLATION

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install spark plug insulators over spark plugs. Ensure the top of the spark plug insulator covers the upper end of the spark plug tube.

(4) Install spark plug cable to coil.

SPARK PLUGS AND CABLES—2.5L

When replacing the spark plug and coil cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise, cross ignition of the spark plugs or short circuit the cables to ground.

CAUTION: Never attempt to file the electrodes or use a wire brush for cleaning platinum plugs. This would damage the platinum pads which would shorten spark plug life.

Never force a gap gauge between the platinum electrodes or adjust the gap on platinum spark plugs without reading the 2.5L Spark Plug Gap Measurement procedures below.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap. Overtightening can also damage the cylinder head. Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

Due to the engine packaging environment for the 2.5L engines, extreme care should be used when installing the spark plugs to avoid cross threading problems.

REMOVAL AND INSTALLATION (Continued)

2.5L SPARK PLUG GAP MEASUREMENT

CAUTION: The Platinum pads can be damaged during the measurement of checking the gap if extreme care is not used.

- **Use only a taper gap gauge** (Fig. 2)
- Never force the gap gauge through the platinum pads. Only apply enough force until resistance is felt.
- Never use a wire brush or spark plug cleaner machine to clean platinum spark plugs
- Use an OSHA approved air nozzle when drying gas fouled spark plugs.

If gap adjustment is required of platinum plug, bend only the ground electrode. DO NOT TOUCH the platinum pads. Use only a proper gapping tool and check with a taper gap gauge (Fig. 1).

Apply a very small amount of anti-seize compound to the threads when reinstalling the vehicle's original spark plugs that have been determined good. **Do not apply anti-seize compound to new spark plugs.**

NOTE: Anti-seize compound is electrically conductive and can cause engine misfires if not applied correctly. It is extremely important that the anti-seize compound doesn't make contact with the spark plug electrodes or ceramic insulator.

SPARK PLUG REMOVAL—#2, #4 or #6

Always remove the ignition cable by grasping at the spark plug boot turning, the boot 1/2 turn and pulling straight back in a steady motion.

(1) Prior to removing the spark plug spray compressed air around the spark plug hole and the area around the spark plug.

(2) Remove the spark plug using a quality socket with a rubber or foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

INSTALLATION

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install ignition cables over spark plugs.

SPARK PLUG REMOVAL—#1, #3 or #5

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Unplug connectors from MAP and intake air temperature sensors (Fig. 30).

(3) Remove plenum support bracket bolt located rearward of MAP sensor (Fig. 30).

(4) Remove bolt holding air inlet resonator to intake plenum (Fig. 31).

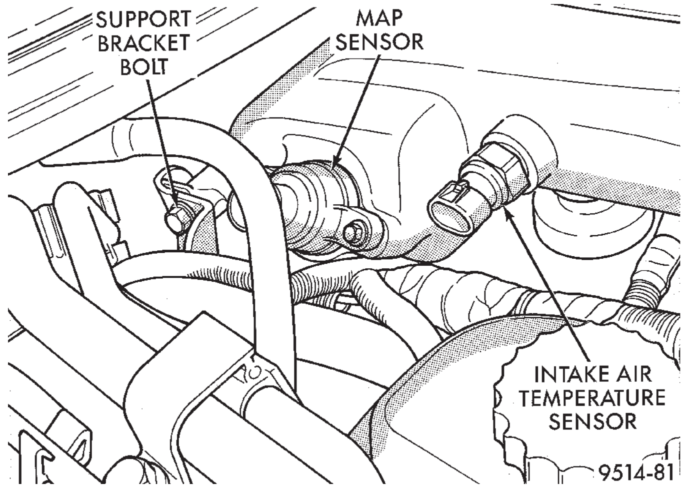


Fig. 30 Intake Manifold Sensors and Left Plenum Support Bolt

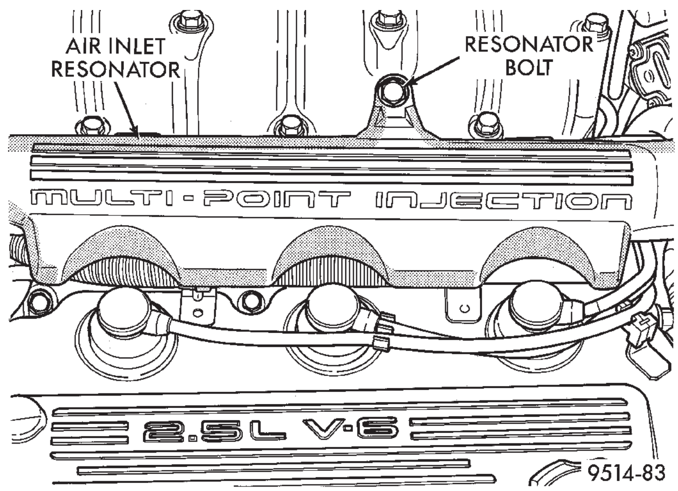


Fig. 31 Air Inlet Resonator

(5) Loosen throttle body air inlet hose clamp.

(6) Release snaps holding air cleaner housing cover to housing.

(7) Remove air cleaner cover and inlet hoses from engine.

(8) Unplug TPS and idle air control motor connectors (Fig. 32) and (Fig. 33).

(9) Pry retainer tab back on throttle cable and slide cable out of bracket (Fig. 34). Remove cable from throttle lever.

(10) Slide Speed control cable out of bracket, if equipped (Fig. 34). Remove cable from throttle lever.

(11) Remove EGR tube from intake plenum (Fig. 35).

(12) Remove plenum support bracket bolt located rearward of EGR tube (Fig. 35).

(13) Remove bolts holding upper intake plenum and remove plenum.

REMOVAL AND INSTALLATION (Continued)

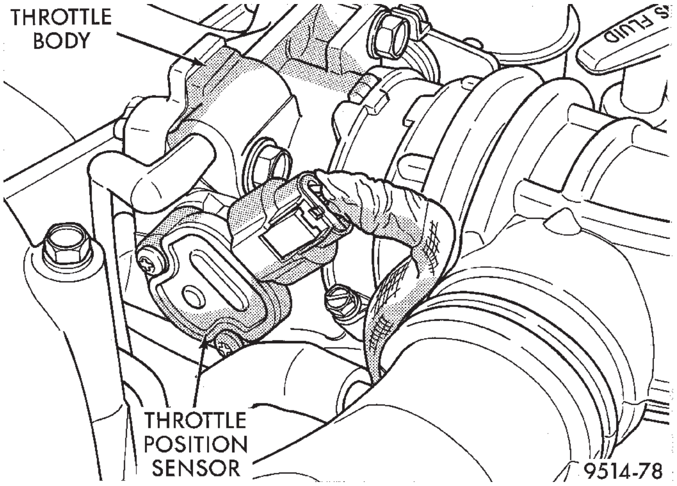


Fig. 32 Throttle Position Sensor

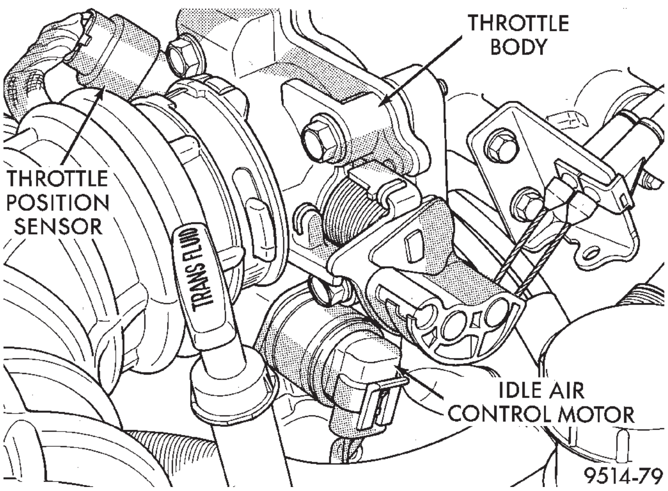


Fig. 33 Idle Air Control Motor

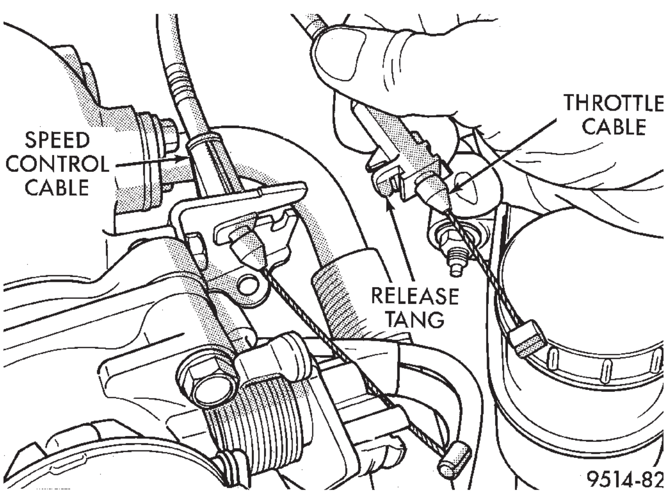


Fig. 34 Throttle Cable Attachment

(14) Always remove the ignition cable by grasping at the spark plug boot turning, the boot 1/2 turn and pulling straight back in a steady motion.

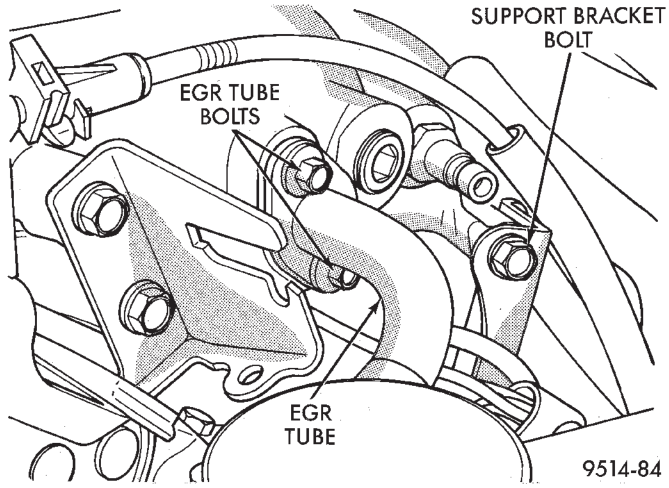


Fig. 35 EGR Tube and Right Manifold Support Bolt

(15) Prior to removing the spark plug spray compressed air around the spark plug hole and the area around the spark plug.

(16) Remove the spark plug using a quality socket with a rubber or foam insert.

(17) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

SPARK PLUG INSTALLATION

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install ignition cables over spark plugs.

(4) Install new gasket and position upper intake plenum. Tighten plenum bolts to 18 N·m (13 ft. lbs.) torque.

(5) Install bolts at plenum support brackets. Tighten bolts to 18 N·m (13 ft. lbs.).

(6) Install EGR tube to plenum. Tighten EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs.).

(7) Install throttle and speed control (if equipped) cables.

(8) Attach electrical connectors to sensors.

(9) Tighten air inlet tube clamps to 3 N·m ±1 (25 ±5 in. lbs.) torque.

(10) Connect negative terminal to auxiliary jumper terminal.

IGNITION COIL—2.0/2.4L

The electronic ignition coil pack attaches directly to the valve cover (Fig. 36) or (Fig. 37).

REMOVAL

(1) Disconnect electrical connector from coil pack.

(2) Remove coil pack mounting nuts.

(3) Remove coil pack.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install coil pack on valve cover.

(2) Transfer spark plug cables to new coil pack. The coil pack towers are numbered with the cylinder identification. Be sure the ignition cables snap onto the towers.

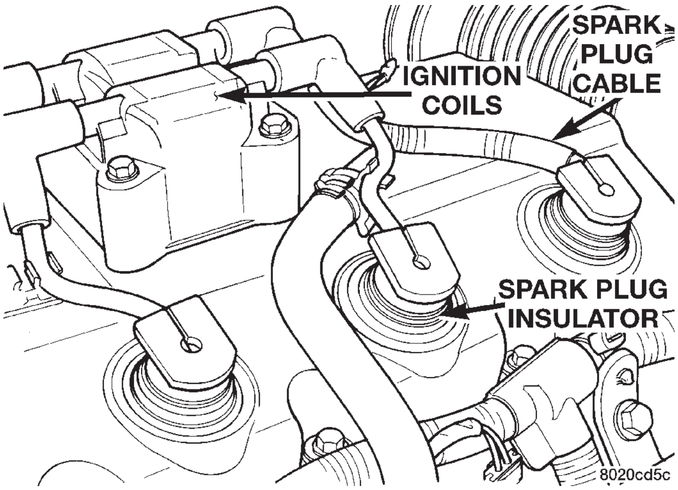


Fig. 36 Electronic Ignition Coil Pack—2.0L

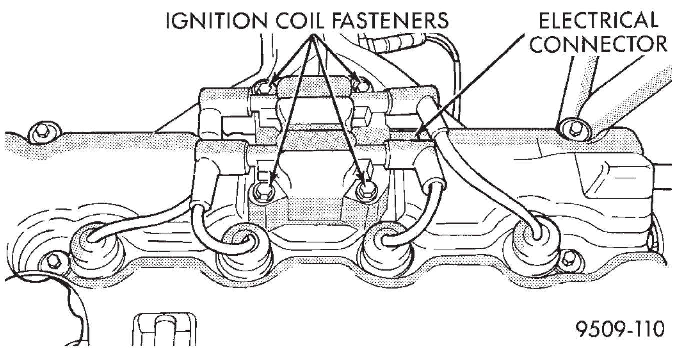


Fig. 37 Electronic Ignition Coil Pack—2.4L

IGNITION COIL—2.5L

The ignition coil is located in the distributor housing (Fig. 38).

If ignition coil is defective, replace distributor assembly. Refer to Distributor Service.

AUTOMATIC SHUTDOWN RELAY

The relay is located in the Power Distribution Center (PDC) (Fig. 39). The PDC is located in the engine compartment. For the location of the relay within the PDC, refer to the PDC cover for location. Check electrical terminals for corrosion and repair as necessary.

CAMSHAFT POSITION SENSOR—SOHC

The camshaft position sensor is mounted to the rear of the cylinder head (Fig. 40).

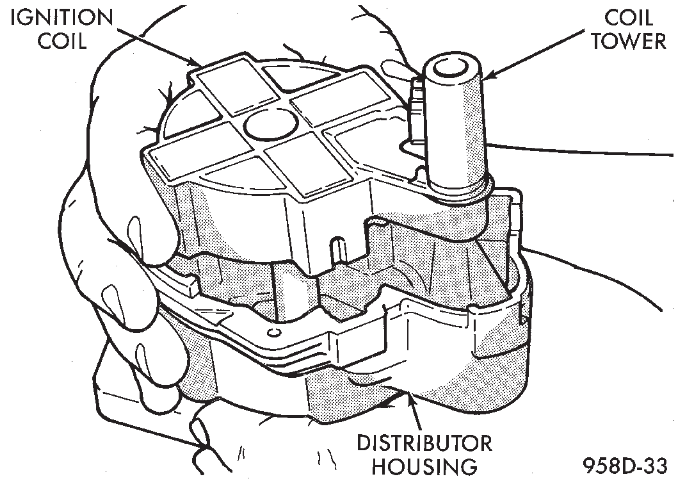


Fig. 38 Ignition Coil

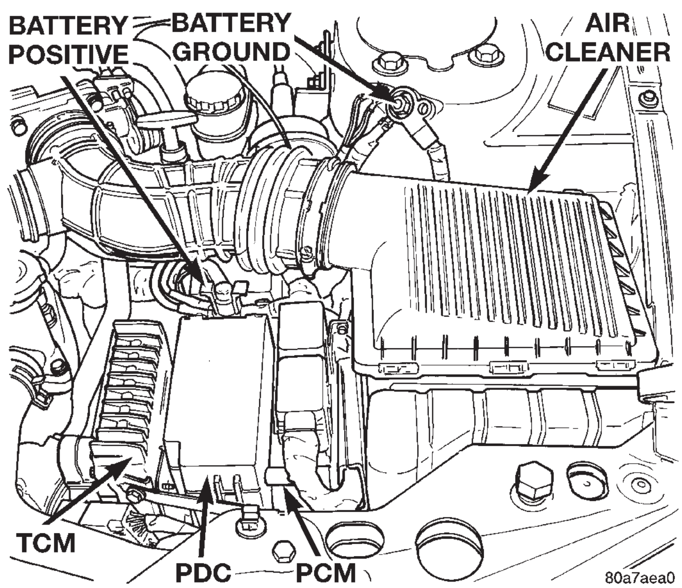


Fig. 39 Power Distribution Center (PDC)

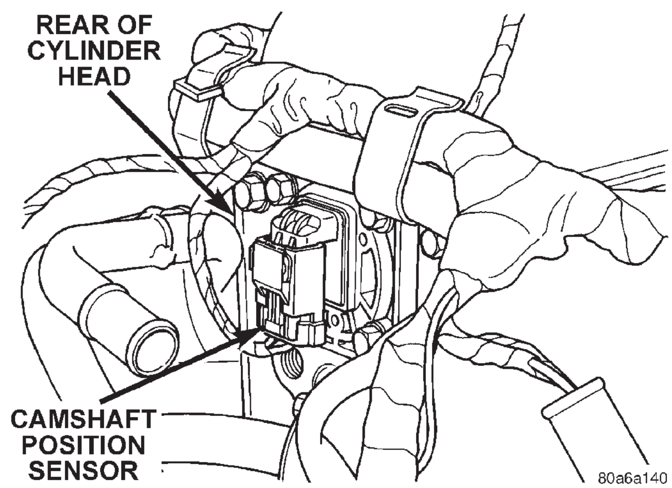


Fig. 40 Camshaft Position Sensor Location—SOHC

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect the filtered air tube from the throttle body and air cleaner housing. Remove filtered air tube.

(2) Remove the air cleaner inlet tube.

(3) Disconnect electrical connectors from engine coolant sensor and camshaft position sensor.

(4) Remove brake booster hose and electrical connector from holders on end of cylinder head cover.

(5) Remove camshaft position sensor mounting screws. Remove sensor.

(6) Loosen screw attaching target magnet to rear of camshaft (Fig. 41).

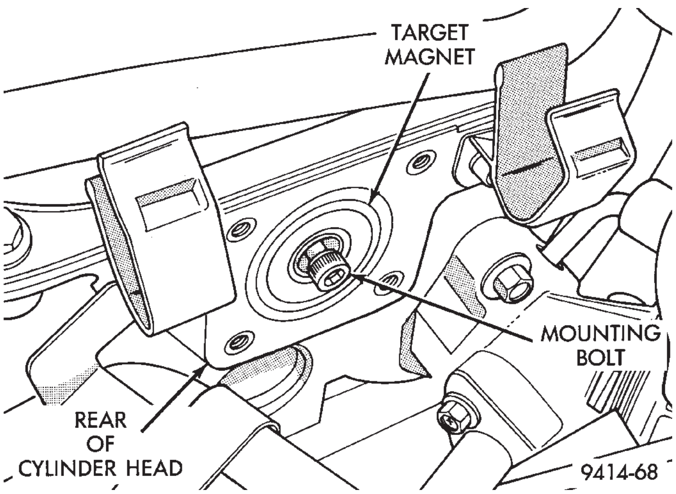


Fig. 41 Target Magnet Removal/Installation

INSTALLATION

The target magnet has two locating dowels that fit into machined locating holes in end of the camshaft.

(1) Install target magnet in end of camshaft. Tighten mounting screw to 3.4 N·m (30 in. lbs.) torque.

(2) Install camshaft position sensor. Tighten sensor mounting screws to 9 N·m (80 in. lbs.) torque.

(3) Place brake booster hose and electrical harness in holders on end of valve cover.

(4) Attach electrical connectors to coolant temperature sensor and camshaft position sensor.

(5) Install air cleaner inlet tube and filtered air tube.

CAMSHAFT POSITION SENSOR—DOHC

The camshaft position sensor is mounted to the rear of the cylinder head (Fig. 42).

REMOVAL

(1) Remove filtered air tube from the throttle body and air cleaner housing.

(2) Disconnect electrical connector from camshaft position sensor.

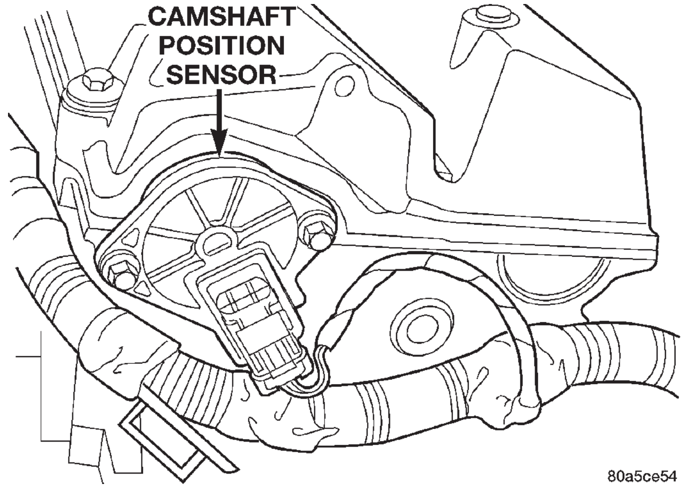


Fig. 42 Camshaft Position Sensor Location—DOHC

(3) Remove camshaft position sensor mounting screws. Remove sensor.

(4) Loosen screw attaching target magnet to rear of camshaft (Fig. 43).

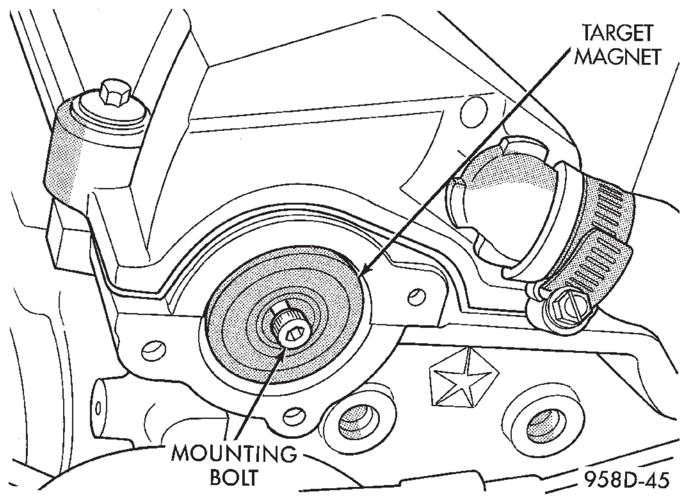


Fig. 43 Target Magnet Removal/Installation

INSTALLATION

The target magnet has locating dowels that fit into machined locating holes in the end of the camshaft (Fig. 44).

(1) Install target magnet in end of camshaft. Tighten mounting screw to 3 N·m (30 in. lbs.) torque.

(2) Install camshaft position sensor. Tighten sensor mounting screws to 9 N·m (80 in. lbs.) torque.

(3) Carefully attach electrical connector to camshaft position sensor. Installation at an angle may damage the sensor pins.

(4) Install filtered air tube. Tighten clamps to 3 N·m ±1 (25 in. lbs. ±5) torque.

REMOVAL AND INSTALLATION (Continued)

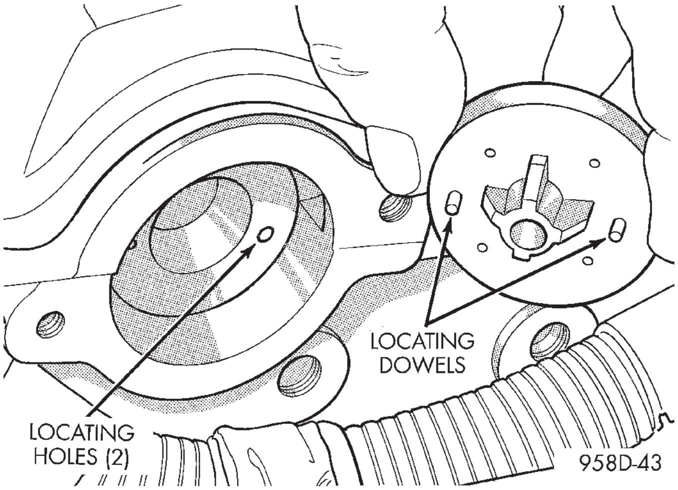


Fig. 44 Target Magnet Installation

CRANKSHAFT POSITION SENSOR—2.0/2.4L

The crankshaft position sensor mounts to the engine block behind the generator, just above the oil filter (Fig. 45).

REMOVAL

(1) Disconnect electrical connector from crankshaft position sensor.

(2) Remove sensor mounting screw. Remove sensor.

INSTALLATION

(1) Reverse procedure for installation.

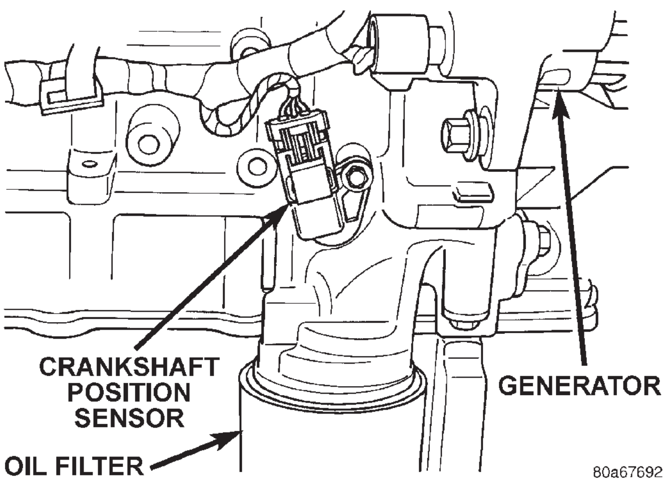


Fig. 45 Crankshaft Position Sensor—2.0/2.4L

CRANKSHAFT POSITION SENSOR—2.5L

REMOVAL

(1) Remove speed control servo from driver's side strut tower.

(2) Remove crankshaft position sensor retaining bolt (Fig. 46).

(3) Pull crankshaft position sensor straight up out of the transaxle housing.

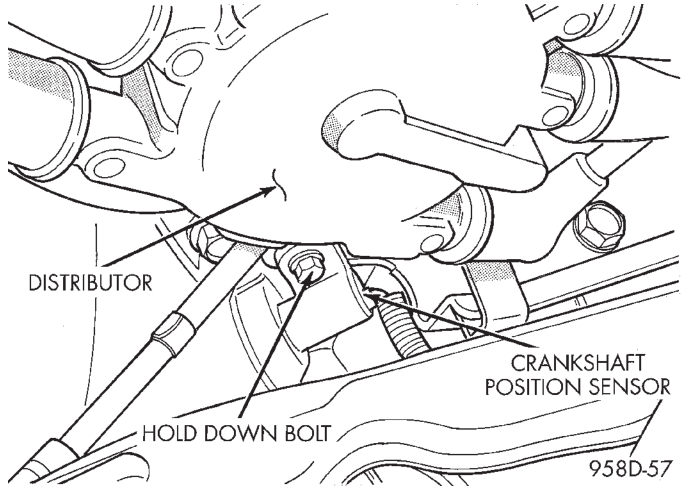


Fig. 46 Crankshaft Position Sensor

(4) (Disconnect crankshaft position sensor electrical connector from the wiring harness connector.

INSTALLATION—ADJUSTABLE

All vehicles will be equipped with an adjustable crankshaft position sensor. This can be identified by an elongated mounting hole in the sensor.

NOTE: If the removed sensor is to be reinstalled, clean off the old spacer on the sensor face. A NEW SPACER must be attached to the sensor face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face of the new sensor (Fig. 47).

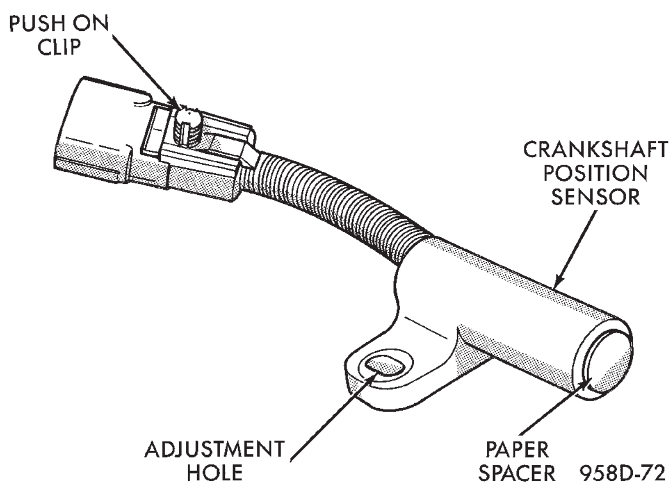


Fig. 47 Crankshaft Position Sensor and Spacer

(1) Install sensor in transaxle and push sensor down until contact is made with the drive plate. While holding the sensor in this position, install and tighten the retaining bolt to 12 N·m (105 in. lbs.) torque.

(2) Connect crankshaft position sensor electrical connector to the wiring harness connector.

(3) Attach connector to heater tube bracket.

REMOVAL AND INSTALLATION (Continued)

(4) Install speed control servo. Tighten nuts to 9 N·m (80 in. lbs.) torque.

DISTRIBUTOR—2.5L

REMOVAL

(1) Remove bolt holding air inlet resonator to intake manifold.

(2) Loosen clamps holding air cleaner cover to air cleaner housing.

(3) Remove PCV make-up air hose from air inlet tube.

(4) Loosen hose clamp at throttle body.

(5) Remove air inlet tube, resonator and air cleaner cover.

(6) Remove EGR tube.

(7) Remove spark plug cables from distributor cap.

(8) Loosen distributor cap holddown screws and remove cap (Fig. 48).

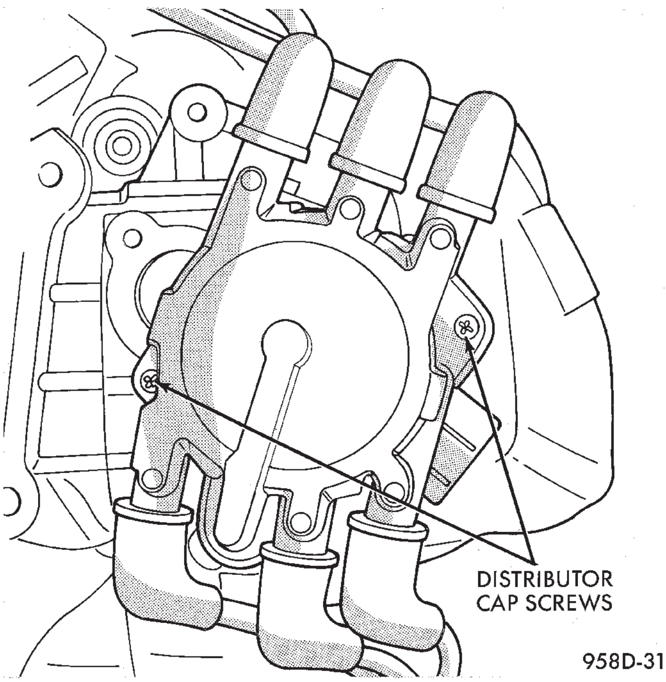


Fig. 48 Distributor Cap Screws

(9) Mark the rotor position and remove rotor. The mark indicates where to position the rotor when reinstalling the distributor.

(10) Remove 2 harness connectors from distributor (Fig. 49).

(11) Remove 2 sets of distributor holddown nuts and washers from studs.

(12) Remove bolt and spark plug cable mounting bracket from top of distributor housing.

(13) Remove bolt and transmission dipstick tube.

(14) Carefully remove distributor from engine.

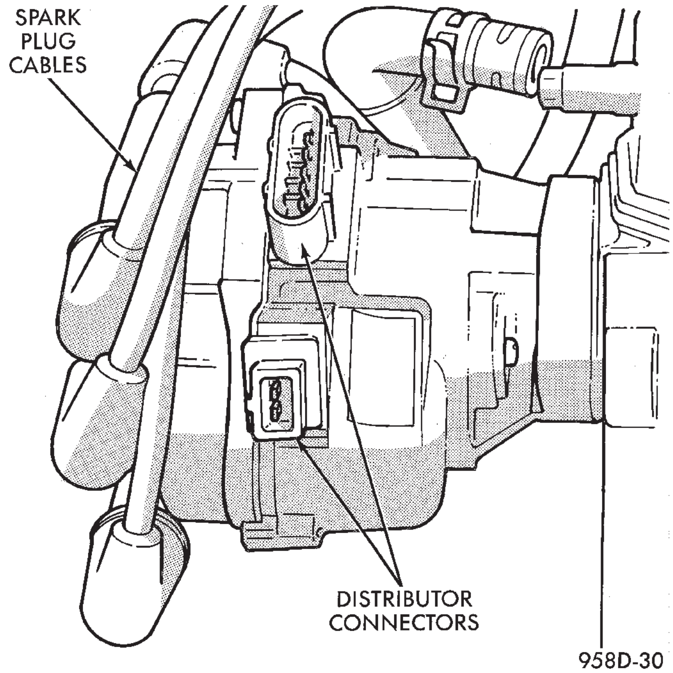


Fig. 49 Distributor Electrical Connectors—Viewed From Rear of Distributor

INSTALLATION

(1) Install rotor on shaft.

(2) Position distributor in engine. Make certain that O-ring is properly seated on distributor. If O-ring is cracked or nicked replace with a new one.

(3) Carefully engage distributor drive with slotted end of camshaft. When the distributor is installed properly, the rotor will be in line with previously scribe line on air intake plenum. **If engine was cranked while distributor was removed, establish proper relationship between the distributor shaft and Number 1 piston position as follows:**

(a) Rotate the crankshaft until number one piston is at top of compression stroke.

(b) Rotate rotor to number one rotor terminal.

(c) Lower distributor into opening, engaging distributor drive with drive on camshaft. With distributor fully seated on engine, rotor should be under the number 1 terminal.

(4) Install distributor holddown washers and nuts. Tighten nuts to 13 N·m (9 ft. lbs.).

(5) Install spark plug cable bracket.

(6) Install 2 harness connectors to distributor.

(7) Install distributor cap.

(8) Install spark plug cables onto distributor cap. The cap is numbered as well as the cables. Ensure sure all high tension wires are firmly in the cap towers.

(9) Install transmission dispstick tube.

(10) Install EGR tube to intake manifold. Tighten bolts to 11 N·m (95 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

DISTRIBUTOR CAP—2.5L

REMOVAL

(1) Remove bolt holding air inlet resonator to intake manifold.

(2) Loosen clamps holding air cleaner cover to air cleaner housing.

(3) Remove PCV make-up air hose from air inlet tube.

(4) Loosen hose clamp at throttle body.

(5) Remove air inlet tube, resonator and air cleaner cover.

(6) Remove EGR tube.

(7) Remove spark plug cables from distributor cap.

(8) Loosen distributor cap holddown screws and remove cap (Fig. 48).

(9) Transfer cables from old cap to new cap. The cap is numbered and so are the cables.

INSTALLATION

(1) Install distributor cap.

(2) Install distributor holddown washers and nuts. Tighten nuts to 13 N·m (9 ft. lbs.).

(3) Install EGR tube.

(4) Install air inlet tube, resonator and air cleaner cover.

(5) Tighten hose clamp at throttle body.

(6) Install PCV make-up air hose from air inlet tube.

(7) Tighten clamps holding air cleaner cover to air cleaner housing.

(8) Install bolt holding air inlet resonator to intake manifold.

DISTRIBUTOR ROTOR—2.5L

REMOVAL

(1) Remove bolt holding air inlet resonator to intake manifold.

(2) Loosen clamps holding air cleaner cover to air cleaner housing.

(3) Remove PCV make-up air hose from air inlet tube.

(4) Loosen hose clamp at throttle body.

(5) Remove air inlet tube, resonator and air cleaner cover.

(6) Remove EGR tube.

(7) Remove spark plug cables from distributor cap.

(8) Loosen distributor cap holddown screws and remove cap (Fig. 48).

(9) Mark the rotor position and remove rotor. The mark indicates where to position the rotor when reinstalling the distributor.

INSTALLATION

(1) Install rotor on shaft.

(2) Install distributor cap.

(3) Install spark plug cables onto distributor cap. The cap is numbered as well as the cables. Ensure sure all high tension wires are firmly in the cap towers.

(4) Install EGR tube to intake manifold. Tighten bolts to 11 N·m (95 in. lbs.) torque.

(5) Install air inlet tube, resonator and air cleaner cover.

(6) Tighten hose clamp at throttle body.

(7) Install PCV make-up air hose to air inlet tube.

(8) Tighten clamps holding air cleaner cover to air cleaner housing.

(9) Tighten bolt holding air inlet resonator to intake manifold.

IGNITION SWITCH

The ignition switch attaches to the lock cylinder housing on the end opposite the lock cylinder (Fig. 50). For ignition switch terminal and circuit identification, refer to Group 8W, Wiring Diagrams.

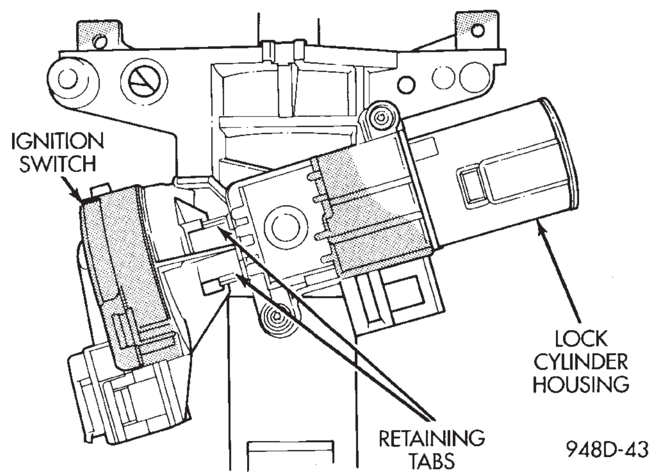


Fig. 50 Ignition Switch—Viewed From Below Column

REMOVAL

(1) Disconnect negative cable from auxillary jumper terminal on driver's side strut tower.

(2) Remove fuse panel cover from left end of instrument panel. Remove screw holding end of instrument panel top cover (Fig. 51).

(3) Pull center bezel off (Fig. 52).

(4) Remove screws holding instrument panel top cover to center of instrument panel (Fig. 53).

(5) Pull instrument panel top cover up enough to gain access to knee bolster screws (Fig. 54).

(6) Remove lower knee bolster screws and knee bolster.

REMOVAL AND INSTALLATION (Continued)

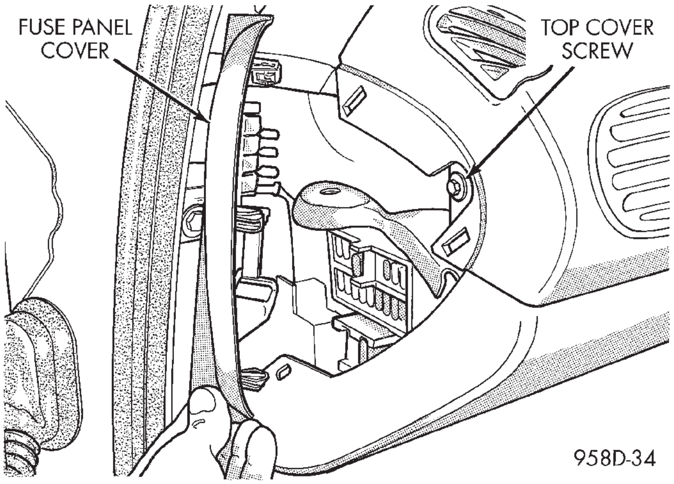


Fig. 51 Instrument Panel Top Cover—Left End

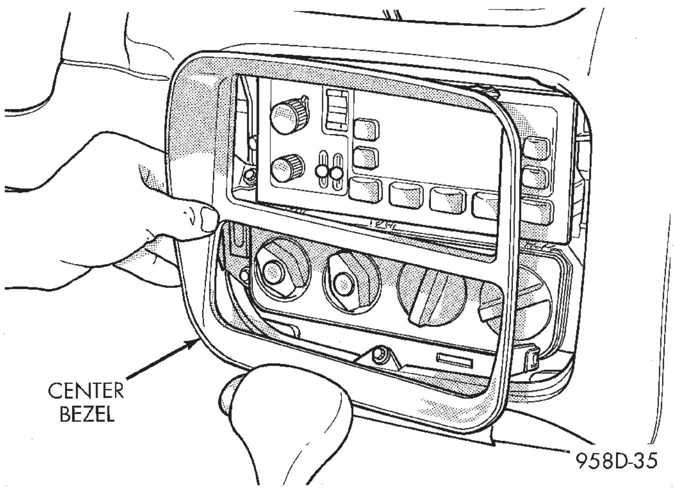


Fig. 52 Center Bezel

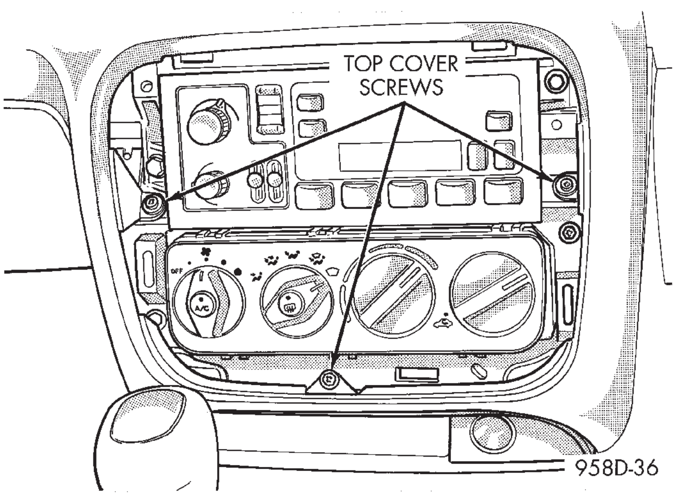


Fig. 53 Instrument Panel Top Cover—Center

(7) Remove screws from lower steering column shroud (Fig. 55).

(8) Pull lower shroud to clear ignition cylinder and key release, if equipped (Fig. 56).

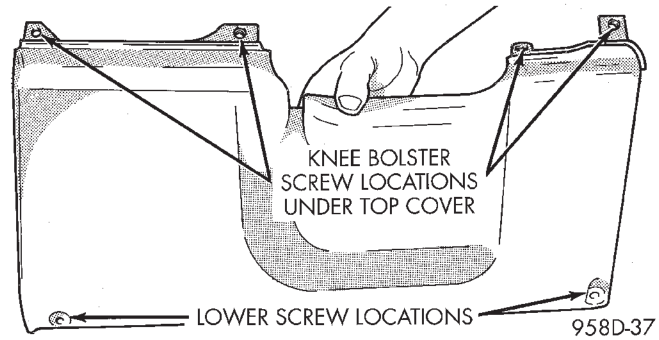


Fig. 54 Knee Bolster Attaching Points

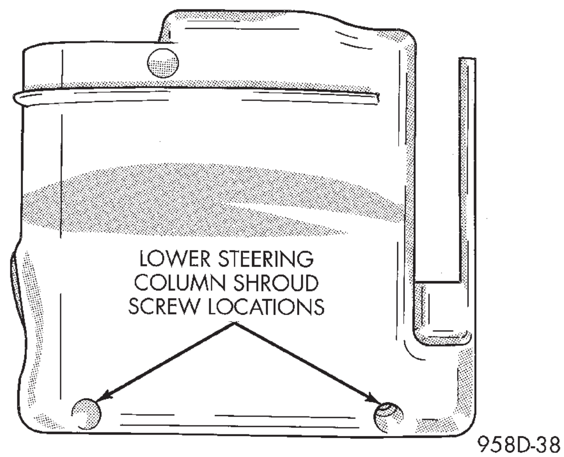


Fig. 55 Lower Steering Column Shroud Screw Locations

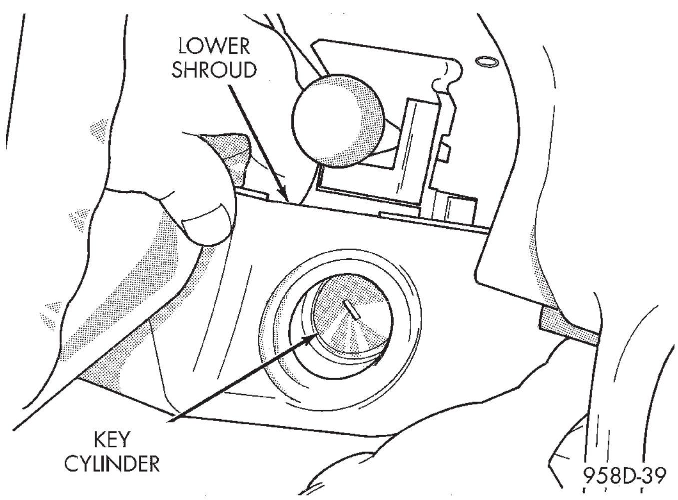


Fig. 56 Remove Lower Shroud From Ignition Cylinder

(9) Hold tilt wheel lever down and slide lower shroud forward to remove it from column (Fig. 57).

(10) Tilt wheel to full down position and remove upper steering column shroud.

REMOVAL AND INSTALLATION (Continued)

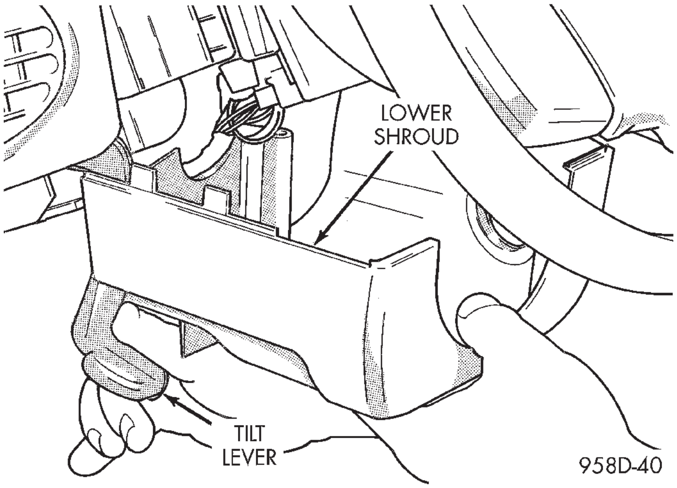


Fig. 57 Lower Shroud Removal

(11) Remove screws holding multi-function switch to lock housing (Fig. 58).

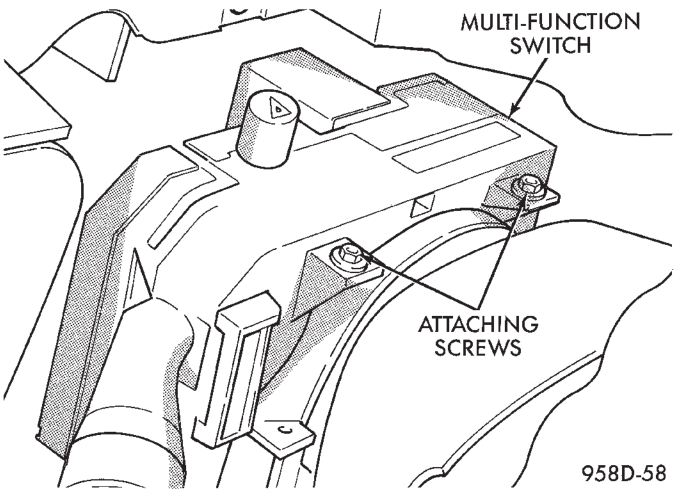


Fig. 58 Multi-Function Switch Removal/Installation

(12) Place key cylinder in RUN position. Depress lock cylinder retaining tab and remove key cylinder (Fig. 59).

(13) Disconnect electrical connectors from ignition switch (Fig. 60) and (Fig. 61).

(14) Remove ignition switch mounting screw (Fig. 60) with a #10 Torx® tamper proof bit.

(15) Depress retaining tabs (Fig. 50) and pull ignition switch from steering column.

INSTALLATION

(1) Ensure the ignition switch is in the RUN position and the actuator shaft in the lock housing is in the RUN position.

(2) Carefully install the ignition switch. The switch will snap over the retaining tabs (Fig. 62). Install mounting screw (Fig. 60).

(3) Install electrical connectors to ignition switch.

(4) Install upper and lower shrouds.

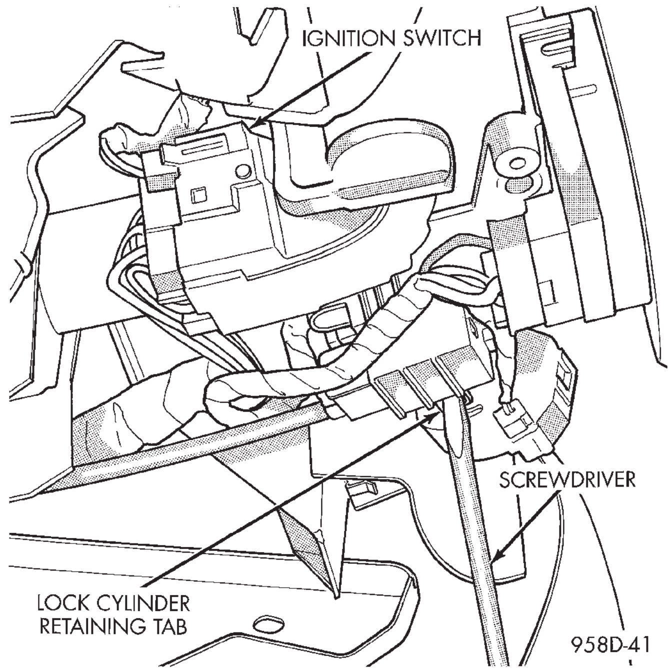


Fig. 59 Lock Cylinder Removal

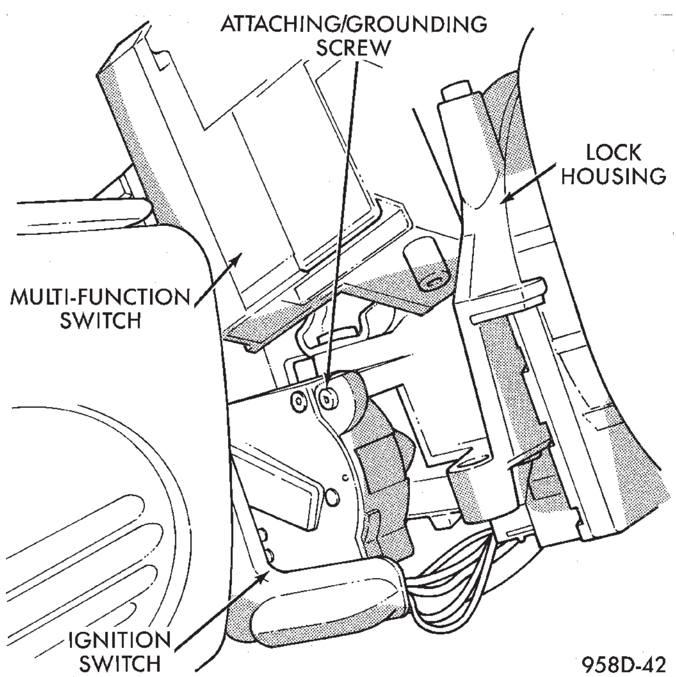


Fig. 60 Ignition Switch

(5) Install key cylinder (cylinder retaining tab will depress only in the RUN position).

(6) Connect negative cable to battery.

(7) Check for proper operation of ignition switch and key-in warning switch.

REMOVAL AND INSTALLATION (Continued)

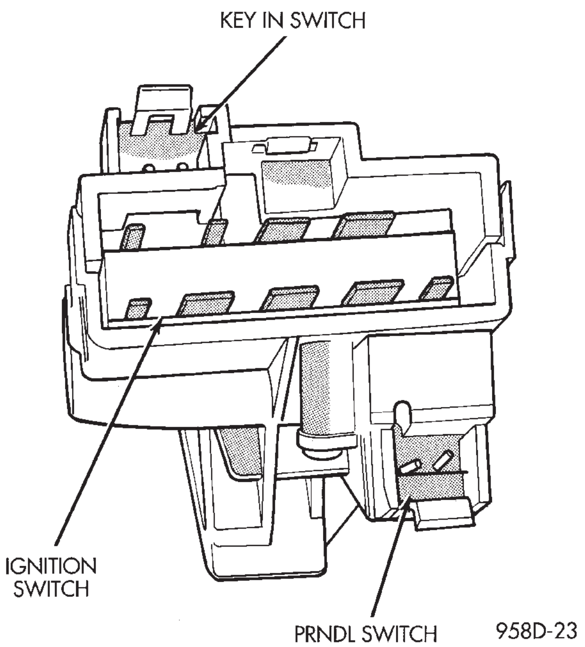


Fig. 61 Ignition Switch Connectors

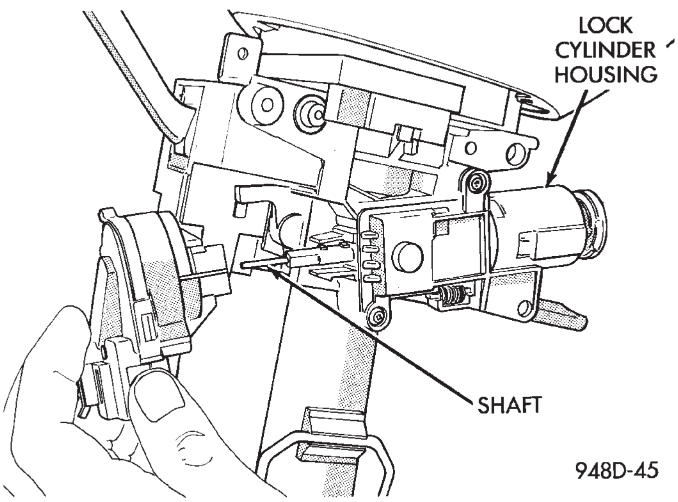


Fig. 62 Ignition Switch Installation

LOCK KEY CYLINDER

REMOVAL

(1) Disconnect negative cable from auxillary jumper terminal.

(2) Remove upper steering column shroud.

(3) Pull lower shroud down far enough to access lock cylinder retaining tab.

(4) Place key cylinder in RUN position. Depress retaining tab and remove key cylinder (Fig. 63).

INSTALLATION

(1) Install key in lock cylinder. Turn key to run position (retaining tab on lock cylinder can be depressed).

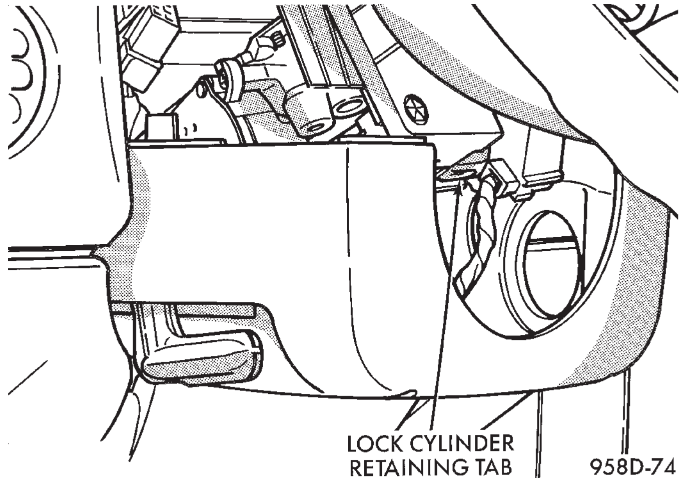


Fig. 63 Lock Cylinder Retaining Tab

(2) The shaft at the end of the lock cylinder aligns with the socket in the end of the housing. To align the socket with the lock cylinder, ensure the socket is in the Run position (Fig. 64).

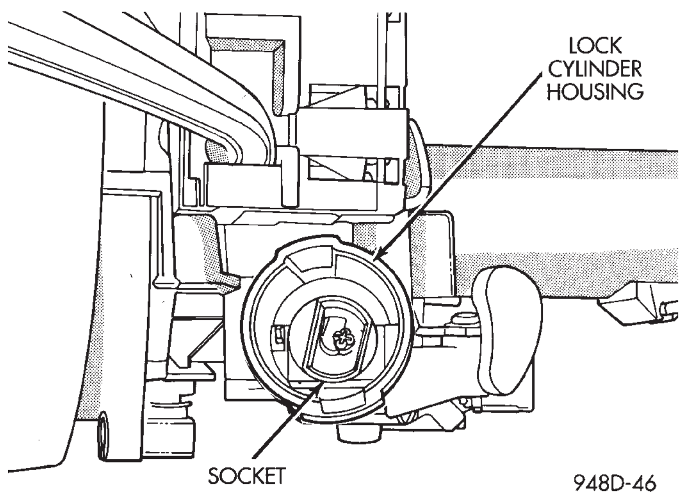


Fig. 64 Socket in Lock Cylinder Housing

(3) Align the lock cylinder with the grooves in the housing. Slide the lock cylinder into the housing until the tab sticks through the opening in the housing.

(4) Turn the key to the Off position. Remove the key.

(5) Install steering column shrouds.

(6) Connect negative cable to auxillary battery terminal on shock tower.

IGNITION INTERLOCK

Refer to Group 21, Transaxle for Shifter/Ignition Interlock Service.

LOCK CYLINDER HOUSING

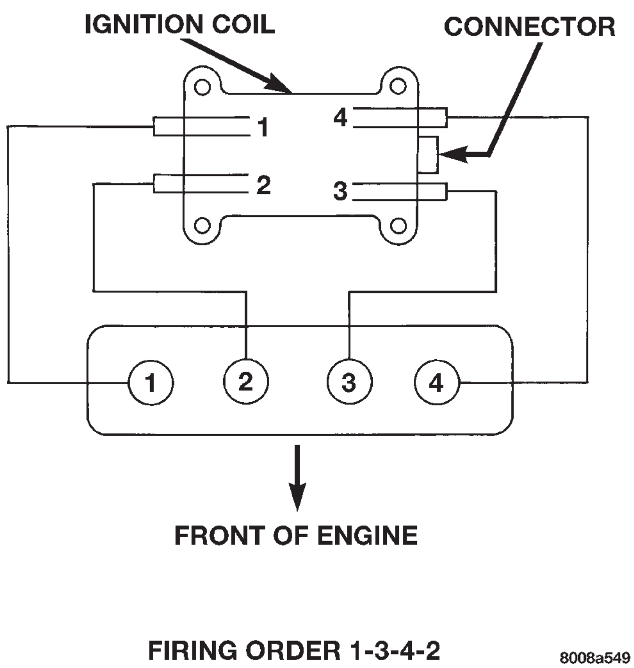
Refer to Steering Column in Group 19, Steering, for Lock Cylinder Housing Service.

SPECIFICATIONS

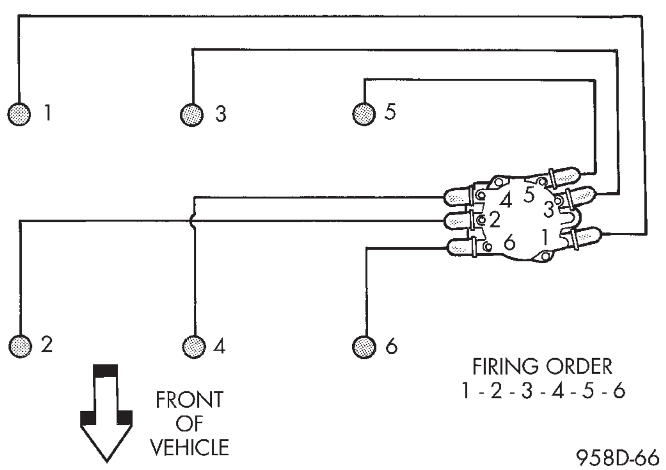
VECI LABEL

Always use the information found on the Vehicle Emission Control Information (VECI) label. The VECI label is located in the engine compartment.

FIRING ORDER



FIRING ORDER—2.0/2.4L



FIRING ORDER—2.5L

TORQUE SPECIFICATION

DESCRIPTION	TORQUE
Air Inlet tube Clamp	3 N·m (25 in. lbs.)
Camshaft Position Sensor Screw	12 N·m (105 in. lbs.)
SOHC Cam Magnet/Target	4.5 N·m (40 in. lbs.)
Coolant Sensor—2.0L	7 N·m (60 in. lbs.)
Coolant Sensor—2.4L	27 N·m (20 ft. lbs.)
Coolant Sensor—2.5L	27 N·m (20 ft. lbs.)
Crankshaft Position Sensor Screw	12 N·m (105 in. lbs.)
Coolant Temp. Sensor	18.6 N·m (165 in. lbs.)
Distributor Holddown Nut—2.5L	13 N·m (9 ft. lbs.)
EGR Tube to Intake	11 N·m (95 in. lbs.)
Ignition Coil to Cyl. Head—2.0/2.4L	12 N·m (105 in. lbs.)
IAT Sensor—2.0L	6.8 N·m (60 in. lbs.)
IAT Sensor—2.4/2.5L	11.5 N·m (100 in. lbs.)
Knock Sensor	10 N·m (90 in. lbs.)
MAP/IAT Sensor Plastic Manifold	2 N·m (20 in. lbs.)
MAP/IAT Sensor Aluminum Manifold	3 N·m (30 in. lbs.)
MAP Sensor—2.5L	3.4 N·m (30 in. lbs.)
Spark Plugs	28 N·m (20 ft. lbs.)

SPARK PLUG CABLE RESISTANCE—2.0L

CABLE	RESISTANCE
#1,#4	3500 ohms— 4900 ohms
#2,#3	2950 ohms— 4100 ohms

SPARK PLUG CABLE RESISTANCE—2.4L

CABLE	RESISTANCE
#1,#4	3500 ohms— 4900 ohms
#2,#3	2950 ohms— 4100 ohms

SPARK PLUG CABLE RESISTANCE—2.5L

MINIMUM	MAXIMUM
250 Ohms Per Inch	560 Ohms Per Inch
3000 Ohms Per Foot	6700 Ohms Per Foot

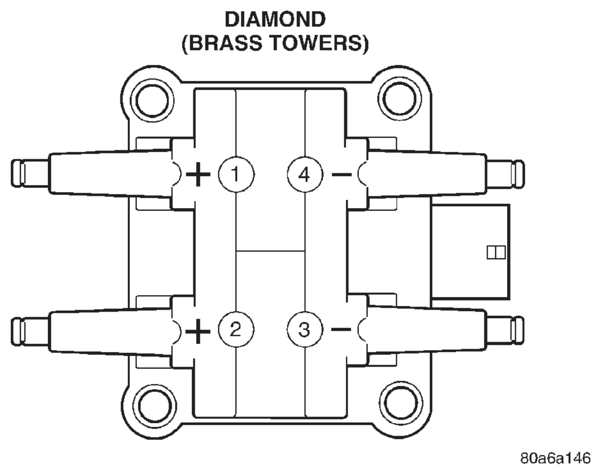
SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
2.0L	RC9YC	0.838 to 0.965 mm (0.033 to 0.038 in.)
2.4L	RC12YC5	1.219 to 1.346 mm (0.048 to 0.053 in.)
2.5L	RC10PYP4	0.965 to 1.092 mm (0.038 to 0.043 in.)

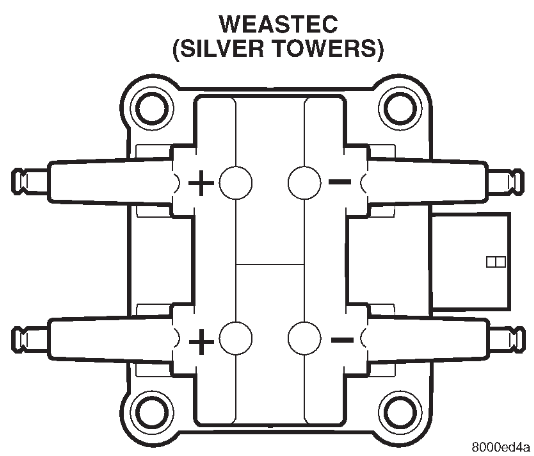
SPECIFICATIONS (Continued)

IGNITION COILS

Engines	Coil Manufacture	Primary Resistance at 21°C-27°C (70°F-80°F)	Secondary Resistance at 21°C-27°C (70°F-80°F)
2.0/2.4L	Toyodenso/ Diamond	0.51 TO 0.61 Ohms	11,500 to 13,500 Ohms
2.5L	Melco	0.6 TO 0.8 Ohms	12,500 to 18,000 Ohms



Coil Polarity



Coil Polarity

IGNITION SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

SPARK PLUGS — 2.5L With Leaded Fuel Option

The 2.5L engines that are calibrated to run on leaded fuel do not use the platinum spark plugs. Refer to the maintenance schedule in Group 0 of this service manual.

All engines use resistor spark plugs. They have resistance values ranging from 6,000 to 20,000 ohms when checked with at least a 1000 volt spark plug tester.

The spark plugs are double copper tipped, and have a recommended service life of 30,000 miles for normal driving conditions per schedule A in this manual.

SPECIFICATIONS

SPARK PLUGS

Engine	Spark Plug	Gap	Thread Size
2.0L	RC9YC	0.033 to 0.038 in.	14mm(3/4 in.) reach
2.5L	RC10PYP4	0.038 to 0.043 in.	14mm(3/4in.) reach
2.5L W/Leaded Fuel PKG.	RC8YCC	0.038 to 0.043 in.	14mm(3/4in.) reach

INSTRUMENT PANEL AND SYSTEMS

CONTENTS

GENERAL INFORMATION

ELECTRO/MECHANICAL INSTRUMENT CLUSTER

The mechanical instrument cluster is an electro-mechanical module which receives most of its information from the Body Control Module (BCM) via the CCD bus.

The cluster (Fig. 1) includes:

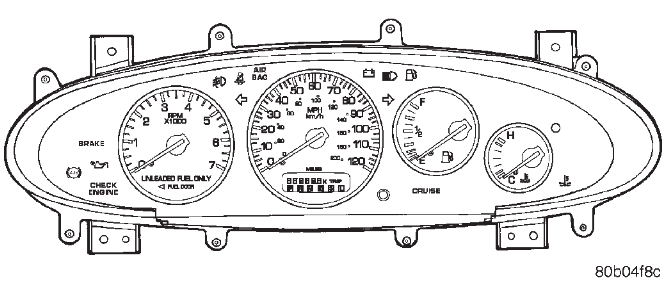


Fig. 1 Cluster

- (120 MPH) 200 km/h speedometer
- Tachometer
- Odometer/trip odometer and transmission range indicator with automatic transmission
- Fuel gauge
- Temperature gauge
- Security alarm indicator (optional)

The warning and information indicators include the following:

- Check Engine
- Airbag
- Charging system
- Low oil pressure
- High temperature
- Low fuel
- Seat belt
- Cruise (optional)
- Brake/park brake
- Anti-lock brake system (optional)
- High beam
- Fog lamps (optional)
- Vehicle Theft Security System alarm LED indicator (optional)
- Turn signals

The gauges are the magnetic air-core type. When the ignition switch is OFF, the gauge pointers should rest at or below the low graduation.

DESCRIPTION AND OPERATION

AUTOSTICK

Vehicles with Autostick will have a unique Transmission Range Indicator display (Fig. 2). When in the Autostick mode, a box around the gear position will be displayed to inform the driver which transmission gear is currently engaged.

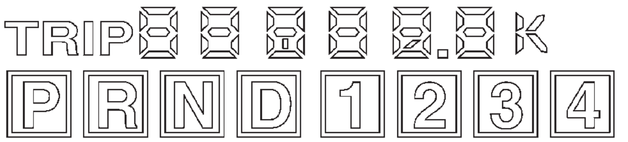


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Fig. 2 Autostick Odometer/Transmission Range Indicator

DATA LINK CONNECTOR

Data link connector is located on the left side kick panel just above hood release.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURE

In order to diagnose the instrument cluster function, a DRB lll® scan tool and the proper Body Diagnostic Procedures Manual are required.

As a quick diagnosis, the cluster will perform a function check immediately after the ignition is switched to the RUN/START position. The electronic display, odometer and transmission range indicator and all warning lamps except:

- Cruise
- Fog lamps
- High beam
- Low fuel
- Turn signal

will illuminate for a brief period.

If the cluster is not receiving CCD bus messages, the cluster will appear nonfunctional except for the continuously illuminated AIRBAG, ABS, and CHECK ENGINE indicators and NO BUS message displayed.

If the cluster is not receiving CCD bus messages, refer to the pre-diagnostic test described in proper Body Diagnostic Procedures Manual or refer to the Instrument Cluster Self-Diagnostic Test below.

INSTRUMENT CLUSTER SELF- DIAGNOSTICS

Initiate instrument cluster self-diagnostic by depressing the odometer/trip reset button while turning the ignition key to the OFF/RUN/START position. This will cycle an electronic display segment check and illumination in sequence of all CCD bus activated cluster warning indicators. There are four Check (CHEC) functions:

(1) CHEC 1, checks the gauges.

(2) CHEC 2, checks the warning lamps.

(3) CHEC 3, checks the odometer/trip meter.

(4) CHEC 4, Transmission Range Indicator for the automatic transmission or the autostick transmission.

If the diagnostic procedure determines that a replacement of an instrument cluster component is required, refer to the proper component removal procedure.

CHEC 1 - GAUGE DISPLAY

TACHOMETER …6000 rpm SPEEDOMETER …100mph (220 kmh) FUEL GAUGE pointer ON …F TEMPERATURE GAUGE pointer ON …H
TACHOMETER …3000 rpm SPEEDOMETER …75mph (120 kmh) FUEL GAUGE pointer ON …1/2 TEMPERATURE GAUGE pointer ON …midscale
TACHOMETER …3000 rpm SPEEDOMETER …55mph (100 kmh) FUEL GAUGE pointer ON …1/2 TEMPERATURE GAUGE pointer ON …midscale
TACHOMETER …1000 rpm SPEEDOMETER …20mph (40 kmh) FUEL GAUGE pointer ON …E TEMPERATURE GAUGE pointer ON …C

CHEC 1

(1) If all gauges fail to move, replace Cluster Printed Circuit (PC) Board.

(2) If any gauge fails to move, replace the gauge assembly.

(3) If any gauge(s) is not in the proper position, replace Cluster Printed Circuit Board.

CHEC 2

(1) If any lamp does not light, check lamp.

(2) If lamp is not OK, replace lamp.

(3) If lamp is OK, replace Cluster Printed Circuit Board.

DIAGNOSIS AND TESTING (Continued)

CHEC 2 - WARNING LAMP DISPLAY

CHECK ENGINE
SEAT BELT
AIRBAG
CHARGING SYSTEM
LOW FUEL
HIGH BEAM INDICATOR
ENGINE TEMPERATURE
CRUISE

CHEC 3 - VACUUM FLORESCENT (VF) DISPLAY

TRIP
ODOMETER CENTER
ODOMETER LOWER RIGHT
ODOMETER BOTTOM
ODOMETER LOWER LEFT
ODOMETER UPPER LEFT
ODOMETER TOP
ODOMETER UPPER RIGHT
ALL ODOMETER V/F DISPLAY DIGIT SEGMENTS ON

CHEC 3

If any V/F segment does not light, replace Odometer/Transmission Range Indication.

CHEC 4 - TRANSMISSION RANGE (VF) DISPLAY - AUTOMATIC TRANSMISSION

PRND3L
PRND3L AND BOX AROUND P
PRND3L AND BOX AROUND R
PRND3L AND BOX AROUND N
PRND3L AND BOX AROUND D
PRND3L AND BOX AROUND 3
PRND3L AND BOX AROUND L
PRND3L AND ALL BOXES
END

CHEC 4 - AUTOMATIC TRANSMISSION

If any V/F segment does not light, replace Odometer/Transmission Range Indication.

TRANSMISSION RANGE (VF) DISPLAY - AUTOSTICK

PRND1234
PRND1234 AND BOX AROUND 1
PRND1234 AND BOX AROUND 2
PRND1234 AND BOX AROUND 3
PRND1234 AND BOX AROUND 4
PRND1234 AND BOX AROUND P
PRND1234 AND BOX AROUND R
PRND1234 AND BOX AROUND N
PRND1234 AND BOX AROUND D
PRND1234 AND ALL BOXES
END

CHEC 4 - AUTOMATIC TRANSMISSION

If any V/F segment does not light, replace Odometer/Transmission Range Indication.

REMOVAL AND INSTALLATION

BODY CONTROL MODULE (BCM)

REMOVAL

The Junction Block and Body Control Module (BCM) are attached to each other. After removal they can be separated.

(1) Remove Junction Block / Body Control Module from vehicle. Refer to Group 8O, Power Distribution Systems for Removal and Installation.

(2) With the Junction Block/BCM removed from the vehicle, separate the BCM from the Junction Block.

(3) Remove the two BCM attaching screws and release the two BCM locking latches from the Junction Block.

(4) Disconnect BCM from the Junction Block.

NOTE: The Remote Keyless Entry (RKE) module is attached to the BCM with three screws. This must be transferred (if equipped) to the new BCM if being replaced.

NOTE: If BCM is replaced, the VTSS must be enabled in the new BCM via the DRB III® in order to start the vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

For installation, reverse the above procedures.

CENTER BEZEL

REMOVAL

Pull center bezel straight rearward along the sides of the radio and A/C control openings to disengage four clips (Fig. 3).

INSTALLATION

For installation, reverse the above procedures.

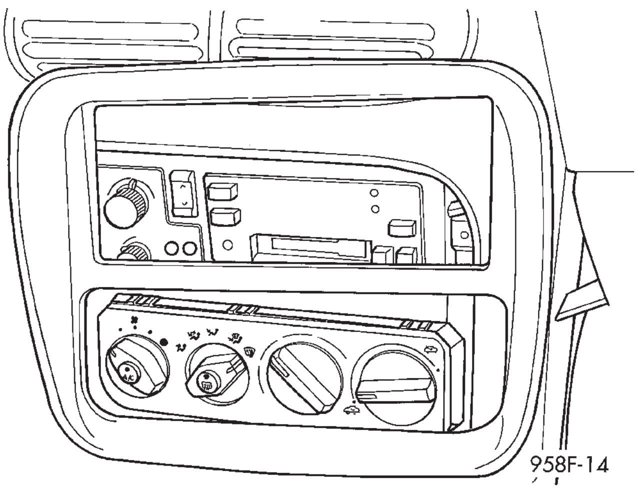


Fig. 3 Center Bezel

CIGAR LIGHTER / POWER OUTLET

REMOVAL

(1) Remove cubby bin. Refer to Cubby Bin / Lamp Removal and Installation in this section.

(2) Disconnect the two power outlet wiring connectors from power outlet. Unscrew shell and clamp assembly to replace power outlet.

INSTALLATION

For installation, reverse the above procedures. The clamp has a locating feature. The cubby bin must engage the console at its forward edge prior to installing the mounting screws.

CLUSTER HOOD

REMOVAL

(1) Remove instrument panel left end cap.

(2) Tilt steering column down to its lowest position.

(3) Remove instrument panel center bezel by disengaging the four clips (Fig. 3).

(4) Remove instrument cluster hood (Fig. 4).

(a) Remove three attaching screws under the center bezel.

(b) Remove screw at left end of panel.

(c) Pull hood straight back to disengage the eight clips. If equipped with a Compass/Temperature Mini Trip Computer pull rearward about 3 inches and stop. Reach through the radio opening in the cluster hood and disconnect the CMTC wire connector.

(d) Remove the cluster hood.

INSTALLATION

For installation, reverse the above procedures. Keep the forward edge of the hood down on the instrument panel while sliding the hood forward to engage the retaining clips.

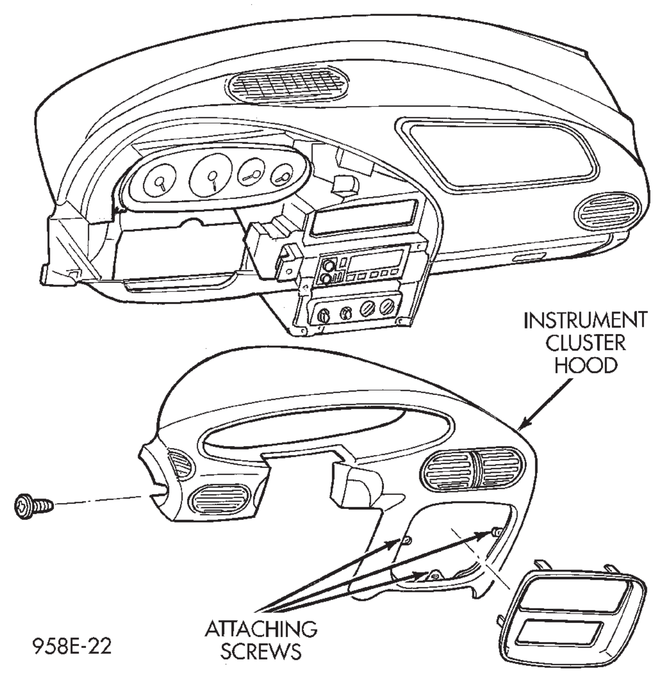


Fig. 4 Instrument Cluster Hood

CLUSTER LAMP

Refer to (Fig. 5) for appropriate lamp locations. Replace fog lamp indicator lamp, ABS indicator lamp and security LED socket assembly only if equipped.

CLUSTER PRINTED CIRCUIT BOARD

REMOVAL

(1) Remove six cluster back cover retaining screws and remove the cover.

(2) Disconnect odometer/transmission range indicator connector from the printed circuit board.

(3) Remove nine printed circuit board attaching screws and remove. There are two screws located at the base of each connector (Fig. 6).

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

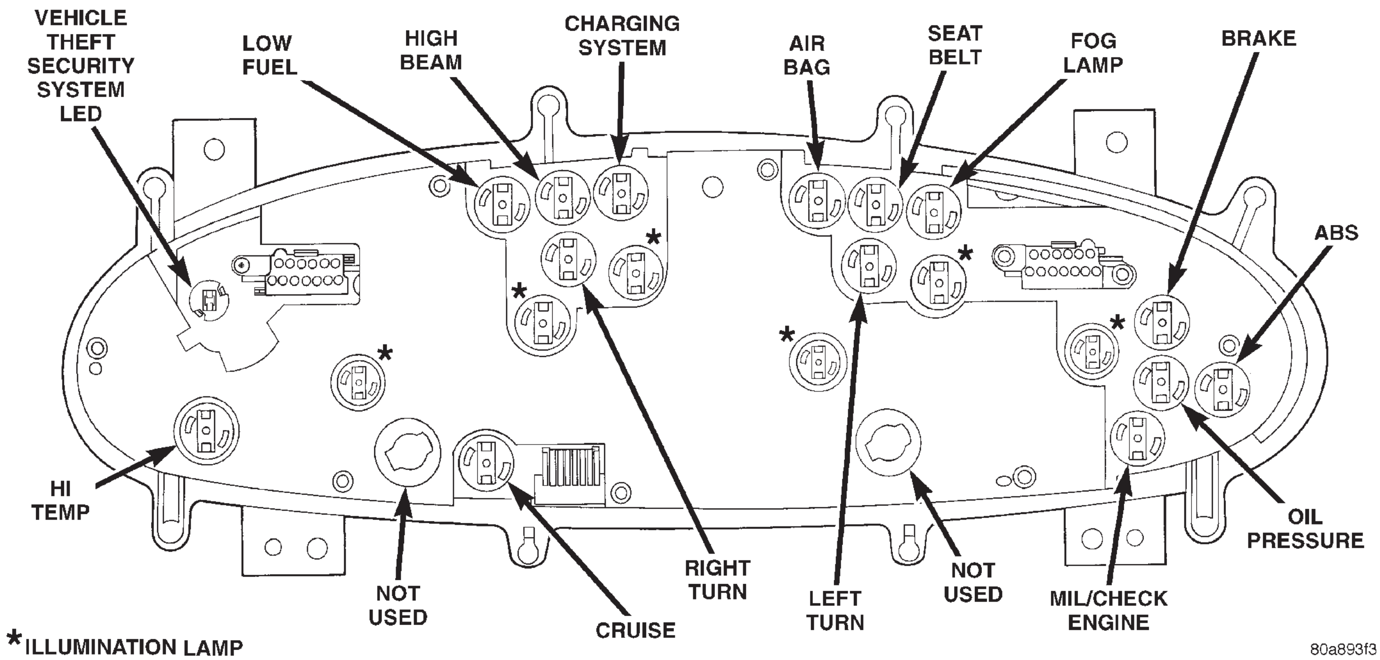


Fig. 5 Lamp Location

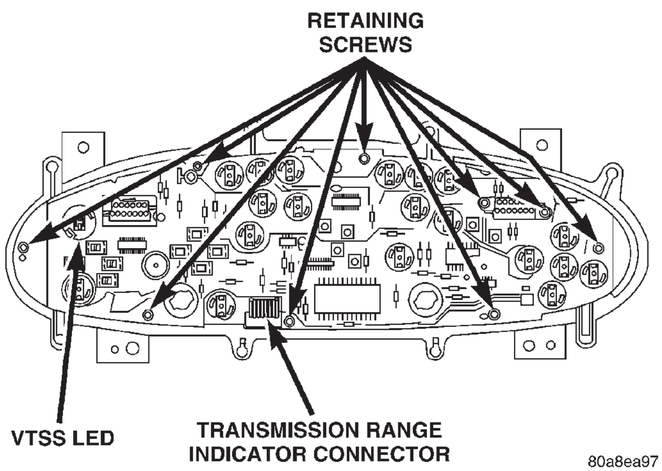


Fig. 6 Printed Circuit Board

CUBBY BIN/LAMP

REMOVAL

(1) Remove center bezel.

(2) Remove instrument cluster hood screws.

(a) Remove two screws adjacent radio.

(b) Remove screw below HVAC control in the center.

(c) Remove screw at left end of panel.

(d) Flex instrument cluster hood slightly to give access to the cubby bin screws.

(3) Remove the cubby bin mounting screws and remove bin.

INSTALLATION

For installation, reverse the above procedures. The cubby bin must engage the console at its forward edge prior to installing the mounting screws.

FUEL GAUGE AND TEMPERATURE GAUGE

REMOVAL

(1) Remove mask/lens retaining screws and remove mask/lens (Fig. 7).

(2) Disconnect odometer/transmission range indicator connector from the printed circuit board (Fig. 8).

(3) Remove screws attaching speedometer/tachometer to housing and remove (Fig. 9).

(4) Remove the fuel/temperature gauge attaching screws from the housing and remove (Fig. 10).

INSTALLATION

For installation, reverse the above procedures.

GLOVE BOX DOOR HANDLE

REMOVAL

(1) Open glove door.

(2) Remove four door handle attaching screws.

(3) Remove handle.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

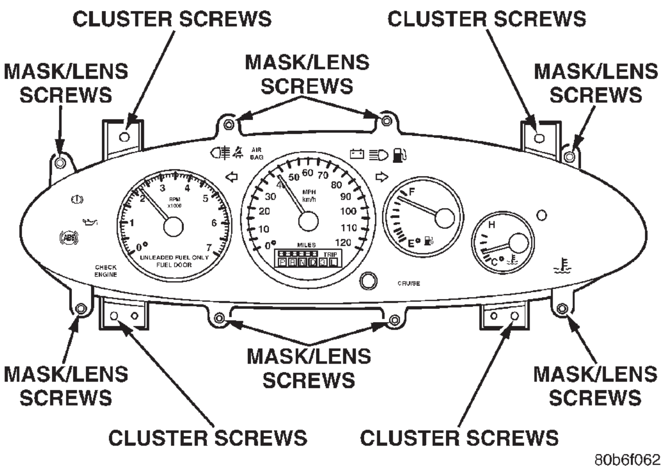


Fig. 7 Mask/Lens Retaining Screws

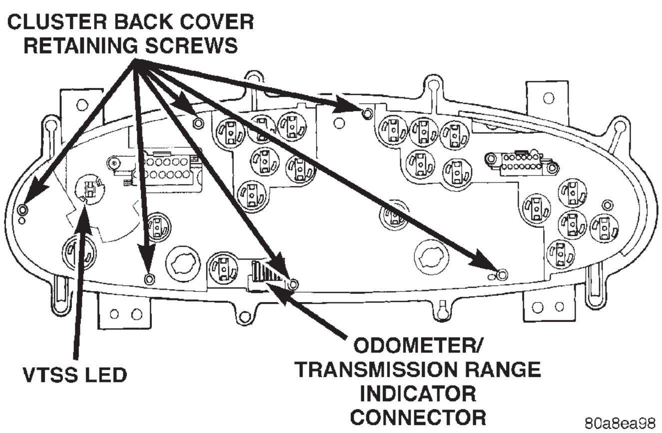


Fig. 8 Back Cover Retaining Screws

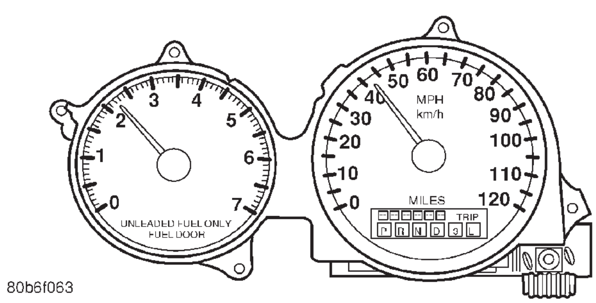


Fig. 9 Speedometer/Tachometer

GLOVE BOX DOOR LOCK

REMOVAL

(1) Remove glove box door handle.

(2) Insert the proper key in lock cylinder, depress the gray locking key on back side housing at the 3 O'clock position.

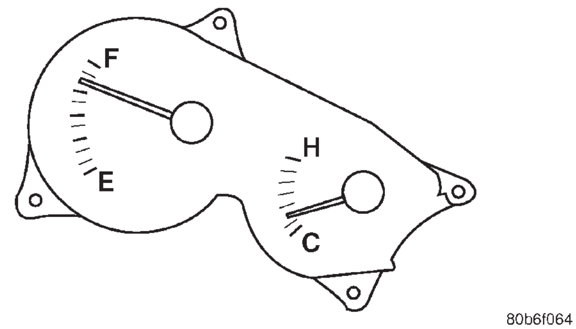


Fig. 10 Fuel Gauge and Temperature Gauge

(3) Rotate the key clockwise to disengage cylinder from housing.

INSTALLATION

For installation, reverse the above procedures.

HVAC CONTROL

REMOVAL

(1) Remove center bezel by pulling rearward to disengage four clips and remove attaching screws from cubby bin (Fig. 3).

(2) Remove the HVAC control attaching screws. Pull the control out to disconnect two electrical connectors and two control cables. Remove HVAC control.

INSTALLATION

For installation, reverse the above procedures. The forward edge of bin must engage the forward console.

INSTRUMENT CLUSTER

REMOVAL

To service any instrument cluster component, the instrument cluster must be removed from the instrument panel.

(1) Remove instrument cluster hood, refer to Cluster Hood Removal and Installation procedures.

(2) Remove the four cluster attaching screws (Fig. 7).

(3) Remove instrument cluster and disconnect wire connectors from instrument panel by pulling cluster rearward.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

INSTRUMENT PANEL

WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM.

FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.

REMOVAL

When removing a passenger airbag module refer to Group 8M, Restraint Systems for Passenger Air Bag Module Removal.

(1) Disconnect and isolate the battery negative remote cable.

(2) Open both vehicle front doors. Remove left end cover by pulling outboard. Remove right end cover by pulling rearward (Fig. 11).

(3) Remove transmission range indicator bezel from floor console. Use care not to mar the bezel or console.

(4) Remove floor center console. Remove two mounting screws in the front and two mounting screws under the decorative caps in the rear.

(5) Disconnect Airbag Control Module (ACM).

(6) Using a trim stick (special tool #C-4755), gently pry out on center instrument panel trim bezel and remove.

(7) Remove instrument cluster hood.

(a) Remove two screws adjacent radio.

(b) Remove the screw below HVAC control.

(c) Remove screw at left end of panel.

(d) Pull on hood to disengage the eight clips.

(8) Remove two cubby bin screws and remove.

(9) Remove five knee bolster mounting screws.

(10) Open glove box door and press sidewalls inboard while pulling the back panel rearward to lower door from panel to access forward floor console.

(11) Remove forward floor console nine attaching screws and one push pin at forward driver's side.

(12) Pull the driver's under panel silencer outboard off the distribution duct.

(13) Remove left and right A-pillar moldings, starting from the top edge and pulling them out.

(14) Remove instrument panel top cover attaching screw on passenger side.

(a) Lift the right rear edge of top cover to disengage the vertical clips along the rear edge. Proceeding from right to the left side. Do not use a nylon trim stick, to avoid marring cover or panel.

(b) Lift rear edge and slide top cover rearward disengaging angular clips and remove cover.

(15) Remove HVAC control attaching screws.

(16) Remove center distribution duct screws from behind radio and duct.

(17) Remove radio. Access and remove the three HVAC attaching screws to duct and panel. Remove the three HVAC attaching bolts from the cross-car beam.

(18) Close glove box door.

(19) Remove five screws attaching panel retainer to plenum.

(20) Remove steering column intermediate shaft attaching bolt.

(21) Disconnect engine and body wire harness from Junction Block/BCM.

(22) Remove fasteners:

- Four at left end and three at the right end of the cross car beam
- Two at steering column plenum
- One at glove box hinge to cowl
- Two at center support to the floor pan bracket

(23) Remove attaching screw at the rear of HVAC to the center support bracket.

(24) Lift up instrument panel and move rearward to remove.

INSTALLATION

For installation, reverse the above procedures. DO NOT CONNECT battery negative remote cable. Refer to Group 8M, Restraint Systems for Air Bag System test.

INSTRUMENT PANEL END COVERS – LEFT AND RIGHT

REMOVAL

(1) Open the left door and pull on the access handle and pivoting around A-pillar to disengage end cover clips. Fuse Puller, Spare Fuses And Fuse Diagram Are Located On Left End Cover. Fuse Access Is Under Left End Cover (Fig. 11).

(2) Open right door and glove box door.

(3) Remove right end cover by pulling rearward to disengage clips.

INSTALLATION

For installation, reverse the above procedures. Ensure spare fuses are seated to left end cover.

INSTRUMENT PANEL SPEAKERS

REMOVAL

(1) Remove instrument panel top cover, refer to Instrument Panel Top Cover Removal procedures.

REMOVAL AND INSTALLATION (Continued)

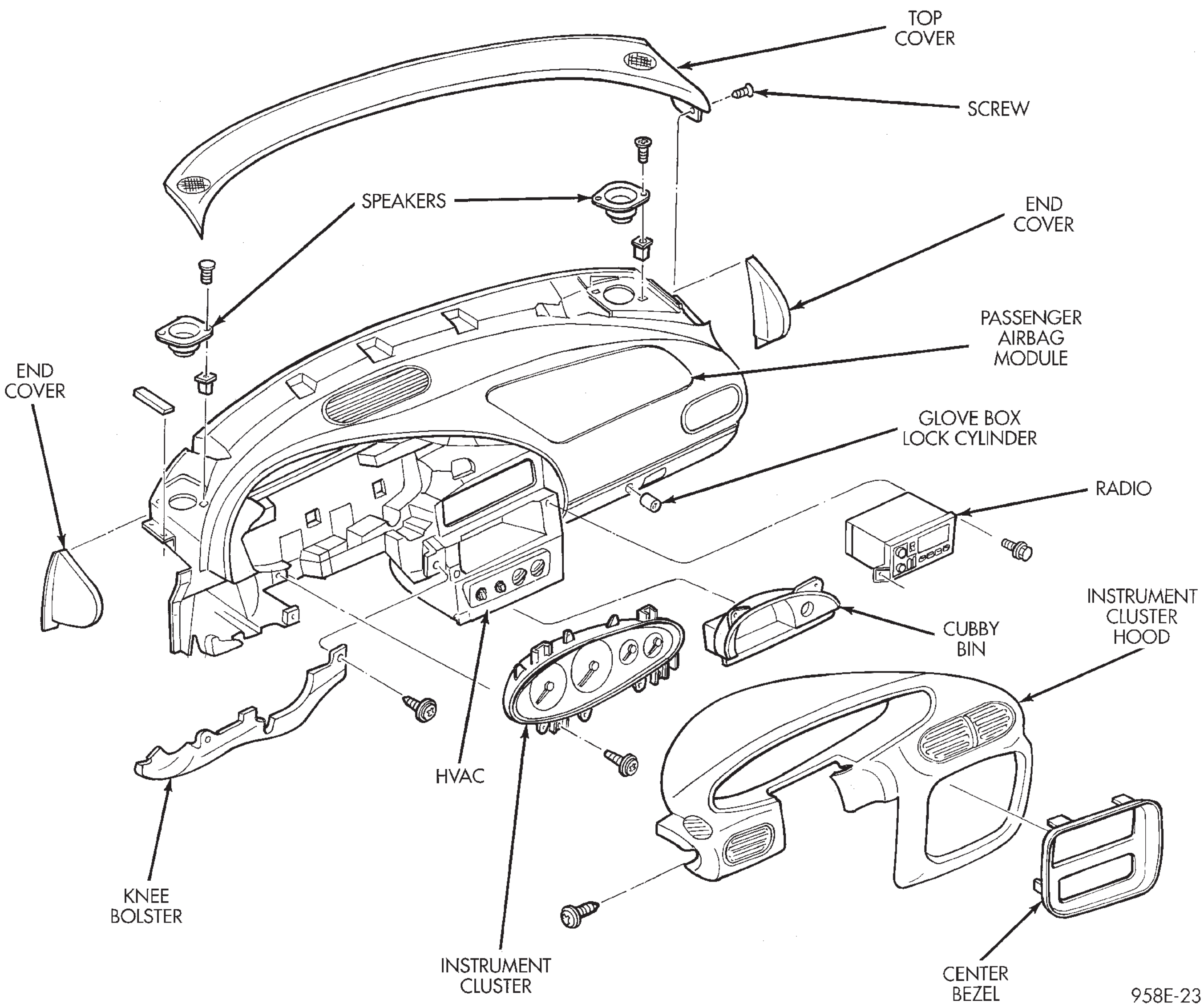


Fig. 11 Instrument Panel Breakdown

(2) Remove two screws on each speaker and lift up, disconnect wiring connector and remove speaker.

INSTALLATION

For installation, reverse the above procedures

INSTRUMENT PANEL TOP COVER

REMOVAL

(1) Open glove box door.

(2) Remove right end cap and remove screw at right end.

(3) Remove left and right A-pillar moldings by disengaging the top christmas tree fasteners and then pulling the moldings out vertically.

(4) Lift the right rear edge of top cover to disengage the clips along the rear edge. Proceeding from right to the left side. Do not use a nylon trim stick, to avoid potential damage (Fig. 12).

(5) Lift rear edge and slide top cover rearward disengaging angular clips and remove cover.

INSTALLATION

For installation, reverse the above procedures. Ensure the two center clips are engaged first. Place thumb in VIN opening and pull towards pad to ensure VIN alignment. If a gap exist between the top cover and pad after installation check for a damaged clip. The clip must be removed and replaced.

REMOVAL AND INSTALLATION (Continued)

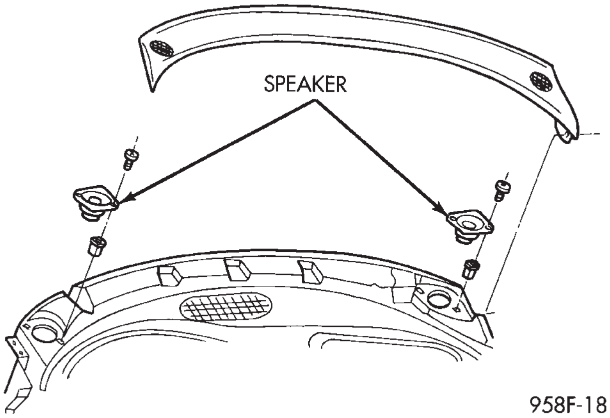


Fig. 12 Top Cover

LEFT UNDER INSTRUMENT PANEL SILENCER/ DUCT

REMOVAL

(1) Remove two lower knee bolster screws and slip silencer off outboard attaching formation.

(2) Maneuver part off of center floor distribution duct to remove.

INSTALLATION

For installation, reverse the above procedures. Install prior to knee bolster.

MASK/LENS

REMOVAL

Remove mask/lens retaining screws and remove mask/lens (Fig. 7).

INSTALLATION

For installation, reverse the above procedures.

ODOMETER/TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove speedometer/tachometer, refer to Speedometer/Tachometer and Odometer Transmission Range Indicator Removal and Installation

(2) Remove screws attaching from the back of speedometer and remove the odometer/transmission range indicator display (Fig. 13).

INSTALLATION

For installation, reverse the above procedures.

RADIO

For Radio removal procedures, Refer to Group 8F, Audio Systems.

RIGHT UNDER INSTRUMENT PANEL SILENCER/DUCT

REMOVAL

(1) Remove push-in fastener under right end of instrument panel.

(2) Maneuver part off center floor distribution duct to remove.

INSTALLATION

For installation, reverse the above procedures.

SPEEDOMETER/TACHOMETER AND ODOMETER TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove mask/lens retaining screws and remove mask/lens (Fig. 7).

(2) Disconnect odometer/transmission range indicator connector from the printed circuit board (Fig. 8).

(3) Remove screws attaching speedometer/tachometer to housing and remove (Fig. 9).

(4) Remove screws attaching from the back of speedometer and remove the odometer/transmission range indicator display (Fig. 13).

INSTALLATION

For installation, reverse the above procedures.

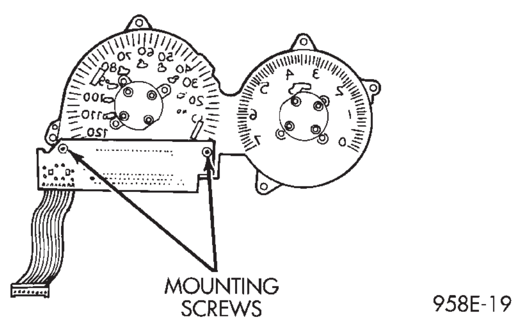


Fig. 13 Odometer/Transmission Range Indicator

VEHICLE THEFT SECURITY SYSTEM LED

REMOVAL

(1) Disconnect Vehicle Theft Security System LED socket assembly indicator from the printed circuit board (Fig. 5).

(2) Rotate LED socket counter clockwise and remove from printed circuit board (Fig. 8).

INSTALLATION

For installation, reverse the above procedures.

INSTRUMENT PANEL AND GAUGE

CONTENTS

GENERAL INFORMATION

ELECTRO/MECHANICAL INSTRUMENT CLUSTER

The mechanical instrument cluster is an electro-mechanical module which receives most of its information from the Body Control Module (BCM) via the CCD bus.

The cluster (Fig. 1) includes:

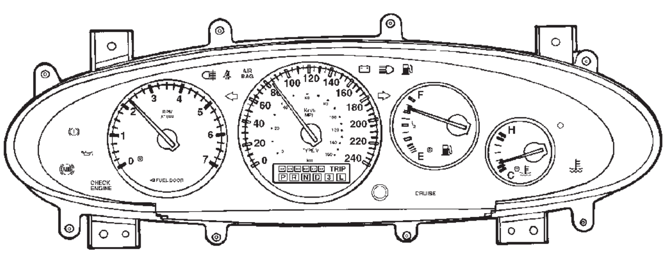


Fig. 1 Cluster

- 240 km/h (180 MPH) speedometer
- Tachometer
- Odometer/trip odometer and transmission range indicator with automatic transmission
- Fuel gauge
- Temperature gauge
- Security alarm indicator (optional)

The warning and information indicators include the following:

- Malfunction indicator lamp (Check Engine)
- Airbag
- Charging system
- Low oil pressure
- High temperature
- Low fuel
- Seat belt
- Cruise
- Brake/park brake
- Anti-lock brake system (optional)
- High beam
- Fog lamps (optional)
- Vehicle Theft Security System alarm LED indicator (optional)
- Turn signals

The gauges are the magnetic air-core type. When the ignition switch is OFF, the gauge pointers should rest at or below the low graduation.

DIAGNOSIS AND TESTING

HEADLAMP LEVELING SWITCH

(1) Remove headlamp leveling switch from instrument panel and disconnect the wire harness connector from the switch. Refer to Wiring Diagrams for the proper wire circuits and connector connections.

(2) Using a voltmeter, connect B+ lead to Pin 1 of the Wire harness connector. Connect the negative lead to Pin 2. Turn ON the headlamp switch to the low beam position. If battery voltage, OK. If not OK, go to Step 3.

DIAGNOSIS AND TESTING (Continued)

(3) Connect the ground lead to a good ground, if no voltage, refer to Wiring Diagrams and test circuit back to headlamp switch. If battery voltage, repair Pin 2 ground circuit as necessary.

(4) Turn headlamps OFF. Connect the wire harness connector to the headlamp leveling switch. Turn ON the headlamp switch to the low beam position. Check voltage at Pin 3, while rotating the headlamp leveling switch knob through it's range. The voltage reading should change as the switch is rotated. If the voltage does not vary replace switch. If OK, test the headlamp leveling motors and/or circuit to the motors.

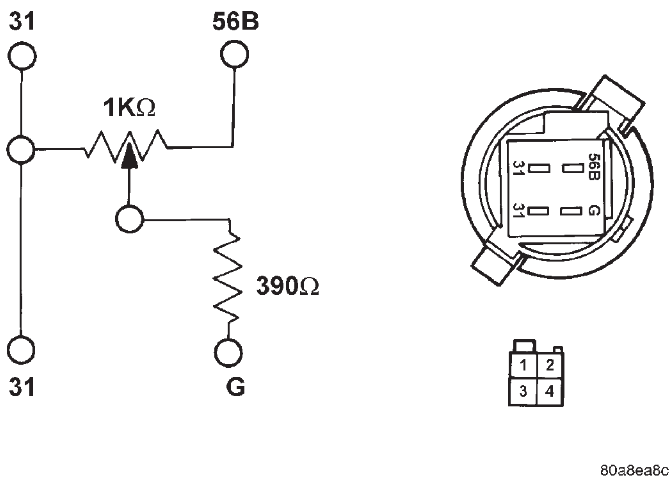


Fig. 2 Headlamp Leveling Switch Circuit Diagram

REMOVAL AND INSTALLATION

FUEL GAUGE AND TEMPERATURE GAUGE

REMOVAL

(1) Remove mask/lens retaining screws and remove mask/lens (Fig. 3).

(2) Disconnect odometer/transmission range indicator connector from the printed circuit board (Fig. 4).

(3) Remove screws attaching speedometer/tachometer to housing and remove (Fig. 5).

(4) Remove the fuel/temperature gauge attaching screws from the housing and remove (Fig. 6).

INSTALLATION

For installation, reverse the above procedures.

HEADLAMP LEVELING SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

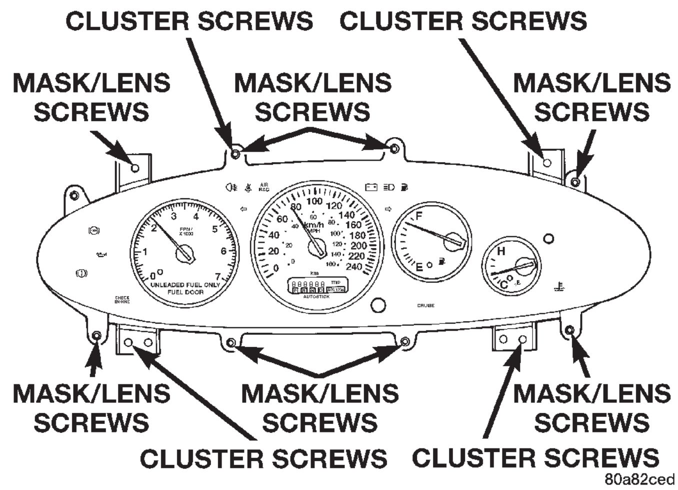


Fig. 3 Mask/Lens Retaining Screws

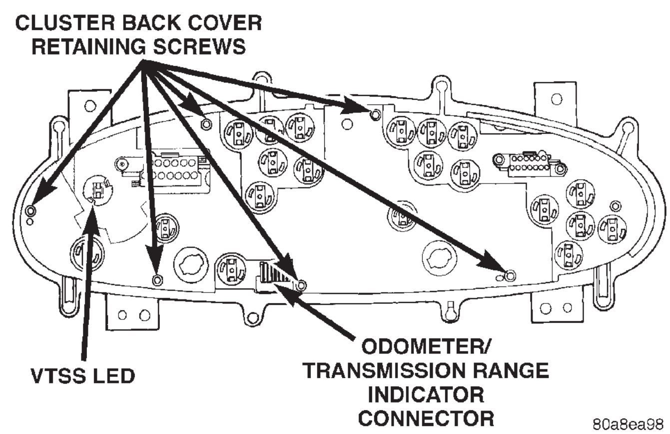


Fig. 4 Back Cover Retaining Screws

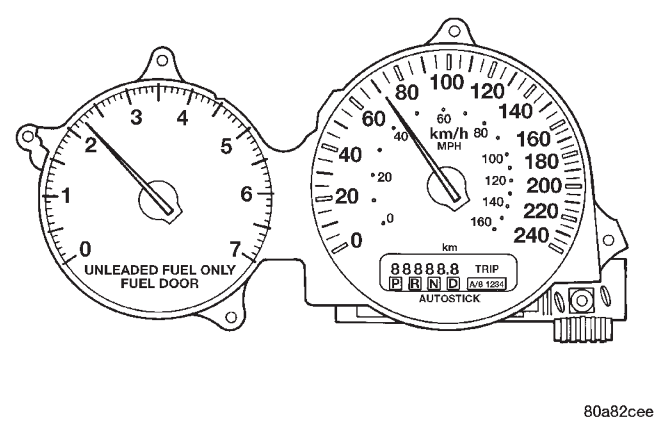


Fig. 5

(2) Using a trim stick or other suitable wide flat bladed tool, pry gently around the edges of the headlamp leveling switch (Fig. 7).

REMOVAL AND INSTALLATION (Continued)

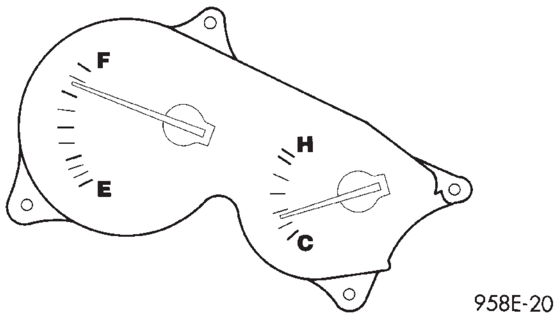


Fig. 6 Fuel Gauge and Temperature Gauge

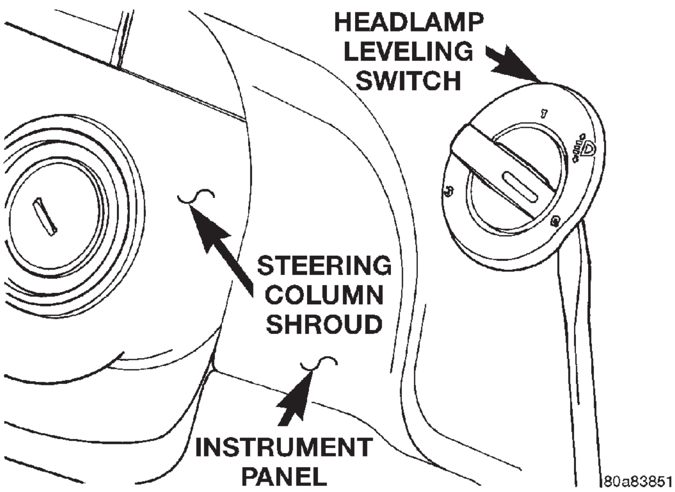


Fig. 7 Headlamp Leveling Switch

(3) Pull the headlamp leveling switch out from the instrument cluster hood far enough to disengage the wiring connector.

(4) Remove the switch from the instrument cluster hood.

INSTALLATION

Reverse the preceding operation.

SPEEDOMETER/TACHOMETER AND ODOMETER TRANSMISSION RANGE INDICATOR

REMOVAL

(1) Remove mask/lens retaining screws and remove mask/lens (Fig. 3).

(2) Disconnect odometer/transmission range indicator connector from the printed circuit board (Fig. 4).

(3) Remove screws attaching speedometer/tachometer to housing.

(4) Remove screws attaching from the back of speedometer and remove the odometer/transmission range indicator display (Fig. 8).

INSTALLATION

For installation, reverse the above procedures.

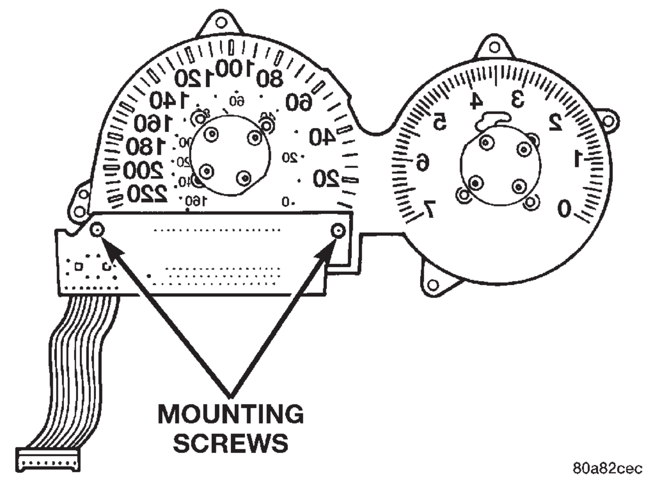


Fig. 8 Odometer/Transmission Range Indicator

AUDIO SYSTEMS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

For operation of the factory installed standard and optional radios with cassette or compact disc player, refer to the Sound Systems Operating Instructions in the Owners Manual supplied with the vehicle.

The vehicles are shipped with fuse 5 removed from the Junction Block. The fuse replaces the ignition-off draw (IOD) connector. Fuse 5 is a ten amp fuse. When removed it prevents the battery from discharging during storage. For specific wiring and location, refer to Group 8W, Wiring Diagrams.

DESCRIPTION AND OPERATION

INTERFERENCE ELIMINATION

Some components used on the vehicles are equipped with a capacitor to suppress radio frequency interference/static.

Capacitors are mounted in various locations internal to the generator, instrument cluster and windshield wiper motor.

Ground straps provide noise suppression by conducting very small high frequency electrical signals to ground. A ground strap is mounted from the engine to shock tower, and another is mounted from the rear of the muffler mounting bracket. 2.5L engines are also equipped with a ground strap mounted from the engine to the transmission. These ground straps should be securely tightened to assure good metal to metal contact.The radio grounds to the cross car beam through pinch brackets that grounds automatically as the radio is installed into the instrument panel.

Radio resistance type spark plug cables in the high tension circuit of the ignition system complete the interference suppression. Faulty or deteriorated spark plug wires should be replaced.

POWER ANTENNA

The power operated radio antenna is a telescoping type antenna, extended and retracted by a reversible electric motor.

The Automatic Power Antenna is controlled by a combination of an internal relay and limit switches which, are built into the antenna motor housing. This antenna is actuated when the radio is switched ON and the ignition switch in ON or ACCESSORY position. When the ignition switch or the radio is turned OFF the antenna mast should retract fully.

Many antenna problems may be avoided by frequent cleaning of the antenna mast telescoping sections. Clean the antenna mast sections with a clean soft cloth.

Before an antenna is removed, the antenna performance should be tested to decide if it is a reception problem or an operational problem.

Whenever a operational malfunction occurs, first verify that the radio antenna wire harness is properly connected. Check all connectors before starting normal diagnosis and repair procedures.

REMOTE AMPLIFIER

The amplifier is located under the right front seat.

When the radio system is ON, and all or some speakers are not operating or have a noise distortion

DESCRIPTION AND OPERATION (Continued)

refer to the diagnostic tests. Refer to Group 8W, Wiring Diagrams for Pin numbers and location.

REMOTE CD CHANGER

The remote CD changer is located in the center console and is capable of holding up to six discs in a magazine. The magazine can be ejected at anytime that the ignition switch is in the ON position. After the ignition switch is turned OFF, the magazine can only be ejected within one minute. After that period, the magazine will be locked in the CD changer.

DIAGNOSIS AND TESTING

AUDIO DIAGNOSTIC TEST PROCEDURES

CAUTION: The CD player will only operate between approximate temperatures of -23°C and +65°C (-10°F and +145°F).

Whenever a radio malfunction occurs;

(1) First check FUSES in the Fuse Block:

(a) Fuse 5, Memory feed and the Power Antenna (if equipped)

(b) Fuse 7, Illumination

(c) Fuse 8, Power Amplifier

(d) Fuse 14, Ignition feed

NOTE: The vehicles are shipped with the INTERIOR LAMP fuse disconnected.

(2) Verify, the radio wire harness is properly connected before starting normal diagnosis and repair procedures. Refer to Audio Diagnostic Charts and/or Group 8W, Wiring Diagrams.

DIAGNOSTIC CONDITIONS

NOISE DISTORTION IN ALL SPEAKERS

Does the distortion occur through all operations:

- AM and FM stations
- Cassette tape
- Compact disc

If not, check for radio interference, damaged tape or disc that may be causing the distortion. Refer to Sound Systems Operating Instructions in the Owners Manual for cleaning procedures of the cassette tape player.

- Check battery voltage, for 11 Volts or more
- Check amplifier connectors, and wires for proper connection
- If OK, check radio, refer to Radio Diagnosis
- If OK, replace amplifier

ELECTRICAL NOISE DISTORTION ONE SPEAKER

- Remove output signal connector from amplifier and check for short to ground on the speaker with the distortion. Refer to Group 8W, Wiring Diagrams for the appropriate pin numbers.
- If shorted to ground, disconnect speaker connector and recheck from the amplifier for short to ground.
- If still shorted to ground, repair wires. Not shorted to ground, replace speaker.
- Not shorted to ground, check speaker resistance at amplifier connector for three to eight ohms.
- If resistance is OK, refer to Radio Diagnosis. If radio checks OK, replace amplifier.
- If resistance is less than three ohms, replace speaker. If resistance is OK, repair wires

MECHANICAL NOISE DISTORTION

- Check trim for loose parts, and speaker attachments for buzzes
- Remove speaker that is still connected and listen for distortion. If distortion remains, replace speaker.

ONE SPEAKER NON-OPERATIVE

- Remove output signal connector from amplifier and check for three to eight ohms resistance to the non-operative speaker. Refer to Group 8W, Wiring Diagrams for the appropriate pin numbers.
- If resistance is less than three ohms, speaker is OK.
- If OK, repair wire. If not OK, replace speaker.

ALL SPEAKERS NON-OPERATIVE

- Check radio for being ON, are the display lights on
- Radio not ON, refer to Radio Diagnosis
- Check fuses, amplifier connectors and wires for proper connection
- Check for good ground
- Check amplifier, for battery voltage and ON/OFF voltage

(1) Battery voltage OK and NO voltage at the ON/OFF terminal, check for short or open in the ON/OFF circuit.

(2) ON/OFF voltage OK, and NO battery voltage, check for short or open in battery circuit.

(3) Prior to replacing amplifier check fuse to the cigar lighter and horn. If not OK, replace fuse. If fuse blows again disconnect amplifier B+ wire connector. Refer to Group 8W, Wiring Diagrams for the proper connector.

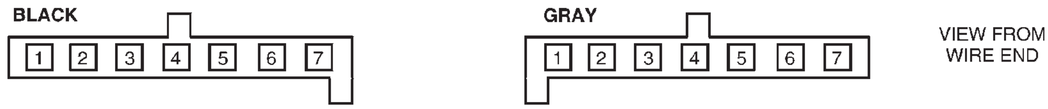
(4) If fuse still blows the problem is not the amplifier. If fuse does not blow replace the amplifier.

(5) If shorted or open circuit repair as necessary.

DIAGNOSIS AND TESTING (Continued)

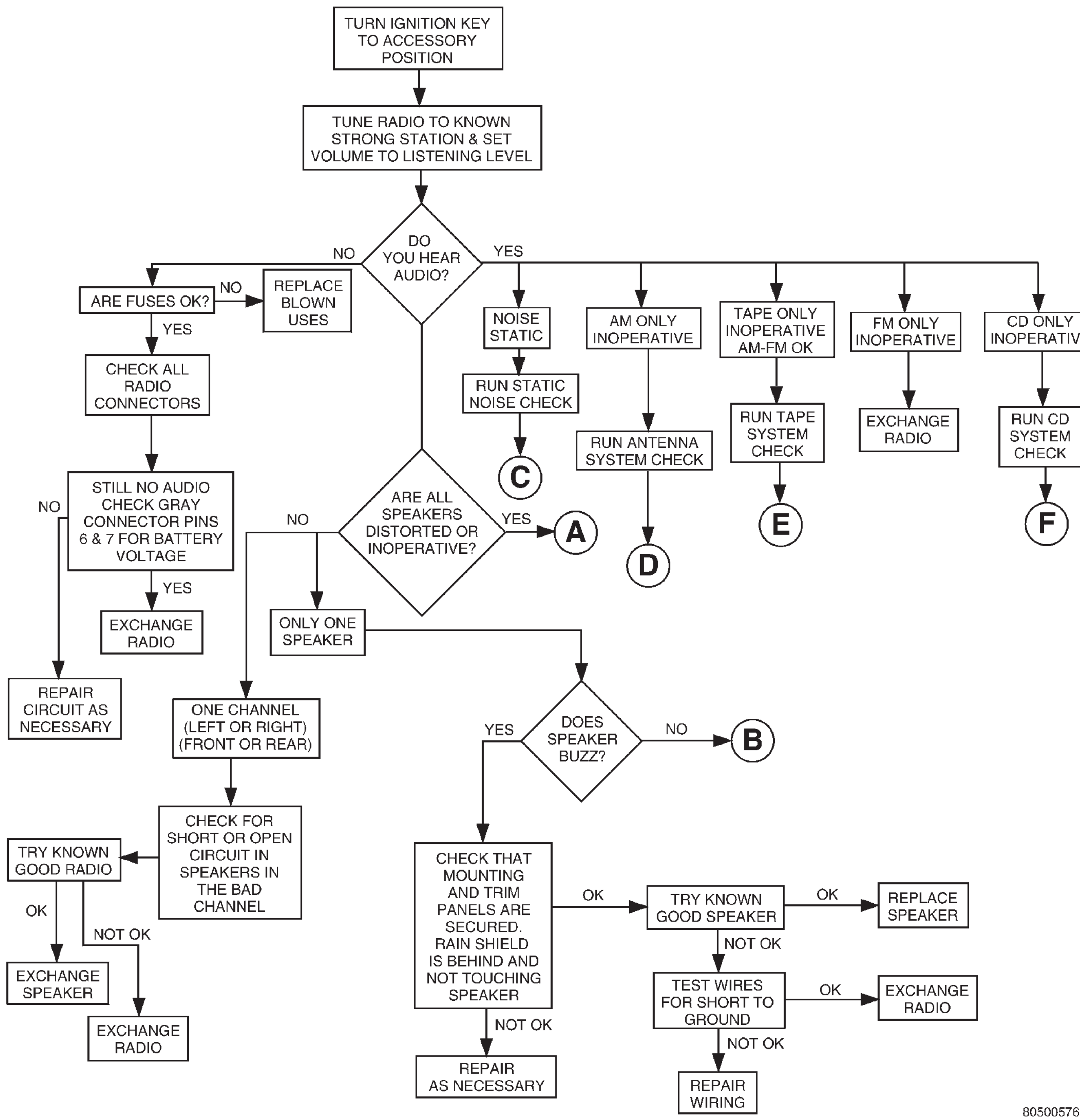
RADIO CONNECTORS

BASE 6 SPEAKER SYSTEM

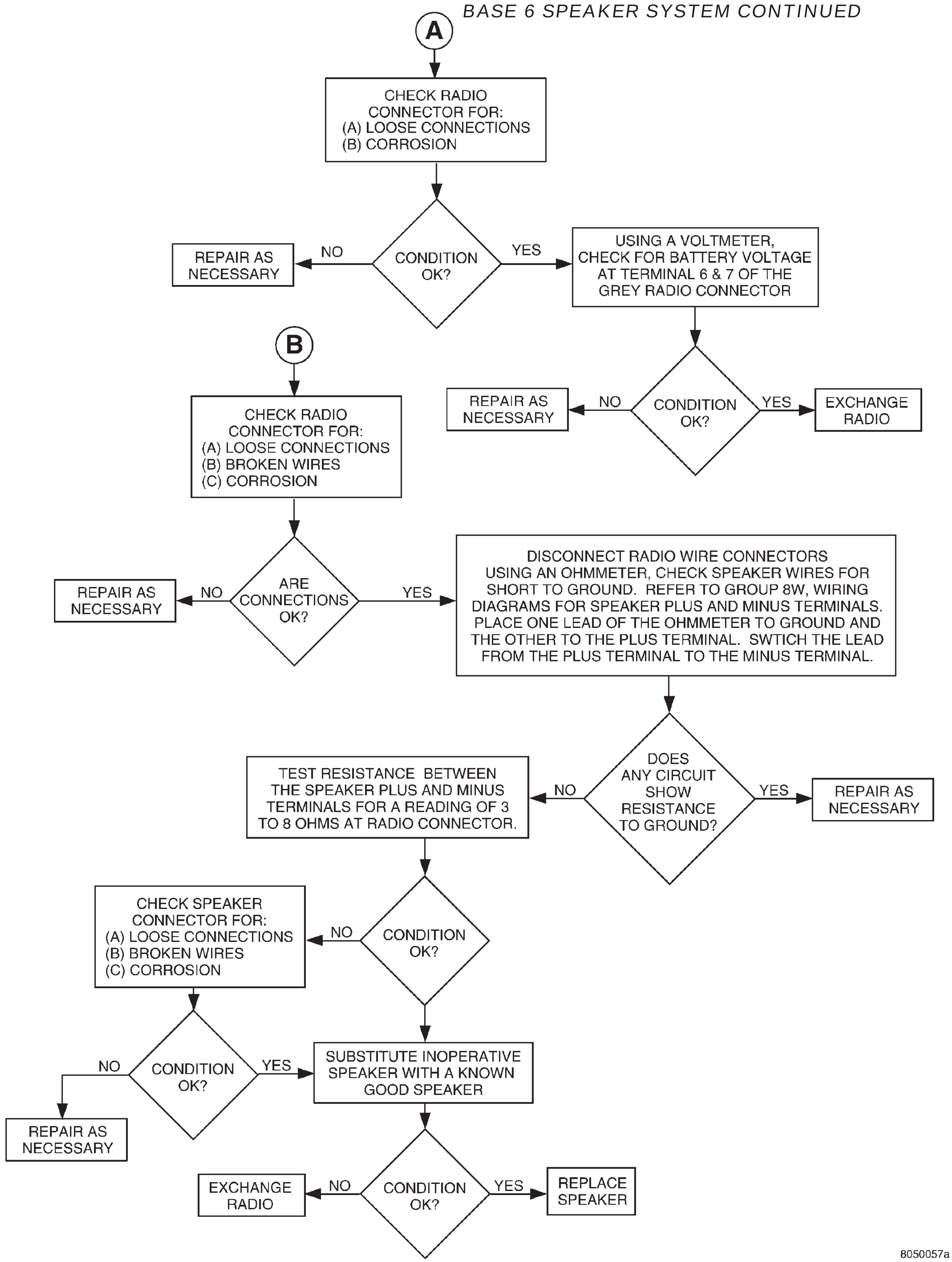


LEGEND:

BLACK	GRAY
1 - AMP ON-OFF SIGNAL/ANT UP SIGNAL	1 - RADIO MUTE
2 - LEFT REAR SPEAKER FEED (+)	2 - LEFT FRONT SPEAKER RETURN (-)
3 - RIGHT REAR SPEAKER FEED (+)	3 - RIGHT FRONT SPEAKER RETURN (-)
4 - LEFT FRONT SPEAKER FEED (+)	4 - MARKER -- (HEAD/PARK LAMPS)
5 - RIGHT FRONT SPEAKER FEED (+)	5 - DIMMER -- (PANEL, LAMPS, VARIABLE)
6 - LEFT REAR SPEAKER RETURN (-)	6 - ACCESSORY -- (SWITCHED B+)
7 - RIGHT REAR SPEAKER RETURN (-)	7 - BATTERY -- (MEMORY)

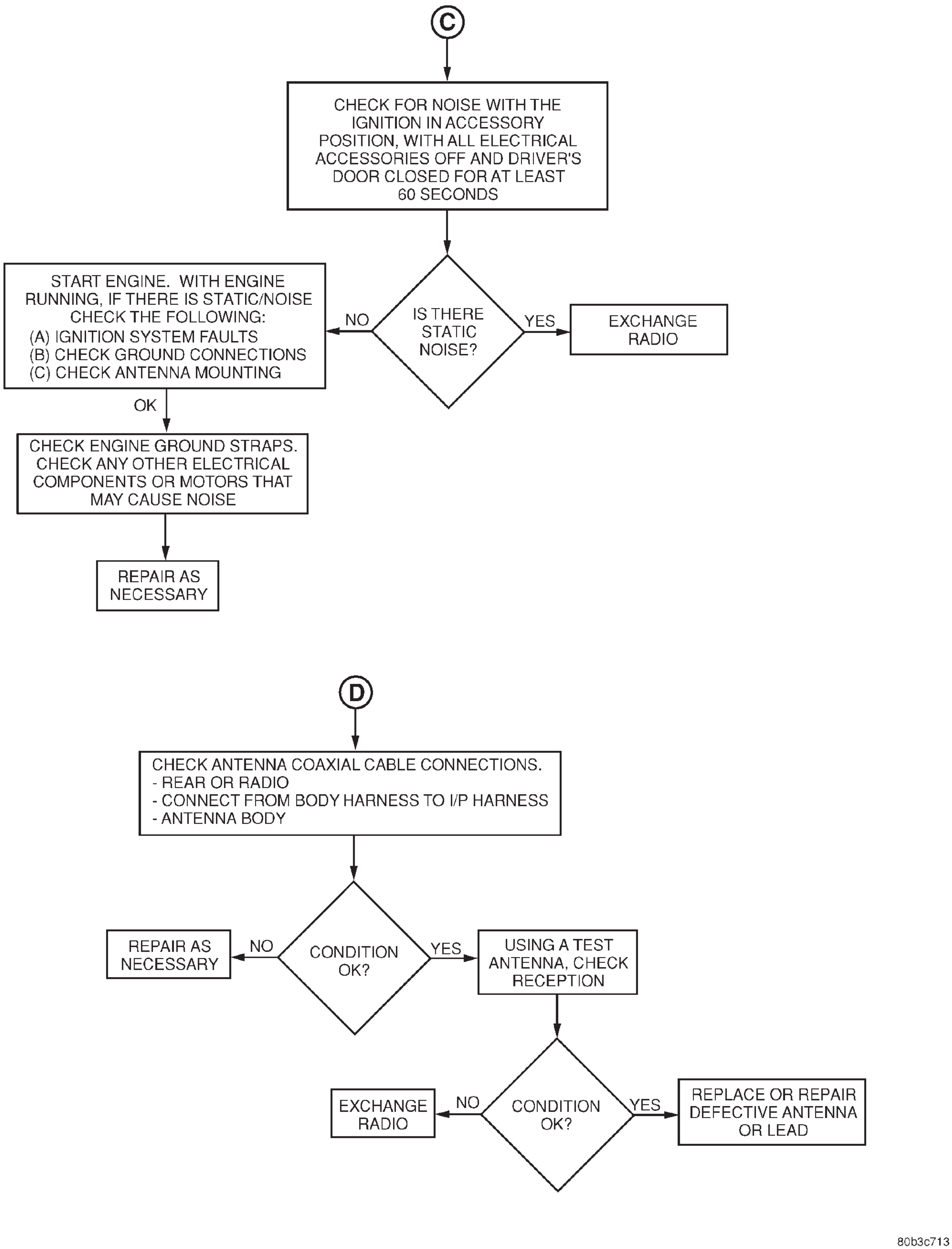


DIAGNOSIS AND TESTING (Continued)

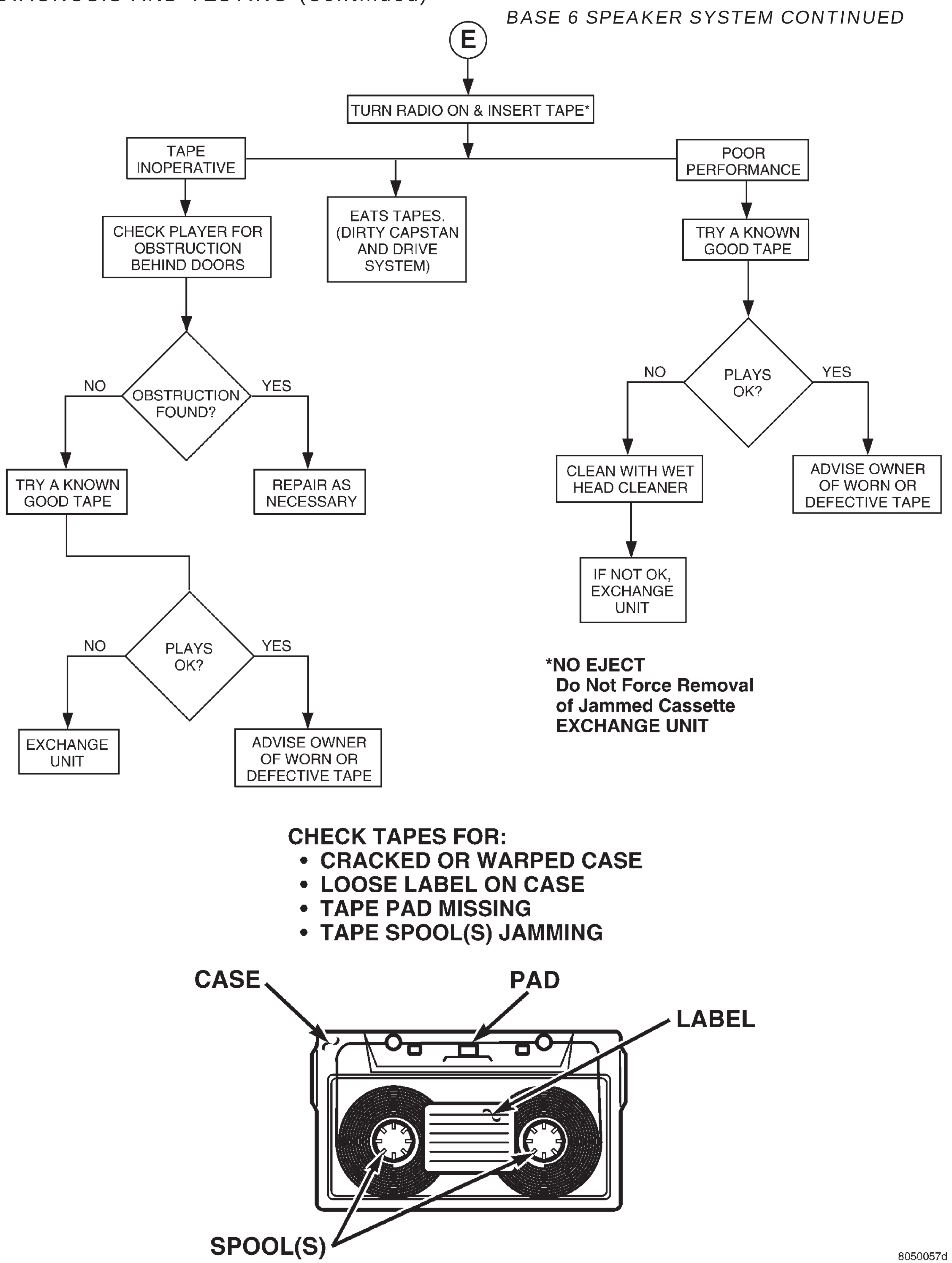


DIAGNOSIS AND TESTING (Continued)

BASE 6 SPEAKER SYSTEM CONTINUED



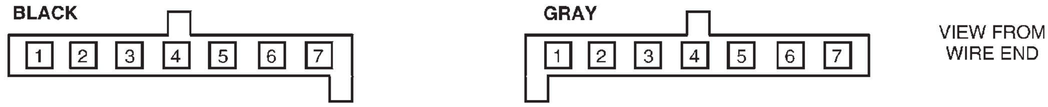
DIAGNOSIS AND TESTING (Continued)



DIAGNOSIS AND TESTING (Continued)

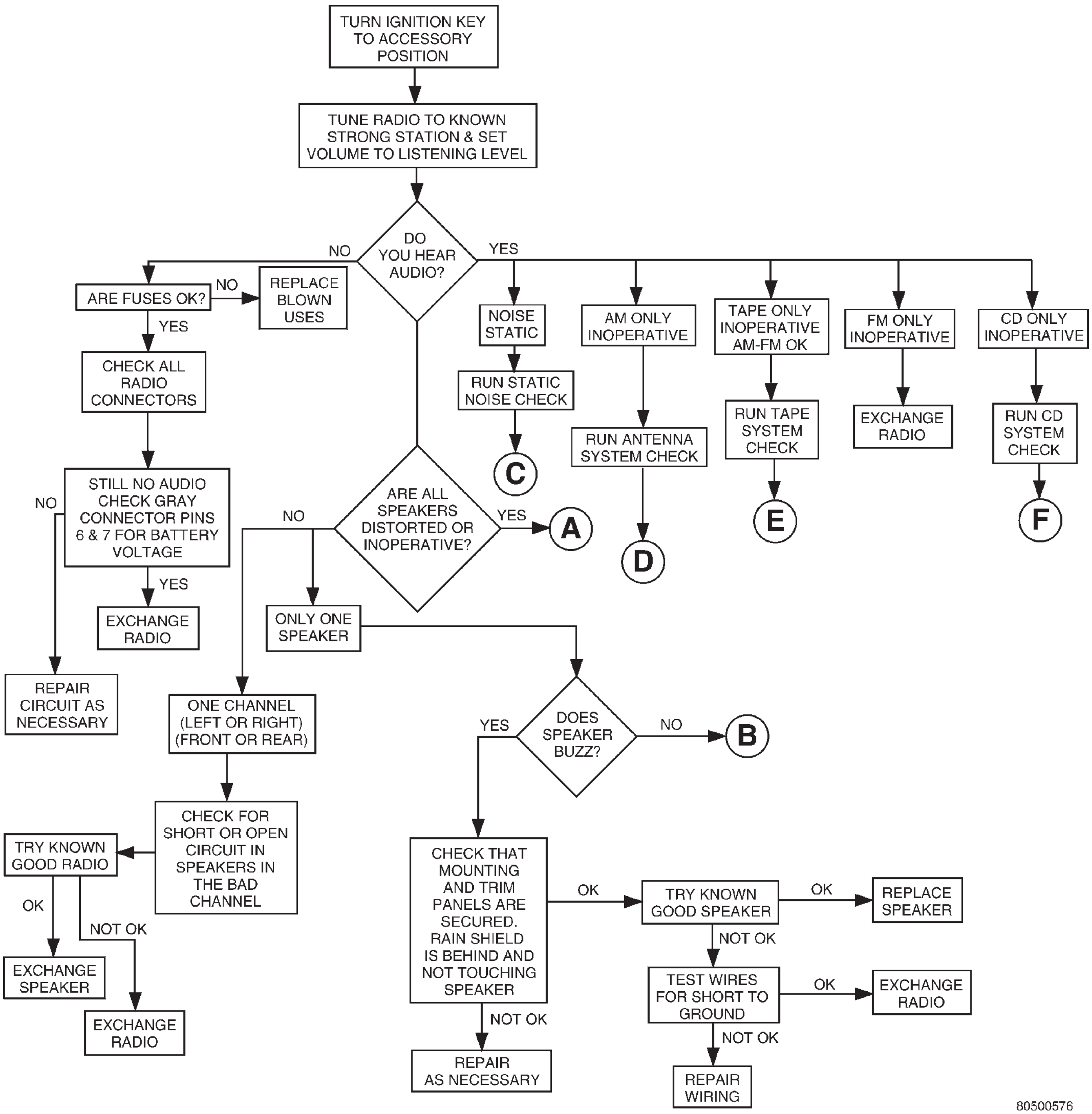
AMPLIFIED

RADIO CONNECTORS

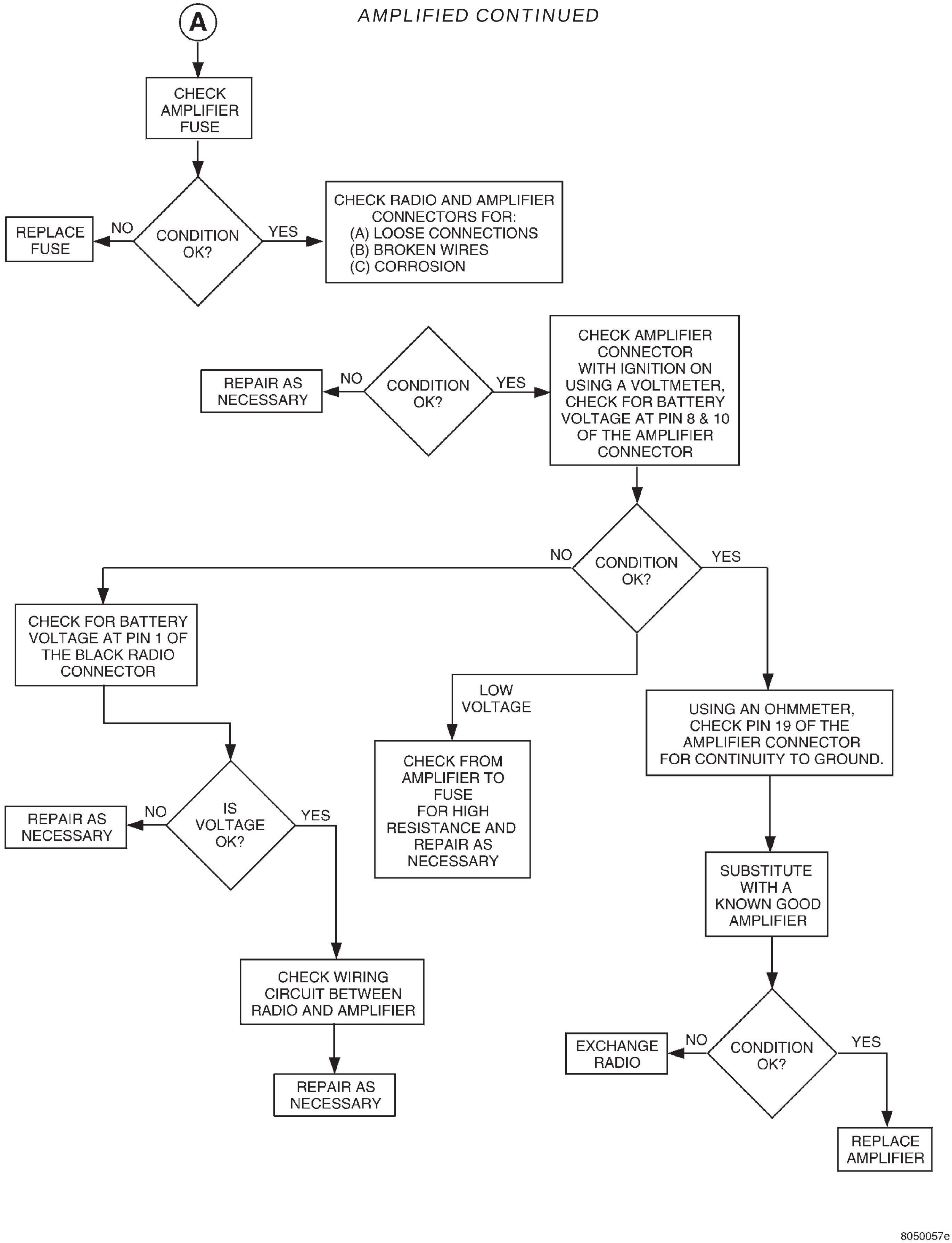


LEGEND:

BLACK	GRAY
1 - AMP ON-OFF SIGNAL/ANT UP SIGNAL	1 - RADIO MUTE
2 - LEFT REAR SPEAKER FEED (+)	2 - LEFT FRONT SPEAKER RETURN (-)
3 - RIGHT REAR SPEAKER FEED (+)	3 - RIGHT FRONT SPEAKER RETURN (-)
4 - LEFT FRONT SPEAKER FEED (+)	4 - MARKER -- (HEAD/PARK LAMPS)
5 - RIGHT FRONT SPEAKER FEED (+)	5 - DIMMER -- (PANEL, LAMPS, VARIABLE)
6 - LEFT REAR SPEAKER RETURN (-)	6 - ACCESSORY -- (SWITCHED B+)
7 - RIGHT REAR SPEAKER RETURN (-)	7 - BATTERY -- (MEMORY)

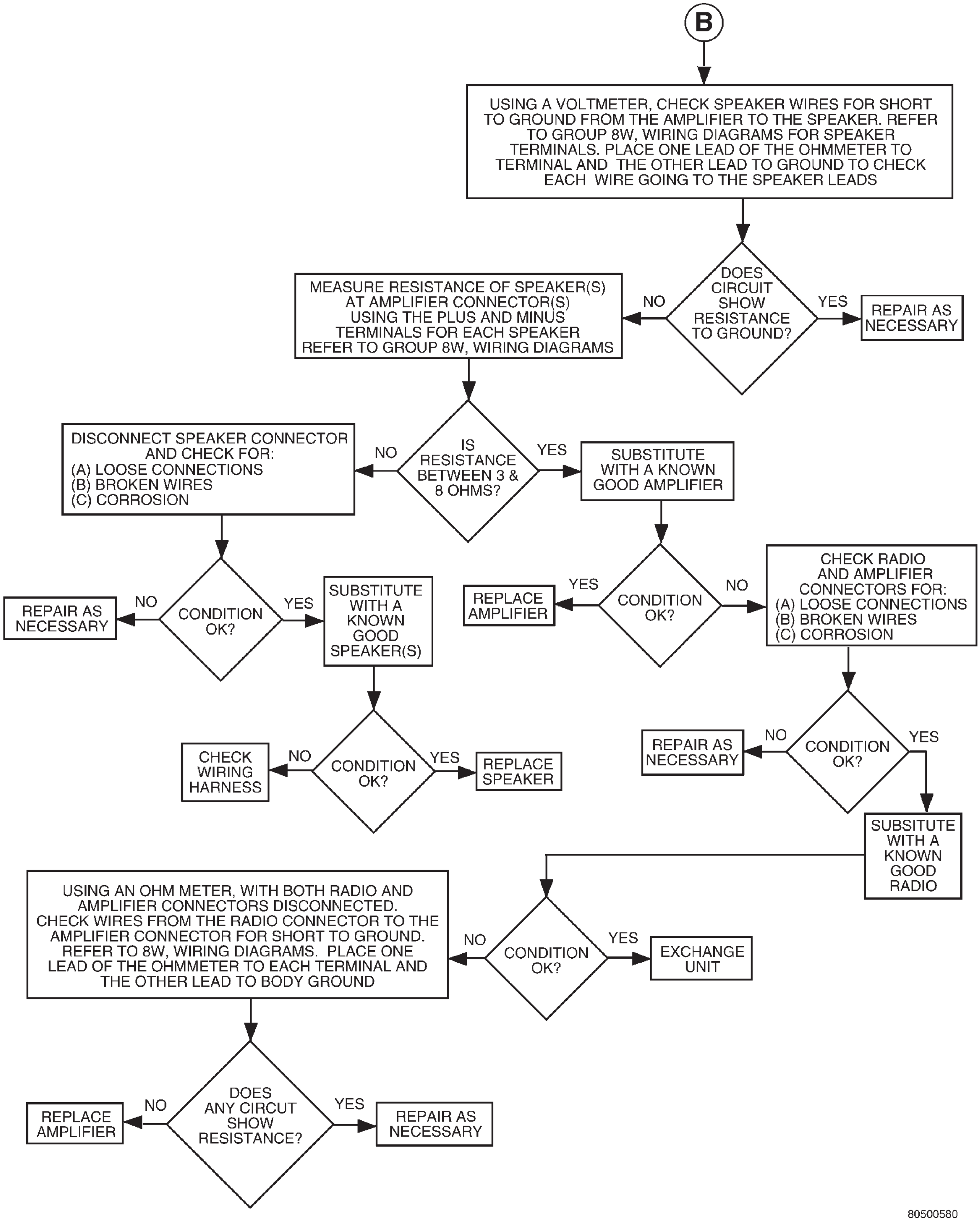


DIAGNOSIS AND TESTING (Continued)



DIAGNOSIS AND TESTING (Continued)

AMPLIFIED CONTINUED



DIAGNOSIS AND TESTING (Continued)

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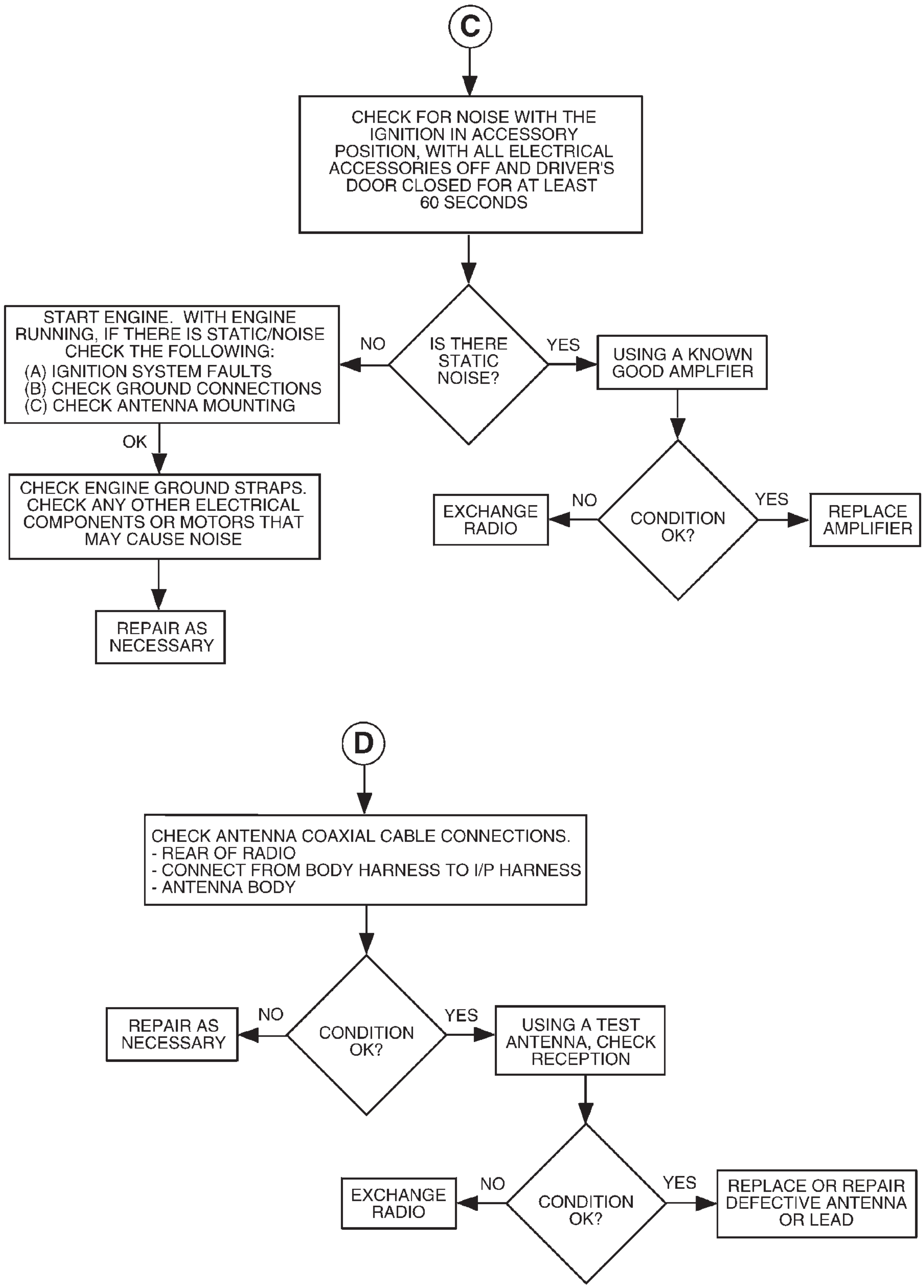

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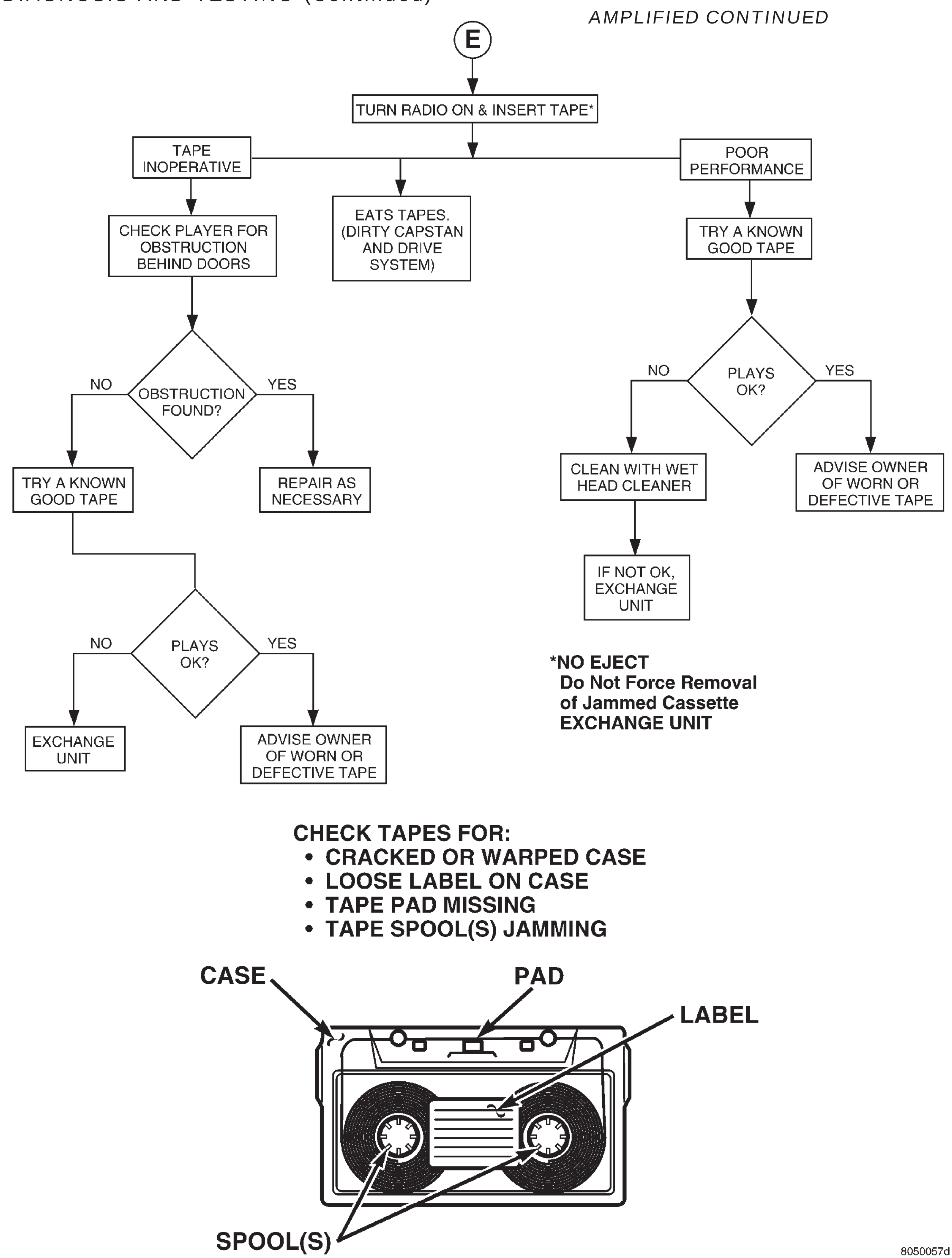
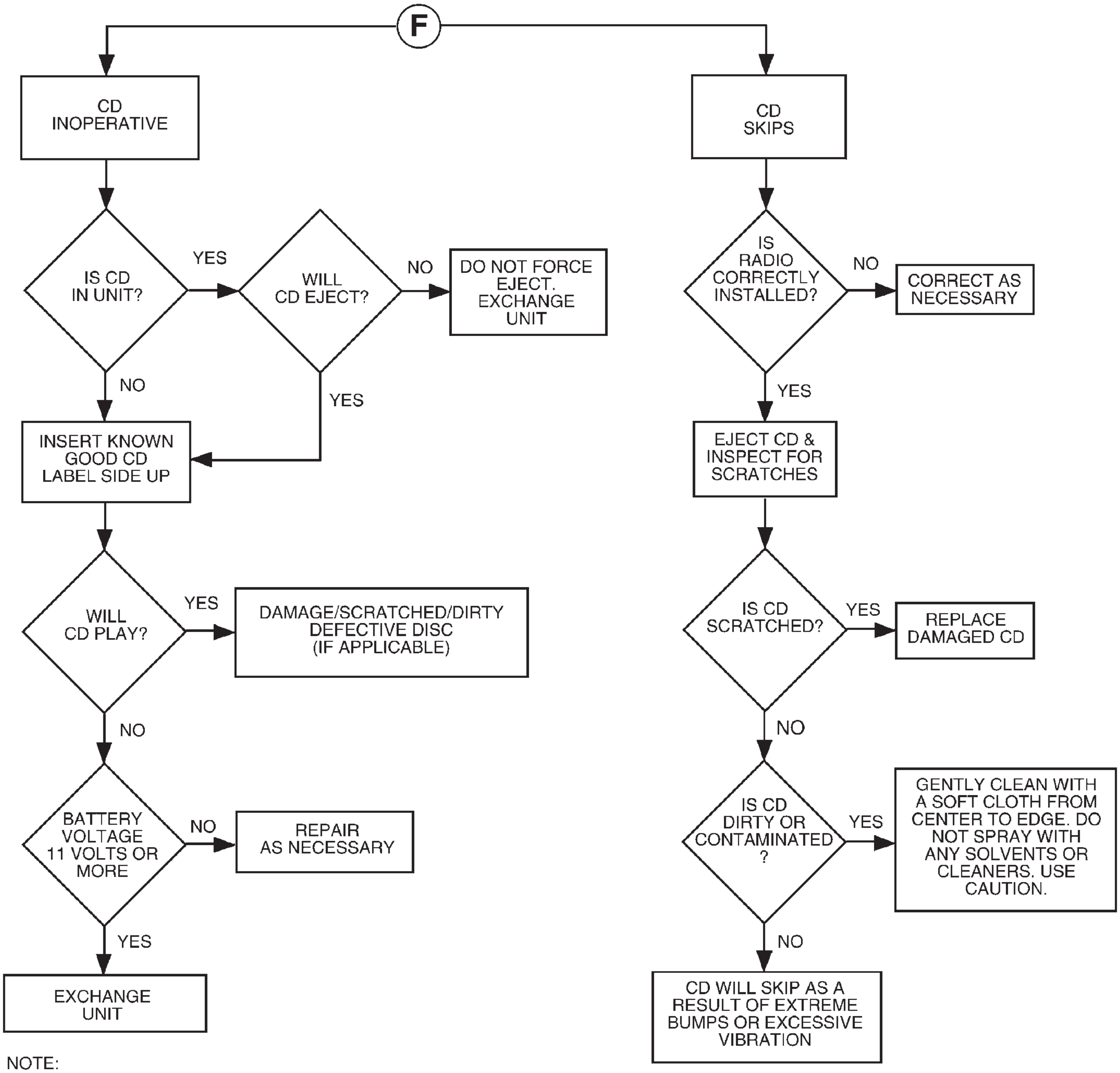
DIAGNOSIS AND TESTING (Continued)



DIAGNOSIS AND TESTING (Continued)

AMPLIFIED CONTINUED



NOTE:
THE CD PLAYER WILL ONLY OPERATE BETWEEN APPROXIMATE TEMPERATURES OF -23°C AND +65°C (-10°F AND +145°F)

80500581

DIAGNOSIS AND TESTING (Continued)

NO BASS FREQUENCIES, HIGH AND MID FREQUENCIES OK

• Check radio for being ON, are the display lights on
• Radio not ON, refer to Radio Diagnosis
• Check fuses, amplifier connectors and wires for proper connection
• Check for good ground
• Check amplifier for battery voltage, and ON/OFF voltage

(1) Battery voltage OK and NO voltage at the ON/OFF terminal, check for short or open in the ON/OFF circuit.

(2) ON/OFF voltage OK, and NO battery voltage, check for short or open in battery circuit.

(3) Prior to replacing amplifier, check fuse to the cigar lighter and horn. If not OK, replace fuse. If fuse blows again, disconnect amplifier B+ wire connector. Refer to Group 8W, Wiring Diagrams for the proper connector.

(4) If fuse still blows, the problem is not the amplifier. If fuse does not blow, replace the amplifier.

(5) If shorted or open circuit, repair as necessary.

MANUAL ANTENNA

Check for short or open circuits with an ohmmeter or continuity light once the antenna cable is disconnected from the radio. The radio coax cable has a connector that connects behind the between passenger seat and console.

(1) Continuity should be present between the antenna mast and radio end pin of antenna cable plug (Fig. 1).

(2) No continuity should be observed or a very high resistance of several megohms between the ground shell of the connector and radio end pin.

(3) Continuity should be observed between the ground shell of the connector and the mounting hardware in the trunk right rear quarter panel

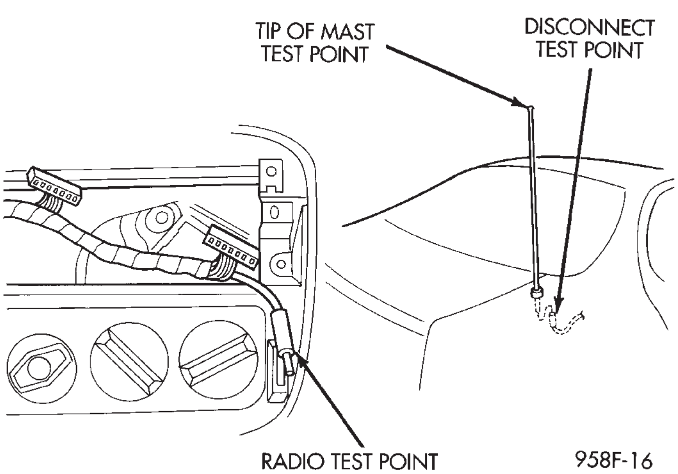


Fig. 1 Antenna Test Points

POWER ANTENNA

(1) To extend antenna, using jumper wires, attach one end to a battery positive source and the other to the red and green wire terminals for up direction. Connect the second lead to a good ground or to the antenna mounting bracket (Fig. 2).

(2) To retract antenna attach the battery positive source to the red wire terminal for the down direction. Connect the second lead to a good ground or to the antenna mounting bracket.

(3) If the motor will not operate, replace the antenna assembly.

(4) If the motor runs freely and the antenna does not extend or retract, the mast or drive assembly is at fault. Remove the mast and verify that all the drive teeth are intact. If not replace mast.

(5) If the mast jumps or travel rate is slow during operation or the motor labors.

(a) Check for bent mast. If bent replace mast.

(b) Check for dirty mast and clean it as necessary. If corroded, replace mast. Do not grease or lubricate antenna mast.

(c) If cleaning the antenna sections does not solve the problem, the antenna mast should be replaced.

(6) If mast fails to extend or retract completely, or motor continued to operate after full extension or retraction of mast. Check for broken teeth on the mast drive rod or bent mast.

(7) If the mast checks good, the antenna assembly should be replaced.

(8) Upon establishing that the fault is in the antenna assembly, it may be traced to one or more of the following conditions:

(a) Broken lead-in wire or shielding.

(b) Grounded lead-in wire or mast.

(c) Moisture in support tube or lead-in assembly.

(d) Poor connection at antenna lead-in assembly or shielding ground.

REMOTE CD CHANGER TEST

CD changer inoperative.

(1) The CD changer receives its power and ground through the radio via the DIN cable. Verify that the radio powers up and functions before proceeding.

(2) With the radio turned ON, check the radio display when pushing the MODE/EJECT button to select the CD mode.

(a) If the display shows - - - -, then insert a CD magazine in the changer.

(b) If the display shows nocd, then insert a CD into the magazine.

(c) If the display shows Err xxxx, then check the Error Message table below.

(d) If the radio only switches between AM and FM turning modes, then perform the following:

DIAGNOSIS AND TESTING (Continued)

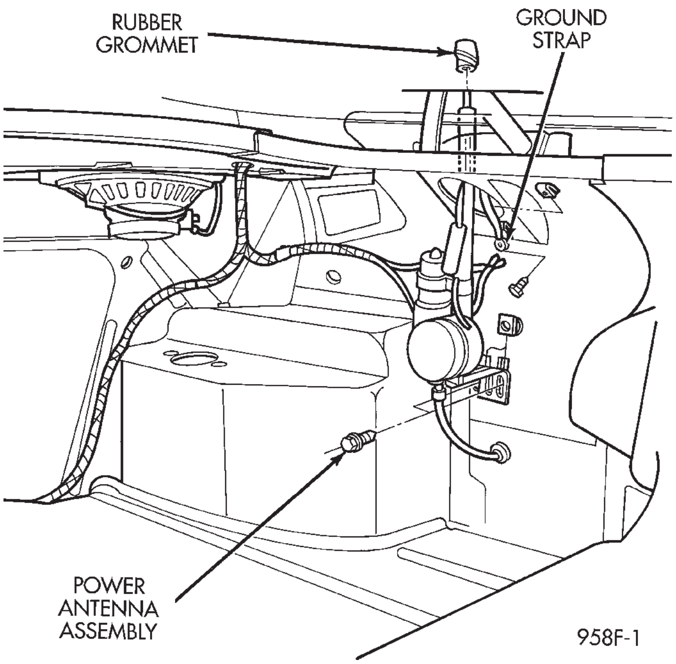


Fig. 2 Power Antenna Assembly

(I) Check the connection of the DIN cable to the CD changer and radio.

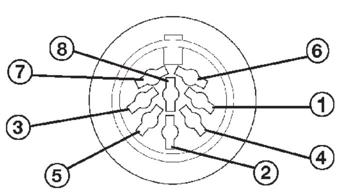
(II) If OK, then check the DIN cable at the CD changer side.

(III) Make sure the DIN cable is connected to the radio and radio is turned ON and operating properly. Check for battery voltage at Pins 6 and 7 using Pin 8 for ground.

(IV) If OK, then replace CD changer.

(V) If not OK, then remove DIN cable from radio and changer. Check DIN cable for continuity from connector to connector, using a ohmmeter on each Pin.

(VI) If the DIN cable OK, then replace the radio.



DIN Cable Connector

DIN CABLE PIN-OUTS

PIN 1	DATA BUS (-)	PIN 5	AUDIO IN (L)
PIN 2	AUDIO GRD	PIN 6	BATTERY
PIN 3	DATA BUS (+)	PIN 7	IGNITION
PIN 4	AUDIO IN (R)	PIN 8	GROUND

ERROR MESSAGES

DISPLAY	EXPLANATION	WHAT TO DO
nocd	No disc or discs in magazine	Load discs in magazine
- - - -	No magazine in player	Load magazine in player
Err HOT	Player overheating	Allow to cool down
Err EE EE	Communication problem	Turn ignition OFF to reset, check cable connection. If OK, replace changer.
Err E-01	Deadlock problem	Replace changer.
Err E-02	Disc eject problem	Replace changer.
Err E-06	Elevator problem	Replace Changer.
Err E-07	Magazine eject problem	Check that the magazine is OK. If OK, replace changer.
Err PLAY	Discs cannot play	Check disc loading, or try another disc. If OK, replace changer.

REMOVAL AND INSTALLATION

DOOR MOUNTED SPEAKER

CAUTION: Do not operate the radio with speaker leads detached. Damage to the output devices may result.

REMOVAL

(1) Remove window crank handle if equipped. Carefully, pry speaker grille away from door trim panel (Fig. 3).

(2) Remove three speaker retaining screws.

(3) Pull speaker away from door and disconnect wiring.

INSTALLATION

For installation, reverse the above procedures. Ensure speaker is in the proper position

REMOVAL AND INSTALLATION (Continued)

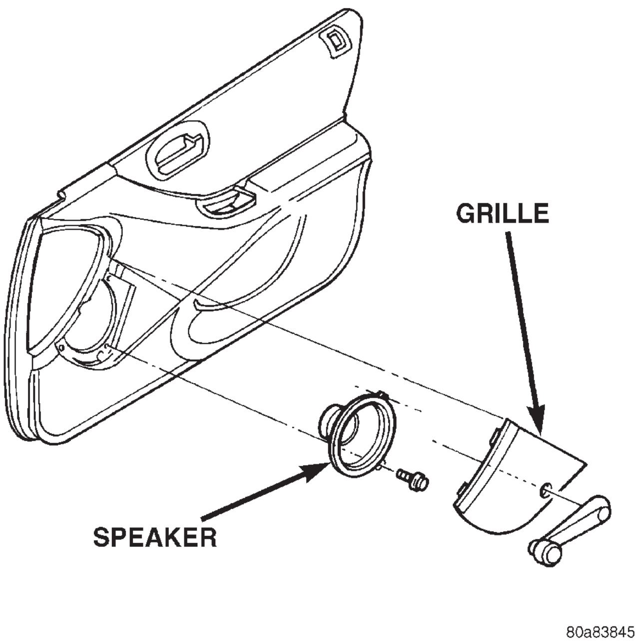


Fig. 3 Door Mounted Speaker

INSTRUMENT PANEL SPEAKER

CAUTION: Do not operate the radio with speaker leads detached. Damage to the output devices may result.

REMOVAL

(1) Remove instrument panel top cover:

(a) Remove screw from right side of the top cover.

(b) Carefully, pry up each end of top cover to disengage clips (Fig. 4).

(c) Lift rear edge of top cover using a trim stick along rear edge.

(d) While lifting rear edge slide top cover rearward to disengage front clips and remove the top cover.

(2) To remove right or left speaker remove two retaining screws. Lift up speaker and disconnect wire connector (Fig. 5).

INSTALLATION

For installation, reverse the above procedures.

MANUAL ANTENNA AND MAST

REMOVAL

(1) Inside trunk, pull the right side trunk liner aside.

(2) Unplug antenna lead from base of antenna body.

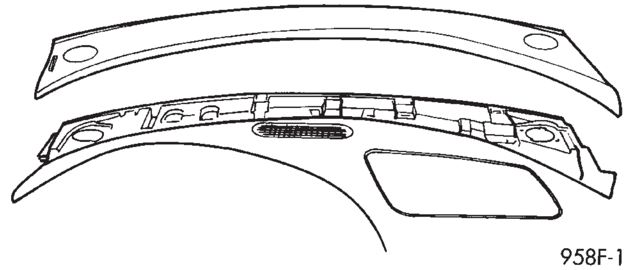


Fig. 4 Instrument Panel Top Cover

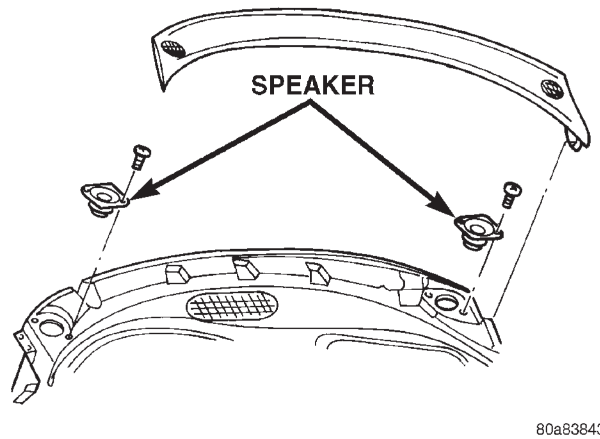


Fig. 5 Instrument Panel Speakers

(3) Remove antenna mast by unscrewing mast from antenna body.

(4) Remove screw from mounting bracket (Fig. 6).

(5) Pull antenna body down through the rubber grommet.

INSTALLATION

For installation, reverse the above procedures. Check that the grommet locating tab is in-line with the slot in the body before installing antenna. Ensure the ball of the antenna body is inside grommet.

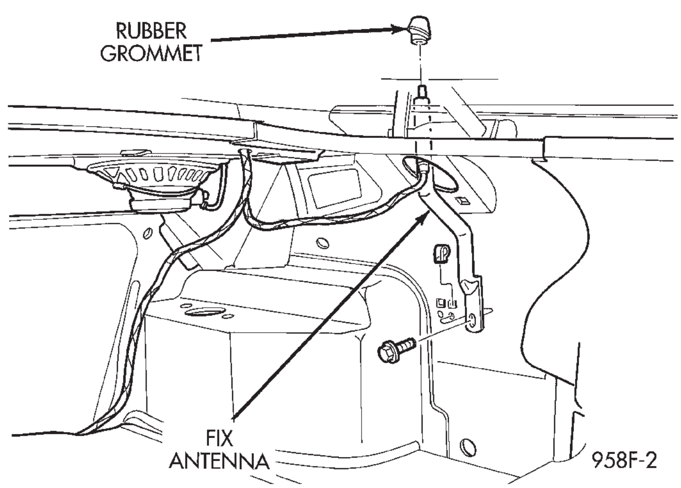


Fig. 6 Antenna Mounting Removal

REMOVAL AND INSTALLATION (Continued)

POWER ANTENNA

REMOVAL

(1) Disconnect battery negative cable.

(2) Inside trunk, pull trunk liner aside.

(3) Unplug antenna lead from pigtail connector, disconnect wire connector, remove drain tube from grommet (Fig. 2).

(4) Remove screws attaching ground strap and antenna brace.

(5) Pull antenna body down through the rubber grommet.

INSTALLATION

For installation, reverse the above procedures. Check that the grommet locating tab is in-line with the slot in the body before installing antenna. Ensure the ball of antenna body is inside grommet. Tighten antenna bracket ground strap screws to 4 N·m (40 in. lbs.) torque.

POWER ANTENNA MAST

REMOVAL

(1) Remove cap nut.

(2) Turn ignition key to ACCESSORY position and turn on radio.

(3) While the mast is moving up pull upward to remove mast, contact spring and drive rod from the mast tube.

INSTALLATION

(1) Insert new drive rod into mast tube with drive teeth toward antenna motor (Fig. 7).

(2) Turn off radio and guide mast into tube. The mast may not be fully lowered when first installed.

(3) Replace the cap nut and tighten to 1.5 N·m (15 in. lbs.) torque.

(4) Turn radio on and off to extend and retract antenna. Mast should be fully lowered after recycling.

RADIO

REMOVAL

(1) Remove center bezel by pulling straight back (Fig. 8).

(2) Remove two radio mounting screws (Fig. 9).

(3) Turn OFF radio and ignition switch. DO NOT disconnect the radio with ignition switch ON.

(4) Pull radio from panel and disconnect wire connectors and antenna lead from radio.

(5) Remove radio.

INSTALLATION

For installation, reverse the above procedure.

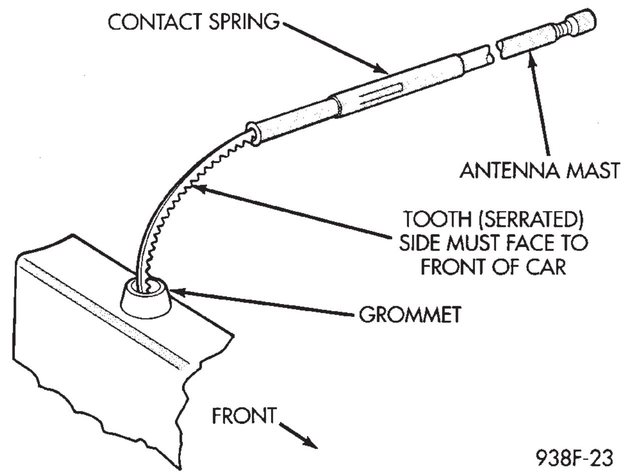


Fig. 7 Power Mast Replacement

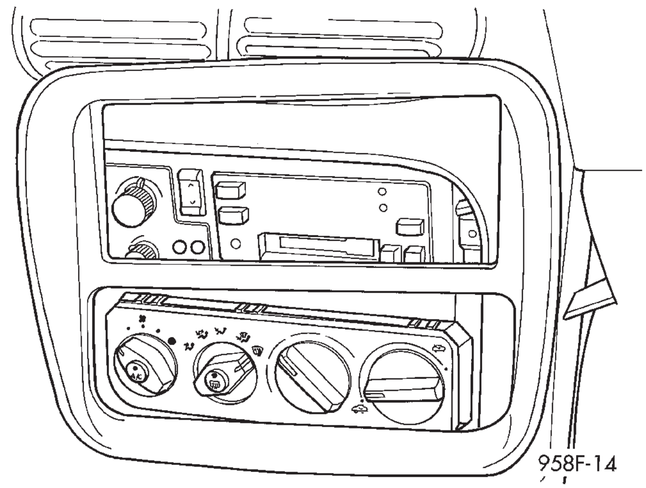


Fig. 8 Center Bezel Removal

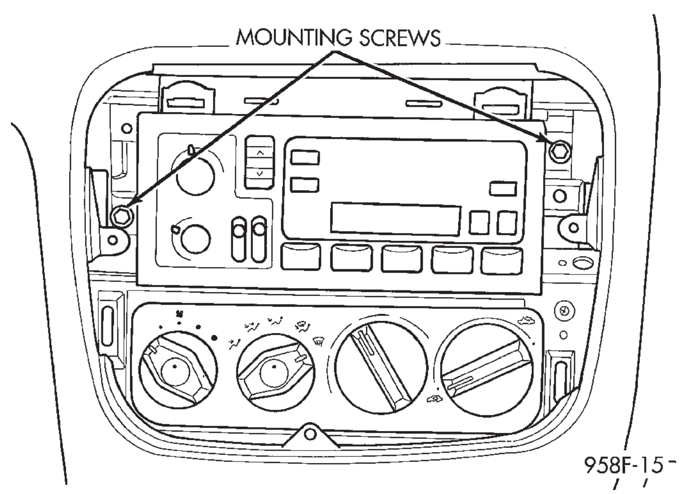


Fig. 9 Radio Assembly

REMOVAL AND INSTALLATION (Continued)

REAR SPEAKER

CAUTION: Do not operate the radio with speaker leads detached. Damage to the output devices may result.

The wire connectors can be accessed through the trunk.

REMOVAL

(1) Remove parcel shelf panel, refer to Group 23, Body.
(2) Remove four retaining screws (Fig. 10).
(3) Disconnect wire connector and remove speaker.

INSTALLATION

For installation, reverse the above procedures. Be sure that the wire connectors are facing outward in vehicle.

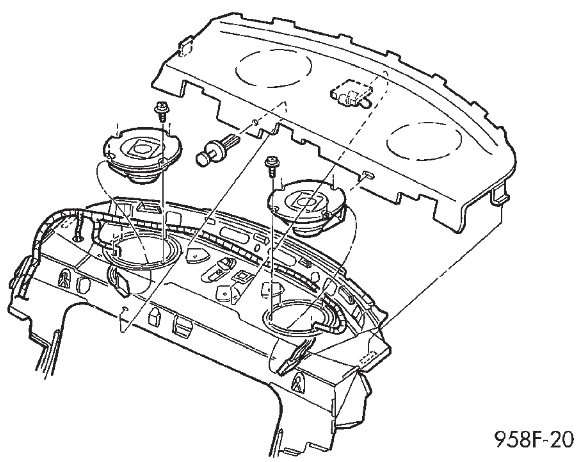


Fig. 10 Rear Speakers

REMOTE AMPLIFIER

REMOVAL

(1) Remove the right front seat.
(2) Remove the two screws and one nut attaching the amplifier (Fig. 11).
(3) Disconnect the electrical connectors and remove.

INSTALLATION

For installation, reverse the above procedures. Tighten fasteners to 4 N·m (40 in. lbs.) torque.

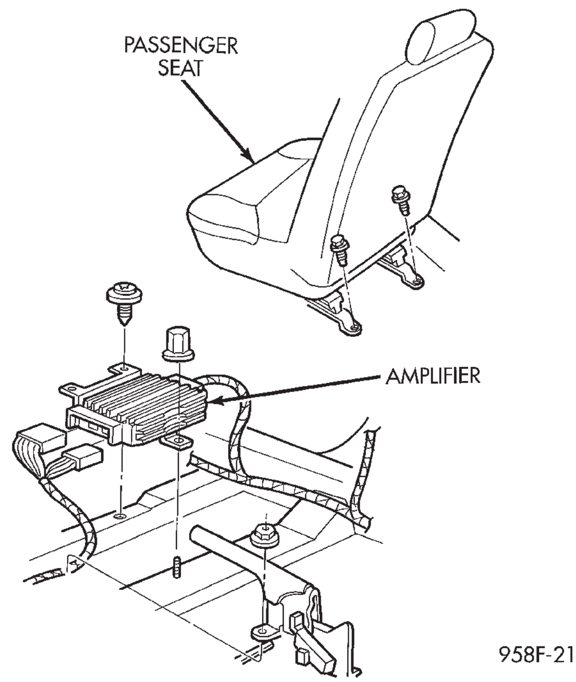


Fig. 11 Amplifier Location

REMOTE CD CHANGER

REMOVAL

(1) Turn ignition switch to the OFF position.
(2) Remove the instrument cluster hood. Refer to Group 8E, Instrument Panel and Systems for removal procedures.
(3) Remove the two CD changer attaching screws located under the HVAC control.
(4) Slide the CD changer/power outlet assembly rearward in the vehicle.
(5) Disconnect CD DIN cable, power outlet, and the light socket assembly wire connectors.
(6) Remove the CD changer.
(7) Remove mounting bracket and power outlet from cd changer. Transfer to new unit if replacing changer.

INSTALLATION

For installation, reverse the above procedure. Be sure to index rear tab on changer mounting bracket into slot in vehicle mounting bracket.

HORNS

CONTENTS

DESCRIPTION AND OPERATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

The horn circuit consists of a horn contact, horn relay, and horns. The horn circuit feed is from the fuse to the horn relay in the Junction Block. When the horn contact is depressed, it completes the ground circuit. Then the horn relay coil closes a set of contacts which allows current to flow to the horns. The horn(s) are grounded at the shock tower. Refer to Group 8W, Wiring Diagrams for horn circuit.

HORN RELAY

The horn relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than on the conventional ISO relay.

The horn relay is a electromechanical device that switches current to the horn when the Driver Airbag Module is depressed. See the Diagnosis and Testing section of this group for more information on the operation of the horn relay.

The horn relay is located in the Junction Block. Refer to the Junction Block label for horn relay identification and location.

If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the Junction Block until further diagnosis is completed. The horn relay cannot be repaired and, if faulty, it must be replaced.

DIAGNOSIS AND TESTING

HORN

(1) Disconnect wire connector at horn.

(2) Using a voltmeter, connect one lead to ground terminal and the other lead to the horn relay output wire terminal (Fig. 1).

(3) Depress the horn switch, battery voltage should be present.

(4) If no voltage, refer to Horn Does Not Sound. If voltage is OK, go to Step 5.

(5) Using ohmmeter, test ground wire for continuity to ground.

(6) If no ground repair as necessary.

(7) If wires test OK and horn does not sound, replace horn.

HORN CONNECTOR PIN CALL-OUT

PIN #	CIRCUIT NAME
1	GROUND
2	HORN RELAY OUTPUT

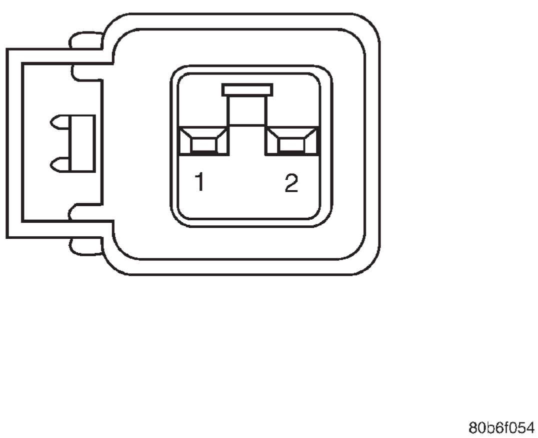


Fig. 1 Horn Connector Pin Call - Out

HORN CONTACT SWITCH

The horn contact consist of,

- A contact switch is mounted between the Driver Airbag Module and steering wheel
- The horn wire is attached to Driver Airbag Module mounting bracket.
- When the Driver Airbag Module is pressed the contact ring touches the bracket mounting bolts and makes contact to ground. The ground signal is carried to the horn relay and horn sounds.

(1) Ground horn wire (Fig. 2).

(2) If horn does not sound, check for corrosion on wire, bracket or airbag contact ring and ensure horn wire is properly connected.

(3) If bracket needs to be replaced, the steering wheel must be replaced. If contact ring is bad the Driver Airbag Module must be replaced.

(4) Refer to Group 8W, Wiring Diagrams if wire circuit needs to be repaired.

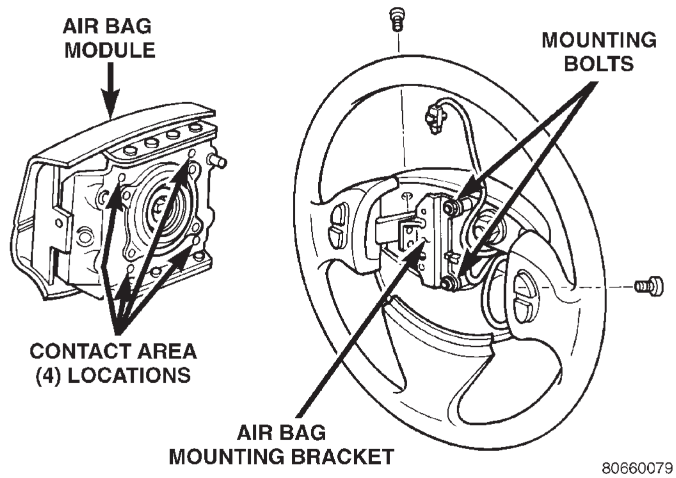


Fig. 2 Horn Contact

HORN RELAY

(1) Remove horn relay from the Junction Block (Fig. 3).

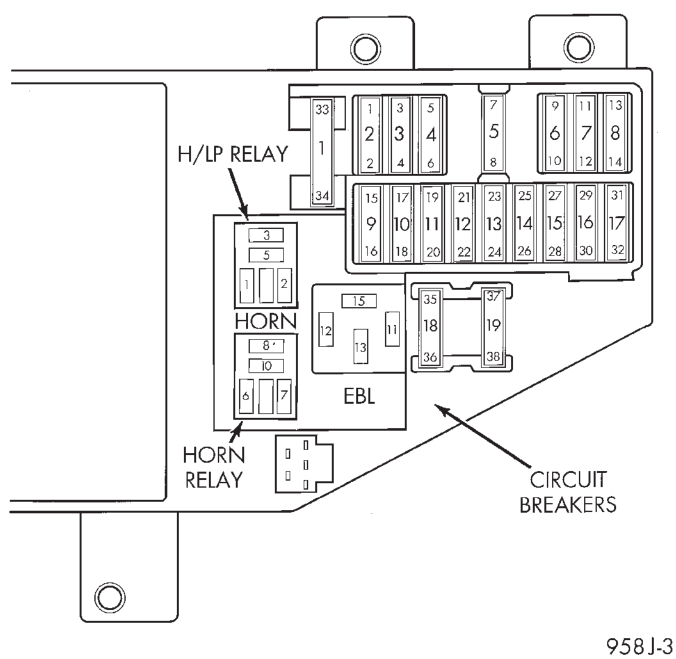


Fig. 3 Horn Relay Location

(2) Using ohmmeter, test between the Junction Block relay terminal 7 and ground for continuity.

DIAGNOSIS AND TESTING (Continued)

(a) When the horn contact is not depressed, no continuity.

(b) Continuity to ground when horn contact is depressed.

(c) If continuity is not correct, repair horn contact or wiring as necessary. Refer to Group 8W, Wiring diagrams.

(3) Insert a jumper wire between terminals 8 and 10 of the horn relay in the Junction Block.

(a) If horns sound replace relay.

(b) If the horns do not sound, install horn relay and refer to Horn Test.

(4) Using voltmeter, test battery voltage:

(a) Test Junction Block horn relay terminals 6 and 8 for voltage from fuse 8.

(b) If not OK, repair as necessary. Refer to Group 8W, Wiring Diagrams.

HORNS WILL NOT SOUND

Check horn fuse 14 in the Power Distribution Center and fuse 8 in the Junction Block. If fuse is blown refer to FUSE BLOWN section. If fuse is OK, refer to FUSE OK section.

FUSE BLOWN

(1) Verify condition of battery terminals and voltage, refer to Group 8A, Battery. If battery connections and battery charge is OK, go to Step 2.

(2) Using a voltmeter, test for battery voltage at both sides of horn fuse 8. If voltage is OK, on both sides of fuse, go to Fuse OK. If voltage is OK, on one side of fuse, the fuse is blown, go to Step 3.

(3) Using a suitable ammeter in place of the fuse, test amperage draw of the horn circuit. If amperage draw is greater than 20 amps without the horn switch depressed, a grounded circuit exists between the fuse and the horn relay. Go to Step 4. If amperage draw is greater than 20 amps with the horn switch depressed, a grounded circuit exists between the horn relay and the horn. Go to Step 6.

(4) Remove the horn relay from the Junction Block. If the amperage draw drops to 0 amps, the horn switch or circuit is shorted. Refer to group 8W, Wiring Diagrams for circuit information. If amperage does not drop go to Step 5.

(5) Disconnect both horns. If amperage does not drop with both horns disconnected and the horn switch depressed, go to Step 7. If the amperage draw drops go to Step 6.

(6) Disconnect the wire connector from one of the horns. If amperage drops and the connected horn sounds, reverse the procedure, and replace the faulty horn.

(7) Using a continuity tester, with the horns disconnected test continuity of the X2 cavity of the horn relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information. If continuity is detected, the circuit is grounded between the Junction Block and the horns. Locate and repair pinched harness. If the amperage draw does not drop to 0 amps, repair short at the Junction Block.

FUSE OK

(1) Remove the horn relay from the Junction Block.

(2) Using a continuity tester, Depress horn switch and test continuity from the X3 cavity of the horn relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information.

(a) If continuity is detected, go to Step 3.

(b) If NO continuity, go to Step 4.

(3) Using a suitable jumper wire, jump across the fuse F62 cavity and the X2 cavity of the horn relay in the Junction Block.

(a) If the horn sounds, replace the horn relay.

(b) If the horn does not sound, go to Step 4.

(4) Remove airbag/horn pad from steering wheel. Refer to Group 8M, Restraint Systems for proper procedures.

(5) Test continuity across horn switch connectors with horn switch depressed.

(a) If continuity is detected, repair open circuit between the relay and the horn switch.

(b) If NO continuity, replace airbag cover.

(6) Install horn relay into Junction Block.

(7) Disconnect the wire connectors from horns.

(8) Using a voltmeter, with the horn switch depressed test voltage across horn connector terminals of the wire harness (Fig. 1).

(a) If voltage is detected, replace horns.

(b) If NO voltage, go to Step 9.

(9) With the horn switch depressed, test for voltage between the X2 circuit and ground.

(a) If voltage OK, repair system ground at right cowl area. Refer to Group 8W, Wiring Diagrams.

(b) If NO voltage, repair open X2 circuit between the relay and the horns.

SYSTEM TEST

CAUTION: Continuous sounding of horns will cause horn relay to fail.

Check fuse 8 in the Junction Block, and refer to Horn System Test table.

Refer to Group 8W, Wiring Diagrams for circuit and wiring information.

DIAGNOSIS AND TESTING (Continued)

HORN SYSTEM TEST

CONDITION	POSSIBLE CAUSE	CORRECTION
HORN SOUNDS CONTINUOUSLY. NOTE: IMMEDIATELY UNPLUG HORN RELAY IN THE JUNCTION BLOCK	(1) FAULTY HORN RELAY. (2) HORN CONTROL CIRCUIT TO RELAY SHORTED TO GROUND. (3) PINCHED HORN SWITCH WIRE UNDER DRIVER AIRBAG MODULE. (4) DEFECTIVE HORN SWITCH	(1) REFER TO HORN RELAY TEST. (2) CHECK HORN RELAY TERMINAL 8 IN THE JUNCTION BLOCK FOR CONTINUITY TO GROUND INDICATES: (A) WIRING HARNESS SHORTED TO GROUND. (B) FIND THE SHORT AND REPAIR AS NECESSARY. (3) REMOVE DRIVER AIRBAG MODULE AND CHECK FOR RUBBING, SHORTED OR LOOSE WIRE CONNECTOR AND REPAIR AS NECESSARY. (4) REPLACE DRIVER AIRBAG MODULE.
HORN SOUND INTERMITTENTLY AS THE STEERING WHEEL IS TURNED.	(1) HORN RELAY CONTROL CIRCUIT X3 IS SHORTED TO GROUND INSIDE STEERING COLUMN OR THE WHEEL. (2) PINCHED HORN SWITCH WIRE UNDER DRIVER AIRBAG MODULE (3) DEFECTIVE HORN SWITCH	(1) REMOVE DRIVER AIRBAG MODULE AND/OR STEERING WHEEL AS NEEDED. CHECK FOR RUBBING OR LOOSE WIRE/CONNECTOR, REPAIR AS NECESSARY. (2) REPLACE DRIVER AIRBAG MODULE. (3) REPLACE DRIVER AIRBAG MODULE.
HORN DOES NOT SOUND	(1) CHECK FUSE 8 IN THE JUNCTION BLOCK. (2) NO VOLTAGE AT HORN RELAY TERMINALS 6 & 8, AND FUSE IS OK. (3) DEFECTIVE OR DAMAGED HORN. (4) DEFECTIVE HORN SWITCH	(1) REPLACE FUSE IF BLOWN AS REPAIR AS NECESSARY. (2) NO VOLTAGE, REPAIR OR REPLACE JUNCTION BLOCK AS NECESSARY. (3) VOLTAGE AT HORN WHEN HORN SWITCH IS PRESSED, REPLACE HORN. (4) REPLACE DRIVER AIRBAG MODULE.
FUSE BLOWS WHEN HORN IS BLOWN	(1) SHORT CIRCUIT IN HORN OR HORN WIRING	(1) REMOVE HORN RELAY, CHECK FOR SHORTED HORN OR HORN WIRING. DISCONNECT HORN WIRE HARNESS TO ISOLATE SHORT AND REPAIR AS NECESSARY.
FUSE BLOWS WITHOUT BLOWING HORN NOTE: FOR WIRING REPAIRS REFER TO GROUP 8W, WIRE DIAGRAMS.	(1) SHORT CIRCUIT	(1) REMOVE RELAY, INSTALL NEW FUSE, IF FUSE DOES NOT BLOW REPLACE HORN RELAY. IF FUSE BLOWS WITH RELAY REMOVED, CHECK FOR SHORT TO GROUND WITH OHMMETER ON CIRCUIT BETWEEN TERMINALS 6 & 8 AND THE FUSE TERMINAL. REPAIR AS NECESSARY.

REMOVAL AND INSTALLATION

HORNS

REMOVAL

(1) Hoist and support front vehicle on safety stands.

(2) The horns are located behind the front fascia on the right front frame rail. Remove the splash shield as necessary for access.

(3) Disconnect the wire connector from the horn.

(4) Remove mount bracket attaching bolt from the front frame rail. Do not remove horn from mounting bracket (Fig. 4).

(5) Remove horn from vehicle.

INSTALLATION

For installation, reverse the above procedures.

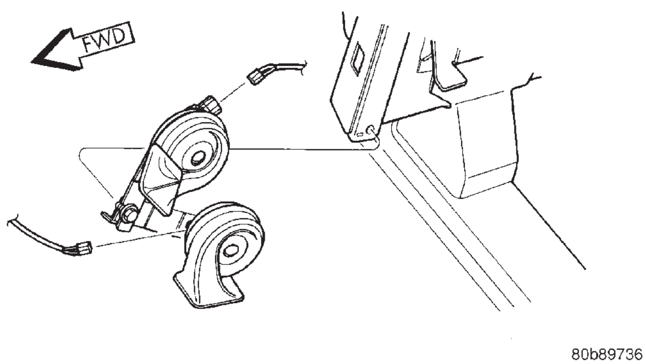


Fig. 4 Horn Location

HORN CONTACT SWITCH

WARNING: BEFORE BEGINNING ANY AIRBAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE CABLE FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate battery negative cable in engine compartment.

(2) Remove the screws that attach the Driver Airbag Module to the steering wheel.

(3) Lift the module to gain access and disconnect the squib wire.

(4) Place Driver Airbag Module on a clean level surface with pad facing upward.

(5) If the contact area is bad, replace Driver Airbag Module. If the mounting bracket or bushings are bad, replace steering wheel.

INSTALLATION

For installation, reverse the above procedures. Use caution not to pinch wires.

HORN RELAY

REMOVAL

(1) Open driver's door and remove instrument panel end cover.

(2) Remove horn relay (Fig. 3).

INSTALLATION

For installation, reverse the above procedures.

VEHICLE SPEED CONTROL SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

SPEED CONTROL SYSTEM

DESCRIPTION

The speed control system is electronically controlled and vacuum operated. The electronic control is integrated into the Powertrain Control Module, located on the left side of the engine compartment next to the air cleaner. The controls are located on the steering wheel and consist of two switches. The ON, OFF, RESUME, ACCEL, SET, COAST, and CANCEL, buttons are located on a spoke of the steering wheel (Fig. 1). For identification and location of the major components (Fig. 2).

The system is designed to operate at speeds above 30 mph (50 km/h).

WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

OPERATION

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 30 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

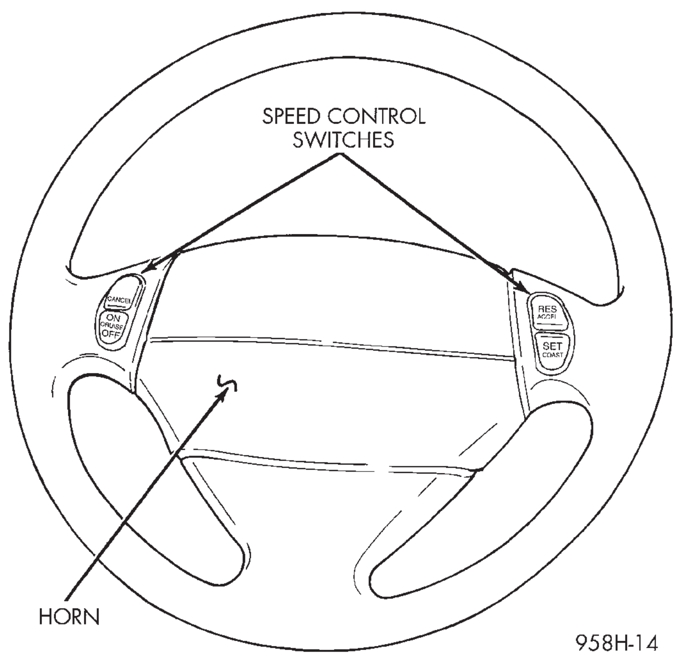


Fig. 1 Speed Control Switch

The speed control can be disengaged manually by:
- Stepping on the brake pedal

DESCRIPTION AND OPERATION (Continued)

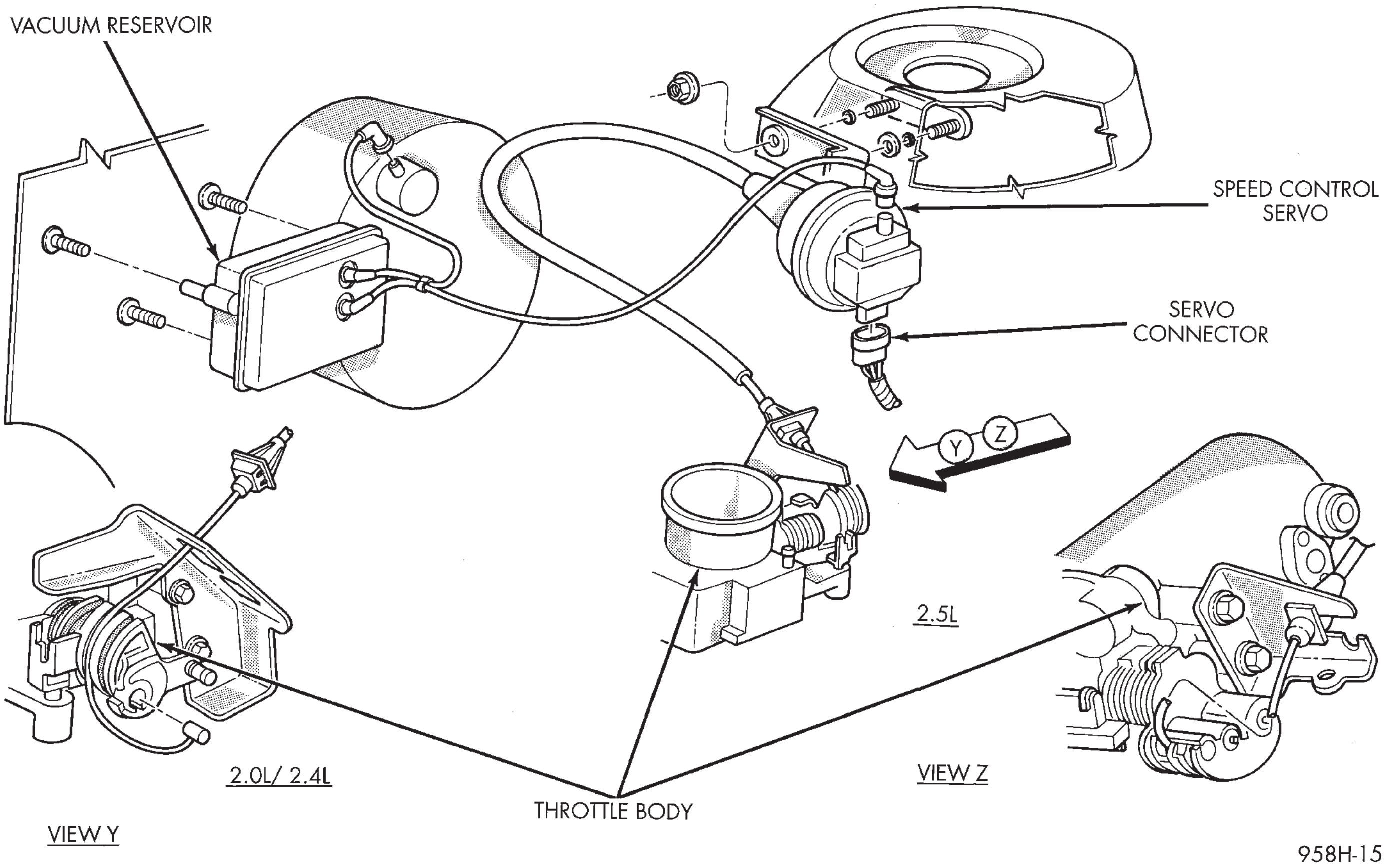


Fig. 2 Speed Control System

- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.

For added safety, the speed control system is programmed to disengaged for any of the following conditions:

- An indication of Park or Neutral
- An rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RESUME switch when speed is greater than 25 mph restores the vehicle to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the ACCEL switch. The new target speed is stored in the PCM when the ACCEL is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACCEL switch. The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST switch until the desired speed is reached, then release the switch.

SPEED CONTROL SERVO

DESCRIPTION

The servo unit consists of a solenoid valve body, and a vacuum chamber.

OPERATION

The PCM controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

DESCRIPTION AND OPERATION (Continued)

SPEED CONTROL SWITCHES

DESCRIPTION

There are two separate switch pods that operate the speed control system.

OPERATION

The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

AUTOMATIC SPEED CONTROL OVERSPEED REDUCTION

OPERATION

Transmission control software includes an automatic speed control overspeed reduction feature. This maintains vehicle speed at the selected set point when descending a grade.

The Transmission Control Module (TCM) first senses that the speed control is set. If the set speed is exceeded by more than 4 mph (6.5 km/hr) and the throttle is closed, the TCM causes the transaxle to downshift to THIRD gear. After downshifting, the automatic speed control resumes normal operation. To ensure that an upshift is appropriate after the set speed is reached, the TCM waits until the speed control system opens the throttle at least 6 degrees before upshifting to OVERDRIVE again.

If the driver applies the brakes, canceling automatic speed control operation with the transaxle still in THIRD gear, the TCM maintains this gear until the driver opens the throttle at least 6 degrees to avoid an inappropriate upshift. The upshift is also delayed for 2.5 seconds after reaching the 6 degrees throttle opening in anticipation that the driver might open the throttle enough to require THIRD gear. This will avoid unnecessary and disturbing transmission cycling. If the automatic speed control RESUME feature is used after braking, the upshift is delayed until the set speed is achieved to reduce cycling and provide better response.

STOP LAMP SWITCH

DESCRIPTION

The switch is mounted on the brake pedal mounting bracket under the instrument panel.

OPERATION

Vehicles equipped with the speed control option use a dual function stop lamp switch. The PCM monitors the state of the dual function stop lamp switch. Refer to the Brake section for more information on stop lamp switch service and adjustment procedures.

SERVO CABLE

DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

OPERATION

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

POWERTRAIN CONTROL MODULE

OPERATION

The speed control electronic control circuitry is integrated into the Powertrain Control Module (PCM). The PCM is located in the engine compartment. The PCM speed control functions are monitored by the On-Board Diagnostics (OBD). All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. The PCM cannot be repaired and must be replaced if faulty.

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW PCM WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

VACUUM RESERVOIR

OPERATION

The reservoir contains a one-way check valve to trap engine vacuum in the reservoir. When engine vacuum drops, as in climbing a grade while driving, the reservoir supplies the vacuum needed to maintain proper speed control operation. The vacuum reservoir cannot be repaired and must be replaced if faulty.

VEHICLE SPEED AND DISTANCE

OPERATION

The 4 speed automatic Transmission Control Module (TCM) supplies the speed input to the PCM. The PCM determines acceleration rates. The speed con-

DESCRIPTION AND OPERATION (Continued)

trol software in the PCM uses vehicle speed and acceleration to control to the set speed.

Vehicles with a 3 speed automatic or manual transmission have a Vehicle Speed Sensor (VSS) mounted to an adapter near the transmission output shaft. The sensor is driven through the adapter by a speedometer pinion gear. The VSS pulse signal is monitored by the PCM to determine vehicle speed and to maintain speed control set speed. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnosis and testing of this component.

DIAGNOSIS AND TESTING

ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to the Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies a surge following a set and the speedometer operates properly see “Overshoot/Undershoot on speed control set”.

If a road test verifies an inoperative system, and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar Multipurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment at both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Conduct electrical test at PCM.
- Failed speed control servo. Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

CHECKING FOR DIAGNOSTIC CODES

When trying to verify a speed control system electronic malfunction: Connect a DRB scan tool if available to the data link connector. The connector is located at left side of the steering column, and at lower edge of the panel.

(1) A speed control malfunction may occur without a diagnostic code being indicated.

For further information and usage of the DRB scan tool and a more complete list of Diagnostic Trouble Code and No Trouble Codes, refer to the Powertrain Diagnostic Manual.

SPEED CONTROL SLOWS DOWN BY ITSELF

Test the vehicle speed sensor/output speed sensor. If sensor fails replace sensor, if it passes perform the following test:

(1) Check for transmission DTC.

(2) Perform the speed control switch test on the DECEL switch, if it fails replace switch.

(3) If the switch passes, conduct the vacuum supply test.

(4) If it passes, conduct the servo vacuum test. If it fails replace servo.

(5) If continuity, replace the PCM.

SPEED CONTROL ELECTRICAL TEST

Electronic speed control systems may be tested using two different methods. One involves use of a DRB. If this test method is desired, refer to the Powertrain Diagnostic Test Procedures for charging and speed control system manual.

The other test method uses a volt/ohm meter. The volt/ohm meter method is described in the following tests.

If any information is needed concerning wiring, refer to Group 8W, Wiring Diagrams.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals, or seals. If these components are damaged, intermittent or complete system failure may occur.

When electrical connections are removed, corrosion should be removed from electrical terminals and a light coating of Mopar Multi-Purpose Grease, or equivalent, applied. Inspect connectors for damage terminals.

A poor connection can cause a complete or intermittent malfunction and is also the only connection in the circuit, that can not be tested. For this reason, a loose connection may be misdiagnosed as a component malfunction.

DIAGNOSIS AND TESTING (Continued)

OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET

If the operator repeatedly presses and releases the set button with their foot off of the accelerator (a "lift foot set" to begin speed control operation), the vehicle may accelerate and exceed the desired set speed by up to 5 MPH (8 km/h) and then decelerate to less than the desired set speed before finally achieving the desired set speed.

The Speed Control has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. When the speed control is set with the vehicle operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts. If the lift foot sets are continually used, the speed control overshoot/undershoot condition will develop.

To "unlearn" the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed with the accelerator pedal (not decelerating or accelerating), and then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. This procedure must be performed approximately 10–15 times to completely unlearn the overshoot/undershoot condition.

SERVO VACUUM TEST

(1) Turn ignition switch to the ON position without starting engine. Activate speed control ON switch.

(2) Disconnect the four-way electrical connector and the vacuum harness at the servo (Fig. 3).

(3) Connect a jumper wire from Pin 3 of the servo to Pin 3 of the wire connector.

(4) Ground Pins 2 and 4 in the servo. Do not connect pin 1.

(5) Connect a hand held vacuum pump to the vacuum nipple and apply 10 - 15 inches of vacuum.

(6) If servo pulls cable, replace servo.

(7) Ground Pin 1 on servo.

(8) Check that the throttle cable pulls in and holds as long as the vacuum pump is connected. After one minute, check if cable is still holding. If cable does not hold replace the servo.

(9) Disconnect jumper from pin 3. Cable should return to rest position. If not, replace servo.

(10) Connect 4 way electrical connector and vacuum harness to servo.

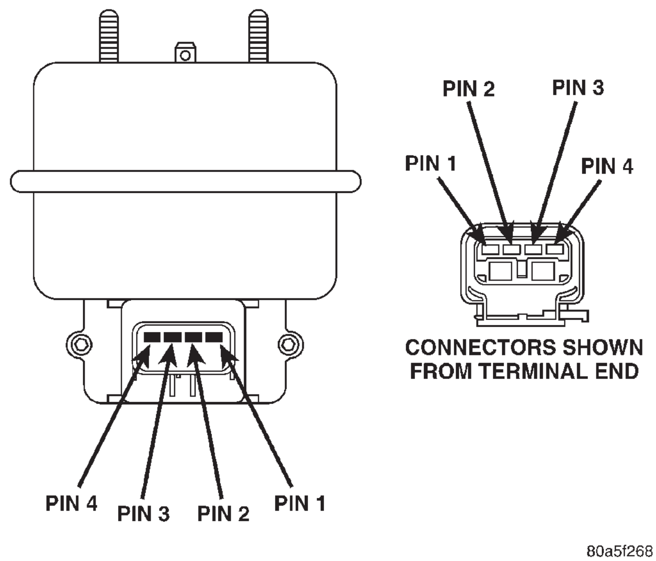


Fig. 3 Servo Harness Connector

SPEED CONTROL SWITCH TEST

Refer to the appropriate Powertrain Diagnostic Manual for switch test values.

STOP LAMP SWITCH TEST

(1) Remove the stop lamp switch refer to Stop Switch Removal/Installation in this section. Disconnect connector from stop lamp switch (Fig. 4). Using an ohmmeter, switch continuity may be checked as follows:

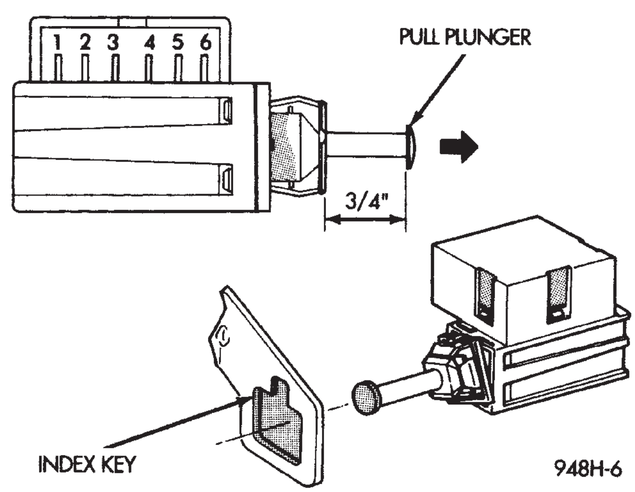


Fig. 4 Stop Lamp Wiring

DIAGNOSIS AND TESTING (Continued)

(2) With switch plunger released, there should be continuity between Pin 5 and Pin 6.

(3) With switch plunger depressed, there should be continuity:

- Between Pin 1 and Pin 2.
- Between Pin 3 and Pin 4.

(4) If the above results are not obtained, the stop lamp switch is defective or out of adjustment.

(5) Stop lamp switch adjustment is detailed in the Brake section.

ELECTRICAL TESTS AT POWERTRAIN CONTROL MODULE

(1) Unplug the GRAY 40-way connector from the Powertrain Control Module (PCM), (Fig. 5).

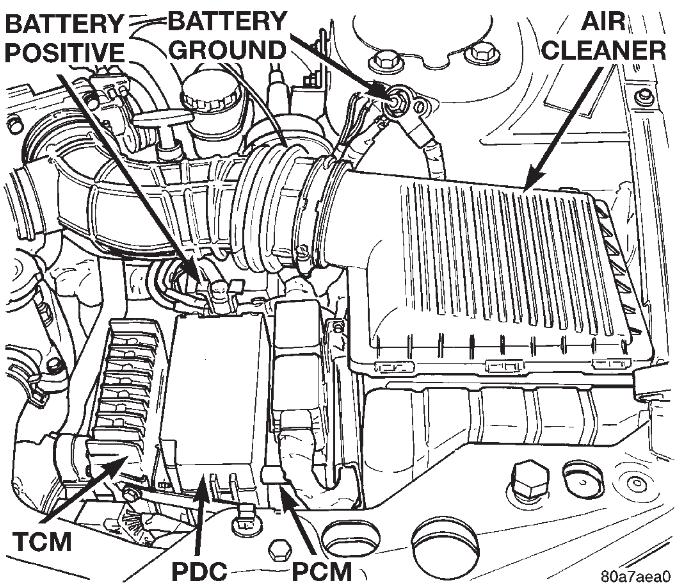


Fig. 5 Powertrain Control Module Location

(2) Remove both steering wheel speed control switches and disconnect the wire connectors.

(a) Using an ohmmeter, check for continuity between cavity 41 of the PCM connector and cavity 1 of each speed control switch connector (Fig. 6).

(b) If no continuity, repair as necessary.

(c) Using an ohmmeter, check for continuity between cavity 41 of the PCM connector and ground.

(d) If continuity, repair as necessary.

(e) If no continuity, perform the Switch Test.

(f) Plug GRAY 40 way connector into PCM.

(g) Plug switch connectors back into switches.

(3) Unplug speed control servo electrical connector.

(4) Place ignition switch in the ON position and turn on the speed control system, for the following tests.

(a) Using a voltmeter, measure voltage from cavity 3 of servo connector to ground. Voltmeter should read ignition voltage. If voltage is low, skip to Step 7.

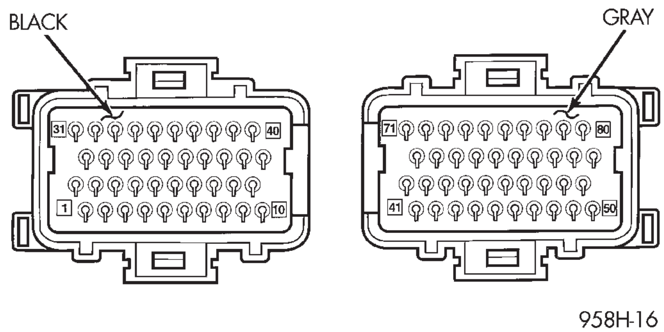


Fig. 6 PCM 40—Way Connectors

(b) Turn speed control and ignition switch OFF. Using an ohmmeter, place positive lead on pin 3 and negative lead on pin 4 on the speed control servo. Check continuity from pin 3 to pin 4.

(c) If no continuity, replace the speed control servo. If continuity is greater than 49 ohms, clean terminals.

(d) Using an ohmmeter, place positive lead on pin 3 and negative lead on pin 2 on the speed control servo. Check continuity from pin 3 to pin 2.

(e) If no continuity, replace the speed control servo. If continuity is greater than 49 ohms, clean terminals.

(f) Using an ohmmeter, place positive lead on pin 3 and negative lead on pin 1 on the speed control servo. Check continuity from pin 3 to pin 1.

(g) If no continuity, replace the speed control servo. If continuity is greater than 49 ohms, clean terminals.

(h) Using an ohmmeter at the servo connector, place positive lead on cavity 4 and negative lead on ground. Check continuity from cavity 4 to ground. If no continuity, repair open circuit

(i) Unplug 2 40-way PCM connectors

(j) Using an ohmmeter, check continuity from cavity 1 of servo connector to cavity 56 on PCM connector. If no continuity, repair open circuit

(k) Using an ohmmeter, check continuity from cavity 1 of servo connector to ground. If continuity, repair as necessary.

(l) If continuity is OK, check continuity from cavity 2 of servo connector to cavity 80 of PCM connector. If no continuity, repair open circuit

(m) Using an ohmmeter, check continuity from cavity 2 of servo connector to ground. If continuity, repair as necessary.

(n) Using an ohmmeter, check continuity from cavity 1 of servo connector to cavity 2 of servo connector. If continuity, repair as necessary.

(o) Reconnect the 4 way connector to servo.

DIAGNOSIS AND TESTING (Continued)

(5) Using an ohmmeter, check continuity from cavity 62 of the PCM connector to ground. If continuity is OK with brake pedal in unpressed position, proceed to Step 6.

(a) If no continuity, perform the Stop Lamp switch test. Replace or adjust switch as required.

(b) If switch passes test, check continuity from cavity 62 of the PCM connector to cavity 1 of the stop lamp switch connector. Repair open circuit as required.

(c) If continuity is OK between cavity 62 and cavity 1, repair open circuit between cavity 2 of the stop lamp switch connector and ground.

(6) Using an ohmmeter, check continuity from cavity 76 on PCM connector to ground with the transmission in park or neutral. If no continuity, test TRS/Park-Neutral switch and switch wiring

(7) Turn speed control and ignition switch OFF.

(8) Unplug the BLACK 40-way connector from the Powertrain Control Module (PCM)

(9) Using an ohmmeter, check continuity from cavity 3 of servo connector to cavity 5 on the PCM connector.

(a) If continuity is OK, replace PCM. Check circuit for short to ground before replacing PCM.

(b) If no continuity, remove stop lamp switch and conduct Stop Lamp Switch Test. If test fails, adjust or replace as necessary.

(c) If switch passes, measure continuity from cavity 4 of stop lamp switch connector to cavity 3 of servo connector. Repair open circuit if necessary.

(d) If continuity is OK, measure continuity from cavity 3 of stop lamp switch to cavity 5 of PCM connector. Repair open circuit as necessary.

(e) Install PCM connectors onto PCM and speed control servo connector to servo.

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at the servo and install a vacuum gauge in the hose (Fig. 7).

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury. Shut off engine, the vacuum should continue to hold 10 inches of mercury.

(3) If vacuum does not meet this requirement, check and correct the following vacuum leaks in the vacuum lines, check valve, vacuum reservoir or poor engine performance.

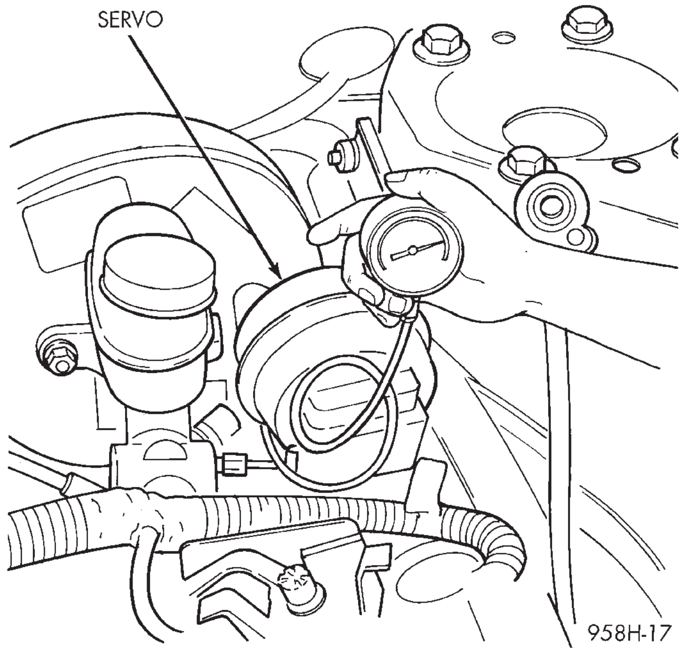


Fig. 7 Vacuum Gauge Test

VEHICLE SPEED SIGNAL

For diagnosis and testing of the Vehicle Speed Signal (VSS), refer to the appropriate Powertrain Diagnostic Procedures service manual. Also refer to the DRB scan tool.

REMOVAL AND INSTALLATION

SERVO

REMOVAL

(1) Remove two nuts attaching speed control cable and mounting bracket to servo.

(2) Remove servo from the mounting bracket.

(3) Disconnect electrical connectors and vacuum hose.

(4) Remove cable from thottle cam. Refer to Speed Control Servo Cable Removal/Installation in this section.

(5) Remove clip attaching cable to servo.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install servo cable to servo and install clip.

(2) Install speed control cable to throttle cam.

(3) Connect vacuum hose to servo.

(4) Connect electrical connector.

(5) Insert servo studs through holes in speed control cable and mounting bracket.

(6) Install nuts, tighten to 7 N·m (60 in. lbs.).

SPEED CONTROL SWITCH

The speed control switches are mounted in the steering wheel and wired through the clock spring device under the airbag module (Fig. 1).

WARNING: IF REMOVAL OF AIRBAG MODULE IS NECESSARY, REFER TO THE RESTRAINT SYSTEMS.

REMOVAL

(1) Turn off ignition.

(2) Remove two screws from side of each switch.

(3) Rock switch away from airbag and steering wheel.

(4) Disconnect two-way electrical connector.

(5) Repeat for the other switch.

INSTALLATION

(1) Install switches.

(2) Connect two-way electrical connector.

(3) Install two screws to the side of each switch.

(4) Install airbag, refer to the Restraint Systems

STOP LAMP SWITCH

REMOVAL

Remove the switch from the bracket by depressing the brake pedal and rotating the switch in a counterclockwise direction approximately 30 degrees. Pull the switch rearward and remove from bracket. Disconnect wiring harness connector.

INSTALLATION

Before installing the switch, reset the adjustable switch plunger by pulling on the plunger head until the plunger reaches the end of its travel. A ratcheting sound will be heard during this procedure.

Connect the wiring harness to the switch. Mount the switch into the bracket by holding the switch with the plunger facing forward in car. There is an index key on the switch that mates with the bracket slot at the top of the square hole. Align key and push switch into square hole in bracket while depressing the brake pedal. Once the switch is seated in the hole, rotate clockwise approximately 30 degrees to lock into place. The switch will automatically adjust when the pedal is released. Pull back on the pedal to assure correct adjustment.

SPEED CONTROL SERVO CABLE

REMOVAL

(1) Remove throttle control shield, if equipped (Fig. 8).

(2) Remove throttle cable clasp from the throttle body cam.

(3) Remove speed control cable from throttle cam by sliding clasp out hole used for throttle cable.

(4) Compress the retaining tabs on the cable and slide cable out of bracket.

(5) Remove 2 nuts retaining bracket to servo.

(6) Remove retaining clip holding cable to servo.

INSTALLATION

(1) Install retaining clip to cable at servo.

(2) Slide cable bell housing over servo mounting studs.

(3) Install 2 nuts at cable to servo and servo bracket, tighten to 7 N·m (60 ins. lbs.).

(4) Slide cable into throttle cable bracket and engage retaining tabs.

(5) Rotate the throttle cam forward to the wide open position and install speed control cable clasp.

REMOVAL AND INSTALLATION (Continued)

(6) Rotate the throttle cam forward to the wide open position and install throttle cable clasp.

(7) Install throttle control shield, if equipped.

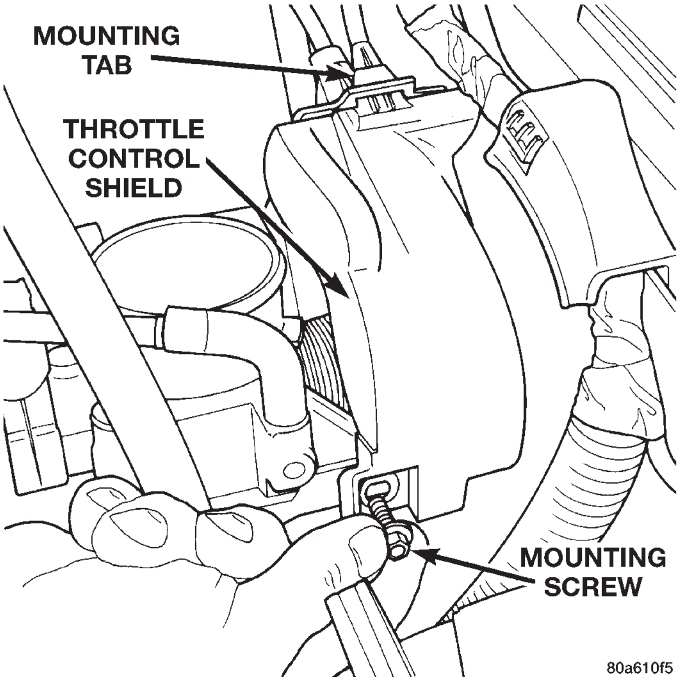


Fig. 8 Throttle Control Shield

VACUUM RESERVOIR

The vacuum reservoir is located on the dash panel next to the brake booster.

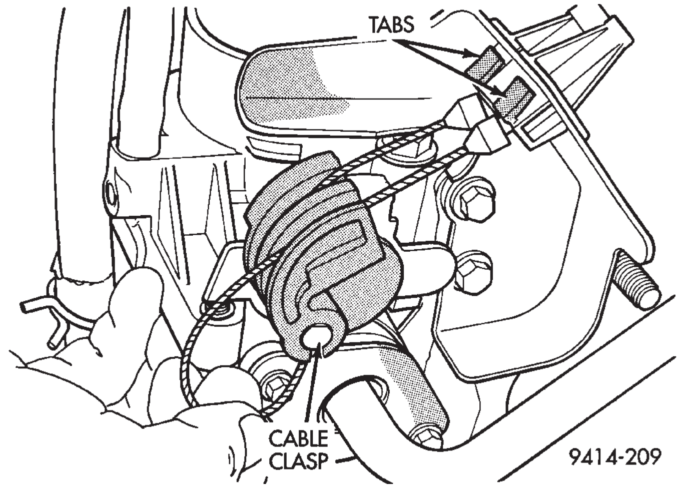


Fig. 9 Disconnecting Throttle Cable—Typical

REMOVAL

(1) **2.5L ONLY** Remove the intake manifold, refer to the Engine section.

(2) Disconnect vacuum hoses from reservoir.

(3) Pull vacuum reservoir from dash panel.

INSTALLATION

(1) Push reservoir onto dash panel.

(2) Connect hoses to reservoir.

(3) **2.5L ONLY** Install intake manifold, refer to the Engine section.

TURN SIGNAL AND FLASHERS

CONTENTS

GENERAL INFORMATION

MULTI-FUNCTION SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR AIRBAG REMOVAL PROCEDURES.

The multi-function switch (Fig. 1) contains:
- Turn signals
- Hazard warning
- Headlamps
- Headlamp beam select
- Parking lamps
- Panel dimmer
- Fog Lamp
- Headlamp optical horn
- Windshield wiper
- Pulse wipe
- Mist wipe
- Windshield washer switches.

The multi-function switch is mounted center of the steering column. There are two levers, one on each side of the steering column. The left side controls the signaling and lighting. The right side controls the windshield wiper and washer system. When the driver wishes to signal his intentions to change direction of travel, he moves the left lever upward to cause the right signals to flash and downward to cause the left signals to flash. After completion of a turn the system is deactivated automatically. As the steering wheel returns to the straight ahead position the turn signals are canceled. A canceling cam is molded to the clockspring mechanism which comes in contact with the cancel actuator on the multi-function switch. The canceling cam lobe pushes on the cancel actuator and returns the switch to the off position.

If only momentary signaling such as indication of a lane change is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the OFF position as soon as the lever is released.

When the system is activated, one of two indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating. The windshield wiper and wash system is covered in Group 8K, Windshield Wipers and Washers.

DESCRIPTION AND OPERATION

COMBINATION FLASHER

The turn signal flasher and the hazard warning flasher are combined into one unit called a combination flasher (combo-flasher). An inoperative or incomplete turn signal circuit will result in an increase in flasher speed.

The flasher is mounted to the back side of the multi-function switch.

EXTERIOR LAMPS

To turn lamps ON:

- Parking lamps, using left stalk turn headlamp switch to the first detent
- Headlamps, turn switch to second detent
- Headlamp beam select, from low beam to high beam or high to low, pull left stalk towards steering wheel. The ignition switch must be in the RUN position for the instrument panel high beam indicator to light.
- Headlamp optical horn, pull left stalk towards steering wheel, headlamps will stay ON as long as stalk is held.
- Fog lamps, pull switch outward with headlamps on low beam
- Panel dimmer, rotating dimmer switch regulates density of the instrument panel illumination. There

DESCRIPTION AND OPERATION (Continued)

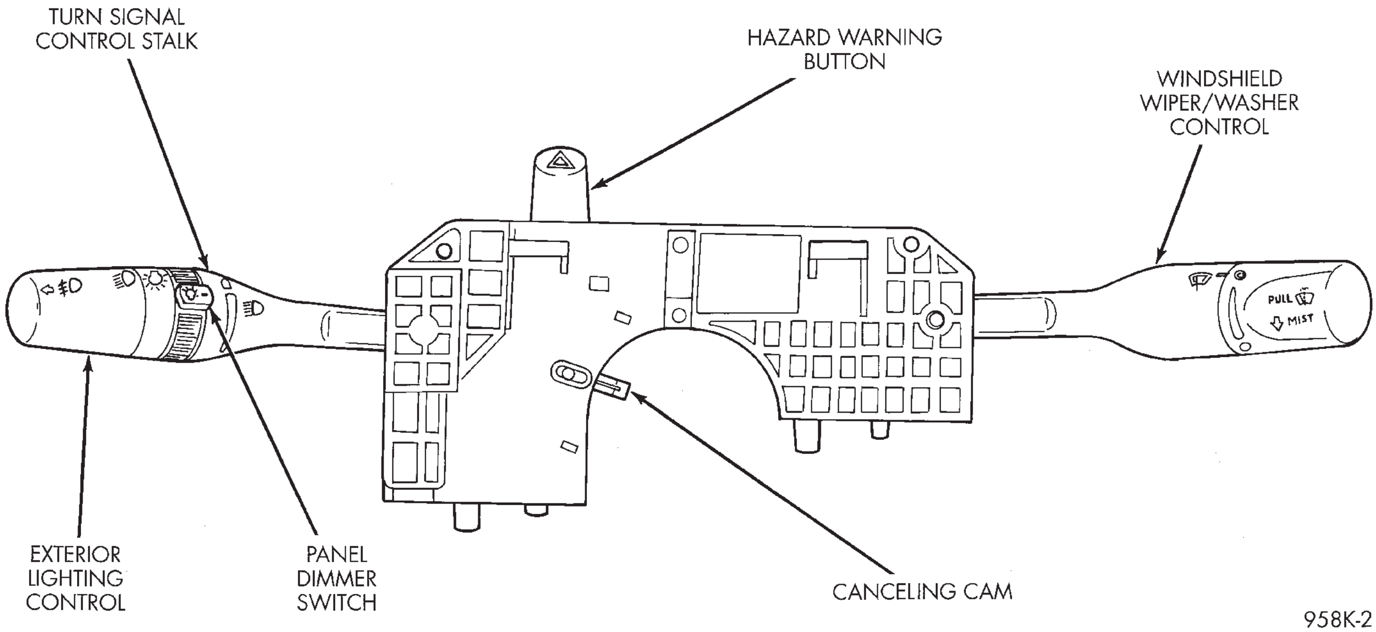


Fig. 1 Multi-Function Switch

are nine detentes (steps) of density. Detent 1 is full brightness and each detent thereafter is lower. Testing the dimmer switch using the continuity test, the resistance value is measured for each detent. Detents 3 through 8 are measured in equal graduations, up or down and referred to as linear. Example: if detent 3 was 5 ohms and detent 4 was 7 ohms detent 5 should be 9 ohms.

HAZARD WARNING SYSTEM

The hazard warning system is actuated by a push button located on the top of the steering column between the steering wheel and the instrument panel. The hazard switch is identified with a double triangle on top of the button. Push and release the button to turn the hazard function ON or OFF. The button will move out from the steering column in the ON position and will remain in toward the column in the OFF position.

DIAGNOSIS AND TESTING

COMBINATION FLASHER

For combination flasher Diagnosis and Testing, refer to the Combination Flasher Diagnosis table.

COMBINATION FLASHER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
SYSTEM DOES NOT FLASH ON ONE SIDE, INDICATOR LAMP FLASHES AT DOUBLE NORMAL RATE.	1) FAULTY EXTERNAL LAMP. 2) POOR GROUND AT LAMP. 3) OPEN CIRCUIT IN WIRING TO EXTERNAL LAMP. 4) FAULTY CONTACT ON SWITCH.	1) REPLACE LAMP. 2) CHECK AND/OR REPLACE WIRING. 3) REPLACE WIRING HARNESS. CHECK CONNECTORS. 4) REPLACE MULTIFUNCTION SWITCH.
INDICATOR LAMP FLASHES AT DOUBLE THE NORNAL RATE. EXTERNAL LAMP-DIM AND FLASHES RAPIDLY OR NO FLASH	1) LOOSE OR CORRODED EXTERNAL LAMP CONNECTION. 2) POOR GROUND CIRCUIT OR EXTERNAL LAMP.	1) REPLACE SOCKET/HARNESS. 2) REPLACE WIRING/HARNESS. CHECK CONNECTORS.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HAZARD WARNING MALFUNCTION/SYSTEM DOES NOT FLASH	1) FAULTY FUSE. 2) FAULTY FLASHER. 3) OPEN CIRCUIT IN FEED WIRE TO SWITCH. 4) FAULTY CONTACT IN SWITCH. 5) OPEN OR GROUNDED CIRCUIT IN WIRING TO EXTERNAL LAMPS.	1) REPLACE FUSE. 2) REPLACE FLASHER. 3) REPLACE WIRING/HARNESS. CHECK CONNECTORS. 4) REPLACE MULTIFUNCTION SWITCH. 5) REPLACE WIRING/HARNESS.
INDICATOR LAMP FLASHES AT DOUBLE NORMAL RATE, EXTERNAL LAMP DOES NOT LIGHT	1) OPEN CIRCUIT IN WIRE TO EXTERNAL LAMP. 2) BURNED OUT LAMP.	1) REPLACE WIRING/HARNESS. 2) REPLACE LAMP.
SYSTEM DOES NOT FLASH ON EITHER SIDE	1) FAULTY FUSE. 2) FAULTY FLASHER UNIT. 3) LOOSE BULKHEAD CONNECTOR. 4) LOOSE OR FAULTY REAR WIRING/HARNESS OR TERMINALS. 5) OPEN CIRCUIT TO FLASHER UNIT. 6) OPEN CIRCUIT IN FEED WIRE TO TURN SIGNAL SWITCH. 7) FAULTY SWITCH CONNECTION. 8) OPEN OR GROUNDED CIRCUIT IN WIRING TO EXTERNAL LAMPS. 9) BURNED OUT LAMPS.	1)REPLACE FUSE. 2) REPLACE FLASHER. 3) TIGHTEN CONNECTOR. 4) REPLACE WIRING/HARNESS. 5) CHECK CONNECTORS, REPLACE WIRING/HARNESS. 6) CHECK CONNECTORS, REPLACE WIRING/HARNESS. 7) REPLACE SWITCH. 8) REPLACE WIRING/HARNESS. 9) REPLACE LAMPS.
SYSTEM DOES NOT CANCEL AFTER COMPLETION OF TURN	1) BROKEN CANCELLING FINGER ON SWITCH. 2) BROKEN OR MISSING CANCELLING CAM ON CLOCKSPRING. 3) STICKING CANCELLING FINGER ON MULTIFUNCTION SWITCH.	1) REPLACE MULTIFUNCTION SWITCH. 2) REPLACE CLOCKSPRING. 3) REPLACE MULTIFUNCTION SWITCH.
EXTERNAL LAMPS OPERATE PROPERLY, NO INDICATOR LAMP OPERATION	1) FAULTY INDICATOR LAMP IN INSTRUMENT CLUSTER.	1) REPLACE LAMP.

MULTI-FUNCTION SWITCH

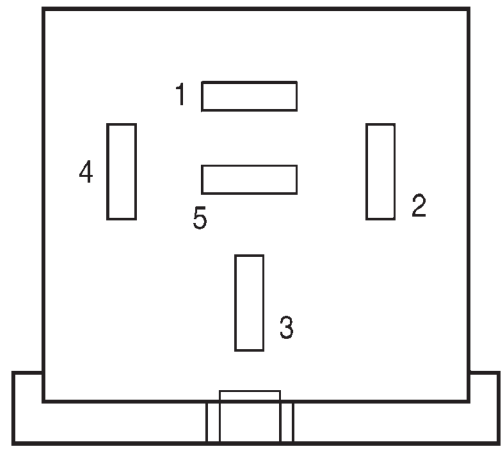
(1) Remove multi-function switch, refer to Multi-function Switch Removal and Installation in this section.

(2) Using an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the following continuity charts (Fig. 2).

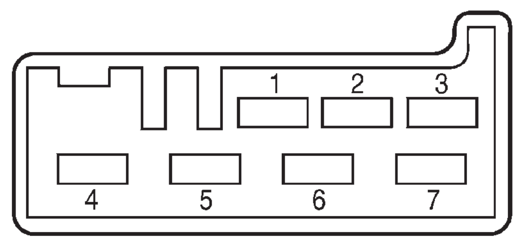
The switch assembly is mounted over the center of the steering column. Should any function of the switch fail, the entire switch assembly must be replaced.

DIAGNOSIS AND TESTING (Continued)

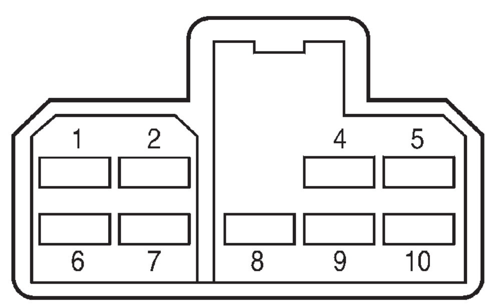
SWITCH POSITION	MODE	CONTINUITY BETWEEN
TURN SIGNAL with HAZARD WARNING SWITCH OFF	RIGHT	A-1 and B-6
	LEFT	A-1 and B-7
TURN SIGNAL with HAZARD WARNING SWITCH ON	RIGHT or OFF or LEFT	A-1 and B-6 A-2 and A-5 A-1 and B-7 B-6 and B-7
HEADLAMP BEAM ON	PARK	C-2 and C-1
	LOW	C-2 and C-1 C-4 and C-7
	HIGH	C-2 and C-1 C-4 and C-8
PANEL DIMMER DETENT	 1 2 3 to 8 9	A-2 and C-6 <100 Ω 300 to 2630 Ω LINEAR 4.99k to 10.5k Ω
OPTICAL HORN	ON	C-4 and C-8
FRONT FOG	ON	C-9 and C-10
WIPER	INT DETENT 1 2 3 4 5 6	B-3 and B2 11.87k Ω 9.87k Ω 7.87k Ω 5.87k Ω 3.87k Ω 1.87k Ω
	LOW	B-3 and B-2 1.25k Ω
	HIGH	B-3 and B-2 1.82k Ω
MIST	ON	B-3 and B-2 1.25k Ω
WASHER	ON	B-3 and B-1



COMBO-FLASHER-A



7-WAY CONNECTOR-B



10-WAY CONNECTOR-C

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Fig. 2 Multi-Function Switch Continuity Test

REMOVAL AND INSTALLATION

COMBINATION FLASHER

The flasher is mounted to the back side of the multi-function switch. To gain access, the upper steering column cover must be removed. Refer to Steering Column Cover Removal and Installation in this section. The flasher can be removed by pulling it forward. The flasher is serviced separately from the multi-function switch. The flasher is black in color for ease of identification (Fig. 3).

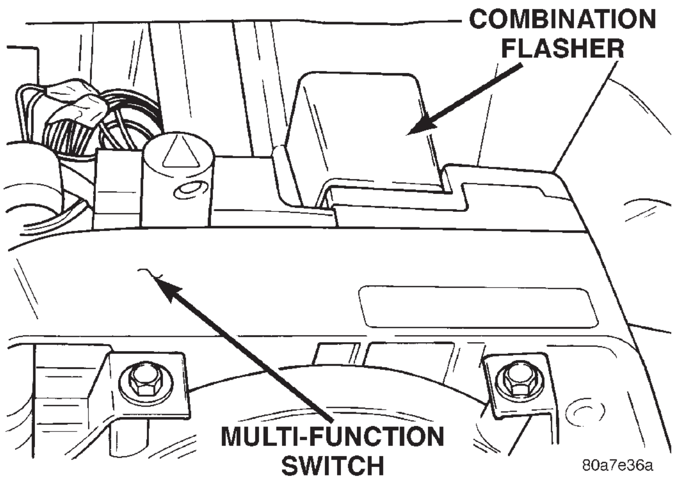

Fig. 3 Combination Flasher Location

MULTI-FUNCTION SWITCH

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove the upper steering column cover. Refer to Steering Column Cover Removal and Installation in this section.

(3) Remove multi-function switch mounting screws (Fig. 4).

(4) Disconnect wire connectors. Lift the switch straight up to remove.

INSTALLATION

For installation, reverse the above procedures.

(1) Tighten multi-function switch to column retaining screws to 2.3 N·m (20 in. lbs.) torque.

(2) Tighten steering column cover retaining screws to 2 N·m (17 in. lbs.) torque.

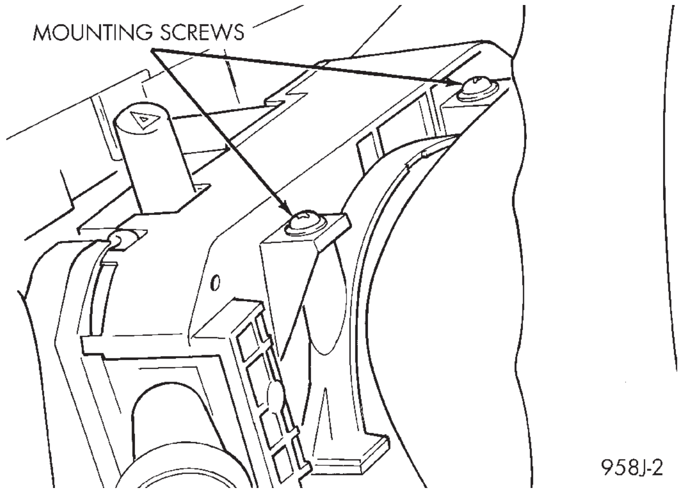

Fig. 4 Multi-Function Switch

STEERING COLUMN COVER

REMOVAL

(1) Remove three lower cover attaching screws.

(2) Remove five knee bolster mounting screws and remove bolster.

(3) Remove upper and lower covers.

(4) If removing the upper half only:

(a) Remove lower cover attaching screws.

(b) Loosen the lower part of instrument cluster hood for clearance as necessary.

(c) Remove upper cover.

INSTALLATION

(1) For installation, reverse the above procedures.

(2) Tighten steering column cover retaining screws to 2 N·m (17 in. lbs.) torque.

TURN SIGNAL AND FLASHERS

CONTENTS

GENERAL INFORMATION

MULTI-FUNCTION SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR AIRBAG REMOVAL PROCEDURES.

The multi-function switch (Fig. 1) contains:
- Turn signals
- Hazard warning
- Headlamps
- Headlamp beam select
- Park lamps
- Panel dimmer
- Front Fog Lamp
- Rear Fog Lamp
- Headlamp optical horn
- Windshield wiper
- Pulse wipe
- Mist wipe
- Windshield washer switches.

The multi-function switch is mounted center of the steering column. There are two levers, one on each side of the steering column. The left side controls the signaling and lighting. The right side controls the windshield wiper and washer system. When the driver wishes to signal his intentions to change direction of travel, he moves the left lever upward to cause the right signals to flash and downward to cause the left signals to flash. After completion of a turn the system is deactivated automatically. As the steering wheel returns to the straight ahead position the turn signals are canceled. A canceling cam is molded to the clockspring mechanism which comes in contact with the cancel actuator on the multi-function switch. The canceling cam lobe pushes on the

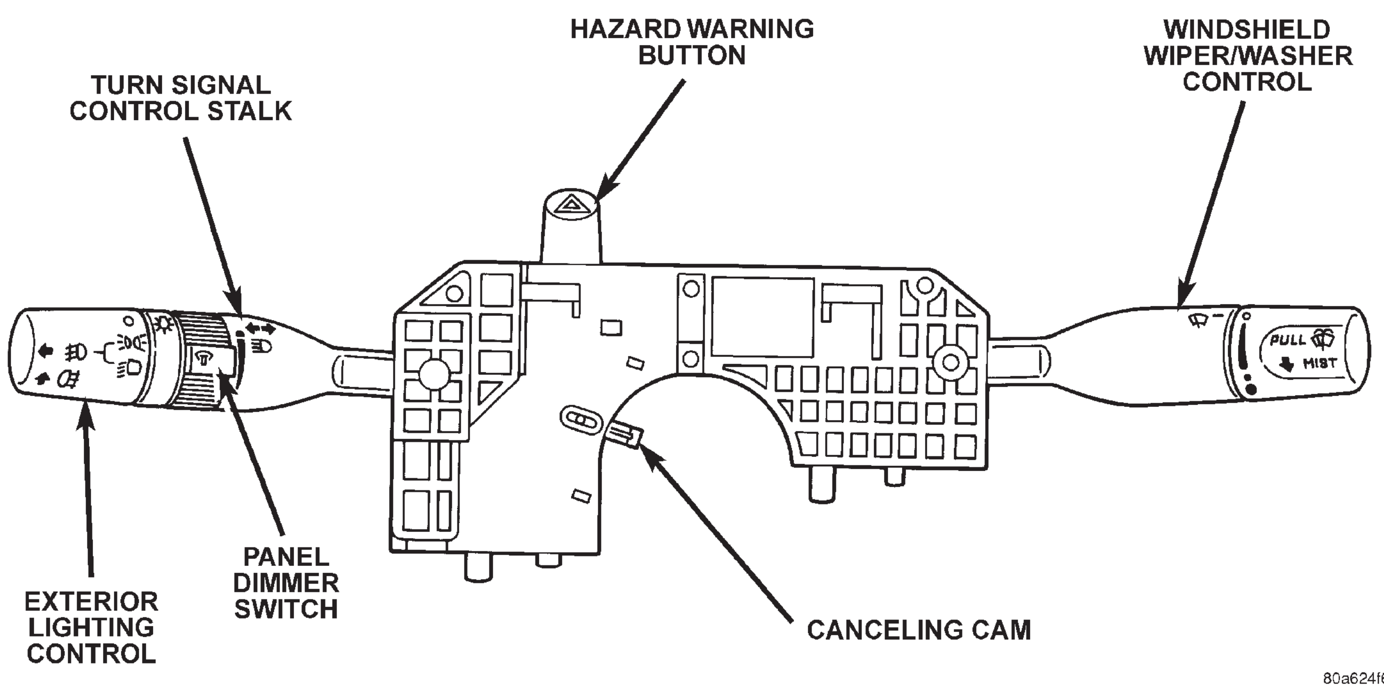

Fig. 1 Multi - Function Switch

GENERAL INFORMATION (Continued)

cancel actuator and returns the switch to the off position.

If only momentary signaling such as indication of a lane change is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the OFF position as soon as the lever is released.

When the system is activated, one of two indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating. The windshield wiper and wash system is covered in Group 8K, Windshield Wipers and Washers.

DESCRIPTION AND OPERATION

EXTERIOR LAMPS

To turn lamps ON:

- Park lamps, using left stalk turn headlamp switch to the first detent
- Headlamps, turn switch to second detent
- Headlamp beam select, from low beam to high beam or high to low, pull left stalk towards steering wheel. The ignition switch must be in the RUN position for the instrument panel high beam indicator to light.
- Headlamp optical horn, pull left stalk towards steering wheel, headlamps will stay ON as long as stalk is held.
- Front Fog lamps, pull switch outward with park lamps or headlamps ON.
- Rear Fog lamps, pull switch outward with park lamps or headlamps on and turn switch to the third detent.
- Panel dimmer, rotating dimmer switch regulates intensity of the instrument panel illumination. There are nine detentes (steps) of intensity. Detent 1 is full brightness and each detent thereafter is lower. Testing the dimmer switch using the continuity test, the resistance value is measured for each detent. Detents 3 through 8 are measured in equal graduations, up or down and referred to as linear. Example: if detent 3 was 5 ohms and detent 4 was 7 ohms detent 5 should be 9 ohms.

DIAGNOSIS AND TESTING

MULTI-FUNCTION SWITCH

(1) Remove multi-function switch.

(2) Using an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the following continuity charts (Fig. 2).

The switch assembly is mounted center of the steering column. Should any function of the switch fail, the entire switch assembly must be replaced.

REMOVAL AND INSTALLATION

COMBINATION FLASHER

The flasher is mounted to the back side of the multi-function switch. To gain access the upper steering column cover must be removed. The flasher can be removed by pulling it forward. The flasher is serviced separately from the multi-function switch. The flasher is blue in color for ease of identification.

REMOVAL AND INSTALLATION (Continued)

SWITCH POSITION	MODE	CONTINUITY BETWEEN
TURN SIGNAL with HAZARD WARNING SWITCH OFF	RIGHT	A-1 and B-6
	LEFT	A-1 and B-7
TURN SIGNAL with HAZARD WARNING SWITCH OFF	RIGHT or OFF or LEFT	A-1 and B-6 A-2 and A-5 A-1 and B-7 B-6 and B-7
HEADLAMP BEAM ON	PARK	C-2 and C-1
	LOW	C-2 and C-1 C-4 and C-7
	HIGH	C-2 and C-1 C-4 and C-8
PANEL DIMMER DETENT	 1 2 3 to 8 9	A-2 and C-6 <100Ω 300 to 2630Ω LINEAR 4.99k to 10.5kΩ
OPTICAL HORN	ON	C-4 and C-8
FRONT FOG	ON	C-9 and C-10
REAR FOG	ON	C-4 and C-5 C-2 and C-7 C-1 and C-10
WIPER	INT DETENT 1 2 3 4 5 6	B-3 and B-2 11.87kΩ 9.87kΩ 7.87kΩ 5.87kΩ 3.87kΩ 1.87Ω
	LOW	B-3 and B-2 1.25kΩ
	HIGH	B-3 and B-2 0.82Ω
MIST	ON	B-3 and B-2 1.25kΩ
WASHER	ON	B-3 and B-1

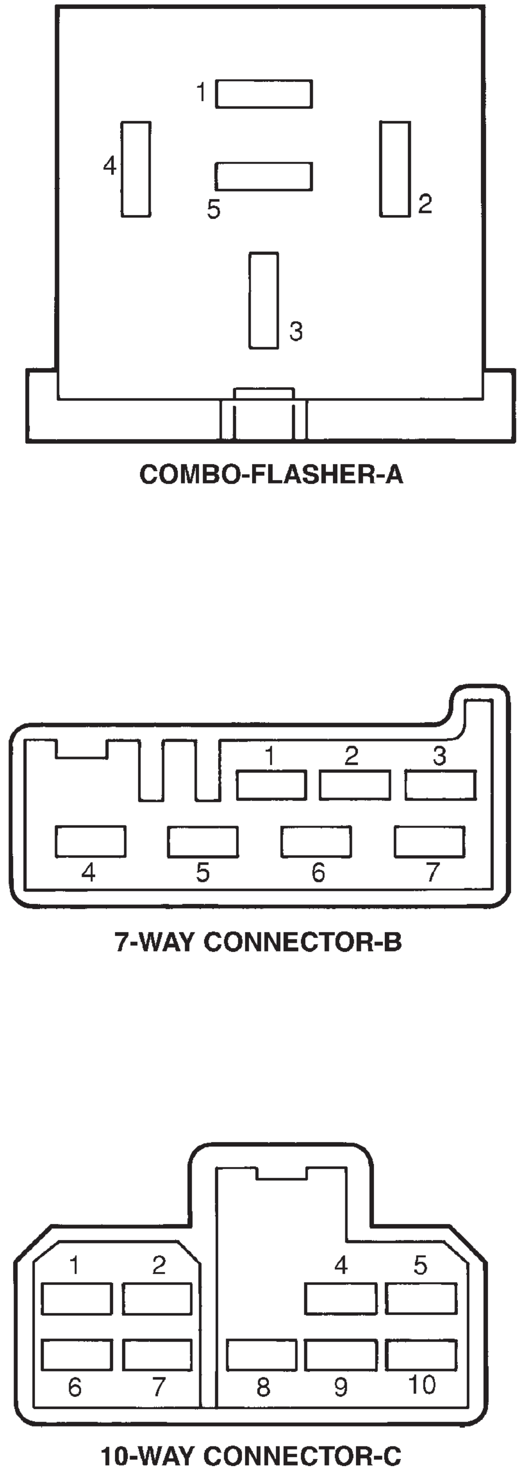

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Fig. 2

WINDSHIELD WIPERS AND WASHERS

CONTENTS

GENERAL INFORMATION

MULTI-FUNCTION SWITCH

WARNING: VEHICLES ARE EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN SERVICE PROCEDURES.

The multi-function switch (Fig. 1) contains:

- Turn signals
- Hazard warning
- Headlamps
- Headlamp beam select
- Parking lamps
- Panel dimmer
- Fog Lamp
- Headlamp optical horn
- Windshield wiper
- Pulse wipe
- Mist wipe
- Windshield washer switches.

The multi-function switch is mounted center of the steering column. There are two levers, one on each side of the steering column. The left side controls the signaling and lighting. The right side controls the windshield wiper and washer system. To use the washers pull lever toward the driver. The mist is a single wipe operation by pushing lever down and releasing the lever. Intermittent wiper operation is controlled by the Body Control Module (BCM). The lever has a selection of delay intervals and by turning the lever the wiper will cycle every half second to 36 seconds depending ON the vehicle's speed. The wiper has two cycle two speeds.

The windshield wipers will only operate when the ignition switch is in the ACCESSORY or IGNITION RUN position. Fuse 15, located in the Junction Block, fuses 8 and 14 in the Power Distribution Center (PDC) block, protects the wiper/washer system circuitry. The wiper motor also has an internal non-serviceable circuit breaker to provide protection against motor stall conditions.

The wiper and washer motors have magnetic fields created by internal permanent magnet. Electric power applied to the motor armature, located in the magnetic field, causes the motor to turn.

The wiper system internal operation uses the low speed motor circuit in combination with intermittent wipe relay. The washer pump motor has one internal circuit and therefore operates at one speed.

The wiper and washer system switch located on the steering column selects the mode of operation of the motors. The switch provides input to the BCM, which in turn operates the two relays. The intermittent wipe relay turns the wiper ON and OFF. The other changes the HIGH/LOW speeds. The switch also provides power to the washer pump motor.

The intermittent wiper system, in addition to low and high speed, has a delay mode. The delay mode

GENERAL INFORMATION (Continued)

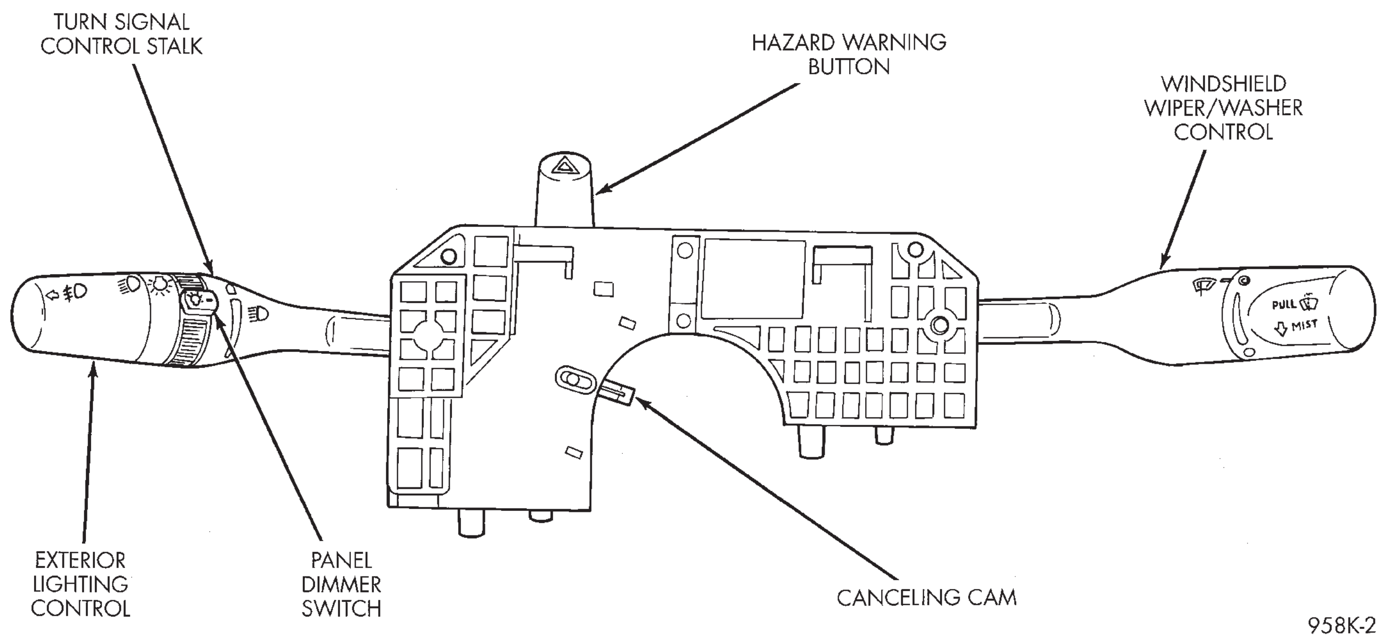


Fig. 1 Multi-Function Switch

has a range of 1/2 to 18 seconds when the vehicle speed is over 10 m.p.h.. The wiper delay times will automatically double to a range of 1 to 36 seconds when the vehicle speed is less than 10 m.p.h.. The delay is controlled by a variable resistor in the wiper switch and BCM.

The wiper motor and washer motor are designed to reduce radio frequency interference and provide electro-magnetic compatibility (RFI/EMC) in the vehicle environment. This is done with suppression circuits designed into the motors.

The wiper system completes the wipe cycle when the switch is turned OFF. The blades park in the lowest portion of the wipe pattern.

When using a scan tool (DRB) refer to the Body Diagnostic Manual for the procedures.

WINDSHIELD WASHERS

All models are equipped with electric operated windshield washer pumps. The wash function can be accessed in the OFF or ON position of the multi-function wiper control switch.

DESCRIPTION AND OPERATION

WINDSHIELD WASHERS

Pulling the lever towards the driver when the wiper switch is in the OFF position will operate the wipers and washer motor pump continuously until the lever is released. Releasing the lever will stop the washer pump but the wipers will complete the current wipe cycle. Followed by an average of two more wipe cycles (±1) before the wipers park and the module turns off.

The electric pump assembly is mounted with a grommet directly to the reservoir. Fluid is gravity fed from the reservoir to the motor. The fluid is forced by the pump through rubber hoses to the hood mounted nozzles which direct the fluid streams to the windshield. The hose assembly has two one way flow check valves located just before each hood nozzle. The purpose of the check valves is to improve fluid flow response time and to prevent excessive washer fluid staining the surface of the hood. The hood mounted nozzles evenly distribute washer fluid across the surface of the windshield. The nozzles are not adjustable. The pump and reservoir are serviced as separate assemblies.

WIPER BLADES

When the wiper blade rubber element is exposed to the weather for a long period of time, it tends to lose wiping ability. Periodic cleaning of the wiper blade element is suggested to remove the accumulation of salt and road film. The wiper blades, arms, and windshield should be cleaned with a sponge or cloth and a mild detergent or non-abrasive cleaner. If the blades continue to streak or smear, they should be replaced. The driver and the passenger blade elements are 550 mm in length. Only the driver's side wiper blade has a air foil on it (Fig. 2).

DESCRIPTION AND OPERATION (Continued)

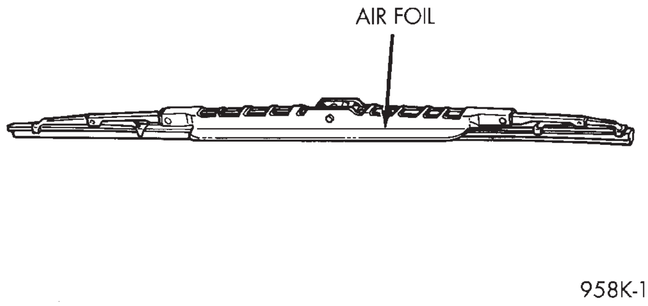


Fig. 2 Driver's Wiper Blade

DIAGNOSIS AND TESTING

MULTI-FUNCTION SWITCH – WINDSHIELD WIPER

To test the multi-function windshield wiper switch, refer to Group 8J Turn Signals and Hazard Warning Flashers, for diagnosis and testing of the Multi-Function Switch.

WINDSHIELD WASHERS

Whenever a windshield washer malfunction occurs, first verify that the windshield washer wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Windshield Washer Test table.

WINDSHIELD WASHER TEST

CONDITION	POSSIBLE CAUSE	CORRECTION
PUMP RUNS NO FLUID FLOWING.	1. NO FLUID IN THE RESERVOIR. 2. NOZZLE PLUGGED OR FROZEN. 3. BROKEN, LOOSE OR PINCHED HOSE. 4. FAULTY PUMP.	1. FILL RESERVOIR. 2. THAW AND CHECK FLOW IF BLOCKED 3. CHECK FLOW THROUGH HOSE CONNECTIONS. 4. APPLY BATTERY VOLTAGE TO MOTOR TERMINALS, REPLACE IF PUMP DOES NOT RUN.
SYSTEM OPERATES INTERMITTENTLY.	1. LOOSE WIRE CONNECTION. 2. FAULTY SWITCH.	1. CHECK WIRE CONNECTIONS. 2. DISCONNECT WIRE HARNESS USE VOLTMETER TO CHECK SWITCH.
SYSTEM OUTPUT IS LOW.	1. PINCHED HOSE. 2. HOSE BLOCKED.	1. CHECK FLOW THROUGH HOSE CONNECTION. 2. DISCONNECT HOSE AT NOZZLE AND Y CONNECTOR CHECK FOR FLOW. REPLACE ASS NECESSARY.

WINDSHIELD WIPER SYSTEM CONDITIONS

The following is a list of general wiper motor system problems and tests that are to be performed to locate the faulty part, and the corrective action to be taken. These tests will cover both two speed and intermittent wiper functions.

Actuation of the wiper relays can be performed using ACTUATOR TESTS on the DRB lll. Status of the wiper pardk switch can also be monitored.

MOTOR WILL NOT RUN IN ANY SWITCH POSITION

(1) Check fuse 15, in the Junction Block and fuse 8 and 18 in the Power Distribution Center (Fig. 3) and (Fig. 4). Refer to Group 8W, Wiring Diagrams for pin call outs.

(a) If fuse(s) are OK, go to Step 2.

(b) If fuse(s) are defective, replace and check motor operation in all switch positions.

(c) If motor is still inoperative and the fuse does not blow, go to Step 2.

(d) If replacement fuse blows, go to Step 11.

(2) Disconnect motor wire harness connector.

(3) Check the wiper motor low speed. Using two jumper wires, connect one jumper wire between the battery positive jump start terminal and Pin B on the wiper motor connector (Fig. 5). Connect the other jumper wire to ground and Pin C on the wiper motor connector. Check the wiper motor high speed, connect the positive jumper wire to Pin A on the wiper motor connector. Connect the negative jumper wire to Pin C on the wiper motor connector.

(a) If motor runs, go to Step 4.

(b) If motor does not run, high or low speed replace the wiper motor.

(4) Using a ohmmeter, check for good ground at Pin C of the wiper motor wire harness connector. If OK, replace motor. If not repair the ground circuit as necessary.

DIAGNOSIS AND TESTING (Continued)

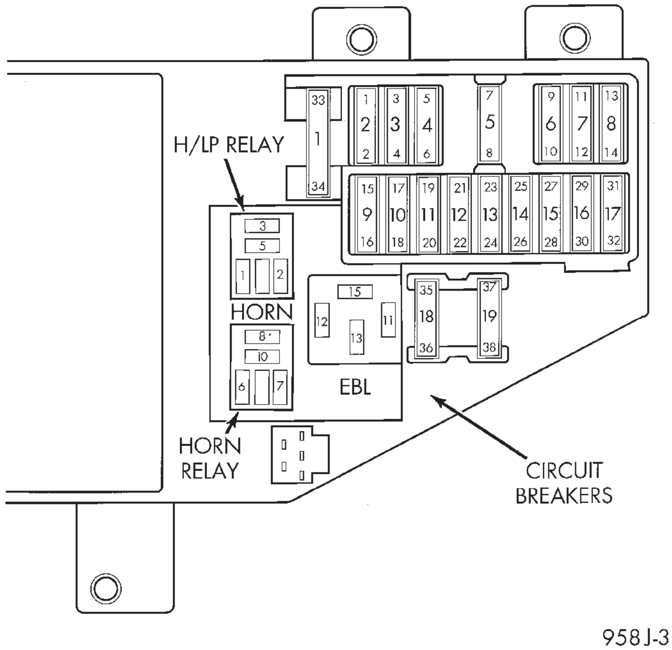


Fig. 3 Junction Block

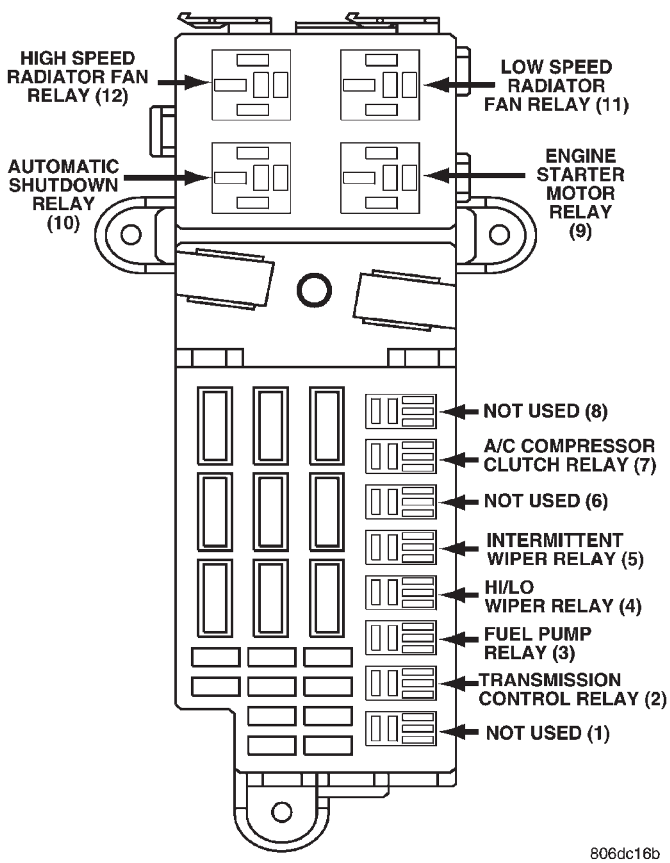
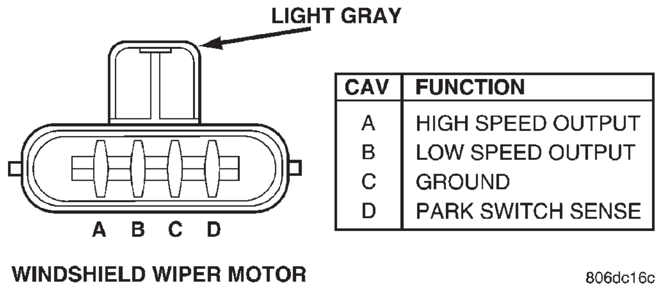


Fig. 4 Power Distribution Center

(5) The wiper switch in the ON position. Using an voltmeter, check for battery voltage at terminal 29 of the intermittent wiper relay in the Power Distribution Center. If no voltage check fuse 18 (Fig. 4). If OK, go to Step 6. If not repair as necessary.



CAV	FUNCTION
A	HIGH SPEED OUTPUT
B	LOW SPEED OUTPUT
C	GROUND
D	PARK SWITCH SENSE

Fig. 5 Motor Wire Connector

(6) Using an ohmmeter, check from terminal 28 of the HI-LO wiper relay to Pin A of the motor wire connector for continuity. Check from terminal 11 of the HI-LO wiper relay to Pin B of the motor wire connector for continuity. If OK, go to Step 7. If not repair as necessary.

(7) Using an ohmmeter, check for continuity between the HI-LO wiper relay and the intermittent wiper relay. Check from terminal 36 of the HI- LO wiper relay to terminal 37 of the intermittent wiper relay. If OK, check for faulty relays. If not repair as necessary.

(8) Disconnect the J3 14-way connector from the BCM (Fig. 6).

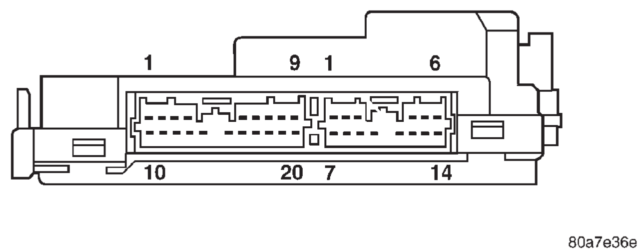


Fig. 6 Body Control Module 14-Way Connector

(9) Using an ohmmeter, check for continuity from terminal 7 of the J3 14-way connector to the terminal 15 of the intermittent wiper relay. If OK, go to Step 10. If not repair as necessary.

(10) Using a voltmeter, connect positive lead to terminal 10 of the BCM J1 22-way connector and negative lead to ground (Fig. 7). Turn ignition switch to the ON position. Slowly move the wiper switch from OFF position through each position to HIGH.

(a) If voltage increases from zero to approximately 10 volts in the HIGH position, replace BCM. If no voltage, go to Step b.

(b) Using an ohmmeter, check for continuity from terminal 2 of wiper switch connector to terminal 10 of the BCM J3 22-way connector. If no continuity, repair circuit. If OK, go to Step 11.

DIAGNOSIS AND TESTING (Continued)

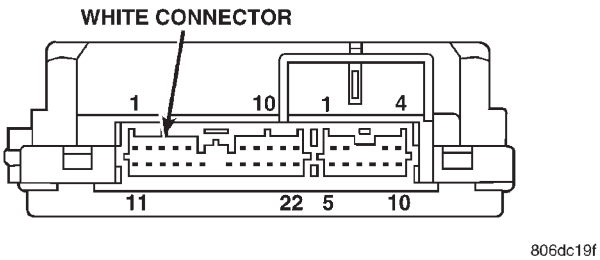


Fig. 7 Body Control Module 22-Way Connector

(11) Disconnect motor connector and replace fuse 15 from the Junction Block.

(a) If fuse does not blow, go to Step 2.

(b) If fuse blows, wiper control circuit is at fault, repair as necessary, refer to Group 8W, Wiring Diagrams.

MOTOR RUNS SLOWLY AT ALL SPEEDS

(1) Disconnect the wire harness from the wiper motor. Remove wiper arms and blades. Disconnect motor drive link from motor. Connect an ammeter between battery negative jump start terminal and Pin C on the wiper motor connector (Fig. 5). Connect battery positive wire to Pin B on the wiper motor connector. When replacing drive link nut tighten to 11 to 12 N·m (98 to 106 in. lbs.) torque.

(a) If average ammeter reading is more than 6 amps, replace motor.

(b) If motor runs and average ammeter reading is less than 6 amps, go to Step 2.

(2) Check to see if wiper linkage or pivots are binding or caught.

MOTOR WILL RUN AT HIGH SPEED, BUT NOT MOVE AT LOW SPEED. MOTOR WILL RUN AT LOW SPEED, BUT WILL NOT MOVE AT HIGH SPEED

(1) Disconnect motor connector.

(2) If motor will not run on low speed, connect a jumper wire between battery positive jump start terminal and Pin B on the wiper motor connector. Connect a second jumper wire between ground and Pin C on the wiper motor connector (Fig. 5).

(a) If motor runs, go to Step 3.

(b) If motor does not run, replace the motor.

(3) If motor will not run on high speed, connect a jumper wire between battery positive remote cable terminal and Pin A. Connect a second jumper wire between ground and Pin C of the motor connector.

(a) If motor runs, go to Step 4.

(b) If motor does not run, replace the motor.

(4) If wipers will not run at low speed, using an ohmmeter, check for open circuit. Check between terminal 11 of the HI-LO wiper relay to Pin B of the wiper motor wire harness connector for continuity. If OK, go to Step 5. If not repair as necessary.

(5) If wiper will not run at the high speed, using an ohmmeter, check for an open circuit. Check between terminal 28 of the HI-LO wiper relay and Pin A of the wiper motor wire harness connector for continuity. If OK, go to Step 6. If not repair as necessary.

(6) Check for faulty HI-LO wiper relay.

WIPERS RUN AT HIGH SPEED WITH SWITCH IN LOW SPEED POSITION. WIPERS OPERATE IN INTERMITTENT MODE, BUT EACH WIPE IS AT HIGH SPEED.

(1) Disconnect motor connector.

(2) Using two jumper wires, connect one between the battery positive jump start terminal and Pin B on the wiper motor connector. Connect the second lead between ground and Pin C on the wiper motor connector (Fig. 5). If motor runs at low speed, go to Step 3. If motor runs at high speed, replace the motor.

(3) Check for faulty HI-LO wiper relay. Check for crossed wires in harness from HI-LO relay to motor.

(4) Disconnect J3 14-way connector from the BCM and remove the intermittent wiper relay.

(5) Using an ohmmeter, check for short to ground Pin 8 of the J3 14–way connector.

(6) If continuity to ground is present, repair as necessary. If no continuity to ground, replace the BCM.

WIPERS RUN AT LOW SPEED WITH SWITCH IN HIGH SPEED POSITION

(1) Check for faulty HI-LO wiper relay.

(2) Using an ohmmeter, check for open circuit between terminal 12 of the HI-LO wiper relay and terminal 8 of the BCM J3 14-way connector. If OK, go to Step 3. If not OK, repair as necessary.

(3) Check wiper switch.

(4) Check for binding linkage

(5) Refer to MOTOR RUNS SLOWLY AT ALL SPEEDS.

MOTOR WILL KEEP RUNNING WITH SWITCH IN OFF POSITION.

Using a ohmmeter, Check Pin 8 of the BCM J3 14–way connector for continuity to ground signal when the wipers are in the park position only.

(1) If no ground signal, test wiper motor.

(2) If a ground is received test the multi-function switch.

(3) If the multi-function switch test OK, replace the BCM.

DIAGNOSIS AND TESTING (Continued)

WIPER WILL RUN CONTINUOUSLY WITH SWITCH IN THE INTERMITTENT POSITION. WHEN COLUMN SWITCH IS TURNED OFF, WIPERS STOP WHEREVER THEY ARE, WITHOUT RETURNING TO PARK POSITION.

(1) Using an ohmmeter, check for ground at Pin D on the wiper motor connector. If grounded, replace motor.

(2) Using an ohmmeter, with the wiper motor in the PARK position, check for continuity between Pin C and Pin D on the wiper motor connector. If continuous continuity, go to Step 3. If not OK, replace motor.

(3) Disconnect the wiper motor wire harness connector and the J3 14–way connector. Check for continuity between Pin D of the wiper motor wire harness connector and terminal 2 of J3 14-way connector of the BCM. If no continuity, repair as necessary. If continuity is OK, test the wiper motor.

WIPERS DO NOT RUN WHEN WASHER MOTOR IS ENGAGED

(1) Backprobe the J3 14-way connector from the BCM. Refer to Group 8E-Instrument Panel and Systems to access.

(2) Using a voltmeter, connect positive lead to terminal 10 of the 14-way connector and the negative lead to ground.

(3) Engage the washer switch so that the washer motor runs continuously.

(a) If the voltage is zero, check the wiring between the washer motor and the BCM. Repair as necessary.

(b) If the battery voltage, ensure that the 14–way connector is disconnected and check Pin 10 if it has 12 volts. If no voltage replace the BCM. If battery voltage, test for a wiring short refer to Group 8W, Wiring Diagrams.

NOTE: Make sure to test the multi-function switch before replacing the BCM.

WIPERS OPERATE IN INTERMITTENT SETTINGS BUT DOES NOT HAVE SIX DIFFERENT SPEEDS.

To test the multi-function windshield wiper switch, refer to Group 8J, Turn Signals and Hazard Warning Flashers, for diagnosis and testing of the Multi-Function Switch.

WIPER MOTOR SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.

Whenever a wiper motor malfunction occurs, disconnect motor wire harness and clean the terminals. Ensure the wire harness is properly connected before starting diagnosis and repair procedures. Refer to Wiper Motor Test table.

WIPER MOTOR TEST

CONDITION	POSSIBLE CAUSES	CORRECTION
WIPER BLADES DO NOT PARK PROPERLY	1) WIPER ARMS INPROPERLY PARKED. 2) WIPER ARMS ARE LOOSE ON PIVOT SHAFT. 3) MOTOR CRANK LOOSE AT OUTPUT SHAFT.	1) REMOVE WIPER ARMS AND RUN WIPER MOTOR TO PARK POSITION. REFER TO WIPER ARM REPLACEMENT 2) REMOVE WIPER ARM AND RUN WIPER MOTOR TO PARK POSITION. REFER TO WIPER ARM REPLACEMENT. 3) REMOVE WIPER ARM. RUN WIPER MOTOR TO PARK POSITION AND REMOVE THE MODULE. WITHOUT ROTATING THE MOTOR OUTPUT SHAFT, REMOVE THE CRANK AND CLEAN THE MOTOR SHAFT OF METAL FITTINGS. MOUNT THE MOTOR CRANK ON THE MOTOR SHAFT TOWARD THE MOTOR SO IT CAN SLIDE WITH THE LINKAGE IN THE FULL REVERSAL POSITION. TORQUE TO 25-35 N•m (18-23 ft. lbs.), WITHOUT ROTATING THE MOTOR OUTPUT SHAFT. INSTALL WIPER SYSTEM, REFER TO WIPER MODULE REPLACEMENT.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
MOTOR STOPS IN ANY POSITION WHEN THE SWITCH IS TURNED OFF	1) OPEN PARK CIRCUIT.	1) CHECK PARK SWITCH BY DISCONNECTING WIRE CONNECTOR AND APPLY BATTERY VOLTAGE TO PIN A. PLACE A JUMPER WIRE FROM PIN B TO PIN C, THEN TO AN EXTERNAL GROUND. REPLACE MOTOR IF IT DOES NOT PARK.
MOTOR WILL NOT STOP WHEN SWITCH IS TURNED OFF	1) FAULTY SWITCH. 2) FAULTY RELAY.	1) CHECK SWITCH IN LOW, HIGH, AND INTERMITTANT POSITION. REPLACE IF NECESSARY. PARK SWITCH MAY BE SHORTED TO GROUND.
WIPER BLADES SLAP AGAINST COWL SCREEN OR WINDOW MOLDINGS	1) WIPER ARMS ARE PARKED INCORRECTLY.	) REPARK WIPER ARMS. REFER TO WIPER ARM REPLACEMENT.
BLADES CHATTER	1) FOREIGN SUBSTANCE SUCH AS POLISH ON GLASS OR BLADES. 2) ARMS TWISTED, BLADE AT WRONG ANGLE ON GLASS. 3) BLADE STRUCTURE BENT. 4) BLADE ELEMENT HAS PERMANENT SET.	1) CLEAN GLASS AND BLADE ELEMENT WITH NON-ABRASIVE CLEANER. 2) REPLACE ARM. 3) REPLACE BLADE. 4) REPLACE BLADE ELEMENT.
WIPER KNOCK AT REVERSAL	1) LINKAGE BUSHINGS WORN. 2) ARMATURE ENDPLAY IN MOTOR.	1) REPLACE WORN LINK. REFER TO WIPER LINKAGE REMOVAL. 2) REPLACE WIPER MOTOR. REFER TO WIPER MOTOR REPLACEMENT.
WIPER MOTOR WILL NOT RUN	1) BLOWN FUSE. 2) NEW FUSE BLOWS AGAIN. 3) NEW FUSE BLOWS AGAIN. 4) NO VOLTAGE AT MOTOR. 5) POOR GROUND.	1) REPLACE FUSE, RUN SYSTEM. 2) CHECK FOR SHORT IN WIRING OR SWITCH. 3) REPLACE FUSE, REMOVE MOTOR CONNECTOR, TURN SWITCH ON, FUSE DOES NOT BLOW, REPLACE MOTOR. 4) CHECK SWITCH AND WIRING. 5) CLEAN GROUND WIRE CONNECTION FROM CORROSION.

REMOVAL AND INSTALLATION

MULTI-FUNCTION SWITCH

REMOVAL

(1) Disconnect battery negative cable.
(2) Remove the upper steering column cover. Refer to steering column cover removal procedures below.
(3) Remove multi-function switch mounting screws (Fig. 8).
(4) Disconnect wire connectors. Lift the switch straight up to remove.

INSTALLATION

For installation, reverse the above procedures.
(1) Tighten multi-function switch to column retaining screws to 2.3 N·m (20 in. lbs.) torque.
(2) Tighten steering column cover retaining screws to 2 N·m (17 in. lbs.) torque.

WASHER NOZZLE

REMOVAL

To replace nozzle, disconnect washer fluid hose. Using a needle nose pliers, squeeze together the locking tabs on the nozzle.

INSTALLATION

For installing make sure that both locking tabs are securely snapped into position. Connect washer fluid

REMOVAL AND INSTALLATION (Continued)

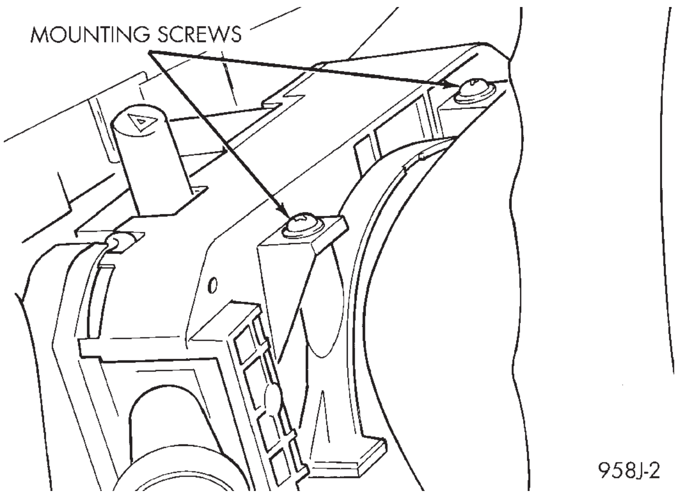


Fig. 8 Multi-Function Switch

hose. If no washer spray, check fluid hoses kinks or leaks (Fig. 9).

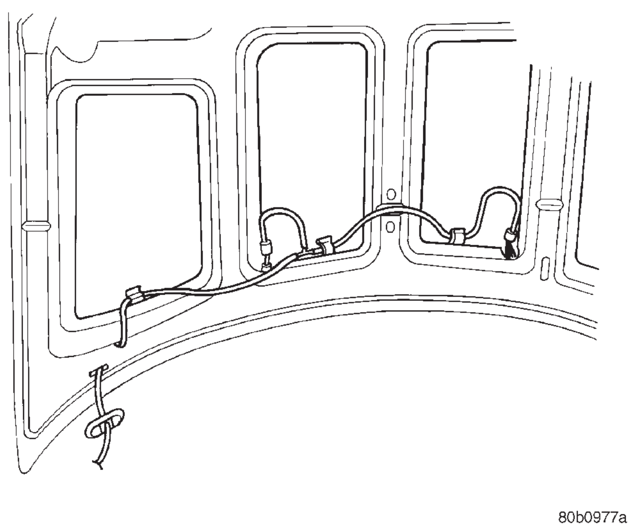


Fig. 9 Washer Fluid Hose Location

WASHER RESERVOIR

REMOVAL

(1) Disconnect washer fluid hose at in-line connector on top of the right shock tower.

(2) Partially remove bumper fascia as needed to gain access to the reservoir. Refer to Group 23, Body.

(3) Disconnect wire connector from washer pump and harness mounting tab (Fig. 10).

(4) Slide rearward and drop down and away from vehicle.

(5) Drain washer fluid from reservoir into an appropriate container.

(6) Disconnect the washer hose from the reservoir.

INSTALLATION

For installation, reverse the above procedures.

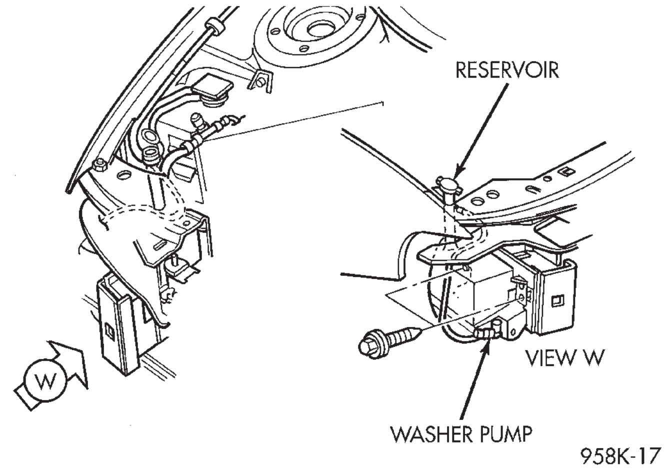


Fig. 10 Reservoir Removal

WASHER RESERVOIR PUMP

REMOVAL

(1) Partially remove the bumper fascia as needed to gain access to the reservoir pump. Refer to Group 23, Body.

(2) Place a drain bucket below the reservoir to catch any washer solvent that may leak out.

(3) Firmly grasping pump by hand twist and pull away from reservoir and out of grommet. Care must be taken not to puncture reservoir (Fig. 11).

(4) Remover rubber grommet from reservoir and throw away.

INSTALLATION

For installation, reverse the above procedures. A new grommet is required for installation. Refill reservoir with the washer solvent.

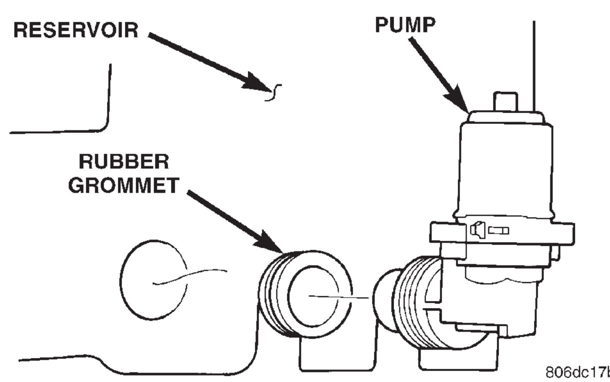


Fig. 11 Washer Pump

REMOVAL AND INSTALLATION (Continued)

WIPER ARM AND BLADE

REMOVAL

(1) Place the wiper arm/blades in the PARK position and turn ignition OFF.

(2) Unsnap arm cover. By hand rock gently side to side and slide away from arm pivot. To remove the left side raise hood for clearance

(3) Loosen retention nut.

(4) Remove the arm from the pivot by using a universal claw puller or by hand rock gently side to side and slide. Raise blade and arm off glass and rock side to side while applying pressure with the puller till loose. Ensure that the puller is not on the collar below the arm.

(5) Remove arm retention nut and arm.

INSTALLATION

(1) Place arm on pivot shaft, align blade with wiper location made on windshield

(2) Start retention nut.

(3) Raise arm and blade off windshield while tightening retention nut. Tighten nut to 33 to 40 N· mm (23 to 29 ft. lbs.).

(4) Install arm head cover.

WIPER BLADE

REMOVAL

(1) Turn wiper switch ON, position blades to a convenient place on the windshield by turning the ignition switch ON and OFF. Turn ignition switch OFF, when blade is in the desirable position.

(2) Lift wiper arm to raise blade off glass.

(3) Remove blade assembly from arm by pushing release tab under arm tip and slide blade away from arm tip (Fig. 12) and (Fig. 13).

(4) The driver's side wiper blade has a air foil on it and the air foil points downward as in (Fig. 2).

(5) Gently place wiper arm tip on windshield.

INSTALLATION

For installation reverse the above procedures. When complete turn ignition switch ON. Turn wiper switch OFF allowing the wiper blades PARK, then turn ignition switch OFF.

WIPER BLADE ELEMENT

REMOVAL

(1) Lift wiper arm to raise blade off the windshield.

(2) Remove blade assembly from arm by pushing release tab under arm tip and slide blade away from arm tip (Fig. 12) and (Fig. 13). Gently place wiper arm tip on windshield.

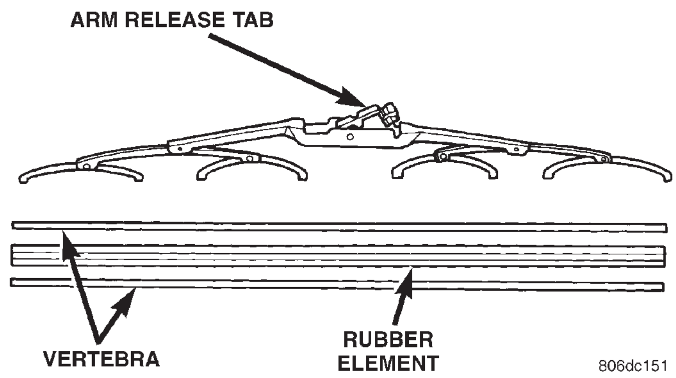


Fig. 12 Wiper Blade and Element

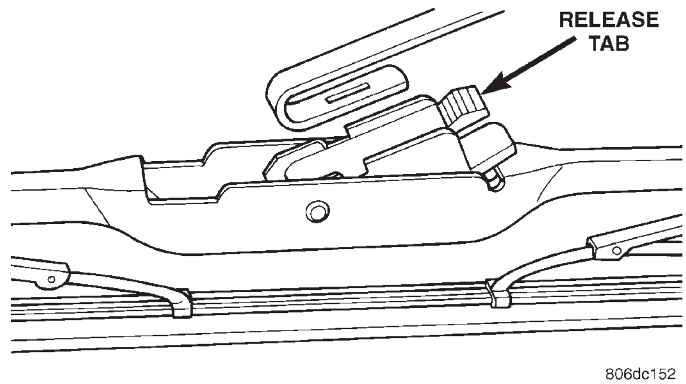


Fig. 13 Remove Blade from Arm

(3) Remove wiping rubber element by pulling stopper of the rubber element, out of the claws of blade assemble (Fig. 14). The wiper rubber element and two vertebra will be removed.

INSTALLATION

(1) Slide the rubber element into the blade assembly through the claws.

(2) Slide the metal vertebra into the top element slot, with the vertebra curved to match the windshield

(3) Ensure that the final blade claw is locked into the slot at the end of the rubber element (Fig. 14).

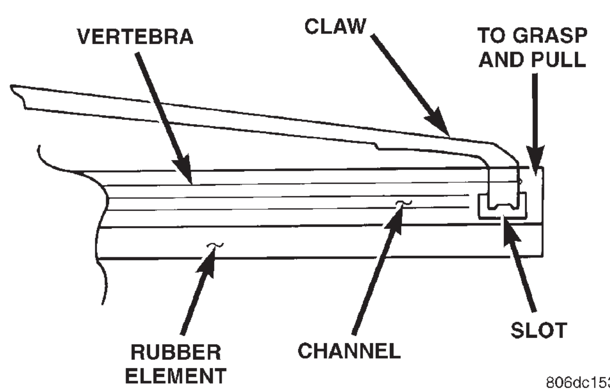


Fig. 14 Wiper Blade and Element

REMOVAL AND INSTALLATION (Continued)

WIPER ARM LINKAGE OR CAP

REMOVAL

(1) Remove wiper arms and blades.

(2) Remove the cowl screen.

(3) Remove wiper motor assembly.

(4) Disconnect wiper arm linkage, by using an ball joint/tie rod separator, separate the right and left ball cap from the ball (Fig. 15).

(5) Disconnect drive link from the motor crank. Using an ball joint/tie rod separator and separate the ball cap from the ball.

INSTALLATION

For installation, reverse the above procedures. Align link ball cap over ball and gently press fit against shoulder of cap to lock cap into position. If motor output crank nut was removed, tighten nut to 25 to 30 N·m (19 to 23 ft. lbs.).

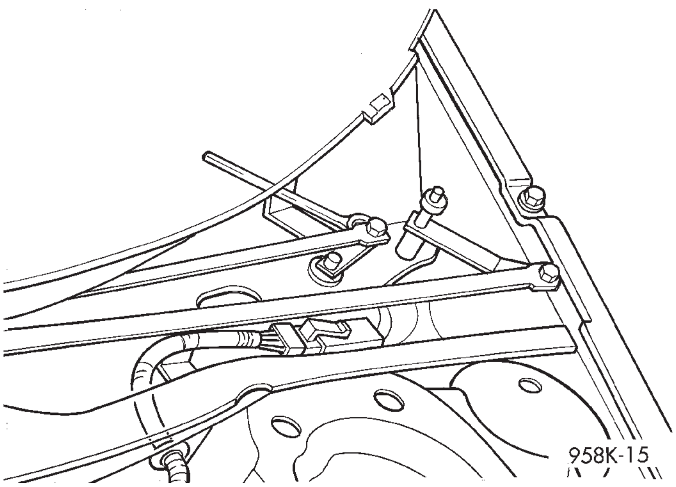


Fig. 15 Linkage Removal

WIPER MOTOR

REMOVAL

(1) Remove wiper arms and blades.

(2) Remove the cowl screen.

(3) Remove wiper motor assembly.

(4) Disconnect drive linkage from motor output crank. Using an ball joint/tie rod separator, separate the ball cap from the ball (Fig. 15).

(5) Remove motor mounting nuts and remove motor.

(6) Disconnect wire connector at motor.

INSTALLATION

For installation, reverse the above procedures. Tighten the mounting screws to 10 to 12 N·m (89 to 106 in. lbs.) torque. Ensure that the motor connector seal is properly positioned. Tighten the motor mounting nuts to 25 to 30 N·m (19 to 23 ft. lbs.) torque.

WIPER MOTOR ASSEMBLY

REMOVAL

(1) Remove wiper arms and blades (Fig. 16).

(2) Remove the cowl screen.

(3) Remove the four wiper motor mounting screws then lift assembly to gain access to clip.

(4) Disconnect harness clip from the forward mounting leg.

(5) Disconnect wire connector at motor and remove assembly.

INSTALLATION

For installation, reverse the above procedures. Tighten the mounting screws to 10 to 12 N·m (89 to 106 in. lbs.) torque. Ensure that the motor connector seal is properly positioned.

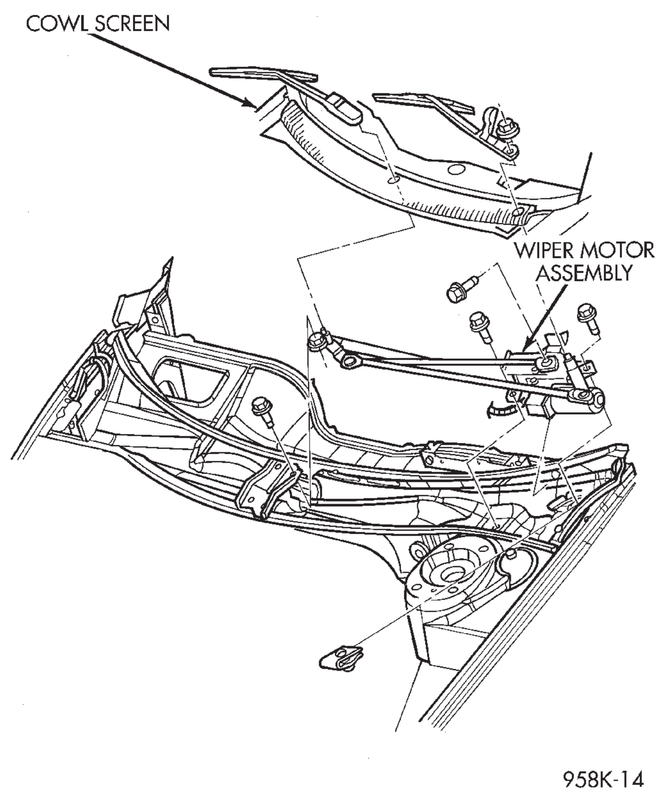


Fig. 16 Wiper Motor and Linkage Module

WIPER MOTOR ASSEMBLY MOUNTING GROMMET

REMOVAL

(1) Remove wiper arms and blades.

(2) Remove the cowl screen.

(3) Remove wiper motor assembly.

(4) Remove the four grommets.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

For installation, reverse the above procedures. Ensure proper position of grommets when installing:

(1) The right inboard grommet is installed with insert flat facing down. The remaining grommets installed with insert flat facing up.

(2) The left outboard grommet has a small eyelet.

(3) The right inboard grommet threaded eyelet.

(4) The two center grommets have a large eyelets

CLEANING AND INSPECTION

WIPER BLADES

Wiper blades exposed to the weather for a long period of time tend to lose their wiping effectiveness. Periodic cleaning of the wiper blade is recommended to remove the accumulation of salt and road grime. The wiper blades, arms and windshield should be cleaned with a sponge or cloth and a mild detergent or nonabrasive cleaner. If the wiper blades continue to streak or smear, they should be replaced. The wiper blade should run smoothly across the windshield in both directions. The wiper blade should slightly roll over center when the blade reverses direction. A wiper blade insert that has lost flexibility or a wiper arm that has lost spring tension, will cause the blade to skip or chatter across the windshield. If the wiper blades are new and the wiper arm spring tension is OK and a chattering sound is emitted from the wiper(s), the wiper blade is not rolling over center. If this condition exists, refer to the Wiper Arm Alignment paragraph of this group.

ADJUSTMENTS

WIPER ARM

High speed, wet windshield operation, the right blade tip may override the cowl screen slightly. This is normal and should not affect wiper system performance.

(1) Lift arms and blade assemble to a over centered position.

(2) Turn ignition switch to ON or ACC position.

(3) Use LOW speed setting and cycle the wiper motor to the PARK position.

(4) Turn ignition OFF.

(5) Carefully lower arm and blades to the windshield.

(6) Measure the distance from the blade tip to the cowl screen edge. The blade should be 18 to 42 mm (.75 to 1.60 ins.).

(7) If not OK, check for worn parts.

(8) In the event the blade tip strikes the cowl screen or molding remove arm. Position arm on windshield and tighten to 33 to 40 N·m (23 to 29 ft. lbs.) torque (Fig. 17).

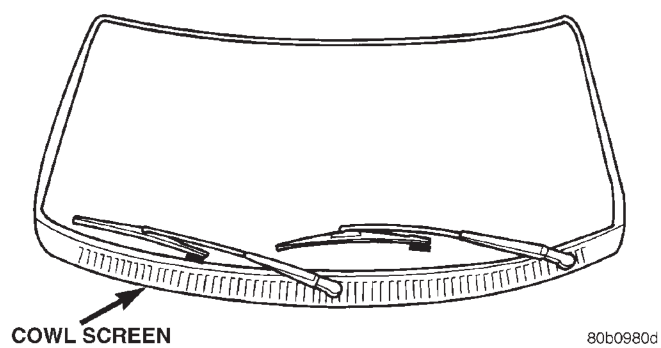


Fig. 17 Arm Adjustment

WIPER AND WASHER SYSTEMS

CONTENTS

HEADLAMP WASHERS

INDEX

GENERAL INFORMATION

INTRODUCTION

Headlamp washers are available as a factory-installed option on this model. The headlamp washers on this vehicle work in conjunction with the windshield washers. The headlamp washers are enabled with the headlamps “ON” and the windshield washers activated. With the windshield washers activated the headlamp washers will spray for a preset amount of time controlled by a relay.

The headlamp washer system utilizes a separate pump that is attached to the windshield washer reservoir. The headlamp washer pump feeds two nozzles that are mounted in the front fascia of the vehicle. These nozzles spray the headlamps when the system is activated.

REMOVAL AND INSTALLATION

WINDSHIELD/HEADLAMP WASHER RESERVOIR

Removal

(1) Disconnect the washer fluid hose at the in-line connector at the top of the right shock tower.

(2) Remove the right headlamp assembly. Refer to Group 8L, Lamps.

(3) Partially remove the inner fender well as needed to gain access to the reservoir.

(4) Disconnect the windshield washer pump and headlamp washer pump electrical connectors.

(5) Remove the headlamp washer relay from bracket.

(6) Disconnect the headlamp washer pump hose.

(7) Remove the reservoir mounting bolts (Fig. 1).

(8) Slide the reservoir rearward and remove from the vehicle.

Installation

(1) For installation, reverse the above procedures.

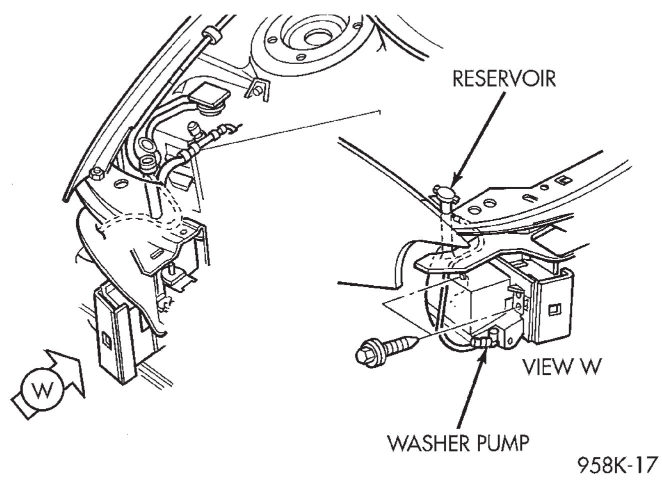


Fig. 1 Reservoir Removal

HEADLAMP WASHER NOZZLE

Removal

(1) Remove the headlamp assembly. Refer to Group 8L, Lamps.

(2) Disconnect the hose at the headlamp washer nozzle.

(3) Remove the headlamp washer nozzle retaining clip and remove the nozzle from the front fascia.

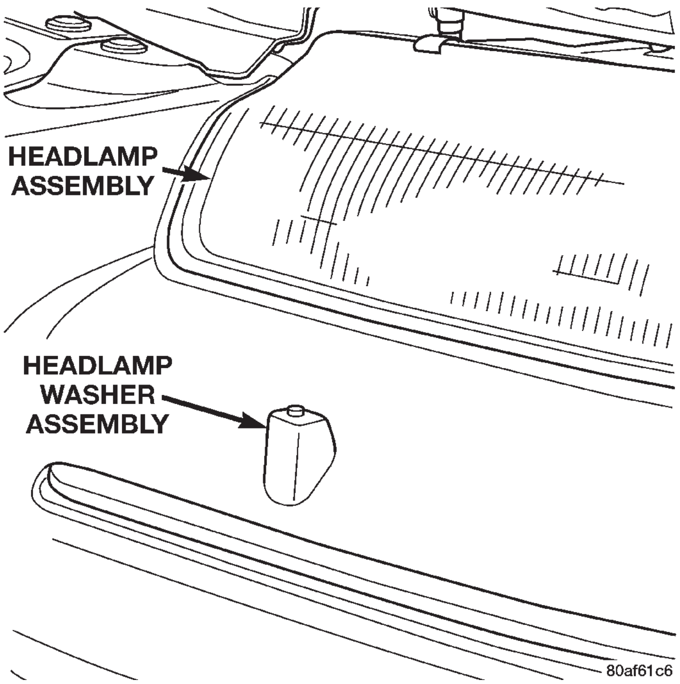


Fig. 2 HeadLamp Washer Nozzle

Installation

(1) For installation, reverse the above procedures.

HEADLAMP WASHER PUMP

Removal

(1) Disconnect the washer fluid hose at the in-line connector at the top of the right shock tower.

(2) Remove the right headlamp assembly. Refer to Group 8L, Lamps.

(3) Partially remove the inner fender well as needed to gain access to the reservoir.

(4) Disconnect the windshield washer pump and headlamp washer pump electrical connectors.

(5) Remove the headlamp washer relay from bracket.

(6) Disconnect the headlamp washer pump hose.

(7) Remove the reservoir mounting bolts.

(8) Slide the reservoir rearward and remove from the vehicle.

(9) Remove the headlamp washer pump from the reservoir.

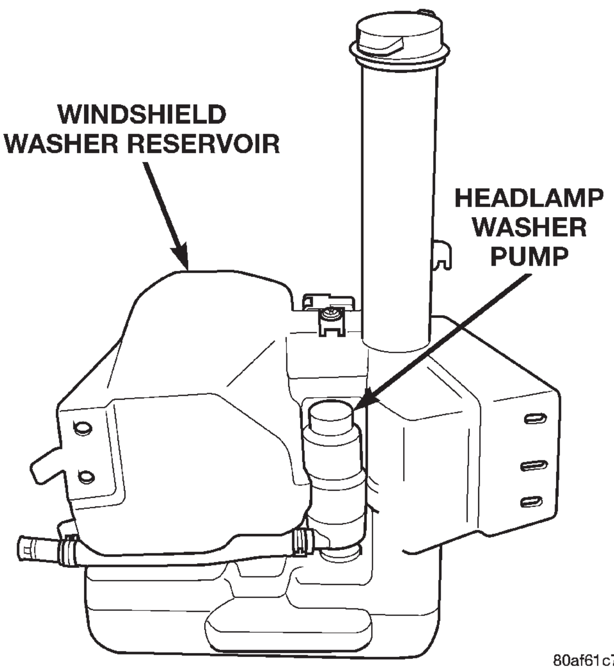


Fig. 3 Headlamp Washer Pump

Installation

(1) For installation, reverse the above procedures.

LAMPS

CONTENTS

GENERAL LIGHTING DIAGNOSIS

INDEX

GENERAL INFORMATION

DIAGNOSTIC PROCEDURES

JA vehicles use lighting on the interior and exterior of the vehicle for illuminating and indicating purposes. Lighting circuits are protected by fuses or circuit breakers. Lighting circuits require an overload protected power source, on/off device, lamps and body ground to operate properly. Plastic lamps require a wire in the harness to supply body ground to the lamp socket. Lamp sockets that are exposed to moisture should be coated with Mopar® Multi-purpose Grease, or equivalent, to avoid corrosion. If a socket has become corroded, clean socket and bulb base with abrasive fiber sanding pad or metallic bristle brush. Replace sockets and bulbs that are deformed from corrosion that could prevent continuous body ground.

Wire connectors can make intermittent contact or become corroded. Before coupling wire connectors, inspect the terminals inside the connector. Male terminals should not be bent or disengaged from the insulator. Female terminals should not be sprung open or disengaged from the insulator. Bent and sprung terminals can be repaired using needle nose pliers and pick tool. Corroded terminals appear chalky or green. Corroded terminals should be replaced to avoid recurrence of the problem symptoms. Wire connector terminals should be coated with Mopar® Multi-purpose Grease, or equivalent, to avoid corrosion.

Begin electrical system failure diagnosis by testing related fuses and circuit breakers in the fuse block and engine compartment. Verify that bulbs are in good condition and test continuity of the circuit ground. Refer to Group 8W, Wiring Diagrams for component location and circuit information.

SAFETY PRECAUTIONS

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result. Do not use bulbs with higher candle power than indicated in the Bulb Application table at the end of this group. Damage to lamp can result. Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges are not holding the component in place.

GENERAL INFORMATION (Continued)

SYSTEM DIAGNOSTIC PROCEDURES

When a vehicle experiences problems with the headlamp system, verify the condition of the battery connections, charging system, headlamp bulbs, wire connectors, relay, high beam dimmer switch and headlamp switch. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

HEADLAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system, refer to Group 8A,
	4. Battery has insufficient charge.	4. Test battery state-of -charge, refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery, refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	7. Both headlamp bulbs defective.	7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system, refer to Group 8A.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system, refer to Group 8A.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	3. High resistance in headlamp circuit.	3. Test amperage draw of headlamp circuit.
	4. Both headlamp bulbs defective.	4. Replace both headlamp bulbs.
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	2. High resistance in headlamp circuit.	2. Test amperage draw of headlamp circuit.
	3. Faulty headlamps switch circuit breaker.	3. Replace headlamp switch.
	4. Loose or corroded terminals or splices in circuit.	4. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS DO NOT ILLUMINATE	1. No voltage to headlamps.	1. Repair open headlamp circuit, refer to Group 8W.
	2. No Z1-ground at headlamps.	2. Repair circuit ground, refer to Group 8W.
	3. Faulty headlamp switch.	3. Replace headlamp switch.
	4. Faulty headlamp dimmer (multi-function) switch.	4. Replace multi-function switch.
	5. Broken connector terminal or wire splice in headlamp circuit.	5. Repair connector terminal or wire splice.

GENERAL INFORMATION (Continued)

FOG LAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system, refer to Group 8A,
	4. Battery has insufficient charge.	4. Test battery state-of -charge, refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery, refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	7. Both fog lamp bulbs defective.	7. Replace both fog lamp bulbs.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system, refer to Group 8A.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices, refer to Group 8W.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system, refer to Group 8A.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	3. High resistance in fog lamp circuit.	3. Test amperage draw of fog lamp circuit.
	4. Both fog lamp bulbs defective.	4. Replace both fog lamp bulbs.
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	2. High resistance in fog lamp circuit.	2. Test amperage draw of fog lamp circuit.
	3. Faulty fog lamp switch.	3. Replace fog lamp switch.
	4. Loose or corroded terminals or splices in circuit.	4. Inspect and repair all connectors and splices, refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamps.	1. Replace fuse, refer to Group 8W.
	2. No Z1-ground at fog lamps.	2. Repair circuit ground, refer to Group 8W.
	3. Faulty fog lamp switch.	3. Replace fog lamp switch.
	4. Broken connector terminal or wire splice in fog lamp circuit.	4. Repair connector terminal or wire splice.

HEADLAMP AND FOG LAMP ALIGNMENT

INDEX

GENERAL INFORMATION

HEADLAMP ALIGNMENT

JA vehicle headlamps are equipped with a bubble level to aid up/down headlamp alignment (Fig. 1). The bubble level is used to assist headlamp alignment when compensating for vehicle ride height changes due to heavy luggage compartment loads. The bubble level cannot be calibrated, the headlamp must be replaced if bubble level vial is faulty. A gauge wheel is located on the top of the headlamp module to assist left/right alignment (Fig. 2).

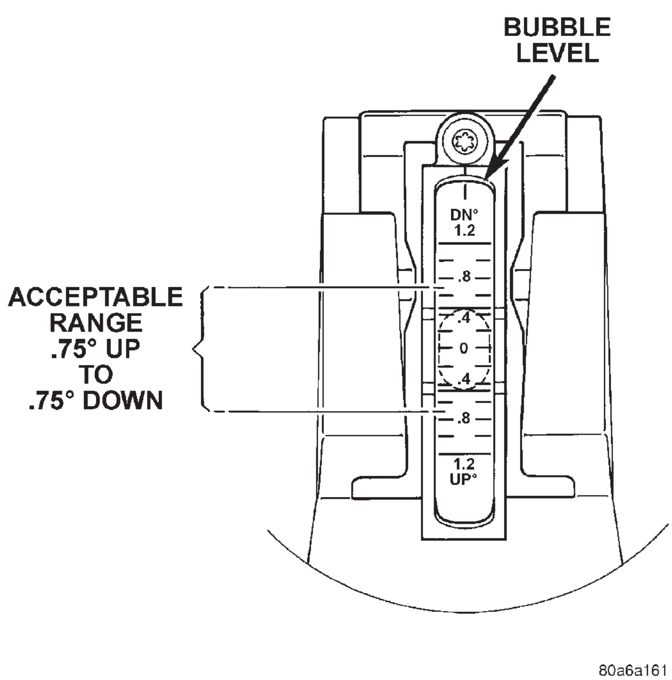


Fig. 1 Bubble Level

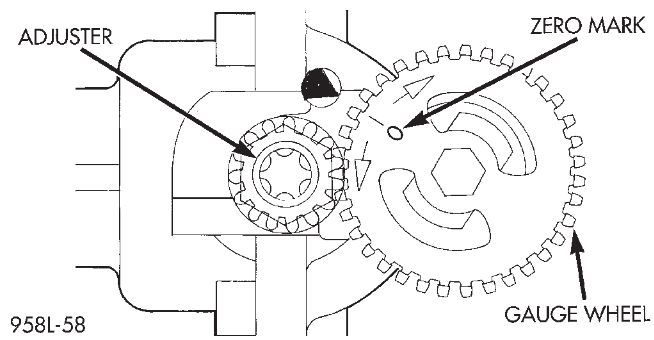


Fig. 2 Gauge Wheel

HEADLAMP ALIGNMENT PREPARATION

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Inspect and correct damaged or defective components that could interfere with proper headlamp alignment.

(3) Verify proper tire inflation.

(4) Clean headlamp lenses.

(5) Verify that luggage area is not heavily loaded.

(6) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

ADJUSTMENTS

HEADLAMP ADJUSTMENT USING ALIGNMENT SCREEN

ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft.) away from front of headlamp lens (Fig. 3).

(2) If necessary, tape a line on the floor 7.62 meters (25 ft.) away from and parallel to the wall.

(3) From the ground up 1.27 meters (5 ft.), tape a line on the wall at the center line of the vehicle. Sight along the center line of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.

ADJUSTMENTS (Continued)

(4) Rock vehicle side-to-side three times to allow suspension to stabilize.

(5) Jounce front suspension three times by pushing downward on front bumper and releasing.

(6) Measure the distance from the center of headlamp lens to the ground. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(7) Measure distance from the center line of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each side of vehicle center line. Use these lines for left/right adjustment reference.

HEADLAMP ADJUSTMENT

A properly aimed left low beam headlamp will project the center of the low beam hot spot on the alignment screen 8 in. (203 mm) below the horizontal center line and 5 in. (127 mm) right of headlamp center line. A properly aimed right low beam headlamp will project the center of the low beam hot spot on the alignment screen 7 in. (178 mm) below the horizontal center line and 9 in. (229 mm) right of headlamp center line (Fig. 3). **The preferred headlamp alignment is 0 (± 0.76°) for the up/down adjustment as indicated on bubble level. Preferred left/right alignment is 0 (± 0.76°) as indicated on the gauge wheel.** The high beam headlamps cannot be aligned. The high beam pattern should be correct when the low beams are aligned properly.

NOTE: The bubble level and gauge wheel is calibrated before the headlamp is installed in the vehicle. The bubble level cannot be calibrated without damaging the headlamp module. If bubble level is faulty, replace headlamp module.

To adjust headlamp alignment, rotate alignment screws to achieve the specified low beam hot spot pattern (Fig. 4).

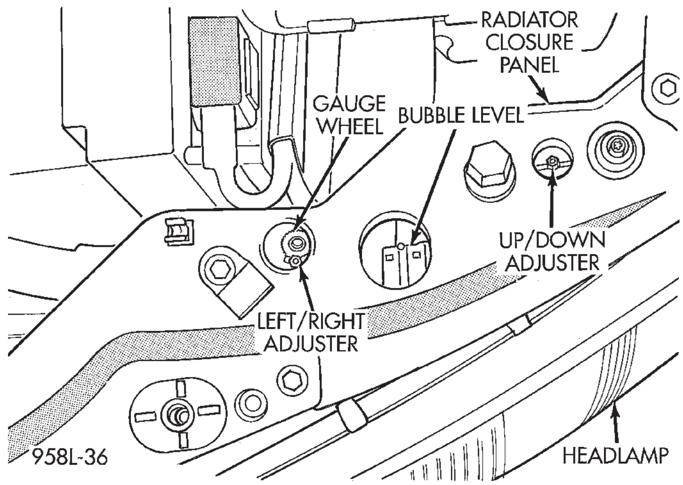


Fig. 4 Headlamp Alignment Screws

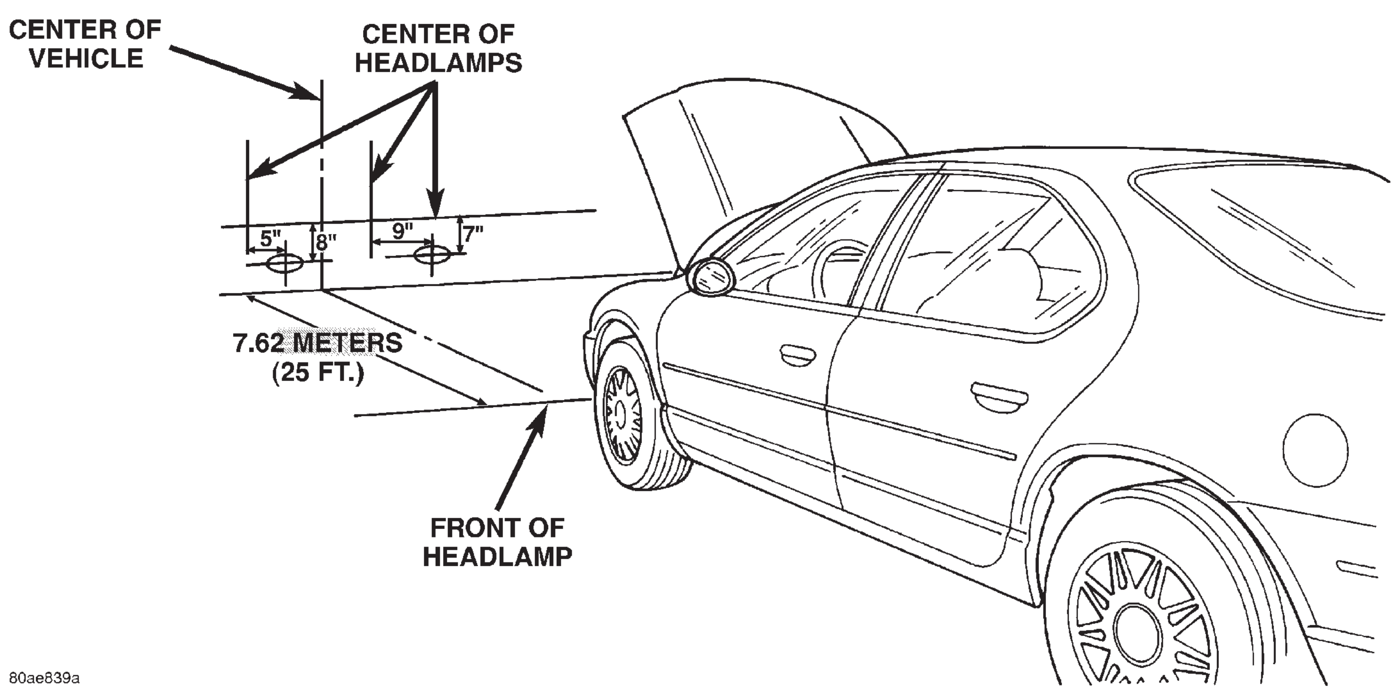


Fig. 3 Headlamp Alignment Screen

ADJUSTMENTS (Continued)

FOG LAMP ALIGNMENT

Prepare a alignment screen (Fig. 5). Refer to Alignment Screen Preparation paragraph in this section. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp center line and straight ahead.

To adjust fog lamp alignment, rotate alignment screw to achieve the specified low beam hot spot pattern (Fig. 6).

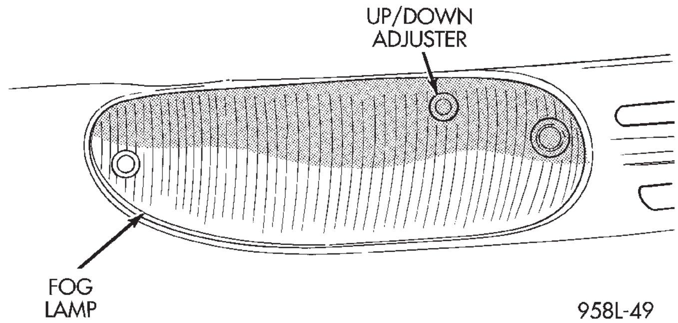


Fig. 6 Fog Lamp Adjuster

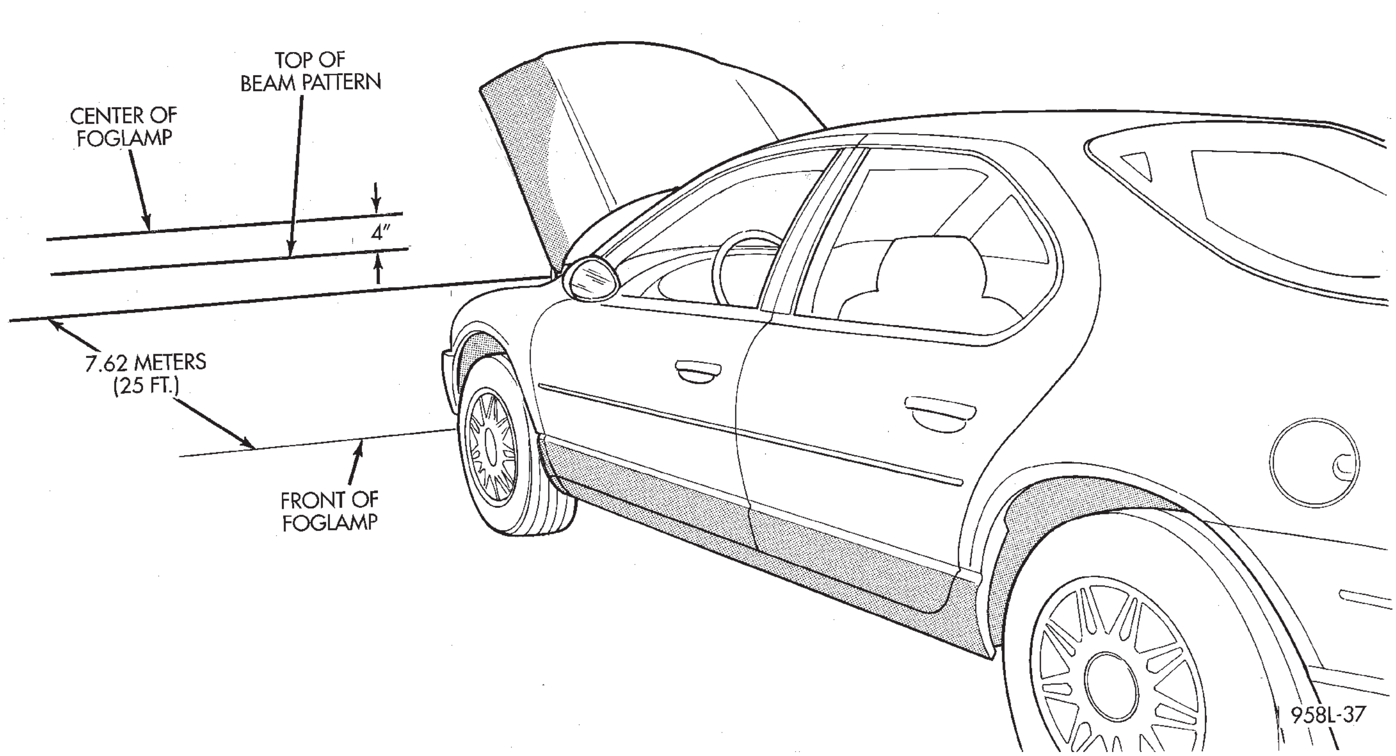


Fig. 5 Fog Lamp Alignment

EXTERIOR LAMP SWITCHES

INDEX

REMOVAL AND INSTALLATION

HEADLAMP SWITCH

Service procedures for the headlamp switch can be found in Group 8E, Instrument Panel and Gauges. More information can be found in Group 8W, Wiring Diagrams.

HEADLAMP DIMMER SWITCH

The headlamp dimmer switch is incorporated into the turn signal switch. Proper procedures can be found in Group 8J, Turn Signal and Flashers. More information can be found in Group 8W, Wiring Diagrams.

LAMP BULB SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

(1) Release hood latch and open hood.
(2) Remove screws holding headlamp module to radiator closure panel.
(3) Remove headlamp module from radiator closure panel.
(4) Disconnect wire connector from back of headlamp bulb (Fig. 1).
(5) Rotate retaining ring counterclockwise one quarter turn.
(6) Remove retaining ring from headlamp module (Fig. 2).
(7) Pull bulb from headlamp module (Fig. 3).

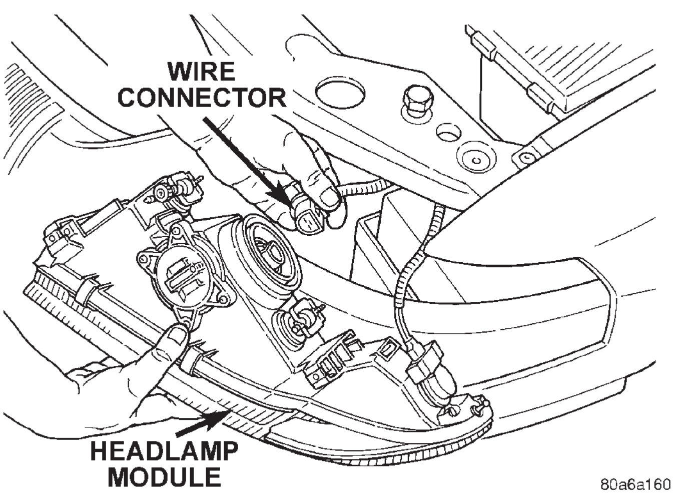


Fig. 1 Headlamp Connector

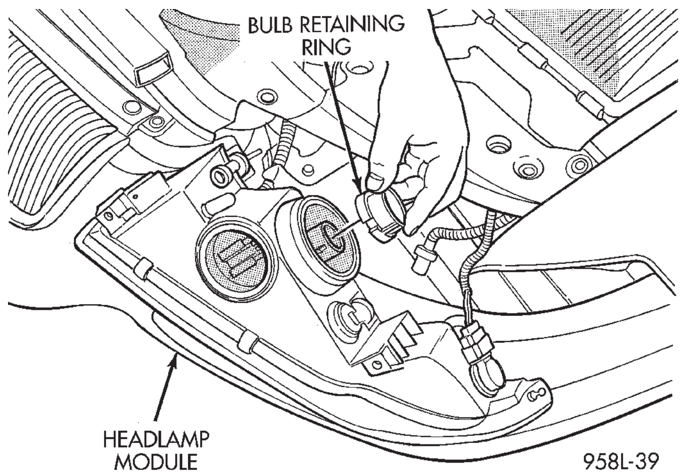


Fig. 2 Headlamp Bulb Retaining Ring

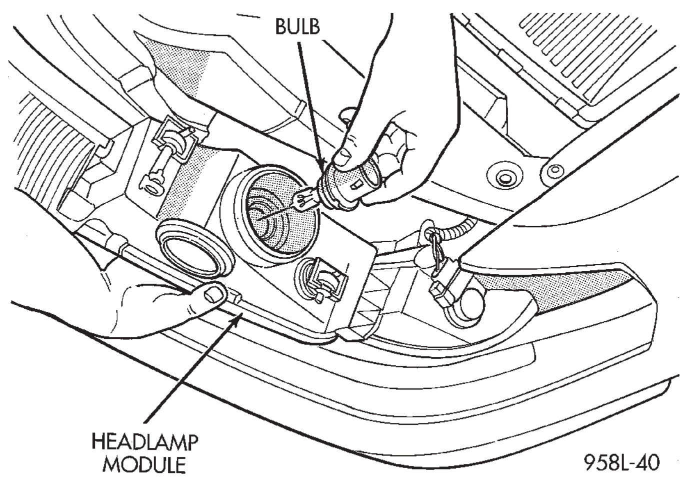


Fig. 3 Headlamp Bulb

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

Reverse the preceding operation.

FOG LAMP BULB

REMOVAL

(1) Remove fog lamp from front bumper fascia.

(2) Disengage wire connector from back of fog lamp.

(3) Rotate bulb base counterclockwise one quarter turn.

(4) Pull bulb from back of lamp (Fig. 4).

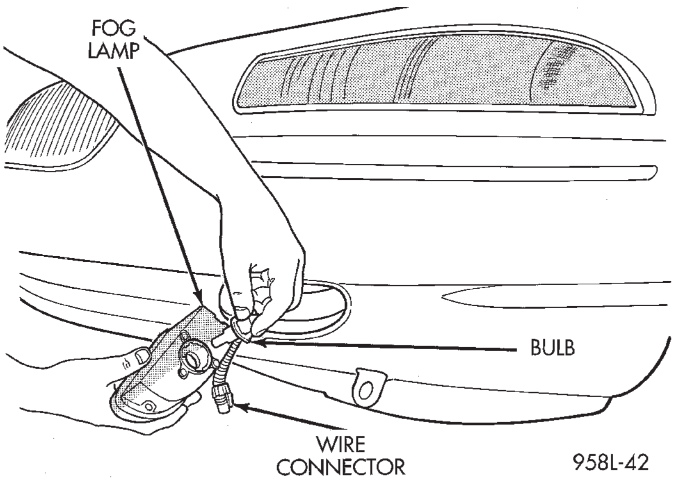


Fig. 4 Fog Lamp Bulb

INSTALLATION

Reverse the preceding operation.

PARK AND TURN SIGNAL LAMP BULB

REMOVAL

(1) Release hood latch and open hood.

(2) Remove screws holding headlamp module to radiator closure panel.

(3) Remove headlamp module from radiator closure panel.

(4) Rotate socket counterclockwise one quarter turn.

(5) Pull socket from back of lamp (Fig. 5).

(6) Pull bulb from socket.

INSTALLATION

Reverse the preceding operation.

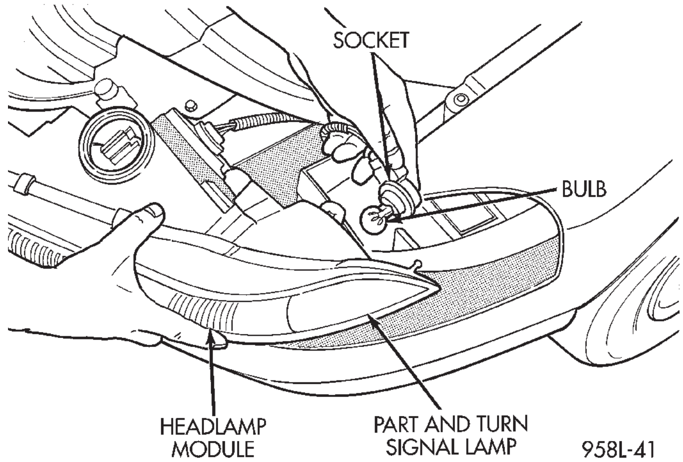


Fig. 5 Park and Turn Signal Lamp Bulb

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Release decklid latch and open decklid.

(2) Rotate socket counterclockwise one quarter turn.

(3) Pull socket from back of lamp.

(4) Pull bulb from socket (Fig. 6).

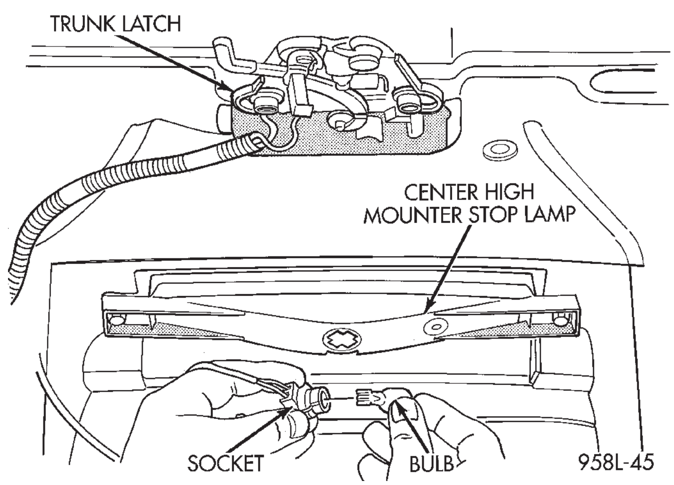


Fig. 6 Center High Mounted Stop Lamp Bulb

INSTALLATION

Reverse the preceding operation.

TAIL/STOP AND TURN SIGNAL LAMP BULB

REMOVAL

(1) Release decklid latch and open decklid.

(2) Remove wing-nuts attaching tail lamp to rear closure panel.

(3) Remove lamp from opening in quarter panel.

(4) Disconnect wire connector from back of tail lamp.

REMOVAL AND INSTALLATION (Continued)

(5) Rotate socket counterclockwise one quarter turn.

(6) Pull socket from back of lamp (Fig. 7).

(7) Pull bulb from socket.

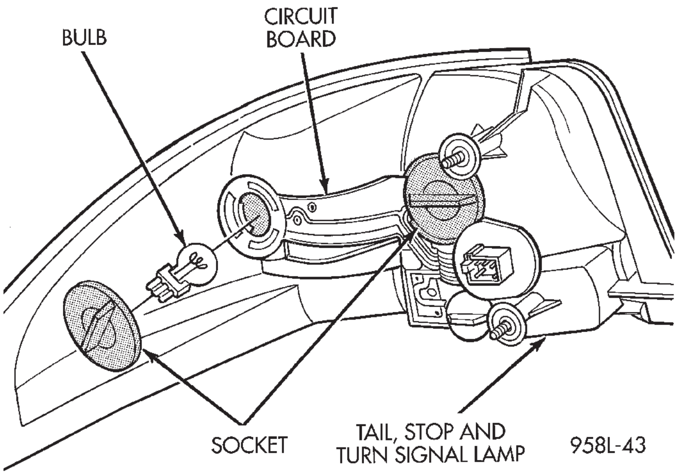


Fig. 7 Tail, Stop, and Turn Signal Lamp Bulb

INSTALLATION

Reverse the preceding operation.

BACK-UP LAMP BULB

REMOVAL

(1) Release decklid latch and open decklid.

(2) Remove wing-nuts attaching tail lamp to rear closure panel.

(3) Remove lamp from opening in quarter panel.

(4) Disconnect wire connector from back of tail lamp.

(5) Rotate socket counterclockwise one quarter turn.

(6) Pull socket from back of lamp (Fig. 8).

(7) Pull bulb from socket.

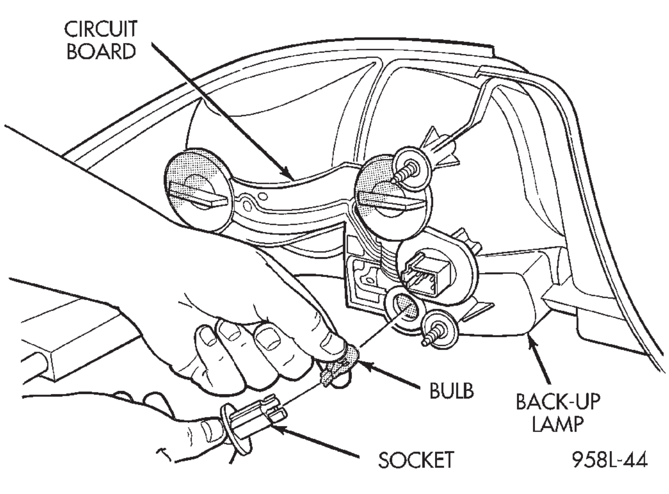


Fig. 8 Back – Up Lamp Bulb

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP BULB

REMOVAL

(1) Remove screws attaching license plate lamp to rear bumper fascia.

(2) Remove license plate lamp from rear fascia.

(3) Rotate socket counterclockwise one quarter turn.

(4) Pull socket from back of lamp.

(5) Pull bulb from socket.

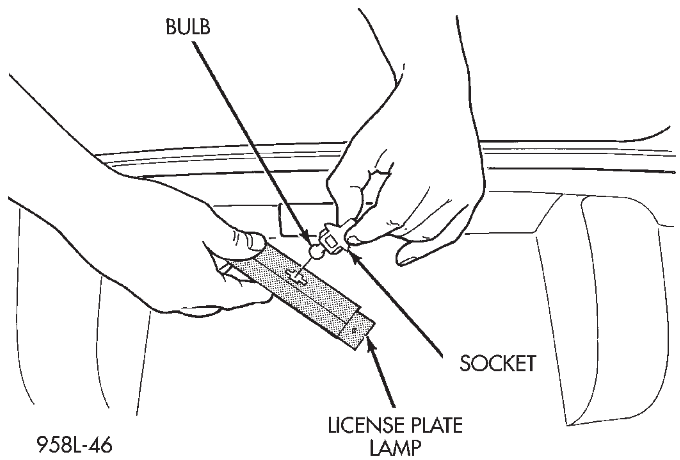


Fig. 9 License Plate Lamp Bulb

INSTALLATION

Reverse the preceding operation.

DOME LAMP BULB

REMOVAL

(1) Remove lamp lens from lamp assembly by inserting a flat bladed pry tool in the slot provided in the bezel.

(2) Separate lamp lens from lamp assembly.

(3) Pull dome lamp bulb from socket.

INSTALLATION

(1) Push dome lamp bulb into socket.

(2) Install lamp lens by first inserting the two tabs located opposite the lamp switch and then pushing upward on lens to engage remainder of tabs.

FRONT READING LAMP BULB

REMOVAL

(1) Remove front reading lamp from headlining. Do not remove wire connector from lamp assembly.

REMOVAL AND INSTALLATION (Continued)

(2) Pull lamp reflector from lamp assembly by grasping lamp reflector opposite lamp bulbs and pulling upward.
(3) Pull bulbs from socket as necessary.

INSTALLATION

(1) Push bulbs into sockets.
(2) Push lamp reflector onto lamp assembly starting bulb end first.
(3) Install front reading lamp to headlining.

ASH RECEIVER/CUP HOLDER LAMP BULB

REMOVAL

(1) Using a small, flat bladed pry tool inserted into slot in lamp bezel, release tab holding lamp to cubby bin.
(2) Pull bezel and lamp assembly from cubby bin.
(3) Pull lamp socket from assembly.
(4) Pull bulb from socket.

INSTALLATION

(1) Push bulb into lamp socket.
(2) Push lamp socket into assembly.
(3) Push bezel and lamp assembly into cubby bin to engage tabs.

GLOVE BOX LAMP BULB

REMOVAL

(1) Open glove box door.
(2) Pull downward on lamp/switch assembly to disengage tabs from instrument panel.
(3) Pull bulb from socket.

INSTALLATION

Push upward on lamp/switch assembly to engage tabs holding assembly to instrument panel.

FLOOR TRANSMISSION RANGE INDICATOR BEZEL LAMP BULB

The floor transmission range indicator bezel lamp has no serviceable bulb. If the lamp does not function properly, the transmission range indicator bezel assembly must be replaced.

LAMP SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP MODULE

The headlamp module contains the park and turn signal lamps and is serviced as an assembly.

REMOVAL

(1) Release hood latch and open hood.
(2) Remove screws holding headlamp module to radiator closure panel (Fig. 1).
(3) Separate headlamp module from radiator closure panel.
(4) Disengage wire connector from back of headlamp bulb.
(5) Rotate Park lamp socket counterclockwise one quarter turn.
(6) Pull socket from back of lamp.
(7) Separate headlamp module from vehicle.

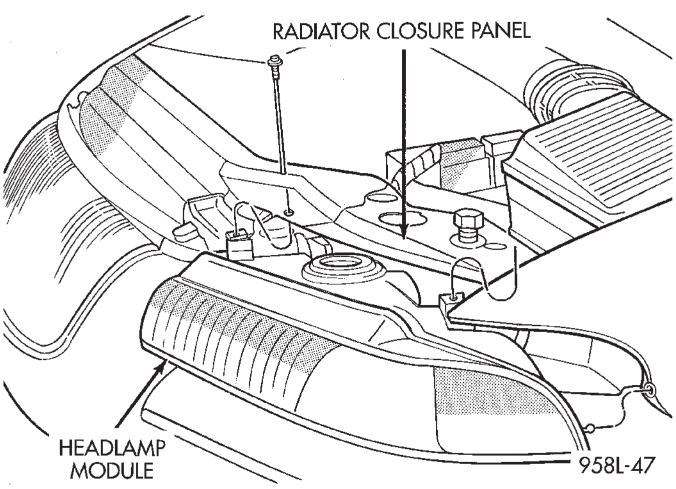


Fig. 1 Headlamp Module

INSTALLATION

Reverse the preceding operation.

FOG LAMP

REMOVAL

(1) Remove screws holding fog lamp to front bumper fascia.
(2) Remove fog lamp from fascia.
(3) Disconnect wire connector from fog lamp bulb base.
(4) Remove fog lamp from vehicle (Fig. 2).

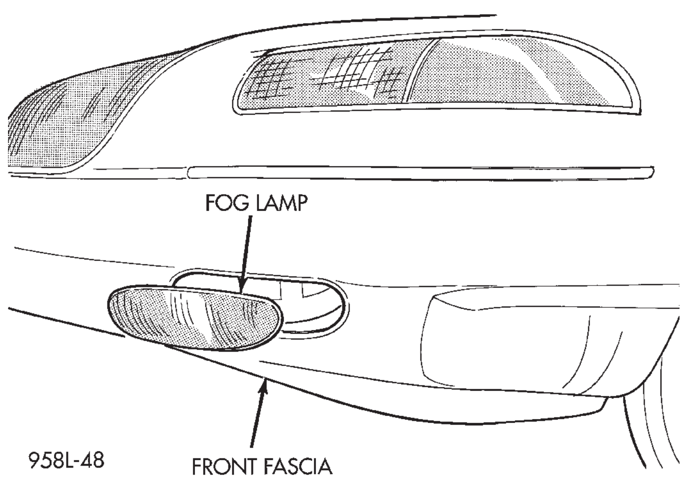


Fig. 2 Fog Lamp

INSTALLATION

Reverse the preceding operation.

PARK AND TURN SIGNAL LAMP BULB

REMOVAL

(1) Release hood latch and open hood.
(2) Remove screws attaching headlamp module to radiator closure panel.
(3) Remove headlamp module from radiator closure panel.

REMOVAL AND INSTALLATION (Continued)

(4) Rotate socket counterclockwise one quarter turn.
(5) Pull socket from back of lamp (Fig. 3).
(6) Pull bulb from socket.

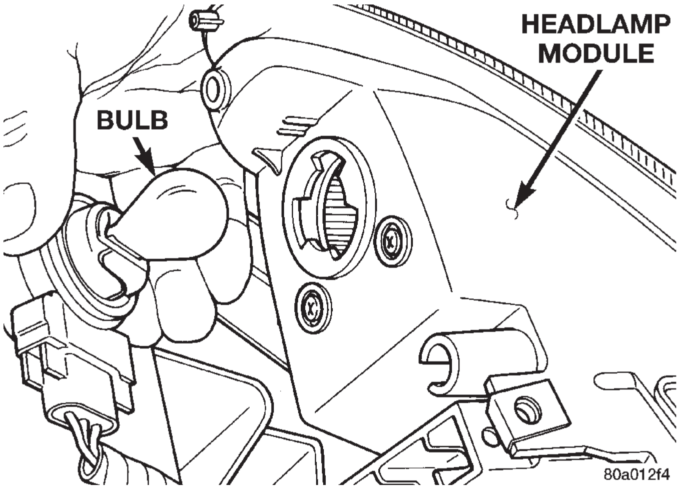


Fig. 3 Park and Turn Signal Lamp Bulb

INSTALLATION

(1) Push bulb into socket.
(2) Position socket into back of lamp.
(3) Rotate socket clockwise one quarter turn.
(4) Position headlamp module to radiator closure panel.
(5) Install screws attaching headlamp module to radiator closure panel.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Release decklid latch and open decklid.
(2) Remove socket from CHMSL.
(3) Remove nuts attaching CHMSL to decklid (Fig. 4).
(4) Remove CHMSL from decklid.

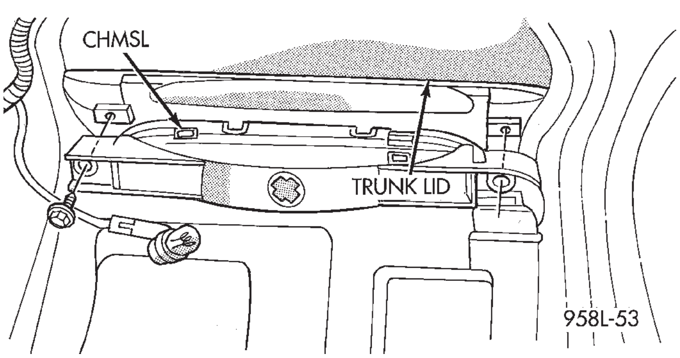


Fig. 4 Center High Mounted Stop Lamp

INSTALLATION

Reverse the preceding operation.

TAIL, STOP, TURN SIGNAL, AND BACK-UP LAMP

REMOVAL

(1) Release decklid latch and open decklid.
(2) Remove wing-nuts attaching tail lamp to rear closure panel (Fig. 5).
(3) Remove lamp from opening in quarter panel.
(4) Disconnect wire connector from back of tail lamp (Fig. 6).
(5) Remove tail lamp from vehicle.

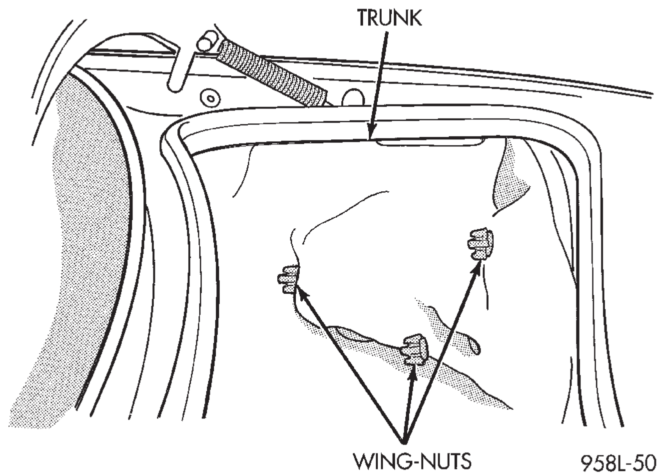


Fig. 5 Tail Lamp

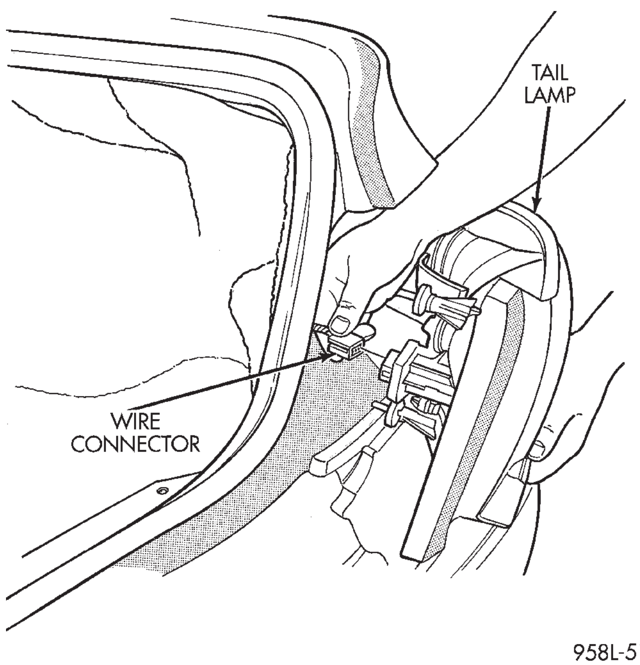


Fig. 6 Tail Lamp Wire Connector

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

TAIL LAMP CIRCUIT BOARD

REMOVAL

(1) Remove tail lamp.

(2) Remove bulb sockets.

(3) Remove circuit board from tail lamp (Fig. 7).

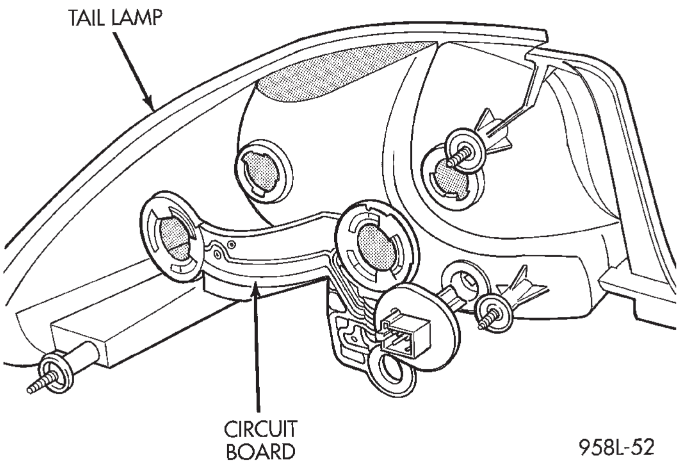


Fig. 7 Tail Lamp Circuit Board

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP

REMOVAL

(1) Remove screws attaching license plate lamp to rear bumper fascia (Fig. 8).

(2) Remove license plate lamp from fascia.

(3) Remove socket from lamp.

(4) Remove lamp from vehicle.

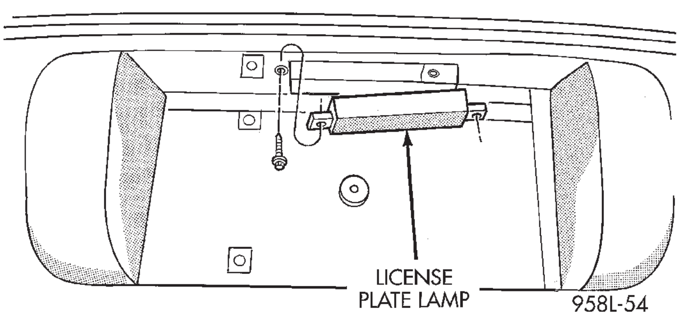


Fig. 8 License Plate Lamp

INSTALLATION

Reverse the preceding operation.

DOME LAMP

REMOVAL

(1) Pull downward on dome lamp bezel to disengage clips holding dome lamp to roof bow.

(2) Disconnect wire connector from dome lamp.

(3) Remove dome lamp from vehicle.

INSTALLATION

(1) Position dome lamp to vehicle.

(2) Connect wire connector to dome lamp.

(3) Center dome lamp in headlining opening.

(4) Insert switch end of dome lamp into headlining opening.

(5) Push upward on dome lamp to engage clips on dome lamp bezel to roof bow.

(6) Verify that dome lamp is flush to headlining.

FRONT READING LAMP

REMOVAL

(1) Pull downward on reading lamp to disengage clips holding reading lamp to roof header.

(2) Disconnect wire connector from reading lamp.

(3) Remove reading lamp from vehicle.

INSTALLATION

(1) Position front reading lamp to vehicle.

(2) Connect wire connector to reading lamp.

(3) Center reading lamp in headlining opening.

(4) Push upward on reading lamp to engage clips attaching reading lamp to roof header.

(5) Verify that reading lamp is flush to headlining.

ASH RECEIVER/CUP HOLDER LAMP

REMOVAL

(1) Using a small, flat bladed pry tool inserted into slot in lamp bezel, release tab holding lamp to cubby bin.

(2) Pull bezel and lamp assembly from cubby bin.

(3) Disconnect wire connector from lamp assembly.

(4) Remove lamp assembly from vehicle.

INSTALLATION

(1) Position lamp assembly to vehicle.

(2) Connect wire connector to lamp assembly.

(3) Push bezel and lamp assembly into cubby bin to engage tabs.

GLOVE BOX LAMP

REMOVAL

(1) Open glove box door.

(2) Pull downward on lamp/switch assembly to disengage tabs from instrument panel.

(3) Disengage wire connector from assembly.

(4) Separate assembly from vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position lamp/switch assembly from vehicle.

(2) Engage wire connector to assembly.

(3) Push upward on lamp/switch assembly to engage tabs holding assembly to instrument panel.

FLOOR TRANSMISSION RANGE INDICATOR LAMP

REMOVAL

(1) Remove gear shift knob. Refer to Group 21, Transmissions, for procedure.

(2) Using a plastic trim stick, Special Tool C-4755, disengage the forward or rear edge of transmission range indicator bezel from floor console.

(3) Pull upward carefully on transmission range indicator bezel and disengage tabs from rear floor console bezel.

(4) Disconnect wire connector to lamp assembly.

(5) Remove transmission range indicator bezel and lamp assembly from vehicle.

INSTALLATION

(1) Position transmission range indicator bezel and lamp assembly to vehicle.

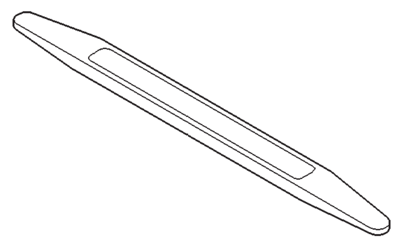
(2) Connect wire connector to lamp assembly.

(3) Engage tabs on transmission range indicator bezel to slots in rear floor console bezel.

(4) Push downward on transmission range indicator bezel to engage to bezel to floor console.

SPECIAL TOOLS

LAMP SERVICE



Trim Stick C-4755

LAMP SYSTEMS

INDEX

DESCRIPTION AND OPERATION

DAYTIME RUNNING LAMP (CANADA)

JA vehicles built for use in Canada are equipped with a Daytime Running Lamp (DRL) system. The DRL system operates the headlamps at 50% illumination with the headlamp switch OFF, park brake released and the ignition ON. The DRL system is controlled by the Daytime Running Lamp Module located on the back of the multi-function module behind the instrument panel (Fig. 1). The DRL module overrides the headlamp switch when the headlamps are turned OFF. The headlamps operate normally when the headlamps are turned ON. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

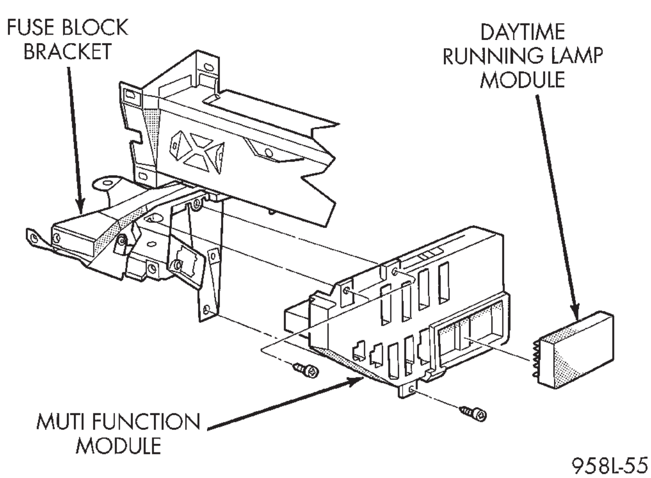


Fig. 1 Daytime Running Lamp Module

HEADLAMP TIME DELAY SYSTEM

The optional Headlamp Time Delay system is controlled by the Body Controller (BC) and a relay located in the junction block. The headlamp time delay system can be activated by turning ON the headlamps when the engine is running, turn OFF the ignition switch, then turn OFF the headlamp switch. The BC will allow the headlamps to remain ON for 90 seconds before they automatically turn off. Refer to the Owner's Manual for more information.

ILLUMINATED ENTRY

The Illuminated Entry System is available on vehicles equipped with the Remote Keyless Entry system. The Illuminated Entry System turns ON the courtesy lamps when the remote keyless entry system is activated. The Remote Keyless Entry Module and the Body Controller are used to control the system. Courtesy lamps will turn on for 30 seconds (±1 second) and fade to OFF over a five second period.

The Illuminated Entry System also turns ON the courtesy lamps (and ignition switch lamp) when door is opened. The courtesy lamps will remain ON while the door is open, then fade to OFF 30 seconds (±1 second) after the last door is closed.

The courtesy and ignition switch lamps will fade to OFF immediately when the ignition is switched to ON.

The Illuminated Entry System cannot be activated during the 30 second (±1 second) period after the ignition switch is turned OFF. After a door is opened and closed during this 30 second period, the system will function as previously described.

When the battery voltage has been interrupted to the Illuminated Entry System, the system will not function until the remote keyless entry UNLOCK is actuated.

DIAGNOSIS AND TESTING

GENERAL LAMP SYSTEM DIAGNOSTIC PROCEDURES

Refer to Group 8W, Wiring Diagrams for component location and circuit information. Refer to the Body Systems Diagnostic Procedures Manual for more information.

DIAGNOSIS AND TESTING (Continued)

ILLUMINATED ENTRY DIAGNOSTIC PROCEDURES

When testing the system, all doors must be closed to prevent courtesy lamps from lighting. Verify that remote keyless entry system is operating properly before testing illuminated entry circuits. The body controller uses input from the remote keyless entry system to switch ON the courtesy lamps.

Refer to Group 8W, Wiring Diagrams for component location and circuit information. Refer to Body Systems Diagnostic Procedures Manual for more information.

BULB APPLICATION

INDEX

SPECIFICATIONS

EXTERIOR LAMPS

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result.

CAUTION: Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

Back-up	921 (W16W)
Center High Mounted Stop	921 (W16W)
Fog	9006
Headlamp	9007QL or 9007
License Plate	168
Park/Turn Signal	3157K or 3157
Tail – DH/DP/PH	916
Stop/Turn Signal – DH/DP/PH	3157K
Tail/Stop/Turn Signal – CH	3157K

INTERIOR LAMPS

DIMMER CONTROLLED LAMPS

Service procedures for most of the lamps in the instrument panel, Instrument cluster and switches are located in Group 8E, Instrument Panel and Gauges. Some components have lamps that can only be serviced by a Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC.

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result.

CAUTION: Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

A/C Heater Control	37
A/C Heater ISO Symbols	LED
Ash Receiver	37
A/C Heater Control	37
Instrument Cluster	PC194
Radio	ASC

INDICATOR LAMPS

Service procedures for most of the lamps in the instrument panel, instrument cluster and switches are located in Group 8E, Instrument Panel and Gauges.

A/C Compressor	LED
Air Bag	PC194
Anti-lock Brake	PC194
Brake Warning	PC194
Check Engine	PC194
Console Shift Indicator	LED
Engine Oil Pressure	PC194
Engine Temperature	PC194
Fog Lamp	PC161
Generator	PC194
High Beam	PC194
Low Fuel	PC194
Rear Window Defogger	LED
Seat Belt	PC194
Security Alarm	LED
Shift Indicator	VF Display
Speed Control	PC194
Turn Signal	PC194

NON-DIMMING LAMPS

Service procedures for most of the lamps in the following list can be found in Group 23, Body. Some components have lamps that can only be serviced by a Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC.

Dome Courtesy	578
Ignition Lock	Mopar
Reading Lamp	906
Trunk	906
Visor Vanity	6501966

LAMPS

CONTENTS

LAMP DIAGNOSIS

INDEX

GENERAL INFORMATION

HEADLAMP LEVELING MOTOR

This vehicle is equipped with a remote headlamp leveling system. This system allows the driver to adjust the vertical headlamp aim from the interior of the vehicle to compensate for passenger or cargo load. A headlamp leveling switch is located in the instrument panel and controls the headlamp leveling motor found mounted to the headlamp module.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

When a vehicle experiences problems with the headlamp system, verify the condition of the battery connections, fuses, charging system, headlamp bulbs, wire connectors, relay, high beam switch, dimmer switch, and headlamp switch. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

DIAGNOSIS AND TESTING

HEADLAMP LEVELING MOTOR DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE MOTOR DOES NOT OPERATE	1. Poor connection at motor. 2. No voltage at motor. 3. Defective motor.	1. Secure connector on motor. 2. Repair circuit. Refer to Group 8W, Wiring. 3. Replace motor.
BOTH MOTORS DO NOT OPERATE	1. No voltage at headlamp leveling switch. 2. No voltage at both motors. 3. Poor connection at motors. 4. Both motors defective.	1. Repair circuit or replace fuse. Refer to Group 8W, Wiring. 2. Repair circuit or replace fuse. Refer to Group 8W, Wiring. 3. Secure connectors on motors. 4. Replace motors.

HEADLAMP AND FOG LAMP ALIGNMENT

INDEX

GENERAL INFORMATION

HEADLAMP ALIGNMENT PREPARATION

(1) Verify headlamp are on low beam setting.

(2) Verify that the headlamp leveling switch is in the “0” position.

(3) Inspect and correct damaged or defective components that could interfere with proper headlamp alignment.

(4) Verify proper tire inflation.

(5) Clean headlamp lenses.

(6) Verify that luggage area is loaded as the vehicle is routinely used.

(7) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

ADJUSTMENTS

HEADLAMP/FOG LAMP ADJUSTMENT USING ALIGNMENT SCREEN

ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 10 meters (32.8 ft.) away from front of headlamp lens (Fig. 1).

(2) Place 75 kg in the driver's seat to simulate the ride height of the vehicle when driven.

(3) If necessary, tape a line on the floor 10 meters (32.8 ft) away from and parallel to the wall.

(4) From the floor up 1.27 meters (5 ft), tape a line on the wall at the centerline of the vehicle. Sight along the centerline of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.

(5) Rock vehicle side-to-side three times and allow suspension to stabilize.

(6) Jounce front suspension three times by pushing downward on front bumper and releasing.

(7) Measure the distance from the center of headlamp lens to the floor. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(8) Place a tape line 130 mm below and parallel to the center of headlamp line.

(9) Measure distance from the centerline of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each side of vehicle centerline. Use these lines for left/right adjustment reference.

ADJUSTMENTS (Continued)

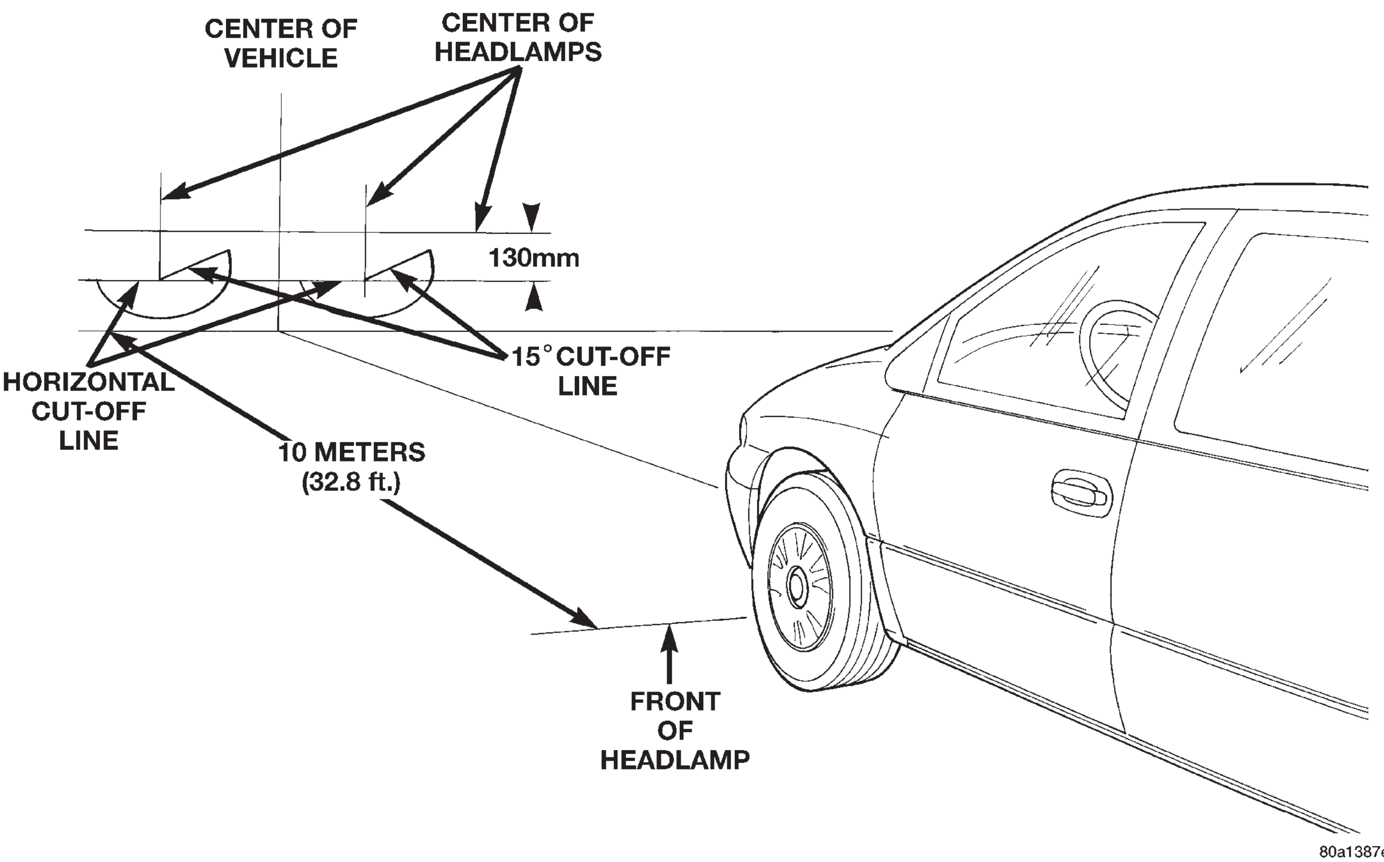


Fig. 1 Headlamp Alignment Screen—Typical

HEADLAMP ADJUSTMENT

A properly aimed low beam headlamp will project a high intensity light pattern on the screen with the horizontal cut-off line aligned with the tape line 130 mm (5.12 in.) below the headlamp centerline (Fig. 1). The intersection of the horizontal and 15 degree cut-off lines in the projected pattern should align to the intersection of the headlamp centerline vertical tape line and the tape line 130 mm (5.12 in.) below the headlamp horizontal centerline. The high beams on a vehicle with aero headlamps cannot be aligned. The high beam pattern should be correct when the low beams are aligned properly.

To adjust headlamp alignment, rotate alignment screws to achieve the specified low beam hot spot pattern.

ADJUSTMENTS (Continued)

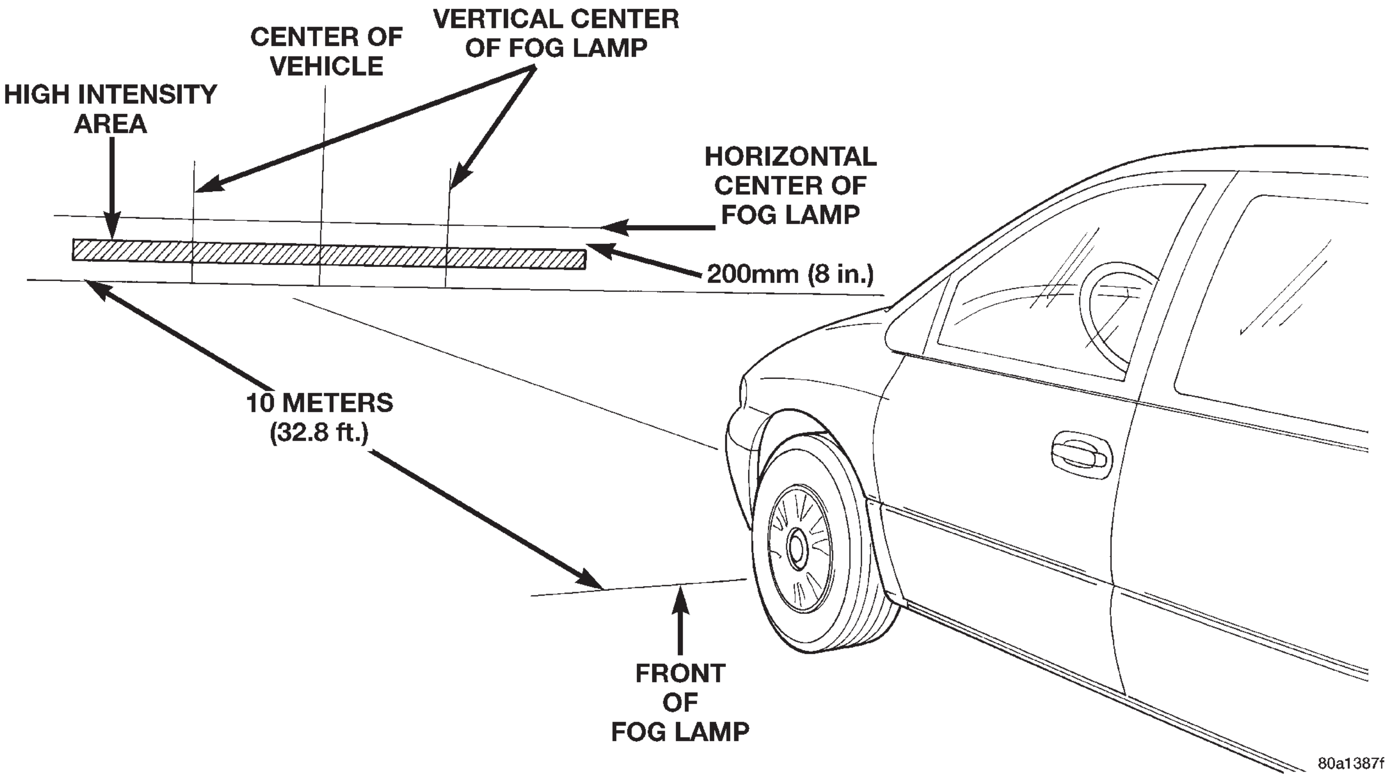


Fig. 2 Fog Lamp Alignment-Typical

FOG LAMP ALIGNMENT

Prepare an alignment screen. Refer to the Alignment Screen Preparation paragraph in this section. A properly aligned fog lamp will project a pattern on the alignment screen 200 mm (8 in.) below the fog lamp centerline and straight ahead (Fig. 2). To improve visual interpretation of the fog lamp pattern on the alignment screen, disable the headlamps by disengaging the wire connectors from the headlamp bulbs.

LAMP BULB SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

(1) Release hood latch and open hood.
(2) Remove screws holding headlamp module to radiator closure panel.
(3) Separate headlamp module from radiator closure panel.
(4) Disengage wire connector from back of headlamp bulb.
(5) Remove rubber boot seal (Fig. 1).
(6) Disengage retaining ring from headlamp module (Fig. 2).
(7) Pull bulb from headlamp module (Fig. 3).

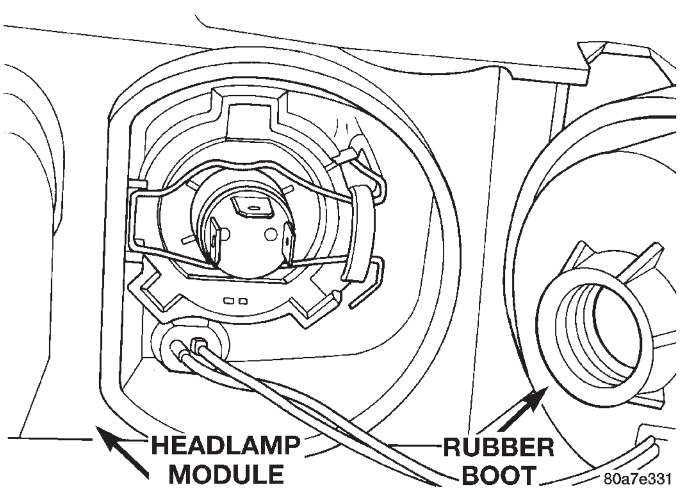


Fig. 1 Rubber Boot Seal

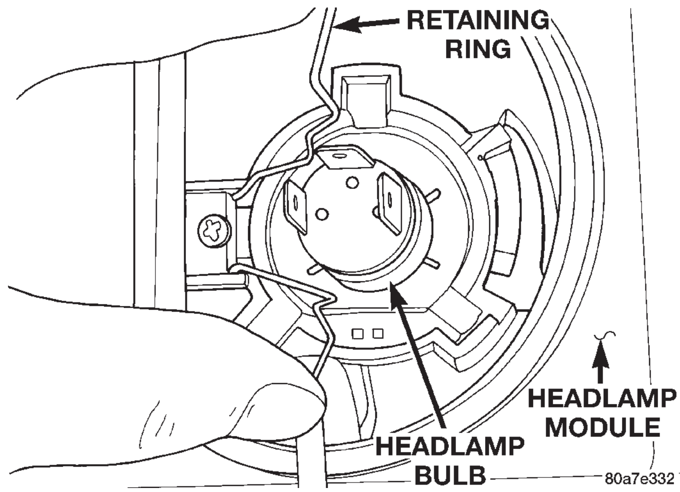


Fig. 2 Headlamp Bulb Retaining Ring

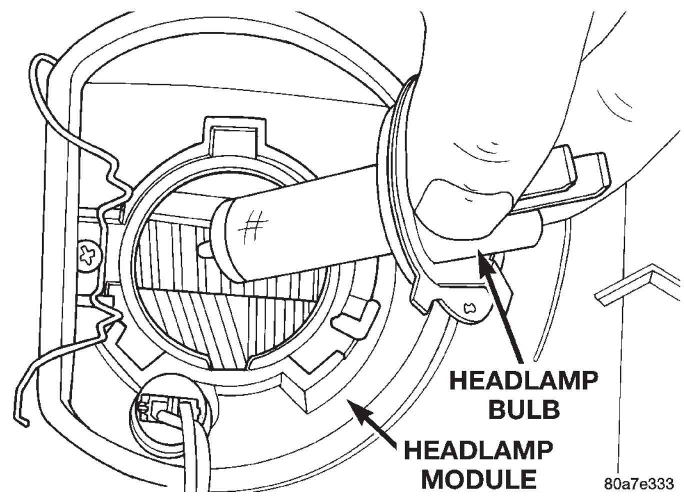


Fig. 3 Headlamp Bulb

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

TURN SIGNAL LAMP BULB

REMOVAL

(1) Release hood latch and open hood.
(2) Remove screws holding headlamp module to radiator closure panel.
(3) Separate headlamp module from radiator closure panel.
(4) Rotate socket counterclockwise one quarter turn.
(5) Pull socket from back of lamp (Fig. 4).
(6) Twist and pull bulb from socket.

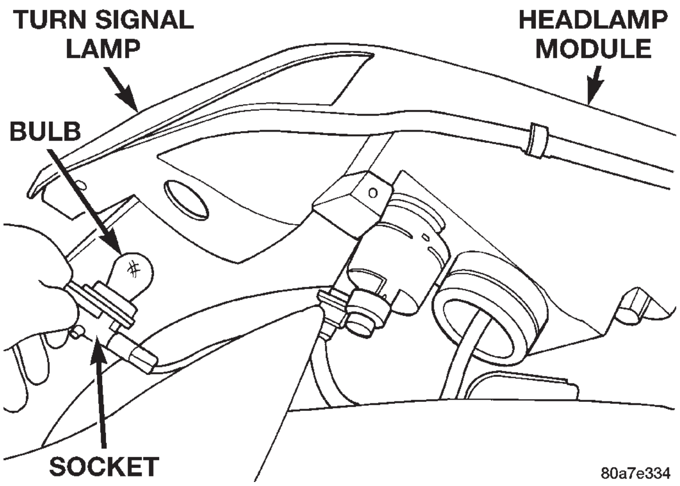


Fig. 4 Turn Signal Lamp Bulb

INSTALLATION

Reverse the preceding operation.

PARK LAMP BULB

REMOVAL

(1) Release hood latch and open hood.
(2) Remove screws holding headlamp module to radiator closure panel.
(3) Separate headlamp module from radiator closure panel.
(4) Disengage wire connector from back of headlamp bulb.
(5) Remove rubber seal boot (Fig. 5).
(6) Pull park lamp bulb socket from headlamp module (Fig. 6).
(7) Pull bulb from socket.

INSTALLATION

(1) Reverse the preceding operation.

SIDE REPEATER LAMP BULB

REMOVAL

(1) Open door to gain access to side repeater lamp socket.
(2) Rotate side repeater lamp socket counter clockwise one quarter turn.

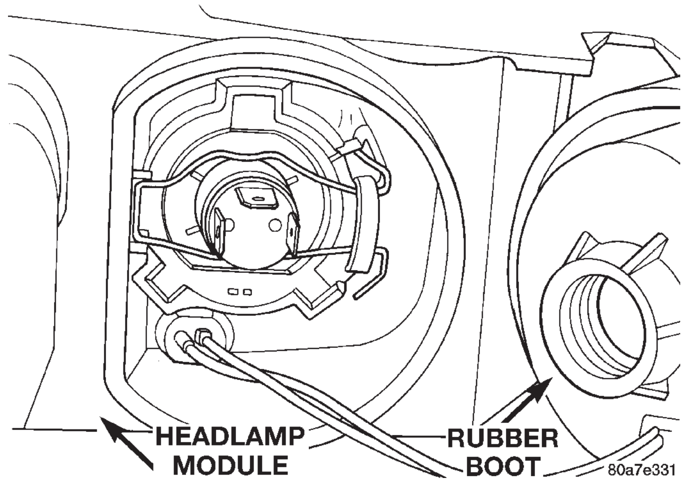


Fig. 5 Rubber Boot Seal

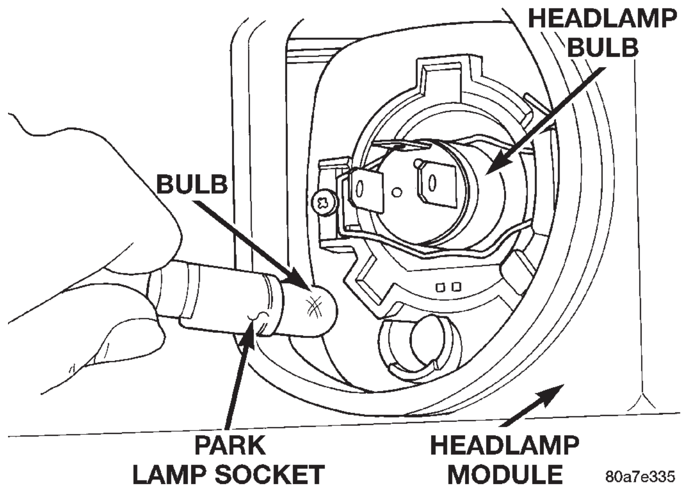


Fig. 6 Park Lamp Bulb

(3) Separate side repeater lamp socket from side repeater lamp (Fig. 7).
(4) Rotate and pull bulb from socket.

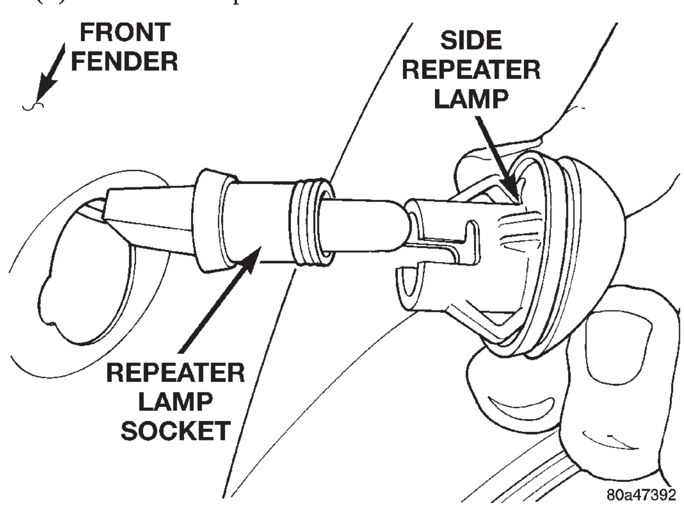


Fig. 7 Side Repeater Lamp Socket

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

REAR FOG LAMP BULB

Removal

(1) Remove screws holding rear fog lamp to rear bumper fascia.

(2) Separate rear fog lamp from rear bumper fascia (Fig. 8).

(3) Rotate rear fog lamp socket counterclockwise one quarter turn.

(4) Pull socket from rear fog lamp (Fig. 9).

(5) Twist and pull bulb from socket.

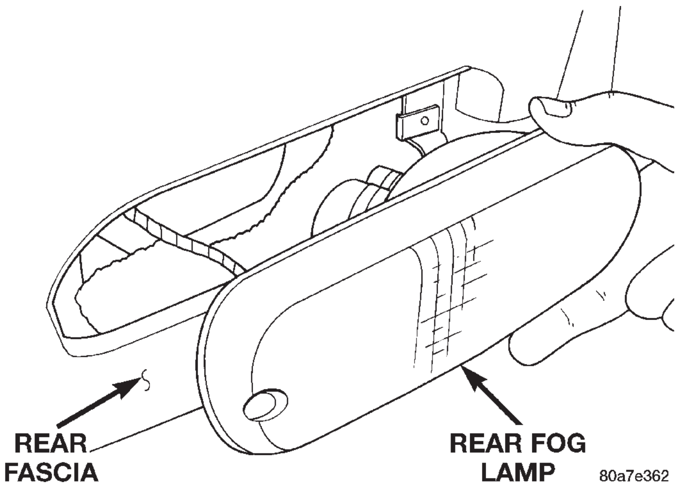


Fig. 8 Rear Fog Lamp

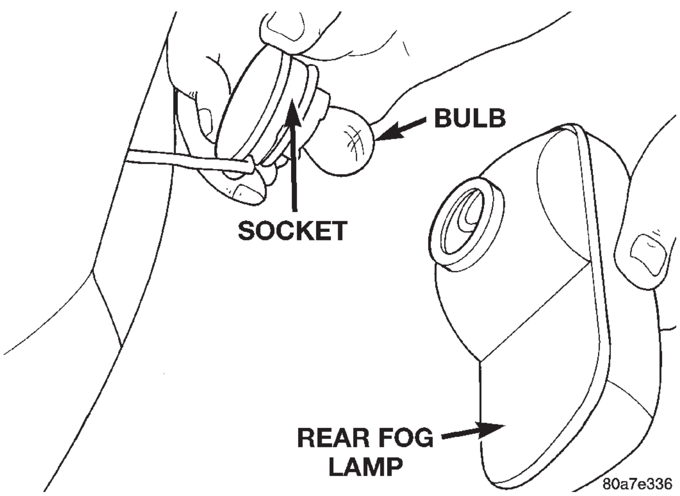


Fig. 9 Rear Fog Lamp Bulb

INSTALLATION

Reverse the preceding operation.

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Open the trunklid to gain access to center high mounted stop lamp socket.

(2) Rotate the CHMSL lamp socket counter clockwise until the socket can be removed from the CHMSL assembly.

(3) Remove the bulb from the socket assembly.

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP BULB

REMOVAL

(1) Remove screws holding license plate lamp to rear bumper fascia.

(2) Separate license plate lamp from rear fascia (Fig. 10).

(3) Rotate socket counterclockwise one quarter turn.

(4) Pull socket from back of lamp.

(5) Pull bulb from socket.

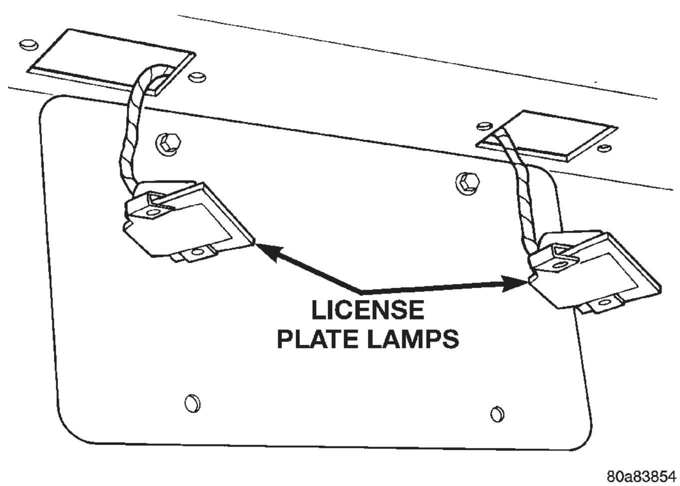


Fig. 10 License Plate Lamps

INSTALLATION

Reverse the preceding operation.

LAMP SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP MODULE

REMOVAL

(1) Release hood latch and open hood.
(2) Remove screws holding headlamp module to radiator closure panel.
(3) Separate headlamp module from radiator closure panel.
(4) Disengage wire connector from back of headlamp bulb.
(5) Remove rubber seal boot (Fig. 1).
(6) Pull park lamp bulb socket from headlamp module.
(7) Disengage retaining ring from headlamp leveling motor connector.
(8) Pull connector from motor.
(9) rotate turn signal socket counterclockwise one quarter turn.
(10) Pull socket from headlamp module (Fig. 2).
(11) Separate headlamp module from vehicle.

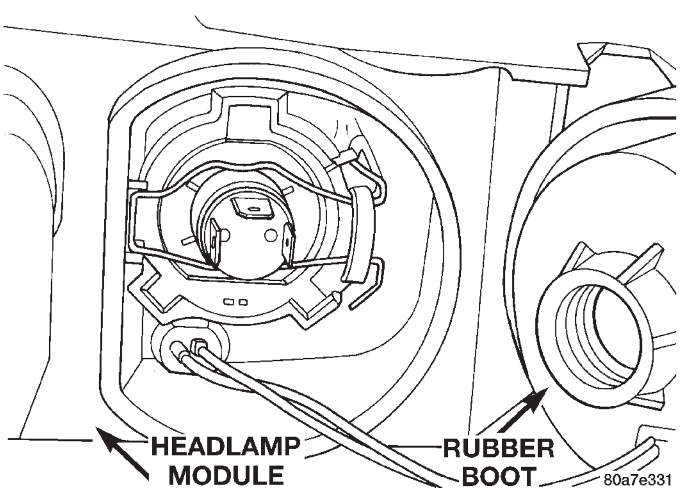


Fig. 1 Rubber Boot Seal

INSTALLATION

Reverse the preceding operation.

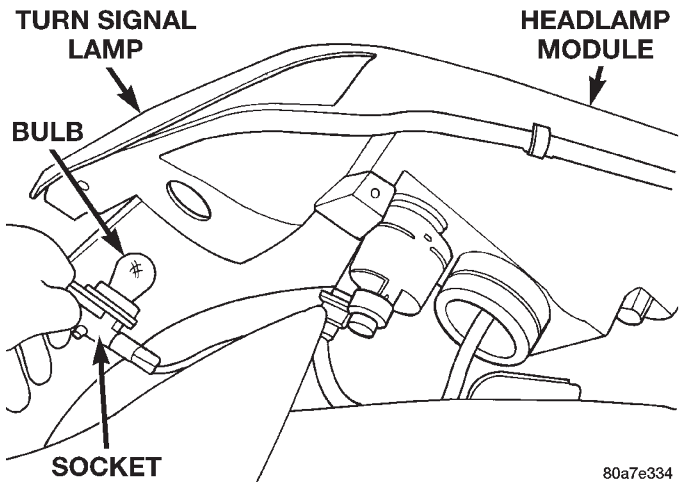


Fig. 2 Headlamp Module

HEADLAMP LEVELING MOTOR

REMOVAL

(1) Remove headlamp module from vehicle. Refer to Headlamp Module Removal.
(2) Rotate headlamp leveling motor counterclockwise one quarter turn (Fig. 3).
(3) Pry headlamp leveling motor from headlamp module.

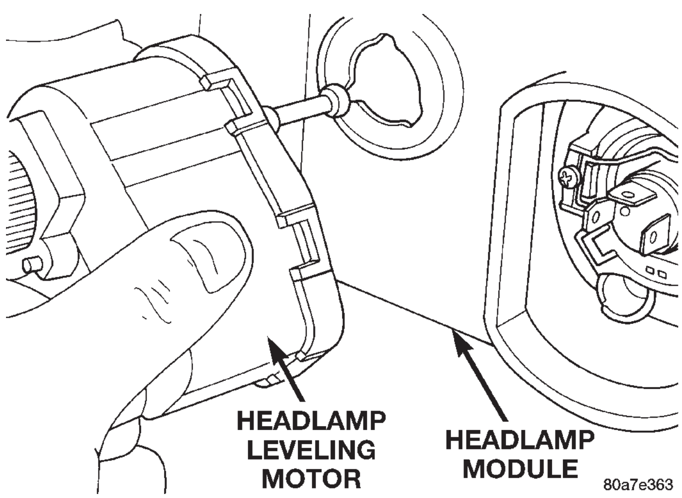


Fig. 3 Headlamp Leveling Motor

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

NOTE: Make sure headlamp leveling motor ball stud lines up with socket in headlamp module.

(1) Insert and rotate headlamp leveling motor into the headlamp module.

(2) With a flat blade screwdriver gently pry on headlamp reflector mechanism and fully seat headlamp leveling motor ball stud into the socket (Fig. 4).

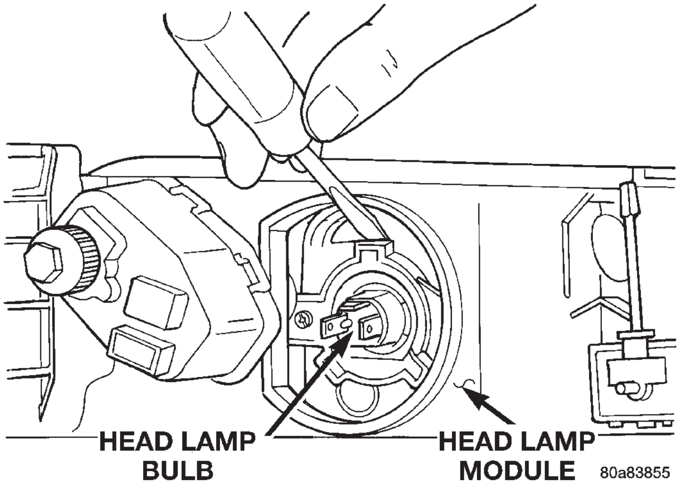


Fig. 4 Seating Headlamp Leveling Motor

SIDE REPEATER LAMP

REMOVAL

(1) Open door to gain access to side repeater lamp

(2) Disengage side repeater lamp socket from side repeater lamp (Fig. 5).

(3) Depress tabs holding side repeater lamp to fender (Fig. 6).

(4) Separate side repeater lamp from vehicle.

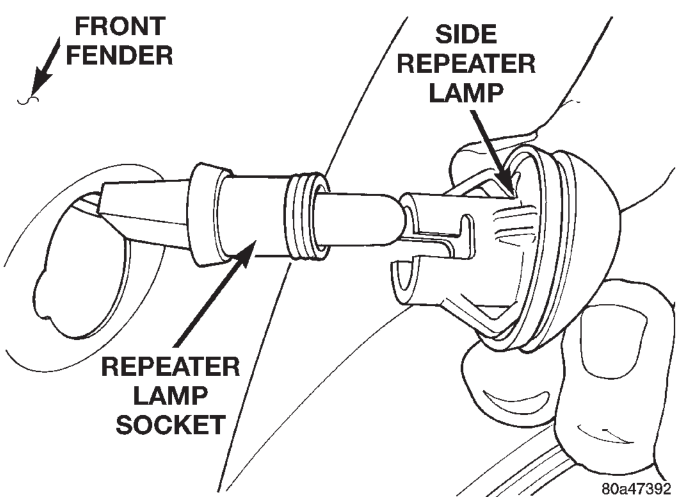


Fig. 5 Side Repeater Lamp Socket

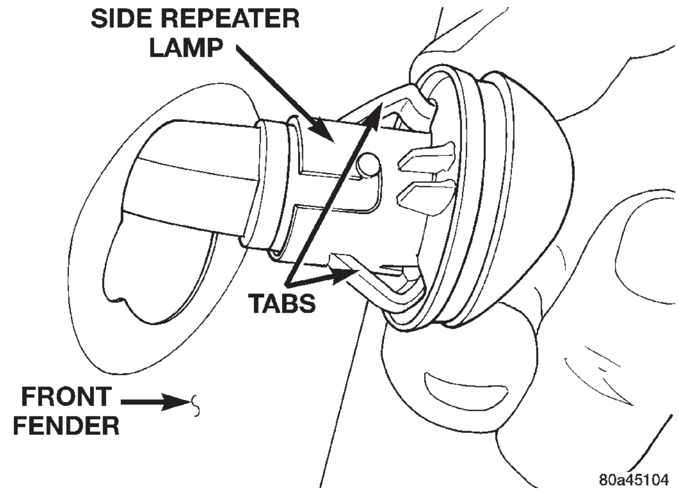


Fig. 6 Side Repeater Lamp

INSTALLATION

(1) Position side repeater lamp to hole in fender.

(2) Push side repeater lamp into fender until both tabs are engaged to backside of fender.

(3) Engage repeater lamp socket to repeater lamp.

REAR FOG LAMP

REMOVAL

(1) Remove screws holding rear fog lamp to rear bumper fascia.

(2) Separate rear fog lamp from fascia (Fig. 7).

(3) Rotate rear fog lamp socket counterclockwise one quarter turn.

(4) Pull socket from back of lamp.

(5) Separate rear fog lamp from vehicle.

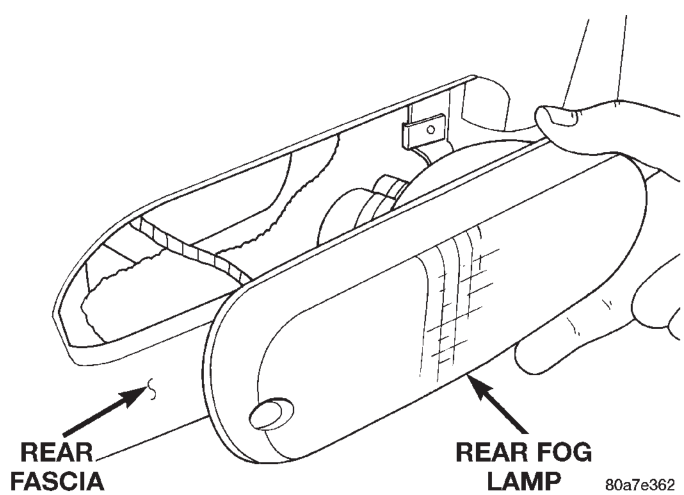


Fig. 7 Rear Fog Lamp

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Release trunk latch and open trunk lid.
(2) Disengage wire connector from CHMSL harness.
(3) Remove nuts holding CHMSL to trunk lid.
(4) Separate CHMSL from trunk lid.

INSTALLATION

Reverse the preceding operation.

LICENSE PLATE LAMP

REMOVAL

(1) Remove screws holding license plate lamp to rear bumper fascia.
(2) Separate license plate lamp from fascia (Fig. 8).
(3) Remove socket from lamp.
(4) Separate lamp from vehicle.

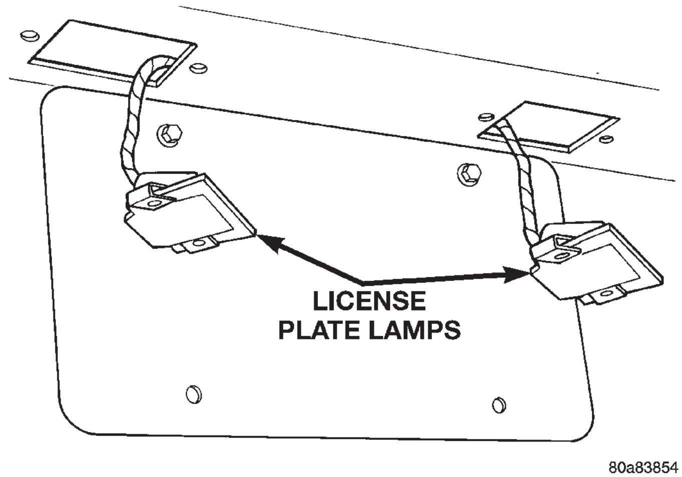


Fig. 8 License Plate Lamps

INSTALLATION

Reverse the preceding operation.

BULB APPLICATION

INDEX

SPECIFICATIONS

EXTERIOR LAMPS

Back-up	P21–5W
Fog	9006
Rear Fog	P21W
Headlamp	H4
Park Lamp	W5W
Side Repeater	TW4
License Plate	W5W
Front Turn Signal	PY21W
Tail/Stop	P21/5W
Turn Signal	P21W
CHMSL Lamp	921W/16/W

PASSIVE RESTRAINT SYSTEMS

CONTENTS

GENERAL INFORMATION

WARNINGS AND PRECAUTIONS

WARNING: THIS SYSTEM IS A SENSITIVE, COMPLEX ELECTRO–MECHANICAL UNIT. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A SOLID SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED AND COULD RESULT IN PERSONAL INJURY. WHEN CARRYING OR HANDLING AN UNDEPLOYED AIRBAG MODULE, THE TRIM SIDE OF THE AIRBAG SHOULD BE POINTING AWAY FROM THE BODY TO MINIMIZE POSSIBILITY OF INJURY IF ACCIDENTAL DEPLOYMENT OCCURS.

REPLACE AIRBAG SYSTEM COMPONENTS WITH MOPAR® REPLACEMENT PARTS. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WEAR SAFETY GLASSES, RUBBER GLOVES, AND LONG SLEEVED CLOTHING WHEN CLEANING POWDER RESIDUE FROM VEHICLE AFTER AIRBAG DEPLOYMENT. SODIUM HYDROXIDE POWDER RESIDUE EMITTED FROM A DEPLOYED AIRBAG CAN CAUSE SKIN IRRITATION. FLUSH AFFECTED AREA WITH COOL WATER IF IRRITATION IS EXPERIENCED. IF NASAL OR THROAT IRRITATION IS EXPERIENCED, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

DO NOT USE A REPLACEMENT AIRBAG THAT IS NOT IN THE ORIGINAL PACKAGING, IMPROPER DEPLOYMENT AND PERSONAL INJURY CAN RESULT.

THE FACTORY INSTALLED FASTENERS, SCREWS AND BOLTS USED TO FASTEN AIRBAG COMPONENTS HAVE A SPECIAL COATING AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. DO NOT USE SUBSTITUTE FASTENERS, USE ONLY ORIGINAL EQUIPMENT FASTENERS LISTED IN THE PARTS CATALOG WHEN FASTENER REPLACEMENT IS REQUIRED.

NOTE: Airbags should be stored in a cool dry location away from excessive heat and static electrical activity with the fabric airbag facing UP, or a premature deployment can result.

If the Driver/Passenger Airbag Module is defective and not deployed, refer to Chrysler Corporation current return list for proper handling procedures.

DESCRIPTION AND OPERATION

AIRBAG CONTROL MODULE (ACM)

The Airbag Control Module (ACM) contains the impact sensor and energy reserve capacitor. The impact sensor acts as a threshold sensitive switch that completes a circuit when an impact provides sufficient deceleration. The sensor is calibrated for the specific vehicle and reacts to the severity and direction of the impact.

The ACM monitors the system to determine the system readiness. The ACM stores sufficient energy to deploy the airbags for approximately two minutes after the battery is disconnected. The ACM contains on-board diagnostics, and illuminates the AIRBAG warning lamp in the cluster when a diagnostic trouble code occurs. The warning equipment is tested for a few seconds every time the vehicle is started.

CLOCKSPRING

The clockspring is mounted to the steering column behind the steering wheel. The clockspring is used to maintain a continuous electrical circuit between the wiring harness and the:

- Driver's airbag module
- Speed control switches
- Horn switch

The clockspring consists of a flat, ribbon like, electrically conductive tape that winds and unwinds with the steering wheel rotation.

DRIVER AND PASSENGER AIRBAG MODULES

WARNING: NEVER DISASSEMBLE THE DRIVER OR PASSENGER AIRBAG MODULES, THERE ARE NO SERVICEABLE PARTS WITHIN THE MODULES.

The Driver Airbag Module located in the center of the steering wheel is the most visible part of the system (Fig. 1). It contains the airbag cushion and its supporting components. The airbag module contains a housing in which the cushion and inflator are attached and sealed.

The driver side inflator assembly is mounted from the back of the module housing. When supplied with the proper electrical signal, the inflator assembly produces a gas and discharges it directly into the cushion. A protective cover is fitted to the front of the Driver Airbag Module and forms a decorative cover in the center of the steering wheel. The Driver Airbag Module is mounted directly to the steering wheel.

The Passenger Airbag Module is located beneath the decorative cover of the instrument panel, facing the passenger seat (Fig. 1).

The passenger inflator assembly is within the module housing. The module is mounted to the instrument panel retainer and support structure. When supplied with the proper electrical signal the inflator will produce a gas and discharge it directly into the cushion. A protective cover is fitted into the instrument panel over the airbag module and forms a decorative cover.

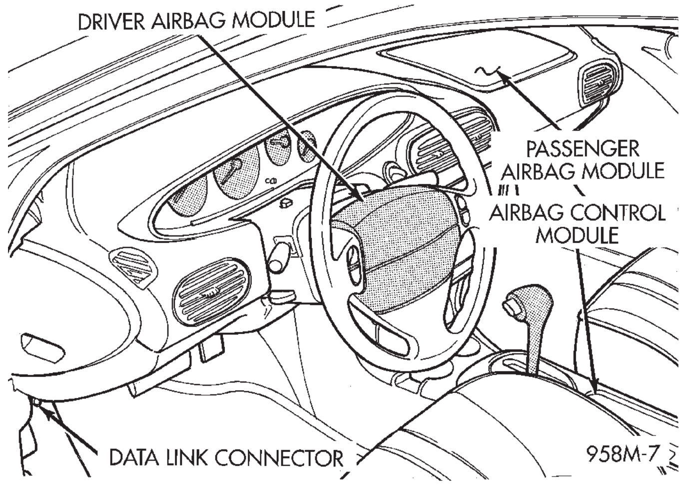


Fig. 1 Driver and Passenger Airbag Modules

The Passenger Airbag Module (PAB) consists of:

- Inflator assembly
- Reaction canister
- Airbag Pillow
- Deployment door

The PAB module is mounted to the instrument panel and pad assembly. When supplied with the proper electrical signal, the inflator produces gas and discharges it directly into the pillow. The deployment door will hinge, allowing the pillow to fully inflate.

DIAGNOSIS AND TESTING

AIRBAG SYSTEM TEST

(1) Connect the DRB lll® scan tool to the Data Link connector which is located on the left side kick panel just above the hood release.

(2) Turn the ignition key to the ON position. Exit vehicle with the scan tool.

(3) After checking that no one is inside the vehicle, connect the battery negative remote terminal.

(4) Using the scan tool, read and record the active Diagnostic Trouble Code (DTC) data.

(5) Read and record any stored DTC's.

(6) Refer to the proper Body Diagnostic Procedures Manual if any DTC's are found in Step 4 and Step 5.

(7) Erase stored DTC's if there are no active codes. If problems remain, DTC's will not erase. Refer to the proper Body Diagnostic Procedures Manual to diagnose the problem. If the airbag warning lamp either fails to light, or goes on and stays on, there is a system malfunction. Refer to the proper Body Diagnostic Procedures Manual to diagnose the problem. To test the airbag warning lamp operation in the cluster only, refer to Group 8E, Instrument Panel and Systems.

SERVICE PROCEDURES

CLEANUP PROCEDURE

CAUTION: When working around deployed Airbags, rubber gloves, eye protection and long sleeves should be worn. There may be deposits that could irritate the skin and eyes.

Roll or fold the Passenger Airbag Module towards the instrument panel surface and close the door over the folded bag. Then tape the door shut.

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Work from the outside in to avoid kneeling or sitting in a contaminated area. Vacuum the heater and A/C outlets as well (Fig. 2). If the heater or air conditioner was in RECIRC mode at time of airbag deployment, operate blower motor on low speed and vacuum powder residue expelled from the heater and A/C outlets. Multiple vacuum cleaning may to necessary to decontaminate the interior of the vehicle.

NOTE: Dispose of deployed airbags properly. Contact dealer or government agency for disposal recommendations.

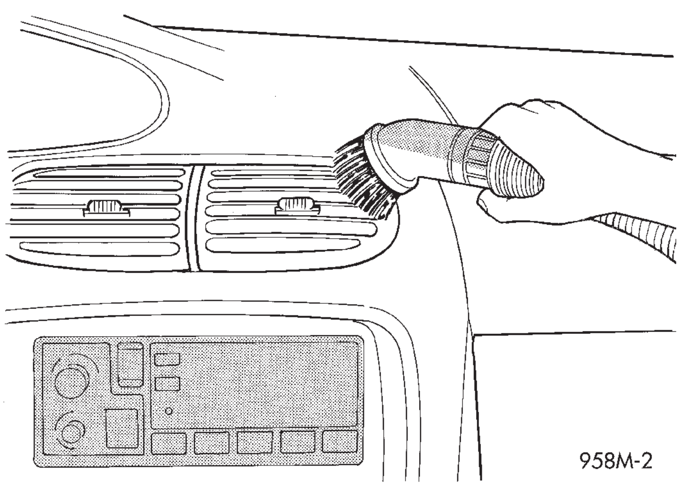


Fig. 2 Vacuum Heater and A/C Outlets

SERVICE OF DEPLOYED AIRBAG MODULE

DRIVER AIRBAG

After a Driver Airbag Module has been deployed:

- Driver Airbag Module
- Steering wheel
- Clockspring assembly
- Steering Column assembly

The component above must be replaced because they cannot be reused. Replace any other driver airbag system components if damaged.

PASSENGER AIRBAG

After a Passenger Airbag Module has been deployed:

- Passenger Airbag Module
- Instrument panel and pad assembly

The components above must be replaced because of visible or non visible structural damage.

The glove box, top cover, cluster hood, steering column cover, right trim bezel and/or end cap, or any other components should be checked and replaced if damaged.

HANDLING AIRBAG MODULES

DEPLOYED MODULE

CAUTION: The vehicle interior may contain a very small amount of sodium hydroxide powder, a by-product of airbag deployment. Sodium hydroxide powder can irritate the skin, eyes, nose and throat. Wear safety glasses, rubber gloves, and long sleeved clothing when cleaning any of the powder residue from the vehicle.

If you find that the cleanup is irritating your skin, run cool water over the affected area. Also, if you experience nasal or throat irritation, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

UNDEPLOYED

The airbag modules must be stored in its original special container until used for service. At no time should a source of electricity be permitted near the inflator on the back of an airbag module. When carrying or handling an undeployed airbag module, the trim side of the airbag should be pointing away from the body to minimize possibility of injury if accidental deployment occurs. Do not place undeployed airbag face down on a solid surface, the airbag will propel into the air if accidentally deployment occurs.

MAINTENANCE INSPECTION

Check the airbag warning lamp for proper operation as follows:

(1) Turn the ignition switch to the ON position. The airbag warning lamp should illuminate. If does not, test the system using a DRB lll® scan tool and Body Diagnostic Procedures Manual. Repair as required.

(2) The airbag warning lamp lights, but fails to go out after ten seconds. Test the system using a scan tool and Body Diagnostic Procedures Manual. Repair as required.

(3) Erasing stored Diagnostic Trouble Codes (DTC's) is not required.

REMOVAL AND INSTALLATION

AIRBAG CONTROL MODULE (ACM)

WARNING: REPLACE AIRBAG SYSTEM COMPONENTS WITH CHRYSLER MOPAR® SPECIFIED REPLACEMENT PARTS. SUBSTITUTE PARTS MAY VISUALLY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

THE ACM CONTAINS A IMPACT SENSOR WHICH ENABLES THE SYSTEM TO DEPLOY THE AIRBAGS. TO AVOID ACCIDENTAL DEPLOYMENT, NEVER CONNECT ACM ELECTRICALLY TO THE SYSTEM WHILE VEHICLE BATTERY IS CONNECTED.

REMOVAL

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

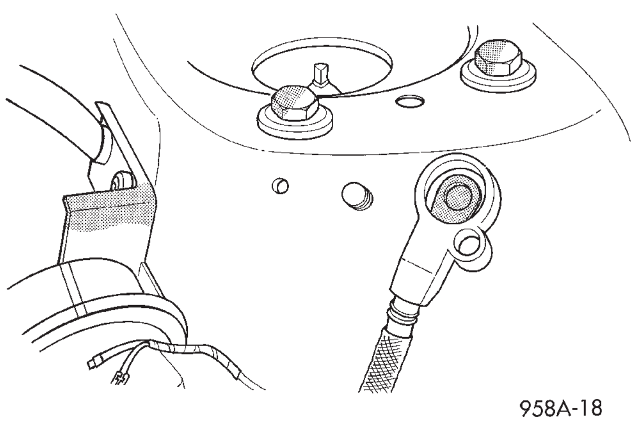


Fig. 3 Disconnect Battery Negative Remote Cable

(2) For a manual transmission, remove shifter knob and boot.

(3) Remove the four attaching screws floor console.

(4) Remove the four floor shifter mounting nuts.

(5) Remove two rear module mounting nuts and remove module (Fig. 4).

INSTALLATION

CAUTION: USE SUPPLIED NUTS ONLY.

For installation, reverse the above procedures.

(1) Position ACM (arrow pointing forward) on center tunnel area mounting studs.

(2) Attach the two rear mounting nuts and tighten to 15 to 19 N·m (125 to 160 in. lbs.) torque.

(3) Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

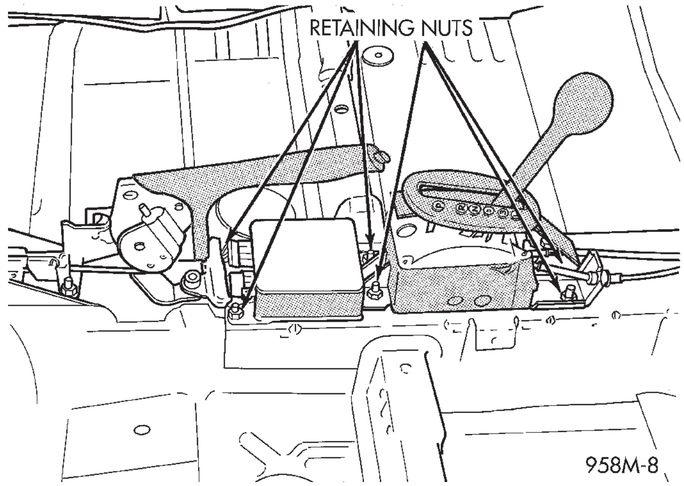


Fig. 4 Airbag Control Module

CLOCKSPRING

REMOVAL

CAUTION: When removing a deployed module, rubber gloves, eye protection and long sleeves should be worn. There may be deposits on the surface which could irritate the skin and eyes.

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

(2) Remove the two steering column lower cover attaching screws. Remove upper cover.

(3) Remove the Driver Airbag Module attaching T-30 Torx bolts from back side of the steering wheel. Lift the module and disconnect the wire by:

(a) Lifting the secondary latch.

(b) Disconnect the connector from back of the airbag module using the finger grips. Use care not to pull on wires. Never use a metallic tool to pry on the connector.

(4) Remove the speed control switch screws from back of the steering wheel. Pull the switch pods out and disconnect the wires.

(5) Disconnect the horn wire from the steering wheel and remove the speed control wires from the wire guides.

(6) Remove the steering wheel. Carefully feed all wires through the steering wheel armature to avoid damaging wires. When replacing a deployed Driver Airbag Module, a new clockspring must be installed (Fig. 5).

(7) Remove the nut attaching steering wheel to the steering column.

(8) Disconnect the natural 3-way and the yellow 2-way connectors from back side of the Driver Airbag Module.

(9) Remove the steering column shrouds by unfastening the two fasteners.

REMOVAL AND INSTALLATION (Continued)

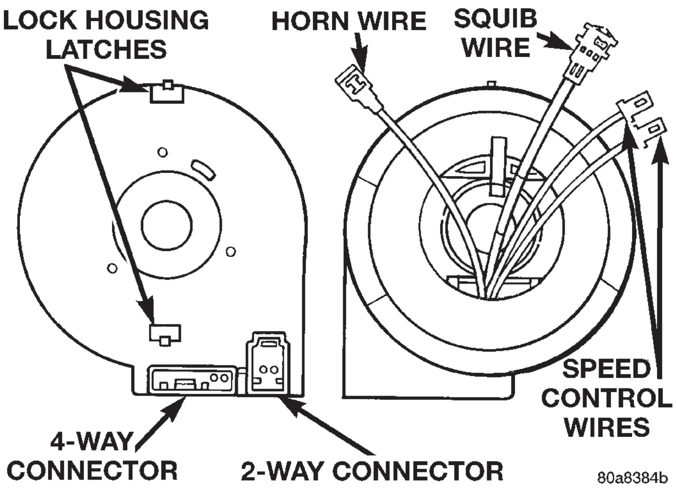


Fig. 5 Clockspring

(10) Remove multi-function switch by unfastening the two screws.

(11) Remove the clockspring by lifting the top lock housing latches up slightly to guide it over the lock housing. The clockspring cannot be serviced.

INSTALLATION

(1) Adjust the steering wheel so that the tires are straight ahead position.

(2) Center the clockspring by ensuring the yellow indicator visually seen through the centering window. Refer to Clockspring Centering Procedure.

(3) Align the top locking tab with the slot on the lock housing. Gently push into place.

(4) Install the multi-function switch and tighten to 1.5 to 2.5 N·m (14 to 22 in. lbs.) torque.

(5) Install the steering column shrouds and tighten to 1.7 to 2.3 N·m (15 to 20 in. lbs.) torque.

(6) Carefully route the wires through the hole in the steering wheel armature. Install steering wheel and Tighten to 61 N·m (45 ft. lbs.) torque.

(7) Route the speed control wires under the horn mechanism and through the speed control switch pockets. Connect the speed control wires to switches and install switches. Tighten screws to 0.7 to 2.7 N·m (6 to 24 in. lbs.) torque.

(8) Connect horn lead to the airbag module mounting bracket.

(9) Connect the yellow airbag lead to the Driver Airbag Module and push secondary latch into place (Fig. 5). Ensure the wires do not get pinched during installation.

(10) Install the airbag module bolts and tighten to 9 to 10 N·m (80 to 90 in. lbs.) torque. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting the battery negative remote cable.

DRIVER AIRBAG MODULE

REMOVAL

CAUTION: When removing a deployed Driver Airbag Module, rubber gloves, eye protection and long sleeves should be worn. There may be deposits on the surface that could irritate the skin and eyes.

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

(2) Remove the Driver Airbag Module attaching T-30 Torx bolts from back side of the steering wheel (Fig. 6). Lift the module and disconnect the wire by:

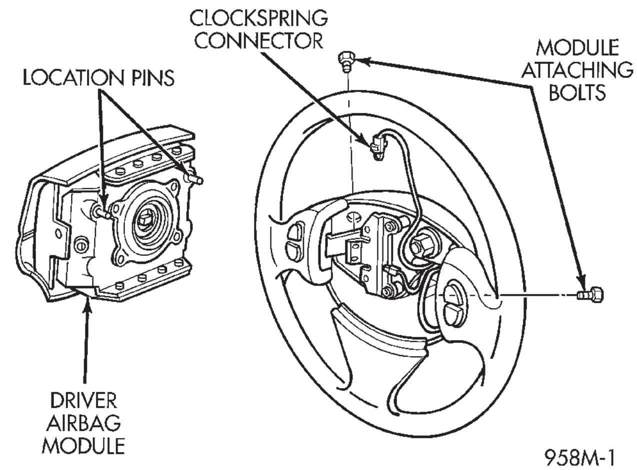


Fig. 6 Driver Airbag Module

(a) Lifting the secondary latch.

(b) Disconnect the connector from back of the Driver Airbag Module using the finger grips. Use care not to pull on wires. Never use a metallic tool to pry off the connector.

(3) Remove the speed control switch screws from the back of the steering wheel. Pull the switch pods out and disconnect the wires.

(4) Disconnect the horn wire from the airbag mounting bracket. Remove the speed control wires from the wire guides.

(5) When replacing a deployed Driver Airbag Module, the clockspring must also be replaced. Refer to Clockspring Removal and Installation in this section.

INSTALLATION

(1) Connect horn wire to the Driver Airbag Module mounting bracket. Connect the Driver Airbag Module connector to the back of the module. Make airbag connection by pressing straight in on the connector then push the secondary latch into place. The connector should be fully seated to ensure a positive connection. Ensure that the wires do not get pinched during installation.

REMOVAL AND INSTALLATION (Continued)

(2) Install the two module bolts and tighten to 9 to 10 N·m (80 to 90 in. lbs.) torque.

(3) Connect wire connectors to the speed control switches and install the switches. Tighten the screws to 0.7 to 2.7 N·m (6 to 24 in lbs.). Refer to Diagnosis and Testing for Airbag System Test procedures before connecting the battery negative remote cable.

PASSENGER AIRBAG MODULE

DEPLOYED MODULE

CAUTION: When removing a deployed Passenger Airbag Module, rubber gloves, eye protection and long sleeves should be worn. There may be deposits on the surface that could irritate the skin and eyes.

REMOVAL

(1) Remove Instrument Panel. Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

(2) After removal of the instrument panel disconnect Passenger Airbag Module wire connector.

(3) Remove the four nuts and two screws attaching airbag assembly to the instrument panel collar.

(4) Lift Passenger Airbag Module up and out of panel cavity.

INSTALLATION

For installation, reverse the above procedures.

(1) Remove all of the instrument panel components that are not damaged and replace any components that are damaged.

(2) Use a new instrument panel and pad assembly.

(3) Transfer all of the components.

(4) Install a new Passenger Airbag Module and tighten nuts to 11 N·m (100 in. lbs.) and screws to 2 N·m (20 in. lbs.) torque. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

UNDEPLOYED MODULE

REMOVAL

When removing a Passenger Airbag Module for any reason other than DEPLOYMENT:

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

(2) Open and lower glove box fully to gain access to Passenger Airbag Module (PAB) attaching screws inside of the glove box (Fig. 7). Glove box removal not required.

(3) Disconnect wire connector from the Passenger Airbag Module.

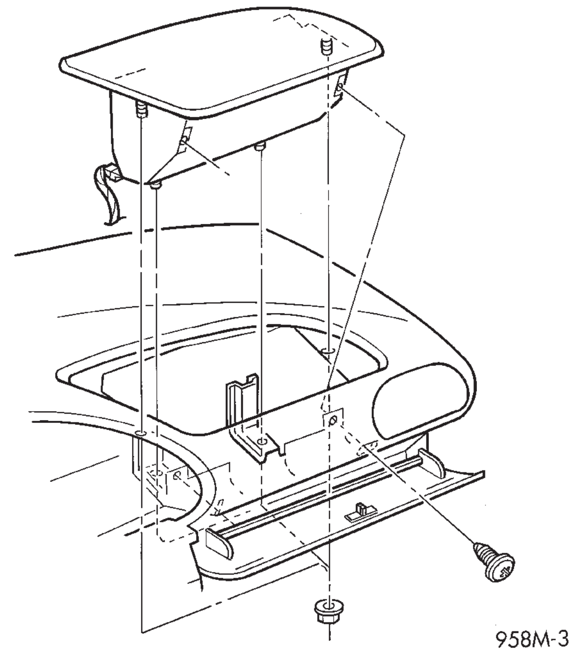


Fig. 7 Passenger Airbag Removal

(4) Remove the four nuts and two screws attaching airbag assembly to the instrument panel collar.

(5) Lift Passenger Airbag Module up and out of panel cavity.

INSTALLATION

For installation, reverse the above procedures. Install a new Passenger Airbag Module and tighten nuts to 11 N·m (100 in. lbs.) and screws to 2 N·m (20 in. lbs.) torque. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

STEERING WHEEL

REMOVAL

(1) Adjust the steering wheel so that the tires are in the straight ahead position.

(2) Disconnect and isolate the battery negative remote cable (Fig. 3).

(3) Remove the Driver Airbag Module attaching T-30 Torx bolts from back side of the steering wheel. Lift the module and disconnect the wire by:

(a) Lifting the secondary latch.

(b) Disconnect the connector from the module using the finger grips. Use care not to pull on wires. Never use a metallic tool to pry on the connector.

(4) Remove the speed control switch screws from back of the steering wheel. Pull the switch pods out and disconnect the wires.

(5) Disconnect the horn wire from the airbag module mounting bracket. Remove the speed control wires from under the bracket and from the wire guides.

REMOVAL AND INSTALLATION (Continued)

(6) Remove the steering wheel retaining nut.

(7) Remove the steering wheel with wheel puller tool. Carefully feed all of the wires through the steering wheel armature to avoid damaging wires.

INSTALLATION

(1) Ensure that the road wheels are in the straight ahead position.

(2) Ensure that the clockspring is centered by using the centering indicator. Refer to Clockspring Centering Procedure in this section.

(3) Ensure that the turn signal stalk is in the neutral position.

(4) Carefully route the wires through the hole in the steering wheel armature. Install steering wheel and tighten to 61 N·m (45 ft. lbs.) torque.

(a) Ensure that the driving key on the steering wheel hub lines up with the slot in the clockspring rotor.

(b) Ensure that the block tooth in the steering wheel hub lines up with the missing tooth on the steering column shaft.

(5) Route the speed control wires under the horn mechanism and through the speed control switch pockets. Connect the speed control wires to switches and install switches. Tighten bolts to 1.7 $\pm$ 1 N·m (15 $\pm$ 10 in. lbs.) torque.

(6) Connect the horn lead to steering wheel.

(7) Connect the yellow airbag lead to the Driver Airbag Module and push secondary latch into place (Fig. 5). Check that the wires do not get pinched during installation.

(8) Install the airbag module bolts and tighten the left side first. Tighten to 9 to 10 N·m (80 to 90 in. lbs.) torque.

(9) Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

ADJUSTMENTS

CLOCKSPRING CENTERING PROCEDURE

WARNING: If the rotating tape within the clockspring is not positioned properly with the steering wheel and the front wheels, the clockspring may fail during use. The clockspring is centered when yellow appears in the centering window and the arrow on the rotor points to the window. If clockspring is not centered, the following procedure MUST BE USED to center the clockspring:

(1) To center the clockspring, with steering wheel removed, depress the two plastic locking pins to disengage the mechanism. Rotate clockspring until yellow appears in the centering window.

(2) The arrow on the rotor will be pointing at the window if the clockspring is centered. Release locking pins to engage locking mechanism.

(3) For installation, refer to Clockspring Removal and Installation in this section. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

ELECTRICALLY HEATED SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

INTRODUCTION

For proper operation of the Rear Window Defogger system refer to the Owner's Manual.

The system consists of a rear glass with two vertical bus bars and a series of electrically connected grid lines on the inside surface (Fig. 1). The control switch is located in the HVAC Control Module. The relay is located in the junction block. The timer is located in the Body Control Module (BCM).

Circuit protection for heated grid is provided by:

- Fuse 12 (EBL) located in the power distribution center
- Rear window defogger relay (EBL) located in the Junction Block

When the button is depress to the ON position, current is directed to the rear defogger grid lines. A yellow indicator within the center of the button will illuminate while the defogger is ON. The heated grid lines will heat the rear glass and clear the window surface of fog or frost.

CAUTION: Grid lines can be damaged or scraped off with sharp instruments, care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

HVAC CONTROL MODULE

The rear window control switch and circuit are integrated into the HVAC control module (Fig. 2). When actuating the switch it sends a ground signal to the Body Control Module (BCM). The BCM actuates the relay allowing current to flow through the grid lines for ten minutes upon initial actuation. Then 5 minutes with each subsequent actuation or until either the switch or ignition is turned off. An indicating lamp illuminates the rear window defogger switch.

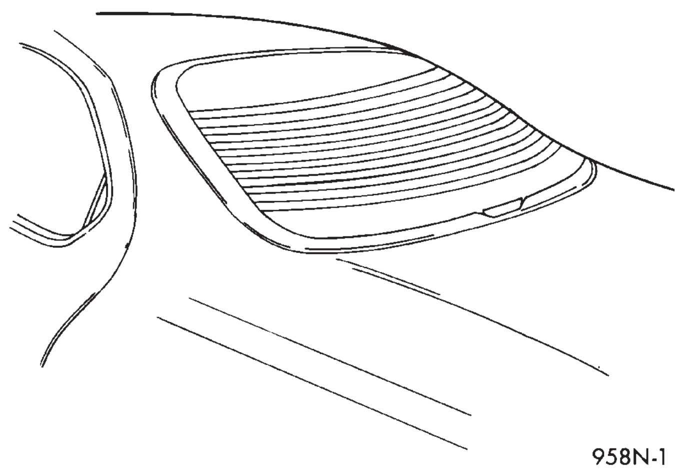


Fig. 1 Rear Window Defogger

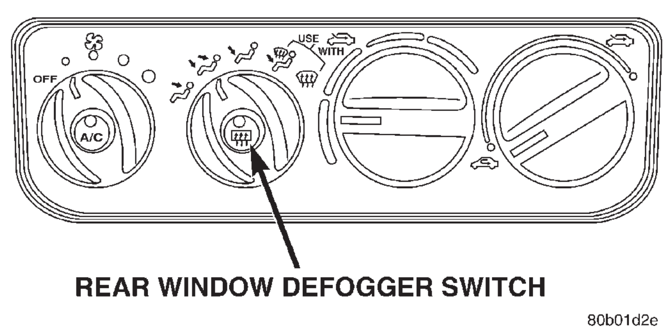


Fig. 2 HVAC Control Module

DIAGNOSIS AND TESTING

SYSTEM TEST

Electrically heated rear window defogger operation can be checked in vehicle in the following manner:

(1) Turn ignition switch to the ON position.

(2) Make sure defogger switch is OFF.

(3) Remove the battery negative remote cable from the terminal. Using a ammeter (capable of a 30 AMP range), connect the ammeter is series between the battery cable and the remote terminal. Turn the Defogger control switch ON, a distinct increase in amperage draw should be noted.

(4) The rear window defogger operation can be checked by feeling the glass. A distinct difference in temperature between the grid lines and adjacent clear glass can be detected in 3 to 4 minutes of operation.

(5) Using a DC voltmeter (Fig. 3) contact terminal B with the negative lead, and terminal A with the positive lead. The voltmeter should read 10-14 volts.

(6) Step 3, Step 4, and Step 5 above will confirm system operation. Indicator light illumination means that there is power available at the output of the relay only, and does not necessarily verify system operation.

(7) If the indicator light is not on, then check fuse #6 in the junction block.

(8) If turning the switch ON produced no distinct current draw on the ammeter the problem should be isolated in the following manner:

(a) Confirm the ignition switch is ON.

(b) Ensure that the heated rear glass feed wire is connected to the terminal or pigtail and that the ground wire is in fact grounded.

(c) Ensure that fuse 12 (EBL) in the Power Distribution Center is OK.

(9) When the above steps have been completed and the system is still inoperative, one or more of the following is defective:

(a) Control switch in the HVAC control module

(b) Rear window defogger relay (EBL) in the Junction Block

(c) Timer circuit in the Body Control Module

(d) Rear window grid lines, all grid lines would have to be broken or one of the feed wires are not connected for the system to be inoperative.

(10) If depressing the switch button ON produces severe voltmeter deflection, the circuit should be closely checked for a shorting condition.

(11) If the system operation has been verified but indicator bulb does not light, check fuse 6 in the junction block. If not OK, replace as necessary. If OK, test the HVAC control module.

(12) For detailed wiring information, refer to group 8W, Wiring Diagrams.

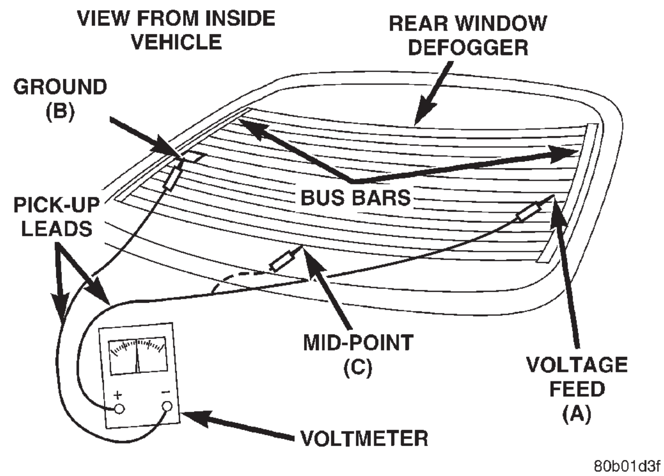


Fig. 3 Grid Line Test

GRID LINES

The horizontal grid lines and vertical bus bar lines printed and fired on inside surface of rear window glass (Fig. 3) comprise an electrical parallel circuit. The electrically conductive lines are composed of a silver-ceramic material which when fired on glass becomes bonded to the glass and is highly resistant to abrasion. It is possible, however, that a break may occur in an individual grid line resulting in no current flow through the line. To detect breaks in grid lines the following procedure is required:

(1) Turn ignition switch to the ON position. Depress the control switch button to ON position. The indicator light should come on.

(2) Using a DC voltmeter with 0-15 volt range, contact the ground terminal with negative lead of voltmeter. With positive lead of voltmeter, contact feed terminal (Fig. 3). The voltmeter should read 10-14 volts. A lower voltage reading indicates a poor ground connection.

(3) Connect the negative lead of voltmeter to a good body ground point. The voltage reading should not be more than two tenth of a volt difference. If more than two tenth of a volt repair the ground circuit.

(4) Connect negative lead of voltmeter to ground terminal and touch each grid line at Mid-Point with Positive lead. A reading of approximately 6 volts indicates a line is good. A reading of 0 volts indicates a break in line between Mid-Point and feed terminal. A reading of 10-14 volts indicates a break between Mid-Point and ground terminal. Move toward break and voltage will change as soon as break is crossed (Fig. 3). Refer to Group 8W, Wiring Diagrams for circuit information.

HVAC CONTROL MODULE

The control switch and timer circuit may be tested in the vehicle with or without scan tool (DRB).

DIAGNOSIS AND TESTING (Continued)

TESTING WITH SCAN TOOL

If using the scan tool, refer to the proper Body Diagnostic Procedures Manual.

TESTING WITHOUT SCAN TOOL

(1) Remove the control switch from console and do not disconnect control switch (Fig. 4).

(2) Using a ohmmeter, check leads between Pins 5 and 8 of the 8-way connector. Depress the rear window defogger button and the resistance reading should be 500 to 520 ohms. If not OK, replace HVAC. If OK, check:

- Rear window relay (EBL)
- Blown fuse
- Cut wire
- Poor ground
- Poor connection
- Defective BCM
- Bulkhead connector inoperative

Refer to Group 8W, Wiring Diagrams.

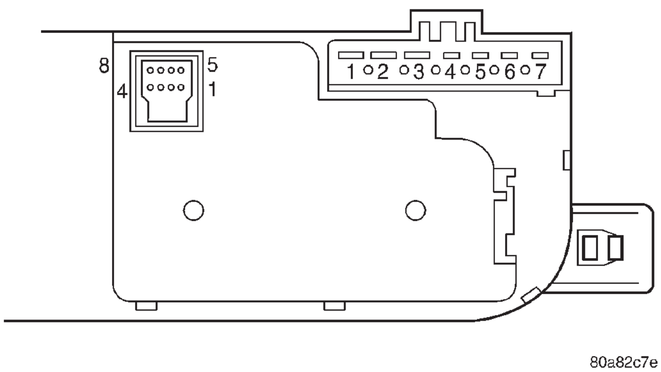


Fig. 4 HVAC Control Module Connectors

REAR WINDOW DEFOGGER RELAY

(1) Check fuses.

(a) Fuse 15 in the Junction Block

(b) Fuse 8 and 12 in the Power Distribution Center.

(2) Remove the rear window defogger relay (EBL) from the Junction Block (Fig. 5).

(3) Using voltmeter, test battery voltage:

(a) Test rear window defogger relay terminals 13 for battery voltage. If voltage is OK, go to Step b. If voltage is not OK, repair A4 circuit.

(b) Test the rear window defogger relay terminal for battery voltage with the key in the run position. If voltage is OK, go to Step c. If voltage is not OK, repair A31circuit.

(c) Use a known good relay. If not OK, repair circuits as necessary. Refer to Group 8W, Wiring Diagrams. If OK, replace relay.

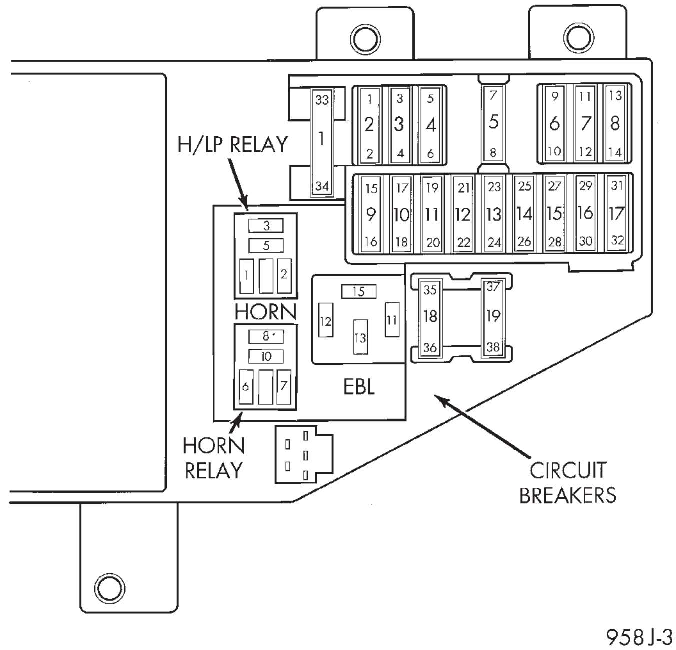


Fig. 5 Rear Window Defogger Relay (EBL)

SERVICE PROCEDURES

REPAIR GRID LINES, TERMINALS AND PIGTAILS

WARNING: REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION.

THE KIT CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER AND HARMFUL:

- **DO NOT TAKE INTERNALLY, IF SWALLOWED INDUCE VOMITING AND CALL A PHYSICIAN IMMEDIATELY.**
- **IF CONTACTED WITH SKIN, WASH AFFECTED AREAS WITH SOAP AND WATER.**
- **IF CONTACTED WITH EYES, FLUSH WITH PLENTY OF WATER.**

USE WITH ADEQUATE VENTILATION.

DO NOT USE NEAR FIRE OR OPEN FLAME THE CONTENTS CONTAIN FLAMMABLE SOLVENTS.

KEEP OUT OF REACH OF CHILDREN.

The repair of the grid lines or the terminal is possible using the Mopar® Repair Package or equivalent.

(1) Mask repair area so conductive epoxy can be extended onto the line or the bus bar (Fig. 6).

(2) Follow instructions in repair kit for preparing damaged area.

(3) Remove package separator clamp and mix plastic conductive epoxy thoroughly. Fold in half and cut center corner to dispense epoxy.

SERVICE PROCEDURES (Continued)

(4) Apply conductive epoxy through slit in masking tape. Overlap both ends of the break by 19 mm (3/4 inch).

(5) For a terminal or pigtail replacement, mask adjacent areas so epoxy can be extended onto line as well as bus bar. Apply a thin layer of epoxy to area where terminal was fastened and to adjacent line.

(6) Apply a thin layer of conductive epoxy on terminal and place terminal on desired location. To prevent terminal from moving while the epoxy is curing, it must be wedged or clamped.

(7) Carefully remove masking tape from grid line.

CAUTION: Do not allow the glass surface to exceed 204°C (400°F), glass may fracture.

(8) Allow epoxy to cure 24 hours at room temperature or use heat gun with a 260° to 371°C (500° to 700°F) range for 15 minutes. Hold gun approximately 254 mm (10 inches) from repaired area.

(9) After conductive epoxy is properly cured remove wedge from terminal and check out operation of rear window defogger. Do not attach connectors until curing is complete.

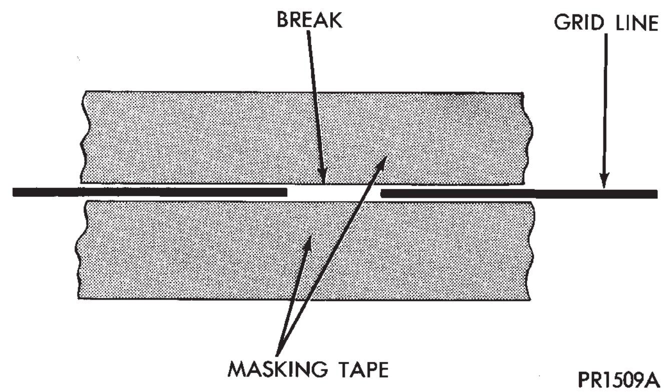


Fig. 6 Grid Line Repair

REMOVAL AND INSTALLATION

HVAC CONTROL

Refer to Group 8E, Instrument Panel and Systems for proper Removal and Installation procedures.

REAR WINDOW DEFOGGER RELAY

(1) Open the driver's door and remove instrument panel end cover.

(2) Remove rear window defogger relay from the Junction Block (Fig. 5).

ELECTRICALLY HEATED SYSTEMS

CONTENTS

HEATED SEATS

INDEX

GENERAL INFORMATION

INTRODUCTION

Individually controlled electrically heated front seats are available factory-installed optional equipment on this model. The seat heaters will only operate when the ignition switch is in the On position, and the surface temperature at the front seat heating element sensors is below the temperature set point (1–6) on the heated seat switch.

There is a rotating six-position switch located in the floor console that controls the temperature for each front seat. Six positions can be selected, the 0 position set point is off and the (1–6) positions provide various temperature control for each front seat, with position 6 being the warmest. When the switch is turned on Light-Emitting Diodes (LED) will illuminate the number on the switch to give a visual indication that the system is on. Each switch controls a Heated Seat Control Module (HSCM) mounted to the seat cushion frame under each front seat.

When a seat heater is turned on, a sensor located near the seat cushion electric heater element provides the HSCM with an input indicating the surface temperature of the seat cushion. If the surface temperature input is below the temperature set point for the selected switch position, a relay in the HSCM energizes the heating elements in the seat cushion and back. When the sensor input indicates the correct temperature set point has been achieved, the HSCM de-energizes the relay. The HSCM will continue to cycle the relay as needed to maintain the temperature set point.

The control circuit operates on ignition switched power from a 10 amp fuse in cavity # 11 of the junction block and a 20 amp fused battery feed in cavity # 11 of the Power Distribution Center. The system is turned off automatically when the ignition switch is turned to the Off – Lock position, and returns automatically to the previously set heat setting when the ignition switch is turned back ON. The heating elements operate on power supplied through a 20 amp MAXI fuse located in the power distribution center in the engine compartment. The HSCM automatically disconnects power from the heating elements if it detects an open in the sensor circuit, but the LED's will remain on. If the heating element shorts, causing excessive current draw, the 20 amp MAXI fuse in the Power Distribution Center will blow and/or the HSCM will disconnect power from the heating elements, but the LED's will remain on.

Following are general descriptions of the major components in the heated seat system. Refer to 8W-63 - Power Seat With Heated Seats in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

DESCRIPTION AND OPERATION

HEATED SEAT SWITCH

The heated seat switch is located in the floor console. The two six-position rotating-type switches, one switch for each front seat, provide a voltage signal to their respective Heated Seat Control Module (HSCM). Each switch has 0 – 6 positions so that both the driver and front seat passenger can select a preferred heat setting.

There are three Light-Emitting Diodes (LED's) in the heated seat switch. The first LED illuminates the heated seat symbol on the switch any time the ignition switch is turned on and the remaining LED's illuminate the numbers on each switch to indicate the system is turned on.The heated seat switch and their LED's cannot be repaired. If faulty, the switch unit must be replaced.

HEATED SEAT CONTROL MODULE

The Heated Seat Control Module (HSCM) is an electronic thermostatic module designed to operate the electric seat heater elements. Two modules are used in the vehicle, one for each front seat. The HSCM for each seat is mounted to the seat cushion frame.

Inputs to the module include the rheostat heated seat switch, the seat cushion temperature sensors, an ignition-switched battery feed, an unswitched battery feed, and a ground. The only HSCM output is the feed for the seat heating elements.

The HSCM cannot be repaired and, if faulty, must be replaced.

HEATED SEAT ELEMENTS AND SENSOR

Three seat heating elements are used in each front seat, two for the seat cushion and one for the seat back. The three elements for each seat are connected in series with the HSCM.

The temperature sensor is a negative temperature coefficient thermistor. One temperature sensor is used for each seat, and it is integrated into the seat cushion heating element.

The heating elements are sewn into the seat cushion cover and seat back cover assemblies, which are serviced individually. The heating elements and temperature sensor cannot be repaired and, if faulty, the affected seat cover assembly must be replaced. Refer to Group 23 - Body Components for the seat cover service procedures.

DIAGNOSIS AND TESTING

HEATED SEAT SYSTEM

For circuit descriptions and diagrams, refer to 8W-63 - Power Seat With Heated Seats in Group 8W - Wiring Diagrams.

Before testing the individual components in the heated seat system check the following:

- If the heated seat switch LED's do not light with the ignition switch in the On position and the heated seat switch in 1– 6 positions, check the 10 amp fuse in cavity #11 located in the junction block. If the fuse is OK, test the heated seat switch as described in this group.
- If the heated seat switch LED's light, but the heating elements do not heat, check the 20 amp MAXI fuse located in cavity # 11 of the Power Distribution Center in the engine compartment. If the fuse is OK, remove the front seat and test the heating elements for continuity.

HEATED SEAT SWITCH

For circuit descriptions and diagrams, refer to 8W-63 - Power Seat With Heated Seats in Group 8W - Wiring Diagrams.

(1) Remove the heated seat switch as described in this group and inspect connector for damage. Unplug the 7-way connector from the switch and check the harness terminals for ignition voltage and ground.

(2) Check the drivers switch for resistance between pin terminals PB and 86B. Resistance should vary from 0–500 ohms as the switch is rotated (Fig. 1). If OK, go to Step 3. If not OK, replace the heated seat switch.

(3) Check the passenger switch for resistance between pin terminals PF and 86F. Resistance should vary from 0–500 ohms as the switch is rotated (Fig. 1). If OK, test heated seat control module as described in this group. If not OK, replace the heated seat switch.

HEATED SEAT CONTROL MODULE

For circuit descriptions and diagrams refer to 8W-63 - Power Seats With Heated Seats in Group 8W - Wiring Diagrams. Before testing the heated seat control module, test the heated seat switch 6–way connector located under each front seat for voltage and ground. If testing of the heated seat elements, and switch reveals no problems, remove the module as described in this group. Turn the ignition switch on.

(1) Check for battery voltage at the red wire of the heated seat control module connector. If OK go to Step 2. If not OK check the 20 amp MAXI fuse located in the Power Distribution Center.

DIAGNOSIS AND TESTING (Continued)

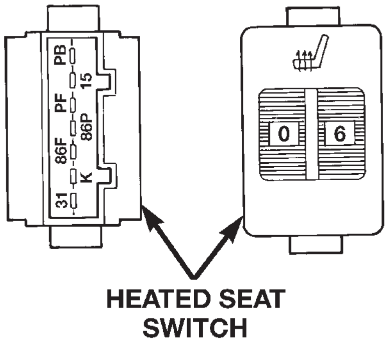


Fig. 1 Heated Seat Switch

(2) Turn ignition switch and heated seat switch on and check for 9 - 16.5 volts at the white/black wire of the heated seat control module connector. If OK go to Step 3. If not OK check the 10 amp fuse in cavity # 11 located in the Junction Block and the 20 amp fuse in cavity # 8 of the Power Distribution Center.

(3) Turn ignition switch and heated seat switch on and check for 7 - 16.5 volts at the purple wire of the heated seat control module connector. If OK go to Step 4. If not OK test heated seat switch and harness as described in this group.

(4) Turn ignition switch and heated seat switch on and check for 9 - 16.5 volts at the red/white wire of the heated seat control module connector. The surface temperature at the front seat heating element sensor must be below the temperature setting (1-6) on the heated seat switch, for the red/white wire to be at battery voltage. If OK go to Step 5. If not OK test heated seat switch and harness as described in this group.

(5) Check for continuity between a known good ground and the black wire of the heated seat control module connector. If OK replace the heated seat control module. If not OK inspect the harness for an open.

HEATED SEAT ELEMENT

The connectors for the seat cushion and seat back heating elements are located under the seat near the rear edge of the seat cushion frame. For circuit descriptions and diagrams, refer to 8W-63 - Power Seat With Heated Seats in Group 8W - Wiring Diagrams.

SEAT CUSHION

(1) Disconnect and isolate the battery negative cable and remove the seat from the vehicle, refer to Front Seats in Group 23.

(2) Disconnect the green 4–way heated seat cushion connector and check for continuity between pins A and B of the heated seat cushion connector. There should be continuity, if OK, test the heated seat back for continuity. If not OK, check the green 2–way seat cushion connector. If OK, replace the faulty seat cushion cover (Fig. 2).

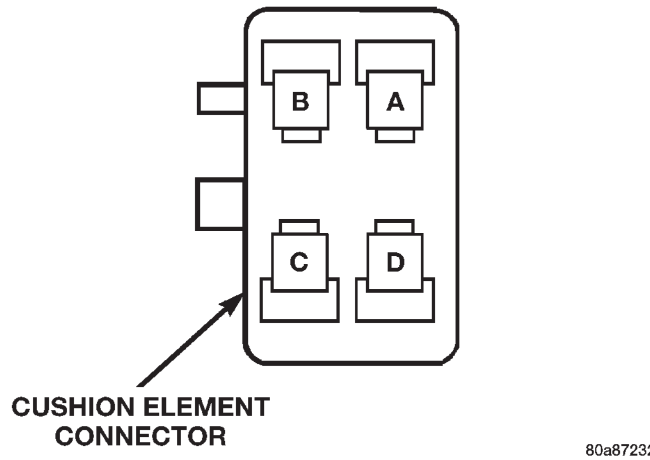


Fig. 2 Seat Cushion Element Connector

SEAT BACK

(1) Disconnect and isolate the battery negative cable and remove the seat from the vehicle, refer to Front Seats in Group 23.

(2) Disconnect the green 2-way heated seat back connector and check for continuity between pins A and B of the heated seat back connector. There should be continuity, if OK, test the Heated Seat Control Module as described in this group. If not OK, replace the faulty seat back cover.

REMOVAL AND INSTALLATION

HEATED SEAT SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center console. Refer to Group 23, Body for a procedure.

(3) Depress both locking tabs and push switch out of center console.

(4) Disconnect the electrical connector from the switch.

INSTALLATION

Reverse the removal procedure to install.

CAUTION: Be sure the “UP” labeling on the switch faces the proper position upon installation.

REMOVAL AND INSTALLATION (Continued)

HEATED SEAT CONTROL MODULE

(1) Move the power seat adjuster to its upper-most and rearward-most stop positions.

(2) Disconnect and isolate the battery negative cable.

(3) Reach under the front of the seat cushion and separate the heated seat control module from the seat cushion frame (Fig. 3).

(4) Unplug the wiring connector and remove the module from under the seat.

(5) Reverse the removal procedures to install.

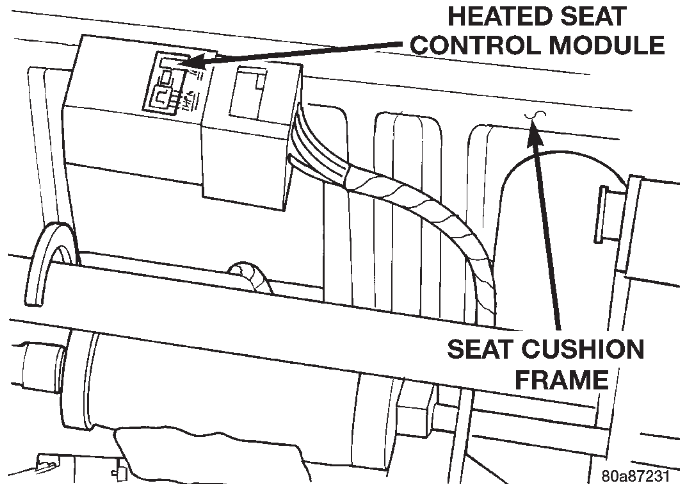


Fig. 3 Heated Seat Control Module

POWER DISTRIBUTION SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

POWER DISTRIBUTION SYSTEM

This group covers the various standard and optional power distribution components used on this model. Refer to the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams of the various power distribution components.

The power distribution system for this vehicle is designed to provide safe, reliable, centralized and convenient to access distribution of the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, comfort and convenience systems. At the same time, these systems were designed to provide centralized locations for conducting diagnosis of faulty circuits, and for sourcing the additional current requirements of many aftermarket vehicle accessory and convenience items.

These power distribution systems also incorporate various types of circuit control and protection features, including:

- Fuses
- Fuse cartridges
- Fusible links
- Automatic resetting circuit breakers
- Relays
- Flashers
- Timers
- Circuit splice blocks.

The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Junction Block (JB)
- Accessory power outlet.

Following are general descriptions of the major components in the power distribution system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the power distribution system components.

POWER DISTRIBUTION CENTER (PDC)

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC). The molded plastic PDC housing is located in the left front corner of the engine compartment, just behind the battery. The PDC housing has a molded plastic cover that includes an integral hinge feature on the inboard side, and an integral latch on the outboard side. The PDC cover is easily removed for service access and has a convenient fuse and relay layout label affixed to the inside surface of the cover to ensure proper component identification.

The PDC housing is secured in the engine compartment on the left front corner with three screws to the transmission and engine control module bracket. A small red molded plastic protective cover on the top near the rear of the PDC is unsnapped to access the battery/generator cable input connection stud. All of the PDC outputs are through the integral engine compartment wire harness, which exits from the rear of the PDC housing.

All of the current from the battery/generator cable connection enters the PDC through a 140 ampere fusible link that is secured to the top of the PDC housing. The PDC houses up to ten maxi-fuse cartridges, which replace all in-line fusible links. The PDC also houses up to eight blade-type fuses, up to four full International Standards Organization (ISO) relays, and up to eight ISO micro-relays. Internal connection of all the PDC circuits is accomplished by an intricate network of hard wiring and bus bars. Refer to **Power Distribution** in the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams.

The fusible link, fuse cartridges, fuses and relays are available for service replacement. The PDC unit cannot be repaired and is only serviced as a unit with the engine compartment wire harness. If the PDC is faulty or damaged, the engine compartment wire harness assembly must be replaced.

DESCRIPTION AND OPERATION (Continued)

JUNCTION BLOCK (JB)

An electrical Junction Block (JB) is located in the left endcap of the instrument panel. The JB combines the functions previously provided by a separate fuse-block module and relay center. It also serves to simplify and centralize numerous electrical components, as well as to distribute electrical current to many of the accessory systems in the vehicle. It eliminates the need for numerous splice connections and serves in place of a bulkhead connector between many of the engine compartment, instrument panel, and body wire harnesses.

The JB is positioned on a mounting bracket up and under the left instrument panel. It is secured by three screws. The JB is concealed behind the left instrument panel endcap. The left instrument panel endcap is a snap-fit fuse access cover that conceals the JB fuses. A fuse puller and spare fuse holders are located on the back of the endcap, as well as the fuse layout to ensure proper fuse identification. The left instrument panel endcap must be removed to access components other than the fuses in the JB.

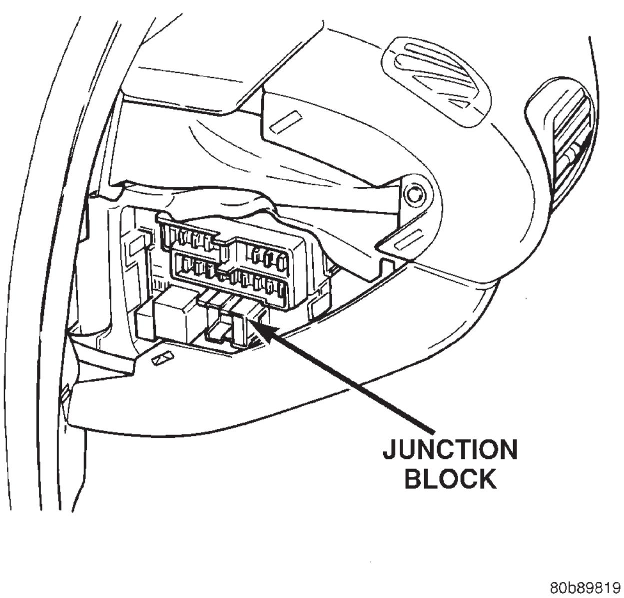


Fig. 1 Junction Block Location

All of the current entering and leaving the JB does so through wire harnesses, which are connected to the JB through integral connector receptacles molded into the JB housing. The JB houses blade-type fuses, blade-type automatic resetting circuit breakers, full International Standards Organization (ISO) relays, and ISO micro-relays. Internal connection of all the JB circuits is accomplished by an intricate network of hard wiring and bus bars. Refer to **Junction Block** in the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams.

The fuses, circuit breakers, relays, and are available for service replacement. The JB unit cannot be repaired and is only serviced as an assembly. If any internal circuit or the JB housing is faulty or damaged, the entire Junction Block assembly must be replaced.

REMOVAL AND INSTALLATION

JUNCTION BLOCK (JB)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The Junction Block (JB) and Body Control Module (BCM) are attached to each other. After removal they can be separated. Junction Block and Body Control Module assemblies are located on the driver's side of the vehicle (Fig. 2).

connectors are in good condition and connectors are properly installed.

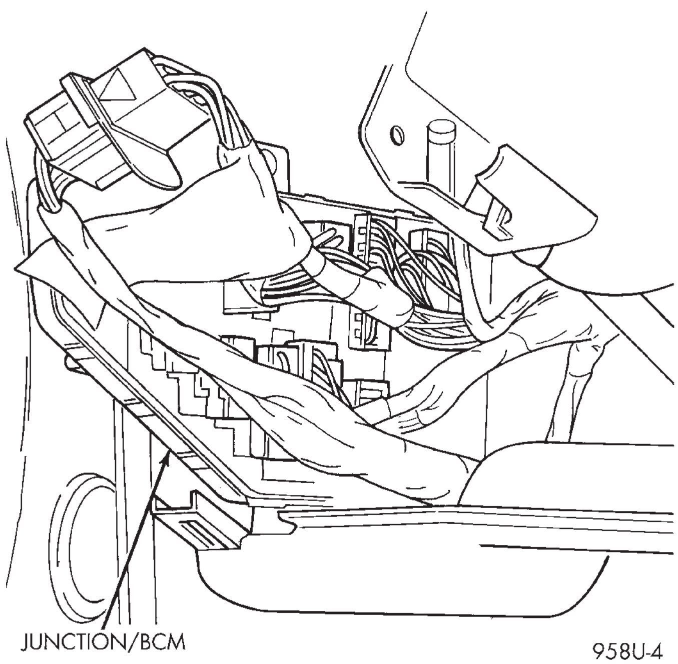


Fig. 2 Junction Block/BCM Location

REMOVAL AND INSTALLATION (Continued)

(1) Open hood then disconnect and isolate the battery negative remote cable from the remote terminal on the left shock tower (Fig. 3).

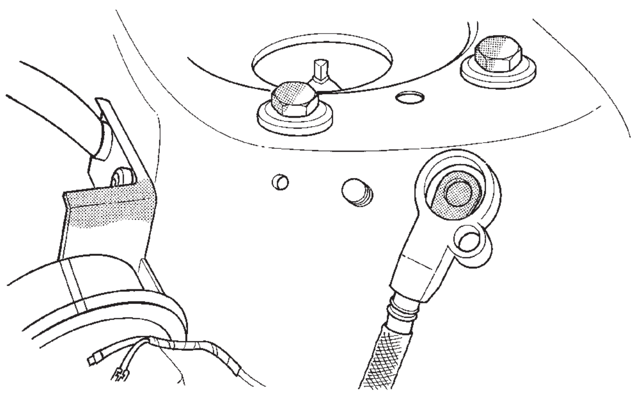


Fig. 3 Battery Negative Remote Cable

(2) Open the front driver's door and remove end cap.
(3) Remove center bezel.
(4) Remove instrument cluster hood.
(5) Remove silencer.
(6) Remove wire harness connectors from Junction Block.
(7) Remove Junction Block three mounting screws.
(8) Remove Junction Block/BCM by pulling straight down from the mounting bayonet.
(9) Disconnect BCM wire connectors and remove the assembly.
(10) Remove Junction Block/BCM from vehicle.
(11) With the Junction Block/BCM removed from the vehicle, separate the BCM from the Junction Block.
(12) Remove the two BCM attaching screws and release the two BCM locking latches from the Junction Block.
(13) Disconnect BCM from the Junction Block.

INSTALLATION

For installation, reverse the above procedures. Ensure that the wire terminals and connectors are in good condition and connectors are properly installed

POWER DISTRIBUTION CENTER

The Power Distribution Center (PDC) is serviced as a unit with the engine compartment wire harness. If any internal circuit of the PDC or the PDC housing is faulty or damaged, the entire PDC and engine compartment wire harness unit must be replaced.

REMOVAL

(1) Open hood then disconnect and isolate the battery negative remote cable from the remote terminal on the left shock tower (Fig. 3).
(2) Remove the Air Inlet System (housing and resonator). Refer to Group 14, Fuel System for Removal and Installation.
(3) Disconnect each of the engine compartment wire harness connectors. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the locations of the affected connectors.
(4) Remove the fasteners that secure each of the engine compartment wire harness ground eyelets to the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the ground eyelet locations.
(5) Disengage each of the retainers that secure the engine compartment wire harness to the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the retainer locations.
(6) Remove the three screws retaining the PDC to its mounting bracket.
(7) Remove the PDC and the engine compartment wire harness from the engine compartment as a unit.

INSTALLATION

NOTE: If the power distribution center is being replaced with a new unit, be certain to transfer each of the fuses, fuse cartridges, fusible links and relays from the old power distribution center to the proper cavities of the new power distribution center. Refer to Power Distribution in Group 8W - Wiring Diagrams for the proper power distribution center cavity assignments.

(1) Position the PDC over the mounting bracket between the Powertrain and Transmission Control Modules in the engine compartment.
(2) Align the PDC mounting slots with the blades on the PDC mounting bracket.
(3) Install the three mounting screws into the PDC.
(4) Route the engine compartment wire harness from the PDC through the engine compartment, engaging each of the harness retainers to the mounting provisions in the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the harness routing and retainer locations.

REMOVAL AND INSTALLATION (Continued)

(5) Install and tighten the fasteners that secure each of the engine compartment wire harness ground eyelets to the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the ground eyelet locations. See the table below for the proper fastener tightness values.

(6) Reconnect each of the engine compartment wire harness connectors. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the locations of the affected connectors.

(7) Reconnect the battery negative remote cable (Fig. 3) to the remote terminal on the left strut tower.

POWER LOCK SYSTEMS

CONTENTS

POWER DOOR LOCKS

INDEX

GENERAL INFORMATION

INTRODUCTION

All doors can be locked or unlocked electrically by operating the switch on either front door panels.

The rear doors can be locked or unlocked by actuation of the front door switch, or can be locked or unlocked mechanically and independently with their respective locking knobs.

The front doors can be locked or unlocked mechanically with the locking knob regardless of electrical locking and unlocking actuation with the front door knobs.

The right and left front door on all vehicles can be locked or unlocked mechanically from the outside with the key or electrically as described above. The left front can also be unlocked by actuation of the inside remote door handle. The right front door can be unlocked by actuation of the inside remote door handle.

DESCRIPTION AND OPERATION

AUTOMATIC DOOR LOCKS

The system includes an automatic door locking feature actuated by the Body Control Module (BCM). **The vehicle is built with the system enabled.**

When the system is disabled the door locks will work by use of the door lock switches only. When this system is enabled the automatic door locks will work automatically.

The BCM controls the power locks when the door lock switch is activated. If the door lock switch is pressed for longer than eight consecutive seconds, the BCM will de-energize the door lock relay. Also, the BCM will automatically lock all doors when all of the conditions below are met:

- All doors are closed
- The vehicle speed exceeds 15 ± 1 M.P.H.
- The throttle position sensor tip-in is greater than 10 ± 2 degrees

The automatic door lock system can be enabled/disabled either by the customer or with the DRB lll® scan tool. Refer to the DRB lll® or the vehicle owners manual for enabling/disabling procedures.

The BCMwill automatically re-lock all doors if the above conditions are met and if any of the doors become ajar and then closes again.

The power latches are also equipped with a thermal protection system which prevents the latches from burning out.

CENTRAL LOCKING SYSTEM

The central locking system is part of the Vehicle Theft Security System. Using the key, turn the driv-

DESCRIPTION AND OPERATION (Continued)

er's or passenger door cylinder lock to the lock position, all doors will lock. This feature operates differently on each door. Turn key in the driver's door to the unlock position once will unlock driver's door only. Turning the key a second time to the unlock position within five seconds of the first time will unlock all doors. Turn key once in the passenger's door to the unlock position will unlock all doors.

The lock/unlock operation will arm/disarm the Vehicle Theft Security System and will also activate/cancel the illuminated entry feature.

CHILD PROTECTION LOCK

The child protection locks are on the rear doors only. The lock when engaged, will disable the inside door handle from opening the door. The lock is part of the latch/lock assembly. The lock is engaged by moving a lever that is located on the rearward inside edge of the door.

DOOR LOCK INHIBIT

With the key in the ignition switch in the ON or OFF position and the driver's door open the BCM will ignore the command to lock the power door locks. Once the key is removed, or the driver's door is closed, the body control module will allow the power door locks to lock.

KEYLESS ENTRY SYSTEM

The system allows locking and unlocking of vehicle door(s) by remote control using a hand held radio transmitter.

DIAGNOSIS AND TESTING

DOOR LOCK MOTOR/LATCH

Ensure battery is in good condition before performing the circuit tests.

To determine which latch is faulty, check each individual door for electrical lock and unlock or disconnect the latch connectors one at a time, while operating the door lock switch. In the event that none of the latches work, the problem maybe caused by a short or a bad switch. Disconnecting the defective latch will allow the others to work.

To test an individual door latch, disconnect the electrical connector from the latch. To lock the door, connect a 12 volt power source to the positive pin of the latch and a ground wire to the other pin (Fig. 1). To unlock the door reverse the wire connections at the latch pin terminals. If these results are NOT obtained, replace the door latch assembly.

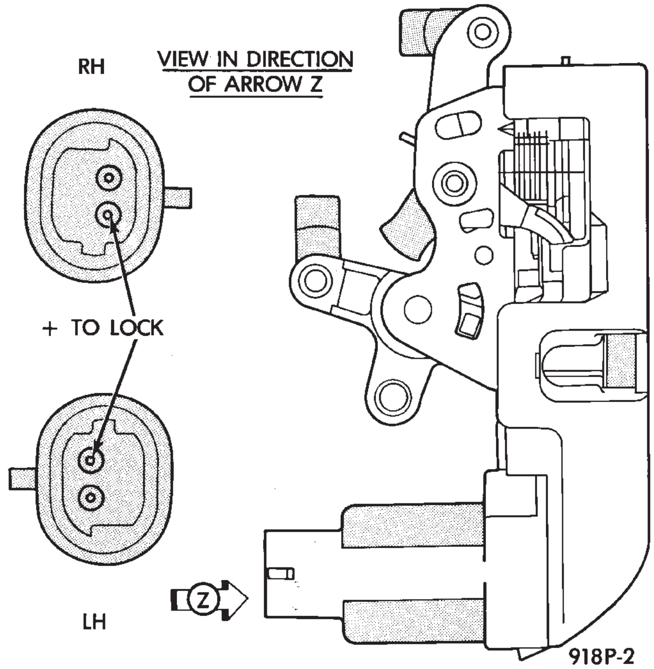
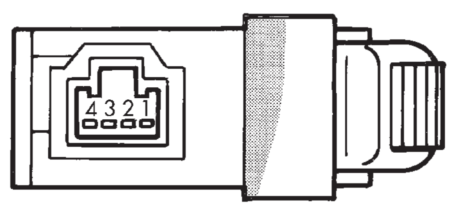


Fig. 1 Door motor/Latch Assembly

DOOR LOCK SWITCH

Remove the switch from its mounting location. Using an ohmmeter, test door lock switch continuity. Refer to (Fig. 2) and move the switch to the Lock and Unlock positions. If the resistance values are not obtained, replace the switch.



SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE VALUE
UNLOCK	1 and 4	2700 Ω ± 10%
LOCK	1 and 4	620 Ω ± 10%

958P-6

Fig. 2 Door Lock Switch Continuity Test

DOOR LOCK SYSTEM

For complete testing of the automatic door lock systems, refer to the proper Body Diagnostic Procedures Manual.

DIAGNOSIS AND TESTING (Continued)

VOLTAGE

The following circuit test sequence determines whether or not voltage is continuous through the body harness to switch.

(1) Remove the driver door trim panel. Refer to Group 23, Body for proper procedures.

(2) Carefully separate multiple terminal block on wiring harness from switch body. Refer to Group 8W, Wiring Diagrams.

(3) Using a voltmeter, connect the ground lead to the Pin 3 of the door lock connector.

(a) Using the positive lead, check Pin 1 of the connector for battery voltage. If OK, go to Step b. If not OK, check fuse #5 in the Junction Block, and fuse #4 in the Power Distribution Center. If the fuse is OK, repair wire as necessary.

(b) Check Pin 2 of the connector for battery voltage. If OK, go to Switch Test. If not OK, check fuse 4 in the Junction Block, and fuse #16 in the Power Distribution Center. If the fuse is OK, repair wire as necessary.

REMOVAL AND INSTALLATION

DOOR LOCK MOTOR/LATCH

REMOVAL

(1) Remove door trim panel, refer to Group 23 Body, for removal procedures.

(2) Disconnect motor/latch wire connector (Fig. 1).

(3) Disconnect linkage from:

- Outside door handle
- Inside door handle
- Locking knobs
- Key cylinder

(4) Remove motor/latch assembly attaching screws and remove assembly.

INSTALLATION

For installation, reverse the above procedures.

DOOR LOCK SWITCH

REMOVAL

(1) Remove door trim panel, refer to Group 23 Body, for removal procedures.

(2) Disconnect switch wire connector.

(3) Remove switch attaching screws and remove.

INSTALLATION

For installation, reverse the above procedures.

REMOTE KEYLESS ENTRY

INDEX

GENERAL INFORMATION

INTRODUCTION

The Remote Keyless Entry System (RKE) allows locking/unlocking of vehicle door(s) by remote control using a hand held radio frequency (RF) key fob transmitter.

The Body Control Module (BCM) may receive signals from up to four key fob transmitters. Each key fob transmitter has its own ID with a rolling code-.The code is programmed and stored into BCM memory. The ID code of the key fob transmitter never changes. However the rolling code portion changes every time a button is pressed. If the key fob transmitter is replaced or an additional transmitter is added, the codes of all units may have to be reprogrammed into the BCM memory. If a BCM is replaced, the key fob transmitter codes must be programmed in the new BCM memory. If a programmed key fob transmitter button is pressed more than 250 times outside of the vehicle range, the rolling code will go out of synchronization. In this case the rolling code has to be synchronized again for complete operation. Refer to Synchronization of Rolling Code.

OPERATION

The key fob transmitter has three buttons for operation (Fig. 1). They are LOCK, UNLOCK, and PANIC.

Depressing the button:

- UNLOCK button will unlock the driver's door and enable illuminated entry, if equipped. Pushing and releasing the button once will unlock the driver's door. Pushing and releasing the button two times, within five seconds interval, will unlock all doors.
- LOCK button, the horn will sound a short CHIRP to notify that the all door lock signal was received and set. The illuminated entry operation will be cancelled and all interior lamps will immediately turn OFF.
- PANIC button will start the panic mode when the button is pressed for more than one second. The driver door will unlock. The horn will sound and the headlamps flash approximately once a second. The interior lamps will come ON. The PANIC mode can be canceled by pressing the unlock button, or will time out in approximately three minutes.

The BCM is capable of retaining Vehicle Access Code (VAC) even when power is removed.

Each Remote Keyless Entry Module must have at least one and no more than four key fob transmitters.

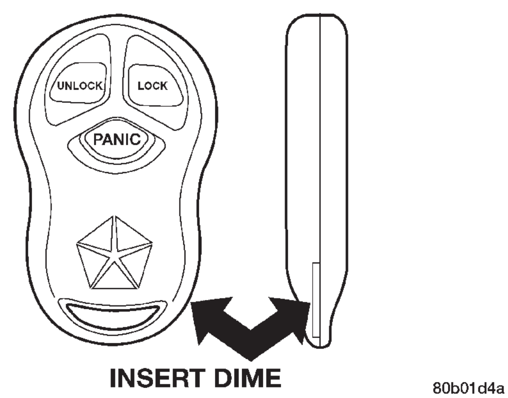


Fig. 1 Remote Keyless Entry (RKE) Transmitter

DESCRIPTION AND OPERATION

TRANSMITTER BATTERY

The transmitter has two 3 volt batteries, which can be removed and replaced without special tools. The battery is available at local retail stores. Recommended batteries are Toshiba CR2016 or equivalent. Battery life is about one to two years.

DIAGNOSIS AND TESTING

DIAGNOSTIC CONDITIONS

Refer to (Fig. 2) for internal BCM relay configuration.

When trouble shooting problems with the Remote Keyless Entry System, always verify that the power door lock/unlock switches are functional. If the doors do not lock/unlock with the power switches, the following modules should be analyzed: Lock/Unlock Switches, Body Control Module, and the door lock/unlock latches. Refer to Group 8W, Wiring Diagrams.

FUSE TEST

If the following modules do not work:

- Remote Keyless Entry System
- Body Control Module
- Door lock switches

A blown fuse is the probable cause. The Body Control Module (BCM) battery feed fuse are located in the Power Distribution Center (PDC). Check fuses 4, 15 and 18 in the PDC and fuses 4, 5 and 9 in the Junction Block.

Key fob transmitter will not lock or unlock doors.

(1) Check that the BCM has power and ground.

(2) If the RKE still doesn't function. Check the key fob transmitter battery(s) for 3 Volts each. If less than 3 Volts, replace the battery(s).

(3) If the system still does not work, replace the key fob transmitter. Refer to Programing Remote Keyless Entry Key Fob Transmitter.

(4) Check country code setting in BCM. Set to U.S. or Canada.

All doors will not unlock with the key fob transmitter.

(1) With the driver's door in the unlocked position. Using a voltmeter, check Pin 4 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the unlock button once.

(2) If no voltage pulse, replace BCM. If voltage is measured, repair the harness between the BCM and the driver door latch.

(3) Check Pins 1, 2, and 3 of the BCM 20 Pin connector for quick voltage pulse when the unlock button is pressed twice within a 5 second interval.

(4) If no voltage pulse is measured at Pin 1, 2, and/or 3, replace the BCM. If voltage is measured repair the harness between terminal and door latch.

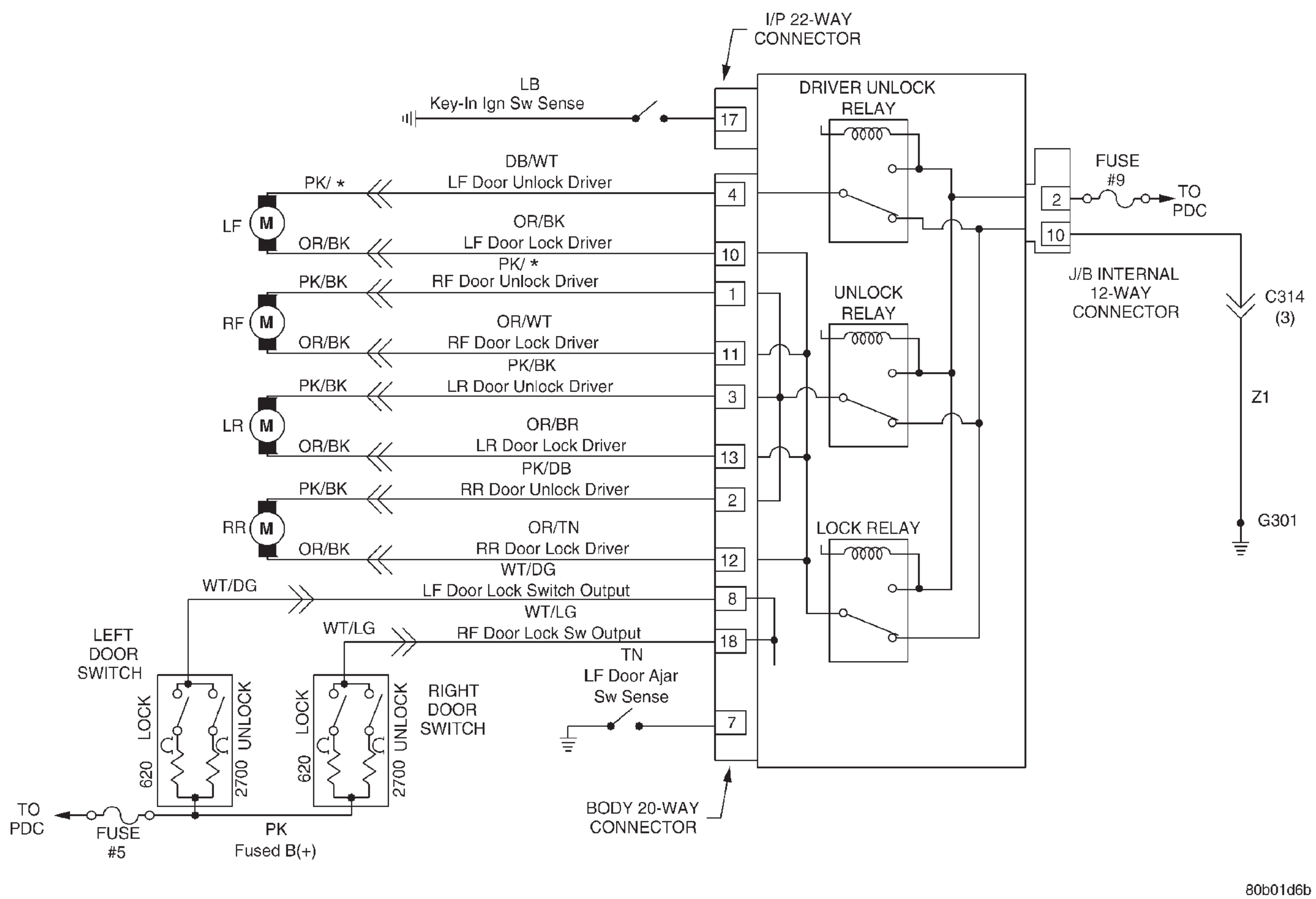


Fig. 2 Internal BCM Lock/Unlock Relay Configuration

DIAGNOSIS AND TESTING (Continued)

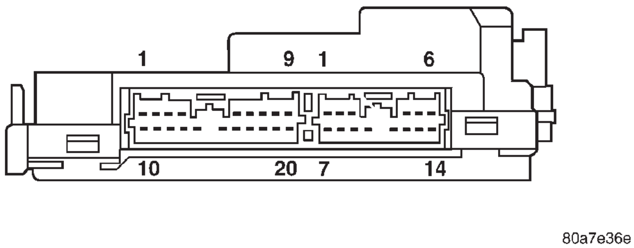


Fig. 3 BCM 20-Way Connector

Driver doors will NOT unlock with the key fob transmitter, but other doors unlock.

(1) With the driver's door in the unlocked position. Using a voltmeter, check Pin 4 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Depress the unlock button, the voltmeter should read battery voltage for approximately 1 second.

(2) If no voltage pulse is measured, replace the BCM. If voltage is measured repair harness from BCM to the driver door latch.

Driver door will unlock with the key fob transmitter, but all other doors will not unlock.

(1) With the driver's door in the unlocked position. Using a voltmeter, check Pin 1, 2, and 3 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the unlock button twice, within a 5 second interval.

(2) If no voltage pulse is measured, replace the BCM. If voltage is measured, repair the harness to the unlock relay.

All doors do not lock with the key fob transmitter.

(1) Using a voltmeter, check Pins 10, 11, 12 and 13 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the lock button on the key fob transmitter. Wait for quick voltage pulse. It may be necessary to press the key fob transmitter several times. The voltage pulse only appears for milliseconds.

(2) If no voltage pulse is measured, replace BCM. If a voltage is measured, repair the harness to the lock relay.

Doors will lock with the key fob transmitter but there is no horn CHIRP.

(1) Press horn button, listen horn sound.

(2) If the horn does not CHIRP, first verify at the horn is enabled using a DRB lll® scan tool. Then check the horn relay and the horn(s). Repair as necessary.

(3) Using a voltmeter, check horn relay for voltage pulse (Fig. 3). Press the lock button on the key fob transmitter.

CAUTION: Be careful not to short the relay terminals together. Doing so will cause BCM damage and then module replacement.

(4) If no voltage pulse measured, replace the BCM. If voltage is measured, repair the Junction Block as necessary.

Unable to program BCM with a new key fob transmitter, door locks will not cycle.

Check BCM country code setting and refer to the proper Body Diagnostic Procedure Manual.

Unable to program BCM with a new key fob transmitter, door locks cycle. The locks will not cycle when the transmitter button is depressed.

Refer to the proper Body Diagnostic Procedure Manual.

SERVICE PROCEDURES

HORN CHIRP ENABLE/DISABLE

The DRB lll® scan tool must be used to enable/disable the Horn Chirp. Refer to the DRB lll® scan tool for the procedure.

REMOVAL AND INSTALLATION

JUNCTION BLOCK/BODY CONTROL MODULE

Refer to Group 8E, Instrument Panel and Systems.

JUNCTION BLOCK (JB)

Refer to Group 8O, Power Distribution Systems for Removal and Installation.

ADJUSTMENTS

PROGRAMMING RKE MODULE

The scan tool (DRB) and the transmitter must be used to program the Remote Keyless Entry Module. Refer to the scan tool (DRB) for the procedure.

SYNCHRONIZATION OF ROLLING CODE

Pressing any button twice on the transmitter will cause it to re-synchronize.

SPECIFICATIONS

TRANSMITTER CONTROL RANGE

Operation range is within 7 meters (23 ft.) of the BCM.

REMOTE KEYLESS ENTRY

CONTENTS

REMOTE KEYLESS ENTRY

INDEX

GENERAL INFORMATION

INTRODUCTION

The Remote Keyless Entry System (RKE) allows locking/unlocking of vehicle door(s) by remote control using a hand held radio frequency (RF) key fob transmitter.

The Body Control Module (BCM) may receive signals from up to four key fob transmitters. Each key fob transmitter has its own ID with a rolling code. The code is programmed and stored into BCM memory. The ID code of the key fob transmitter never changes. However the rolling code portion changes every time a button is pressed. If the key fob transmitter is replaced or an additional transmitter is added, the codes of all units may have to be reprogrammed into the BCM memory. If a BCM is replaced, the key fob transmitter codes must be programmed in the new BCM memory. If a programmed key fob transmitter button is pressed more than 250 times outside of the vehicle range, the rolling code will go out of synchronization. In this case the rolling code has to be synchronized again for complete operation. Refer to Synchronization of Rolling Code.

OPERATION

The key fob transmitter has three buttons for operation (Fig. 1). They are LOCK, UNLOCK, and TRUNK.

Depressing the button:

- UNLOCK button will unlock the driver's door and enable illuminated entry, if equipped. Pushing and releasing the button once will unlock the driver's door. Pushing and releasing the button two times, within five seconds interval, will unlock all doors.
- LOCK button, the horn will sound a short CHIRP to notify that the all door lock signal was received and set. The illuminated entry operation will be cancelled and all interior lamps will immediately turn OFF.
- DECK LID button will release the deck lid when the button is pressed twice within two seconds.

The BCM is capable of retaining Vehicle Access Code (VAC) even when power is removed.

GENERAL INFORMATION (Continued)

Each Remote Keyless Entry Module must have at least one and no more than four key fob transmitters.

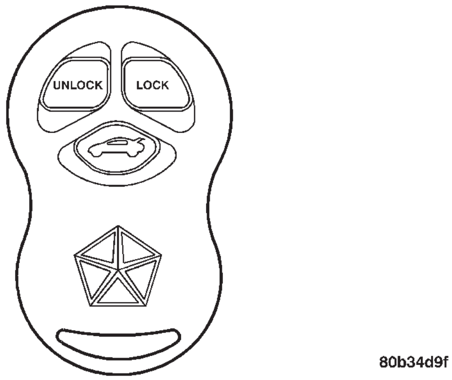


Fig. 1 Remote Keyless Entry (RKE) Transmitter

DESCRIPTION AND OPERATION

DECK LID RELEASE RELAY

The Deck Lid Release circuit works in conjunction with the BCM to prevent unwanted operation after the Vehicle Theft Security System is set. The VTSS portion of the BCM will also disable the Universal Transmitter (garage door opener). The relay is energized from either the deck lid release switch or from the BCM from a signal from the Remote RKE fob transmitter.

TRANSMITTER BATTERY

The transmitter has two 3 volt batteries, which can be removed and replaced without special tools. The battery is available at local retail stores. Recommended battery is CR2016 Panasonic or equivalent. Battery life is about one to two years.

DIAGNOSIS AND TESTING

DECK LID RELEASE RELAY TEST

RELAY TEST

The deck lid release relay is located on the right side of the brake pedal mounting bracket (Fig. 2).

Remove the starter relay from mounting bracket to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ±5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery B+ lead to terminals 86 and a ground lead to terminal 85 to energize the relay.

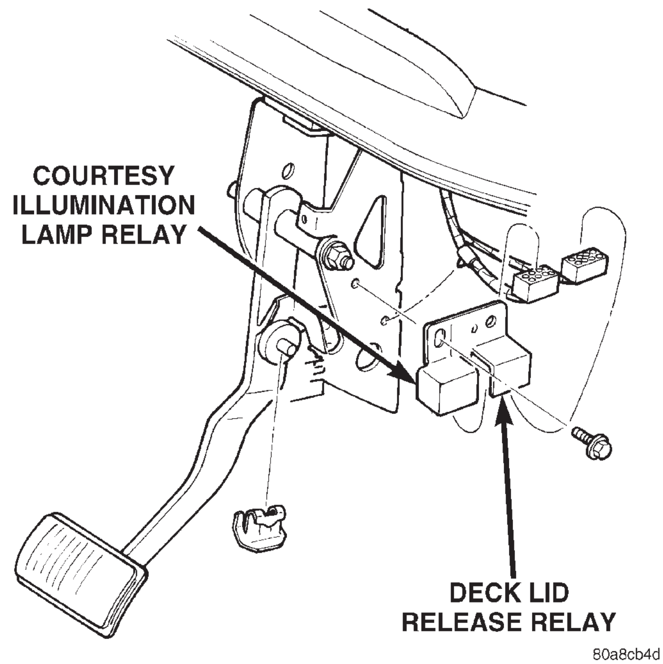
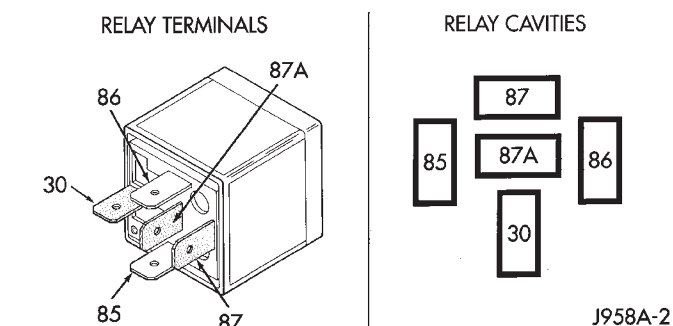


Fig. 2 Deck Lid Release Relay Location

The relay should click. Also test for continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to Relay Circuit Test procedure. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Deck Lid Release Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the circuit breaker as required.

(2) The relay normally open terminal (87) is connected to the common feed (movable contact) terminal (30) in the energized position. This terminal

DIAGNOSIS AND TESTING (Continued)

when energized supplies battery voltage to the deck lid release solenoid. If OK, go to Step 3. If not OK, repair the open circuit to the deck lid release solenoid as required.

(3) The coil battery (+) terminal (86) is connected to the electromagnet in the relay. It has battery (+) at all times. Check for battery voltage at cavity (86) of the relay connector. If OK, go to Step 4. If not OK, check for an open circuit to the deck lid release relay and repair as necessary.

(4) The relay coil ground (-) terminal (85) is connected to the Body Control Module Q33 circuit and deck lid release switch. This terminal will receive a ground (-) through the BCM, or the deck lid release switch, when the key fob transmitter button, or the deck lid release switch is depressed. If not OK, check for an open circuit to the BCM and repair as necessary.

(5) When the Vehicle Theft Security System is armed the BCM opens the ground circuit to the deck lid release switch.

DIAGNOSTIC CONDITIONS

When trouble shooting problems with the Remote Keyless Entry System, always verify that the power door lock/unlock switches are functional. If the doors do not lock/unlock with the power switches, the following modules should be analyzed: Lock/Unlock Switches, Body Control Module, and the door lock/unlock latches. Refer to Group 8W, Wiring Diagrams.
FUSE TEST

If the following modules do not work:

- Remote Keyless Entry System
- Body Control Module
- Door lock switches

A blown fuse is the probable cause. The Body Control Module (BCM) battery feed fuse are located in the Power Distribution Center (PDC). Check fuses 4, 15 and 18 in the PDC and fuses 4, 5 and 9 in the Junction Block.

Key fob transmitter will not lock or unlock doors.

(1) Check that the BCM has power and ground.

(2) Re-synchronize the key fob rolling code with the receiver by pressing and holding the lock button then the deck lid button simultaneously for at least five seconds. Then wait until the doors unlock indicating that the code has been synchronized. This may take as long as six minutes. This procedure is to be used for a key fob transmitter that has been previously programmed to this vehicle only.

(3) If the RKE system still doesn't function, replace the key fob transmitter. Refer to Programming Remote Keyless Entry Key Fob Transmitter.

All doors will not unlock with the key fob transmitter.

(1) Using a voltmeter, check Pin 4 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the unlock button once.

(2) If no voltage pulse, replace RKE module. If voltage is measured, repair the harness between the BCM and the driver door latch.

(3) Check Pin 1 of the BCM 20 Pin connector for a quick voltage pulse when the unlock button is pressed.

(4) If no voltage pulse is measured at Pin 1, replace the BCM. Repair the harness between terminal and lock latch.

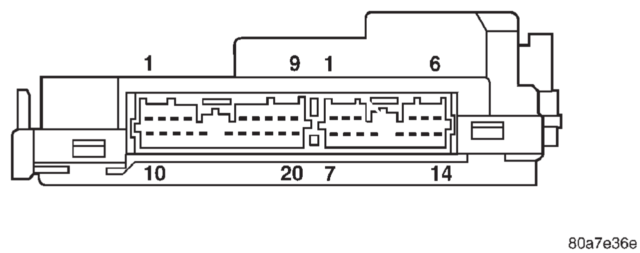


Fig. 3 BCM 20-Way Connector

Driver door will NOT unlock with the key fob transmitter, but passenger door will unlock.

(1) Using a voltmeter, check Pin 4 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Depress the unlock button. The voltmeter should read battery voltage for approximately 1 second.

(2) If no voltage pulse is measured, replace the BCM. If voltage is measured repair harness from BCM to the driver door latch.

Driver door will unlock with the key fob transmitter, but passenger door will not lock.

(1) Using a voltmeter, check Pin 1 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the unlock button.

(2) If no voltage pulse is measured, replace the BCM. If voltage is measured, repair the harness to the door latch.

Doors do not lock with the key fob transmitter.

(1) Using a voltmeter, check Pins 10 and 11 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the lock button on the transmitter. Wait for quick voltage pulse. It may be necessary to press the key fob transmitter several times. The voltage pulse only appears for milliseconds.

(2) If no voltage pulse is measured, replace BCM. If a voltage is measured, repair the Junction Block as necessary.

DIAGNOSIS AND TESTING (Continued)

Doors will lock with the key fob transmitter but there is no horn CHIRP.

(1) Press horn button, listen horn sound.

(2) If the horn does not CHIRP, check if horn is disabled with the scan tool (DRB). Then check the horn relay and the horn(s). Repair as necessary.

(3) Using a voltmeter, check horn relay for voltage pulse. Press the lock button on the key fob transmitter.

(4) If no voltage pulse measured, replace the BCM. If voltage is measured, repair harness to the horn relay.

Unable to program BCM with a new key fob transmitter, door locks will not cycle.

Refer to the proper Body Diagnostic Procedure Manual.

Unable to program BCM with a new key fob transmitter, door locks cycle. The locks will not cycle when the transmitter button is depressed.

Refer to the proper Body Diagnostic Procedure Manual.

SERVICE PROCEDURES

HORN CHIRP ENABLE/DISABLE

The scan tool (DRB) must be used to enable/disable the Horn Chirp. Refer to the scan tool (DRB) for the procedure.

SYNCHRONIZATION OF ROLLING CODE

The key fob transmitter code will go out of synchronization if any button is press more than 250 times outside the range of the receiver which is inside of the BCM. In other words the transmitter will not work. To synchronize the code of a particular key fob transmitter with the receiver, press and hold the lock button then the deck lid button simultaneously for at lease five seconds. Then wait until the doors unlock indicating that the code has been synchronized. This may take as long as six minutes. This is for a key fob transmitter that has been previously programed to this vehicle only.

REMOVAL AND INSTALLATION

DECK LID RELEASE RELAY

REMOVAL

(1) The relay is located above the brake pedal to the right side.

(2) Grasp the relay and pull downward to disconnect the relay.

INSTALLATION

Align the relay pins with the connector terminals and push the relay in to place.

BODY CONTROL MODULE (BCM)

Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

ADJUSTMENTS

PROGRAMMING RKE MODULE

The scan tool (DRB) and the transmitter must be used to program the Remote Keyless Entry Module. Refer to the scan tool (DRB) for the procedure.

SPECIFICATIONS

TRANSMITTER CONTROL RANGE

Operation range is within 7 meters (23 ft.) of the BCM.

VEHICLE THEFT / SECURITY SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The Vehicle Theft Security System (VTSS) is available factory-installed optional equipment for this model. It is a passive system and is designed to protect against whole vehicle theft. The system monitors vehicle doors and deck lid key cylinder for unauthorized operation.

If the vehicle is equipped with VTSS, it will also include the Sentry Key Immobilizer System (SKIS) factory-installed option. Refer to the vehicle owner's manual for more information on the use and operation of the Sentry Key Immobilizer System (SKIS). Refer to Group 8W, Wiring Diagrams for complete circuit descriptions and diagrams.

SENTRY KEY IMMOBILIZER SYSTEM (SKIS)

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by preventing the engine from operating while the system is armed. The primary components of this system are the Sentry Key Immobilizer Module (SKIM), the Sentry Key transponder, the Vehicle Theft / Security System (VTSS) indicator LED, and the Powertrain Control Module (PCM).

The SKIM is installed on the steering column near the ignition lock cylinder. The transponder is located under the molded rubber cap on the head of the ignition key. The VTSS indicator LED is located in the instrument cluster.

The SKIS includes three valid Sentry Key transponders from the factory, one being a valet key. This is so the customer can self program new keys if one is lost. If the customer wishes, additional non-coded blank Sentry Keys are available. These blank keys can be cut to match a valid ignition key, but the engine will not start unless the key transponder is also programmed to the vehicle. The SKIS will recognize no more than eight valid Sentry Key transponders at any one time.

The SKIS performs a self-test each time the ignition switch is turned to the ON position, and will store Diagnostic Trouble Codes (DTCs) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a DRB lll® scan tool as described in the proper Body Diagnostic Procedures Manual.

DESCRIPTION AND OPERATION

CENTRAL LOCK/UNLOCK SYSTEM

The central lock/unlock system uses the Vehicle Theft Security System (VTSS) door key cylinder switches to lock and unlock all doors using the key. Turning the key to the lock position in the driver's or passenger's door will lock all doors. Turning the key in the driver's door to the unlock position once will

DESCRIPTION AND OPERATION (Continued)

unlock driver's door only. Turning the key a second time within five seconds of the first time will unlock all doors. Turning the key in the passenger's door to the unlock position will unlock all doors.

Using the door key cylinder or the RKE transmitter lock/unlock operation will arm/disarm the Vehicle Theft Security System (VTSS).

SENTRY KEY IMMOBILIZER MODULE (SKIM)

The Sentry Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a central processing unit, which includes the Sentry Key Immobilizer System (SKIS) program logic. The SKIS programming enables the SKIM to program and retain in memory the codes of at least two, but no more than eight electronically coded Sentry Key transponders. The SKIS programming also enables the SKIM to communicate over the Chrysler Collision Detection (CCD) data bus network with the Powertrain Control Module (PCM), the instrument cluster and/or the DRB lll® scan tool.

The SKIM transmits and receives RF signals through a tuned antenna enclosed within a molded plastic ring formation that is integral to the SKIM housing. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing. This antenna ring must be located within eight millimeters (0.31 inches) of the Sentry Key in order to ensure proper RF communication between the SKIM and the Sentry Key transponder.

For added system security, each SKIM is programmed with a unique "Secret Key" code and a security code. The SKIM keeps the "Secret Key" code in memory and sends the code over the CCD data bus to the PCM, which also keeps this code in its memory. The SKIM also sends the "Secret Key" code to each of the programmed Smart Key transponders. The security code is used by the assembly plant to access the SKIS for initialization, or by the dealer technician to access the system for service. The SKIM also stores in its memory the Vehicle Identification Number (VIN), which it learns through a CCD data bus message from the PCM during initialization.

The SKIM and the PCM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized SKIS disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKIM or the PCM. However, the use of this strategy also means that replacement of either the SKIM or the PCM units will require a system initialization procedure to restore system operation.

When the ignition switch is turned to the ON or START positions, the SKIM transmits an RF signal to excite the Sentry Key transponder. The SKIM then listens for a return RF signal from the transponder of the Sentry Key that is inserted in the ignition lock cylinder. If the SKIM receives an RF signal with valid "Secret Key" and transponder identification codes, the SKIM then sends a "valid key" message to the PCM over the CCD data bus. If the SKIM receives an invalid RF signal or no response, it sends "invalid key" messages to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages.

The SKIM also sends messages to the instrument cluster over the CCD data bus network to control the VTSS indicator LED. The SKIM sends messages to the instrument cluster to turn the LED on for about three seconds when the ignition switch is turned to the ON position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the LED off for a duration of about one second. Then the SKIM sends messages to turn the LED on or off based upon the results of the SKIS self-tests. If the VTSS indicator LED comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

If the SKIM detects an invalid key when the ignition switch is turned to the ON position, it sends messages to the instrument cluster to flash the VTSS indicator LED. The SKIM can also send messages to the instrument cluster to flash the LED and to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its "Customer Learn" programming mode. See Sentry Key Immobilizer System Transponder Programming in this group for more information on the "Customer Learn" programming mode.

For diagnosis or initialization of the SKIM and the PCM, a DRB lll® scan tool and the proper Body Diagnostic Procedures Manual are required. The SKIM cannot be repaired, and if faulty or damaged, the unit must be replaced.

SENTRY KEY IMMOBILIZER TRANSPONDER

The Sentry Key Immobilizer System (SKIS) uses a transponder that is integral to each of three ignition key that are supplied with the vehicle when it is shipped from the factory. The transponder chip is insulated within a nylon mount inserted in the head of the key, and invisible beneath a molded rubber cap (Fig. 1).

Each Sentry Key transponder has a unique transponder identification code programmed into it by the manufacturer. The Sentry Key Immobilizer Module

DESCRIPTION AND OPERATION (Continued)

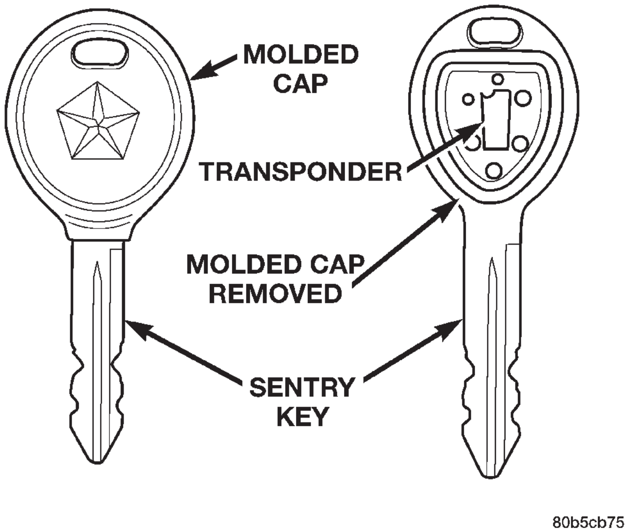


Fig. 1 Sentry Key Immobilizer Transponder

(SKIM) has a unique "Secret Key" code programmed into it by the manufacturer. When a Sentry Key transponder is programmed into the memory of the SKIM, the SKIM learns the transponder identification code from the transponder, and the transponder learns the "Secret Key" code from the SKIM. Each of these codes is stored within the transponder and in the nonvolatile memory of the SKIM. Therefore, blank keys for the SKIS must be programmed by and into the SKIM, in addition to being cut to match the mechanical coding of the ignition lock cylinder. See Sentry Key Immobilizer System Transponder Programming in this group for more information.

The Sentry Key transponder is within the range of the SKIM transceiver antenna ring when it is inserted in the ignition lock cylinder. When the ignition switch is turned to the START or RUN positions, the SKIM transceiver issues a Radio Frequency (RF) signal that excites the transponder chip. The transponder chip responds by issuing an RF signal containing its transponder identification code and the "Secret Key" code. The SKIM transceiver compares the transponder codes with the codes stored in its memory to determine whether a valid key is in the ignition lock cylinder.

The Sentry Key transponder cannot be repaired and, if faulty or damaged, it must be replaced.

SENTRY KEY IMMOBILIZER SYSTEM INDICATOR LAMP

The Sentry Key Immobilizer System (SKIS) uses the Vehicle Theft Security System (VTSS) indicator LED to give an indication when the SKIS is faulty or when the vehicle has been immobilized due to the use of an invalid ignition key. The LED is controlled by the instrument cluster circuitry based upon messages received from the Sentry Key Immobilizer Module (SKIM) through the Body Control Module (BCM) on the Chrysler Collision Detection (CCD) data bus.

The SKIM sends messages to the instrument cluster, via the BCM, to turn the LED on for about three seconds when the ignition switch is turned to the ON position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the LED off for a duration of about one second. Then the SKIM sends messages to the instrument cluster circuitry to turn the LED on or off based upon the results of the SKIS self-tests. If the VTSS indicator LED comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative. If the SKIM detects an invalid key when the ignition switch is turned to the ON position, it sends messages to the instrument cluster to flash the VTSS indicator LED.

The SKIM can also send messages to the instrument cluster to flash the LED and to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its "Customer Learn" programming mode. See Sentry Key Immobilizer System Transponder Programming in this group for more information on the "Customer Learn" programming mode.

The VTSS indicator LED uses a replaceable Light Emitting Diode (LED) on the instrument cluster electronic circuit board. Refer to Group 8E - Instrument Panel Systems for Diagnosis and Testing and service of a faulty VTSS indicator LED. If the VTSS indicator LED comes on and stays on after the bulb test function, diagnosis of the SKIS should be performed with a DRB lll® scan tool and the proper Body Diagnostic Procedures Manual.

TRIGGERING THE VTSS

Using the power door switch, ignition key or the Remote Keyless Entry (RKE) transmitter will arm the system. Any of the following actions will trigger the system:

(1) Opening any door.
(2) Removing the deck lid lock cylinder.
(3) Turning the ignition to the ON position.

CAUTION: The VTSS indicator LED will trigger and engine will continue to run if the vehicle is equipped with SKIS and the proper key is used to start the vehicle. This condition will occur if the VTSS has been triggered.

DESCRIPTION AND OPERATION (Continued)

NOTE: The ignition switch can be turned to the accessory position without triggering alarm system.

VEHICLE THEFT SECURITY SYSTEM (VTSS)

Passive arming occurs upon normal vehicle exit: Open door, lock with power locks, close door. The Vehicle Theft security LED lamp in the instrument cluster will flash quickly for 15 seconds, indicating that arming is in progress. If no monitored switches are activated during this period, the system will arm. After 15 seconds the LED lamp will continue to flash but at a slower rate. This indicates that the system is armed. If the deck lid key cylinder switch is not sensed by the system, the LED lamp will remain lit during the arming process, although the system will still arm.

The VTSS activates:

- Sounding of the horn
- Flashing of the interior lamps
- Flashing of the headlamps
- An engine kill feature (SKIS module controlled)

The system is to be considered as an active armed system when using:

- The Remote Keyless Entry
- The Central Lock Feature.

If the LED lamp does not illuminate at all upon door closing it indicates that the system is not arming or the LED lamp is not operation. Refer to the System Self-Tests.

Passive disarming occurs upon normal vehicle entry by unlocking either door with the ignition key/ remote transmitter. This disarming will also halt the alarm once it has been activated.

A tamper alert exists to notify the driver that the alarm had been activated. If the alarm has since timed-out for at least 3 minutes but not more than 18 minutes the tamper alert will sound. If the trunk lid has been activated the tamper alert will sound till the VTSS is disarmed. The temper alert consists of 3 horn pulses when the vehicle is disarmed.

The alarm system will not arm if the doors are locked manually by pushing the lock knobs. This will manually override the system.

The VTSS also deactivates the Universal Transmitter (garage door opener) when the vehicle is armed. The deck lid can only be opened using the key or inside release handle when the VTSS is armed. When the vehicle is disarmed, the systems are restored to normal operation.

DIAGNOSIS AND TESTING

HEADLAMP RELAY

For test of headlamp relay use a known good relay. Refer to Group 8W. Wiring Diagrams for circuits.

HORN RELAY

Refer to Group 8G, Horns for test procedures.

SENTRY KEY IMMOBILIZER SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Sentry Key Immobilizer System (SKIS) involves the use of a DRB lll® scan tool. Refer to the proper Body Diagnostic Procedures Manual.

The Sentry Key Immobilizer System (SKIS) and the Chrysler Collision Detection (CCD) data bus network should be diagnosed using a DRB lll® scan tool. The DRB lll® will allow confirmation that the CCD data bus is functional, that the Sentry Key Immobilizer Module (SKIM) is placing the proper messages on the CCD data bus, and that the Powertrain Control Module (PCM) and the instrument cluster are receiving the CCD data bus messages. Refer to the proper Body Diagnostic Procedures Manual. Refer to Group 8W, Wiring Diagrams for complete circuit descriptions and diagrams.

(1) Check the fuses in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Disconnect and isolate the battery negative remote cable (Fig. 2). Unplug the wire harness connector at the SKIM. Check for continuity between the ground circuit cavity of the SKIM wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) Connect the battery negative remote cable. Check for battery voltage at the fused B(+) circuit cavity of the SKIM wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the fuse in the junction block as required.

(4) Turn the ignition switch to the ON position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the SKIM wire harness connector. If OK, use a DRB lll® scan tool and the proper Body Diagnostic Procedures Manual to complete the diagnosis of the SKIS. If not OK,

DIAGNOSIS AND TESTING (Continued)

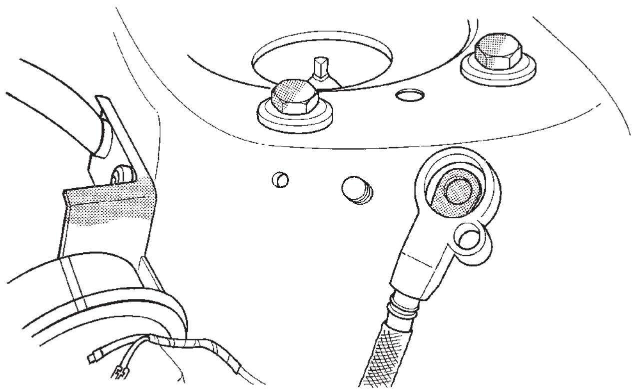


Fig. 2 Battery Negative Remote Cable

repair the open circuit to the fuse in the junction block as required.

VEHICLE THEFT / SECURITY SYSTEM (VTSS) SELF - TESTS

A diagnostics test mode is available in the system to verify operation of all monitored switches or circuits. To enter diagnostics mode, use a DRB lll® scan tool and the proper Body Diagnostic Procedure Manual.

The horn will pulse twice to indicate that the deck lid security switch is present Placing the key in the ignition will allow the warning lamp, headlamps and interior lamps to be checked for proper flashing operation. If any door is open the interior lamps will not flash. Remove the ignition key from the ignition switch in order to check for door key cylinder switch operation. At the completion of each of the following operations, a horn pulse will occur to indicate proper operation. Each action must be separated by a minimum of one second or horn pulse will not occur.

- Activate the power door locks in both the lock and unlock positions.
- Open then close each door one at a time.
- Rotate the ignition key in each of the door lock cylinders to the lock and unlock positions.
- Cycle the ignition switch key to the ON position as the last step. A single horn pulse will indicate proper operation of the ignition switch. This will also take the system out of the stand alone diagnostic mode.

The self diagnostic mode may also be exited by using the DRB lll® scan tool.

Activating the Remote Keyless Entry System (RKE) to exercise any of the above inputs will also cause the horn to pulse. When the RKE lock button is pressed, the RKE module itself will also pulse the horn. This is part of the RKE normal operation.

SERVICE PROCEDURES

SENTRY KEY IMMOBILIZER SYSTEM INITIALIZATION

The Sentry Key Immobilizer System (SKIS) initialization should be performed following a SKIM module replacement. It can be summarized by the following:

(1) Obtain the vehicles unique PIN number assigned to it's original SKIM module from the vehicle owner, the vehicle's invoice or from Chrysler's Customer Center.

(2) With the DRB lll® scan tool, select “Theft Alarm,” “SKIM,” Miscellaneous.” Select “SKIM Module Replaced” function and the DRB lll® will prompt you through the following steps.

(3) Enter secured access mode using the unique four digit PIN number.

(4) Program the vehicle's VIN number into the SKIM's memory.

(5) Program the country code into the SKIM's memory (U.S.).

(6) Transfer the vehicle's unique Secret Key data from the PCM. This process will require the SKIM module to be in **secured access mode**. The PIN number must be entered into the DRB lll® before the SKIM will enter **secured access mode**. Once **secured access mode** is active, the SKIM will remain in that mode for 60 seconds.

(7) Program all customer keys into the SKIM's memory. This required that the SKIM be in **secured access mode** The SKIM module will immediately exit **secured access mode** after each key is programmed.

NOTE: SECURED ACCESS MODE is not required to query the programmed status of the key.

NOTE: If a PCM is replaced, the unique “Secret Key” data must be transferred from the SKIM module to the PCM. This procedure requires the SKIM to be placed in SECURED ACCESS MODE using the four digit PIN code.

SENTRY KEY IMMOBILIZER SYSTEM TRANSPONDER PROGRAMMING

Three programmed Sentry Key transponders are included with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key Immobilizer Module (SKIM) can be programmed to recognize up to five additional transponders, for a total of eight Sentry Keys. The following “Customer Learn” programming procedure for the programming of additional transponders

SERVICE PROCEDURES (Continued)

requires access to at least two of the valid Sentry Keys. If two valid Sentry Keys are not available, Sentry Key programming will require the use of a DRB lll® scan tool.

CUSTOMER LEARN PROGRAMMING

(1) Obtain the additional Sentry Key transponder blank(s) that are to be programmed for the vehicle. Cut the additional Sentry Key transponder blanks to match the ignition lock cylinder mechanical key codes.

(2) Insert one of the two valid Sentry Key transponders into the ignition switch and turn the ignition switch to the ON position.

(3) After the ignition switch has been in the ON position for about three seconds, but no more than fifteen seconds, cycle the ignition switch back to the OFF position. Replace the first valid Sentry Key in the ignition lock cylinder with the second valid Sentry Key and turn the ignition switch back to the ON position. Both operations must be performed within 15 seconds.

(4) About ten seconds after the completion of Step 3, the VTSS indicator LED will start to flash and a single audible chime tone will sound to indicate that the system has entered the “Customer Learn” programming mode.

(5) Within about fifty seconds of entering the “Customer Learn” programming mode, turn the ignition switch to the OFF position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the ON position.

(6) About ten seconds after the completion of Step 5, a single audible chime tone will sound and the VTSS indicator LED will stop flashing and stay on solid for about three seconds to indicate that the blank Sentry Key transponder has been successfully programmed. The SKIS will immediately return to normal system operation following exit from the “Customer Learn” programming mode.

(7) Go back to Step 2 and repeat this process for each additional Sentry Key transponder blank to be programmed.

If any of the above steps is not completed in the proper sequence, or within the allotted time, the SKIS will automatically exit the “Customer Learn” programming mode. The SKIS will also automatically exit the “Customer Learn” programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight valid Sentry Keys, or if the ignition switch is turned to the OFF position for more than about fifty seconds.

PROGRAMMING BLANK SENTRY KEY TRANSPONDERS WITH A DRB lll® SCAN TOOL

When programming a blank Sentry Key transponder, the key blank must first be cut to match the ignition lock cylinder. It will also be necessary to enter the vehicle’s four digit PIN code into the DRB lll® scan tool to enter the Sentry Key Immobilizer Module’s (SKIM’s) secured access mode.

NOTE: Once a Sentry Key is programmed to a particular vehicle, it cannot be transferred to another vehicle.

Insert the blank key into the ignition and turn it to the RUN position. Using the DRB lll® scan tool, select “Theft Alarm,” then “SKIM,” then “Miscellaneous.” Select “Program New Key.” Enter the four digit PIN code using the DRB lll®. When programming is completed, the SKIM will exit secured access mode and display the status of the key. One of five different status messages may be displayed as follows:

- “Programming Successful” is displayed if SKIM Sentry Key programming succeeds.
- “Learned Key in Ignition” is displayed if the key in the ignition has already been programmed into that vehicle’s SKIM.
- “8 Keys Already Learned (At The Maximum) Programming Not Done” is displayed if eight keys have already been programmed into the SKIM. In this case, if a new key needs to be added due to a lost or defective key, the “Erase All Keys” function (requires entering secured access mode) has to be performed. Then the customer is seven keys plus the new key MUST be reprogrammed into the SKIM.
- “Programming Not Attempted” is displayed after an “Erase All Keys” function is executed.
- “Programming Key Failed” is displayed if further diagnosis is required.
- To learn additional keys, turn the ignition OFF, remove the learned key, and insert the next new blank key. Turn ignition to the RUN position and re-enter the secured access mode function and repeat the “Program New Key” procedure outlined above.

REMOVAL AND INSTALLATION

BODY CONTROL MODULE (BCM)

For service of the Body Control Module (BCM), Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

NOTE: If BCM is replaced, the VTSS must be enabled in the new BCM via the DRB lll®, in order to start the vehicle.

REMOVAL AND INSTALLATION (Continued)

JUNCTION BLOCK (JB)

Refer to Group 8O, Power Distribution Systems for Removal and Installation.

SENTRY KEY IMMOBILIZER MODULE (SKIM)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative remote cable (Fig. 2).

(2) Remove knee bolster. Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

(3) Remove the steering column upper and lower shrouds. Refer to Group 19, Steering for Removal and Installation.

(4) Disengage the steering column wire harness from the Sentry Key Immobilizer Module (SKIM).

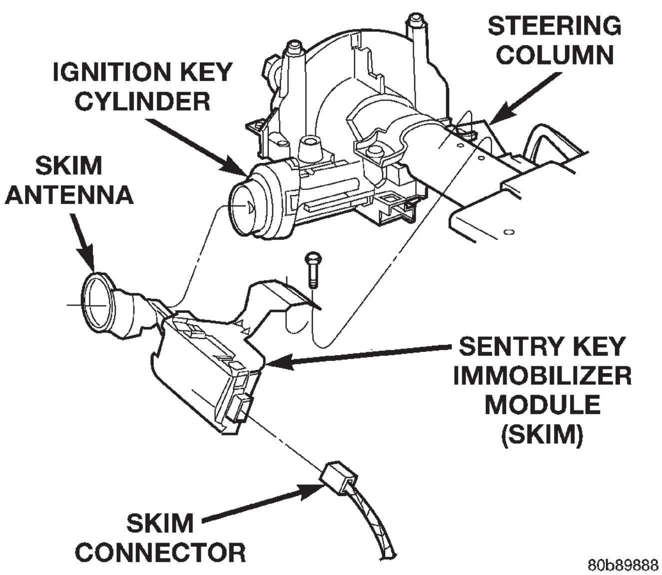


Fig. 3 Sentry Key Immobilizer Module (SKIM) Remove / Install

(5) Remove the two screws securing the SKIM module to the top of the steering column.

(6) Rotate the SKIM and its mounting bracket upwards and then to the side away from the steering column to slide the SKIM antenna ring from around the ignition switch lock cylinder housing.

(7) Remove the SKIM from the vehicle.

INSTALLATION

(1) For installation, reverse the above procedures.

(2) If the SKIM is replaced with a new unit, a DRB lll® scan tool MUST be used to initialize the new SKIM and to program at least two Sentry Key transponders. Refer to Sentry Key Immobilizer Module Initialization in this section.

VEHICLE THEFT / SECURITY SYSTEM (VTSS) DECK LID SECURITY SWITCH

The Vehicle Theft Security System (VTSS) Deck Lid Security Switch is part of the deck lid latch. If replacement of the deck lid security switch is required, the deck lid latch will need to be replaced. Refer to Group 23, Body for deck lid latch Removal and Installation.

VEHICLE THEFT / SECURITY SYSTEM (VTSS) DOOR KEY CYLINDER SWITCH

REMOVAL

(1) Refer to Group 23, Body for door trim and water shield Removal and Installation.

(2) Remove illuminated entry switch wiring clip and disconnect connector (Fig. 4).

(3) Remove disarming switch from door handle.

INSTALLATION

For installation reverse above procedures.

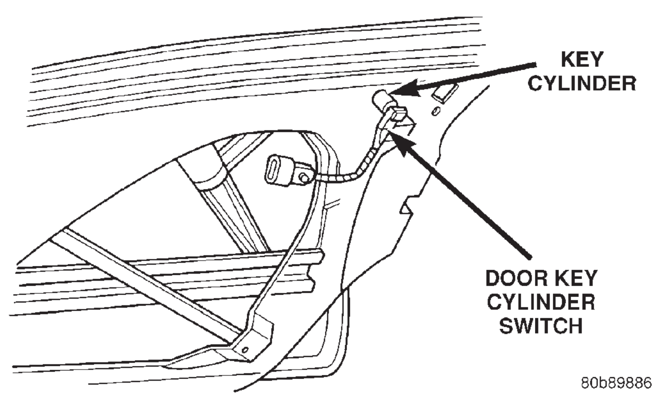


Fig. 4 VTSS Door Key Cylinder Switch Location

VEHICLE THEFT/SECURITY SYSTEMS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The Sentry Key Immobilizer System (SKIS) is available factory-installed optional equipment for this model. Following are some general descriptions of the features and components of the SKIS. Refer to the vehicle owner's manual for more information on the use and operation of the SKIS. Refer to 8W-30 - Fuel/ Ignition System in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by preventing the engine from operating while the system is armed. The primary components of this system are the Sentry Key Immobilizer Module (SKIM), the Sentry Key transponder, the SKIS indicator lamp, and the Powertrain Control Module (PCM), for gasoline engines, and the Body Control Module (BCM) for diesel engines.

The SKIM is installed on the steering column near the ignition lock cylinder. The transponder is located under the molded rubber cap on the head of the ignition key. The SKIS indicator lamp is located in the instrument cluster.

The SKIS includes three valid Smart Key transponders from the factory. If the customer wishes, additional non-coded blank Smart Keys are available. These blank keys can be cut to match a valid ignition key, but the engine will not start unless the key transponder is also programmed to the vehicle. The SKIS will recognize no more than eight valid Smart Key transponders at any one time.

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store Diagnostic Trouble Codes (DTCs) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a DRB scan tool as described in the proper Diagnostic Procedures manual.

DESCRIPTION AND OPERATION

SENTRY KEY IMMOBILIZER MODULE

The Sentry Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a central processing unit, which includes the Sentry Key Immobilizer System (SKIS) program logic. The SKIS programming enables the SKIM to program and retain in memory the codes of at least two, but no more than eight electronically coded Sentry Key transponders. The SKIS programming also enables the SKIM to communicate over the Chrysler Collision Detection (CCD) data bus network with the Powertrain Control Module (PCM), the instrument cluster and/or the DRB scan tool.

The SKIM transmits and receives RF signals through a tuned antenna enclosed within a molded plastic ring formation that is integral to the SKIM housing. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing. This antenna ring must be located within eight millimeters (0.31 inches) of the Sentry Key in order to ensure proper RF communication between the SKIM and the Sentry Key transponder.

For added system security, each SKIM is programmed with a unique “Secret Key” code and a security code. The SKIM keeps the “Secret Key” code in memory and sends the code over the CCD data bus to the PCM, which also keeps this code in its memory. The SKIM also sends the “Secret Key” code to each of the programmed Sentry Key transponders. The security code is used by the assembly plant to

DESCRIPTION AND OPERATION (Continued)

access the SKIS for initialization, or by the dealer technician to access the system for service. The SKIM also stores in its memory the Vehicle Identification Number (VIN), which it learns through a CCD data bus message from the PCM during initialization.

The SKIM and the PCM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized SKIS disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKIM or the PCM. However, the use of this strategy also means that replacement of either the SKIM or the PCM units will require a system initialization procedure to restore system operation.

When the ignition switch is turned to the On or Start positions, the SKIM transmits an RF signal to excite the Sentry Key transponder. The SKIM then listens for a return RF signal from the transponder of the Sentry Key that is inserted in the ignition lock cylinder. If the SKIM receives an RF signal with valid “Secret Key” and transponder identification codes, the SKIM sends a “valid key” message to the PCM over the CCD data bus. If the SKIM receives an invalid RF signal or no response, it sends “invalid key” messages to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages.

The SKIM also sends messages to the instrument cluster over the CCD data bus network to control the SKIS indicator lamp. The SKIM sends messages to the instrument cluster to turn the lamp on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the lamp off for a duration of about one second. Then the SKIM sends messages to turn the lamp on or off based upon the results of the SKIS self-tests. If the SKIS indicator lamp comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to the instrument cluster to flash the SKIS indicator lamp. The SKIM can also send messages to the instrument cluster to flash the lamp and to generate a single audible chime tone.

For diagnosis or initialization of the SKIM and the PCM, a DRB scan tool and the proper Diagnostic Procedures manual are required. The SKIM cannot be repaired and, if faulty or damaged, the unit must be replaced.

SENTRY KEY IMMOBILIZER TRANSPONDER

The Sentry Key Immobilizer System (SKIS) uses a transponder that is integral to each of the two ignition keys that are supplied with the vehicle when it is shipped from the factory. The transponder chip is insulated within a nylon mount inserted in the head of the key, and invisible beneath a molded rubber cap (Fig. 1).

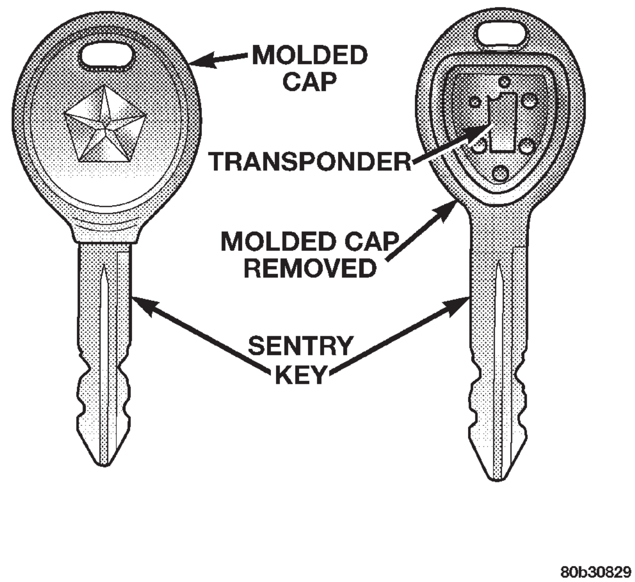


Fig. 1 Sentry Key Immobilizer Transponder

Each Sentry Key transponder has a unique transponder identification code programmed into it by the manufacturer. The Sentry Key Immobilizer Module (SKIM) has a unique “Secret Key” code programmed into it by the manufacturer. When a Sentry Key transponder is programmed into the memory of the SKIM, the SKIM learns the transponder identification code from the transponder, and the transponder learns the “Secret Key” code from the SKIM. Each of these codes is stored within the transponder and in the nonvolatile memory of the SKIM. Therefore, blank keys for the SKIS must be programmed by and into the SKIM, in addition to being cut to match the mechanical coding of the ignition lock cylinder. See Sentry Key Immobilizer System Transponder Programming in this group for more information.

The Sentry Key transponder is within the range of the SKIM transceiver antenna ring when it is inserted in the ignition lock cylinder. When the ignition switch is turned to the Start or On positions, the SKIM transceiver issues a Radio Frequency (RF) signal that excites the transponder chip. The transponder chip responds by issuing an RF signal containing its transponder identification code and the “Secret

DESCRIPTION AND OPERATION (Continued)

Key" code. The SKIM transceiver compares the transponder codes with the codes stored in its memory to determine whether a valid key is in the ignition lock cylinder.

The Sentry Key transponder cannot be repaired and, if faulty or damaged, it must be replaced.

SENTRYKEY IMMOBILIZER SYSTEM INDICATOR LAMP

The Sentry Key Immobilizer System (SKIS) indicator lamp gives an indication when the SKIS is faulty or when the vehicle has been immobilized due to the use of an invalid ignition key. The lamp is controlled by the instrument cluster circuitry based upon messages received from the Sentry Key Immobilizer Module (SKIM) on the Chrysler Collision Detection (CCD) data bus.

The SKIM sends messages to the instrument cluster to turn the lamp on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the lamp off for a duration of about one second. Then the SKIM sends messages to the instrument cluster circuitry to turn the lamp on or off based upon the results of the SKIS self-tests. If the SKIS indicator lamp comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative. If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to the instrument cluster to flash the SKIS indicator lamp.

The SKIM can also send messages to the instrument cluster to flash the lamp and to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its "Customer Learn" programming mode. See Sentry Key Immobilizer System Transponder Programming in this group for more information on the "Customer Learn" programming mode.

The SKIS indicator lamp uses a replaceable incandescent bulb and bulb holder on the instrument cluster electronic circuit board. Refer to Group 8E - Instrument Panel Systems for diagnosis and service of a faulty SKIS indicator lamp. If the SKIS indicator lamp comes on and stays on after the bulb test function, diagnosis of the SKIS should be performed with a DRB scan tool and the proper Diagnostic Procedures manual.

DIAGNOSIS AND TESTING

SENTRY KEY IMMOBILIZER SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Sentry Key Immobilizer System involves the use of a DRB scan tool. Refer to the proper Diagnostic Procedures manual for the procedures.

The Sentry Key Immobilizer System (SKIS) and the Chrysler Collision Detection (CCD) data bus network should be diagnosed using a DRB scan tool. The DRB will allow confirmation that the CCD data bus is functional, that the Sentry Key Immobilizer Module (SKIM) is placing the proper messages on the CCD data bus, and that the Powertrain Control Module (PCM) and the instrument cluster are receiving the CCD data bus messages. Refer to the proper Diagnostic Procedures manual for the procedures. Refer to 8W-30 - Fuel/Ignition System in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

(1) Check the fuses in the fuseblock module. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Disconnect and isolate the battery negative cable. Unplug the wire harness connector at the SKIM. Check for continuity between the ground circuit cavity of the SKIM wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the SKIM wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the fuse in the fuseblock module as required.

DIAGNOSIS AND TESTING (Continued)

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the SKIM wire harness connector. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to complete the diagnosis of the SKIS. If not OK, repair the open circuit to the fuse in the fuseblock module as required.

SERVICE PROCEDURES

SENTRY KEY IMMOBILIZER SYSTEM TRANSPONDER PROGRAMMING

Two programmed Sentry Key transponders are included with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key Immobilizer Module (SKIM) can be programmed to recognize up to six additional transponders, for a total of eight Sentry Keys. Sentry Key programming will require the use of a DRB scan tool and the proper Diagnostic Procedures manual.

PROGRAMMING THE SKIM MODULE WITH THE DRBIII

(1) Turn the ignition on. Transmission must be in park or neutral. Alarm set lamp will flash.

(2) Use the DRBIII and select “SKIM” under the “MISCELLANEOUS” menu.

(3) Select “PROGRAM PIN” and enter the customer 4–digit PIN number.

(4) Select “UPDATE VIN”. The SKIM module will learn the VIN from the PCM in gasoline engine vehicles, and from the BCM in diesel engine vehicles.

(5) Select “COUNTRY CODE” and enter the correct country.

(6) Select “PROGRAM NEW EMS”. The SKIM module will send the “secret key” data to the PCM.

(7) Program ignition keys to the SKIM module.

PROGRAMMING IGNITION KEYS WITH THE DRBIII

(1) Turn ignition on. Transmission must be in park or neutral. Alarm set lamp will flash.

(2) Use the DRBIII and select “SKIM” under the “MISCELLANEOUS” menu.

(3) Select “LEARN NEW KEY”. Alarm Set lamp will begin flashing.

NOTE: The PIN must be re-entered each time an additional key is learned.

(4) Insert key into ignition switch. Once the key has been learned, the Alarm Set lamp will turn off.

REMOVAL AND INSTALLATION

SENTRY KEY IMMOBILIZER MODULE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knee blocker from the instrument panel. See Knee Blocker in Group 8E - Instrument Panel Systems for the procedures.

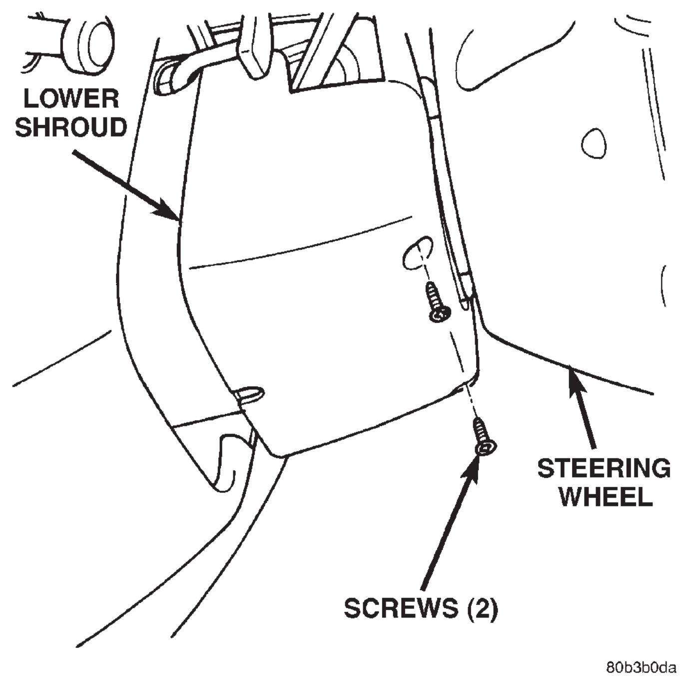


Fig. 2 Steering Column Shrouds Remove/Install

(3) Remove the three screws that secure the lower steering column shroud to the upper shroud.

(4) If the vehicle is so equipped, move the tilt steering column to the fully lowered position.

(5) If the vehicle is so equipped, loosen the two nuts that secure the non-tilt steering column upper mounting bracket to the dash panel steering column support bracket studs. Lower the column far enough to remove the upper steering column shroud.

REMOVAL AND INSTALLATION (Continued)

(6) Remove both the upper and lower shrouds from the steering column.

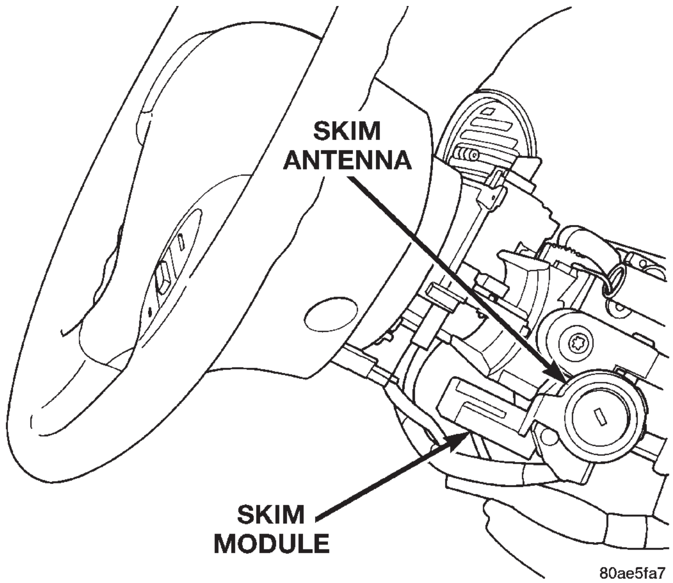


Fig. 3 Sentry Key Immobilizer Module Remove/ Install

(7) Unplug the wire harness connector from the SKIM receptacle.

(8) Remove the screw securing the SKIM module to the steering column.

(9) Release the clip holding the SKIM antenna to the ignition lock housing on the steering column.

(10) Remove the SKIM from the vehicle.

(11) Reverse the removal procedures to install. Tighten the non-tilt steering column mounting nuts to 22 N·m (200 in. lbs.) and the steering column shroud mounting screws to 2 N·m (18 in. lbs.).

(12) If the SKIM is replaced with a new unit, a DRB scan tool and the proper Diagnostic Procedures manual MUST be used to initialize the new SKIM and to program at least two Sentry Key transponders.

POWER SEATS

CONTENTS

DESCRIPTION AND OPERATION

INTRODUCTION

Power seats can be adjusted in 8 different directions:

- Front riser up and down
- Rear riser up and down
- Forward and backward
- Seat back recliner up and down

Four single armature permanent magnet reversible motors are coupled through cables to worm gear box assemblies. They are located in the seat tracks and upper supports. The two single gear motor assemblies attach to the seat tracks provide the various seat movements.

The electrical circuit is protected by a 20 amp circuit breaker located in the junction block.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURE

Before any testing is attempted the battery should be carefully charged and all connections and terminals cleaned and tightened to insure proper continuity and grounds.

With dome lamp on, apply switch in direction of failure. If dome lamp dims the seat motor is trying to work indicating mechanical jamming. If dome lamp does not dim, then proceed with the following electrical tests.

CIRCUIT BREAKER

Find correct circuit breaker on fuse block. Pull out slightly but be sure that circuit breaker terminals still contact terminals in fuse block. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive wire, check both terminals of circuit breaker for battery voltage. If only one terminal checks at battery voltage, circuit breaker is defective and must be replaced. If neither terminal shows battery voltage, check for open or shorted circuit to circuit breaker.

SEAT MOTORS

(1) Remove power seat switch from seat.

(2) Disconnect wire harness connector.

(3) Check Pin 5 for battery voltage and Pin 1 for ground.

(4) To test the seat motors, refer to the (Fig. 1), and verify proper seat responses. Using two jumper wires, connect one to a battery supply and the second to a ground. Connect the other ends to the seat wire harness connector as described in the Switch Harness Connector Circuit Test table (Fig. 1).

DIAGNOSIS AND TESTING (Continued)

SWITCH HARNESS CONNECTOR CIRCUIT TEST

CAVITY	TEST		FUNCTION
	(+)	(–)	
1			GROUND
2	2	4	SEATBACK RECLINER UP
3	3	6	SEAT BACKWARD
4	4	2	SEATBACK RECLINER DOWN
5			BATTERY
6	6	3	SEAT FORWARD
7	7	10	FRONT RISER UP
8	8	9	REAR RISER UP
9	9	8	REAR RISER DOWN
10	10	7	FRONT RISER DOWN

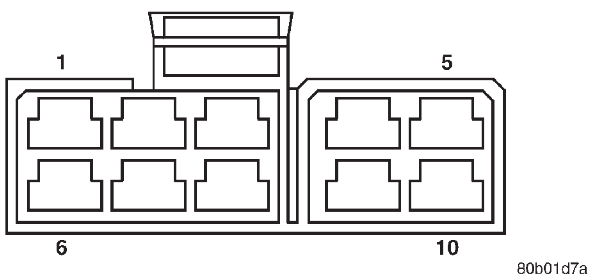


Fig. 1 Switch Harness Connector

SEAT SWITCH

(1) Remove switch from mounting position Refer to (Fig. 2)

(2) Using an ohmmeter, perform the switch continuity tests. Refer to the Switch Continuity Test table. If there is no continuity in any of the switch positions, replace switch.

SWITCH CONTINUITY TEST

SWITCH POSITION	CONTINUITY BETWEEN
OFF	1-2, 1-3, 1-4, 1-6, 1-7, 1-8, 1-9, 1-10
SEATBACK RECLINER UP	5-2, 1-4
SEATBACK RECLINER DOWN	5-4, 1-2
SEAT BACKWARD	5-3, 1-6
SEAT FORWARD	5-6, 1-3
FRONT RISER UP	5-4, 1-10
FRONT RISER DOWN	5-10, 1-7
REAR RISER UP	5-8, 1-9
REAR RISER DOWN	5-9, 1-8

DIAGNOSIS AND TESTING (Continued)

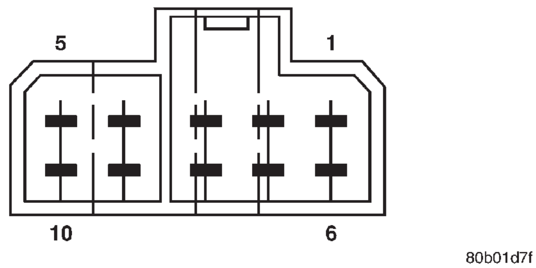


Fig. 2 Power Seat Switch

VOLTAGE

The following test will determine whether or not voltage is continuous through the body harness to the switch.

(1) Remove power seat switch from mounting position and disconnect switch from wiring harness.

(2) Using a voltmeter, connect the ground lead to Pin 5 of the switch harness connector. Connect the positive lead to Pin 1. If battery voltage is seen, the ground and B+ circuit is OK. If no voltage is seen, check the circuit breaker and repair as necessary.

REMOVAL AND INSTALLATION

FRONT SEAT ASSEMBLY

Refer to Group 23, Body for Front Seat Removal and Installation.

POWER FRONT SEAT ADJUSTER

Before the seat adjuster can be serviced, the front seat assembly must be removed from the vehicle. Refer to Group 23, Body for Front Seat Removal and Installation.

REMOVAL

Once the front seat is removed, lay it on a clean surface upside down to expose the underside of the seat assembly.

(1) Remove the four screws retaining the left and right seat cushion side shields.

(2) Disconnect the power seat switch connectors from the seat cushion side shield and remove side shield.

(3) Remove the four bolts retaining the power seat adjuster to the seat assembly and remove.

INSTALLATION

For installation, reverse the above procedures.

POWER SEAT SWITCH

REMOVAL

(1) Remove left cushion side shield (Fig. 3).

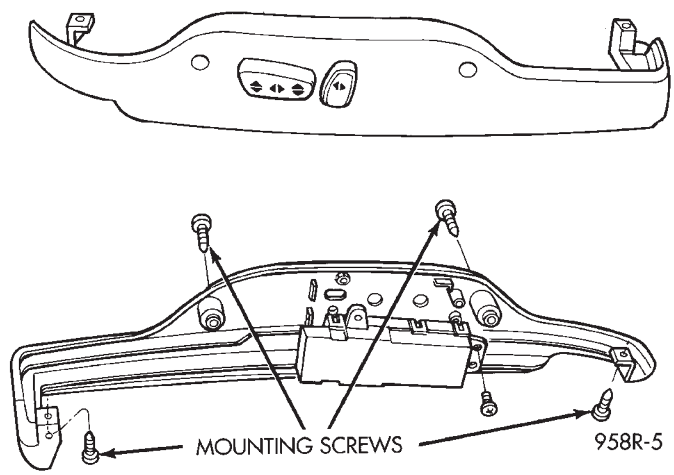


Fig. 3 Switch Removal

(2) Disconnect wiring from switch.

(3) Remove the seat and recliner switch knobs.

(4) Remove attaching screws and switch from bezel.

INSTALLATION

For installation, reverse the above procedure.

POWER WINDOWS

CONTENTS

GENERAL INFORMATION

INTRODUCTION

Front and rear door window lift motors are of the permanent magnet type. A battery positive and negative connection to either of the two motor terminals will cause the motor to rotate in one direction. Reversing current through these same two connections will cause the motor to rotate in the opposite direction.

Each individual motor is grounded through the master switch.

DIAGNOSIS AND TESTING

VOLTAGE

The following circuit test sequence determines whether or not voltage is continuous through the body harness to switch.

(1) Remove the driver door trim panel. Refer to Group 23, Body for proper procedures.

(2) Carefully separate wiring harness connector from switch body. Refer to Group 8W, Wiring Diagrams.

(3) Using a voltmeter, connect the ground lead to the Pin 10 of the wiring harness connector.

(4) Using the positive lead, check Pin 1 of the harness connector for battery voltage. If OK, go to Window Switch Test below. If not OK, check 20 amp circuit breaker in the Junction Block, if the circuit breaker is OK, repair wire as necessary. For wiring, specific connector type and location, refer to Group 8W, Wiring Diagrams.

WINDOW MOTOR

(1) Remove door trim panel, refer to Group 23 Body for removal procedures.

(2) Connect positive (+) lead from a test battery to either of the two motor terminals.

(3) Connect negative (-) lead from test battery to remaining motor terminal.

(4) The motor should now rotate in one direction to either move window up or down.

(a) If window happens to already be in full UP position and motor is connected so as to move it in UP direction no movement will be observed.

(b) Likewise, motor connected to move window in DOWN direction no movement will be observed if window is already in full DOWN position.

(c) Reverse battery leads in Step 1 and Step 2 and window should now move. If window does not move, replace motor. See below for motor removal from vehicle.

(5) If window moved completely up or down, the test leads should be reversed one more time to complete a full window travel inspection.

(6) If window does not move, check to make sure that it is free.

(7) It is necessary that the window be free to slide up and down in the glass channels. If the window is not free to move up and down, the window lift motor will not be able to move the glass.

(8) To determine if the glass is free is to disconnect the regulator from the glass lift plate. Remove the two attaching screws, and slide the window up and down by hand.

WINDOW SWITCH

For switch testing, remove the switch from its mounting, refer to Switch Removal. Using an ohmmeter, refer to Window Switch Continuity Charts to determine if continuity is correct (Fig. 1) and (Fig. 2). If the results are not obtained, replace the switch.

The master window switch has an Auto-Down feature. Actuation of the master switch to the second down position will move the drivers side window completely down. The electronic switch will automatically disconnect the motor approximately 1 second after the window bottoms out. Failure of the electronic switch to detect stall current, will cause the switch to disconnect after approximately 13 seconds. The auto down function can be canceled by any movement of that switch.

DIAGNOSIS AND TESTING (Continued)

SWITCH POSITION		CONTINUITY BETWEEN TERMINALS
OFF		PIN 10 to 2
		PIN 10 to 3
		PIN 10 to 4
		PIN 10 to 7
		PIN 10 to 8
		PIN 10 to 9
		PIN 10 to 11
		PIN 10 to 12
UP	DRIVER'S	PIN 1 to 7
		PIN 8 to 10
UP	RIGHT FRONT	PIN 1 to 12
		PIN 10 to 11
UP	LEFT REAR	PIN 3 to 10
		PIN 1 to 2
UP	RIGHT REAR	PIN 1 to 4
		PIN 9 to 10
DOWN	DRIVER'S	PIN 1 to 8
		PIN 7 to 10
DOWN	RIGHT FRONT	PIN 1 to 11
		PIN 10 to 12
DOWN	LEFT REAR	PIN 3 to 1
		PIN 2 to 10
DOWN	RIGHT REAR	PIN 1 to 9
		PIN 4 to 10
WINDOW LOCK		PIN 1 to 5

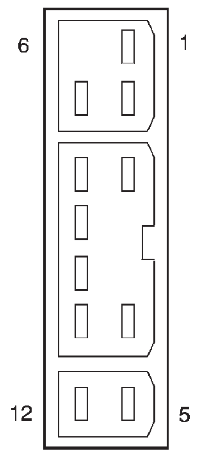


Fig. 1 Master Window Switch Continuity Test

SWITCH POSITION	CONTINUITY BETWEEN TERMINALS
OFF	PIN 2 to 5 PIN 1 to 4
UP	PIN 1 to 4 PIN 5 to 6
DOWN	PIN 2 to 5 PIN 1 to 6

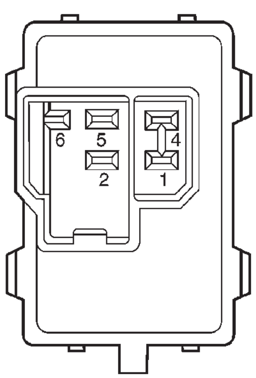


Fig. 2 Passenger Window Switch Continuity Test

REMOVAL AND INSTALLATION

WINDOW MOTOR

WARNING: DO NOT HAVE ANY HANDS OR FINGERS IN SECTOR GEAR AREA WHERE THEY CAN BE PINCHED BY SMALL MOVEMENTS OF REGULATOR LINKAGE.

REMOVAL

(1) Move the window to the full-up position, if possible.

(2) Remove door trim panel and window regulator, refer to Group 23 Body for removal procedures.

WARNING: FAILURE TO CLAMP THE SECTOR GEAR TO THE MOUNTING PLATE WHEN REMOVING THE MOTOR CAN RESULT IN INJURY.

(3) Disconnect wiring connector from motor.

(4) Secure the sector gear and mounting plate with a C clamp or similar clamping tool. This will prevent a sudden and forceful movement of the regulator when the motor is removed.

(5) Remove three mounting screws that hold motor gearbox to regulator (Fig. 3).

(6) Remove motor from regulator.

INSTALLATION

(1) Install new motor on regulator by positioning motor gearbox so that it engages regulator sector teeth.

(2) A slight rotational or rocking movement may be necessary to bring three motor gearbox screw holes into proper position.

(3) Install three gearbox screws and one tie down bracket screw, if applicable. Tighten to 5.6 to 8 N·m (50 to 70 in. lbs.) torque.

(4) Install regulator, using the switch, test operation of motor.

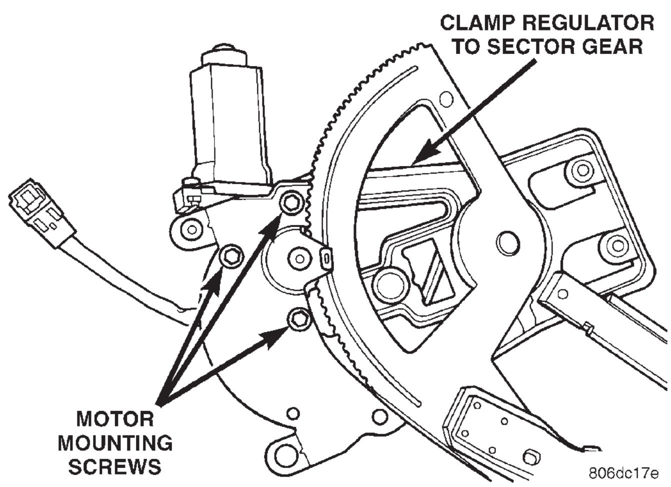


Fig. 3 Motor Removal

REMOVAL AND INSTALLATION (Continued)

WINDOW SWITCH

MASTER SWITCH

REMOVAL

(1) Remove driver's door trim panel, refer to Group 23, Body for removal procedures.
(2) Remove three mounting screws.
(3) Remove switch and disconnect wire connector.

INSTALLATION

For installation, reverse the above procedures.

PASSENGER SWITCH

REMOVAL

(1) Remove passenger door trim panel, refer to Group 23 Body, for removal procedures.
(2) Disconnect switch wire connector.
(3) Using a trim stick (special tool #C-4755), gently pry out switch from bezel being careful not to damage bezel. First, insert the trim stick into the switch pocket in the flush side to release that side from the pocket. Use only enough force on the trim stick to permit the switch to be released from the pocket, and avoid twisting the stick to prevent damage to the switch or plastic pocket.

NOTE: The connector is flush with one side of the switch housing (Fig. 4).

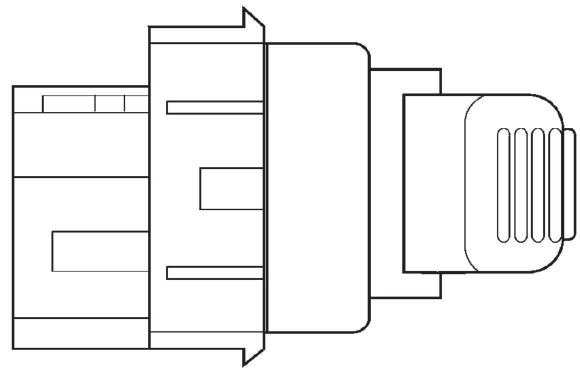


Fig. 4 Passenger Power Window Switch

(4) After the flush side is released, release the non-flush side with similar care.

NOTE: Releasing the non-flush side first will make the flush side less accessible requiring extra force to remove.

INSTALLATION

For installation, reverse the above procedures.

POWER MIRRORS

CONTENTS

DESCRIPTION AND OPERATION

INTRODUCTION

Power mirrors are controlled by a single switch located on the driver's door. The switch has a rocker buttons mark L (left) and R (right) for mirror selection and four buttons for mirror direction movement (Fig. 1).

The motors which operate the mirrors are part of the mirror assembly and cannot be replaced separately.

The vehicle is equipped with an Ignition Off Draw Fuse which is used when it is originally shipped from the factory. This fuse is located in the Junction Block and helps to prevent battery discharge during storage when disconnected.

This fuse is included in the power mirror circuity and should be checked if the mirrors are inoperative.

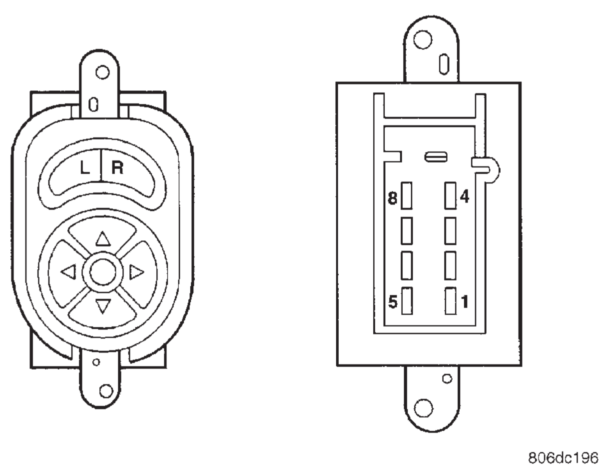


Fig. 1 Power Mirror Switch

HEATED MIRROR

Heated mirrors are available with Power Mirrors and Rear Window Defogger only. The heated mirror is controlled by the rear window defogger switch. Only time that the heated mirror is on is when the rear window defogger is on. The mirror should become warm to the touch.

DIAGNOSIS AND TESTING

HEATED MIRROR

(1) Using a ohmmeter, check Pin 1 of the mirror motor harness connector for continuity to ground. If OK, go to Step 2. If not OK, repair as necessary. Refer to Group 8W, Wiring Diagrams.

(2) Activate the rear window defogger switch, use a voltmeter and check Pin 2 for battery voltage.

(a) If OK, go to Step 3. If not OK, check fuse 5 & 6 in the Junction Block and also fuse #12 in the Power Distribution Center and repair as necessary.

(b) Check rear window defogger switch, refer to Group 8N, Electrically Heated Systems, Rear Window Defogger. If OK, go to Step c. If not OK, replace HVAC control.

(c) If no voltage repair wire as necessary. Refer to Group 8W, Wiring Diagrams.

(3) Remove mirror glass and check wires. If wires are OK, replace mirror glass. If not OK, repair as necessary or replace mirror.

DIAGNOSIS AND TESTING (Continued)

MIRROR MOTOR

(1) Remove door trim panel. Refer to Group 23, Body.

(2) Disconnect wire connector from the switch.

(3) Using two jumper wires, one connected to a 12 volt battery source, and the other connected to a good body ground. Refer to the Mirror Test (Fig. 2) for appropriate mirror response, using the mirror switch wiring harness connector.

(4) If test results are not obtained as shown in the (Fig. 2), check for open or shorted circuit, or replace mirror assembly as necessary.

MIRROR SWITCH HARNESS CONNECTOR			
		Mirror Reaction	
12 Volt	Ground	Left	Right
PIN 4	PIN 5		UP
PIN 8	PIN 5	UP	
PIN 5	PIN 4		DOWN
PIN 5	PIN 8	DOWN	
PIN 6	PIN 3		RIGHT
PIN 6	PIN 7	RIGHT	
PIN 3	PIN 6		LEFT
PIN 7	PIN 6	LEFT	

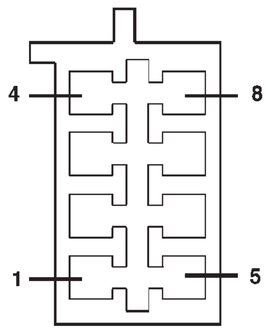


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Fig. 2 Mirror Motor Test

MIRROR SWITCH

(1) Remove door trim panel. Refer to Group 23, Body.

(2) Disconnect wire connector.

(3) Using an ohmmeter, test for continuity between the terminals of the switch as shown in the Mirror Switch Test (Fig. 3).

(4) If test results are not obtained as shown in the (Fig. 3), replace the switch.

SWITCH POSITION Move Button	CONTINUITY BETWEEN TERMINALS
Mirror in L Position	
▲	PIN 1 to 5 PIN 2 to 8
▶	PIN 1 to 7 PIN 2 to 6
▼	PIN 1 to 8 PIN 2 to 5
◀	PIN 1 to 6 PIN 2 to 7
Mirror in R Position	
▲	PIN 1 to 5 PIN 2 to 4
▶	PIN 1 to 3 PIN 2 to 6
▼	PIN 1 to 4 PIN 2 to 5
◀	PIN 1 to 6 PIN 2 to 3

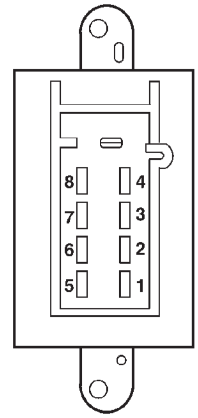

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Fig. 3 Mirror Switch Test

REMOVAL AND INSTALLATION

MIRROR ASSEMBLY

REMOVAL

(1) For door trim panel and mirror removal, refer to Group 23, Body.

(2) Disconnect mirror.

(3) Remove attaching nuts.

(4) Test operation of mirror before installing door trim panel.

INSTALLATION

For installation, reverse the above procedures.

MIRROR SWITCH

REMOVAL

(1) Remove door trim panel. Refer to Group 23, Body.

(2) Disconnect wire connector.

(3) Remove attaching screws.

INSTALLATION

For installation, reverse the above procedures.

CHIME WARNING / REMINDER SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO THE AIRBAG PORTION OF THIS SECTION FOR STEERING WHEEL OR SWITCH REMOVAL AND INSTALLATION PROCEDURES.

The chime warning/reminder system includes signals for fasten seat belts, exterior lamps left ON, key left in ignition and door ajar (Fig. 1).

Use the DRB lll® scan tool and the proper Body Diagnostic Procedures Manual.

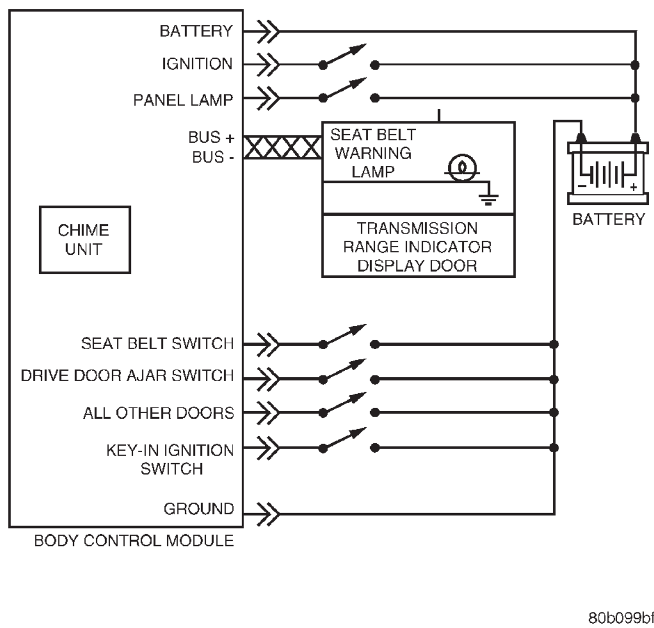


Fig. 1 Chime Warning / Reminder System Wiring

FASTEN SEAT BELTS

A warning lamp on the instrument panel, and an audible chime tone are used as the fasten seat belt warning/reminder.

EXTERIOR LAMPS LEFT ON

An audible chime tone that indicates the exterior lamps were left on.

KEY LEFT IN IGNITION

An audible chime tone that indicates the key was left in ignition.

DESCRIPTION AND OPERATION

DOOR AJAR CHIME

An audible chime will sound when the vehicle begins to move and the transmission range indicator display will indicate DOOR.

EXTERIOR LAMPS LEFT ON

To test the headlamps left on function, turn ignition off, turn exterior lamps on with driver's door open. Chime should sound until headlamps are turned off or drivers door is closed.

FASTEN SEAT BELTS

To test, the ignition switch must be in the off position before testing the fasten seat belts. Turn the ignition switch to the ON position with the driver's seat belt unbuckled and fully retracted. The seat belt warning lamp should light for 4 to 8 seconds and the tone should sound 4 to 8 seconds.

KEY LEFT IN IGNITION SWITCH

To test the key left in ignition function:

- The ignition switch must be in the OFF position with key in ignition.
- Driver's door open.
- Chime should sound until key is removed from ignition or drivers door is closed.

DIAGNOSIS AND TESTING

CHIME DIAGNOSTIC CONDITIONS

For Removal and Installation of Junction Block (JB), refer to Group 8O, Power Distribution Systems.

For Removal and Installation of Body Control Module (BCM), refer to Group 8E, Instrument Panel and Systems.

NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVERS SEAT BELT IS UNBUCKLED AND FULLY RETRACTED

(1) Check driver's seat belt retractor switch for a ground when belt is retracted.

(2) Use scan tool to perform CCD diagnostics on Body Control Module for battery, ignition and seat belt switch inputs.

(3) Use scan tool to perform actuator diagnostics on Body Control Module Chime.

(4) Check for tone in any other function.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module (Fig. 2). Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

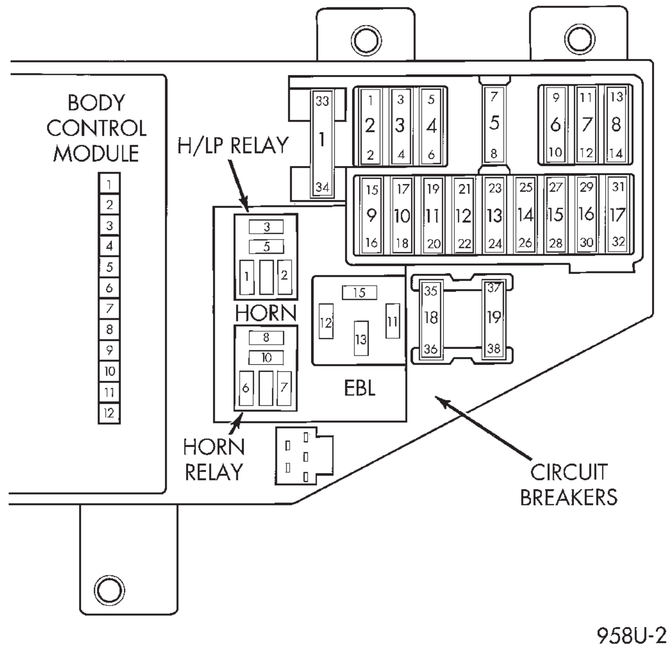


Fig. 2 Junction Block Connector to the BCM

NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON

(1) Use DRB lll® scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch inputs.

(2) Check for burned out bulb.

(3) Using the DRB lll® scan tool, do the actuator test on cluster. Refer to proper Body Diagnostic Procedures Manual.

(4) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(5) If voltage not OK, repair as necessary.

FASTEN SEAT BELT LAMP OR TONE CONTINUE FOR MORE THAN 10 SECONDS AFTER SEAT BELTS ARE FASTENED AND IGNITION ON

(1) Use scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch input.

(2) Inspect Body Control Module connectors and wires for proper connection.

NO TONE OR DOOR INDICATED IN PLACE OF ODOMETER WHEN A DOOR IS AJAR AND VEHICLE BEGINS MOVING

The vehicle must be moving for the chime to occur. However the door indicator will come ON regardless of the vehicle movement. The CCD bus, Transmission Control Module (TCM) and Powertrain Control Module (PCM) must be operational.

DIAGNOSIS AND TESTING (Continued)

(1) Check all door jamb switches.

(2) Use DRB lll® scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch input

(3) Inspect Body Control Module connectors and wires for proper connection.

(4) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for the location of the terminals.

(5) If voltage not OK, repair as necessary.

NO TONE WHEN HEADLAMPS ARE ON, IGNITION SWITCH IS OFF AND DRIVER'S DOOR IS OPEN.

(1) Check left door jamb switch for good ground when driver's door is open.

(2) Use DRB lll® scan tool to perform CCD diagnostics on Body Control Module for battery, ignition switch input, headlamp and driver's door input and Chime Output Test.

(3) Check headlamp switch.

(4) Inspect Body Control Module connectors and wires for proper connection.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

NO TONE WHEN IGNITION KEY IS LEFT IN IGNITION SWITCH AND IT IS IN THE OFF POSITION WITH DRIVER'S DOOR IS OPEN

(1) Check left door jamb switch for good ground when drivers door is open.

(2) Use DRB lll® scan tool to perform CCD diagnostics on Body Control Module for battery, ignition switch input, key-in-switch and driver's door input and Chime Output Test.

(3) Check key-in switch.

(4) Inspect Body Control Module connectors and wires for proper connection.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

CHIMES CONTINUE WHEN HEADLAMPS ARE TURNED OFF AND/OR KEY IS REMOVED FROM IGNITION

(1) Use DRB lll® scan tool to perform CCD diagnostics on Body Control Module for headlamp or key-in-ignition inputs.

(2) Check wiring for a grounded condition between key-in switch and Body Control Module. Check headlamp switch to Body Control Module wiring for short to battery.

(3) Inspect Body Control Module connectors and wires for proper connection.

REMOVAL AND INSTALLATION

BODY CONTROL MODULE (BCM)

Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

HEADLAMP SWITCH

Refer to Group 8E, Instrument Panel and Systems.

JUNCTION BLOCK (JB)

Refer to Group 8O, Power Distribution Systems for Removal and Installation.

KEY-IN SWITCH

The Key-in switch is built into the ignition switch assembly. Should the Key-in switch require service, the ignition switch assembly must be replaced. Refer to Group 8D, Ignition System for service procedures.

SEAT BELT BUCKLE

Refer to Group 23, Body for service procedures.

CHIME WARNING/REMINDER SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO THE AIRBAG PORTION OF THIS SECTION FOR STEERING WHEEL OR SWITCH REMOVAL AND INSTALLATION PROCEDURES.

The chime warning/reminder system includes signals for fasten seat belts, exterior lamps left ON, key left in ignition and door ajar (Fig. 1).

When using the scan tool (DRB), refer to the proper Body Chassis Diagnostic Manual.

FASTEN SEAT BELTS

A warning lamp on the instrument panel, and if equipped an audible chime tone are used as the fasten seat belt warning/reminder.

EXTERIOR LAMPS LEFT ON

An audible chime tone that indicates the exterior lamps were left on.

KEY LEFT IN IGNITION

An audible chime tone that indicates the key was left in ignition.

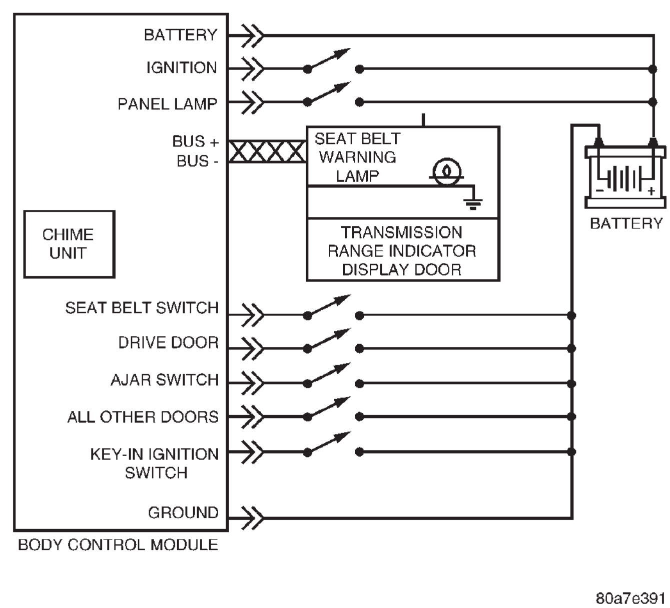


Fig. 1 Chime Warning/Reminder Wiring

DESCRIPTION AND OPERATION

FASTEN SEAT BELTS

To test, the ignition switch must be in the off position before testing the fasten seat belts. Turn the ignition switch to the ON position with the driver's seat belt unbuckled and fully retracted. The seat belt warning lamp should light for 4 to 8 seconds and if equipped a tone should sound 4 to 8 seconds.

On vehicles so equipped the seat belt indicator lamp will remain on continuously anytime the ignition switch is on and the driver is not wearing the seat belt.

HIGH SPEED WARNING CHIME

If equipped an audible chime will sound continuously any time the vehicle speed is 120 Km/h or faster.

DIAGNOSIS AND TESTING

CHIME CONDITIONS

NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVERS SEAT BELT IS UNBUCKLED AND FULLY RETRACTED

(1) Check driver's seat belt retractor switch for a ground when belt is retracted.

(2) Use scan tool to perform CCD diagnostics on Body Control Module for battery, ignition and seat belt switch inputs.

DIAGNOSIS AND TESTING (Continued)

(3) Use scan tool to perform actuator diagnostics on Body Control Module Chime.

(4) Check for tone in any other function.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module (Fig. 2). Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

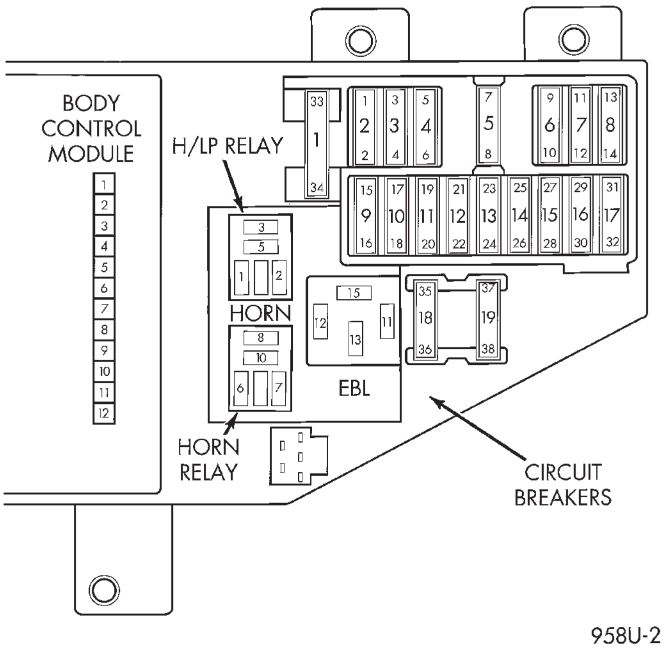


Fig. 2 Junction Block Connector to the BCM

NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON

(1) Use scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch inputs.

(2) Check for burned out bulb.

(3) Using the scan tool, do the actuator test on cluster. Refer to proper Body Diagnostic Manual.

(4) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(5) If voltage not OK, repair as necessary.

FASTEN SEAT BELT LAMP OR TONE CONTINUE FOR MORE THAN 10 SECONDS AFTER SEAT BELTS ARE FASTENED AND IGNITION ON

NOTE: On vehicles so equipped no audible chime tone will sound or the seat belt indicator lamp will remain on continuously anytime the ignition switch is on and the driver is not wearing the seat belt.

(1) Use scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch input.

(2) Inspect Body Control Module connectors and wires for proper connection.

NO TONE OR DOOR INDICATED IN PLACE OF ODOMETER WHEN A DOOR IS AJAR AND VEHICLE BEGINS MOVING

The vehicle must be moving for the chime to occur. However the door indicator will come ON regardless of the vehicle movement. The CCD bus, Transmission Control Module (TCM) and Powertrain Control Module (PCM) must be operational.

(1) Check all door jamb switches.

(2) Use scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch input

(3) Inspect Body Control Module connectors and wires for proper connection.

(4) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for the location of the terminals.

(5) If voltage not OK, repair as necessary.

NO TONE WHEN HEADLAMPS ARE ON, IGNITION SWITCH IS OFF AND DRIVER'S DOOR IS OPEN.

(1) Check left door jamb switch for good ground when driver's door is open.

(2) Use scan tool to perform CCD diagnostics on Body Control Module for battery, ignition switch input, headlamp and driver's door input and Chime Output Test.

(3) Check headlamp switch.

(4) Inspect Body Control Module connectors and wires for proper connection.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

NO TONE WHEN IGNITION KEY IS LEFT IN IGNITION SWITCH AND IT IS IN THE OFF POSITION WITH DRIVER'S DOOR IS OPEN

(1) Check left door jamb switch for good ground when drivers door is open.

(2) Use scan tool to perform CCD diagnostics on Body Control Module for battery, ignition switch input, key-in-switch and driver's door input and Chime Output Test.

(3) Check key-in switch.

DIAGNOSIS AND TESTING (Continued)

(4) Inspect Body Control Module connectors and wires for proper connection.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

CHIMES CONTINUE WHEN HEADLAMPS ARE TURNED OFF AND/OR KEY IS REMOVED FROM IGNITION

(1) Use scan tool to perform CCD diagnostics on Body Control Module for headlamp or key-in-ignition inputs.

(2) Check wiring for a grounded condition between key-in switch and Body Control Module. Check headlamp switch to Body Control Module wiring for short to battery.

(3) Inspect Body Control Module connectors and wires for proper connection.

WIRING DIAGRAMS

CONTENTS

8W-01 GENERAL INFORMATION

INDEX

DESCRIPTION AND OPERATION

INTRODUCTION

Chrysler wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use Chrysler wiring diagrams to diagnose and repair a Chrysler vehicle, it is important to understand all of their features and characteristics.

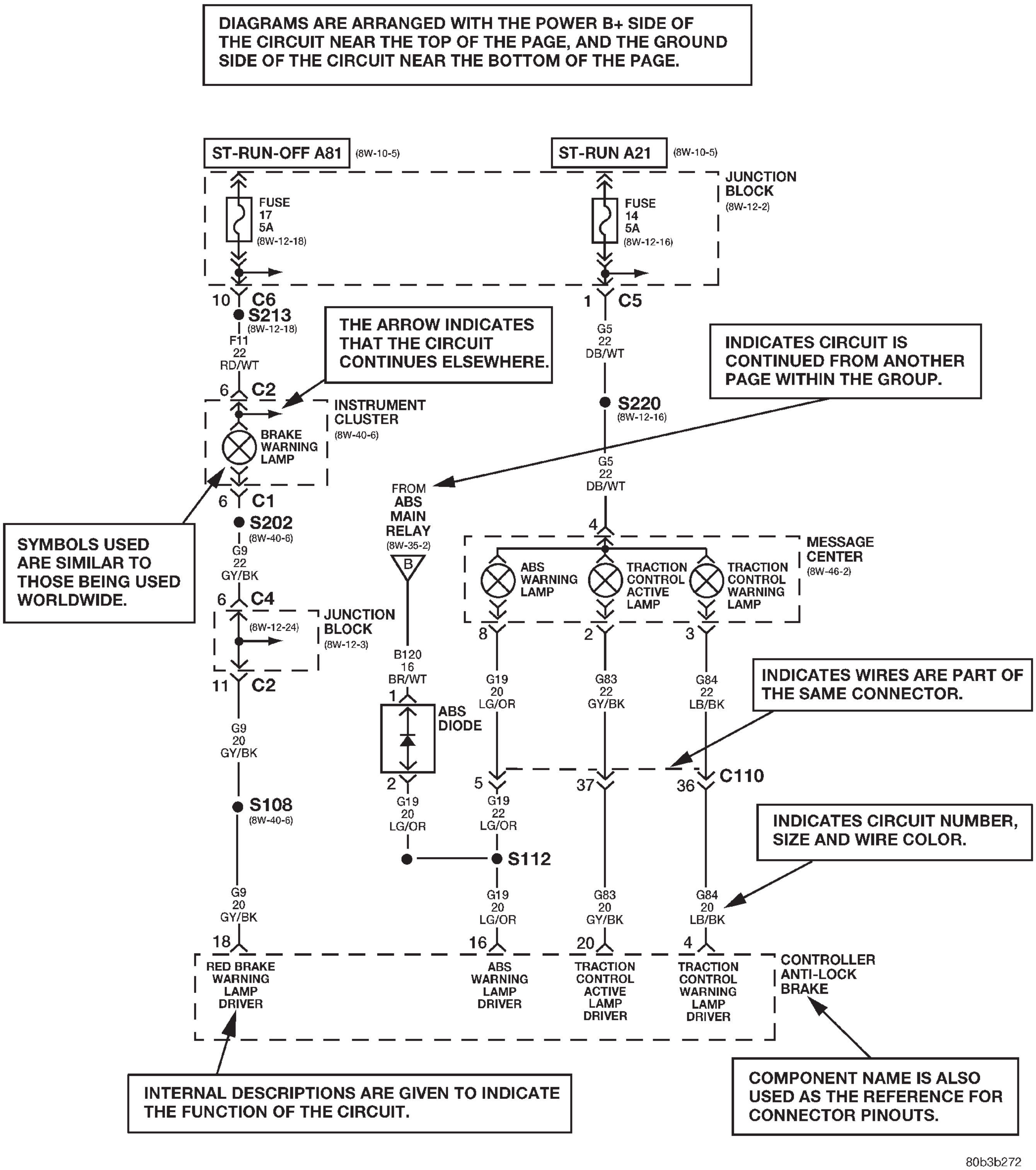
Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the igntion.

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around a component indicates that the component being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

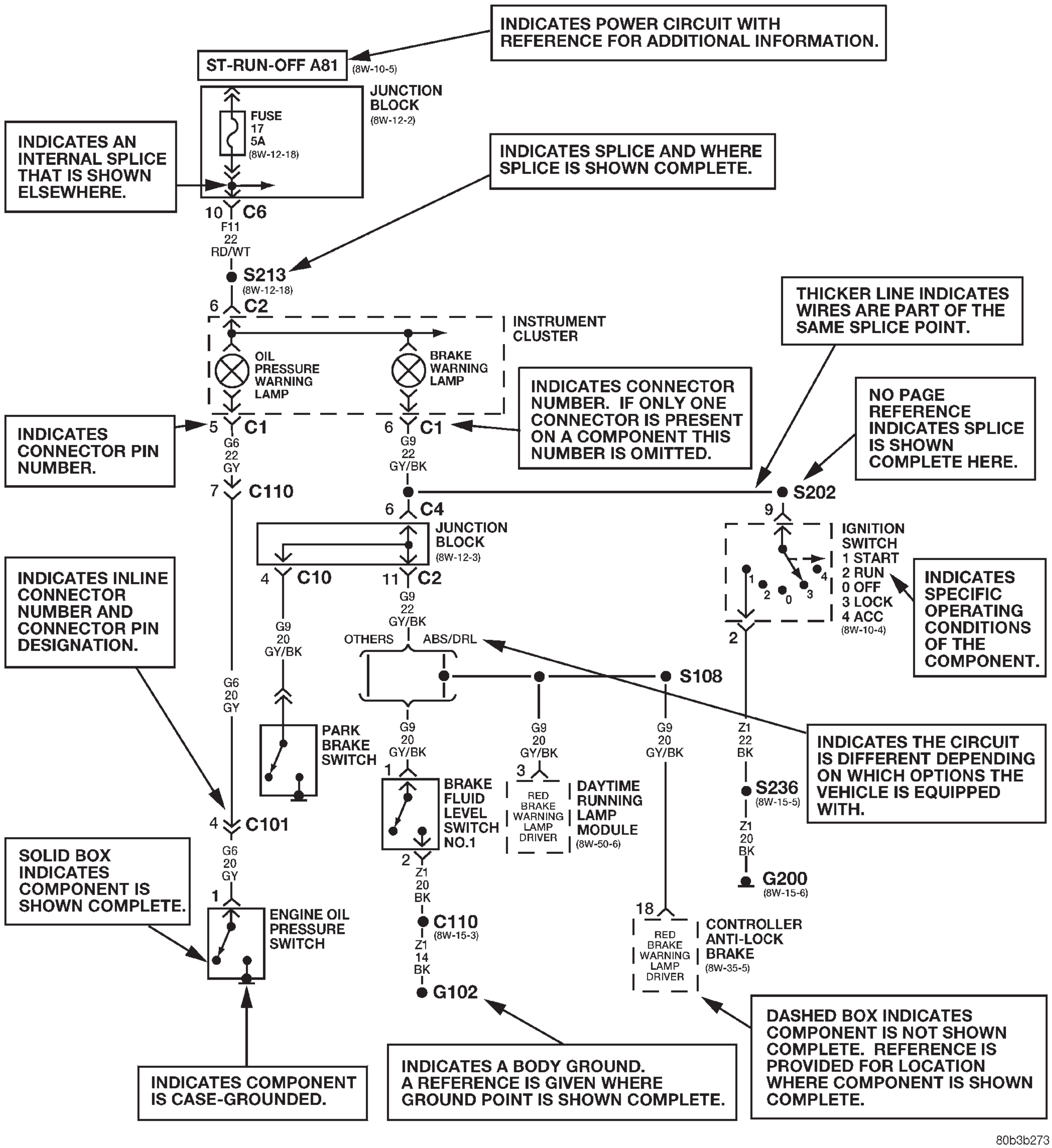
It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

DESCRIPTION AND OPERATION (Continued)



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

DESCRIPTION AND OPERATION (Continued)



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

DESCRIPTION AND OPERATION (Continued)

CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, part of the main circuit, gage of wire, and color (Fig. 1).

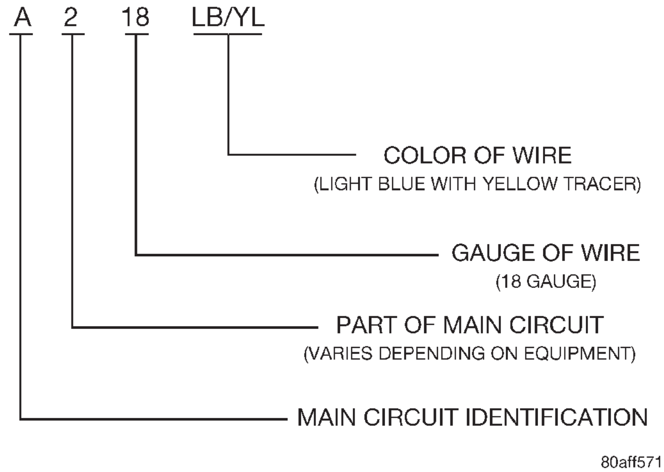


Fig. 1 Wire Code Identification

WIRE COLOR CODE CHART

COLOR CODE	COLOR	STANDARD TRACER COLOR
BL	BLUE	WT
BK	BLACK	WT
BR	BROWN	WT
DB	DARK BLUE	WT
DG	DARK GREEN	WT
GY	GRAY	BK
LB	LIGHT BLUE	BK
LG	LIGHT GREEN	BK
OR	ORANGE	BK
PK	PINK	BK or WT
RD	RED	WT
TN	TAN	WT
VT	VIOLET	WT
WT	WHITE	BK
YL	YELLOW	BK
*	WITH TRACER	

CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and its function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	OPEN
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	NOT USED
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/WASHER
W	OPEN
X	AUDIO SYSTEMS
Y	OPEN
Z	GROUNDS

DESCRIPTION AND OPERATION (Continued)

SECTION IDENTIFICATION

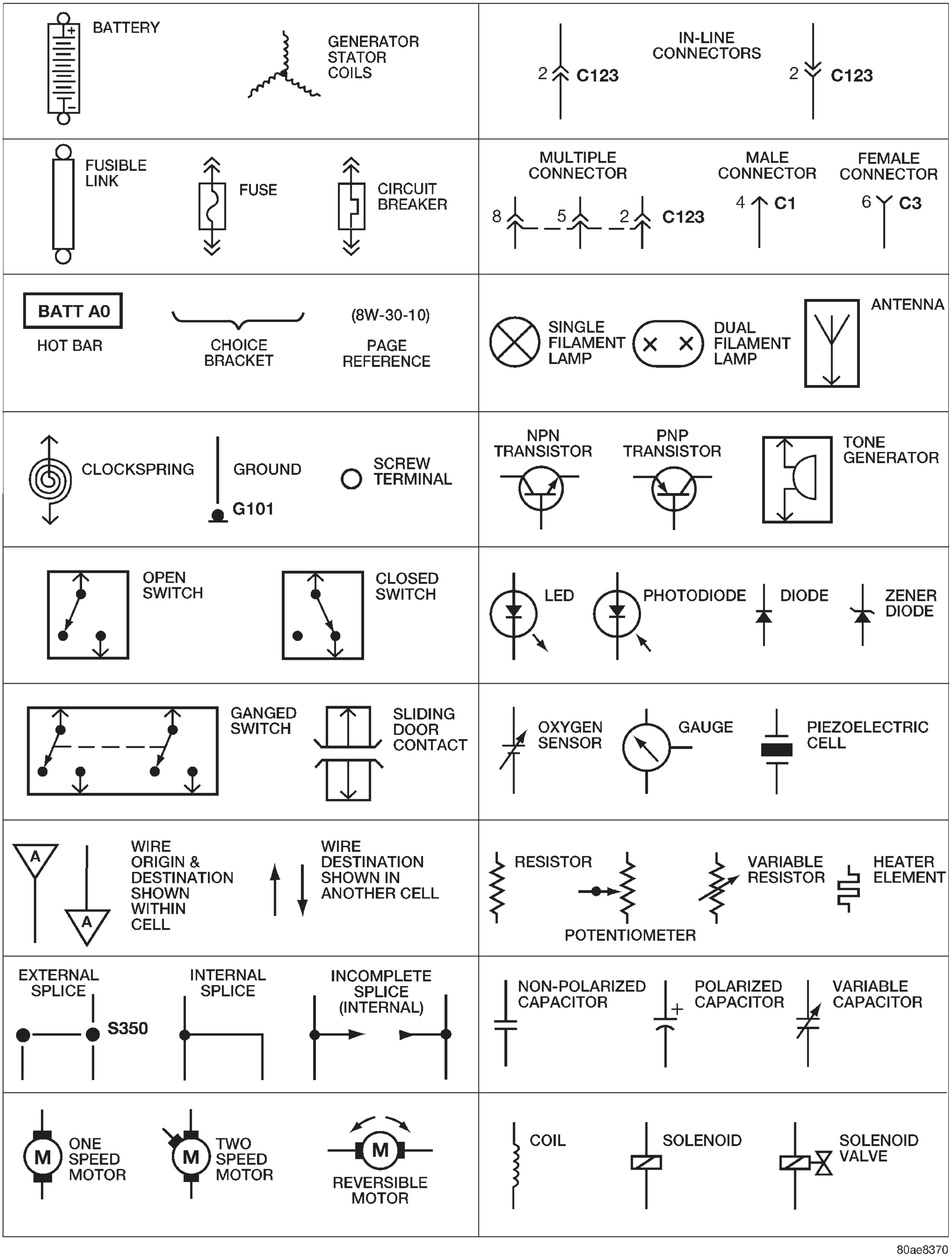
The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

GROUP	TOPIC
8W-01 thru 8W-09	General Information and Diagram Overview
8W-10 thru 8W-19	Main Sources of Power and Vehicle Grounding
8W-20 thru 8W-29	Starting and Charging
8W-30 thru 8W-39	Powertrain/Drivetrain Systems
8W-40 thru 8W-49	Body Electrical items and A/C
8W-50 thru 8W-59	Exterior Lighting, Wipers, and Trailer Tow
8W-60 thru 8W-69	Power Accessories
8W-70	Splice Information
8W-80	Connector Pin Outs
8W-90	Connector Locations (including grounds)
8W-95	Splice Locations

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world

DESCRIPTION AND OPERATION (Continued)



Wiring Diagram Symbols

DESCRIPTION AND OPERATION (Continued)

TERMINOLOGY

This a list of terms with there definitions used in the wiring diagrams.

Built-Up-Export	Vehicles Built For Sale In Markets Other Than North America
Except-Built-Up-Export	Vehicles Built For Sale In North America
LHD	Left Hand Drive Vehicles
RHD	Right Hand Drive Vehicles
ATX	Automatic Transmission-Front Wheel Drive
MTX	Manual Transmission-Front Wheel Drive
AT	Automatic Transmission-Rear Wheel Drive
MT	Manual Transmission-Rear Wheel Drive
SOHC	Single Over Head Cam Engine
DOHC	Dual Over Head Cam Engine

CONNECTOR INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located on the **engine compartment harness** are **C100** series numbers.
- Connectors located on the **instrument panel harness** are **C200** series numbers.
- Connectors located on the **body harness** are **C300** series numbers.
- **Jumper harness connectors** are **C400** series numbers.
- **Grounds and ground connectors** are identified with a **"G"** and follow the same series numbering as the in-line connector.

Component connectors are identified by the component name instead of a number (Fig. 2). Multiple connectors on a component use a C1, C2, etc. identifier (Fig. 3).

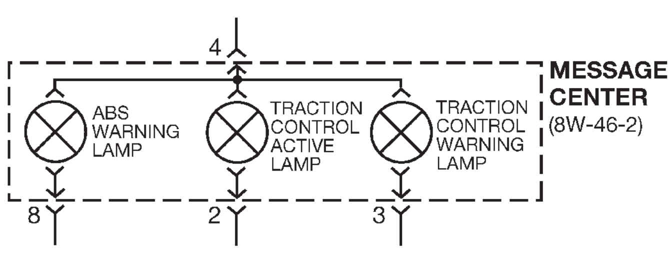


Fig. 2 Component Identification

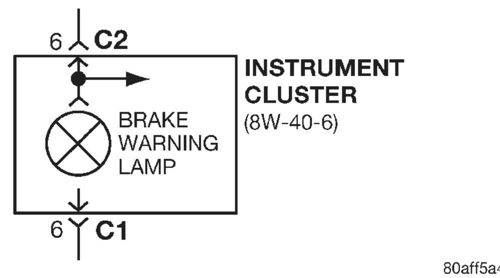


Fig. 3 Connector Identification

LOCATIONS

Section 8W-90 contains connector/ground location illustrations. The illustrations contain the connector name (or number)/ground number and component identification. Connector/ground location charts in Section 8W-90 reference the illustration number for components and connectors.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the Diagram pages.

SPLICE LOCATIONS

Splice Location charts in Section 8W-70 show the entire splice, and provide references to other sections the splice serves.

Section 8W-95 contains illustrations that show the general location of the splices in each harness. The illustrations show the splice by number, and provide a written location.

NOTES, CAUTIONS, and WARNINGS

Throughout this group additional important information is presented in three ways; Notes, Cautions, and Warnings.

NOTES are used to help describe how switches or components operate to complete a particular circuit. They are also used to indicate different conditions that may appear on the vehicle. For example, an up-to and after condition.

CAUTIONS are used to indicate information that could prevent making an error that may damage the vehicle.

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

DESCRIPTION AND OPERATION (Continued)

WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD (S), TAIL PIPE, CATALYTIC CONVERTER, AND MUFFLER.

WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING.

TAKE OUTS

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component.

ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 4) is used to indicate this. When handling any component with this symbol comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.

(3) When using a voltmeter, be sure to connect the ground lead first.

(4) Do not remove the part from its protective packing until it is time to install the part.

(5) Before removing the part from its package, ground the package to a known good ground on the vehicle.

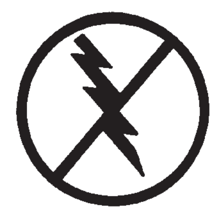


Fig. 4 Electrostatic Discharge Symbol

DIAGNOSIS AND TESTING

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

• Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.

• Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicle are solid state. When checking voltages in these circuits use a meter with a 10-megohm or greater impedance rating.

• Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: - Most of the electrical components used in today's vehicle are Solid State. When checking resistance in these circuits use a meter with a 10-megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle electrical system can cause damage to the equipment and provide false readings.

DIAGNOSIS AND TESTING (Continued)

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 5). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.

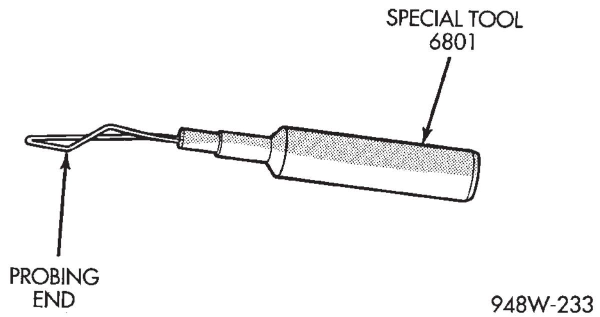


Fig. 5 Probing Tool

INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly check the following items.

- Connectors are fully seated
- Spread terminals, or terminal push out
- Terminals in the wiring assembly are fully seated into the connector/component and locked in position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt and moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation covering.
- Wiring broken inside of the insulation

TROUBLESHOOTING TESTS

Before beginning any tests on a vehicles electrical system use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems in this section.

TESTING FOR VOLTAGE POTENTIAL

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 6).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

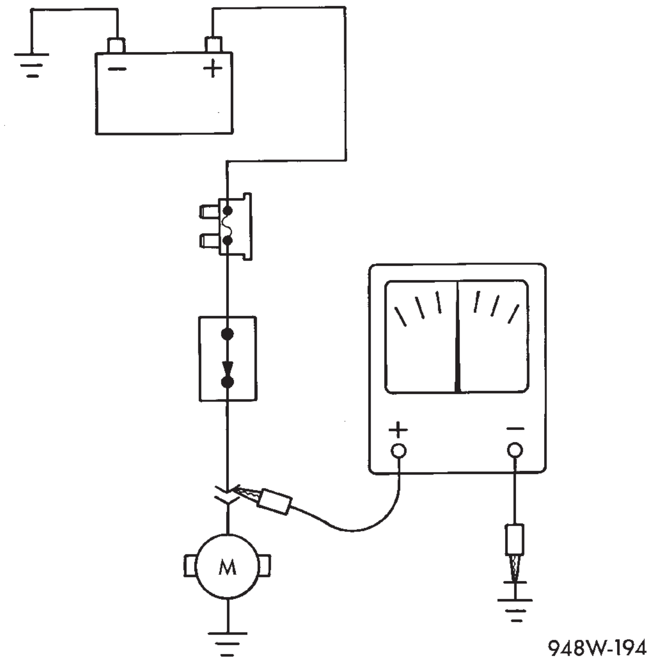


Fig. 6 Testing for Voltage Potential

TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 7).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

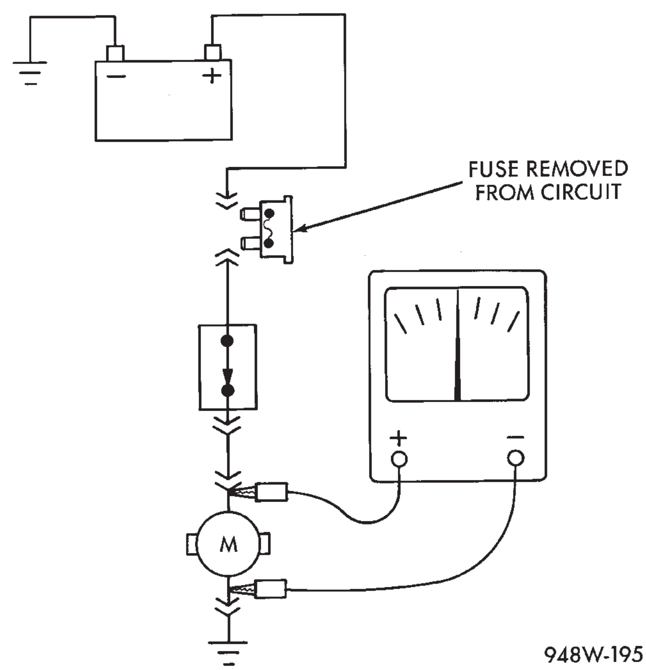


Fig. 7 Testing for Continuity

DIAGNOSIS AND TESTING (Continued)

TESTING FOR A SHORT TO GROUND

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

(1) Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

TESTING FOR A VOLTAGE DROP

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 8).

(2) Connect the other lead of the voltmeter to the other side of the switch or component.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

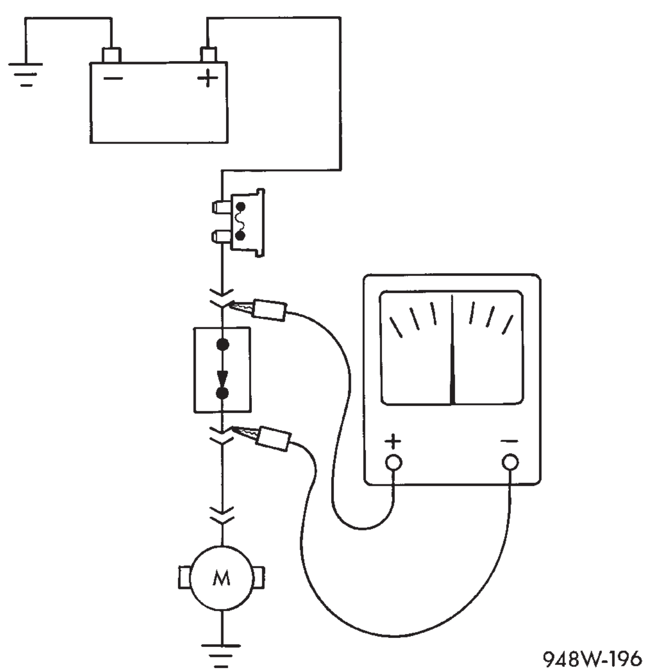


Fig. 8 Testing for Voltage Drop

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.

(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.

(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.

(4) Isolate the problem area.

(5) Repair the problem.

(6) Verify proper operation. For this step check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

SERVICE PROCEDURES

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gage be used as shown in the wiring diagrams. The wires must also be held securely in place to prevent damage to the insulation.

(1) Disconnect battery negative cable

(2) Remove 1 inch of insulation from each end of the wire.

(3) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(4) Spread the strands of the wire apart on each part of the exposed wire (example 1). (Fig. 9)

(5) Push the two ends of wire together until the strands of wire are close to the insulation (example 2) (Fig. 9)

(6) Twist the wires together (example 3) (Fig. 9)

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(8) Center the heat shrink tubing over the joint, and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(9) Secure the wire to the existing ones to prevent chafing or damage to the insulation

(10) Connect battery and test all affected systems.

CONNECTOR REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector that is to be repaired from its mating half/component

SERVICE PROCEDURES (Continued)

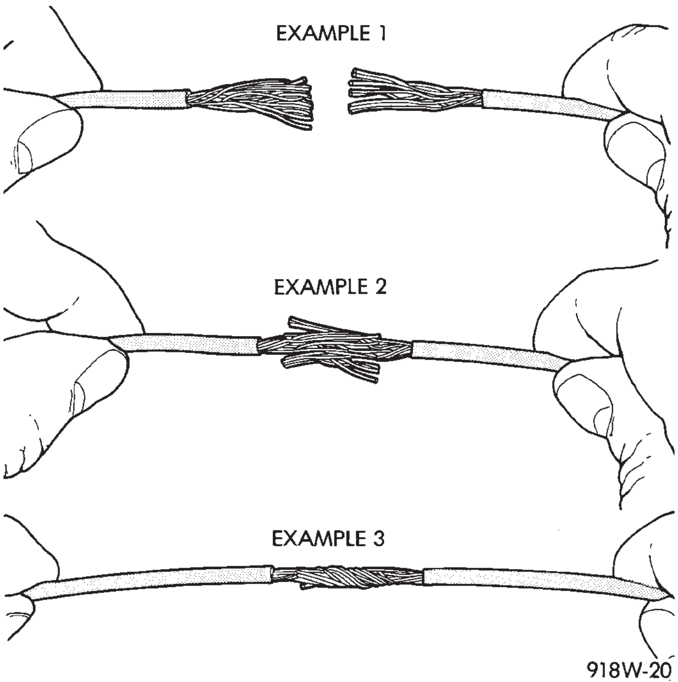


Fig. 9 Wire Repair

(3) Remove the connector locking wedge, if required (Fig. 10)

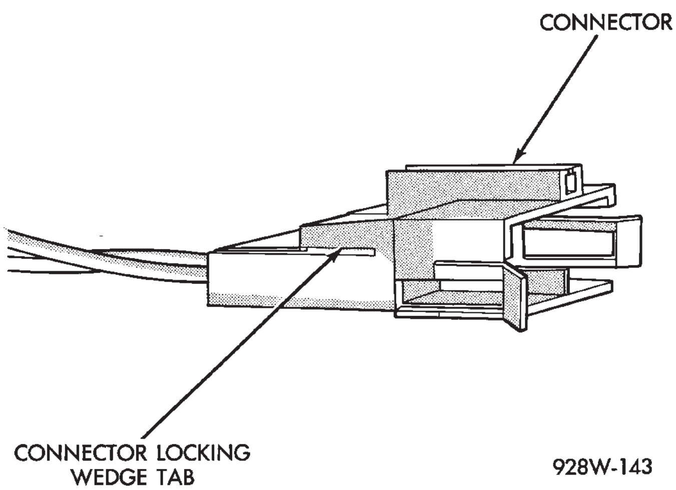


Fig. 10 Connector Locking Wedge

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 11) (Fig. 12).

(5) Reset the terminal locking tang, if it has one.

(6) Insert the removed wire in the same cavity on the repair connector.

(7) Repeat steps four through six for each wire in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.

(8) Insert the connector locking wedge into the repaired connector, if required.

(9) Connect connector to its mating half/component.

(10) Connect battery and test all affected systems.

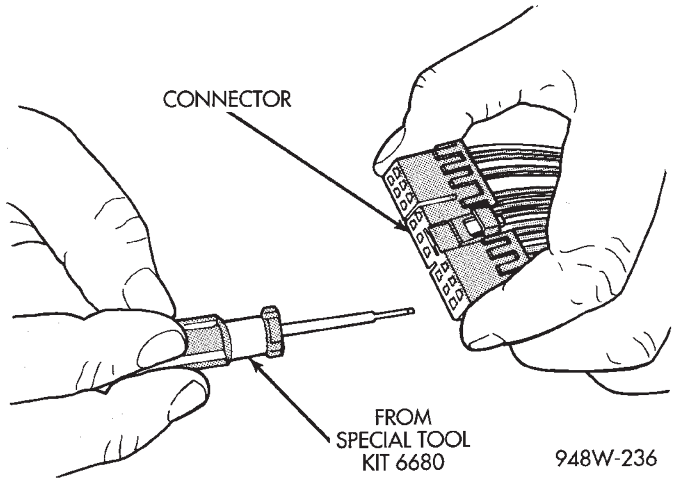


Fig. 11 Terminal Removal

CONNECTOR AND TERMINAL REPLACEMENT

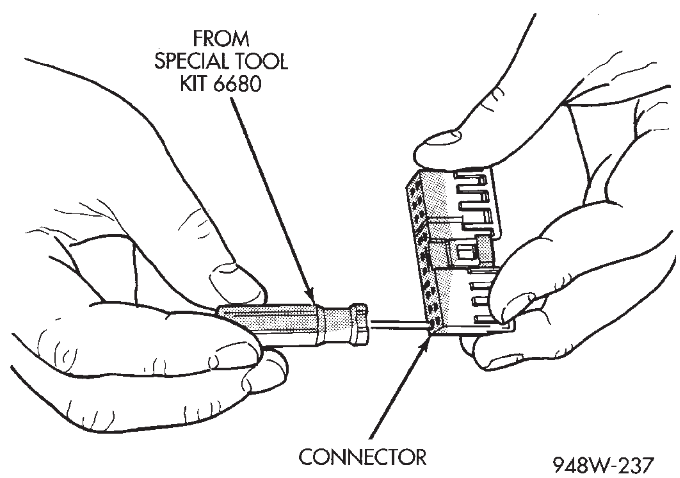


Fig. 12 Terminal Removal Using Special Tool

(1) Disconnect battery.

(2) Disconnect the connector (that is to be repaired) from its mating half/component.

(3) Cut off the existing wire connector directly behind the insulator. Remove six inches of tape from the harness.

(4) Stagger cut all wires on the harness side at 1/2 inch intervals (Fig. 13).

(5) Remove 1 inch of insulation from each wire on the harness side.

(6) Stagger cut the matching wires on the repair connector assembly in the opposite order as was done on the harness side of the repair. Allow extra length for soldered connections. Check that the overall length is the same as the original (Fig. 13).

(7) Remove 1 inch of insulation from each wire.

SERVICE PROCEDURES (Continued)

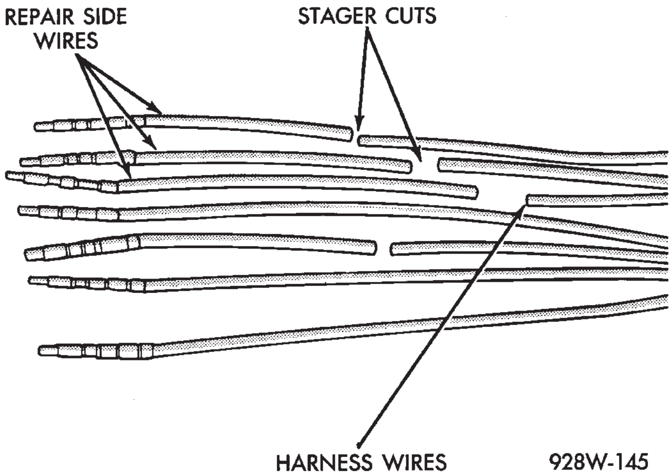


Fig. 13 Stagger Cutting Wires

(8) Place a piece of heat shrink tubing over one side of the wire. Be sure the tubing will be long enough to cover and seal the entire repair area.

(9) Spread the strands of the wire apart on each part of the exposed wires.

(10) Push the two ends of wire together until the strands of wire are close to the insulation.

(11) Twist the wires together.

(12) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(13) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing

(14) Repeat steps 8 through 13 for each wire.

(15) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(16) Re-connect the repaired connector.

(17) Connect the battery, and test all affected systems.

TERMINAL/CONNECTOR REPAIR- AUGAT CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

(3) Push down on the yellow connector locking tab to release the terminals (Fig. 14).

(4) Using special tool 6932, push the terminal to remove it from the connector (Fig. 15).

(5) Repair or replace the connector or terminal as necessary.

(6) When re-assembling the connector, the locking wedge must be placed in the locked position to prevent terminal push out.

TERMINAL REPLACEMENT

(1) Disconnect battery.

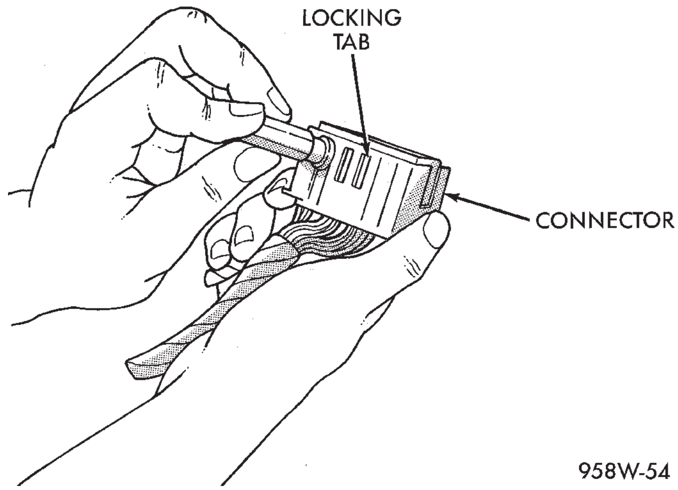


Fig. 14 Augat Connector Repair

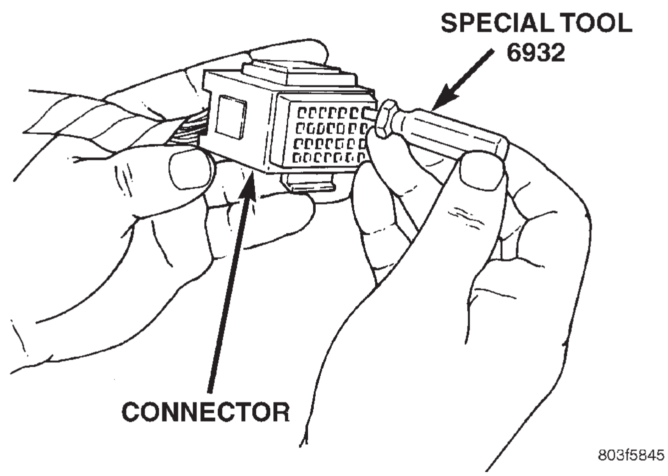


Fig. 15 Using Special Tool 6932

(2) Disconnect the connector being repaired from its mating half. Remove connector locking wedge, if required (Fig. 16).

(3) Remove connector locking wedge, if required (Fig. 16).

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 17) (Fig. 18).

(5) Cut the wire 6 inches from the back of the connector.

(6) Remove 1 inch of insulation from the wire on the harness side.

(7) Select a wire from the terminal repair assembly that best matches the color wire being repaired.

(8) Cut the repair wire to the proper length and remove 1 inch of insulation.

(9) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(10) Spread the strands of the wire apart on each part of the exposed wires.

SERVICE PROCEDURES (Continued)

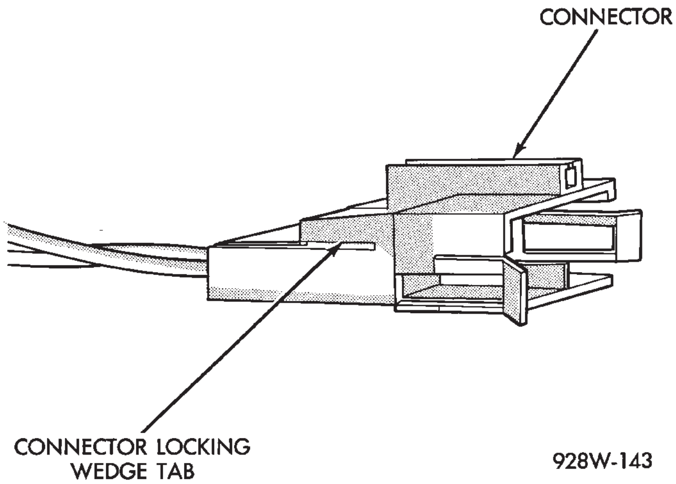


Fig. 16 Connector Locking Wedge Tab (Typical)

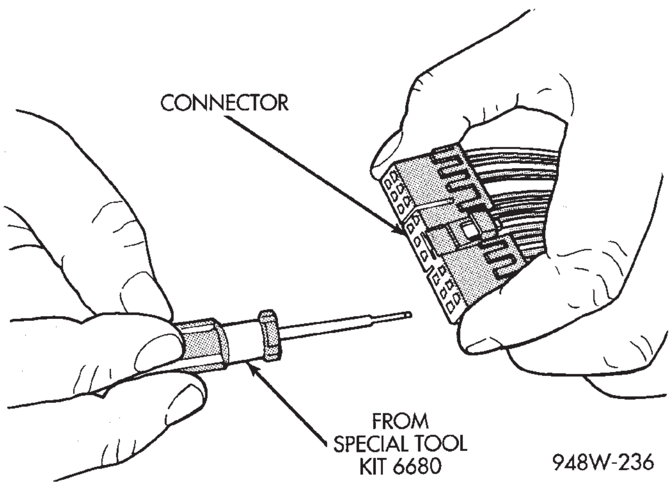


Fig. 17 Terminal Removal

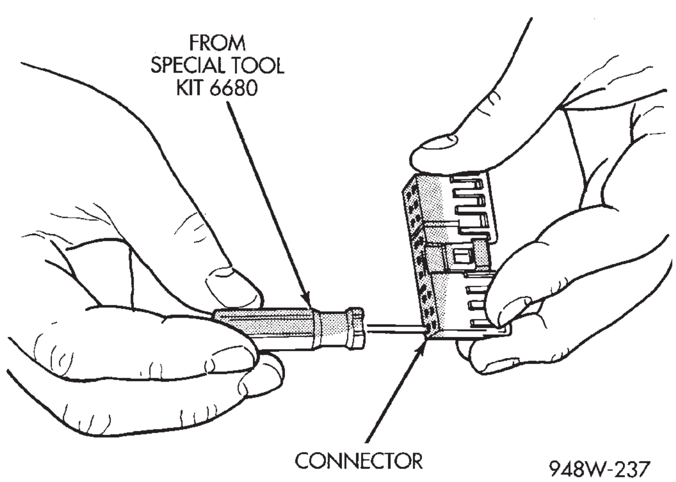


Fig. 18 Terminal Removal Using Special Tool

(11) Push the two ends of wire together until the strands of wire are close to the insulation.

(12) Twist the wires together.

(13) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(14) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(15) Insert the repaired wire into the connector.

(16) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(17) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(18) Connect battery, and test all affected systems.

DIODE REPLACEMENT

(1) Disconnect the battery.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 19).

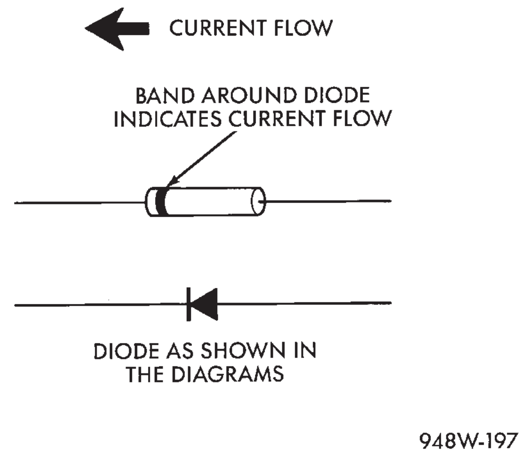


Fig. 19 Diode Identification

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

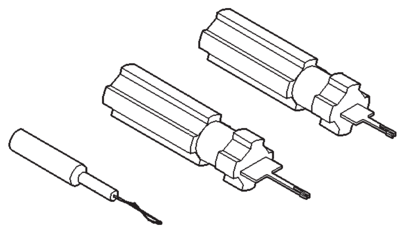
(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

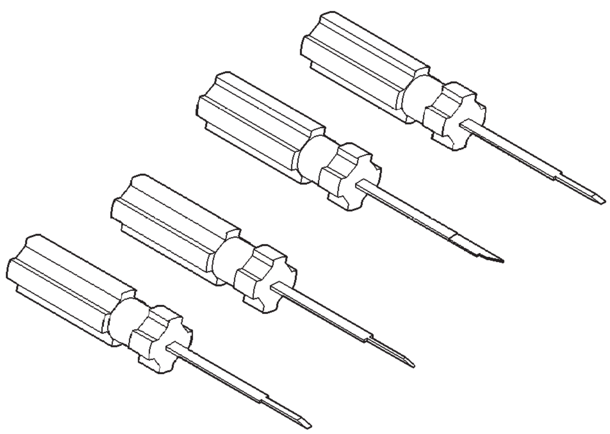
(8) Re-connect the battery, and test affected systems.

SPECIAL TOOLS

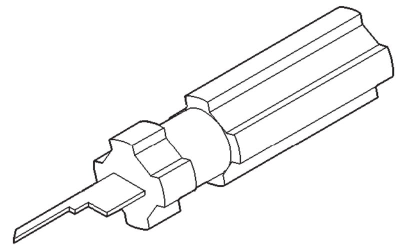
WIRING/TERMINAL



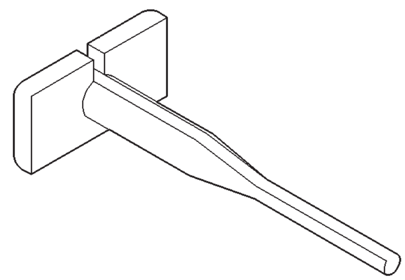
Probing Tool Package 6807



Terminal Pick 6680



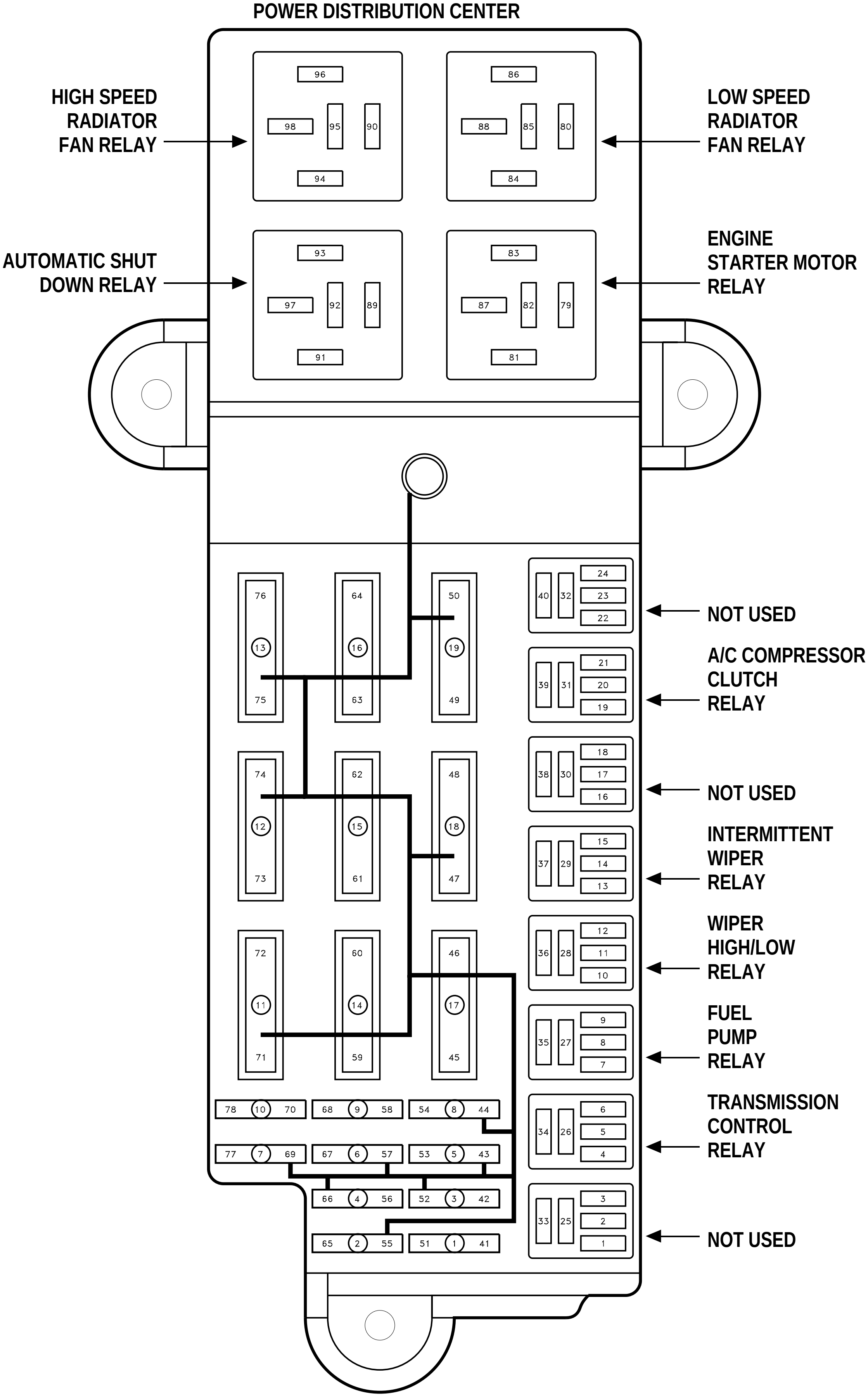
Terminal Removing Tool 6932



Terminal Removing Tool 6934

8W-02 COMPONENT INDEX

8W-10 POWER DISTRIBUTION


POWER DISTRIBUTION CENTER
HIGH SPEED RADIATOR FAN RELAY
LOW SPEED RADIATOR FAN RELAY
AUTOMATIC SHUT DOWN RELAY
ENGINE STARTER MOTOR RELAY
NOT USED
A/C COMPRESSOR CLUTCH RELAY
NOT USED
INTERMITTENT WIPER RELAY
WIPER HIGH/LOW RELAY
FUEL PUMP RELAY
TRANSMISSION CONTROL RELAY
NOT USED

FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	10A	F142 18OR/DG	A142 18DG/OR
2	20A	A20 12RD/DB	A0 4RD
3	20A	A24 16PK/YL	A0 4RD
		A24 16PK/YL	A0 4RD
4	20A	A7 16RD/BK	A0 4RD
5	20A	A14 16RD/TN	A0 4RD
6	20A	A15 16PK	A0 4RD
7	10A	A51 20RD/LB	A0 4RD
8	20A	A1 16RD	A0 4RD
9	10A	F18 20LG/BK	A21 16DB
10	10A	F12 18DB/WT	A21 16DB
			A21 16DB
11* ●	20A	P86 16PK/BK	A0 4RD
12	40A	A4 12 BK/PK	A0 4RD
13	40A	A10 12RD/DG	A0 4RD
14	40A	A13 12PK/WT	A0 4RD
15	40A	A3 12RD/WT	A0 4RD
16	40A	A2 12PK/BK	A0 4RD
17*	30A	A53 14RD/YL	A0 4RD
18	40A	A5 12RD/GY	A0 4RD
19	40A	A16 12RD/LG	A0 4RD

* BUILT-UP-EXPORT

● HEATED SEATS

JAI01003

A/C COMPRESSOR CLUTCH RELAY

CAVITY	CIRCUIT	FUNCTION
19	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
20	-	-
21	C28 20DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
31	C3 14DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
39	A16 12RD/LG	FUSED B(+)

AUTOMATIC SHUT DOWN RELAY

CAVITY	CIRCUIT	FUNCTION
89	A142 18 DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
	A142 18 DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
91	A14 16RD/TN	FUSED B(+)
92	-	-
93	K51 20DB/VT	AUTOMATIC SHUT DOWN RELAY CONTROL
97	A14 16RD/TN	FUSED B(+)

ENGINE STARTER MOTOR RELAY (EATX)

CAVITY	CIRCUIT	FUNCTION
79	T40 14BR	ENGINE STARTER MOTOR RELAY OUTPUT
81	A41 16YL/OR	FUSED IGNITION SWITCH OUTPUT (ST)
	A41 16YL/OR	FUSED IGNITION SWITCH OUTPUT (ST)
82	-	-
83	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
87	A1 16RD	FUSED B(+)

ENGINE STARTER MOTOR RELAY (MTX)

CAVITY	CIRCUIT	FUNCTION
79	T40 14BR	ENGINE STARTER MOTOR RELAY OUTPUT
81	T141 16YL/RD	FUSED IGNITION SWITCH OUTPUT (ST)
82	-	-
83	Z1 18BK	GROUND
87	A1 16RD	FUSED B(+)

FUEL PUMP RELAY

CAVITY	CIRCUIT	FUNCTION
7	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	-	-
9	K31 20BR/LG	FUEL PUMP RELAY CONTROL
27	A141 14DG/WT	FUEL PUMP RELAY OUTPUT
35	A1 16RD	FUSED B(+)

HIGH SPEED RADIATOR FAN RELAY

CAVITY	CIRCUIT	FUNCTION
90	C25 12YL/VT	HIGH SPEED RADIATOR FAN RELAY OUTPUT
94	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
95	-	-
96	C27 20DB/PK	HIGH SPEED RADIATOR FAN RELAY CONTROL
98	A16 12RD/LG	FUSED B(+)

INTERMITTENT WIPER RELAY

CAVITY	CIRCUIT	FUNCTION
13	F13 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	F13 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
14	Z1 16BK	GROUND
15	V14 20PK/VT	INTERMITTENT WIPER RELAY CONTROL
29	A5 12RD/GY	FUSE B(+)
37	V5 14DG/VT	WIPER RELAY COMMON

LOW SPEED RADIATOR FAN RELAY

CAVITY	CIRCUIT	FUNCTION
80	C23 12DG/LG	LOW SPEED RADIATOR FAN RELAY OUTPUT
84	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
85	-	-
86	C24 20DB/TN	LOW SPEED RADIATOR FAN RELAY CONTROL
88	A16 12RD/LG	FUSED B(+)

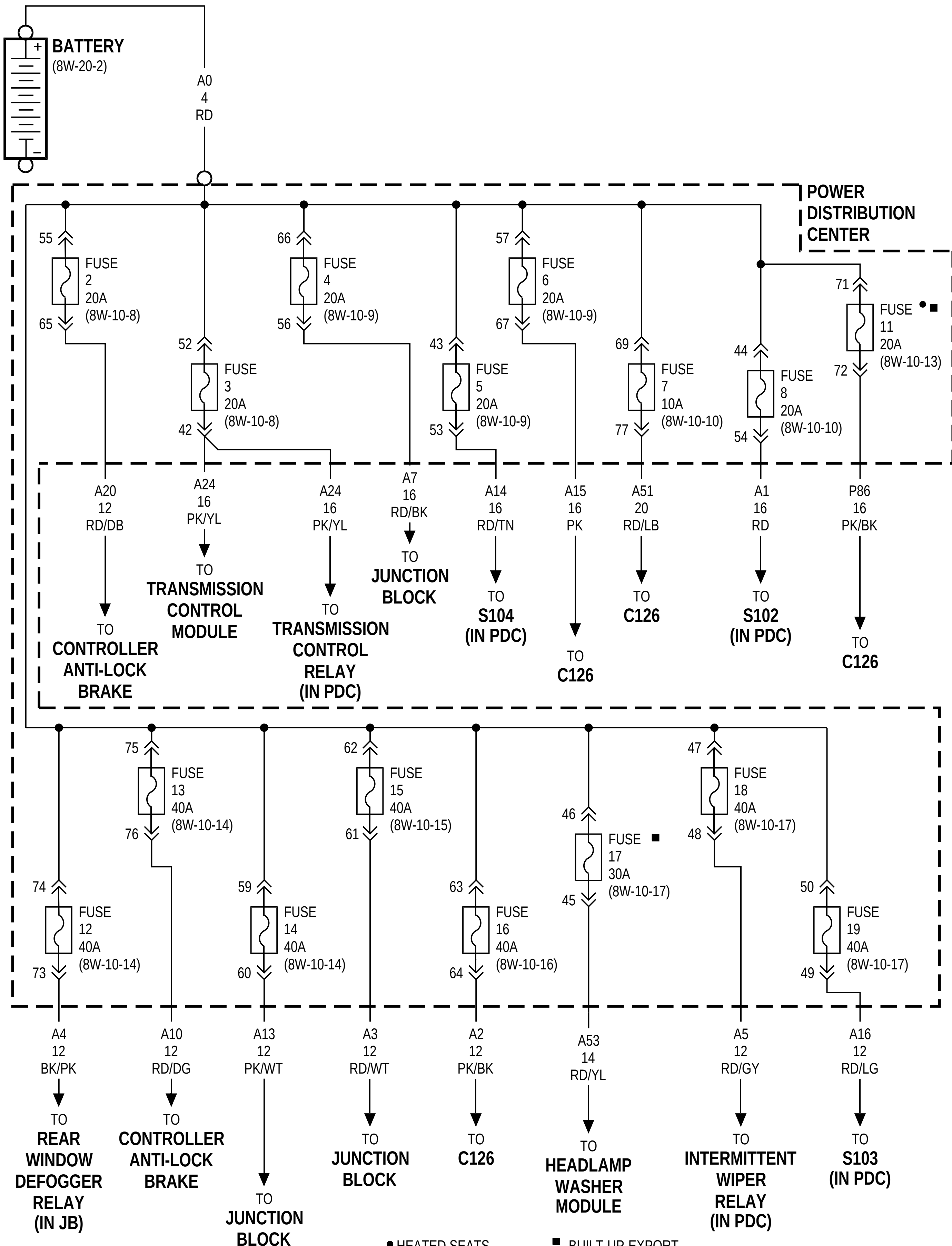
TRANSMISSION CONTROL RELAY

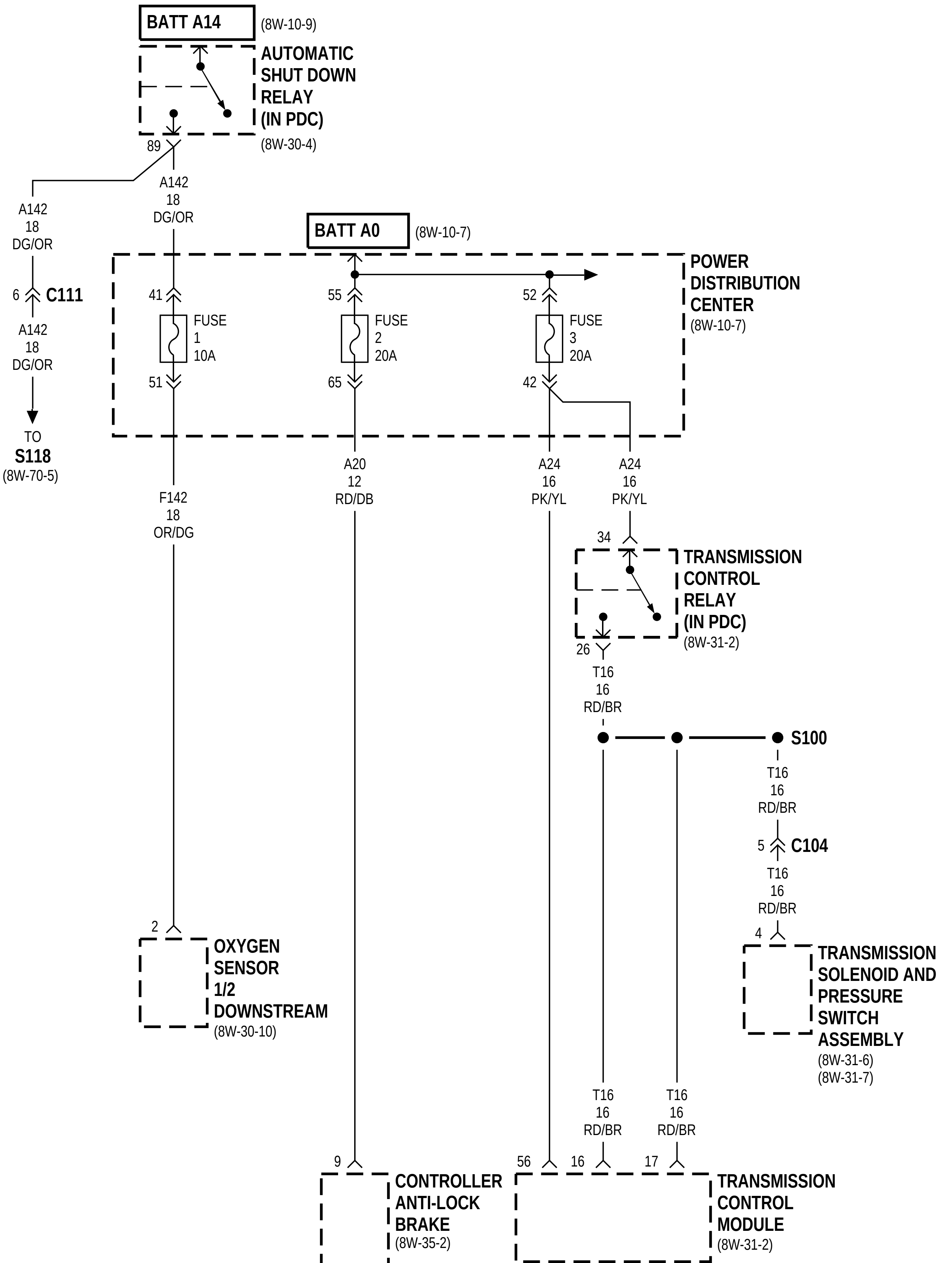
CAVITY	CIRCUIT	FUNCTION
4	T15 20LG/YL	12V SUPPLY
5	-	-
6	Z13 20BK/RD	GROUND
26	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
34	A24 16PK/YL	FUSED B(+)

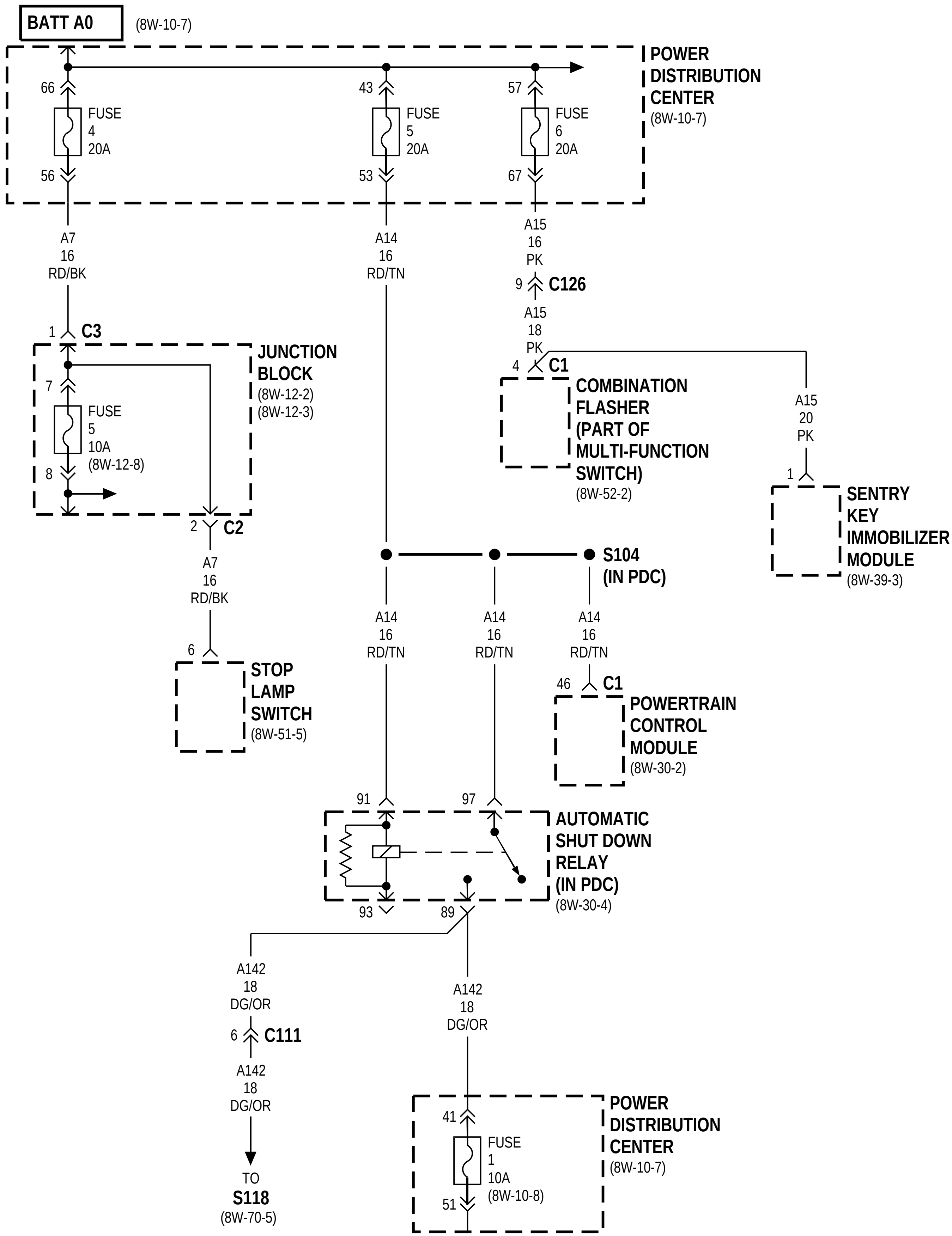
WIPER HIGH/LOW RELAY

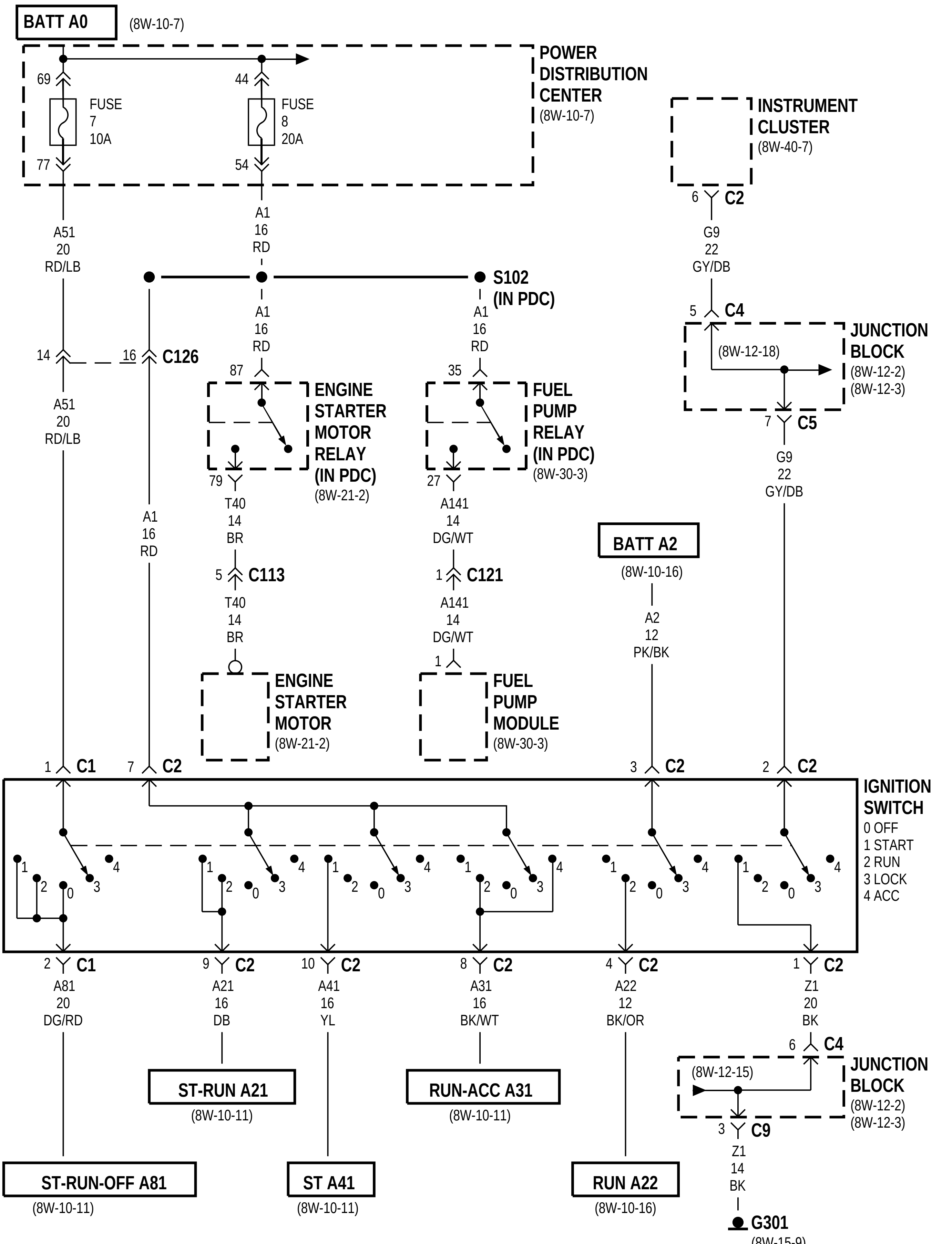
CAVITY	CIRCUIT	FUNCTION
10	F13 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
11	V3 14BR/OR	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
12	V16 20VT/PK	WIPER HIGH/LOW RELAY CONTROL
28	V4 14RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
36	V5 14DG/VT	WIPER RELAY COMMON

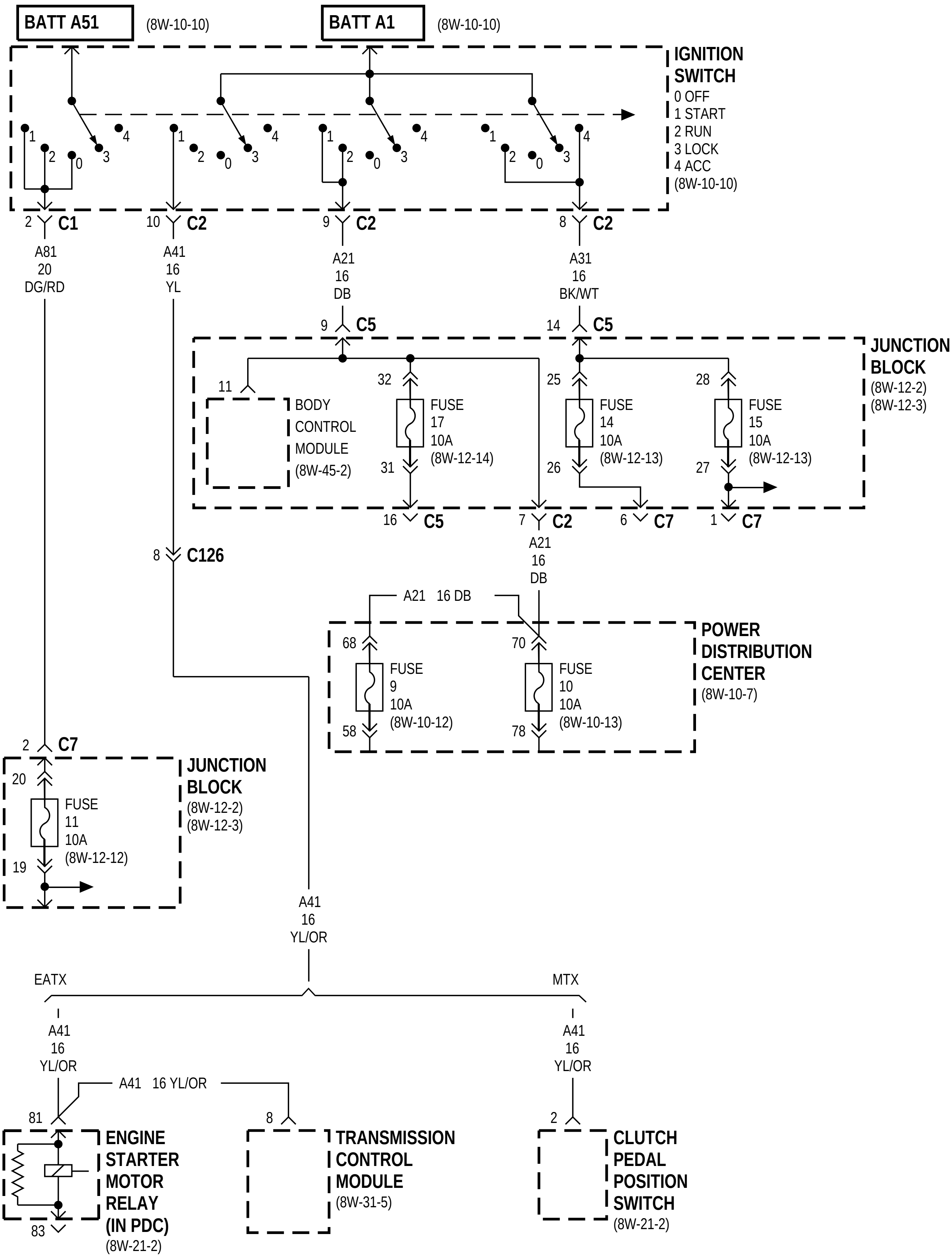
J998W-16 JAI01006

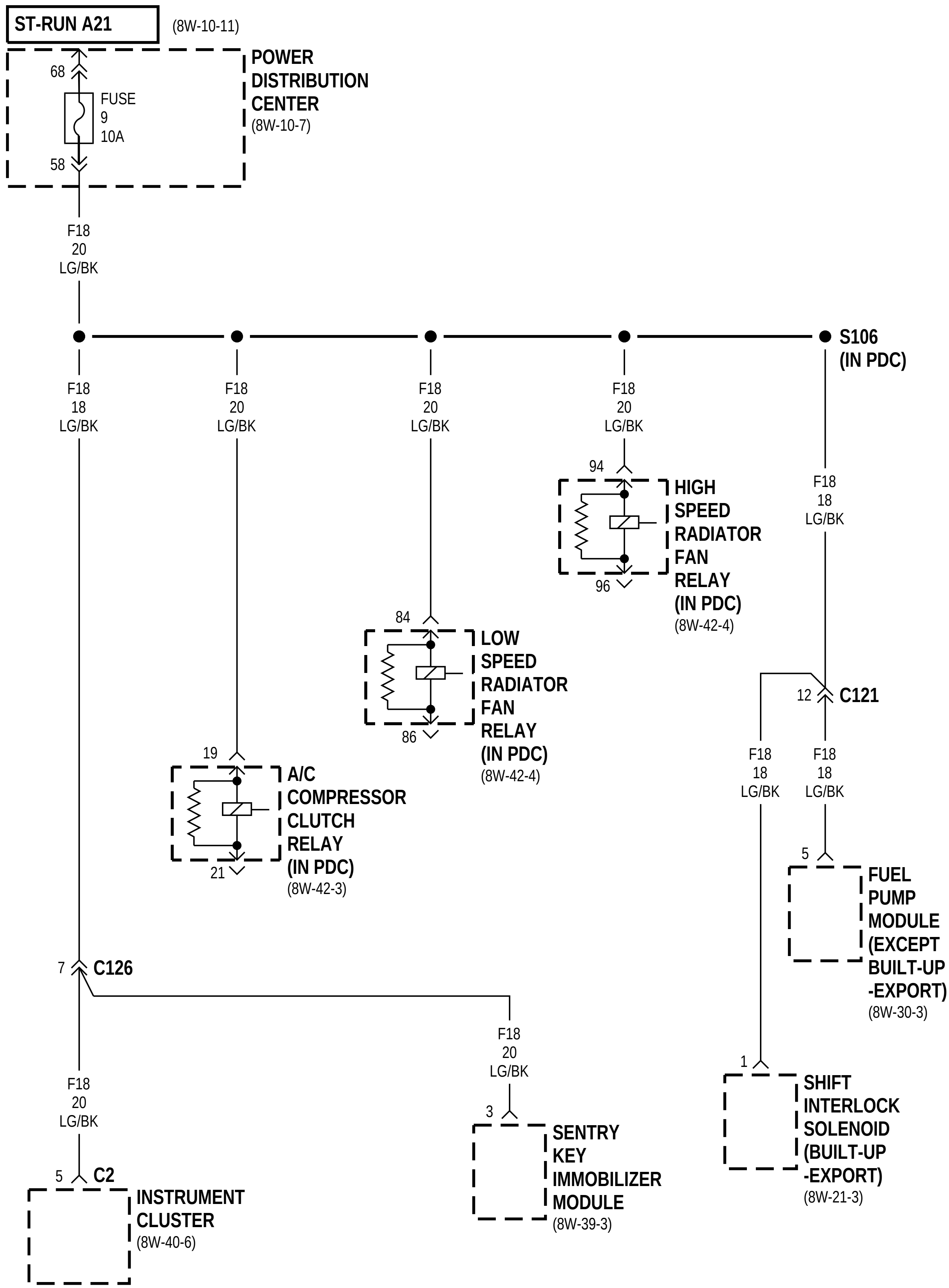

BATTERY
(8W-20-2)
A0
4
RD
POWER
DISTRIBUTION
CENTER
FUSE 2 20A (8W-10-8)
FUSE 3 20A (8W-10-8)
FUSE 4 20A (8W-10-9)
FUSE 5 20A (8W-10-9)
FUSE 6 20A (8W-10-9)
FUSE 7 10A (8W-10-10)
FUSE 8 20A (8W-10-10)
FUSE 11 20A (8W-10-13)
A20 12 RD/DB TO CONTROLLER ANTI-LOCK BRAKE
A24 16 PK/YL TO TRANSMISSION CONTROL MODULE
A24 16 PK/YL TO TRANSMISSION CONTROL RELAY (IN PDC)
A7 16 RD/BK TO JUNCTION BLOCK
A14 16 RD/TN TO S104 (IN PDC)
A15 16 PK TO C126
A51 20 RD/LB TO C126
A1 16 RD TO S102 (IN PDC)
P86 16 PK/BK TO C126
FUSE 12 40A (8W-10-14)
FUSE 13 40A (8W-10-14)
FUSE 14 40A (8W-10-14)
FUSE 15 40A (8W-10-15)
FUSE 16 40A (8W-10-16)
FUSE 17 30A (8W-10-17)
FUSE 18 40A (8W-10-17)
FUSE 19 40A (8W-10-17)
A4 12 BK/PK TO REAR WINDOW DEFOGGER RELAY (IN JB)
A10 12 RD/DG TO CONTROLLER ANTI-LOCK BRAKE
A13 12 PK/WT TO JUNCTION BLOCK
A3 12 RD/WT TO JUNCTION BLOCK
A2 12 PK/BK TO C126
A53 14 RD/YL TO HEADLAMP WASHER MODULE
A5 12 RD/GY TO INTERMITTENT WIPER RELAY (IN PDC)
A16 12 RD/LG TO S103 (IN PDC)
● HEATED SEATS
■ BUILT-UP-EXPORT
JAI01007
J998W-16

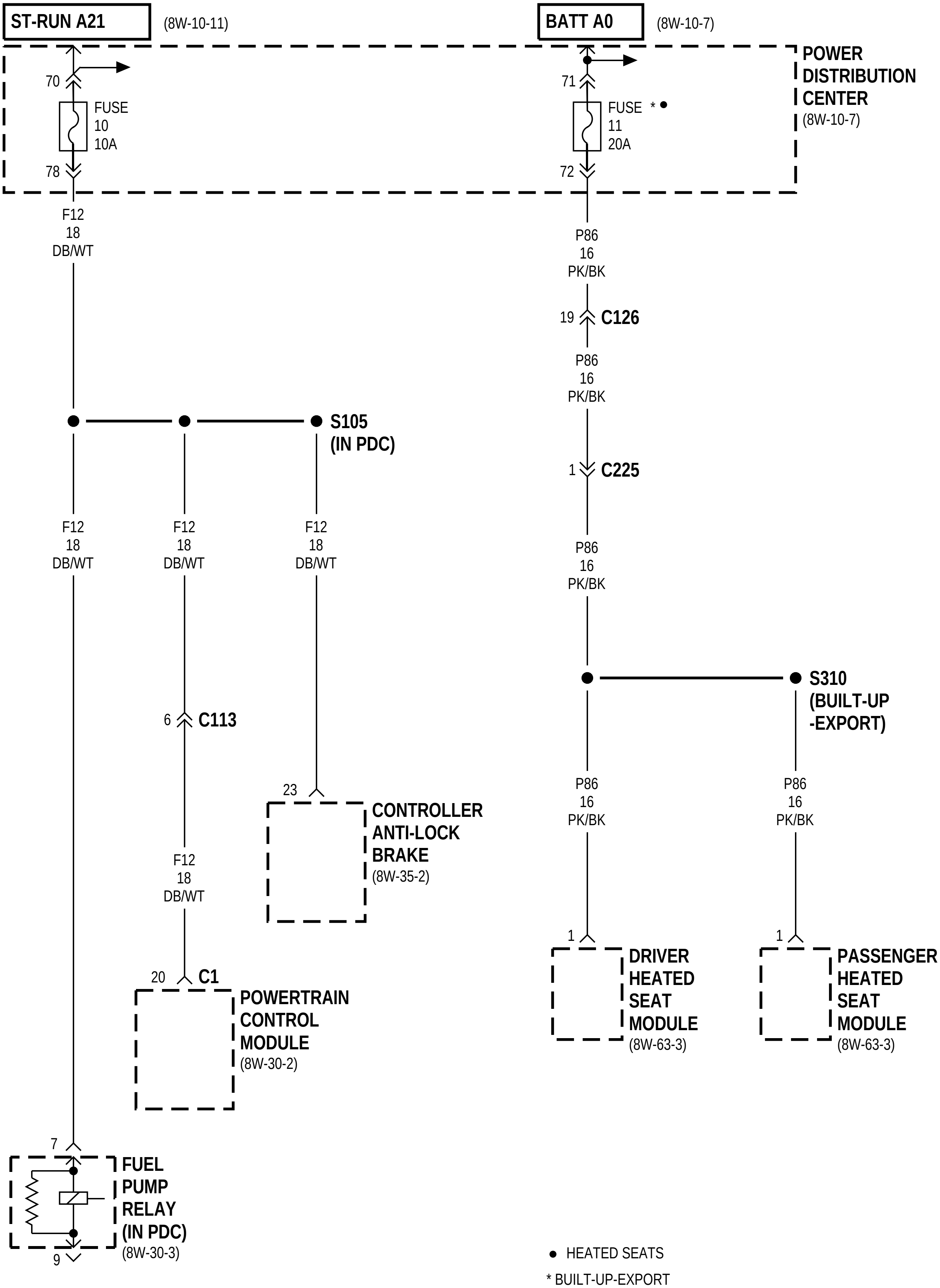

BATT A14
(8W-10-9)
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-4)
89
A142 18 DG/OR
A142 18 DG/OR
6
C111
A142 18 DG/OR
TO S118
(8W-70-5)
BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
41
FUSE 1 10A
51
55
FUSE 2 20A
65
52
FUSE 3 20A
42
F142 18 OR/DG
A20 12 RD/DB
A24 16 PK/YL
A24 16 PK/YL
34
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
26
T16 16 RD/BR
S100
T16 16 RD/BR
5
C104
T16 16 RD/BR
4
TRANSMISSION SOLENOID AND PRESSURE SWITCH ASSEMBLY
(8W-31-6)
(8W-31-7)
2
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-10)
T16 16 RD/BR
T16 16 RD/BR
9
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
56
16
17
TRANSMISSION CONTROL MODULE
(8W-31-2)

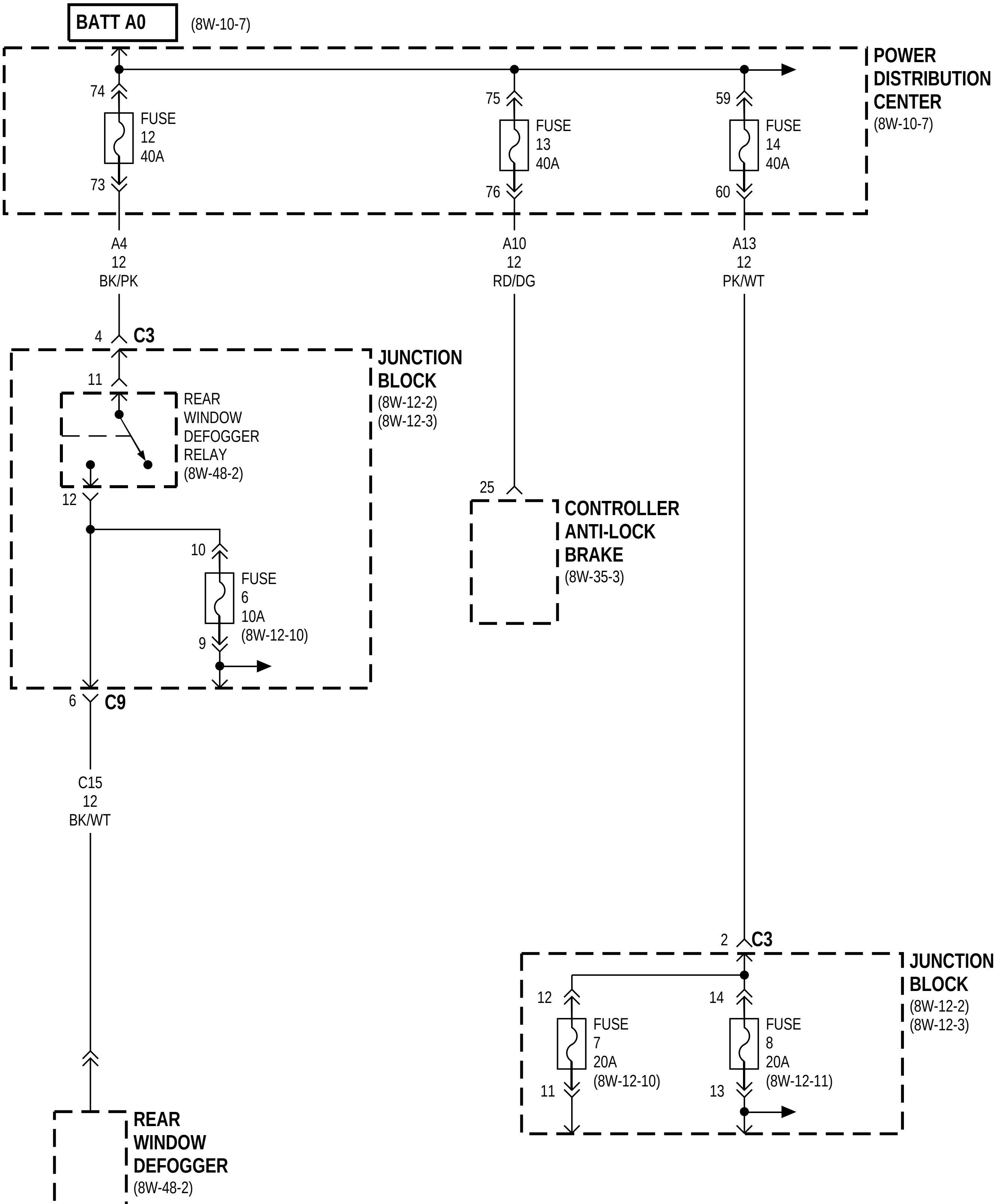

BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
66
FUSE 4 20A
56
43
FUSE 5 20A
53
57
FUSE 6 20A
67
A7 16 RD/BK
A14 16 RD/TN
A15 16 PK
9 C126
A15 18 PK
4 C1
COMBINATION FLASHER (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
A15 20 PK
1
SENTRY KEY IMMOBILIZER MODULE
(8W-39-3)
1 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
7
FUSE 5 10A (8W-12-8)
8
2 C2
A7 16 RD/BK
6
STOP LAMP SWITCH
(8W-51-5)
S104 (IN PDC)
A14 16 RD/TN
A14 16 RD/TN
A14 16 RD/TN
46 C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
91
97
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-4)
93
89
A142 18 DG/OR
6 C111
A142 18 DG/OR
TO S118
(8W-70-5)
A142 18 DG/OR
POWER DISTRIBUTION CENTER
(8W-10-7)
41
FUSE 1 10A (8W-10-8)
51

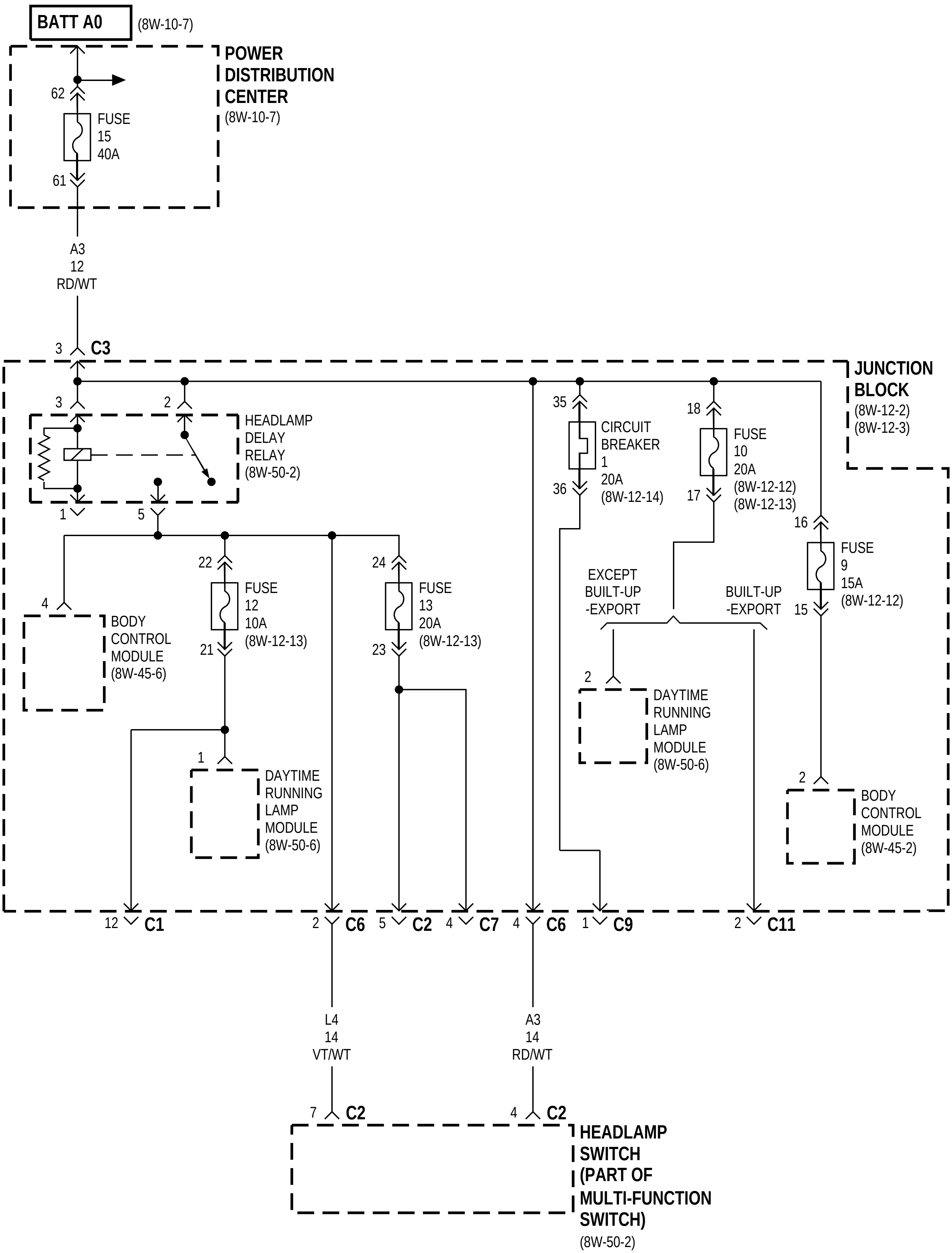

BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
69
FUSE 7 10A
77
44
FUSE 8 20A
54
INSTRUMENT CLUSTER
(8W-40-7)
6 C2
G9 22 GY/DB
5 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-18)
7 C5
G9 22 GY/DB
A51 20 RD/LB
A1 16 RD
S102 (IN PDC)
A1 16 RD
A1 16 RD
14
16 C126
A51 20 RD/LB
87
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
35
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
79
T40 14 BR
27
A141 14 DG/WT
A1 16 RD
5 C113
T40 14 BR
1 C121
A141 14 DG/WT
BATT A2
(8W-10-16)
A2 12 PK/BK
1
ENGINE STARTER MOTOR
(8W-21-2)
FUEL PUMP MODULE
(8W-30-3)
1 C1
7 C2
3 C2
2 C2
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
2 C1
A81 20 DG/RD
9 C2
A21 16 DB
10 C2
A41 16 YL
8 C2
A31 16 BK/WT
4 C2
A22 12 BK/OR
1 C2
Z1 20 BK
6 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-15)
3 C9
Z1 14 BK
ST-RUN A21
(8W-10-11)
RUN-ACC A31
(8W-10-11)
ST-RUN-OFF A81
(8W-10-11)
ST A41
(8W-10-11)
RUN A22
(8W-10-16)
G301
(8W-15-9)

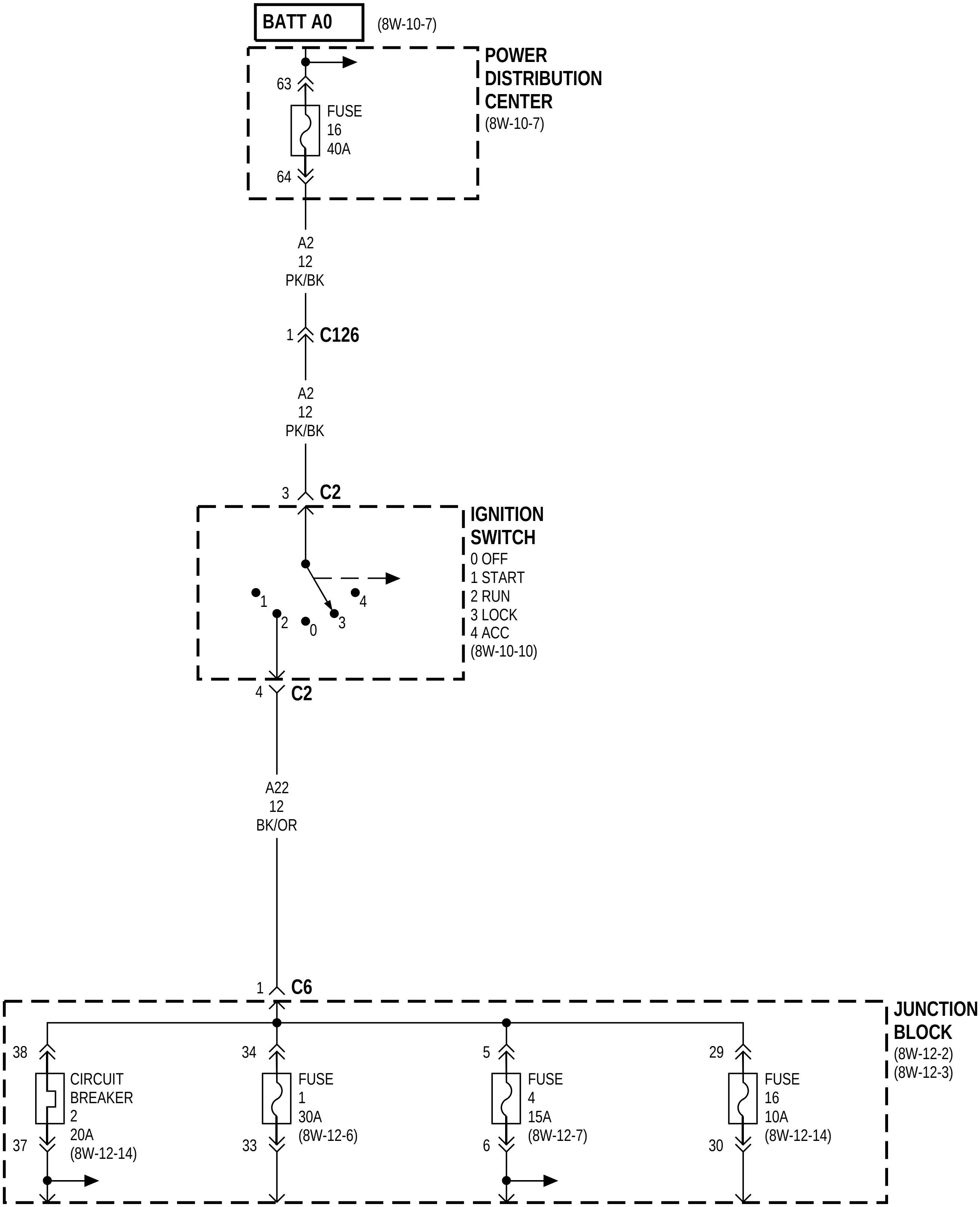

BATT A51
(8W-10-10)
BATT A1
(8W-10-10)
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-10)
C1
C2
C2
C2
A81
20
DG/RD
A41
16
YL
A21
16
DB
A31
16
BK/WT
C5
C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-2)
FUSE 17 10A (8W-12-14)
FUSE 14 10A (8W-12-13)
FUSE 15 10A (8W-12-13)
C5
C2
C7
C7
A21
16
DB
C126
A21 16 DB
POWER DISTRIBUTION CENTER
(8W-10-7)
FUSE 9 10A (8W-10-12)
FUSE 10 10A (8W-10-13)
C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 11 10A (8W-12-12)
A41
16
YL/OR
EATX
MTX
A41
16
YL/OR
A41 16 YL/OR
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
TRANSMISSION CONTROL MODULE
(8W-31-5)
CLUTCH PEDAL POSITION SWITCH
(8W-21-2)

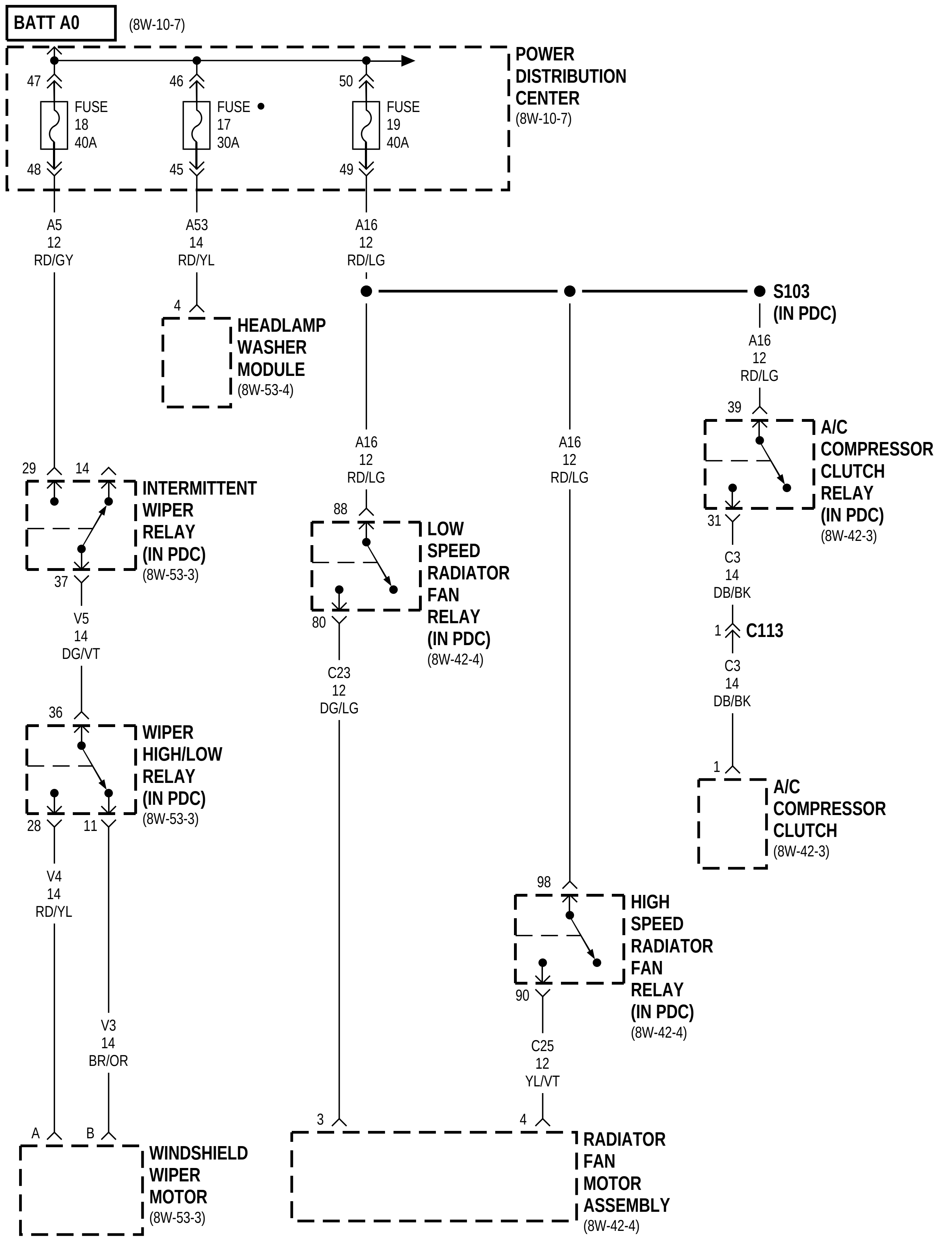

ST-RUN A21
(8W-10-11)
68
FUSE
9
10A
58
POWER
DISTRIBUTION
CENTER
(8W-10-7)
F18
20
LG/BK
S106
(IN PDC)
F18
18
LG/BK
F18
20
LG/BK
F18
20
LG/BK
F18
20
LG/BK
94
HIGH
SPEED
RADIATOR
FAN
RELAY
(IN PDC)
(8W-42-4)
96
F18
18
LG/BK
84
LOW
SPEED
RADIATOR
FAN
RELAY
(IN PDC)
(8W-42-4)
86
12
C121
F18
18
LG/BK
F18
18
LG/BK
19
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-42-3)
21
5
FUEL
PUMP
MODULE
(EXCEPT
BUILT-UP
-EXPORT)
(8W-30-3)
7
C126
F18
20
LG/BK
1
SHIFT
INTERLOCK
SOLENOID
(BUILT-UP
-EXPORT)
(8W-21-3)
F18
20
LG/BK
3
SENTRY
KEY
IMMOBILIZER
MODULE
(8W-39-3)
5
C2
INSTRUMENT
CLUSTER
(8W-40-6)


ST-RUN A21
(8W-10-11)
BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
70
FUSE
10
10A
78
71
FUSE * •
11
20A
72
F12
18
DB/WT
P86
16
PK/BK
19
C126
1
C225
S105
(IN PDC)
S310
(BUILT-UP -EXPORT)
6
C113
23
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
20
C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
1
DRIVER HEATED SEAT MODULE
(8W-63-3)
PASSENGER HEATED SEAT MODULE
(8W-63-3)
7
9
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
• HEATED SEATS
* BUILT-UP-EXPORT

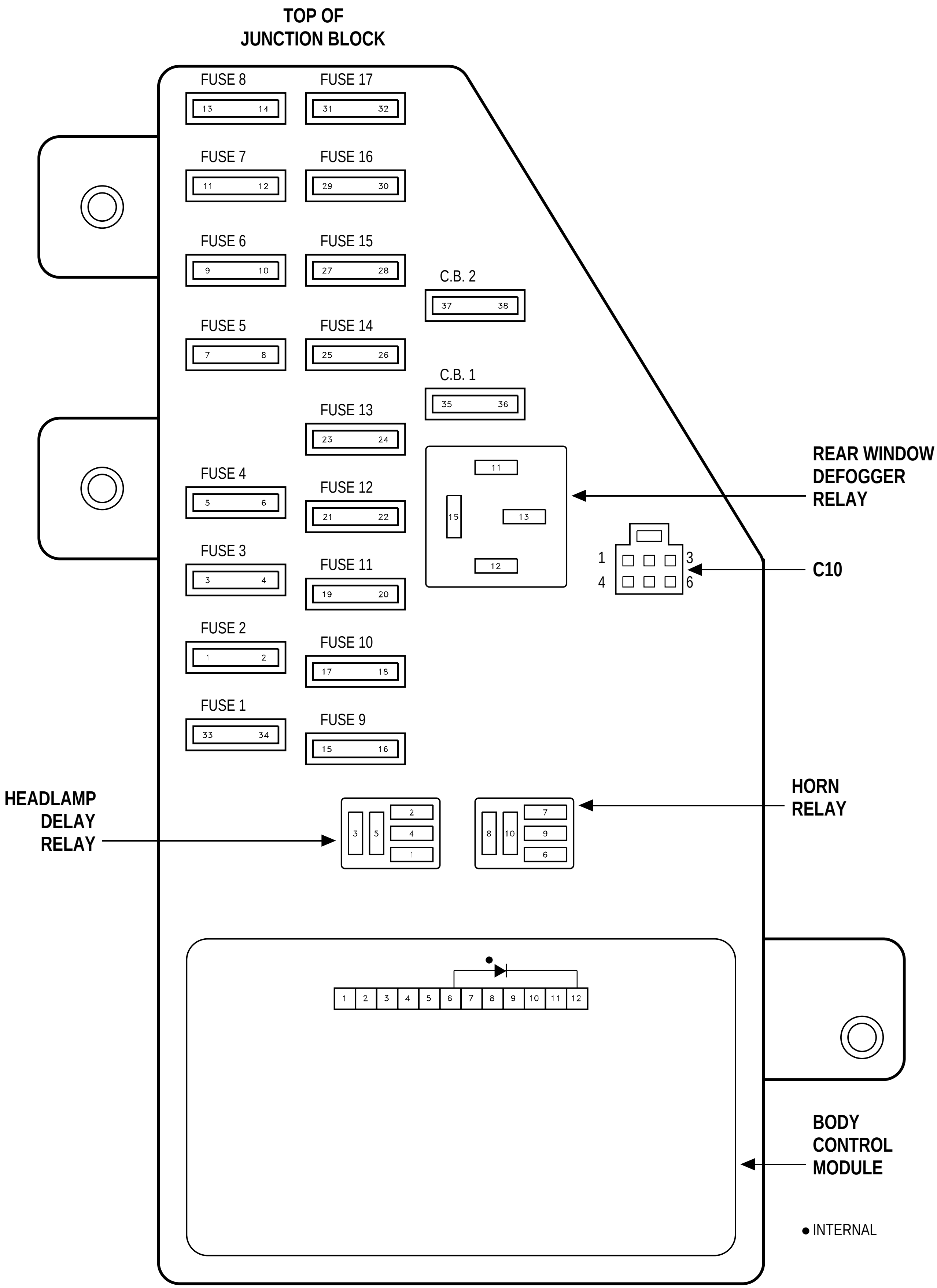

BATT A0
(8W-10-7)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
74
FUSE
12
40A
73
75
FUSE
13
40A
76
59
FUSE
14
40A
60
A4
12
BK/PK
A10
12
RD/DG
A13
12
PK/WT
4
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
11
REAR
WINDOW
DEFOGGER
RELAY
(8W-48-2)
12
10
FUSE
6
10A
(8W-12-10)
9
6
C9
C15
12
BK/WT
25
CONTROLLER
ANTI-LOCK
BRAKE
(8W-35-3)
2
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
12
FUSE
7
20A
(8W-12-10)
11
14
FUSE
8
20A
(8W-12-11)
13
REAR
WINDOW
DEFOGGER
(8W-48-2)

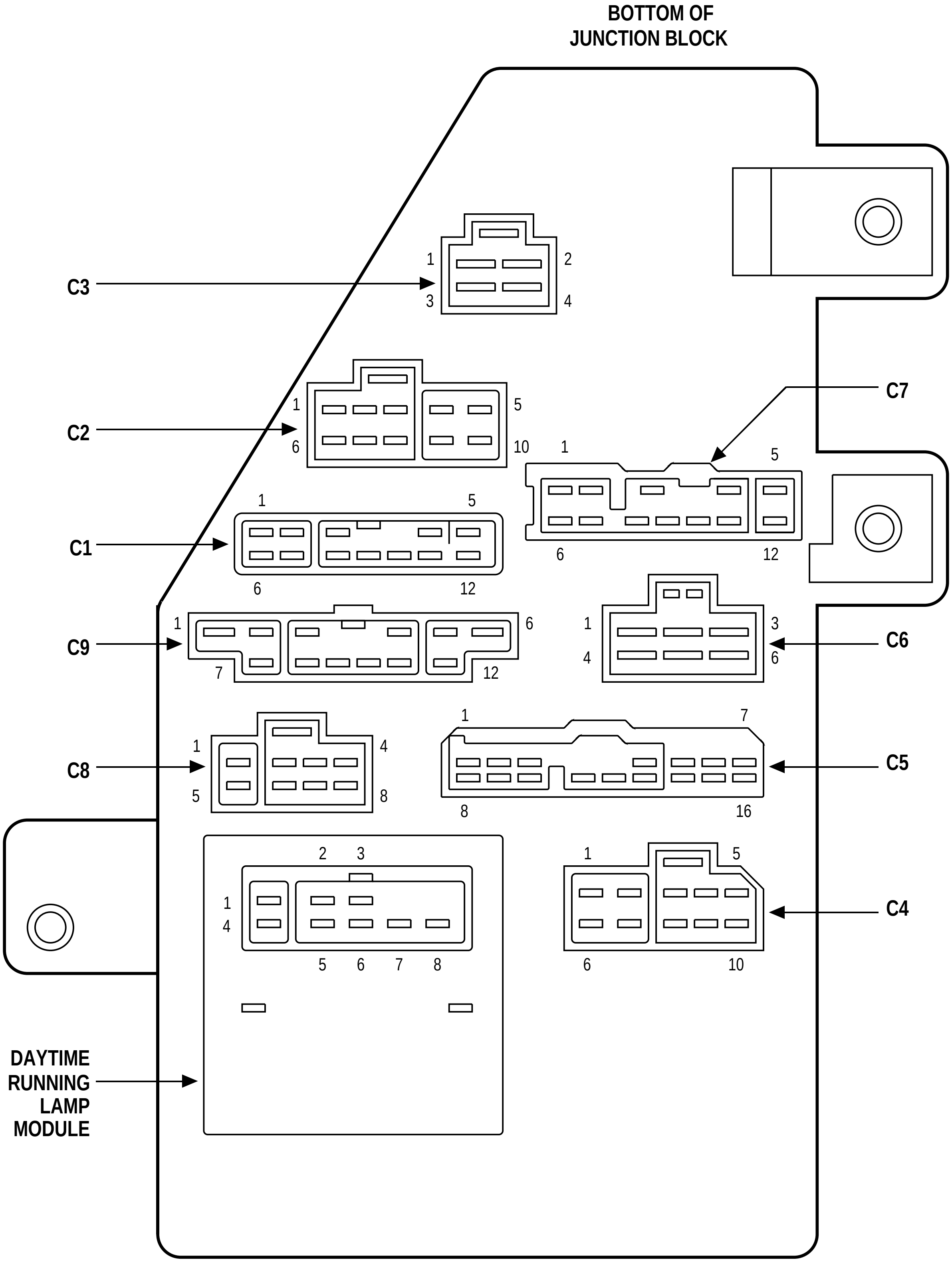

BATT A0
(8W-10-7)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
62
FUSE
15
40A
61
A3
12
RD/WT
3
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
3
2
HEADLAMP
DELAY
RELAY
(8W-50-2)
1
5
35
CIRCUIT
BREAKER
1
20A
(8W-12-14)
36
18
FUSE
10
20A
(8W-12-12)
(8W-12-13)
17
16
FUSE
9
15A
(8W-12-12)
15
EXCEPT
BUILT-UP
-EXPORT
BUILT-UP
-EXPORT
4
BODY
CONTROL
MODULE
(8W-45-6)
22
FUSE
12
10A
(8W-12-13)
21
24
FUSE
13
20A
(8W-12-13)
23
2
DAYTIME
RUNNING
LAMP
MODULE
(8W-50-6)
1
DAYTIME
RUNNING
LAMP
MODULE
(8W-50-6)
2
BODY
CONTROL
MODULE
(8W-45-2)
12
C1
2
C6
5
C2
4
C7
4
C6
1
C9
2
C11
L4
14
VT/WT
A3
14
RD/WT
7
C2
4
C2
HEADLAMP
SWITCH
(PART OF
MULTI-FUNCTION
SWITCH)
(8W-50-2)


BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
63
FUSE
16
40A
64
A2
12
PK/BK
1
C126
A2
12
PK/BK
3
C2
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-10)
1
2
0
3
4
4
C2
A22
12
BK/OR
1
C6
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
38
CIRCUIT BREAKER
2
20A
(8W-12-14)
37
34
FUSE
1
30A
(8W-12-6)
33
5
FUSE
4
15A
(8W-12-7)
6
29
FUSE
16
10A
(8W-12-14)
30


BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
47
46
50
FUSE 18 40A
FUSE • 17 30A
FUSE 19 40A
48
45
49
A5 12 RD/GY
A53 14 RD/YL
A16 12 RD/LG
4
HEADLAMP WASHER MODULE
(8W-53-4)
S103 (IN PDC)
A16 12 RD/LG
39
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-3)
31
C3 14 DB/BK
1
C113
C3 14 DB/BK
1
A/C COMPRESSOR CLUTCH
(8W-42-3)
A16 12 RD/LG
A16 12 RD/LG
29
14
INTERMITTENT WIPER RELAY (IN PDC)
(8W-53-3)
37
V5 14 DG/VT
36
WIPER HIGH/LOW RELAY (IN PDC)
(8W-53-3)
28
11
V4 14 RD/YL
V3 14 BR/OR
A
B
WINDSHIELD WIPER MOTOR
(8W-53-3)
88
LOW SPEED RADIATOR FAN RELAY (IN PDC)
(8W-42-4)
80
C23 12 DG/LG
98
HIGH SPEED RADIATOR FAN RELAY (IN PDC)
(8W-42-4)
90
C25 12 YL/VT
3
4
RADIATOR FAN MOTOR ASSEMBLY
(8W-42-4)
• BUILT-UP-EXPORT

8W-12 JUNCTION BLOCK


TOP OF
JUNCTION BLOCK
FUSE 8
13 14
FUSE 17
31 32
FUSE 7
11 12
FUSE 16
29 30
FUSE 6
9 10
FUSE 15
27 28
C.B. 2
37 38
FUSE 5
7 8
FUSE 14
25 26
C.B. 1
35 36
FUSE 13
23 24
FUSE 4
5 6
FUSE 12
21 22
FUSE 3
3 4
FUSE 11
19 20
FUSE 2
1 2
FUSE 10
17 18
FUSE 1
33 34
FUSE 9
15 16
REAR WINDOW
DEFOGGER
RELAY
11
15
13
12
C10
1
3
4
6
HEADLAMP
DELAY
RELAY
3
5
2
4
1
HORN
RELAY
8
10
7
9
6
1 2 3 4 5 6 7 8 9 10 11 12
BODY
CONTROL
MODULE
● INTERNAL


BOTTOM OF
JUNCTION BLOCK
C3
C2
C1
C9
C8
C7
C6
C5
C4
DAYTIME
RUNNING
LAMP
MODULE

FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	30A	C1 12DG	INTERNAL
2	10A	INTERNAL	INTERNAL
3	10A	INTERNAL	INTERNAL
4	15A	INTERNAL	INTERNAL
5	10A	INTERNAL	INTERNAL
6	10A	INTERNAL	INTERNAL
7	20A	INTERNAL	INTERNAL
8	20A	INTERNAL	INTERNAL
9	15A	INTERNAL	INTERNAL
10	20A	L92 18LG *	INTERNAL
		INTERNAL **	INTERNAL
11	10A	INTERNAL	A81 20DG/RD
12	10A	INTERNAL	INTERNAL
13	20A	INTERNAL	INTERNAL
14	10A	X12 16RD/WT	INTERNAL
15	10A	INTERNAL	INTERNAL
16	10A	F23 18WT	INTERNAL
17	10A	F14 18LG/YL	INTERNAL

CIRCUIT BREAKERS

C.B.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	20A	F35 16RD	INTERNAL
2	20A	INTERNAL	INTERNAL

* BUILT-UP-EXPORT
** EXCEPT BUILT-UP-EXPORT

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HEADLAMP DELAY RELAY

CAVITY	CIRCUIT	FUNCTION
1	INTERNAL	HEADLAMP DELAY RELAY CONTROL
2	INTERNAL	FUSED B (+)
3	INTERNAL	FUSED B (+)
4	-	-
5	INTERNAL	HEADLAMP DELAY RELAY OUTPUT

HORN RELAY

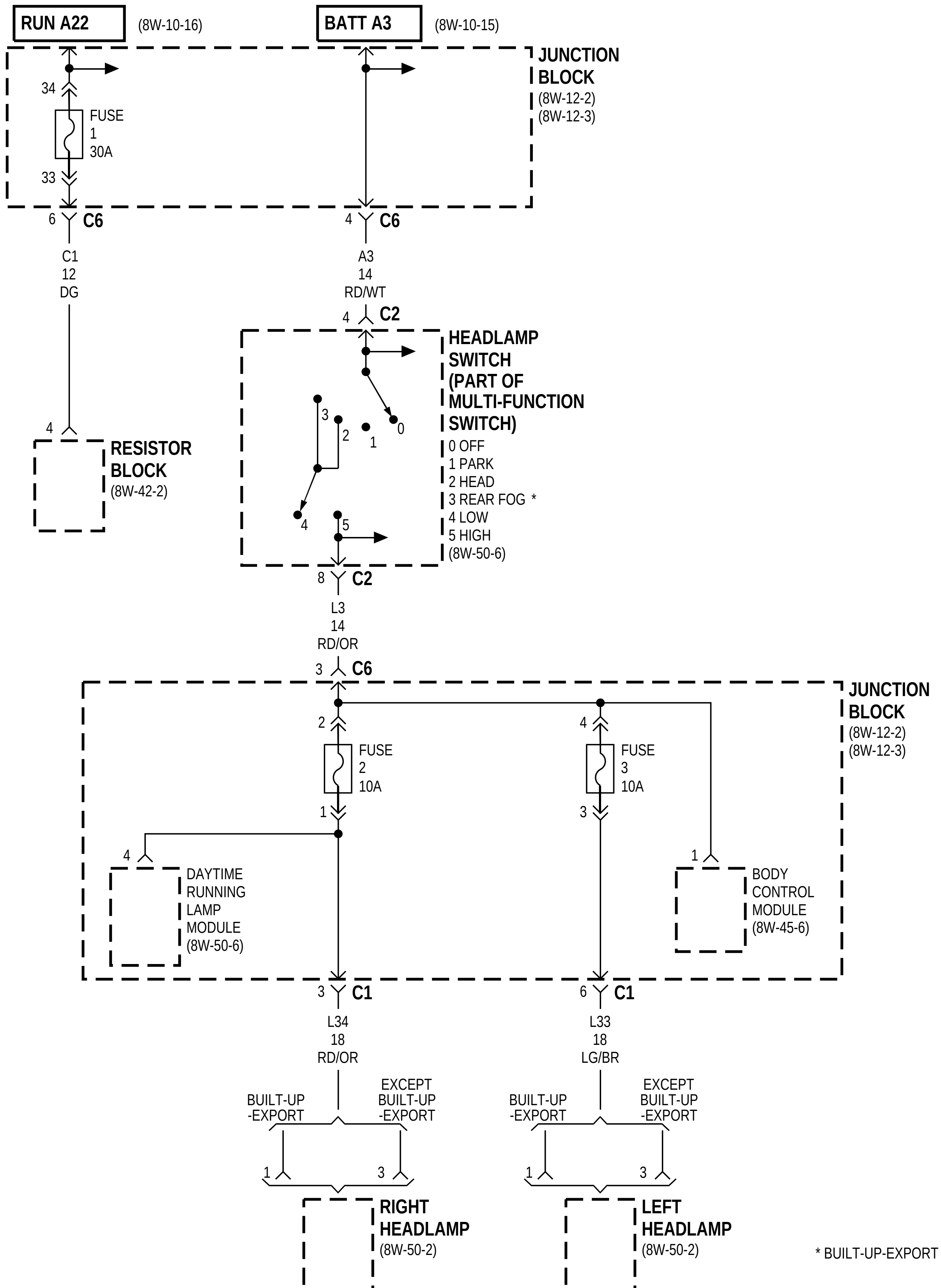
CAVITY	CIRCUIT	FUNCTION
6	INTERNAL	FUSED B(+)
7	INTERNAL	HORN RELAY CONTROL
8	INTERNAL	FUSED B(+)
9	-	-
10	X2 18DG/PK	HORN RELAY OUTPUT
	X2 18DG/PK	HORN RELAY OUTPUT

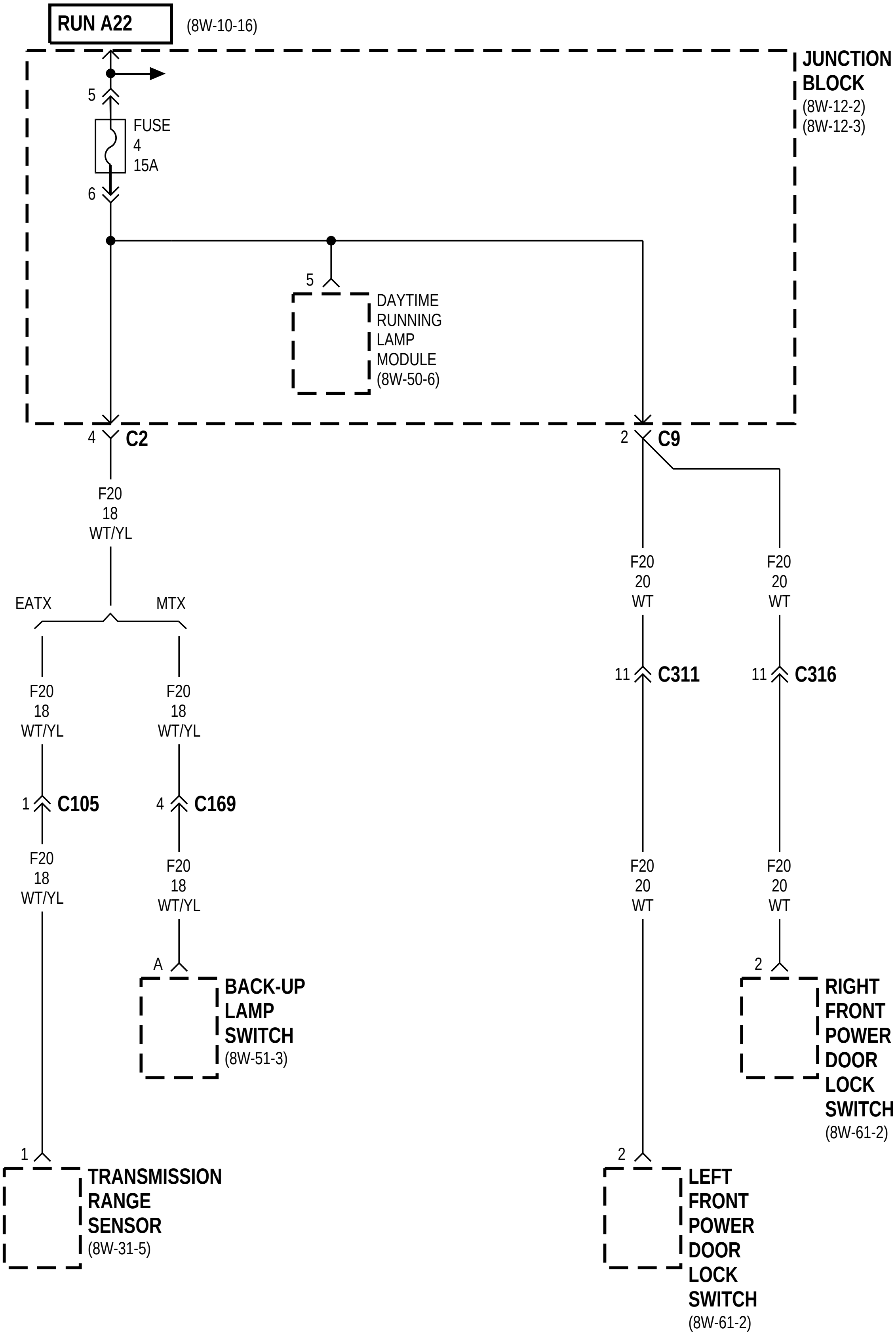
REAR WINDOW DEFOGGER RELAY

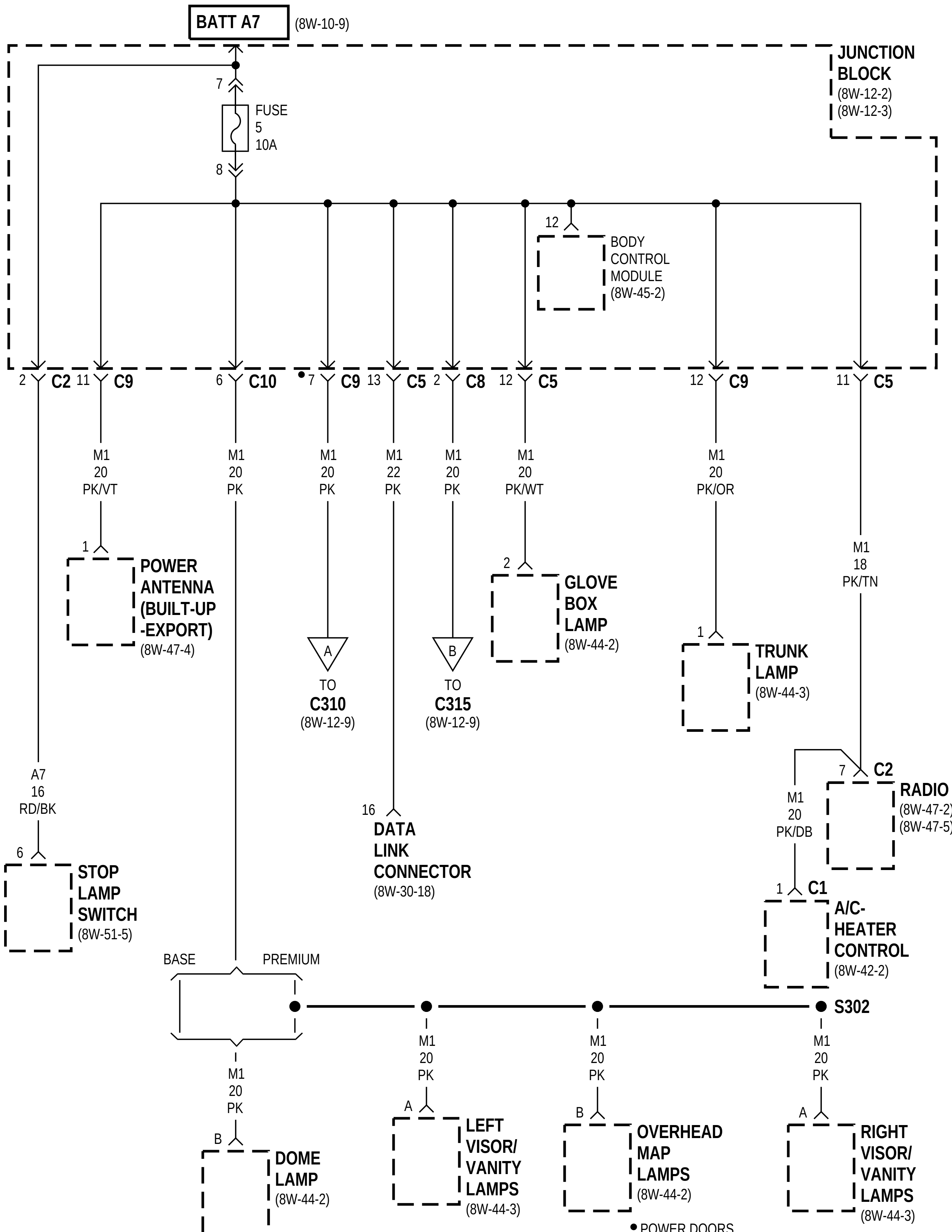
CAVITY	CIRCUIT	FUNCTION
11	A4 12BK/PK	FUSED B (+)
12	INTERNAL	REAR WINDOW DEFOGGER RELAY OUTPUT
13	INTERNAL	REAR WINDOW DEFOGGER RELAY CONTROL
15	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)

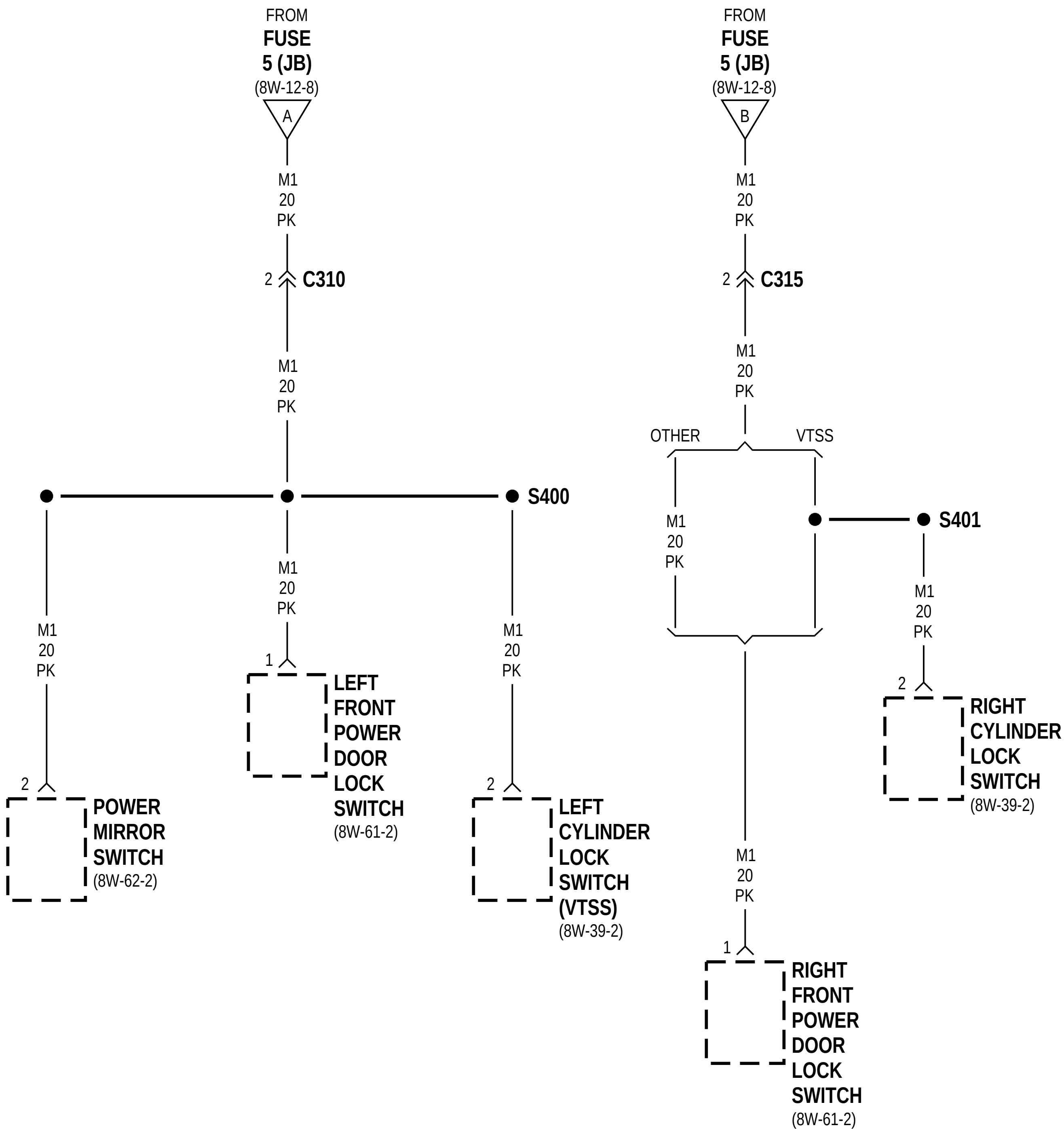
DAYTIME RUNNING LAMP MODULE

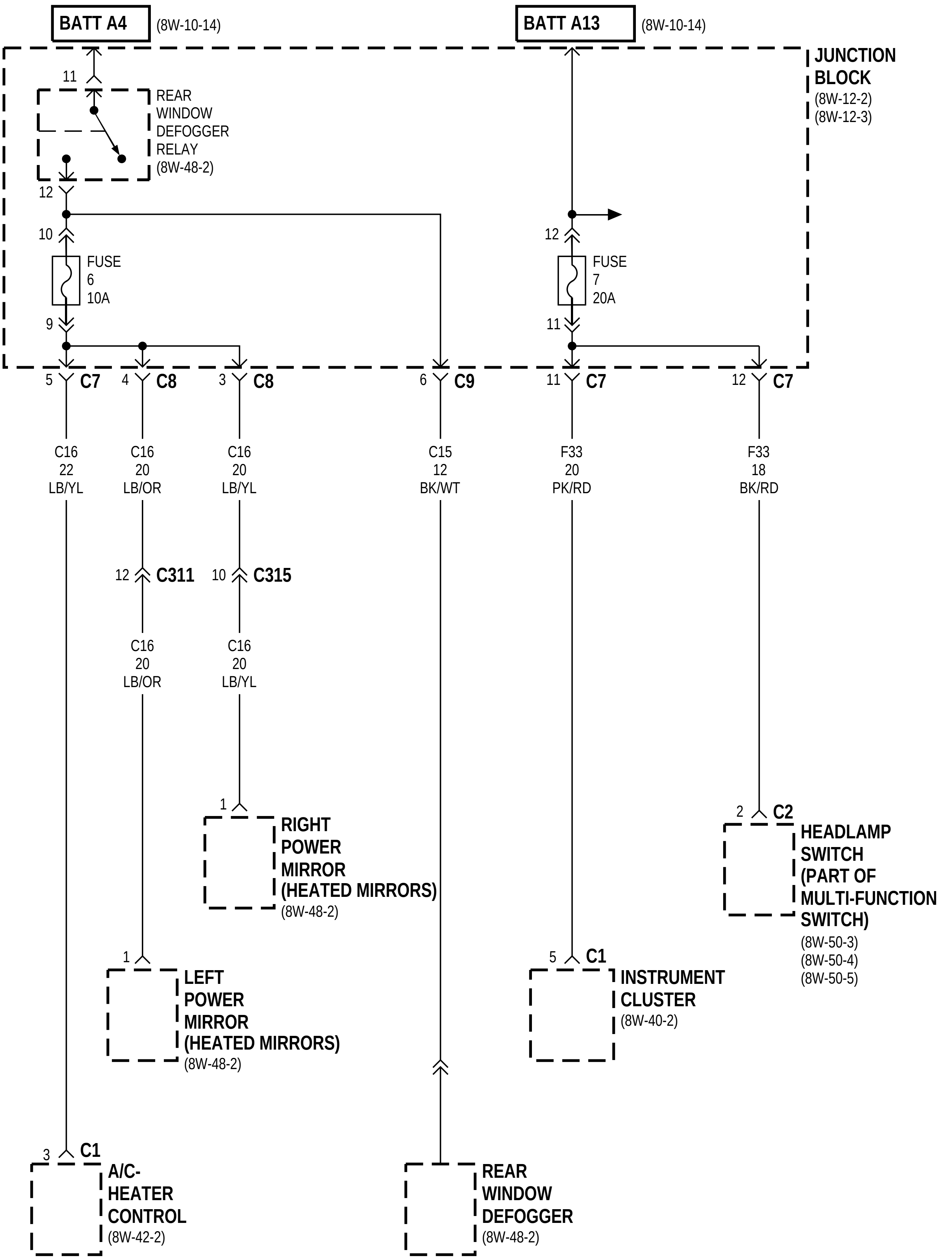
CAVITY	CIRCUIT	FUNCTION
1	INTERNAL	FUSED LEFT LOW BEAM OUTPUT
2	INTERNAL	FUSED B(+)
3	-	-
4	INTERNAL	FUSED RIGHT HIGH BEAM OUTPUT
5	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
6	INTERNAL	RED BRAKE WARNING INDICATOR DRIVER
7	-	-
8	INTERNAL	GROUND


RUN A22
(8W-10-16)
BATT A3
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
34
FUSE
1
30A
33
6
C6
4
C6
C1
12
DG
A3
14
RD/WT
4
C2
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG *
4 LOW
5 HIGH
(8W-50-6)
4
RESISTOR BLOCK
(8W-42-2)
8
C2
L3
14
RD/OR
3
C6
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
2
FUSE
2
10A
1
4
FUSE
3
10A
3
4
DAYTIME RUNNING LAMP MODULE
(8W-50-6)
1
BODY CONTROL MODULE
(8W-45-6)
3
C1
6
C1
L34
18
RD/OR
L33
18
LG/BR
BUILT-UP -EXPORT
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
EXCEPT BUILT-UP -EXPORT
1
3
1
3
RIGHT HEADLAMP
(8W-50-2)
LEFT HEADLAMP
(8W-50-2)
* BUILT-UP-EXPORT


RUN A22
(8W-10-16)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
5
FUSE
4
15A
6
5
DAYTIME
RUNNING
LAMP
MODULE
(8W-50-6)
4
C2
2
C9
F20
18
WT/YL
EATX
MTX
F20
18
WT/YL
F20
18
WT/YL
1
C105
4
C169
F20
18
WT/YL
F20
18
WT/YL
A
BACK-UP
LAMP
SWITCH
(8W-51-3)
1
TRANSMISSION
RANGE
SENSOR
(8W-31-5)
F20
20
WT
F20
20
WT
11
C311
11
C316
F20
20
WT
F20
20
WT
2
RIGHT
FRONT
POWER
DOOR
LOCK
SWITCH
(8W-61-2)
2
LEFT
FRONT
POWER
DOOR
LOCK
SWITCH
(8W-61-2)


BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 10A
7
8
12
BODY CONTROL MODULE
(8W-45-2)
2 C2
11 C9
6 C10
7 C9
13 C5
2 C8
12 C5
12 C9
11 C5
M1 20 PK/VT
M1 20 PK
M1 20 PK
M1 22 PK
M1 20 PK
M1 20 PK/WT
M1 20 PK/OR
M1 18 PK/TN
1
POWER ANTENNA (BUILT-UP -EXPORT)
(8W-47-4)
A
TO C310
(8W-12-9)
B
TO C315
(8W-12-9)
2
GLOVE BOX LAMP
(8W-44-2)
1
TRUNK LAMP
(8W-44-3)
7 C2
RADIO
(8W-47-2)
(8W-47-5)
M1 20 PK/DB
1 C1
A/C-HEATER CONTROL
(8W-42-2)
A7 16 RD/BK
6
STOP LAMP SWITCH
(8W-51-5)
16
DATA LINK CONNECTOR
(8W-30-18)
BASE
PREMIUM
S302
M1 20 PK
B
DOME LAMP
(8W-44-2)
M1 20 PK
A
LEFT VISOR/ VANITY LAMPS
(8W-44-3)
M1 20 PK
B
OVERHEAD MAP LAMPS
(8W-44-2)
M1 20 PK
A
RIGHT VISOR/ VANITY LAMPS
(8W-44-3)
● POWER DOORS


FROM
FUSE
5 (JB)
(8W-12-8)
A
M1
20
PK
2
C310
M1
20
PK
S400
M1
20
PK
2
POWER
MIRROR
SWITCH
(8W-62-2)
1
LEFT
FRONT
POWER
DOOR
LOCK
SWITCH
(8W-61-2)
2
LEFT
CYLINDER
LOCK
SWITCH
(VTSS)
(8W-39-2)
FROM
FUSE
5 (JB)
(8W-12-8)
B
M1
20
PK
2
C315
OTHER
VTSS
S401
2
RIGHT
CYLINDER
LOCK
SWITCH
(8W-39-2)
1
RIGHT
FRONT
POWER
DOOR
LOCK
SWITCH
(8W-61-2)



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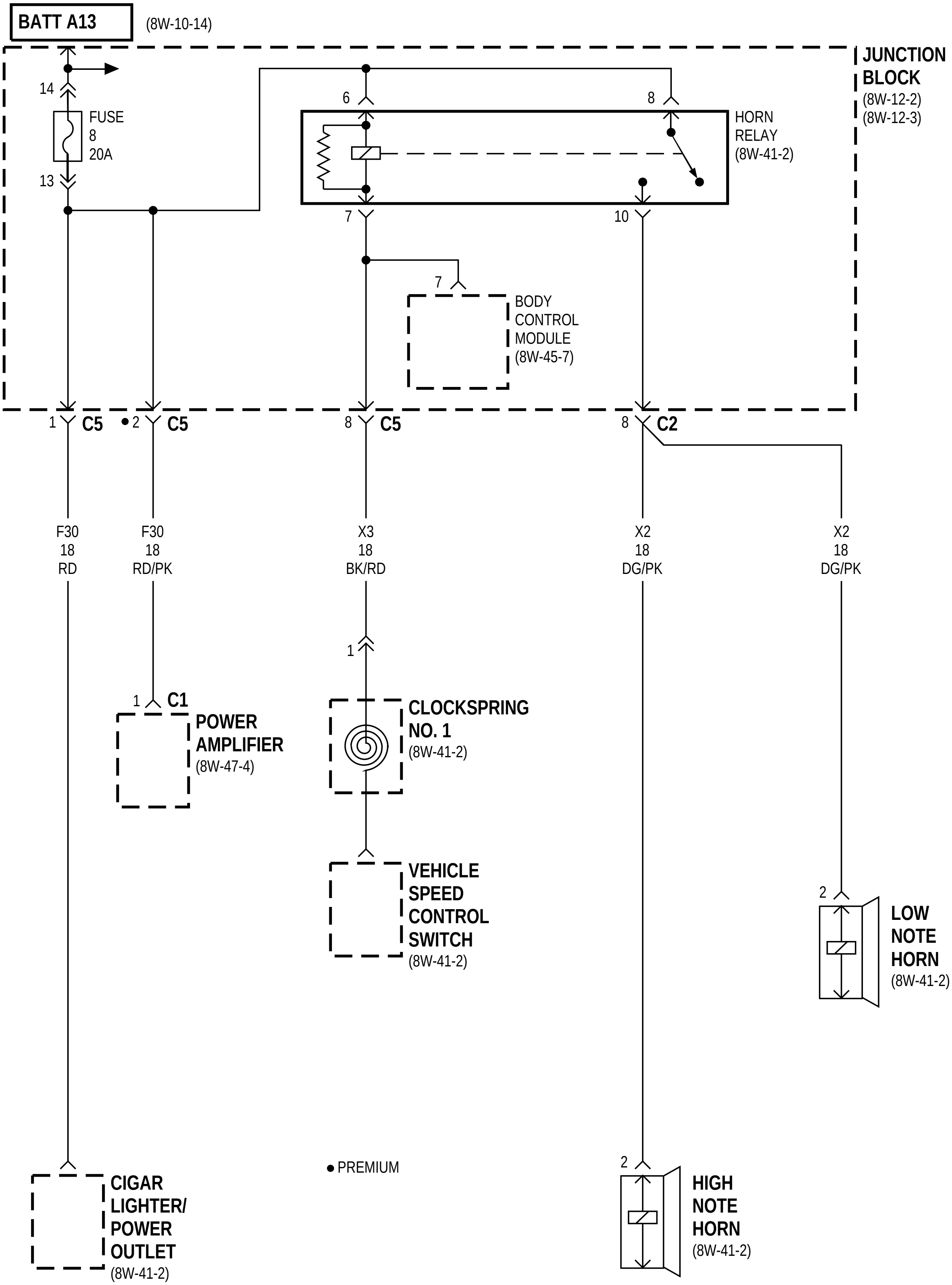
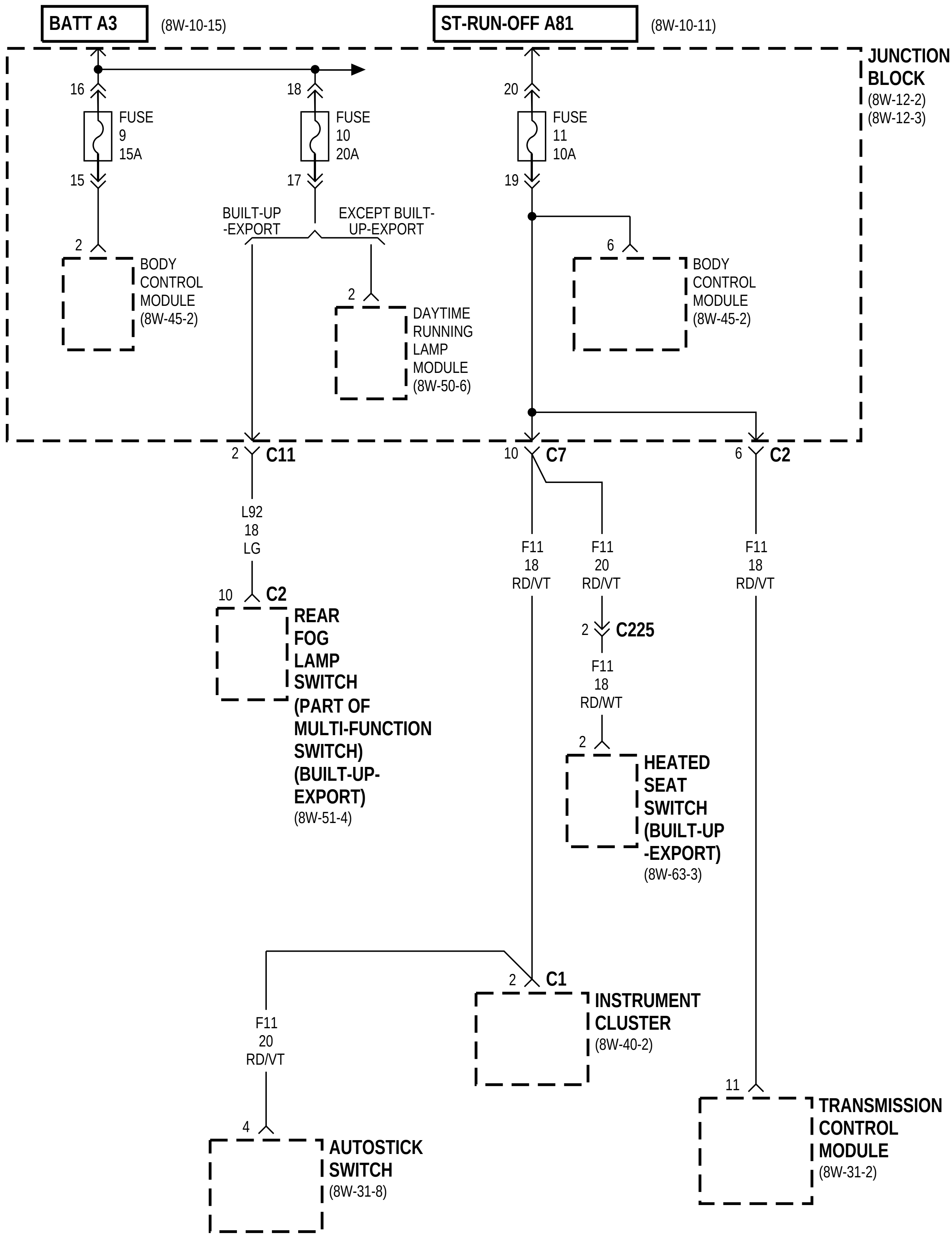
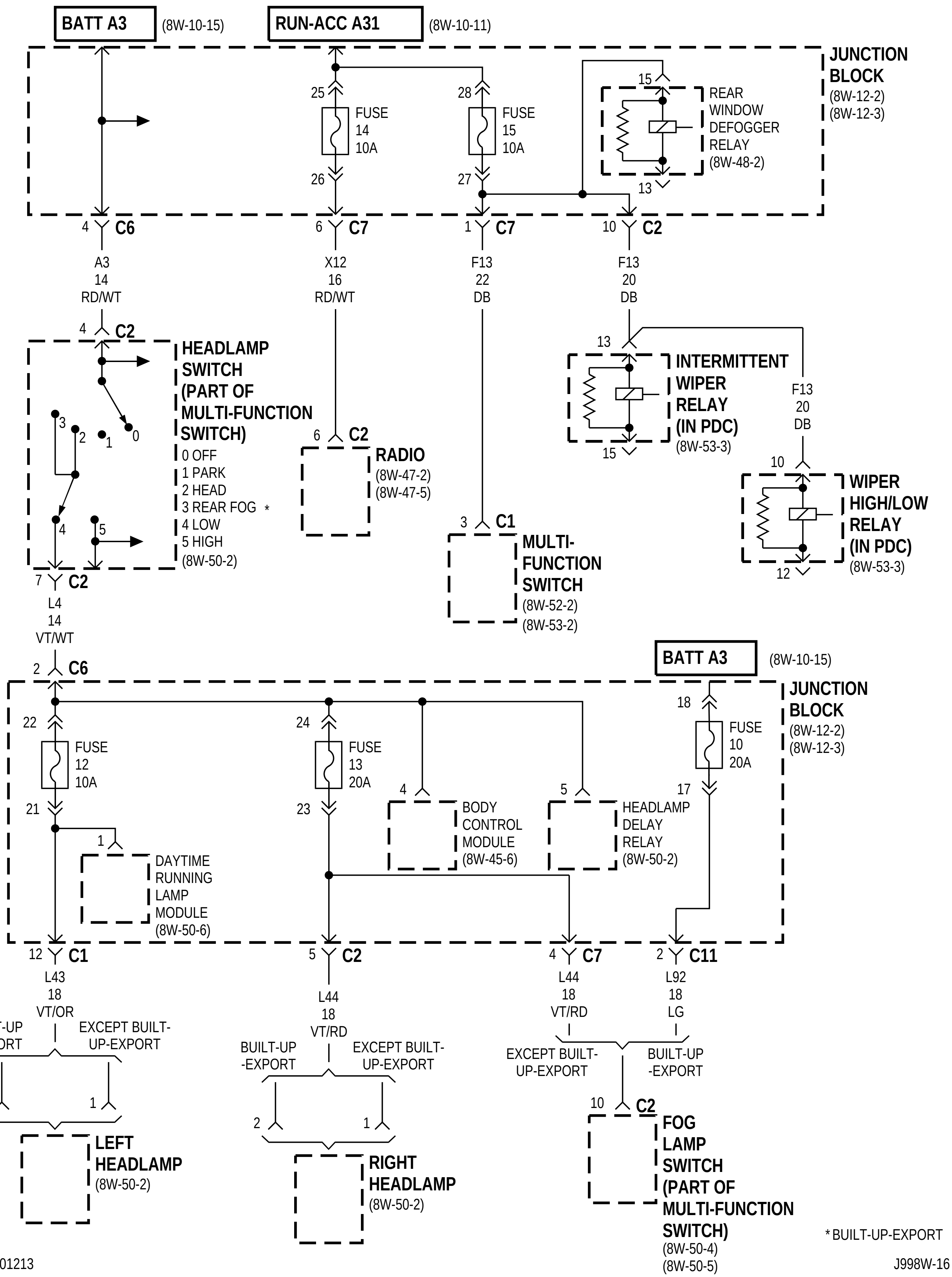
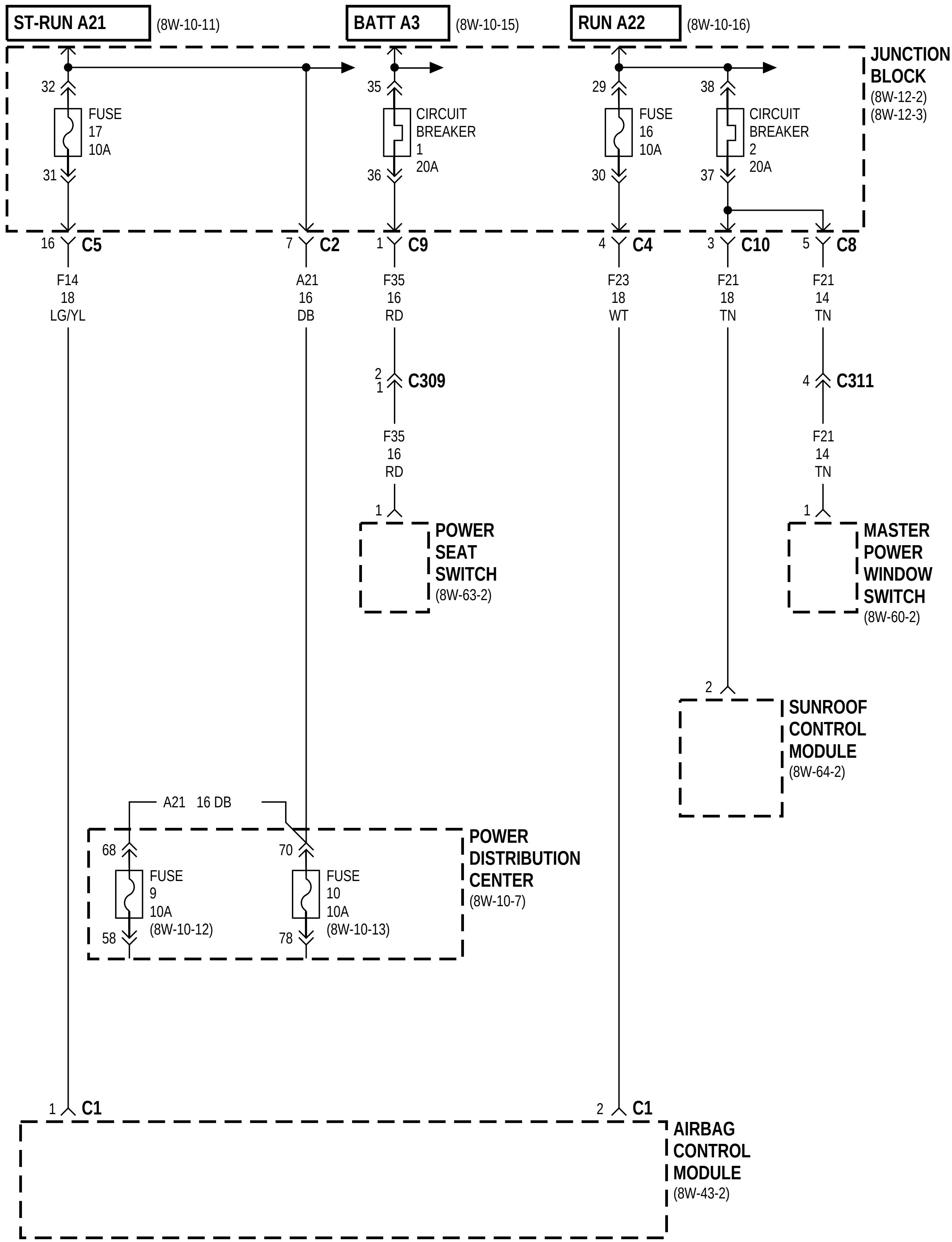
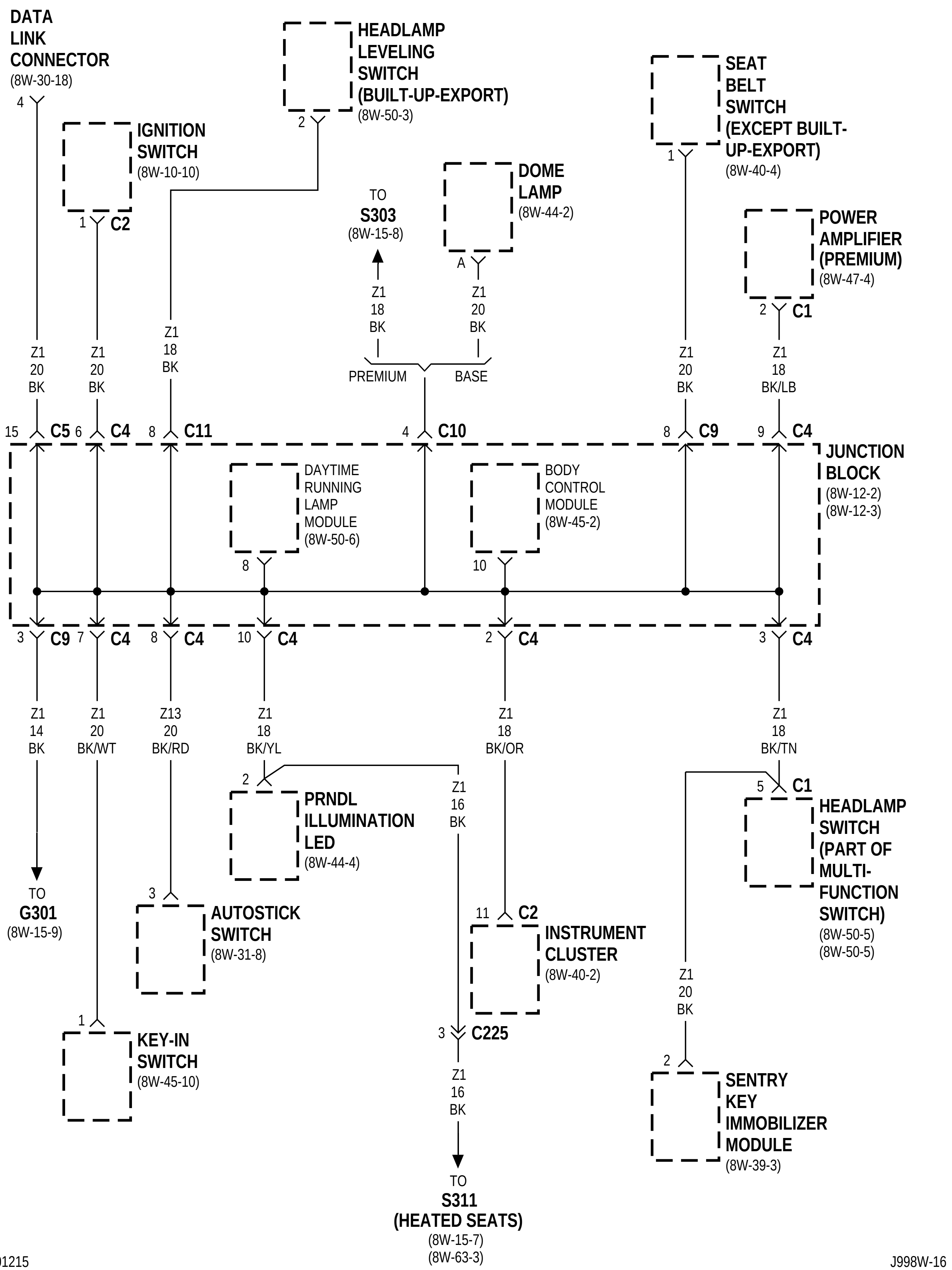
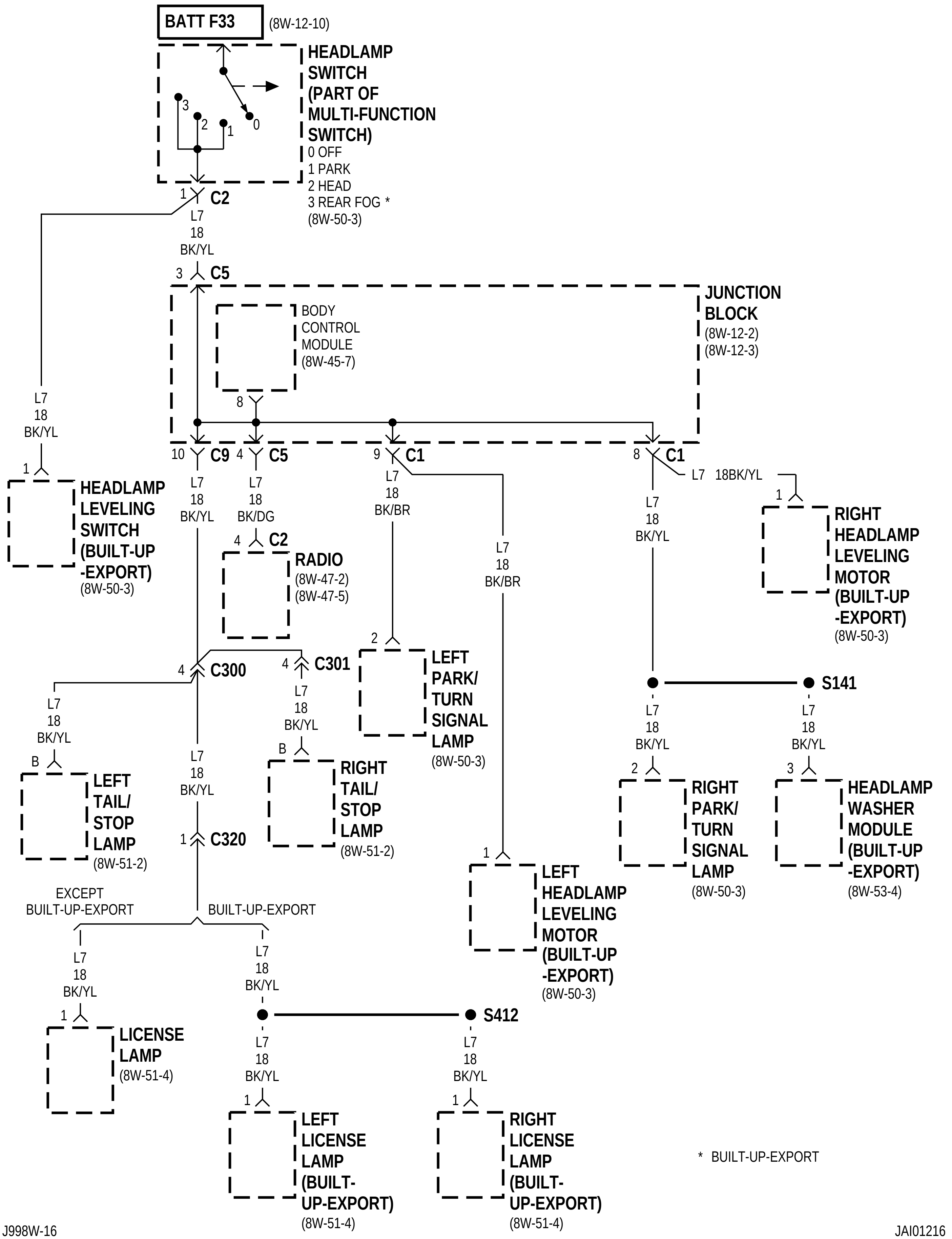

BATT A13
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
14
FUSE
8
20A
13
6
8
HORN RELAY
(8W-41-2)
7
10
7
BODY CONTROL MODULE
(8W-45-7)
1 C5
2 C5
8 C5
8 C2
F30
18
RD
F30
18
RD/PK
X3
18
BK/RD
X2
18
DG/PK
X2
18
DG/PK
1
1 C1
POWER AMPLIFIER
(8W-47-4)
CLOCKSPRING NO. 1
(8W-41-2)
VEHICLE SPEED CONTROL SWITCH
(8W-41-2)
2
LOW NOTE HORN
(8W-41-2)
PREMIUM
2
HIGH NOTE HORN
(8W-41-2)
CIGAR LIGHTER/ POWER OUTLET
(8W-41-2)

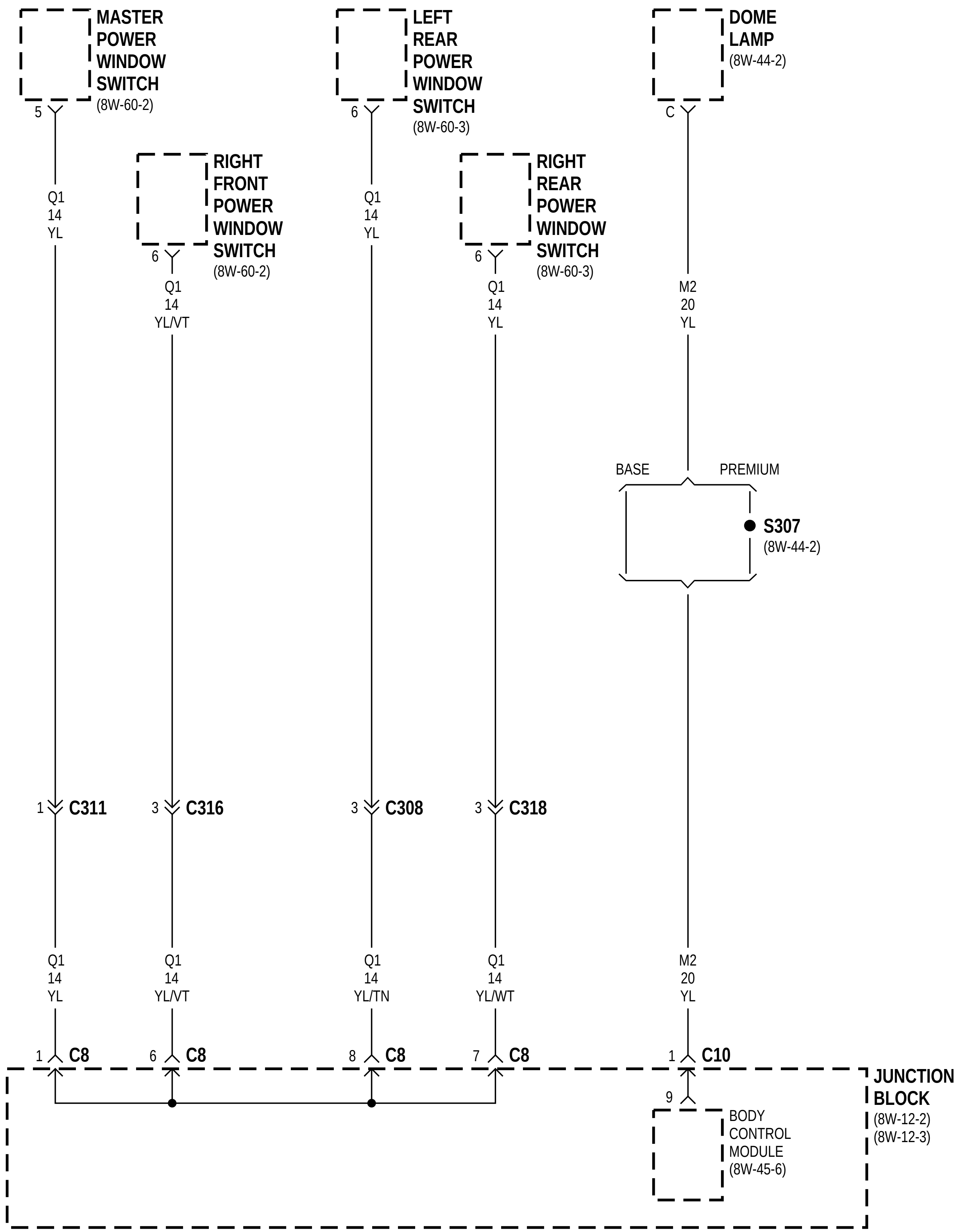

BATT A3
(8W-10-15)
ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
16
18
20
FUSE 9 15A
FUSE 10 20A
FUSE 11 10A
15
17
19
BUILT-UP -EXPORT
EXCEPT BUILT-UP-EXPORT
2
BODY CONTROL MODULE (8W-45-2)
2
DAYTIME RUNNING LAMP MODULE (8W-50-6)
6
BODY CONTROL MODULE (8W-45-2)
2 C11
10 C7
6 C2
L92 18 LG
F11 18 RD/VT
F11 20 RD/VT
F11 18 RD/VT
10 C2
REAR FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH) (BUILT-UP-EXPORT) (8W-51-4)
2 C225
F11 18 RD/WT
2
HEATED SEAT SWITCH (BUILT-UP -EXPORT) (8W-63-3)
2 C1
INSTRUMENT CLUSTER (8W-40-2)
F11 20 RD/VT
4
AUTOSTICK SWITCH (8W-31-8)
11
TRANSMISSION CONTROL MODULE (8W-31-2)

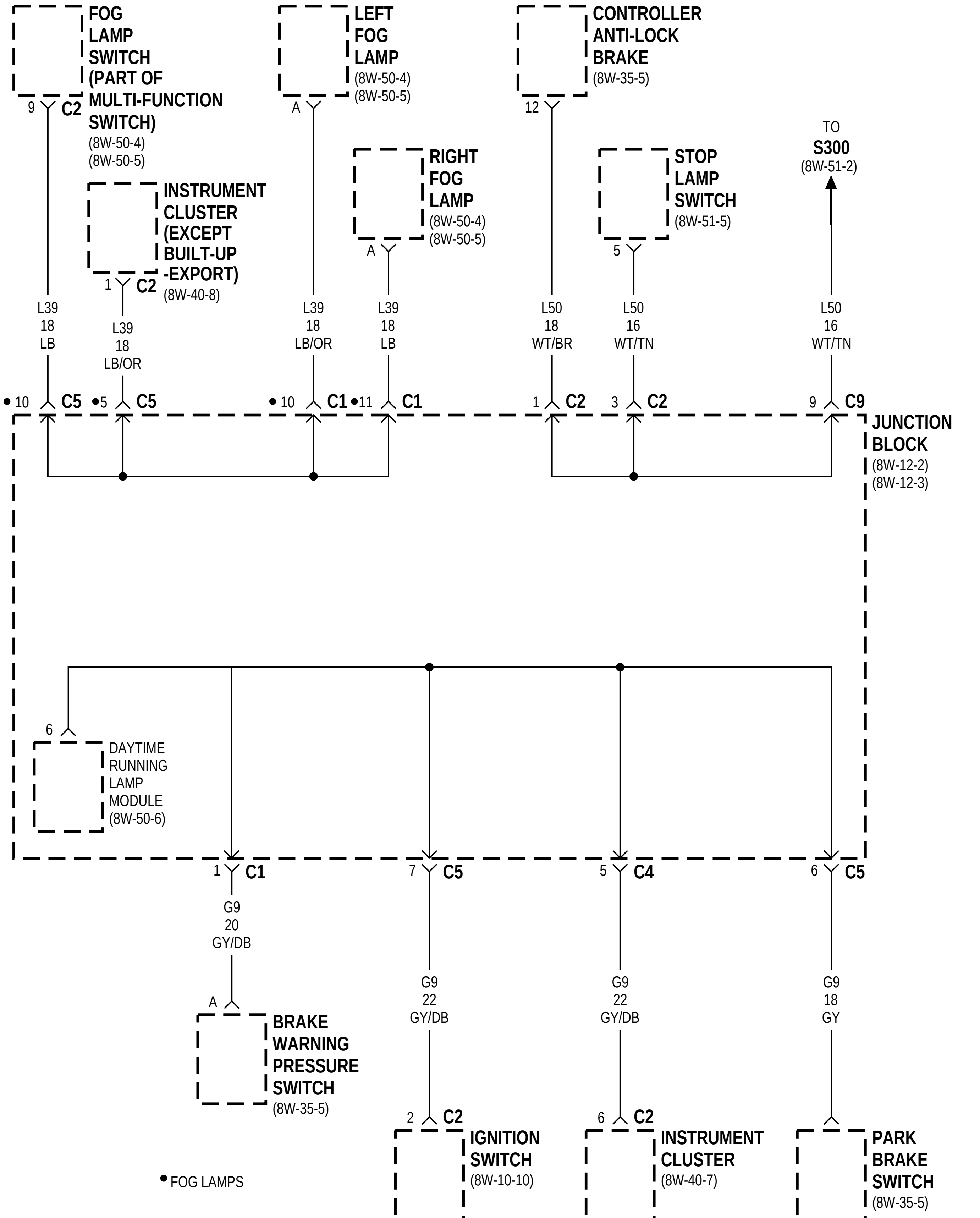

BATT A3
(8W-10-15)
RUN-ACC A31
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 10A
FUSE 15 10A
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
C6
C7
C2
A3 14 RD/WT
X12 16 RD/WT
F13 22 DB
F13 20 DB
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG *
4 LOW
5 HIGH
(8W-50-2)
RADIO
(8W-47-2)
(8W-47-5)
INTERMITTENT WIPER RELAY (IN PDC)
(8W-53-3)
WIPER HIGH/LOW RELAY (IN PDC)
(8W-53-3)
C1
MULTI-FUNCTION SWITCH
(8W-52-2)
(8W-53-2)
L4 14 VT/WT
FUSE 12 10A
FUSE 13 20A
FUSE 10 20A
BODY CONTROL MODULE
(8W-45-6)
HEADLAMP DELAY RELAY
(8W-50-2)
DAYTIME RUNNING LAMP MODULE
(8W-50-6)
C11
L43 18 VT/OR
L44 18 VT/RD
L44 18 VT/RD
L92 18 LG
BUILT-UP -EXPORT
EXCEPT BUILT-UP-EXPORT
LEFT HEADLAMP
(8W-50-2)
RIGHT HEADLAMP
(8W-50-2)
FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-50-4)
(8W-50-5)
* BUILT-UP-EXPORT

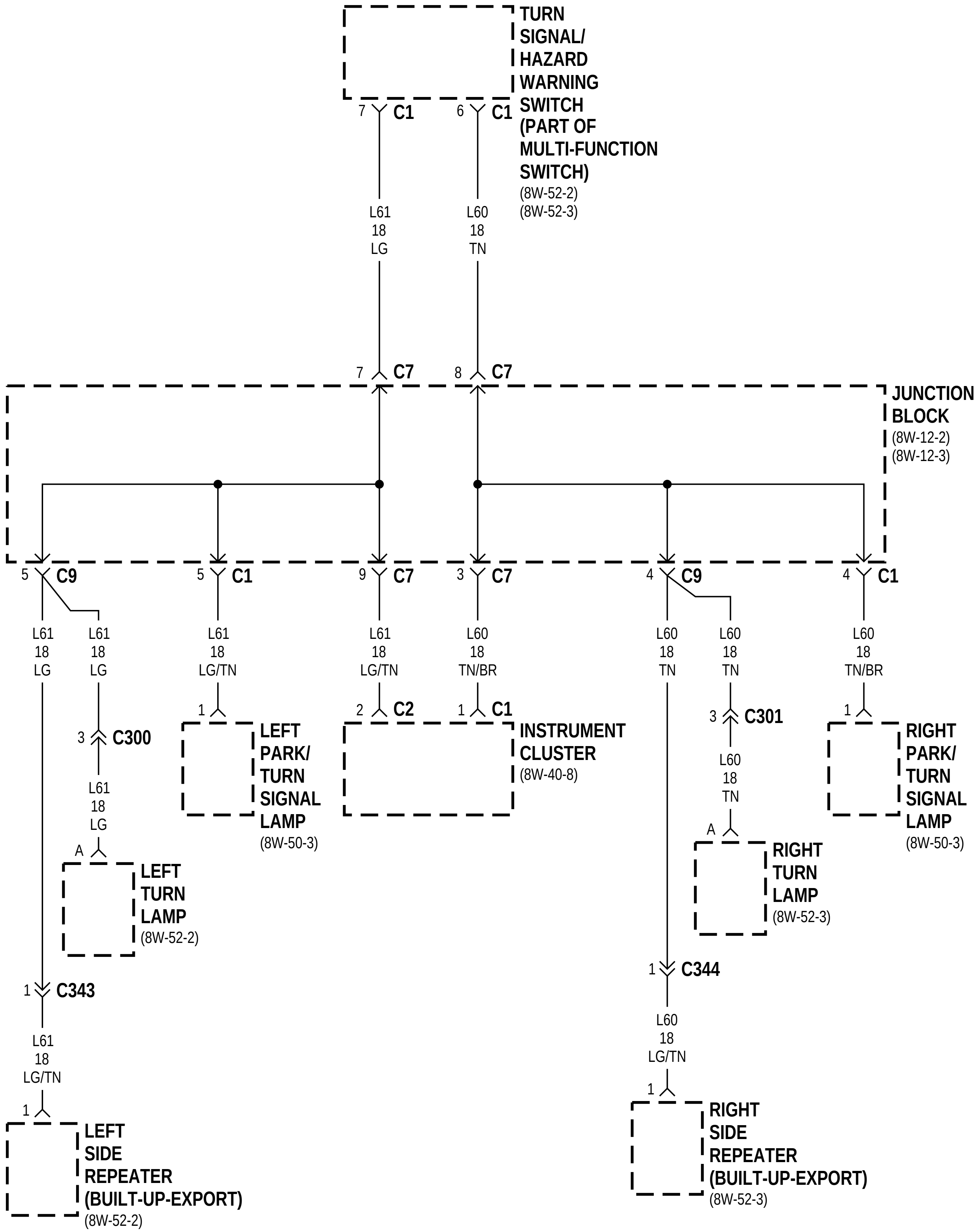

ST-RUN A21
(8W-10-11)
BATT A3
(8W-10-15)
RUN A22
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
32
FUSE 17 10A
31
35
CIRCUIT BREAKER 1 20A
36
29
FUSE 16 10A
30
38
CIRCUIT BREAKER 2 20A
37
16 C5
7 C2
1 C9
4 C4
3 C10
5 C8
F14 18 LG/YL
A21 16 DB
F35 16 RD
F23 18 WT
F21 18 TN
F21 14 TN
2 1 C309
4 C311
F35 16 RD
F21 14 TN
1
POWER SEAT SWITCH
(8W-63-2)
1
MASTER POWER WINDOW SWITCH
(8W-60-2)
2
SUNROOF CONTROL MODULE
(8W-64-2)
A21 16 DB
68
70
FUSE 9 10A (8W-10-12)
58
FUSE 10 10A (8W-10-13)
78
POWER DISTRIBUTION CENTER
(8W-10-7)
1 C1
2 C1
AIRBAG CONTROL MODULE
(8W-43-2)


DATA LINK CONNECTOR (8W-30-18)
IGNITION SWITCH (8W-10-10)
HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT) (8W-50-3)
TO S303 (8W-15-8)
DOME LAMP (8W-44-2)
SEAT BELT SWITCH (EXCEPT BUILT-UP-EXPORT) (8W-40-4)
POWER AMPLIFIER (PREMIUM) (8W-47-4)
PREMIUM
BASE
Z1 20 BK
Z1 18 BK
Z1 18 BK/LB
C5
C4
C11
C10
C9
C2
C1
JUNCTION BLOCK (8W-12-2) (8W-12-3)
DAYTIME RUNNING LAMP MODULE (8W-50-6)
BODY CONTROL MODULE (8W-45-2)
Z1 14 BK
Z1 20 BK/WT
Z13 20 BK/RD
Z1 18 BK/YL
Z1 18 BK/OR
Z1 18 BK/TN
Z1 16 BK
TO G301 (8W-15-9)
PRNDL ILLUMINATION LED (8W-44-4)
AUTOSTICK SWITCH (8W-31-8)
KEY-IN SWITCH (8W-45-10)
INSTRUMENT CLUSTER (8W-40-2)
C225
TO S311 (HEATED SEATS) (8W-15-7) (8W-63-3)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH) (8W-50-5) (8W-50-5)
SENTRY KEY IMMOBILIZER MODULE (8W-39-3)


BATT F33
(8W-12-10)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG *
(8W-50-3)
C2
L7 18 BK/YL
C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-7)
C9
C5
C1
C1
L7 18BK/YL
L7 18 BK/DG
L7 18 BK/BR
HEADLAMP LEVELING SWITCH (BUILT-UP -EXPORT)
(8W-50-3)
RADIO
(8W-47-2)
(8W-47-5)
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP -EXPORT)
(8W-50-3)
C300
C301
LEFT PARK/ TURN SIGNAL LAMP
(8W-50-3)
S141
LEFT TAIL/ STOP LAMP
(8W-51-2)
RIGHT TAIL/ STOP LAMP
(8W-51-2)
RIGHT PARK/ TURN SIGNAL LAMP
(8W-50-3)
HEADLAMP WASHER MODULE (BUILT-UP -EXPORT)
(8W-53-4)
C320
LEFT HEADLAMP LEVELING MOTOR (BUILT-UP -EXPORT)
(8W-50-3)
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S412
LICENSE LAMP
(8W-51-4)
LEFT LICENSE LAMP (BUILT-UP-EXPORT)
(8W-51-4)
RIGHT LICENSE LAMP (BUILT-UP-EXPORT)
(8W-51-4)
* BUILT-UP-EXPORT

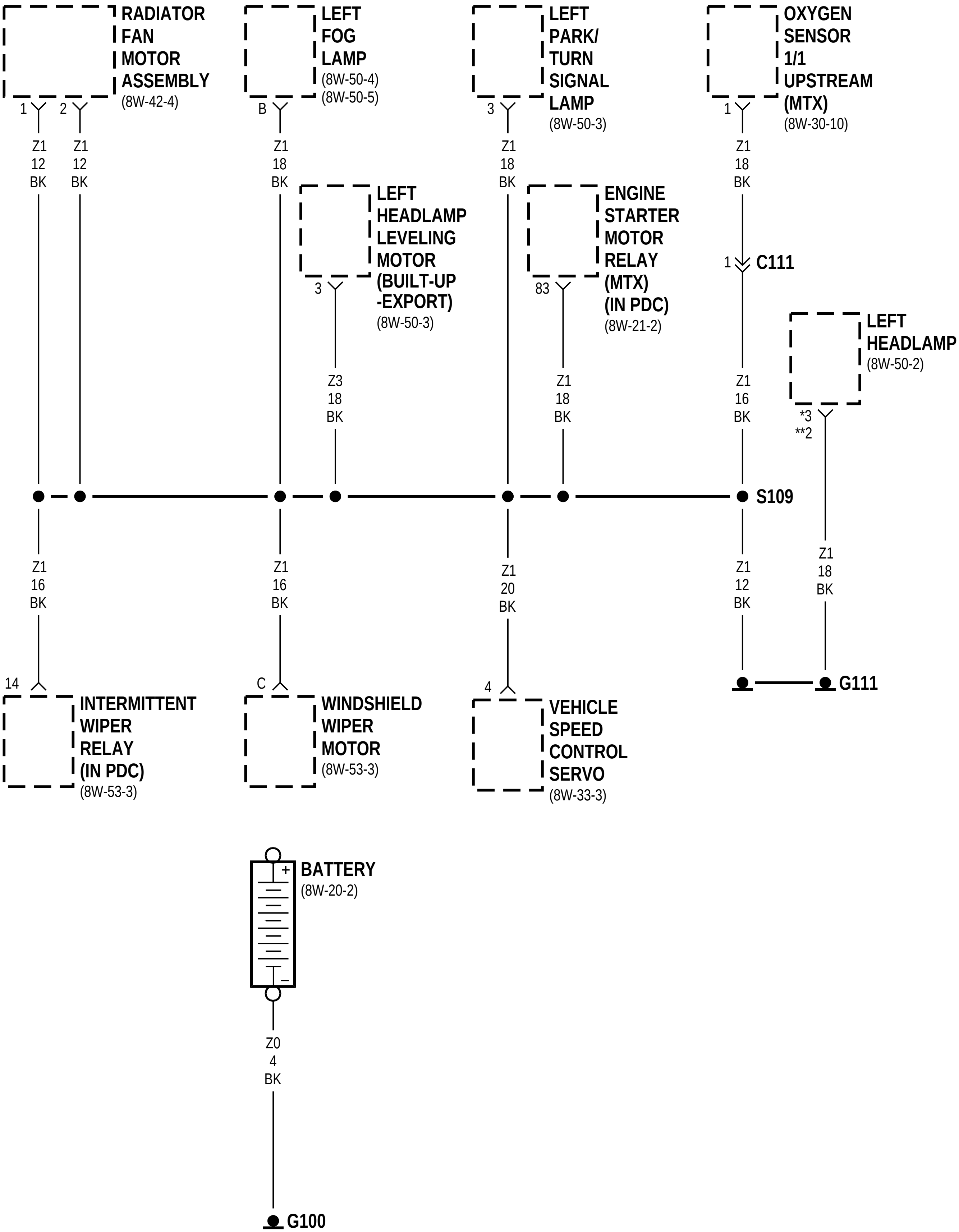

MASTER POWER WINDOW SWITCH
(8W-60-2)
5
Q1
14
YL
RIGHT FRONT POWER WINDOW SWITCH
(8W-60-2)
6
Q1
14
YL/VT
LEFT REAR POWER WINDOW SWITCH
(8W-60-3)
6
Q1
14
YL
RIGHT REAR POWER WINDOW SWITCH
(8W-60-3)
6
Q1
14
YL
DOME LAMP
(8W-44-2)
C
M2
20
YL
BASE
PREMIUM
S307
(8W-44-2)
1 C311
3 C316
3 C308
3 C318
Q1
14
YL
Q1
14
YL/VT
Q1
14
YL/TN
Q1
14
YL/WT
M2
20
YL
1 C8
6 C8
8 C8
7 C8
1 C10
9
BODY CONTROL MODULE
(8W-45-6)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)


FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-50-4)
(8W-50-5)
9 C2
LEFT FOG LAMP
(8W-50-4)
(8W-50-5)
A
CONTROLLER ANTI-LOCK BRAKE
(8W-35-5)
12
TO S300
(8W-51-2)
INSTRUMENT CLUSTER (EXCEPT BUILT-UP -EXPORT)
(8W-40-8)
1 C2
RIGHT FOG LAMP
(8W-50-4)
(8W-50-5)
A
STOP LAMP SWITCH
(8W-51-5)
5
L39 18 LB
L39 18 LB/OR
L39 18 LB/OR
L39 18 LB
L50 18 WT/BR
L50 16 WT/TN
L50 16 WT/TN
10 C5
5 C5
10 C1
11 C1
1 C2
3 C2
9 C9
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
6
DAYTIME RUNNING LAMP MODULE
(8W-50-6)
1 C1
7 C5
5 C4
6 C5
G9 20 GY/DB
G9 22 GY/DB
G9 22 GY/DB
G9 18 GY
A
BRAKE WARNING PRESSURE SWITCH
(8W-35-5)
2 C2
IGNITION SWITCH
(8W-10-10)
6 C2
INSTRUMENT CLUSTER
(8W-40-7)
PARK BRAKE SWITCH
(8W-35-5)
• FOG LAMPS

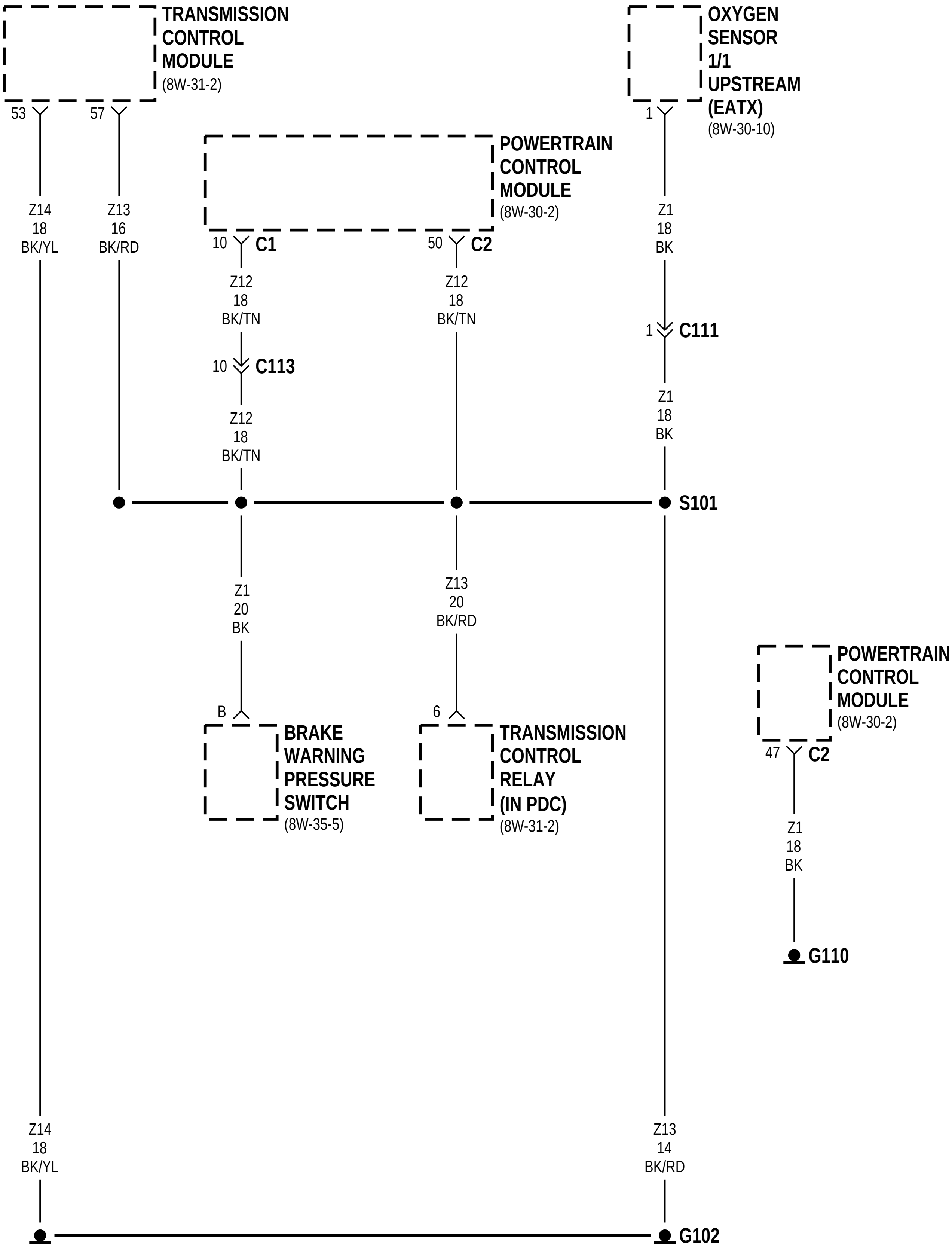

TURN SIGNAL/ HAZARD WARNING SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
(8W-52-3)
7 C1
6 C1
L61 18 LG
L60 18 TN
7 C7
8 C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
5 C9
5 C1
9 C7
3 C7
4 C9
4 C1
L61 18 LG
L61 18 LG
L61 18 LG/TN
L61 18 LG/TN
L60 18 TN/BR
L60 18 TN
L60 18 TN
L60 18 TN/BR
3 C300
L61 18 LG
A
LEFT TURN LAMP
(8W-52-2)
1
LEFT PARK/ TURN SIGNAL LAMP
(8W-50-3)
2 C2
1 C1
INSTRUMENT CLUSTER
(8W-40-8)
3 C301
L60 18 TN
A
RIGHT TURN LAMP
(8W-52-3)
1
RIGHT PARK/ TURN SIGNAL LAMP
(8W-50-3)
1 C343
L61 18 LG/TN
1
LEFT SIDE REPEATER (BUILT-UP-EXPORT)
(8W-52-2)
1 C344
L60 18 LG/TN
1
RIGHT SIDE REPEATER (BUILT-UP-EXPORT)
(8W-52-3)

JAI01219

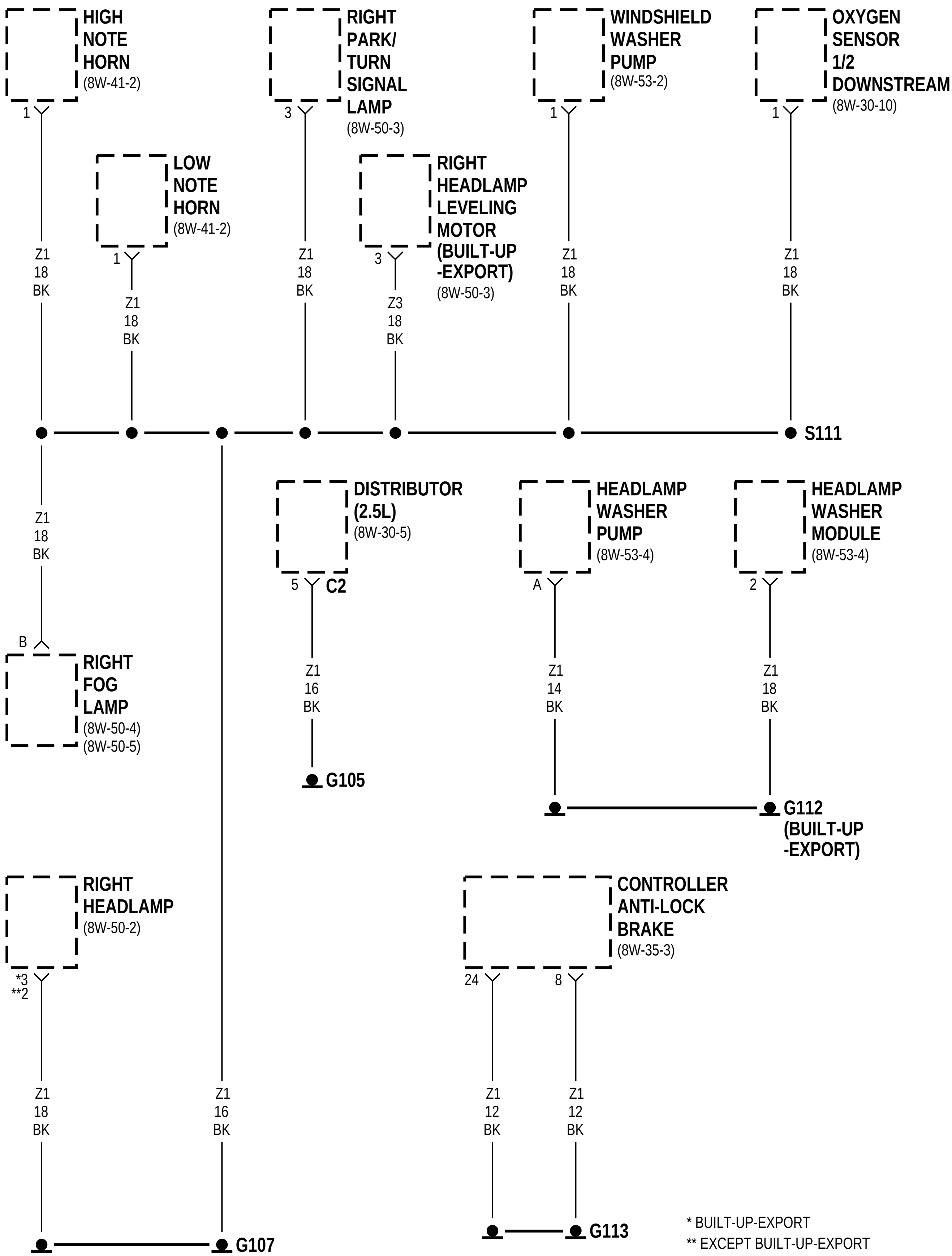
8W-15 GROUND DISTRIBUTION

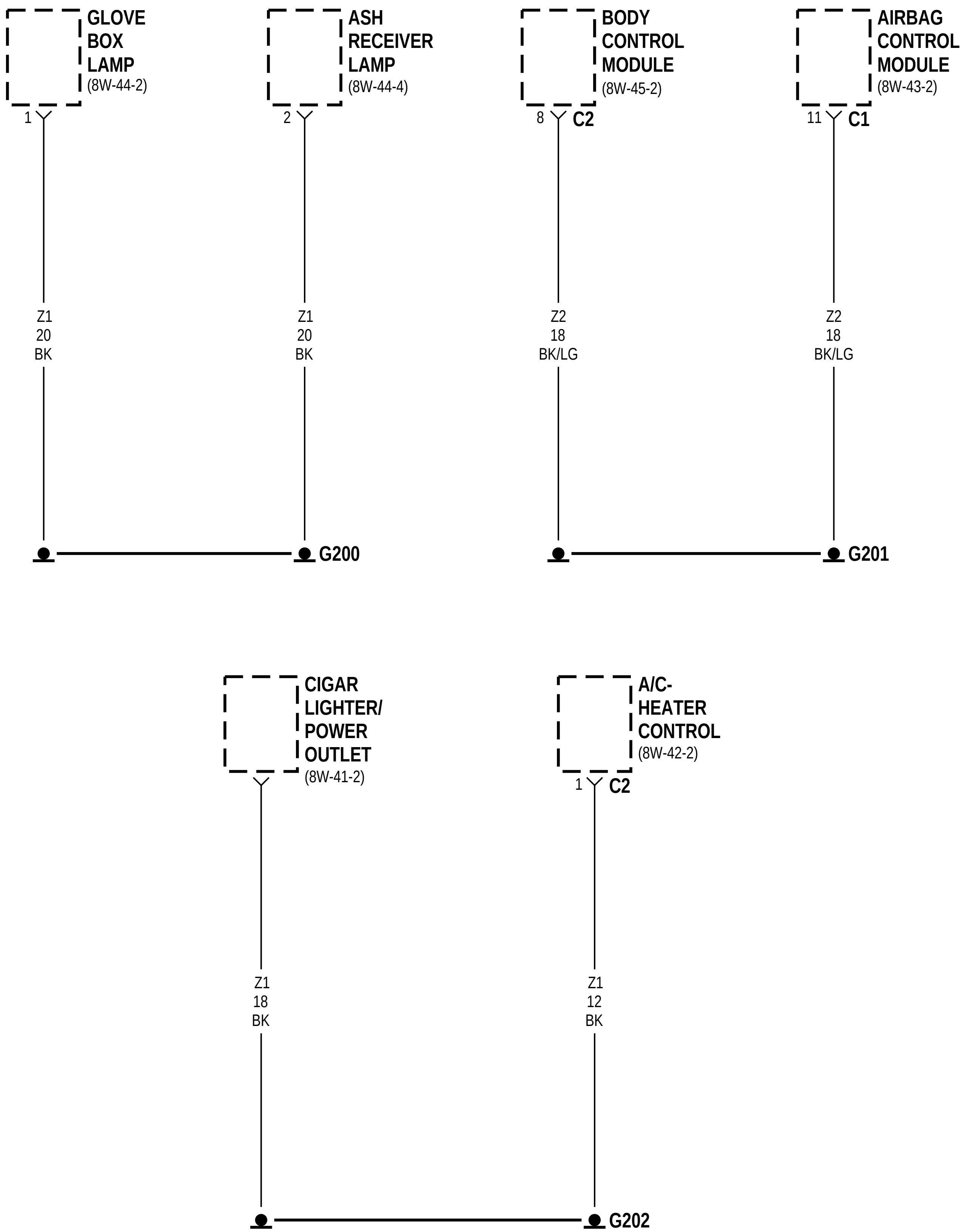


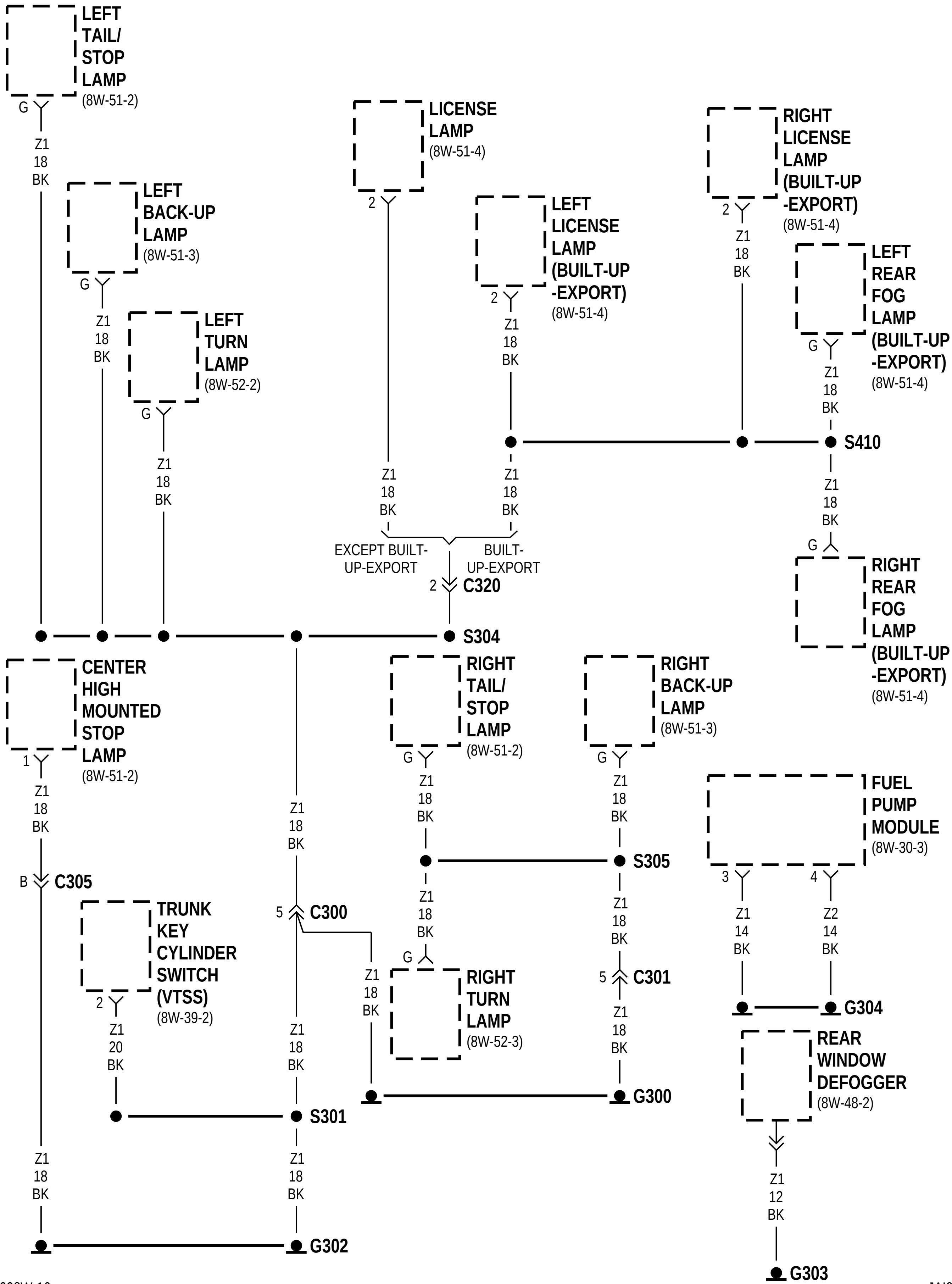
* BUILT-UP-EXPORT
** EXCEPT BUILT-UP-EXPORT

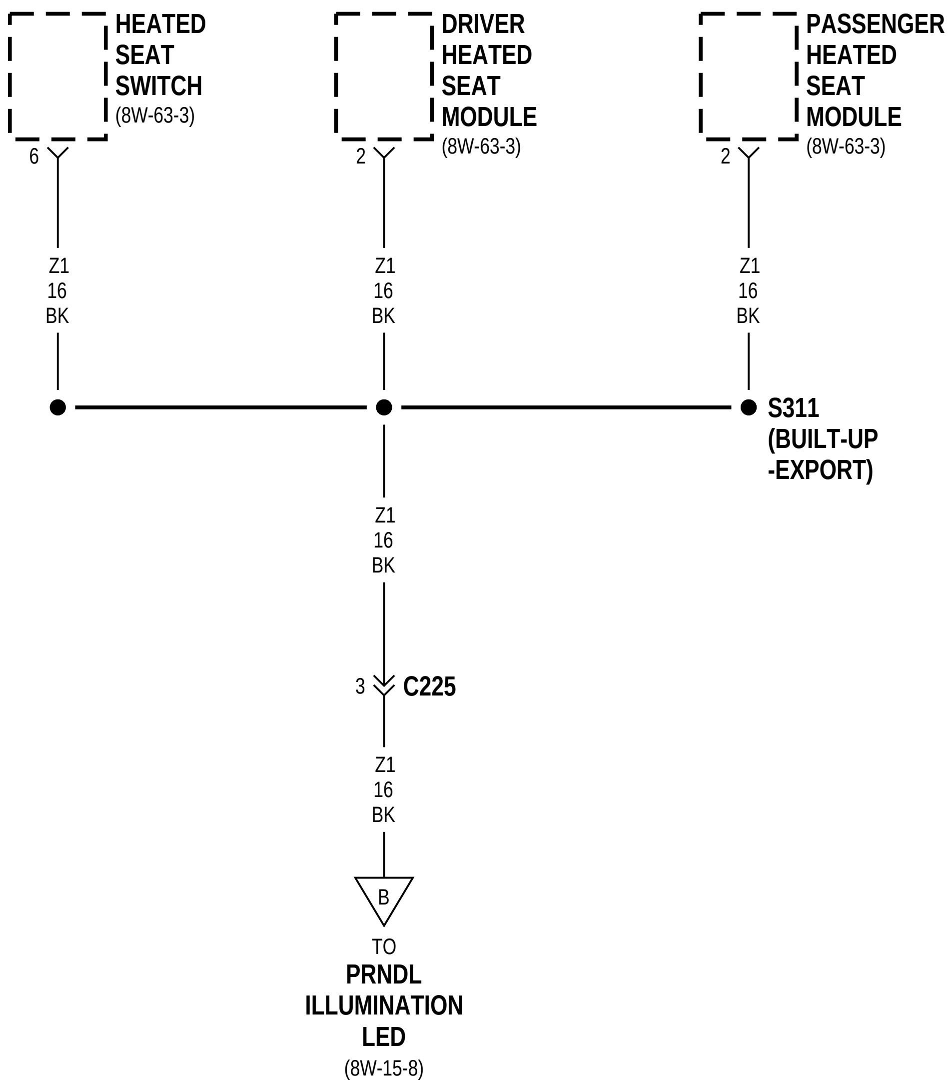


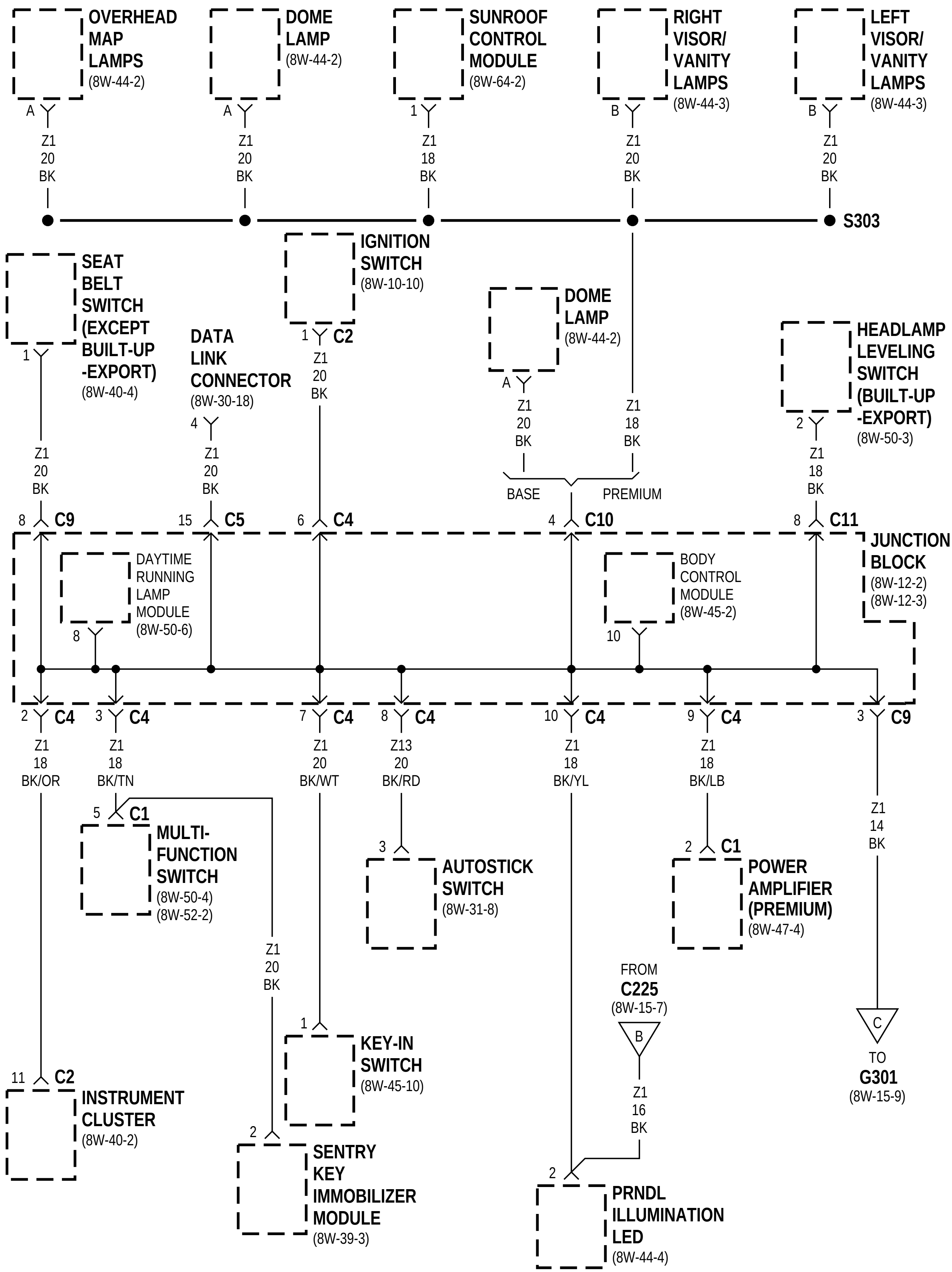
TRANSMISSION CONTROL MODULE
(8W-31-2)
53
57
OXYGEN SENSOR 1/1 UPSTREAM (EATX)
(8W-30-10)
1
POWERTRAIN CONTROL MODULE
(8W-30-2)
Z14 18 BK/YL
Z13 16 BK/RD
10 C1
50 C2
Z1 18 BK
Z12 18 BK/TN
Z12 18 BK/TN
1 C111
10 C113
Z12 18 BK/TN
Z1 18 BK
S101
Z1 20 BK
Z13 20 BK/RD
POWERTRAIN CONTROL MODULE
(8W-30-2)
B
6
BRAKE WARNING PRESSURE SWITCH
(8W-35-5)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
47 C2
Z1 18 BK
G110
Z14 18 BK/YL
Z13 14 BK/RD
G102

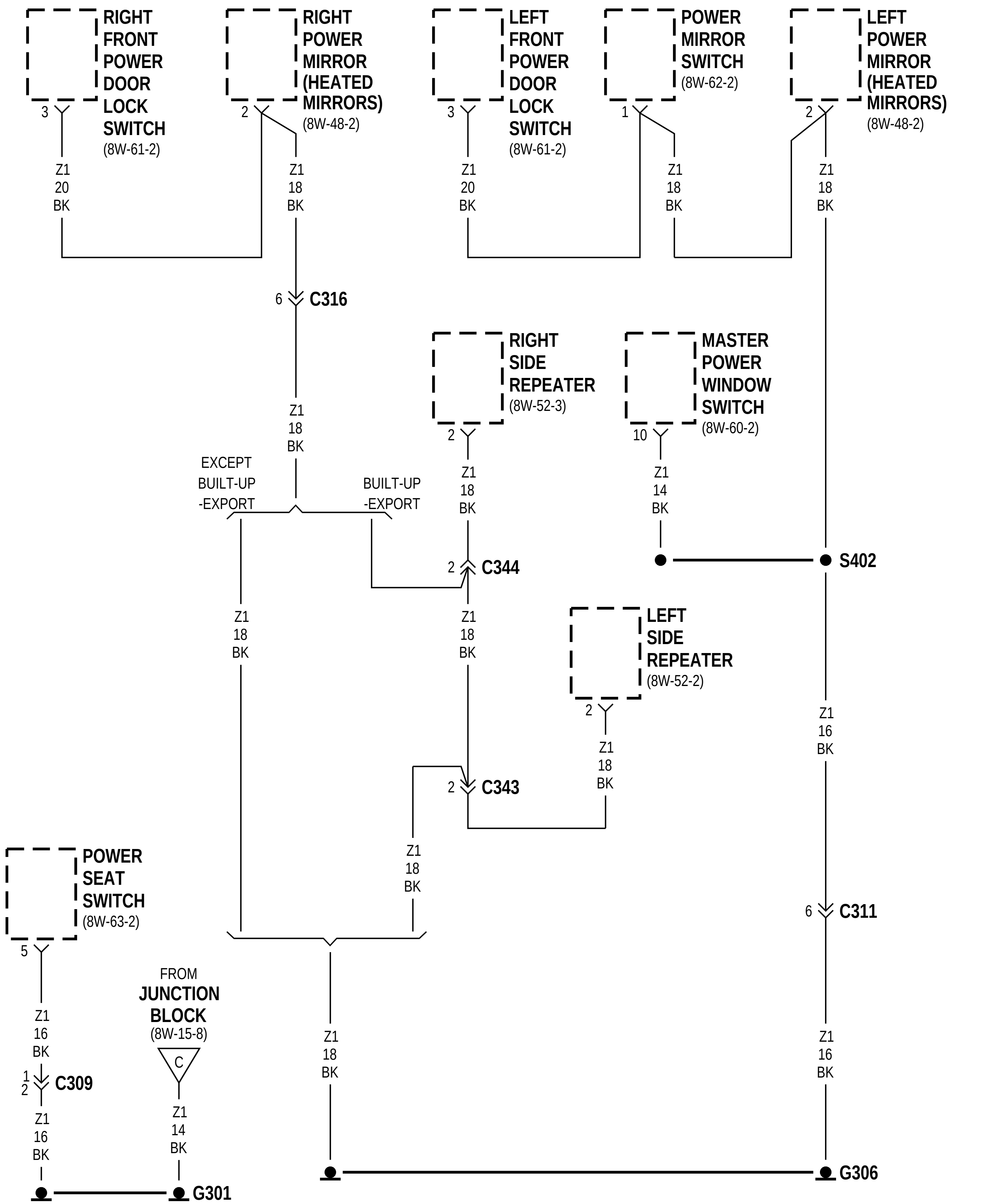

HIGH NOTE HORN (8W-41-2)
1
Z1 18 BK
LOW NOTE HORN (8W-41-2)
1
Z1 18 BK
RIGHT PARK/ TURN SIGNAL LAMP (8W-50-3)
3
Z1 18 BK
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP -EXPORT) (8W-50-3)
3
Z3 18 BK
WINDSHIELD WASHER PUMP (8W-53-2)
1
Z1 18 BK
OXYGEN SENSOR 1/2 DOWNSTREAM (8W-30-10)
1
Z1 18 BK
S111
Z1 18 BK
B
RIGHT FOG LAMP (8W-50-4) (8W-50-5)
DISTRIBUTOR (2.5L) (8W-30-5)
5
C2
Z1 16 BK
G105
HEADLAMP WASHER PUMP (8W-53-4)
A
Z1 14 BK
HEADLAMP WASHER MODULE (8W-53-4)
2
Z1 18 BK
G112 (BUILT-UP -EXPORT)
RIGHT HEADLAMP (8W-50-2)
*3
**2
Z1 18 BK
Z1 16 BK
G107
CONTROLLER ANTI-LOCK BRAKE (8W-35-3)
24
8
Z1 12 BK
Z1 12 BK
G113
* BUILT-UP-EXPORT
** EXCEPT BUILT-UP-EXPORT


GLOVE
BOX
LAMP
(8W-44-2)
1
Z1
20
BK
ASH
RECEIVER
LAMP
(8W-44-4)
2
Z1
20
BK
G200
BODY
CONTROL
MODULE
(8W-45-2)
8
C2
Z2
18
BK/LG
AIRBAG
CONTROL
MODULE
(8W-43-2)
11
C1
Z2
18
BK/LG
G201
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-2)
Z1
18
BK
A/C-
HEATER
CONTROL
(8W-42-2)
1
C2
Z1
12
BK
G202


LEFT TAIL/ STOP LAMP (8W-51-2)
G
Z1 18 BK
LEFT BACK-UP LAMP (8W-51-3)
LEFT TURN LAMP (8W-52-2)
LICENSE LAMP (8W-51-4)
2
LEFT LICENSE LAMP (BUILT-UP -EXPORT) (8W-51-4)
RIGHT LICENSE LAMP (BUILT-UP -EXPORT) (8W-51-4)
LEFT REAR FOG LAMP (BUILT-UP -EXPORT) (8W-51-4)
S410
RIGHT REAR FOG LAMP (BUILT-UP -EXPORT) (8W-51-4)
EXCEPT BUILT- UP-EXPORT
BUILT- UP-EXPORT
C320
S304
CENTER HIGH MOUNTED STOP LAMP (8W-51-2)
1
RIGHT TAIL/ STOP LAMP (8W-51-2)
RIGHT BACK-UP LAMP (8W-51-3)
FUEL PUMP MODULE (8W-30-3)
3
4
Z1 14 BK
Z2 14 BK
G304
S305
B
C305
TRUNK KEY CYLINDER SWITCH (VTSS) (8W-39-2)
Z1 20 BK
5
C300
RIGHT TURN LAMP (8W-52-3)
C301
G300
S301
REAR WINDOW DEFOGGER (8W-48-2)
Z1 12 BK
G302
G303

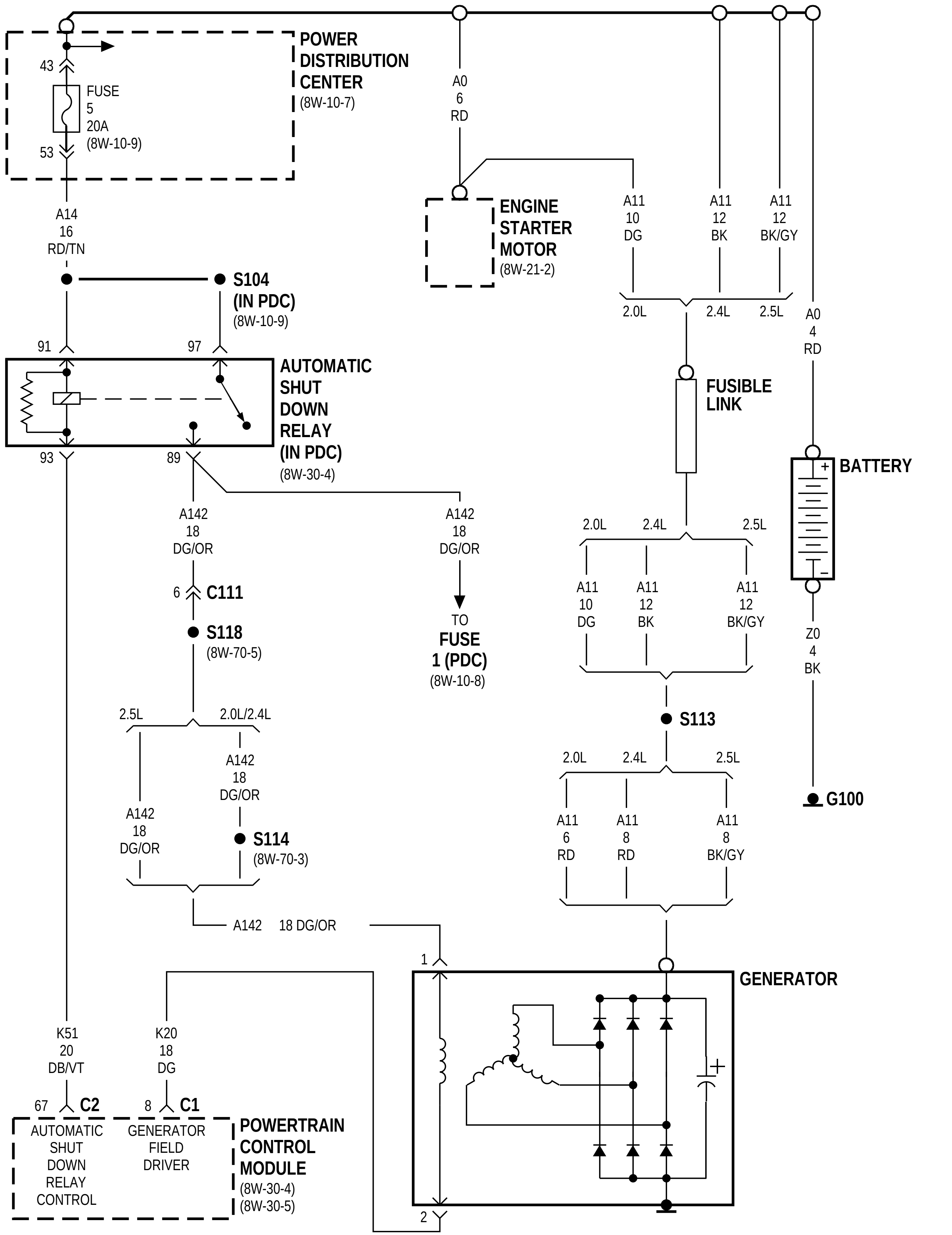

HEATED
SEAT
SWITCH
(8W-63-3)
DRIVER
HEATED
SEAT
MODULE
(8W-63-3)
PASSENGER
HEATED
SEAT
MODULE
(8W-63-3)
6
2
2
Z1
16
BK
Z1
16
BK
Z1
16
BK
S311
(BUILT-UP
-EXPORT)
Z1
16
BK
3
C225
Z1
16
BK
B
TO
PRNDL
ILLUMINATION
LED
(8W-15-8)


OVERHEAD MAP LAMPS (8W-44-2)
A
Z1 20 BK
DOME LAMP (8W-44-2)
A
Z1 20 BK
SUNROOF CONTROL MODULE (8W-64-2)
1
Z1 18 BK
RIGHT VISOR/ VANITY LAMPS (8W-44-3)
B
Z1 20 BK
LEFT VISOR/ VANITY LAMPS (8W-44-3)
B
Z1 20 BK
S303
SEAT BELT SWITCH (EXCEPT BUILT-UP -EXPORT) (8W-40-4)
1
Z1 20 BK
IGNITION SWITCH (8W-10-10)
1 C2
Z1 20 BK
DATA LINK CONNECTOR (8W-30-18)
4
Z1 20 BK
DOME LAMP (8W-44-2)
A
Z1 20 BK
Z1 18 BK
BASE
PREMIUM
HEADLAMP LEVELING SWITCH (BUILT-UP -EXPORT) (8W-50-3)
2
Z1 18 BK
8 C9
15 C5
6 C4
4 C10
8 C11
JUNCTION BLOCK (8W-12-2) (8W-12-3)
DAYTIME RUNNING LAMP MODULE (8W-50-6)
8
BODY CONTROL MODULE (8W-45-2)
10
2 C4
Z1 18 BK/OR
3 C4
Z1 18 BK/TN
7 C4
Z1 20 BK/WT
8 C4
Z13 20 BK/RD
10 C4
Z1 18 BK/YL
9 C4
Z1 18 BK/LB
3 C9
Z1 14 BK
5 C1
MULTI-FUNCTION SWITCH (8W-50-4) (8W-52-2)
Z1 20 BK
3
AUTOSTICK SWITCH (8W-31-8)
2 C1
POWER AMPLIFIER (PREMIUM) (8W-47-4)
FROM C225 (8W-15-7)
B
Z1 16 BK
C
TO G301 (8W-15-9)
1
KEY-IN SWITCH (8W-45-10)
11 C2
INSTRUMENT CLUSTER (8W-40-2)
2
SENTRY KEY IMMOBILIZER MODULE (8W-39-3)
2
PRNDL ILLUMINATION LED (8W-44-4)

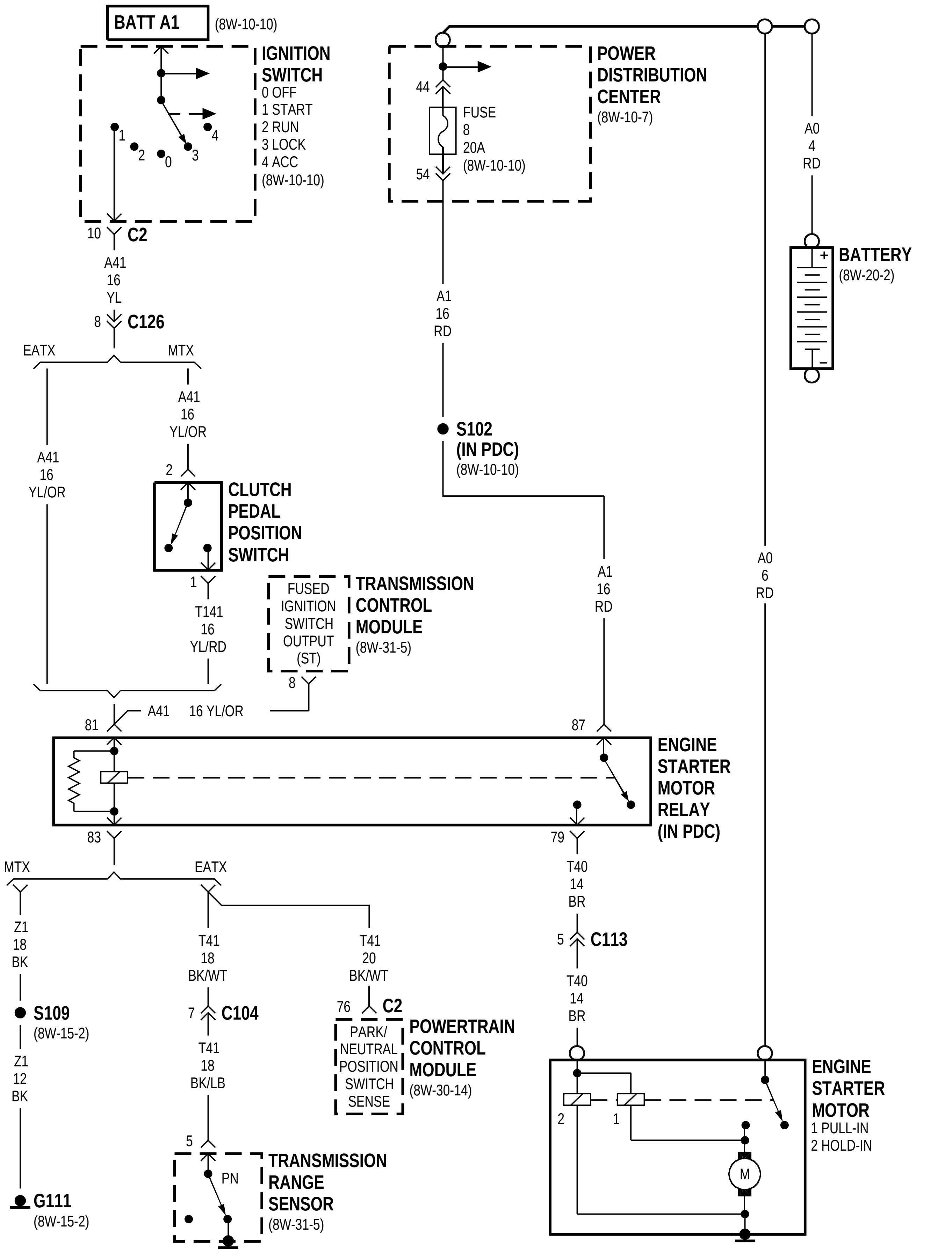


JAI01509 J998W-16

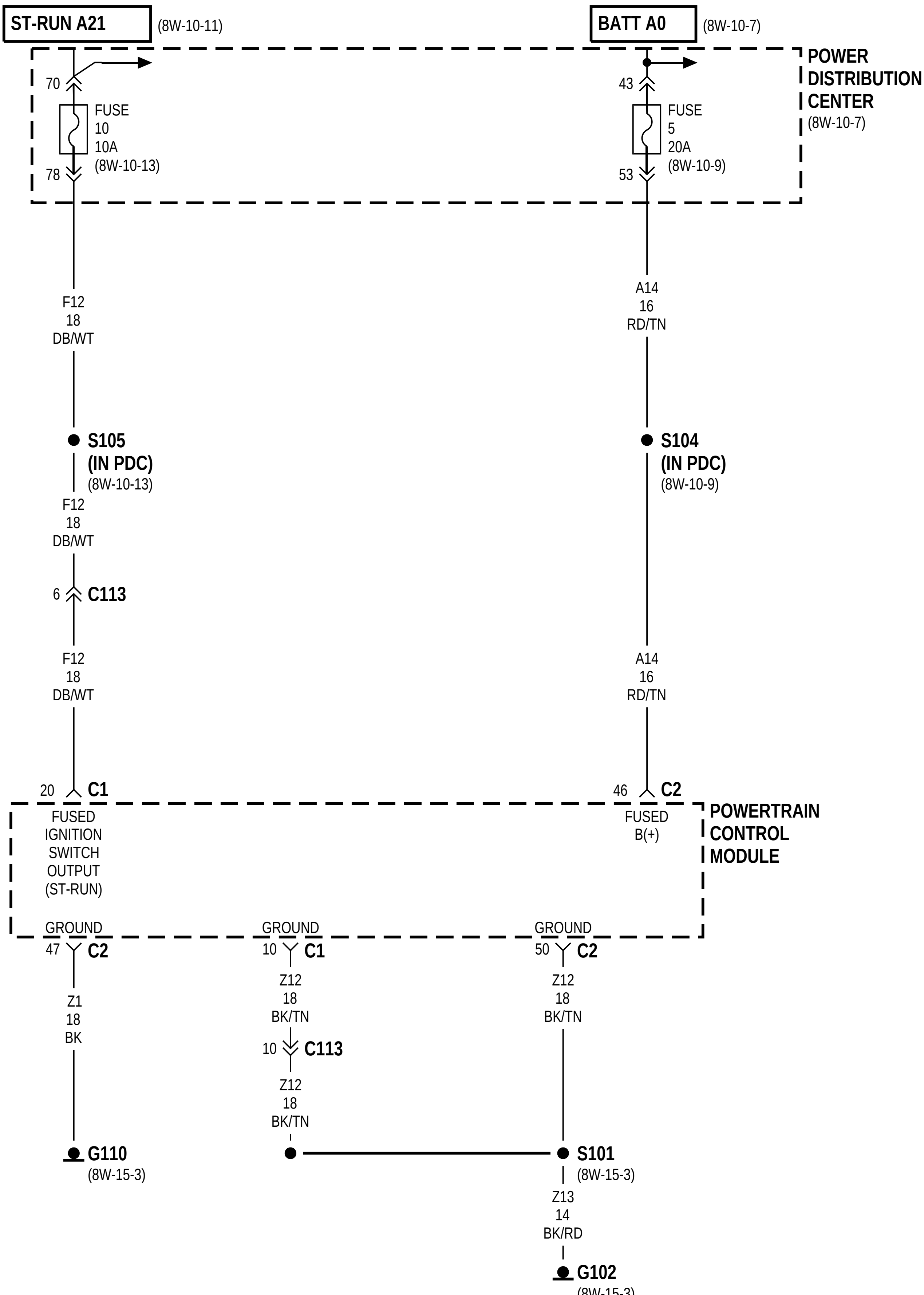
8W-20 CHARGING SYSTEM

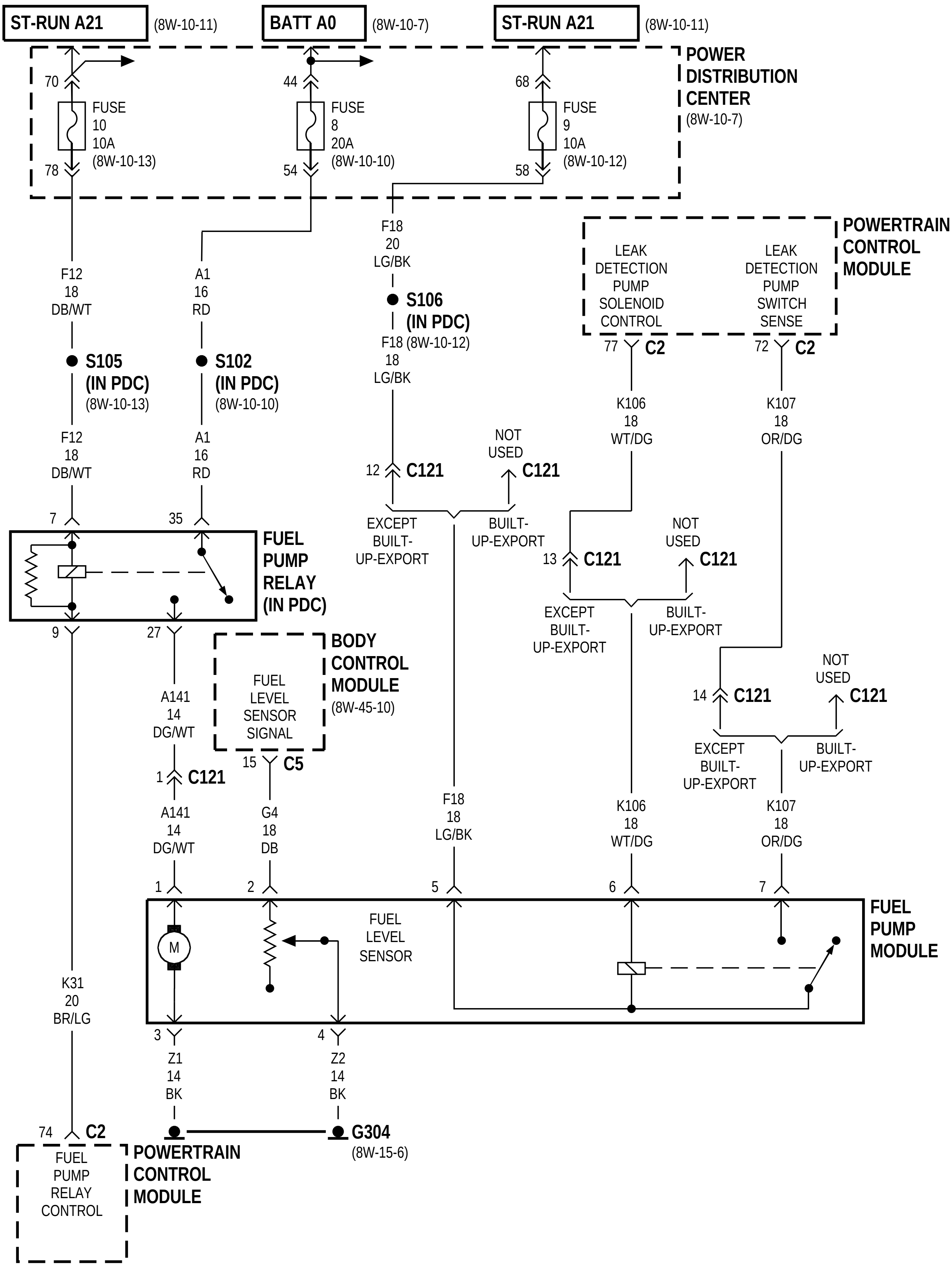

POWER DISTRIBUTION CENTER
(8W-10-7)
43
FUSE
5
20A
(8W-10-9)
53
A14
16
RD/TN
S104
(IN PDC)
(8W-10-9)
91
97
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-4)
93
89
A142
18
DG/OR
A142
18
DG/OR
6
C111
S118
(8W-70-5)
TO FUSE 1 (PDC)
(8W-10-8)
2.5L
2.0L/2.4L
A142
18
DG/OR
A142
18
DG/OR
S114
(8W-70-3)
A142 18 DG/OR
A0
6
RD
ENGINE STARTER MOTOR
(8W-21-2)
A11
10
DG
A11
12
BK
A11
12
BK/GY
2.0L
2.4L
2.5L
A0
4
RD
FUSIBLE LINK
BATTERY
2.0L
2.4L
2.5L
A11
10
DG
A11
12
BK
A11
12
BK/GY
Z0
4
BK
S113
2.0L
2.4L
2.5L
G100
A11
6
RD
A11
8
RD
A11
8
BK/GY
1
2
GENERATOR
K51
20
DB/VT
K20
18
DG
67
C2
8
C1
AUTOMATIC SHUT DOWN RELAY CONTROL
GENERATOR FIELD DRIVER
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-5)

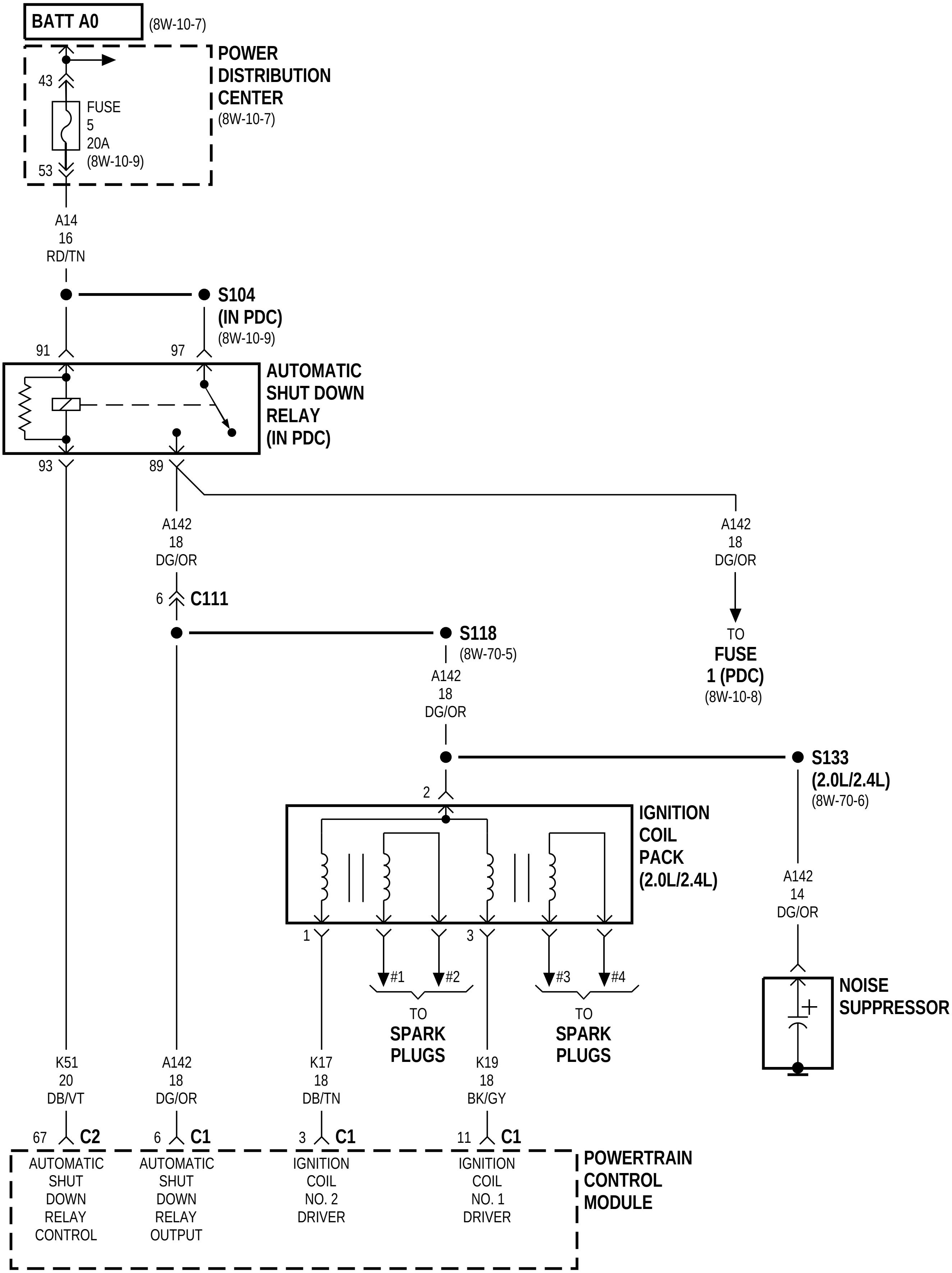
8W-21 STARTING SYSTEM


BATT A1
(8W-10-10)
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-10)
10 C2
A41 16 YL
8 C126
EATX
MTX
A41 16 YL/OR
2
CLUTCH PEDAL POSITION SWITCH
1
T141 16 YL/RD
A41 16 YL/OR
FUSED IGNITION SWITCH OUTPUT (ST)
TRANSMISSION CONTROL MODULE
(8W-31-5)
8
81
A41 16 YL/OR
POWER DISTRIBUTION CENTER
(8W-10-7)
44
FUSE 8 20A (8W-10-10)
54
A1 16 RD
S102 (IN PDC)
(8W-10-10)
A1 16 RD
87
A0 4 RD
BATTERY
(8W-20-2)
A0 6 RD
ENGINE STARTER MOTOR RELAY (IN PDC)
83
79
MTX
EATX
Z1 18 BK
S109
(8W-15-2)
Z1 12 BK
G111
(8W-15-2)
T41 18 BK/WT
7 C104
T41 18 BK/LB
5
PN
TRANSMISSION RANGE SENSOR
(8W-31-5)
T41 20 BK/WT
76 C2
PARK/ NEUTRAL POSITION SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-14)
T40 14 BR
5 C113
T40 14 BR
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN
M

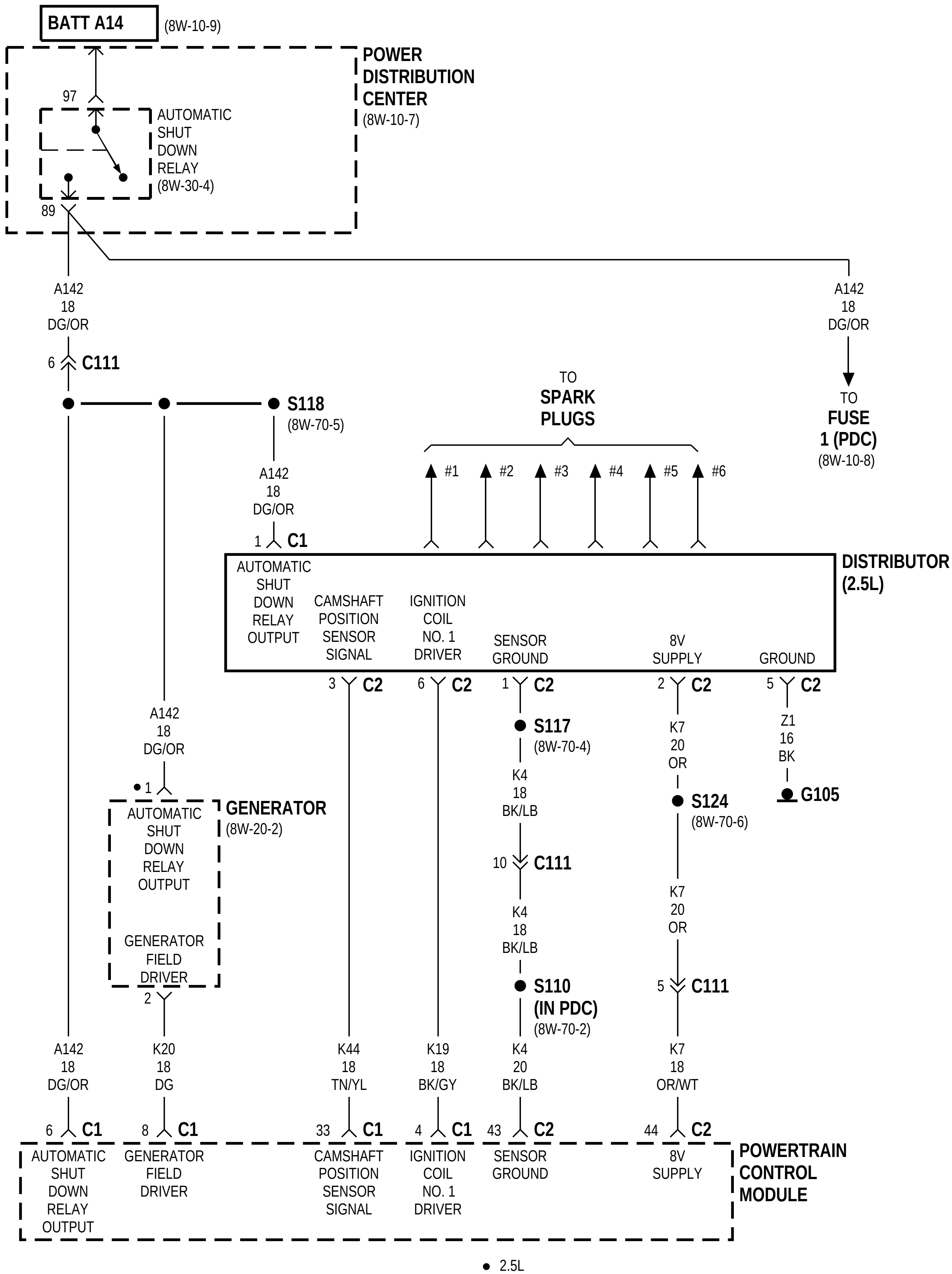
8W-30 FUEL/IGNITION SYSTEM

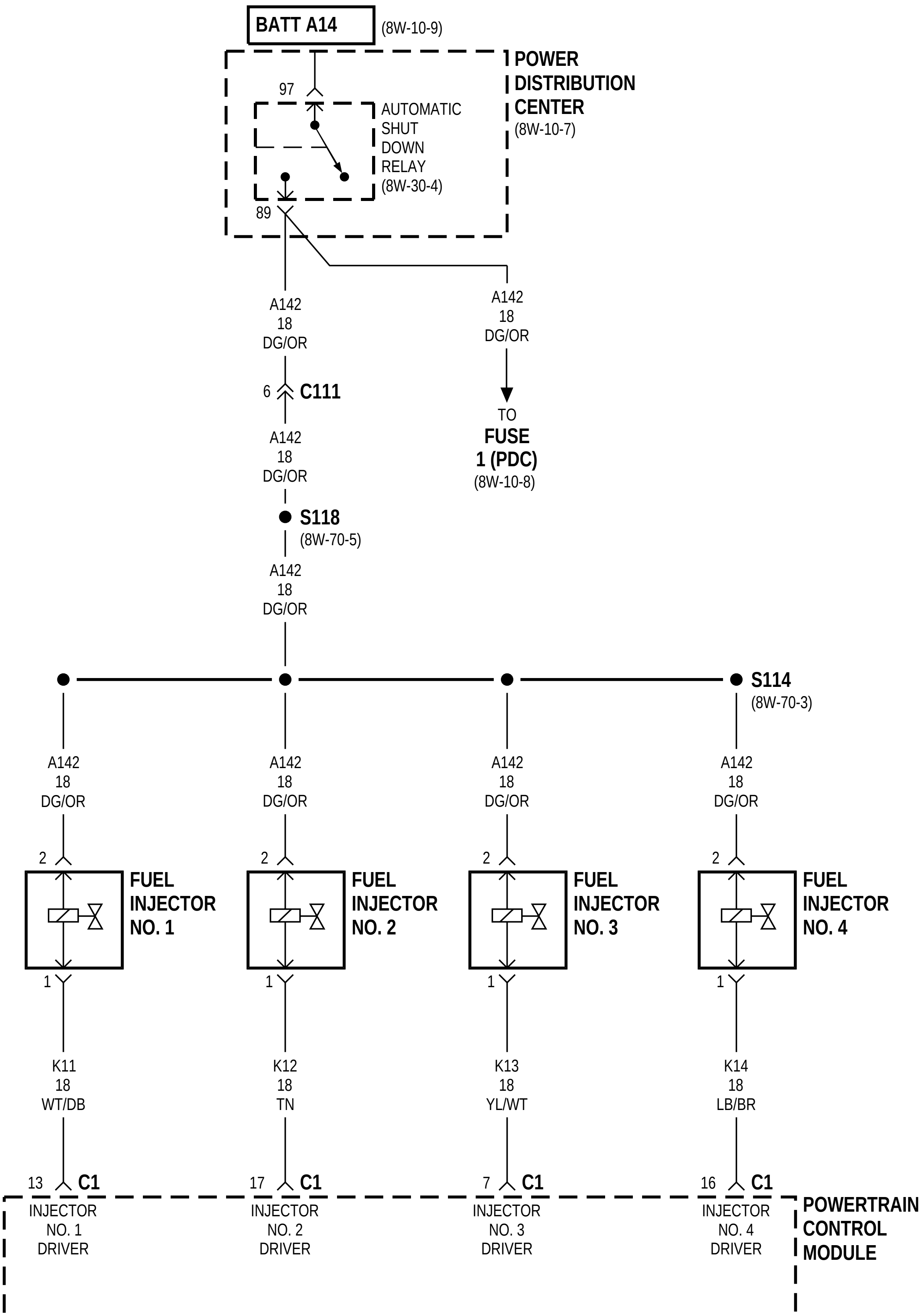

ST-RUN A21
(8W-10-11)
BATT A0
(8W-10-7)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
70
FUSE
10
10A
(8W-10-13)
78
43
FUSE
5
20A
(8W-10-9)
53
F12
18
DB/WT
A14
16
RD/TN
S105
(IN PDC)
(8W-10-13)
S104
(IN PDC)
(8W-10-9)
F12
18
DB/WT
6
C113
F12
18
DB/WT
A14
16
RD/TN
20
C1
46
C2
POWERTRAIN
CONTROL
MODULE
FUSED
IGNITION
SWITCH
OUTPUT
(ST-RUN)
FUSED
B(+)
GROUND
47
C2
GROUND
10
C1
GROUND
50
C2
Z1
18
BK
Z12
18
BK/TN
10
C113
Z12
18
BK/TN
Z12
18
BK/TN
G110
(8W-15-3)
S101
(8W-15-3)
Z13
14
BK/RD
G102
(8W-15-3)

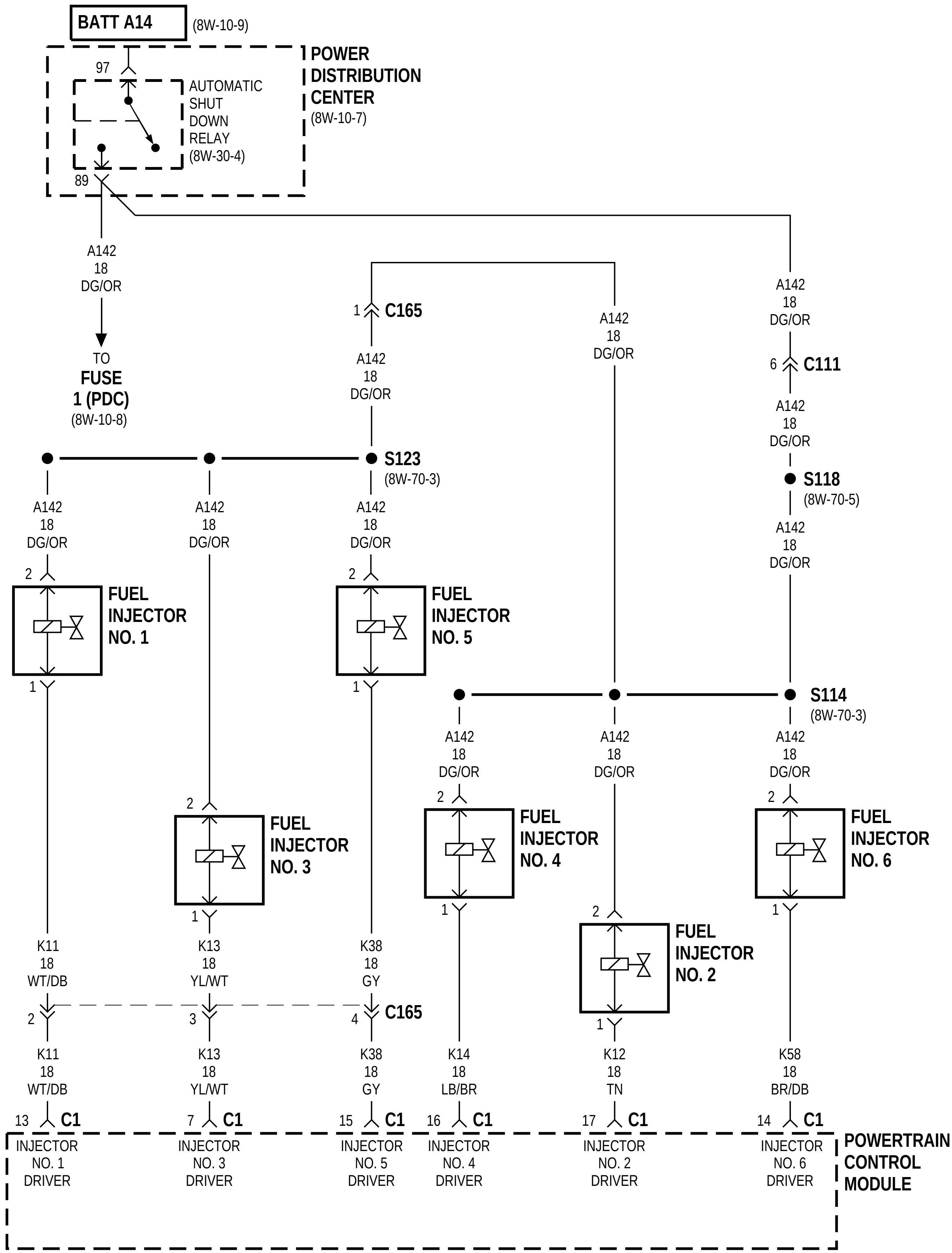

ST-RUN A21
(8W-10-11)
BATT A0
(8W-10-7)
ST-RUN A21
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
70
FUSE 10 10A (8W-10-13)
78
44
FUSE 8 20A (8W-10-10)
54
68
FUSE 9 10A (8W-10-12)
58
F12 18 DB/WT
S105 (IN PDC)
(8W-10-13)
F12 18 DB/WT
A1 16 RD
S102 (IN PDC)
(8W-10-10)
A1 16 RD
F18 20 LG/BK
S106 (IN PDC)
F18 (8W-10-12)
18 LG/BK
POWERTRAIN CONTROL MODULE
LEAK DETECTION PUMP SOLENOID CONTROL
LEAK DETECTION PUMP SWITCH SENSE
77 C2
72 C2
K106 18 WT/DG
K107 18 OR/DG
12 C121
NOT USED C121
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
13 C121
NOT USED C121
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
7
35
FUEL PUMP RELAY (IN PDC)
9
27
BODY CONTROL MODULE
(8W-45-10)
FUEL LEVEL SENSOR SIGNAL
15 C5
A141 14 DG/WT
1 C121
A141 14 DG/WT
G4 18 DB
14 C121
NOT USED C121
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
F18 18 LG/BK
K106 18 WT/DG
K107 18 OR/DG
1
2
5
6
7
M
FUEL LEVEL SENSOR
FUEL PUMP MODULE
K31 20 BR/LG
3
4
Z1 14 BK
Z2 14 BK
74 C2
G304
(8W-15-6)
FUEL PUMP RELAY CONTROL
POWERTRAIN CONTROL MODULE

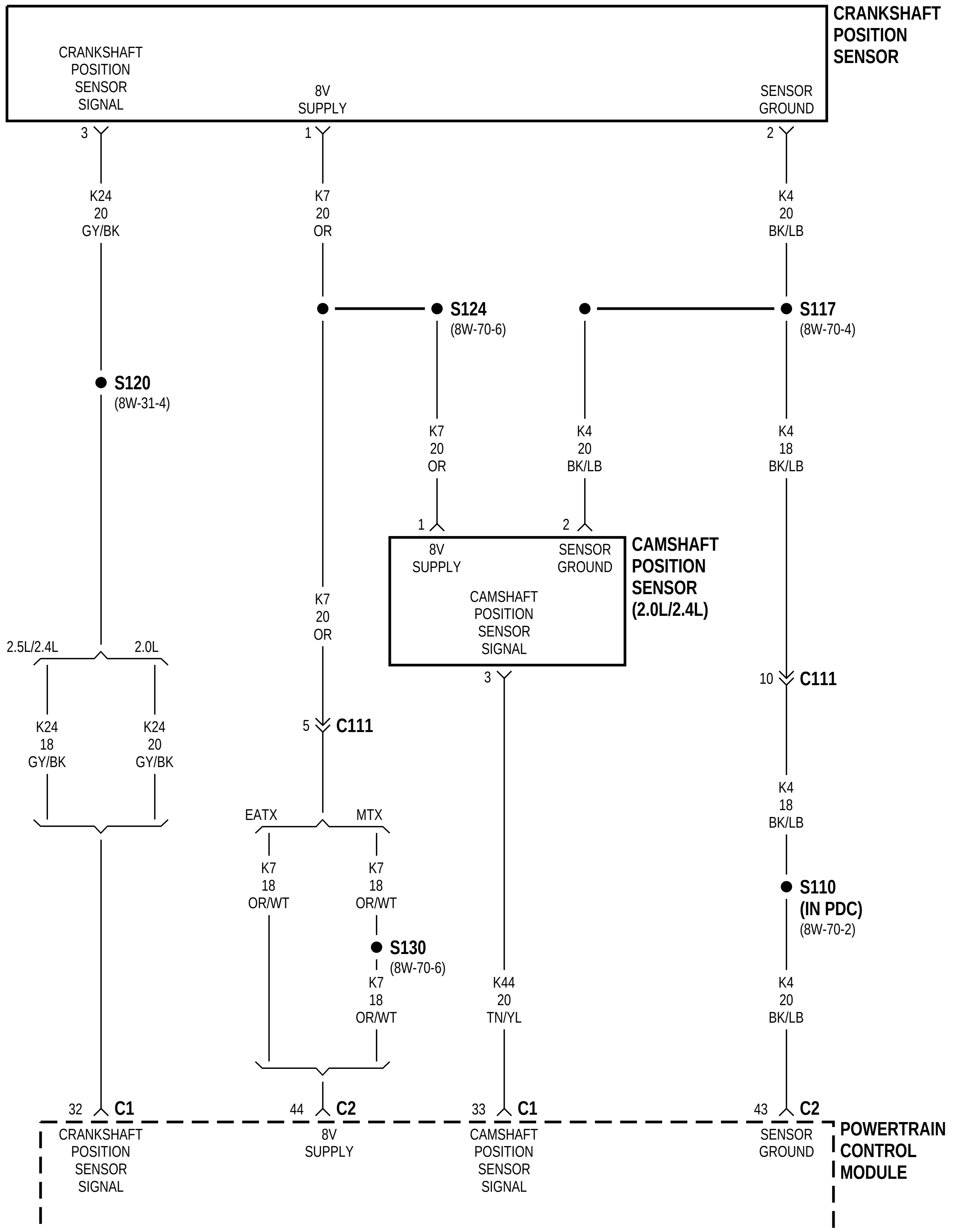


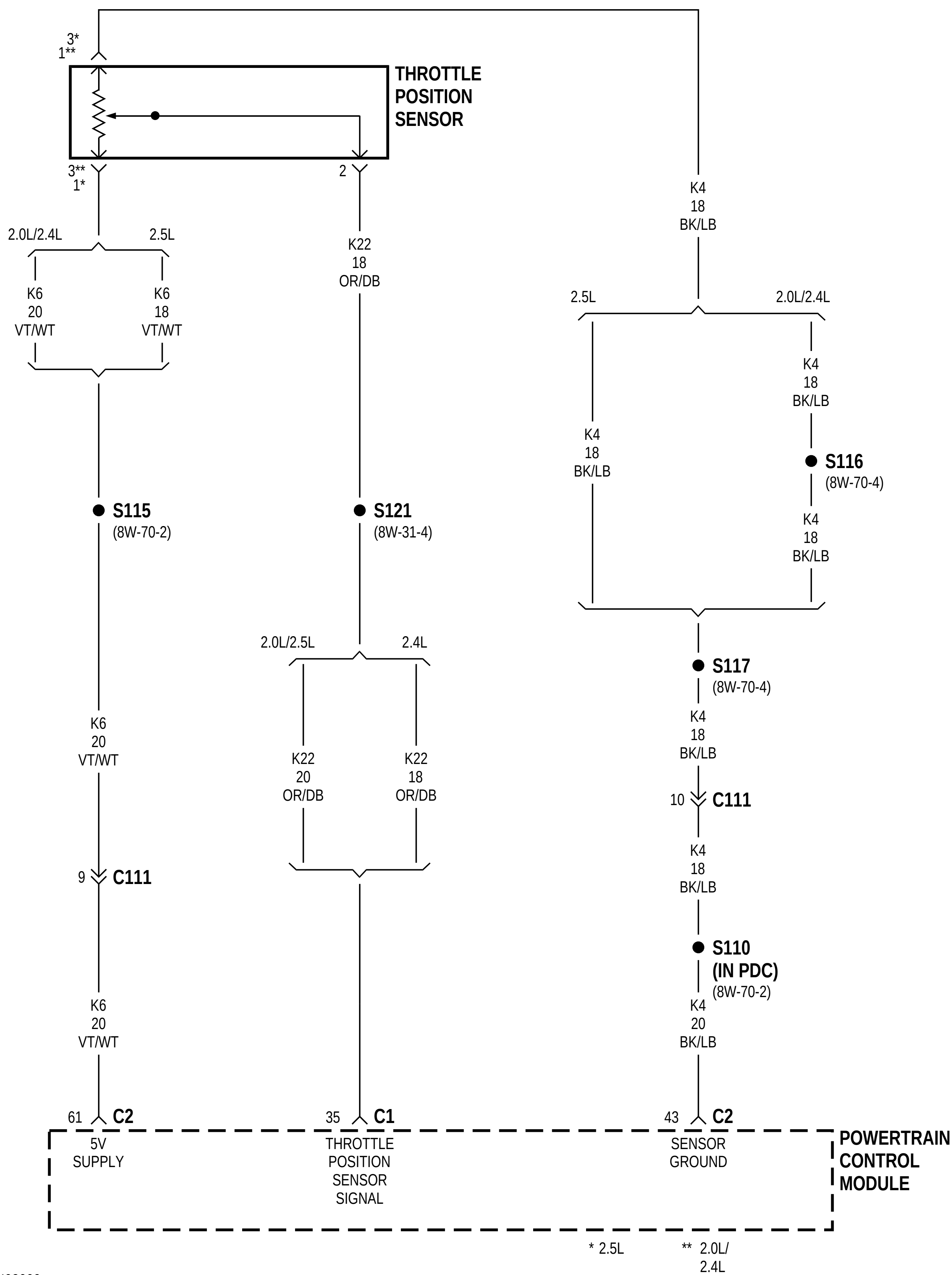
BATT A0
(8W-10-7)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
43
FUSE
5
20A
(8W-10-9)
53
A14
16
RD/TN
S104
(IN PDC)
(8W-10-9)
91
97
AUTOMATIC
SHUT DOWN
RELAY
(IN PDC)
93
89
A142
18
DG/OR
A142
18
DG/OR
6
C111
S118
(8W-70-5)
A142
18
DG/OR
TO
FUSE
1 (PDC)
(8W-10-8)
S133
(2.0L/2.4L)
(8W-70-6)
2
IGNITION
COIL
PACK
(2.0L/2.4L)
A142
14
DG/OR
1
3
#1
#2
#3
#4
TO
SPARK
PLUGS
TO
SPARK
PLUGS
NOISE
SUPPRESSOR
K51
20
DB/VT
A142
18
DG/OR
K17
18
DB/TN
K19
18
BK/GY
67 C2
6 C1
3 C1
11 C1
AUTOMATIC
SHUT
DOWN
RELAY
CONTROL
AUTOMATIC
SHUT
DOWN
RELAY
OUTPUT
IGNITION
COIL
NO. 2
DRIVER
IGNITION
COIL
NO. 1
DRIVER
POWERTRAIN
CONTROL
MODULE

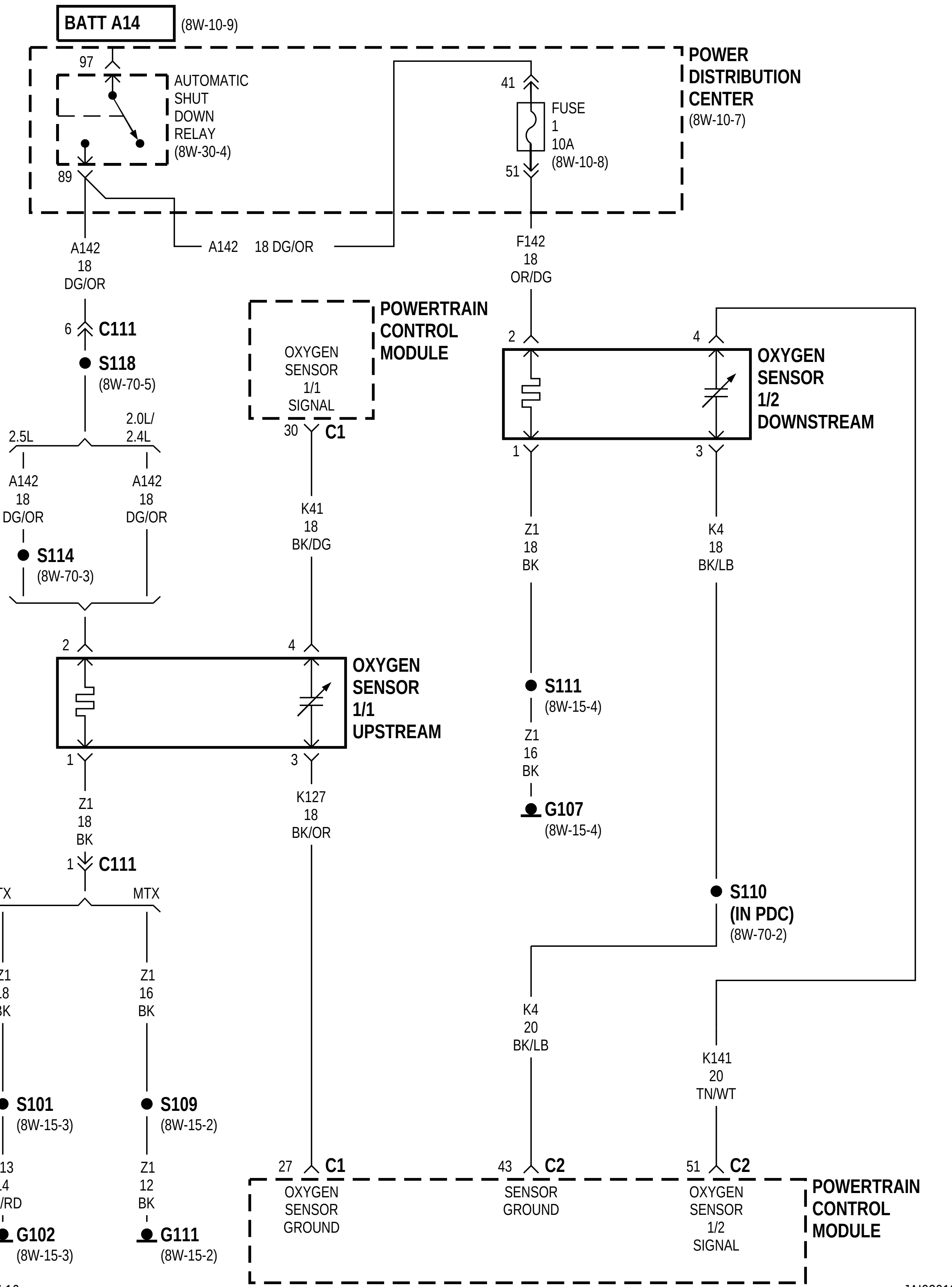

BATT A14
(8W-10-9)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
97
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-4)
89
A142
18
DG/OR
A142
18
DG/OR
6
C111
S118
(8W-70-5)
TO
FUSE
1 (PDC)
(8W-10-8)
TO
SPARK
PLUGS
#1
#2
#3
#4
#5
#6
A142
18
DG/OR
1
C1
DISTRIBUTOR
(2.5L)
AUTOMATIC
SHUT
DOWN
RELAY
OUTPUT
CAMSHAFT
POSITION
SENSOR
SIGNAL
IGNITION
COIL
NO. 1
DRIVER
SENSOR
GROUND
8V
SUPPLY
GROUND
3
C2
6
C2
1
C2
2
C2
5
C2
S117
(8W-70-4)
K7
20
OR
Z1
16
BK
G105
S124
(8W-70-6)
K4
18
BK/LB
10
C111
K4
18
BK/LB
K7
20
OR
5
C111
S110
(IN PDC)
(8W-70-2)
A142
18
DG/OR
1
GENERATOR
(8W-20-2)
AUTOMATIC
SHUT
DOWN
RELAY
OUTPUT
GENERATOR
FIELD
DRIVER
2
A142
18
DG/OR
K20
18
DG
K44
18
TN/YL
K19
18
BK/GY
K4
20
BK/LB
K7
18
OR/WT
6
C1
8
C1
33
C1
4
C1
43
C2
44
C2
POWERTRAIN
CONTROL
MODULE
AUTOMATIC
SHUT
DOWN
RELAY
OUTPUT
GENERATOR
FIELD
DRIVER
CAMSHAFT
POSITION
SENSOR
SIGNAL
IGNITION
COIL
NO. 1
DRIVER
SENSOR
GROUND
8V
SUPPLY
● 2.5L

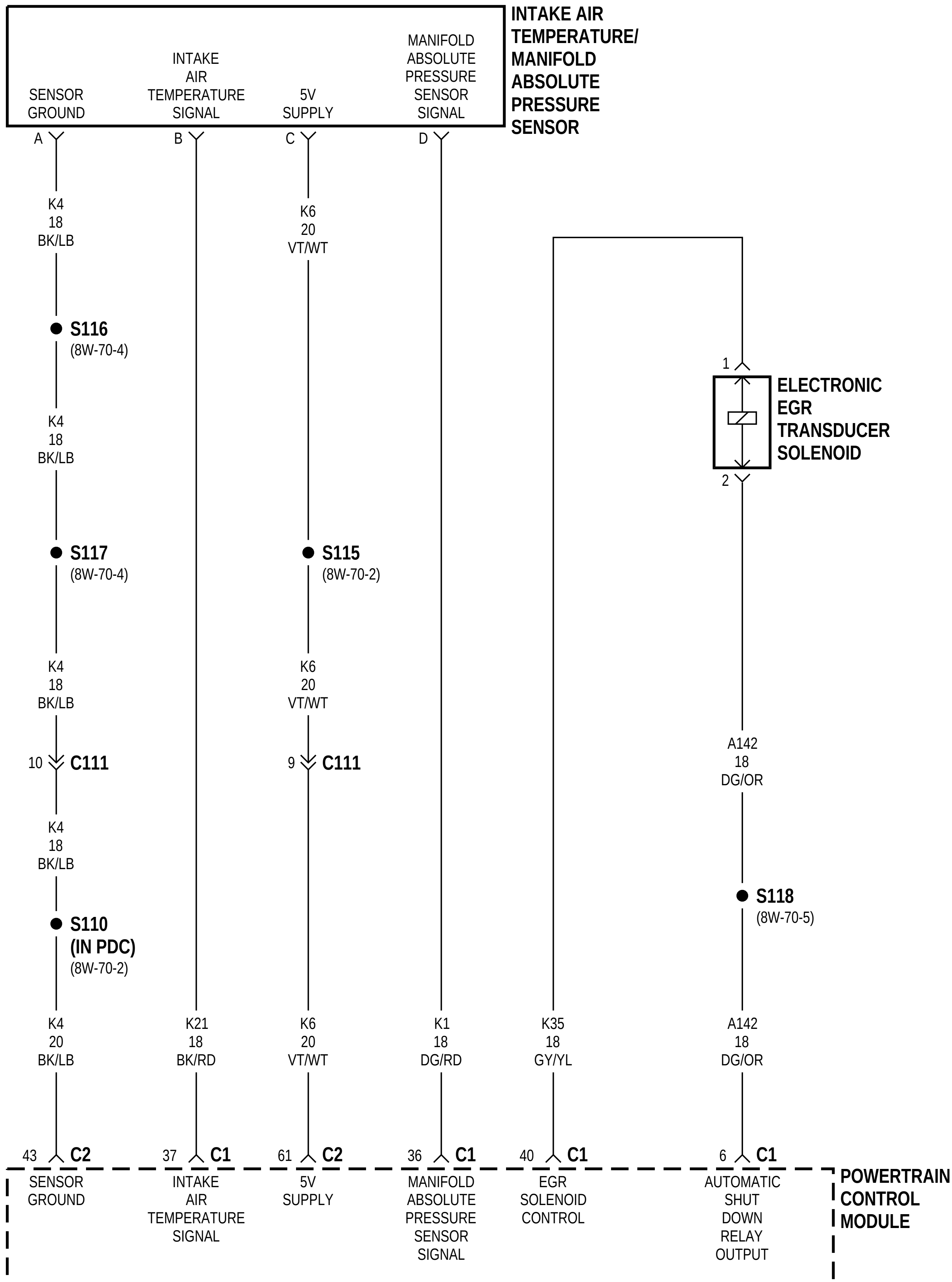

BATT A14
(8W-10-9)
97
AUTOMATIC SHUT DOWN RELAY
(8W-30-4)
POWER DISTRIBUTION CENTER
(8W-10-7)
89
A142 18 DG/OR
A142 18 DG/OR
6
C111
TO
FUSE 1 (PDC)
(8W-10-8)
A142 18 DG/OR
S118
(8W-70-5)
A142 18 DG/OR
S114
(8W-70-3)
A142 18 DG/OR
A142 18 DG/OR
A142 18 DG/OR
A142 18 DG/OR
2
2
2
2
FUEL INJECTOR NO. 1
FUEL INJECTOR NO. 2
FUEL INJECTOR NO. 3
FUEL INJECTOR NO. 4
1
1
1
1
K11 18 WT/DB
K12 18 TN
K13 18 YL/WT
K14 18 LB/BR
13 C1
17 C1
7 C1
16 C1
INJECTOR NO. 1 DRIVER
INJECTOR NO. 2 DRIVER
INJECTOR NO. 3 DRIVER
INJECTOR NO. 4 DRIVER
POWERTRAIN CONTROL MODULE

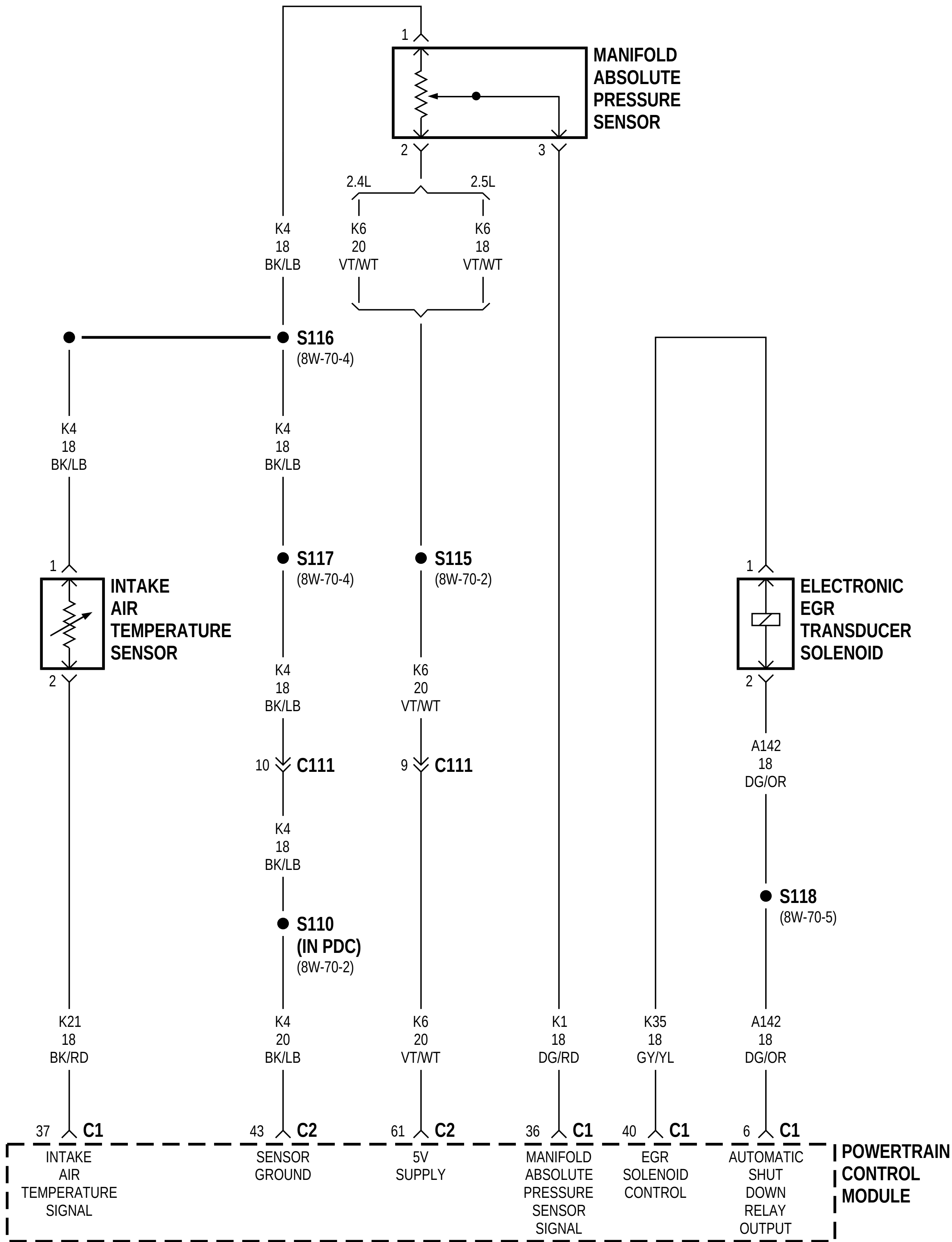

BATT A14
(8W-10-9)
97
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-4)
89
POWER
DISTRIBUTION
CENTER
(8W-10-7)
A142
18
DG/OR
TO
FUSE
1 (PDC)
(8W-10-8)
C165
C111
S123
(8W-70-3)
S118
(8W-70-5)
S114
(8W-70-3)
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 5
FUEL
INJECTOR
NO. 4
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 6
K11
18
WT/DB
K13
18
YL/WT
K38
18
GY
K14
18
LB/BR
K12
18
TN
K58
18
BR/DB
C1
INJECTOR
NO. 1
DRIVER
INJECTOR
NO. 3
DRIVER
INJECTOR
NO. 5
DRIVER
INJECTOR
NO. 4
DRIVER
INJECTOR
NO. 2
DRIVER
INJECTOR
NO. 6
DRIVER
POWERTRAIN
CONTROL
MODULE

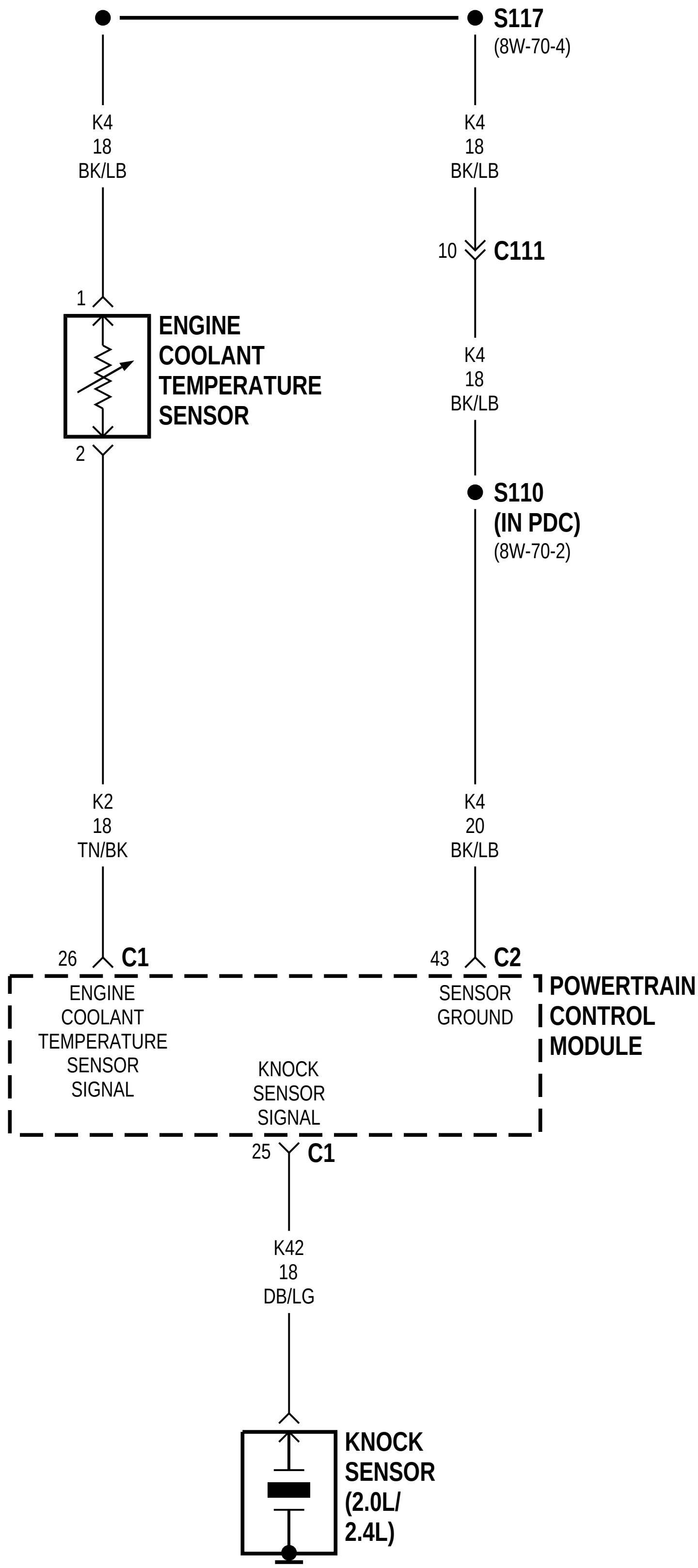

CRANKSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR SIGNAL
8V SUPPLY
SENSOR GROUND
3
1
2
K24 20 GY/BK
K7 20 OR
K4 20 BK/LB
S124 (8W-70-6)
S117 (8W-70-4)
S120 (8W-31-4)
K7 20 OR
K4 20 BK/LB
K4 18 BK/LB
1
2
8V SUPPLY
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
CAMSHAFT POSITION SENSOR (2.0L/2.4L)
3
K7 20 OR
2.5L/2.4L
2.0L
10 C111
5 C111
K24 18 GY/BK
K24 20 GY/BK
K4 18 BK/LB
EATX
MTX
K7 18 OR/WT
K7 18 OR/WT
S110 (IN PDC) (8W-70-2)
S130 (8W-70-6)
K7 18 OR/WT
K44 20 TN/YL
K4 20 BK/LB
32 C1
44 C2
33 C1
43 C2
CRANKSHAFT POSITION SENSOR SIGNAL
8V SUPPLY
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
POWERTRAIN CONTROL MODULE

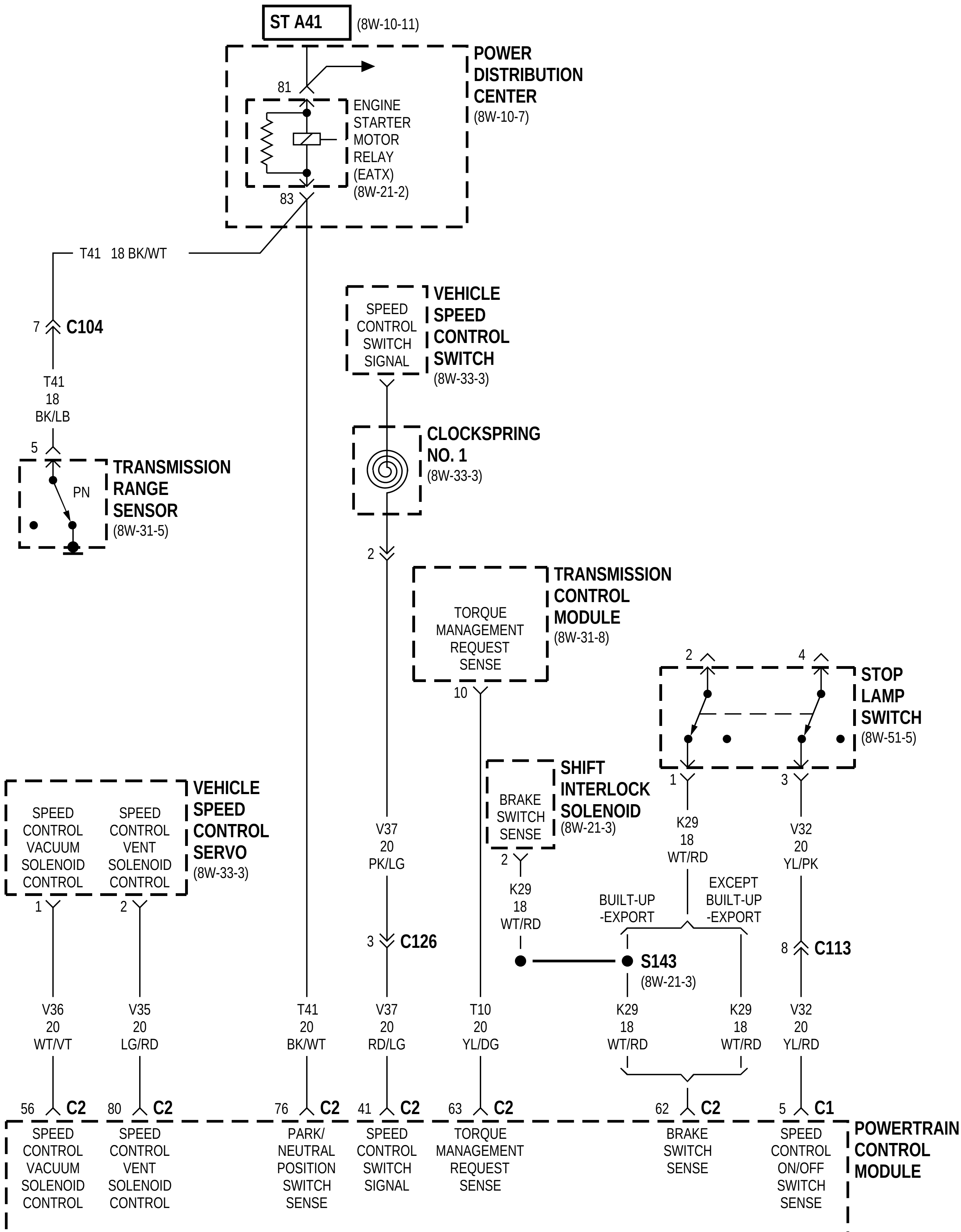

THROTTLE POSITION SENSOR
3*
1**
3**
1*
2
2.0L/2.4L
2.5L
K6
20
VT/WT
K6
18
VT/WT
K22
18
OR/DB
K4
18
BK/LB
2.5L
2.0L/2.4L
S115
(8W-70-2)
S121
(8W-31-4)
S116
(8W-70-4)
2.0L/2.5L
2.4L
K22
20
OR/DB
K22
18
OR/DB
S117
(8W-70-4)
10 C111
9 C111
S110
(IN PDC)
(8W-70-2)
K4
20
BK/LB
61 C2
35 C1
43 C2
5V SUPPLY
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
POWERTRAIN CONTROL MODULE
* 2.5L
** 2.0L/ 2.4L

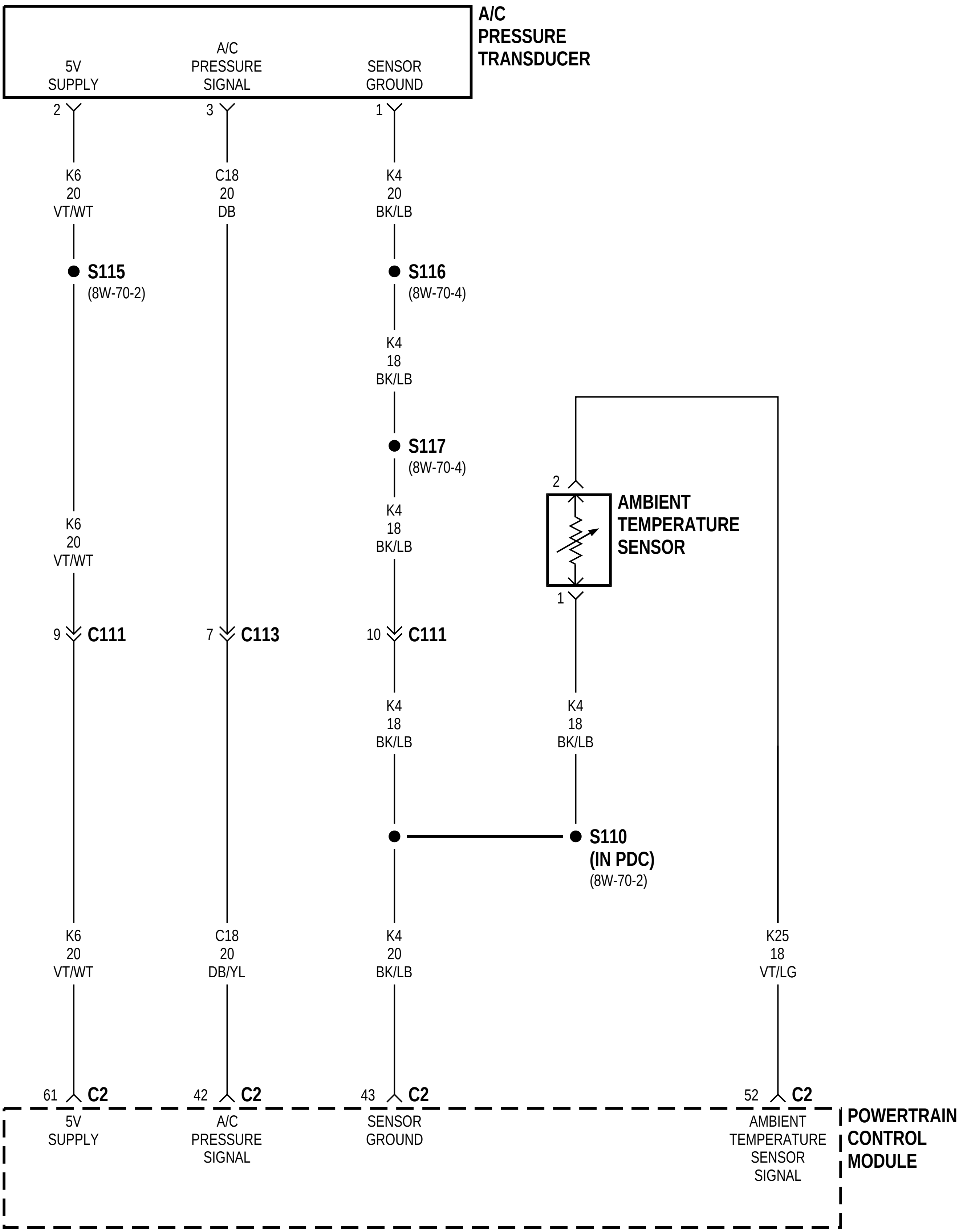

BATT A14
(8W-10-9)
97
AUTOMATIC SHUT DOWN RELAY
(8W-30-4)
89
41
FUSE 1 10A
(8W-10-8)
51
POWER DISTRIBUTION CENTER
(8W-10-7)
A142 18 DG/OR
A142 18 DG/OR
F142 18 OR/DG
6 C111
S118
(8W-70-5)
POWERTRAIN CONTROL MODULE
OXYGEN SENSOR 1/1 SIGNAL
30 C1
2.5L
2.0L/2.4L
A142 18 DG/OR
A142 18 DG/OR
S114
(8W-70-3)
K41 18 BK/DG
2
4
OXYGEN SENSOR 1/2 DOWNSTREAM
1
3
Z1 18 BK
K4 18 BK/LB
2
4
OXYGEN SENSOR 1/1 UPSTREAM
1
3
S111
(8W-15-4)
Z1 16 BK
G107
(8W-15-4)
Z1 18 BK
K127 18 BK/OR
1 C111
EATX
MTX
S110 (IN PDC)
(8W-70-2)
Z1 18 BK
Z1 16 BK
K4 20 BK/LB
K141 20 TN/WT
S101
(8W-15-3)
S109
(8W-15-2)
Z13 14 BK/RD
Z1 12 BK
27 C1
43 C2
51 C2
OXYGEN SENSOR GROUND
SENSOR GROUND
OXYGEN SENSOR 1/2 SIGNAL
POWERTRAIN CONTROL MODULE
G102
(8W-15-3)
G111
(8W-15-2)

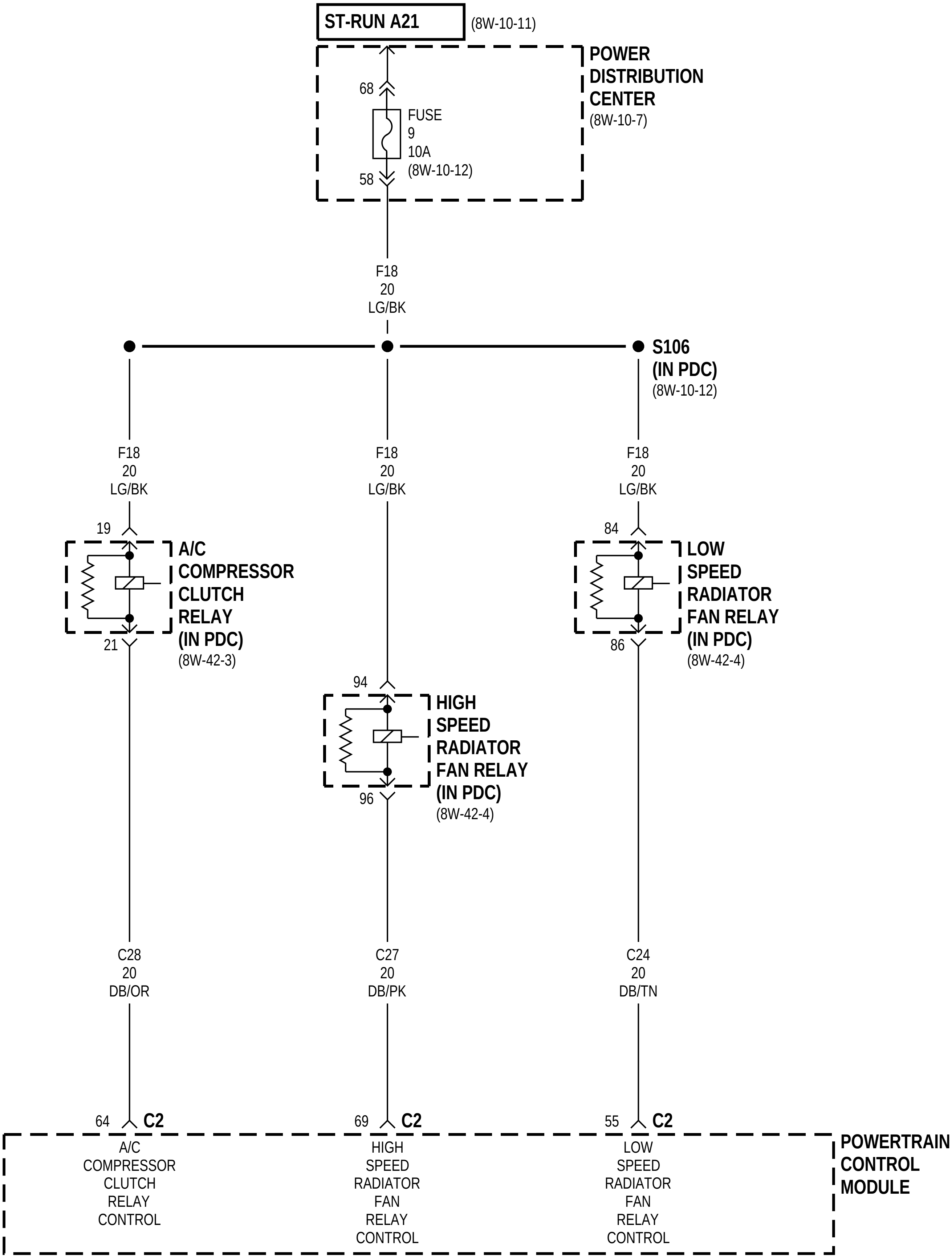

INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE SENSOR
SENSOR GROUND
INTAKE AIR TEMPERATURE SIGNAL
5V SUPPLY
MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
A
B
C
D
K4 18 BK/LB
K6 20 VT/WT
S116 (8W-70-4)
K4 18 BK/LB
S117 (8W-70-4)
S115 (8W-70-2)
K4 18 BK/LB
K6 20 VT/WT
10 C111
9 C111
K4 18 BK/LB
S110 (IN PDC) (8W-70-2)
1
2
ELECTRONIC EGR TRANSDUCER SOLENOID
A142 18 DG/OR
S118 (8W-70-5)
K4 20 BK/LB
K21 18 BK/RD
K6 20 VT/WT
K1 18 DG/RD
K35 18 GY/YL
A142 18 DG/OR
43 C2
37 C1
61 C2
36 C1
40 C1
6 C1
SENSOR GROUND
INTAKE AIR TEMPERATURE SIGNAL
5V SUPPLY
MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
EGR SOLENOID CONTROL
AUTOMATIC SHUT DOWN RELAY OUTPUT
POWERTRAIN CONTROL MODULE


1
MANIFOLD ABSOLUTE PRESSURE SENSOR
2
3
2.4L
2.5L
K4 18 BK/LB
K6 20 VT/WT
K6 18 VT/WT
S116
(8W-70-4)
K4 18 BK/LB
K4 18 BK/LB
1
INTAKE AIR TEMPERATURE SENSOR
2
S117
(8W-70-4)
S115
(8W-70-2)
1
ELECTRONIC EGR TRANSDUCER SOLENOID
2
K4 18 BK/LB
K6 20 VT/WT
A142 18 DG/OR
10
C111
9
C111
K4 18 BK/LB
S118
(8W-70-5)
S110
(IN PDC)
(8W-70-2)
K21 18 BK/RD
K4 20 BK/LB
K6 20 VT/WT
K1 18 DG/RD
K35 18 GY/YL
A142 18 DG/OR
37 C1
43 C2
61 C2
36 C1
40 C1
6 C1
INTAKE AIR TEMPERATURE SIGNAL
SENSOR GROUND
5V SUPPLY
MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
EGR SOLENOID CONTROL
AUTOMATIC SHUT DOWN RELAY OUTPUT
POWERTRAIN CONTROL MODULE

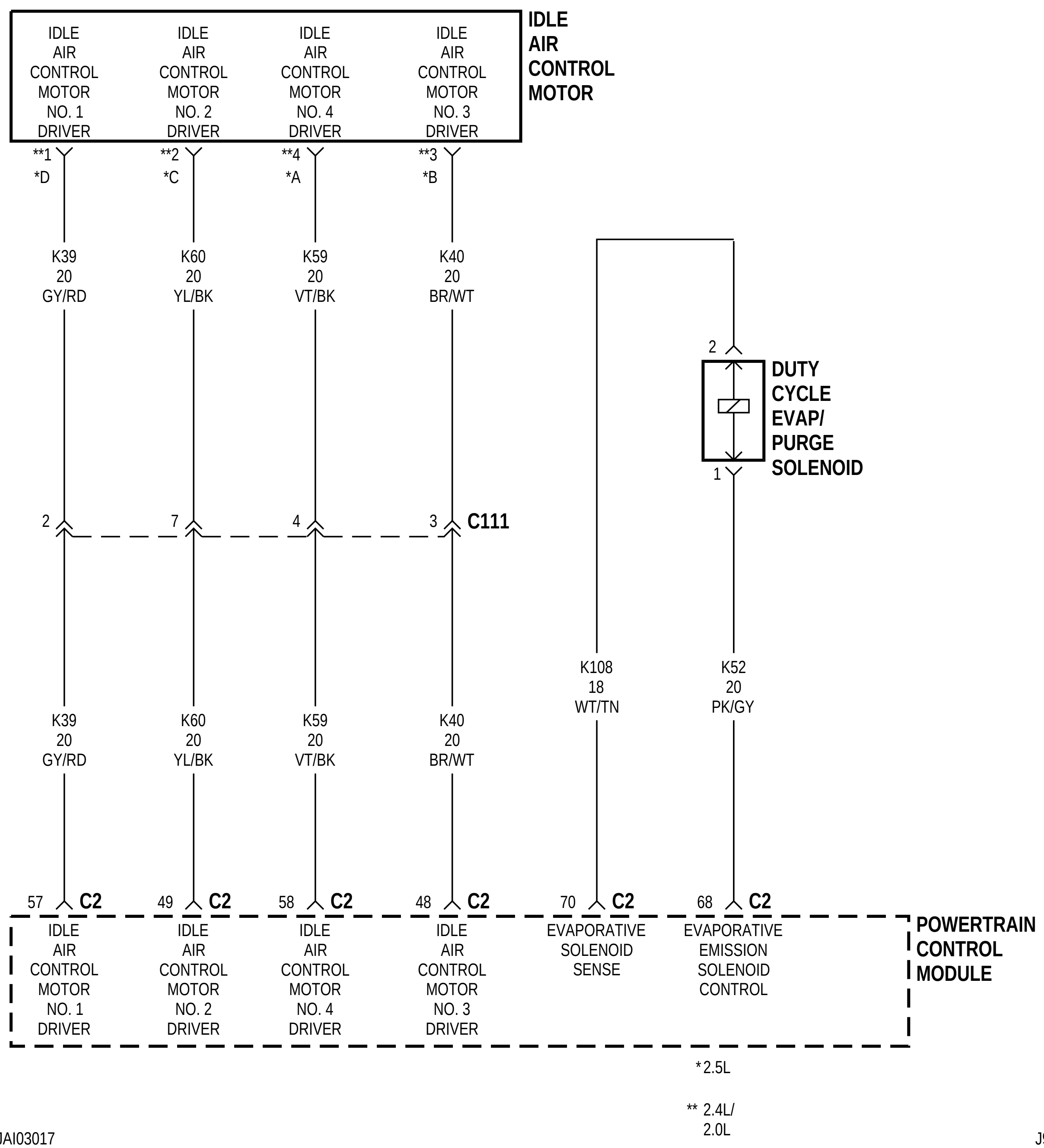

S117
(8W-70-4)
K4
18
BK/LB
K4
18
BK/LB
10
C111
1
ENGINE
COOLANT
TEMPERATURE
SENSOR
2
K4
18
BK/LB
S110
(IN PDC)
(8W-70-2)
K2
18
TN/BK
K4
20
BK/LB
26
C1
43
C2
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE
KNOCK
SENSOR
SIGNAL
25
C1
K42
18
DB/LG
KNOCK
SENSOR
(2.0L/
2.4L)

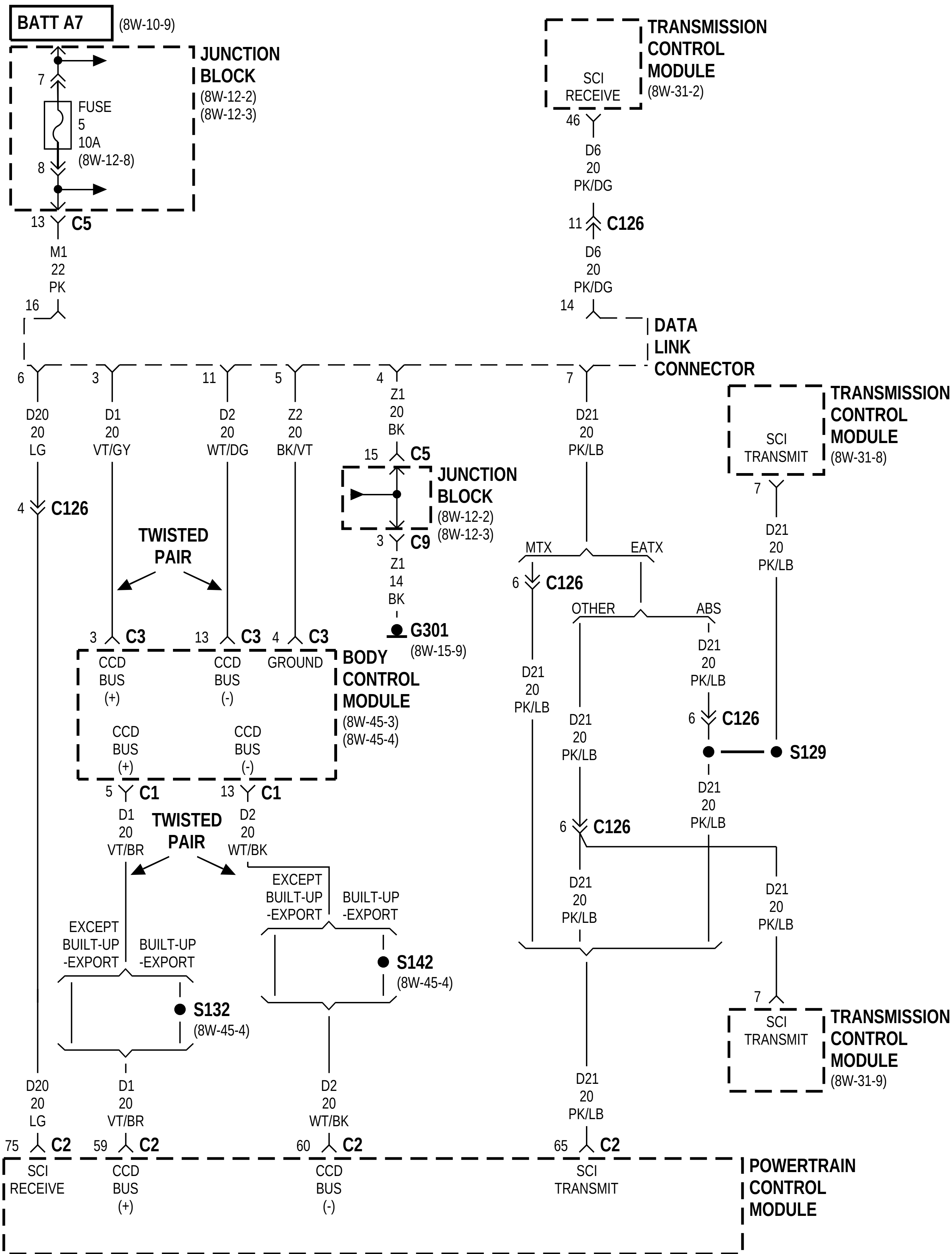

ST A41
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
81
83
ENGINE STARTER MOTOR RELAY (EATX)
(8W-21-2)
T41 18 BK/WT
7 C104
T41 18 BK/LB
5
TRANSMISSION RANGE SENSOR
(8W-31-5)
PN
VEHICLE SPEED CONTROL SWITCH
(8W-33-3)
SPEED CONTROL SWITCH SIGNAL
CLOCKSPRING NO. 1
(8W-33-3)
2
TRANSMISSION CONTROL MODULE
(8W-31-8)
TORQUE MANAGEMENT REQUEST SENSE
10
STOP LAMP SWITCH
(8W-51-5)
2
4
1
3
SHIFT INTERLOCK SOLENOID
(8W-21-3)
BRAKE SWITCH SENSE
2
K29 18 WT/RD
V32 20 YL/PK
V37 20 PK/LG
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
1
2
BUILT-UP -EXPORT
EXCEPT BUILT-UP -EXPORT
3 C126
8 C113
S143
(8W-21-3)
V36 20 WT/VT
V35 20 LG/RD
T41 20 BK/WT
V37 20 RD/LG
T10 20 YL/DG
K29 18 WT/RD
K29 18 WT/RD
V32 20 YL/RD
56 C2
80 C2
76 C2
41 C2
63 C2
62 C2
5 C1
POWERTRAIN CONTROL MODULE
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
PARK/ NEUTRAL POSITION SWITCH SENSE
SPEED CONTROL SWITCH SIGNAL
TORQUE MANAGEMENT REQUEST SENSE
BRAKE SWITCH SENSE
SPEED CONTROL ON/OFF SWITCH SENSE

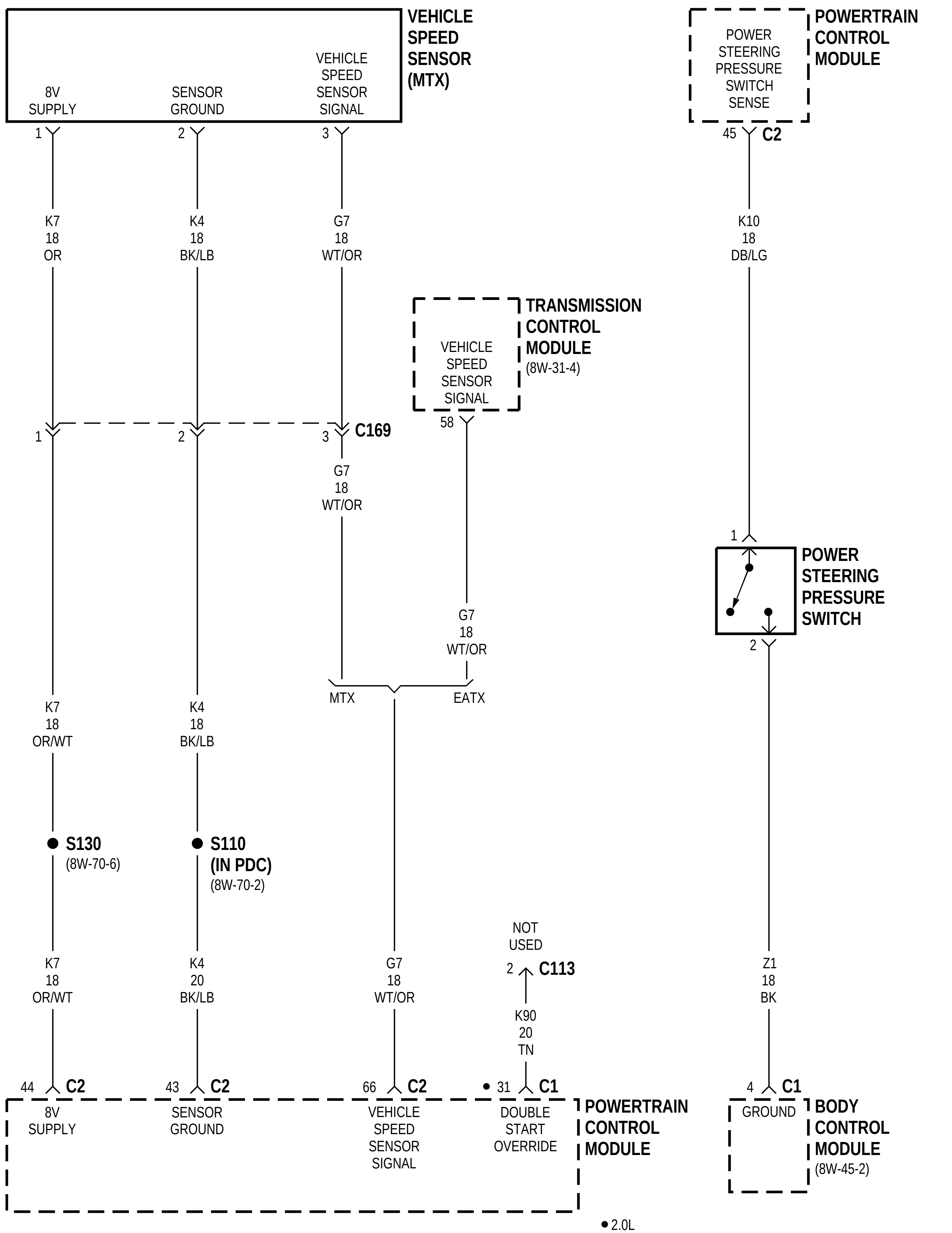

A/C PRESSURE TRANSDUCER
5V SUPPLY
A/C PRESSURE SIGNAL
SENSOR GROUND
2
3
1
K6 20 VT/WT
C18 20 DB
K4 20 BK/LB
S115 (8W-70-2)
S116 (8W-70-4)
K4 18 BK/LB
S117 (8W-70-4)
K4 18 BK/LB
K6 20 VT/WT
2
AMBIENT TEMPERATURE SENSOR
1
9 C111
7 C113
10 C111
K4 18 BK/LB
K4 18 BK/LB
S110 (IN PDC) (8W-70-2)
K6 20 VT/WT
C18 20 DB/YL
K4 20 BK/LB
K25 18 VT/LG
61 C2
42 C2
43 C2
52 C2
5V SUPPLY
A/C PRESSURE SIGNAL
SENSOR GROUND
AMBIENT TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE



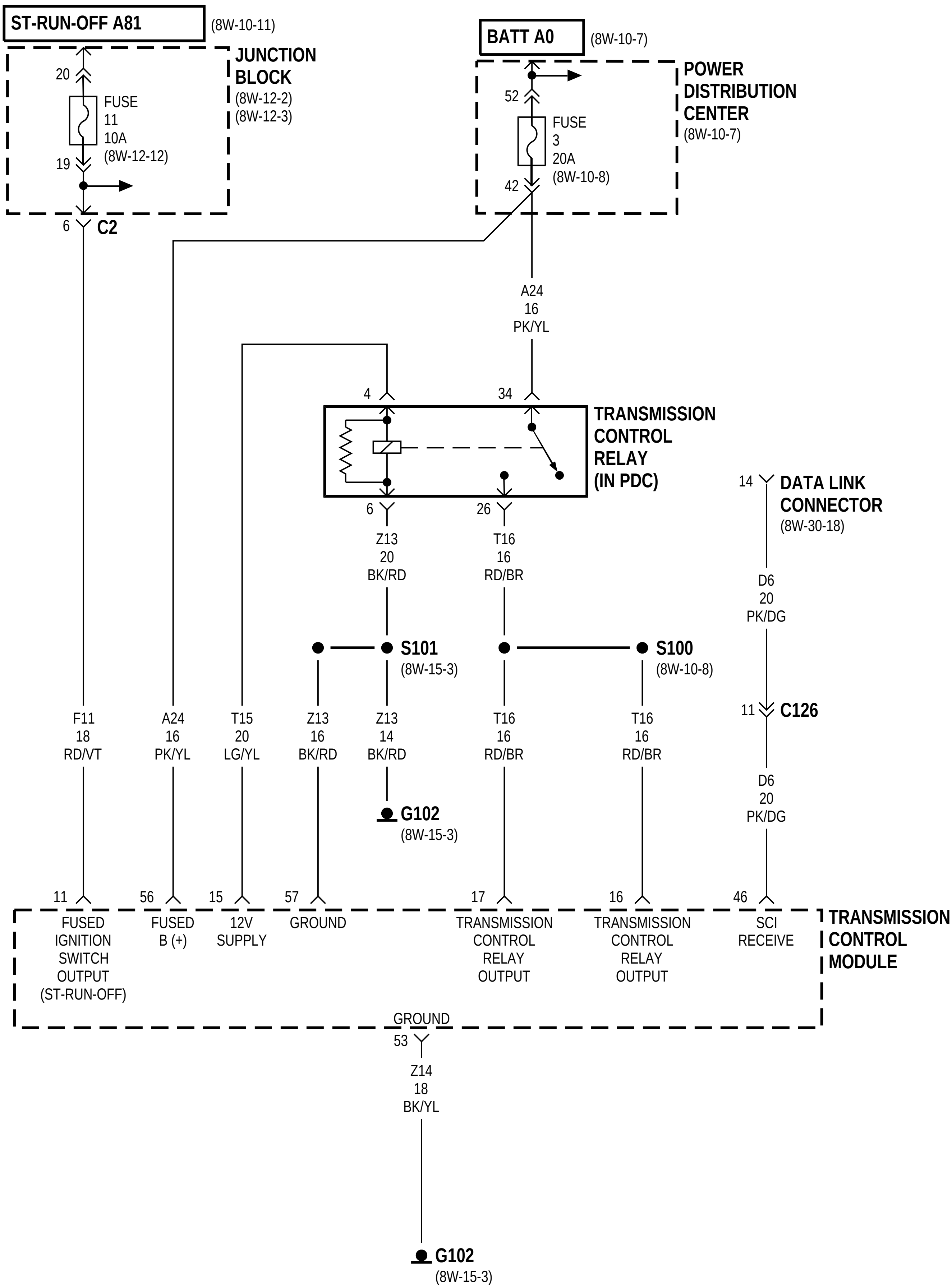
ST-RUN A21
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
68
FUSE
9
10A
(8W-10-12)
58
F18
20
LG/BK
S106
(IN PDC)
(8W-10-12)
F18
20
LG/BK
F18
20
LG/BK
F18
20
LG/BK
19
A/C COMPRESSOR CLUTCH RELAY
(IN PDC)
(8W-42-3)
21
84
LOW SPEED RADIATOR FAN RELAY
(IN PDC)
(8W-42-4)
86
94
HIGH SPEED RADIATOR FAN RELAY
(IN PDC)
(8W-42-4)
96
C28
20
DB/OR
C27
20
DB/PK
C24
20
DB/TN
64 C2
69 C2
55 C2
A/C COMPRESSOR CLUTCH RELAY CONTROL
HIGH SPEED RADIATOR FAN RELAY CONTROL
LOW SPEED RADIATOR FAN RELAY CONTROL
POWERTRAIN CONTROL MODULE

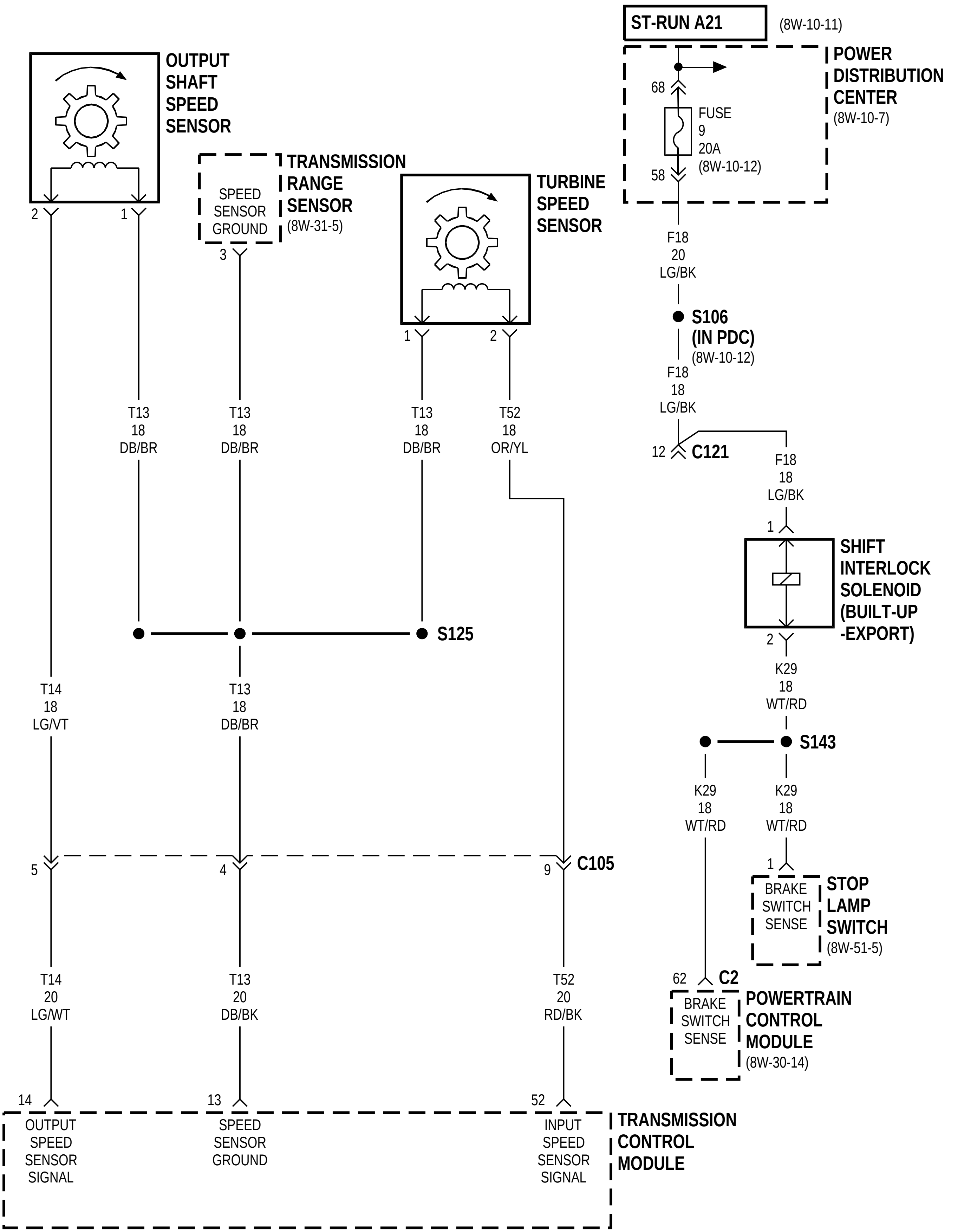

IDLE AIR CONTROL MOTOR
IDLE AIR CONTROL MOTOR NO. 1 DRIVER
IDLE AIR CONTROL MOTOR NO. 2 DRIVER
IDLE AIR CONTROL MOTOR NO. 4 DRIVER
IDLE AIR CONTROL MOTOR NO. 3 DRIVER
**1 *D
**2 *C
**4 *A
**3 *B
K39 20 GY/RD
K60 20 YL/BK
K59 20 VT/BK
K40 20 BR/WT
2
7
4
3
C111
DUTY CYCLE EVAP/ PURGE SOLENOID
2
1
K108 18 WT/TN
K52 20 PK/GY
57 C2
49 C2
58 C2
48 C2
70 C2
68 C2
POWERTRAIN CONTROL MODULE
EVAPORATIVE SOLENOID SENSE
EVAPORATIVE EMISSION SOLENOID CONTROL
*2.5L
** 2.4L/ 2.0L


BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 10A (8W-12-8)
C5
M1 22 PK
TRANSMISSION CONTROL MODULE
SCI RECEIVE
(8W-31-2)
D6 20 PK/DG
C126
D6 20 PK/DG
DATA LINK CONNECTOR
D20 20 LG
D1 20 VT/GY
D2 20 WT/DG
Z2 20 BK/VT
Z1 20 BK
D21 20 PK/LB
TRANSMISSION CONTROL MODULE
SCI TRANSMIT
(8W-31-8)
C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
C9
Z1 14 BK
G301
(8W-15-9)
C126
TWISTED PAIR
MTX
EATX
OTHER
ABS
C3
BODY CONTROL MODULE
CCD BUS (+)
CCD BUS (-)
GROUND
(8W-45-3)
(8W-45-4)
S129
C1
D1 20 VT/BR
D2 20 WT/BK
TWISTED PAIR
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
S142
(8W-45-4)
S132
(8W-45-4)
TRANSMISSION CONTROL MODULE
SCI TRANSMIT
(8W-31-9)
D20 20 LG
D1 20 VT/BR
D2 20 WT/BK
D21 20 PK/LB
C2
POWERTRAIN CONTROL MODULE
SCI RECEIVE
CCD BUS (+)
CCD BUS (-)
SCI TRANSMIT

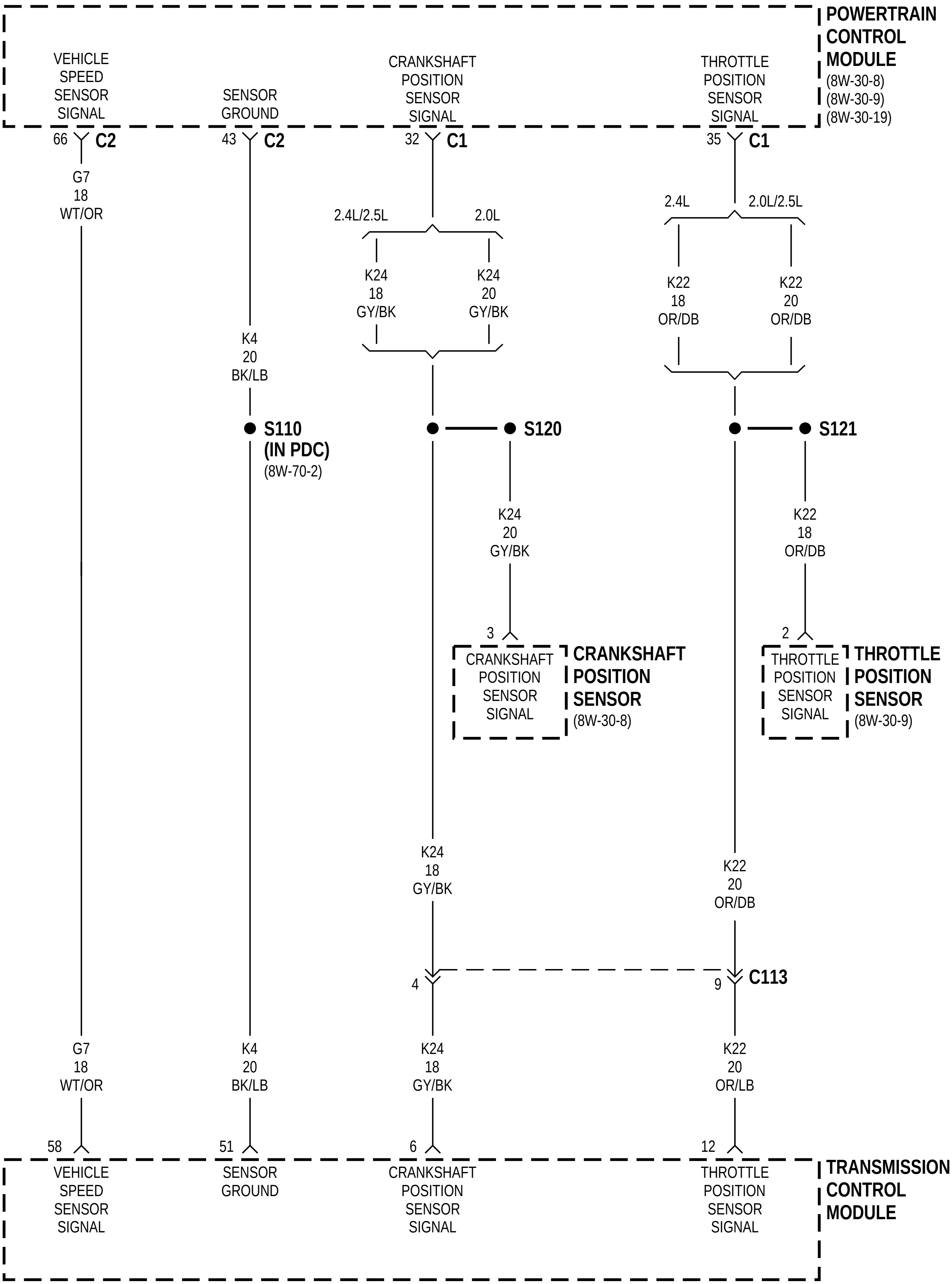

VEHICLE SPEED SENSOR (MTX)
8V SUPPLY
SENSOR GROUND
VEHICLE SPEED SENSOR SIGNAL
1
2
3
K7 18 OR
K4 18 BK/LB
G7 18 WT/OR
POWERTRAIN CONTROL MODULE
POWER STEERING PRESSURE SWITCH SENSE
45 C2
K10 18 DB/LG
TRANSMISSION CONTROL MODULE
(8W-31-4)
VEHICLE SPEED SENSOR SIGNAL
58
C169
G7 18 WT/OR
G7 18 WT/OR
POWER STEERING PRESSURE SWITCH
MTX
EATX
K7 18 OR/WT
K4 18 BK/LB
S130
(8W-70-6)
S110
(IN PDC)
(8W-70-2)
NOT USED
2 C113
K7 18 OR/WT
K4 20 BK/LB
G7 18 WT/OR
K90 20 TN
Z1 18 BK
44 C2
43 C2
66 C2
31 C1
4 C1
8V SUPPLY
SENSOR GROUND
VEHICLE SPEED SENSOR SIGNAL
DOUBLE START OVERRIDE
POWERTRAIN CONTROL MODULE
GROUND
BODY CONTROL MODULE
(8W-45-2)
● 2.0L

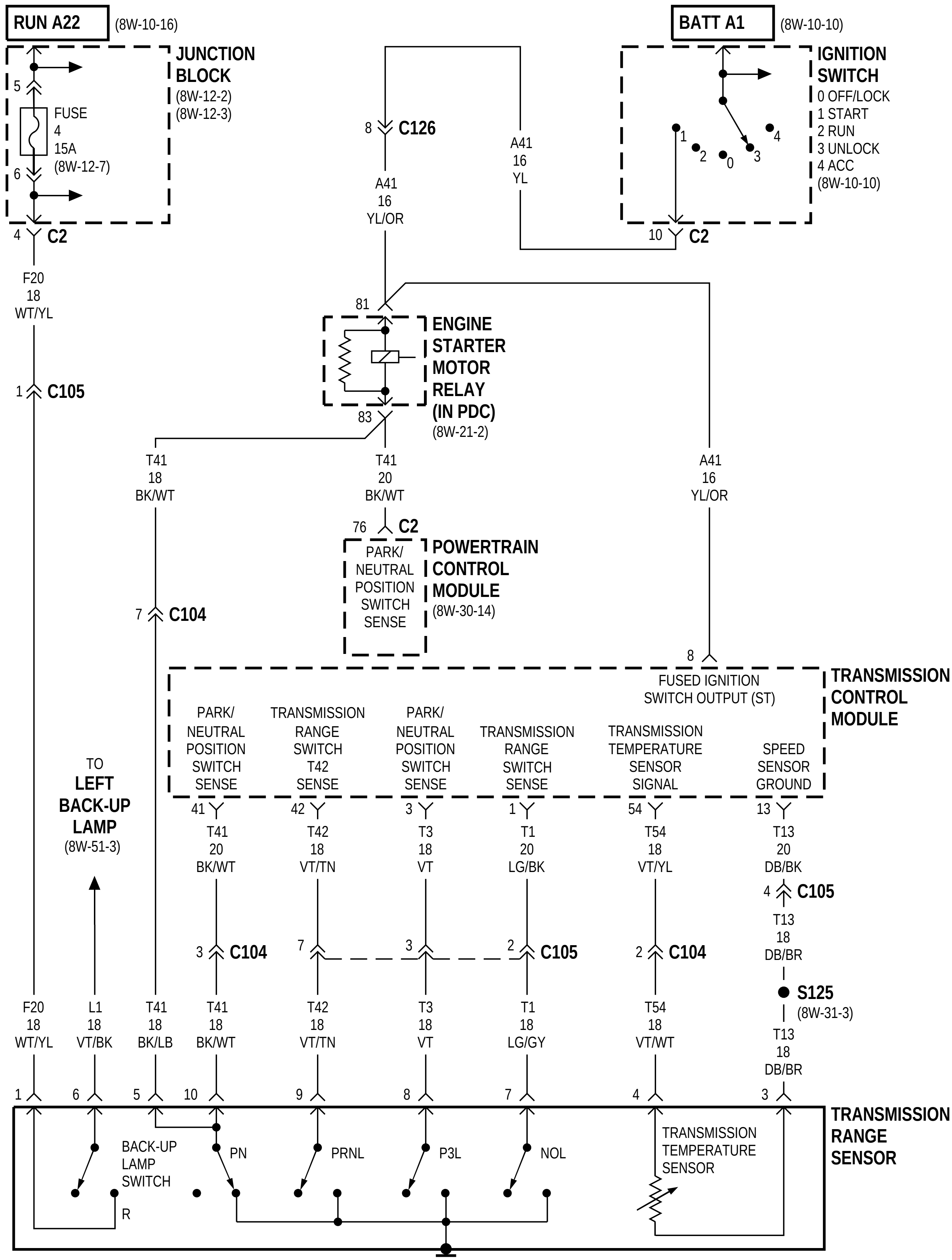
8W-31 TRANSMISSION CONTROL SYSTEM

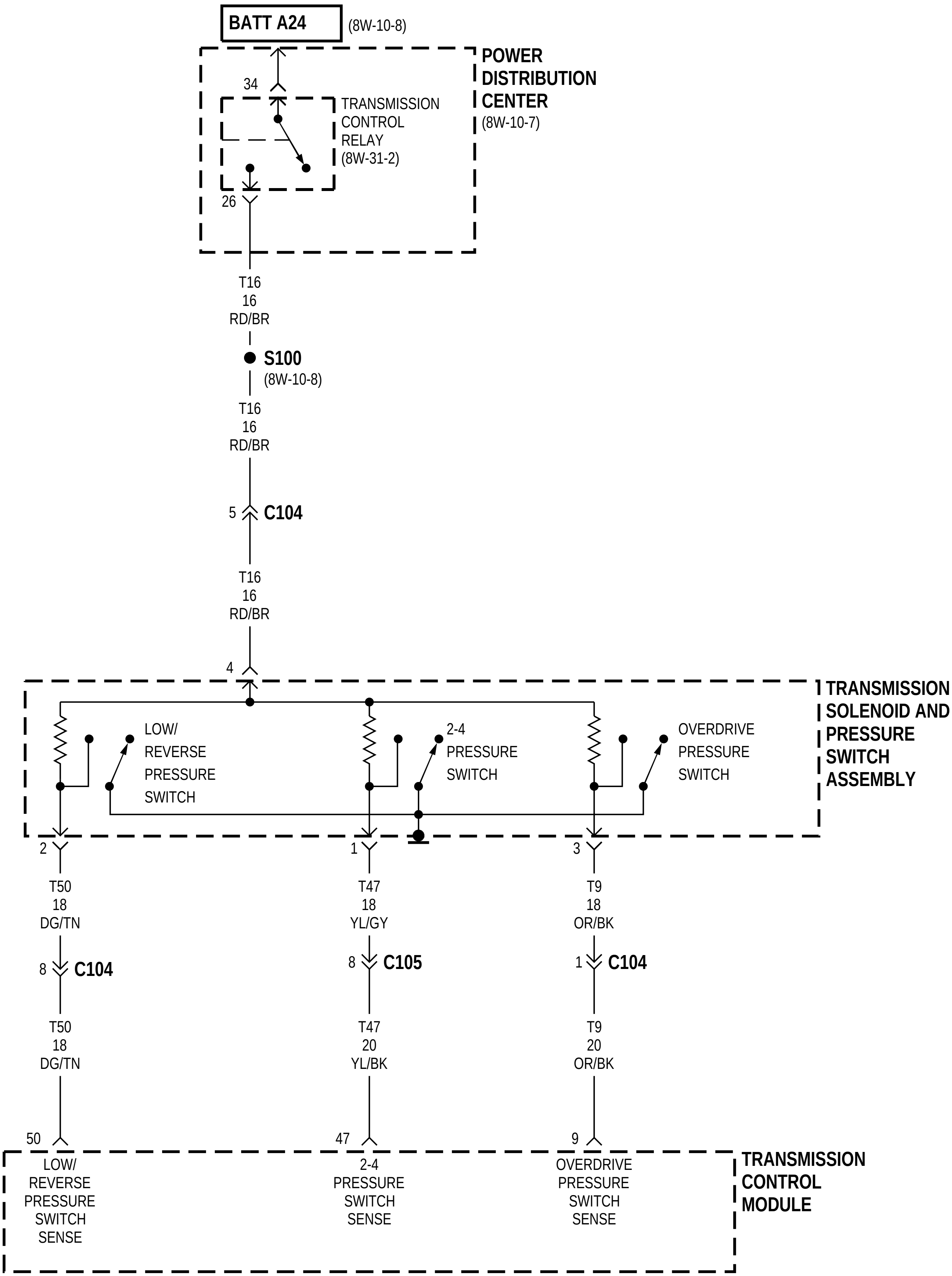

ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
20
FUSE
11
10A
(8W-12-12)
19
6
C2
BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
52
FUSE
3
20A
(8W-10-8)
42
A24
16
PK/YL
4
34
TRANSMISSION CONTROL RELAY (IN PDC)
6
26
Z13
20
BK/RD
T16
16
RD/BR
14
DATA LINK CONNECTOR
(8W-30-18)
D6
20
PK/DG
S101
(8W-15-3)
S100
(8W-10-8)
11
C126
F11
18
RD/VT
A24
16
PK/YL
T15
20
LG/YL
Z13
16
BK/RD
Z13
14
BK/RD
T16
16
RD/BR
T16
16
RD/BR
D6
20
PK/DG
G102
(8W-15-3)
11
56
15
57
17
16
46
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
FUSED B (+)
12V SUPPLY
GROUND
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY OUTPUT
SCI RECEIVE
TRANSMISSION CONTROL MODULE
GROUND
53
Z14
18
BK/YL
G102
(8W-15-3)

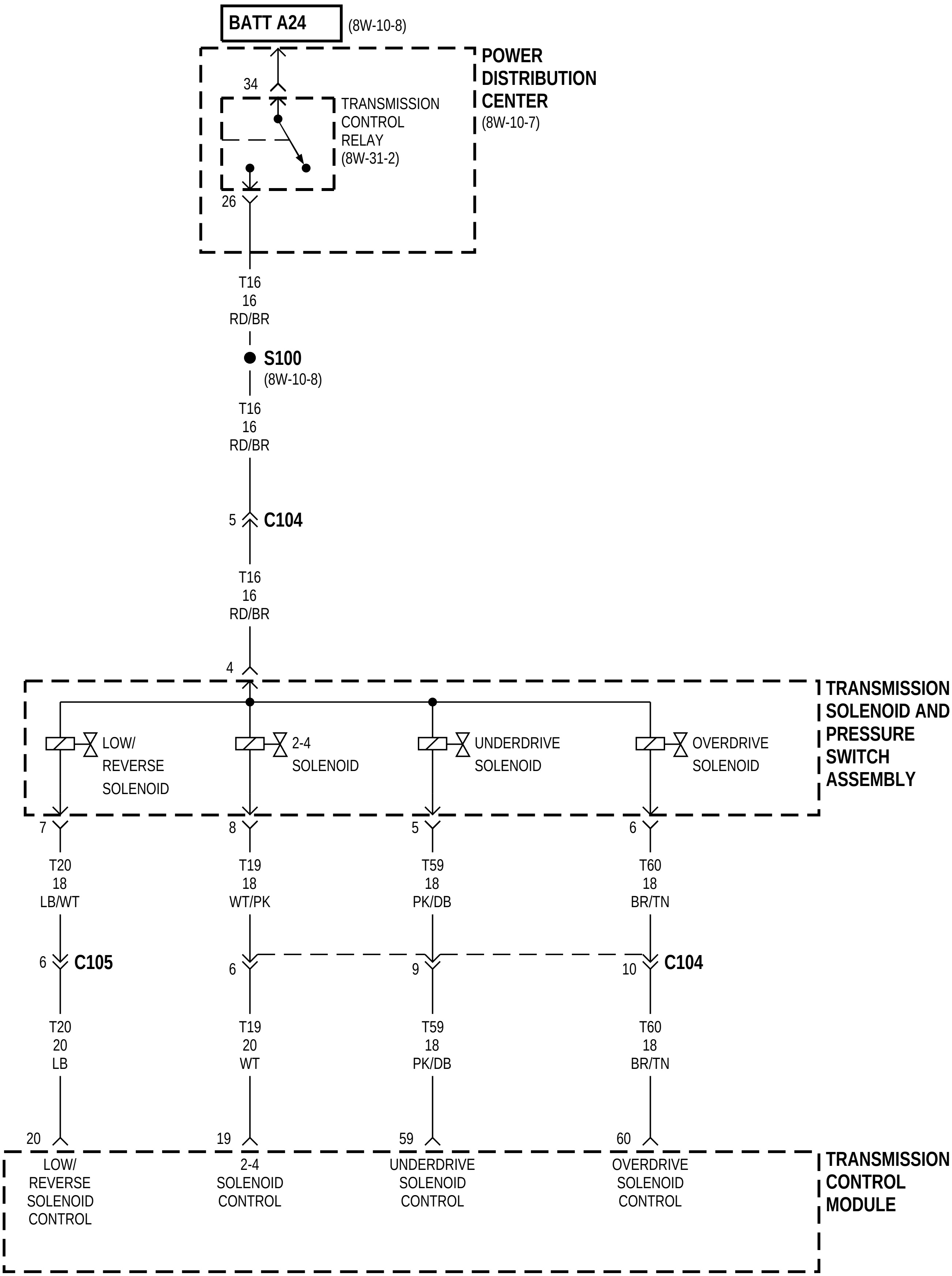


ST-RUN A21
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
68
FUSE
9
20A
(8W-10-12)
58
F18
20
LG/BK
S106
(IN PDC)
(8W-10-12)
F18
18
LG/BK
12
C121
F18
18
LG/BK
1
SHIFT INTERLOCK SOLENOID (BUILT-UP -EXPORT)
2
K29
18
WT/RD
S143
K29
18
WT/RD
K29
18
WT/RD
1
BRAKE SWITCH SENSE
STOP LAMP SWITCH
(8W-51-5)
62
C2
BRAKE SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-14)
OUTPUT SHAFT SPEED SENSOR
2
1
SPEED SENSOR GROUND
TRANSMISSION RANGE SENSOR
(8W-31-5)
3
TURBINE SPEED SENSOR
1
2
T13
18
DB/BR
T13
18
DB/BR
T13
18
DB/BR
T52
18
OR/YL
S125
T14
18
LG/VT
T13
18
DB/BR
5
4
9
C105
T14
20
LG/WT
T13
20
DB/BK
T52
20
RD/BK
14
13
52
OUTPUT SPEED SENSOR SIGNAL
SPEED SENSOR GROUND
INPUT SPEED SENSOR SIGNAL
TRANSMISSION CONTROL MODULE

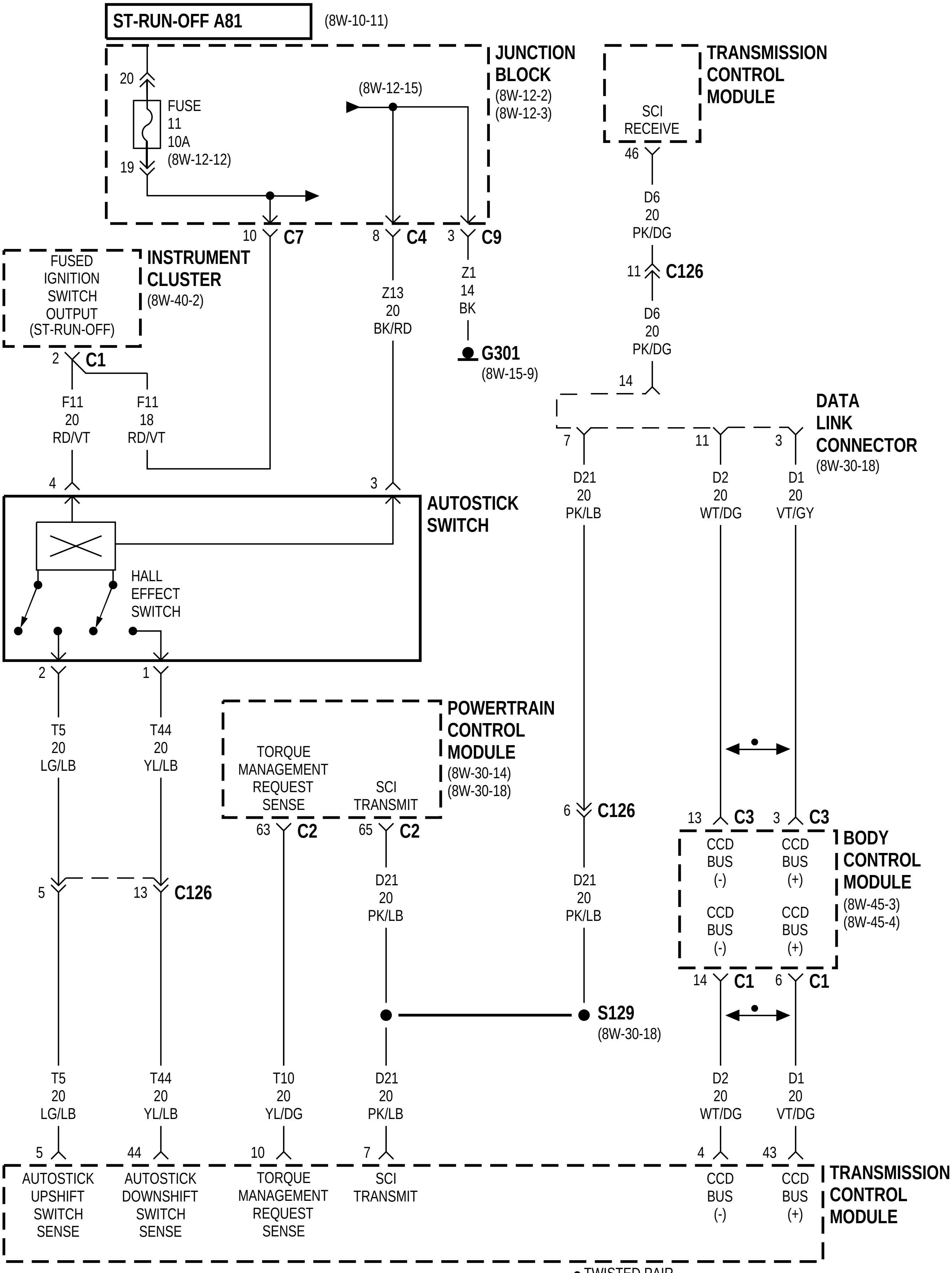

POWERTRAIN CONTROL MODULE
(8W-30-8)
(8W-30-9)
(8W-30-19)
VEHICLE SPEED SENSOR SIGNAL
SENSOR GROUND
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
66 C2
43 C2
32 C1
35 C1
G7 18 WT/OR
2.4L/2.5L
2.0L
K24 18 GY/BK
K24 20 GY/BK
2.4L
2.0L/2.5L
K22 18 OR/DB
K22 20 OR/DB
K4 20 BK/LB
S110 (IN PDC)
(8W-70-2)
S120
S121
K24 20 GY/BK
K22 18 OR/DB
3
2
CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR
(8W-30-8)
THROTTLE POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR
(8W-30-9)
K24 18 GY/BK
K22 20 OR/DB
4
9
C113
G7 18 WT/OR
K4 20 BK/LB
K24 18 GY/BK
K22 20 OR/LB
58
51
6
12
VEHICLE SPEED SENSOR SIGNAL
SENSOR GROUND
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
TRANSMISSION CONTROL MODULE

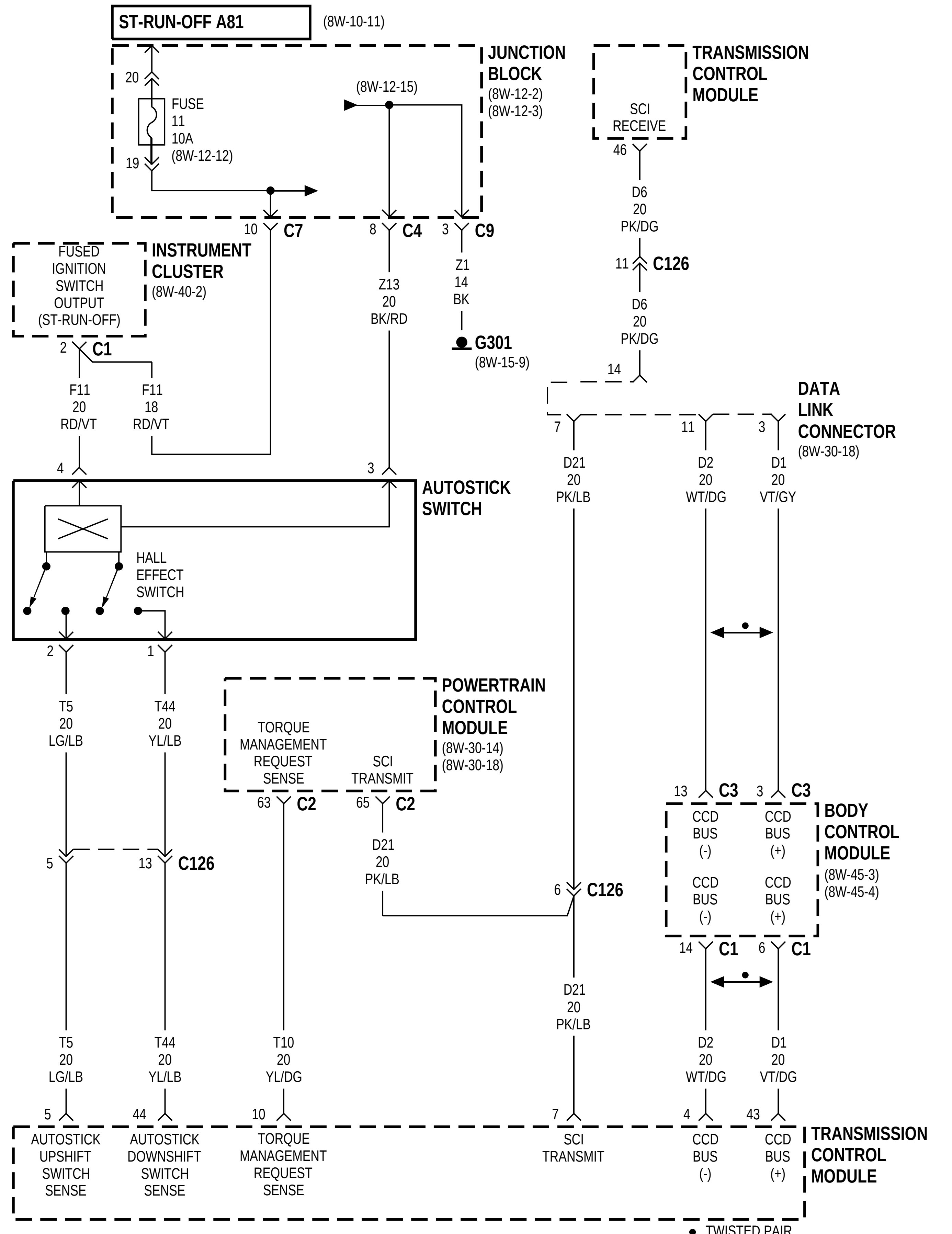

RUN A22
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 15A (8W-12-7)
BATT A1
(8W-10-10)
IGNITION SWITCH
0 OFF/LOCK
1 START
2 RUN
3 UNLOCK
4 ACC
(8W-10-10)
C126
A41 16 YL/OR
A41 16 YL
C2
F20 18 WT/YL
C105
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
T41 18 BK/WT
T41 20 BK/WT
A41 16 YL/OR
POWERTRAIN CONTROL MODULE
(8W-30-14)
PARK/ NEUTRAL POSITION SWITCH SENSE
C104
TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (ST)
PARK/ NEUTRAL POSITION SWITCH SENSE
TRANSMISSION RANGE SWITCH T42 SENSE
PARK/ NEUTRAL POSITION SWITCH SENSE
TRANSMISSION RANGE SWITCH SENSE
TRANSMISSION TEMPERATURE SENSOR SIGNAL
SPEED SENSOR GROUND
TO LEFT BACK-UP LAMP
(8W-51-3)
T41 20 BK/WT
T42 18 VT/TN
T3 18 VT
T1 20 LG/BK
T54 18 VT/YL
T13 20 DB/BK
T13 18 DB/BR
S125
(8W-31-3)
F20 18 WT/YL
L1 18 VT/BK
T41 18 BK/LB
T41 18 BK/WT
T42 18 VT/TN
T3 18 VT
T1 18 LG/GY
T54 18 VT/WT
T13 18 DB/BR
TRANSMISSION RANGE SENSOR
BACK-UP LAMP SWITCH
R
PN
PRNL
P3L
NOL
TRANSMISSION TEMPERATURE SENSOR


BATT A24
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-7)
34
TRANSMISSION CONTROL RELAY
(8W-31-2)
26
T16
16
RD/BR
S100
(8W-10-8)
T16
16
RD/BR
5
C104
T16
16
RD/BR
4
LOW/ REVERSE PRESSURE SWITCH
2-4 PRESSURE SWITCH
OVERDRIVE PRESSURE SWITCH
TRANSMISSION SOLENOID AND PRESSURE SWITCH ASSEMBLY
2
1
3
T50
18
DG/TN
T47
18
YL/GY
T9
18
OR/BK
8
C104
8
C105
1
C104
T50
18
DG/TN
T47
20
YL/BK
T9
20
OR/BK
50
47
9
LOW/ REVERSE PRESSURE SWITCH SENSE
2-4 PRESSURE SWITCH SENSE
OVERDRIVE PRESSURE SWITCH SENSE
TRANSMISSION CONTROL MODULE

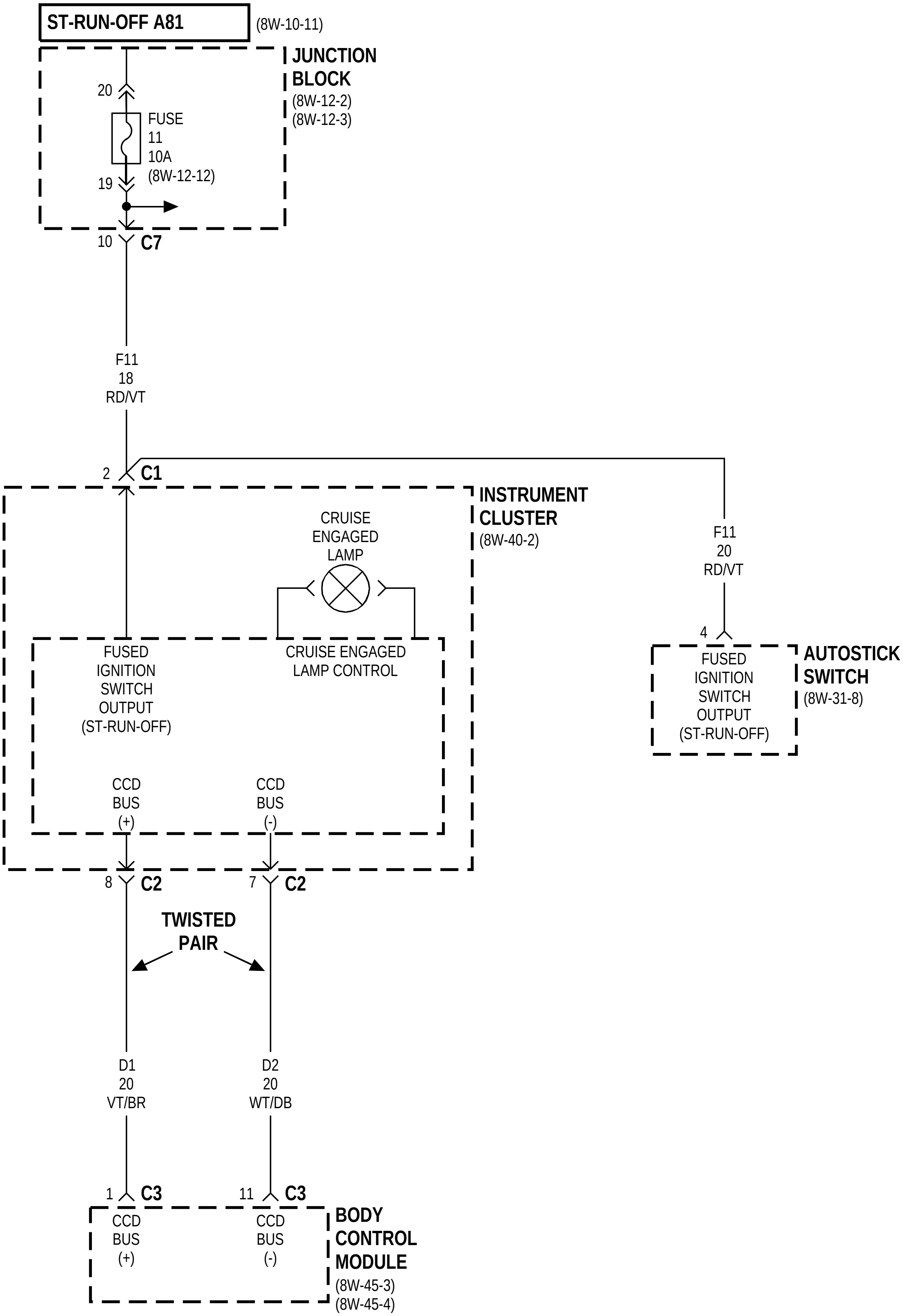

BATT A24
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
34
TRANSMISSION
CONTROL
RELAY
(8W-31-2)
26
T16
16
RD/BR
S100
(8W-10-8)
T16
16
RD/BR
5
C104
T16
16
RD/BR
4
LOW/
REVERSE
SOLENOID
2-4
SOLENOID
UNDERDRIVE
SOLENOID
OVERDRIVE
SOLENOID
TRANSMISSION
SOLENOID AND
PRESSURE
SWITCH
ASSEMBLY
7
8
5
6
T20
18
LB/WT
T19
18
WT/PK
T59
18
PK/DB
T60
18
BR/TN
6
C105
6
9
10
C104
T20
20
LB
T19
20
WT
T59
18
PK/DB
T60
18
BR/TN
20
19
59
60
LOW/
REVERSE
SOLENOID
CONTROL
2-4
SOLENOID
CONTROL
UNDERDRIVE
SOLENOID
CONTROL
OVERDRIVE
SOLENOID
CONTROL
TRANSMISSION
CONTROL
MODULE

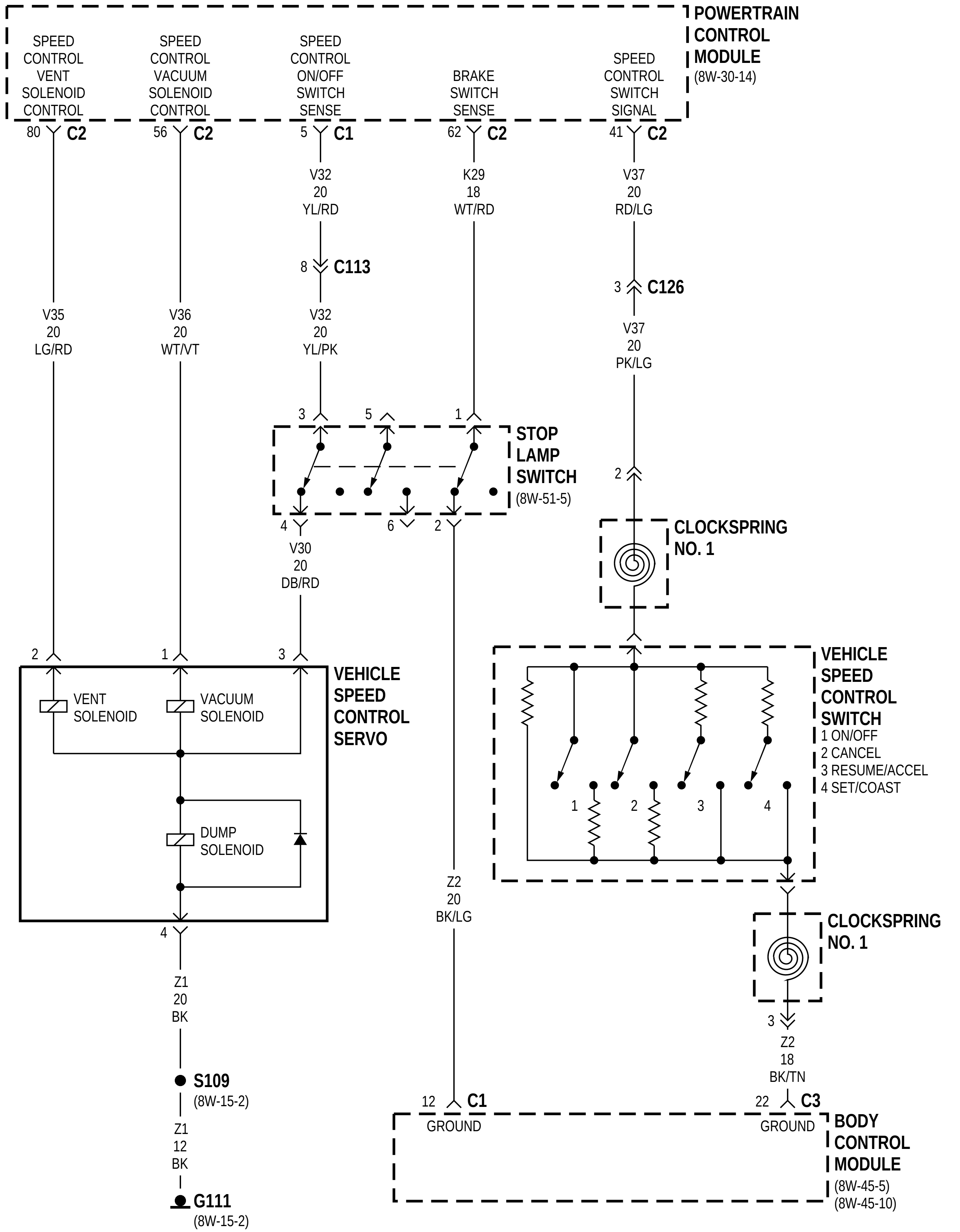
ABS


ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
20
FUSE
11
10A
(8W-12-12)
19
(8W-12-15)
10 C7
8 C4
3 C9
TRANSMISSION CONTROL MODULE
SCI RECEIVE
46
D6
20
PK/DG
11 C126
D6
20
PK/DG
14
DATA LINK CONNECTOR
(8W-30-18)
7
11
3
D21
20
PK/LB
D2
20
WT/DG
D1
20
VT/GY
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
INSTRUMENT CLUSTER
(8W-40-2)
2 C1
F11
20
RD/VT
F11
18
RD/VT
Z13
20
BK/RD
Z1
14
BK
G301
(8W-15-9)
4
3
AUTOSTICK SWITCH
HALL EFFECT SWITCH
2
1
T5
20
LG/LB
T44
20
YL/LB
POWERTRAIN CONTROL MODULE
(8W-30-14)
(8W-30-18)
TORQUE MANAGEMENT REQUEST SENSE
SCI TRANSMIT
63 C2
65 C2
6 C126
13 C3
3 C3
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
CCD BUS (-)
CCD BUS (+)
CCD BUS (-)
CCD BUS (+)
14 C1
6 C1
5
13 C126
D21
20
PK/LB
D21
20
PK/LB
S129
(8W-30-18)
T5
20
LG/LB
T44
20
YL/LB
T10
20
YL/DG
D21
20
PK/LB
D2
20
WT/DG
D1
20
VT/DG
5
44
10
7
4
43
AUTOSTICK UPSHIFT SWITCH SENSE
AUTOSTICK DOWNSHIFT SWITCH SENSE
TORQUE MANAGEMENT REQUEST SENSE
SCI TRANSMIT
CCD BUS (-)
CCD BUS (+)
TRANSMISSION CONTROL MODULE
• TWISTED PAIR


ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
11
10A
(8W-12-12)
(8W-12-15)
20
19
10 C7
8 C4
3 C9
TRANSMISSION CONTROL MODULE
SCI RECEIVE
46
D6 20 PK/DG
11 C126
D6 20 PK/DG
14
INSTRUMENT CLUSTER
(8W-40-2)
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
2 C1
F11 20 RD/VT
F11 18 RD/VT
Z13 20 BK/RD
Z1 14 BK
G301
(8W-15-9)
DATA LINK CONNECTOR
(8W-30-18)
7
11
3
D21 20 PK/LB
D2 20 WT/DG
D1 20 VT/GY
4
3
AUTOSTICK SWITCH
HALL EFFECT SWITCH
2
1
T5 20 LG/LB
T44 20 YL/LB
POWERTRAIN CONTROL MODULE
(8W-30-14)
(8W-30-18)
TORQUE MANAGEMENT REQUEST SENSE
SCI TRANSMIT
63 C2
65 C2
D21 20 PK/LB
13 C3
3 C3
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
CCD BUS (-)
CCD BUS (+)
CCD BUS (-)
CCD BUS (+)
5
13 C126
6 C126
14 C1
6 C1
D21 20 PK/LB
T5 20 LG/LB
T44 20 YL/LB
T10 20 YL/DG
D2 20 WT/DG
D1 20 VT/DG
5
44
10
7
4
43
TRANSMISSION CONTROL MODULE
AUTOSTICK UPSHIFT SWITCH SENSE
AUTOSTICK DOWNSHIFT SWITCH SENSE
TORQUE MANAGEMENT REQUEST SENSE
SCI TRANSMIT
CCD BUS (-)
CCD BUS (+)
● TWISTED PAIR

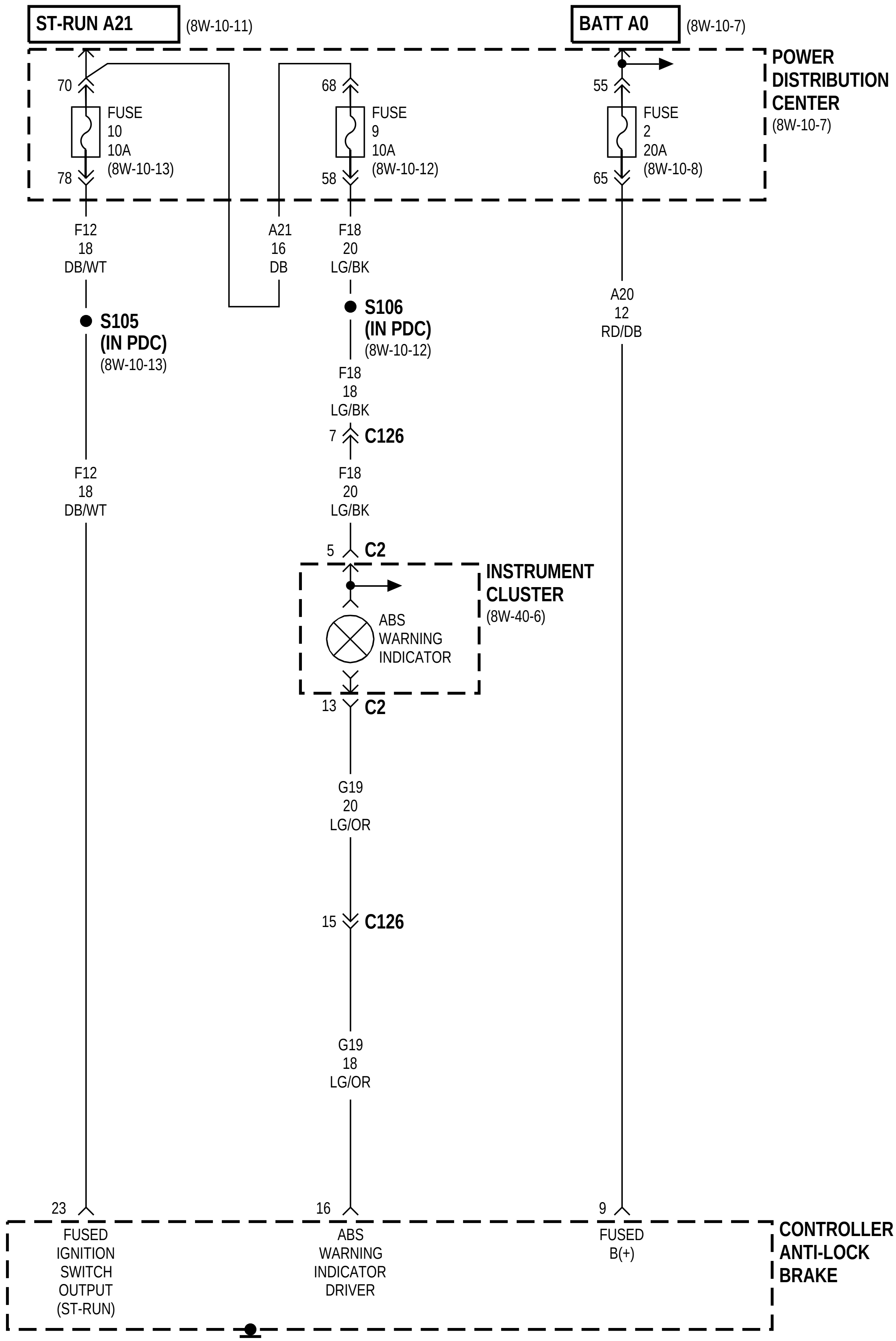
8W-33 VEHICLE SPEED CONTROL

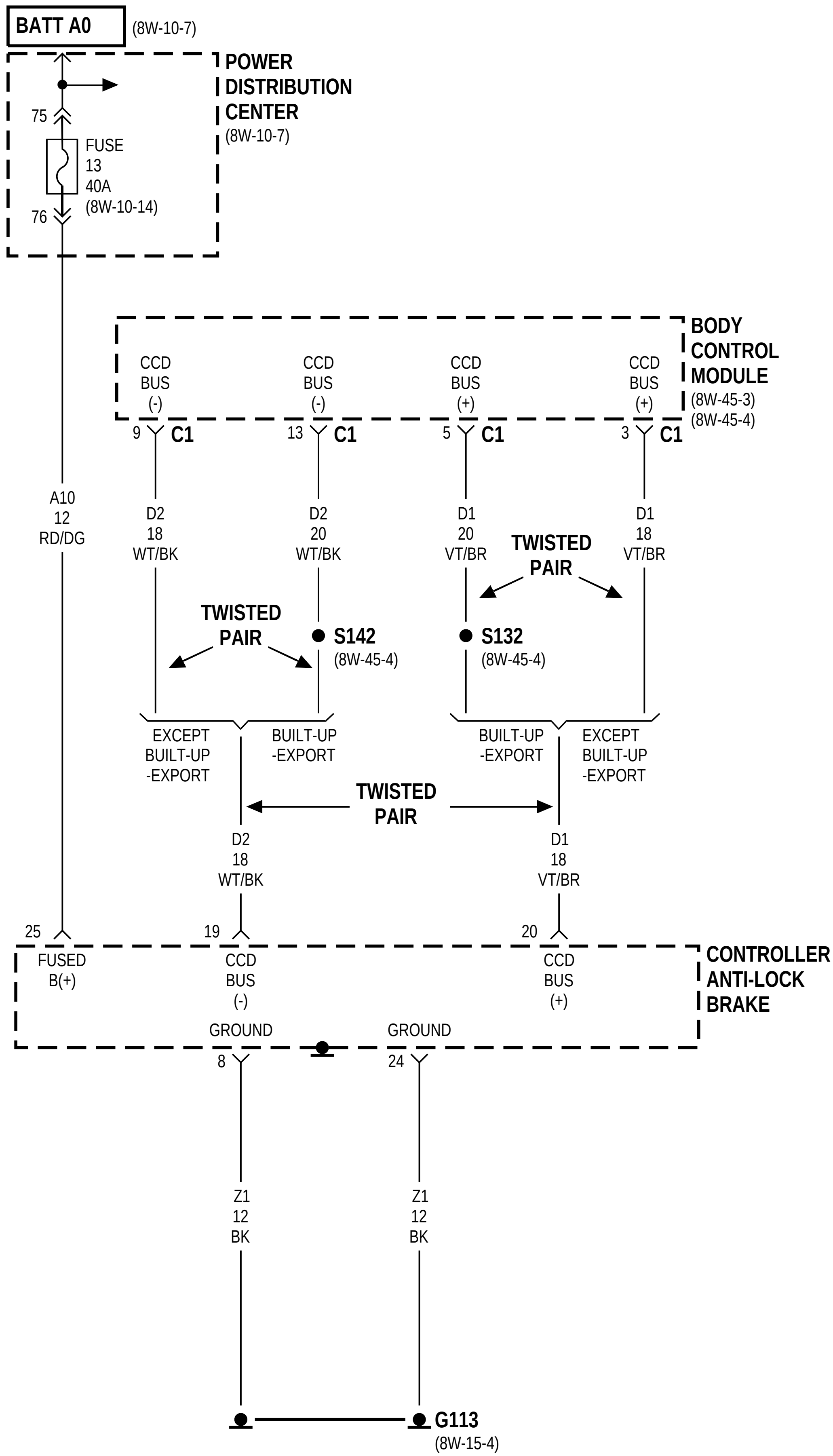

ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
20
FUSE
11
10A
(8W-12-12)
19
10
C7
F11
18
RD/VT
2
C1
INSTRUMENT CLUSTER
(8W-40-2)
CRUISE ENGAGED LAMP
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
CRUISE ENGAGED LAMP CONTROL
CCD BUS (+)
CCD BUS (-)
F11
20
RD/VT
4
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
AUTOSTICK SWITCH
(8W-31-8)
8
C2
7
C2
TWISTED PAIR
D1
20
VT/BR
D2
20
WT/DB
1
C3
11
C3
CCD BUS (+)
CCD BUS (-)
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)

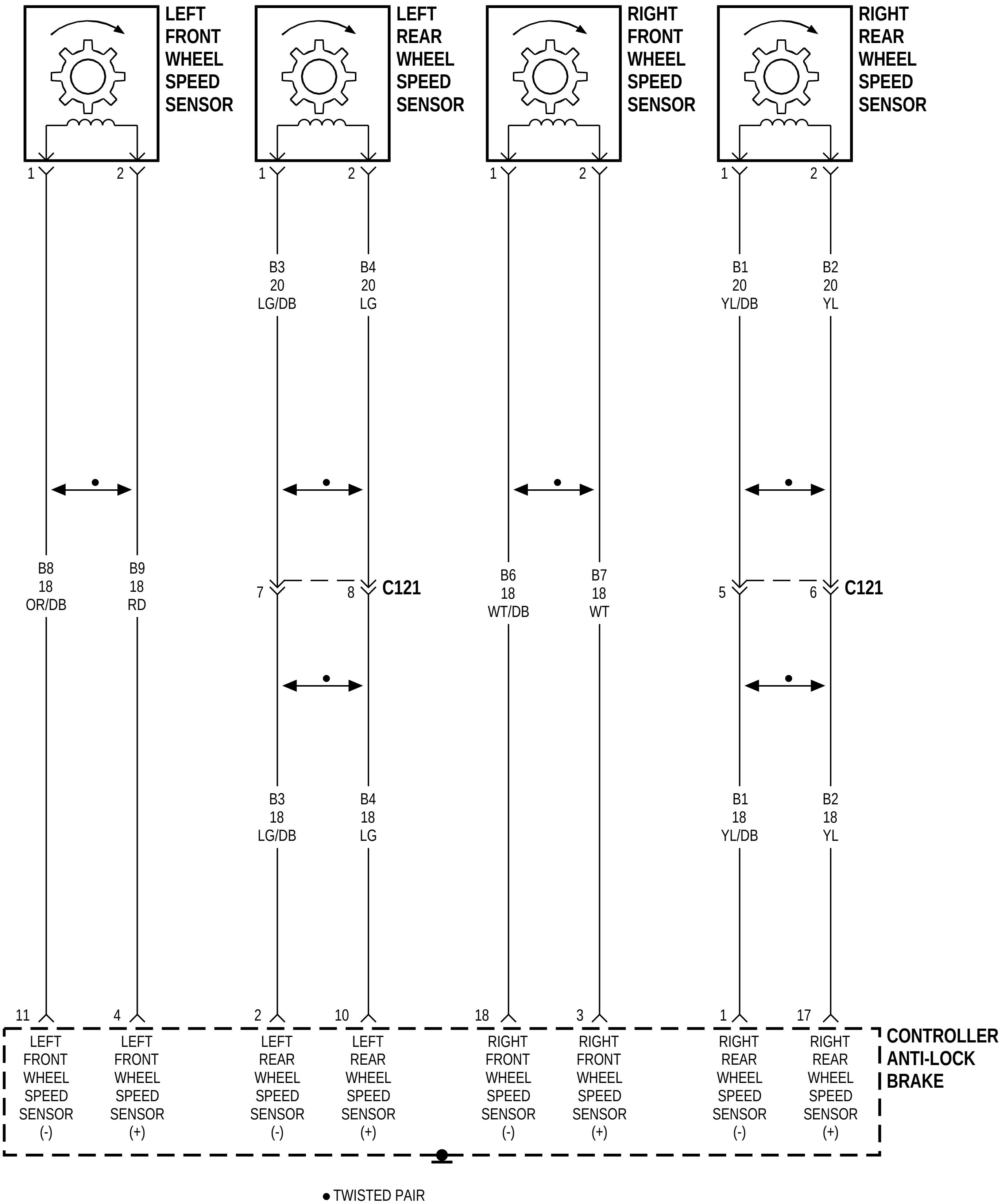


JAI03303 J998W-16

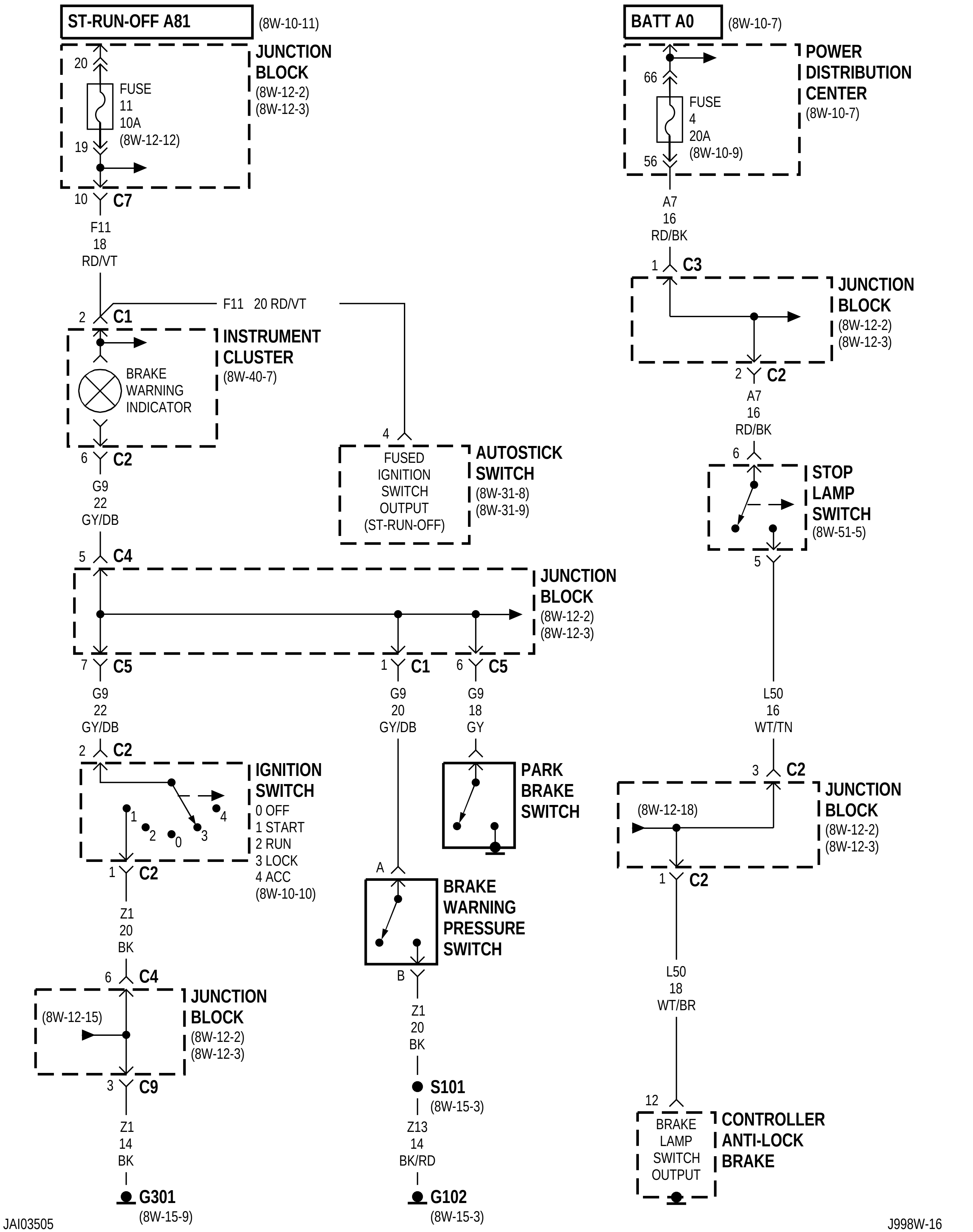
8W-35 ANTI-LOCK BRAKES


ST-RUN A21
(8W-10-11)
BATT A0
(8W-10-7)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
70
FUSE
10
10A
(8W-10-13)
78
68
FUSE
9
10A
(8W-10-12)
58
55
FUSE
2
20A
(8W-10-8)
65
F12
18
DB/WT
A21
16
DB
F18
20
LG/BK
S105
(IN PDC)
(8W-10-13)
S106
(IN PDC)
(8W-10-12)
A20
12
RD/DB
F18
18
LG/BK
7
C126
F12
18
DB/WT
F18
20
LG/BK
5
C2
INSTRUMENT
CLUSTER
(8W-40-6)
ABS
WARNING
INDICATOR
13
C2
G19
20
LG/OR
15
C126
G19
18
LG/OR
23
16
9
FUSED
IGNITION
SWITCH
OUTPUT
(ST-RUN)
ABS
WARNING
INDICATOR
DRIVER
FUSED
B(+)
CONTROLLER
ANTI-LOCK
BRAKE

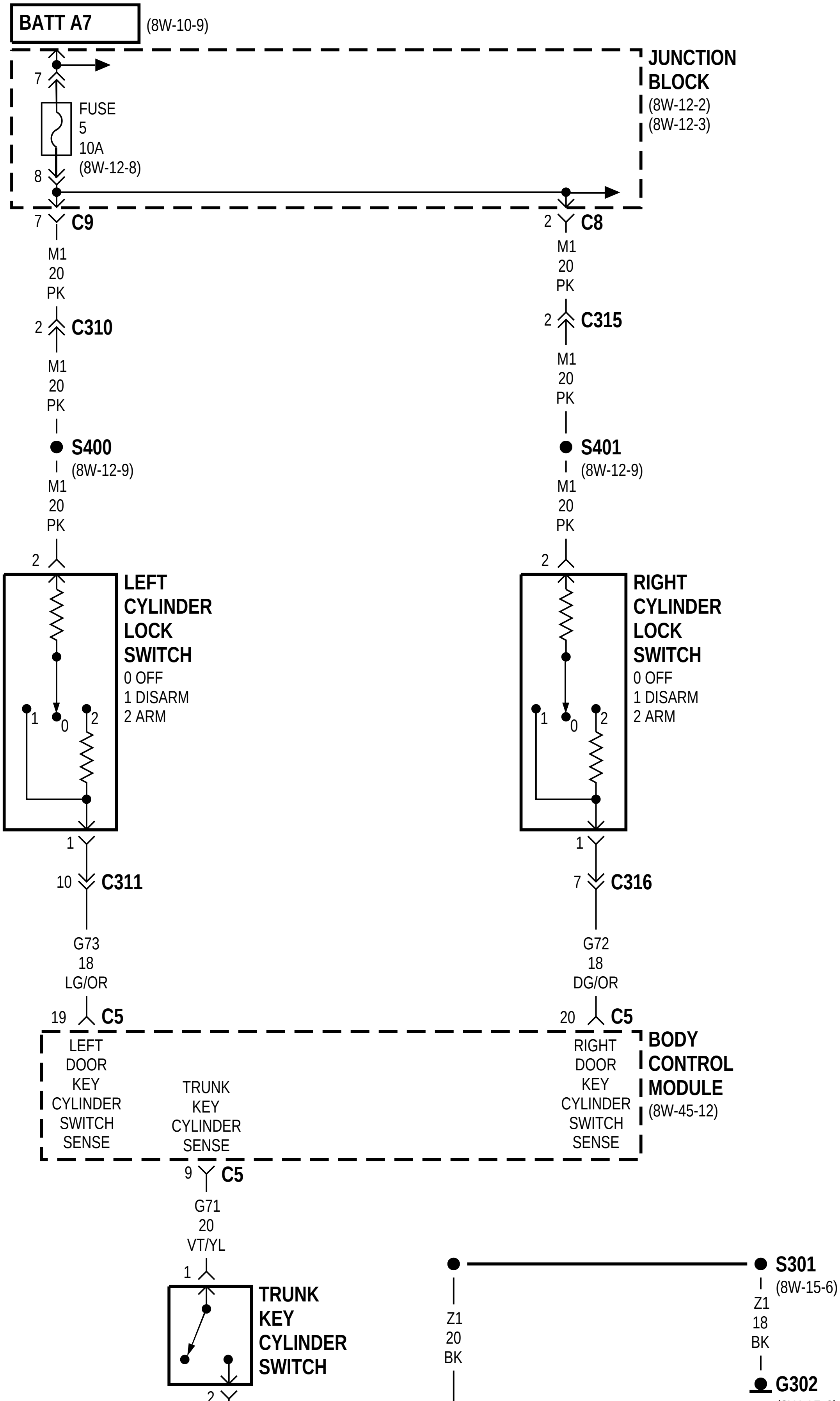

BATT A0
(8W-10-7)
POWER
DISTRIBUTION
CENTER
(8W-10-7)
75
FUSE
13
40A
(8W-10-14)
76
BODY
CONTROL
MODULE
(8W-45-3)
(8W-45-4)
CCD
BUS
(-)
9 C1
CCD
BUS
(-)
13 C1
CCD
BUS
(+)
5 C1
CCD
BUS
(+)
3 C1
A10
12
RD/DG
D2
18
WT/BK
D2
20
WT/BK
D1
20
VT/BR
D1
18
VT/BR
TWISTED
PAIR
TWISTED
PAIR
S142
(8W-45-4)
S132
(8W-45-4)
EXCEPT
BUILT-UP
-EXPORT
BUILT-UP
-EXPORT
BUILT-UP
-EXPORT
EXCEPT
BUILT-UP
-EXPORT
TWISTED
PAIR
D2
18
WT/BK
D1
18
VT/BR
25
19
20
FUSED
B(+)
CCD
BUS
(-)
CCD
BUS
(+)
CONTROLLER
ANTI-LOCK
BRAKE
GROUND
GROUND
8
24
Z1
12
BK
Z1
12
BK
G113
(8W-15-4)

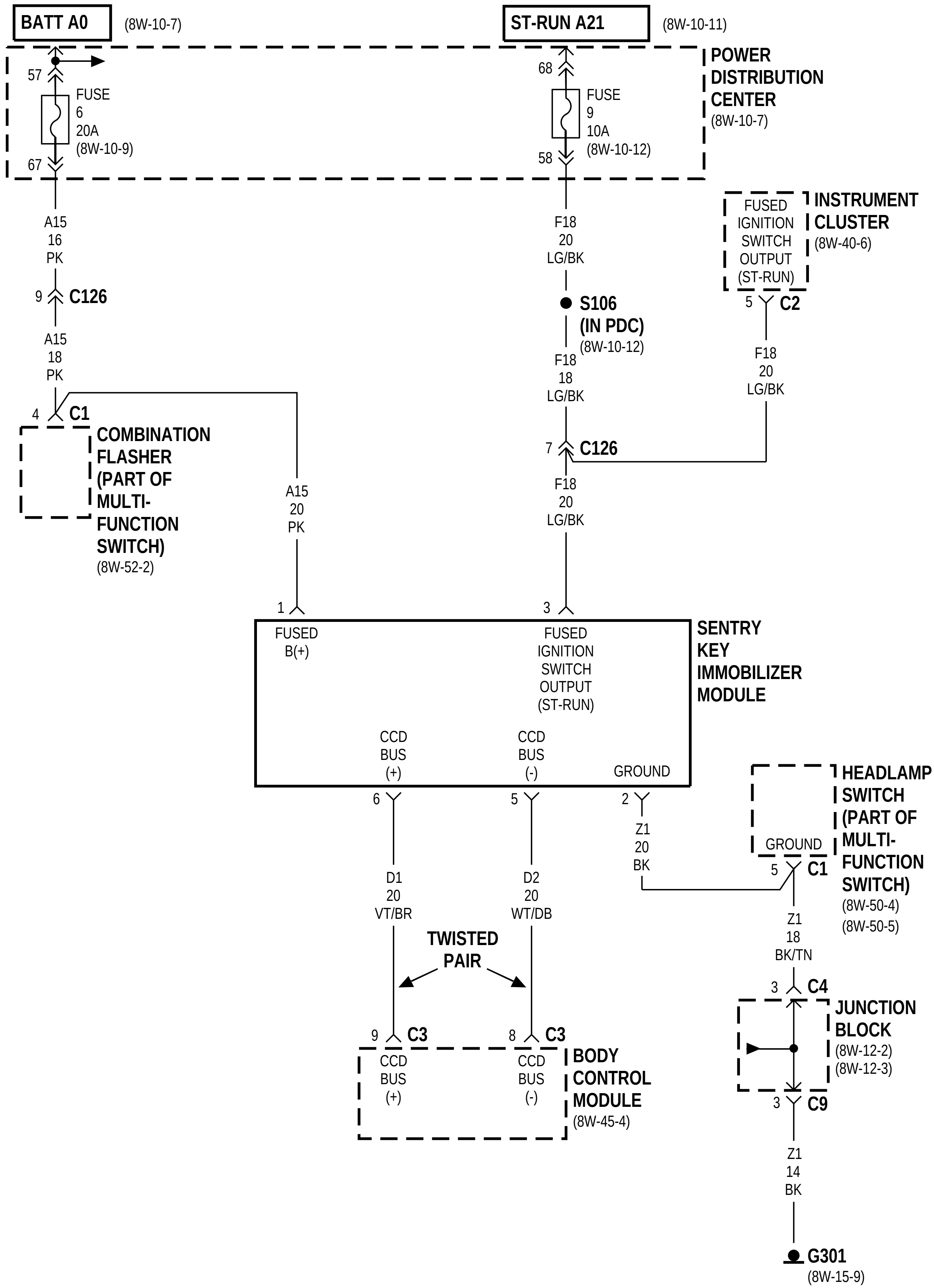


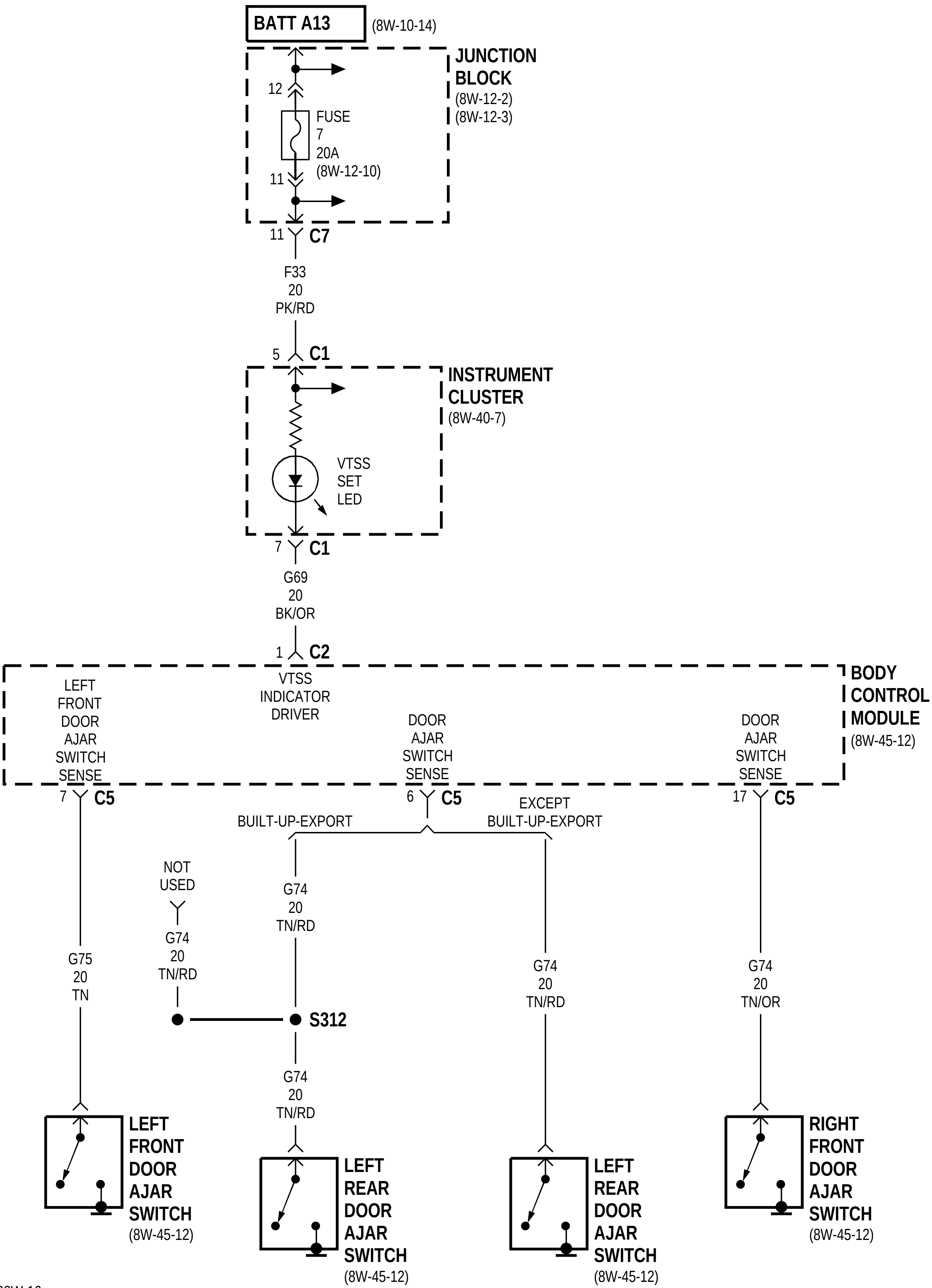
J998W-16 JAI03504

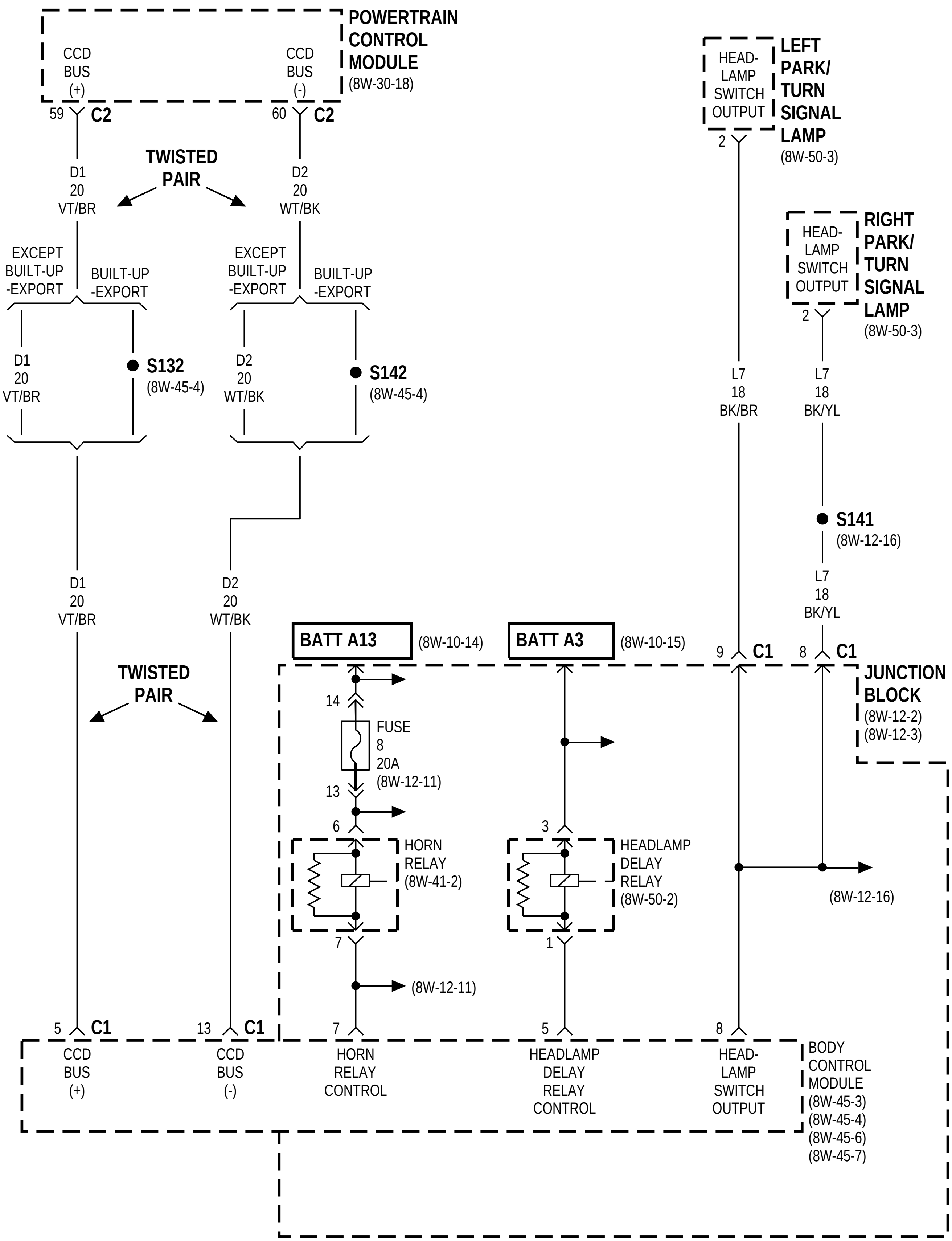

ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 11 10A (8W-12-12)
20
19
10 C7
F11 18 RD/VT
F11 20 RD/VT
2 C1
INSTRUMENT CLUSTER
(8W-40-7)
BRAKE WARNING INDICATOR
6 C2
G9 22 GY/DB
4
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
AUTOSTICK SWITCH
(8W-31-8)
(8W-31-9)
5 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
7 C5
1 C1
6 C5
G9 22 GY/DB
G9 20 GY/DB
G9 18 GY
2 C2
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-10)
1 C2
PARK BRAKE SWITCH
A
BRAKE WARNING PRESSURE SWITCH
B
Z1 20 BK
6 C4
JUNCTION BLOCK
(8W-12-15)
(8W-12-2)
(8W-12-3)
3 C9
Z1 14 BK
G301
(8W-15-9)
Z1 20 BK
S101
(8W-15-3)
Z13 14 BK/RD
G102
(8W-15-3)
BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
FUSE 4 20A (8W-10-9)
66
56
A7 16 RD/BK
1 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
2 C2
A7 16 RD/BK
6
STOP LAMP SWITCH
(8W-51-5)
5
L50 16 WT/TN
3 C2
JUNCTION BLOCK
(8W-12-18)
(8W-12-2)
(8W-12-3)
1 C2
L50 18 WT/BR
12
BRAKE LAMP SWITCH OUTPUT
CONTROLLER ANTI-LOCK BRAKE
JAI03505
J998W-16

8W-39 VEHICLE THEFT SECURITY SYSTEM

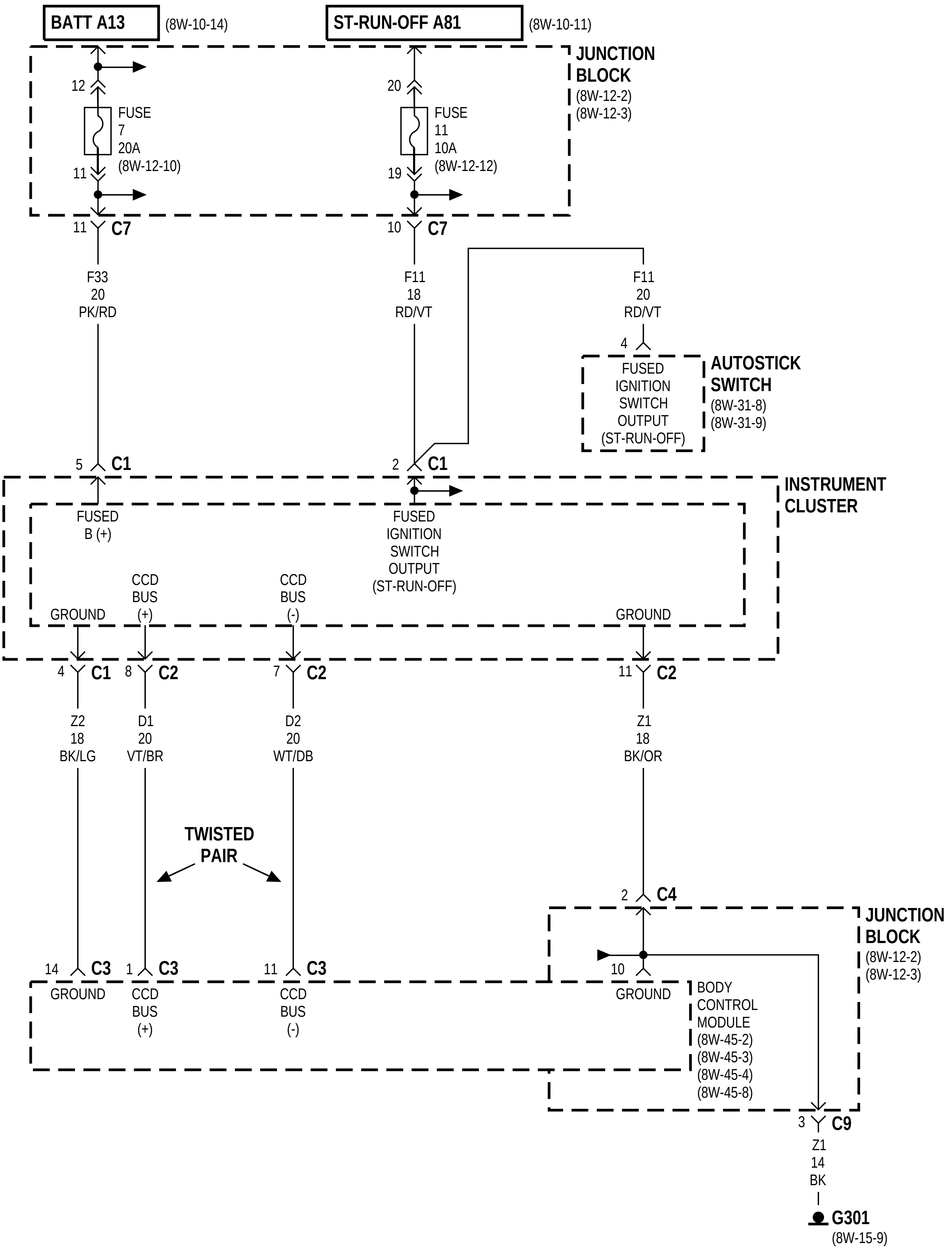

BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
7
FUSE
5
10A
(8W-12-8)
8
7
C9
2
C8
M1
20
PK
2
C310
2
C315
M1
20
PK
S400
(8W-12-9)
S401
(8W-12-9)
M1
20
PK
2
2
LEFT CYLINDER LOCK SWITCH
0 OFF
1 DISARM
2 ARM
RIGHT CYLINDER LOCK SWITCH
0 OFF
1 DISARM
2 ARM
1
0
2
1
1
10
C311
7
C316
G73
18
LG/OR
G72
18
DG/OR
19
C5
20
C5
BODY CONTROL MODULE
(8W-45-12)
LEFT DOOR KEY CYLINDER SWITCH SENSE
TRUNK KEY CYLINDER SENSE
RIGHT DOOR KEY CYLINDER SWITCH SENSE
9
C5
G71
20
VT/YL
1
TRUNK KEY CYLINDER SWITCH
2
Z1
20
BK
S301
(8W-15-6)
Z1
18
BK
G302
(8W-15-6)

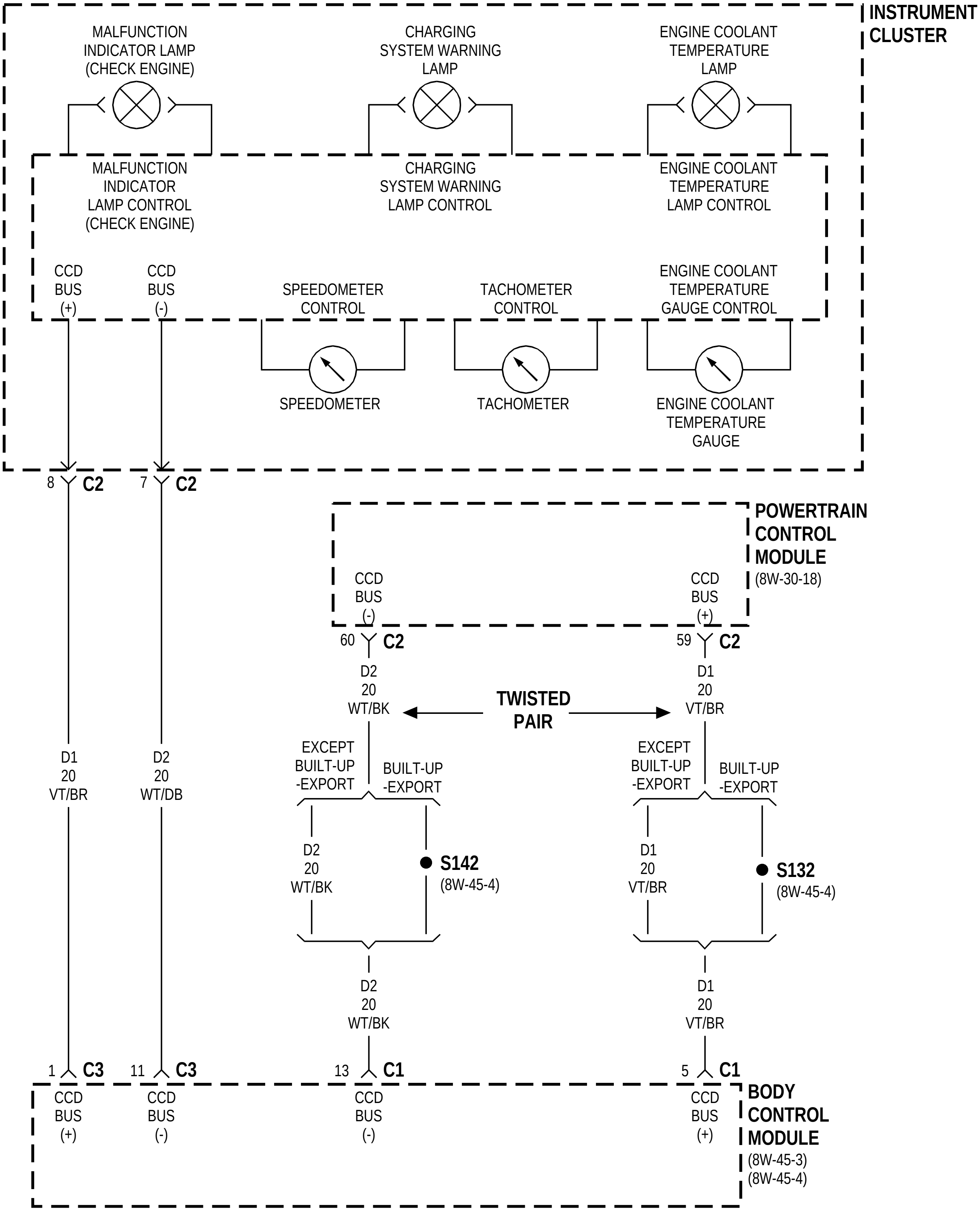

BATT A0
(8W-10-7)
ST-RUN A21
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
57
FUSE
6
20A
(8W-10-9)
67
68
FUSE
9
10A
(8W-10-12)
58
A15
16
PK
9 C126
A15
18
PK
4 C1
COMBINATION FLASHER (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
A15
20
PK
F18
20
LG/BK
S106 (IN PDC)
(8W-10-12)
F18
18
LG/BK
7 C126
F18
20
LG/BK
INSTRUMENT CLUSTER
(8W-40-6)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
5 C2
F18
20
LG/BK
1
3
SENTRY KEY IMMOBILIZER MODULE
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
CCD BUS (+)
CCD BUS (-)
GROUND
6
5
2
D1
20
VT/BR
D2
20
WT/DB
Z1
20
BK
TWISTED PAIR
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-50-4)
(8W-50-5)
GROUND
5 C1
Z1
18
BK/TN
3 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
3 C9
Z1
14
BK
G301
(8W-15-9)
9 C3
8 C3
CCD BUS (+)
CCD BUS (-)
BODY CONTROL MODULE
(8W-45-4)

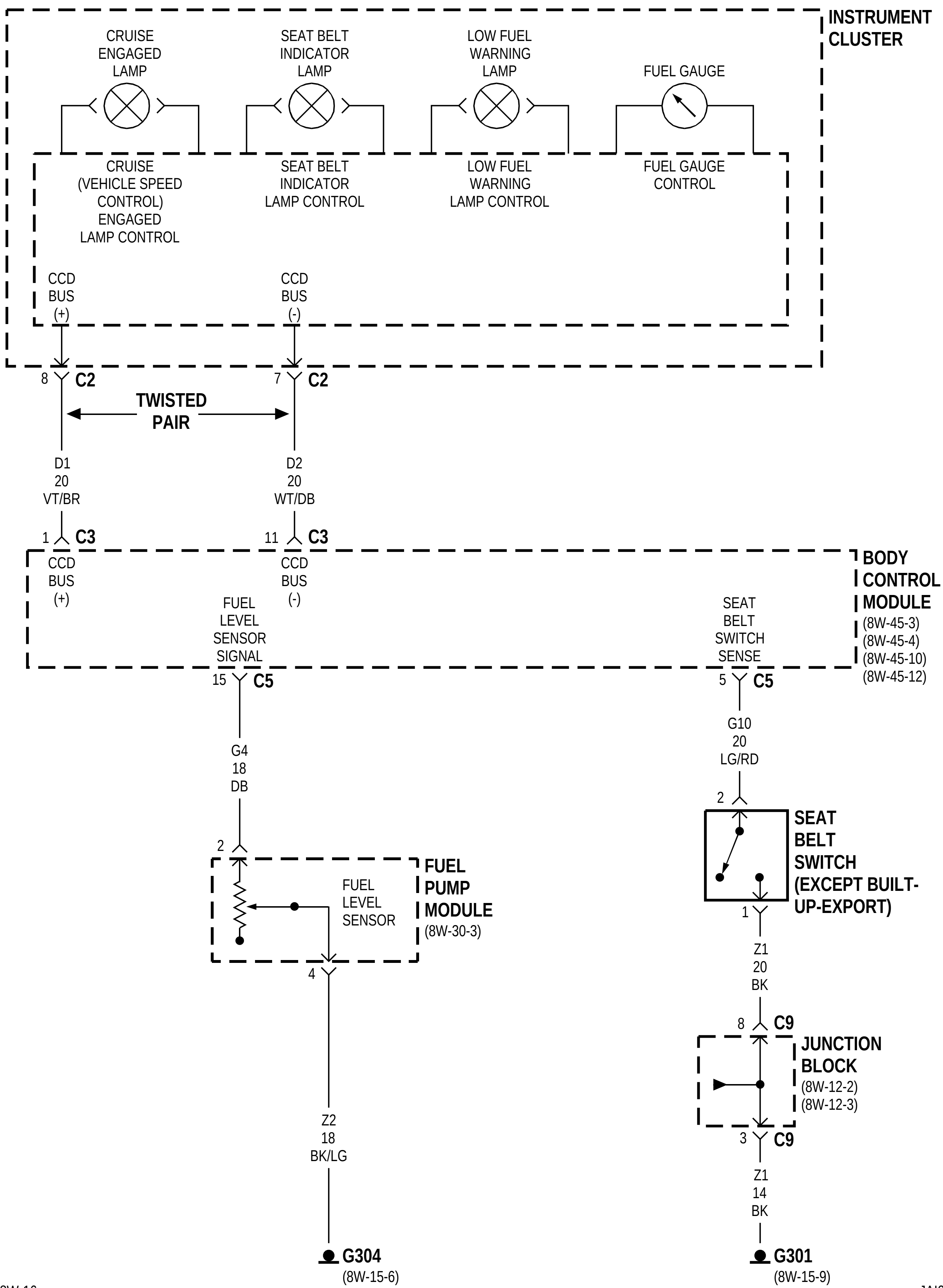

BATT A13
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
12
FUSE
7
20A
(8W-12-10)
11
11
C7
F33
20
PK/RD
5
C1
INSTRUMENT CLUSTER
(8W-40-7)
VTSS
SET
LED
7
C1
G69
20
BK/OR
1
C2
BODY CONTROL MODULE
(8W-45-12)
LEFT FRONT DOOR AJAR SWITCH SENSE
VTSS INDICATOR DRIVER
DOOR AJAR SWITCH SENSE
DOOR AJAR SWITCH SENSE
7
C5
6
C5
17
C5
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
NOT USED
G74
20
TN/RD
G74
20
TN/RD
G75
20
TN
S312
G74
20
TN/RD
G74
20
TN/RD
G74
20
TN/OR
LEFT FRONT DOOR AJAR SWITCH
(8W-45-12)
LEFT REAR DOOR AJAR SWITCH
(8W-45-12)
LEFT REAR DOOR AJAR SWITCH
(8W-45-12)
RIGHT FRONT DOOR AJAR SWITCH
(8W-45-12)

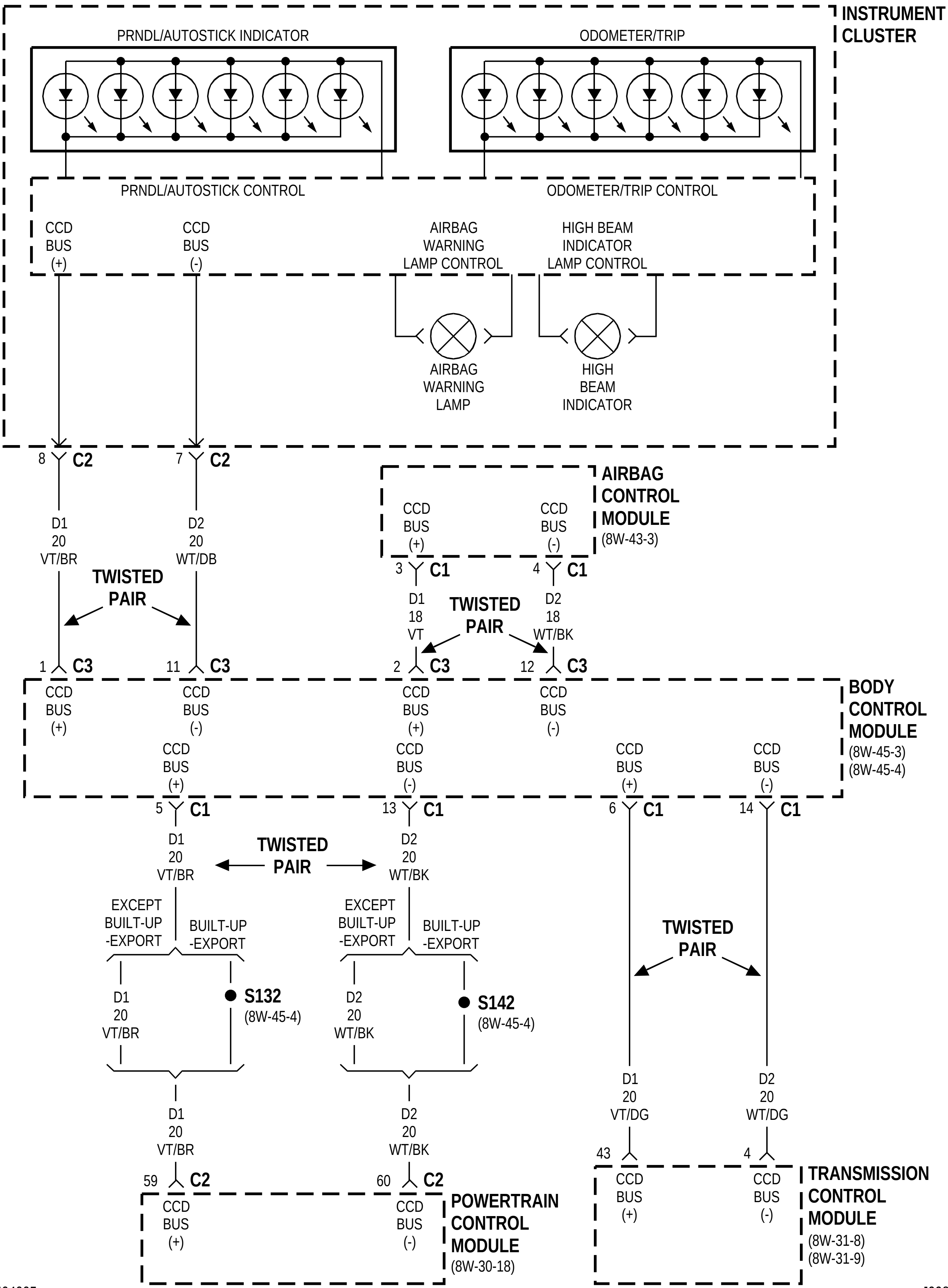

POWERTRAIN CONTROL MODULE
(8W-30-18)
CCD BUS (+)
CCD BUS (-)
59 C2
60 C2
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
S132
(8W-45-4)
S142
(8W-45-4)
LEFT PARK/ TURN SIGNAL LAMP
(8W-50-3)
HEAD-LAMP SWITCH OUTPUT
RIGHT PARK/ TURN SIGNAL LAMP
(8W-50-3)
L7 18 BK/BR
L7 18 BK/YL
S141
(8W-12-16)
BATT A13
(8W-10-14)
BATT A3
(8W-10-15)
9 C1
8 C1
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 8 20A
(8W-12-11)
HORN RELAY
(8W-41-2)
HEADLAMP DELAY RELAY
(8W-50-2)
(8W-12-16)
(8W-12-11)
5 C1
13 C1
HORN RELAY CONTROL
HEADLAMP DELAY RELAY CONTROL
HEAD-LAMP SWITCH OUTPUT
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
(8W-45-6)
(8W-45-7)

8W-40 INSTRUMENT CLUSTER

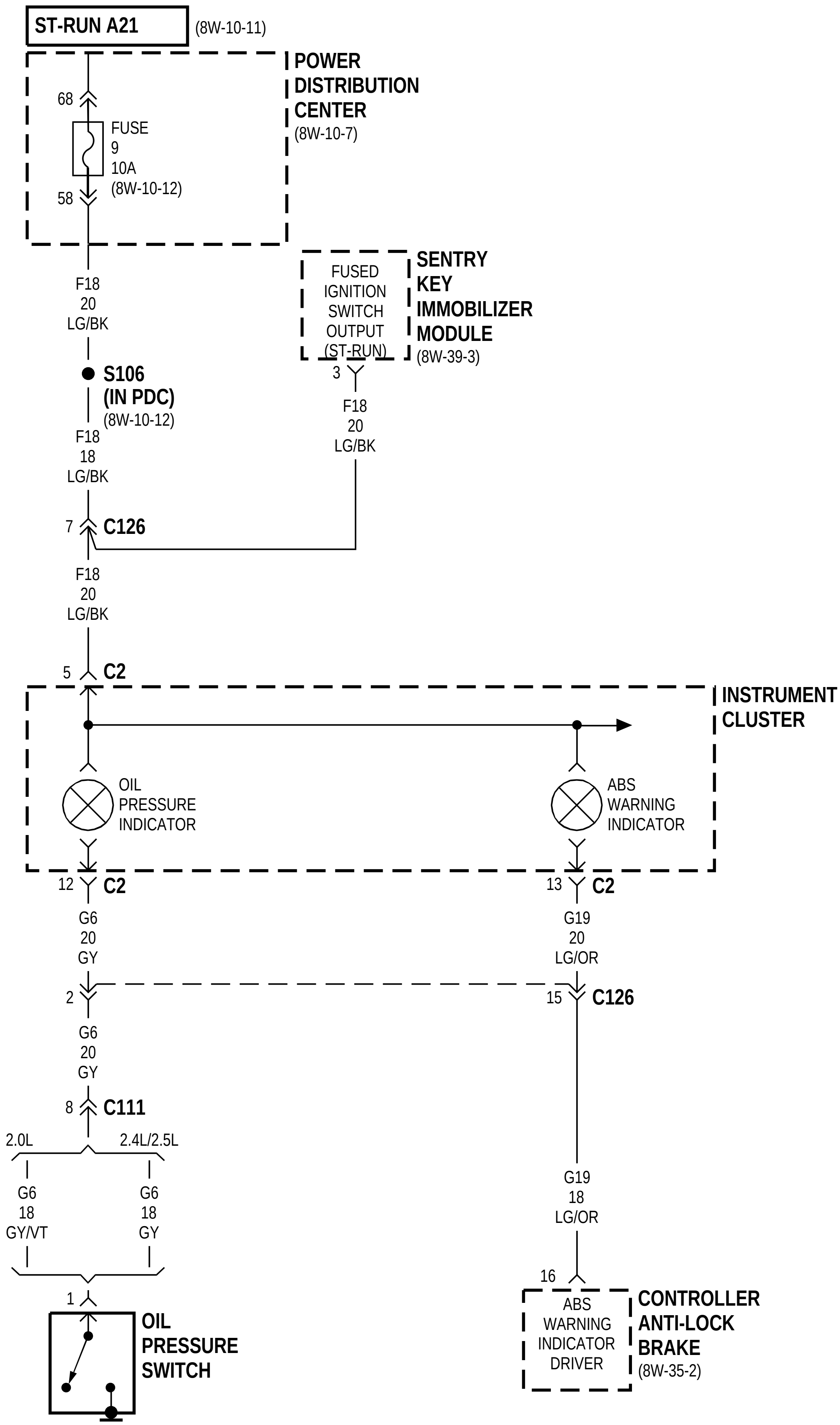

BATT A13
(8W-10-14)
ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
12
FUSE
7
20A
(8W-12-10)
11
20
FUSE
11
10A
(8W-12-12)
19
11 C7
10 C7
F33
20
PK/RD
F11
18
RD/VT
F11
20
RD/VT
4
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
AUTOSTICK SWITCH
(8W-31-8)
(8W-31-9)
5 C1
2 C1
INSTRUMENT CLUSTER
FUSED B (+)
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
GROUND
CCD BUS (+)
CCD BUS (-)
GROUND
4 C1
8 C2
7 C2
11 C2
Z2
18
BK/LG
D1
20
VT/BR
D2
20
WT/DB
Z1
18
BK/OR
TWISTED PAIR
2 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
14 C3
1 C3
11 C3
10
GROUND
CCD BUS (+)
CCD BUS (-)
GROUND
BODY CONTROL MODULE
(8W-45-2)
(8W-45-3)
(8W-45-4)
(8W-45-8)
3 C9
Z1
14
BK
G301
(8W-15-9)

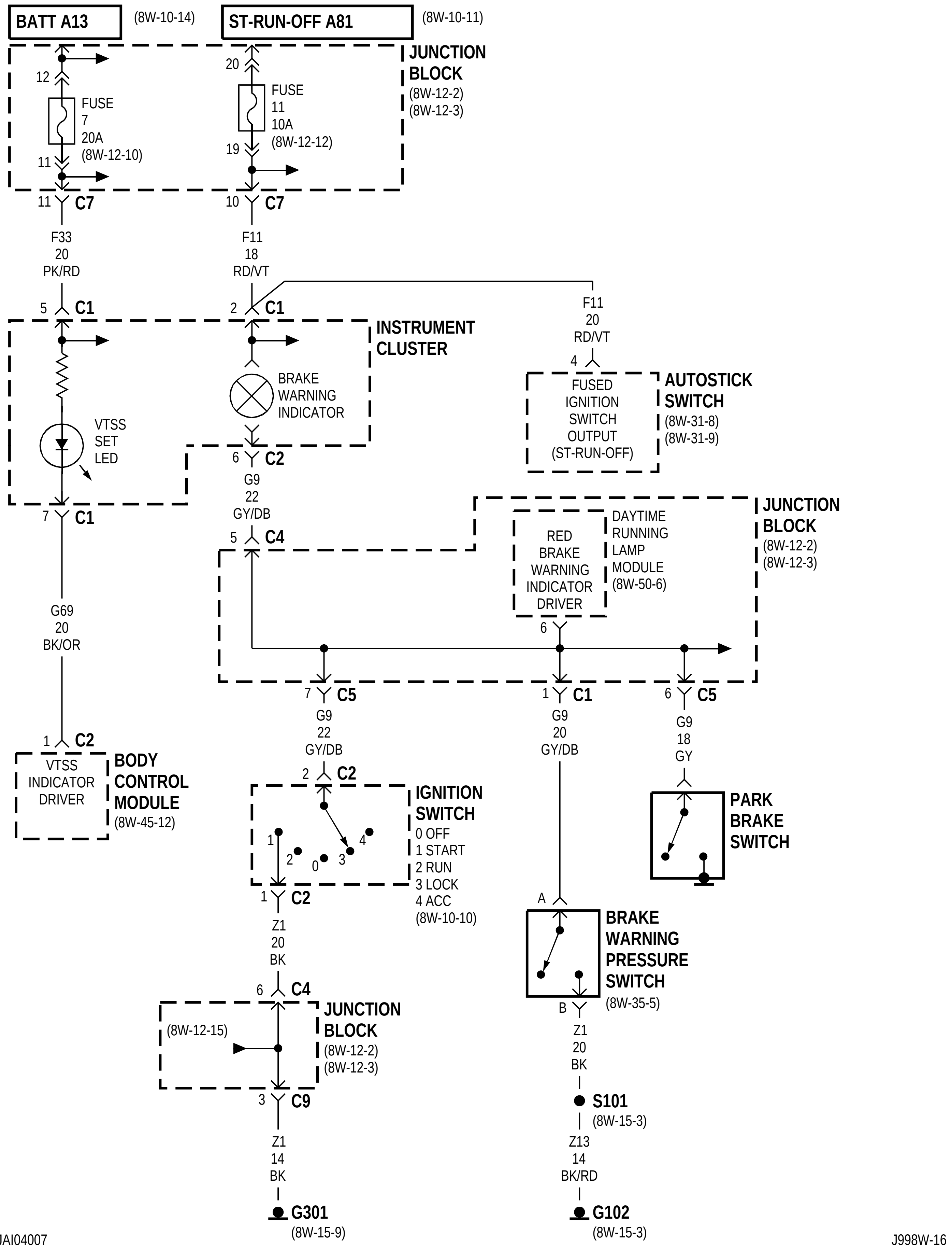

INSTRUMENT CLUSTER
MALFUNCTION INDICATOR LAMP (CHECK ENGINE)
CHARGING SYSTEM WARNING LAMP
ENGINE COOLANT TEMPERATURE LAMP
MALFUNCTION INDICATOR LAMP CONTROL (CHECK ENGINE)
CHARGING SYSTEM WARNING LAMP CONTROL
ENGINE COOLANT TEMPERATURE LAMP CONTROL
CCD BUS (+)
CCD BUS (-)
SPEEDOMETER CONTROL
TACHOMETER CONTROL
ENGINE COOLANT TEMPERATURE GAUGE CONTROL
SPEEDOMETER
TACHOMETER
ENGINE COOLANT TEMPERATURE GAUGE
8 C2
7 C2
POWERTRAIN CONTROL MODULE
(8W-30-18)
CCD BUS (-)
CCD BUS (+)
60 C2
59 C2
D2 20 WT/BK
TWISTED PAIR
D1 20 VT/BR
D1 20 VT/BR
D2 20 WT/DB
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
D2 20 WT/BK
S142
(8W-45-4)
D1 20 VT/BR
S132
(8W-45-4)
D2 20 WT/BK
D1 20 VT/BR
1 C3
11 C3
13 C1
5 C1
CCD BUS (+)
CCD BUS (-)
CCD BUS (-)
CCD BUS (+)
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)

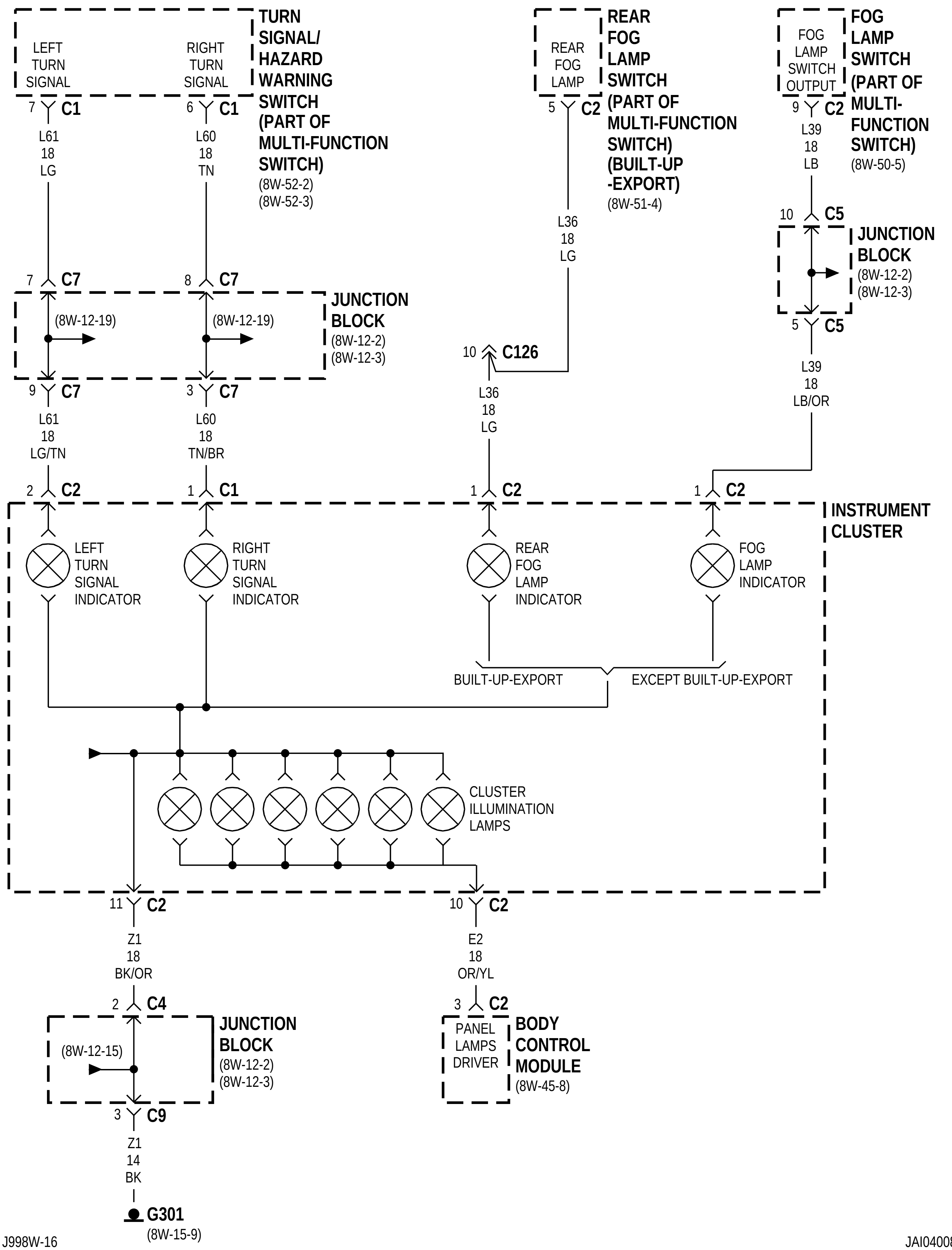

INSTRUMENT CLUSTER
CRUISE ENGAGED LAMP
SEAT BELT INDICATOR LAMP
LOW FUEL WARNING LAMP
FUEL GAUGE
CRUISE (VEHICLE SPEED CONTROL) ENGAGED LAMP CONTROL
SEAT BELT INDICATOR LAMP CONTROL
LOW FUEL WARNING LAMP CONTROL
FUEL GAUGE CONTROL
CCD BUS (+)
CCD BUS (-)
8 C2
7 C2
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/DB
1 C3
11 C3
CCD BUS (+)
CCD BUS (-)
FUEL LEVEL SENSOR SIGNAL
SEAT BELT SWITCH SENSE
BODY CONTROL MODULE (8W-45-3) (8W-45-4) (8W-45-10) (8W-45-12)
15 C5
5 C5
G4 18 DB
G10 20 LG/RD
2
FUEL LEVEL SENSOR
FUEL PUMP MODULE (8W-30-3)
4
SEAT BELT SWITCH (EXCEPT BUILT-UP-EXPORT)
1
Z1 20 BK
8 C9
JUNCTION BLOCK (8W-12-2) (8W-12-3)
3 C9
Z1 14 BK
Z2 18 BK/LG
G304 (8W-15-6)
G301 (8W-15-9)



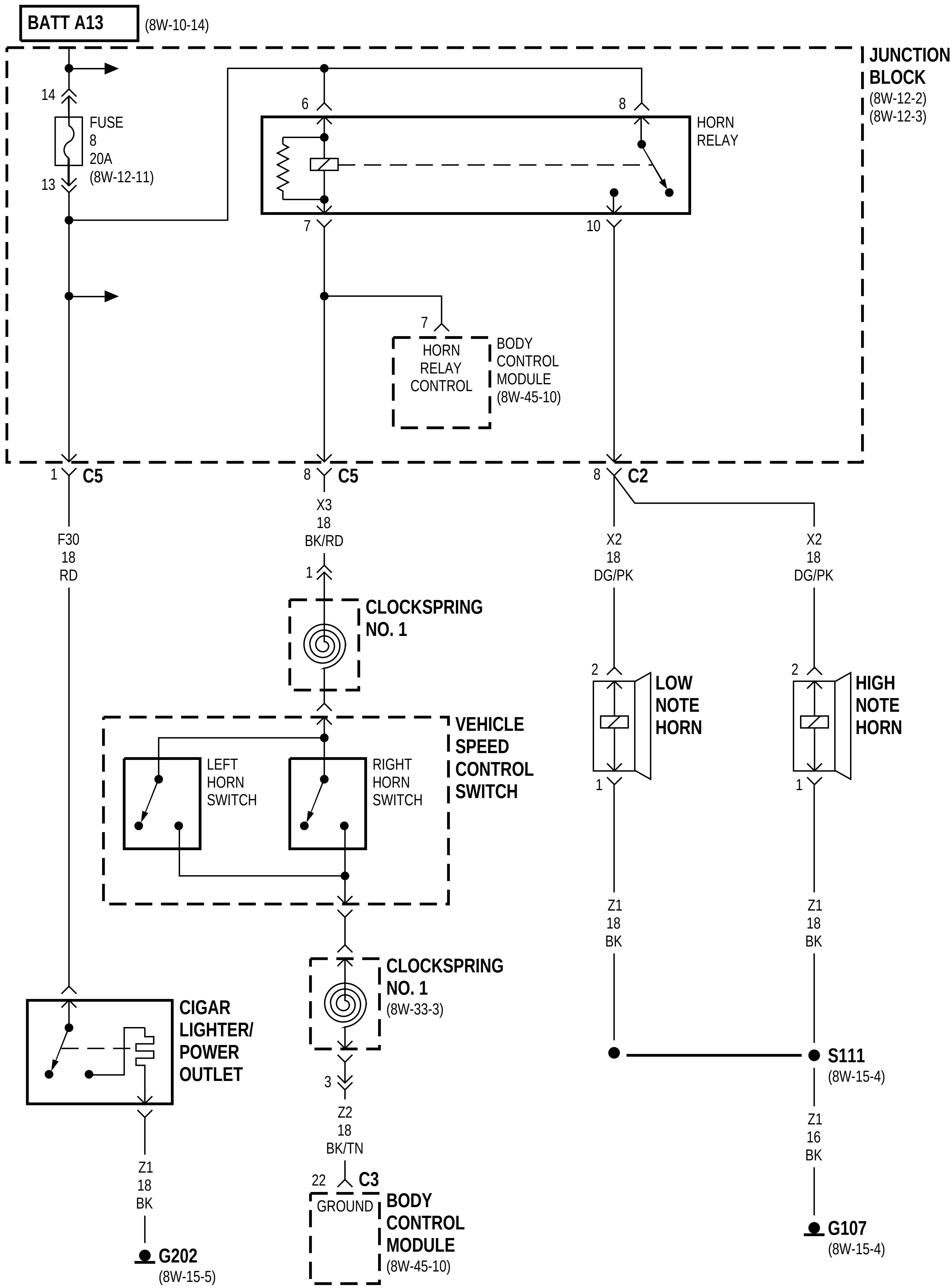
JAI04005 J998W-16


ST-RUN A21
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
68
FUSE
9
10A
(8W-10-12)
58
F18
20
LG/BK
SENTRY KEY IMMOBILIZER MODULE
(8W-39-3)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
3
S106
(IN PDC)
(8W-10-12)
F18
18
LG/BK
F18
20
LG/BK
7
C126
F18
20
LG/BK
5
C2
INSTRUMENT CLUSTER
OIL PRESSURE INDICATOR
ABS WARNING INDICATOR
12
C2
13
C2
G6
20
GY
G19
20
LG/OR
2
15
C126
G6
20
GY
8
C111
2.0L
2.4L/2.5L
G6
18
GY/VT
G6
18
GY
G19
18
LG/OR
1
OIL PRESSURE SWITCH
16
ABS WARNING INDICATOR DRIVER
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)

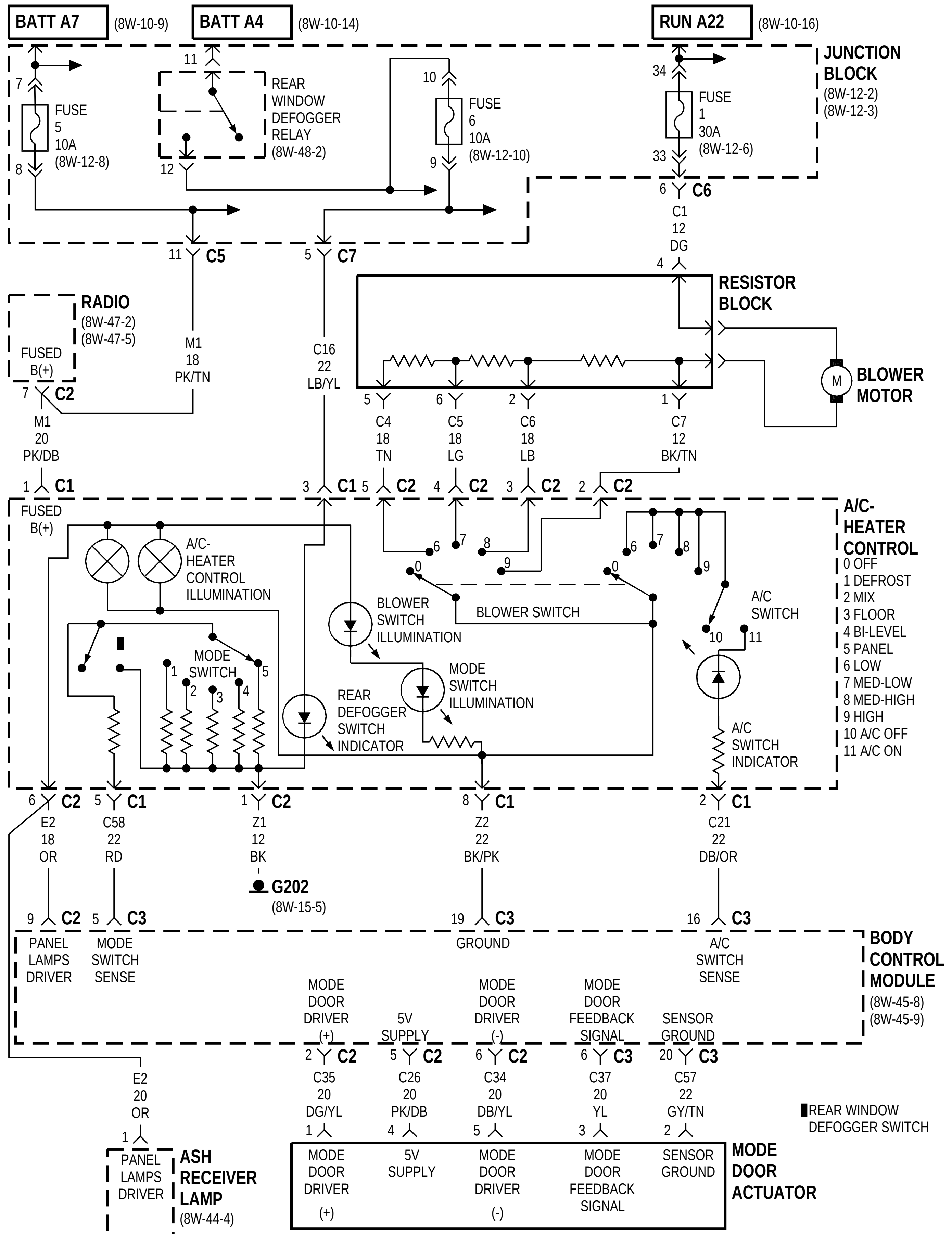

BATT A13
(8W-10-14)
ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 7 20A (8W-12-10)
FUSE 11 10A (8W-12-12)
12
11
20
19
11 C7
10 C7
F33 20 PK/RD
F11 18 RD/VT
5 C1
2 C1
F11 20 RD/VT
INSTRUMENT CLUSTER
BRAKE WARNING INDICATOR
VTSS SET LED
6 C2
7 C1
4
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
AUTOSTICK SWITCH
(8W-31-8)
(8W-31-9)
G9 22 GY/DB
5 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
RED BRAKE WARNING INDICATOR DRIVER
DAYTIME RUNNING LAMP MODULE (8W-50-6)
6
G69 20 BK/OR
7 C5
1 C1
6 C5
G9 22 GY/DB
G9 20 GY/DB
G9 18 GY
1 C2
VTSS INDICATOR DRIVER
BODY CONTROL MODULE
(8W-45-12)
2 C2
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-10)
1 2 0 3 4
PARK BRAKE SWITCH
1 C2
Z1 20 BK
A
BRAKE WARNING PRESSURE SWITCH
(8W-35-5)
B
6 C4
JUNCTION BLOCK
(8W-12-15)
(8W-12-2)
(8W-12-3)
3 C9
Z1 20 BK
S101
(8W-15-3)
Z1 14 BK
Z13 14 BK/RD
G301
(8W-15-9)
G102
(8W-15-3)
JAI04007


LEFT TURN SIGNAL
RIGHT TURN SIGNAL
TURN SIGNAL/ HAZARD WARNING SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
(8W-52-3)
7 C1
6 C1
L61 18 LG
L60 18 TN
7 C7
8 C7
(8W-12-19)
(8W-12-19)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
9 C7
3 C7
L61 18 LG/TN
L60 18 TN/BR
2 C2
1 C1
REAR FOG LAMP
REAR FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH) (BUILT-UP -EXPORT)
(8W-51-4)
5 C2
L36 18 LG
10 C126
L36 18 LG
1 C2
FOG LAMP SWITCH OUTPUT
FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-50-5)
9 C2
L39 18 LB
10 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
5 C5
L39 18 LB/OR
1 C2
INSTRUMENT CLUSTER
LEFT TURN SIGNAL INDICATOR
RIGHT TURN SIGNAL INDICATOR
REAR FOG LAMP INDICATOR
FOG LAMP INDICATOR
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
CLUSTER ILLUMINATION LAMPS
11 C2
10 C2
Z1 18 BK/OR
E2 18 OR/YL
2 C4
(8W-12-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
3 C9
Z1 14 BK
G301
(8W-15-9)
3 C2
PANEL LAMPS DRIVER
BODY CONTROL MODULE
(8W-45-8)

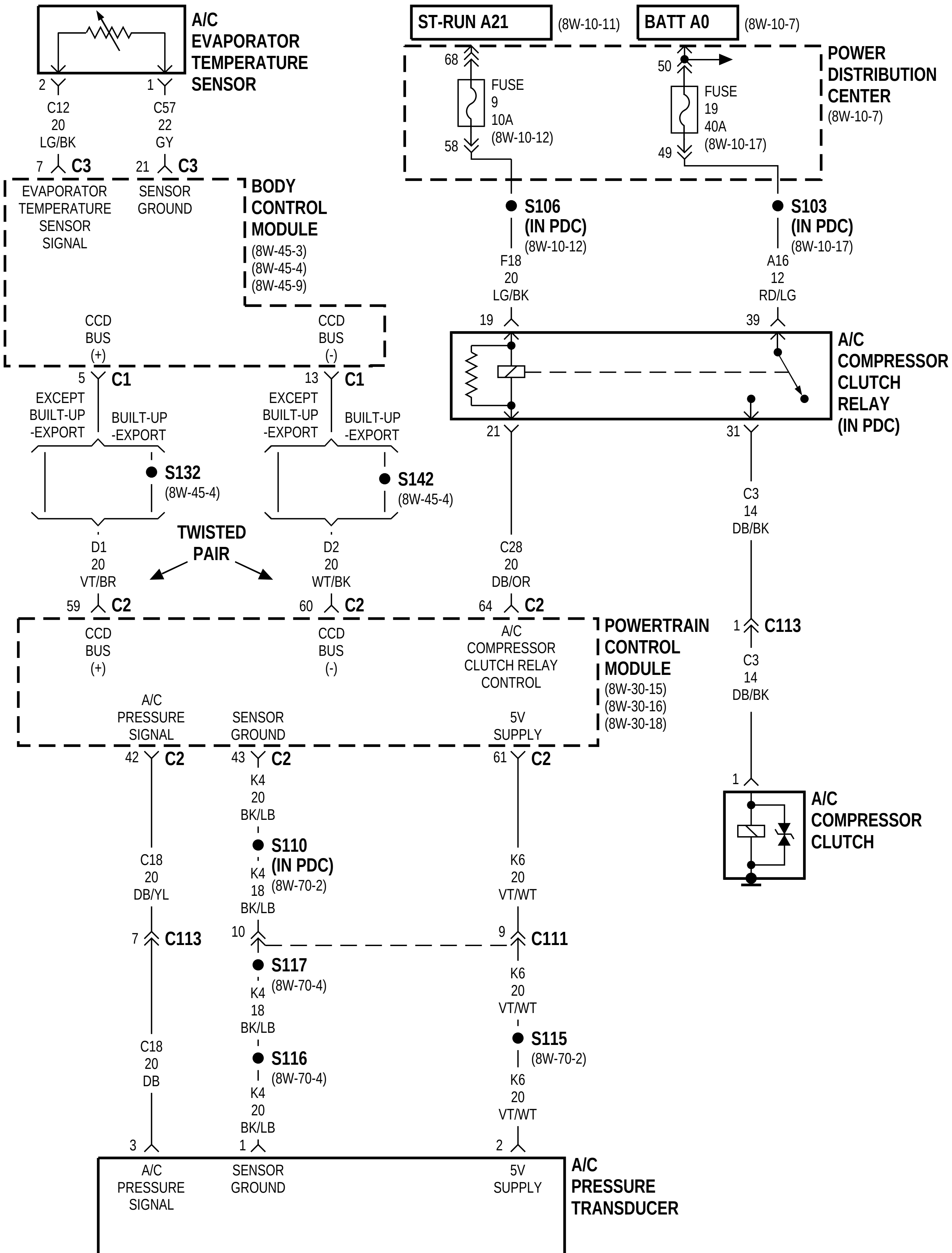
8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

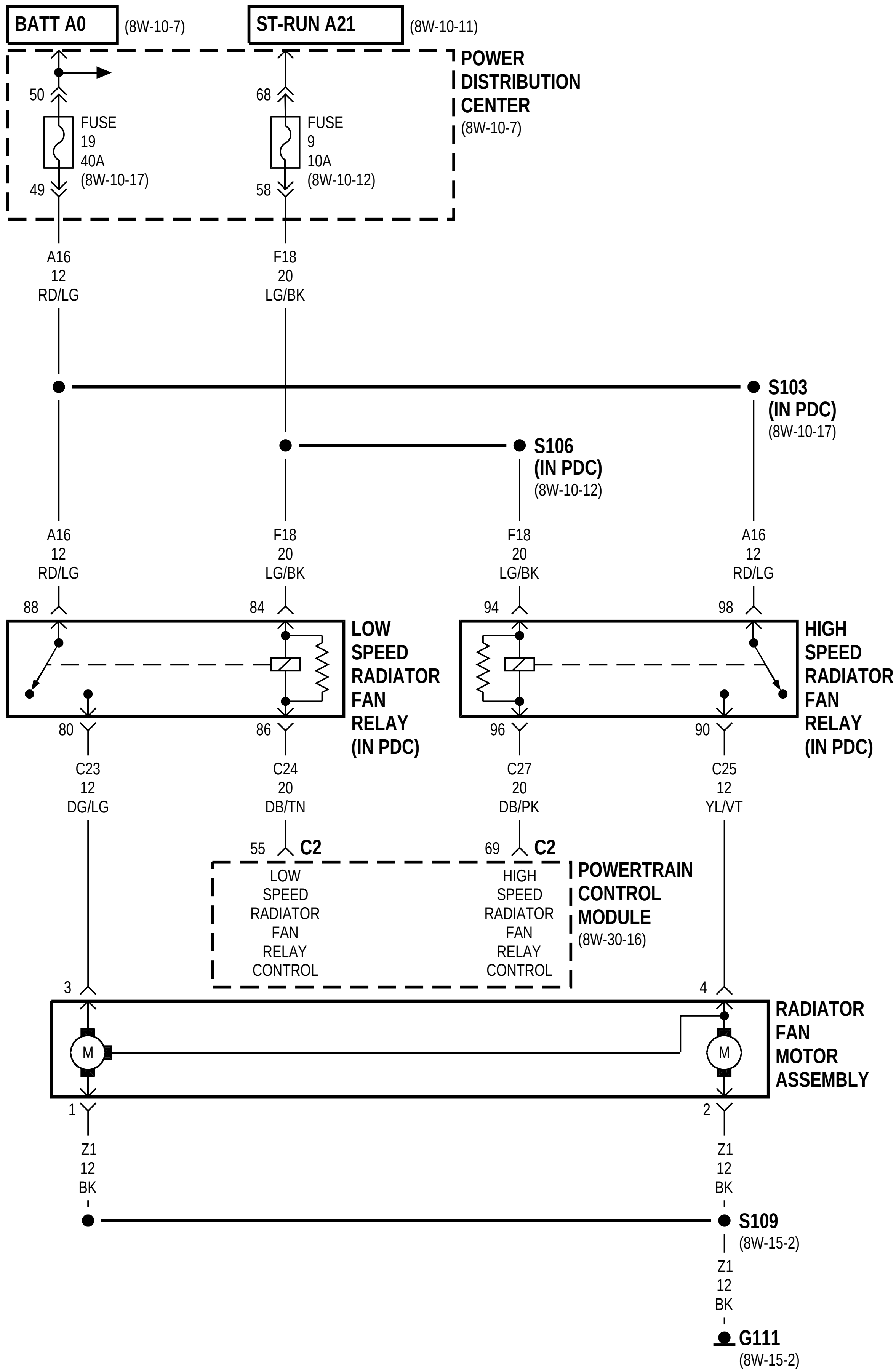

BATT A13
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
14
FUSE
8
20A
(8W-12-11)
13
6
8
HORN
RELAY
7
10
7
HORN
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-10)
1
C5
8
C5
8
C2
F30
18
RD
X3
18
BK/RD
X2
18
DG/PK
X2
18
DG/PK
1
CLOCKSPRING
NO. 1
VEHICLE
SPEED
CONTROL
SWITCH
LEFT
HORN
SWITCH
RIGHT
HORN
SWITCH
2
LOW
NOTE
HORN
1
2
HIGH
NOTE
HORN
1
Z1
18
BK
Z1
18
BK
CLOCKSPRING
NO. 1
(8W-33-3)
CIGAR
LIGHTER/
POWER
OUTLET
S111
(8W-15-4)
3
Z2
18
BK/TN
Z1
16
BK
22
C3
GROUND
BODY
CONTROL
MODULE
(8W-45-10)
Z1
18
BK
G202
(8W-15-5)
G107
(8W-15-4)

8W-42 AIR CONDITIONING-HEATER

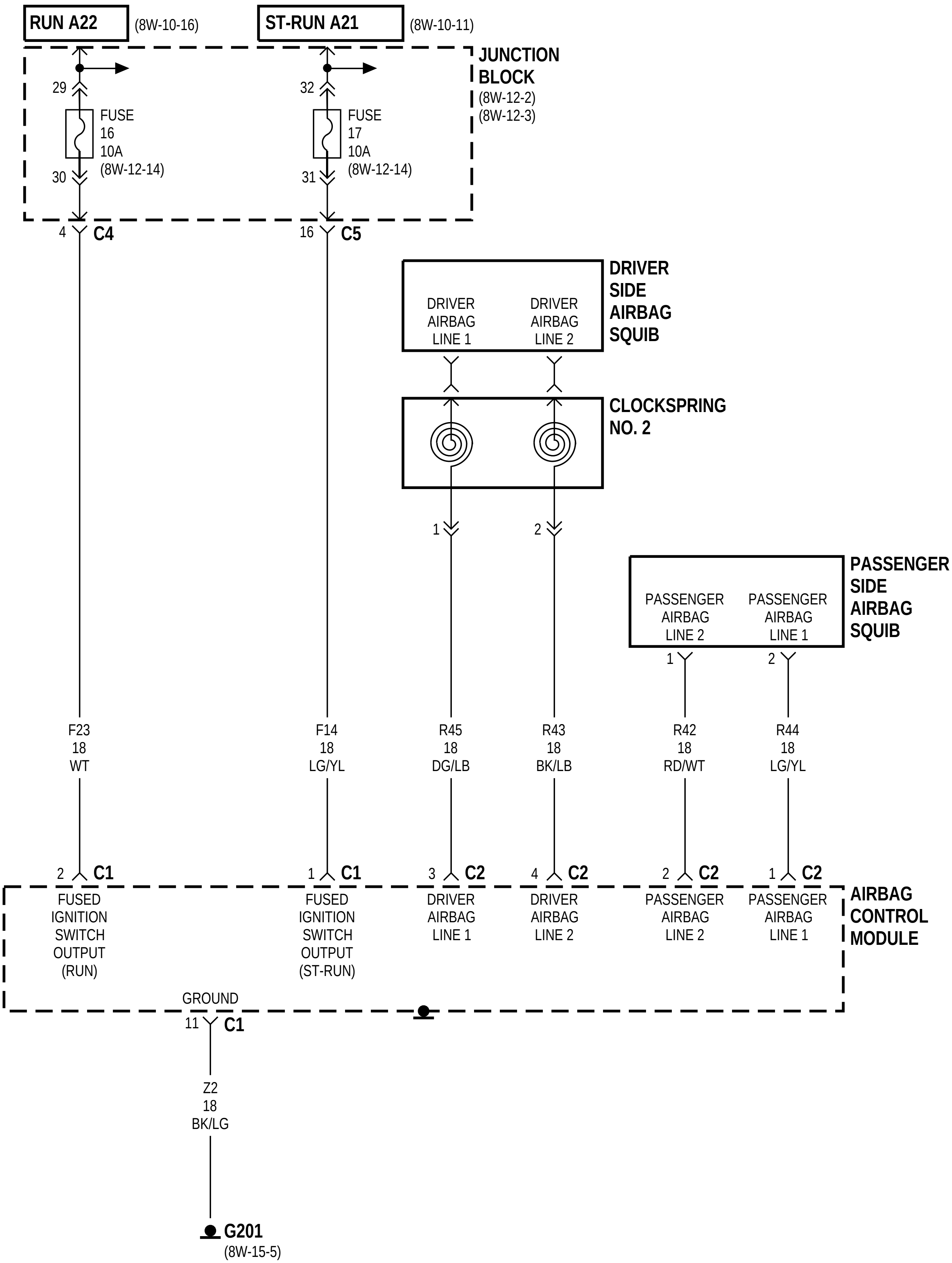


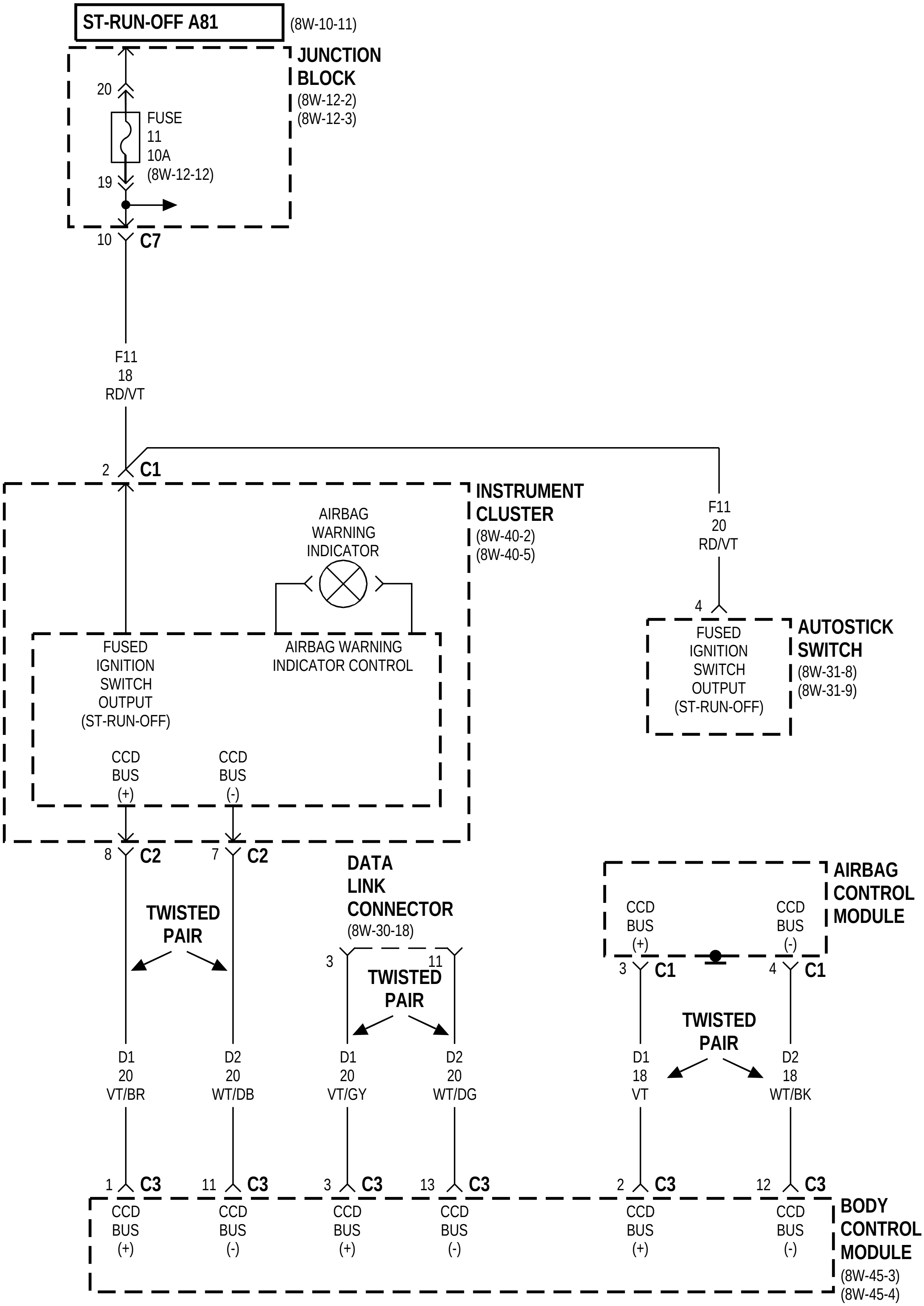
J998W-16 JAI04202


A/C EVAPORATOR TEMPERATURE SENSOR
ST-RUN A21 (8W-10-11)
BATT A0 (8W-10-7)
POWER DISTRIBUTION CENTER (8W-10-7)
FUSE 9 10A (8W-10-12)
FUSE 19 40A (8W-10-17)
C12 20 LG/BK
C57 22 GY
EVAPORATOR TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
BODY CONTROL MODULE (8W-45-3) (8W-45-4) (8W-45-9)
S106 (IN PDC) (8W-10-12)
S103 (IN PDC) (8W-10-17)
F18 20 LG/BK
A16 12 RD/LG
CCD BUS (+)
CCD BUS (-)
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
S132 (8W-45-4)
S142 (8W-45-4)
C3 14 DB/BK
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
C28 20 DB/OR
POWERTRAIN CONTROL MODULE (8W-30-15) (8W-30-16) (8W-30-18)
A/C COMPRESSOR CLUTCH RELAY CONTROL
A/C PRESSURE SIGNAL
5V SUPPLY
C113
K4 20 BK/LB
S110 (IN PDC) (8W-70-2)
K4 18 BK/LB
C18 20 DB/YL
K6 20 VT/WT
A/C COMPRESSOR CLUTCH
C111
S117 (8W-70-4)
S115 (8W-70-2)
C18 20 DB
S116 (8W-70-4)
A/C PRESSURE TRANSDUCER

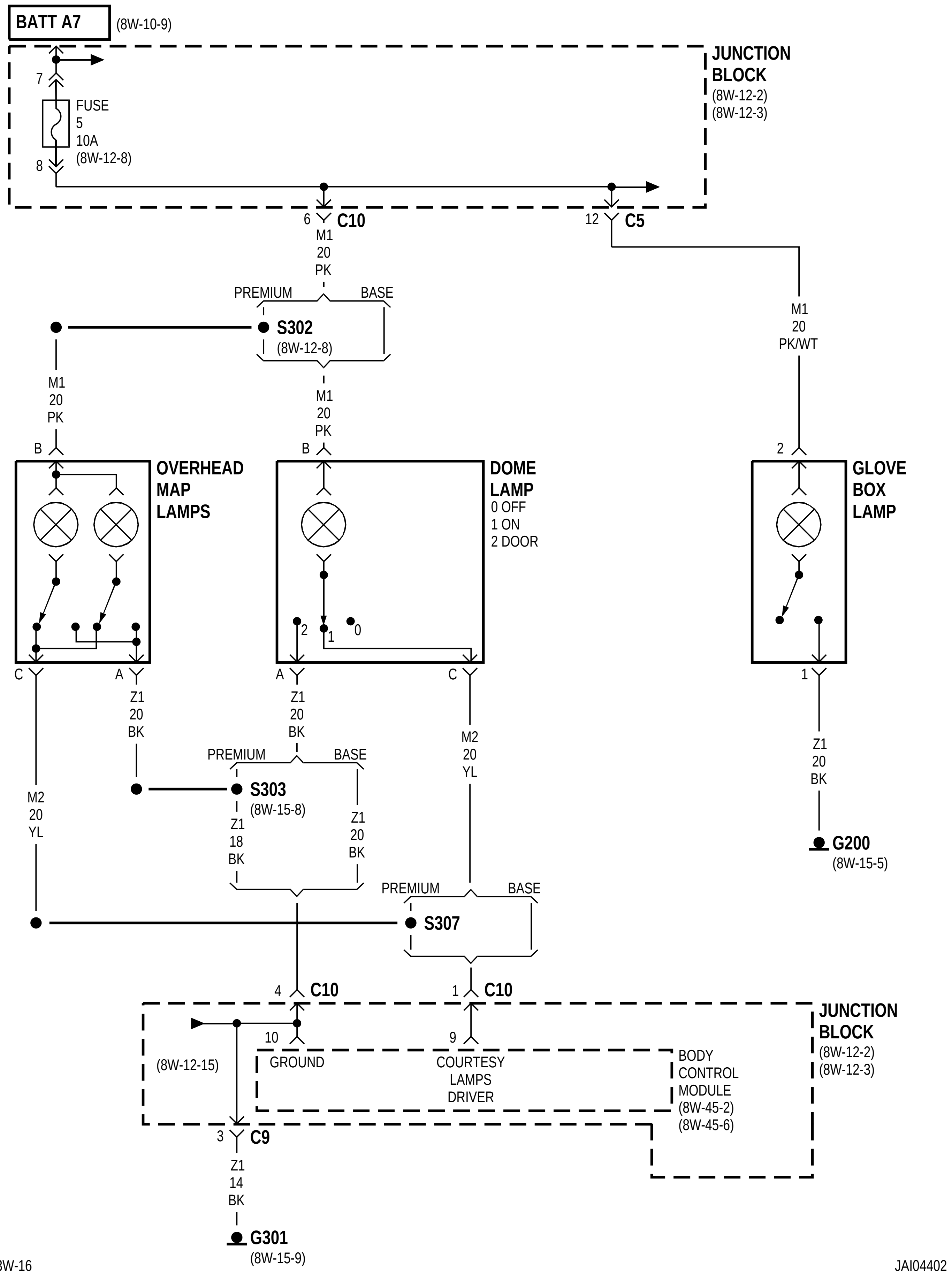

BATT A0
(8W-10-7)
ST-RUN A21
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-7)
50
FUSE 19 40A
(8W-10-17)
49
68
FUSE 9 10A
(8W-10-12)
58
A16 12 RD/LG
F18 20 LG/BK
S103 (IN PDC)
(8W-10-17)
S106 (IN PDC)
(8W-10-12)
A16 12 RD/LG
F18 20 LG/BK
F18 20 LG/BK
A16 12 RD/LG
88
84
94
98
LOW SPEED RADIATOR FAN RELAY (IN PDC)
HIGH SPEED RADIATOR FAN RELAY (IN PDC)
80
86
96
90
C23 12 DG/LG
C24 20 DB/TN
C27 20 DB/PK
C25 12 YL/VT
55 C2
69 C2
LOW SPEED RADIATOR FAN RELAY CONTROL
HIGH SPEED RADIATOR FAN RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-16)
3
4
M
M
RADIATOR FAN MOTOR ASSEMBLY
1
2
Z1 12 BK
Z1 12 BK
S109
(8W-15-2)
Z1 12 BK
G111
(8W-15-2)

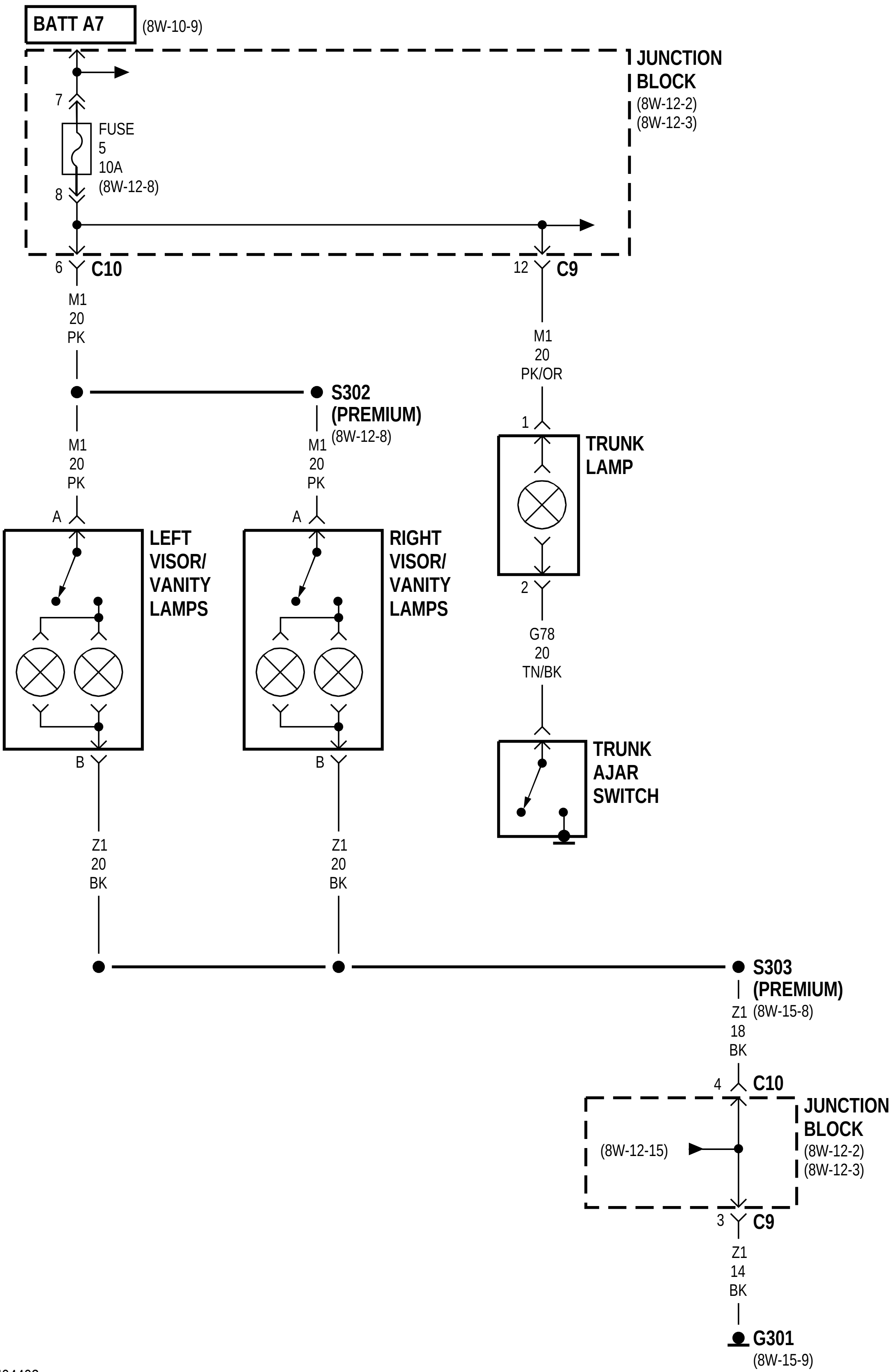
8W-43 AIRBAG SYSTEM

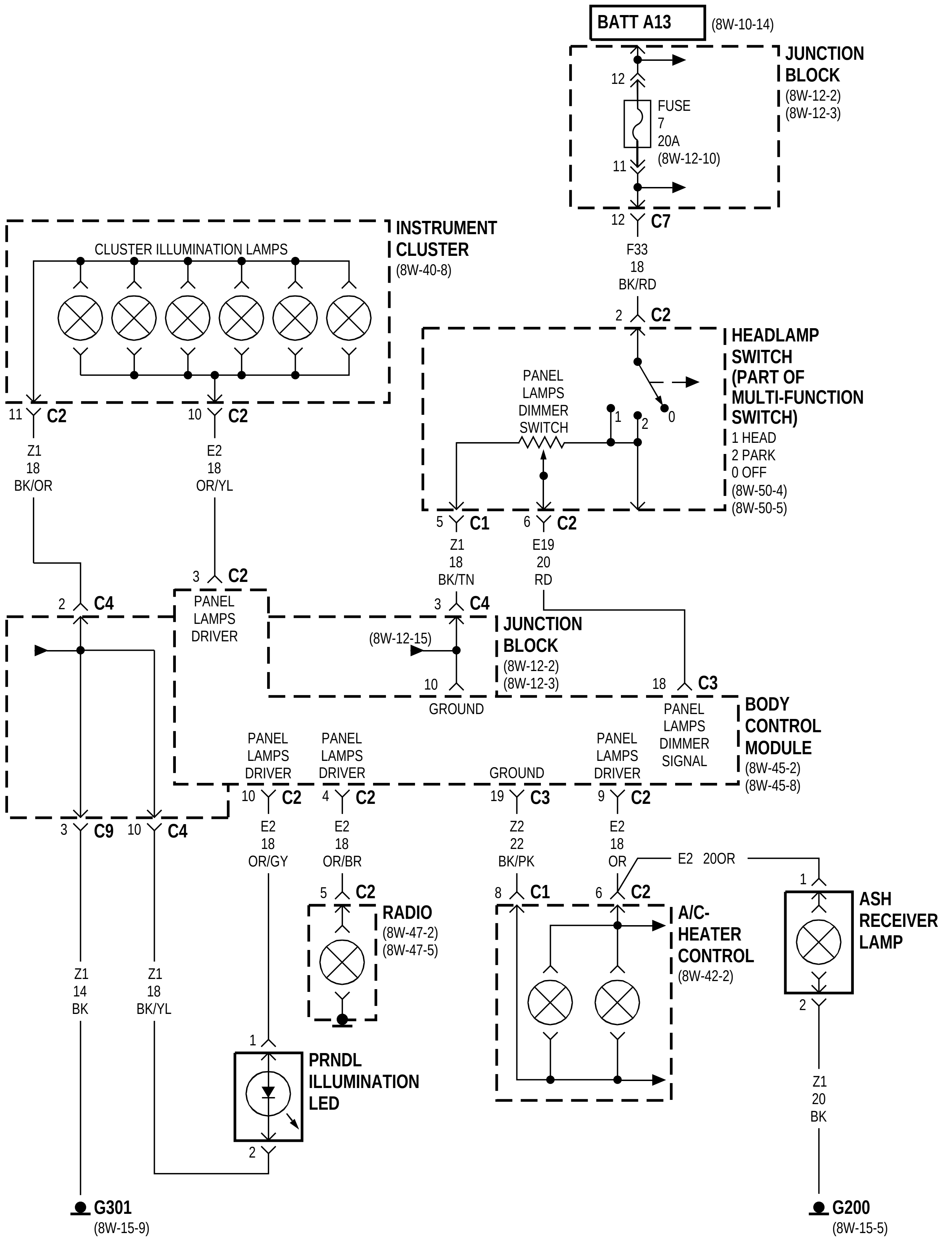

RUN A22
(8W-10-16)
ST-RUN A21
(8W-10-11)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
29
FUSE
16
10A
(8W-12-14)
30
32
FUSE
17
10A
(8W-12-14)
31
4
C4
16
C5
DRIVER
AIRBAG
LINE 1
DRIVER
AIRBAG
LINE 2
DRIVER
SIDE
AIRBAG
SQUIB
CLOCKSPRING
NO. 2
1
2
PASSENGER
AIRBAG
LINE 2
PASSENGER
AIRBAG
LINE 1
PASSENGER
SIDE
AIRBAG
SQUIB
1
2
F23
18
WT
F14
18
LG/YL
R45
18
DG/LB
R43
18
BK/LB
R42
18
RD/WT
R44
18
LG/YL
2
C1
1
C1
3
C2
4
C2
2
C2
1
C2
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
FUSED
IGNITION
SWITCH
OUTPUT
(ST-RUN)
DRIVER
AIRBAG
LINE 1
DRIVER
AIRBAG
LINE 2
PASSENGER
AIRBAG
LINE 2
PASSENGER
AIRBAG
LINE 1
AIRBAG
CONTROL
MODULE
GROUND
11
C1
Z2
18
BK/LG
G201
(8W-15-5)


ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
20
FUSE
11
10A
(8W-12-12)
19
10
C7
F11
18
RD/VT
2
C1
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-5)
F11
20
RD/VT
AIRBAG WARNING INDICATOR
4
AUTOSTICK SWITCH
(8W-31-8)
(8W-31-9)
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
AIRBAG WARNING INDICATOR CONTROL
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
CCD BUS (+)
CCD BUS (-)
8
C2
7
C2
DATA LINK CONNECTOR
(8W-30-18)
AIRBAG CONTROL MODULE
CCD BUS (+)
CCD BUS (-)
TWISTED PAIR
3
11
TWISTED PAIR
3
C1
4
C1
TWISTED PAIR
D1
20
VT/BR
D2
20
WT/DB
D1
20
VT/GY
D2
20
WT/DG
D1
18
VT
D2
18
WT/BK
1
C3
11
C3
3
C3
13
C3
2
C3
12
C3
CCD BUS (+)
CCD BUS (-)
CCD BUS (+)
CCD BUS (-)
CCD BUS (+)
CCD BUS (-)
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)

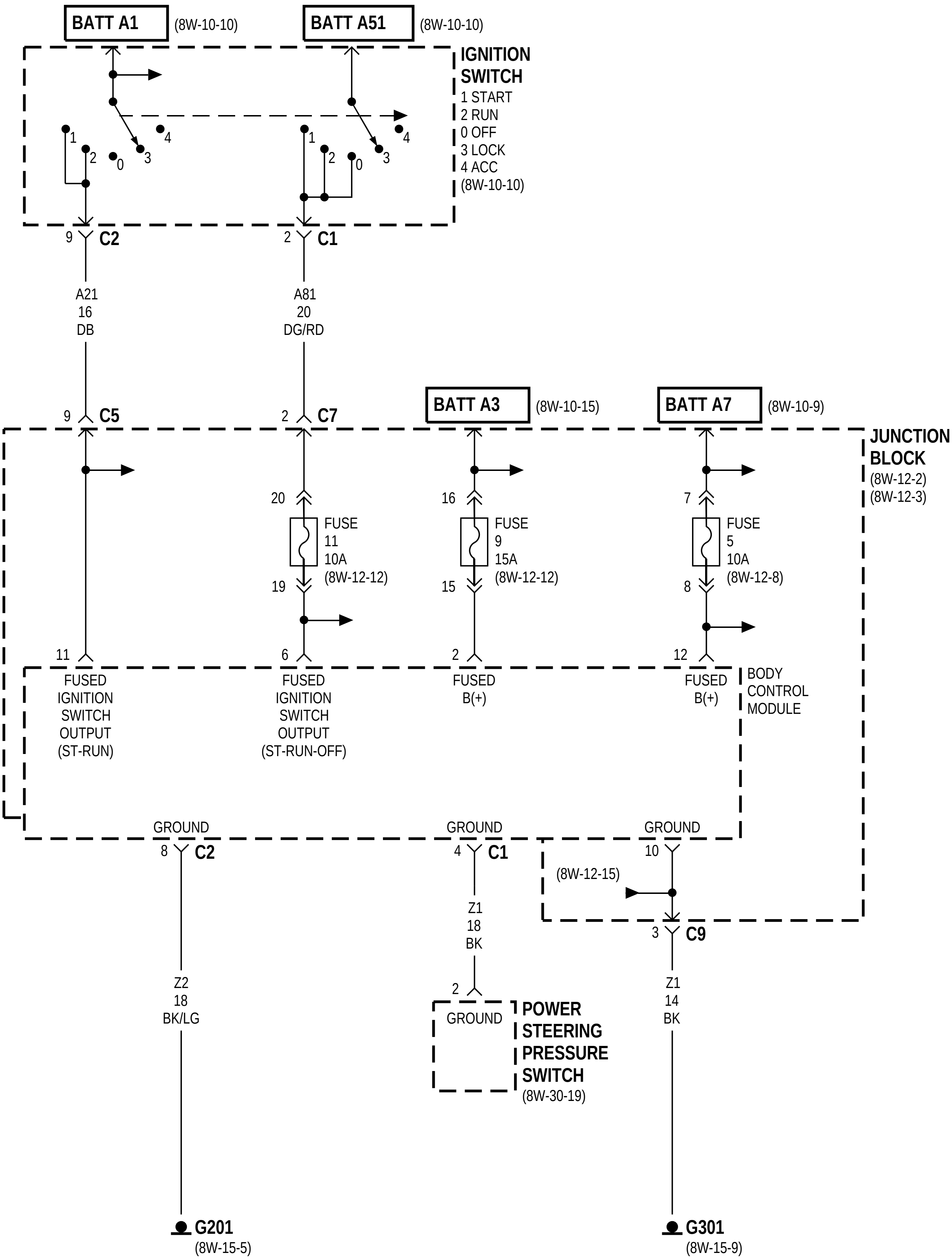
8W-44 INTERIOR LIGHTING


BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
7
FUSE
5
10A
(8W-12-8)
8
6
C10
12
C5
M1
20
PK
PREMIUM
BASE
S302
(8W-12-8)
M1
20
PK/WT
M1
20
PK
M1
20
PK
B
B
2
OVERHEAD MAP LAMPS
DOME LAMP
0 OFF
1 ON
2 DOOR
GLOVE BOX LAMP
2
1
0
C
A
A
C
1
Z1
20
BK
Z1
20
BK
PREMIUM
BASE
M2
20
YL
Z1
20
BK
S303
(8W-15-8)
M2
20
YL
Z1
18
BK
Z1
20
BK
G200
(8W-15-5)
PREMIUM
BASE
S307
4
C10
1
C10
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
10
9
(8W-12-15)
GROUND
COURTESY LAMPS DRIVER
BODY CONTROL MODULE
(8W-45-2)
(8W-45-6)
3
C9
Z1
14
BK
G301
(8W-15-9)

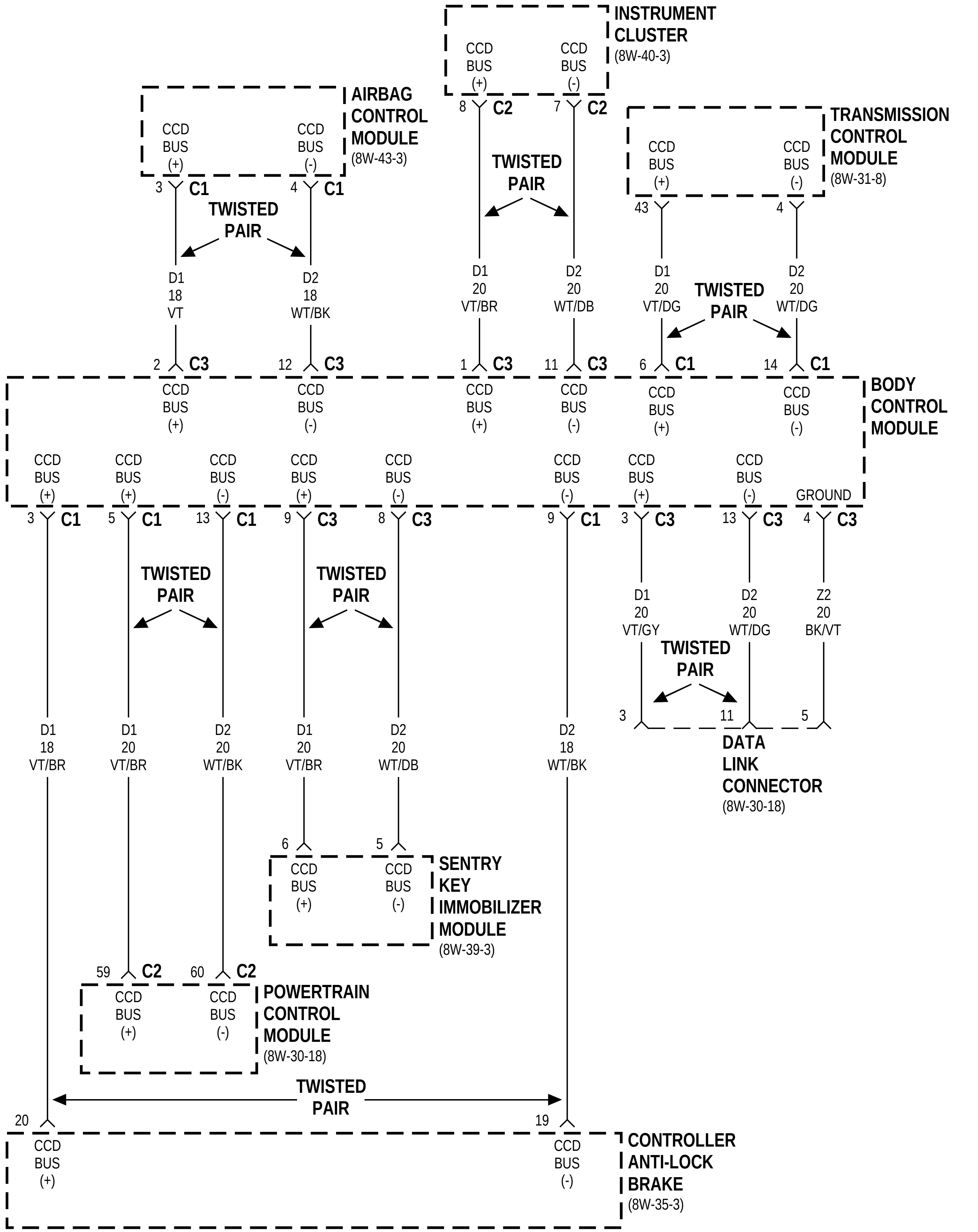

BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
7
FUSE
5
10A
(8W-12-8)
8
6
C10
12
C9
M1
20
PK
M1
20
PK/OR
S302
(PREMIUM)
(8W-12-8)
M1
20
PK
M1
20
PK
1
TRUNK LAMP
A
LEFT VISOR/ VANITY LAMPS
A
RIGHT VISOR/ VANITY LAMPS
2
G78
20
TN/BK
TRUNK AJAR SWITCH
B
B
Z1
20
BK
Z1
20
BK
S303
(PREMIUM)
(8W-15-8)
Z1
18
BK
4
C10
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-15)
3
C9
Z1
14
BK
G301
(8W-15-9)


BATT A13
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
12
FUSE
7
20A
(8W-12-10)
11
12 C7
F33
18
BK/RD
2 C2
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
1 HEAD
2 PARK
0 OFF
(8W-50-4)
(8W-50-5)
PANEL LAMPS DIMMER SWITCH
1
2
0
5 C1
6 C2
Z1
18
BK/TN
E19
20
RD
INSTRUMENT CLUSTER
(8W-40-8)
CLUSTER ILLUMINATION LAMPS
11 C2
10 C2
Z1
18
BK/OR
E2
18
OR/YL
3 C2
2 C4
PANEL LAMPS DRIVER
3 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-15)
10
GROUND
18 C3
BODY CONTROL MODULE
(8W-45-2)
(8W-45-8)
PANEL LAMPS DIMMER SIGNAL
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
GROUND
PANEL LAMPS DRIVER
10 C2
4 C2
19 C3
9 C2
3 C9
10 C4
E2
18
OR/GY
E2
18
OR/BR
Z2
22
BK/PK
E2
18
OR
E2 20OR
5 C2
RADIO
(8W-47-2)
(8W-47-5)
8 C1
6 C2
A/C-HEATER CONTROL
(8W-42-2)
1
ASH RECEIVER LAMP
2
Z1
20
BK
Z1
14
BK
Z1
18
BK/YL
1
PRNDL ILLUMINATION LED
2
G301
(8W-15-9)
G200
(8W-15-5)

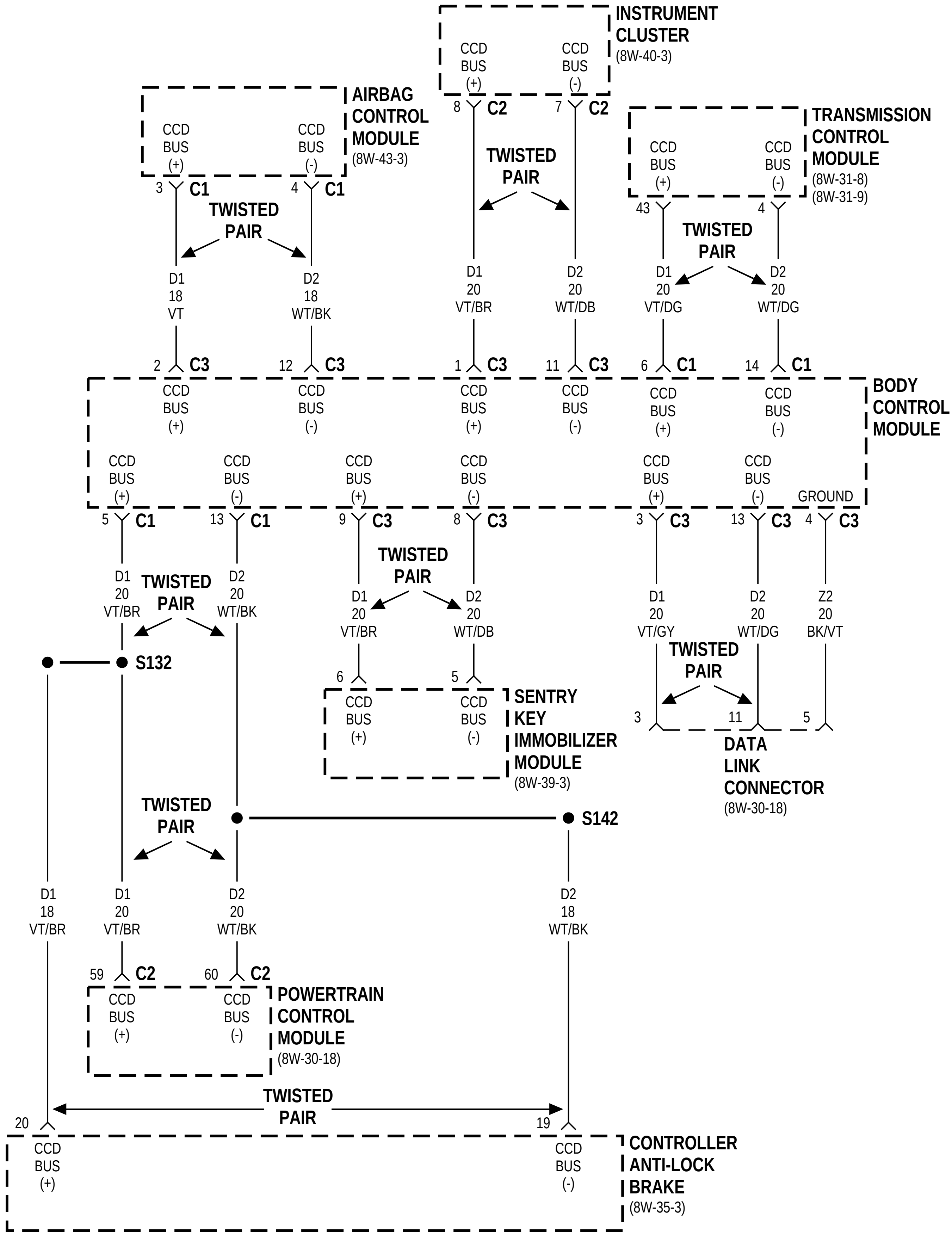
8W-45 BODY CONTROL MODULE

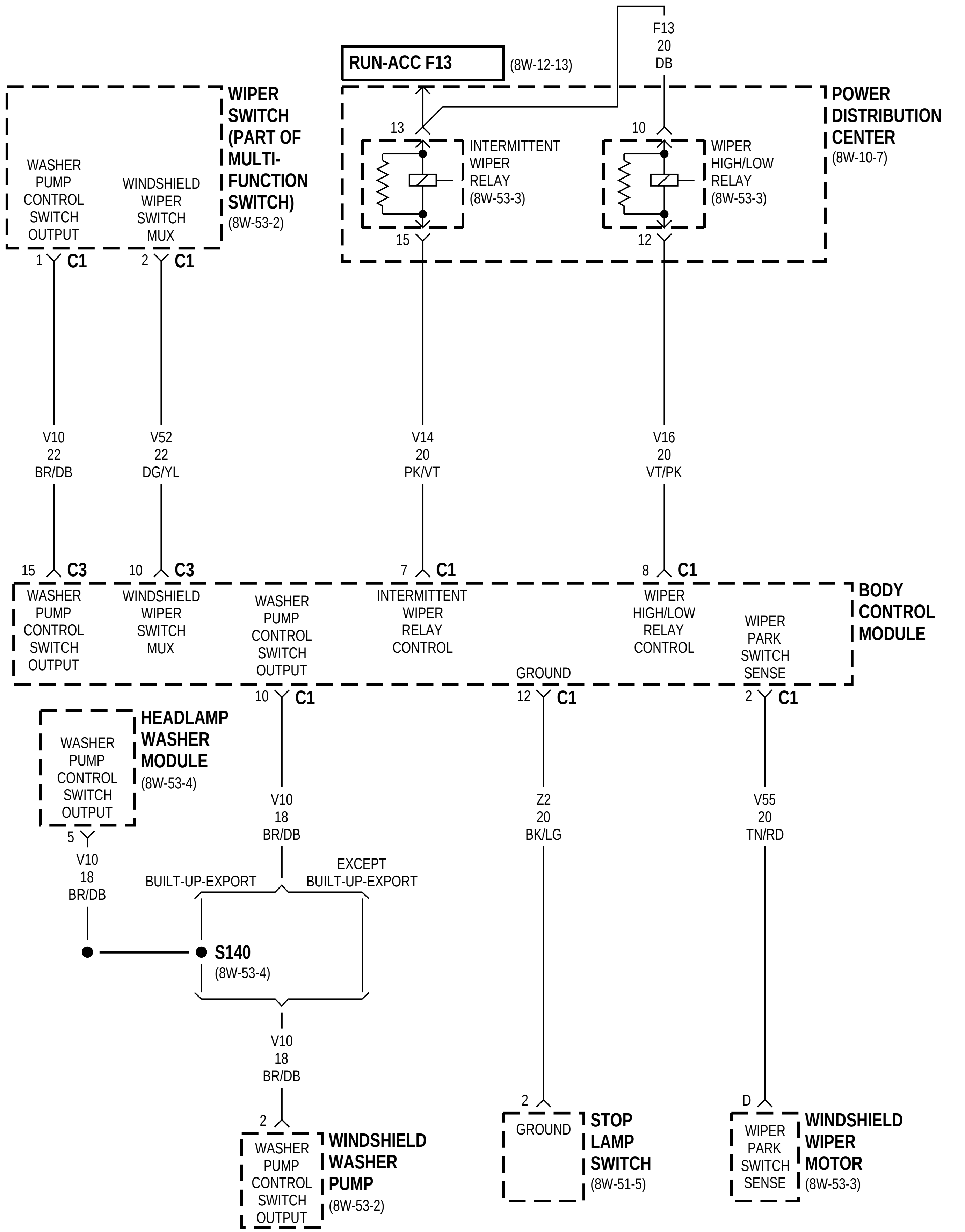


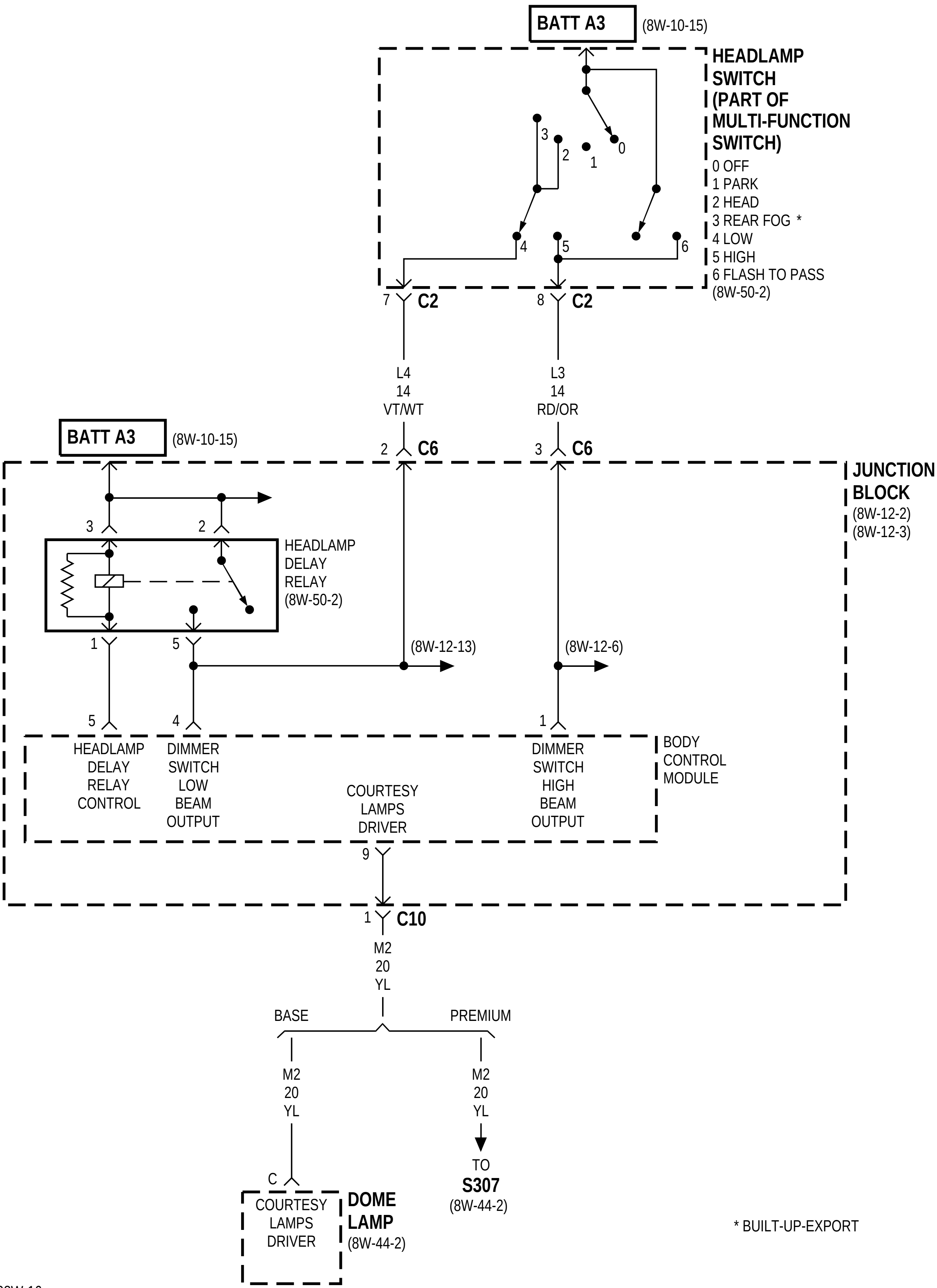
BATT A1
(8W-10-10)
BATT A51
(8W-10-10)
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-10)
9 C2
2 C1
A21
16
DB
A81
20
DG/RD
9 C5
2 C7
BATT A3
(8W-10-15)
BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
20
FUSE
11
10A
(8W-12-12)
19
16
FUSE
9
15A
(8W-12-12)
15
7
FUSE
5
10A
(8W-12-8)
8
11
6
2
12
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
FUSED B(+)
FUSED B(+)
BODY CONTROL MODULE
GROUND
8 C2
GROUND
4 C1
GROUND
10
(8W-12-15)
3 C9
Z2
18
BK/LG
Z1
18
BK
2
GROUND
POWER STEERING PRESSURE SWITCH
(8W-30-19)
Z1
14
BK
G201
(8W-15-5)
G301
(8W-15-9)

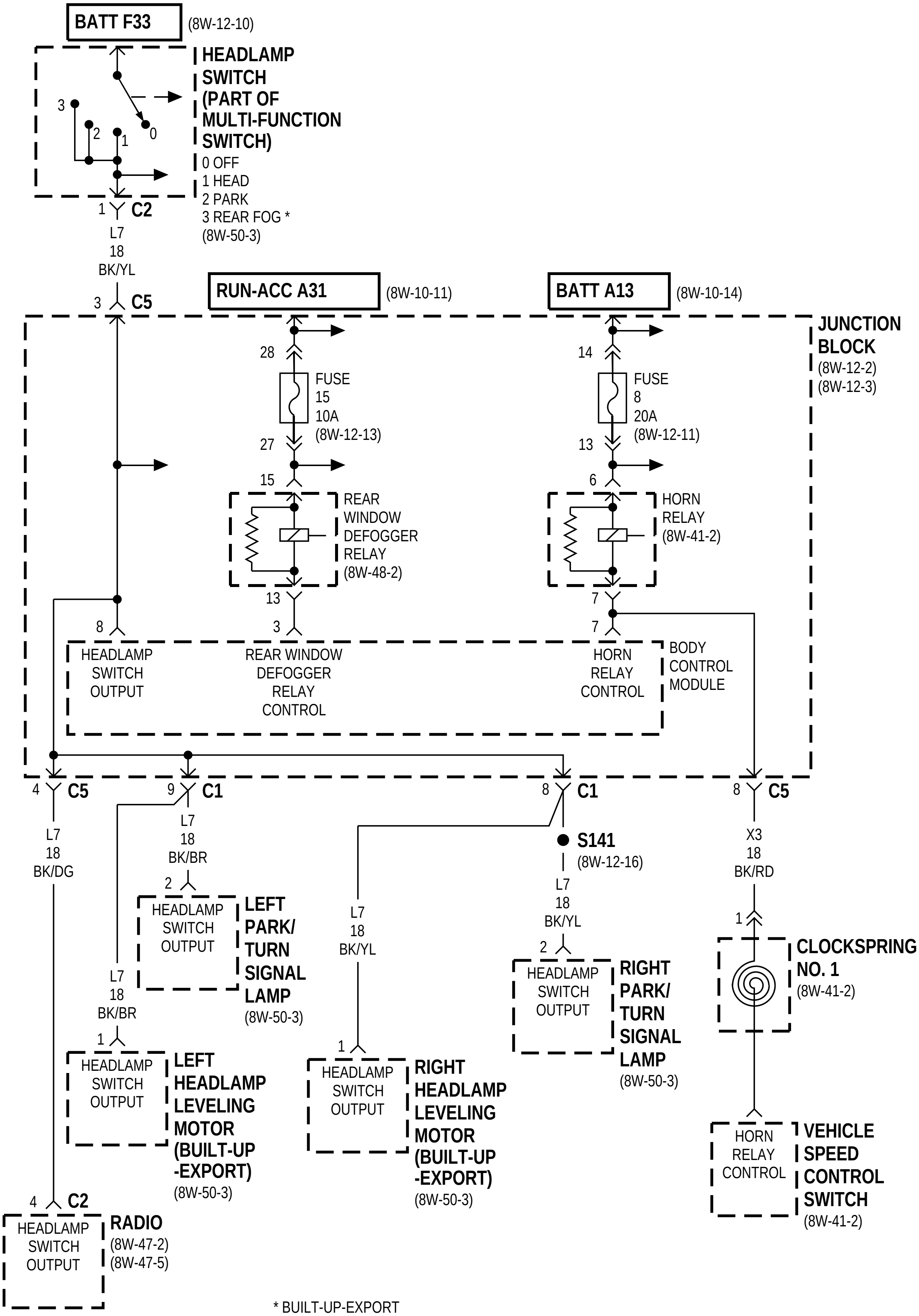

INSTRUMENT CLUSTER
(8W-40-3)
CCD BUS (+)
CCD BUS (-)
8 C2
7 C2
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/DB
1 C3
11 C3
AIRBAG CONTROL MODULE
(8W-43-3)
CCD BUS (+)
CCD BUS (-)
3 C1
4 C1
TWISTED PAIR
D1 18 VT
D2 18 WT/BK
2 C3
12 C3
TRANSMISSION CONTROL MODULE
(8W-31-8)
CCD BUS (+)
CCD BUS (-)
43
4
D1 20 VT/DG
D2 20 WT/DG
TWISTED PAIR
6 C1
14 C1
BODY CONTROL MODULE
CCD BUS (+)
CCD BUS (-)
GROUND
3 C1
5 C1
13 C1
9 C3
8 C3
9 C1
3 C3
13 C3
4 C3
TWISTED PAIR
TWISTED PAIR
D1 20 VT/GY
D2 20 WT/DG
Z2 20 BK/VT
TWISTED PAIR
3
11
5
DATA LINK CONNECTOR
(8W-30-18)
D1 18 VT/BR
D1 20 VT/BR
D2 20 WT/BK
D1 20 VT/BR
D2 20 WT/DB
D2 18 WT/BK
6
5
SENTRY KEY IMMOBILIZER MODULE
(8W-39-3)
59 C2
60 C2
POWERTRAIN CONTROL MODULE
(8W-30-18)
TWISTED PAIR
20
19
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
CCD BUS (+)
CCD BUS (-)

BUILT-UP-EXPORT

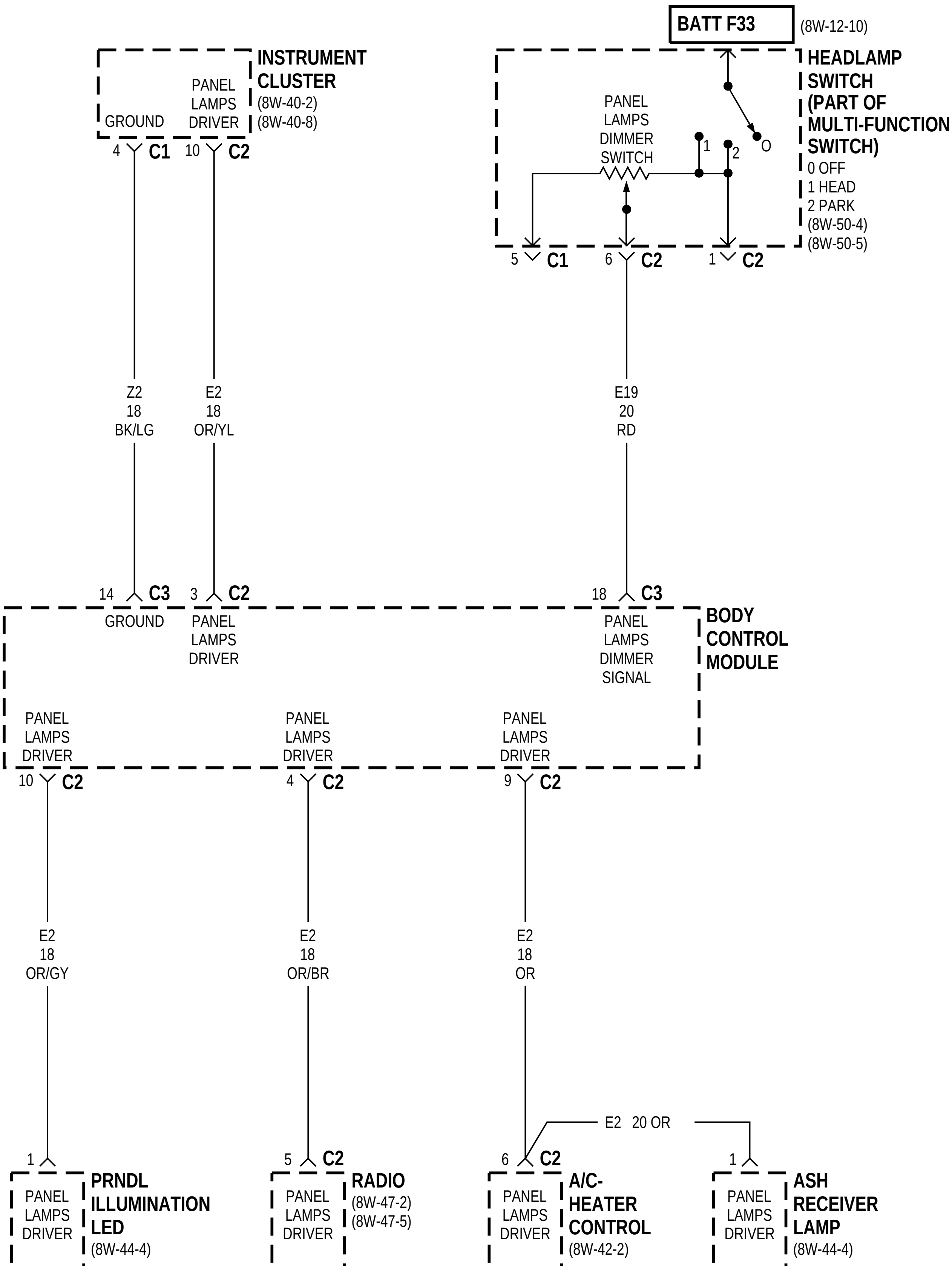


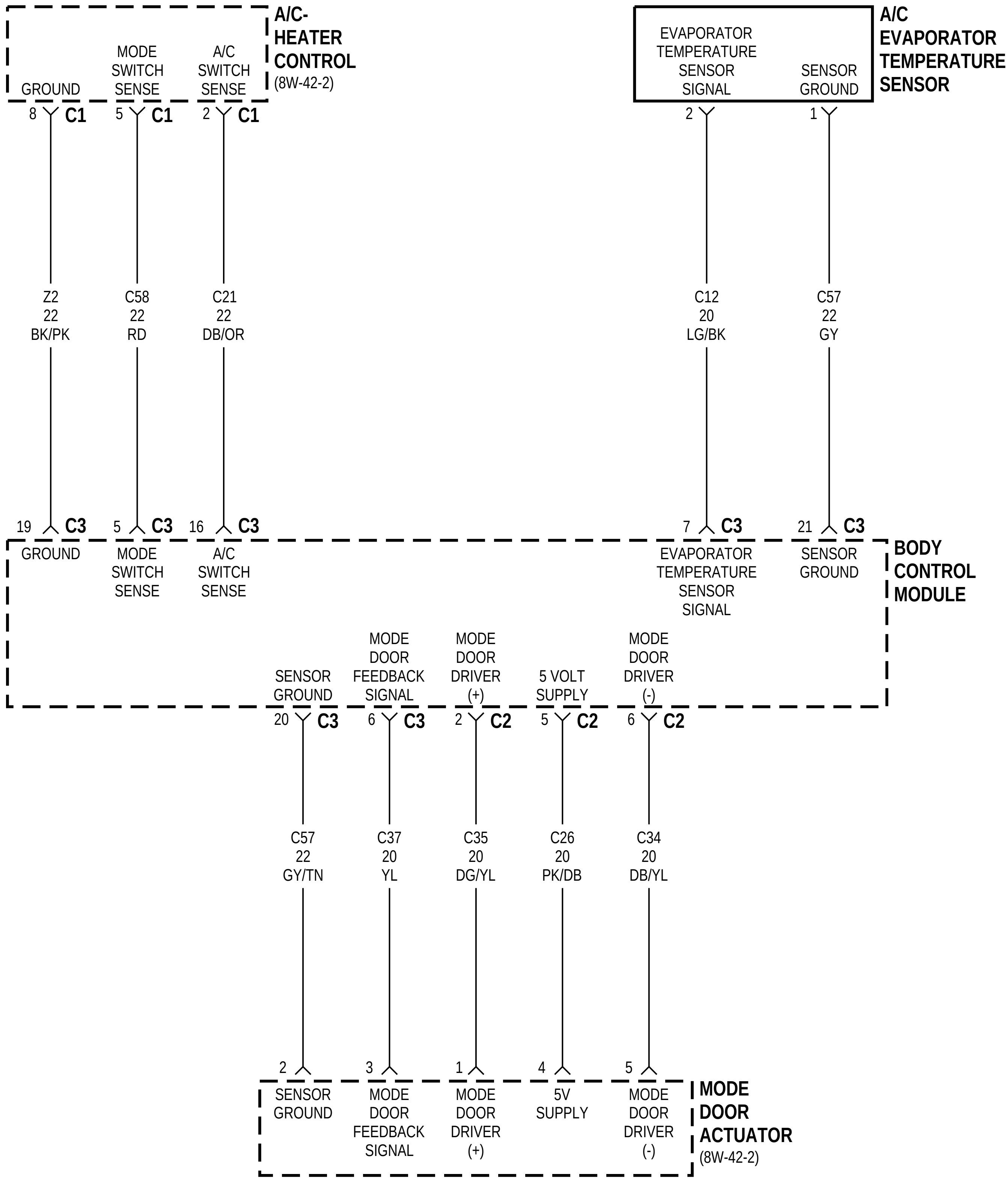

F13
20
DB
RUN-ACC F13
(8W-12-13)
WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-53-2)
WASHER PUMP CONTROL SWITCH OUTPUT
WINDSHIELD WIPER SWITCH MUX
1 C1
2 C1
POWER DISTRIBUTION CENTER
(8W-10-7)
13
15
INTERMITTENT WIPER RELAY
(8W-53-3)
10
12
WIPER HIGH/LOW RELAY
(8W-53-3)
V10
22
BR/DB
V52
22
DG/YL
V14
20
PK/VT
V16
20
VT/PK
15 C3
10 C3
7 C1
8 C1
BODY CONTROL MODULE
WASHER PUMP CONTROL SWITCH OUTPUT
WINDSHIELD WIPER SWITCH MUX
WASHER PUMP CONTROL SWITCH OUTPUT
INTERMITTENT WIPER RELAY CONTROL
WIPER HIGH/LOW RELAY CONTROL
WIPER PARK SWITCH SENSE
GROUND
10 C1
12 C1
2 C1
HEADLAMP WASHER MODULE
(8W-53-4)
WASHER PUMP CONTROL SWITCH OUTPUT
5
V10
18
BR/DB
V10
18
BR/DB
Z2
20
BK/LG
V55
20
TN/RD
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
S140
(8W-53-4)
V10
18
BR/DB
2
WASHER PUMP CONTROL SWITCH OUTPUT
WINDSHIELD WASHER PUMP
(8W-53-2)
2
GROUND
STOP LAMP SWITCH
(8W-51-5)
D
WIPER PARK SWITCH SENSE
WINDSHIELD WIPER MOTOR
(8W-53-3)

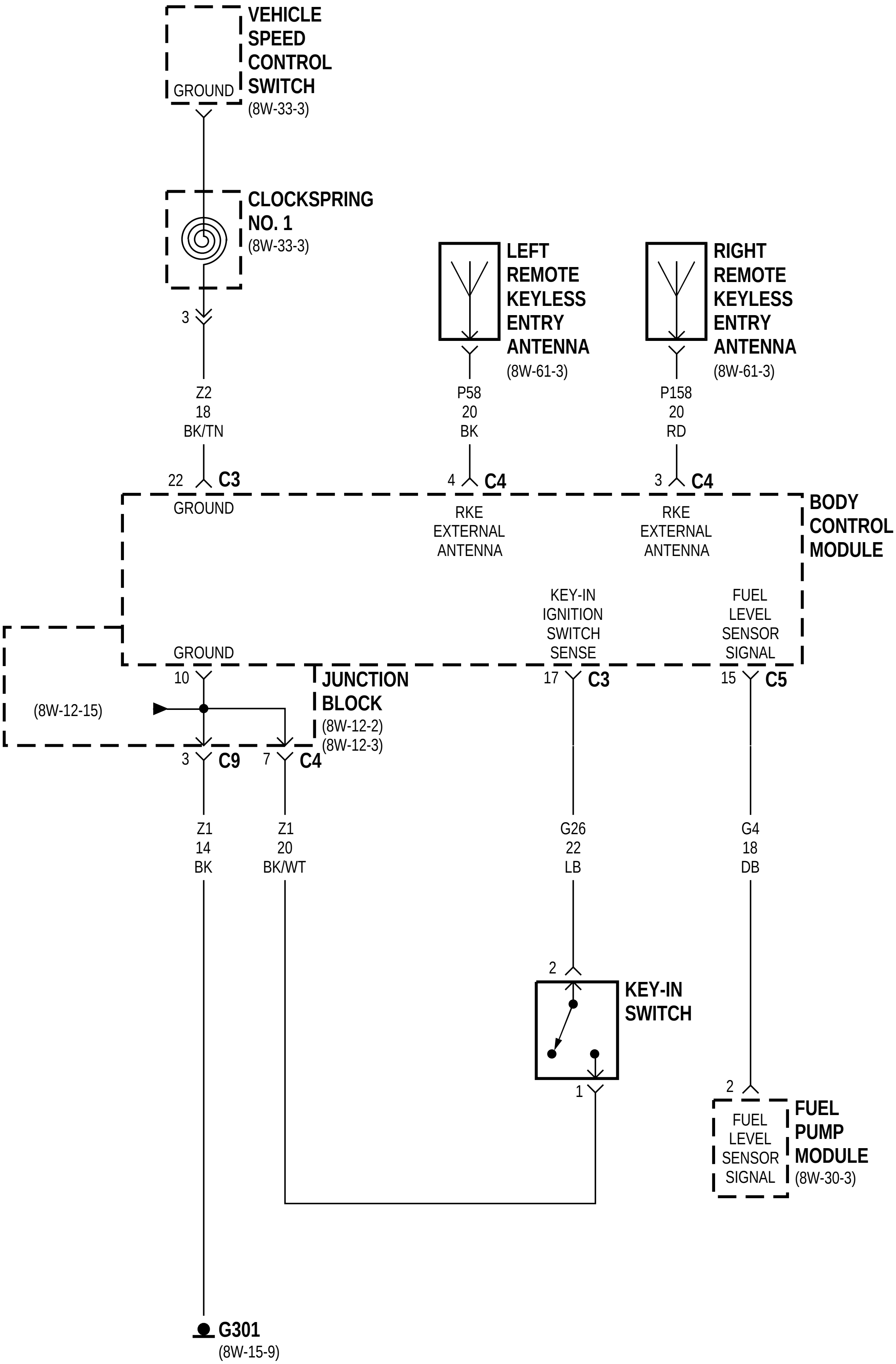

BATT A3
(8W-10-15)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG *
4 LOW
5 HIGH
6 FLASH TO PASS
(8W-50-2)
3
2
1
0
4
5
6
7 C2
8 C2
L4
14
VT/WT
L3
14
RD/OR
BATT A3
(8W-10-15)
2 C6
3 C6
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
3
2
HEADLAMP DELAY RELAY
(8W-50-2)
1
5
(8W-12-13)
(8W-12-6)
5
4
1
HEADLAMP DELAY RELAY CONTROL
DIMMER SWITCH LOW BEAM OUTPUT
COURTESY LAMPS DRIVER
DIMMER SWITCH HIGH BEAM OUTPUT
BODY CONTROL MODULE
9
1 C10
M2
20
YL
BASE
PREMIUM
M2
20
YL
M2
20
YL
C
COURTESY LAMPS DRIVER
DOME LAMP
(8W-44-2)
TO
S307
(8W-44-2)
* BUILT-UP-EXPORT

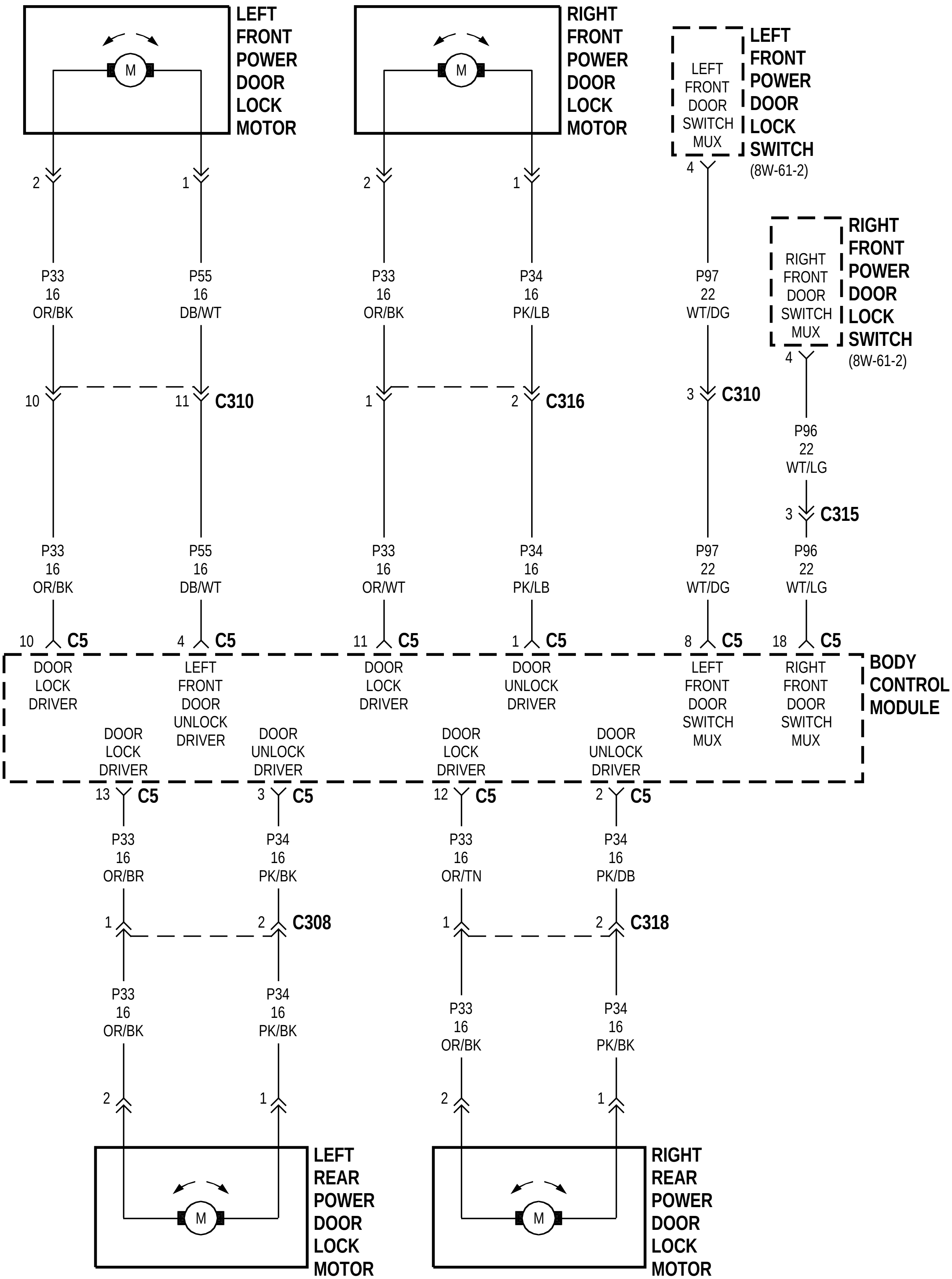


JAI04507 J998W-16

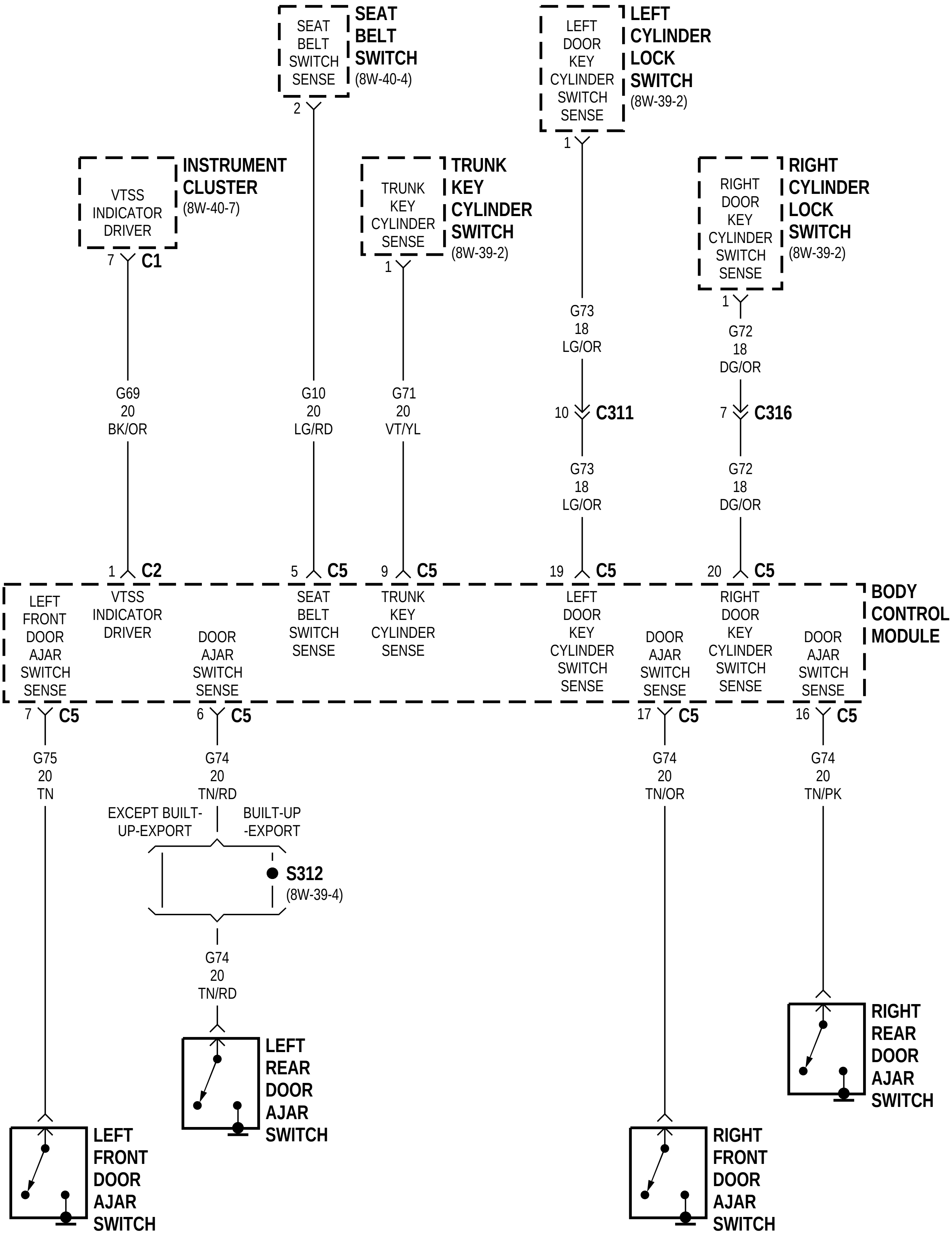

BATT F33
(8W-12-10)
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-8)
GROUND
PANEL LAMPS DRIVER
4 C1
10 C2
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 HEAD
2 PARK
(8W-50-4)
(8W-50-5)
PANEL LAMPS DIMMER SWITCH
1
2
O
5 C1
6 C2
1 C2
Z2 18 BK/LG
E2 18 OR/YL
E19 20 RD
14 C3
3 C2
18 C3
BODY CONTROL MODULE
GROUND
PANEL LAMPS DRIVER
PANEL LAMPS DIMMER SIGNAL
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
10 C2
4 C2
9 C2
E2 18 OR/GY
E2 18 OR/BR
E2 18 OR
E2 20 OR
1
5 C2
6 C2
1
PANEL LAMPS DRIVER
PRNDL ILLUMINATION LED
(8W-44-4)
PANEL LAMPS DRIVER
RADIO
(8W-47-2)
(8W-47-5)
PANEL LAMPS DRIVER
A/C-HEATER CONTROL
(8W-42-2)
PANEL LAMPS DRIVER
ASH RECEIVER LAMP
(8W-44-4)


A/C-HEATER CONTROL
(8W-42-2)
GROUND
MODE SWITCH SENSE
A/C SWITCH SENSE
8 C1
5 C1
2 C1
Z2 22 BK/PK
C58 22 RD
C21 22 DB/OR
A/C EVAPORATOR TEMPERATURE SENSOR
EVAPORATOR TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
2
1
C12 20 LG/BK
C57 22 GY
19 C3
5 C3
16 C3
7 C3
21 C3
BODY CONTROL MODULE
GROUND
MODE SWITCH SENSE
A/C SWITCH SENSE
EVAPORATOR TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
SENSOR GROUND
MODE DOOR FEEDBACK SIGNAL
MODE DOOR DRIVER (+)
5 VOLT SUPPLY
MODE DOOR DRIVER (-)
20 C3
6 C3
2 C2
5 C2
6 C2
C57 22 GY/TN
C37 20 YL
C35 20 DG/YL
C26 20 PK/DB
C34 20 DB/YL
2
3
1
4
5
SENSOR GROUND
MODE DOOR FEEDBACK SIGNAL
MODE DOOR DRIVER (+)
5V SUPPLY
MODE DOOR DRIVER (-)
MODE DOOR ACTUATOR
(8W-42-2)

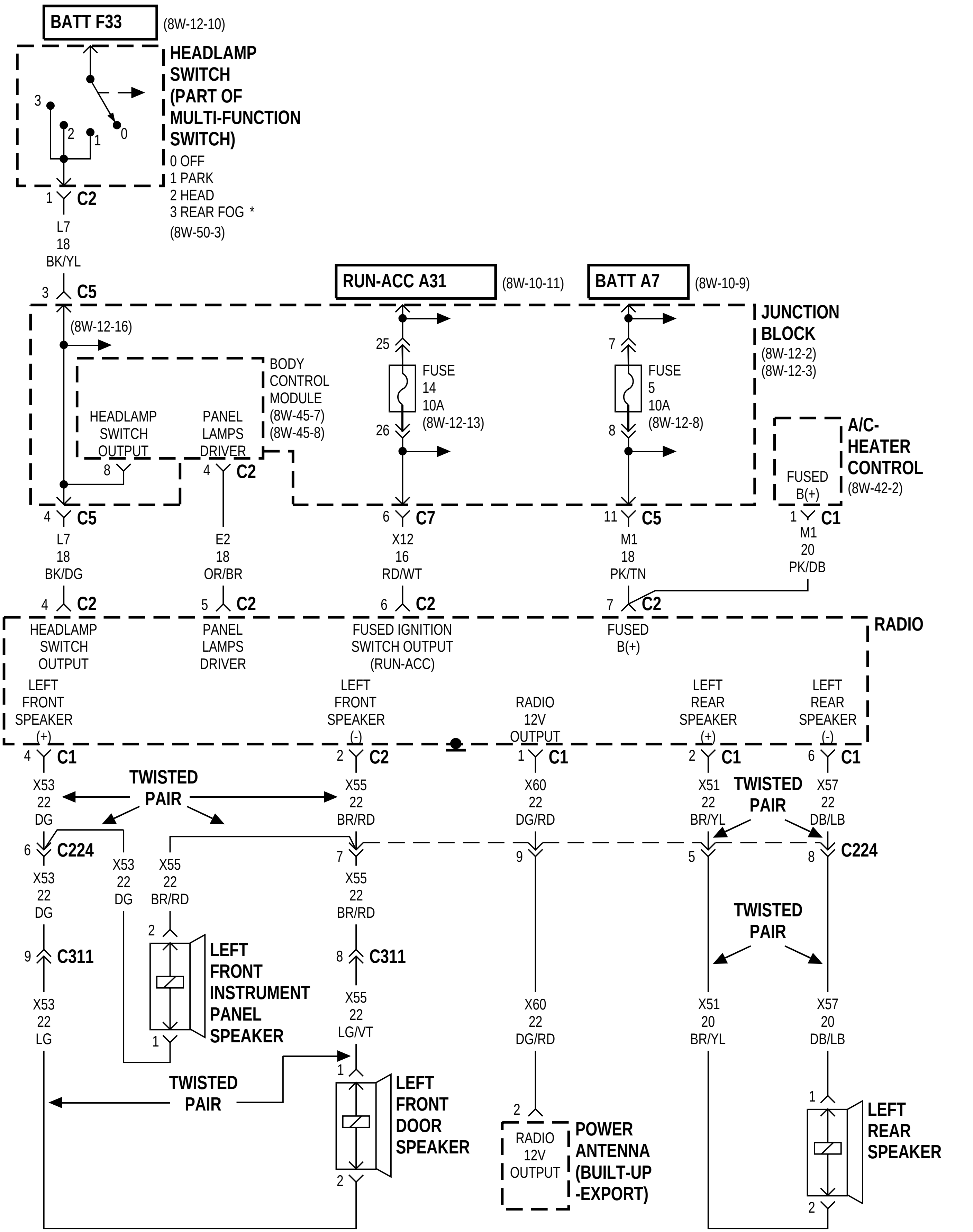

VEHICLE SPEED CONTROL SWITCH
GROUND
(8W-33-3)
CLOCKSPRING NO. 1
(8W-33-3)
3
Z2
18
BK/TN
LEFT REMOTE KEYLESS ENTRY ANTENNA
(8W-61-3)
P58
20
BK
RIGHT REMOTE KEYLESS ENTRY ANTENNA
(8W-61-3)
P158
20
RD
22 C3
GROUND
4 C4
RKE EXTERNAL ANTENNA
3 C4
RKE EXTERNAL ANTENNA
BODY CONTROL MODULE
KEY-IN IGNITION SWITCH SENSE
FUEL LEVEL SENSOR SIGNAL
GROUND
10
17 C3
15 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-15)
3 C9
7 C4
Z1
14
BK
Z1
20
BK/WT
G26
22
LB
G4
18
DB
2
KEY-IN SWITCH
1
2
FUEL LEVEL SENSOR SIGNAL
FUEL PUMP MODULE
(8W-30-3)
G301
(8W-15-9)



LEFT FRONT POWER DOOR LOCK MOTOR
M
RIGHT FRONT POWER DOOR LOCK MOTOR
M
LEFT FRONT DOOR SWITCH MUX
LEFT FRONT POWER DOOR LOCK SWITCH (8W-61-2)
RIGHT FRONT DOOR SWITCH MUX
RIGHT FRONT POWER DOOR LOCK SWITCH (8W-61-2)
2
1
2
1
4
4
P33 16 OR/BK
P55 16 DB/WT
P33 16 OR/BK
P34 16 PK/LB
P97 22 WT/DG
10
11 C310
1
2 C316
3 C310
P96 22 WT/LG
3 C315
P33 16 OR/BK
P55 16 DB/WT
P33 16 OR/WT
P34 16 PK/LB
P97 22 WT/DG
P96 22 WT/LG
10 C5
4 C5
11 C5
1 C5
8 C5
18 C5
DOOR LOCK DRIVER
LEFT FRONT DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
LEFT FRONT DOOR SWITCH MUX
RIGHT FRONT DOOR SWITCH MUX
BODY CONTROL MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
13 C5
3 C5
12 C5
2 C5
P33 16 OR/BR
P34 16 PK/BK
P33 16 OR/TN
P34 16 PK/DB
1
2 C308
1
2 C318
P33 16 OR/BK
P34 16 PK/BK
P33 16 OR/BK
P34 16 PK/BK
2
1
2
1
M
LEFT REAR POWER DOOR LOCK MOTOR
M
RIGHT REAR POWER DOOR LOCK MOTOR


SEAT BELT SWITCH SENSE
SEAT BELT SWITCH
(8W-40-4)
LEFT DOOR KEY CYLINDER SWITCH SENSE
LEFT CYLINDER LOCK SWITCH
(8W-39-2)
VTSS INDICATOR DRIVER
INSTRUMENT CLUSTER
(8W-40-7)
TRUNK KEY CYLINDER SENSE
TRUNK KEY CYLINDER SWITCH
(8W-39-2)
RIGHT DOOR KEY CYLINDER SWITCH SENSE
RIGHT CYLINDER LOCK SWITCH
(8W-39-2)
C1
G69 20 BK/OR
G10 20 LG/RD
G71 20 VT/YL
G73 18 LG/OR
C311
G72 18 DG/OR
C316
C2
C5
BODY CONTROL MODULE
LEFT FRONT DOOR AJAR SWITCH SENSE
VTSS INDICATOR DRIVER
DOOR AJAR SWITCH SENSE
SEAT BELT SWITCH SENSE
TRUNK KEY CYLINDER SENSE
LEFT DOOR KEY CYLINDER SWITCH SENSE
DOOR AJAR SWITCH SENSE
RIGHT DOOR KEY CYLINDER SWITCH SENSE
DOOR AJAR SWITCH SENSE
G75 20 TN
G74 20 TN/RD
EXCEPT BUILT-UP-EXPORT
BUILT-UP -EXPORT
S312
(8W-39-4)
G74 20 TN/RD
G74 20 TN/OR
G74 20 TN/PK
LEFT FRONT DOOR AJAR SWITCH
LEFT REAR DOOR AJAR SWITCH
RIGHT FRONT DOOR AJAR SWITCH
RIGHT REAR DOOR AJAR SWITCH

8W-47 AUDIO SYSTEM



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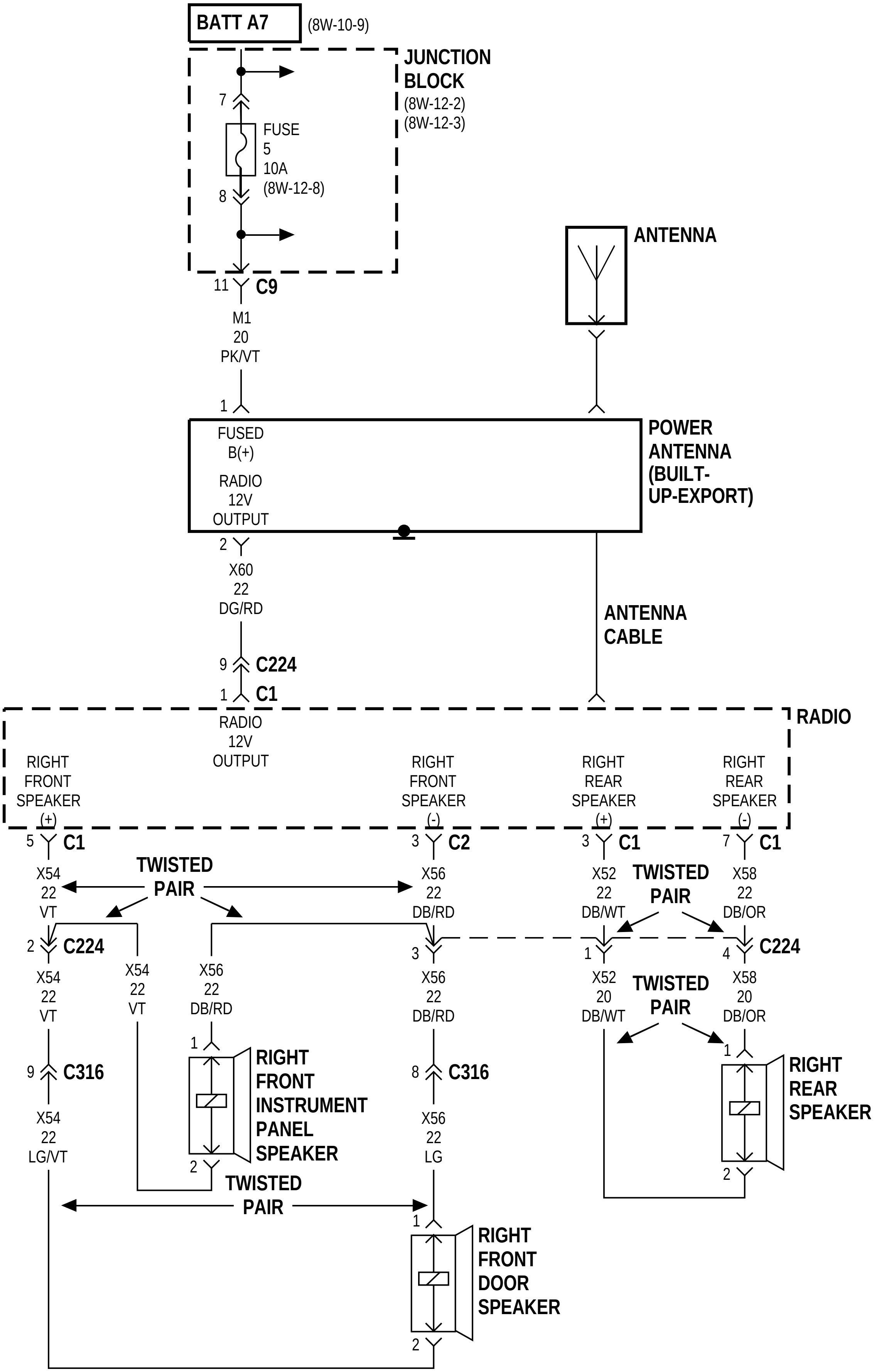
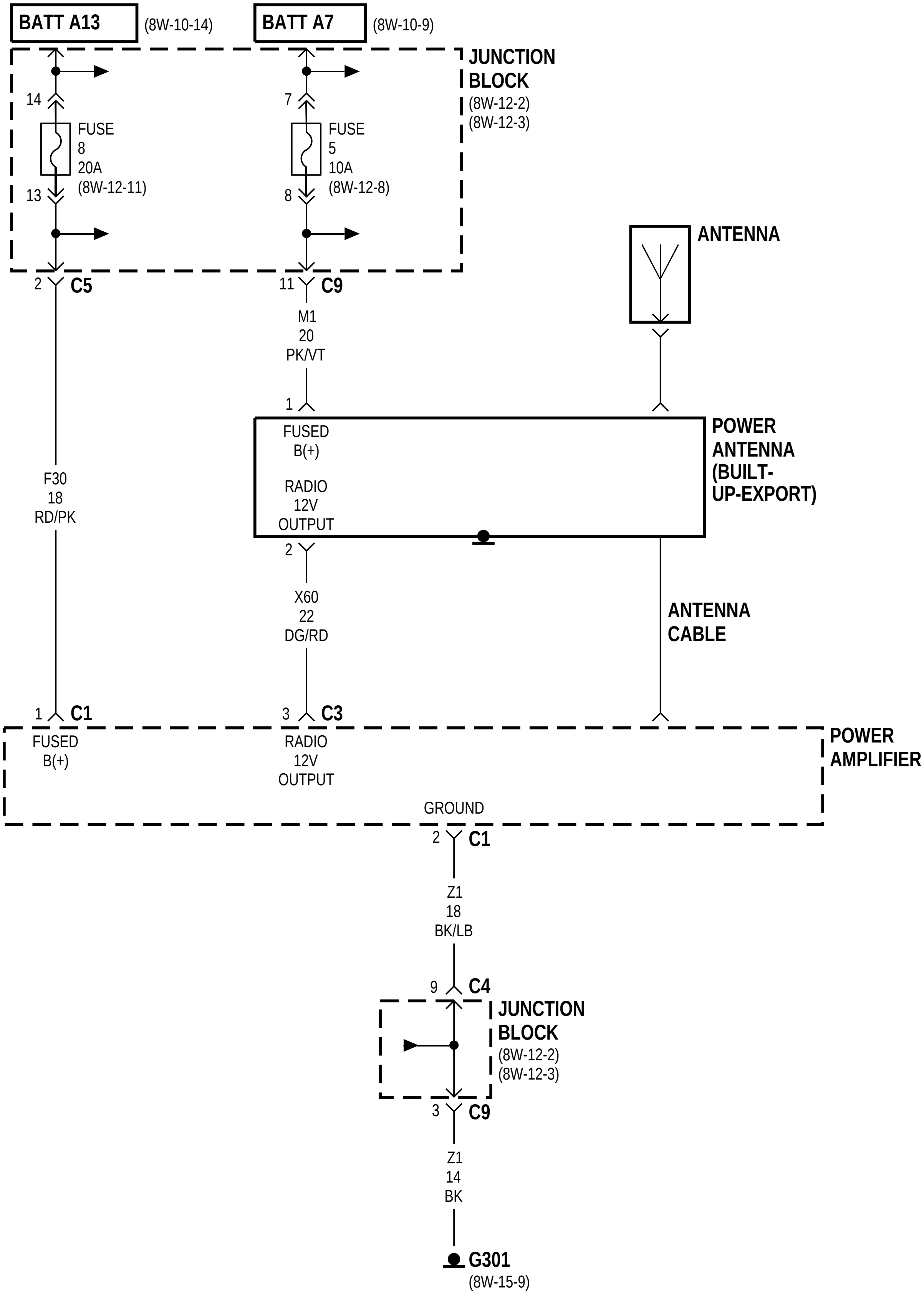
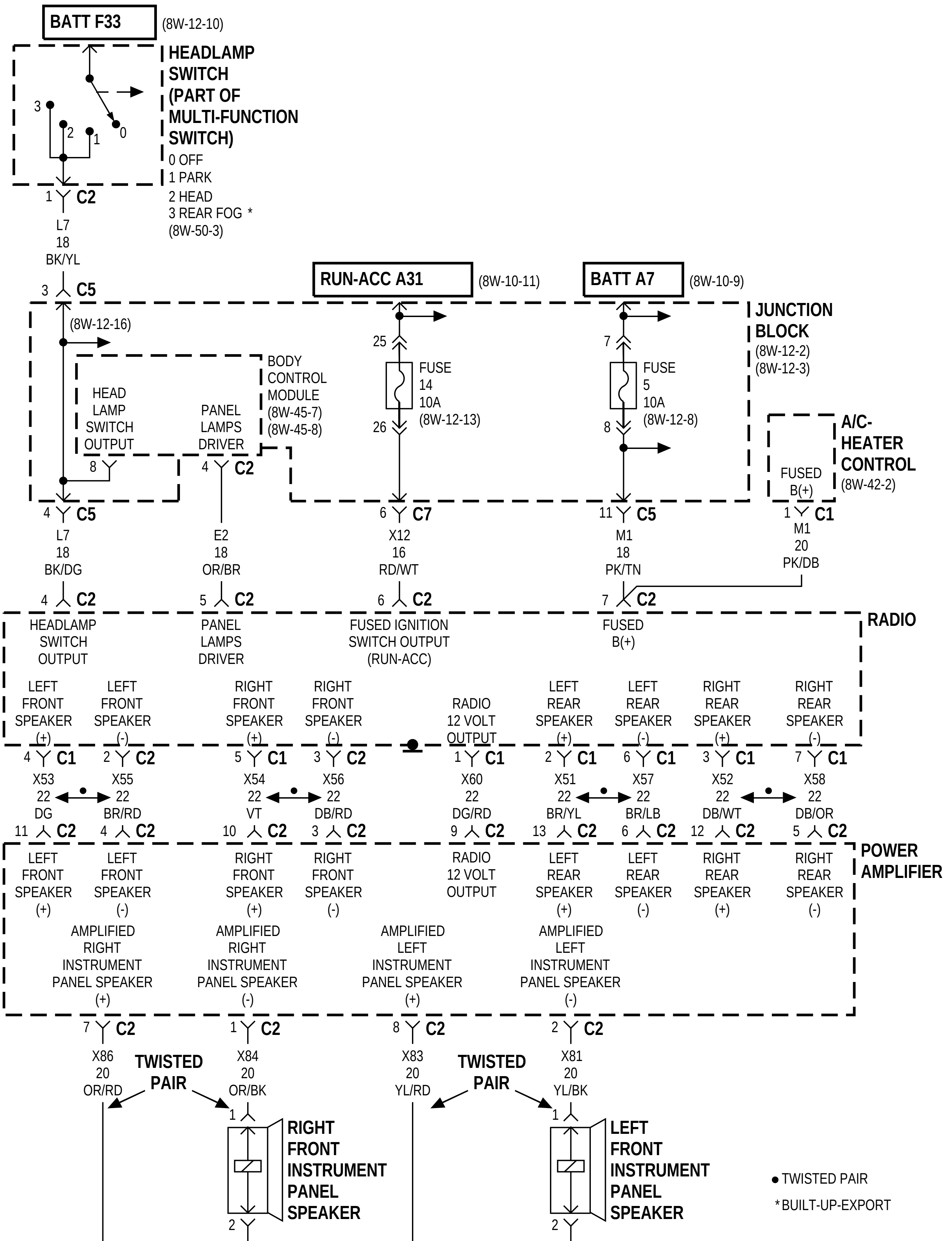
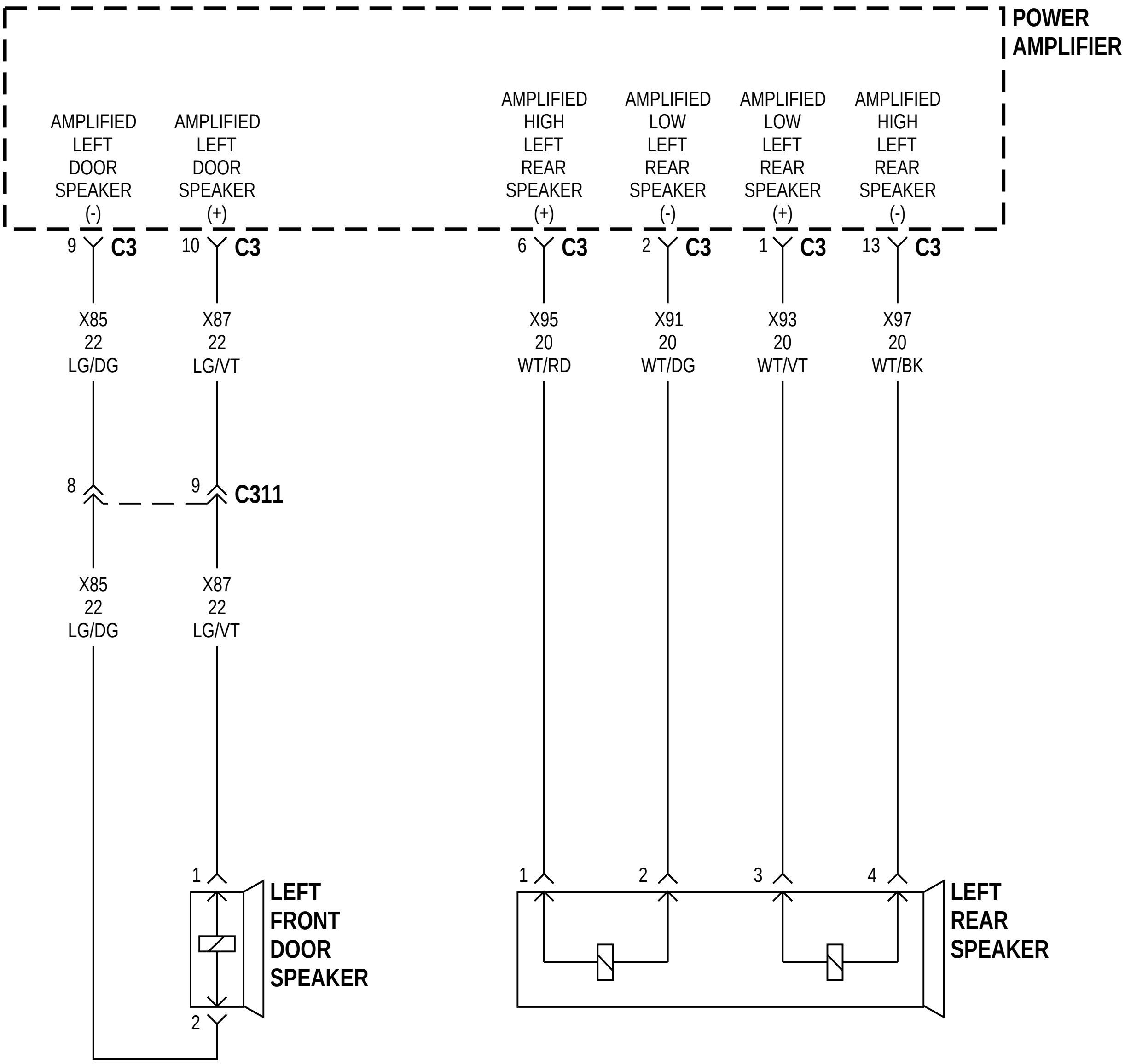
* BUILT-UP-EXPORT

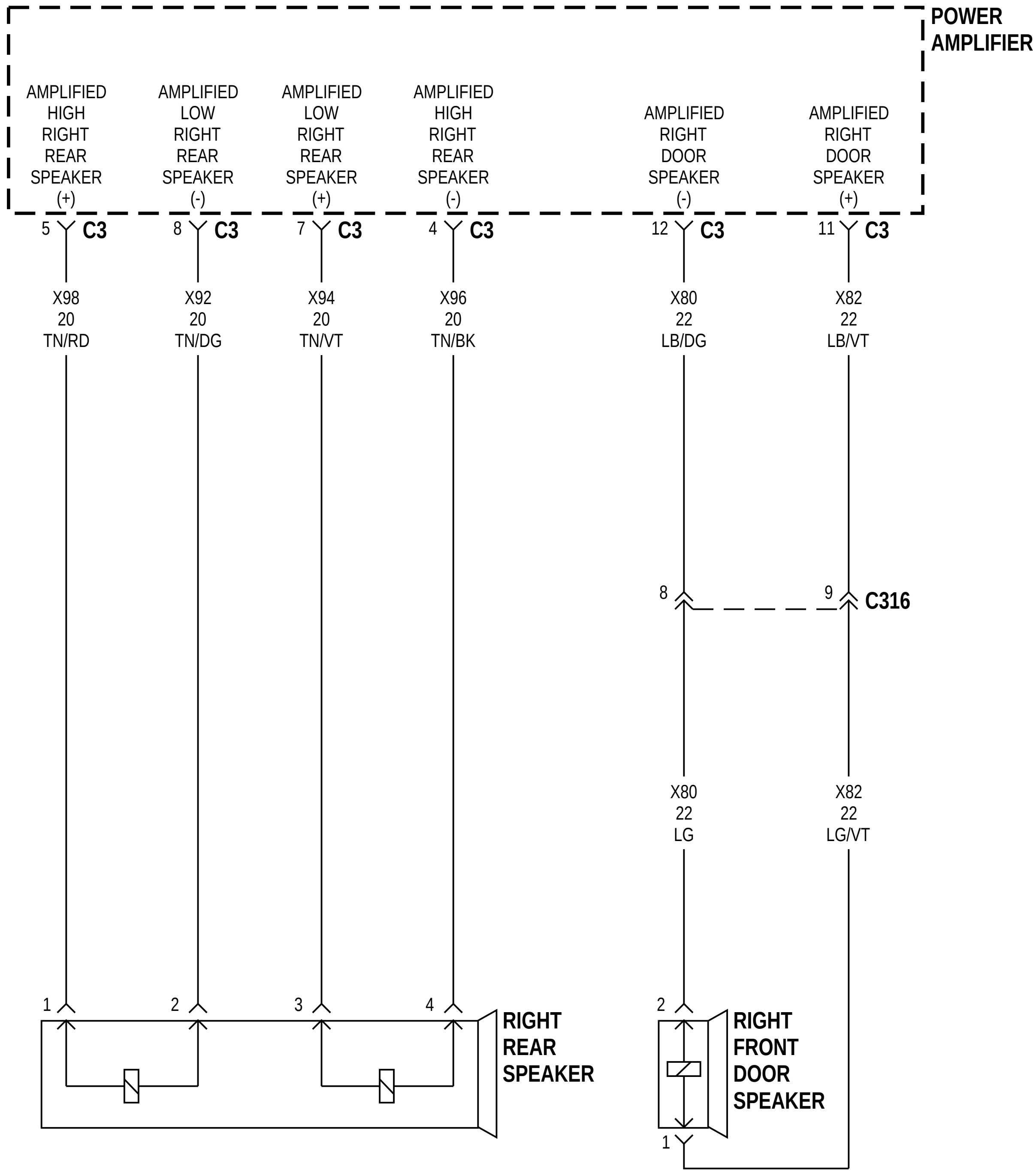
JAI04702


BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
7
FUSE
5
10A
(8W-12-8)
8
11
C9
M1
20
PK/VT
ANTENNA
1
FUSED B(+)
RADIO 12V OUTPUT
POWER ANTENNA (BUILT-UP-EXPORT)
2
X60
22
DG/RD
ANTENNA CABLE
9
C224
1
C1
RADIO
RADIO 12V OUTPUT
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
5
C1
3
C2
3
C1
7
C1
X54
22
VT
TWISTED PAIR
X56
22
DB/RD
X52
22
DB/WT
TWISTED PAIR
X58
22
DB/OR
2
C224
3
1
4
C224
X54
22
VT
X54
22
VT
X56
22
DB/RD
X56
22
DB/RD
X52
20
DB/WT
TWISTED PAIR
X58
20
DB/OR
1
RIGHT FRONT INSTRUMENT PANEL SPEAKER
2
9
C316
8
C316
1
RIGHT REAR SPEAKER
2
X54
22
LG/VT
X56
22
LG
TWISTED PAIR
1
RIGHT FRONT DOOR SPEAKER
2

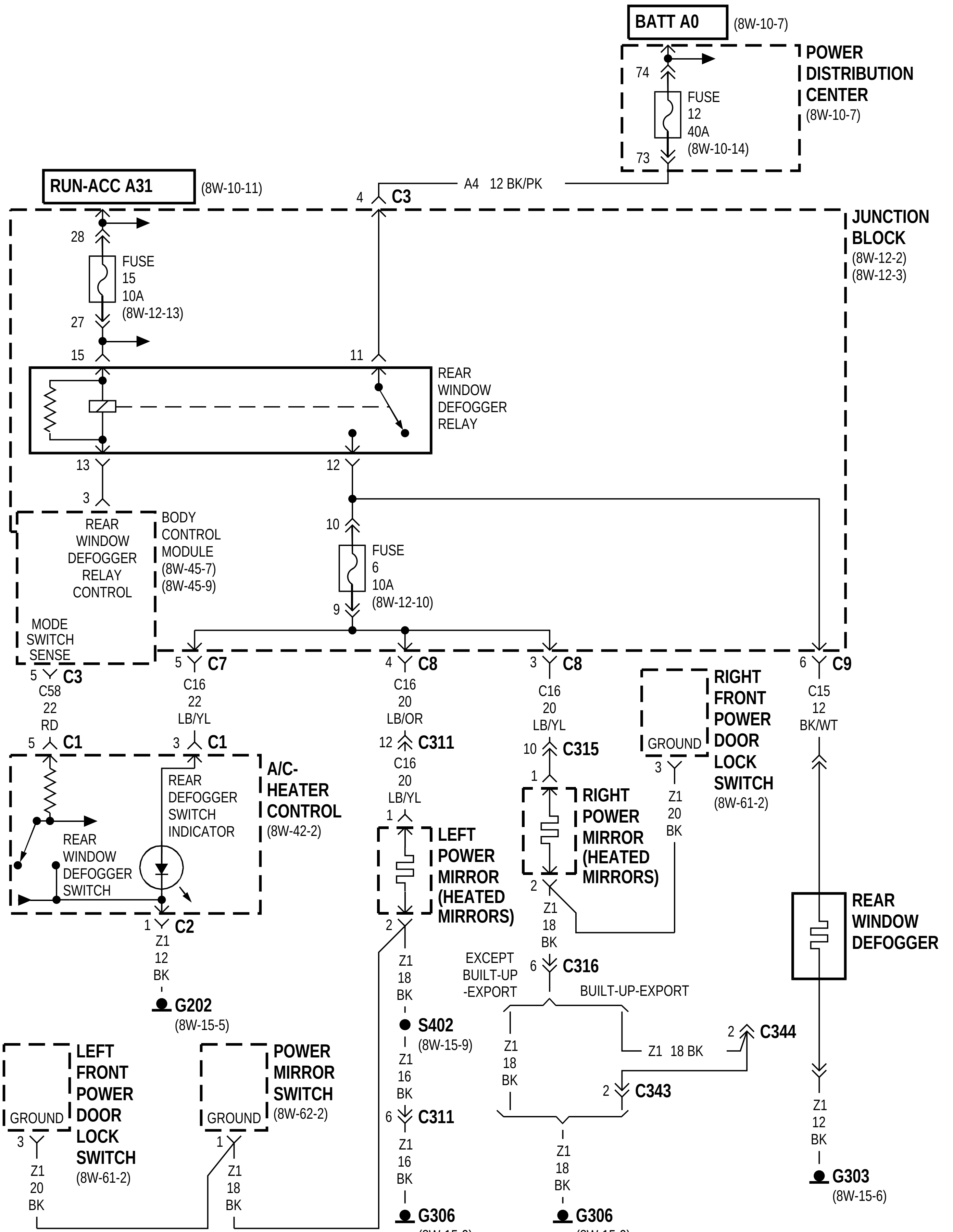

BATT A13
(8W-10-14)
BATT A7
(8W-10-9)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
14
FUSE
8
20A
(8W-12-11)
13
7
FUSE
5
10A
(8W-12-8)
8
2
C5
11
C9
M1
20
PK/VT
ANTENNA
1
FUSED
B(+)
RADIO
12V
OUTPUT
POWER
ANTENNA
(BUILT-
UP-EXPORT)
2
F30
18
RD/PK
X60
22
DG/RD
ANTENNA
CABLE
1
C1
3
C3
FUSED
B(+)
RADIO
12V
OUTPUT
POWER
AMPLIFIER
GROUND
2
C1
Z1
18
BK/LB
9
C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
3
C9
Z1
14
BK
G301
(8W-15-9)


BATT F33
(8W-12-10)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG *
(8W-50-3)
C2
L7 18 BK/YL
C5
RUN-ACC A31
(8W-10-11)
BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-16)
BODY CONTROL MODULE
(8W-45-7)
(8W-45-8)
HEAD LAMP SWITCH OUTPUT
PANEL LAMPS DRIVER
FUSE 14 10A (8W-12-13)
FUSE 5 10A (8W-12-8)
A/C-HEATER CONTROL
(8W-42-2)
FUSED B(+)
C7
C1
L7 18 BK/DG
E2 18 OR/BR
X12 16 RD/WT
M1 18 PK/TN
M1 20 PK/DB
RADIO
HEADLAMP SWITCH OUTPUT
PANEL LAMPS DRIVER
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED B(+)
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
RADIO 12 VOLT OUTPUT
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
X53 22 DG
X55 22 BR/RD
X54 22 VT
X56 22 DB/RD
X60 22 DG/RD
X51 22 BR/YL
X57 22 BR/LB
X52 22 DB/WT
X58 22 DB/OR
POWER AMPLIFIER
AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (+)
AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (-)
AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (+)
AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (-)
X86 20 OR/RD
X84 20 OR/BK
X83 20 YL/RD
X81 20 YL/BK
TWISTED PAIR
RIGHT FRONT INSTRUMENT PANEL SPEAKER
LEFT FRONT INSTRUMENT PANEL SPEAKER
● TWISTED PAIR
* BUILT-UP-EXPORT


POWER AMPLIFIER
AMPLIFIED LEFT DOOR SPEAKER (-)
AMPLIFIED LEFT DOOR SPEAKER (+)
AMPLIFIED HIGH LEFT REAR SPEAKER (+)
AMPLIFIED LOW LEFT REAR SPEAKER (-)
AMPLIFIED LOW LEFT REAR SPEAKER (+)
AMPLIFIED HIGH LEFT REAR SPEAKER (-)
9 C3
10 C3
6 C3
2 C3
1 C3
13 C3
X85 22 LG/DG
X87 22 LG/VT
X95 20 WT/RD
X91 20 WT/DG
X93 20 WT/VT
X97 20 WT/BK
8
9 C311
X85 22 LG/DG
X87 22 LG/VT
1
2
LEFT FRONT DOOR SPEAKER
1
2
3
4
LEFT REAR SPEAKER


POWER AMPLIFIER
AMPLIFIED HIGH RIGHT REAR SPEAKER (+)
AMPLIFIED LOW RIGHT REAR SPEAKER (-)
AMPLIFIED LOW RIGHT REAR SPEAKER (+)
AMPLIFIED HIGH RIGHT REAR SPEAKER (-)
AMPLIFIED RIGHT DOOR SPEAKER (-)
AMPLIFIED RIGHT DOOR SPEAKER (+)
5 C3
8 C3
7 C3
4 C3
12 C3
11 C3
X98 20 TN/RD
X92 20 TN/DG
X94 20 TN/VT
X96 20 TN/BK
X80 22 LB/DG
X82 22 LB/VT
8
9 C316
X80 22 LG
X82 22 LG/VT
1
2
3
4
RIGHT REAR SPEAKER
2
1
RIGHT FRONT DOOR SPEAKER

8W-48 REAR WINDOW DEFOGGER



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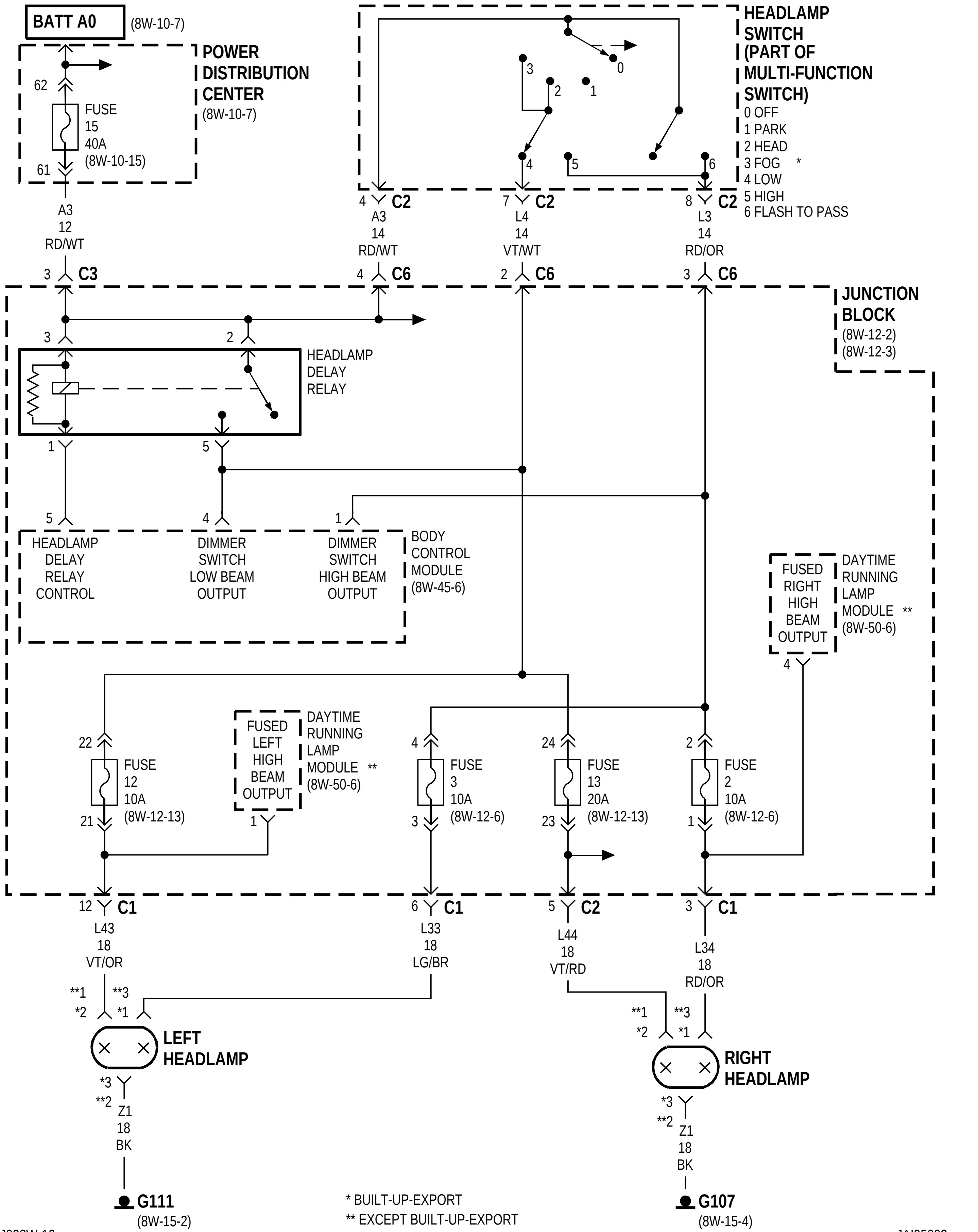
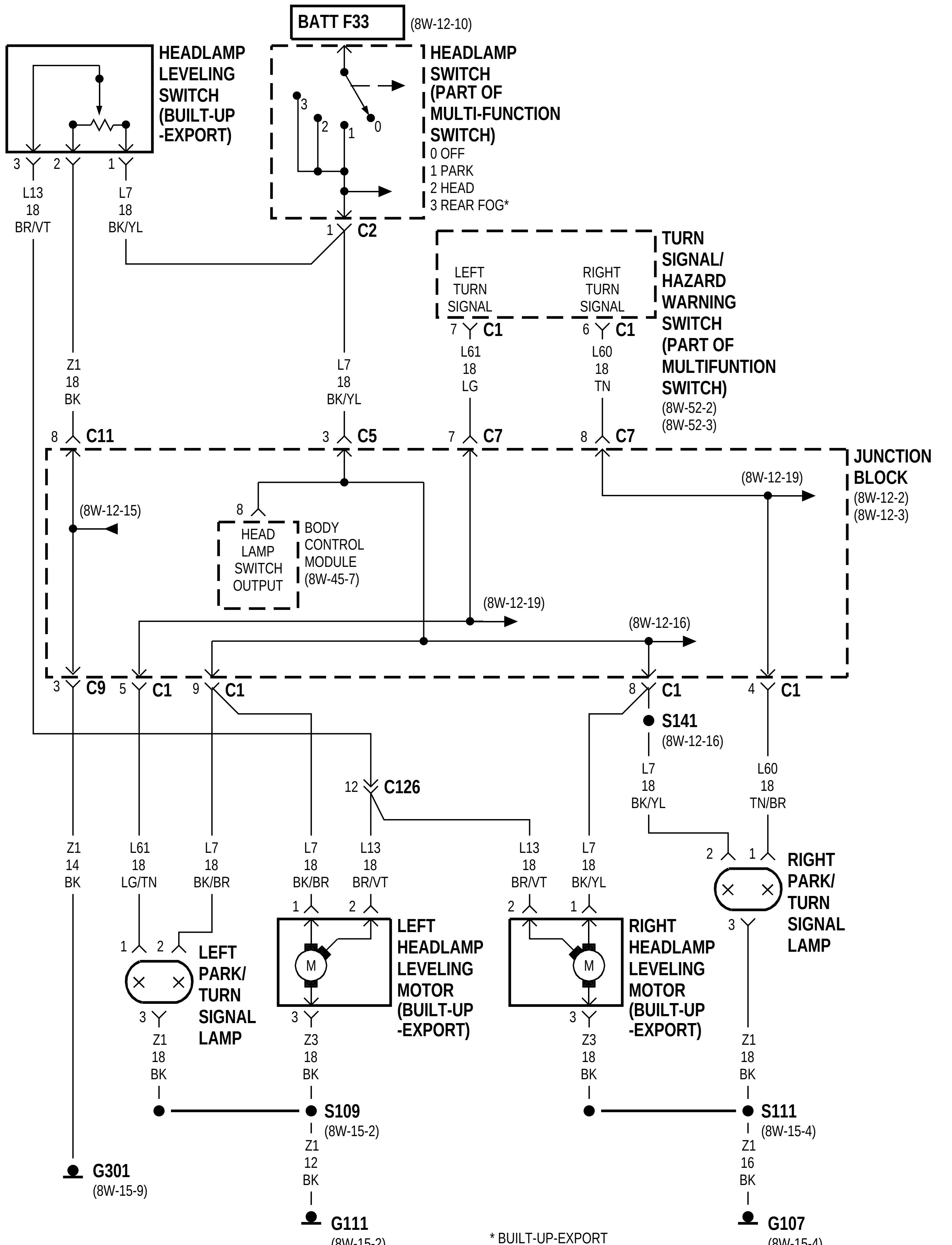
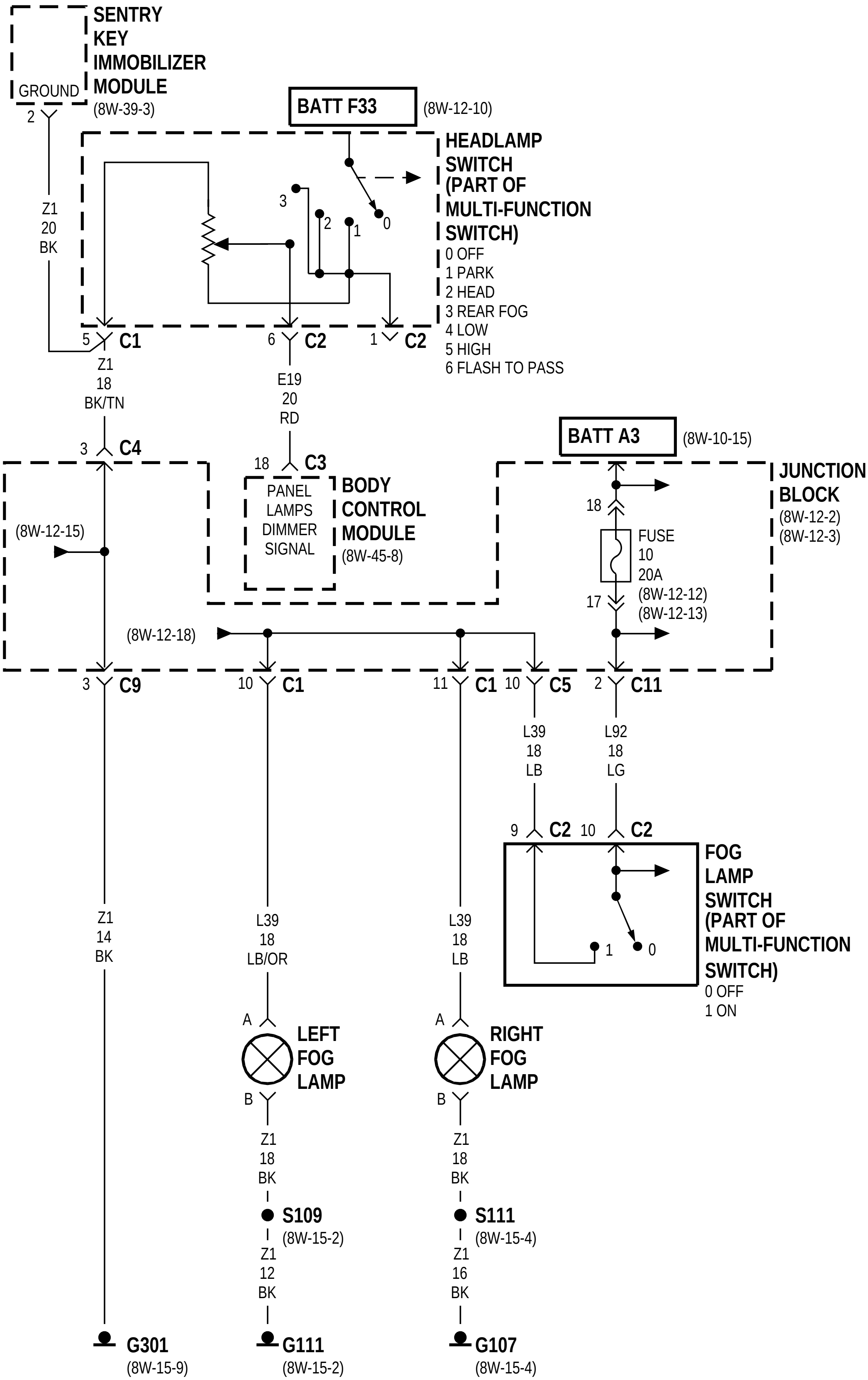
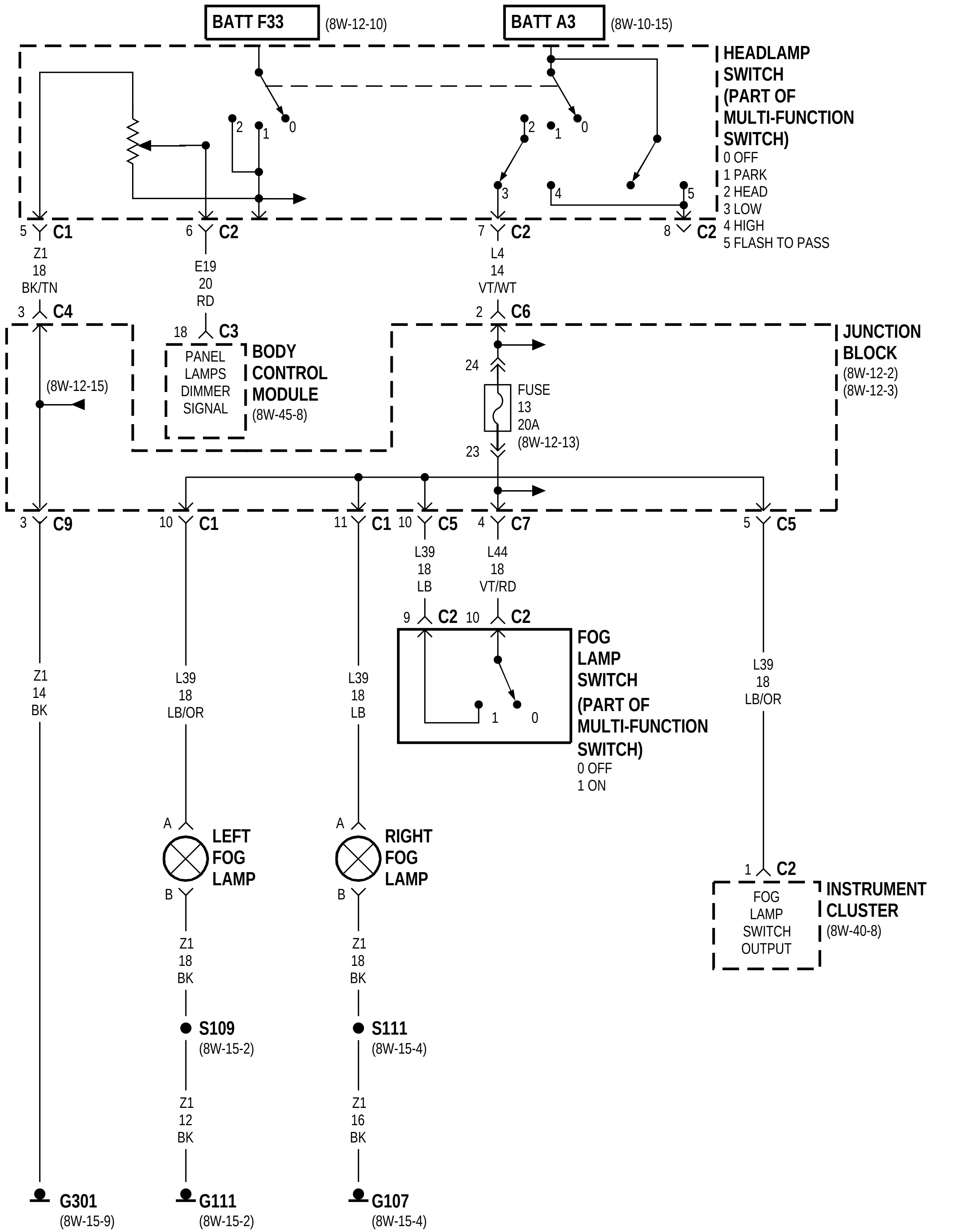
8W-50 FRONT LIGHTING

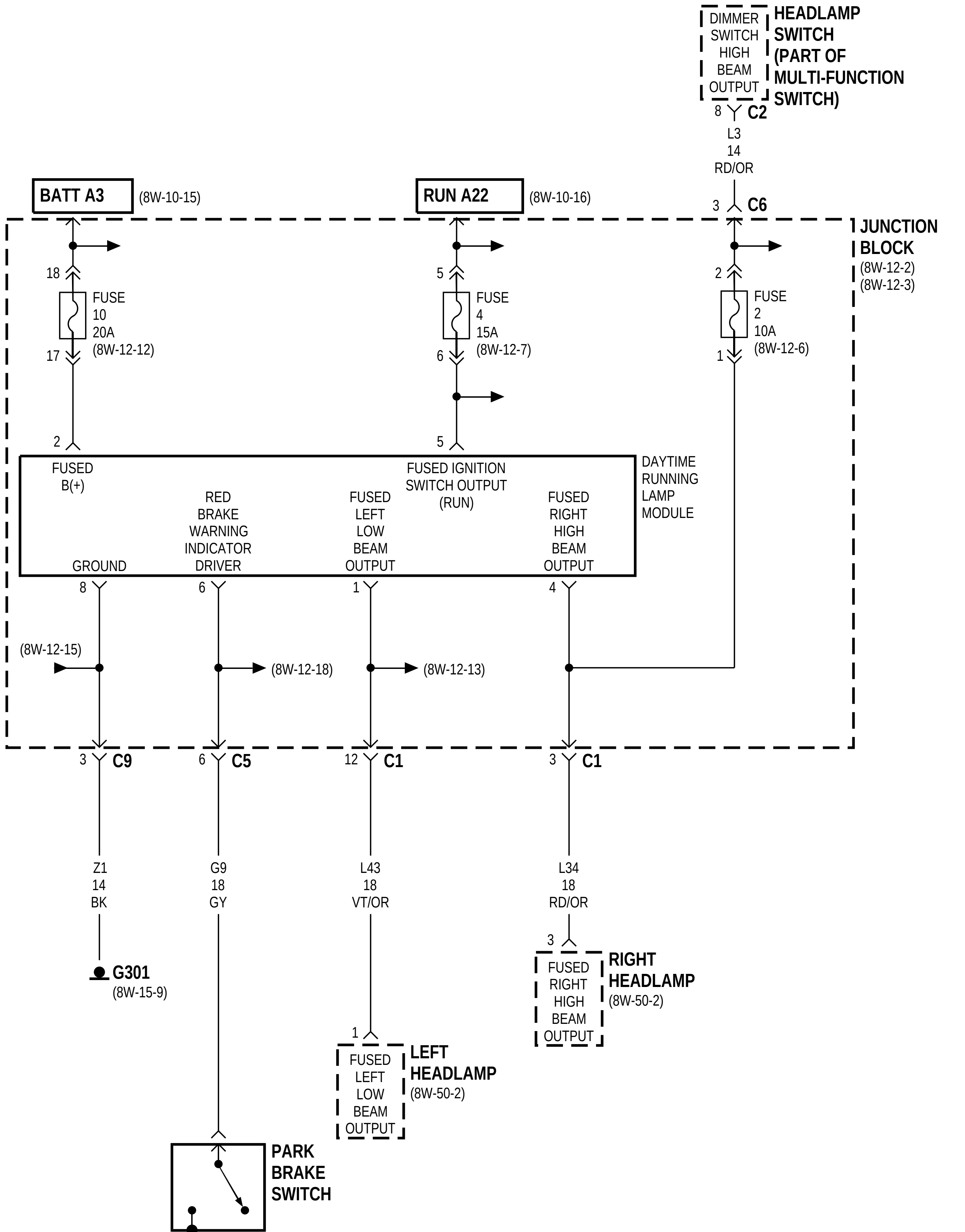

BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
62
FUSE 15 40A (8W-10-15)
61
A3 12 RD/WT
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 FOG *
4 LOW
5 HIGH
6 FLASH TO PASS
4 C2 A3 14 RD/WT
7 C2 L4 14 VT/WT
8 C2 L3 14 RD/OR
3 C3
4 C6
2 C6
3 C6
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
HEADLAMP DELAY RELAY
BODY CONTROL MODULE (8W-45-6)
HEADLAMP DELAY RELAY CONTROL
DIMMER SWITCH LOW BEAM OUTPUT
DIMMER SWITCH HIGH BEAM OUTPUT
FUSED RIGHT HIGH BEAM OUTPUT
DAYTIME RUNNING LAMP MODULE ** (8W-50-6)
FUSED LEFT HIGH BEAM OUTPUT
DAYTIME RUNNING LAMP MODULE ** (8W-50-6)
FUSE 12 10A (8W-12-13)
FUSE 3 10A (8W-12-6)
FUSE 13 20A (8W-12-13)
FUSE 2 10A (8W-12-6)
12 C1 L43 18 VT/OR
6 C1 L33 18 LG/BR
5 C2 L44 18 VT/RD
3 C1 L34 18 RD/OR
**1 **3 *2 *1
LEFT HEADLAMP
RIGHT HEADLAMP
*3 **2 Z1 18 BK
G111 (8W-15-2)
G107 (8W-15-4)
* BUILT-UP-EXPORT
** EXCEPT BUILT-UP-EXPORT


BATT F33
(8W-12-10)
HEADLAMP LEVELING SWITCH (BUILT-UP -EXPORT)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG*
L13 18 BR/VT
L7 18 BK/YL
C2
TURN SIGNAL/ HAZARD WARNING SWITCH (PART OF MULTIFUNTION SWITCH)
(8W-52-2)
(8W-52-3)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
L61 18 LG
L60 18 TN
Z1 18 BK
L7 18 BK/YL
C11
C5
C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
(8W-12-15)
(8W-12-19)
HEAD LAMP SWITCH OUTPUT
BODY CONTROL MODULE (8W-45-7)
(8W-12-19)
(8W-12-16)
C9
C1
S141
(8W-12-16)
L7 18 BK/YL
L60 18 TN/BR
C126
Z1 14 BK
L61 18 LG/TN
L7 18 BK/BR
L7 18 BK/BR
L13 18 BR/VT
L13 18 BR/VT
L7 18 BK/YL
RIGHT PARK/ TURN SIGNAL LAMP
LEFT PARK/ TURN SIGNAL LAMP
LEFT HEADLAMP LEVELING MOTOR (BUILT-UP -EXPORT)
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP -EXPORT)
M
Z1 18 BK
Z3 18 BK
Z3 18 BK
Z1 18 BK
S109
(8W-15-2)
S111
(8W-15-4)
Z1 12 BK
Z1 16 BK
G301
(8W-15-9)
G111
(8W-15-2)
G107
(8W-15-4)
* BUILT-UP-EXPORT

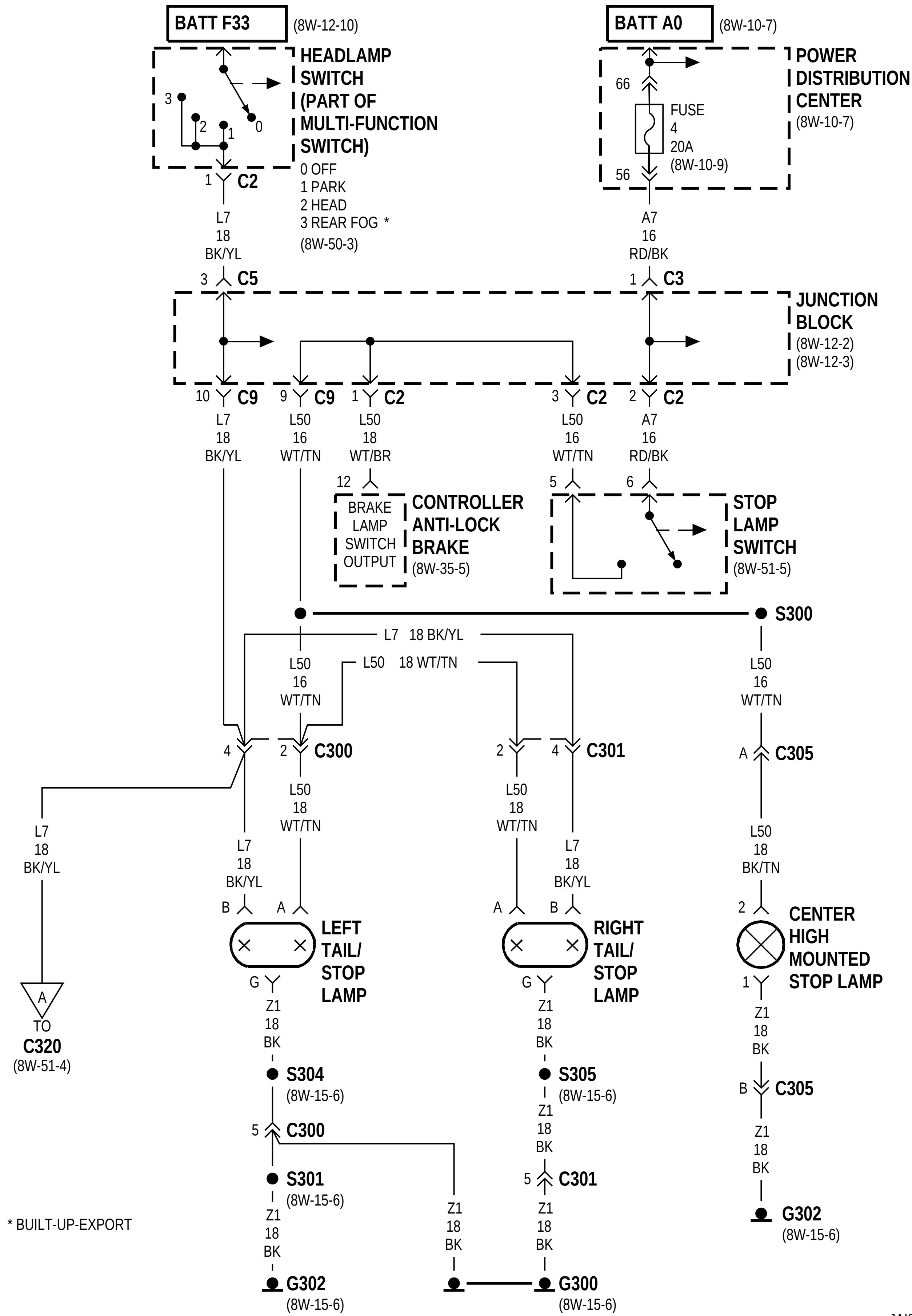

SENTRY KEY IMMOBILIZER MODULE
(8W-39-3)
GROUND
2
Z1
20
BK
BATT F33
(8W-12-10)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG
4 LOW
5 HIGH
6 FLASH TO PASS
5 C1
6 C2
1 C2
Z1
18
BK/TN
E19
20
RD
3 C4
18 C3
PANEL LAMPS DIMMER SIGNAL
BODY CONTROL MODULE
(8W-45-8)
(8W-12-15)
BATT A3
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
18
FUSE
10
20A
(8W-12-12)
(8W-12-13)
17
(8W-12-18)
3 C9
10 C1
11 C1
10 C5
2 C11
L39
18
LB
L92
18
LG
9 C2
10 C2
FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 ON
Z1
14
BK
L39
18
LB/OR
L39
18
LB
A
B
LEFT FOG LAMP
RIGHT FOG LAMP
Z1
18
BK
S109
(8W-15-2)
Z1
12
BK
S111
(8W-15-4)
Z1
16
BK
G301
(8W-15-9)
G111
(8W-15-2)
G107
(8W-15-4)

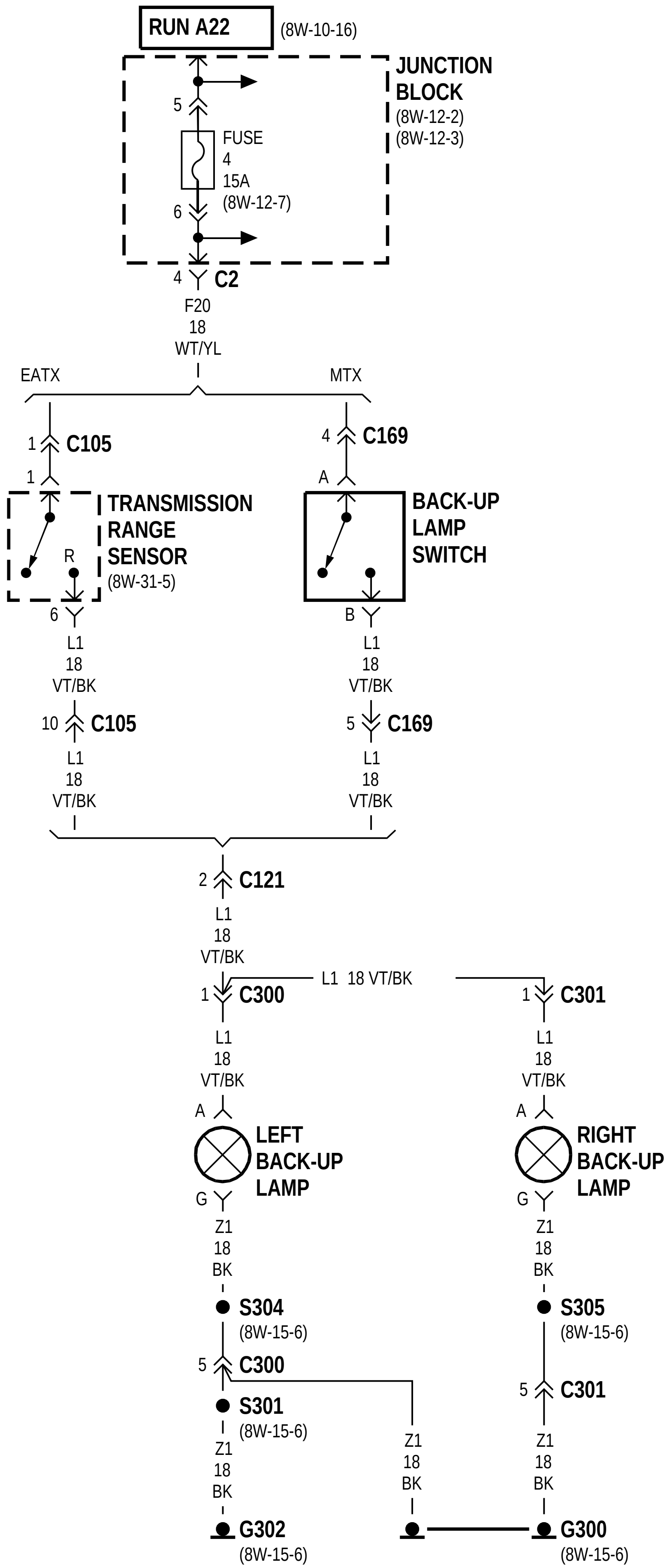
EXCEPT BUILT-UP-EXPORT

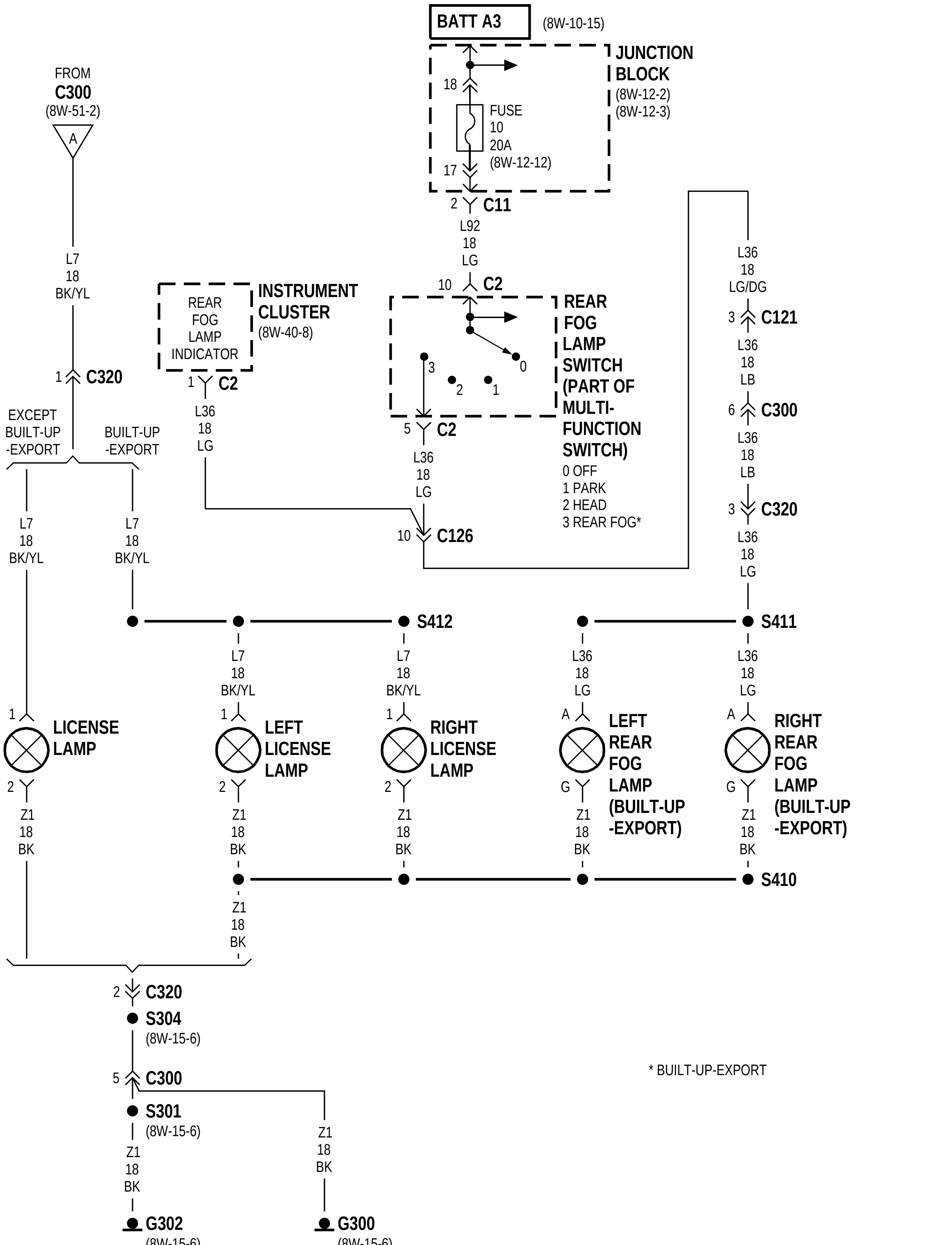


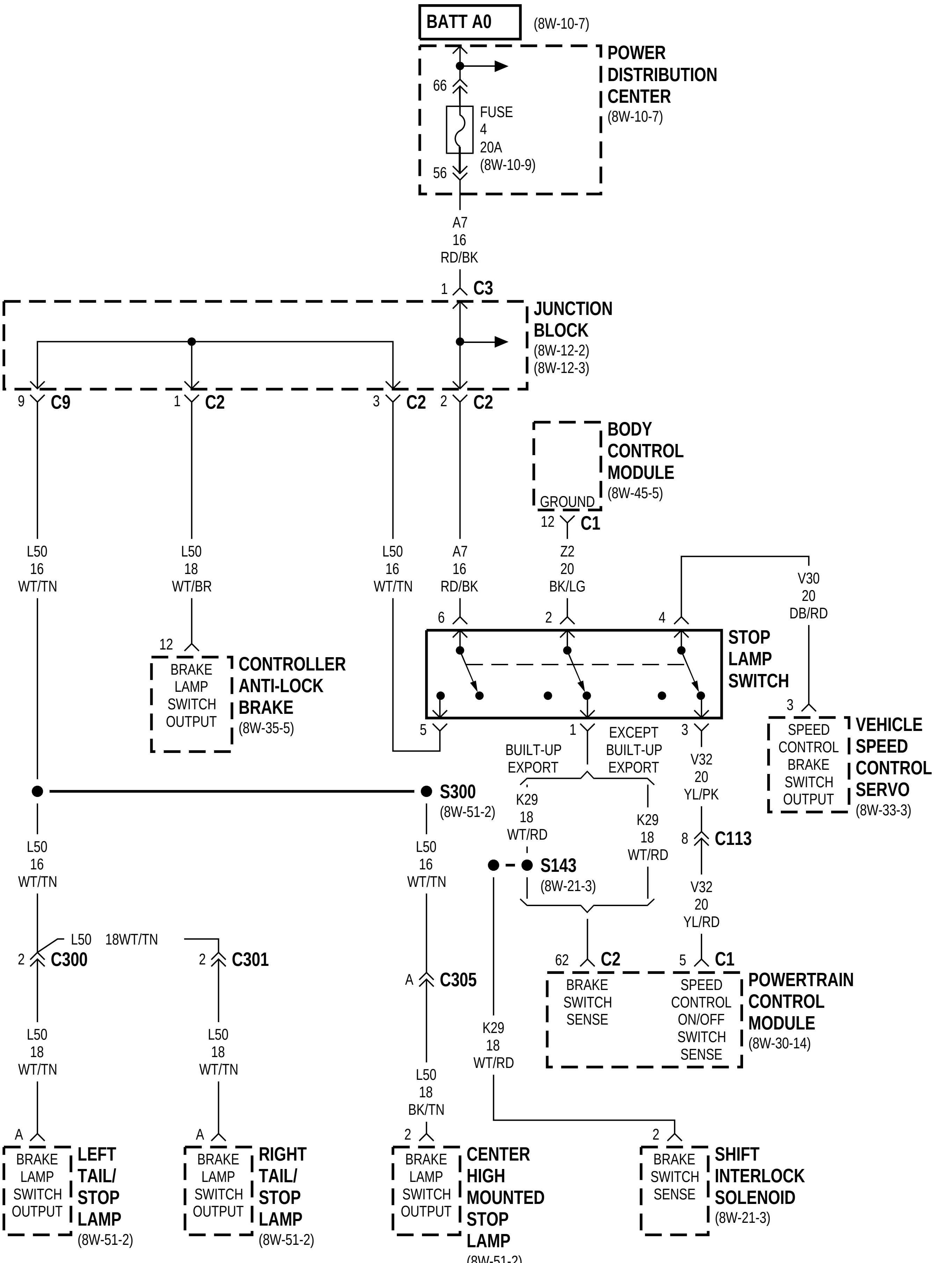

DIMMER SWITCH HIGH BEAM OUTPUT
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
8 C2
L3 14 RD/OR
3 C6
BATT A3
(8W-10-15)
RUN A22
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
18
FUSE 10 20A (8W-12-12)
17
5
FUSE 4 15A (8W-12-7)
6
2
FUSE 2 10A (8W-12-6)
1
2
5
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN)
DAYTIME RUNNING LAMP MODULE
GROUND
RED BRAKE WARNING INDICATOR DRIVER
FUSED LEFT LOW BEAM OUTPUT
FUSED RIGHT HIGH BEAM OUTPUT
8
6
1
4
(8W-12-15)
(8W-12-18)
(8W-12-13)
3 C9
6 C5
12 C1
3 C1
Z1 14 BK
G9 18 GY
L43 18 VT/OR
L34 18 RD/OR
G301
(8W-15-9)
3
FUSED RIGHT HIGH BEAM OUTPUT
RIGHT HEADLAMP
(8W-50-2)
1
FUSED LEFT LOW BEAM OUTPUT
LEFT HEADLAMP
(8W-50-2)
PARK BRAKE SWITCH

8W-51 REAR LIGHTING

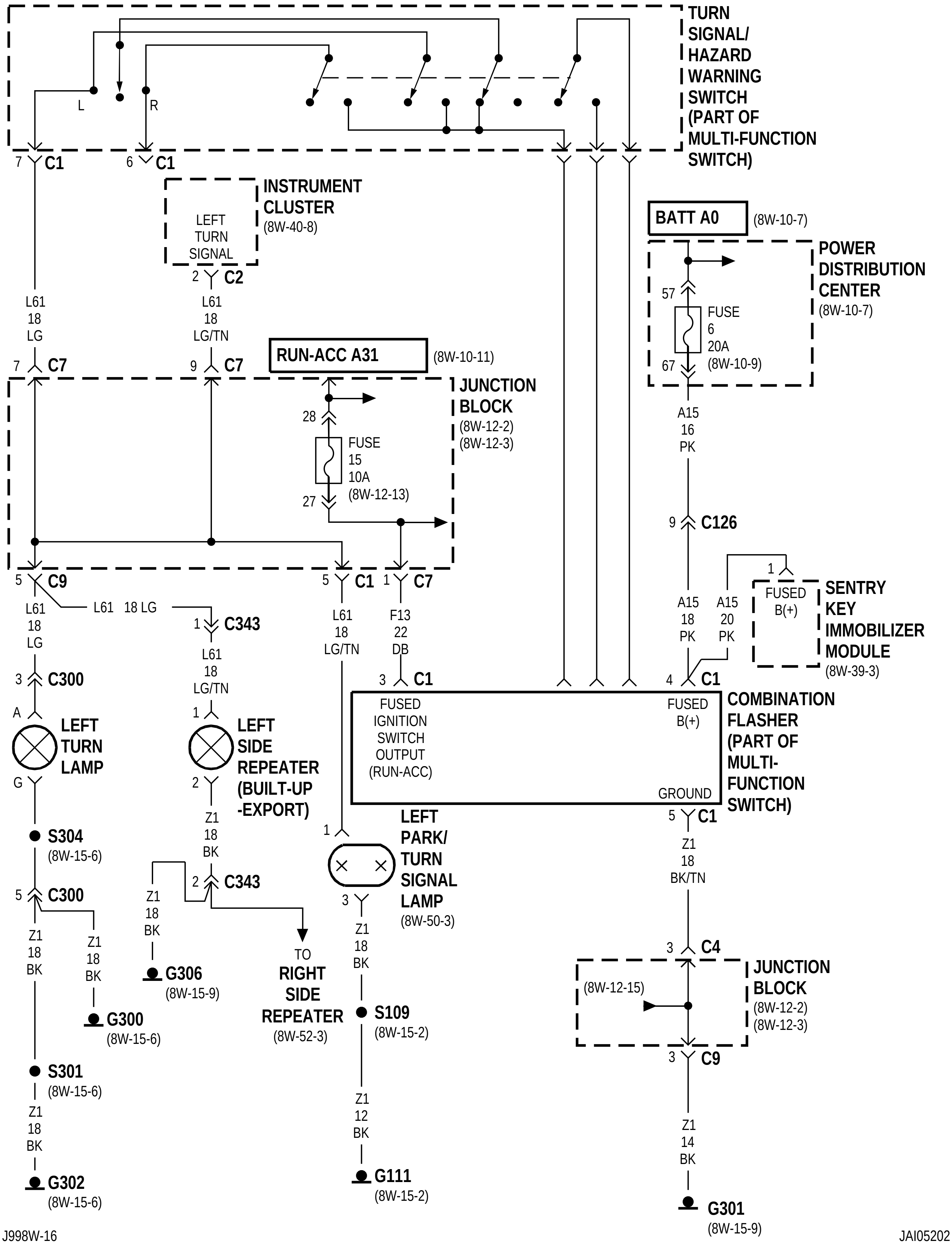

BATT F33
(8W-12-10)
HEADLAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG *
(8W-50-3)
C2
L7 18 BK/YL
C5
BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
FUSE 4 20A (8W-10-9)
A7 16 RD/BK
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
C9
C2
L50 16 WT/TN
L50 18 WT/BR
CONTROLLER ANTI-LOCK BRAKE
BRAKE LAMP SWITCH OUTPUT
(8W-35-5)
STOP LAMP SWITCH
(8W-51-5)
S300
L7 18 BK/YL
L50 18 WT/TN
C300
C301
C305
L50 18 BK/TN
TO C320
(8W-51-4)
LEFT TAIL/ STOP LAMP
RIGHT TAIL/ STOP LAMP
CENTER HIGH MOUNTED STOP LAMP
Z1 18 BK
S304
(8W-15-6)
S305
(8W-15-6)
S301
(8W-15-6)
G302
(8W-15-6)
G300
(8W-15-6)
* BUILT-UP-EXPORT


RUN A22
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
5
FUSE
4
15A
(8W-12-7)
6
4
C2
F20
18
WT/YL
EATX
MTX
1
C105
1
4
C169
A
TRANSMISSION RANGE SENSOR
R
(8W-31-5)
BACK-UP LAMP SWITCH
6
B
L1
18
VT/BK
L1
18
VT/BK
10
C105
5
C169
L1
18
VT/BK
L1
18
VT/BK
2
C121
L1
18
VT/BK
L1 18 VT/BK
1
C300
1
C301
L1
18
VT/BK
L1
18
VT/BK
A
LEFT BACK-UP LAMP
G
A
RIGHT BACK-UP LAMP
G
Z1
18
BK
Z1
18
BK
S304
(8W-15-6)
S305
(8W-15-6)
5
C300
5
C301
S301
(8W-15-6)
Z1
18
BK
Z1
18
BK
Z1
18
BK
G302
(8W-15-6)
G300
(8W-15-6)

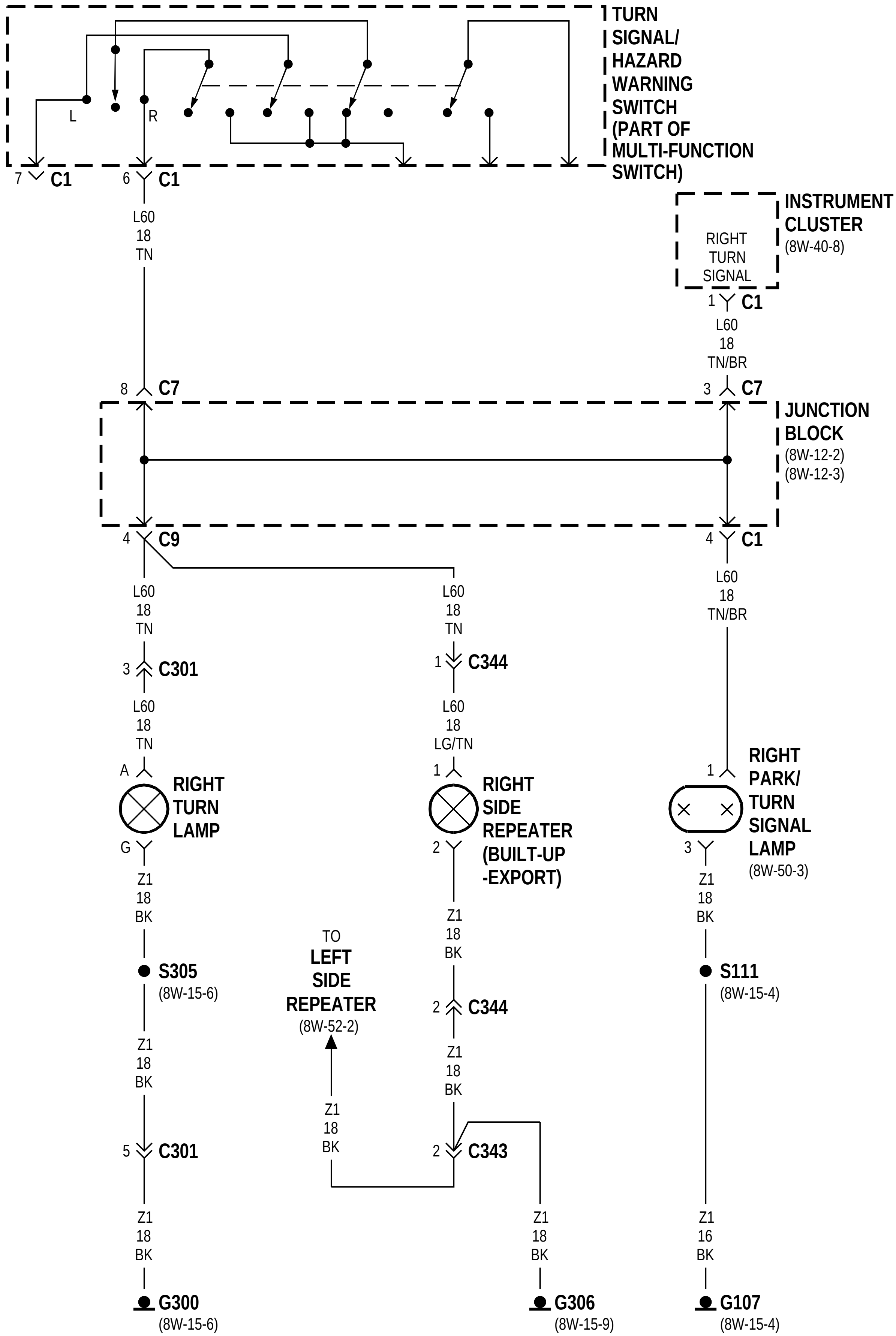

BATT A3
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
18
FUSE
10
20A
(8W-12-12)
17
2 C11
L92
18
LG
10 C2
REAR FOG LAMP SWITCH (PART OF MULTI-FUNCTION SWITCH)
0 OFF
1 PARK
2 HEAD
3 REAR FOG*
5 C2
L36
18
LG
10 C126
FROM C300
(8W-51-2)
A
L7
18
BK/YL
1 C320
EXCEPT BUILT-UP -EXPORT
BUILT-UP -EXPORT
REAR FOG LAMP INDICATOR
INSTRUMENT CLUSTER
(8W-40-8)
1 C2
L36
18
LG
L36
18
LG/DG
3 C121
L36
18
LB
6 C300
L36
18
LB
3 C320
L36
18
LG
S412
S411
LICENSE LAMP
LEFT LICENSE LAMP
RIGHT LICENSE LAMP
LEFT REAR FOG LAMP (BUILT-UP -EXPORT)
RIGHT REAR FOG LAMP (BUILT-UP -EXPORT)
Z1
18
BK
S410
2 C320
S304
(8W-15-6)
5 C300
S301
(8W-15-6)
G302
(8W-15-6)
G300
(8W-15-6)
* BUILT-UP-EXPORT


BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
66
FUSE 4 20A
(8W-10-9)
56
A7 16 RD/BK
1 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
9 C9
1 C2
3 C2
2 C2
BODY CONTROL MODULE
(8W-45-5)
GROUND
12 C1
L50 16 WT/TN
L50 18 WT/BR
L50 16 WT/TN
A7 16 RD/BK
Z2 20 BK/LG
V30 20 DB/RD
6
2
4
STOP LAMP SWITCH
12
BRAKE LAMP SWITCH OUTPUT
CONTROLLER ANTI-LOCK BRAKE
(8W-35-5)
5
1
3
BUILT-UP EXPORT
EXCEPT BUILT-UP EXPORT
3
SPEED CONTROL BRAKE SWITCH OUTPUT
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
S300
(8W-51-2)
K29 18 WT/RD
K29 18 WT/RD
V32 20 YL/PK
8 C113
S143
(8W-21-3)
V32 20 YL/RD
L50 16 WT/TN
L50 16 WT/TN
L50 18WT/TN
2 C300
2 C301
A C305
62 C2
5 C1
BRAKE SWITCH SENSE
SPEED CONTROL ON/OFF SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-14)
L50 18 WT/TN
L50 18 WT/TN
K29 18 WT/RD
L50 18 BK/TN
A
A
2
2
BRAKE LAMP SWITCH OUTPUT
LEFT TAIL/ STOP LAMP
(8W-51-2)
BRAKE LAMP SWITCH OUTPUT
RIGHT TAIL/ STOP LAMP
(8W-51-2)
BRAKE LAMP SWITCH OUTPUT
CENTER HIGH MOUNTED STOP LAMP
(8W-51-2)
BRAKE SWITCH SENSE
SHIFT INTERLOCK SOLENOID
(8W-21-3)

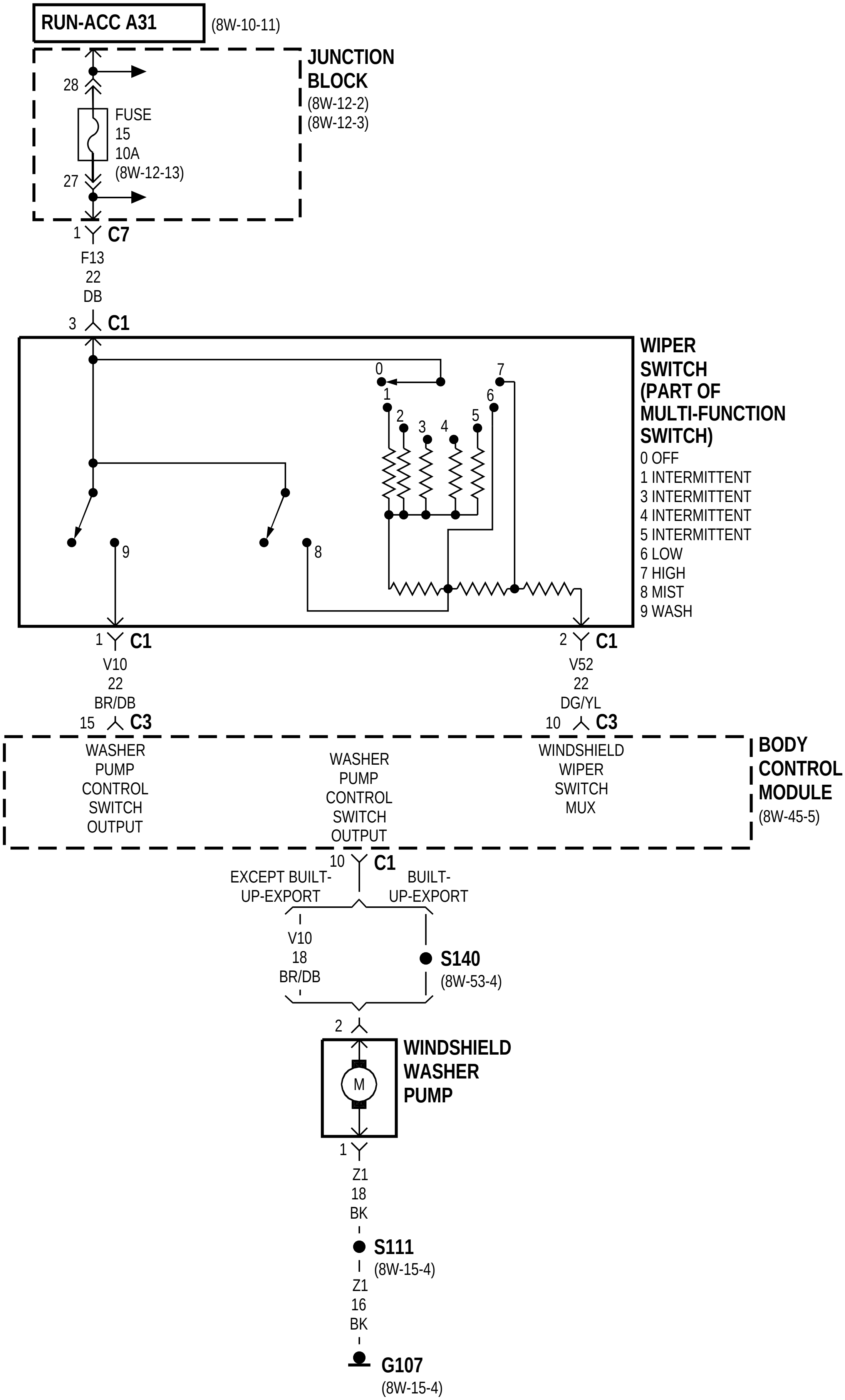
8W-52 TURN SIGNALS

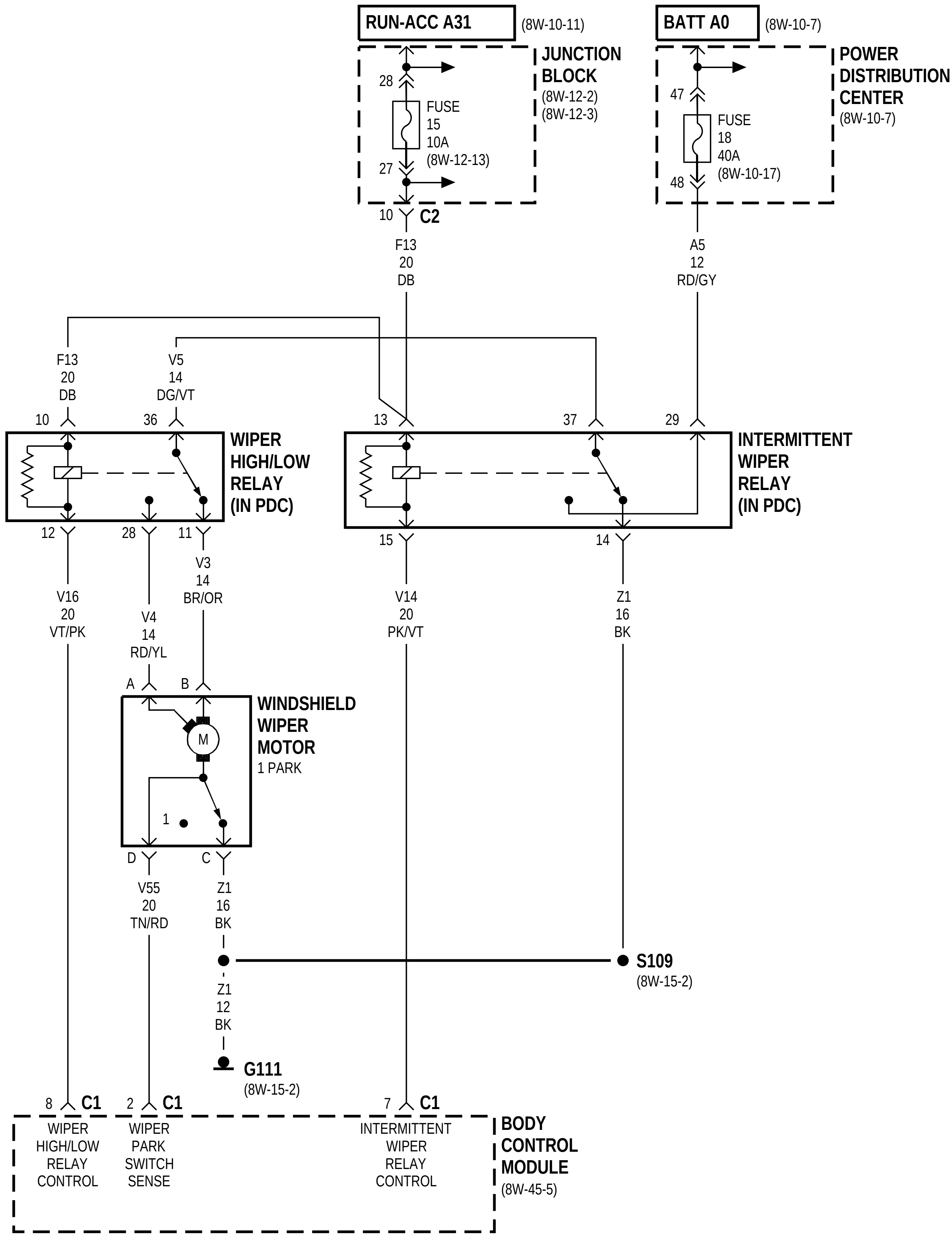


TURN SIGNAL/ HAZARD WARNING SWITCH (PART OF MULTI-FUNCTION SWITCH)
L
R
7 C1
6 C1
INSTRUMENT CLUSTER (8W-40-8)
LEFT TURN SIGNAL
2 C2
L61 18 LG
L61 18 LG/TN
7 C7
9 C7
RUN-ACC A31 (8W-10-11)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
28
FUSE 15 10A (8W-12-13)
27
5 C9
5 C1
1 C7
BATT A0 (8W-10-7)
POWER DISTRIBUTION CENTER (8W-10-7)
57
FUSE 6 20A (8W-10-9)
67
A15 16 PK
9 C126
L61 18 LG
L61 18 LG
1 C343
L61 18 LG/TN
L61 18 LG/TN
F13 22 DB
A15 18 PK
A15 20 PK
1
FUSED B(+)
SENTRY KEY IMMOBILIZER MODULE (8W-39-3)
3 C300
A
LEFT TURN LAMP
G
1
LEFT SIDE REPEATER (BUILT-UP -EXPORT)
2
3 C1
4 C1
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED B(+)
GROUND
COMBINATION FLASHER (PART OF MULTI-FUNCTION SWITCH)
5 C1
S304 (8W-15-6)
Z1 18 BK
1
LEFT PARK/ TURN SIGNAL LAMP (8W-50-3)
Z1 18 BK/TN
5 C300
Z1 18 BK
2 C343
3
Z1 18 BK
Z1 18 BK
Z1 18 BK
TO RIGHT SIDE REPEATER (8W-52-3)
G306 (8W-15-9)
G300 (8W-15-6)
S109 (8W-15-2)
3 C4
(8W-12-15)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
3 C9
S301 (8W-15-6)
Z1 18 BK
Z1 12 BK
Z1 14 BK
G302 (8W-15-6)
G111 (8W-15-2)
G301 (8W-15-9)
J998W-16
JAI05202

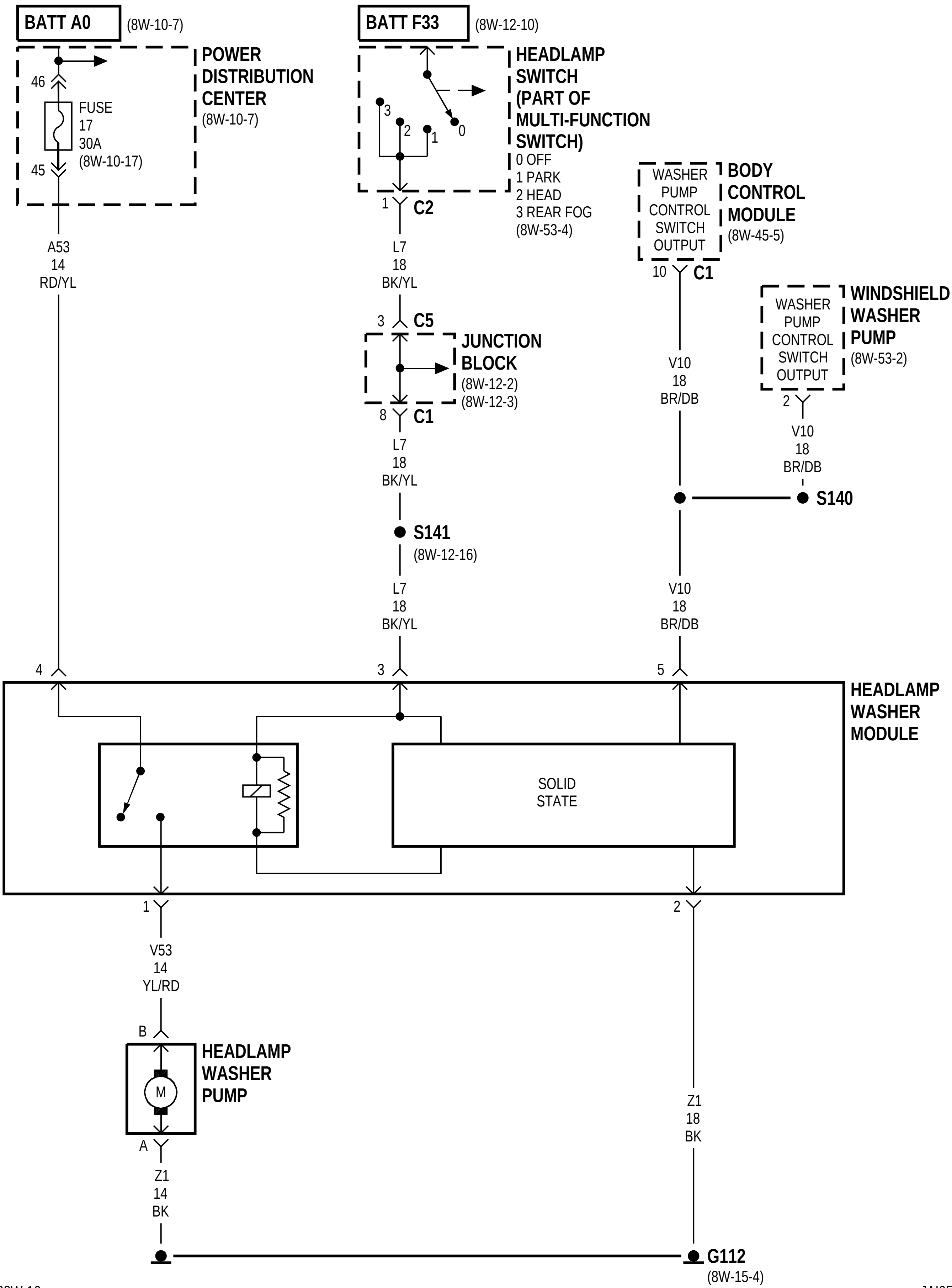

TURN SIGNAL/ HAZARD WARNING SWITCH (PART OF MULTI-FUNCTION SWITCH)
L
R
7 C1
6 C1
L60 18 TN
INSTRUMENT CLUSTER (8W-40-8)
RIGHT TURN SIGNAL
1 C1
L60 18 TN/BR
8 C7
3 C7
JUNCTION BLOCK (8W-12-2) (8W-12-3)
4 C9
4 C1
L60 18 TN
L60 18 TN
L60 18 TN/BR
3 C301
1 C344
L60 18 TN
L60 18 LG/TN
A
1
1
RIGHT TURN LAMP
RIGHT SIDE REPEATER (BUILT-UP -EXPORT)
RIGHT PARK/ TURN SIGNAL LAMP (8W-50-3)
G
2
3
Z1 18 BK
Z1 18 BK
Z1 18 BK
S305 (8W-15-6)
TO LEFT SIDE REPEATER (8W-52-2)
S111 (8W-15-4)
2 C344
Z1 18 BK
Z1 18 BK
Z1 18 BK
5 C301
2 C343
Z1 18 BK
Z1 18 BK
Z1 16 BK
G300 (8W-15-6)
G306 (8W-15-9)
G107 (8W-15-4)

8W-53 WIPERS

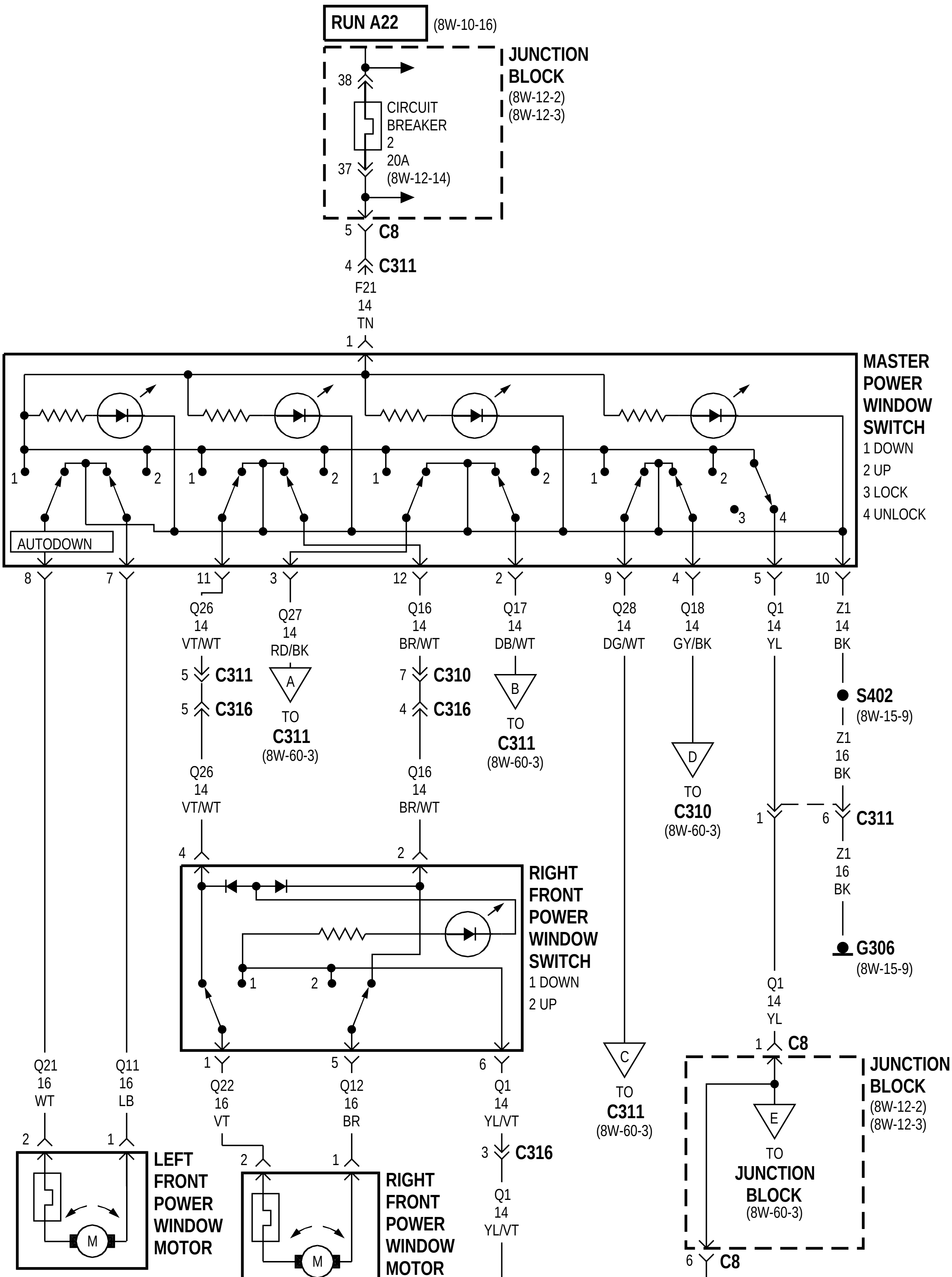

RUN-ACC A31
(8W-10-11)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
28
FUSE
15
10A
(8W-12-13)
27
1
C7
F13
22
DB
3
C1
WIPER
SWITCH
(PART OF
MULTI-FUNCTION
SWITCH)
0 OFF
1 INTERMITTENT
3 INTERMITTENT
4 INTERMITTENT
5 INTERMITTENT
6 LOW
7 HIGH
8 MIST
9 WASH
0
1
2
3
4
5
6
7
9
8
1
C1
V10
22
BR/DB
15
C3
2
C1
V52
22
DG/YL
10
C3
WASHER
PUMP
CONTROL
SWITCH
OUTPUT
WASHER
PUMP
CONTROL
SWITCH
OUTPUT
WINDSHIELD
WIPER
SWITCH
MUX
BODY
CONTROL
MODULE
(8W-45-5)
10
C1
EXCEPT BUILT-
UP-EXPORT
BUILT-
UP-EXPORT
V10
18
BR/DB
S140
(8W-53-4)
2
WINDSHIELD
WASHER
PUMP
M
1
Z1
18
BK
S111
(8W-15-4)
Z1
16
BK
G107
(8W-15-4)

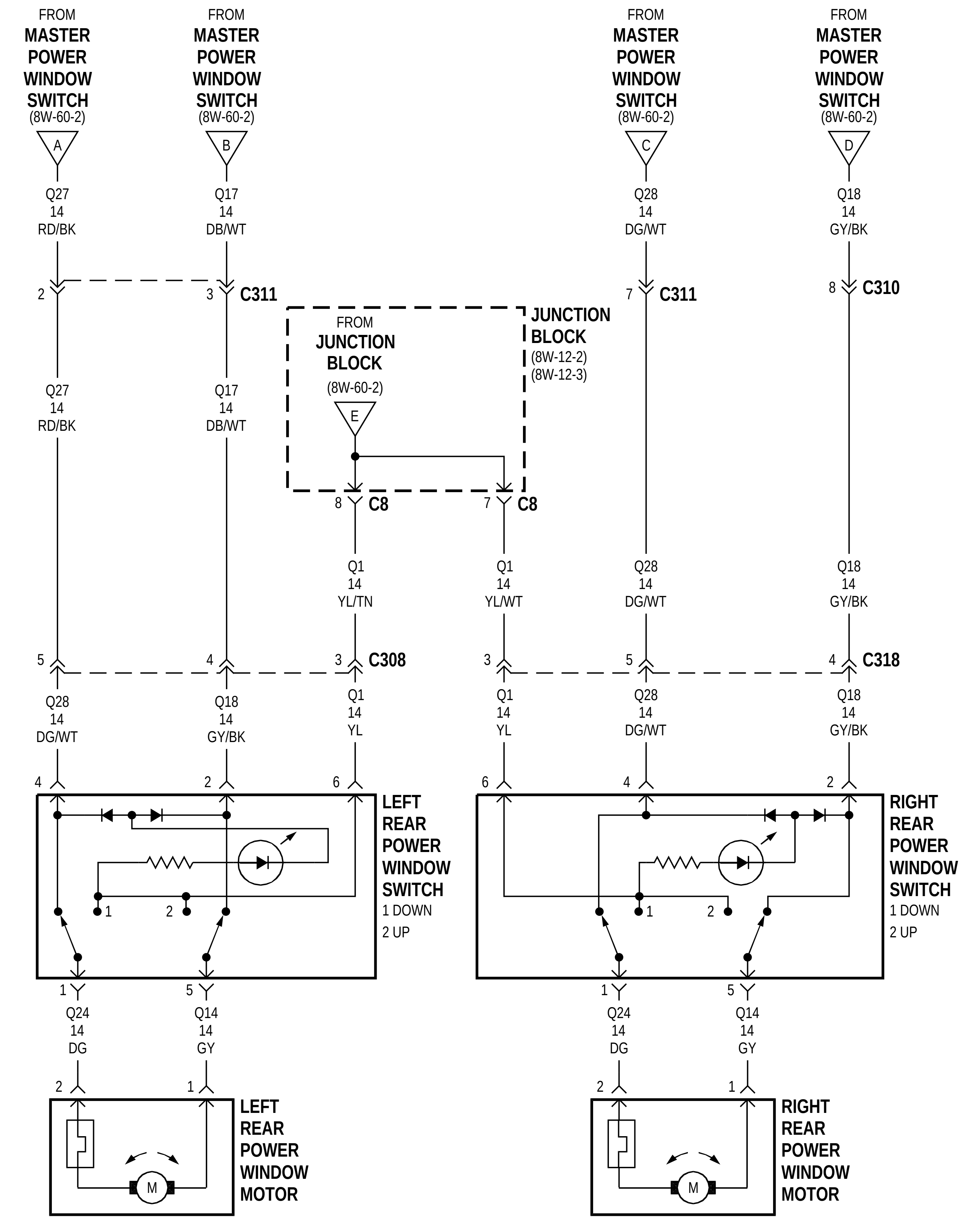

RUN-ACC A31
(8W-10-11)
BATT A0
(8W-10-7)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
28
FUSE
15
10A
(8W-12-13)
27
10
C2
POWER
DISTRIBUTION
CENTER
(8W-10-7)
47
FUSE
18
40A
(8W-10-17)
48
F13
20
DB
A5
12
RD/GY
F13
20
DB
V5
14
DG/VT
10
36
13
37
29
WIPER
HIGH/LOW
RELAY
(IN PDC)
INTERMITTENT
WIPER
RELAY
(IN PDC)
12
28
11
15
14
V3
14
BR/OR
V16
20
VT/PK
V4
14
RD/YL
V14
20
PK/VT
Z1
16
BK
A
B
WINDSHIELD
WIPER
MOTOR
1 PARK
M
1
D
C
V55
20
TN/RD
Z1
16
BK
S109
(8W-15-2)
Z1
12
BK
G111
(8W-15-2)
8
C1
2
C1
7
C1
WIPER
HIGH/LOW
RELAY
CONTROL
WIPER
PARK
SWITCH
SENSE
INTERMITTENT
WIPER
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-5)

BUILT-UP-EXPORT



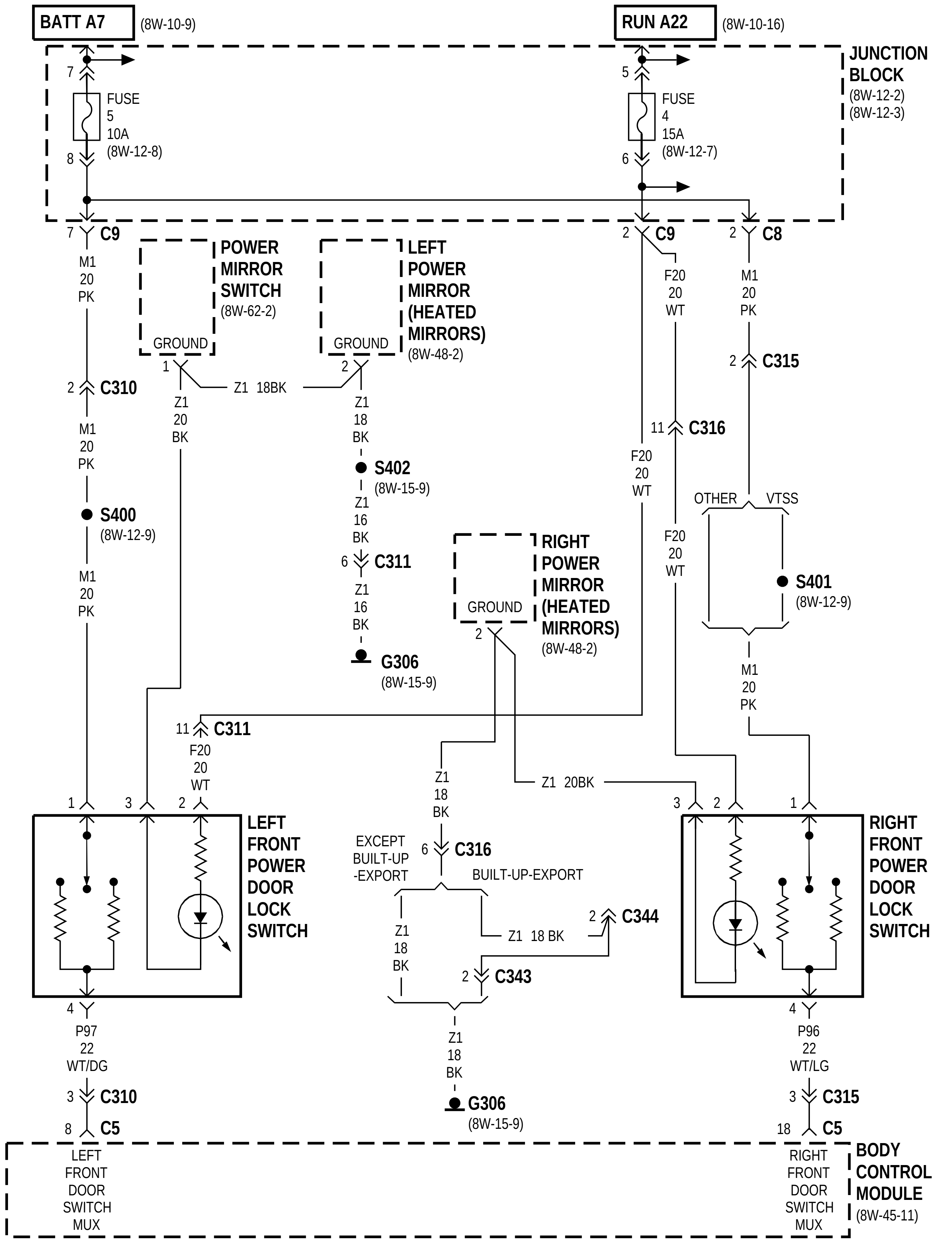
8W-60 POWER WINDOWS


RUN A22
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
38
CIRCUIT BREAKER
2
20A
(8W-12-14)
37
5 C8
4 C311
F21
14
TN
1
MASTER POWER WINDOW SWITCH
1 DOWN
2 UP
3 LOCK
4 UNLOCK
AUTODOWN
8 7 11 3 12 2 9 4 5 10
Q26
14
VT/WT
Q27
14
RD/BK
Q16
14
BR/WT
Q17
14
DB/WT
Q28
14
DG/WT
Q18
14
GY/BK
Q1
14
YL
Z1
14
BK
5 C311
5 C316
A
TO
C311
(8W-60-3)
7 C310
4 C316
B
TO
C311
(8W-60-3)
S402
(8W-15-9)
Z1
16
BK
D
TO
C310
(8W-60-3)
1
6 C311
Z1
16
BK
G306
(8W-15-9)
Q26
14
VT/WT
Q16
14
BR/WT
4
2
RIGHT FRONT POWER WINDOW SWITCH
1 DOWN
2 UP
1
2
Q1
14
YL
1 C8
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
E
TO
JUNCTION BLOCK
(8W-60-3)
C
TO
C311
(8W-60-3)
Q21
16
WT
Q11
16
LB
1 5 6
Q22
16
VT
Q12
16
BR
Q1
14
YL/VT
3 C316
Q1
14
YL/VT
6 C8
2 1
LEFT FRONT POWER WINDOW MOTOR
M
2 1
RIGHT FRONT POWER WINDOW MOTOR
M

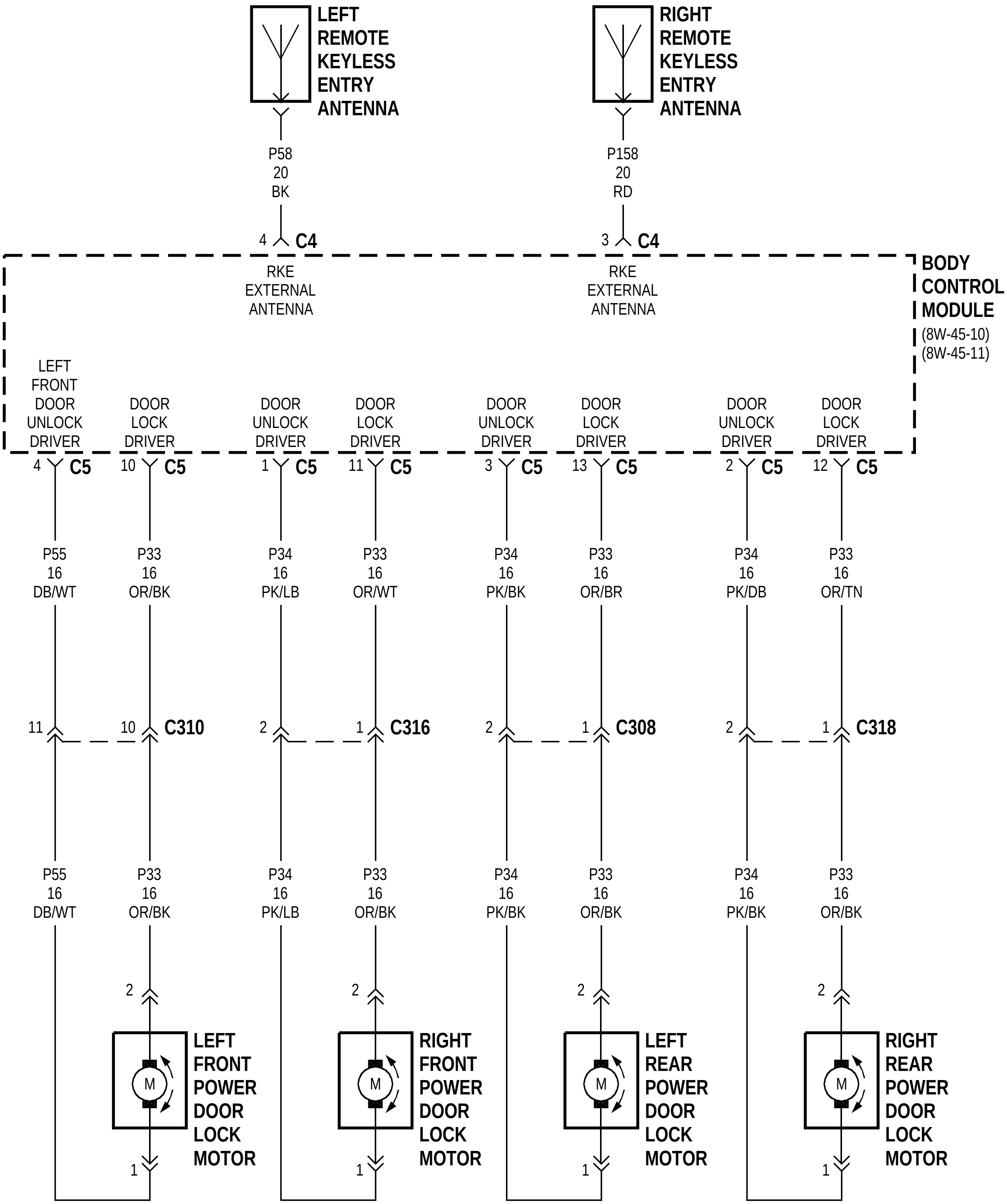

FROM MASTER POWER WINDOW SWITCH (8W-60-2) A
Q27 14 RD/BK
FROM MASTER POWER WINDOW SWITCH (8W-60-2) B
Q17 14 DB/WT
FROM MASTER POWER WINDOW SWITCH (8W-60-2) C
Q28 14 DG/WT
FROM MASTER POWER WINDOW SWITCH (8W-60-2) D
Q18 14 GY/BK
C311
C310
JUNCTION BLOCK (8W-12-2) (8W-12-3)
FROM JUNCTION BLOCK (8W-60-2) E
C8
Q1 14 YL/TN
Q1 14 YL/WT
C308
C318
Q28 14 DG/WT
Q18 14 GY/BK
Q1 14 YL
LEFT REAR POWER WINDOW SWITCH
1 DOWN
2 UP
RIGHT REAR POWER WINDOW SWITCH
1 DOWN
2 UP
Q24 14 DG
Q14 14 GY
LEFT REAR POWER WINDOW MOTOR
RIGHT REAR POWER WINDOW MOTOR
M

JAI06003

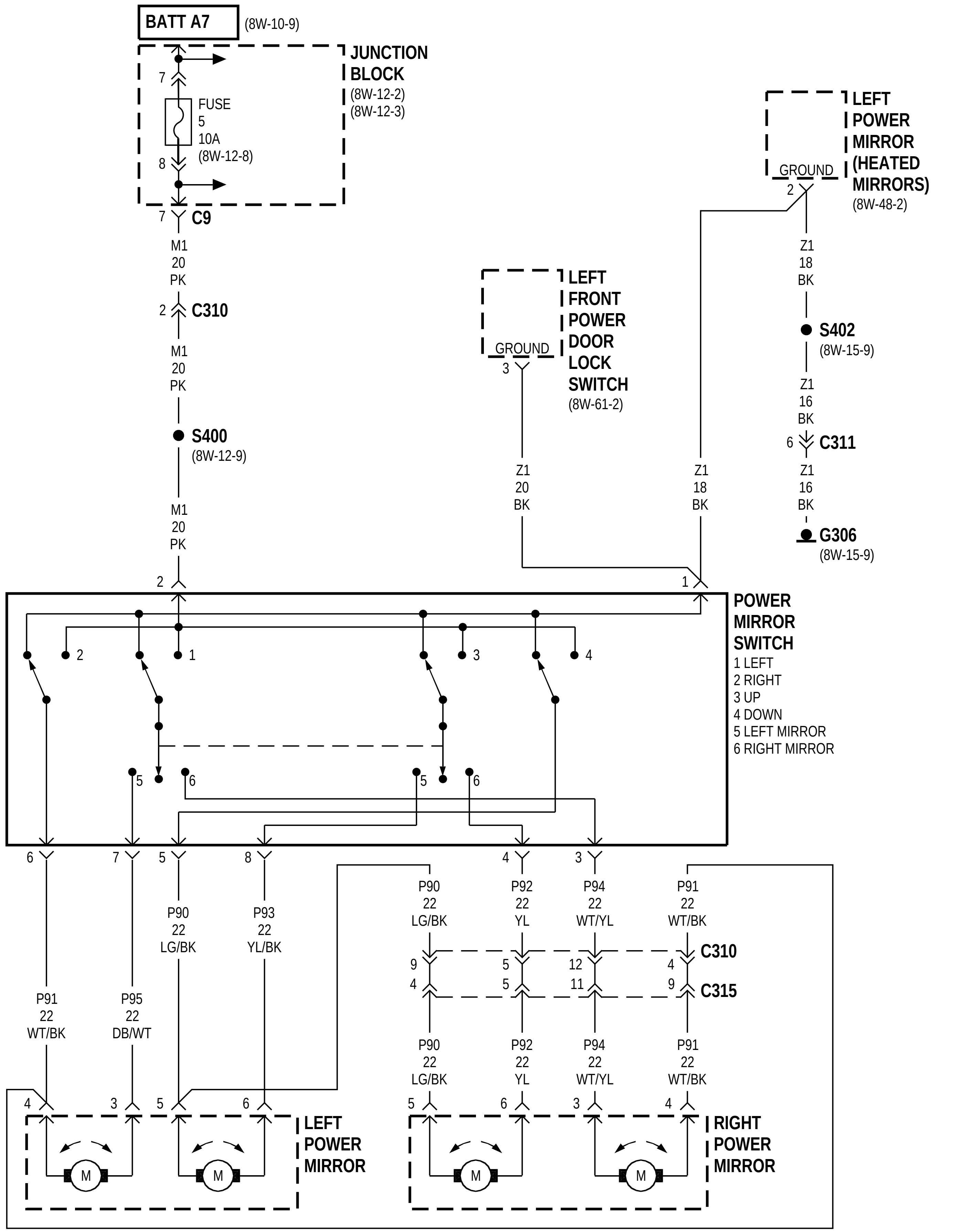
8W-61 POWER DOOR LOCKS



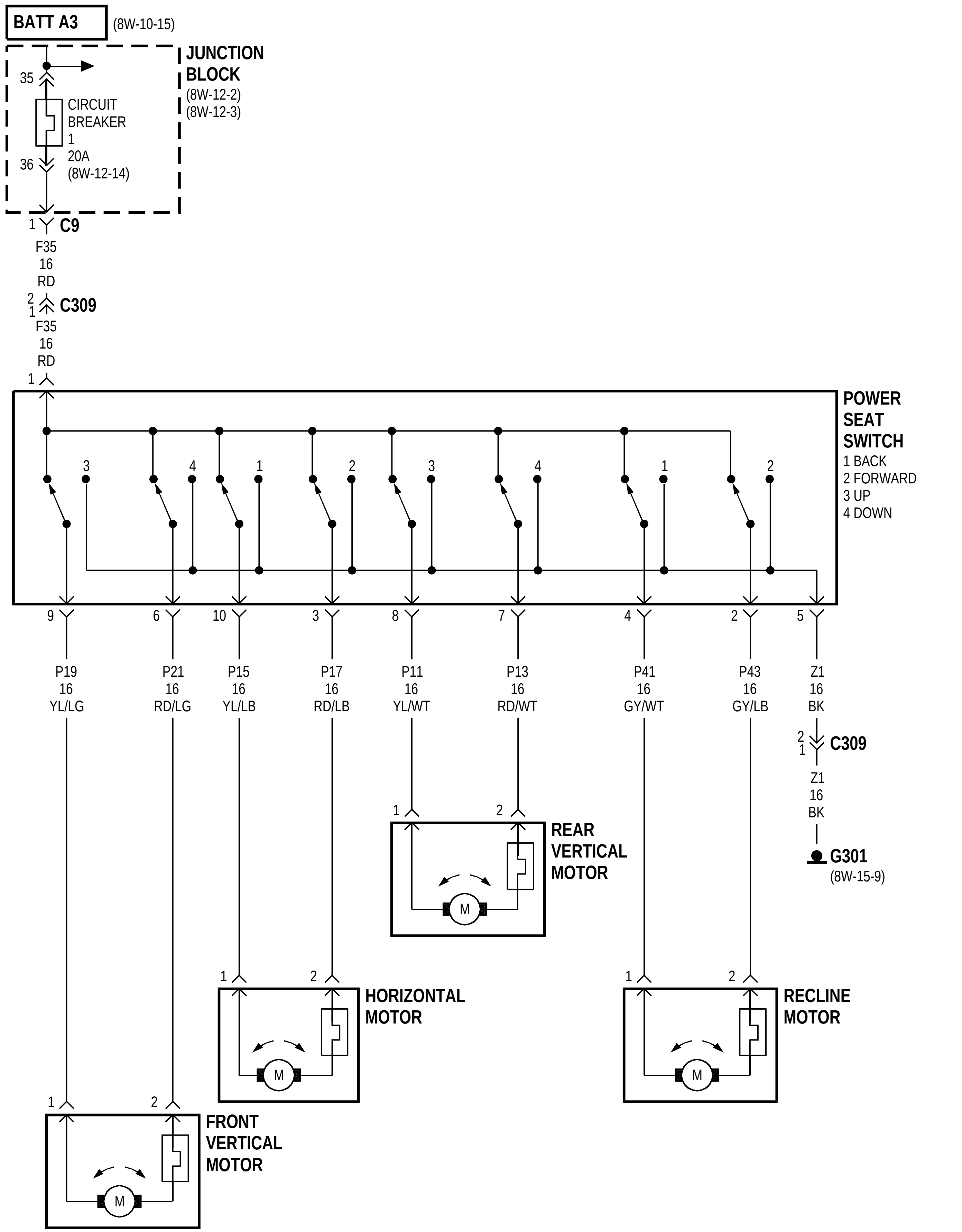
J998W-16 JAI06102


LEFT REMOTE KEYLESS ENTRY ANTENNA
RIGHT REMOTE KEYLESS ENTRY ANTENNA
P58 20 BK
P158 20 RD
4 C4
3 C4
RKE EXTERNAL ANTENNA
RKE EXTERNAL ANTENNA
BODY CONTROL MODULE
(8W-45-10)
(8W-45-11)
LEFT FRONT DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
4 C5
10 C5
1 C5
11 C5
3 C5
13 C5
2 C5
12 C5
P55 16 DB/WT
P33 16 OR/BK
P34 16 PK/LB
P33 16 OR/WT
P34 16 PK/BK
P33 16 OR/BR
P34 16 PK/DB
P33 16 OR/TN
11
10 C310
2
1 C316
2
1 C308
2
1 C318
P55 16 DB/WT
P33 16 OR/BK
P34 16 PK/LB
P33 16 OR/BK
P34 16 PK/BK
P33 16 OR/BK
P34 16 PK/BK
P33 16 OR/BK
2
M
1
LEFT FRONT POWER DOOR LOCK MOTOR
2
M
1
RIGHT FRONT POWER DOOR LOCK MOTOR
2
M
1
LEFT REAR POWER DOOR LOCK MOTOR
2
M
1
RIGHT REAR POWER DOOR LOCK MOTOR

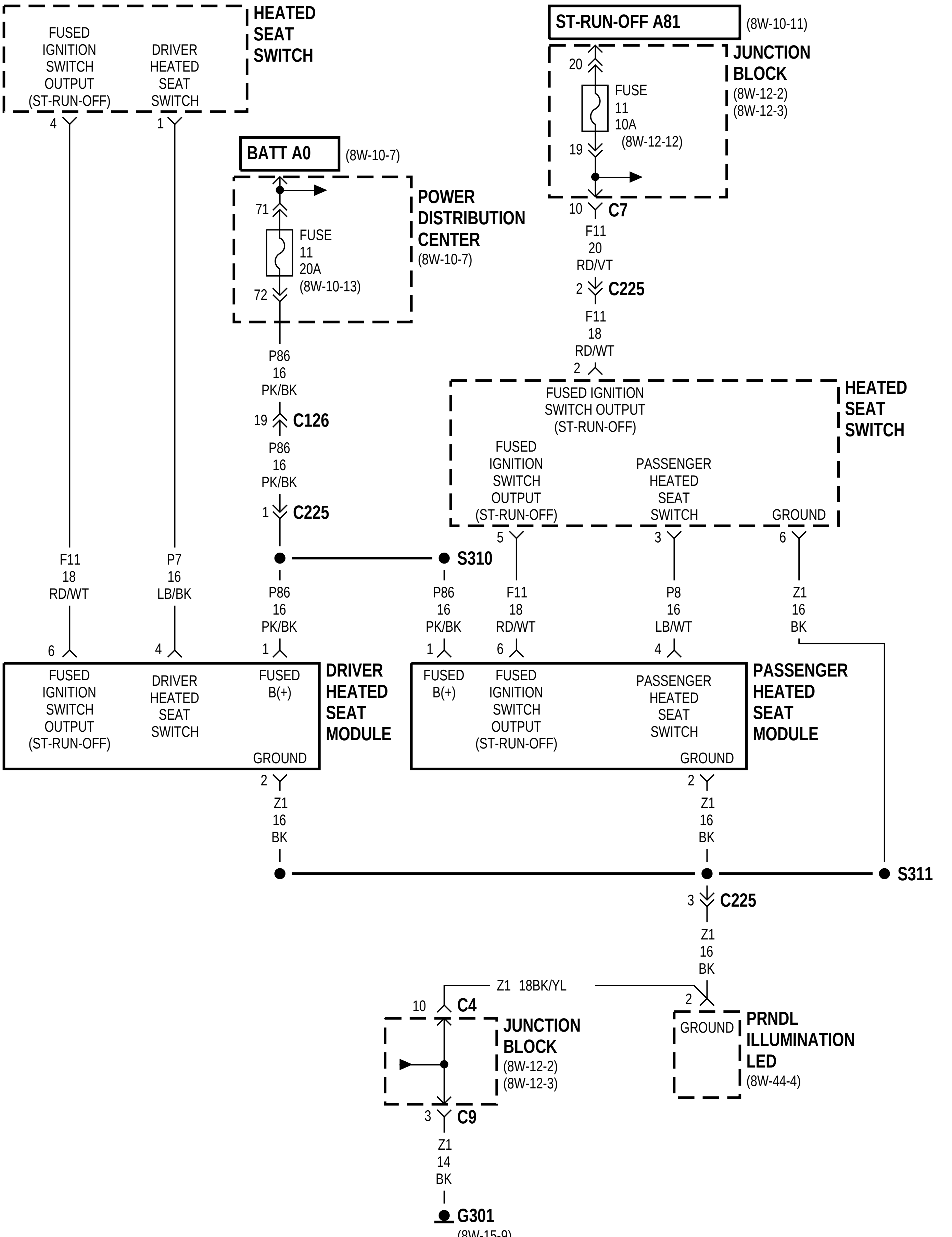
8W-62 POWER MIRRORS


BATT A7
(8W-10-9)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 10A (8W-12-8)
C9
M1 20 PK
C310
S400
(8W-12-9)
LEFT FRONT POWER DOOR LOCK SWITCH
(8W-61-2)
GROUND
LEFT POWER MIRROR (HEATED MIRRORS)
(8W-48-2)
Z1 18 BK
S402
(8W-15-9)
Z1 16 BK
C311
G306
(8W-15-9)
Z1 20 BK
POWER MIRROR SWITCH
1 LEFT
2 RIGHT
3 UP
4 DOWN
5 LEFT MIRROR
6 RIGHT MIRROR
P91 22 WT/BK
P95 22 DB/WT
P90 22 LG/BK
P93 22 YL/BK
P92 22 YL
P94 22 WT/YL
C315
M
LEFT POWER MIRROR
RIGHT POWER MIRROR

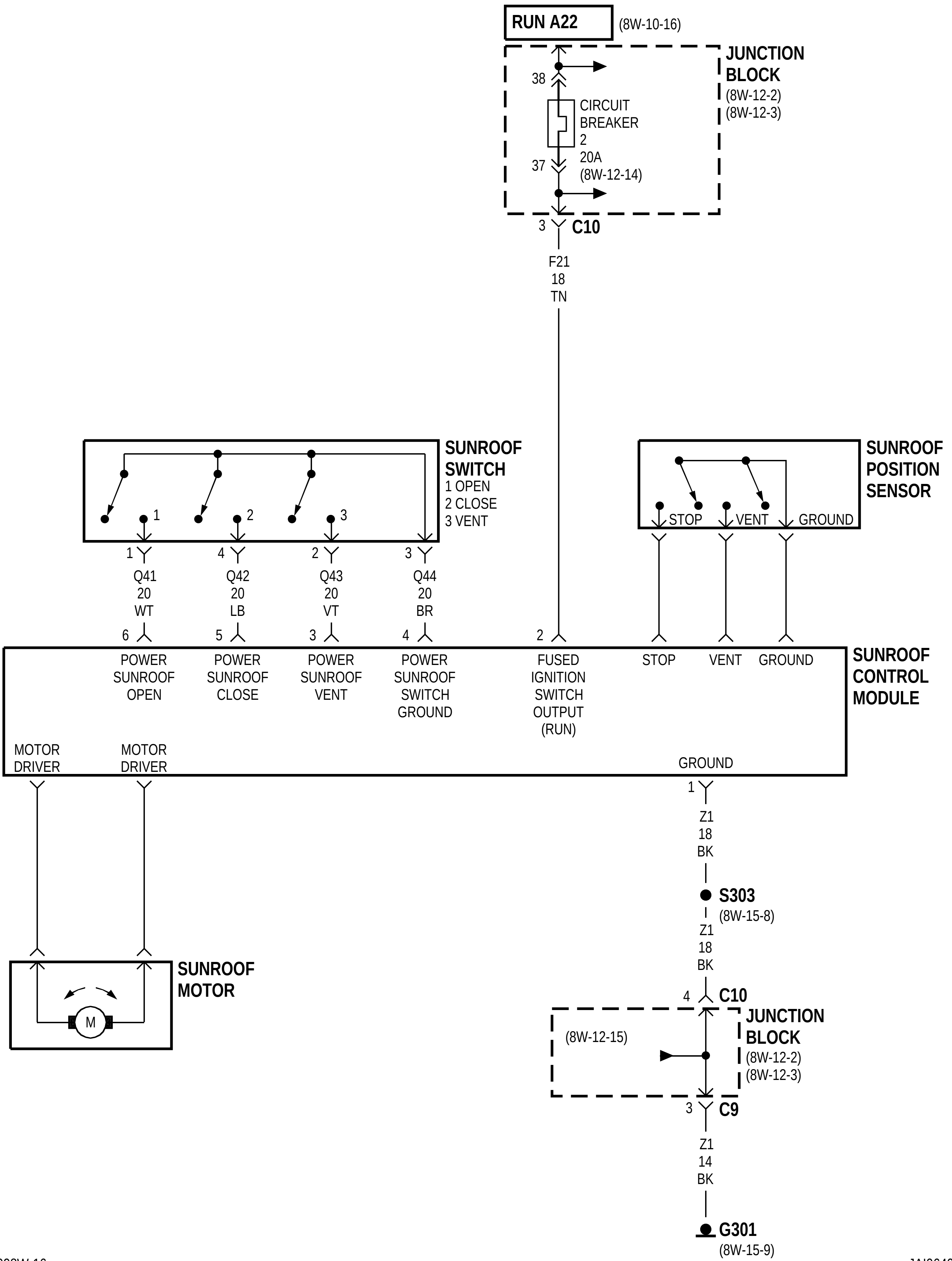
8W-63 POWER SEAT


BATT A3
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
35
CIRCUIT BREAKER
1
20A
(8W-12-14)
36
1 C9
F35
16
RD
2
1 C309
F35
16
RD
1
POWER SEAT SWITCH
1 BACK
2 FORWARD
3 UP
4 DOWN
3 4 1 2 3 4 1 2
9 6 10 3 8 7 4 2 5
P19 16 YL/LG
P21 16 RD/LG
P15 16 YL/LB
P17 16 RD/LB
P11 16 YL/WT
P13 16 RD/WT
P41 16 GY/WT
P43 16 GY/LB
Z1 16 BK
2
1 C309
Z1
16
BK
G301
(8W-15-9)
1 2
REAR VERTICAL MOTOR
M
1 2
HORIZONTAL MOTOR
M
1 2
RECLINE MOTOR
M
1 2
FRONT VERTICAL MOTOR
M

HEATED SEAT

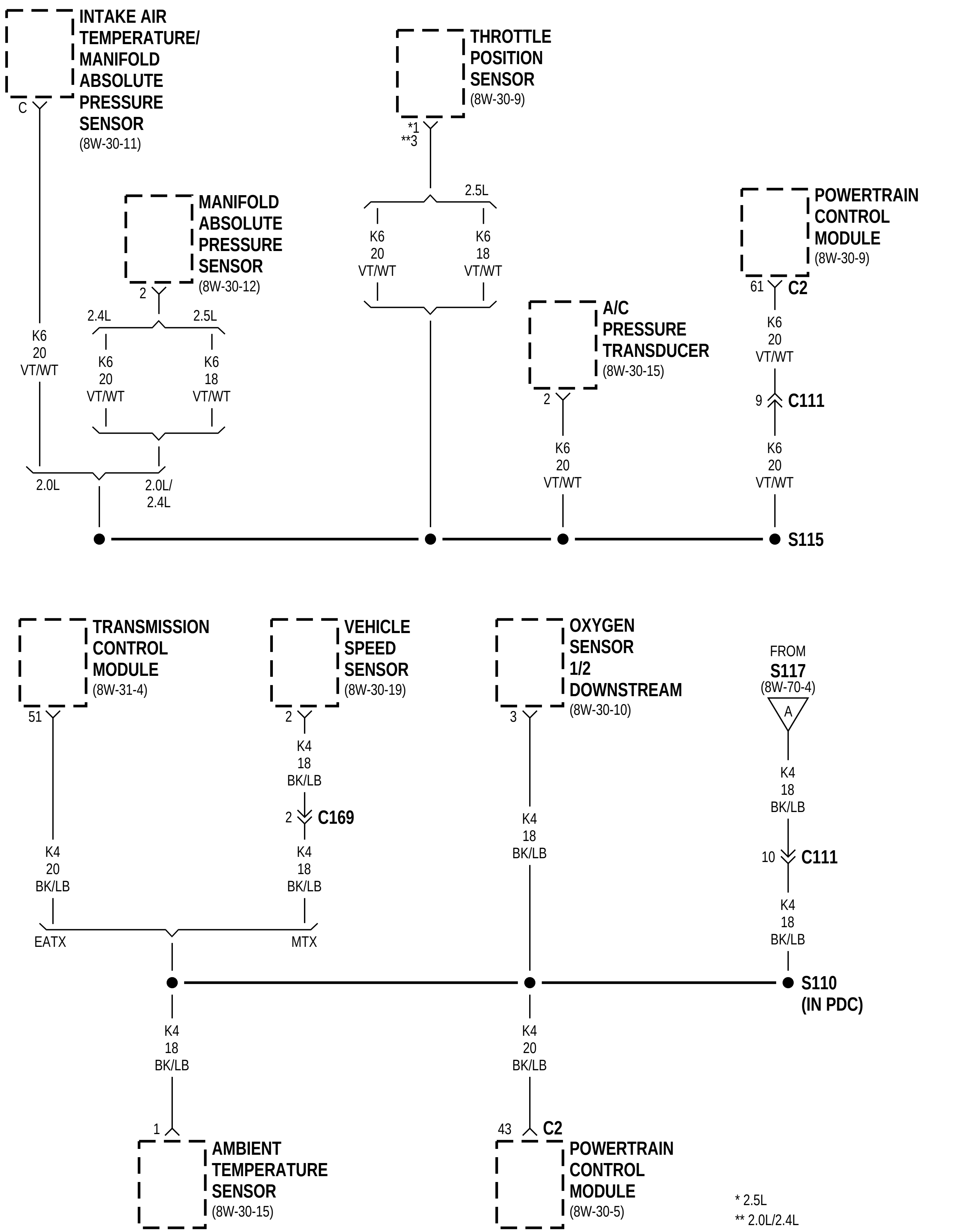

HEATED SEAT SWITCH
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
DRIVER HEATED SEAT SWITCH
4
1
F11
18
RD/WT
P7
16
LB/BK
BATT A0
(8W-10-7)
POWER DISTRIBUTION CENTER
(8W-10-7)
71
FUSE
11
20A
(8W-10-13)
72
P86
16
PK/BK
19
C126
P86
16
PK/BK
1
C225
S310
ST-RUN-OFF A81
(8W-10-11)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
20
FUSE
11
10A
(8W-12-12)
19
10
C7
F11
20
RD/VT
2
C225
F11
18
RD/WT
2
HEATED SEAT SWITCH
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
PASSENGER HEATED SEAT SWITCH
GROUND
5
3
6
P86
16
PK/BK
P86
16
PK/BK
F11
18
RD/WT
P8
16
LB/WT
Z1
16
BK
6
4
1
1
6
4
DRIVER HEATED SEAT MODULE
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
DRIVER HEATED SEAT SWITCH
FUSED B(+)
GROUND
PASSENGER HEATED SEAT MODULE
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
PASSENGER HEATED SEAT SWITCH
GROUND
2
Z1
16
BK
2
Z1
16
BK
S311
3
C225
Z1
16
BK
Z1 18BK/YL
10
C4
2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
GROUND
PRNDL ILLUMINATION LED
(8W-44-4)
3
C9
Z1
14
BK
G301
(8W-15-9)

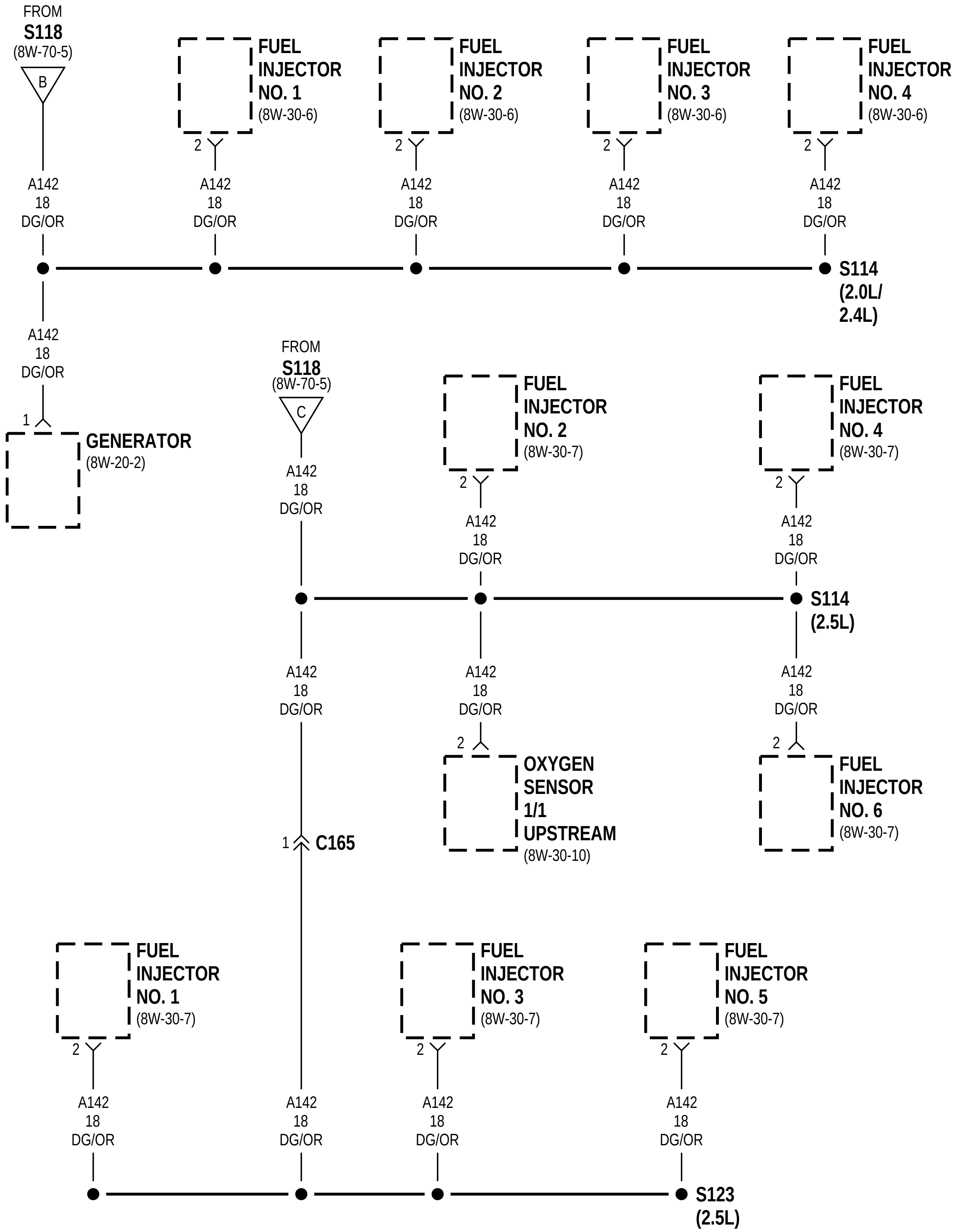
8W-64 POWER SUNROOF

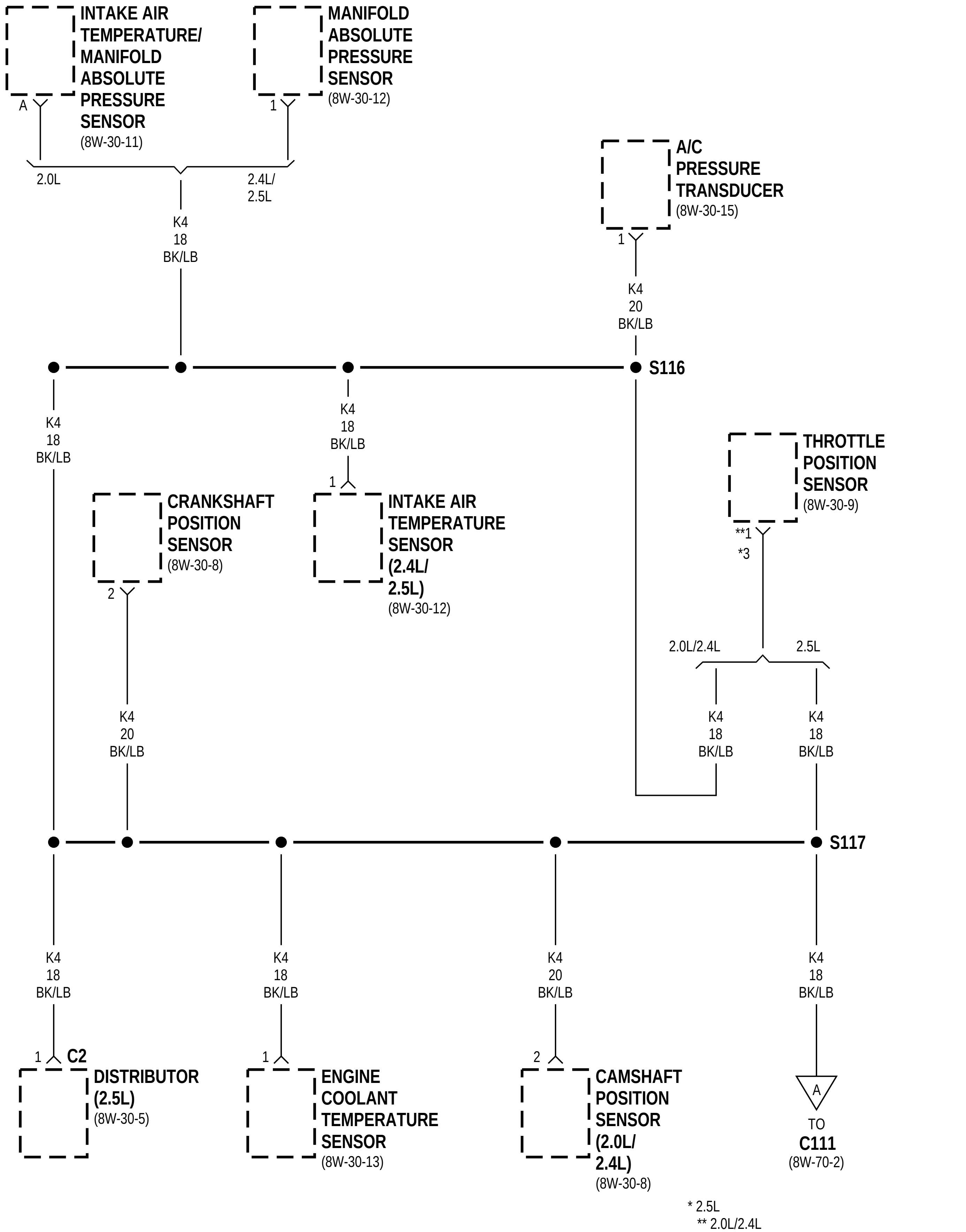


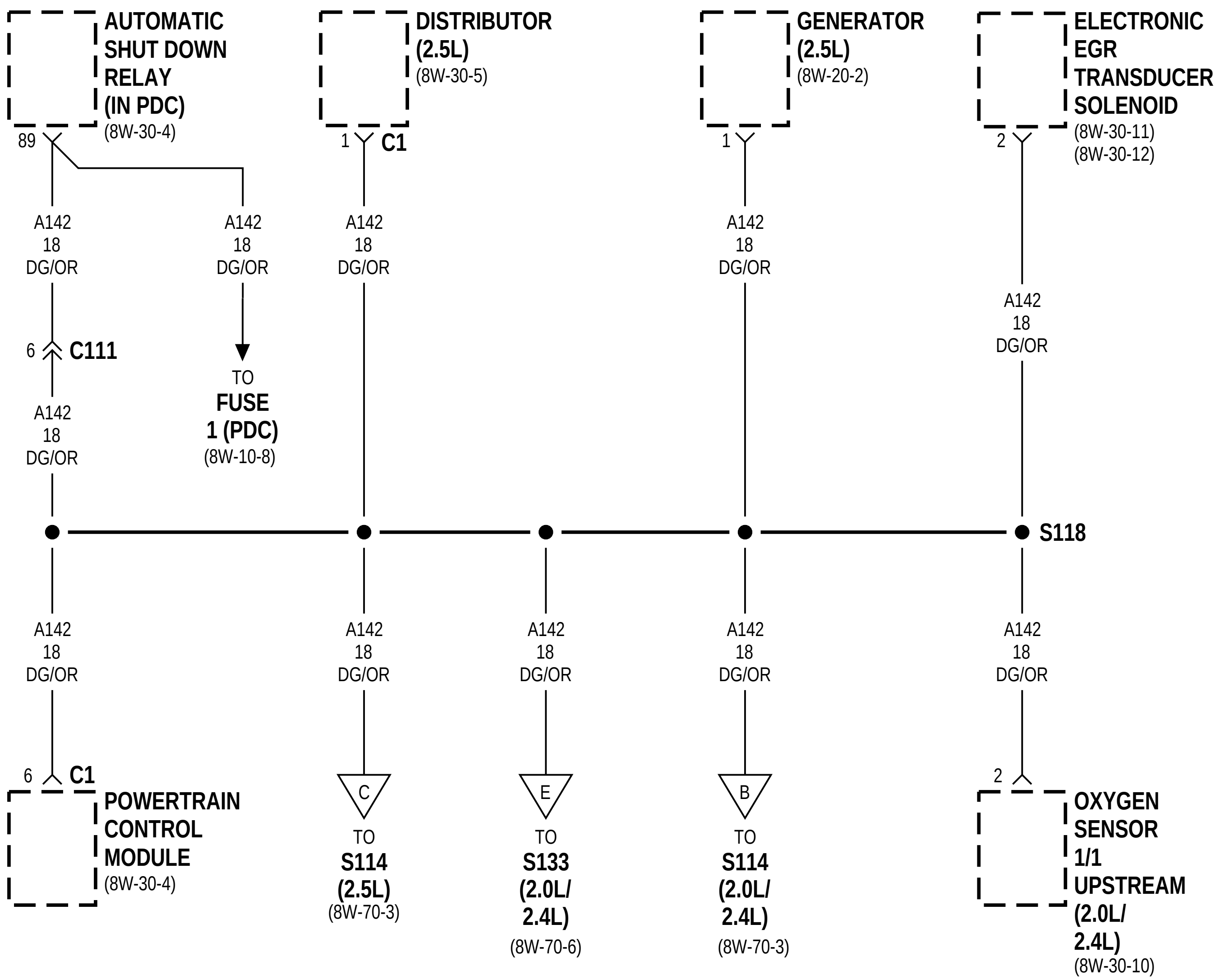
RUN A22
(8W-10-16)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
38
CIRCUIT BREAKER 2 20A
(8W-12-14)
37
3
C10
F21
18
TN
SUNROOF SWITCH
1 OPEN
2 CLOSE
3 VENT
1
2
3
1
4
2
3
Q41 20 WT
Q42 20 LB
Q43 20 VT
Q44 20 BR
SUNROOF POSITION SENSOR
STOP
VENT
GROUND
6
5
3
4
2
POWER SUNROOF OPEN
POWER SUNROOF CLOSE
POWER SUNROOF VENT
POWER SUNROOF SWITCH GROUND
FUSED IGNITION SWITCH OUTPUT (RUN)
STOP
VENT
GROUND
SUNROOF CONTROL MODULE
MOTOR DRIVER
MOTOR DRIVER
GROUND
1
Z1 18 BK
S303
(8W-15-8)
Z1 18 BK
4
C10
JUNCTION BLOCK
(8W-12-15)
(8W-12-2)
(8W-12-3)
3
C9
Z1 14 BK
G301
(8W-15-9)
SUNROOF MOTOR
M

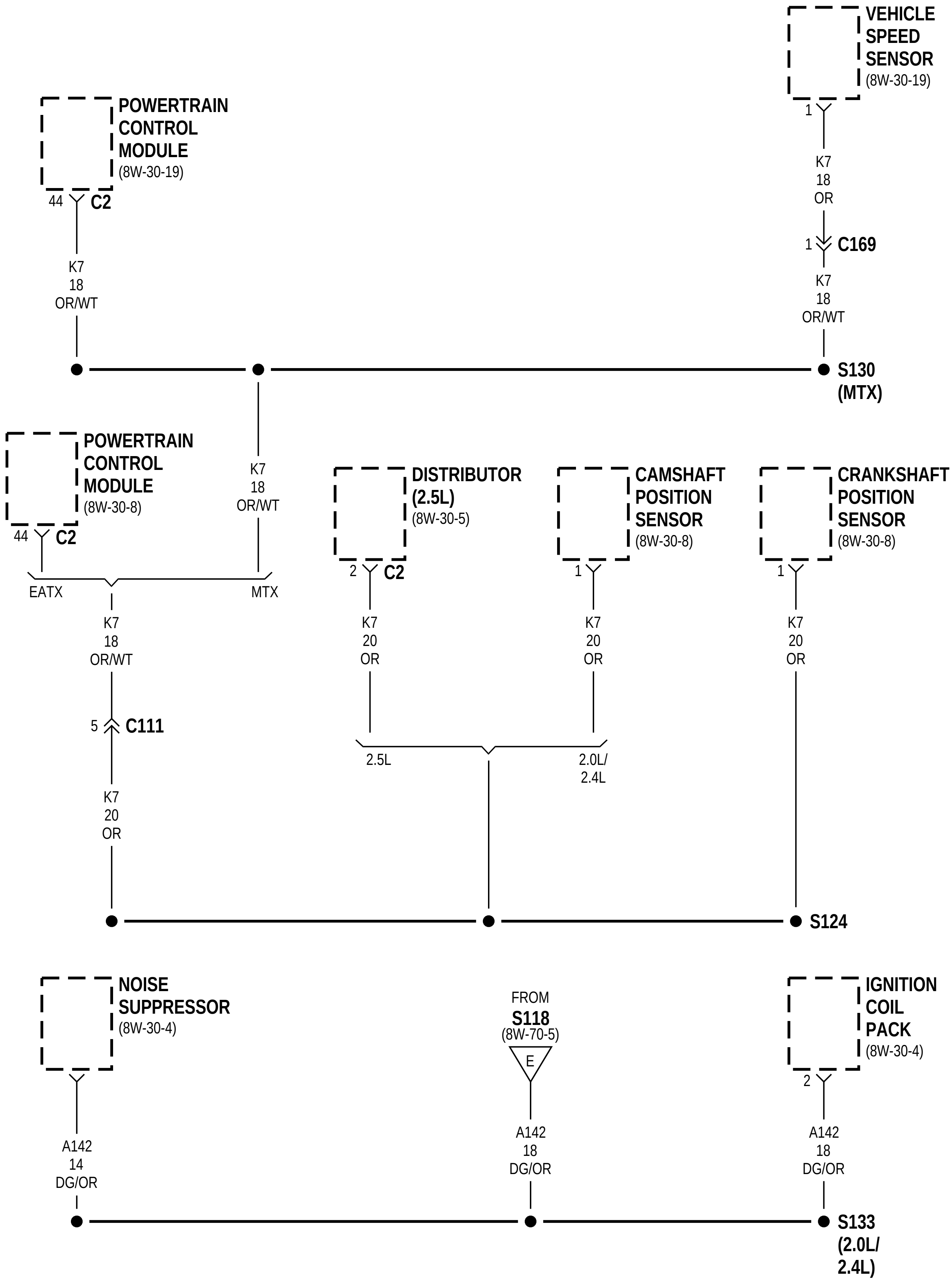
8W-70 SPLICE INFORMATION


INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-11)
C
K6
20
VT/WT
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-12)
2
2.4L
2.5L
K6
20
VT/WT
K6
18
VT/WT
2.0L
2.0L/
2.4L
THROTTLE POSITION SENSOR
(8W-30-9)
*1
**3
2.5L
K6
20
VT/WT
K6
18
VT/WT
A/C PRESSURE TRANSDUCER
(8W-30-15)
2
K6
20
VT/WT
POWERTRAIN CONTROL MODULE
(8W-30-9)
61
C2
K6
20
VT/WT
9
C111
K6
20
VT/WT
S115
TRANSMISSION CONTROL MODULE
(8W-31-4)
51
K4
20
BK/LB
EATX
VEHICLE SPEED SENSOR
(8W-30-19)
2
K4
18
BK/LB
2
C169
K4
18
BK/LB
MTX
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-10)
3
K4
18
BK/LB
FROM
S117
(8W-70-4)
A
K4
18
BK/LB
10
C111
K4
18
BK/LB
S110
(IN PDC)
K4
18
BK/LB
1
AMBIENT TEMPERATURE SENSOR
(8W-30-15)
K4
20
BK/LB
43
C2
POWERTRAIN CONTROL MODULE
(8W-30-5)
* 2.5L
** 2.0L/2.4L

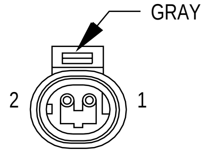

FROM
S118
(8W-70-5)
B
FUEL INJECTOR NO. 1 (8W-30-6)
FUEL INJECTOR NO. 2 (8W-30-6)
FUEL INJECTOR NO. 3 (8W-30-6)
FUEL INJECTOR NO. 4 (8W-30-6)
A142 18 DG/OR
S114 (2.0L/ 2.4L)
GENERATOR (8W-20-2)
FROM
S118
(8W-70-5)
C
FUEL INJECTOR NO. 2 (8W-30-7)
FUEL INJECTOR NO. 4 (8W-30-7)
S114 (2.5L)
OXYGEN SENSOR 1/1 UPSTREAM (8W-30-10)
FUEL INJECTOR NO. 6 (8W-30-7)
C165
FUEL INJECTOR NO. 1 (8W-30-7)
FUEL INJECTOR NO. 3 (8W-30-7)
FUEL INJECTOR NO. 5 (8W-30-7)
S123 (2.5L)


INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-11)
A
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-12)
1
2.0L
2.4L/ 2.5L
K4 18 BK/LB
A/C PRESSURE TRANSDUCER
(8W-30-15)
1
K4 20 BK/LB
S116
K4 18 BK/LB
K4 18 BK/LB
1
CRANKSHAFT POSITION SENSOR
(8W-30-8)
2
INTAKE AIR TEMPERATURE SENSOR (2.4L/ 2.5L)
(8W-30-12)
THROTTLE POSITION SENSOR
(8W-30-9)
**1
*3
2.0L/2.4L
2.5L
K4 20 BK/LB
K4 18 BK/LB
K4 18 BK/LB
S117
K4 18 BK/LB
K4 18 BK/LB
K4 20 BK/LB
K4 18 BK/LB
1
C2
DISTRIBUTOR (2.5L)
(8W-30-5)
1
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-13)
2
CAMSHAFT POSITION SENSOR (2.0L/ 2.4L)
(8W-30-8)
A
TO
C111
(8W-70-2)
* 2.5L
** 2.0L/2.4L


AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-4)
89
DISTRIBUTOR (2.5L)
(8W-30-5)
1
C1
GENERATOR (2.5L)
(8W-20-2)
1
ELECTRONIC EGR TRANSDUCER SOLENOID
(8W-30-11)
(8W-30-12)
2
A142
18
DG/OR
6
C111
TO
FUSE 1 (PDC)
(8W-10-8)
S118
6
C1
POWERTRAIN CONTROL MODULE
(8W-30-4)
C
TO
S114 (2.5L)
(8W-70-3)
E
TO
S133 (2.0L/ 2.4L)
(8W-70-6)
B
TO
S114 (2.0L/ 2.4L)
(8W-70-3)
2
OXYGEN SENSOR 1/1 UPSTREAM (2.0L/ 2.4L)
(8W-30-10)

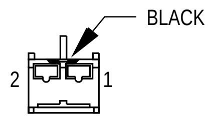

VEHICLE
SPEED
SENSOR
(8W-30-19)
1
K7
18
OR
1
C169
K7
18
OR/WT
POWERTRAIN
CONTROL
MODULE
(8W-30-19)
44
C2
K7
18
OR/WT
S130
(MTX)
POWERTRAIN
CONTROL
MODULE
(8W-30-8)
44
C2
K7
18
OR/WT
EATX
MTX
K7
18
OR/WT
5
C111
K7
20
OR
DISTRIBUTOR
(2.5L)
(8W-30-5)
2
C2
K7
20
OR
CAMSHAFT
POSITION
SENSOR
(8W-30-8)
1
K7
20
OR
CRANKSHAFT
POSITION
SENSOR
(8W-30-8)
1
K7
20
OR
2.5L
2.0L/
2.4L
S124
NOISE
SUPPRESSOR
(8W-30-4)
A142
14
DG/OR
FROM
S118
(8W-70-5)
E
A142
18
DG/OR
IGNITION
COIL
PACK
(8W-30-4)
2
A142
18
DG/OR
S133
(2.0L/
2.4L)

8W-80 CONNECTOR PIN-OUTS



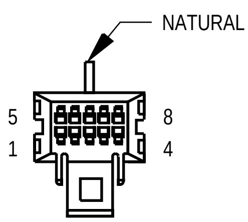
A/C COMPRESSOR CLUTCH

CAV	CIRCUIT	FUNCTION
1	C3 14DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	-	-



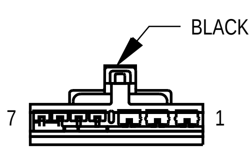
A/C EVAPORATOR TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	C57 22GY	SENSOR GROUND
2	C12 20LG/BK	EVAPORATOR TEMPERATURE SENSOR SIGNAL



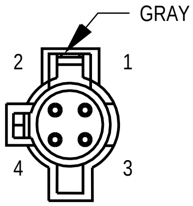
A/C-HEATER CONTROL - C1

CAV	CIRCUIT	FUNCTION
1	M1 20PK/DB	FUSED B(+)
2	C21 22DB/OR	A/C SWITCH SENSE
3	C16 22LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	-	-
5	C58 22RD	MODE SWITCH SENSE
6	-	-
7	-	-
8	Z2 22BK/PK	GROUND



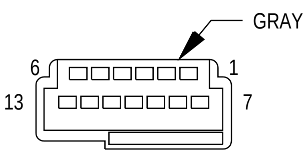
A/C-HEATER CONTROL - C2

CAV	CIRCUIT	FUNCTION
1	Z1 12BK	GROUND
2	C7 12BK/TN	HIGH BLOWER MOTOR DRIVER
3	C6 18LB	M2 BLOWER MOTOR DRIVER
4	C5 18LG	M1 BLOWER MOTOR DRIVER
5	C4 18TN	LOW BLOWER MOTOR DRIVER
6	E2 18OR	PANEL LAMPS DRIVER
	E2 20OR	PANEL LAMPS DRIVER
7	-	-



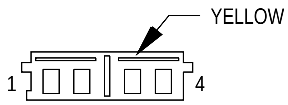
A/C PRESSURE TRANSDUCER

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K6 20VT/WT	5 VOLT SUPPLY
3	C18 20DB	A/C PRESSURE SIGNAL
4	-	-



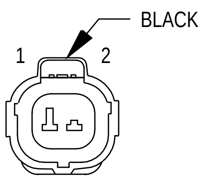
AIRBAG CONTROL MODULE - C1

CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	F23 18WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	D1 18VT	CCD BUS (+)
4	D2 18WT/BK	CCD BUS (-)
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	Z2 18BK/LG	GROUND
12	-	-
13	-	-



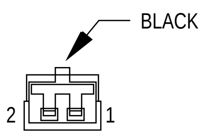
AIRBAG CONTROL MODULE - C2

CAV	CIRCUIT	FUNCTION
1	R44 18LG/YL	PASSENGER AIRBAG LINE 1
2	R42 18RD/WT	PASSENGER AIRBAG LINE 2
3	R45 18DG/LB	DRIVER AIRBAG LINE 1
4	R43 18BK/LB	DRIVER AIRBAG LINE 2



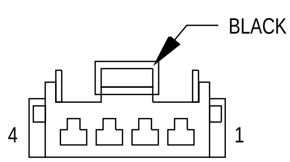
AMBIENT TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K25 18VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL



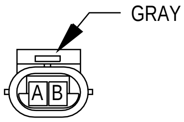
ASH RECEIVER LAMP

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	Z1 20BK	GROUND



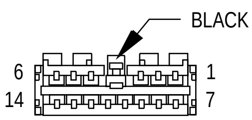
AUTOSTICK SWITCH

CAV	CIRCUIT	FUNCTION
1	T44 20YL/LB	AUTOSTICK DOWNSHIFT SWITCH SENSE
2	T5 20LG/LB	AUTOSTICK UPSHIFT SWITCH SENSE
3	Z13 20BK/RD	GROUND
4	F11 20RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)



BACK-UP LAMP SWITCH (MTX)

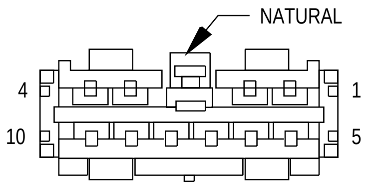
CAV	CIRCUIT	FUNCTION
A	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
B	L1 18VT/BK	BACK-UP LAMP FEED



BODY CONTROL MODULE - C1

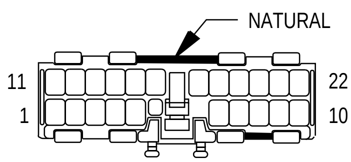
CAV	CIRCUIT	FUNCTION
1	-	-
2	V55 20TN/RD	WIPER PARK SWITCH SENSE
3	D1 18VT/BR ●■■	CCD BUS (+)
4	Z1 18BK	GROUND
5	D1 20VT/BR	CCD BUS (+)
6	D1 20VT/DG ■	CCD BUS (+)
7	V14 20PK/VT	INTERMITTENT WIPER RELAY CONTROL
8	V16 20VT/PK	WIPER HIGH/LOW RELAY CONTROL
9	D2 18WT/BK ●■■	CCD BUS (-)
10	V10 18BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT
11	-	-
12	Z2 20BK/LG	GROUND
13	D2 20WT/BK	CCD BUS (-)
14	D2 20WT/DG ■	CCD BUS (-)

● ABS
■ EATX
■■ EXCEPT BUILT-UP-EXPORT



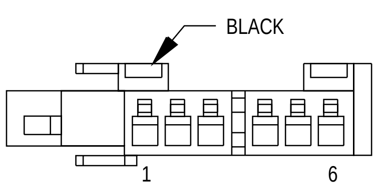
BODY CONTROL MODULE - C2

CAV	CIRCUIT	FUNCTION
1	G69 20BK/OR ●●	VTSS INDICATOR DRIVER
2	C35 20DG/YL	MODE DOOR DRIVER (+)
3	E2 18OR/YL	PANEL LAMPS DRIVER
4	E2 18OR/BR	PANEL LAMPS DRIVER
5	C26 20PK/DB	5 VOLT SUPPLY
6	C34 20DB/YL	MODE DOOR DRIVER (-)
7	-	-
8	Z2 18BK/LG	GROUND
9	E2 18OR	PANEL LAMPS DRIVER
10	E2 18OR/GY	PANEL LAMPS DRIVER



BODY CONTROL MODULE - C3

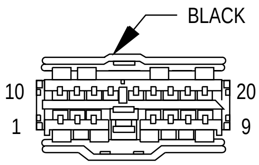
CAV	CIRCUIT	FUNCTION
1	D1 20VT/BR	CCD BUS (+)
2	D1 18VT	CCD BUS (+)
3	D1 20VT/GY	CCD BUS (+)
4	Z2 20BK/VT	GROUND
5	C58 22RD	MODE SWITCH SENSE
6	C37 20YL	MODE DOOR FEEDBACK SIGNAL
7	C12 20LG/BK	EVAPORATOR TEMPERATURE SENSOR SIGNAL
8	D2 20WT/DB ●	CCD BUS (-)
9	D1 20VT/BR ●	CCD BUS (+)
10	V52 22DG/YL	WINDSHIELD WIPER SWITCH MUX
11	D2 20WT/DB	CCD BUS (-)
12	D2 18WT/BK	CCD BUS (-)
13	D2 20WT/DG	CCD BUS (-)
14	Z2 18BK/LG	GROUND
15	V10 22BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT
16	C21 22DB/OR	A/C SWITCH SENSE
17	G26 22LB	KEY-IN IGNITION SWITCH SENSE
18	E19 20RD	PANEL LAMPS DIMMER SIGNAL
19	Z2 22BK/PK	GROUND
20	C57 22GY/TN	SENSOR GROUND
21	C57 22GY	SENSOR GROUND
22	Z2 18BK/TN	GROUND



BODY CONTROL MODULE - C4

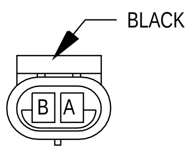
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	P158 20RD	RKE EXTERNAL ANTENNA
4	P58 20BK	RKE EXTERNAL ANTENNA
5	-	-
6	-	-

● SKIM
●● VTSS



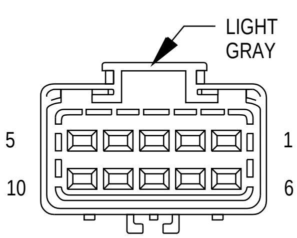
BODY CONTROL MODULE - C5

CAV	CIRCUIT	FUNCTION
1	P34 16PK/LB •	DOOR UNLOCK DRIVER
2	P34 16PK/DB •	DOOR UNLOCK DRIVER
3	P34 16PK/BK •	DOOR UNLOCK DRIVER
4	P55 16DB/WT •	DOOR UNLOCK DRIVER
5	G10 20LG/RD	SEAT BELT SWITCH SENSE
6	G74 20TN/RD	LEFT REAR DOOR AJAR SWITCH SENSE
7	G75 20TN	DOOR AJAR SWITCH SENSE
8	P97 22WT/DG •	LEFT FRONT DOOR SWITCH MUX
9	G71 20VT/YL ••	TRUNK KEY CYLINDER SENSE
10	P33 16OR/BK •	DOOR LOCK DRIVER
11	P33 16OR/WT •	DOOR LOCK DRIVER
12	P33 16OR/TN •	DOOR LOCK DRIVER
13	P33 16OR/BR •	DOOR LOCK DRIVER
14	-	-
15	G4 18DB	FUEL LEVEL SENSOR SIGNAL
16	G74 20TN/PK	RIGHT REAR DOOR AJAR SWITCH SENSE
17	G74 20TN/OR	DOOR AJAR SWITCH SENSE
18	P96 22WT/LG •	RIGHT FRONT DOOR SWITCH MUX
19	G73 18LG/OR ••	LEFT DOOR KEY CYLINDER SWITCH SENSE
20	G72 18DG/OR ••	RIGHT DOOR KEY CYLINDER SWITCH SENSE



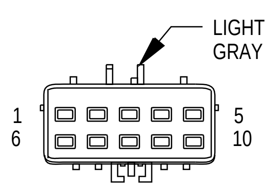
BRAKE WARNING PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
A	G9 20GY/DB	RED BRAKE WARNING INDICATOR DRIVER
B	Z1 20BK	GROUND



C104 (EATX)

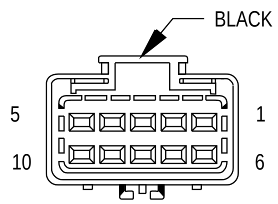
CAV	CIRCUIT
1	T9 20OR/BK
2	T54 18VT/YL
3	T41 20BK/WT
4	-
5	T16 16RD/BR
6	T19 20WT
7	T41 18BK/WT
8	T50 18DG/TN
9	T59 18PK/DB
10	T60 18BR/TN



C104 (EATX)

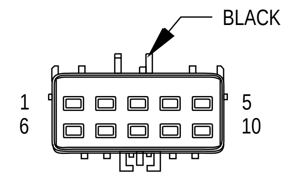
CAV	CIRCUIT
1	T9 18OR/BK
2	T54 18VT/WT
3	T41 18BK/WT
4	-
5	T16 16RD/BR
6	T19 18WT/PK
7	T41 18BK/LB
8	T50 18DG/TN
9	T59 18PK/DB
10	T60 18BR/TN

•POWER DOORS
••VTSS



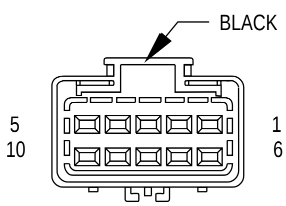
C105 (EATX)

CAV	CIRCUIT
1	F20 18WT/YL
2	T1 20LG/BK
3	T3 18VT
4	T13 20DB/BK
5	T14 20LG/WT
6	T20 20LB
7	T42 18VT/TN
8	T47 20YL/BK
9	T52 20RD/BK
10	L1 18VT/BK



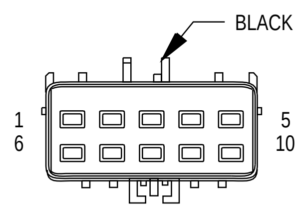
C105 (EATX)

CAV	CIRCUIT
1	F20 18WT/YL
2	T1 18LG/GY
3	T3 18VT
4	T13 18DB/BR
5	T14 18LG/VT
6	T20 18LB/WT
7	T42 18VT/TN
8	T47 18YL/GY
9	T52 18OR/YL
10	L1 18VT/BK



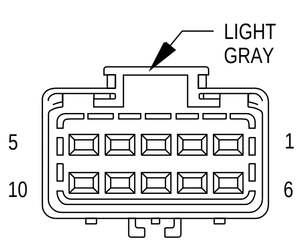
C111

CAV	CIRCUIT
1	Z1 18BK ▼▼
1	Z1 16BK ▼
2	K39 20GY/RD
3	K40 20BR/WT
4	K59 20VT/BK
5	K7 18OR/WT
6	A142 18DG/OR
7	K60 20YL/BK
8	G6 20GY
9	K6 20VT/WT
10	K4 18BK/LB



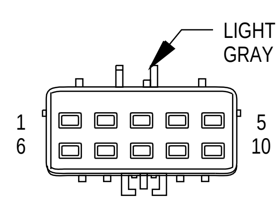
C111

CAV	CIRCUIT
1	Z1 18BK
2	K39 20GY/RD
3	K40 20BR/WT
4	K59 20VT/BK
5	K7 20OR
6	A142 18DG/OR
7	K60 20YL/BK
8	G6 18GY/VT ●
8	G6 18GY ■ ▲
9	K6 20VT/WT
10	K4 18BK/LB



C113

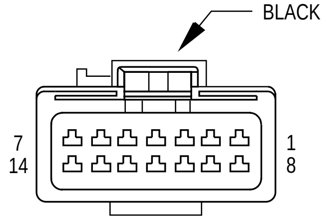
CAV	CIRCUIT
1	C3 14DB/BK
2	-
3	-
4	K24 18GY/BK ▼▼
5	T40 14BR
6	F12 18DB/WT
7	C18 20DB/YL
8	V32 20YL/PK
9	K22 20OR/LB ▼▼
10	Z12 18BK/TN



C113

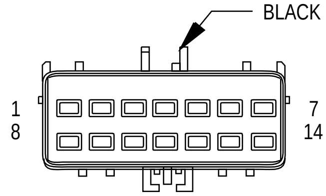
CAV	CIRCUIT
1	C3 14DB/BK
2	K90 20TN ●
3	-
4	K24 18GY/BK ▼▼
5	T40 14BR
6	F12 18DB/WT
7	C18 20DB
8	V32 20YL/RD
9	K22 20OR/DB
10	Z12 18BK/TN

● 2.0L
■ 2.4L
▲ 2.5L
▼ MTX
▼▼ EATX



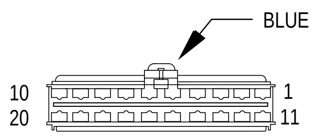
C121

CAV	CIRCUIT
1	A141 14DG/WT
2	L1 18VT/BK
3	L36 18LG/DG ▲▼
4	-
5	B1 18YL/DB ■
6	B2 18YL ■
7	B3 18LG/DB ■
8	B4 18LG ■
9	-
10	-
11	-
12	F18 18LG/BK ▼
	F18 18LG/BK
13	K106 18WT/DG ●●
14	K107 18OR/DG ●●



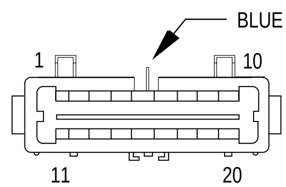
C121

CAV	CIRCUIT
1	A141 14DG/WT
2	L1 18VT/BK
3	L36 18LB ▲▼
4	G74 20TN/RD ▼
5	B1 20YL/DB ■
6	B2 20YL ■
7	B3 20LG/DB ■
8	B4 20LG ■
9	-
10	-
11	-
12	F18 18LG/BK ●●
13	K106 18WT/DG
14	K107 18OR/DG



C126

CAV	CIRCUIT
1	A2 12PK/BK
2	G6 20GY
3	V37 20RD/LG
4	D20 20LG
5	T5 20LG/LB ●◄
6	D21 20PK/LB
	D21 20PK/LB ▼▼
7	F18 18LG/BK
8	A41 16YL/OR
9	A15 16PK
10	L36 18LG/DG ▼▲
11	D6 20PK/DG ◄
12	L13 18BR/VT ▼
	L13 18BR/VT ▼
13	T44 20YL/LB ●
14	A51 20RD/LB
15	G19 18LG/OR ■
16	A1 16RD
17	-
18	-
19	P86 16PK/BK ▼■■
20	-

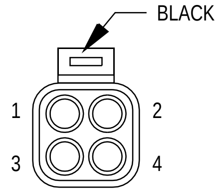


C126

CAV	CIRCUIT
1	A2 12PK/BK
2	G6 20GY
3	V37 20PK/LG
4	D20 20LG
5	T5 20LG/LB ●
6	D21 20PK/LB
7	F18 20LG/BK
	F18 20LG/BK ▼
8	A41 16YL
9	A15 18PK
10	L36 18LG ▲▼
	L36 18LG ▲▼
11	D6 20PK/DG
12	L13 18BR/VT ▼
13	T44 20YL/LB ●
14	A51 20RD/LB
15	G19 20LG/OR
16	A1 16RD
17	-
18	-
19	P86 16PK/BK ▼■■
20	-

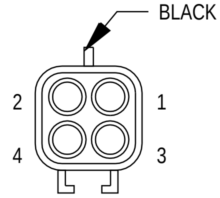
▲ REAR FOG LAMPS
▲▲ VTSS
■ ABS
■■ HEATED SEATS
▼ BUILT-UP-EXPORT
▼▼ EATX/NON ABS
◄ EATX
● AUTOSTICK
●● EXCEPT BUILT-UP-EXPORT

JAI08011 J998W-16



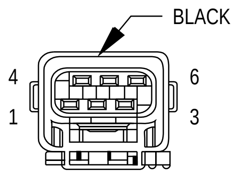
C165
(2.5L)

CAV	CIRCUIT
1	A142 18DG/OR
2	K11 18WT/DB
3	K13 18YL/WT
4	K38 18GY



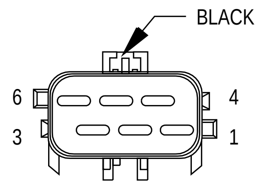
C165
(2.5L)

CAV	CIRCUIT
1	A142 18DG/OR
2	K11 18WT/DB
3	K13 18YL/WT
4	K38 18GY



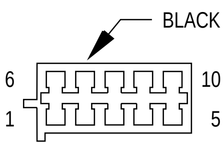
C169
(MTX)

CAV	CIRCUIT
1	K7 18OR/WT
2	K4 18BK/LB
3	G7 18WT/OR
4	F20 18WT/YL
5	L1 18VT/BK
6	-



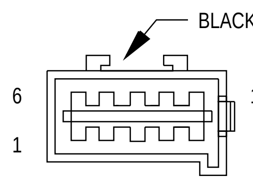
C169
(MTX)

CAV	CIRCUIT
1	K7 18OR
2	K4 18BK/LB
3	G7 18WT/OR
4	F20 18WT/YL
5	L1 18VT/BK
6	-



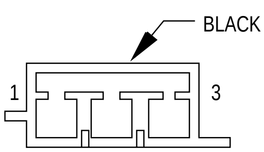
C224

CAV	CIRCUIT
1	X52 20DB/WT
2	X54 22VT
3	X56 22DB/RD
4	X58 20DB/OR
5	X51 20BR/YL
6	X53 22DG
7	X55 22BR/RD
8	X57 20DB/LB
9	X60 22DG/RD •
10	-



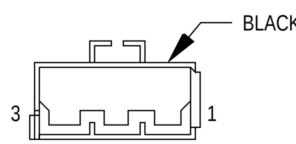
C224

CAV	CIRCUIT
1	X52 22DB/WT
2	X54 22VT X54 22VT
3	X56 22DB/RD X56 22DB/RD
4	X58 22DB/OR
5	X51 22BR/YL
6	X53 22DG X53 22DG
7	X55 22BR/RD X55 22BR/RD
8	X57 22DB/LB
9	X60 22DG/RD •
10	-



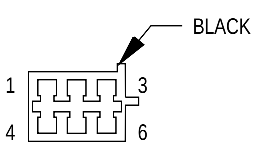
C225
(BUILT-UP-EXPORT)

CAV	CIRCUIT
1	P86 16PK/BK
2	F11 20RD/VT
3	Z1 16BK



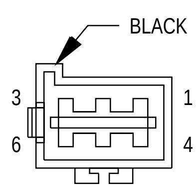
C225
(BUILT-UP-EXPORT)

CAV	CIRCUIT
1	P86 16PK/BK
2	F11 18RD/WT
3	Z1 16BK



C300

CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L61 18LG
4	L7 18BK/YL L7 18BK/YL
5	Z1 18BK
6	L36 18LB



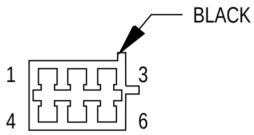
C300

CAV	CIRCUIT
1	L1 18VT/BK L1 18VT/BK
2	L50 16WT/TN L50 18WT/TN
3	L61 18LG
4	L7 18BK/YL L7 18BK/YL
5	Z1 18BK Z1 18BK
6	L36 18LB

• BUILT-UP-EXPORT

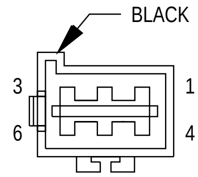
J998W-16

JAI08012



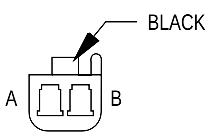
C301

CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L60 18TN
4	L7 18BK/YL
5	Z1 18BK
6	-



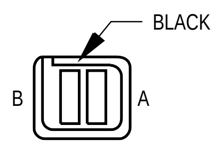
C301

CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L60 18TN
4	L7 18BK/YL
5	Z1 18BK
6	-



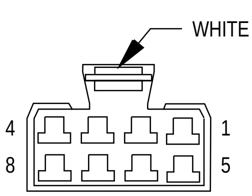
C305

CAV	CIRCUIT
A	L50 16WT/TN
B	Z1 18BK



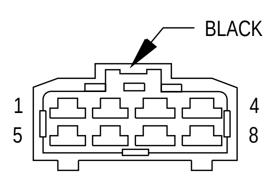
C305

CAV	CIRCUIT
A	L50 18BK/TN
B	Z1 18BK



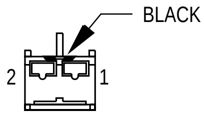
C308

CAV	CIRCUIT
1	P33 16OR/BR
2	P34 16PK/BK
3	Q1 14YL/TN
4	Q17 14DB/WT
5	Q27 14RD/BK
6	-
7	-
8	-



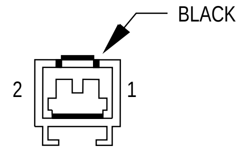
C308

CAV	CIRCUIT
1	P33 16OR/BK
2	P34 16PK/BK
3	Q1 14YL
4	Q18 14GY/BK
5	Q28 14DG/WT
6	-
7	-
8	-



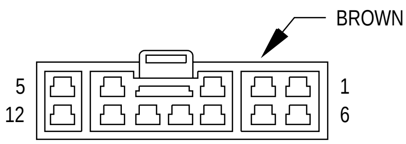
C309
(POWER SEAT)

CAV	CIRCUIT
1	Z1 16BK
2	F35 16RD



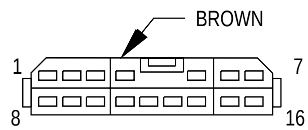
C309
(POWER SEAT)

CAV	CIRCUIT
1	F35 16RD
2	Z1 16BK



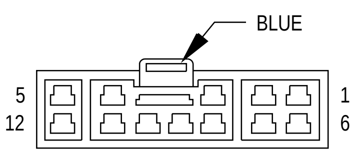
C310

CAV	CIRCUIT
1	-
2	M1 20PK
3	P97 22WT/DG
4	P91 22WT/BK
5	P92 22YL
6	-
7	Q16 14BR/WT
8	Q18 14GY/BK
9	P90 22LG/BK
10	P33 16OR/BK
11	P55 16DB/WT
12	P94 22WT/YL
13	-
14	-
15	-
16	-



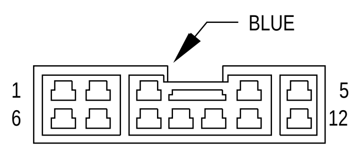
C310

CAV	CIRCUIT
1	-
2	M1 20PK
3	P97 22WT/DG
4	P91 22WT/BK
5	P92 22YL
6	-
7	Q16 14BR/WT
8	Q18 14GY/BK
9	P90 22LG/BK
10	P33 16OR/BK
11	P55 16DB/WT
12	P94 22WT/YL
13	-
14	-
15	-
16	-



C311

CAV	CIRCUIT
1	Q1 14YL
2	Q27 14RD/BK
3	Q17 14DB/WT
4	F21 14TN
5	Q26 14VT/WT
6	Z1 16BK
7	Q28 14DG/WT
8	X55 22BR/RD ▲
8	X85 22LG/DG ▲▲
9	X53 22DG ▲
9	X87 22LG/VT ▲▲
10	G73 18LG/OR ●
11	F20 20WT
12	C16 20LB/OR

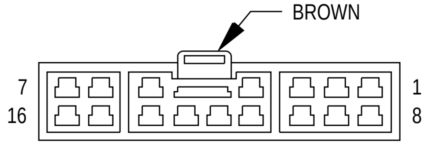


C311

CAV	CIRCUIT
1	Q1 14YL
2	Q27 14RD/BK
3	Q17 14DB/WT
4	F21 14TN
5	Q26 14VT/WT
6	Z1 16BK
7	Q28 14DG/WT
8	X55 22LG/VT ▲
8	X85 22LG/DG ▲▲
9	X53 22LG ▲
9	X87 22LG/VT ▲▲
10	G73 18LG/OR ●
11	F20 20WT
12	C16 20LB/OR

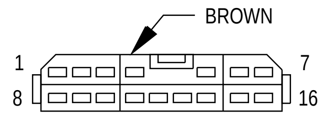
▲ STANDARD RADIO
▲▲ PREMIUM RADIO
● VTSS

J998W-16 JAI08014



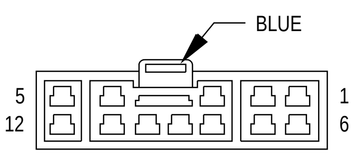
C315

CAV	CIRCUIT
1	-
2	M1 20PK
3	P96 22WT/LG
4	P90 22LG/BK
5	P92 22YL
6	-
7	-
8	-
9	P91 22WT/BK
10	C16 20LB/YL
11	P94 22WT/YL
12	-
13	-
14	-
15	-
16	-



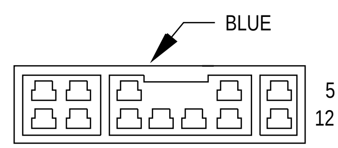
C315

CAV	CIRCUIT
1	-
2	M1 20PK
3	P96 22WT/LG
4	P90 22LG/BK
5	P92 22YL
6	-
7	-
8	-
9	P91 22WT/BK
10	C16 20LB/YL
11	P94 22WT/YL
12	-
13	-
14	-
15	-
16	-



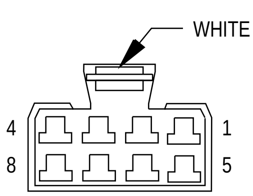
C316

CAV	CIRCUIT
1	P33 16OR/WT
2	P34 16PK/LB
3	Q1 14YL/VT
4	Q16 14BR/WT
5	Q26 14VT/WT
6	Z1 18BK
7	G72 18DG/OR ●
8	X56 22DB/RD ▲
8	X80 22LB/DG ▲▲
9	X54 22VT ▲
9	X82 22LB/VT ▲▲
10	-
11	F20 20WT
12	-



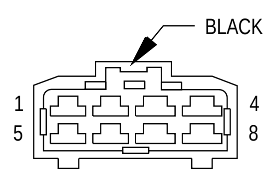
C316

CAV	CIRCUIT
1	P33 16OR/BK
2	P34 16PK/LB
3	Q1 14YL/VT
4	Q16 14BR/WT
5	Q26 14VT/WT
6	Z1 18BK
7	G72 18DG/OR ●
8	X56 22LG ▲
8	X80 22LG ▲▲
9	X54 22LG/VT ▲
9	X82 22LG/VT ▲▲
10	-
11	F20 20WT
12	-



C318

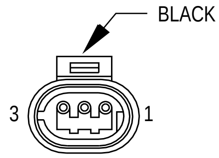
CAV	CIRCUIT
1	P33 16OR/TN
2	P34 16PK/DB
3	Q1 14YL/WT
4	Q18 14GY/BK
5	Q28 14DG/WT
6	-
7	-
8	-



C318

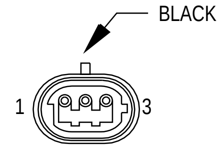
CAV	CIRCUIT
1	P33 16OR/BK
2	P34 16PK/BK
3	Q1 14YL
4	Q18 14GY/BK
5	Q28 14DG/WT
6	-
7	-
8	-

▲ STANDARD RADIO
● VTSS ▲▲ PREMIUM RADIO



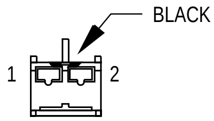
C320

CAV	CIRCUIT
1	L7 18BK/YL
2	Z1 18BK
3	L36 18LG



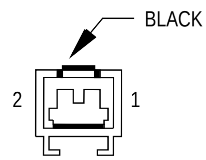
C320

CAV	CIRCUIT
1	L7 18BK/YL
2	Z1 18BK
3	L36 18LB



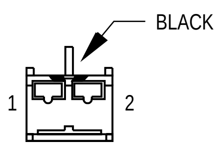
C343
(BUILT-UP-EXPORT)

CAV	CIRCUIT
1	L61 18LG/TN
2	Z1 18BK



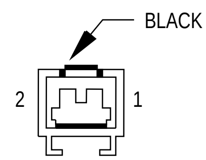
C343
(BUILT-UP-EXPORT)

CAV	CIRCUIT
1	L61 18LG
2	Z1 18BK
	Z1 18BK



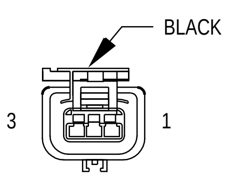
C344
(BUILT-UP-EXPORT)

CAV	CIRCUIT
1	L60 18LG/TN
2	Z1 18BK



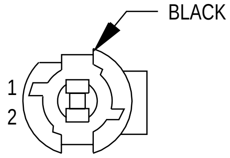
C344
(BUILT-UP-EXPORT)

CAV	CIRCUIT
1	L60 18TN
2	Z1 18BK
	Z1 18BK



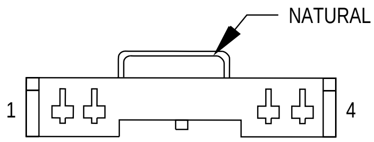
CAMSHAFT
POSITION
SENSOR
(2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8 VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K44 20TN/YL	CAMSHAFT POSITION SENSOR SIGNAL



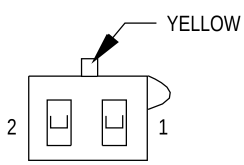
CENTER HIGH MOUNTED STOP LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L50 18BK/TN	BRAKE LAMP SWITCH OUTPUT



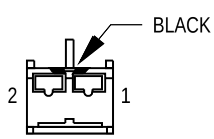
CLOCKSPRING NO. 1

CAV	CIRCUIT	FUNCTION
1	X3 18BK/RD	HORN RELAY CONTROL
2	V37 20PK/LG	SPEED CONTROL SWITCH SIGNAL
3	Z2 18BK/TN	GROUND
4	-	-



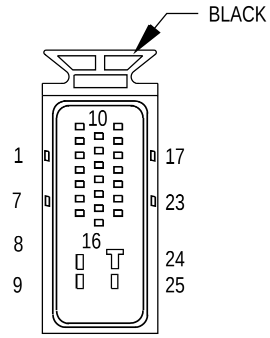
CLOCKSPRING NO. 2

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER AIRBAG LINE 1
2	R43 18BK/LB	DRIVER AIRBAG LINE 2



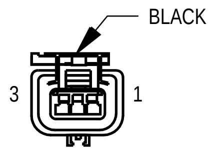
CLUTCH PEDAL POSITION SWITCH (MTX)

CAV	CIRCUIT	FUNCTION
1	T141 16YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
2	A41 16YL/OR	FUSED IGNITION SWITCH OUTPUT (START)



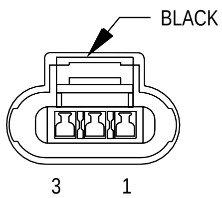
CONTROLLER
ANTI-LOCK
BRAKE

CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
3	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
4	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
5	-	-
6	-	-
7	-	-
8	Z1 12BK	GROUND
9	A20 12RD/DB	FUSED B(+)
10	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
11	B8 18OR/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
12	L50 18WT/BR	BRAKE LAMP SWITCH OUTPUT
13	-	-
14	-	-
15	-	-
16	G19 18LG/OR	ABS WARNING INDICATOR DRIVER
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	D2 18WT/BK	CCD BUS (-)
20	D1 18VT/BR	CCD BUS (+)
21	-	-
22	-	-
23	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
24	Z1 12BK	GROUND
25	A10 12RD/DG	FUSED B(+)



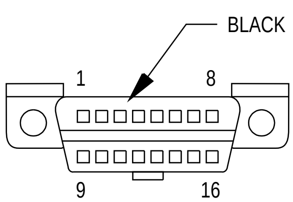
CRANKSHAFT POSITION SENSOR (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8 VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K24 20GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL



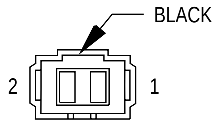
CRANKSHAFT POSITION SENSOR (2.5L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8 VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K24 20GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL



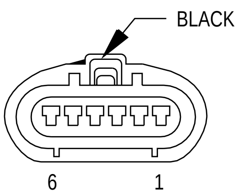
DATA LINK CONNECTOR

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	D1 20VT/GY	CCD BUS (+)
4	Z1 20BK	GROUND
5	Z2 20BK/VT	GROUND
6	D20 20LG	SCI RECEIVE
7	D21 20PK/LB	SCI TRANSMIT
8	-	-
9	-	-
10	-	-
11	D2 20WT/DG	CCD BUS (-)
14	D6 20PK/DG	SCI RECEIVE
15	-	-
16	M1 22PK	FUSED B(+)



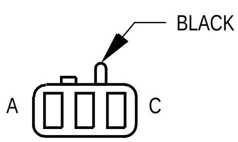
DISTRIBUTOR - C1
(2.5L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUTDOWN RELAY OUTPUT
2	-	-



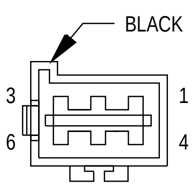
DISTRIBUTOR - C2
(2.5L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K7 20OR	8 VOLT SUPPLY
3	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
4	-	-
5	Z1 16BK	GROUND
6	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER



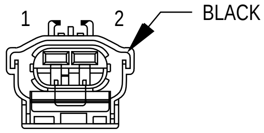
DOME LAMP

CAV	CIRCUIT	FUNCTION
A	Z1 20BK	GROUND
B	M1 20PK	FUSED B(+)
C	M2 20YL	COURTESY LAMPS DRIVER



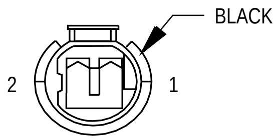
DRIVER HEATED
SEAT MODULE
(BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	P86 16PK/BK	FUSED B(+)
2	Z1 16BK	GROUND
3	-	-
4	P7 16LB/BK	DRIVER HEATED SEAT SWITCH
5	-	-
6	F11 18RD/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)



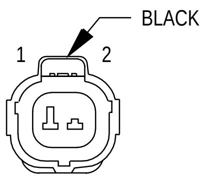
DUTY CYCLE EVAP/PURGE SOLENOID

CAV	CIRCUIT	FUNCTION
1	K52 20PK/GY	EVAPORATIVE EMISSION SOLENOID CONTROL
2	K108 18WT/TN	EVAPORATIVE SOLENOID SENSE



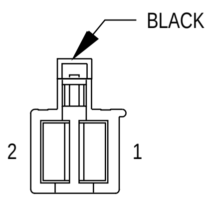
ELECTRONIC EGR TRANSDUCER SOLENOID

CAV	CIRCUIT	FUNCTION
1	K35 18GY/YL	EGR SOLENOID CONTROL
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



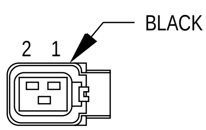
ENGINE COOLANT TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



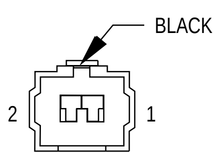
FRONT VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
1	P19 16YL/LG	LEFT POWER SEAT FRONT UP
2	P21 16RD/LG	LEFT POWER SEAT FRONT DOWN



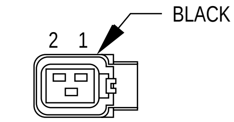
FUEL INJECTOR NO. 1 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	INJECTOR NO. 1 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



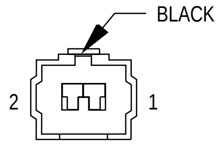
FUEL INJECTOR NO. 1 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	INJECTOR NO. 1 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



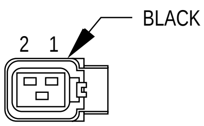
FUEL INJECTOR NO. 2 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K12 18TN	INJECTOR NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



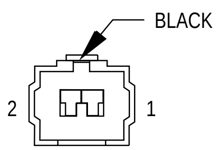
FUEL INJECTOR NO. 2 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K12 18TN	INJECTOR NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



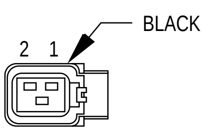
FUEL INJECTOR NO. 3 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	INJECTOR NO. 3 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



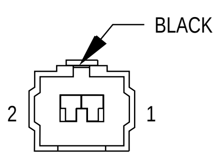
FUEL INJECTOR NO. 3 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	INJECTOR NO. 3 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



FUEL INJECTOR NO. 4 (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	INJECTOR NO. 4 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



FUEL INJECTOR NO. 4 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	INJECTOR NO. 4 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT

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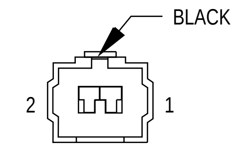
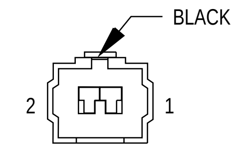


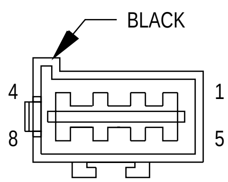
FUEL INJECTOR NO. 5 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K38 18GY	INJECTOR NO. 5 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



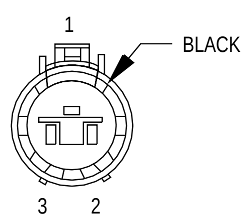
FUEL INJECTOR NO. 6 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K58 18BR/DB	INJECTOR NO. 6 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



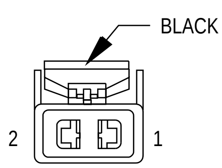
FUEL PUMP MODULE

CAV	CIRCUIT	FUNCTION
1	A141 14DG/WT	FUEL PUMP RELAY OUTPUT
2	G4 18DB	FUEL LEVEL SENSOR SIGNAL
3	Z1 14BK	GROUND
4	Z2 14BK	GROUND
5	F18 18LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
7	K107 18OR/DG	LEAK DETECTION PUMP SWITCH SENSE
8	-	-



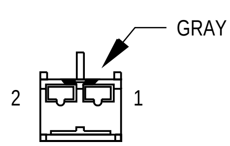
GENERATOR (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K20 18DG	GENERATOR FIELD DRIVER
3	-	-



GENERATOR (2.5L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K20 18DG	GENERATOR FIELD DRIVER



GLOVE BOX LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M1 20PK/WT	FUSED B(+)

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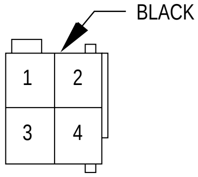
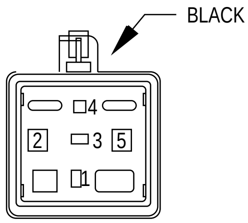


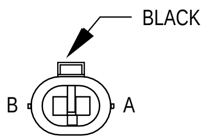
HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND
3	L13 18BR/VT	HEADLAMP ADJUST SIGNAL



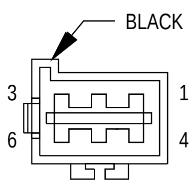
HEADLAMP WASHER MODULE (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	V53 14YL/RD	WASHER RELAY OUTPUT
2	Z1 18BK	GROUND
3	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
4	A53 14RD/YL	FUSED B(+)
5	V10 18BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT



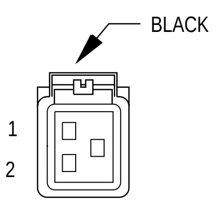
HEADLAMP WASHER PUMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	Z1 14BK	GROUND
B	V53 14YL/RD	WASHER RELAY OUTPUT



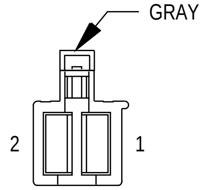
HEATED SEAT SWITCH (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	P7 16LB/BK	DRIVER HEATED SEAT SWITCH
2	F11 18RD/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
3	P8 16LB/WT	PASSENGER HEATED SEAT SWITCH
4	F11 18RD/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
5	F11 18RD/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
6	Z1 16BK	GROUND



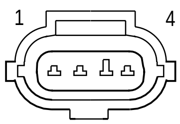
HIGH NOTE HORN

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/PK	HORN RELAY OUTPUT



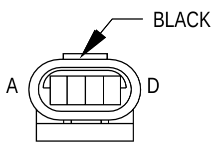
HORIZONTAL MOTOR

CAV	CIRCUIT	FUNCTION
1	P15 16YL/LB	LEFT POWER SEAT HORIZONTAL REARWARD
2	P17 16RD/LB	LEFT POWER SEAT HORIZONTAL FORWARD



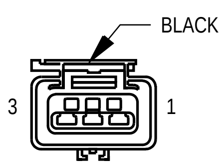
IDLE AIR CONTROL MOTOR (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K39 20GY/RD	IDLE AIR CONTROL NO. 1 DRIVER
2	K60 20YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
3	K40 20BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
4	K59 20VT/BK	IDLE AIR CONTROL NO. 4 DRIVER



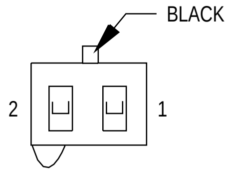
IDLE AIR CONTROL MOTOR (2.5L)

CAV	CIRCUIT	FUNCTION
A	K59 20VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
B	K40 20BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
C	K60 20YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
D	K39 20GY/RD	IDLE AIR CONTROL NO. 1 DRIVER



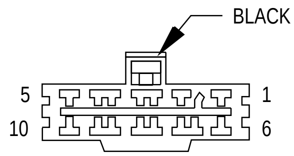
IGNITION COIL PACK (2.0L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER



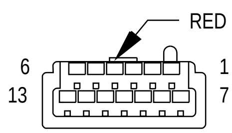
IGNITION SWITCH - C1

CAV	CIRCUIT	FUNCTION
1	A51 20RD/LB	FUSED B(+)
2	A81 20DG/RD	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)



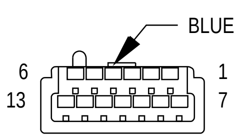
IGNITION SWITCH - C2

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
3	A2 12PK/BK	FUSED B(+)
4	A22 12BK/OR	FUSED IGNITION SWITCH OUTPUT (RUN)
5	-	-
6	-	-
7	A1 16RD	FUSED B(+)
8	A31 16BK/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	A21 16DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
10	A41 16YL	FUSED IGNITION SWITCH OUTPUT (START)



INSTRUMENT CLUSTER - C1

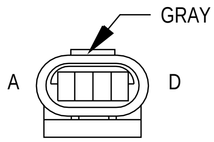
CAV	CIRCUIT	FUNCTION
1	L60 18TN/BR	RIGHT TURN SIGNAL
2	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
	F11 20RD/VT ■■	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
3	-	-
4	Z2 18BK/LG	GROUND
5	F33 20PK/RD	FUSED B(+)
6	-	-
7	G69 20BK/OR ■	VTSS INDICATOR INDICATOR DRIVER
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-



INSTRUMENT CLUSTER - C2

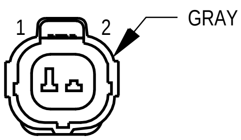
CAV	CIRCUIT	FUNCTION
1	L39 18LB/OR ●●▲	FOG LAMP SWITCH OUTPUT
1	L36 18LG ●▲▲	REAR FOG LAMP
2	L61 18LG/TN	LEFT TURN SIGNAL
3	-	-
4	-	-
5	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
7	D2 20WT/DB	CCD BUS (-)
8	D1 20VT/BR	CCD BUS (+)
9	-	-
10	E2 18OR/YL	PANEL LAMPS DRIVER
11	Z1 18BK/OR	GROUND
12	G6 20GY	ENGINE OIL PRESSURE SWITCH SENSE
13	G19 20LG/OR	ABS WARNING INDICATOR DRIVER

▲ FOG LAMPS
▲▲ REAR FOG LAMPS
■ VTSS
■■ AUTOSTICK
● BUILT-UP-EXPORT
●● EXCEPT BUILT-UP-EXPORT



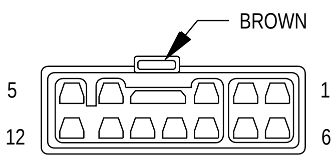
INTAKE AIR TEMPERATURE/MANIFOLD ABSOLUTE PRESSURE SENSOR (2.0L)

CAV	CIRCUIT	FUNCTION
A	K4 18BK/LB	SENSOR GROUND
B	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL
C	K6 20VT/WT	5 VOLT SUPPLY
D	K1 18DG/RD	MAP SENSOR SIGNAL



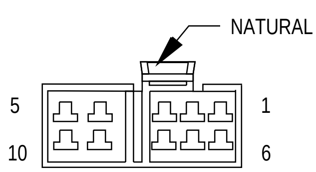
INTAKE AIR TEMPERATURE SENSOR (2.4L/2.5L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL



JUNCTION BLOCK - C1

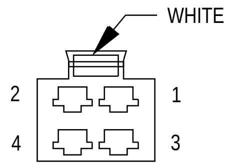
CAV	CIRCUIT	FUNCTION
1	G9 20GY/DB	RED BRAKE WARNING INDICATOR DRIVER
2	-	-
3	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
4	L60 18TN/BR	RIGHT TURN SIGNAL
5	L61 18LG/TN	LEFT TURN SIGNAL
6	L33 18LG/BR	FUSED LEFT HIGH BEAM OUTPUT
7	-	-
8	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
	L7 18BK/YL ▲▲	HEADLAMP SWITCH OUTPUT
9	L7 18BK/BR	HEADLAMP SWITCH OUTPUT
	L7 18BK/BR ▲▲	HEADLAMP SWITCH OUTPUT
10	L39 18LB/OR ●	FOG LAMP SWITCH OUTPUT
11	L39 18LB ●	FOG LAMP SWITCH OUTPUT
12	L43 18VT/OR	FUSED LEFT LOW BEAM OUTPUT



JUNCTION BLOCK - C2

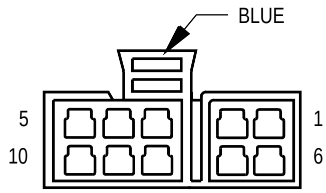
CAV	CIRCUIT	FUNCTION
1	L50 18WT/BR ●●	BRAKE LAMP SWITCH OUTPUT
2	A7 16RD/BK	FUSED B(+)
3	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
4	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
5	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
6	F11 18RD/VT ▲	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
7	A21 16DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	X2 18DG/PK	HORN RELAY OUTPUT
	X2 18DG/PK	HORN RELAY OUTPUT
9	-	-
10	F13 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)

▲ EATX
▲▲ BUILT-UP-EXPORT
● FOG LAMPS
●● ABS



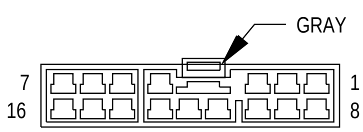
JUNCTION BLOCK - C3

CAV	CIRCUIT	FUNCTION
1	A7 16RD/BK	FUSED B(+)
2	A13 12PK/WT	FUSED B(+)
3	A3 12RD/WT	FUSED B(+)
4	A4 12BK/PK	FUSED B(+)



JUNCTION BLOCK - C4

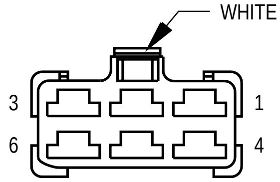
CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 18BK/OR	GROUND
3	Z1 18BK/TN	GROUND
4	F23 18WT	FUSED IGNITION SWITCH OUTPUT (RUN)
5	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
6	Z1 20BK	GROUND
7	Z1 20BK/WT	GROUND
8	Z13 20BK/RD ▲	GROUND
9	Z1 18BK/LB ▲▲	GROUND
10	Z1 18BK/YL	GROUND



JUNCTION BLOCK - C5

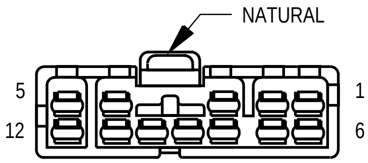
CAV	CIRCUIT	FUNCTION
1	F30 18RD	FUSED B(+)
2	F30 18RD/PK ▲▲	FUSED B(+)
3	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
4	L7 18BK/DG	HEADLAMP SWITCH OUTPUT
5	L39 18LB/OR ●	FOG LAMP SWITCH OUTPUT
6	G9 18GY	RED BRAKE WARNING INDICATOR DRIVER
7	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
8	X3 18BK/RD	HORN RELAY CONTROL
9	A21 16DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
10	L39 18LB ●	FOG LAMP SWITCH OUTPUT
11	M1 18PK/TN	FUSED B(+)
12	M1 20PK/WT	FUSED B(+)
13	M1 22PK	FUSED B(+)
14	A31 16BK/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
15	Z1 20BK	GROUND
16	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)

▲ AUTOSTICK
▲▲ PREMIUM
● FOG LAMPS



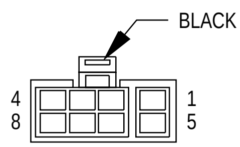
JUNCTION BLOCK - C6

CAV	CIRCUIT	FUNCTION
1	A22 12BK/OR	FUSED IGNITION SWITCH OUTPUT (RUN)
2	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
3	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
4	A3 14RD/WT	FUSED B(+)
5	-	-
6	C1 12DG	BLOWER MOTOR FEED



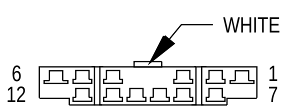
JUNCTION BLOCK - C7

CAV	CIRCUIT	FUNCTION
1	F13 22DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	A81 20DG/RD	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
3	L60 18TN/BR	RIGHT TURN SIGNAL
4	L44 18VT/RD ●	FUSED RIGHT LOW BEAM OUTPUT
5	C16 22LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
6	X12 16RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	L61 18LG	LEFT TURN SIGNAL
8	L60 18TN	RIGHT TURN SIGNAL
9	L61 18LG/TN	LEFT TURN SIGNAL
10	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
	F11 20RD/VT ▲▲▼	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
11	F33 20PK/RD	FUSED B(+)
12	F33 18BK/RD	FUSED B(+)



JUNCTION BLOCK - C8

CAV	CIRCUIT	FUNCTION
1	Q1 14YL	POWER WINDOW SWITCH FEED
2	M1 20PK	FUSED B(+)
3	C16 20LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	C16 20LB/OR	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
6	Q1 14YL/VT	POWER WINDOW SWITCH FEED
7	Q1 14YL/WT	POWER WINDOW SWITCH FEED
8	Q1 14YL/TN	POWER WINDOW SWITCH FEED



JUNCTION BLOCK - C9

CAV	CIRCUIT	FUNCTION
1	F35 16RD ●●	FUSED B(+)
2	F20 20WT ■	FUSED IGNITION SWITCH OUTPUT (RUN)
	F20 20WT ■	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z1 14BK	GROUND
4	L60 18TN	RIGHT TURN SIGNAL
	L60 18TN ▼	RIGHT TURN SIGNAL
5	L61 18LG	LEFT TURN SIGNAL
	L61 18LG ▼	LEFT TURN SIGNAL
6	C15 12BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
7	M1 20PK ■	FUSED B(+)
8	Z1 20BK	GROUND
9	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
10	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
11	M1 20PK/VT ▼	FUSED B(+)
12	M1 20PK/OR	FUSED B(+)

▼ BUILT-UP-EXPORT
▲▲ HEATED SEATS
● EXCEPT BUILT-UP-EXPORT
●● POWER SEATS
■ POWER DOORS

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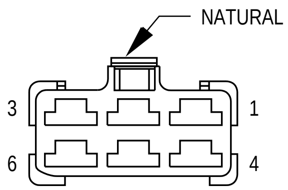
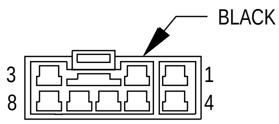


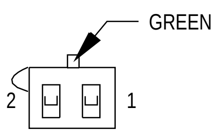
JUNCTION BLOCK - C10

CAV	CIRCUIT	FUNCTION
1	M2 20YL	COURTESY LAMPS DRIVER
2	-	-
3	F21 18TN	FUSED IGNITION SWITCH OUTPUT (RUN)
4	Z1 20BK	GROUND
4	Z1 18BK •	GROUND
5	-	-
6	M1 20PK	FUSED B (+)



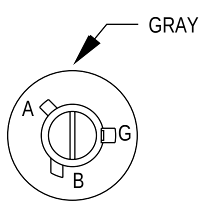
JUNCTION BLOCK - C11

CAV	CIRCUIT	FUNCTION
1	-	-
2	L92 18LG ••	FUSED B(+)
3	-	-
4	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	Z1 18BK ••	GROUND



KEY-IN SWITCH

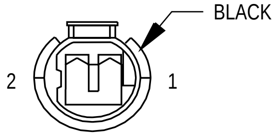
CAV	CIRCUIT	FUNCTION
1	Z1 20BK/WT	GROUND
2	G26 22LB	KEY-IN IGNITION SWITCH SENSE



LEFT BACK-UP LAMP

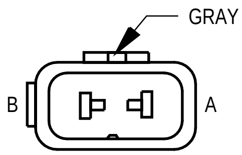
CAV	CIRCUIT	FUNCTION
A	L1 18VT/BK	BACK-UP LAMP FEED
B	-	-
G	Z1 18BK	GROUND

• PREMIUM
•• BUILT-UP-EXPORT



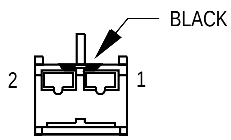
LEFT CYLINDER LOCK SWITCH (VTSS)

CAV	CIRCUIT	FUNCTION
1	G73 18 LG/OR	LEFT DOOR KEY CYLINDER SWITCH SENSE
2	M1 20PK	FUSED B(+)



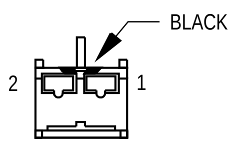
LEFT FOG LAMP

CAV	CIRCUIT	FUNCTION
A	L39 18LB/OR	FOG LAMP SWITCH OUTPUT
B	Z1 18BK	GROUND



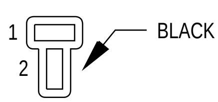
LEFT FRONT DOOR SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X87 22LG/VT	AMPLIFIED LEFT FRONT SPEAKER (+)
2	X85 22LG/DG	AMPLIFIED LEFT FRONT SPEAKER (-)



LEFT FRONT DOOR SPEAKER (STANDARD)

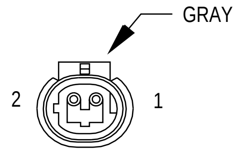
CAV	CIRCUIT	FUNCTION
1	X55 22LG/VT	LEFT FRONT SPEAKER (-)
2	X53 22LG	LEFT FRONT SPEAKER (+)



LEFT FRONT INSTRUMENT PANEL SPEAKER

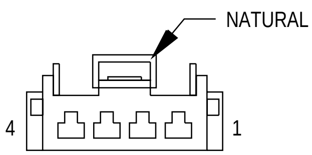
CAV	CIRCUIT	FUNCTION
1	X53 22DG*	LEFT FRONT SPEAKER (+)
1	X81 20YL/BK**	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (-)
2	X55 22BR/RD*	LEFT FRONT SPEAKER (-)
2	X83 20YL/RD**	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (+)

* STANDARD
** PREMIUM



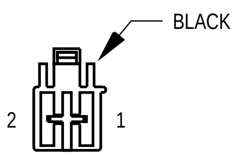
LEFT FRONT POWER DOOR LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P55 16DB/WT	LEFT FRONT DOOR UNLOCK DRIVER
2	P33 16OR/BK	DOOR LOCK DRIVER



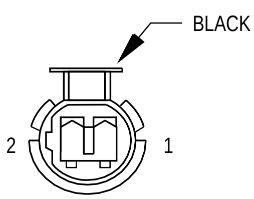
LEFT FRONT POWER DOOR LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z1 20BK	GROUND
4	P97 22WT/DG	LEFT FRONT DOOR SWITCH MUX



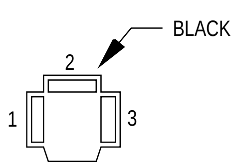
LEFT FRONT POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q11 16LB	LEFT FRONT WINDOW DRIVER (UP)
2	Q21 16WT	LEFT FRONT WINDOW DRIVER (DOWN)



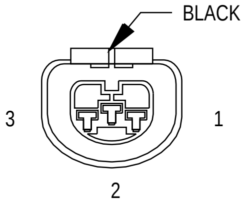
LEFT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B8 18OR/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)



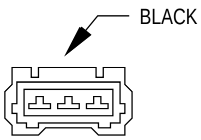
LEFT HEADLAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L33 18LG/BR	FUSED LEFT HIGH BEAM OUTPUT
2	L43 18VT/OR	FUSED LEFT LOW BEAM OUTPUT
3	Z1 18BK	GROUND



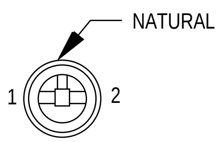
LEFT HEADLAMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L43 18VT/OR	FUSED LEFT LOW BEAM OUTPUT
2	Z1 18BK	GROUND
3	L33 18LG/BR	FUSED LEFT HIGH BEAM OUTPUT



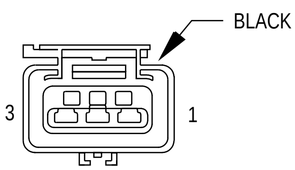
LEFT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 18BK/BR	HEADLAMP SWITCH OUTPUT
2	L13 18BR/VT	HEADLAMP ADJUST SIGNAL
3	Z3 18BK	GROUND



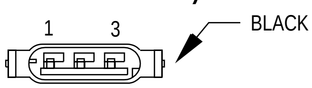
LEFT LICENSE LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND

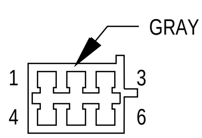


LEFT PARK/ TURN SIGNAL LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L61 18LG/TN	LEFT TURN SIGNAL
2	L7 18BK/BR	HEADLAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



LEFT PARK/ TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)



LEFT POWER MIRROR

CAV	CIRCUIT	FUNCTION
1	C16 20LB/OR •	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
2	Z1 18BK •	GROUND
	Z1 18BK •	GROUND
3	P95 22DB/WT	LEFT POWER MIRROR HORIZONTAL
4	P91 22WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY
	P91 22WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY
5	P90 22LG/BK	POWER MIRROR FEED
	P90 22LG/BK	POWER MIRROR FEED
6	P93 22YL/BK	LEFT POWER MIRROR VERTICAL

• HEATED MIRRORS

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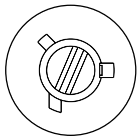
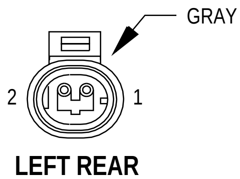


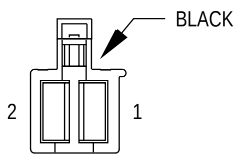
LEFT REAR
FOG LAMP
(BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	L36 18LG	REAR FOG LAMP
G	Z1 18BK	GROUND



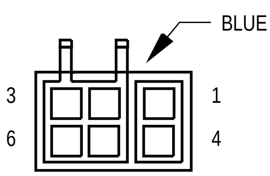
LEFT REAR
POWER DOOR
LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P34 16PK/BK	DOOR UNLOCK DRIVER
2	P33 16OR/BK	DOOR LOCK DRIVER



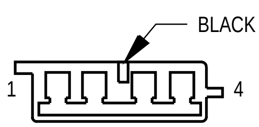
LEFT REAR
POWER WINDOW
MOTOR

CAV	CIRCUIT	FUNCTION
1	Q14 14GY	POWER WINDOW RIGHT REAR B(+) UP
2	Q24 14DG	POWER WINDOW RIGHT REAR B(+) DOWN



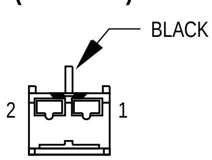
LEFT REAR
POWER WINDOW
SWITCH

CAV	CIRCUIT	FUNCTION
1	Q24 14DG	POWER WINDOW RIGHT REAR B(+) DOWN
2	Q18 14GY/BK	LEFT REAR WINDOW DRIVER (UP)
3	-	-
4	Q28 14DG/WT	LEFT REAR WINDOW DRIVER (DOWN)
5	Q14 14GY	POWER WINDOW RIGHT REAR B(+) UP
6	Q1 14YL	POWER WINDOW SWITCH FEED



LEFT REAR
SPEAKER
(PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X95 20WT/RD	AMPLIFIED HIGH LEFT REAR SPEAKER (+)
2	X91 20WT/DG	AMPLIFIED LOW LEFT REAR SPEAKER (-)
3	X93 20WT/VT	AMPLIFIED LOW LEFT REAR SPEAKER (+)
4	X97 20WT/BK	AMPLIFIED HIGH LEFT REAR SPEAKER (-)



LEFT REAR
SPEAKER
(STANDARD)

CAV	CIRCUIT	FUNCTION
1	X57 20DB/LB	LEFT REAR SPEAKER (-)
2	X51 20BR/YL	LEFT REAR SPEAKER (+)

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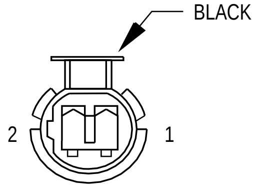
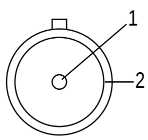


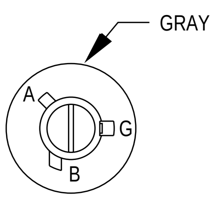
LEFT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B3 20LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 20LG	LEFT REAR WHEEL SPEED SENSOR (+)



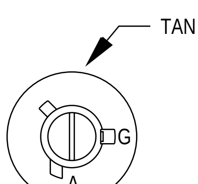
LEFT SIDE REPEATER (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L61 18LG/TN	LEFT TURN SIGNAL
2	Z1 18BK	GROUND



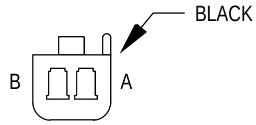
LEFT TAIL/STOP LAMP

CAV	CIRCUIT	FUNCTION
A	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
B	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
G	Z1 18BK	GROUND



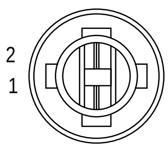
LEFT TURN LAMP

CAV	CIRCUIT	FUNCTION
A	L61 18LG	LEFT TURN SIGNAL
G	Z1 18BK	GROUND



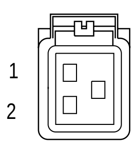
LEFT VISOR/ VANITY LAMPS

CAV	CIRCUIT	FUNCTION
A	M1 20PK	FUSED B(+)
B	Z1 20BK	GROUND



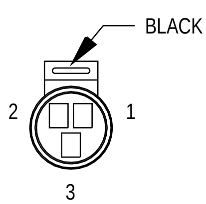
LICENSE LAMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



LOW NOTE HORN

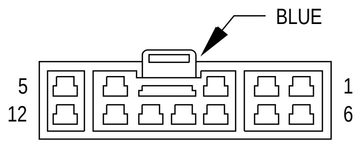
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/PK	HORN RELAY OUTPUT



MANIFOLD ABSOLUTE PRESSURE SENSOR (2.4L/2.5L)

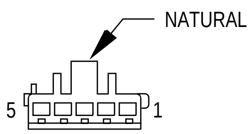
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K6 20VT/WT*	5 VOLT SUPPLY
2	K6 18VT/WT**	5 VOLT SUPPLY
3	K1 18DG/RD	MAP SENSOR SIGNAL

* 2.4L
** 2.5L



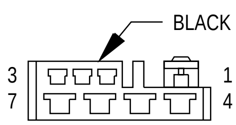
MASTER POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
2	Q17 14DB/WT	LEFT REAR WINDOW DRIVER (UP)
3	Q27 14RD/BK	LEFT REAR WINDOW DRIVER (DOWN)
4	Q18 14GY/BK	RIGHT REAR WINDOW DRIVER (UP)
5	Q1 14YL	POWER WINDOW SWITCH FEED
6	-	-
7	Q11 16LB	LEFT FRONT WINDOW DRIVER (UP)
8	Q21 16WT	LEFT FRONT WINDOW DRIVER (DOWN)
9	Q28 14DG/WT	RIGHT REAR WINDOW DRIVER (DOWN)
10	Z1 14BK	GROUND
11	Q26 14VT/WT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
12	Q16 14BR/WT	MASTER WINDOW SWITCH RIGHT FRONT UP



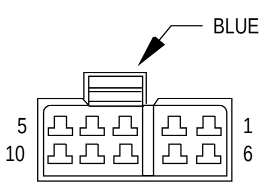
MODE DOOR ACTUATOR

CAV	CIRCUIT	FUNCTION
1	C35 20DG/YL	MODE DOOR DRIVER (+)
2	C57 22GY/TN	SENSOR GROUND
3	C37 20YL	MODE DOOR FEEDBACK SIGNAL
4	C26 20PK/DB	5 VOLT SUPPLY
5	C34 20DB/YL	MODE DOOR DRIVER (-)



MULTI-FUNCTION SWITCH - C1

CAV	CIRCUIT	FUNCTION
1	V10 22BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT
2	V52 22DG/YL	WINDSHIELD WIPER SWITCH MUX
3	F13 22DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	A15 18PK	FUSED B(+)
	A15 20PK ●●	FUSED B(+)
5	Z1 18BK/TN	GROUND
	Z1 20BK ●●	GROUND
6	L60 18TN	RIGHT TURN SIGNAL
7	L61 18LG	LEFT TURN SIGNAL



MULTI-FUNCTION SWITCH - C2

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
	L7 18BK/YL ●	HEADLAMP SWITCH OUTPUT
2	F33 18BK/RD	FUSED B(+)
3	-	-
4	A3 14RD/WT	FUSED B(+)
5	L36 18LG ■●	REAR FOG LAMP
6	E19 20RD	PANEL LAMPS DIMMER SIGNAL
7	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
8	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
9	L39 18LB ▲	FOG LAMP SWITCH OUTPUT
10	L44 18VT/RD ■■	FUSED RIGHT LOW BEAM OUTPUT
10	L92 18LG ●	FUSED FOG LAMP SWITCH FEED

● BUILT-UP-EXPORT
●● SKIM
■ REAR FOG LAMPS
■■ EXCEPT BUILT-UP-EXPORT
▲ FOG LAMPS

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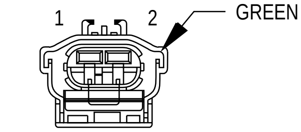
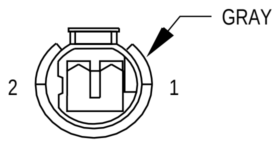


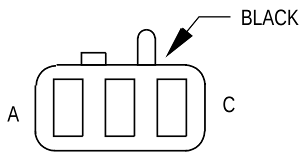
OIL PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	G6 18GY/VT ▲	ENGINE OIL PRESSURE SWITCH SENSE
1	G6 18GY ●▲▲	ENGINE OIL PRESSURE SWITCH SENSE
2	-	-



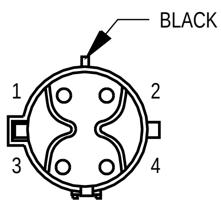
OUTPUT SHAFT SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BR	SPEED SENSOR GROUND
2	T14 18LG/VT	OUTPUT SPEED SENSOR SIGNAL



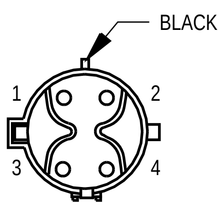
OVERHEAD MAP LAMPS

CAV	CIRCUIT	FUNCTION
A	Z1 20BK	GROUND
B	M1 20PK	FUSED B(+)
C	M2 20YL	COURTESY LAMPS DRIVER



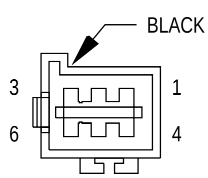
OXYGEN SENSOR 1/1 UPSTREAM

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K127 18BK/OR	OXYGEN SENSOR GROUND
4	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL



OXYGEN SENSOR 1/2 DOWNSTREAM

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	F142 18OR/DG	FUSED AUTOMATIC SHUTDOWN RELAY OUTPUT
3	K4 18BK/LB	SENSOR GROUND
4	K141 20TN/WT	OXYGEN SENSOR 1/2 SIGNAL



PASSENGER HEATED SEAT MODULE (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	P86 16PK/BK	FUSED B(+)
2	Z1 16BK	GROUND
3	-	-
4	P8 18LB/WT	PASSENGER HEATED SEAT SWITCH
5	-	-
6	F11 18RD/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)

▲ 2.0L
▲▲ 2.4L
● 2.5L

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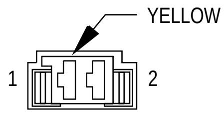
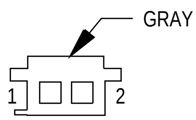


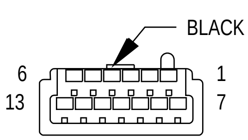
PASSENGER SIDE AIRBAG SQUIB

CAV	CIRCUIT	FUNCTION
1	R42 18RD/WT	PASSENGER AIRBAG LINE 2
2	R44 18LG/YL	PASSENGER AIRBAG LINE 1



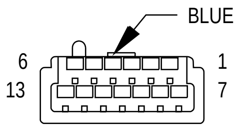
POWER AMPLIFIER - C1 (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	F30 18RD/PK	FUSED B(+)
2	Z1 18BK/LB	GROUND



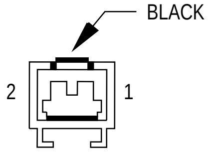
POWER AMPLIFIER - C2 (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X84 20OR/BK	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (-)
2	X81 20YL/BK	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (-)
3	X56 22DB/RD	RIGHT FRONT SPEAKER (-)
4	X55 22BR/RD	LEFT FRONT SPEAKER (-)
5	X58 22DB/OR	RIGHT REAR SPEAKER (-)
6	X57 22BR/LB	LEFT REAR SPEAKER (-)
7	X86 20OR/RD	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (+)
8	X83 20YL/RD	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (+)
9	X60 22DG/RD	RADIO 12 VOLT OUTPUT
10	X54 22VT	RIGHT FRONT SPEAKER (+)
11	X53 22DG	LEFT FRONT SPEAKER (+)
12	X52 22DB/WT	RIGHT REAR SPEAKER (+)
13	X51 22BR/YL	LEFT REAR SPEAKER (+)



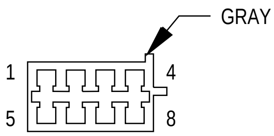
POWER AMPLIFIER - C3 (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X93 20WT/VT	AMPLIFIED LOW LEFT REAR SPEAKER (+)
2	X91 20WT/DG	AMPLIFIED LOW LEFT REAR SPEAKER (-)
3	X60 22DG/RD •	RADIO 12 VOLT OUTPUT
4	X96 20TN/BK	AMPLIFIED HIGH RIGHT REAR SPEAKER (-)
5	X98 20TN/RD	AMPLIFIED HIGH RIGHT REAR SPEAKER (+)
6	X95 20WT/RD	AMPLIFIED HIGH LEFT REAR SPEAKER (+)
7	X94 20TN/VT	AMPLIFIED LOW RIGHT REAR SPEAKER (+)
8	X92 20TN/DG	AMPLIFIED LOW RIGHT REAR SPEAKER (-)
9	X85 22LG/DG	AMPLIFIED LEFT DOOR SPEAKER (-)
10	X87 22LG/VT	AMPLIFIED LEFT DOOR SPEAKER (+)
11	X82 22LB/VT	AMPLIFIED RIGHT DOOR SPEAKER (+)
12	X80 22LB/DG	AMPLIFIED RIGHT DOOR SPEAKER (-)
13	X97 20WT/BK	AMPLIFIED HIGH LEFT REAR SPEAKER (-)



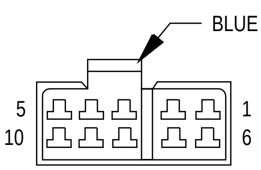
POWER ANTENNA (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	M1 20PK/VT	FUSED B(+)
2	X60 22DG/RD	RADIO 12 VOLT OUTPUT



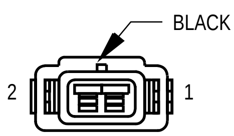
POWER MIRROR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
	Z1 20BK	GROUND
2	M1 20PK	FUSED B(+)
3	P94 22WT/YL	LEFT POWER MIRROR HORIZONTAL
4	P92 22YL	LEFT POWER MIRROR VERTICAL
5	P90 22LG/BK	POWER MIRROR FEED
6	P91 22WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY
7	P95 22DB/WT	LEFT POWER MIRROR HORIZONTAL
8	P93 22YL/BK	LEFT POWER MIRROR VERTICAL



POWER SEAT SWITCH

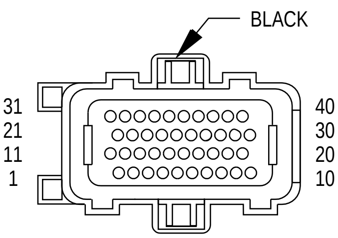
CAV	CIRCUIT	FUNCTION
1	F35 16RD	FUSED B(+)
2	P43 16GY/LB	LEFT SEAT RECLINER SWITCH DOWN
3	P17 16RD/LB	LEFT POWER SEAT HORIZONTAL FORWARD
4	P41 16GY/WT	LEFT SEAT RECLINER SWITCH UP
5	Z1 16 BK	GROUND
6	P21 16RD/LG	LEFT POWER SEAT FRONT DOWN
7	P13 16RD/WT	LEFT POWER SEAT REAR DOWN
8	P11 16YL/WT	LEFT POWER SEAT REAR UP
9	P19 16YL/LG	LEFT POWER SEAT FRONT UP
10	P15 16YL/LB	LEFT POWER SEAT HORIZONTAL REARWARD



POWER STEERING PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	K10 18DB/LG	POWER STEERING PRESSURE SWITCH SENSE
2	Z1 18BK	GROUND

• BUILT-UP-EXPORT



POWERTRAIN CONTROL MODULE - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	K17 18DB/TN ▲●	IGNITION COIL NO. 2 DRIVER
4	K19 18BK/GY ▲▲	IGNITION COIL NO. 1 DRIVER
5	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
6	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
7	K13 18YL/WT	INJECTOR NO. 3 DRIVER
8	K20 18DG	GENERATOR FIELD DRIVER
9	-	-
10	Z12 18BK/TN	GROUND
11	K19 18BK/GY ▲●	IGNITION COIL NO. 1 DRIVER
12	-	-
13	K11 18WT/DB	INJECTOR NO. 1 DRIVER
14	K58 18BR/DB ▲▲	INJECTOR NO. 6 DRIVER
15	K38 18GY ▲▲	INJECTOR NO. 5 DRIVER
16	K14 18LB/BR	INJECTOR NO. 4 DRIVER
17	K12 18TN	INJECTOR NO. 2 DRIVER
18	-	-
19	-	-
20	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
21	-	-
22	-	-
23	-	-
24	-	-
25	K42 18DB/LG ▲●	KNOCK SENSOR SIGNAL
26	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
27	K127 18BK/OR	OXYGEN SENSOR GROUND
28	-	-
29	-	-
30	K41 18BK/DG	HEATED OXYGEN SENSOR 1/1 SIGNAL
31	K90 20TN ●	DOUBLE START OVER RIDE
32	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
32	K24 20GY/BK ●	CRANKSHAFT POSITION SENSOR SIGNAL
33	K44 20TN/YL ▲●	CAMSHAFT POSITION SENSOR SIGNAL
33	K44 18TN/YL ▲▲	CAMSHAFT POSITION SENSOR SIGNAL
34	-	-
35	K22 20OR/DB ▲▲●	THROTTLE POSITION SENSOR SIGNAL
35	K22 18OR/DB ▲	THROTTLE POSITION SENSOR SIGNAL
36	K1 18DG/RD	MAP SENSOR SIGNAL
37	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL
38	-	-
39	-	-
40	K35 18GY/YL	EGR SOLENOID CONTROL

● 2.0L
▲ 2.4L
▲▲ 2.5L

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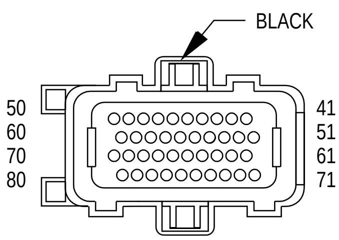
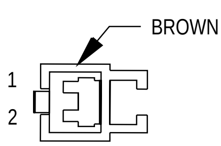


POWERTRAIN CONTROL MODULE - C2

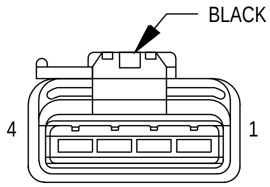
CAV	CIRCUIT	FUNCTION
41	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
42	C18 20DB/YL	A/C PRESSURE SIGNAL
43	K4 20BK/LB	SENSOR GROUND
44	K7 18OR/WT	8 VOLT SUPPLY
45	K10 18DB/LG	POWER STEERING PRESSURE SWITCH SENSE
46	A14 16RD/TN	FUSED B(+)
47	Z1 18BK	GROUND
48	K40 20BR/WT	IDLE AIR CONTROL MOTOR NO. 3 DRIVER
49	K60 20YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
50	Z12 18BK/TN	GROUND
51	K141 20TN/WT	HEATED OXYGEN SENSOR 1/2 SIGNAL
52	K25 18VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
53	-	-
54	-	-
55	C24 20DB/TN	LOW SPEED RADIATOR FAN RELAY CONTROL
56	V36 20WT/VT	SPEED CONTROL VACUUM SOLENOID CONTROL
57	K39 20GY/RD	IDLE AIR CONTROL MOTOR NO. 1 DRIVER
58	K59 20VT/BK	IDLE AIR CONTROL MOTOR NO. 4 DRIVER
59	D1 20VT/BR	CCD BUS (+)
60	D2 20WT/BK	CCD BUS (-)
61	K6 20VT/WT	5 VOLT SUPPLY
62	K29 18WT/RD	BRAKE SWITCH SENSE
63	T10 20YL/DG** ▲▲	TORQUE MANAGEMENT REQUEST SENSE
64	C28 20DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
65	D21 20PK/LB	SCI TRANSMIT
66	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
67	K51 20DB/VT	AUTOMATIC SHUT DOWN RELAY CONTROL
68	K52 20PK/GY	EVAPORATIVE EMISSION SOLENOID CONTROL
69	C27 20DB/PK	HIGH SPEED RADIATOR FAN RELAY CONTROL
70	K108 18WT/TN	EVAPORATIVE SOLENOID SENSE
71	-	-
72	K107 18OR/DG ●	LEAK DETECTION PUMP SWITCH SENSE
73	-	-
74	K31 20BR/LG	FUEL PUMP RELAY CONTROL
75	D20 20LG	SCI RECEIVE
76	T41 20BK/WT** ▲▲	PARK/NEUTRAL POSITION SWITCH SENSE
77	K106 18WT/DG ●	LEAK DETECTION PUMP SOLENOID CONTROL
78	-	-
79	-	-
80	V35 20LG/RD	SPEED CONTROL VENT SOLENOID CONTROL



PRNDL ILLUMINATION LED

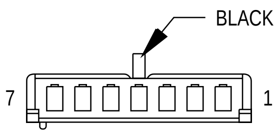
CAV	CIRCUIT	FUNCTION
1	E2 18OR/GY	PANEL LAMPS DRIVER
2	Z1 18BK/YL	GROUND
	Z1 16BK ●●	GROUND

▲▲ EATX
● EXCEPT BUILT-UP-EXPORT
●● HEATED SEATS



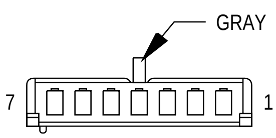
RADIATOR FAN MOTOR ASSEMBLY

CAV	CIRCUIT	FUNCTION
1	Z1 12BK	GROUND
2	Z1 12BK	GROUND
3	C23 12DG/LG	LOW SPEED RADIATOR FAN RELAY OUTPUT
4	C25 12YL/VT	HIGH SPEED RADIATOR FAN RELAY OUTPUT



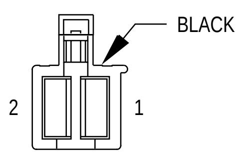
RADIO - C1

CAV	CIRCUIT	FUNCTION
1	X60 22DG/RD ●●▲	RADIO 12 VOLT OUTPUT
2	X51 22BR/YL	LEFT REAR SPEAKER (+)
3	X52 22DB/WT	RIGHT REAR SPEAKER (+)
4	X53 22DG	LEFT FRONT SPEAKER (+)
5	X54 22VT	RIGHT FRONT SPEAKER (+)
6	X57 22BR/LB	LEFT REAR SPEAKER (-)
7	X58 22DB/OR	RIGHT REAR SPEAKER (-)



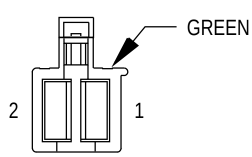
RADIO - C2

CAV	CIRCUIT	FUNCTION
1	-	-
2	X55 22BR/RD	LEFT FRONT SPEAKER (-)
3	X56 22DB/RD	RIGHT FRONT SPEAKER (-)
4	L7 18BK/DG	HEADLAMP SWITCH OUTPUT
5	E2 18OR/BR	PANEL LAMPS DRIVER
6	X12 16RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	M1 18PK/TN	FUSED B(+)
	M1 20PK/DB	FUSED B(+)



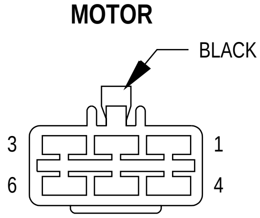
REAR VERTICAL MOTOR

CAV	CIRCUIT	FUNCTION
1	P11 16YL/WT	LEFT POWER SEAT REAR UP
2	P13 16RD/WT	LEFT POWER SEAT REAR DOWN



RECLINE MOTOR

CAV	CIRCUIT	FUNCTION
1	P41 16GY/WT	LEFT SEAT RECLINER SWITCH UP
2	P43 16GY/LB	LEFT SEAT RECLINER SWITCH DOWN



RESISTOR BLOCK

CAV	CIRCUIT	FUNCTION
1	C7 12BK/TN	HIGH BLOWER MOTOR DRIVER
2	C6 18LB	M2 BLOWER MOTOR DRIVER
3	-	-
4	C1 12DG	BLOWER MOTOR FEED
5	C4 18TN	LOW BLOWER MOTOR DRIVER
6	C5 18LG	M1 BLOWER MOTOR DRIVER

●●BUILT-UP-EXPORT
▲PREMIUM

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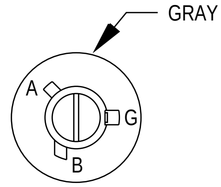
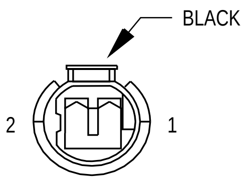


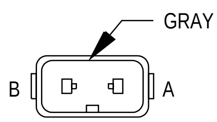
RIGHT BACK-UP LAMP

CAV	CIRCUIT	FUNCTION
A	L1 18VT/BK	BACK-UP LAMP FEED
B	-	-
G	Z1 18BK	GROUND



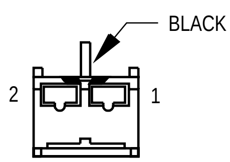
RIGHT CYLINDER LOCK SWITCH (VTSS)

CAV	CIRCUIT	FUNCTION
1	G72 18DG/OR	RIGHT DOOR KEY CYLINDER SWITCH SENSE
2	M1 20PK	FUSED B(+)



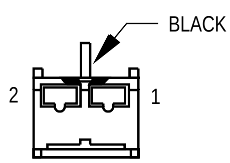
RIGHT FOG LAMP

CAV	CIRCUIT	FUNCTION
A	L39 18LB	FOG LAMP SWITCH OUTPUT
B	Z1 18BK	GROUND



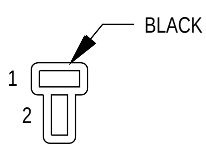
RIGHT FRONT DOOR SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X82 22LG/VT	AMPLIFIED RIGHT FRONT SPEAKER (+)
2	X80 22LG	AMPLIFIED RIGHT FRONT SPEAKER (-)



RIGHT FRONT DOOR SPEAKER (STANDARD)

CAV	CIRCUIT	FUNCTION
1	X56 22LG	RIGHT FRONT SPEAKER (-)
2	X54 22LG/VT	RIGHT FRONT SPEAKER (+)



RIGHT FRONT INSTRUMENT PANEL SPEAKER

CAV	CIRCUIT	FUNCTION
1	X84 20OR/BK ●	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (-)
1	X56 22DB/RD ●●	RIGHT FRONT SPEAKER (-)
2	X86 20OR/RD ●	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (+)
2	X54 22VT ●●	RIGHT FRONT SPEAKER (+)

●PREMIUM
●●STANDARD

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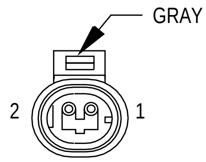
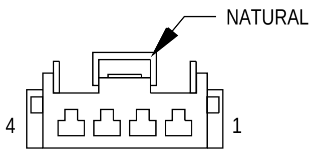


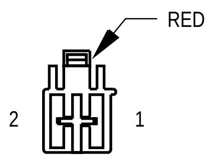
RIGHT FRONT POWER DOOR LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P34 16PK/LB	DOOR UNLOCK DRIVER
2	P33 16OR/BK	DOOR LOCK DRIVER



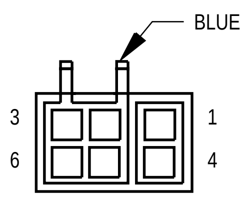
RIGHT FRONT POWER DOOR LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z1 20BK	GROUND
4	P96 22WT/LG	RIGHT FRONT DOOR SWITCH MUX



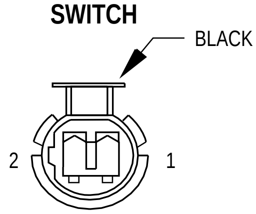
RIGHT FRONT POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q12 16BR	RIGHT FRONT WINDOW DRIVER (UP)
2	Q22 16VT	RIGHT FRONT WINDOW DRIVER (DOWN)



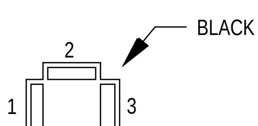
RIGHT FRONT POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q22 16VT	RIGHT FRONT WINDOW DRIVER (DOWN)
2	Q16 14BR/WT	MASTER WINDOW SWITCH RIGHT FRONT UP
3	-	-
4	Q26 14VT/WT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
5	Q12 16BR	RIGHT FRONT WINDOW DRIVER (UP)
6	Q1 14YL/VT	POWER WINDOW SWITCH FEED



RIGHT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



RIGHT HEADLAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
2	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
3	Z1 18BK	GROUND

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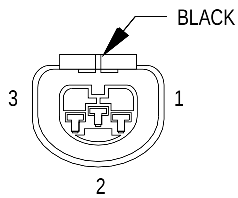
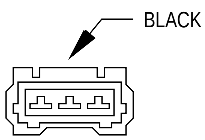


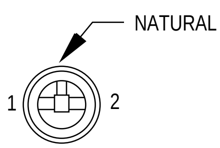
RIGHT HEADLAMP (EXCEPT BUILT-UP -EXPORT)

CAV	CIRCUIT	FUNCTION
1	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
2	Z1 18BK	GROUND
3	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT



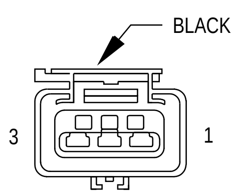
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	L13 18BR/VT	HEADLAMP ADJUST SIGNAL
3	Z3 18BK	GROUND

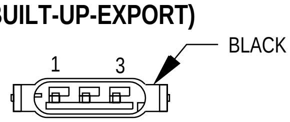


RIGHT LICENSE LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND

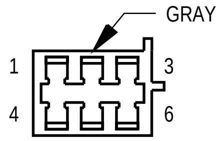


RIGHT PARK/ TURN SIGNAL LAMP (BUILT-UP-EXPORT)



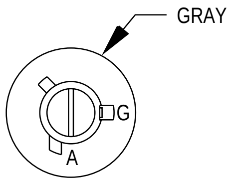
RIGHT PARK/ TURN SIGNAL LAMP (EXCEPT BUILT-UP -EXPORT)

CAV	CIRCUIT	FUNCTION
1	L60 18TN/BR	RIGHT TURN SIGNAL
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



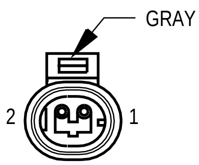
RIGHT POWER MIRROR

CAV	CIRCUIT	FUNCTION
1	C16 20LB/YL*	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
2	Z1 18BK*	GROUND
	Z1 20BK*	GROUND
3	P94 22WT/YL	RIGHT POWER MIRROR VERTICAL
4	P91 22WT/BK	LEFT/RIGHT POWER MIRROR HORIZONTAL SUPPLY
5	P90 22LG/BK	POWER MIRROR FEED
6	P92 22YL	RIGHT POWER MIRROR HORIZONTAL



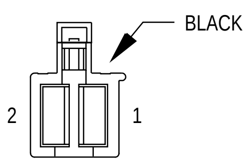
RIGHT REAR FOG LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	L36 18LG	REAR FOG LAMP
G	Z1 18BK	GROUND



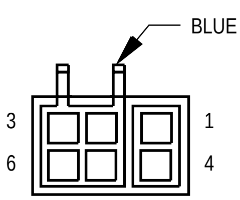
RIGHT REAR POWER DOOR LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P34 16PK/BK	DOOR UNLOCK DRIVER
2	P33 16OR/BK	DOOR LOCK DRIVER



RIGHT REAR POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q14 14GY	POWER WINDOW RIGHT REAR B(+) UP
2	Q24 14DG	POWER WINDOW RIGHT REAR B(+) DOWN



RIGHT REAR POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q24 14DG	POWER WINDOW RIGHT REAR B(+) DOWN
2	Q18 14GY/BK	RIGHT REAR WINDOW DRIVER (UP)
3	-	-
4	Q28 14DG/WT	RIGHT REAR WINDOW DRIVER (DOWN)
5	Q14 14GY	POWER WINDOW RIGHT REAR B(+) UP
6	Q1 14YL	POWER WINDOW SWITCH FEED

* HEATED MIRRORS

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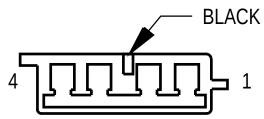
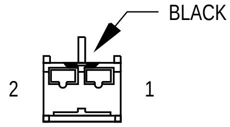


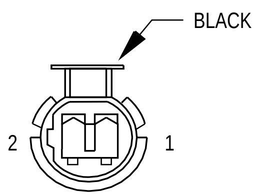
RIGHT REAR SPEAKER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X98 20TN/RD	AMPLIFIED HIGH RIGHT REAR SPEAKER (+)
2	X92 20TN/DG	AMPLIFIED LOW RIGHT REAR SPEAKER (-)
3	X94 20TN/VT	AMPLIFIED LOW RIGHT REAR SPEAKER (+)
4	X96 20TN/BK	AMPLIFIED HIGH RIGHT REAR SPEAKER (-)



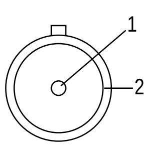
RIGHT REAR SPEAKER (STANDARD)

CAV	CIRCUIT	FUNCTION
1	X58 20DB/OR	RIGHT REAR SPEAKER(-)
2	X52 20DB/WT	RIGHT REAR SPEAKER(+)



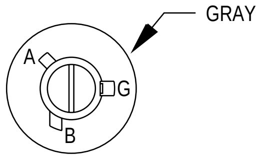
RIGHT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B1 20YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 20YL	RIGHT REAR WHEEL SPEED SENSOR (+)



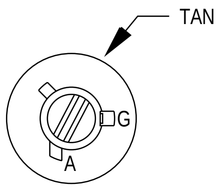
RIGHT SIDE REPEATER (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L60 18LG/TN	RIGHT TURN SIGNAL
2	Z1 18BK	GROUND



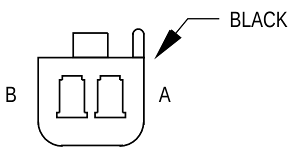
RIGHT TAIL/STOP LAMP

CAV	CIRCUIT	FUNCTION
A	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
B	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
G	Z1 18BK	GROUND



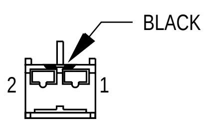
RIGHT TURN LAMP

CAV	CIRCUIT	FUNCTION
A	L60 18TN	RIGHT TURN SIGNAL
G	Z1 18BK	GROUND



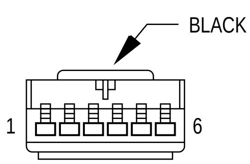
RIGHT VISOR/ VANITY LAMPS

CAV	CIRCUIT	FUNCTION
A	M1 20PK	FUSED B(+)
B	Z1 20BK	GROUND



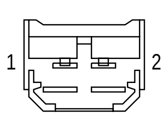
SEAT BELT SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G10 20LG/RD	SEAT BELT SWITCH SENSE



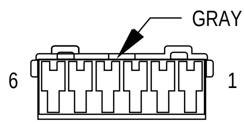
SENTRY KEY IMMOBILIZER MODULE

CAV	CIRCUIT	FUNCTION
1	A15 20PK	FUSED B(+)
2	Z1 20BK	GROUND
3	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
4	-	-
5	D2 20WT/DB	CCD BUS (-)
6	D1 20VT/BR	CCD BUS (+)



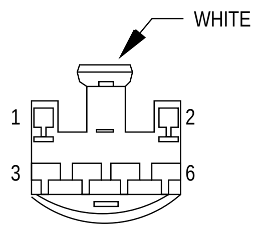
SHIFT INTERLOCK SOLENOID (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	F18 18LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	K29 18WT/RD	BRAKE SWITCH SENSE



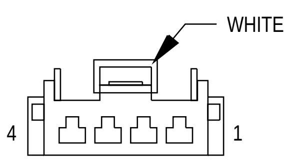
STOP LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	K29 18WT/RD	BRAKE SWITCH SENSE
2	Z2 20BK/LG	GROUND
3	V32 20YL/PK	SPEED CONTROL ON/OFF SWITCH SENSE
4	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
6	A7 16RD/BK	FUSED B(+)



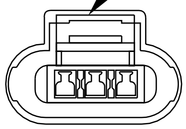
SUNROOF CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	F21 18TN	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Q43 20VT	POWER SUNROOF VENT
4	Q44 20BR	POWER SUNROOF SWITCH GROUND
5	Q42 20LB	POWER SUNROOF CLOSE
6	Q41 20WT	POWER SUNROOF OPEN

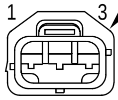


SUNROOF SWITCH

CAV	CIRCUIT	FUNCTION
1	Q41 20WT	POWER SUNROOF OPEN
2	Q43 20VT	POWER SUNROOF VENT
3	Q44 20BR	POWER SUNROOF SWITCH GROUND
4	Q42 20LB	POWER SUNROOF CLOSE

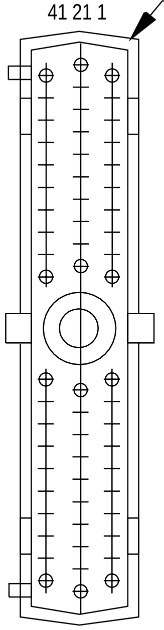


THROTTLE POSITION SENSOR (2.0L)



THROTTLE POSITION SENSOR (2.5L/2.4L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB ▲▲●	SENSOR GROUND
1	K6 18VT/WT ▲	5 VOLT SUPPLY
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K6 20VT/WT ▲▲●	5 VOLT SUPPLY
3	K4 18BK/LB ▲	SENSOR GROUND



TRANSMISSION CONTROL MODULE

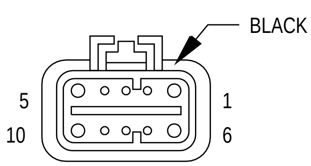
CAV	CIRCUIT	FUNCTION
1	T1 20LG/BK	TRANSMISSION RANGE SWITCH SENSE
2	-	-
3	T3 18VT	PARK/NEUTRAL POSITION SWITCH SENSE
4	D2 20WT/DG	CCD BUS(-)
5	T5 20LG/LB ●●	AUTOSTICK UPSHIFT SWITCH SENSE
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 20PK/LB	SCI TRANSMIT
8	A41 16YL/OR	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 20OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 20YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
12	K22 20OR/LB	THROTTLE POSITION SENSOR SIGNAL
13	T13 20DB/BK	SPEED SENSOR GROUND
14	T14 20LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	T15 20LG/YL	12 VOLT SUPPLY
16	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
18	-	-
19	T19 20WT	2-4 SOLENOID CONTROL
20	T20 20LB	LOW/REVERSE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-

▲ 2.5L
▲▲ 2.4L
● 2.0L
●● AUTOSTICK

(CONTINUED ON NEXT PAGE)

(CONTINUED)

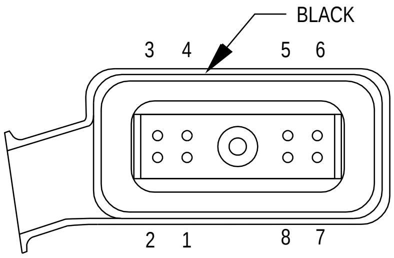
CAV	CIRCUIT	FUNCTION
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
42	T42 18VT/TN	TRANSMISSION RANGE SWITCH T42 SENSE
43	D1 20VT/DG	CCD BUS(+)
44	T44 20YL/LB*	AUTOSTICK DOWNSHIFT SWITCH SENSE
45	-	-
46	D6 20PK/DG	SCI RECEIVE
47	T47 20YL/BK	2-4 PRESSURE SWITCH SENSE
48	-	-
49	-	-
50	T50 18DG/TN	LOW/REVERSE PRESSURE SWITCH SENSE
51	K4 20BK/LB	SENSOR GROUND
52	T52 20RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z14 18BK/YL	GROUND
54	T54 18VT/YL	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	-	-
56	A24 16PK/YL	FUSED B(+)
57	Z13 16BK/RD	GROUND
58	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
59	T59 18PK/DB	UNDERDRIVE SOLENOID CONTROL
60	T60 18BR/TN	OVERDRIVE SOLENOID CONTROL



TRANSMISSION RANGE SENSOR

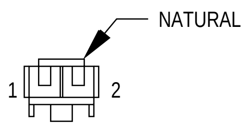
CAV	CIRCUIT	FUNCTION
1	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	T13 18DB/BR	SPEED SENSOR GROUND
4	T54 18VT/WT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
5	T41 18BK/LB	PARK/NEUTRAL POSITION SWITCH SENSE
6	L1 18VT/BK	BACK-UP LAMP FEED
7	T1 18LG/GY	TRANSMISSION RANGE SWITCH SENSE
8	T3 18VT	PARK/NEUTRAL POSITION SWITCH SENSE
9	T42 18VT/TN	TRANSMISSION RANGE SWITCH T42 SENSE
10	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE

* AUTOSTICK



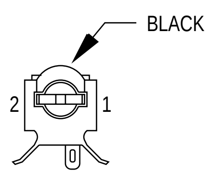
TRANSMISSION SOLENOID AND PRESSURE SWITCH ASSEMBLY

CAV	CIRCUIT	FUNCTION
1	T47 18YL/GY	2-4 PRESSURE SWITCH SENSE
2	T50 18DG/TN	LOW/REVERSE PRESSURE SWITCH SENSE
3	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
4	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
5	T59 18PK/DB	UNDERDRIVE SOLENOID CONTROL
6	T60 18BR/TN	OVERDRIVE SOLENOID CONTROL
7	T20 18LB/WT	LOW/REVERSE SOLENOID CONTROL
8	T19 18WT/PK	2-4 SOLENOID CONTROL



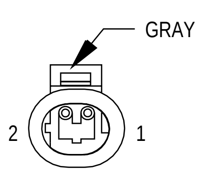
TRUNK KEY CYLINDER SWITCH (VTSS)

CAV	CIRCUIT	FUNCTION
1	G71 20VT/YL	TRUNK KEY CYLINDER SENSE
2	Z1 20BK	GROUND



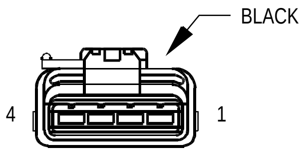
TRUNK LAMP

CAV	CIRCUIT	FUNCTION
1	M1 20PK/OR	FUSED B(+)
2	G78 20TN/BK	DECKLID AJAR SWITCH SENSE



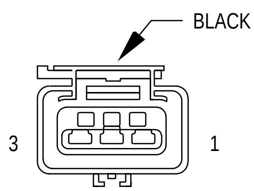
TURBINE SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BR	SPEED SENSOR GROUND
2	T52 18OR/YL	INPUT SPEED SENSOR SIGNAL



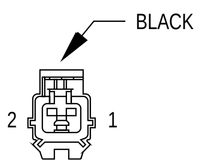
VEHICLE SPEED CONTROL SERVO

CAV	CIRCUIT	FUNCTION
1	V36 20WT/VT	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 20LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
4	Z1 20BK	GROUND



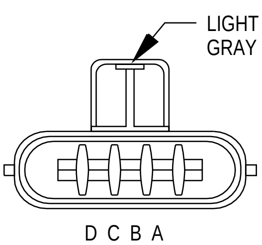
VEHICLE SPEED SENSOR (MTX)

CAV	CIRCUIT	FUNCTION
1	K7 18OR	8 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL



WINDSHIELD WASHER PUMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V10 18BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT



WINDSHIELD WIPER MOTOR

CAV	CIRCUIT	
A	V4 14RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
B	V3 14BR/OR	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
C	Z1 16BK	GROUND
D	V55 20TN/RD	WIPER PARK SWITCH SENSE

8W-90 CONNECTOR/GROUND LOCATIONS

INDEX

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of components, grounds, and connectors in the vehicle. A index is provided. Use the wiring diagrams in each section for connector/ground number identification. Refer to the index for the proper figure number.

CONNECTOR/GROUND LOCATIONS

For items not shown in this section a N/S is placed in the Fig. column

Connector Name/Number	Color	Location	Fig.
A/C Compressor Clutch	GY	Top of Compressor	4, 5
A/C Evaporator Temperature Sensor	BK	RT Side of HVAC	11
A/C-Heater Control - C1	NAT	Rear of Control	11
A/C-Heater Control - C2	BK	Rear of Control	11
A/C Pressure Transducer	GY	Top of A/C Compressor	4, 5
Airbag Control Module - C1	GY	At Module	14
Airbag Control Module - C2	YL	At Module	14
Ambient Temperature Sensor	BK	Near Radiator Grille	2
Ash Receiver Lamp	BK	Rear of Lamp	N/S
Autostick Switch	BK	Base of Shifter	N/S
Back-Up Lamp Switch	GY	Rear of Transmission	6
Blower Motor Resistor Block	BK	RT Side of HVAC	11
Body Control Module - C1	BK	At Module	10

Connector Name/Number	Color	Location	Fig.
Body Control Module - C2	NAT	At Module	9
Body Control Module - C3	NAT	At Module	9
Body Control Module - C4	BK	At Module	13
Body Control Module - C5	BK	At Module	10
Brake Warning Pressure Switch	BK	On Master Cylinder	2
C104	LT/GY	Under PDC	2
C105	BK	Under PDC	2
C111	BK	Rear of PCM	2
C113	LT/GY	Rear of PCM	2
C121	BK	Left Side Cowl Panel	13
C126	BK	Near Junction Block	10
C165 (2.5L)	BK	Left Side of Intake	5
C169	BK	Left Side of Trans	N/S
C224	BK	Left Side of Steering Column	N/S
C225	BK	Left B-Pillar	13
C300	BK	Left Rear Quarter Panel	15

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
C301	BK	Right Rear Quarter Panel	15
C305	BK	Near Trunk Latch	19
C308	WT/ BK	Left B-Pillar	13
C309	BK	Under Seat	N/S
C310	BR	Left A-Pillar	13
C311	BL	Left A-Pillar	13
C315	BR	Right A-Pillar	13
C316	BL	Right A-Pillar	13
C318	WT/ BK	Right B-Pillar	13
C320	BK	Left Rear Quarter Panel	N/S
C343	BK	Left A-Pillar	N/S
C344	BK	Right A-Pillar	N/S
Camshaft Position Sensor (2.0L/2.4L)	BK	Left Side of Cyl Head	4
Center High Mounted Stop Lamp	BK	At Lamp	N/S
Clockspring No.1	NAT	Rear of Clockspring	7
Clockspring No.2	YL	Rear of Clockspring	7
Clutch Pedal Position Switch	BK	Near Stop Lamp Switch T/O	N/S
Controller Anti-Lock Brake	BK	Right Fender Side Shield	3
Crankshaft Position Sensor (2.0L/2.4L)	BK	Rear of Cyl Block	4
Crankshaft Position Sensor (2.5L)	BK	Under Distributor	5
Data Link Connector	BK	LT Side of Steering Column	9,10
Distributor - C1 (2.5L)	BK	On Distributor	5
Distributor - C2 (2.5L)	BK	On Distributor	5
Dome Lamp	BK	At Lamp	16

Connector Name/Number	Color	Location	Fig.
Downstream Heated Oxygen Sensor	BK	Rear of Engine	3
Driver Heated Seat Module	BK	At Center Console	12
Duty Cycle/ EVAP Purge Solenoid	BK	At Solenoid	2
Electronic EGR Transducer Solenoid	BK	At Solenoid	4,5
Engine Coolant Temperature Sensor	BK	At Sensor	4,5
Engine Starter Motor (2.0L-2.4L)	BK	At Starter	4
Engine Starter Motor (2.5L)	BK	At Starter	N/S
Front Vertical Motor	BK	At Motor	N/S
Fuel Injector #1 (2.0L/2.4L)	BK	At Injector	4
Fuel Injector #1 (2.5L)	BK	At Injector	N/S
Fuel Injector #2 (2.0L/2.4L)	BK	At Injector	4
Fuel Injector #2 (2.5L)	BK	At injector	5
Fuel Injecotr #3 (2.0L/2.4L)	BK	At Injector	4
Fuel Injector #3 (2.5L)	BK	At Injector	N/S
Fuel Injector #4 (2.0L/2.4L)	BK	At Injector	4
Fuel Injector #4 (2.5L)	BK	At Injector	5
Fuel Injector #5 (2.5L)	BK	At Injector	N/S
Fuel Injector #6 (2.5L)	BK	At Injector	5
Fuel Pump Module	BK	Center Rear of Trunk Area	15
G100		Left Strut Tower	2
G102		Left Strut Tower	1
G105		Rear of Left Cylinder Head	5

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
G107		Right Strut Tower	3
G110		Left Strut Tower	1
G111		Left Strut Tower	1
G112		Right Strut Tower	3
G113		Right Strut Tower	3
G200		Right Instrument Panel Center Support	8
G201		Base of Gearshift	14
G202		Right Instrument Panel Center Support	8
G300		Center of Trunk Opening	15
G301		Left Side Cowl	13
G302		Center of Deck Lid	19
G303		Rear Window Defogger Ground	N/S
G304		Center of Trunk Opening	15
G306		Left Side Cowl	13
Generator (2.0L/2.4L)	BK	Rear of Generator	4
Generator (2.5L)	BK	Rear of Generator	5
Glove Box Lamp	GY	At Lamp	8
Headlamp Leveling Switch	BK	At Switch	N/S
Headlamp Switch	BK	At Switch	N/S
Heated Seat Switch	BK	Near Center Console	12
Headlamp Washer Module		Right Front Fender	3
Headlamp Washer Pump	BK	At Reservoir	3
High Note Horn	BK	Right Front Fender	3

Connector Name/Number	Color	Location	Fig.
Horizontal Motor	GY	At Motor	N/S
Idle Air Control Motor	BK	On Throttle Body	4,5
Ignition Coil Pack (2.0L/2.4L)	BK	Top of Valve Cover	4
Ignition Switch - C1	BK	At Switch	7
Ignition Switch - C2	BK	At Switch	7
Instrument Cluster - C1	RD	Rear of Clustrer	9
Instrument Cluster - C2	BL	Rear of Cluster	9
Intake Air Temperature/ Manifold Absoulte Pressure sensor (2.0L)	GY	On Intake	4
Intake Air Temperature Sensor (2.4L/2.5L)	GY	Rear of Intake	4,5
Junction Block - C1	BR	At Junction Block	10
Junction Block - C2	NAT	At Junction Block	10
Junction Block - C3	WT	At Junction Block	10
Junction BLock - C4	BL	At Junction Block	9
Junction Block - C5	GY	At Junction Block	9
Junction Block - C6	WT	At Junction Block	9
Junction Block - C7	NAT	At Junction Block	9
Junction Block - C8	BK	At Junction Block	10
Junction Block - C9	WT	At Junction Block	10
Junction Block - C10	NAT	At Junction Block	16
Junction Block - C11	BK	Between Junction Block C4 and C5 T/O’s	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Key-In Halo Lamp	WT	At Lamp	7
Key-In Switch	GN	At Switch	7
Knock Sensor (2.0L-2.4L)	BK	Front of Engine Block	4
Left Back-up Lamp	GY	At Lamp	N/S
Left Cylinder Lock Switch (VTSS)	BK	At Cylinder Lock Switch	17
Left Fog Lamp	GY	At Lamp	1
Left Front Door Speaker	BK	At Speaker	17
Left Front Instrument Panel Speaker	BK	At Speaker	8
Left Front Power Door Lock Motor	GY	At Motor	17
Left Front Power Door Lock Switch	NAT	At Switch	17
Left Front Power Window Motor	BK	At Motor	17
Left Front Wheel Speed Sensor	BK	Left Fender Side Shield	1
Left Headlamp	BK	At Lamp	1
Left Headlamp Leveling Motor	BK	At Motor	1
Left License Lamp	NAT	At Lamp	N/S
Left Park/Turn Signal Lamp	BK	At Lamp	1
Left Power Mirror	GY	At Mirror	17
Left Rear Fog Lamp		At Lamp	N/S
Left Rear Power Door Lock Motor	GY	At Motor	18
Left Rear Power Window Motor	BK	At Motor	18
Left Rear Power Window Switch	BL	At Switch	18

Connector Name/Number	Color	Location	Fig.
Left Rear Speaker	BK	At Speaker	15
Left Rear Wheel Speed Sensor	BK	Left Quarter Panel	15
Left Side Repeater		At Lamp	N/S
Left Tail/Stop Lamp	GY	At Lamp	N/S
Left Turn Lamp	TN	At Lamp	N/S
Left Visor/Vanity Lamps	BK	At Lamp	16
Low Note Horn	BK	Right Front Fender	3
Manifold Absolute Pressure Sensor (2.5L)	BK	Rear of Intake	5
Manifold Absolute Pressure Sensor (2.4L)	BK	Front of Intake Manifold	4
Master Power WIndow Switch	WT	At Switch	N/S
Mode Door Actuator	NAT	LT Side of HVAC	11
Multi-Function Switch - C1	BK	Right Side of Switch	7
Multi-Function Switch - C2	BL	Left Side of Switch	7
Oil Pressure Switch	GN	At Switch	4,5
Output Shaft Speed Sensor	GY	Front of Transmission	6
Overhead Map Lamps	BK	At Lamp	16
Passenger Heated Seat Module	BK	Near Center Console	12
Passenger Side Airbag Squib	YL	At Airbag	9
Power Amplifier - C1	GY	At Amplifier	14
Power Amplifier - C2	BK	At Amplifier	14
Power Amplifier - C3	BL	At Amplifier	13

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Power Antenna	BK	Right Rear Quarter Panel	15
Power Mirror Switch	GY	At Switch	N/S
Power Seat Switch	BL	Under Seat	N/S
Power Steering Pressure Switch	BK	Left Side of Steering Gear	1
Powertrain Control Module - C1	BK	Side of PDC	1
Powertrain Control Module - C2	BK	Side of PDC	2
PRNDL Feed	BK	At Ignition Switch	7
PRNDL Illumination LED	BR	Base of Gearshifter	14
Radiator Fan Motor Assembly	BK	Rear of Motor	1
Radio - C1	BK	Rear of Radio	8
Radio - C2	GY	Rear of Radio	8
Rear Vertical Motor	BK	At Motor	N/S
Recline Motor	GN	At Motor	N/S
Right Back-up Lamp	GY	At Lamp	N/S
Right Cylinder Lock Switch (VTSS)	BK	At Cylinder Lock Swtich	17
Right Fog Lamp	GY	At Lamp	3
Right Front Door Speaker	BK	At Speaker	17
Right Front Instrument Panel Speaker	BK	At Speaker	8
Right Front Power Door Lock Motor	GY	At Motor	17
Right Front Power Door Lock Switch	NAT	At Switch	17
Right Front Power Window Motor	RD	At Motor	17

Connector Name/Number	Color	Location	Fig.
Right Front Power Window Switch	BL	At Switch	17
Right Front Wheel Speed Sensor	BK	Right Fender Side Shield	3
Right Headlamp	BK	At Lamp	3
Right Headlamp Leveling Motor	BK	At Motor	3
Right License Lamp	NAT	At Lamp	N/S
Right Park/Turn Signal Lamp	BK	At Lamp	3
Right Power Mirror	GY	At Mirror	17
Right Rear Fog Lamp	GY	At Lamp	N/S
Right Rear Power Door Lock Motor	GY	At Motor	18
Right Rear Power Window Motor	BK	At Motor	18
Right Rear Power Window Switch	BL	At Switch	18
Right Rear Speaker	BK	At Speaker	15
Right Rear Wheel Speed Sensor	BK	Right Side Trunk Area	N/S
Right Side Repeater		At Lamp	N/S
Right Tail/Stop Lamp	GY	At Lamp	N/S
Right Turn Lamp	TN	At Lamp	N/S
Right Visor/ Vanity Lamps	BK	At Lamp	16
Seat Belt Switch	BK	Left B-Pillar	13
Sentry Key Immobilzer Module	BK	At Ignition Switch	N/S
Stop Lamp Switch	GY	Top of Brake Pedal	N/S
Sunroof Control Module	WT	At Module	16

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Sunroof Switch	WT	At Switch	16
Throttle Position Sensor (2.4L/2.5L)	NAT	On Throttle Body	4, 5
Throttle Position Sensor (2.0L)	BK	On Throttle Body	4
Transmission Control Module	BK	Next to PDC	2
Transmission Range Sensor	BK	Front of Transmision	6
Transmission Solenoid and Pressure Switch Assembly	BK	Front of Transmission	6
Trunk Key Cylinder Switch (VTSS)	NAT	At Switch	19
Trunk Lamp	BK	At Lamp	15

Connector Name/Number	Color	Location	Fig.
Turbine Speed Sensor	GY	Front of Transmission	6
Upstream Heated Oxygen Sensor (2.0L/2.4L)	BK	Rear of Generator	N/S
Upstream Heated Oxygen Sensor (2.5L)	BK	Rear of Generator	5
Vehicle Speed Control Servo	BK	At Servo	2
Vehicle Speed Sensor	BK	Front of Transmission	6
Windshield Washer Pump	BK	Bottom of Reservior	3
Windshield Wiper Motor	LT/GY	Left Strut Tower	1

DESCRIPTION AND OPERATION (Continued)

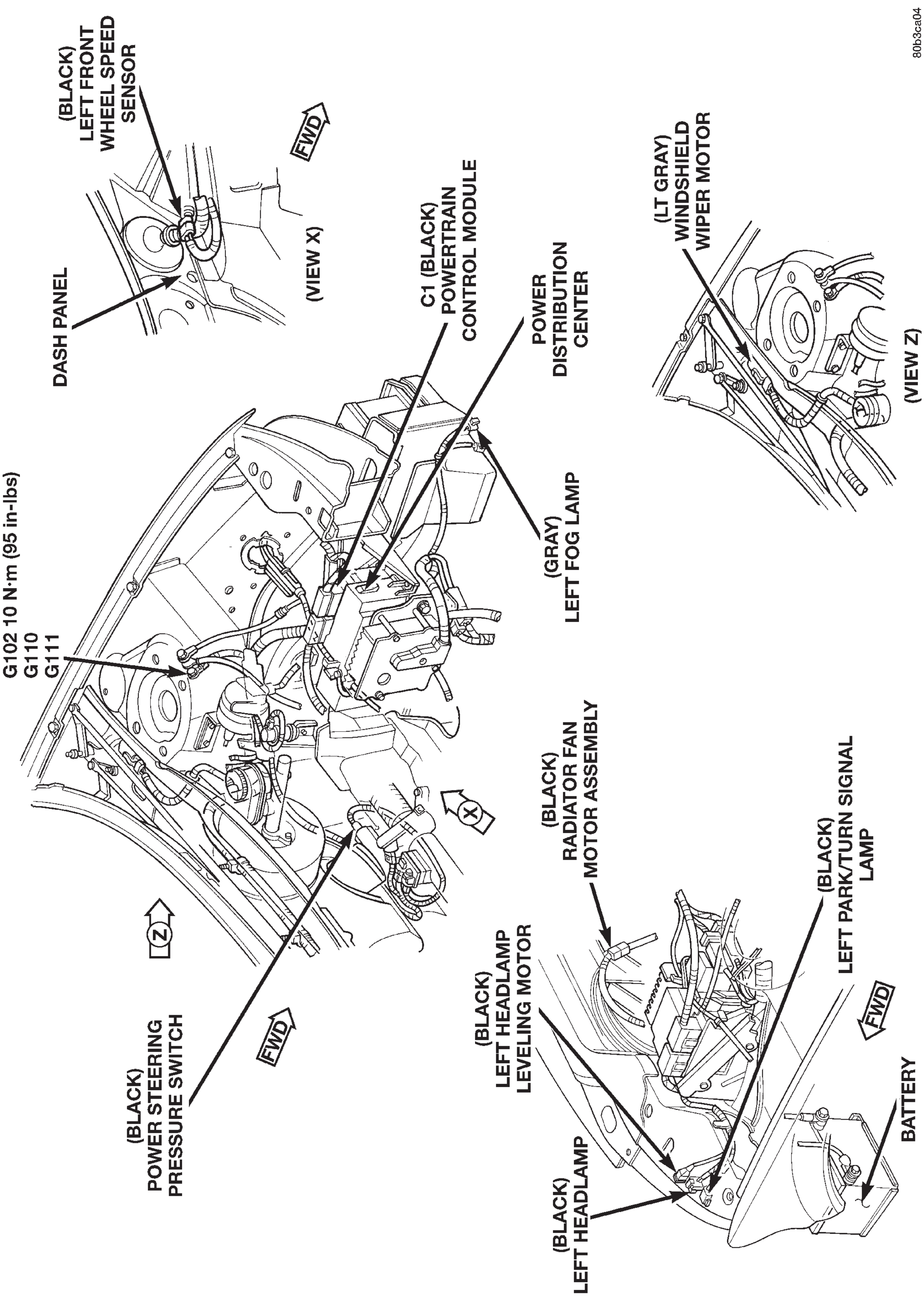


Fig. 1 Engine Compartment Connections (Left Side)

DESCRIPTION AND OPERATION (Continued)

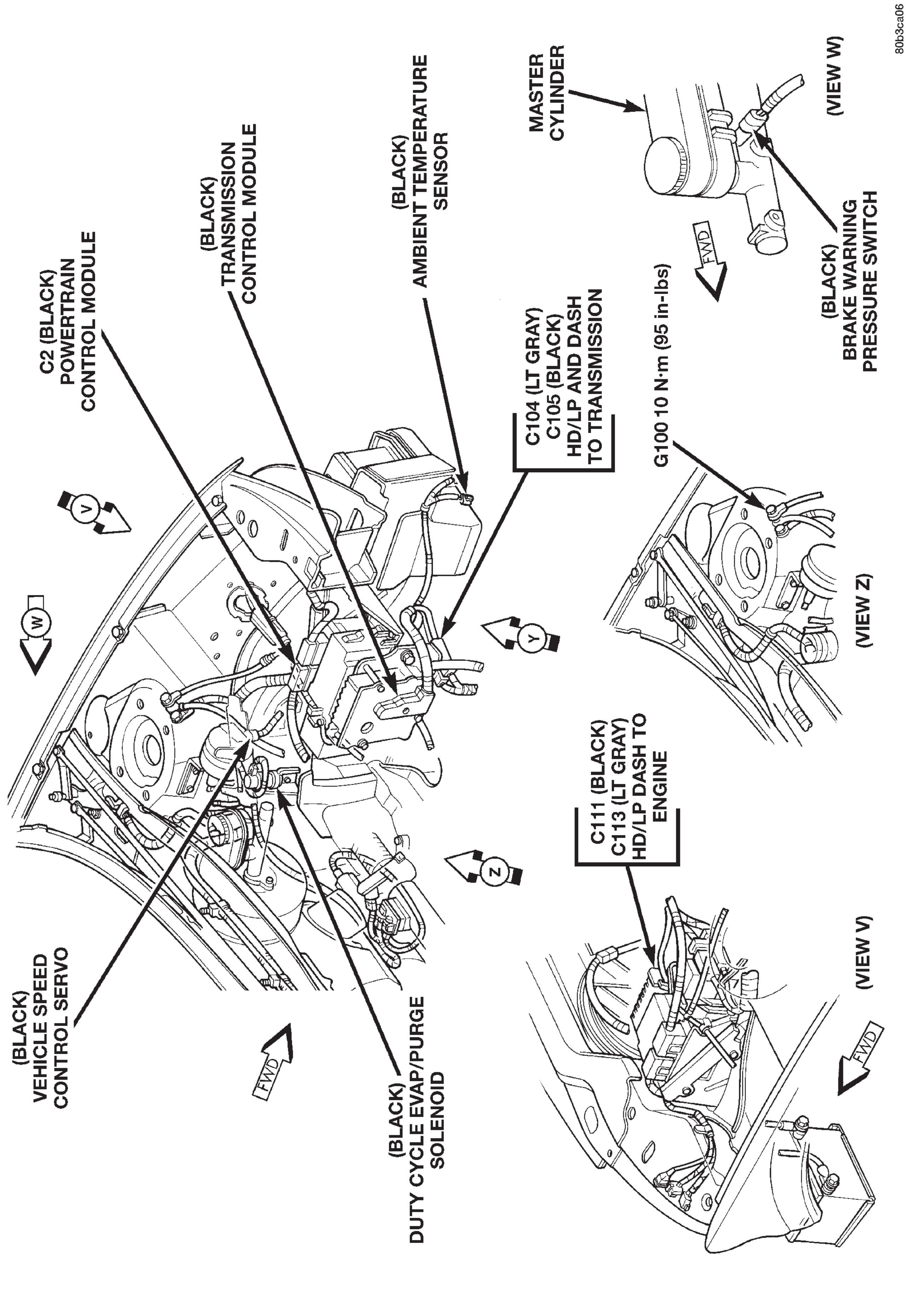


Fig. 2 Engine Compartment Connections (Left Side)

DESCRIPTION AND OPERATION (Continued)

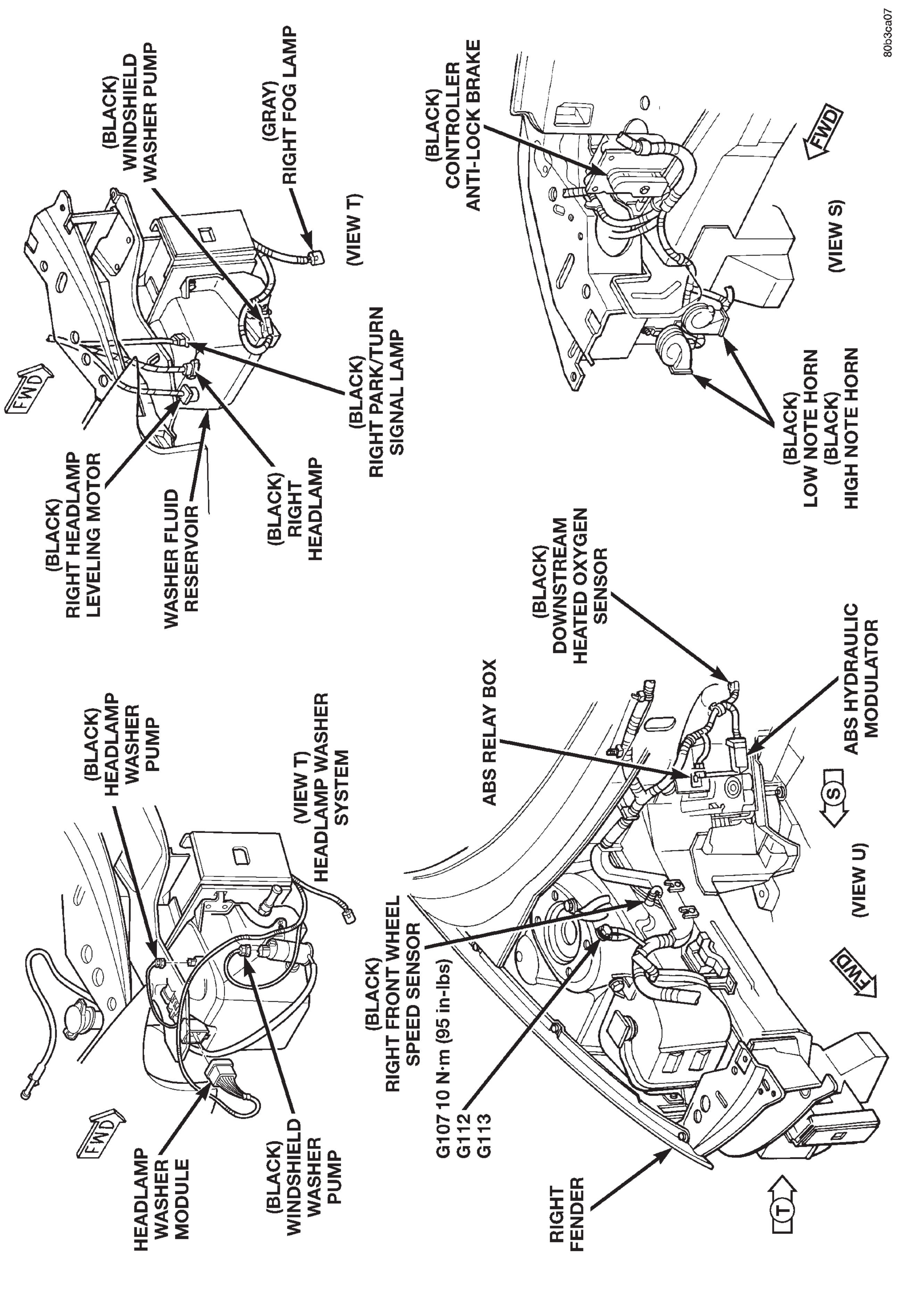


Fig. 3 Engine Compartment Connections (Right Side)

DESCRIPTION AND OPERATION (Continued)

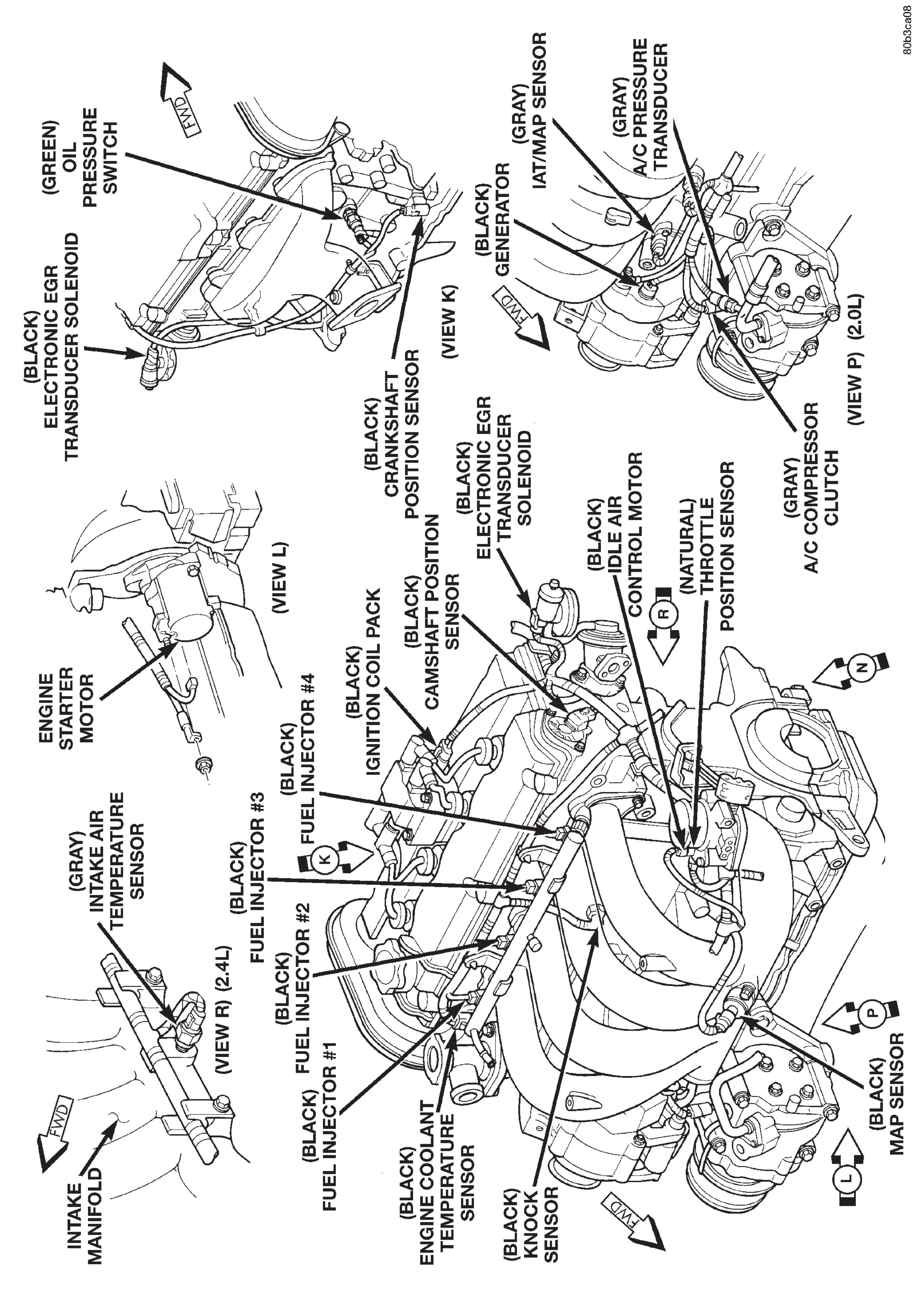


Fig. 4 Engine Connections (2.0L-2.4L)

DESCRIPTION AND OPERATION (Continued)

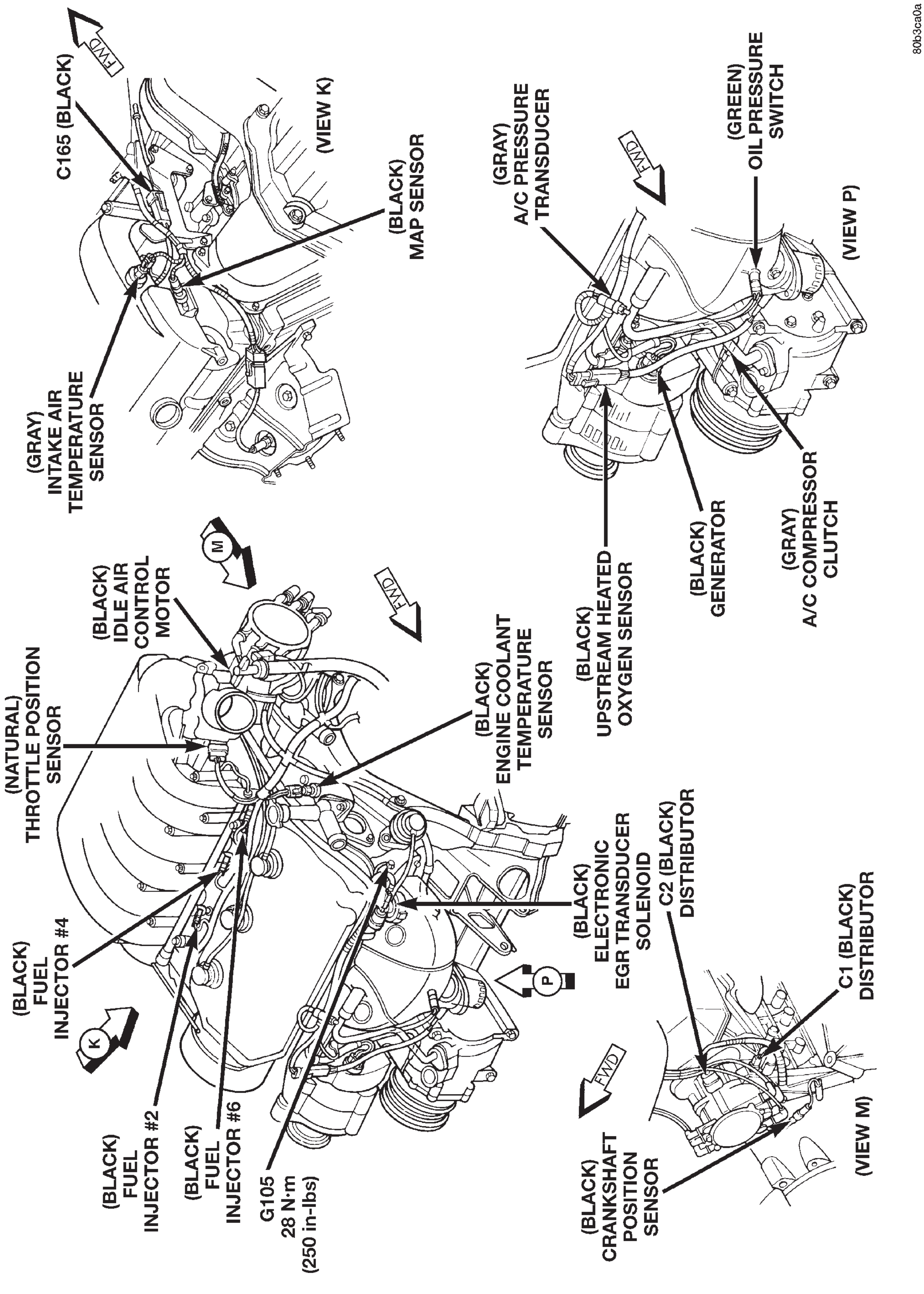


Fig. 5 Engine Connections (2.5L)

DESCRIPTION AND OPERATION (Continued)

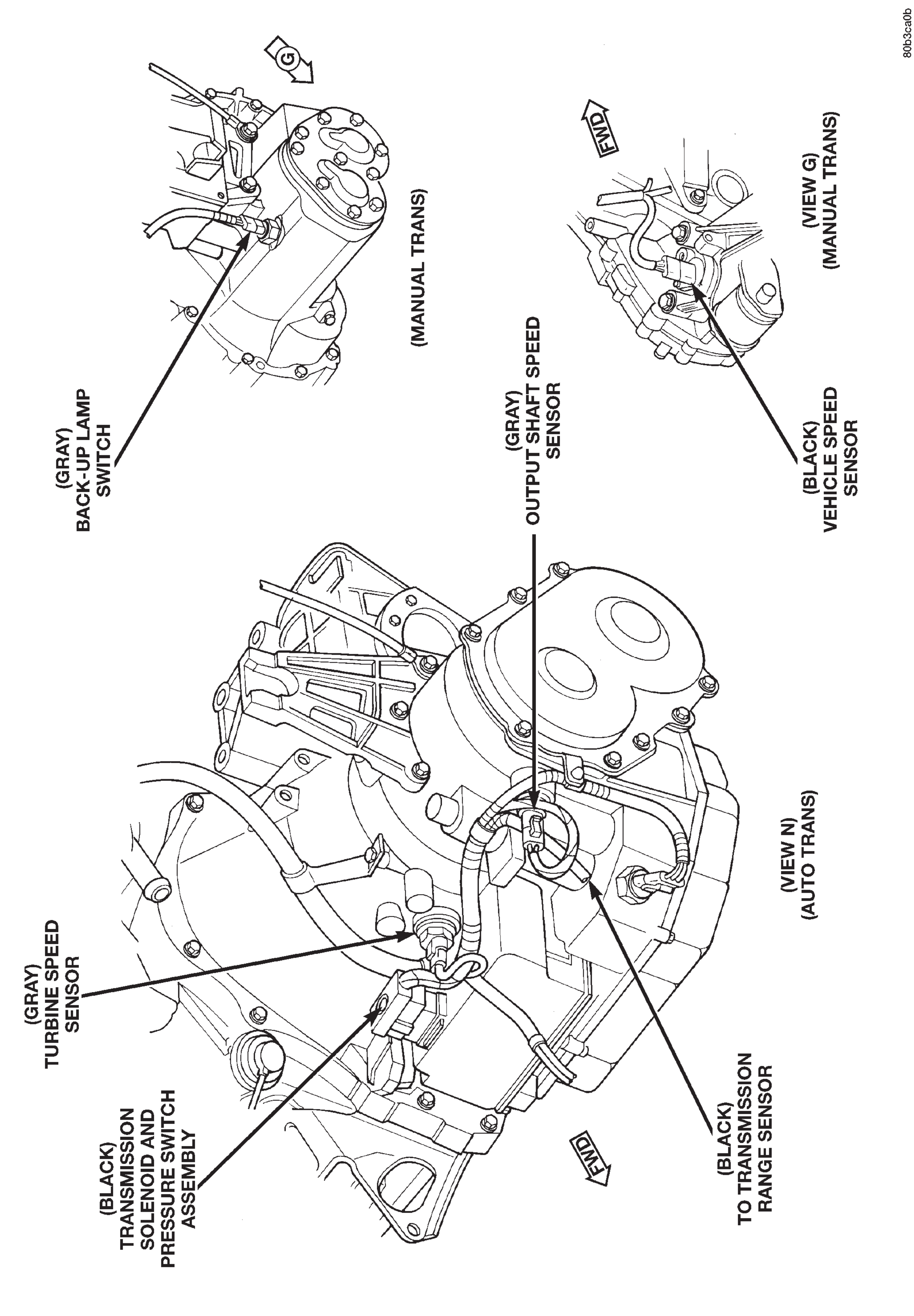


Fig. 6 Transmission Connections

DESCRIPTION AND OPERATION (Continued)

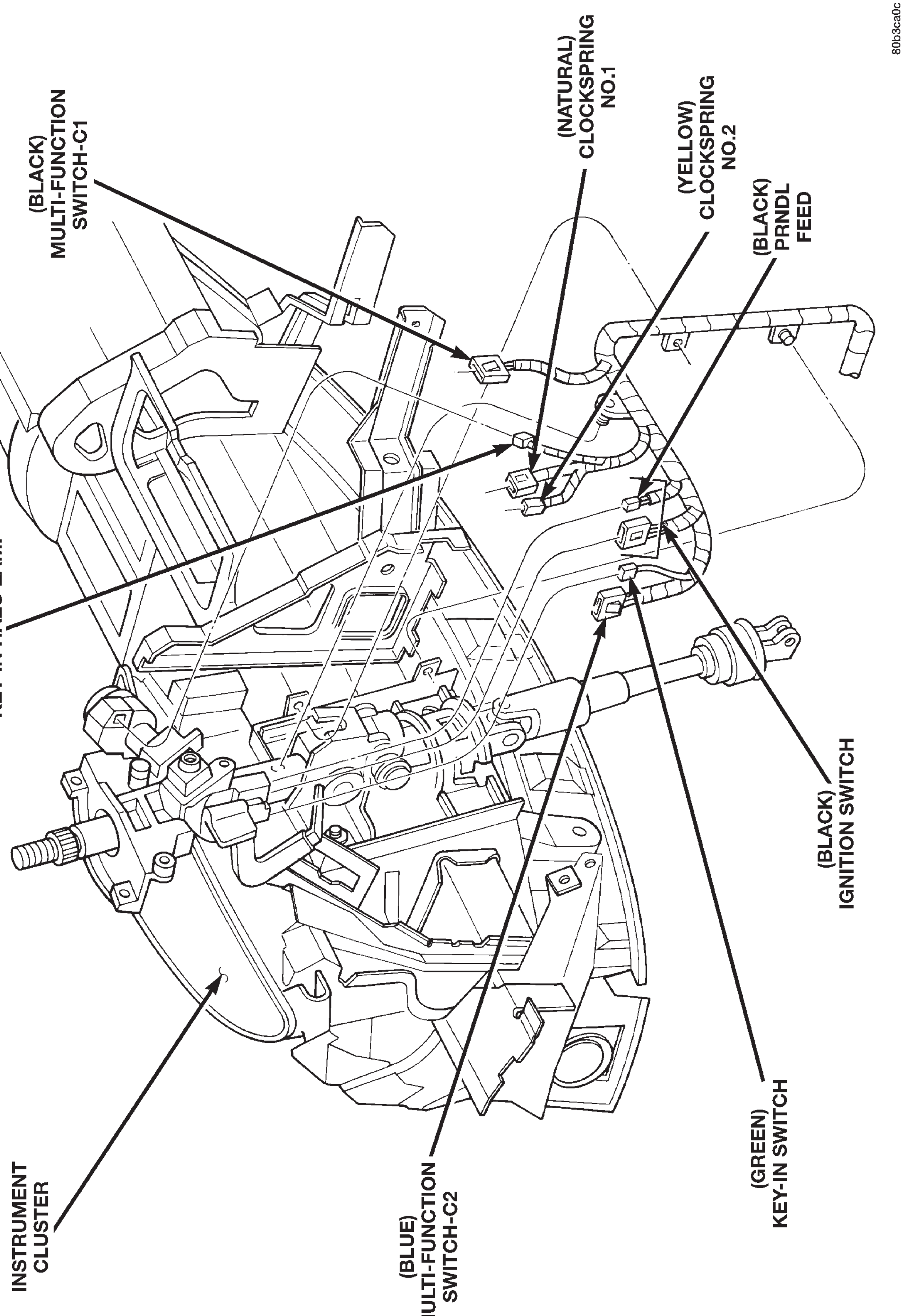


Fig. 7 Steering Column Connections

DESCRIPTION AND OPERATION (Continued)

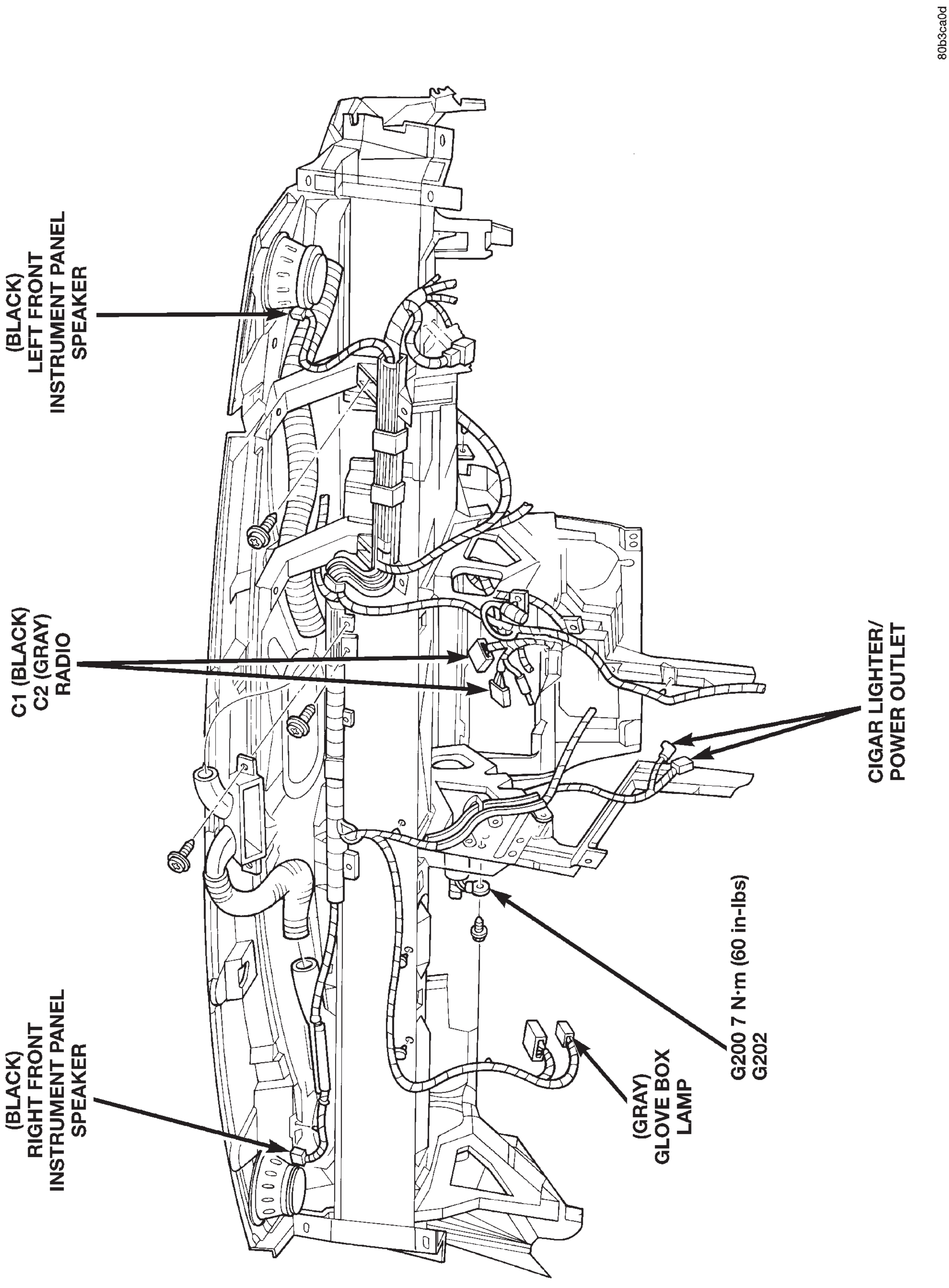


Fig. 8 Instrument Panel Connections

DESCRIPTION AND OPERATION (Continued)

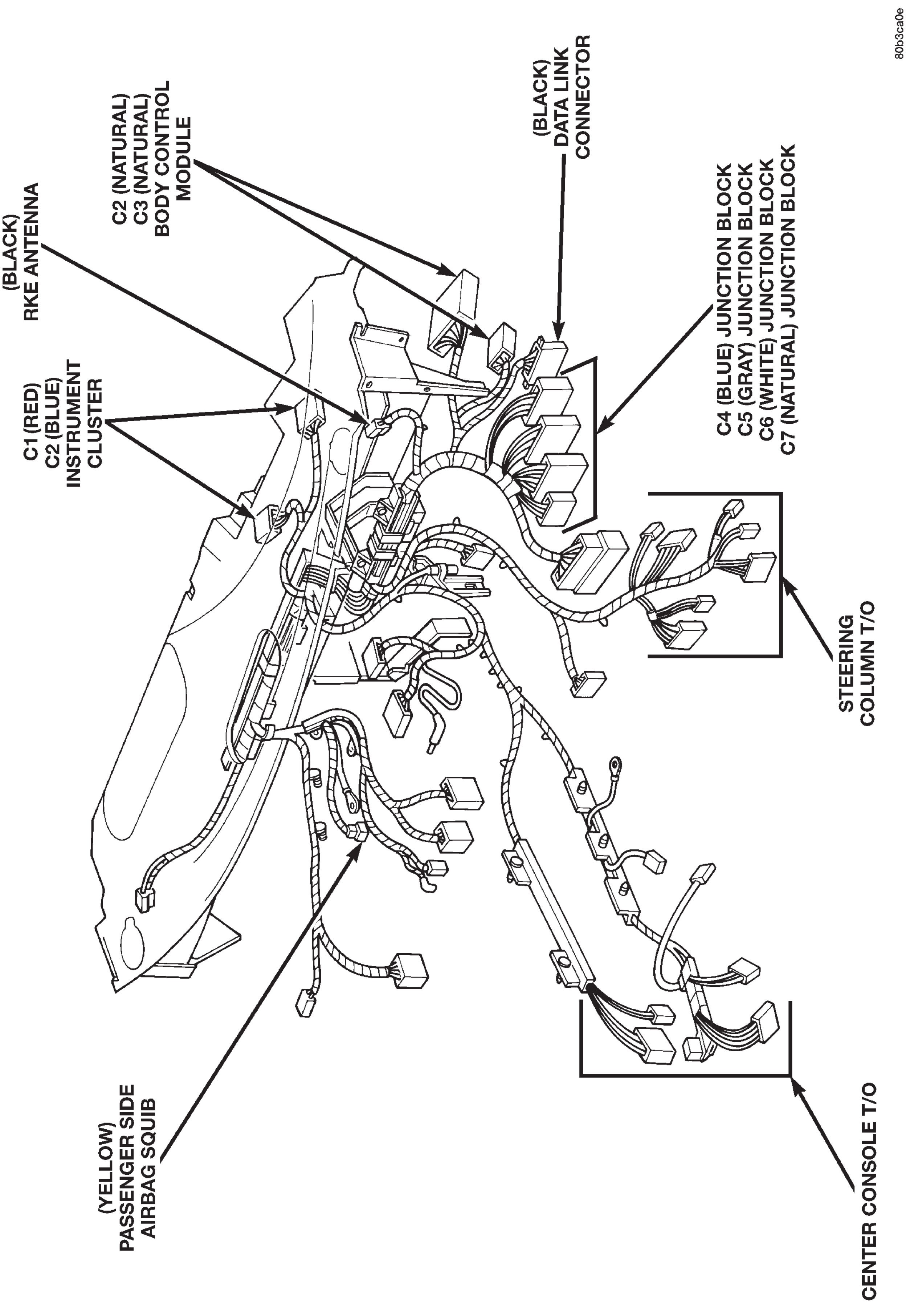


Fig. 9 Instrument Panel Connections

DESCRIPTION AND OPERATION (Continued)

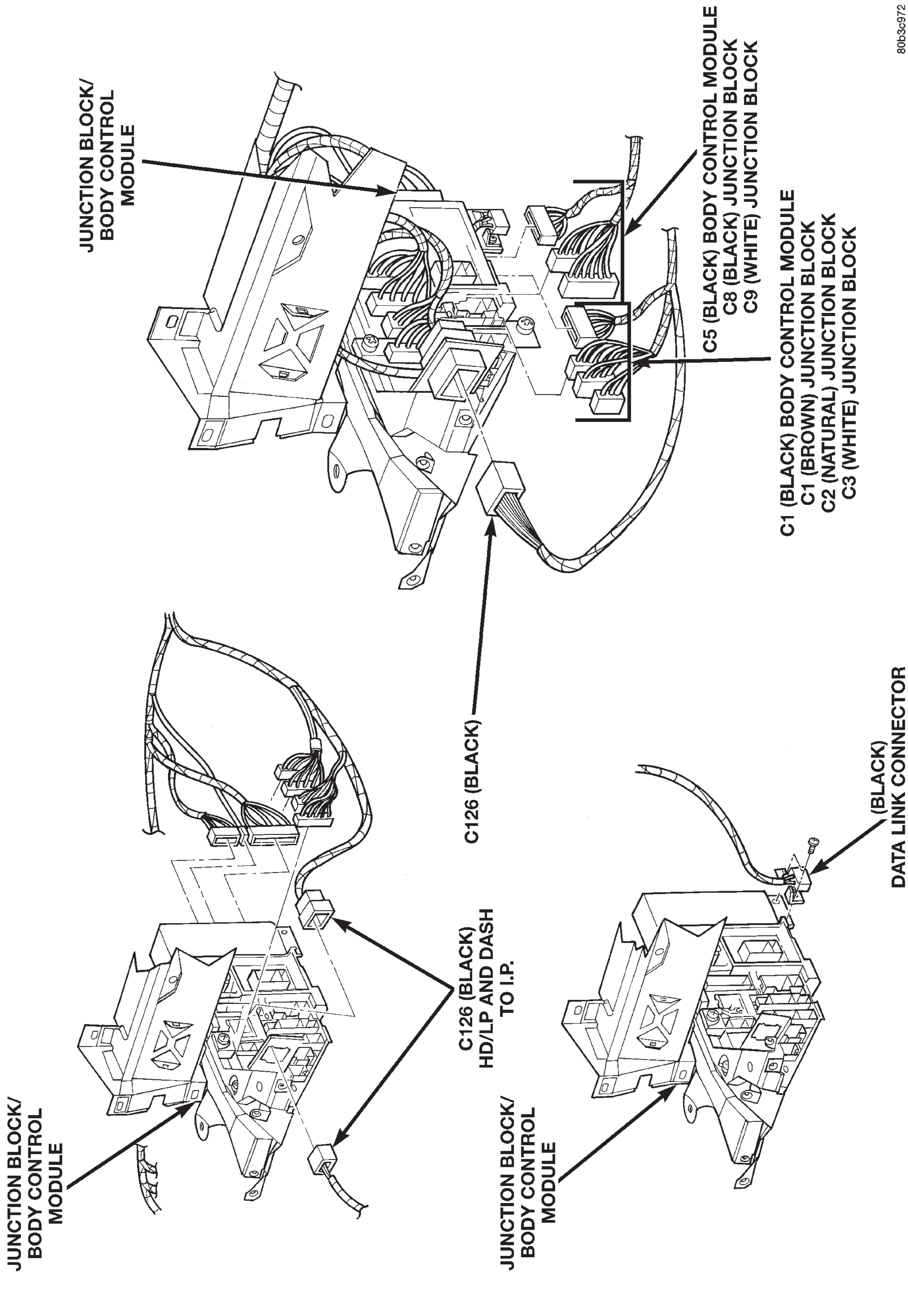


Fig. 10 Junction Block Connections

DESCRIPTION AND OPERATION (Continued)

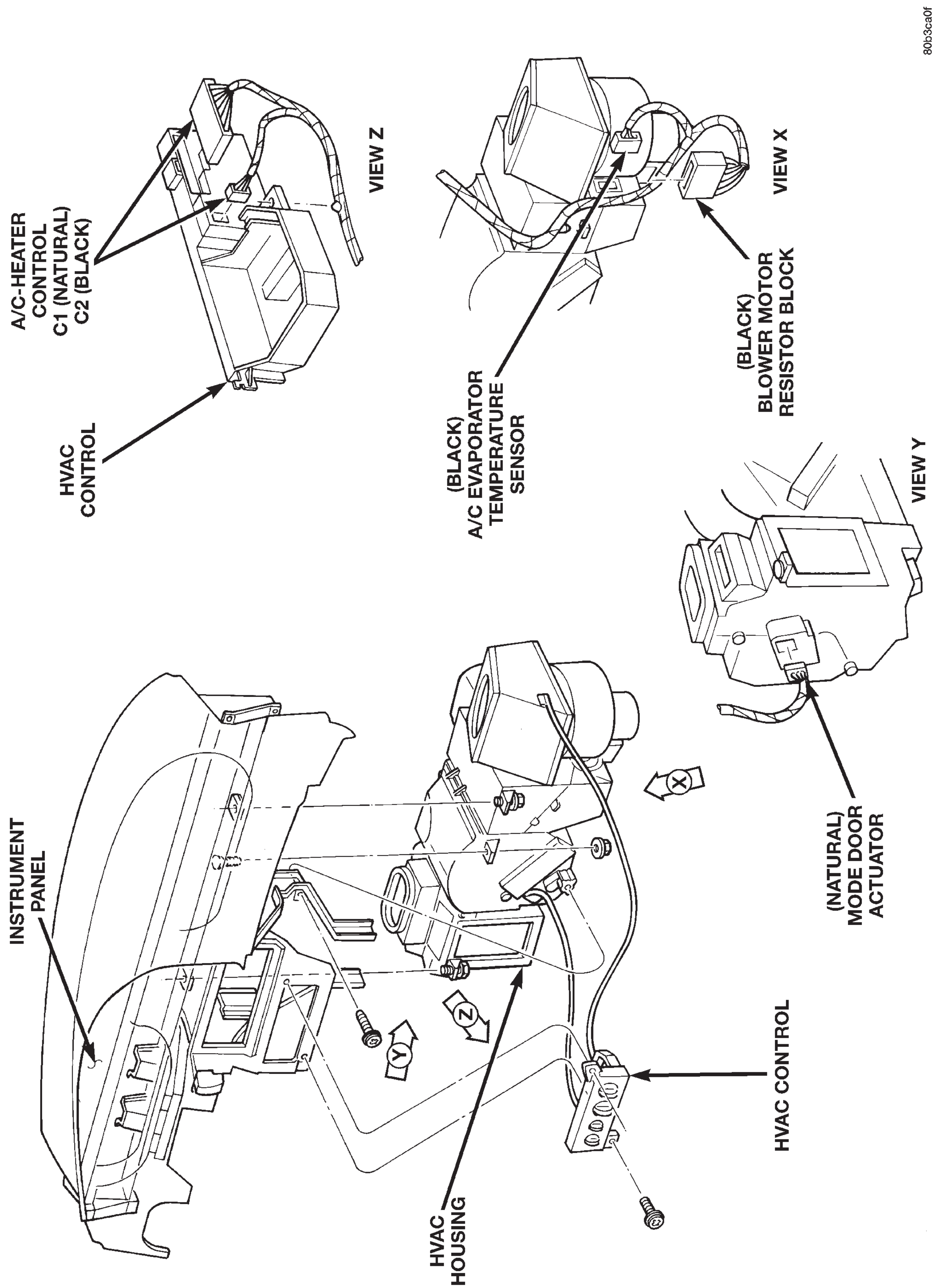


Fig. 11 HVAC Connections

DESCRIPTION AND OPERATION (Continued)

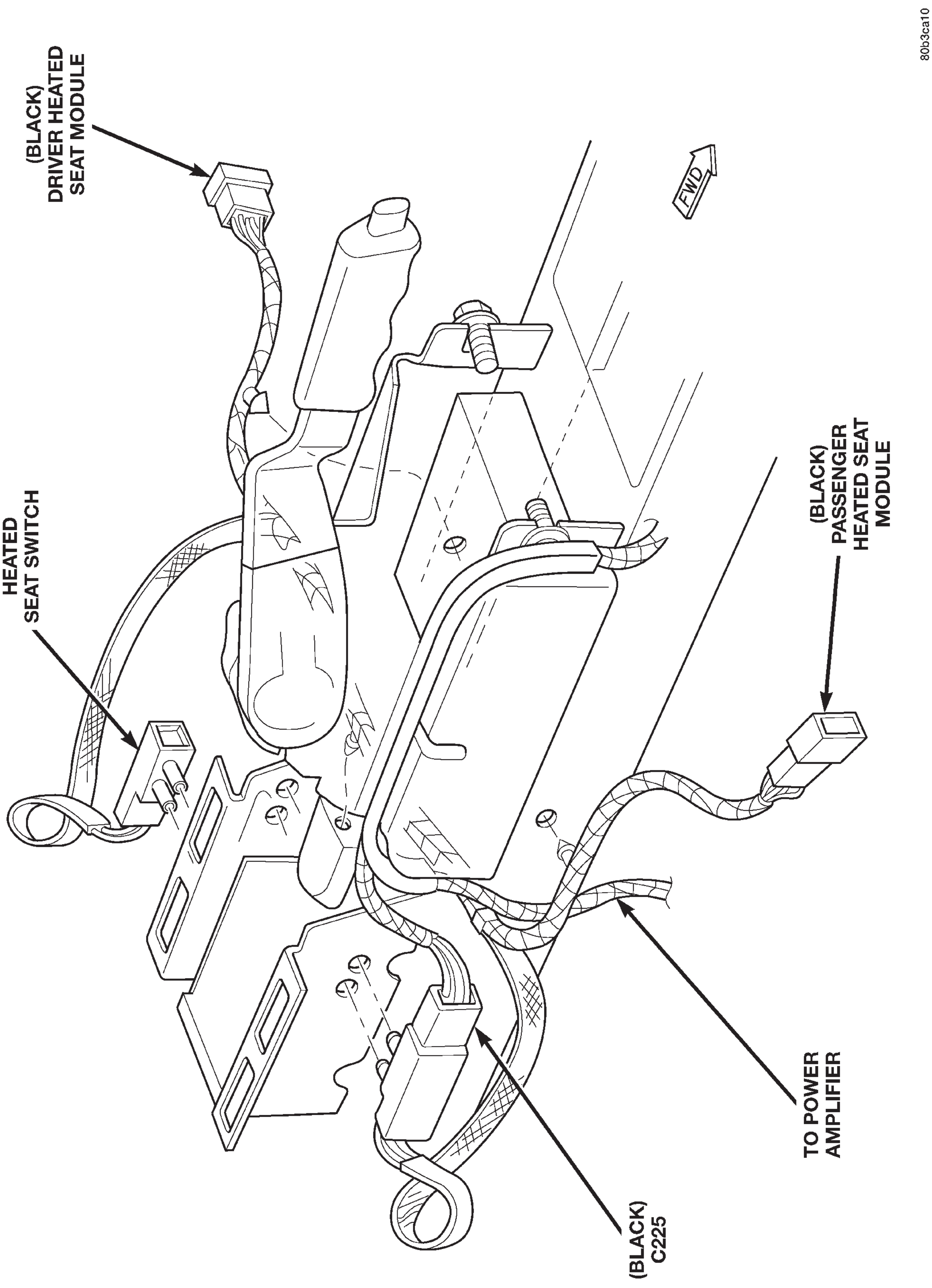


Fig. 12 Heated Seat Connections

DESCRIPTION AND OPERATION (Continued)

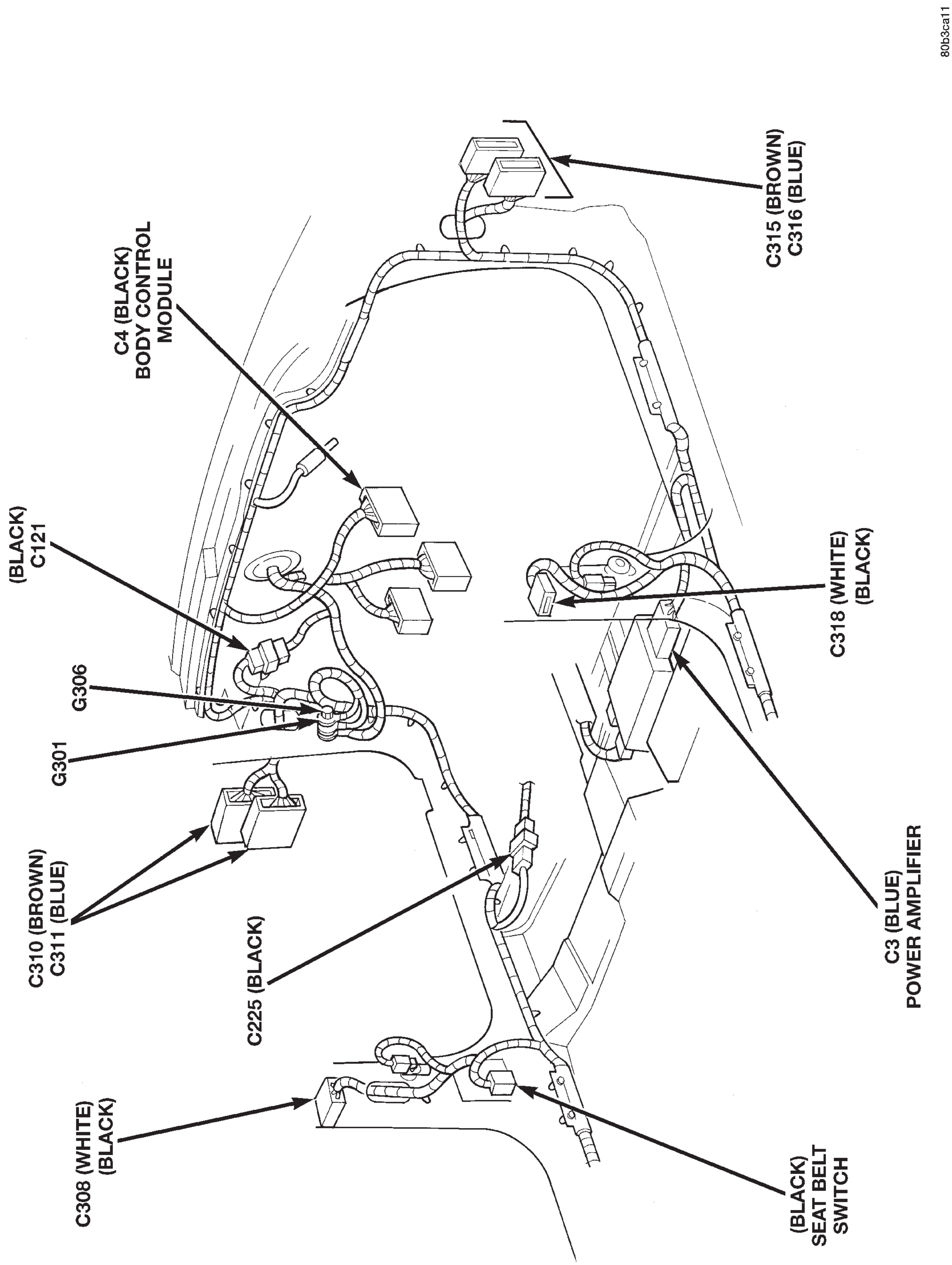


Fig. 13 Body Connections

DESCRIPTION AND OPERATION (Continued)

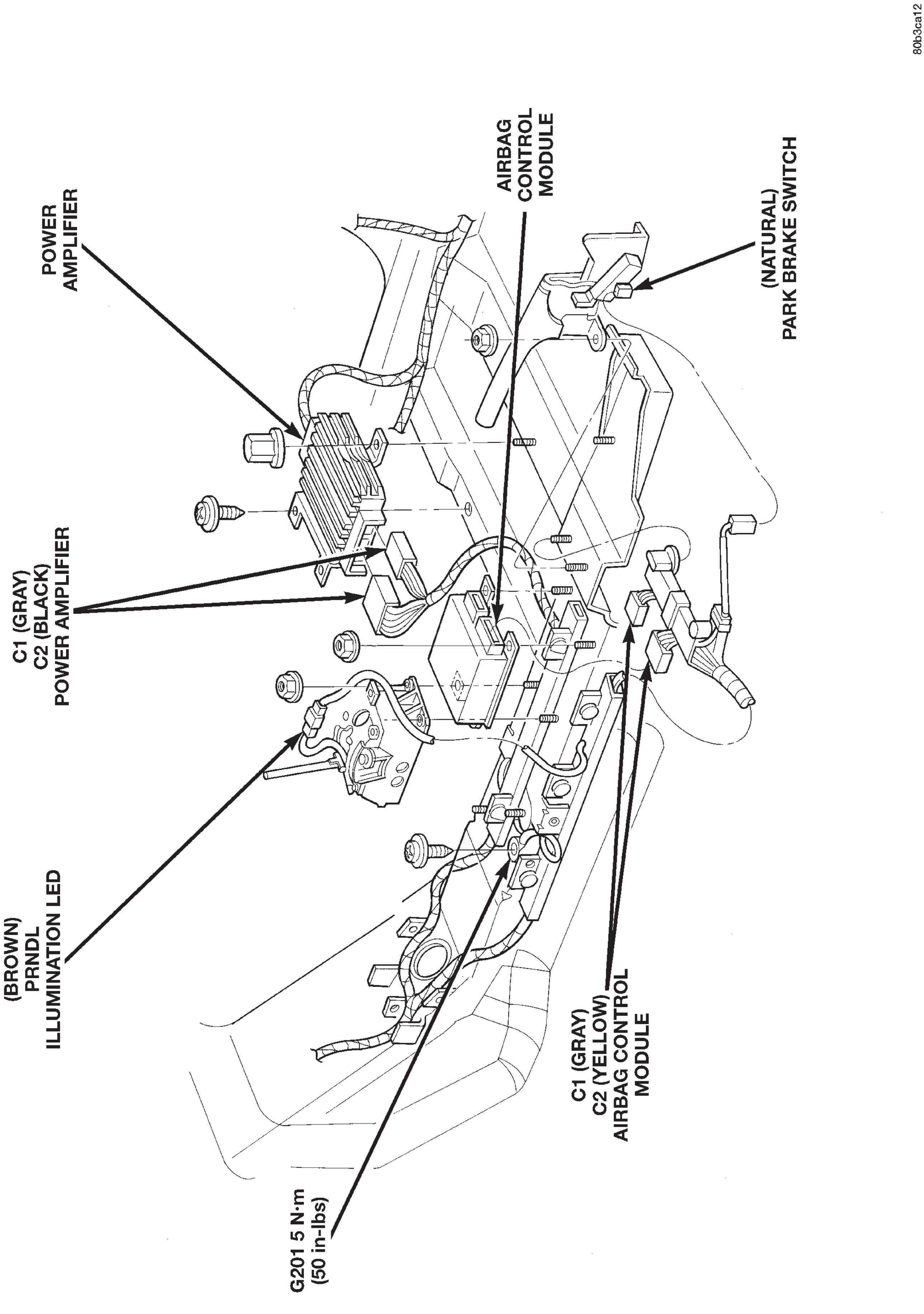


Fig. 14 Body Connections

DESCRIPTION AND OPERATION (Continued)

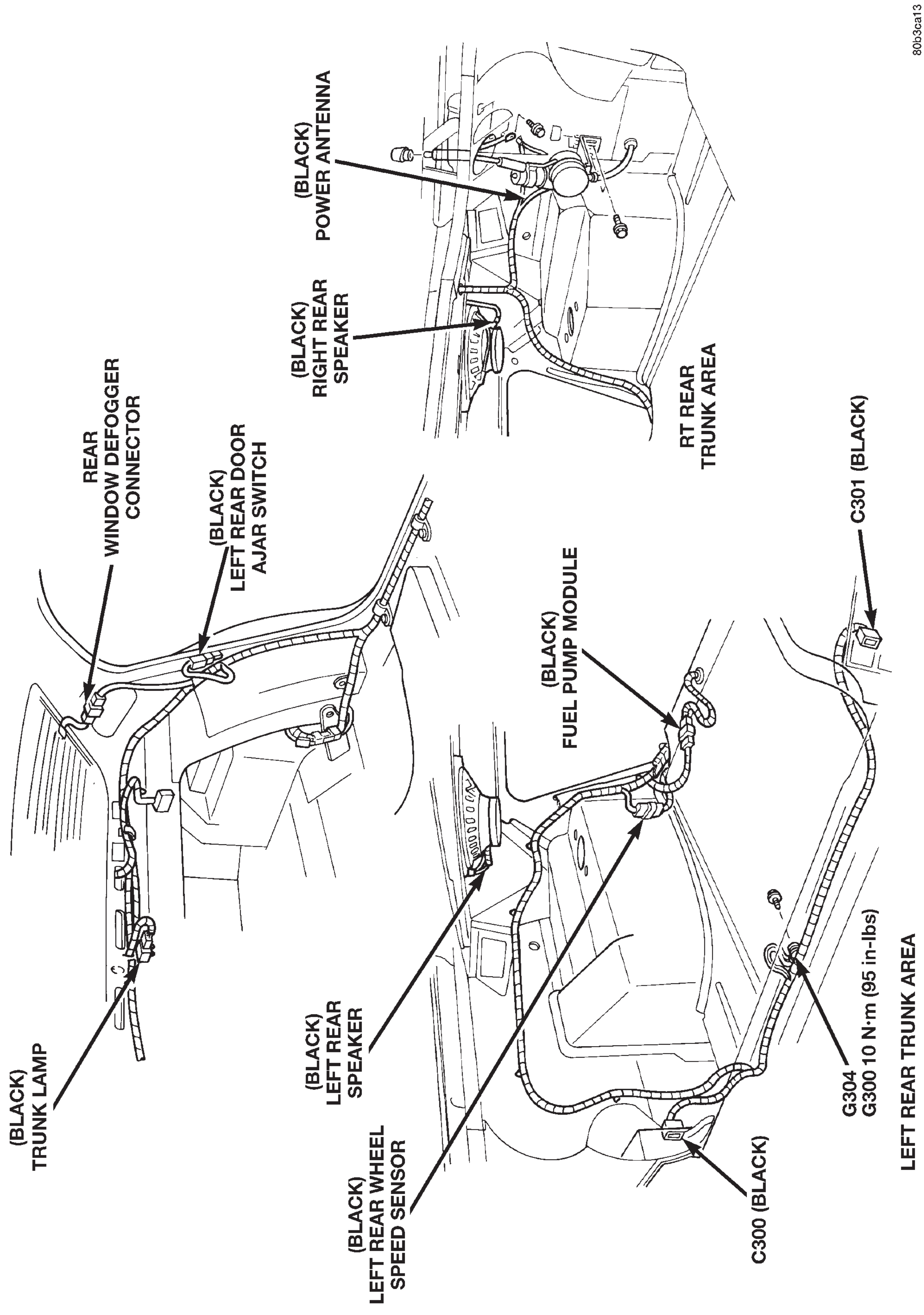


Fig. 15 Body Connections

DESCRIPTION AND OPERATION (Continued)

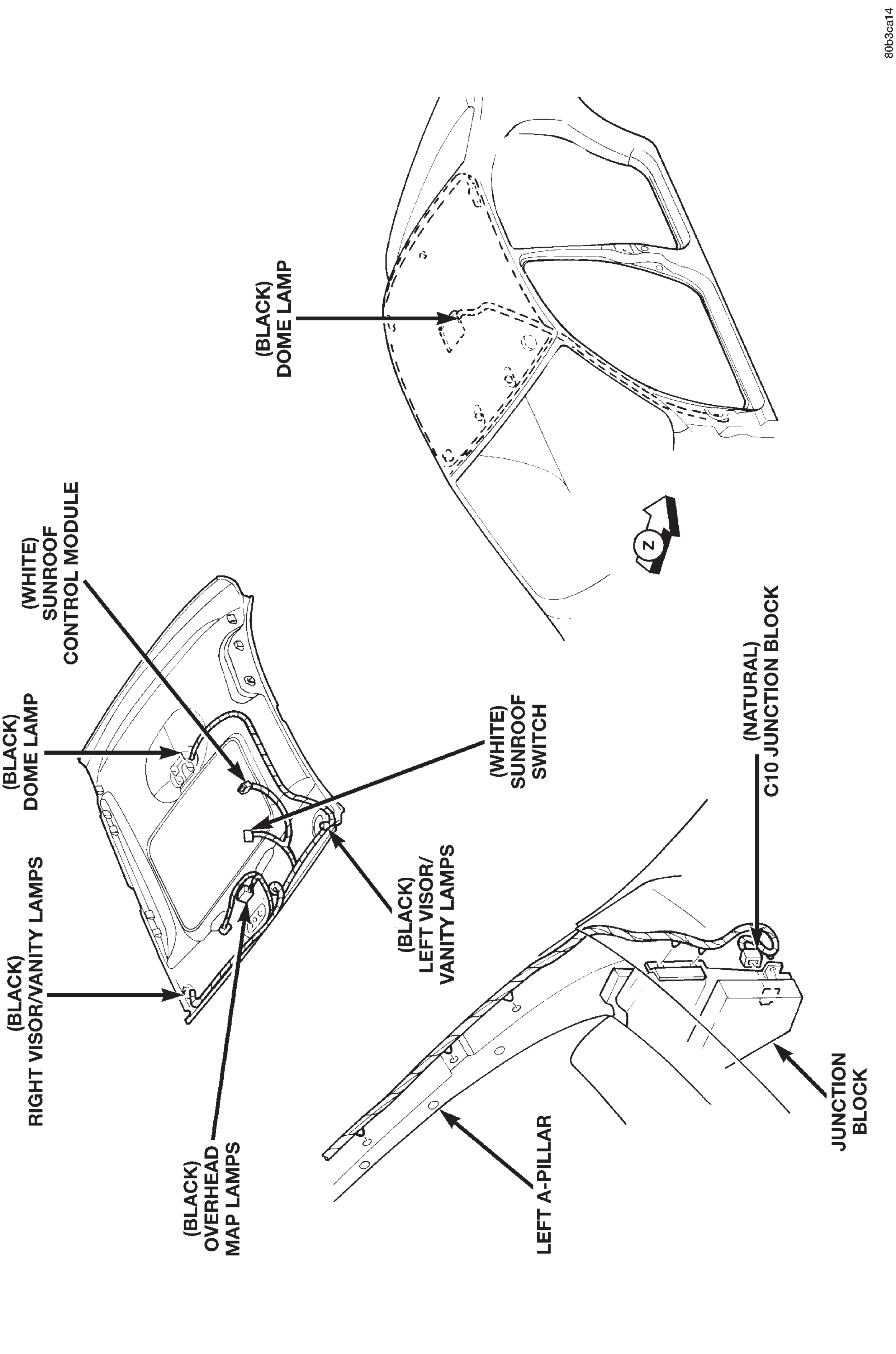


Fig. 16 Roof Connections

DESCRIPTION AND OPERATION (Continued)

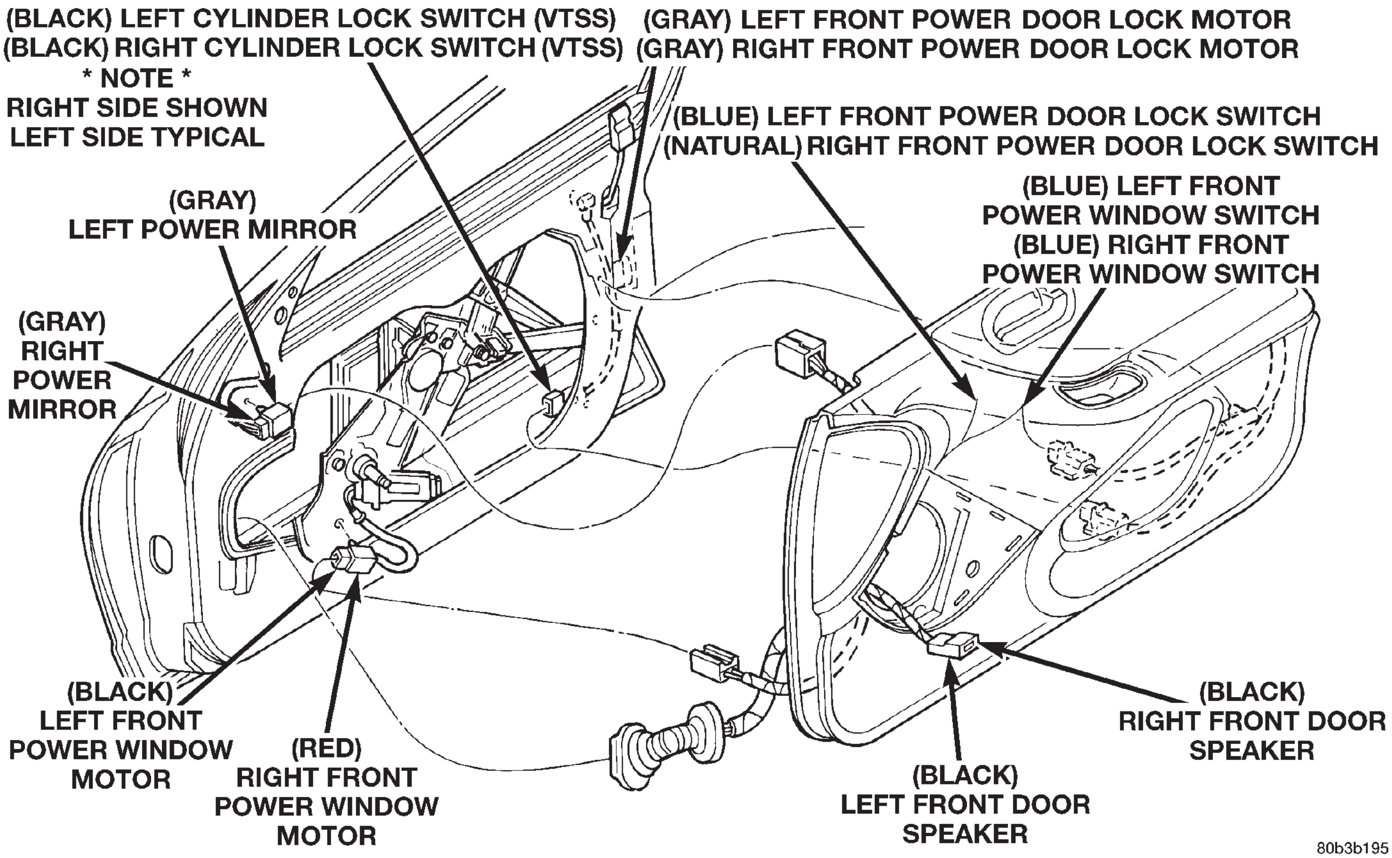


Fig. 17 Door Connections (Front)

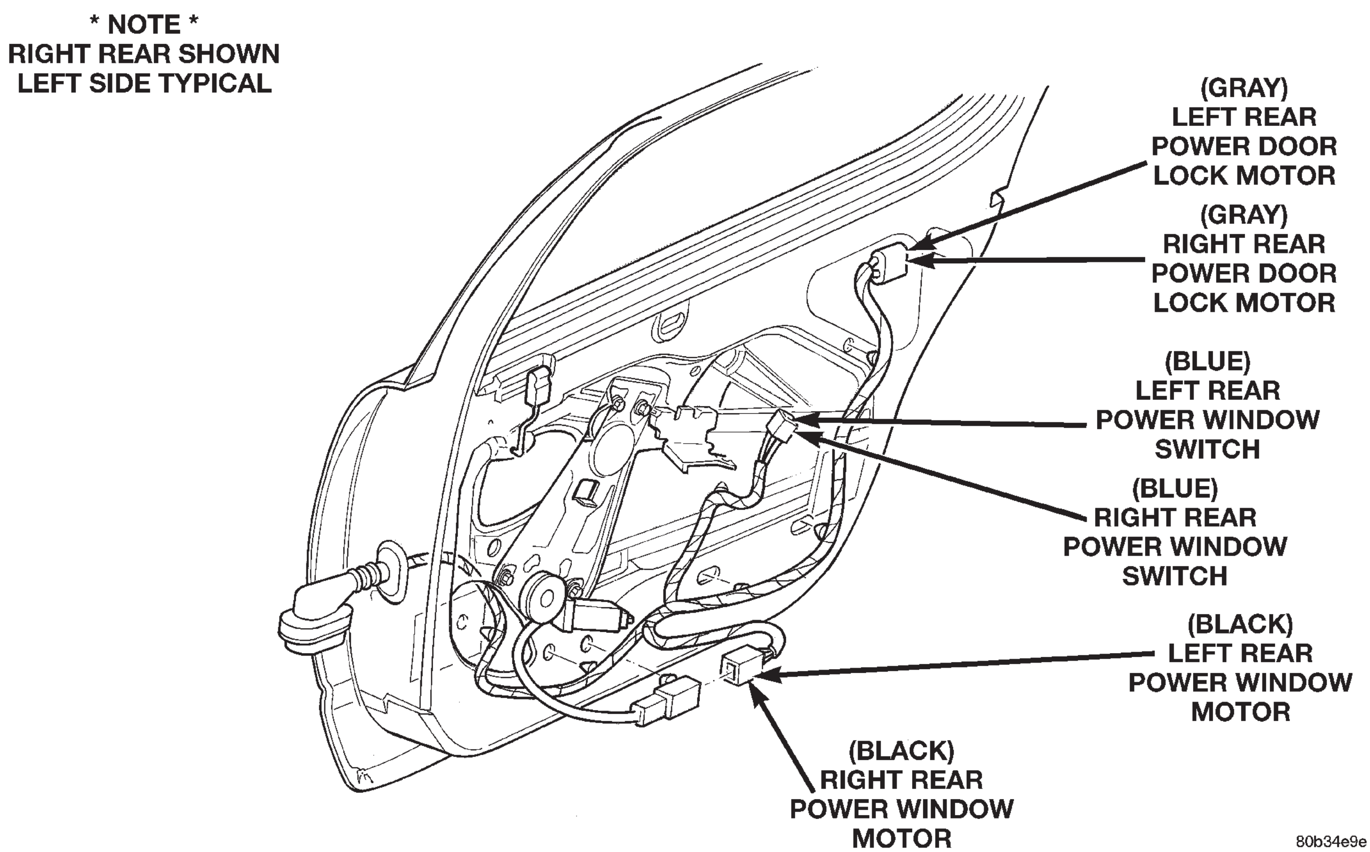


Fig. 18 Door Connections (Rear)

DESCRIPTION AND OPERATION (Continued)

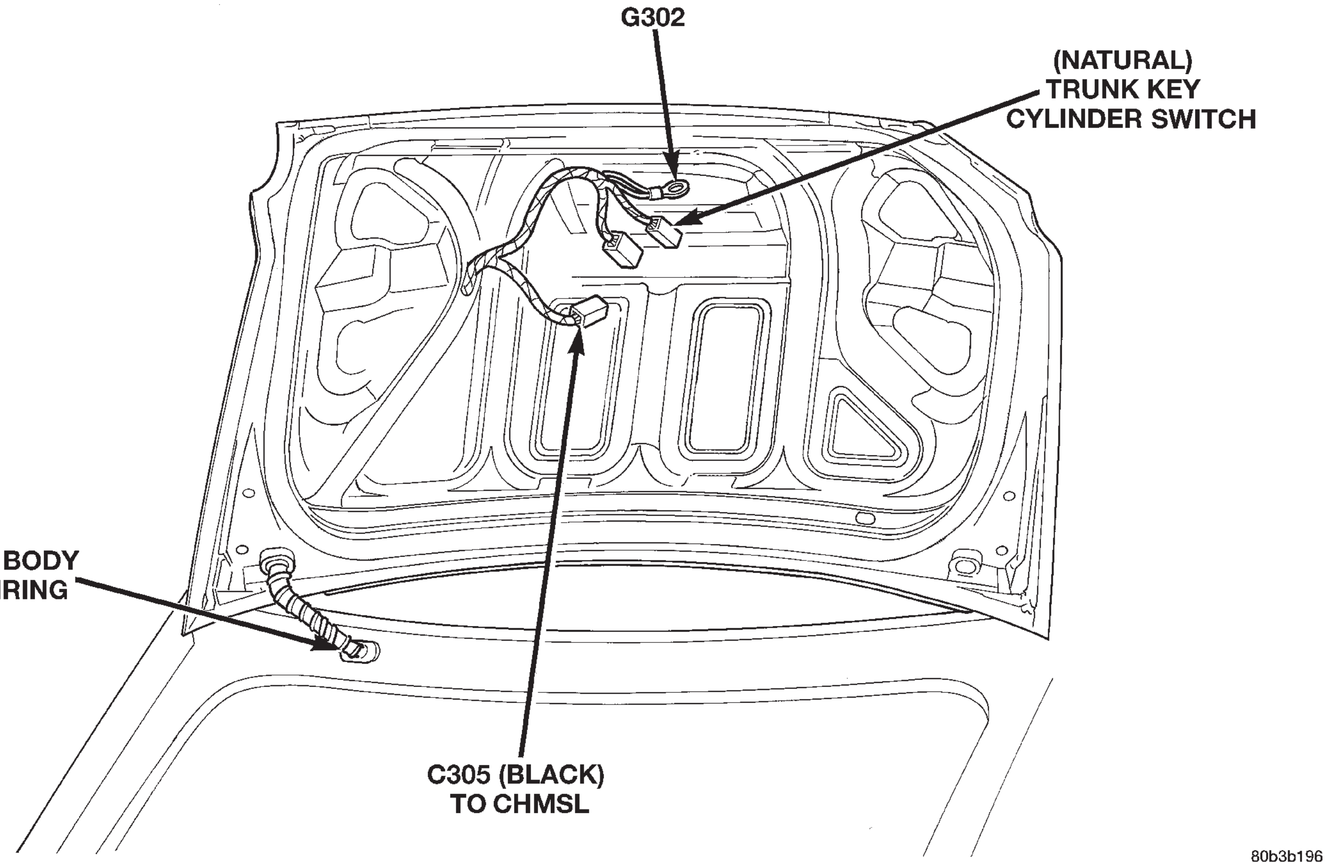


Fig. 19 Deck Lid Connections

8W-95 SPLICE LOCATIONS

INDEX

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of the splices in this vehicle. A splice index is provided. Use the wiring diagrams in each section for splice number identification. Refer to the index for the proper splice number.

SPLICE LOCATIONS

For splices that are not shown in the figures in this section a N/S is plcaed in the Fig. column.

Splice Number	Location	Fig.
S100	In T/O for TCM	1
S101	Near T/O for Grounds G102, G110, G111	1
S102	Internal to the PDC	1
S103	Internal to the PDC	1
S104	Internal to the PDC	1
S105	Internal to the PDC	1
S106	Internal to the PDC	1
S109	Near T/O for Grounds G102,G110,G111	1
S110	Internal to the PDC	1
S111	Right Strut Tower	3
S113	In T/O for Generator Feed Terminal	N/S
S114 (2.0L, 2.4L)	In Injector T/O	5
S114 (2.5L)	Between Inj #2 and #4	6
S115 (2.0L)	Near T/O for MAP/IAT Sensor	5
S115 (2.4L)	Near T/O for Manifold Absolute Pressure Sensor	5
S115 (2.5L)	Near T/O for A/C Pressure Transducer	6
S116 (2.0L)	Near T/O for MAP/IAT Sensor	5
S116 (2.4L)	Near T/O for Intake Air Temperature Sensor	5
S116 (2.5L)	Near Inj #6 T/O	6

Splice Number	Location	Fig.
S117 (2.0L, 2.4L)	Near T/O for Cam Sensor	5
S117 (2.5L)	Near IAC Motor T/O	6
S118 (2.0L, 2.4L)	Near Cam Sensor T/O	5
S118 (2.5L)	Near T/O for ECT Sensor	6
S120	Near T/O for PCM	2
S121	In T/O for PCM	2
S123 (2.5L)	On Fuel Rail Harness	N/S
S124 (2.0L, 2.4L)	Near T/O for Nosie Suppressor	5
S124 (2.5L)	Near Distributor T/O	6
S125	Near T/O for Turbine Speed Sensor	4
S129	Near BCM T/O	N/S
S130	Near T/O for PCM Connector	1
S132	Near T/O for BCM	N/S
S133 (2.0L, 2.4L)	In Ignition Coil T/O	5
S140	Near T/O for Horn High Note Horn and Low Note Horn	N/S
S141	Near T/O for Duty Cycle Evap Purge Solenoid	N/S
S142	Near T/O for Stop Lamp Switch	N/S
S300	Left C-Pillar	7
S301	Near Trunk Latch	8

DESCRIPTION AND OPERATION (Continued)

Splice Number	Location	Fig.
S302	Between LT and RT Visor Lamps	7
S303	Between LT and RT Visor Lamps	7
S304	Near T/O for Left Back-up Lamp	N/S
S305	Near T/O for Right Back-up Lamp	N/S
S307	Near T/O for Left Visor/ Vanity Lamps	7
S310	In T/O for Passenger Heated Seat Module	N/S
S311	In T/O for Passenger Heated Seat Module	N/S

Splice Number	Location	Fig.
S312	Near T/O for Junction Block Connectors	N/S
S400	Near Left Door Speaker	9
S401	Near Right Door Lock SW	9
S402	Near T/O for LT Door Speaker	9
S410	Near Left Rear Fog Lamp T/O	N/S
S411	Near Left Rear Fog Lamp T/O	N/S
S412	Near Left License Lamp T/O	N/S

DESCRIPTION AND OPERATION (Continued)

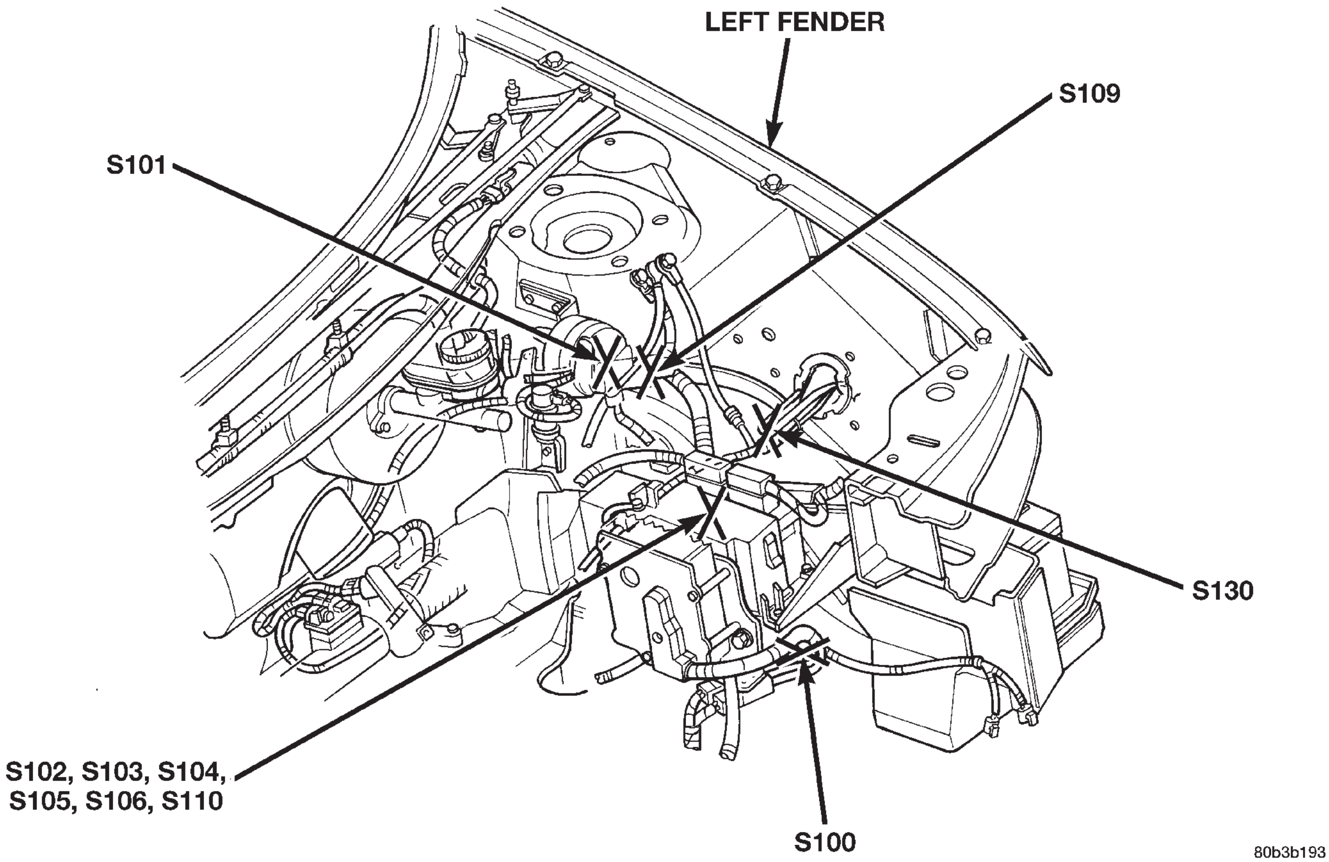


Fig. 1 Engine Compartment Splices

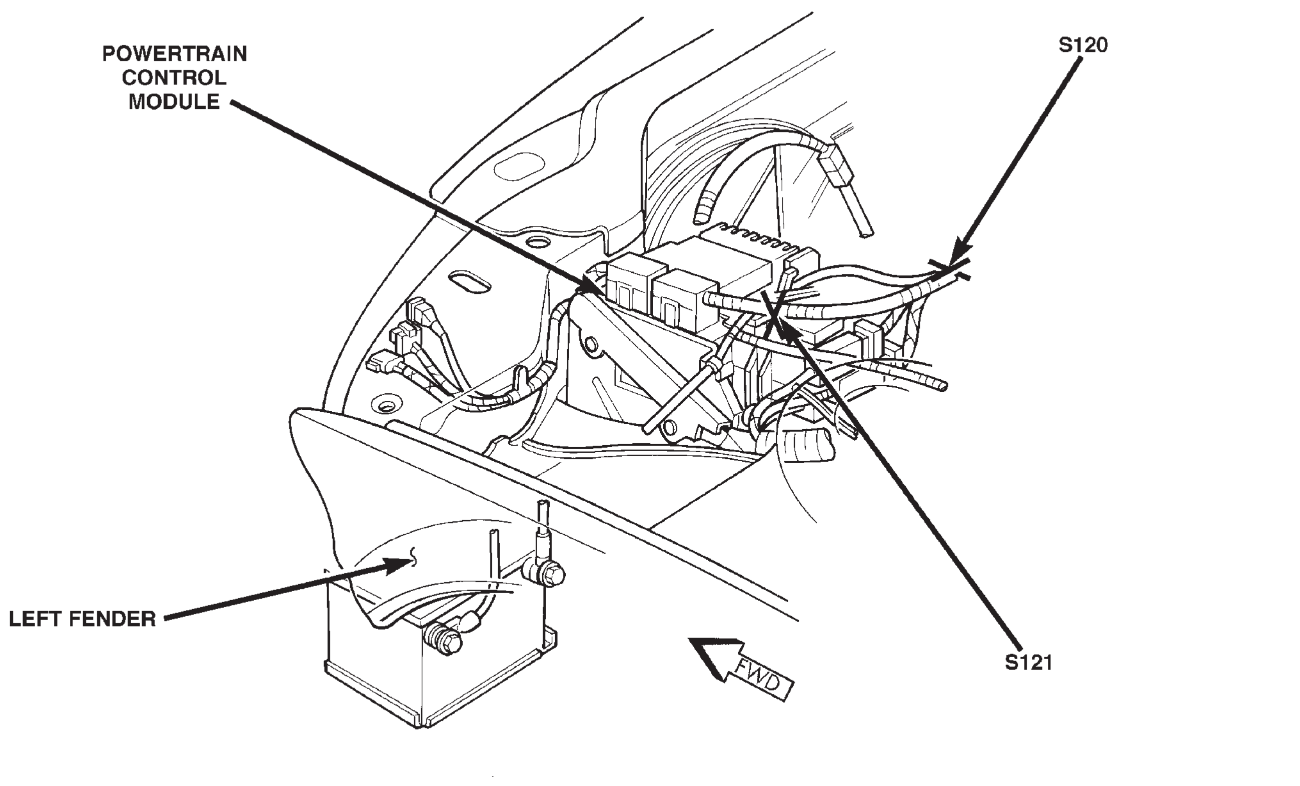


Fig. 2 Engine Compartment Splices

DESCRIPTION AND OPERATION (Continued)

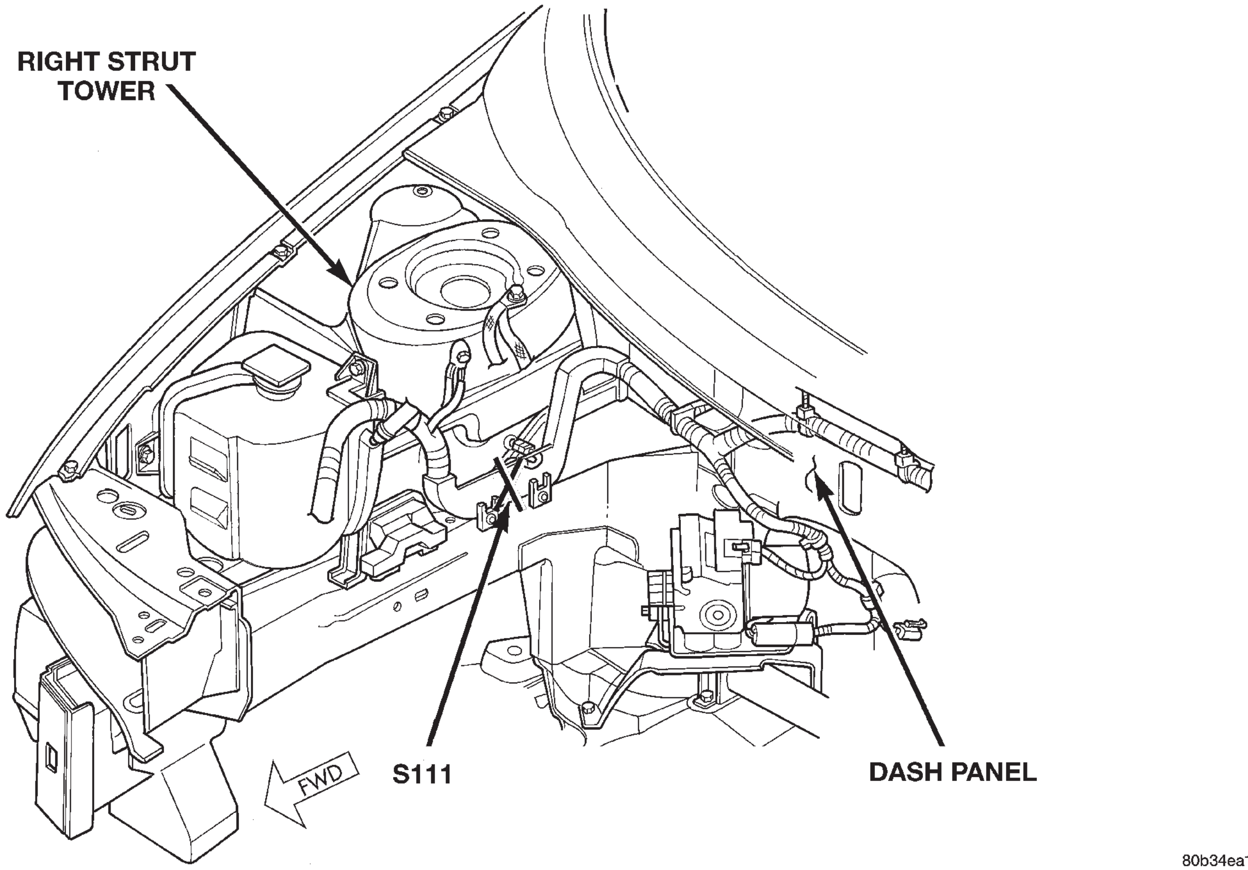


Fig. 3 Engine Compartment Splices

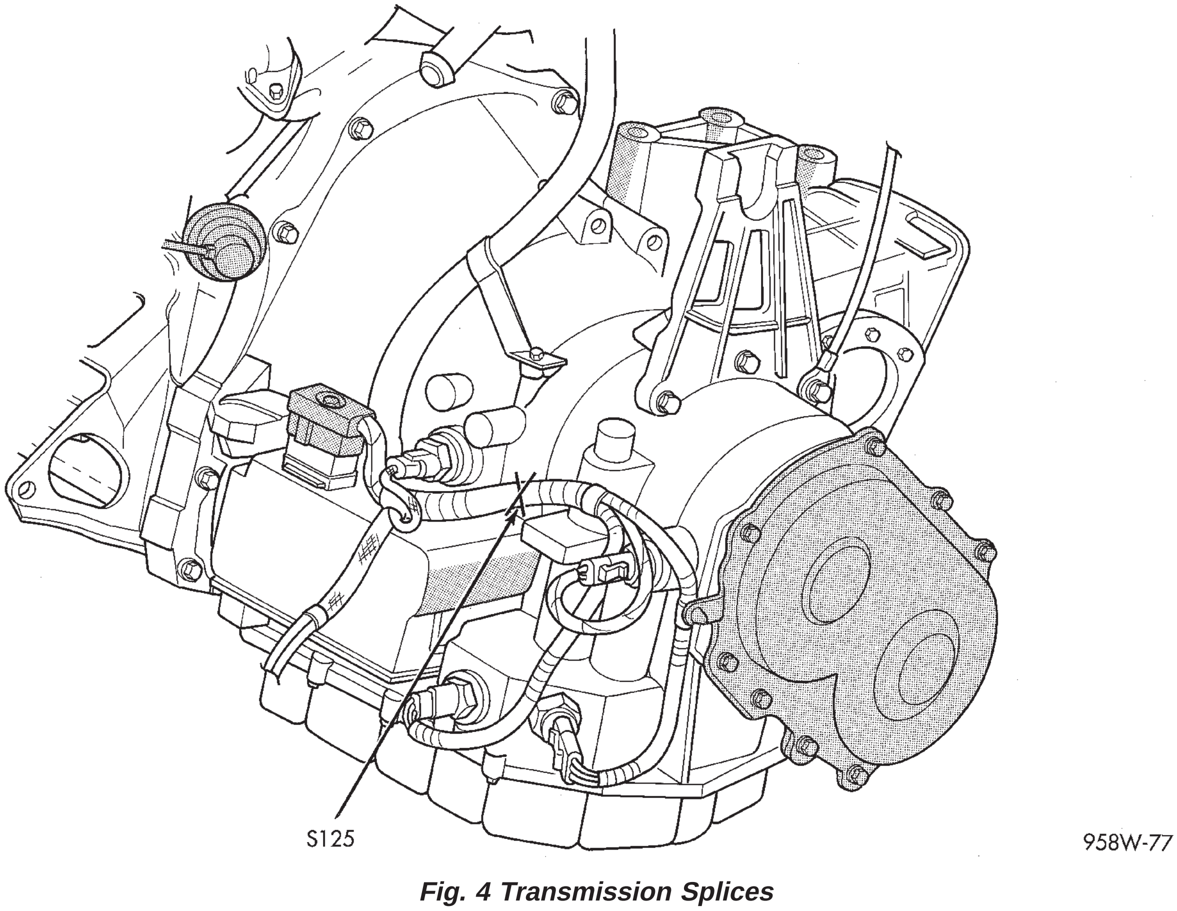


Fig. 4 Transmission Splices

DESCRIPTION AND OPERATION (Continued)

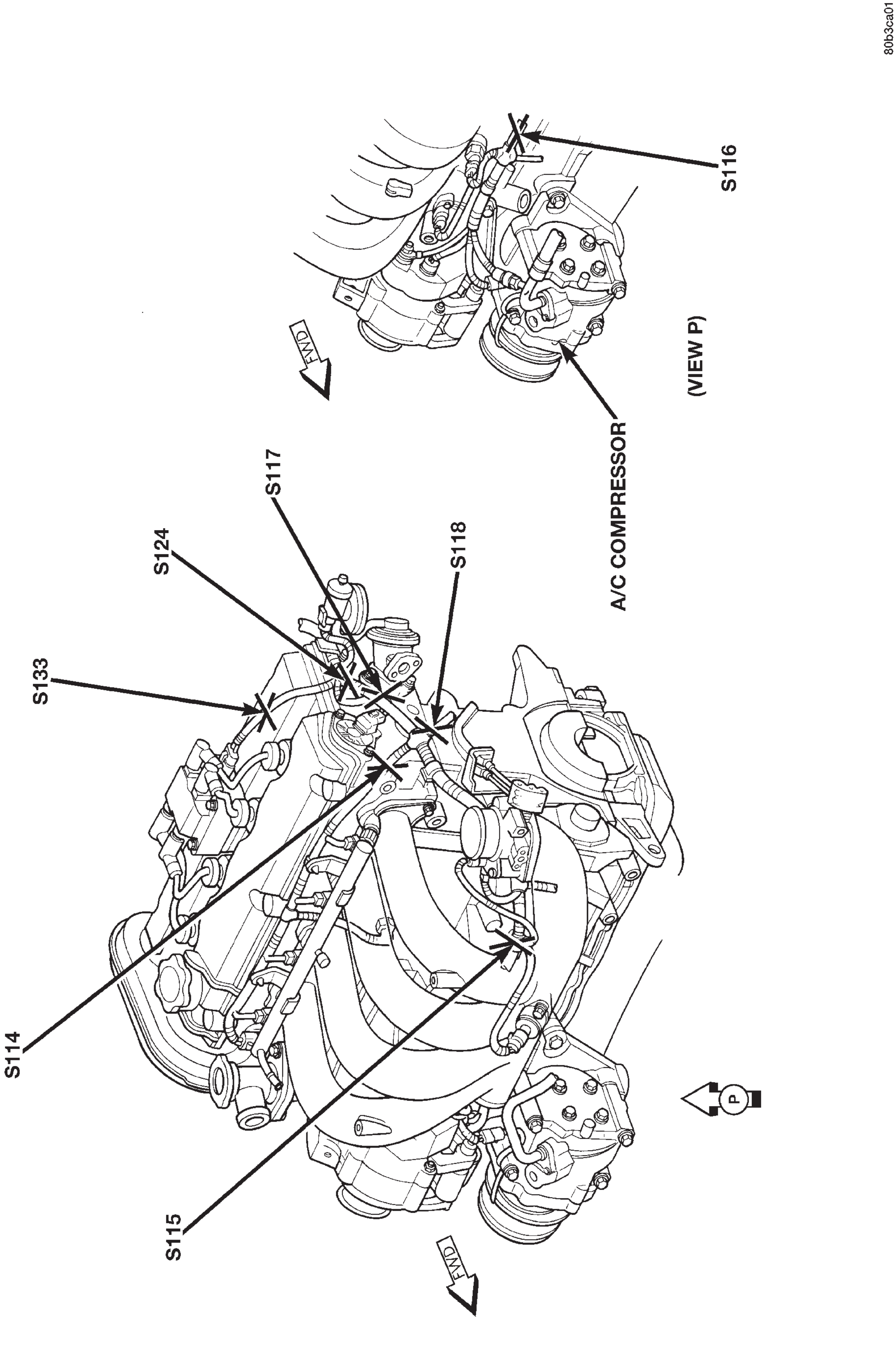


Fig. 5 Engine Splices 2.0L, 2.4L

DESCRIPTION AND OPERATION (Continued)

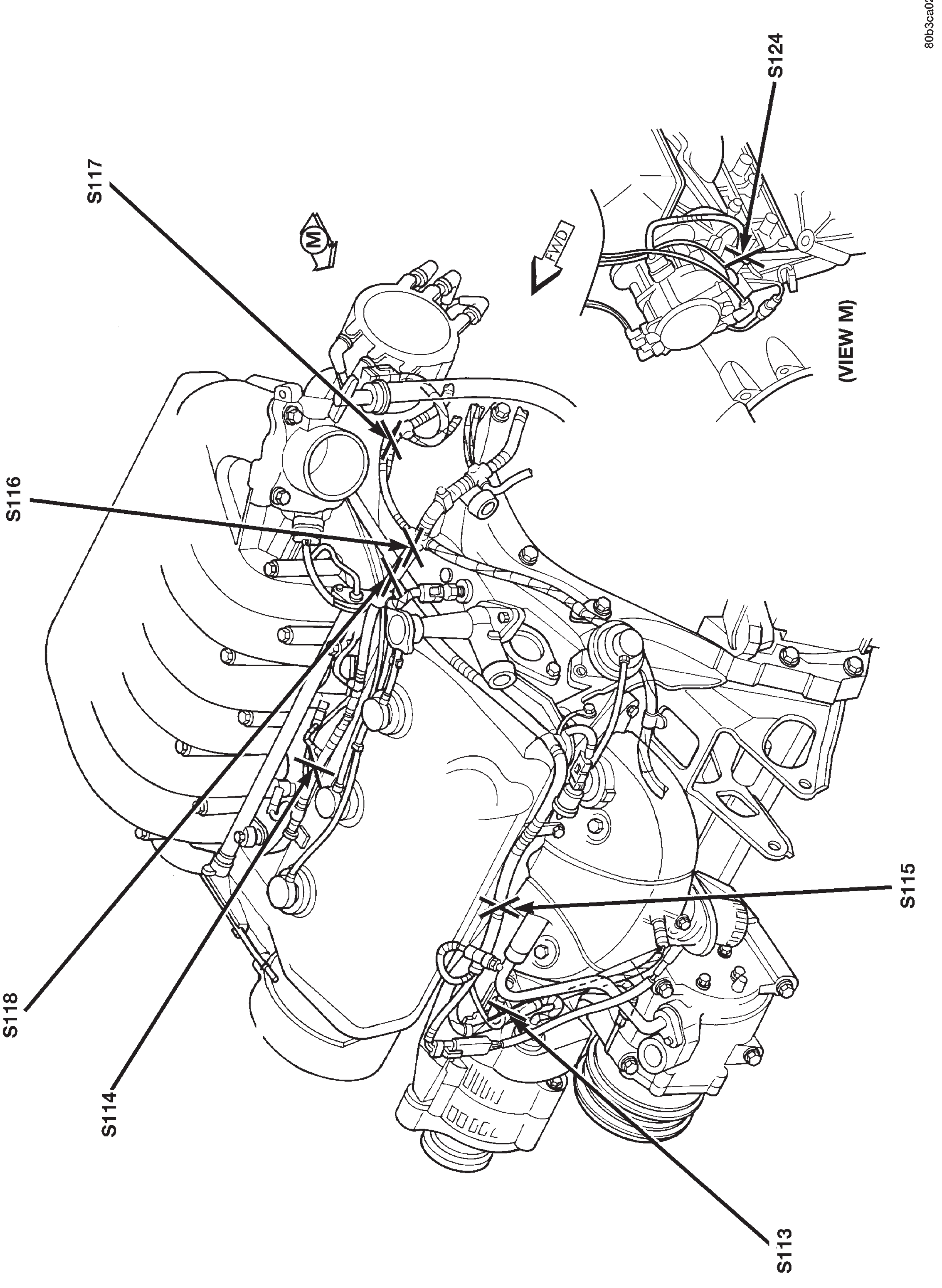


Fig. 6 Engine Splices 2.5L

DESCRIPTION AND OPERATION (Continued)

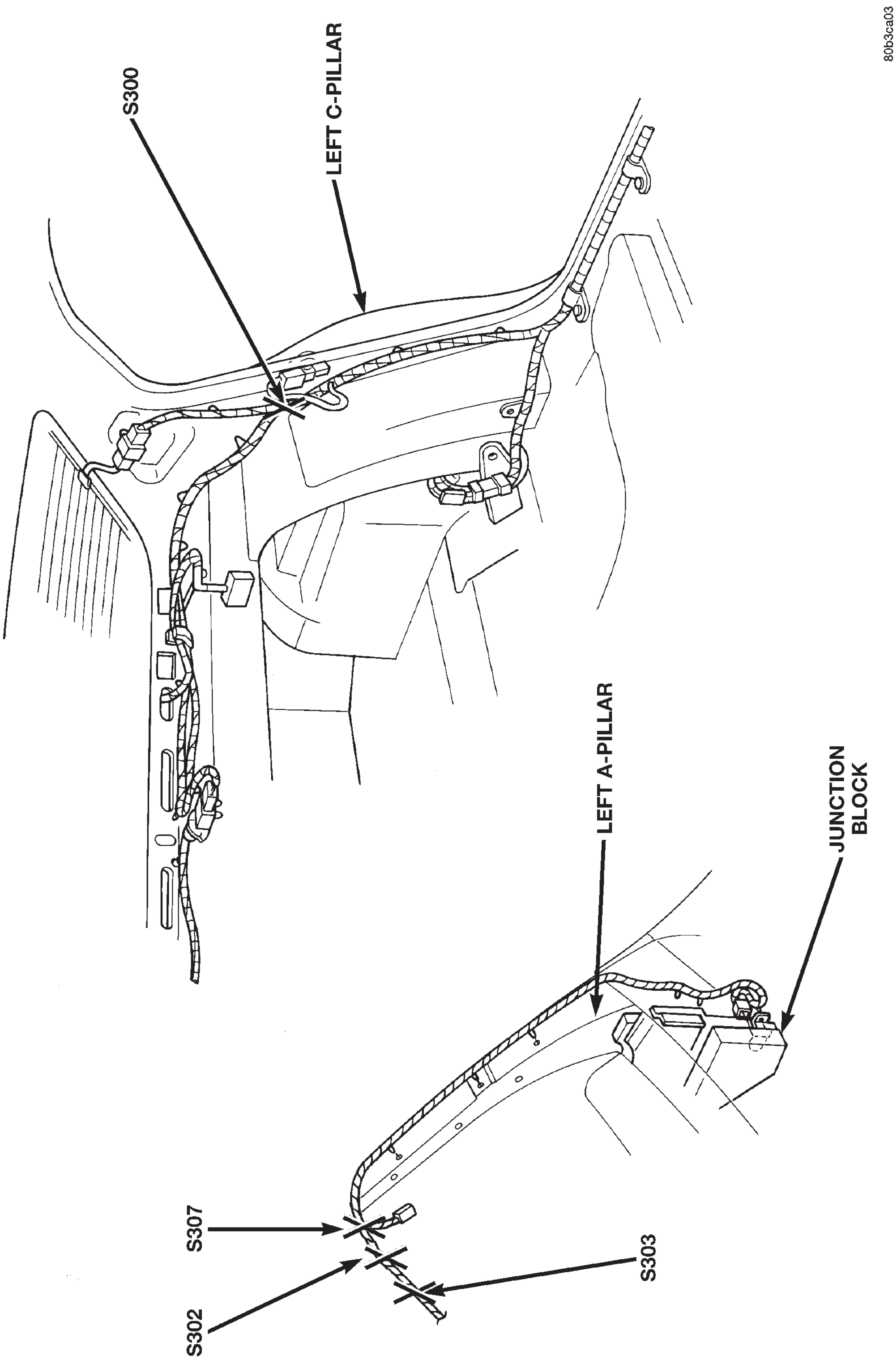


Fig. 7 Body Splices

DESCRIPTION AND OPERATION (Continued)

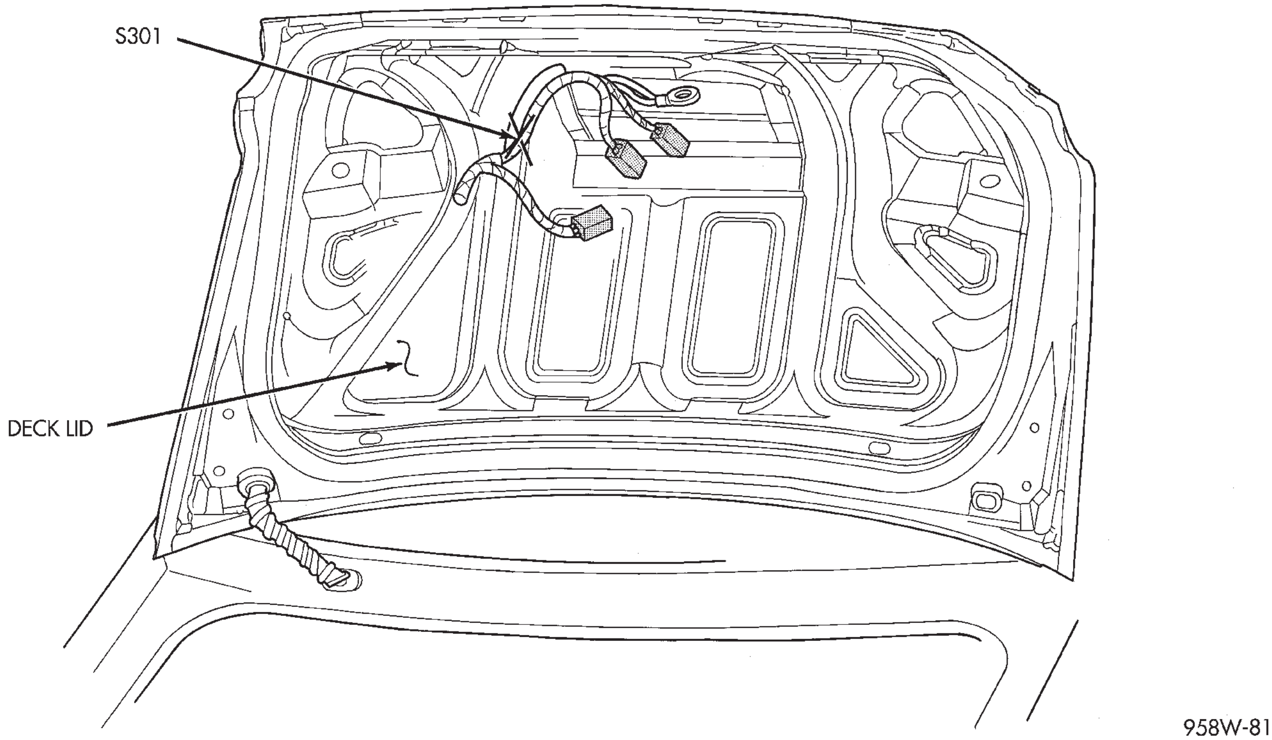


Fig. 8 Deck Lid Splices

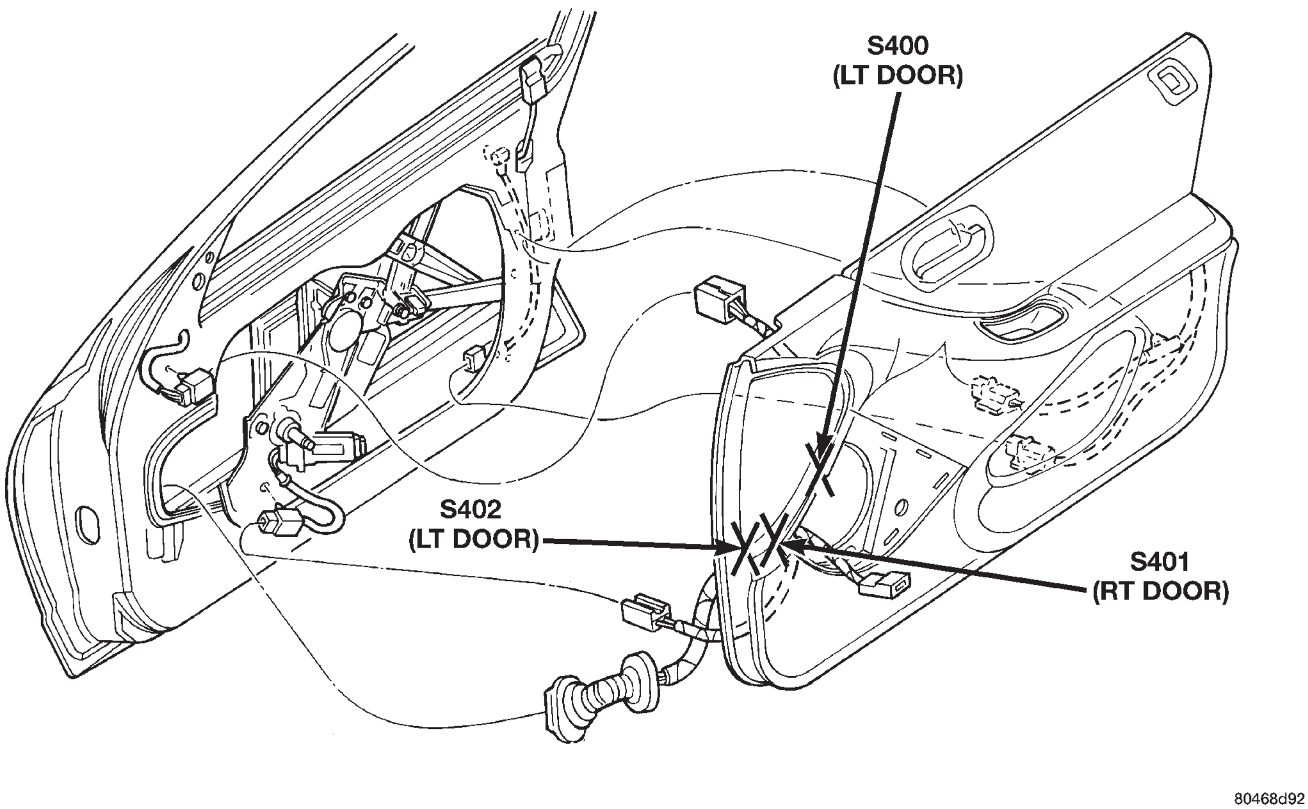


Fig. 9 Door Splices

ENGINE

CONTENTS

STANDARD SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

FORM-IN-PLACE GASKETS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets. **Do not use form-in-place gasket material unless specified** . Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over, a continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine. **Mopar**® Silicone Rubber Adhesive Sealant and **Mopar**® Gasket Maker, (anaerobic) each have different properties and cannot be used interchangeably.

CAUTION: Silicone sealer and anaerobic sealers each will inhibit the cure of the other and care should be taken to keep usages separated as much as possible.

MOPAR® SILICONE RUBBER ADHESIVE SEALANT

Mopar® Silicone Rubber Adhesive Sealant or equivalent, normally black in color, is available in three ounce tubes. Moisture in the air causes the **Mopar**® Silicone Rubber Adhesive Sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of one year and will not properly cure if over age. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material normally red in color. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. It is normally red in color. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® TORQUE CURE GASKET MAKER

Mopar® Torque Cure Gasket Maker is a unique anaerobic type gasket material to be used **ONLY** between the bedplate and engine block. The material cures in the absence of air when torqued between two metallic surfaces. It will not cure if left in the uncovered tube. This anaerobic material is specially made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components.

GENERAL INFORMATION (Continued)

GASKET DISASSEMBLY

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

SURFACE PREPARATION

Scrape clean or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Gasket surfaces must be free of oil and dirt. Make sure old gasket material is removed from blind attaching holes.

FORM-IN-PLACE GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier then using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

The **Mopar**® Silicone Rubber Adhesive Sealant gasket material or equivalent should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towels. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing of material off location.

ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Never use a metal scraper.
- Never use an abrasive pad or paper to clean cylinder block and head.
- Never use a high speed power tool or wire brush on any gasket sealing surface (Fig. 1).

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Only use the following for cleaning gasket surfaces:

- use Mopar® Brake and Parts Cleaner
- use only a plastic or wood scraper (Fig. 1)

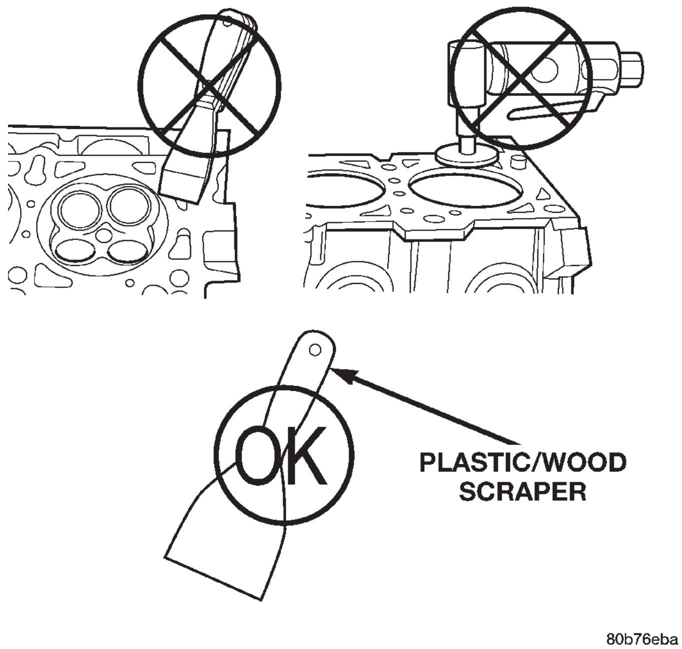


Fig. 1 Proper Tool Usage For Surface Preparation

ENGINE CORE PLUGS

REMOVAL

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 2). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 2).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

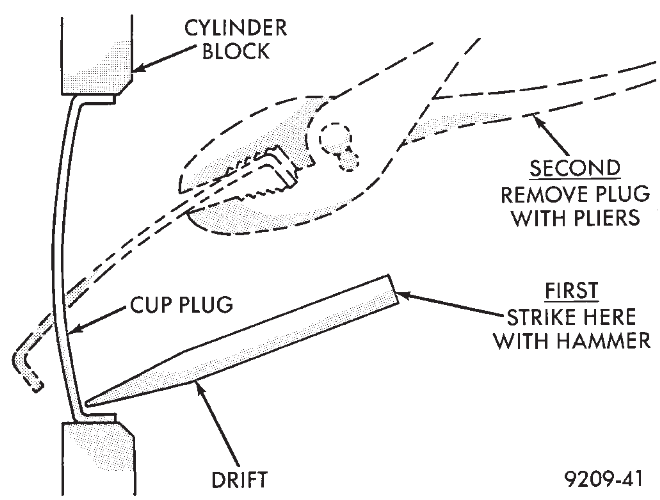


Fig. 2 Core Hole Plug Removal

GENERAL INFORMATION (Continued)

INSTALLATION

Thoroughly clean all debris/rust from inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount Adhesive. Make certain the new plug is cleaned of all oil or grease. Using a proper driver, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 inch.) inside the lead in chamfer (Fig. 2).

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

ENGINE PERFORMANCE

If a loss of performance is noticed, timing belt or chain may have skipped one or two teeth. Camshaft and crankshaft timing should be checked. Refer to Group 9, Engine Timing belt or chain installation.

It is important that the vehicle is operating to its optimum performance level to maintain fuel economy and lowest vehicle emissions. If vehicle is not operating to these standards, refer to Engine Diagnosis outlined is this section. The following procedures can assist in achieving the proper engine diagnosis.

(1) Test cranking amperage draw. Refer to Group 8B, Starting.

(2) Check intake manifold for vacuum leaks.

(3) Perform cylinder compression pressure test. Refer to Engine Diagnosis, outlined in this section.

(4) Clean or replace spark plugs as necessary and adjust gap as specified in Group 8D, Ignition System. Tighten to specifications.

(5) Test resistance of spark plug cables. Refer to Group 8D, Ignition System.

(6) Test ignition coils primary and secondary resistance. Replace parts as necessary. Refer to Group 8D, Ignition System.

(7) Check fuel pump pressure at idle and different RPM ranges. Refer to Group 14, Fuel System for Specifications.

(8) The air filter elements should be replaced as specified in Group 0, Lubrication and Maintenance.

(9) Inspect crankcase ventilation system as outlined in Group 25, Emission Control Systems.

(10) Road test vehicle as a final test.

HONING CYLINDER BORES

(1) Used carefully, the cylinder bore resizing hone C-823 equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, Tool C-3501, equipped with 280 grit stones, if the cylinder bore is straight and round. 20-60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Inspect cylinder walls after each 20 strokes, using a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.**

(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 50-60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 3).

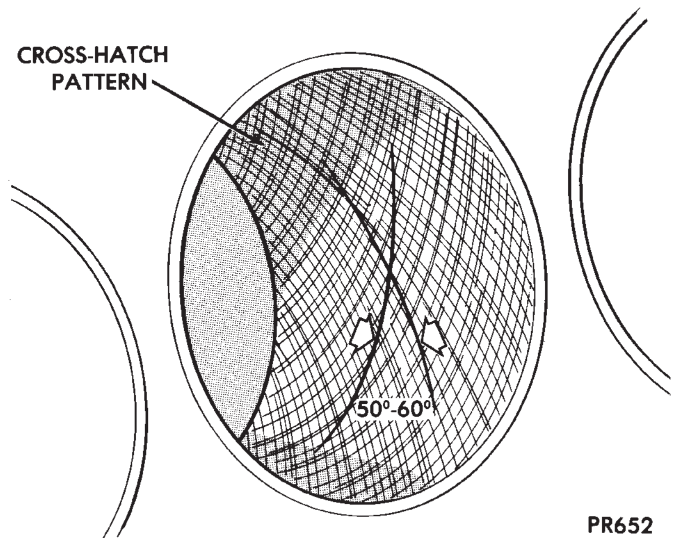


Fig. 3 Cylinder Bore Cross-Hatch Pattern

(4) A controlled hone motor speed between 200-300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 50-60 degree angle. Faster up and down strokes increase the cross-hatch angle.

(5) After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

CAUTION: Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

MEASURING WITH PLASTIGAGE

PLASTIGAGE METHOD

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

GENERAL INFORMATION (Continued)

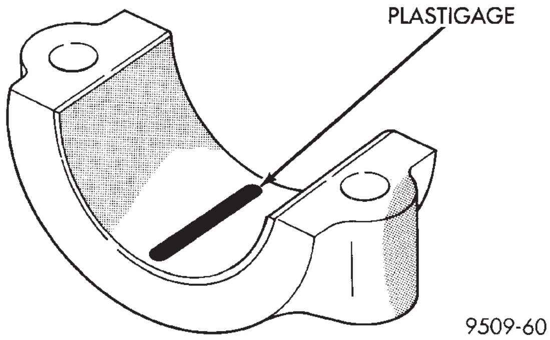


Fig. 4 Plastigage Placed in Lower Shell

NOTE: The total clearance of the main bearings can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

PREFERRED METHOD

Shim the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (0.010 in.) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tightening bolts to 14-20 N·m (10-15 ft. lbs.). The number of main bearing will vary from engine to engine.

ENGINE WITH 5 MAIN BEARINGS

- When checking #1 main bearing shim #2 main bearing.
- When checking #2 main bearing shim #1 & 3 main bearing.
- When checking #3 main bearing shim #2 & 4 main bearing.
- When checking #4 main bearing shim #3 & 5 main bearing.
- When checking #5 main bearing shim #4 main bearing.

ENGINE WITH 4 MAIN BEARING

- When checking #1 main bearing shim # 2 main bearing.
- When checking #2 main bearing shim #1 & #3 main bearing.
- When checking #3 main bearing shim #2 & #4 main bearing.
- When checking #4 main bearing shim #3 main bearing.

NOTE: REMOVE ALL SHIMS BEFORE REASSEMBLING ENGINE

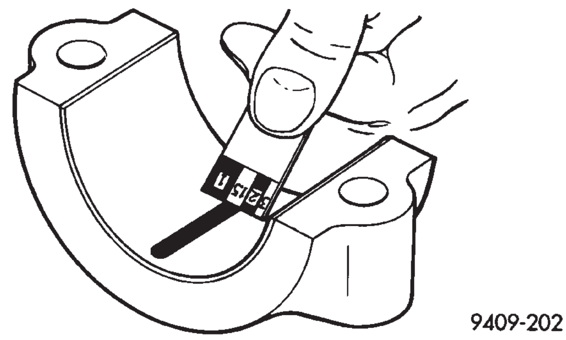


Fig. 5 Clearance Measurement

ALTERNATIVE METHOD

The weight of the crankshaft can be supported by a jack under the counterweight adjacent to the bearing being checked.

PLASTIGAGE PROCEDURE

(1) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(2) Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes (Fig. 4). (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.

(3) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 5) with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

CONNECTING ROD BEARING CLEARANCE

Engine connecting rod bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.

(2) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from

GENERAL INFORMATION (Continued)

the oil hole (Fig. 4). In addition, suspect areas can be checked by placing plastigage in the suspect area.

(4) Assemble the rod cap with Plastigage in place. Tighten the rod cap to the specified torque. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

(5) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 5) with the scale provided on the package. Locate the band closest to the same width. This band indicates the amount of oil clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. If the bearing clearance exceeds 0.076 mm (0.003 in.) replace bearing.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (including aluminum head spark plug threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

CAUTION: Be sure that the tapped holes maintain the original centerline.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, these steps should be used.

CAUTION: Do Not Use Starter Motor To Rotate Engine, severe damage may occur.

(1) Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.

(2) Remove negative battery cable.

(3) Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.

(4) With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.

(5) Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).

(6) Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., Connecting Rods, Pistons, Valves etc.)

(7) Repair engine or components as necessary to prevent this problem from occurring again.

CAUTION: Squirt approximately 1 teaspoon of oil into cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.

(8) Install new spark plugs.

(9) Drain engine oil and remove oil filter.

(10) Fill engine with specified amount of approved oil and install new oil filter.

(11) Connect negative battery cable.

(12) Start engine and check for any leaks.

CHECKING ENGINE OIL LEVEL

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick (Fig. 6), (Fig. 7), or (Fig. 8) and observe oil level. Add oil only when the level is at or below the ADD mark (Fig. 9).

ENGINE OIL SERVICE

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

API SERVICE GRADE CERTIFIED

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

GENERAL INFORMATION (Continued)

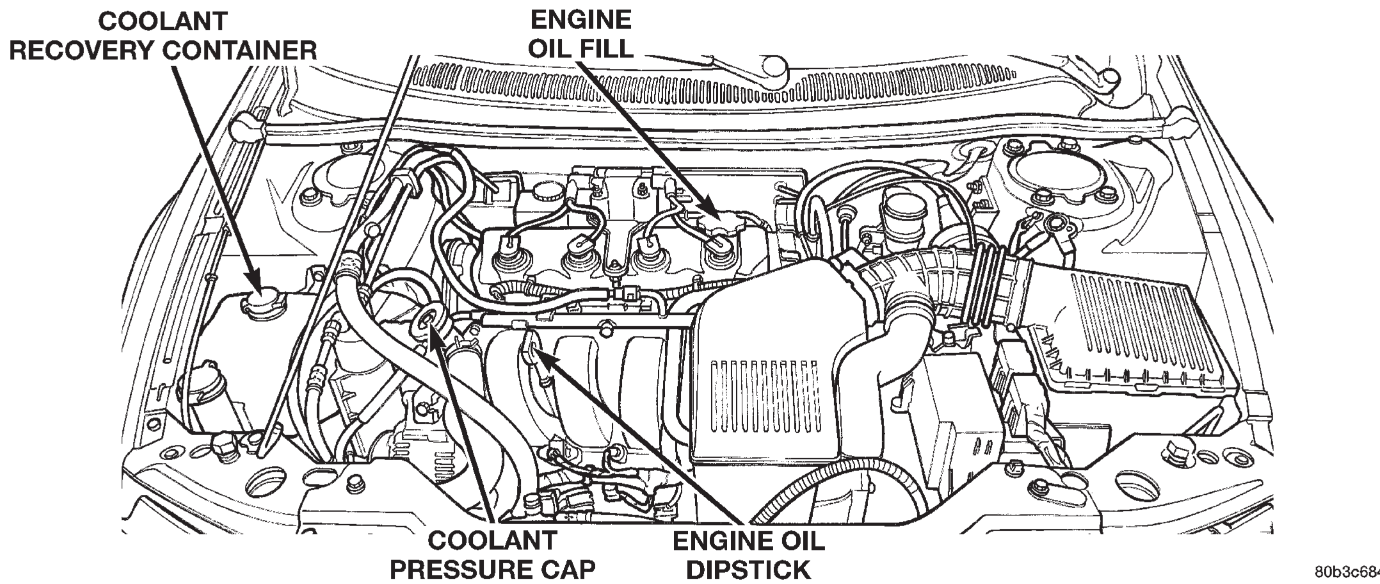


Fig. 6 Dipstick and Engine Oil Fill Locations—2.0L

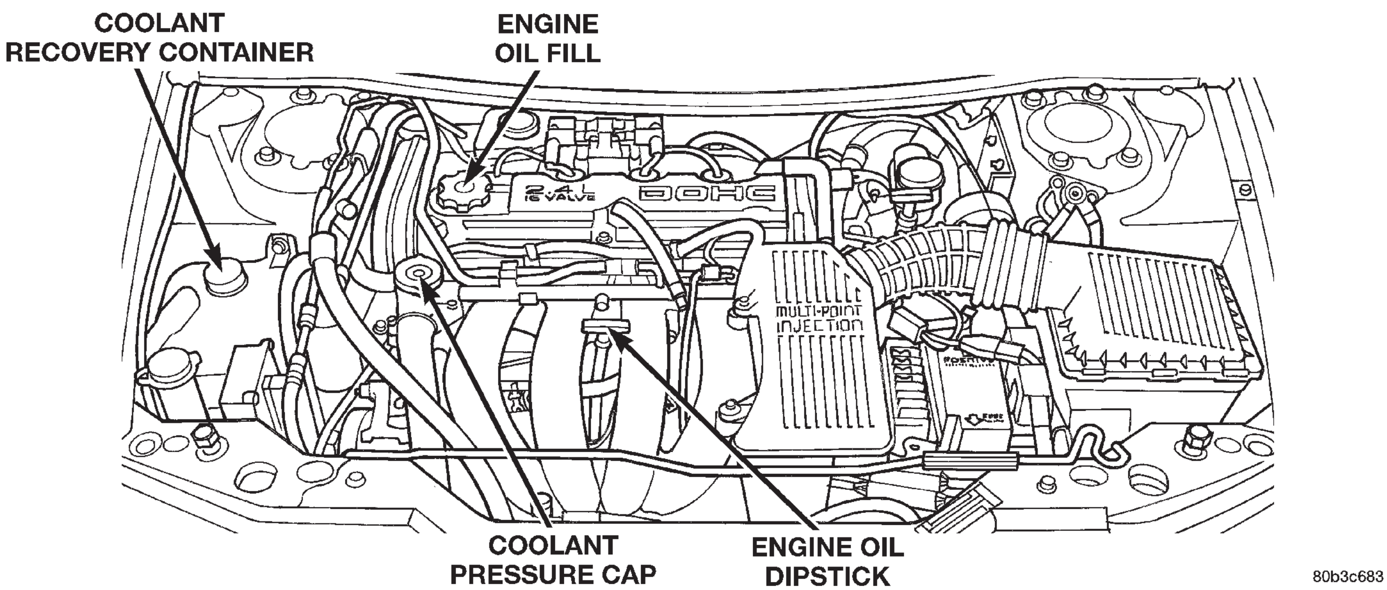


Fig. 7 Dipstick and Engine Oil Fill Locations—2.4L

SAE VISCOSITY

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

ENERGY CONSERVING OIL

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

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 11).

ENGINE OIL CHANGE

CHANGING ENGINE OIL

Change engine oil at mileage and time intervals described in the Maintenance Schedule. Refer to Group 0, Lubrication and Maintenance.

GENERAL INFORMATION (Continued)

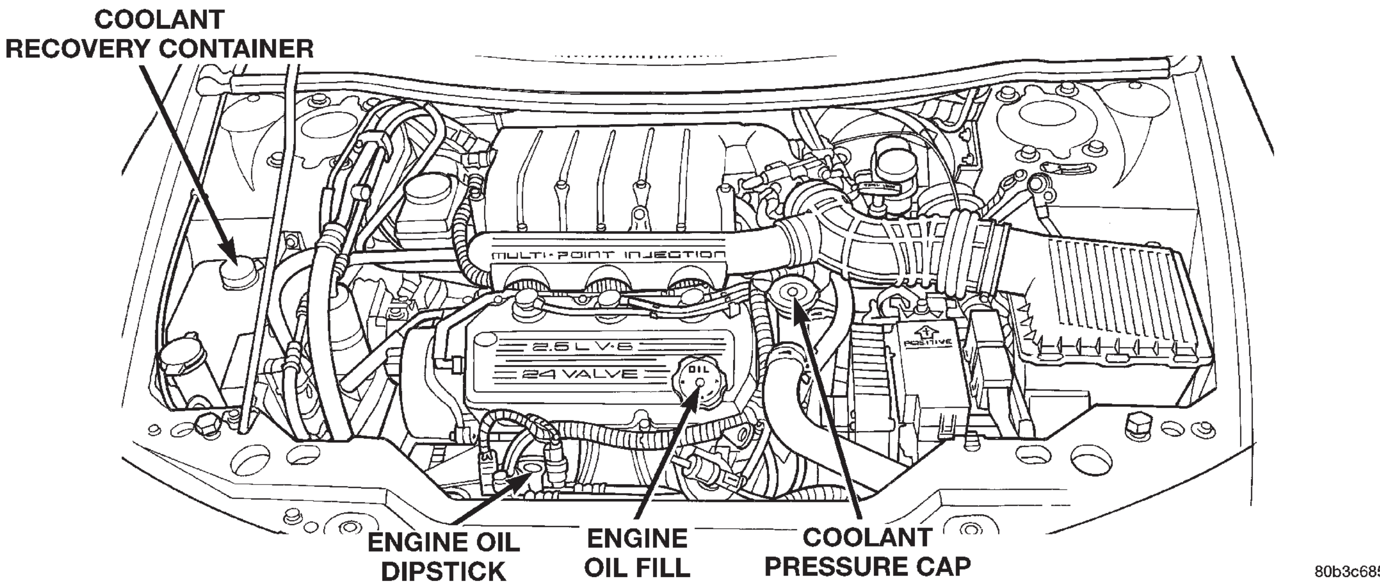


Fig. 8 Dipstick and Engine Oil Fill Locations—2.5L

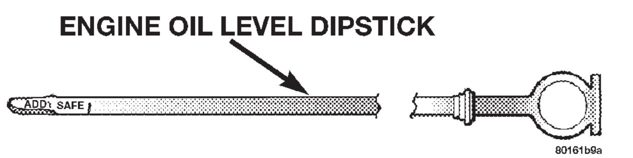


Fig. 9 Oil Level

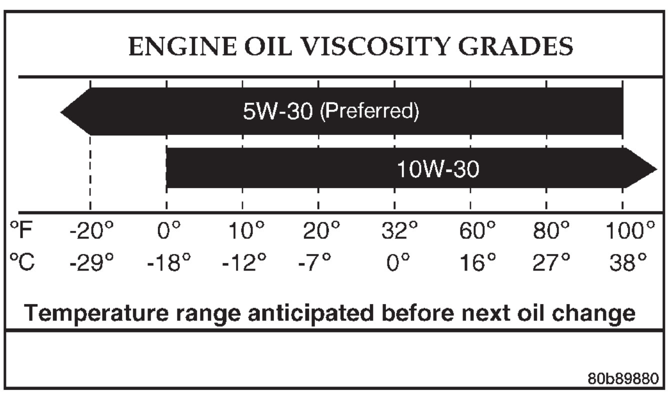


Fig. 10 Temperature/Engine Oil Viscosity

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

Fig. 11 Engine Oil Container Standard Notations

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap Refer to (Fig. 6), (Fig. 7), or (Fig. 8).

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

GENERAL INFORMATION (Continued)

ENGINE OIL FILTER CHANGE

FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. Chrysler Corporation recommends a Mopar® or equivalent oil filter be used.

OIL FILTER REMOVAL

Refer to Removal and Installation Section in Group 9, Engine for procedure.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING listed above.

ENGINE DIAGNOSIS

INDEX

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer to Group 14, Fuel System, for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.

(2) Spray a small stream of water (Spray Bottle) at the suspected leak area.

(3) If engine RPM'S change, the area of the suspected leak has been found.

(4) Repair as required.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Check engine oil level and add oil if necessary.

(2) Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

(3) Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.

(4) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire (Conventional Ignition System). For Direct Ignition System DIS disconnect the coil connector.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gage adaptor into the #1 spark plug hole in cylinder head. Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(7) Repeat the previous step for all remaining cylinders.

(8) Compression should not be less than (689kPa) 100 psi and not vary more than 25 percent from cylinder to cylinder.

(9) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(10) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine**

DIAGNOSIS AND TESTING (Continued)

should not be disassembled to determine the cause of low compression unless some malfunction is present.

(11) Clean or replace spark plugs as necessary and adjust gap as specified in Group 8, Electrical. Tighten to specifications.

(12) Test resistance of spark plug cables. Refer to Group 8, Electrical Ignition System Secondary Circuit Inspection.

(13) Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to Group 8, Electrical Ignition System.

(14) Check fuel pump pressure at idle and different RPM ranges. Refer to Group 14, Fuel System for Specifications.

(15) The air filter elements should be replaced as specified in Group 0, Lubrication and Maintenance, .

(16) Inspect crankcase ventilation system as out lined in Group 0, Lubrication and Maintenance. For emission controls see Group 25, Emission Controls for service procedures.

(17) Inspect and adjust accessory belt drives referring to Group 7, Cooling System, Accessory Drive Belts for proper adjustments.

(18) Road test vehicle as a final test.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE RADIATOR CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage per cylinder.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

(3) During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor pressed into the vertical oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected lash adjusters, and replace as necessary.

INSPECTION (ENGINE OIL LEAKS IN GENERAL)

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to

DIAGNOSIS AND TESTING (Continued)

make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

(5) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:

- Disconnect the fresh air hose (makeup air) at the cylinder head cover and plug or cap the nipple on the cover.
- Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.
- Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
- If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose. Proceed to next step.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area remove transmission for further inspection.

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, oil galley cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the, Inspection (Engine oil Leaks in general).

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

(7) After the oil leak root cause and appropriate corrective action have been identified. Refer to Rear Crankshaft Seals, for proper replacement procedures.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Faulty coil(s) or control unit. 5. Incorrect spark plug gap. 6. Contamination in fuel system. 7. Faulty fuel pump. 8. Incorrect engine timing.	1. Test battery. Charge or replace as necessary. Refer to Group 8A, Battery. 2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals. 3. Test starting system. Refer to Group 8B, Starting. 4. Test and replace as needed. Refer to Group 8D, Ignition System. 5. Set gap. Refer to Group 8D, Ignition System. 6. Clean system and replace fuel filter. 7. Test fuel pump and replace as needed. Refer to Group 14, Fuel System. 8. Check for a skipped timing belt/chain or a loose camshaft sprocket (3.2/3.5L).
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low. 2. Incorrect fuel mixture. 3. Intake manifold leakage. 4. Faulty coil(s).	1. Test minimum air flow. Refer to Group 14, Fuel System. 2. Refer to Group 14, Fuel System. 3. Inspect intake manifold, manifold gasket, and vacuum hoses. 4. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs. 2. Contamination in fuel system. 3. Faulty fuel pump. 4. Incorrect valve timing. 5. Leaking cylinder head gasket. 6. Low compression. 7. Burned, warped, or pitted valves. 8. Plugged or restricted exhaust system. 9. Faulty coil(s).	1. Clean plugs and set gap. Refer to Group 8D, Ignition System. 2. Clean system and replace fuel filter. 3. Test and replace as necessary. Refer to Group 14, Fuel System. 4. Correct valve timing. 5. Replace cylinder head gasket. 6. Test compression of each cylinder. 7. Replace valves. 8. Install new parts, as necessary. 9. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs. 2. Contamination in Fuel System. 3. Burned, warped, or pitted valves. 4. Faulty coil(s).	1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System. 2. Clean fuel system and replace fuel filter. 3. Replace valves. 4. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap. 2. Faulty coil(s). 3. Dirty fuel injector(s). 4. Contamination in fuel system.	1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System. 2. Test and replace as necessary. Refer to Group 8D, Ignition System. 3. Test and replace as necessary. Refer to Group 14, Fuel System. 4. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL

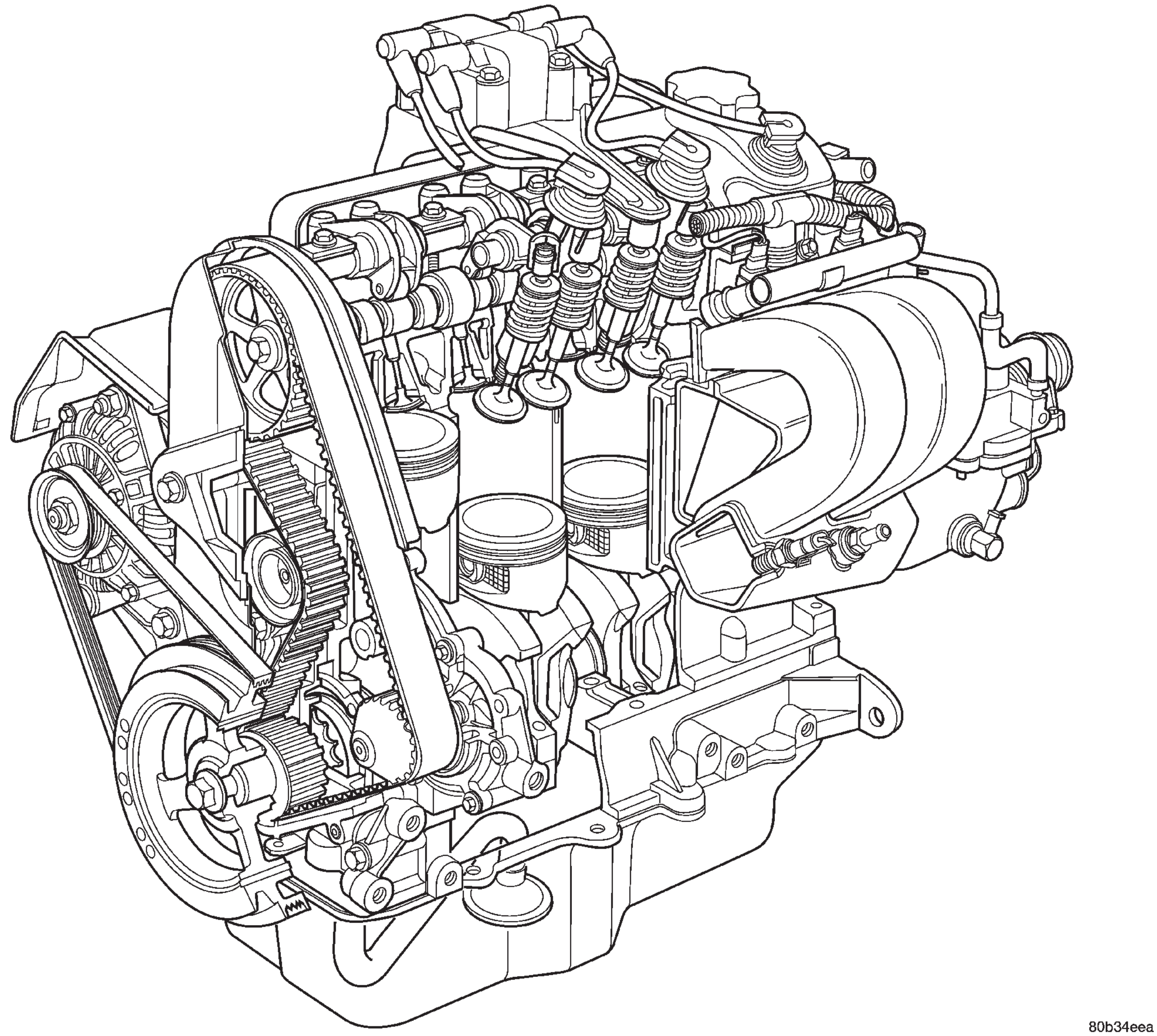
CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check and correct engine oil level.
	2. Thin or diluted oil.	2. Change oil to correct viscosity.
	3. Low oil pressure.	3. Check and correct engine oil level.
	4. Dirt in tappets/lash adjusters.	4. Replace rocker arm/hydraulic lash adjuster assembly.
	5. Worn rocker arms.	5. Inspect oil supply to rocker arms.
	6. Worn tappets/lash adjusters.	6. Install new rocker arm/hydraulic lash adjuster assembly.
	7. Worn valve guides.	7. Ream guides and install new valves with oversize stems.
	8. Excessive runout of valve seats on valve faces.	8. Grind valve seats and valves.
	9. Missing adjuster pivot.	9. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thin or diluted oil.	3. Change oil to correct viscosity.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Connecting rod journal out-of-round.	5. Replace crankshaft or grind surface.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thin or diluted oil.	3. Change oil to correct viscosity.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Excessive end play.	5. Check thrust bearing for wear on flanges.
	6. Crankshaft journal out-of-round or worn.	6. Replace crankshaft or grind journals.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque.
OIL PRESSURE DROP	1. Low oil level.	1. Check engine oil level.
	2. Faulty oil pressure sending unit.	2. Install new sending unit.
	3. Low oil pressure.	3. Check sending unit and main bearing oil clearance.
	4. Clogged oil filter.	4. Install new oil filter.
	5. Worn parts in oil pump.	5. Replace worn parts or pump.
	6. Thin or diluted oil.	6. Change oil to correct viscosity.
	7. Oil pump relief valve stuck.	7. Remove valve and inspect, clean, or replace.
	8. Oil pump suction tube loose.	8. Remove oil pan and install new tube or clean, if necessary.
	9. Oil pump cover warped or cracked.	9. Install new oil pump.
	10. Excessive bearing clearance.	10. Measure bearings for correct clearance.
OIL LEAKS	1. Misaligned or deteriorated gaskets.	1. Replace gasket(s).
	2. Loose fastener, broken or porous metal part.	2. Tighten, repair or replace the part.
	3. Misaligned or deteriorated cup or threaded plug.	3. Replace as necessary.
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction.	1. Check system and repair as necessary. Refer to Group 25, Emission Control Systems.
	2. Worn, scuffed or broken rings.	2. Hone cylinder bores. Install new rings.
	3. Carbon in oil ring slots.	3. Install new rings.
	4. Rings fitted too tightly in grooves.	4. Remove rings and check grooves. If groove is not proper width, replace piston.
	5. Worn valve guide(s).	5. Ream guide(s) and replace valve(s) with oversize valve(s) and seal(s).
	6. Valve stem seal(s) worn or damaged.	6. Replace seal(s).

2.0L SOHC ENGINE

INDEX

DESCRIPTION AND OPERATION

2.0L SOHC ENGINE



2.0L SOHC Engine

ENGINE IDENTIFICATION

The engine identification number is located on the left rear of the cylinder block behind starter (Fig. 1).

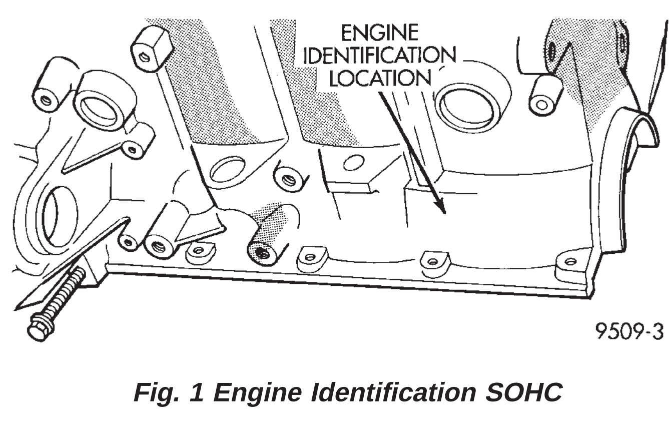


Fig. 1 Engine Identification SOHC

DESCRIPTION AND OPERATION (Continued)

GENERAL SPECIFICATION

Type . . . . In-Line OHV, DOHC & SOHC
Bore . . . . 87.5mm (3.445 Inch)
Stroke . . . . 83.0mm (3.268 inch)
Compression Ratio . . . . DOHC - 9.6:1 SOHC - 9.8:1
Displacement . . . . 2.0 Liters (122 Cubic Inch)
Firing Order 1, 3, 4, 2
Compression Pressure . . . . 1172 - 1551 kPa (170 - 225 psi)
Maximum Variation Between Cylinders 25%
Lubrication . . . Pressure Feed - Full Flow Filtration (Crankshaft Driven Pump)
Engine Oil Capacity . . . . Refer to Group 0, Lubrication and Maintenance

ENGINE COMPONENTS

CYLINDER BLOCK AND BEDPLATE ASSEMBLY: A partial open deck is used for cooling and weight reduction with water pump molded into the block. Nominal wall thickness is 4 mm. The bedplate incorporates main bearing caps. Rear seal retainer is integral with the block.

CRANKSHAFT: A nodular cast iron crankshaft is used. The engine has 5 main bearings, with number 3 flanged to control thrust. The 52 mm diameter main and 48 mm diameter crank pin journals (all) have undercut fillet radiuses that are deep rolled for added strength. To optimize bearing loading 8 counterweights are used. Hydrodynamic seals provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for parting line sealing. A sintered iron timing belt sprocket is mounted on the crankshaft nose. This sprocket transmits crankshaft movement, via timing belt to the camshaft sprocket providing timed valve actuation.

PISTONS: The SOHC Engine **DOES NOT** have provision for a free wheeling valve train. Non free wheeling valve train means, in the event of a broken timing belt Pistons will contact the Valves. All engines use pressed-in piston pins to attach forged powdered metal connecting rods. The connecting rods are a cracked cap design and are not repairable. Hex head cap screw are used to provide alignment and durability in the assembly. Pistons And Connecting rods are serviced as an assembly.

PISTON RINGS: The piston rings include a molybdenum faced top ring for reliable compression sealing and a taper faced intermediate ring for additional cylinder pressure control. Oil Control Ring Package consist of 2 steel rails and a expander spacer.

CYLINDER HEAD—SOHC: It features a Single Over Head Camshaft, four-valves per cylinder cross flow design. The valves are arranged in two inline banks, with the two intake per cylinder facing toward the radiator. The exhaust valves facing toward the dash panel. Rocker arm shafts mount directly to the cylinder head. It incorporates powder metal valve guides and seats. The hollow rocker arm shafts supplies oil to the hydraulic lash adjusters, camshaft and valve mechanisms.

CAMSHAFT—SOHC: The nodular iron camshaft has five bearing journals and 3 cam lobes per cylinder. Provision for cam position sensor on the cam at the rear of cylinder head which also acts as thrust plate. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

VALVES—SOHC: Four valves per cylinder are actuated by roller rocker arms/hydraulic lash adjusters assemblies which pivot on rocker arm shafts. All valves have 6 mm diameter chrome plated valve stems. The valve train has 33 mm (1.299 inch) diameter intake valves and 28 mm (1.10 inch) diameter exhaust valves. Viton rubber valve stem seals are integral with spring seats. Valve springs, spring retainers, and locks are conventional design.

INTAKE MANIFOLD: The intake manifold is a molded plastic composition, attached to the cylinder head with ten fasteners. This long branch design enhances low and mid-range torque.

EXHAUST MANIFOLD: The exhaust manifold is made of nodular cast iron for strength and high temperatures. Exhaust gasses exit through a machined, articulated joint connection to the exhaust pipe.

ENGINE LUBRICATION SYSTEM

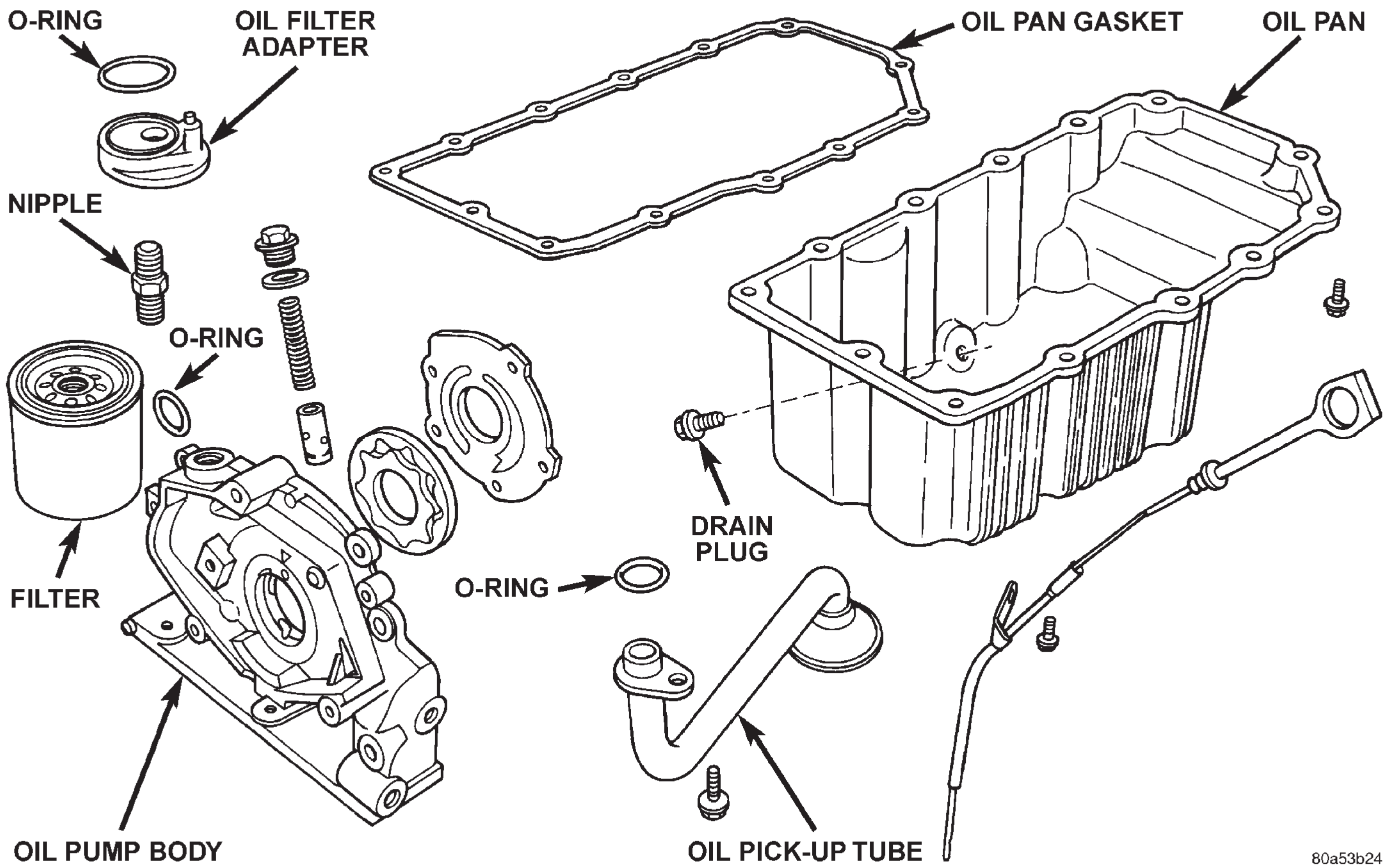
ENGINE LUBRICATION

Refer to Group 0, Lubrication and Maintenance for recommended oil to be used in various engine application. System is full flow filtration, pressure feed type. The oil pump is mounted in the front engine cover and driven by the crankshaft. Pressurized oil is then routed through the main oil gallery, running the length of the cylinder block, supplying main and rod bearings with further routing. Rod bearing oil throw-off lubricates the pistons from directed slots on the side of the connecting rod assemblies. Camshaft and valve mechanisms are lubricated from a full-length cylinder head oil gallery supplied from the crankcase main oil gallery.

PRESSURE LUBRICATION

Oil drawn up through the pickup tube is pressurized by the pump and routed through the full flow filter to the main oil gallery running the length of the cylinder block. A cylinder head restrictor, located in the block, provides increased oil flow to the main oil gallery (Fig. 2).

DESCRIPTION AND OPERATION (Continued)



Engine Lubrication Components

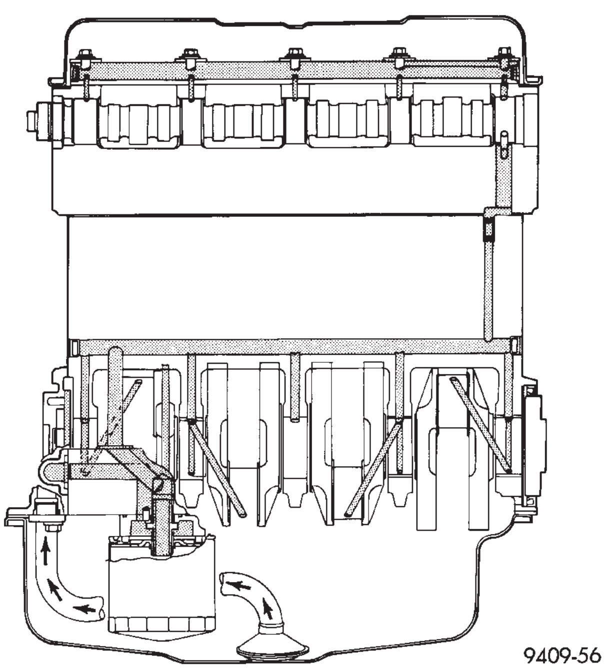


Fig. 2 Engine Lubrication System— SOHC

MAIN/ROD BEARINGS

A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from main bearing journals to connecting rod journals.

CAMSHAFT/HYDRAULIC LASH ADJUSTERS

A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up into the cylinder head. The rocker shafts route oil to the rocker arms/hydraulic lash adjuster assemblies.

SPLASH LUBRICATION

Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure switch and install gauge assembly C-3292 with adaptor.

(2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not perform the 3000 RPM test in the next step.

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170-550 kPa (25-80 psi).

(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open, a clogged oil pick-up screen or a damaged oil pick-up tube O-ring.

SERVICE PROCEDURES

CYLINDER BORE AND PISTON SIZING

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 3). The cylinder bore out-of-round is 0.050 mm (0.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 3). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Cylinder Bore and Piston Specifications Chart.

SIZING PISTONS

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 17.5 mm (11/16 inch) from the bottom of the skirt as shown in (Fig. 4). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 3). Refer to Cylinder Bore and Piston Specifications Chart. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

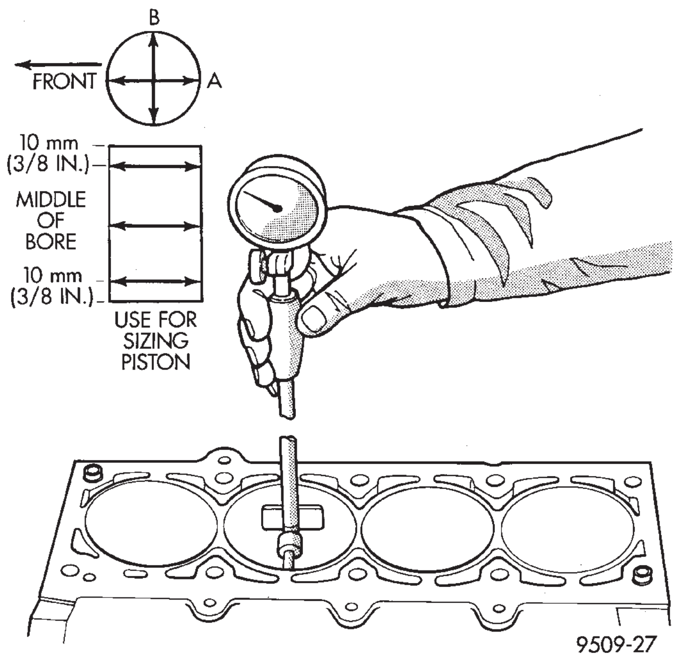


Fig. 3 Checking Cylinder Bore Size

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Maximum Out-of-Round	Maximum Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size 87.463 - 87.481 mm (3.4434 - 3.4441 in.)		
Piston to Bore Clearance 0.012 - 0.044 mm (0.0004 - 0.0017 in.) 0.18 - 0.050 mm (0.0008 - 0.0020 in.)		
Measurements Taken at Piston Size Location		

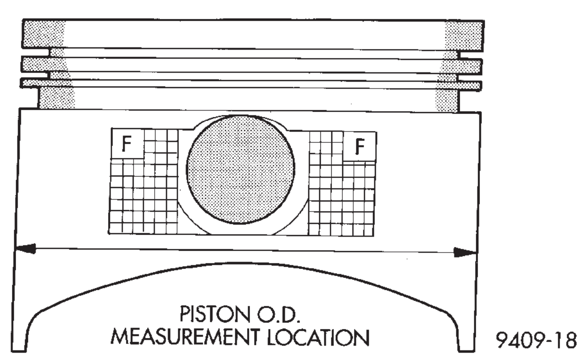


Fig. 4 Piston Measurements

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

SERVICE PROCEDURES (Continued)

FITTING PISTON RINGS

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 5). Refer to Piston Ring Specification Chart.

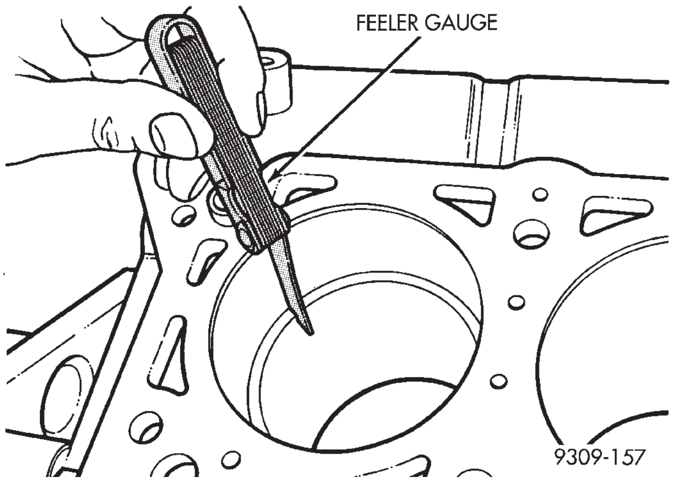


Fig. 5 Piston Ring Gap

(2) Check piston ring to groove side clearance (Fig. 6). Refer to Piston Ring Specification Chart.

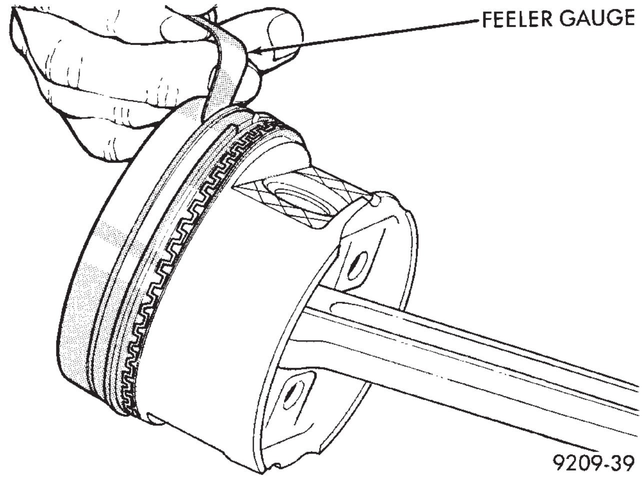


Fig. 6 Piston Ring Side Clearance

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Ring Gap Wear Limit	Groove Clearance	Maximum Groove Clearance
Upper Ring	0.23 - 0.52 mm (0.009 - 0.020 in.)	0.8 mm (0.031 in.)	0.025 - 0.065 mm (0.0010 - 0.0026 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.49 - 0.78 mm (0.019 - 0.031 in.)	1.0 mm (0.039 in.)	0.025 - 0.065 mm (0.0010 - 0.0026 in.)	0.10 mm (0.004 in.)
Oil Control Ring	0.23 - 0.66 mm (0.009 - 0.026 in.)	1.0 mm (0.039 in.)	Oil Ring Side Rails Must Be Free To Rotate After Assembly	

FITTING CONNECTING RODS

(1) Follow the procedure specified in the Standard Service Procedures Section for Measuring Main Bearing Clearance and Connecting Rod Bearing Clearance (Fig. 7). Refer to Connecting Rod Specification Chart for specifications.

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

NOTE: The rod bearing bolts should not be reused.

(2) Before installing the **NEW** bolts the threads should be oiled with clean engine oil.

(3) Install each bolt finger tight than alternately torque each bolt to assemble the cap properly.

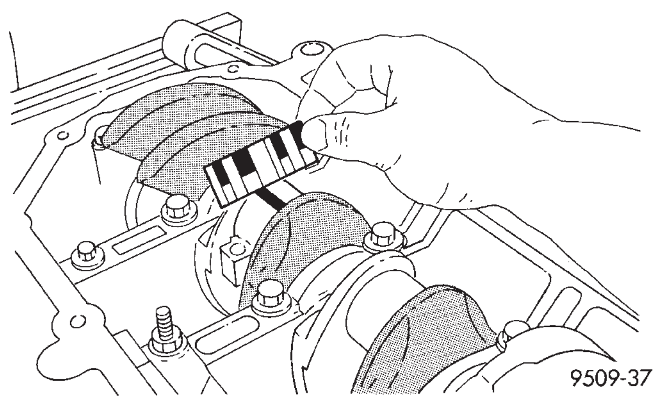


Fig. 7 Connecting Rod Bearing Clearance

SERVICE PROCEDURES (Continued)

(4) Tighten the bolts to 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn) **Do not use a torque wrench for last step.**

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 8). Refer to Connecting Rod Specification Chart for specifications.

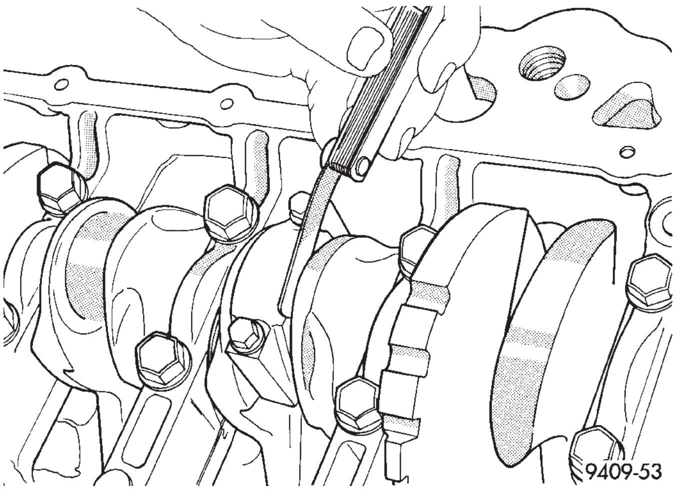


Fig. 8 Connecting Rod Side Clearance

CONNECTING ROD SPECIFICATION CHART

Connecting Rod Bearing Oil Clearance	
New Part:	0.026 - 0.059 mm (0.001 - 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
Connecting Rod Side Clearance	
New Part:	0.13 - 0.38 mm (0.005 - 0.015 in.)
Wear Limit:	0.40 mm (0.016 in.)

FITTING CRANKSHAFT BEARINGS

Refer to Measuring Main Bearing Clearance in Standard Service Procedures. Refer to Crankshaft Specification Chart for specifications.

CRANKSHAFT END PLAY

DIAL INDICATOR METHOD

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 9).

(2) Move crankshaft all the way to the rear of its travel.

(3) Zero the dial indicator.

(4) Move crankshaft all the way to the front and read the dial indicator. Refer to Crankshaft Specification Chart for specifications.

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Wear Limit:	0.37 mm (0.015 in.)
Main Bearing Clearance	
New Part:	0.022 - 0.062 mm (0.0008 - 0.0024 in.)
Connecting Rod Bearing Clearance	
New Part:	0.026 - 0.059 mm (0.001 - 0.0023 in.)
Wear Limit:	0.075 mm (0.003 in.)
Main Bearing Journal Diameter	
Standard:	52.000 ± 0.008 mm (2.0472 ± 0.0003 in.)
1st Undersize:	51.983 ± 0.008 mm (2.0466 ± 0.0003 in.)
Connecting Rod Journal Diameter	
Standard:	48.000 ± 0.008 mm (1.8897 ± 0.0003 in.)
1st Undersize:	47.983 ± 0.008 mm (1.8891 ± 0.0003 in.)

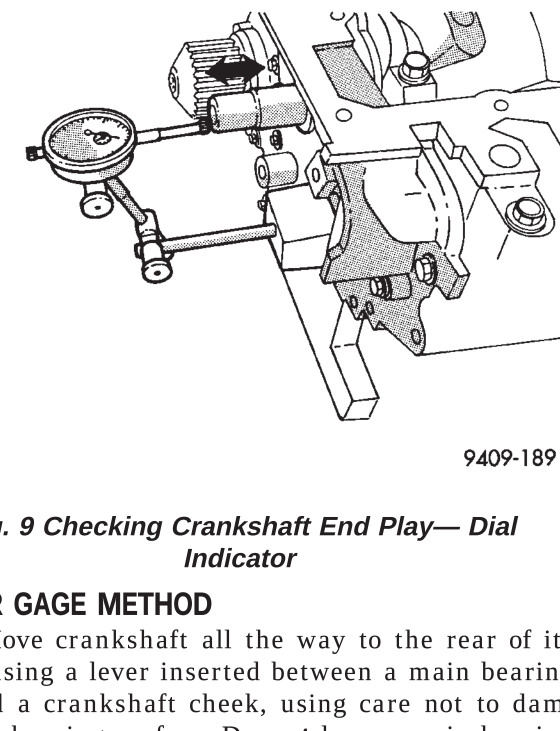


Fig. 9 Checking Crankshaft End Play— Dial Indicator

FEELER GAGE METHOD

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. Do **not** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

SERVICE PROCEDURES (Continued)

CAMSHAFT END PLAY

(1) Oil camshaft journals and remove rocker arm assemblies. Cam sensor installed and fastener tighten to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 10).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.13 - 0.33 mm (0.005 - 0.013 inch.).

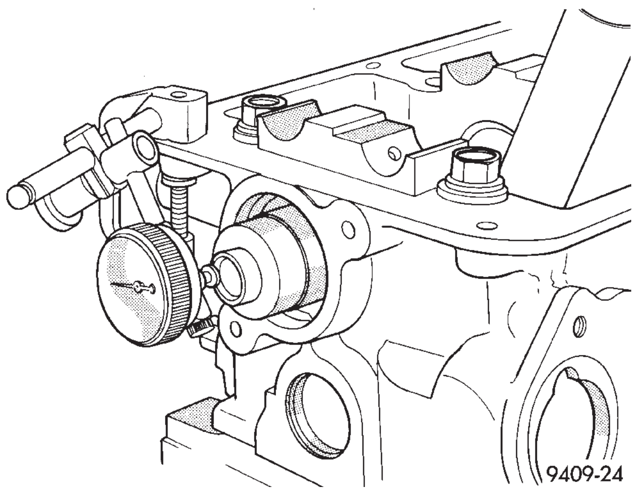


Fig. 10 Camshaft End Play

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT AND REAR

REMOVAL

FRONT MOUNT

(1) Raise vehicle on hoist.

(2) Remove through bolt at front mount (Fig. 13).

(3) Remove attaching bolts from mount to lower radiator support.

NOTE: It may be necessary to tilt engine for front mount removal clearance.

(4) Remove front mount.

REAR MOUNT

(1) Raise vehicle on hoist.

(2) Remove through bolt (A) from rear engine mount and bracket (Fig. 14).

(3) Remove rear strut bracket and brace (Fig. 11).

(4) Remove bending strut from rear mount to engine (Fig. 12).

(5) Remove bolts attaching rear mount to suspension crossmember.

NOTE: It may be necessary to tilt engine for rear mount removal clearance.

(6) Remove rear mount.

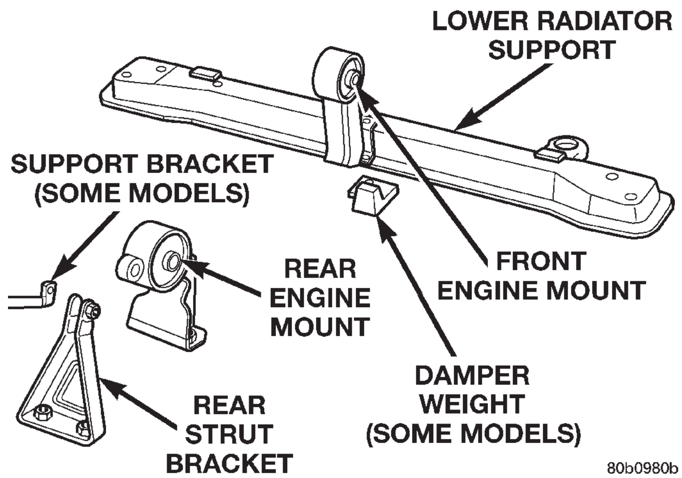


Fig. 11 Engine Mounting—Front and Rear

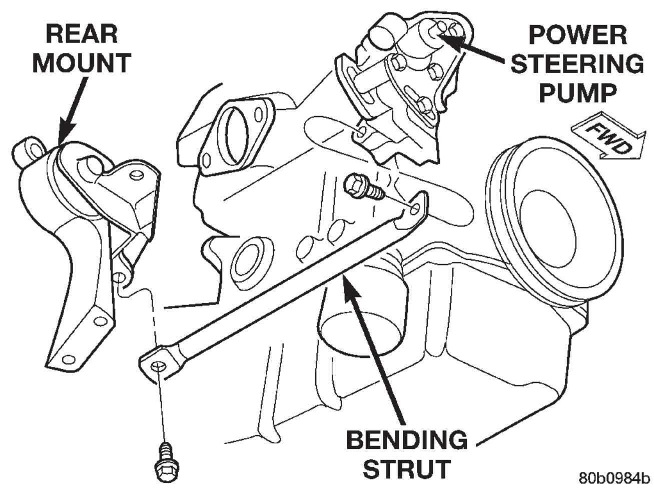


Fig. 12 Bending Strut—2.0L

INSTALLATION

FRONT MOUNT

(1) Position front mount. Position damper weight (some models) and install front mount to lower radiator support attaching bolts. Tighten bolts to 61 N·m (45 ft. lbs.).

(2) Install through bolt and tighten to 61 N·m (45 ft. lbs.) (Fig. 13).

(3) Lower vehicle.

REAR MOUNT

(1) Position rear mount.

REMOVAL AND INSTALLATION (Continued)

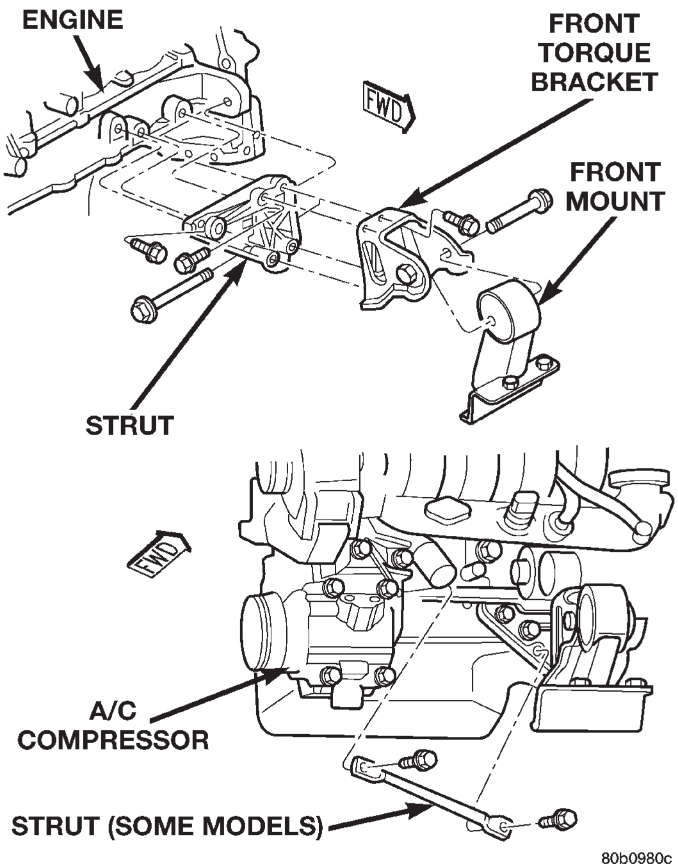


Fig. 13 Engine Mounting—Front 2.0L

(2) Install bolts attaching rear mount to front suspension crossmember. Tighten bolts to 61 N·m (45 ft. lbs.).

(3) Install rear strut and support brackets (Fig. 11). Tighten bolts to the following torque values:

- Bolts attaching strut bracket to front suspension crossmember: 61 N·m (45 ft. lbs.)
- Nut attaching support bracket to front suspension crossmember: 108 N·m (80 ft. lbs.)
- Bolt attaching support bracket to rear strut: 61 N·m (45 ft. lbs.)

(4) Install through bolt (A) and tighten to 61 N·m (45 ft. lbs.) (Fig. 14).

(5) Lower vehicle.

ENGINE MOUNT—RIGHT/ENGINE SUPPORT BRACKET

NOTE: The right side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

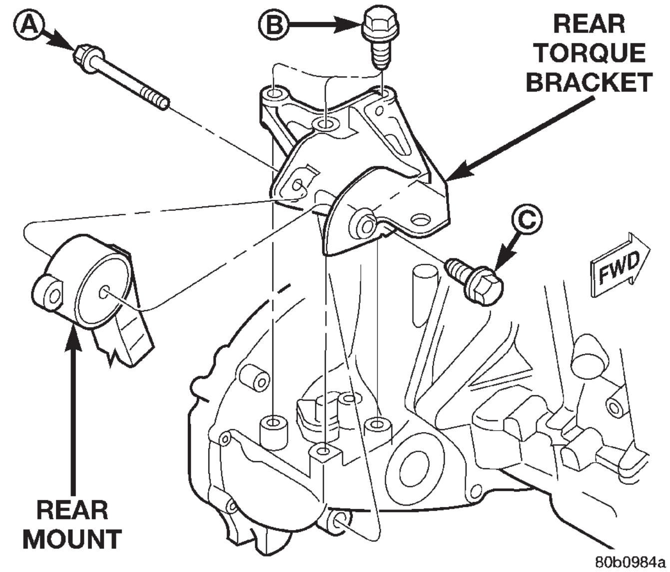


Fig. 14 Engine Mounting—Rear

ITEM	DESCRIPTION	TORQUE
A	Bolt	61 N·m (45 ft. lbs.)
B & C	Bolt—w/Auto. Transaxle	110 N·m (80 ft. lbs.)
	Bolt—w/Manual Transaxle	61 N·m (45 ft. lbs.)

(1) Raise vehicle on a hoist and remove inner splash shield. Remove the right engine support assembly vertical fasteners from frame rail (Fig. 15).

(2) Lower vehicle. Remove the load on the engine motor mounts by carefully supporting the engine assembly with a floor jack.

(3) Remove the three bolts attaching the engine support assembly to the engine bracket.

(4) Move the air conditioning dryer aside.

(5) Remove coolant recovery system tank. Refer to Group 7, Cooling System for procedure.

(6) Remove right engine support.

(7) Remove the three bolts attaching the engine support bracket to the cylinder block.

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

(8) Reverse removal procedure for installation. Refer to (Fig. 15) for torque specifications.

REMOVAL AND INSTALLATION (Continued)

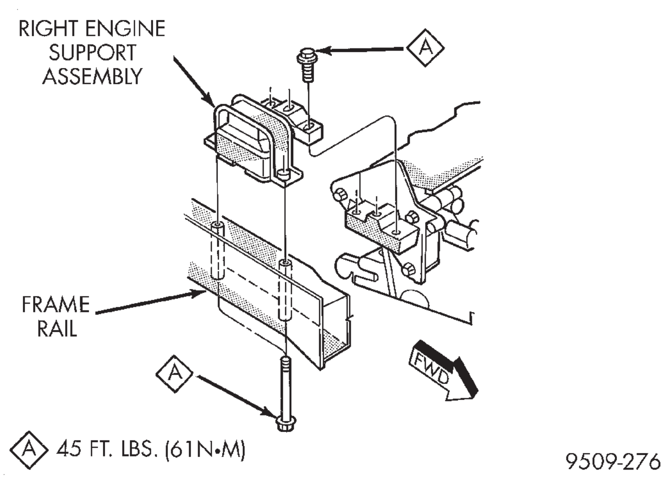


Fig. 15 Engine Mounting—Right Side

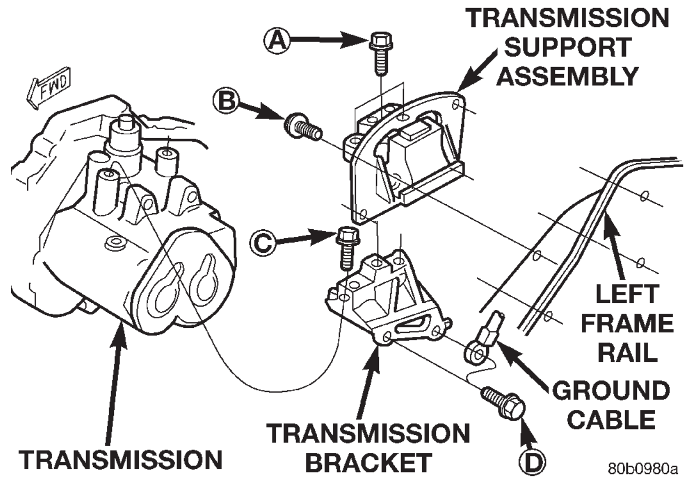


Fig. 16 Left Side Mount—Typical

ITEM	DESCRIPTION	TORQUE
A	Bolt	61 N·m (45 ft. lbs.)
B	Bolt	33 N·m (24 ft. lbs.)
C	Bolt	61 N·m (45 ft. lbs.)
D	Bolt	61 N·m (45 ft. lbs.)

ENGINE MOUNT—LEFT

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

The left side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

REMOVAL

(1) Support the transmission with a transmission jack.

(2) Remove the three vertical bolts (A) from the mount to the transmission bracket (Fig. 16).

(3) Remove the mount to frame rail fasteners (B) and remove mount (Fig. 16).

INSTALLATION

(1) Install mount. Tighten mount to frame rail fasteners (B) to 33 N·m (24 ft. lbs.).

(2) Install mount to transmission bracket vertical bolts (A). Tighten to 61 N·m (45 ft. lbs.).

STRUCTURAL COLLAR

REMOVAL

(1) Raise vehicle on hoist.

NOTE: To remove transaxle dust cover, the front bending strut must be removed.

(2) Remove structural collar from oil pan to transaxle (Fig. 17).

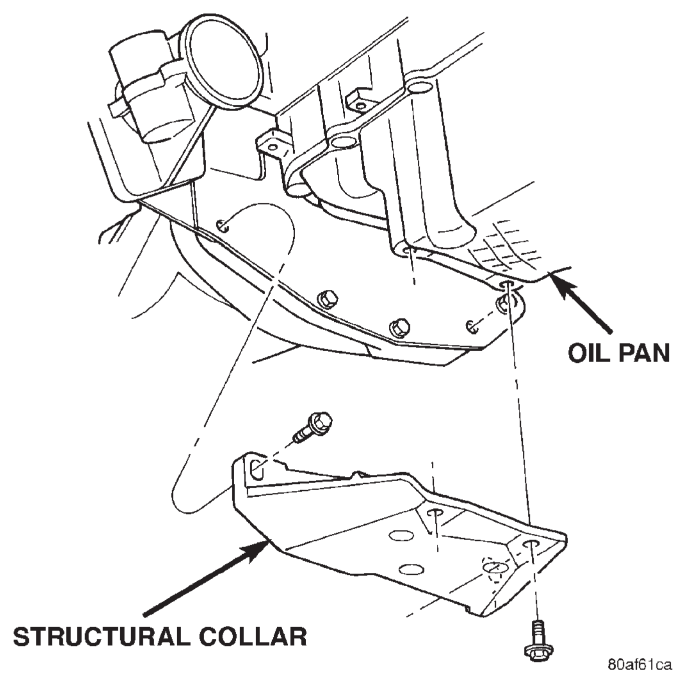


Fig. 17 Structural Collar—Removal and Installation

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: The torque procedure for the structural collar must be followed, as damage to oil pan or collar could occur.

(1) Install the structural collar (Fig. 17) using the following 3 step torque sequence:

- Step 1: Install the collar to oil pan bolts and tighten to 3 N·m (30 in. lbs.).
- Step 2: Install collar to transaxle bolts and tighten to 108 N·m (80 ft. lbs.).
- Step 3: Final torque the collar to oil pan bolts to 54 N·m (40 ft. lbs.).

(2) Lower vehicle.

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect and remove battery and tray. Set Powertrain Control Module (PCM) aside.

(3) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(4) Remove upper radiator hose, radiator and fan module. Refer to Group 7, Cooling System for procedure.

(5) Remove lower radiator hose.

(6) Disconnect automatic transmission cooler lines and plug. If equipped.

(7) Disconnect clutch cable (Manual) and transmission shift linkage.

(8) Disconnect throttle body linkage.

(9) Disconnect engine wiring harness.

(10) Disconnect heater hoses.

(11) Remove refrigerant from air conditioning system using a refrigerant recovery machine. Refer to Group 24, Air Conditioning for procedure.

(12) Hoist vehicle and remove right inner splash shield (Fig. 18).

(13) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(14) Remove axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(15) Disconnect exhaust pipe from manifold.

(16) Remove front and rear engine mount through bolts.

(17) Lower vehicle. Remove air cleaner assembly.

(18) Remove power steering pump and reservoir, Set them aside.

(19) Remove A/C compressor.

(20) Remove ground straps to body.

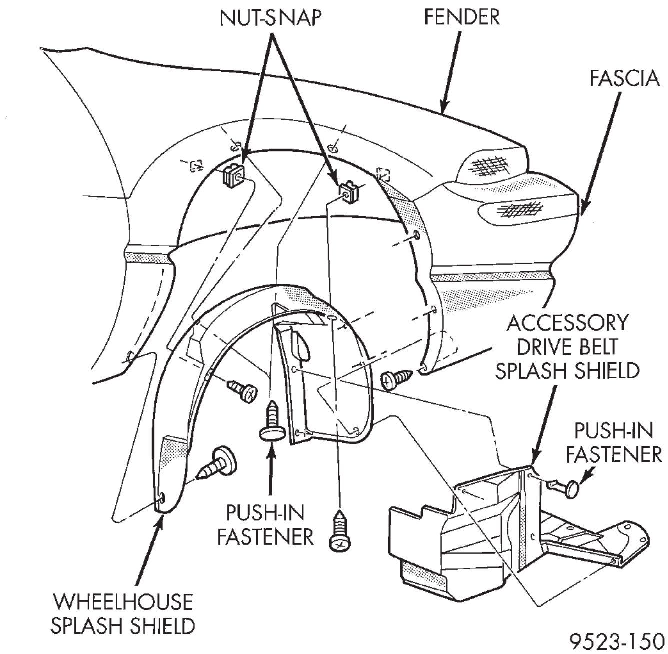


Fig. 18 Right Inner Splash Shield

(21) Raise vehicle enough to allow engine dolly and cradle Special Tools 6135 and 6710 to be installed under vehicle.

(22) Loosen engine support posts to allow movement for positioning onto engine locating holes and flange on the engine bedplate. Lower vehicle and position cradle until the engine is resting on support posts (Fig. 19). Tighten mounts to cradle frame. This will keep support posts from moving when removing or installing engine and transmission.

(23) Install safety straps around the engine to cradle; tighten straps and lock them into position.

(24) Raise vehicle enough to see if straps are tight enough to hold cradle assembly to engine.

(25) Lower vehicle so weight of the engine and transmission ONLY is on the cradle assembly.

(26) Remove right and left engine/transmission mount vertical bolts.

(27) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly with the cradle to allow for removal around body flanges.

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right and left engine/transmission mounts. Refer to procedures outlined in this section.

(3) Remove safety straps from engine and transmission assembly. Slowly raise vehicle enough to remove the engine dolly and cradle.

REMOVAL AND INSTALLATION (Continued)

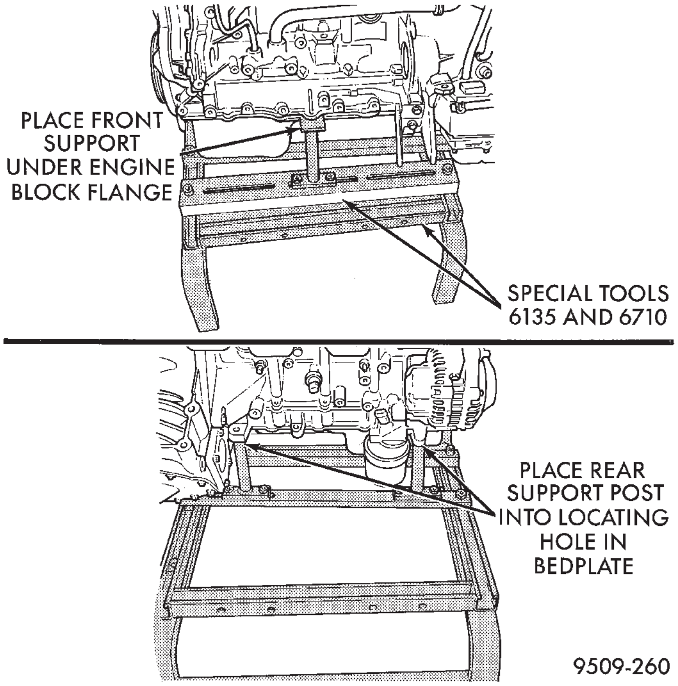


Fig. 19 Positioning Engine Cradle Support Post Mounts

(4) Install axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(5) Install transmission and engine braces and splash shields.

(6) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(7) Install power steering pump and reservoir. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(8) Install A/C compressor and hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(9) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(10) Install front and rear engine mount through bolts.

(11) Install inner splash shield and front wheels.

(12) **Manual Transmission:** Connect clutch cable and linkages. Refer to Group 6, Manual Transaxle Clutch.

(13) **Automatic Transmission:** Connect shifter linkage. Refer to Group 21, Transaxle for procedures.

(14) Connect fuel line and heater hoses.

(15) Install ground straps. Connect engine and throttle body electrical connections and harnesses. Refer to Group 8, Electrical for procedure.

(16) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(17) Install radiator and fan module. Install radiator hoses. Fill cooling system. Refer to Group 7, Cooling System for filling procedure.

(18) Install battery tray and battery. Set Powertrain Control Module (PCM) into place.

(19) Install air cleaner and hoses.

(20) Evacuate and charge air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedures.

(21) Install oil filter. Fill engine crankcase with proper oil to correct level.

(22) Start engine and run until operating temperature is reached.

(23) Adjust transmission linkage, if necessary.

INTAKE MANIFOLD

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

To release fuel pressure, refer to Group 14, Fuel System for procedure.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Disconnect negative cable from auxiliary jumper terminal (Fig. 20).

(3) Remove Air Inlet Resonator. Refer to Group 14, Fuel System for procedure.

(4) Perform fuel system pressure relief procedure and disconnect the fuel supply line quick connect at the fuel rail assembly. Refer to Group 14, Fuel System for procedure.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

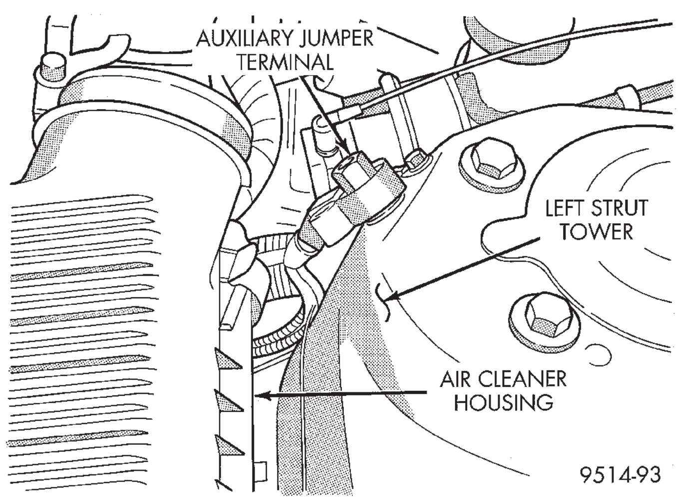


Fig. 20 Auxiliary Jumper Terminal

REMOVAL AND INSTALLATION (Continued)

(5) Remove fuel rail assembly attaching screws and remove fuel rail assembly from engine. Cover injector holes with a suitable covering.

CAUTION: Do not set fuel injectors on their tips, damage may occur to the injectors

(6) Remove accelerator and speed control cables from throttle lever and bracket. Refer to Group 14, Fuel System for procedures.

(7) Disconnect idle air control (IAC) motor and throttle position sensor (TPS) wiring connectors (Fig. 21).

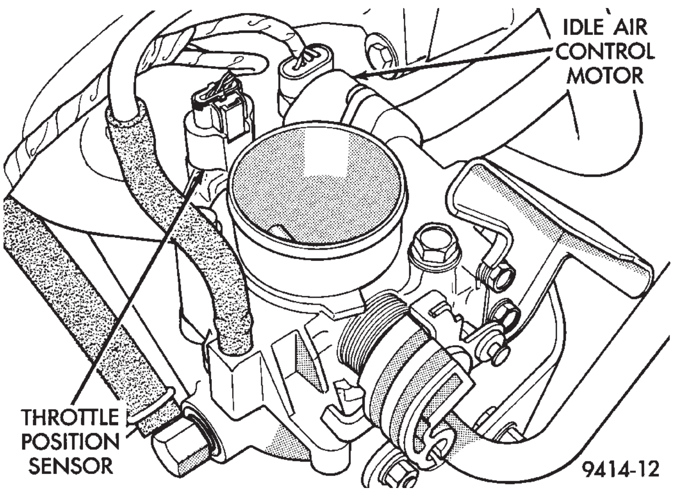


Fig. 21 Idle Air Control (IAC) Motor, Throttle Position Sensor (TPS) Wiring Connectors, and Vacuum Hose Connection.

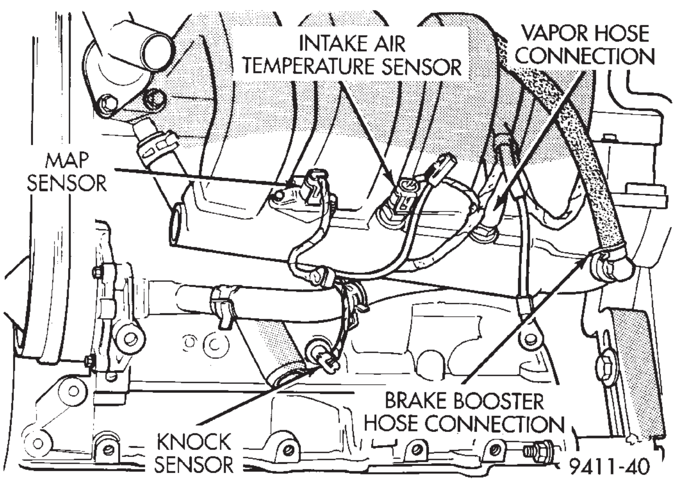


Fig. 22 Intake Manifold Electrical Connectors and Vacuum Hose Connections

(8) Disconnect intake air temperature electrical connector. Disconnect leak detection pump and PCV hoses (Fig. 22).

(9) Disconnect knock sensor electrical connector and disconnect wiring harness from tab located on the intake manifold (Fig. 22).

(10) Remove transaxle to throttle body support bracket fasteners at the throttle body and loosen the fastener at the transaxle end.

(11) Remove EGR tube bolts at the valve and at the intake manifold (Fig. 23). Remove tube from engine and discard gaskets.

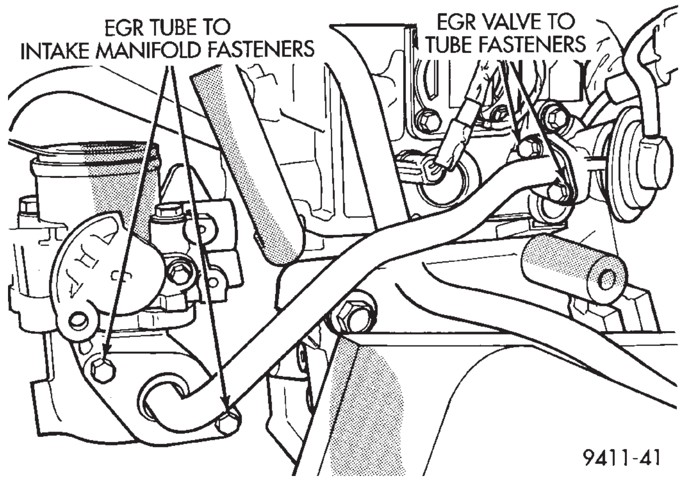


Fig. 23 Tube Assembly—Typical

(12) Remove the intake manifold to inlet water tube support fastener (Fig. 24).

(13) Remove intake manifold fasteners and washer assemblies. Remove intake manifold.

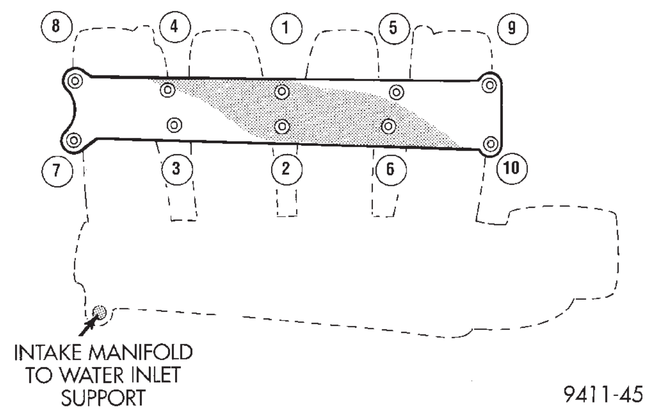


Fig. 24 Intake Manifold Tightening Sequence—2.0L Engine

INSTALLATION

Replace all O-ring seals (Fig. 25). All intake manifold fasteners and washers are to be discarded and replaced with **NEW** fasteners and washers.

(1) Install new intake manifold O-ring seals. Tighten fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 24).

(2) Remove covering from fuel injector holes and insure the holes are clean. Install fuel rail assembly

REMOVAL AND INSTALLATION (Continued)

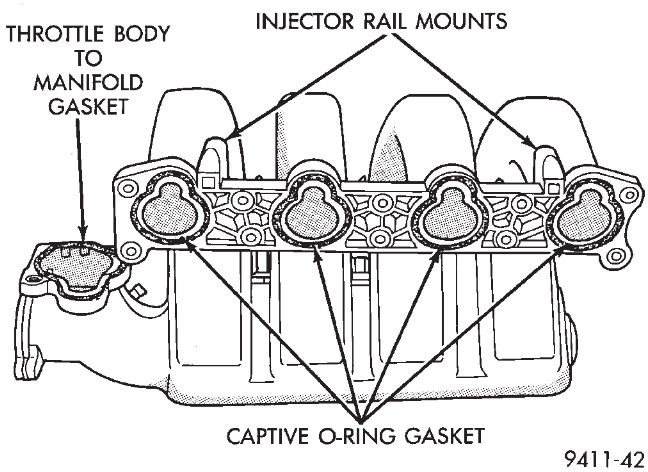


Fig. 25 Intake Manifold O-Rings—2.0L Engine

to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(3) Connect PCV and brake booster hoses.

(4) Inspect quick connect fittings for damage, replace if necessary. Refer to Group 14, Fuel System for procedure. Lubricate tube with clean engine oil. Connect fuel supply hose to fuel rail assembly. Check connection by pulling on connector to insure it locked into position.

(5) Install throttle body. Tighten fasteners to 22 N·m (200 in. lbs.). Install transaxle to throttle body support bracket and tighten to 12 N·m (105 in. lbs.) at the throttle body first. Next tighten the bracket at the transaxle.

(6) Connect manifold absolute pressure (MAP) and intake air temperature sensor wiring connectors.

(7) Connect knock sensor electrical and starter relay connectors. Connect wiring harness to intake manifold tab.

(8) Connect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors.

(9) Connect vacuum hoses to throttle body.

(10) Install accelerator and speed control cables to their bracket and connect them to the throttle lever. Refer to Group 14, Fuel System Throttle Body Installation procedure.

(11) With new EGR gaskets in position, loosely assemble the EGR tube onto valve and intake manifold finger tight. Tighten tube fasteners at the EGR valve first to 11 N·m (95 in. lbs.). Then, tighten the intake manifold side fasteners to 11 N·m (95 in. lbs.).

(12) Connect negative cable to auxiliary jumper terminal.

(13) With the DRB scan tool use ASD Fuel System Test to pressurize system to check for leaks.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

EXHAUST MANIFOLD

REMOVAL

(1) Remove exhaust pipe from manifold. It may be necessary to remove the entire exhaust system. Refer to Group 11 Exhaust System for procedure.

(2) Remove exhaust manifold heat shield (Fig. 26).

(3) Remove 8 exhaust manifold retaining fasteners and remove exhaust manifold (Fig. 27).

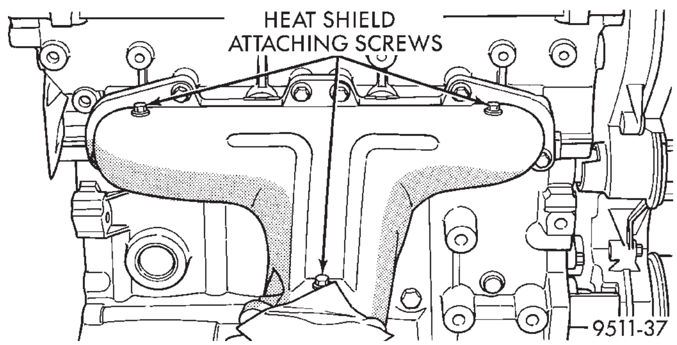


Fig. 26 Exhaust Manifold Heat Shield

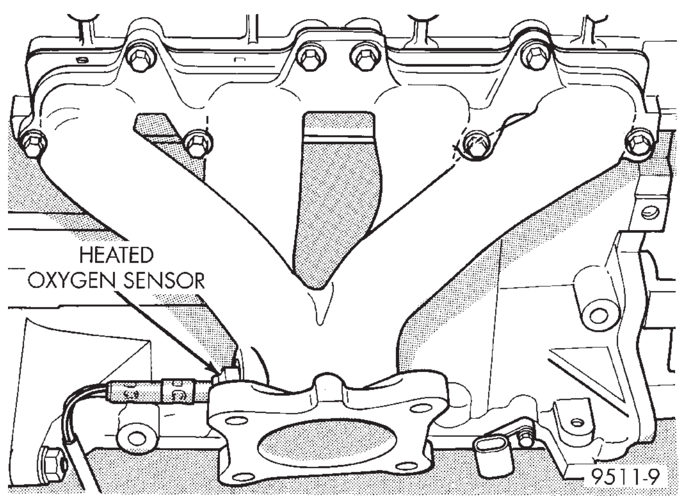


Fig. 27 Exhaust Manifold

INSTALLATION

(1) Install new manifold gasket. **DO NOT APPLY SEALER**.

(2) Position exhaust manifold in place. Tighten fasteners, starting at center and progressing outward in both directions to 23 N·m (200 in. lbs.). Repeat this procedure until all fasteners are at specified torque.

(3) Install exhaust manifold heat shield.

(4) Attach exhaust pipe and tighten fasteners to 28 N·m (250 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

CYLINDER HEAD COVER

REMOVAL

(1) Remove ignition coil pack (Fig. 28).

(2) Remove the cylinder head cover bolts.

(3) Remove cylinder head cover from cylinder head.

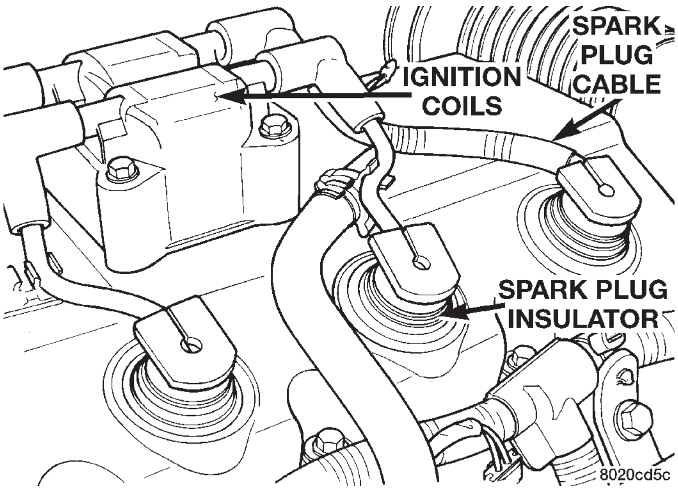


Fig. 28 Ignition Coil Pack

INSTALLATION

Before installation, clean cylinder head and cover mating surfaces. Make certain the cylinder head cover mating surface is flat.

(1) Install new valve cover gasket.

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(2) Install cover assembly to head and tighten fasteners to 12 N·m (105 in. lbs.).

(3) Install ignition coil pack. Tighten fasteners to 23 N·m (200 in. lbs.).

SPARK PLUG TUBE

(1) Remove cylinder head cover. Refer to procedure in this section.

(2) Using locking pliers remove the tube from the cylinder head (Fig. 29). Discard old tube.

(3) Clean area around spark plug with Mopar® parts cleaner or equivalent.

(4) Apply Mopar® Stud and Bearing Mount or equivalent to a new tube approximately 1 mm from the end in a 3 mm wide area.

(5) Install sealer end of tube into the cylinder head. Then carefully install the tube using a hardwood block and mallet until the tube is seated into the bottom of the bore.

(6) Install cylinder head cover. Refer to procedure in this section.

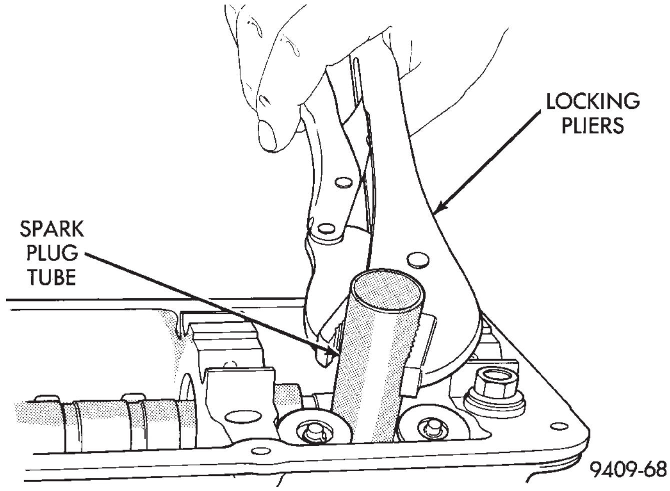


Fig. 29 Servicing Spark Plug Tubes

SPARK PLUG TUBE SEALS

The spark plug tube seals are located in the cylinder head cover (Fig. 30). These seals are pressed into the cylinder head cover to seal the outside perimeter of the spark plug tubes. If these seals show signs of hardness and/or cracking they should be replaced.

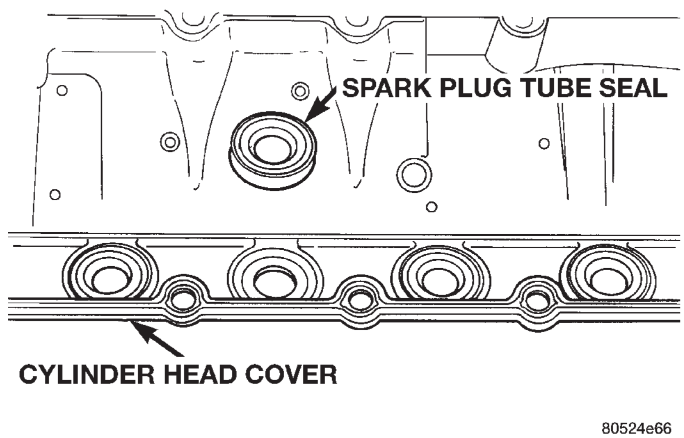


Fig. 30 Spark Plug Tube Seals

CAMSHAFT

NOTE: TO REMOVE CAMSHAFT, THE CYLINDER HEAD MUST BE REMOVED.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System.

(2) Remove the cylinder head cover. Refer to procedure outlined in this section.

(3) Mark rocker arm shaft assemblies so that they are installed in their original positions.

REMOVAL AND INSTALLATION (Continued)

(4) Remove rocker arm shaft bolts. Refer to procedure outlined in this section.

(5) Remove timing belt, timing belt tensioner, and camshaft sprocket. Refer to procedures outlined in this section.

(6) Remove rear timing belt cover.

(7) Remove cylinder head. Refer to procedure outlined in this section.

(8) Remove camshaft sensor and camshaft target magnet.

(9) Remove camshaft from the rear of cylinder head.

INSPECT CYLINDER HEAD FOR THE FOLLOWING:

NOTE:

- **Check oil feed holes for blockage.**
- **Inspect cylinder head camshaft bearings for wear, Refer to Cylinder Head, Inspection and Cleaning.**
- **Check camshaft bearing journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.**

INSTALLATION

(1) Lubricate the camshaft journals with oil and install camshaft **without** rocker arm assemblies installed.

(2) Install camshaft target magnet into the end of the camshaft. Tighten mounting screw to 3.4 N·m (30 in. lbs.).

(3) Install camshaft position sensor and tighten mounting screws to 9 N·m (80 in. lbs.).

(4) Measure camshaft end play using the following procedure:

- Mount dial indicator C-3339 or equivalent, to a stationary point on cylinder head (Fig. 31).
- Using a suitable tool, move camshaft to rearward limits of travel.
- Zero the dial indicator.
- Move camshaft forward to limits of travel and read dial indicator.
- End play travel: 0.13 - 0.33 mm (0.005 - 0.013 in.).

(5) Install front camshaft seal. Camshaft must be installed before the camshaft seal is installed. Refer to procedure outlined in this section.

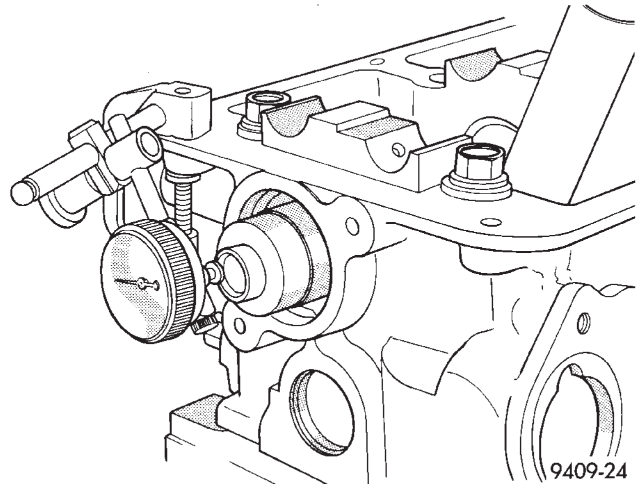


Fig. 31 Camshaft End Play

(6) Install cylinder head. Refer to procedure outlined in this section.

(7) Install camshaft sprocket and tighten to 115 N·m (85 ft. lbs.).

(8) Install rear timing belt cover.

(9) Install timing belt tensioner and timing belt. Refer to procedures outlined in this section.

(10) Install rocker arm assemblies in correct order as removed. Tighten the rocker arm assemblies in sequence shown in (Fig. 32) to 28 N·m (250 in. lbs.).

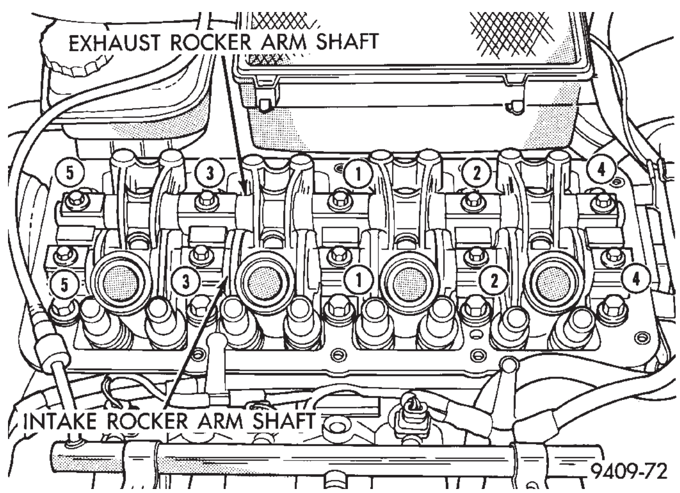


Fig. 32 Rocker Arm Shaft Tightening Sequence

(11) Install cylinder head cover and tighten fasteners to 12 N·m (105 in. lbs.).

(12) Install ignition coil pack and ignition cables.

ROCKER ARM/HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove cylinder head cover using procedure outlined in this section.

(2) Identify the rocker arm shaft assemblies before removal.

REMOVAL AND INSTALLATION (Continued)

(3) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.

(4) Identify the rocker arms spacers and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts from the shaft (Fig. 33).

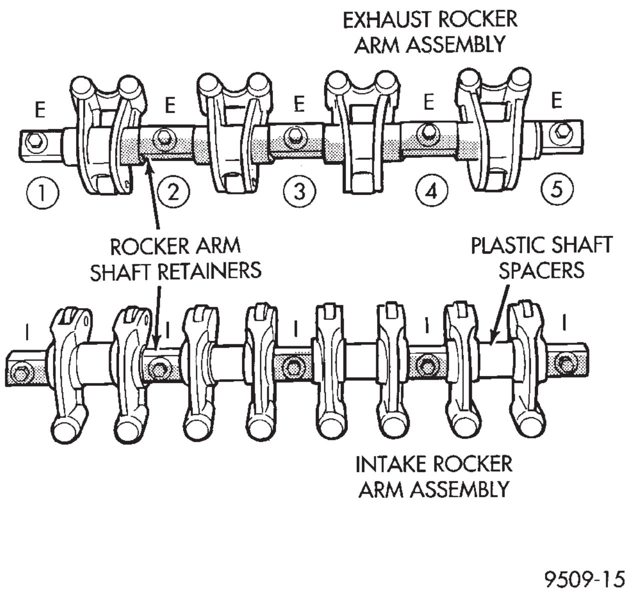


Fig. 33 Rocker Arm Shaft Assemblies

(5) Slide the rocker arms and spacers off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

NOTE: Inspect the rocker arm for scoring, wear on the roller or damage to the rocker arm (Fig. 34) Replace if necessary. Check the location where the rocker arms mount to the shafts for wear or damage. Replace if damaged or worn. The rocker arm shaft is hollow and is used as a lubrication oil duct. Check oil holes for clogging with small wire, clean as required. Lubricate the rocker arms and spacers. Install onto shafts in their original position (Fig. 33).

INSTALLATION

CAUTION: Set crankshaft to 3 notches before TDC before installing rocker arm shafts. Refer to Timing Belt System and Camshaft Seal Service of this section for procedure.

(1) Install rocker arm/hydraulic lash adjuster assembly making sure that adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed. If there is excessive plunger travel. Place the rocker arm assembly into clean engine oil and pump the plunger until the lash adjuster travel is taken up. If travel is not reduced, replace the assembly. Hydraulic

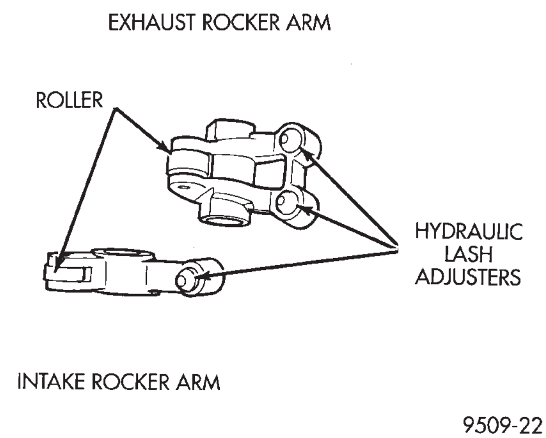


Fig. 34 Rocker Arm Assemblies

lash adjuster and rocker arm are serviced as an assembly.

(2) Install rocker arm and shaft assemblies with NOTCH in the rocker arm shafts pointing up and toward the timing belt side of the engine (Fig. 35). Install the retainers in their original positions on the exhaust and intake shafts (Fig. 33).

CAUTION: When installing the intake rocker arm shaft assembly be sure that the plastic spacers do not interfere with the spark plug tubes. If the spacers do interfere rotate until they are at the proper angle. To avoid damaging the spark plug tubes, do not attempt rotating the spacers by forcing down the shaft assembly.

(3) Tighten bolts to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 36).

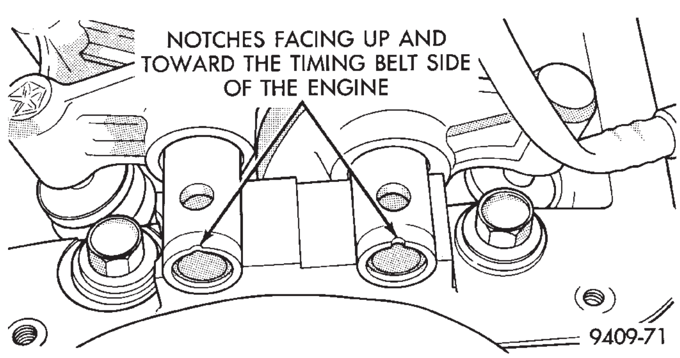


Fig. 35 Rocker Arm Shaft Notches

HYDRAULIC LASH ADJUSTER NOISE

A tappet-like noise may be produced from several items. Refer to Lash Adjuster Noise - Diagnosis in Standard Service Procedures, outlined in this Group. **Lash adjusters are replaced with the rocker arm as an assembly.**

REMOVAL AND INSTALLATION (Continued)

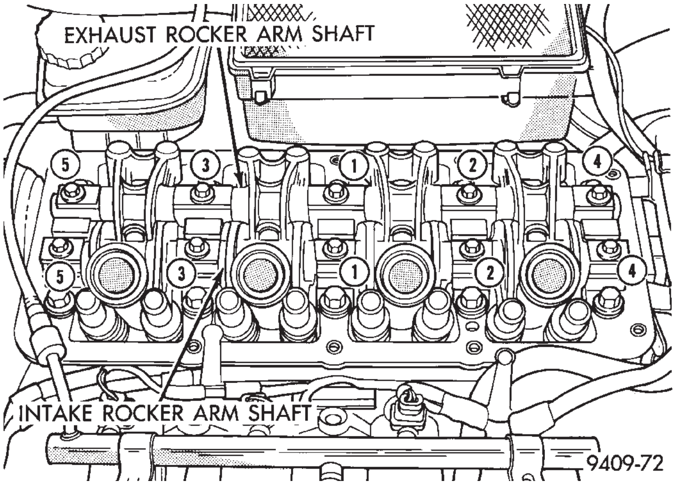


Fig. 36 Rocker Arm Shaft Tightening Sequence

VALVE SEALS AND SPRINGS—IN VEHICLE

REMOVAL

(1) Remove rocker arm shafts assemblies. Refer to procedure in this section.

(2) Rotate crankshaft until piston is at TDC on compression stroke.

(3) With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.

(4) Using Special Tool MD-998772A with adapter 6779 (Fig. 37) compress valve springs and remove valve locks.

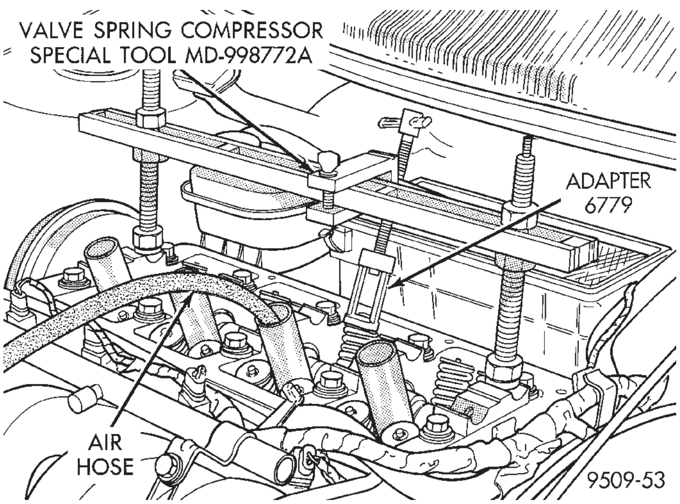


Fig. 37 Removing and Installing Valve Spring

(5) Remove valve spring.

(6) Remove valve stem seal by using a valve stem seal tool (Fig. 38).

INSTALLATION

(1) Install valve seal/valve spring seat assembly. Refer to Valve Installation procedure in this section.

(2) Using Special Tool MD-998772A compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems (air pressure required), piston at TDC.

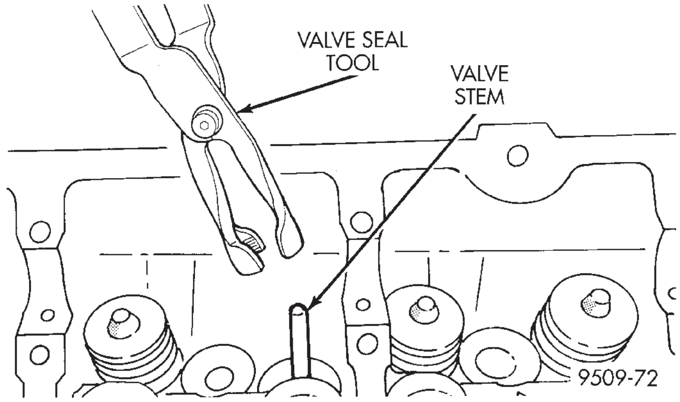


Fig. 38 Valve Stem Oil Seal Tool

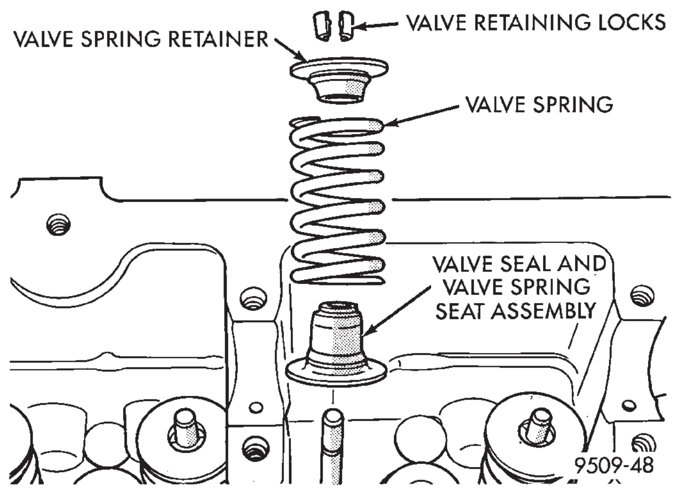


Fig. 39 Valve Spring Assembly

(3) Install rocker arm shaft assemblies. Refer to procedure in this section.

(4) Install cylinder head cover. Refer to procedure in this section.

CYLINDER HEAD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System.

(2) Disconnect battery negative cable from auxiliary jumper terminal.

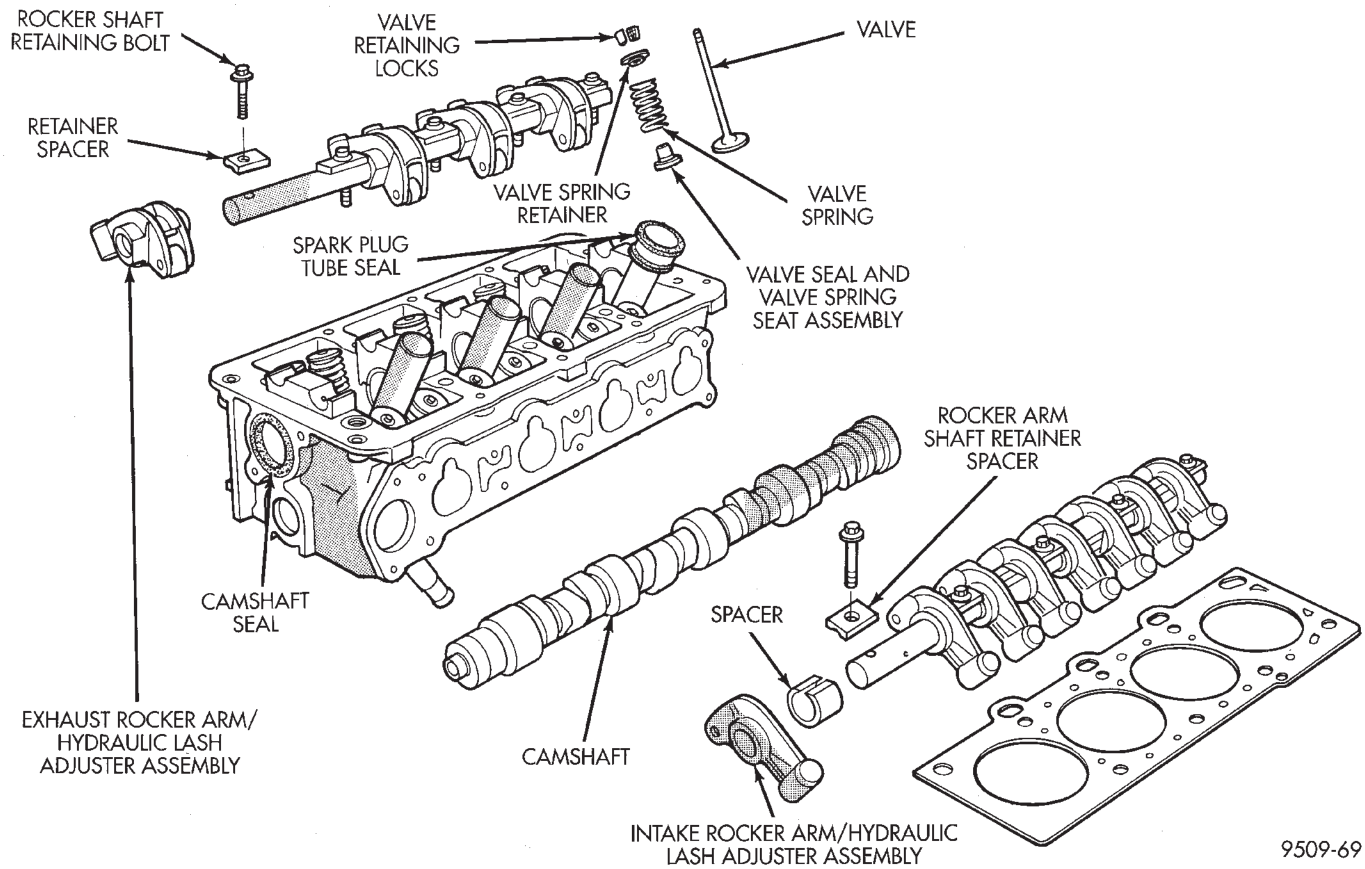
(3) Drain cooling system. Refer to Group 7, Cooling System.

(4) Remove air cleaner inlet duct and air cleaner upper housing, disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.

(5) Remove throttle linkage.

(6) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

REMOVAL AND INSTALLATION (Continued)



Cylinder Head and Valve Assembly

(7) Remove power brake vacuum hose from intake manifold.

(8) Raise vehicle and remove exhaust pipe from manifold.

(9) Remove power steering fluid reservoir and set aside.

(10) Disconnect coil pack wiring connector and remove coil pack and bracket from engine.

(11) Remove cylinder head cover.

(12) Remove cam sensor and fuel injectors wiring connectors.

(13) Remove intake manifold. Refer to procedure in this section.

(14) Remove timing belt and camshaft sprocket. Refer to procedure outlined in this section.

(15) Remove rocker arm shaft assemblies.

(16) Remove cylinder head bolts.

NOTE: Inspect camshaft bearing journals for scoring. Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 40).

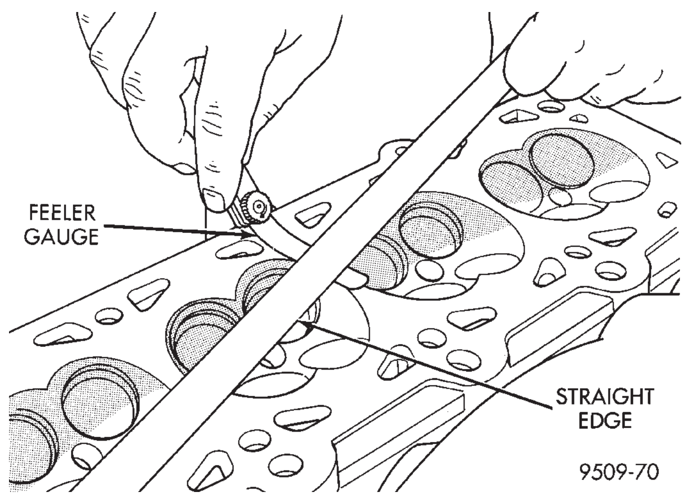


Fig. 40 Checking Cylinder Head Flatness

INSTALLATION

EXAMINING CYLINDER HEAD BOLTS

NOTE: The cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts should be replaced (Fig. 41).

REMOVAL AND INSTALLATION (Continued)

Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale, the bolt(s) should be replaced.

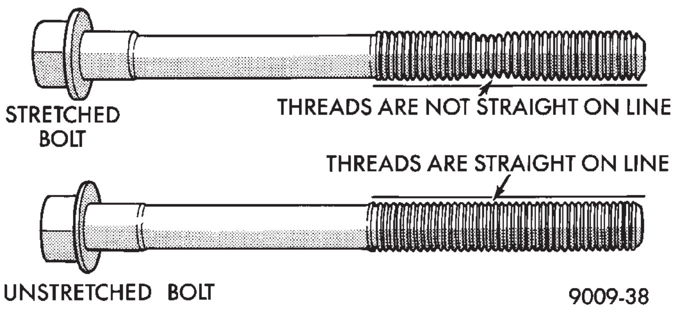


Fig. 41 Checking Bolts for Streching (Necking)

(1) Before installing the cylinder head bolts, the threads should be oiled with engine oil. The 4 short bolts 110 mm (4.330 in.) are to be installed in positions 7, 8, 9, and 10 (Fig. 42).

(2) Tighten the cylinder head bolts in the sequence shown in (Fig. 42). Using the 4 step torque method, tighten according to the following values:

- First All to 34 N·m (25 ft. lbs.)
- Second All to 68 N·m (50 ft. lbs.)
- Third All to 68 N·m (50 ft. lbs.)
- Fourth Turn an additional 1/4 Turn, **Do not use a torque wrench for this step.**

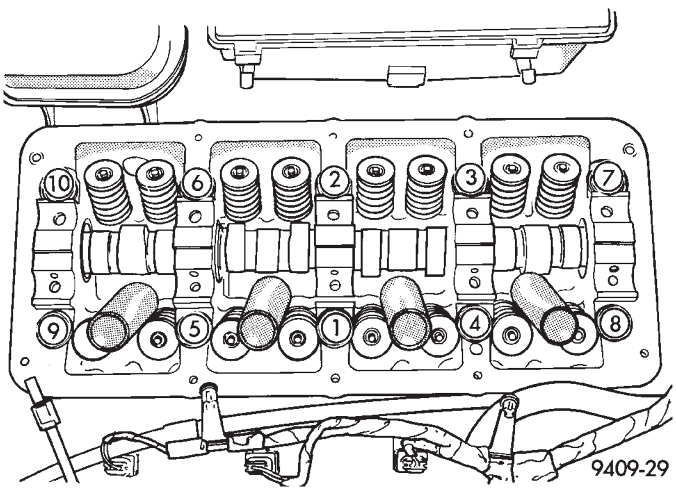


Fig. 42 Cylinder Head Tightening Sequence

(3) Install rocker shaft assemblies in correct order as removed. Tighten rocker arm shaft bolts in sequence shown in (Fig. 43) to 28 N·m (250 in. lbs.).

(4) Install inner timing belt cover and camshaft sprocket.

(5) Install timing belt.

(6) Install intake manifold. Refer to procedure in this section.

(7) Connect electrical connectors to cam sensor and fuel injectors.

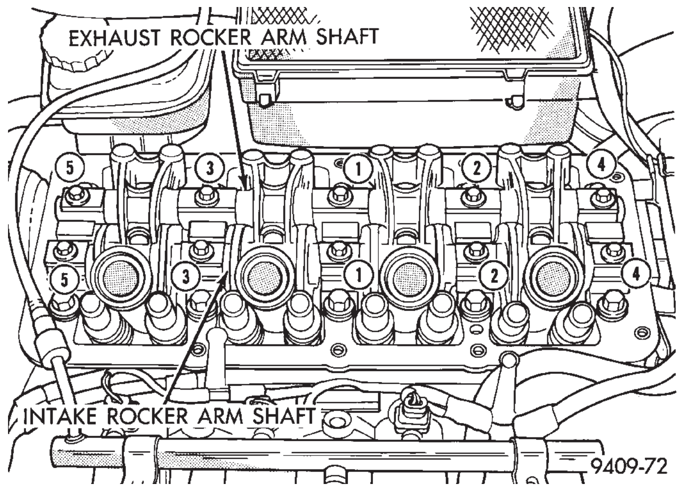


Fig. 43 Rocker arm Tightening Sequence

(8) Install cylinder head cover and tighten fasteners to 12 N·m (105 in. lbs.).

(9) Install power steering reservoir.

(10) Install ignition coil pack and tighten fasteners to 23 N·m (200 in. lbs.). Connect coil pack wiring connector.

(11) Connect power brake booster vacuum hose to intake manifold.

(12) Connect throttle linkage to throttle body.

(13) Connect all vacuum lines and electrical wiring connectors.

(14) Install air cleaner inlet duct and upper air cleaner housing.

(15) Raise vehicle on hoist and connect exhaust system to exhaust manifold.

(16) Lower vehicle and connect negative cable to auxiliary battery terminal

(17) With the DRB scan tool use ASD Fuel System Test to pressurize fuel system. Check for fuel leaks.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

VALVE SERVICE WITH THE CYLINDER HEAD REMOVED

REMOVAL

(1) With cylinder head removed, compress valve springs using Special Tool C-3422-B or equivalent.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

(3) Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

REMOVAL AND INSTALLATION (Continued)

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

(3) If valve stems are worn more than 0.05 mm (.002 in.), replace valve.

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 44). Refer to Valve Guide Specification Chart for specifications. Replace guides if they are not within specification.

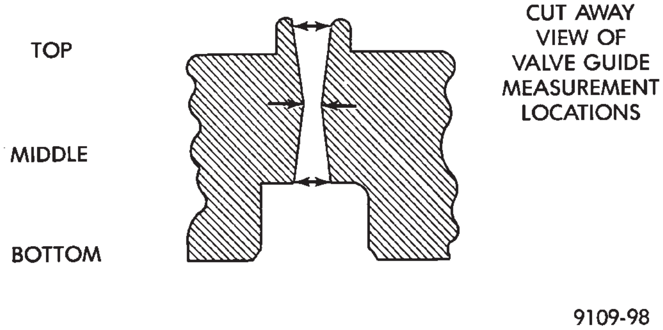


Fig. 44 Checking Wear on Valve Guide—Typical

VALVE GUIDE SPECIFICATION CHART

	Intake Valve	Exhaust Valve
Valve Guide Diameter	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	5.975 - 6.000 mm (0.2352 - 0.2362 in.)
	Valve Guide Clearance	
	Intake Valve	Exhaust Valve
New:	0.023 - 0.066 mm (0.001 - 0.0025 in.)	0.051 - 0.094 mm (0.002 - 0.0037 in.)
Service Limit:	0.25 mm (0.010 in.)	

(3) Check valve guide height (Fig. 45).

TESTING VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested Special Tool C-647. As an example, the compression length of the spring to be tested is 33.34 mm (1-5/16 inches). Turn tool table until surface is in line with the 33.34 mm (1-5/16 inch) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compress-

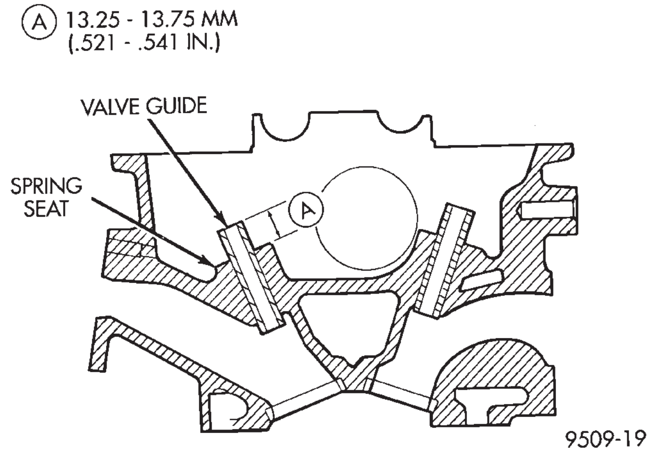


Fig. 45 Valve Guide Height

ing lever to set tone device (Fig. 46). Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Discard the springs that do not meet specifications. The Following specifications apply to both intake and exhaust valve springs.

- Valve Closed Nominal Force— 67 lbs. @ 39.8 mm (1.57 in.)
- Valve Open Nominal Force— 160 lbs. @ 32.6 mm (1.28 in.)

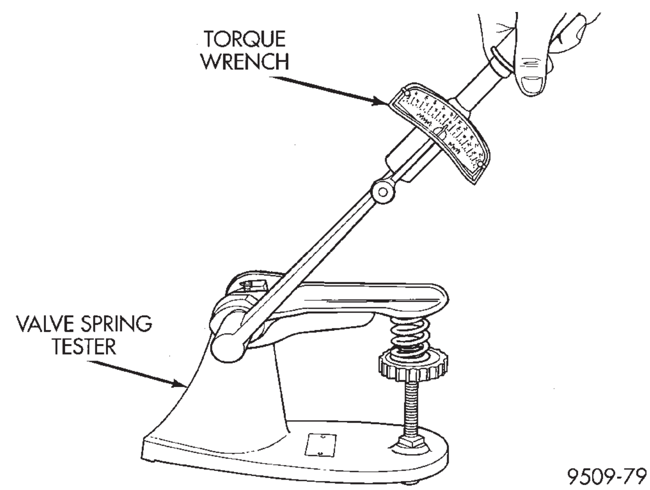


Fig. 46 Valve Spring Testing

(2) Verify springs are not distorted with a steel square and surface plate, check springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and valve face have a 45 degree angle.

REMOVAL AND INSTALLATION (Continued)

(2) Inspect the remaining margin after the valves are refaced (Fig. 47). Intake valves with less than 0.95 mm (1/32 inch.) margin and Exhaust valves with less than 1.05 mm (3/64 inch) margin should be discarded.

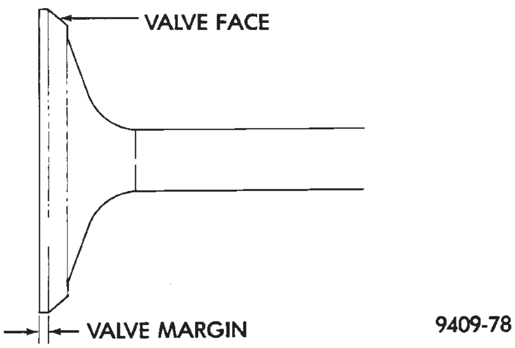


Fig. 47 Intake and Exhaust Valve Refacing

(3) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained. For valve specifications see Valve Specification Chart.

VALVE SPECIFICATION CHART

Face Angle	
Intake and Exhaust:	45 - 45 1/2°
Head Diameter	
Intake:	33.12 - 33.37 mm (1.303 - 1.313 in.)
Exhaust:	28.57 - 28.83 mm (1.124 - 1.135 in.)
Length (Overall)	
Intake:	114.69 - 115.19 mm (4.515 - 4.535 in.)
Exhaust:	116.94 - 117.44 mm (4.603 - 4.623 in.)
Stem Diameter	
Intake:	5.934 - 5.952 mm (0.2337 - 0.2344 in.)
Exhaust:	5.906 - 5.924 mm (0.2326 - 0.2333 in.)
Valve Margin	
Intake:	1.15 - 1.48 mm (0.0452 - 0.0582 in.)
Exhaust:	1.475 - 1.805 mm (0.0580 - 0.0710 in.)

(4) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator. Total runout should not exceed. 0.051 mm (0.002 inch.) (total indicator reading).

(5) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

- Intake valve seat diameter is 33 mm (1.299 in.)
- Exhaust valve seat diameter is 28 mm (1.102 in.)

(6) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. The intake valve seat must be serviced when the valve seat width is 2.0 mm (0.079 in.) or greater. The exhaust valve seat must be serviced when the valve seat width is 2.5 mm (0.098 in.) or greater. Otherwise the cylinder head must be replaced.

(7) When seat is properly positioned the width of intake and exhaust seats should be 0.75 to 1.25 mm (0.030 to 0.049 in.) (Fig. 48).

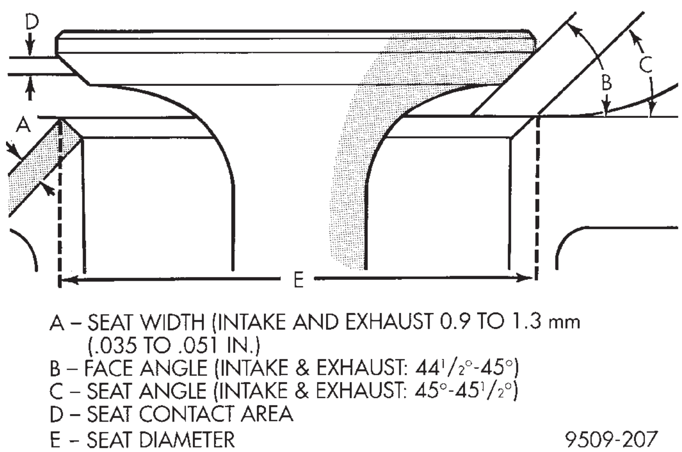


Fig. 48 Valve Seat Refacing

(8) Check valve tip to spring seat dimensions A after grinding the valve seats or faces. Grind valve tip to 43.51 - 44.57 mm (1.71 - 1.75 in.) for exhaust valve and 45.01 - 46.07 mm (1.77 - 1.81 in.) for intake valve over spring seat when installed in the head (Fig. 49). The valve tip chamfer may need to be reground to prevent seal damage when the valve is installed.

CLEANING

Clean all valve guides, valves and valve spring assemblies thoroughly with suitable cleaning solution before reassembling.

VALVE INSTALLATION

(1) Coat valve stems with clean engine oil and insert in cylinder head.

REMOVAL AND INSTALLATION (Continued)

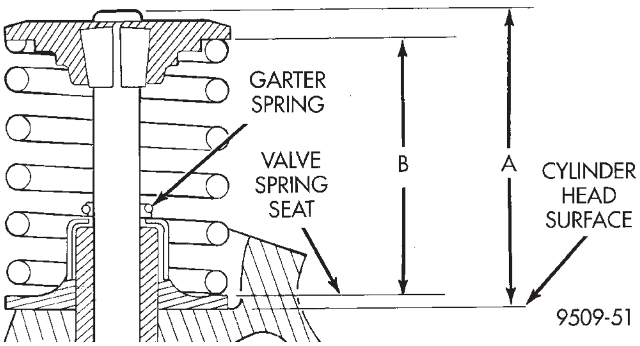


Fig. 49 Spring Installed Height and Valve Tip to Spring Seat Dimensions

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 50). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: If oversize valves are used, there is only one oversize valve available. The same stem seal is used on both the standard and oversize valve.

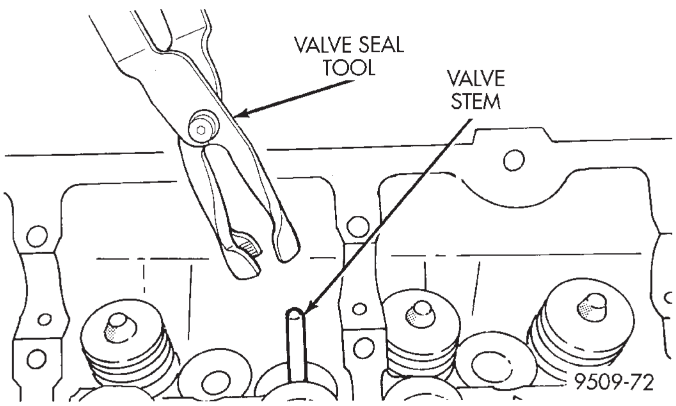


Fig. 50 Valve Stem Oil Seal Tool

(3) Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 49). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 40.18 mm (1.58 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

(5) Install rocker arm shafts as previously described in this section.

(6) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.17 mm (0.046 in.) for intake and 1.28 mm (0.050 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster/s to bleed down before rotating cam.

CRANKSHAFT DAMPER

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure outlined in that section.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 51).

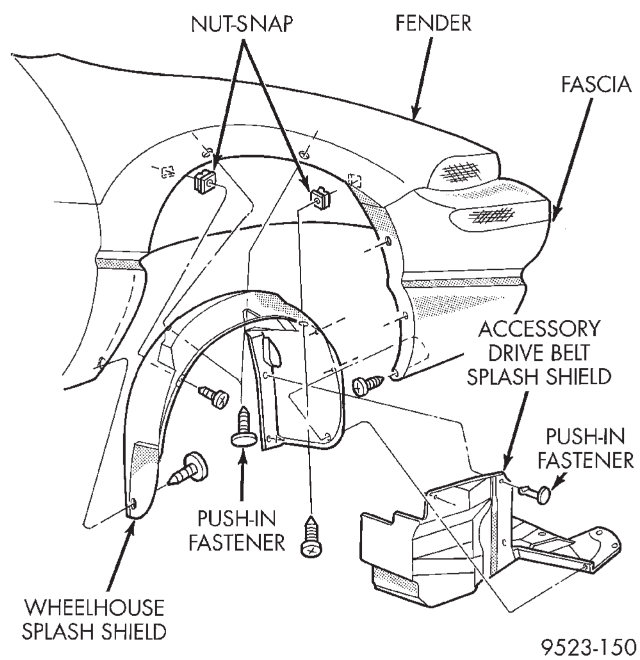


Fig. 51 Right Inner Splash Shield

(3) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827–A (Fig. 52).

INSTALLATION

(1) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 53).

(2) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

REMOVAL AND INSTALLATION (Continued)

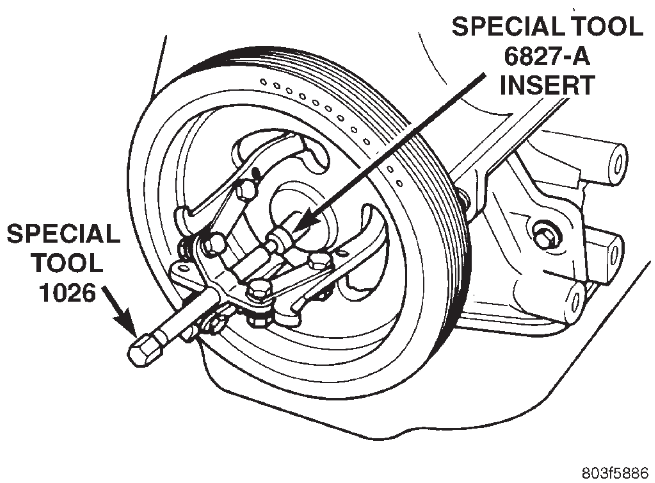


Fig. 52 Crankshaft Damper—Removal

(3) Raise vehicle on hoist and install right inner splash shield.

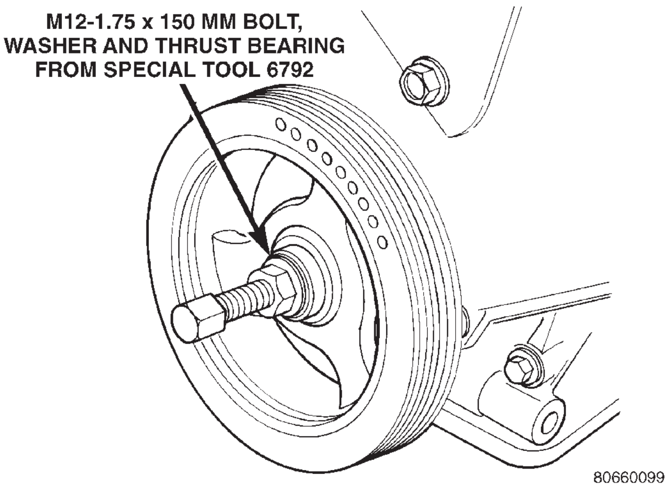


Fig. 53 Crankshaft Damper—Installation

TIMING BELT COVER

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(3) Raise vehicle on a hoist and remove right inner splash shield (Fig. 51).

(4) Remove crankshaft vibration damper. Refer to procedure in this section for removal.

(5) Lower vehicle and place a jack under engine.

(6) Remove right engine mount. Refer to procedure in this section.

(7) Remove generator and bracket (Fig. 54). Refer to Group 8C, Charging System for specific procedures.

(8) Remove right engine mount bracket (Fig. 55).

(9) Remove front timing belt cover (Fig. 56).

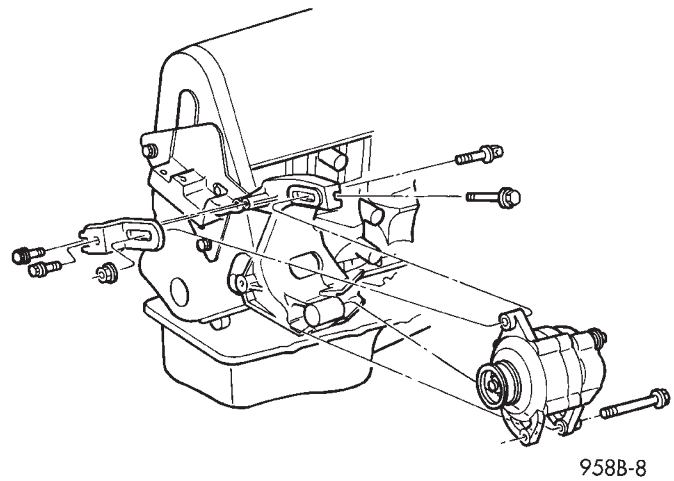


Fig. 54 Generator and Brackets

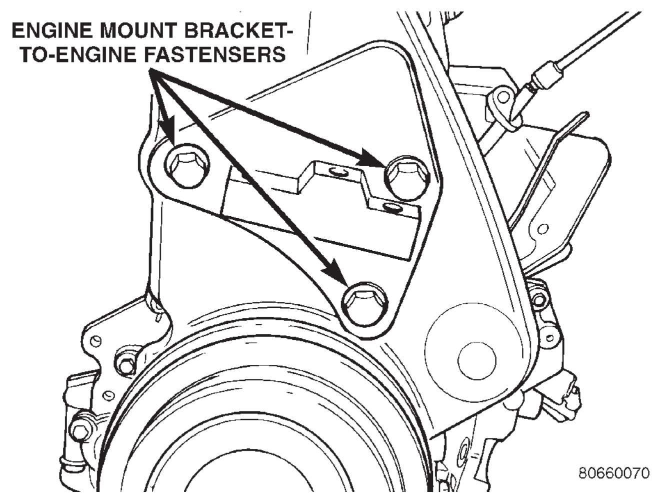


Fig. 55 Right Engine Mount Bracket

INSTALLATION

(1) Install front timing cover.

(2) Install engine mount bracket.

(3) Install right engine mount. Refer to procedure in this section for installation.

(4) Remove jack from under engine.

(5) Install generator bracket (Fig. 54). Tighten mounting bolts to 61 N·m (45 ft. lbs.).

(6) Install generator (Fig. 54). Refer to Group 8C, Charging System for procedures.

(7) Install crankshaft vibration damper. Refer to procedure in this section for installation.

(8) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(9) Raise vehicle on hoist and install right inner splash shield.

(10) Connect negative cable.

REMOVAL AND INSTALLATION (Continued)

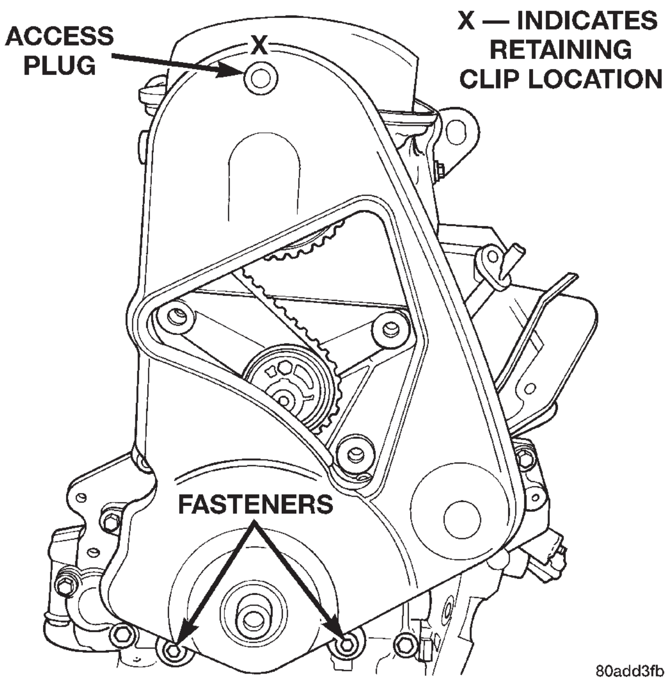


Fig. 56 Timing Belt Cover

CHECKING BELT TIMING—COVER INSTALLED

- Remove number one spark plug.
- Using a dial indicator, set number one cylinder to TDC on the compression stroke.
- Remove the access plug from the outer timing belt cover (Fig. 57).
- Check the timing mark on the camshaft sprocket, it should align with the arrow on the rear belt cover (Fig. 58).

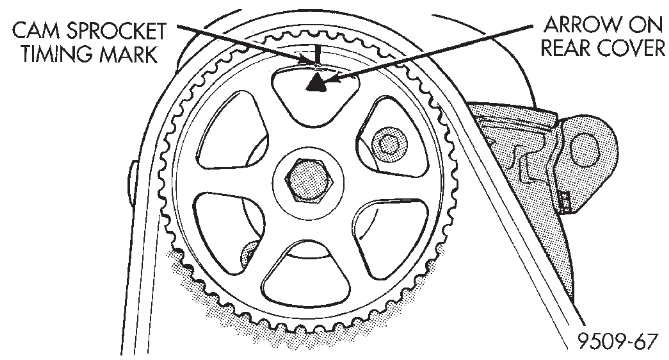


Fig. 58 Camshaft Timing Marks

TIMING BELT—WITH HYDRAULIC TENSIONER

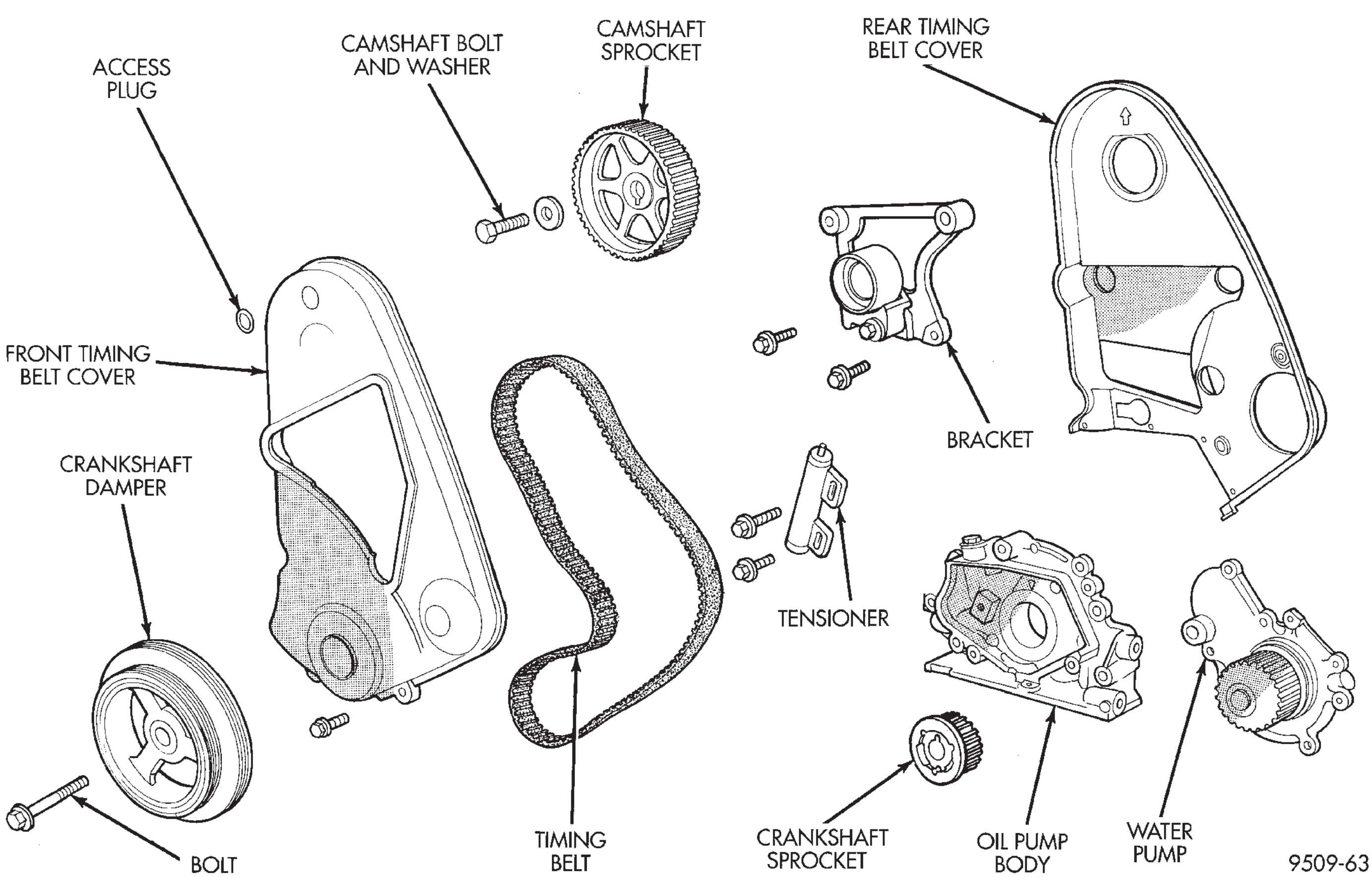


Fig. 57 Timing Belt System

REMOVAL AND INSTALLATION (Continued)

REMOVAL—TIMING BELT

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(3) Raise vehicle on a hoist and remove right inner splash shield (Fig. 59).

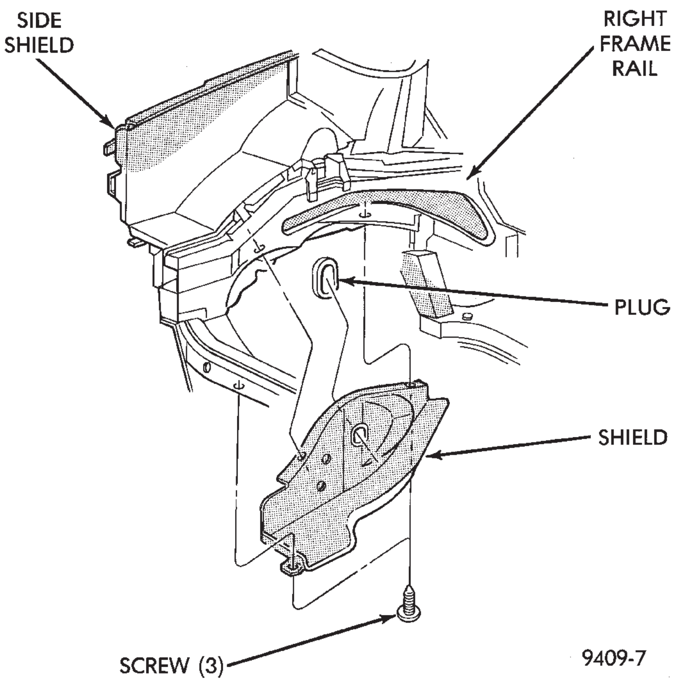


Fig. 59 Right Inner Splash Shield

(4) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 60).

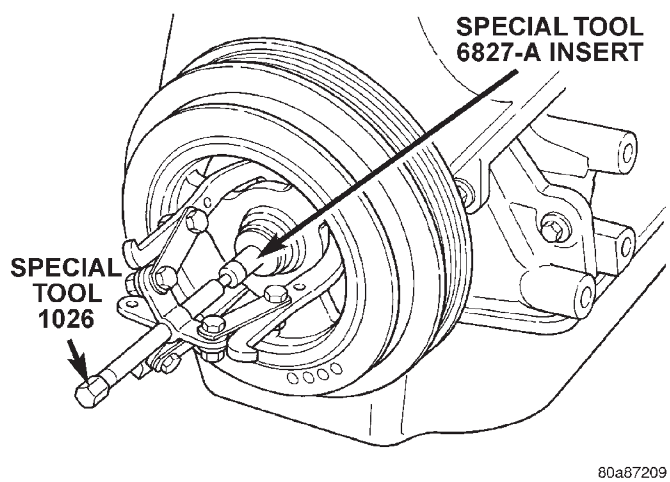


Fig. 60 Crankshaft Damper—Removal

(5) Lower vehicle and place a jack under engine.

(6) Remove right engine mount. Refer to procedure in this section.

(7) Remove generator and bracket (Fig. 61). Refer to Group 8C, Charging System for specific procedure.

(8) Remove right engine mount bracket (Fig. 62).

(9) Remove front timing belt cover (Fig. 63).

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt.

(10) Loosen timing belt tensioner fasteners (Fig. 65) and remove timing belt and tensioner.

CAUTION: Do not loosen, tighten, or remove the tensioner pivot bolt (Fig. 64).

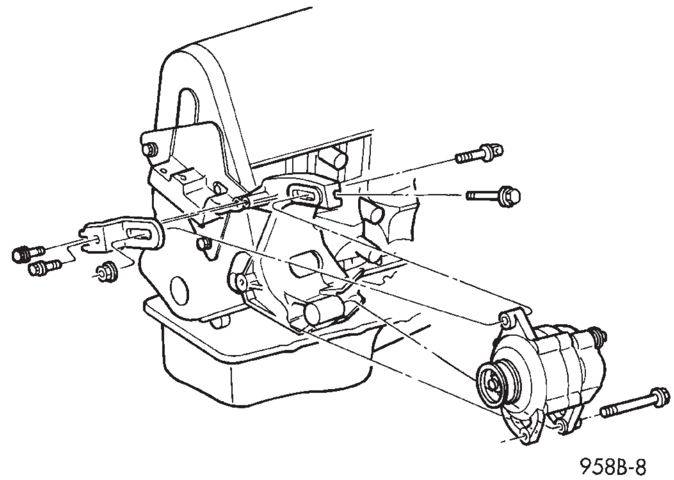


Fig. 61 Generator and Brackets

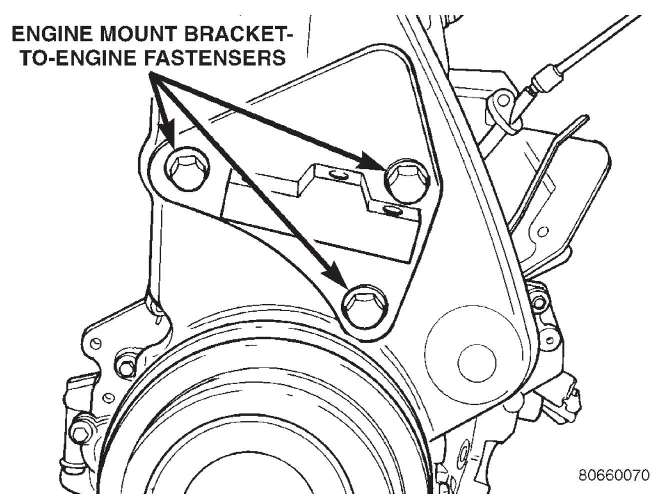


Fig. 62 Right Engine Mount Bracket

REMOVAL AND INSTALLATION (Continued)

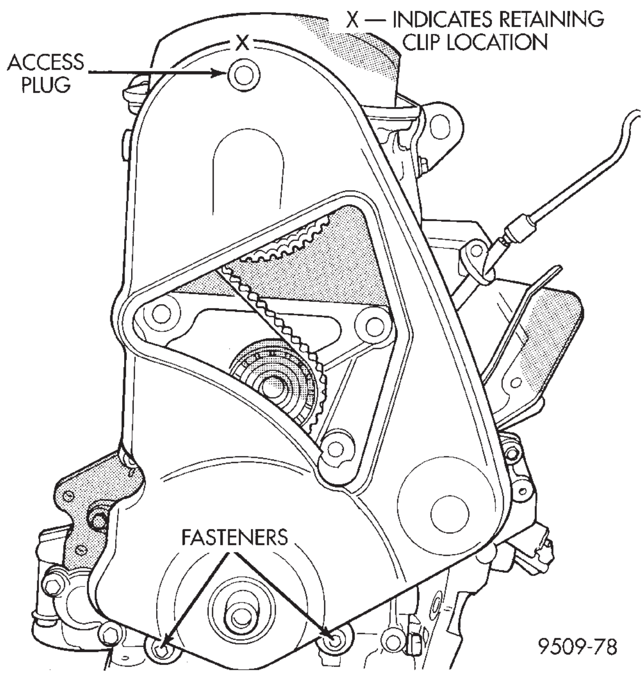


Fig. 63 Timing Belt Cover

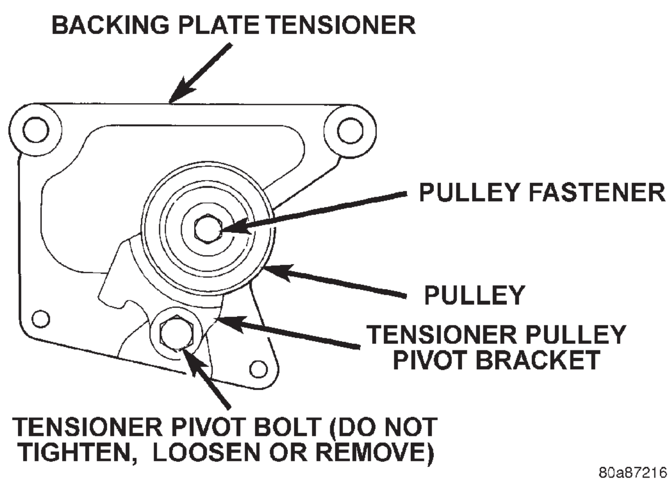


Fig. 64 Tensioner Pulley Assembly

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE AND BELT INSTALLATION —SOHC ENGINE

(1) When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

(2) Place the tensioner into a vise equipped with soft jaws and slowly compress the plunger (Fig. 66).

CAUTION: Index the tensioner in the vise the same way it is installed on the engine. This is to ensure proper pin orientation when tensioner is installed on the engine.

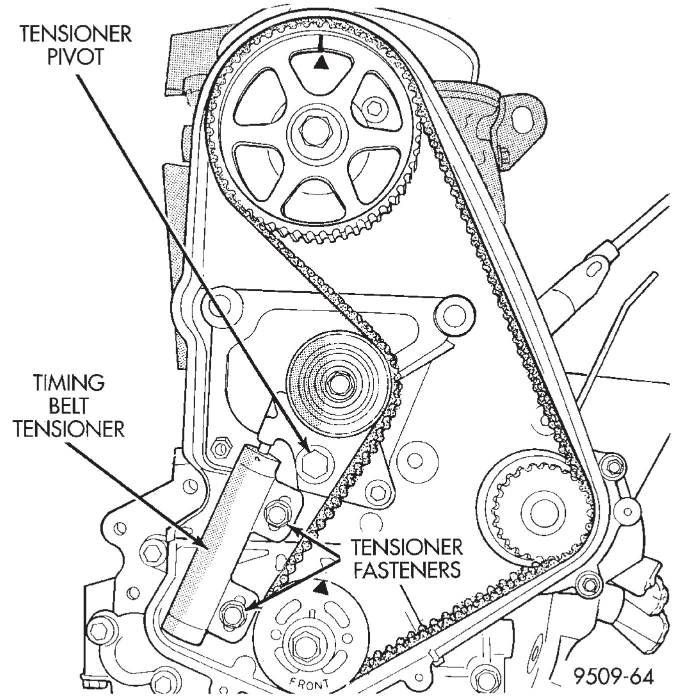


Fig. 65 Remove Timing Belt

(3) When plunger is compressed into the tensioner body install a 1.9 mm (5/64) Allen wrench or pin through the body and plunger to retain plunger in place until tensioner is installed.

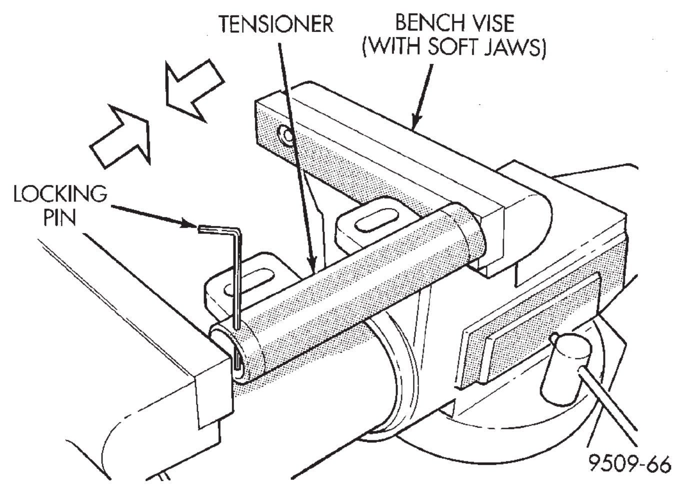


Fig. 66 Compressing Timing Belt Tensioner

(4) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 67).

(5) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear of timing belt cover (Fig. 68).

(6) Move crankshaft to 1/2 mark before TDC (Fig. 69) for belt installation.

(7) Install timing belt. Starting at the crankshaft, go around the water pump sprocket and then around the camshaft sprocket.

REMOVAL AND INSTALLATION (Continued)

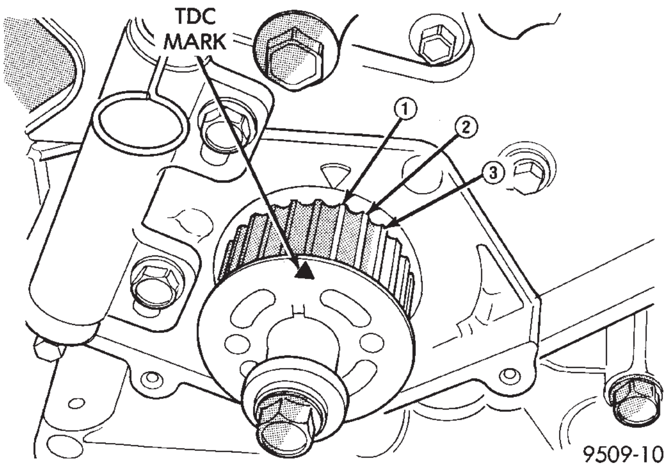


Fig. 67 Crankshaft Sprocket Timing

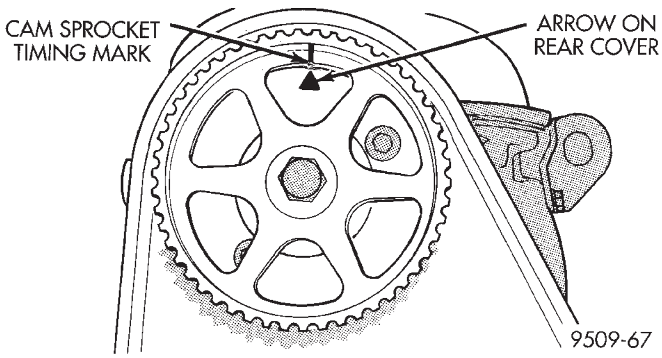


Fig. 68 Camshaft Timing Mark

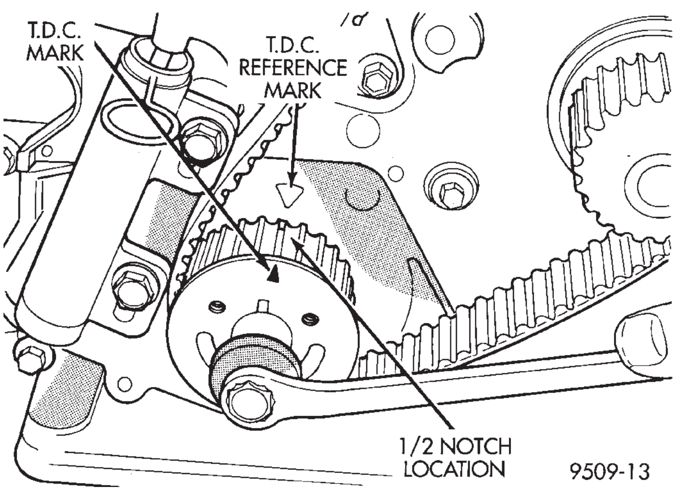


Fig. 69 Adjusting Crankshaft Sprocket for Timing Belt Installation

(8) Move crankshaft sprocket to TDC to take up belt slack. Install tensioner to block but do not tighten fasteners.

(9) Using a torque wrench on the tensioner pulley apply 28 N·m (250 in. lbs.) of torque (Fig. 70).

(10) With torque being applied to the tensioner pulley move the tensioner up against the tensioner pulley bracket and tighten fasteners to 31 N·m (23 ft. lbs.) (Fig. 70).

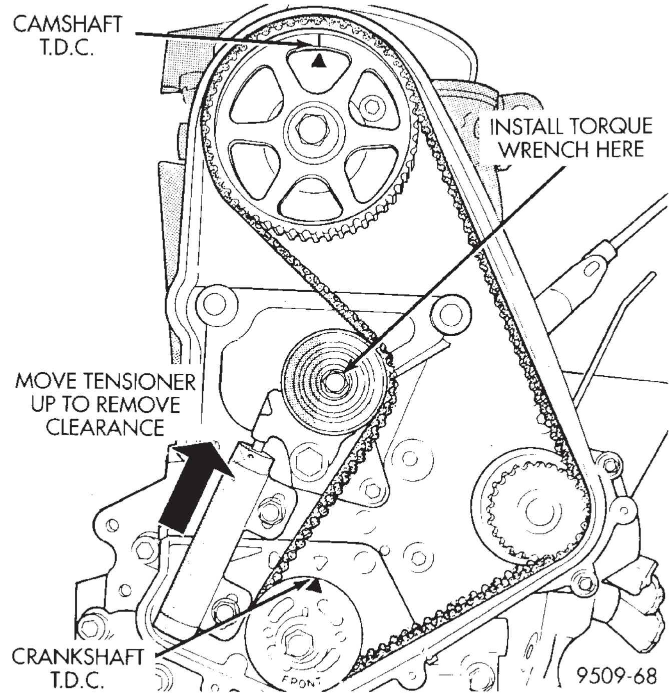


Fig. 70 Adjusting Timing Belt Tension

(11) Pull tensioner plunger pin. Pretension is correct when pin can be removed and installed.

(12) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 70).

(13) Install front half of timing cover.

(14) Install engine mount bracket.

(15) Install generator bracket to engine (Fig. 61). Tighten attaching bolts to 61 N·m (45 ft. lbs.).

(16) Install generator (Fig. 61). Refer to Group 8C, Charging System for procedure.

(17) Install right engine mount. Refer to procedure in this section.

(18) Remove jack from under engine.

(19) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 71).

(20) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(21) Raise vehicle on hoist and install right inner splash shield.

(22) Lower vehicle and connect negative cable.

REMOVAL AND INSTALLATION (Continued)

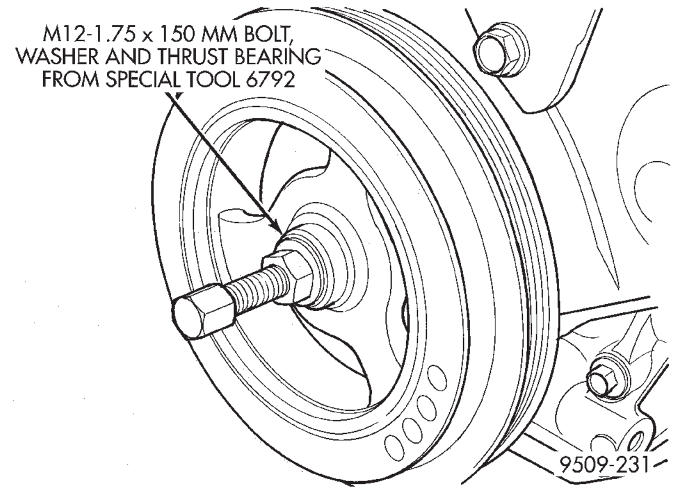


Fig. 71 Crankshaft Damper—Installation

TIMING BELT—WITH MECHANICAL TENSIONER

CHECKING BELT TIMING—COVER INSTALLED

• Remove number one spark plug.

• Using a dial indicator, set number one cylinder to TDC on the compression stroke.

• Remove the access plug from the outer timing belt cover (Fig. 72).

• Check the timing mark on the camshaft sprocket, it should align with the arrow on the rear belt cover (Fig. 73).

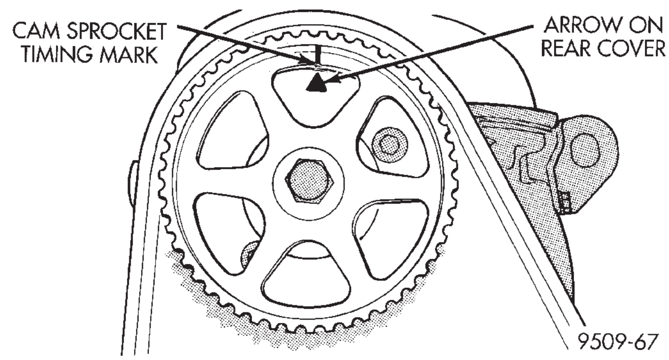


Fig. 73 Camshaft Timing Marks

REMOVAL—TIMING BELT

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(3) Raise vehicle on a hoist and remove right inner splash shield (Fig. 74).

(4) Remove right front wheel.

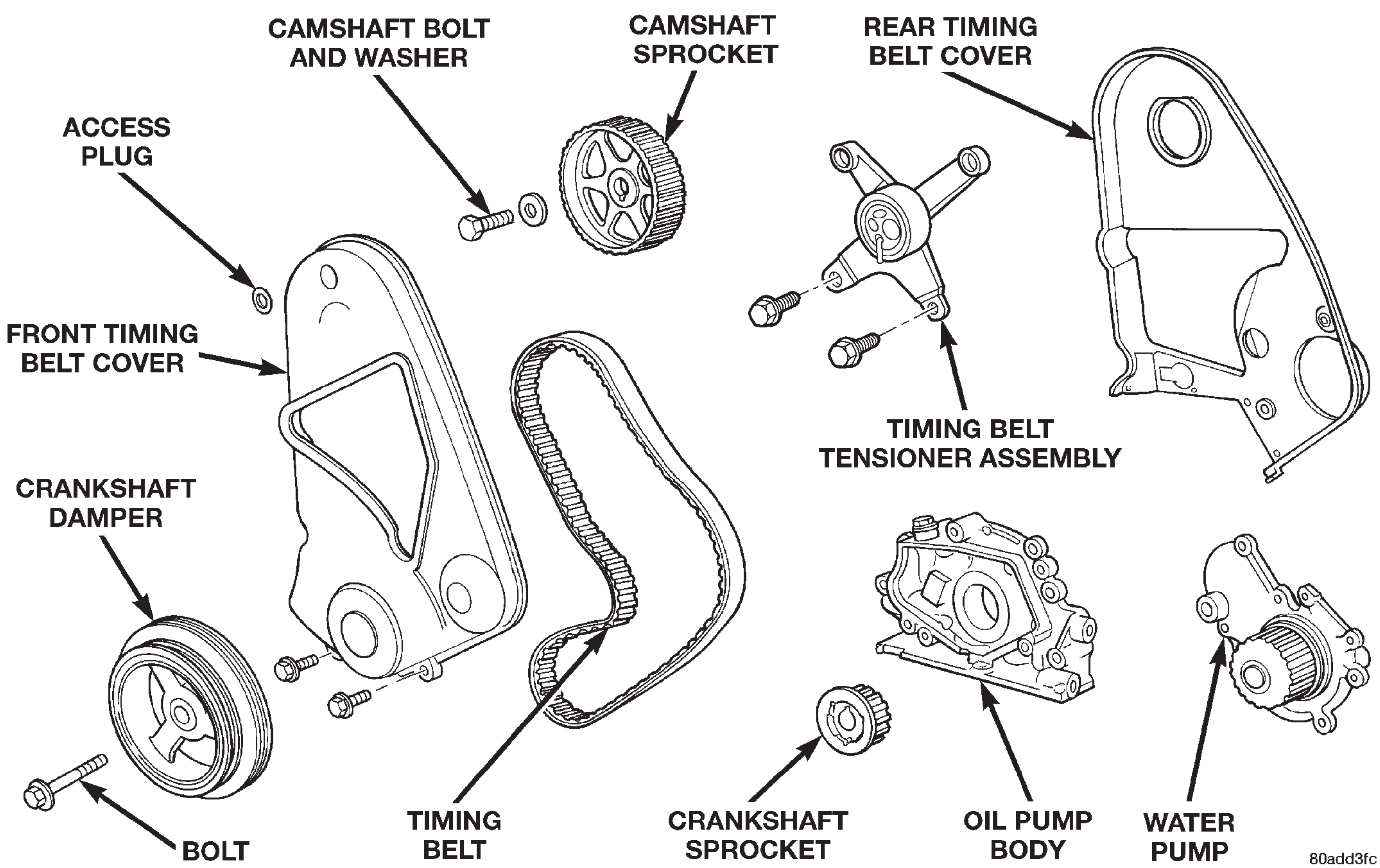


Fig. 72 Timing Belt System

REMOVAL AND INSTALLATION (Continued)

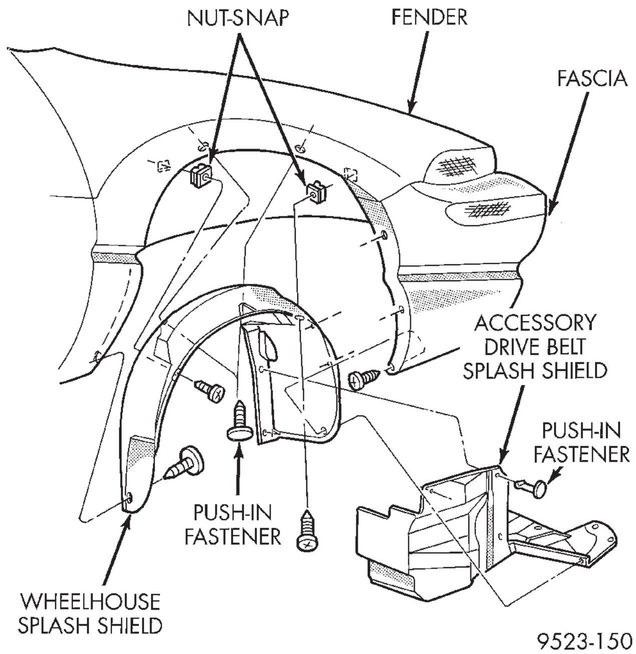


Fig. 74 Right Inner Splash Shield

(5) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 75).

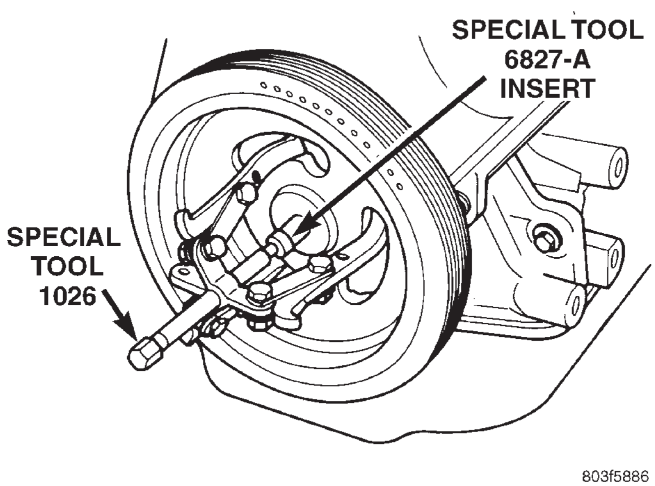


Fig. 75 Crankshaft Damper—Removal

(6) Lower vehicle and place a jack under engine.

(7) Remove right engine mount. Refer to procedure in this section.

(8) Remove generator and bracket (Fig. 76). Refer to Group 8C, Charging System for specific procedures.

(9) Remove right engine mount bracket (Fig. 77).

(10) Remove accessory drive belt idler pulley from generator bracket.

(11) Remove bolts attaching generator bracket to engine. Move bracket away from engine for clearance to remove the front timing cover.

(12) Remove front timing belt cover (Fig. 78).

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt by rotating the engine with the crankshaft.

(13) Install a 8 mm Allen wrench into the belt tensioner. Insert the long end of a 1/8” or 3 mm Allen wrench into the pin hole on the front of the tensioner (Fig. 79). Rotate the tensioner counterclockwise with the 8 mm Allen wrench, while pushing in lightly on the 1/8” or 3 mm Allen wrench until it slides into the locking hole.

(14) Remove timing belt.

CAUTION: Do not rotate the camshaft once the timing belt has been removed as damage to valve components may occur.

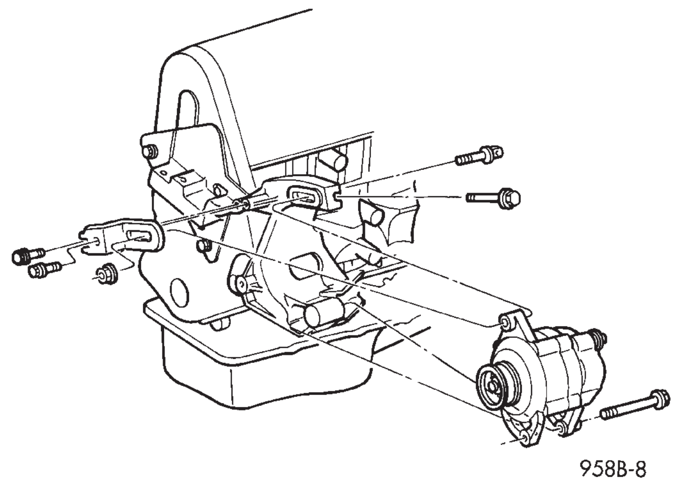


Fig. 76 Generator and Brackets

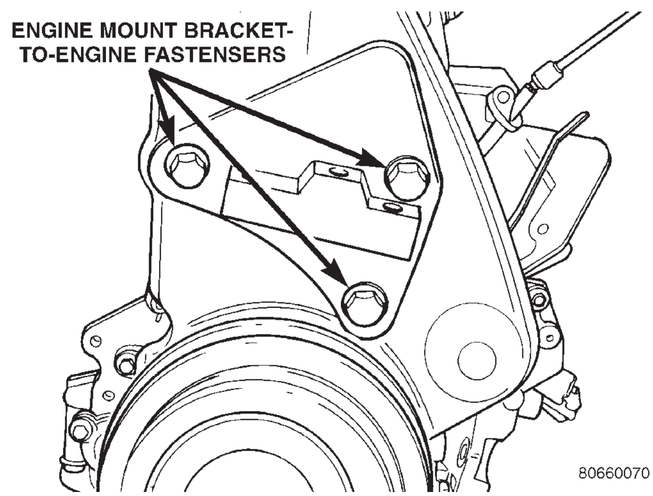


Fig. 77 Right Engine Mount Bracket—Typical

REMOVAL AND INSTALLATION (Continued)

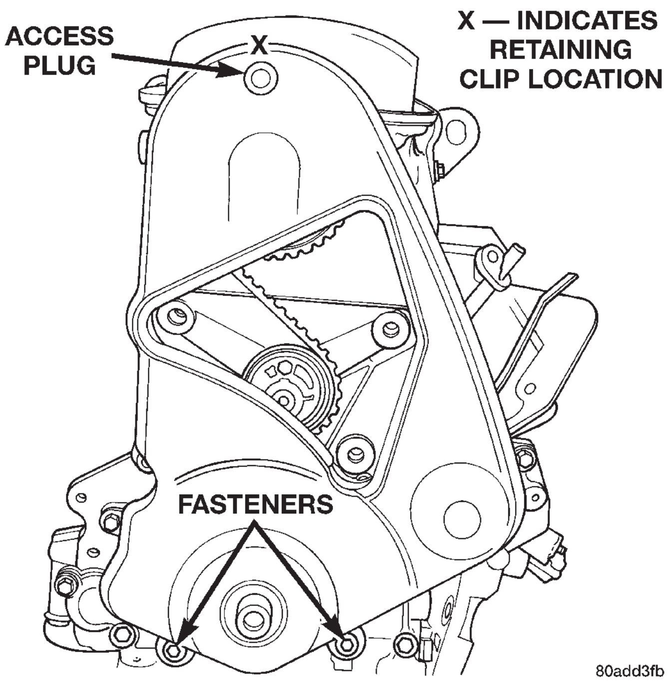


Fig. 78 Timing Belt Cover

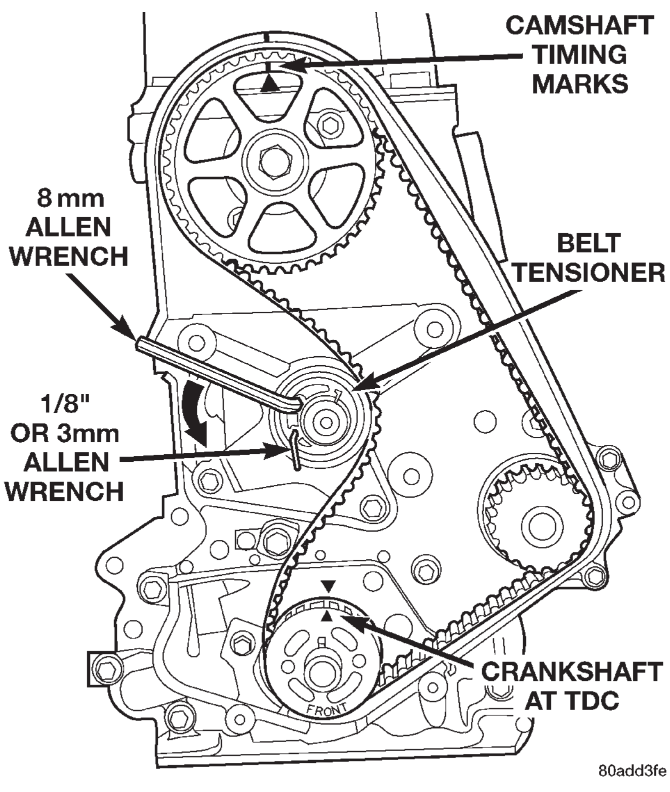


Fig. 79 Remove Timing Belt

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE AND BELT INSTALLATION —SOHC ENGINE

(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 80).

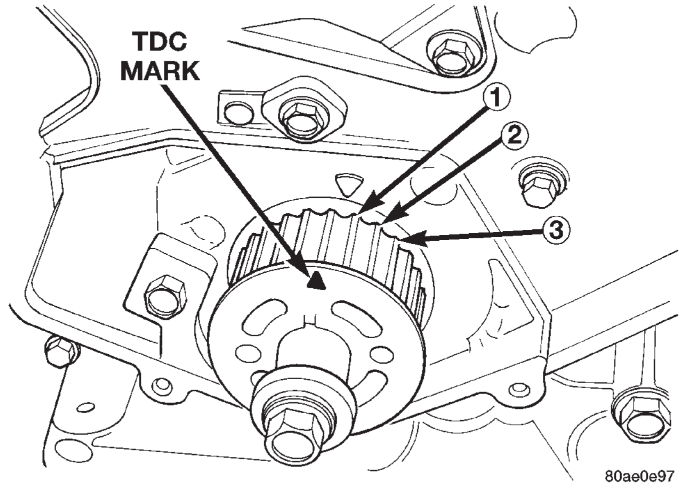


Fig. 80 Crankshaft Sprocket Timing

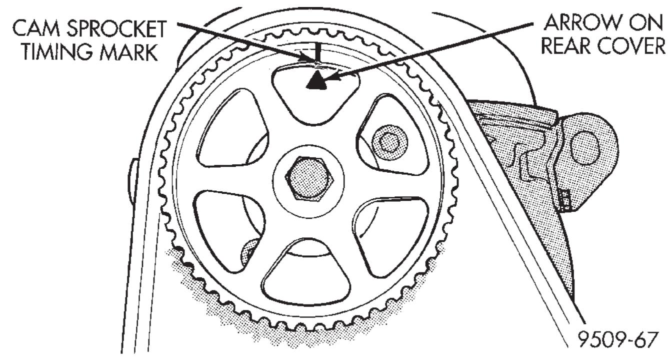


Fig. 81 Camshaft Timing Mark

(2) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear of timing belt cover (Fig. 81).

(3) Move crankshaft to 1/2 mark before TDC (Fig. 82) for belt installation.

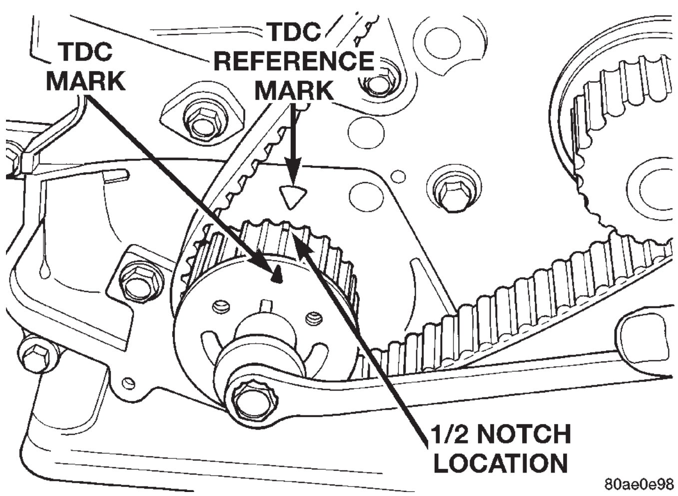


Fig. 82 Adjusting Crankshaft Sprocket for Timing Belt Installation

REMOVAL AND INSTALLATION (Continued)

(4) Install timing belt. Starting at the crankshaft, go around the water pump sprocket and then around the camshaft sprocket.

(5) Move crankshaft sprocket to TDC to take up belt slack.

(6) Remove the 1/8” or 3 mm Allen wrench from belt tensioner.

(7) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 83).

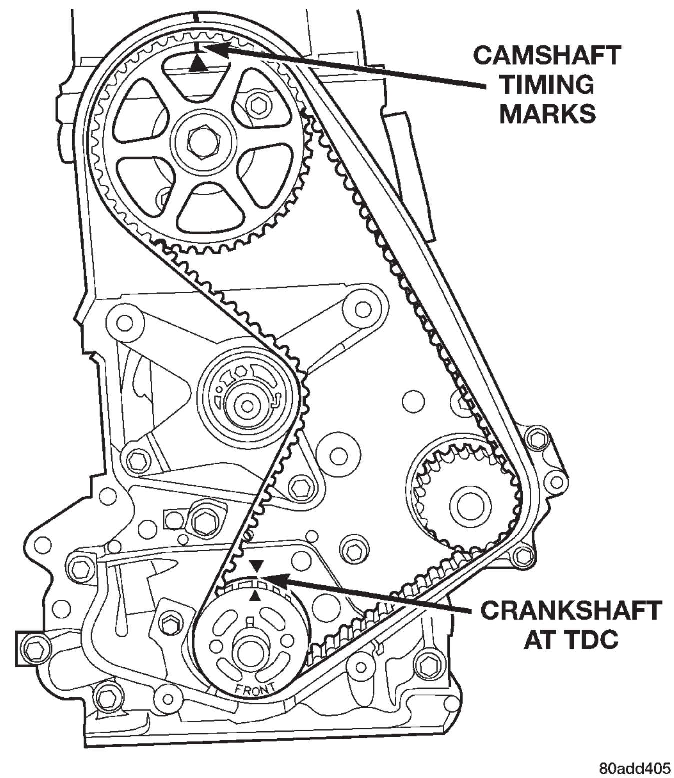


Fig. 83 Crankshaft and Camshaft Timing

(8) Install front half of timing cover.

(9) Install generator bracket and attaching bolts.

(10) Install idler pulley to generator bracket.

(11) Install engine mount bracket.

(12) Install generator bracket to engine (Fig. 76). Tighten attaching bolts to 61 N·m (45 ft. lbs.).

(13) Install generator (Fig. 76). Refer to Group 8C, Charging System for procedure.

(14) Install right engine mount. Refer to procedure in this section.

(15) Remove jack from under engine.

(16) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 84).

(17) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(18) Raise vehicle on hoist and install right inner splash shield.

(19) Install right front wheel and lower vehicle.

(20) Connect negative cable.

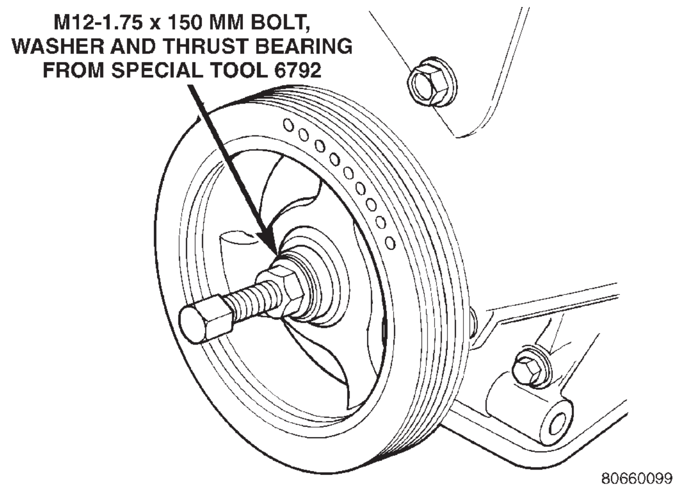


Fig. 84 Crankshaft Damper—Installation

TIMING BELT TENSIONER

REMOVAL

(1) Remove timing belt. Refer to procedure in this section.

(2) Remove tensioner assembly attaching bolts (Fig. 85).

(3) Remove tensioner assembly.

CAUTION: The timing belt tensioner is serviced as an assembly. To prevent premature timing belt failure, DO NOT separate the tensioner pulley from mounting bracket.

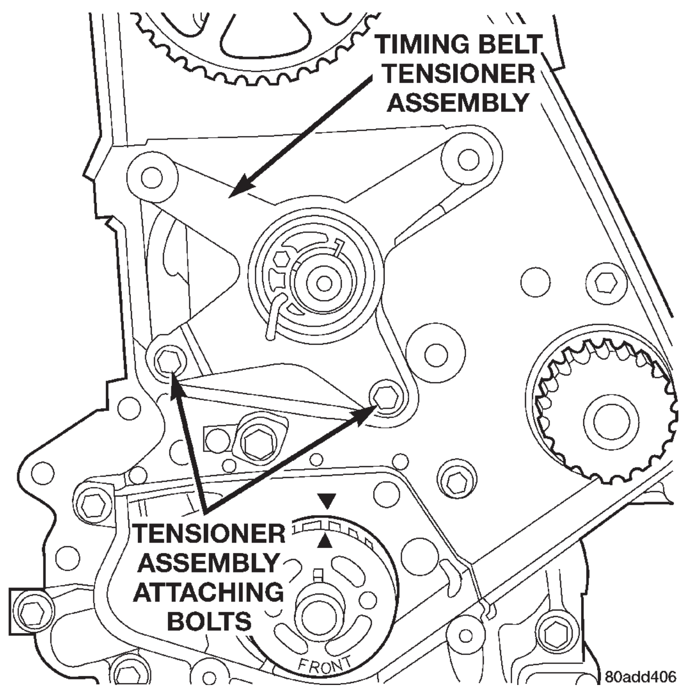


Fig. 85 Timing Belt Tensioner Assembly—Removal/ Installation

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install timing belt tensioner assembly. Tighten attaching bolts to 31 N·m (275 in. lbs.).

(2) Install timing belt. Refer to procedure in this section.

OIL PAN

REMOVAL

(1) Drain engine oil.

(2) Remove front engine mount bracket. Refer to Engine Mount—Front, in this section for procedures.

(3) Remove powertrain bending strut.

(4) Remove structural collar from oil pan to transaxle (Fig. 86).

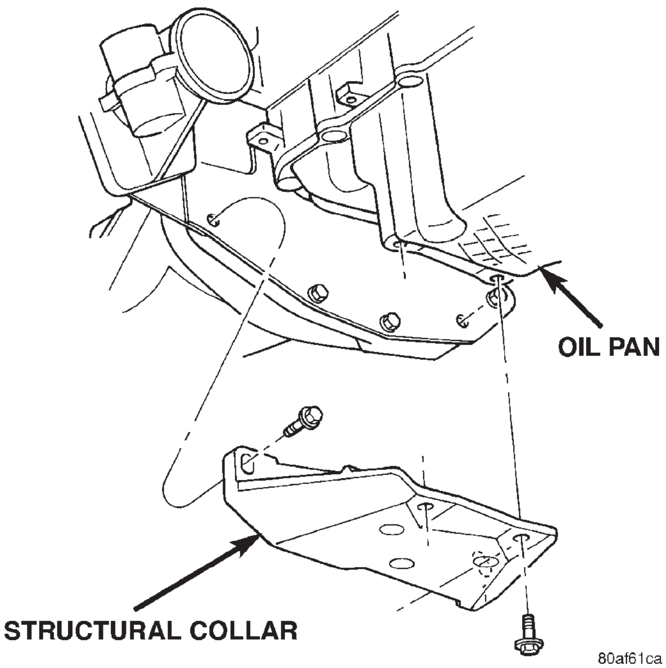


Fig. 86 Structural Collar—Removal and Installation

(5) Remove transaxle lower dust cover.

(6) If equipped with air conditioning remove oil filter and adaptor. Refer to Oil Filter Adapter Removal and Installation in this section.

(7) Remove oil pan.

(8) Clean oil pan and all gasket surfaces.

INSTALLATION

(1) Apply Mopar® Silicone Rubber Adhesive Sealant or equivalent at the oil pump to engine block parting line (Fig. 87).

(2) Install a new oil pan gasket to pan.

(3) Install pan and tighten screws to 12 N·m (105 in. lbs.).

(4) Install oil filter and adaptor.

(5) Install transaxle lower dust cover.

(6) Install powertrain bending strut.

(7) Install front engine mount and bracket.

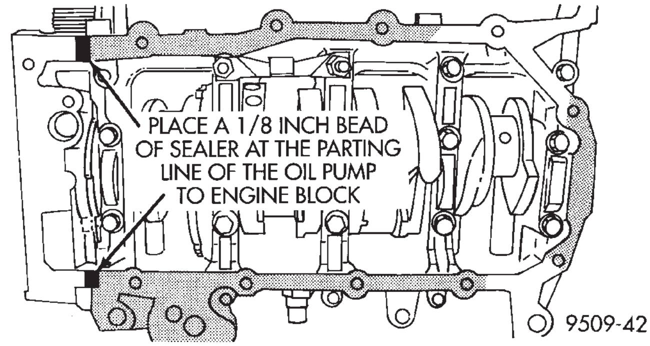


Fig. 87 Oil Pan Sealing

CAUTION: The torque procedure for the structural collar must be followed, as damage to oil pan or collar could occur.

(8) Install the structural collar (Fig. 86) using the following 3 step torque sequence:

• Step 1: Install the collar to oil pan bolts and tighten to 3 N·m (30 in. lbs.).

• Step 2: Install collar to transaxle bolts and tighten to 108 N·m (80 ft. lbs.).

• Step 3: Final torque the collar to oil pan bolts to 54 N·m (40 ft. lbs.).

(9) Fill engine crankcase with proper oil to correct level.

CAMSHAFT OIL SEAL

REMOVAL

CAUTION: Do Not Rotate the camshaft or crankshaft when timing belt is removed damage to the engine may occur.

(1) Remove front timing belt cover, timing belt and tensioner assembly. Refer to procedures in this section.

(2) Remove camshaft sprocket bolt, with the Modified Special Tool C-4687-1 as shown in (Fig. 88).

(3) Hold camshaft sprocket with modified tool while removing bolt. Remove sprocket from camshaft.

(4) Remove rear timing belt cover.

(5) Remove camshaft seal using Special Tool C-4679-A (Fig. 89).

CAUTION: Do not nick shaft seal surface or seal bore.

(6) Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

INSTALLATION

(1) Install camshaft seal flush with cylinder head using Special Tool MD 998306 (Fig. 90).

(2) Install rear timing belt cover.

REMOVAL AND INSTALLATION (Continued)

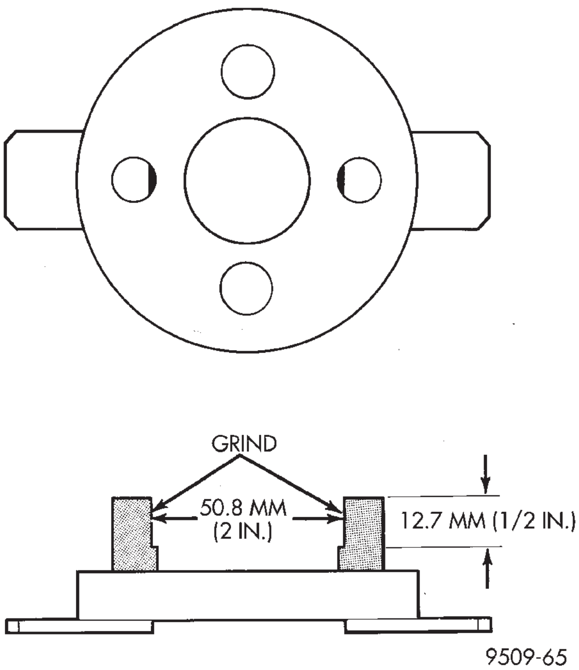


Fig. 88 Modification to Special Tool

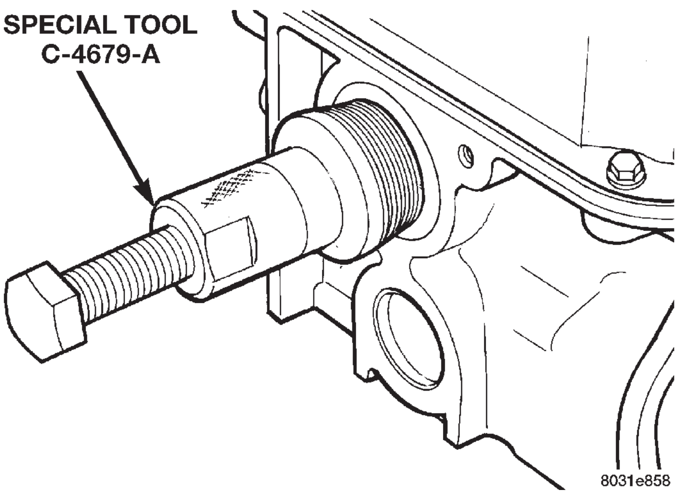


Fig. 89 Removing Camshaft Oil Seal

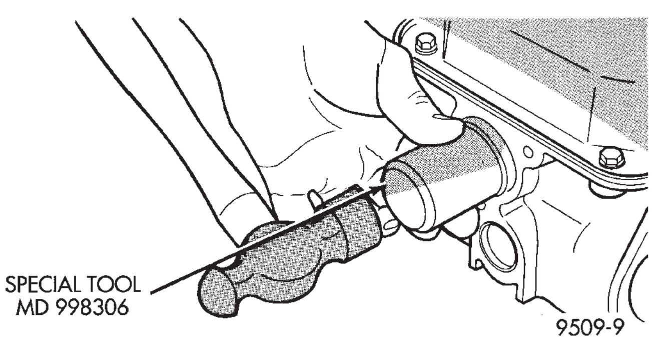


Fig. 90 Installing Camshaft Seal

(3) Install camshaft sprocket retaining bolt. Hold camshaft sprocket with Special Tool C-4687-1 (Fig. 88) and tighten bolt to 115 N·m (85 ft. lbs.).

(4) Install timing belt tensioner, timing belt, and front cover. Refer to procedures in this section.

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Using Special Tool 1026 and Insert 6827–A, remove crankshaft damper (Fig. 91).

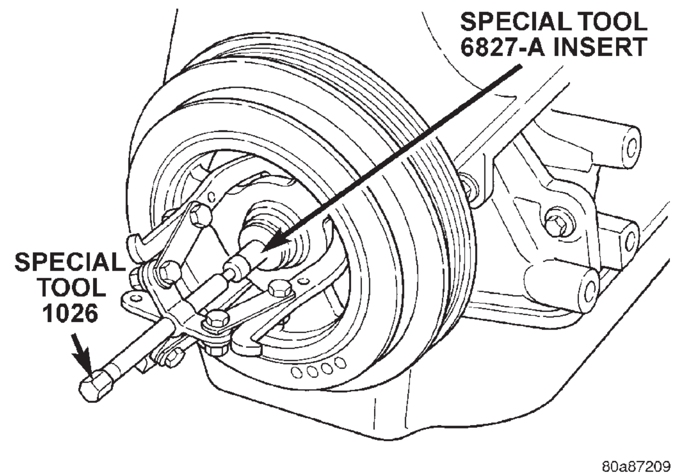


Fig. 91 Crankshaft Damper—Removal

(2) Remove outer timing belt cover and timing belt. Refer to procedure in this section.

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 92).

CAUTION: Do not nick shaft seal surface or seal bore.

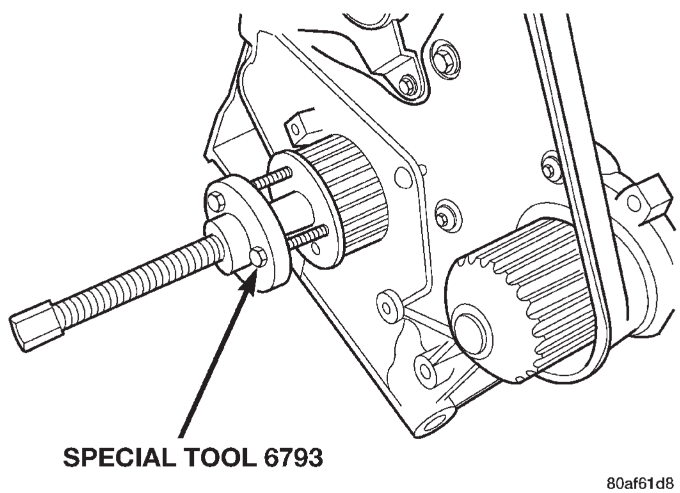


Fig. 92 Crankshaft Sprocket—Removal

REMOVAL AND INSTALLATION (Continued)

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 93). Do not damage the seal contact area on the crankshaft.

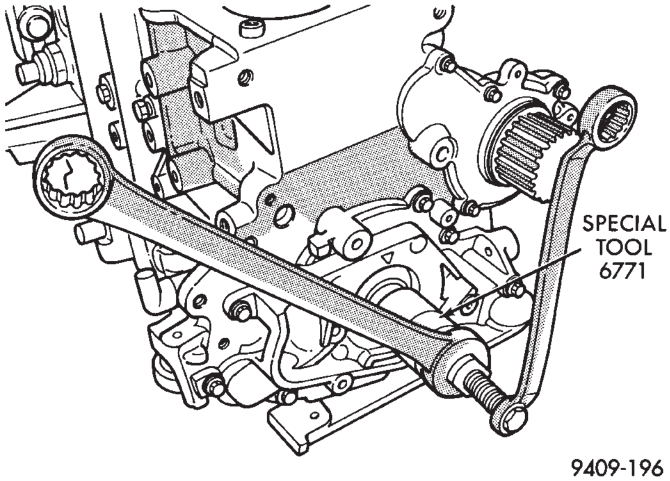


Fig. 93 Front Crankshaft Oil Seal—Removal

INSTALLATION

(1) Install new seal by using Tool 6780–1 (Fig. 94).

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

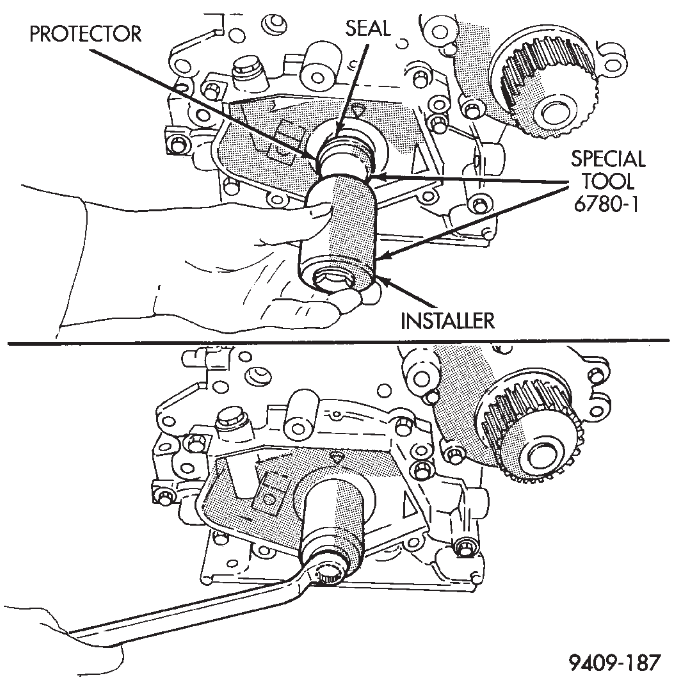


Fig. 94 Front Crankshaft Oil Seal—Installation

(3) Install crankshaft sprocket (Fig. 95). Using Special Tool 6792.

NOTE: Make sure the word "front" on the sprocket is facing you.

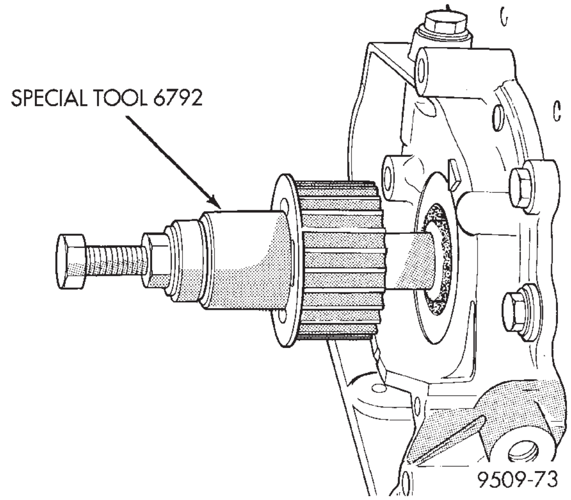


Fig. 95 Crankshaft Sprocket—Installation

(4) Install timing belt and covers. Refer to Timing Belt System in this section for installation.

(5) Install crankshaft damper (Fig. 96). Use thrust bearing/washer and 12M-1.75 x 150 mm bolt from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.)

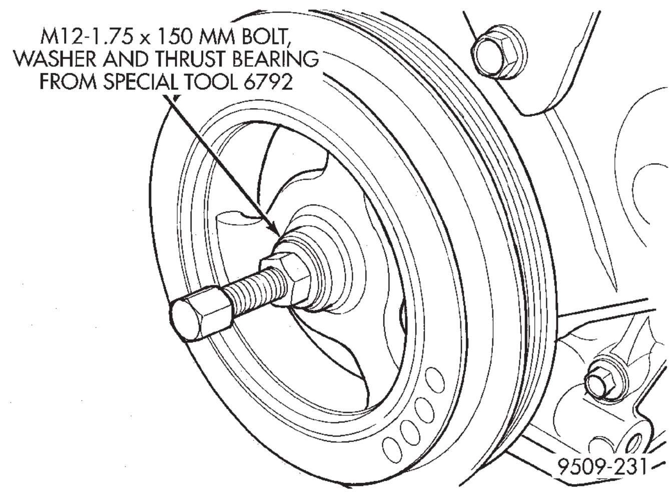


Fig. 96 Crankshaft Damper—Installation

CRANKSHAFT OIL SEAL—REAR

REMOVAL

(1) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 97) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.

REMOVAL AND INSTALLATION (Continued)

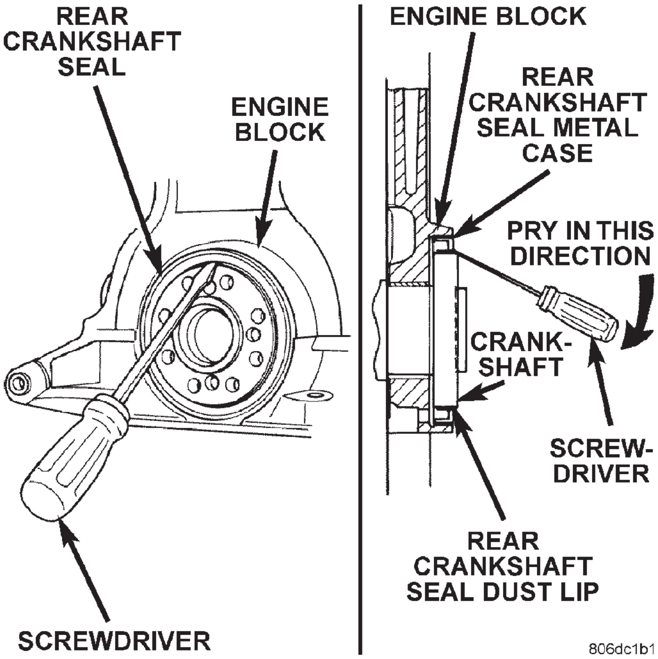


Fig. 97 Rear Crankshaft Oil Seal—Removal

INSTALLATION

CAUTION: If burr or scratch is present on the crankshaft edge (chamfer), cleanup with 400 grit sand paper to prevent seal damage during installation of new seal.

NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 98).

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 98). Pilot tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 99) until the tool bottoms out against the block (Fig. 100).

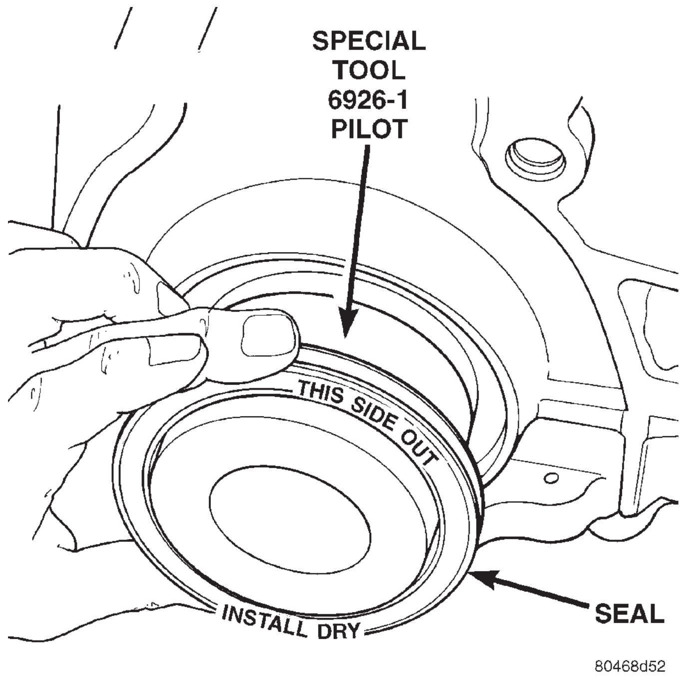


Fig. 98 Rear Crankshaft Seal and Special Tool 6926-1

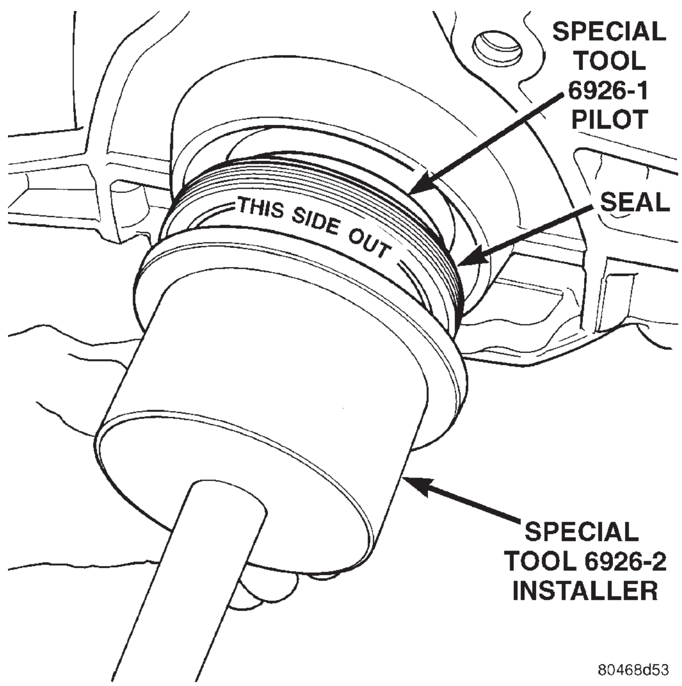


Fig. 99 Crankshaft Seal Special Tool 6926-2

REMOVAL AND INSTALLATION (Continued)

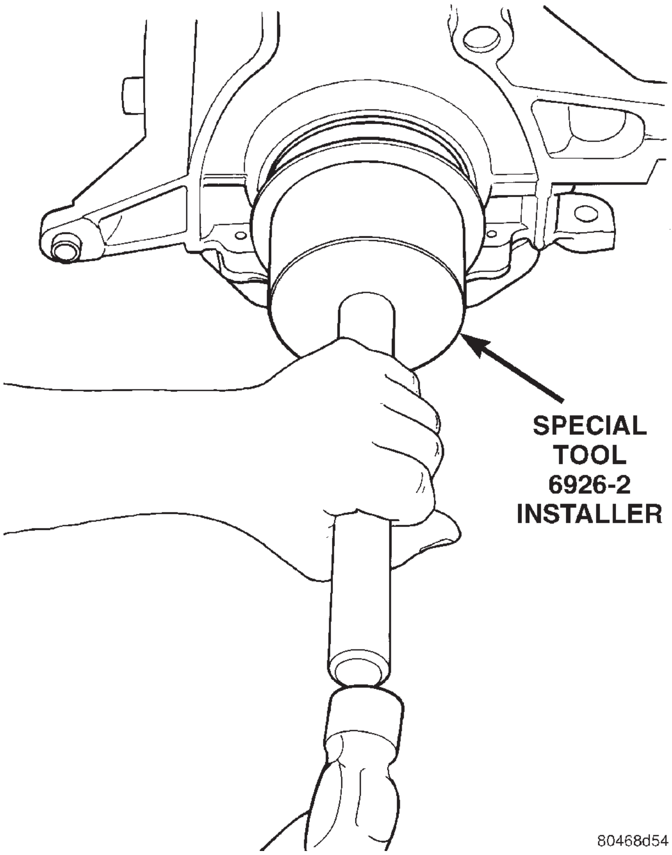


Fig. 100 Rear Crankshaft Seal—Installation

CRANKSHAFT

REMOVAL

(1) Remove engine assembly. Refer to procedure in this section.

(2) Mount engine on an engine stand.

(3) Remove oil filter and adapter from bedplate (Fig. 101).

(4) Remove oil pan. Refer to procedure in this section.

(5) Remove crankshaft sprocket and oil pump. Refer to procedures in this section.

(6) Remove all bedplate bolts from the engine block (Fig. 102).

(7) Using a mallet tap the bedplate loose from the engine block dowel pins.

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block and bedplate alignment.

(8) Bedplate should be removed evenly from the cylinder block dowel pins.

(9) Lift out crankshaft from cylinder block. Be sure not to damage the main bearings or journals when removing the crankshaft.

CRANKSHAFT MAIN BEARINGS LOCATION

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells installed in the (bedplate) main bearing cap are plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 103).

NOTE: The upper and lower main Bearing shells are Not interchangeable. The lower shells have a revised tab to prevent improper installation.

CRANKSHAFT MAIN JOURNALS INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. DO NOT grind thrust faces of Number 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the nodular cast iron crankshafts used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine (Fig. 103). All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersized: 0.016 mm (.0006 inch), .032 mm (.0012 inch), .250 mm (.010 inch). Never install an undersize bearing that will reduce clearance below specifications.

INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block. Install O-ring into recess in the block (Fig. 104).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

CAUTION: Do Not get oil on the bedplate mating surface. It will affect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals and install crankshaft and O-ring in cylinder block.

REMOVAL AND INSTALLATION (Continued)

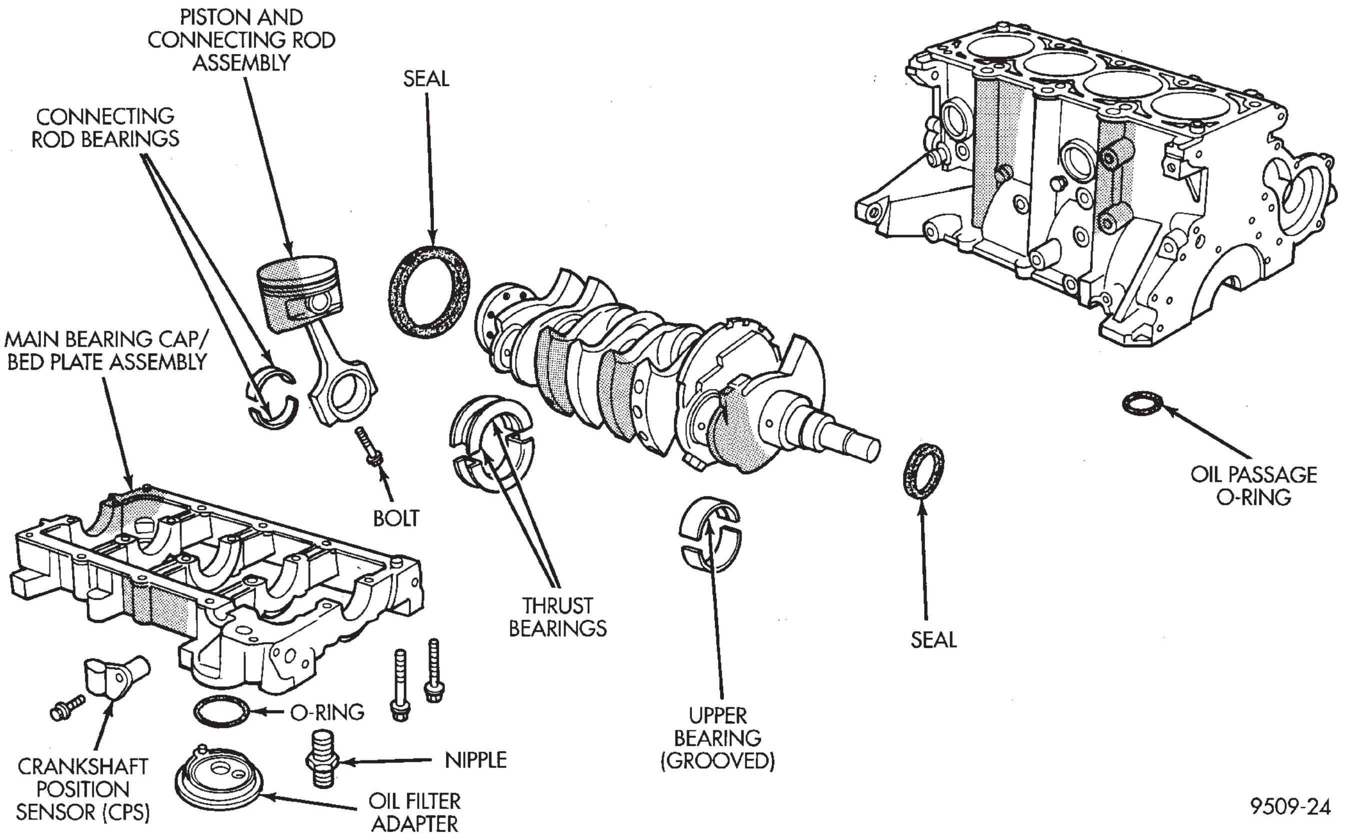


Fig. 101 Cylinder Block and Components

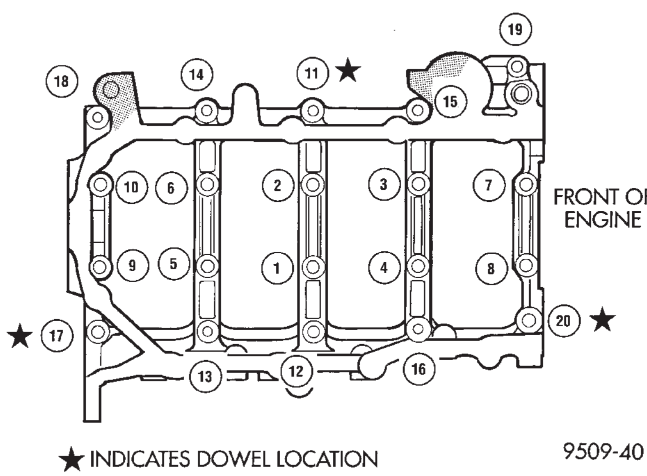


Fig. 102 Bedplate Bolts

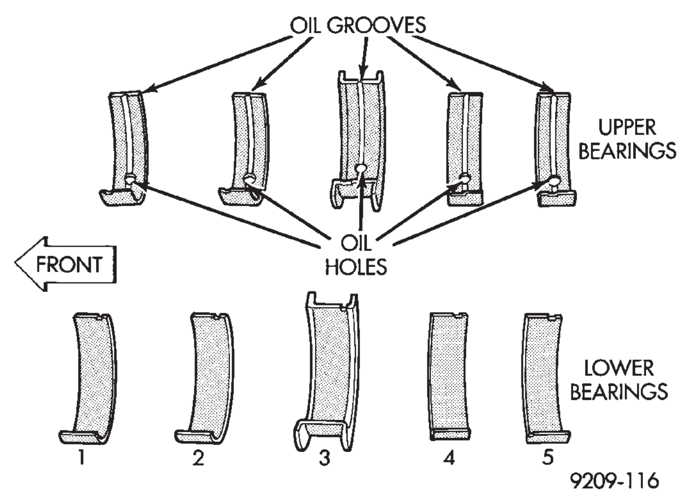


Fig. 103 Main Bearing Identification

REMOVAL AND INSTALLATION (Continued)

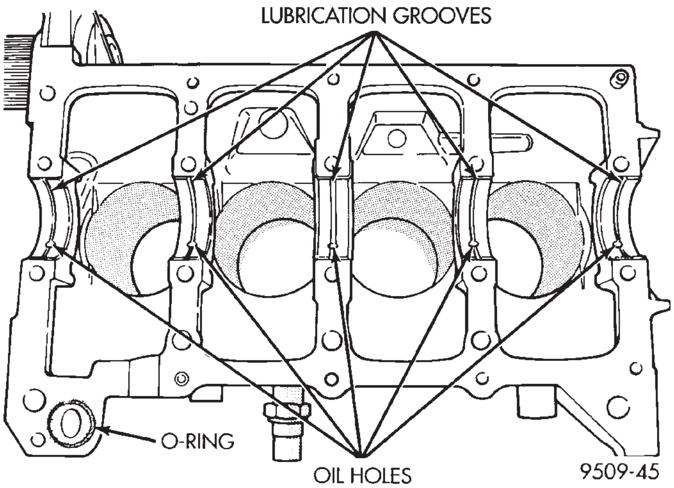


Fig. 104 Installing Main Bearing Upper Shell

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar® Torque Cure Gasket Maker to cylinder block as shown in (Fig. 105).

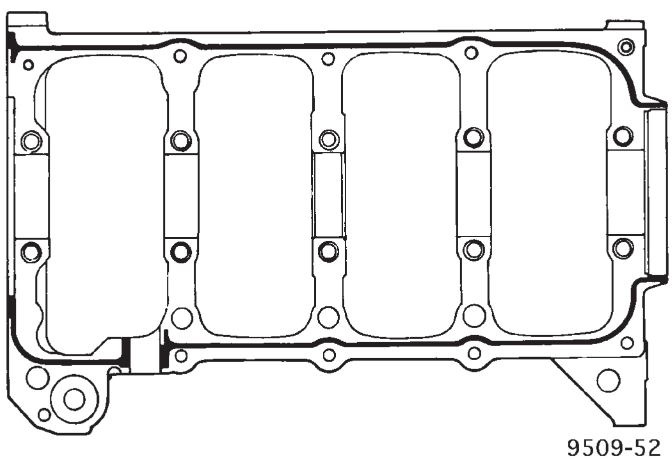


Fig. 105 Main Bearing Caps/Bedplate Sealing

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(6) Before installing the bolts oil threads with clean engine oil, wipe off any excess oil.

(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten this bolts down together until the bedplate contacts the cylinder block. Torque bolts to 30 N·m (22 ft. lbs.) (Fig. 106).

(8) Install main bearing bedplate to engine block bolts (1 – 10) and torque each bolt to 81 N·m (60 ft. lbs.) in sequence shown in (Fig. 106).

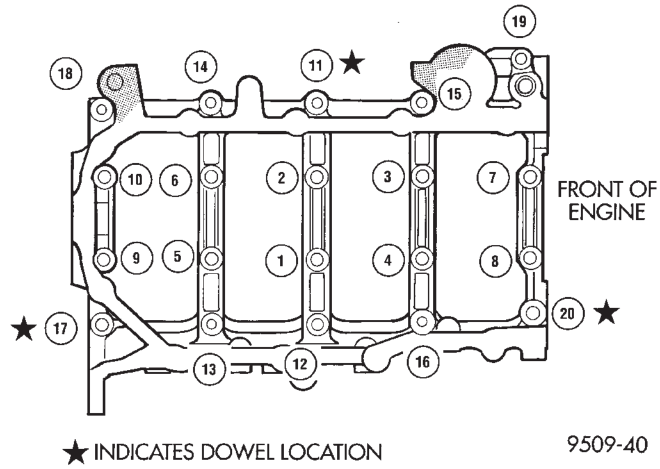


Fig. 106 Main Bearing Caps/Bedplate Torque Sequence

(9) Install main bearing bedplate to engine block bolts (11 – 20), with baffle studs in positions 12, 13 and 16 and torque each bolt to 30 N·m (22 ft. lbs.) in sequence shown in (Fig. 106).

(10) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

(11) Install oil pump. If crankshaft end play is to be checked refer to service procedures in this section.

(12) Install crankshaft sprocket.

(13) Install oil pan.

(14) Install oil filter adapter (Fig. 101) and oil filter.

(15) Install engine assembly. Refer to procedure in this section.

OIL FILTER ADAPTER

REMOVE AND INSTALL

Ensure O-ring is in the groove on adapter. Align roll pin into engine block and tighten assembly to 80 N·m (60 ft. lbs.) (Fig. 107).

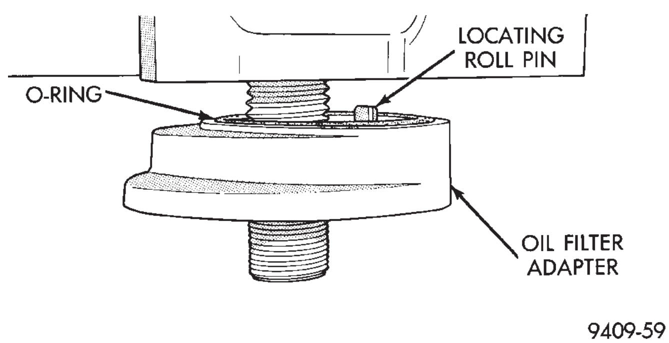


Fig. 107 Engine Oil Filter Adapter to Engine Block

REMOVAL AND INSTALLATION (Continued)

OIL FILTER

REMOVE AND INSTALL

CAUTION: When servicing the oil filter (Fig. 108) avoid deforming the filter, install tool band strap against the seam at the base of the filter. The seam, joining the can to the base is reinforced by the base plate.

(1) Turn counterclockwise to remove.

(2) To install, lubricate new filter gasket. Check filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber. Screw filter on until gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

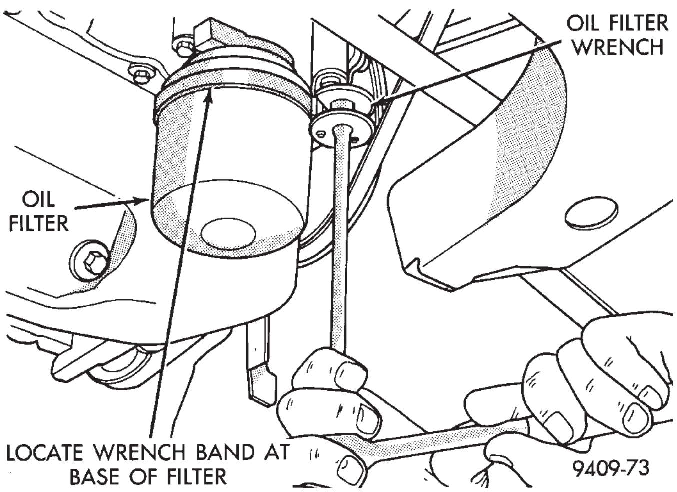


Fig. 108 Engine Oil Filter

OIL PUMP

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove timing belt. Refer to procedure in this section.

(3) Remove oil pan. Refer to procedure in this section.

(4) Remove Crankshaft Sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 109).

(5) Remove oil pick-up tube.

(6) Remove oil pump (Fig. 110) and front crankshaft seal.

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

(2) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 111). Install oil ring into oil pump body discharge passage.

(3) Prime oil pump before installation.

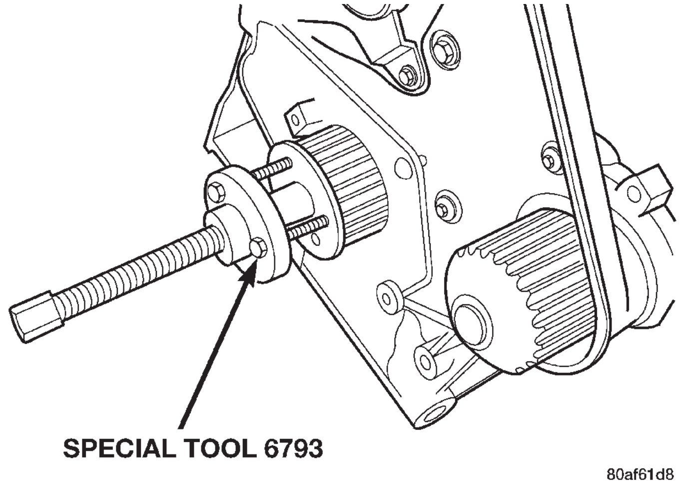


Fig. 109 Crankshaft Sprocket—Removal

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

(5) Torque all oil pump attaching bolts to 28 N·m (250 in. lbs.).

(6) Install new front crankshaft seal using Special Tool 6780 (Fig. 112).

(7) Install crankshaft sprocket, using Special Tool 6792 (Fig. 113).

(8) Install oil pump pick-up tube and oil pan.

(9) Install timing belt. Refer to procedure in this section.

(10) Connect negative cable to battery.

PISTON AND CONNECTING ROD

REMOVAL

(1) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation** . Mark piston with matching cylinder number (Fig. 114).

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 115) for identification.

(3) Pistons will have a stamping in the approximate location shown in (Fig. 114). These stamps will be either a directional arrow or a weight identification for the assembly. L is for light and H is for heavy. These assemblies should all be the same weight class. Service piston assemblies are marked with a S and can be used with either L or H production assemblies. The weight designation stamps should face toward the timing belt side of the engine.

REMOVAL AND INSTALLATION (Continued)

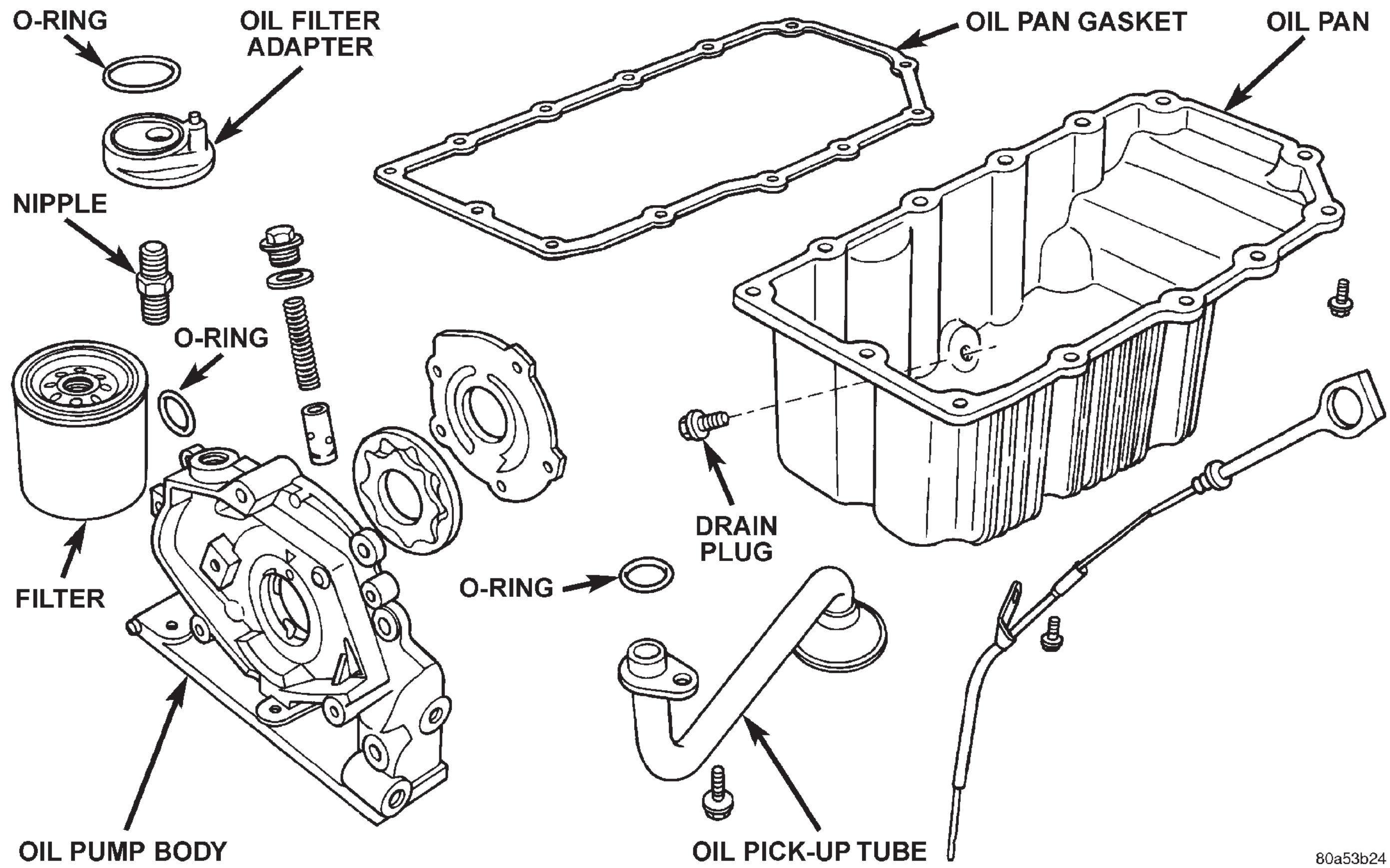


Fig. 110 Oil Pump and Tube

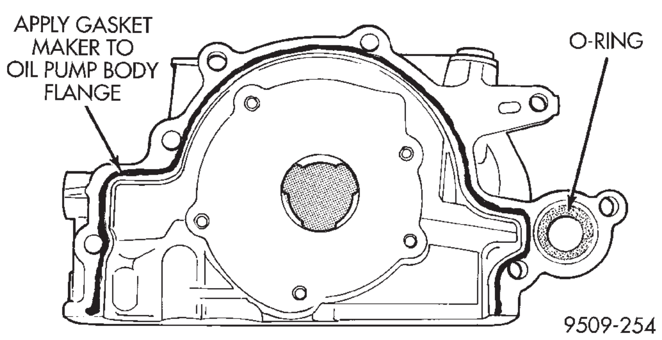


Fig. 111 Oil Pump Sealing

(4) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(5) Remove connecting rod cap bolts. **Do not use old bolts if reinstalling connecting rod.** Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(6) After removal, install bearing cap on the mating rod.

(7) Piston and Rods are serviced as an assembly.

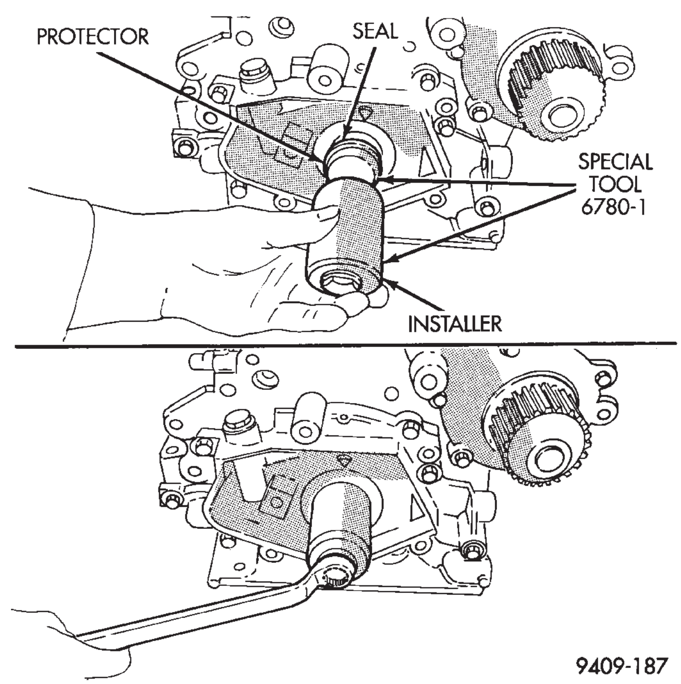


Fig. 112 Front Crankshaft Seal—Installation

REMOVAL AND INSTALLATION (Continued)

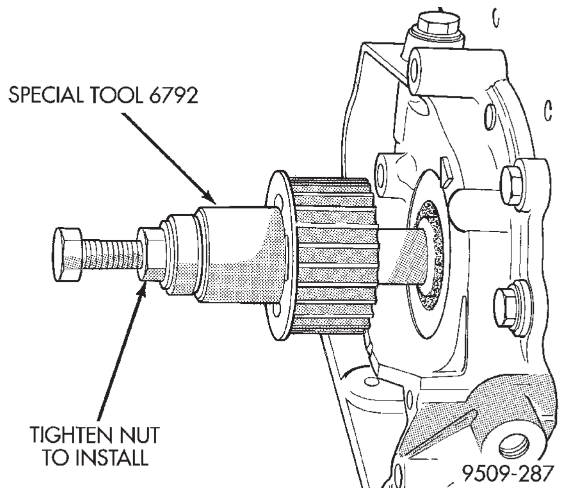


Fig. 113 Crankshaft Sprocket—Installation

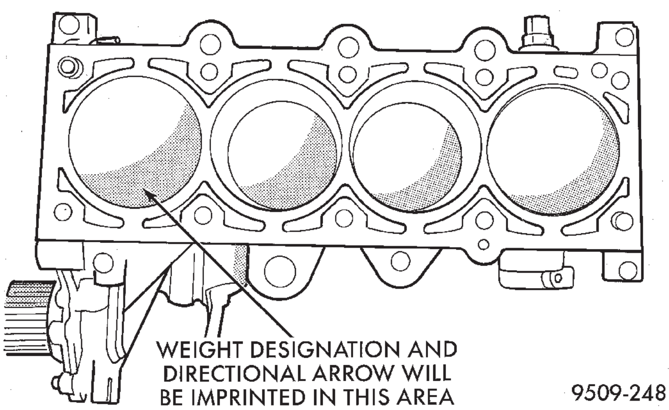


Fig. 114 Piston Markings

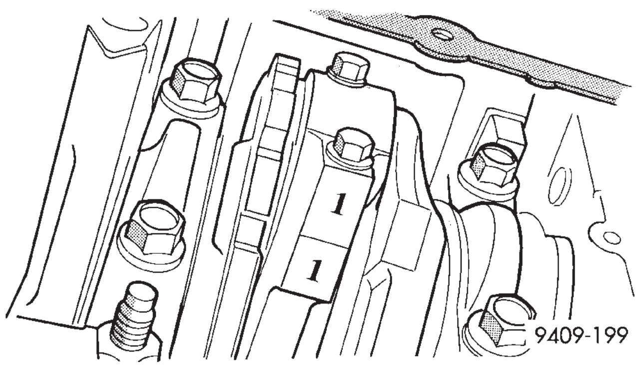


Fig. 115 Identify Connecting Rod to Cylinder

PISTON RING—REMOVAL

(1) ID mark on face of upper and intermediate piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 116).

(3) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

(4) Clean ring grooves of any carbon deposits.

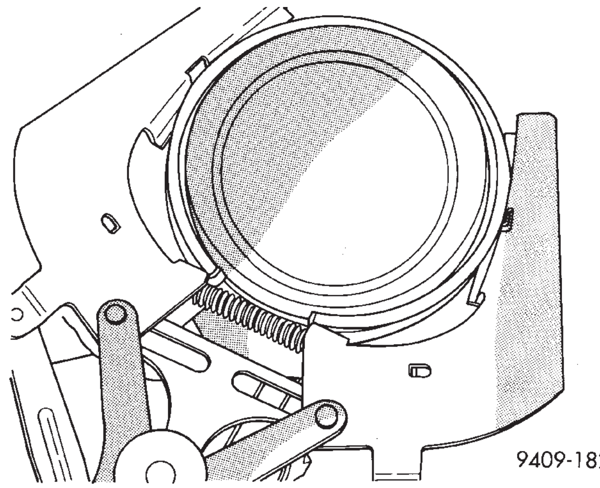


Fig. 116 Piston Rings—Removing and Installing

PISTON RINGS—INSTALLATION

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 117).

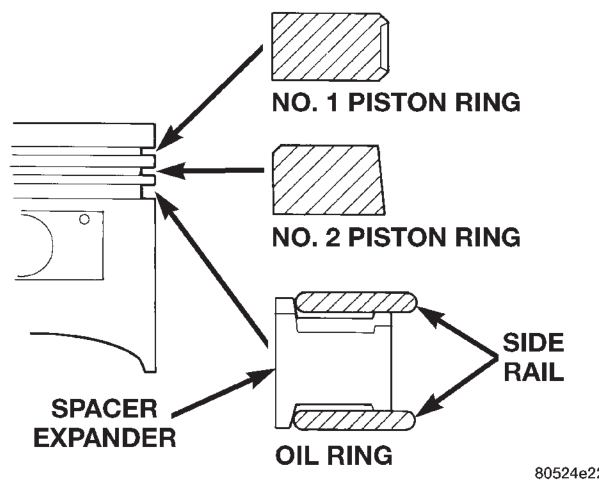


Fig. 117 Piston Ring Installation

CAUTION: Install piston rings in the following order:

a. Oil ring expander.
b. Upper oil ring side rail.
c. Lower oil ring side rail.
d. No. 2 Intermediate piston ring.
e. No. 1 Upper piston ring.
f. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander (Fig. 118).**

(2) Install upper side rail first and then the lower side rail.

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 117).

REMOVAL AND INSTALLATION (Continued)

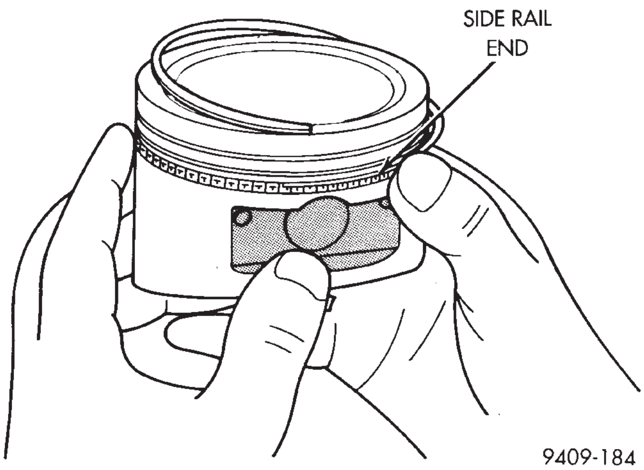


Fig. 118 Installing Side Rail

(4) Position piston ring end gaps as shown in (Fig. 119).

(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.

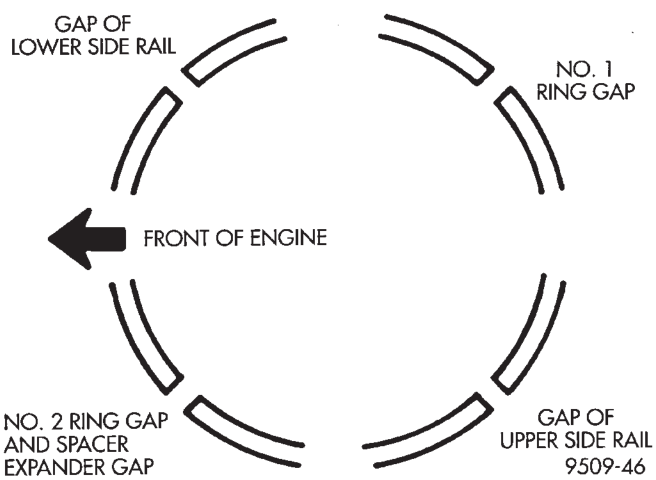


Fig. 119 Piston Ring End Gap Position

PISTON AND ROD —INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 119).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 120). **Be sure position of rings does not change during this operation**.

(4) The weight stamp designation L or H will be in the front half of the piston should face toward the front of the engine for SOHC engine. The arrow should face toward the front of the engine for DOHC engine (Fig. 114).

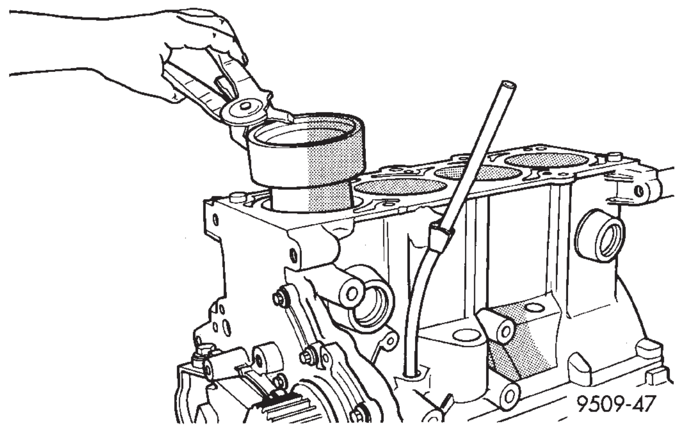


Fig. 120 Installing Piston

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston assembly into cylinder bore and guide rod over the crankshaft journal.

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

(7) Install rod caps. Install **New** bolts and tighten to 27 N·m (20 ft .lb.) Plus 1/4 turn.

DISASSEMBLY AND ASSEMBLY

OIL PUMP

(1) To remove the relief valve, proceed as follows:

(2) Remove the threaded plug and gasket from the oil pump (Fig. 121).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 121) or serious damage may occur.

(3) Remove spring and relief valve (Fig. 121).

(4) Remove oil pump cover screws, and lift off cover.

(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 122).

CLEANING AND INSPECTION

INTAKE MANIFOLD

Clean all mating surfaces.

Check for:

- Cracked or distorted manifold.
- Torn or missing O-rings at the mating surface of the manifold (Fig. 123).

CLEANING AND INSPECTION (Continued)

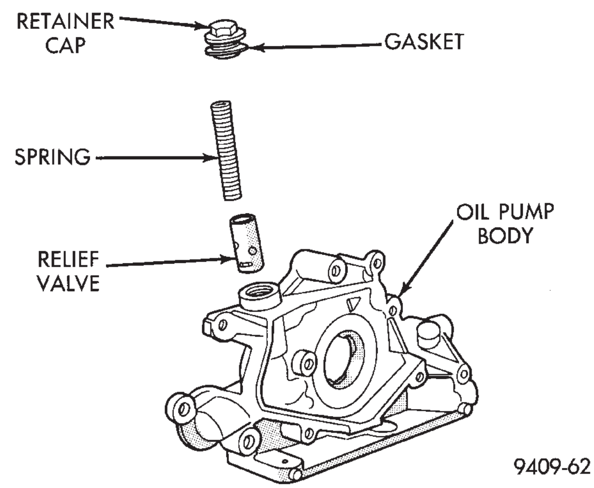


Fig. 121 Oil Pressure Relief Valve

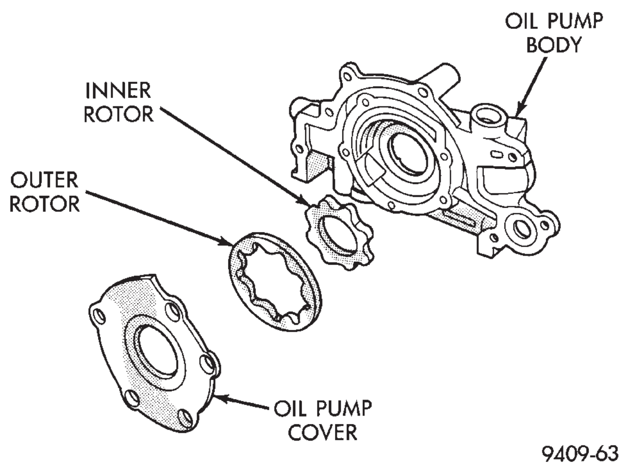


Fig. 122 Oil Pump

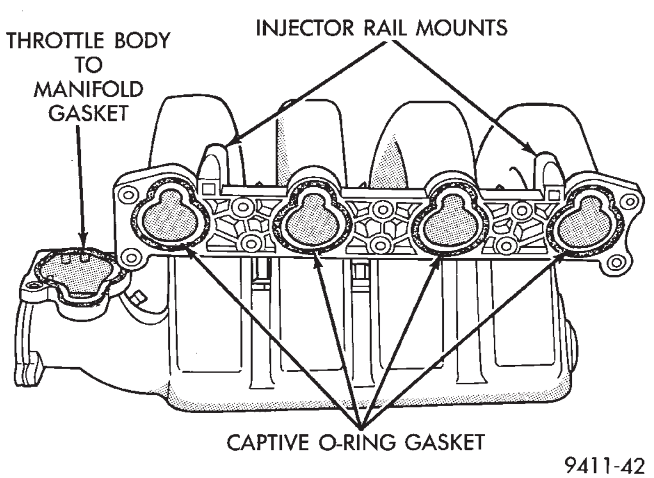


Fig. 123 Intake Manifold O-Rings—2.0L Engine

EXHAUST MANIFOLD

(1) Discard gasket and clean all surfaces of manifolds and cylinder head.

(2) Test manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

(3) Inspect manifolds for cracks or distortion. Replace manifold as necessary.

CYLINDER HEAD AND CAMSHAFT JOURNALS

INSPECTING CYLINDER HEAD

Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 124).

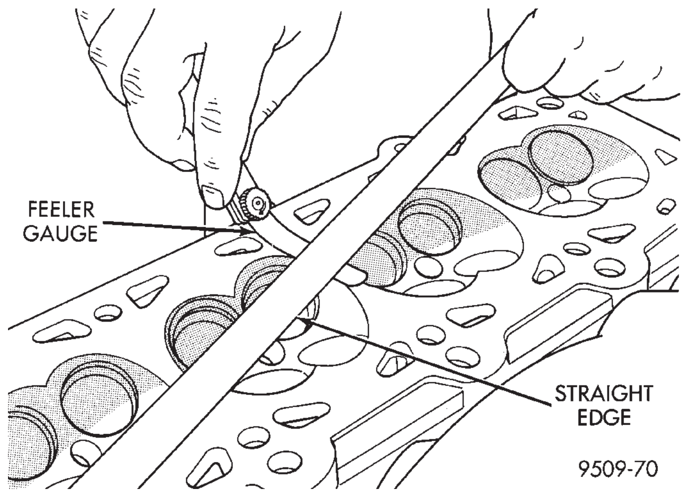


Fig. 124 Checking Cylinder Head Flatness

Inspect cylinder head camshaft bearings for wear.

Check camshaft journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CLEANING

Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

OIL PUMP

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 125). If a 0.076 mm (0.003 inch.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

CLEANING AND INSPECTION (Continued)

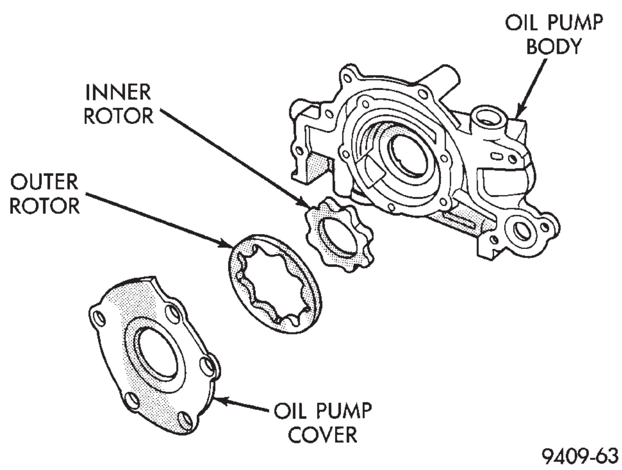


Fig. 125 Checking Oil Pump Cover Flatness

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 inch.) or less (Fig. 126), or if the diameter is 79.95 mm (3.148 inches) or less, replace outer rotor.

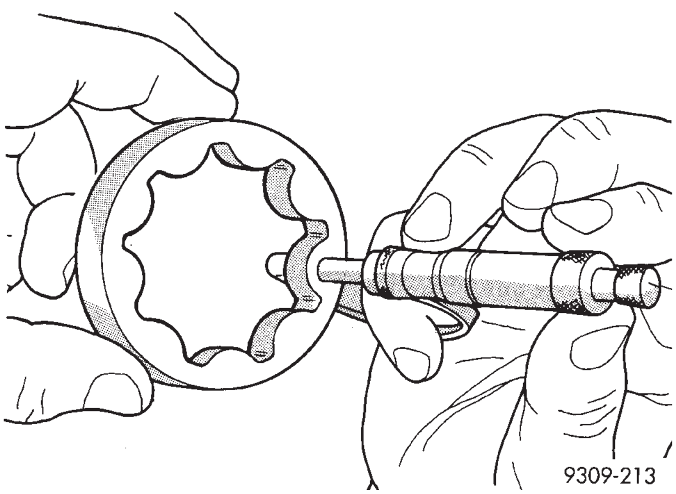


Fig. 126 Measuring Outer Rotor Thickness

(4) If inner rotor measures 7.64 mm (.301 inch) or less replace inner rotor (Fig. 127).

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 128). If measurement is 0.39 mm (0.015 inch.) or more, replace housing only if outer rotor is in specification.

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 129) is .203 mm (.008 inch) or more, replace both rotors.

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of .102 mm (.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 130). **ONLY** if rotors are in specs.

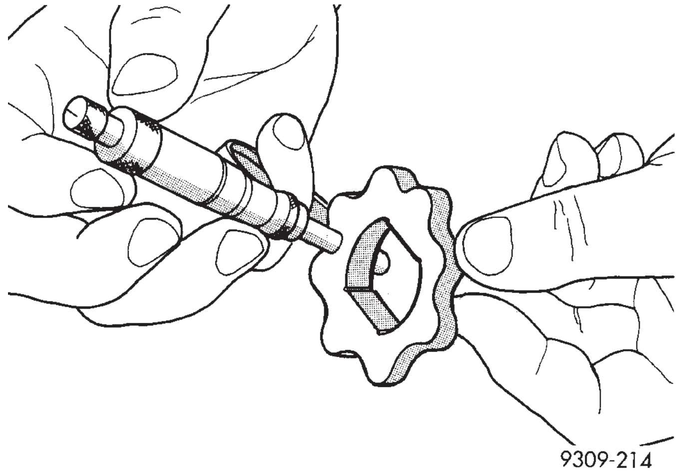


Fig. 127 Measuring Inner Rotor Thickness

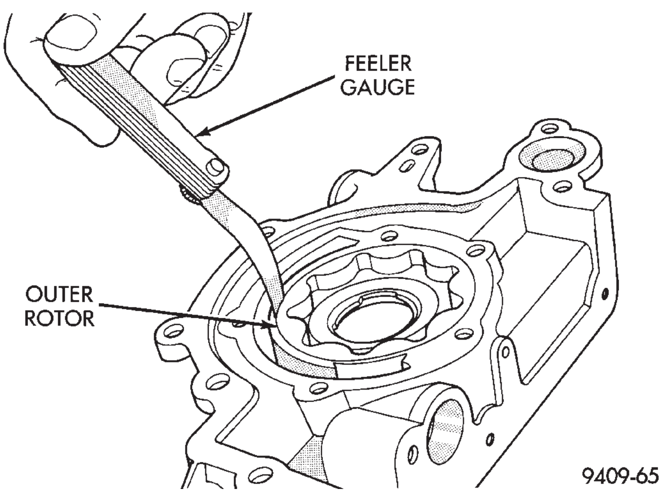


Fig. 128 Measuring Outer Rotor Clearance in Housing

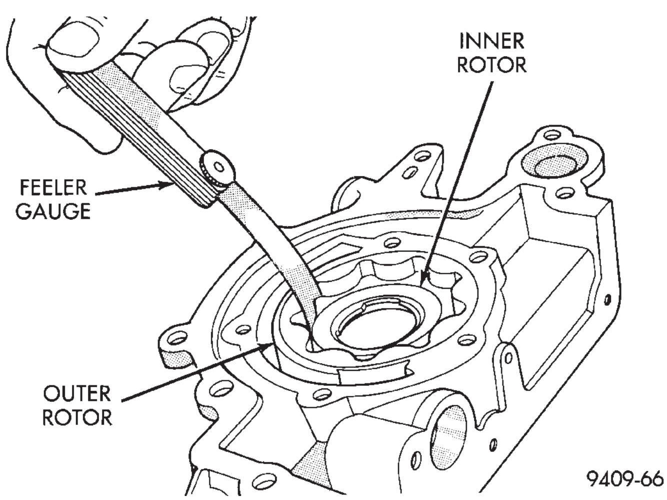


Fig. 129 Measuring Clearance Between Rotors

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

CLEANING AND INSPECTION (Continued)

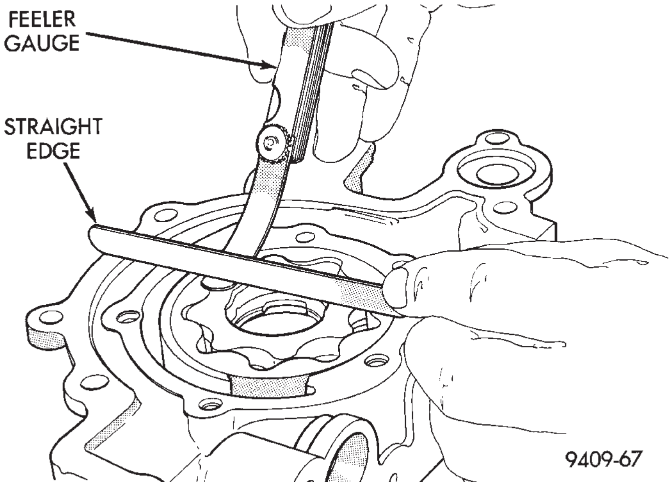


Fig. 130 Measuring Clearance Over Rotors

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings, damaged or missing oil pick-up tube o-ring, clogged oil pick-up tube screen, clogged oil filter and stuck open pressure relief valve or other reasons for oil pressure loss.

CYLINDER BLOCK AND BORE

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, Refer to Engine Core Plugs outlined in this section.

(3) Examine block and cylinder bores for cracks or fractures.

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 131). The cylinder bore out-of-round is 0.050 mm (.002 inch) maximum and cylinder bore taper is 0.051 mm (0.002 inch) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 131). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Cylinder Bore and Piston Specification Chart for specifications.

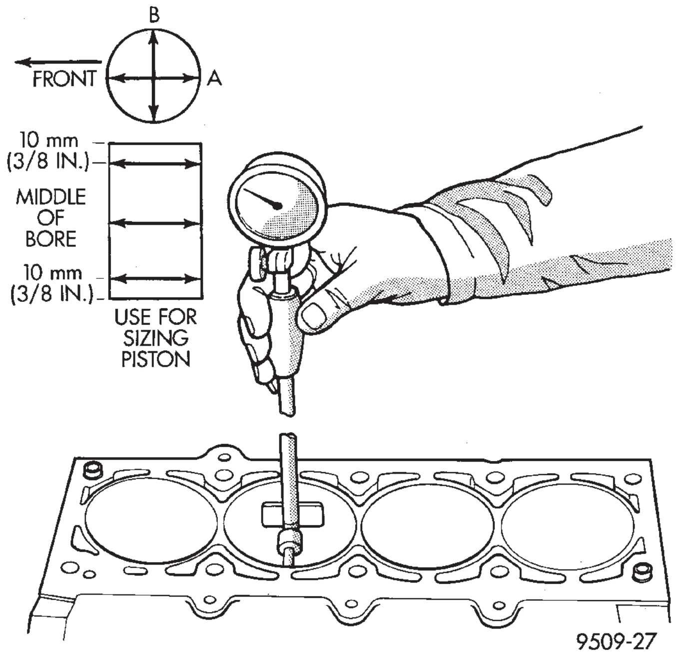


Fig. 131 Checking Cylinder Bore Size

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Max. Out-of-Round	Max. Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
87.463 - 87.481 mm (3.4434 - 3.4441 in.)		
Piston to Bore Clearance		
0.012 - 0.044 mm (0.0005 - 0.0017 in.)		
Measurements taken at Piston Size Location.		

ADJUSTMENTS

ENGINE SUPPORT ADJUSTMENT

The right and left support assemblies are slotted to allow for right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right and left engine support assemblies as required. Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Group 2, Suspension and Driveshaft.
- Any front end structural damage (after repair).
- Support Assembly replacement.

ADJUSTMENTS (Continued)

ENGINE SUPPORT ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine support assembly vertical fasteners.

(3) Loosen the left engine support assembly vertical bolts.

(4) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshaft for driveshaft identification and related assembly length measuring.

(5) Tighten right engine support assembly vertical bolts to 61 N·m (45 ft. lbs.). and tighten left engine support assembly bolts to 61 N·m (45 ft. lbs.).

(6) Recheck drive shaft length.

SPECIFICATIONS

2.0L SOHC ENGINE

DESCRIPTION	SPECIFICATION
Type	In-Line OHV, DOHC & SOHC
Bore	87.5mm (3.445 Inch)
Stroke	83.0mm (3.268 inch)
Compression Ratio	DOHC - 9.6:1 SOHC - 9.8:1
Displacement	2.0 Liters (122 Cubic Inch)
Firing Order	1, 3, 4, 2
Compression Pressure	1172 - 1551 kPa (170 - 225 psi)
Maximum Variation Between Cylinders	25%
Lubrication	Pressure Feed - Full Flow Filtration (Crankshaft Driven Pump)
Engine Oil Capacity	Refer to Group 0, Lubrication and Maintenance
Cylinder Block	
Cylinder Bore Diameter	87.4924 - 87.5076 mm (3.4446 - 3.4452.in.)
Out-of-Round (Max.)	0.051 mm (0.002 in.)
Taper (Max.)	0.051 mm (0.002 in.)
Pistons	
Clearance 17.5 mm (11/16 in.) from bottom of skirt	0.012 - 0.044 mm (0.0004 - 0.0017 in.)
Weight	325 - 335 grams (11.47 - 11.82 oz.)
Land Clearance (Diametrical)	0.734 - 0.797 mm (0.029 - 0.031 in.)
Piston Length	64 mm (2.520 in.)
Piston Ring Groove Depth No. 1	3.989 - 4.188 mm (0.157 - 0.165 in.)
Piston Ring Groove Depth No. 2	4.462 - 4.661 mm (0.176 - 0.184 in.)
Piston Ring Groove Depth No. 3	3.847 - 4.131 mm (0.151 - 0.163 in.)

DESCRIPTION	SPECIFICATION
Piston Pins	
Clearance in Piston	0.008 - 0.020 mm (0.0003 - 0.0008 in.)
In Rod (Interference)	0.018 - 0.043 mm (0.0007 - 0.0017 in.)
Diameter	20.998 - 21.003 mm (0.8267 - 0.8269 in.)
End Play	None
Length	74.75 - 75.25 mm (2.943 - 2.963 in.)
Piston Rings	
Ring Gap Top Compression Ring	0.23 - 0.52 mm (0.009 - 0.020 in.)
Ring Gap 2nd Compression Ring	0.49 - 0.78 mm (0.019 - 0.031 in.)
Ring Gap Oil Control (Steel Rails)	0.23 - 0.66 mm (0.009 - 0.026 in.)
Ring Side Clearance Both Compression Rings	0.025 - 0.065 mm (0.0010 - 0.0026 in.)
Oil Ring (Pack)	0.004 - 0.178 mm (0.0002 - 0.0070 in.)
Ring Width Compression Rings	1.17 - 1.19 mm (0.046 - 0.047 in.)
Oil Ring (Pack)	2.854 - 3.008 mm (0.1124 - 0.1184 in.)
Connecting Rod	
Bearing Clearance	0.026 - 0.059 mm (0.001 - 0.0023 in.)
Piston Pin Bore Diameter	20.96 - 20.98 mm (0.8252 - 0.8260 in.)
Large End Bore Diameter	50.991 - 51.005 mm (2.0075 - 2.0081 in.)
Side Clearance	0.13 - 0.38 mm (0.005 - 0.015 in.)
Total Weight (Less Bearing)	543 grams (1.20 lbs.)
Crankshaft	
Connecting Rod Journal Diameter	47.9924 - 48.0076 mm (1.8894 - 1.8900 in.)
Out-of-Round (Max.)	0.0035 mm (0.0001 in.)
Taper (Max.)	0.0038 mm (0.0001 in.)
Main Bearing Diametrical Clearance No. 1 - 5	0.022 - 0.062 mm (0.0008 - 0.0024 in.)
End Play	0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Main Bearing Journals	
Diameter	51.9924 - 52.0076 mm (2.0469 - 2.0475 in.)
Out-of-Round (Max.)	0.0035 mm (0.0001 in.)
Taper (Max.)	0.0038 mm (0.0001 in.)
Rocker Arm Shaft	
Rocker Arm Shaft Diameter	19.996 – 19.984mm (0.786 – 0.7867 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Rocker Arm Shaft Retainers (Width)	
Intake (All)	28.46 mm (1.12 in.)
Exhaust	1 & 5 29.20 mm (1.14in.) 2, 3, and 4 - 40.45 mm (1.59 in.)
Rocker Arm/Hydraulic Lash Adjuster *	
Rocker Arm Inside Diameter	20.00 – 20.02 mm (0.787 – 0.788 in.)
Rocker Arm Shaft Clearance	0.016 – 0.054 mm (0.0006 – 0.0021 in.)
Body Diameter	22.949 – 22.962 mm (0.9035 – 0.9040 in.)
Plunger Travel Minimum (Dry)	2.2 mm (0.087 in.)
Rocker Arm Ratio	1.4 to 1
Cylinder Head Camshaft Bearing Diameter	
No. 1	41.20 – 41.221 mm (1.622 – 1.6228 in.)
No. 2	41.6 – 41.621 mm (1.637 – 1.638 in.)
No. 3	42.0 – 42.021 mm (1.653 – 1.654 in.)
No. 4	42.4 – 42.421 mm (1.669 – 1.670 in.)
No. 5	42.8 – 42.821 mm (1.685 – 1.6858 in.)
Camshaft Journal Diameter	
No. 1	41.128 – 41.147 mm (1.619 – 1.6199 in.)
No. 2	41.528 – 41.547 mm (1.634 – 1.635 in.)
No. 3	41.928 – 41.947 mm (1.650 – 1.651 in.)
No. 4	42.328 – 42.374 mm (1.666 – 1.668 in.)
No. 5	42.728 – 42.747 mm (1.682 – 1.6829 in.)
Diametrical Bearing Clearance	0.053 – 0.093 mm (0.0027 – 0.003 in.)
Max. Allowable	0.12 mm (0.0047 in.)
End Play	0.05 – 0.39 mm (0.0059 in.)
Lift (Zero Lash)	
Intake	7.2 mm (0.283 in.)
Exhaust	7.03 mm (0.277 in.)
Valve Timing Exhaust Valve**	
Closes (ATDC)	5.4°
Opens (BBDC)	43.7°
Duration	229.1°
Valve Timing Intake Valve **	
Closes (ABDC)	41.1°
Opens (ATDC)	13.9°
Duration	207.2°
Valve Overlap	0°
Cylinder Head	
Material	Cast Aluminum
Gasket Thickness (Compressed)	1.15 mm (0.045 in.)

DESCRIPTION	SPECIFICATION
Valve Seat	
Angle	45°
Runout (Max.)	0.050 mm (0.002)
Width (Finish)	
Intake and Exhaust	0.75 – 1.25 mm (0.030 – 0.049 in.)
Valve Guide Finished	
Diameter I.D.	5.975 – 6.000 mm (.235 – .236 in.)
Guide Bore Diameter (Std.)	11.0 – 11.02 mm (0.4330 – 0.4338 in.)
Valves	
Face Angle Intake and Exhaust	45 – 45-1/2°
Head Diameter Intake	32.12 – 33.37 mm (1.303 – 1.313 in.)
Head Diameter Exhaust	28.57 – 28.83 mm (1.124 – 1.135 in.)
Valve Margin	
Intake	1.15 – 1.48 mm (0.0452 – 0.0582 in.)
Exhaust	1.475 – 1.805 mm (0.058 – 0.071 in.)
Valve Length (Overall)	
Intake	114.69 – 115.19 mm (4.515 – 4.535 in.)
Exhaust	109.59 – 110.09 mm (4.603 – 4.623 in.)
Valve Stem Tip Height	
Intake	45.01 – 46.07 mm (1.77 – 1.81 in.)
Exhaust	43.51 – 44.57 mm (1.71 – 1.75 in.)
Stem Diameter	
Intake	5.934 – 5.952 mm (0.234 – 0.234 in.)
Exhaust	5.906 – 5.924 mm (0.233 – 0.233 in.)
Stem to Guide Clearance	
Intake	0.048 – 0.066 mm (0.0018 – 0.0025 in.)
Exhaust	0.0736 – 0.094 mm (0.0029 – 0.0037 in.)
Max. Allowable Intake	0.076 mm (0.003 in.)
Max. Allowable Exhaust	0.101 mm (0.004 in.)
Valve Springs	
Free Length (Approx.)	44.4 mm (1.747 in.)
Nominal Force (Valve closed)	91 N·m @ 39.8 mm (67 ft. lbs. @ 1.57 in.)
Nominal Force (Valve open)	239 N·m @ 32.6 mm (176 lbs. @ 1.28 in.)
Installed Height	40.18 mm (1.580 in.)

* SERVICE AS AN ASSEMBLY WITH ROCKER ARM.

** ALL READINGS IN CRANKSHAFT DEGREES, AT 0.5 mm (0.019 in.) OF VALVE LIFT.

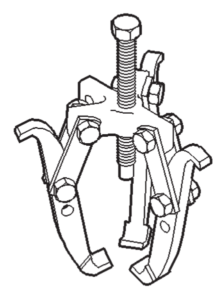
SPECIFICATIONS (Continued)

TORQUE CHART 2.0L SOHC

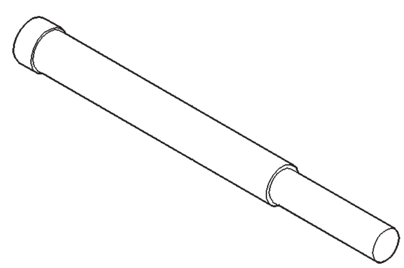
DESCRIPTION	TORQUE
Camshaft Sensor Pick Up	
Bolts	9.6 N·m (85 in. lbs.)
Camshaft Sprocket	
Bolt	115 N·m (85 ft. lbs.)
Connecting Rod Cap	
Bolts	27 N·m (20 ft. lbs.) Plus 1/4 Turn
Collar—Oil Pan to Transaxle	
Step 1: Collar to Oil Pan Bolts	3 N·m (30 in. lbs.)
Step 2: Collar to Transaxle Bolts	108 N·m (80 ft. lbs.)
Step 3: Collar to Oil Pan Bolts	54 N·m (40 ft. lbs.)
Crankshaft Main Bearing Cap/Bedplate	
M8 Bedplate Bolts	30 N·m (22 ft. lbs.)
M11 Main Cap Bolts	81 N·m (60 ft. lbs.)
Crankshaft Damper	
Bolt	142 N·m (105 ft. lbs.)
Cylinder Head	
Bolts	Refer To Cylinder Head Installation
Cylinder Head Cover	
Bolts	12 N·m (105 in. lbs.)
Drive Plate to Flywheel	
Bolts	95 N·m (70 ft. lbs.)
Engine Mount Bracket—Right	
Bolts	61 N·m (45 ft. lbs.)
Engine Mounting	
Bolts	Refer to Engine Mount Installation
Exhaust Manifold to Cylinder Head	
Bolts	23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield	
Bolts	12 N·m (105 in. lbs.)
Front Mount Torque Bracket	
Bolts	33 N·m (24 ft. lbs.)
Front Powertrain Bending Strut	
Long Bolts	101 N·m (75 ft. lbs.)
Short Bolt	61 N·m (45 ft. lbs.)
Intake Manifold	
Bolts	12 N·m (105 in. lbs.)
Oil Filter Adapter	
Fastener	80 N·m (60 ft. lbs.)
Oil Filter	20 N·m (15 ft. lbs.)
Oil Pan	
Bolts	12 N·m (105 in. lbs.)
Drain Plug	27 N·m (20 ft. lbs.)
Oil Pump Attaching	
Bolts	28 N·m (250 in. lbs.)
Oil Pump Cover Fastener	12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Bolt	28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap	41 N·m (30 ft. lbs.)
Rear Torque Bracket—2.0L Engine	
Bolts w/Auto. Transaxle	110 N·m (80 ft. lbs.)
Bolts w/Manual Transaxle	61 N·m (45 ft. lbs.)
Rocker Arm Shaft	
Bolts	28 N·m (250 in. lbs.)
Spark Plugs	28 N·m (20 ft. lbs.)
Thermostat Housing	
Bolts	23 N·m (200 in lbs.)
Timing Belt Cover	
Bolts M6	12 N·m (105 in. lbs.)
Timing Belt Tensioner Assembly—Mechanical	
Bolts	28 N·m (250 in. lbs.)
Timing Belt Tensioner—Hydraulic	
Pulley Bolt	68 N·m (50 ft. lbs.)
Pivot Bracket Bolt	31 N·m (23 ft. lbs.)
Tensioner Bolts	31 N·m (23 ft. lbs.)
Water Pump Mounting	
Bolts	12 N·m (105 in. lbs.)

SPECIAL TOOLS

2.0L SOHC ENGINE

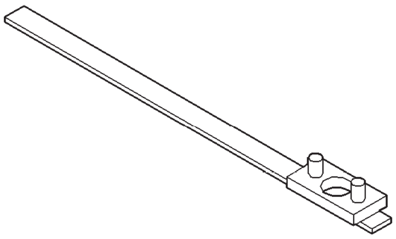


Puller 1026

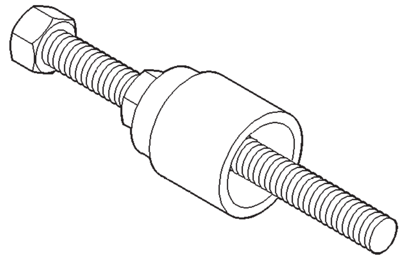


Crankshaft Damper Removal Insert 6827-A

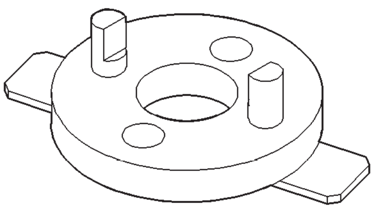
SPECIAL TOOLS (Continued)



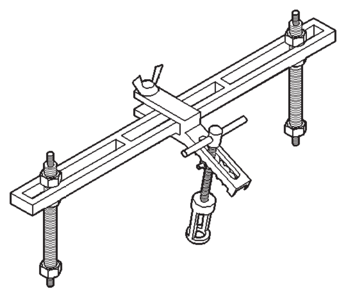
Camshaft Sprocket Remover/Installer C-4687



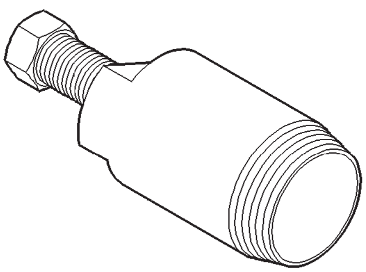
Crankshaft Damper Installer 6792



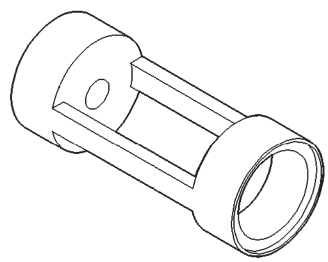
Camshaft Sprocket Remover/Installer Adapter C-4687-1



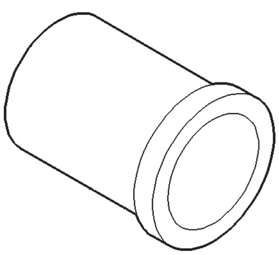
Valve Spring Compressor MD-998772-A



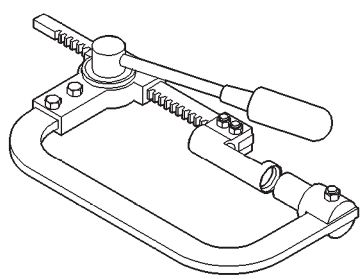
Camshaft Seal Remover C-4679-A



Spring Compressor Adapter 6779

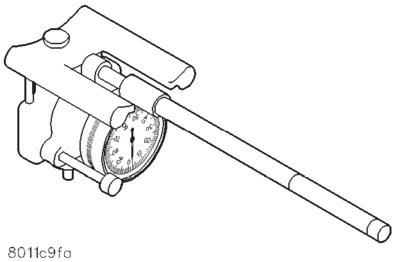


Camshaft Seal Installer MD-998306

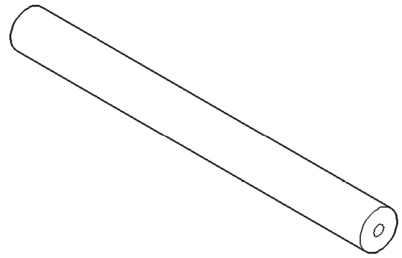


Valve Spring Compressor C-3422-B

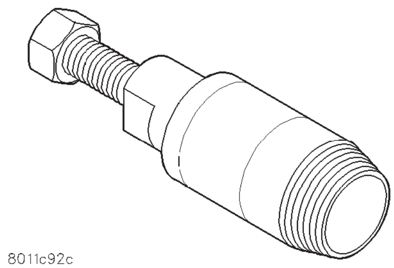
SPECIAL TOOLS (Continued)



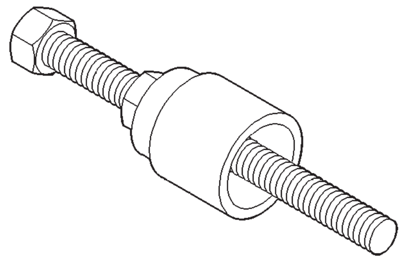
Cylinder Bore Indicator C-119



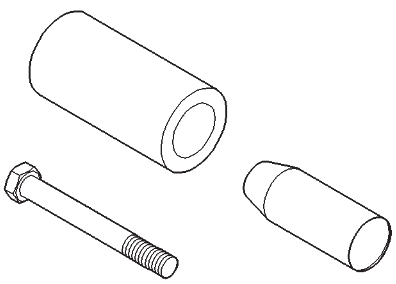
Crankshaft Sprocket Remover Insert C-4685-C2



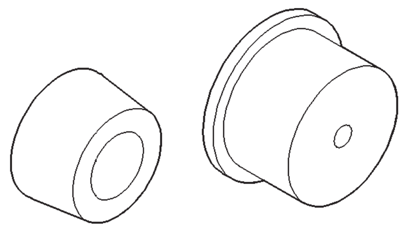
Front Crankshaft Seal Remover 6771



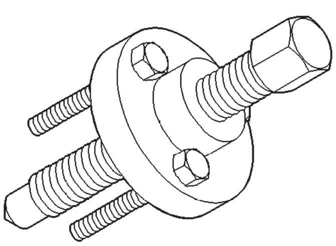
Crankshaft Sprocket Installer 6792



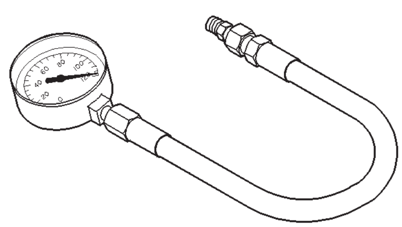
Front Crankshaft Seal Installer 6780



Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2

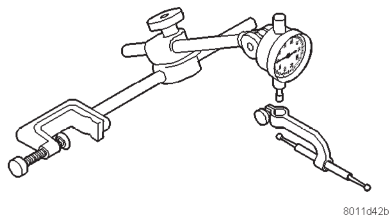


Crankshaft Sprocket Remover 6793

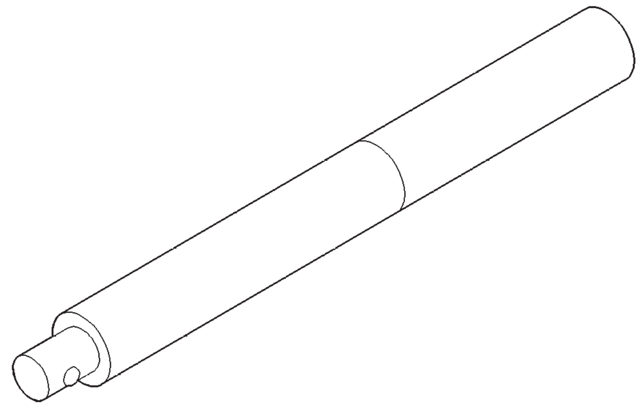


Pressure Gauge C-3292

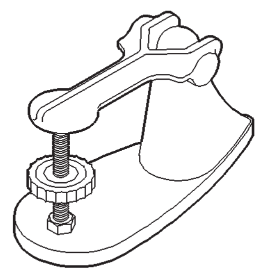
SPECIAL TOOLS (Continued)



Dial Indicator C-3339



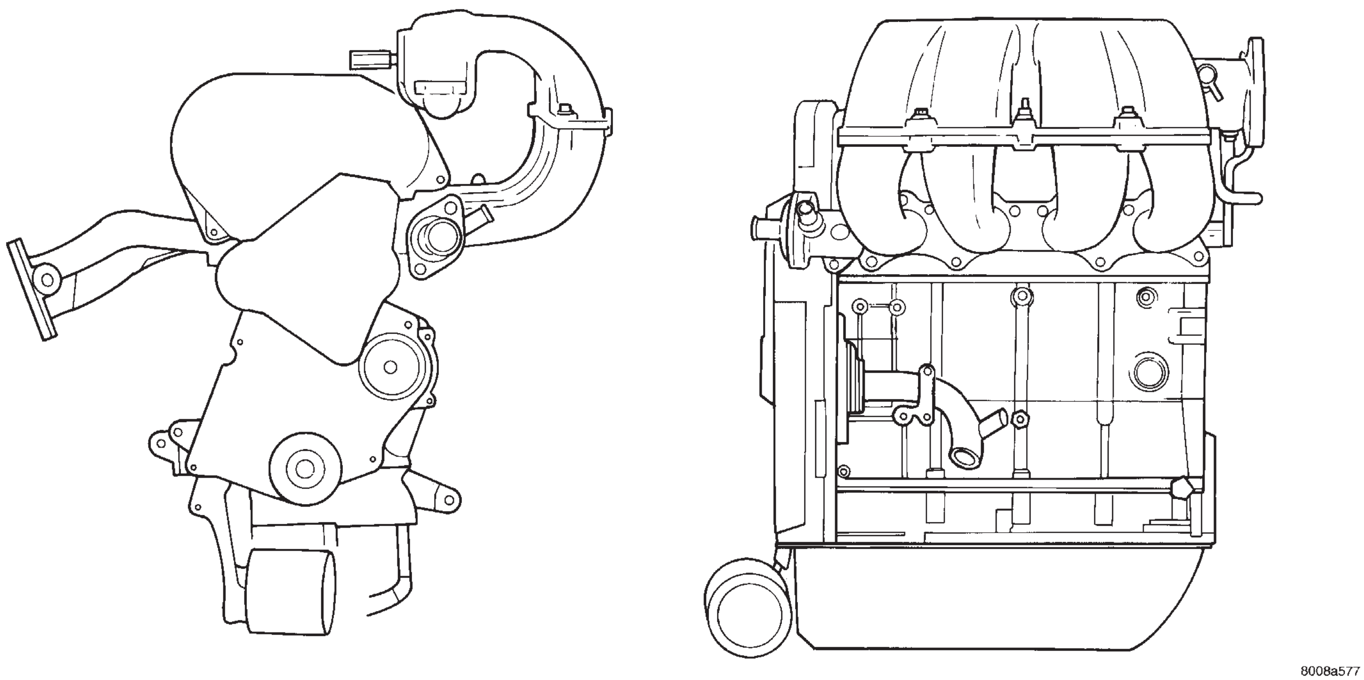
Driver Handle C-4171



Valve Spring Tester C-647

2.4L ENGINE

INDEX



Engine—2.4L

DESCRIPTION AND OPERATION

ENGINE

ENGINE IDENTIFICATION

The engine identification number is located on the rear of the cylinder block (Fig. 1).

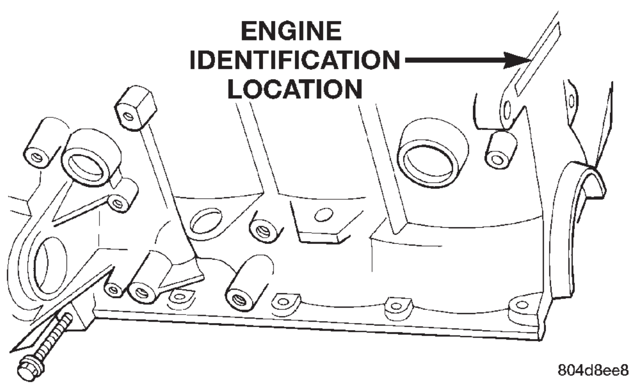


Fig. 1 Engine Identification

GENERAL SPECIFICATIONS

2.4L ENGINE

Type . . . . In-Line OHV, DOHC
Bore . . . . 87.5 mm (3.444 in.)
Stroke . . . . 101 mm (3.976 in.)
Compression Ratio 9.4:1
Displacement . . . . 2.4 Liters (148 Cu. in.)
Firing Order 1-3-4-2
Compression Pressure . . . . 1069 - 1172 kPa (170 - 225 psi)
Max. Variation Between Cylinders 25%
Lubrication . . Pressure Feed-Full Flow Filtration (Direct Crankshaft Driven Pump)

ENGINE COMPONENTS

BALANCE SHAFTS: 2.4L engines are equipped with two balance shafts installed in a carrier attached to the lower crankcase. The shafts interconnect through gears to rotate in opposite directions. These gears are driven by a short chain from the crankshaft, to rotate at two times crankshaft speed. This counterbalances certain engine reciprocating masses.

CYLINDER BLOCK AND BEDPLATE ASSEMBLY: A closed deck design is used for cooling and weight reduction with water pump molded into the block. Nominal wall thickness is 4.5 mm. The bedplate incorporates main bearing caps. Rear seal retainer is integral with the block.

CRANKSHAFT: A nodular cast iron crankshaft is used. The engine has 5 main bearings, with number 3 flanged to control thrust. The 60 mm diameter main and 50 mm diameter crank pin journals (all)

DESCRIPTION AND OPERATION (Continued)

have undercut fillets that are deep rolled for added strength. To evenly distribute bearing loads and minimize internal stress, 8 counterweights are used. Hydrodynamic seals provide end sealing, where the crankshaft exits the block. Anaerobic gasket material is used for parting line sealing in the block. A sintered powder metal timing belt sprocket is mounted on the crankshaft nose. This sprocket provides motive power; via timing belt to the camshaft sprockets (providing timed valve actuation) and to the water pump.

PISTONS: There is provisions for free wheeling valve train. Piston has a unique height. All engines use pressed in piston pins to attach forged powder metal connecting rods. Incorporate hex head cap screw threaded into the connecting rod. Piston and Rods are serviced as a assembly.

PISTONS RINGS: The piston rings include a molybdenum faced top ring for reliable compression sealing and a chrome plated taper faced intermediate ring for additional cylinder pressure control. There are also standard oil control rings.

CYLINDER HEAD: Features a Dual Over Head Camshaft (DOHC) 4 valves per cylinder cross flow design. The valves are arranged in two inline banks, with the ports of the bank of two intake valves per cylinder facing toward the radiator side of engine and ports of the bank of two exhaust valves per cylinder facing toward the dash panel. Incorporates powder metal valve guides and seats. Integral oil galleys within the cylinder head supplies oil to the hydraulic lash adjusters, camshaft and valve mechanisms.

CAMSHAFTS: The nodular iron camshafts have six bearing journals and 2 cam lobes per cylinder. Flanges at the rear journals control camshaft end play. Provision for cam position sensor is located on the intake camshaft at the rear of cylinder head. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

VALVES: 4 valves per cylinder are actuated by roller cam followers which pivot on stationary hydraulic lash adjusters. All valves have 6 mm diameter chrome plated valve stems. The valve sizes are 34.8 mm (1.370 inch.) diameter intake valves and 30.5 mm (1.20 inch.) diameter exhaust valves. Viton rubber valve stem seals are integral with the spring seats. Valve springs, spring retainers, and locks are conventional.

INTAKE MANIFOLD: The intake manifold is a one piece aluminum casting, attached to the cylinder head with ten screws. This long branch fan design enhances low and midspeed torque.

EXHAUST MANIFOLD: The exhaust manifold is made of cast iron for strength and high temperatures.

ENGINE LUBRICATION: Refer to Group 0 Lubrication and Maintenance for recommended oil to be used in various engine application. System is full flow filtration, pressure feed type. The oil pump is mounted in the front engine cover and driven by the crankshaft. Pressurized oil is then routed through the main oil gallery, running the length of the cylinder block, supplying main and rod bearings with further routing. Pistons are lubricated from rod bearing throw off and lubricating slots on the connecting rod assemblies. Camshaft and valve mechanisms are lubricated from a full length cylinder head oil gallery supplied from the crankcase main oil gallery.

ENGINE LUBRICATION SYSTEM

OIL PAN

A structural die cast aluminum oil pan provides lower engine protection as well as serving as the engine oil reservoir. Oil pan is attached to block and sealed with a gasket. The oil pickup tube has a strainer and cover.

PRESSURE LUBRICATION

Oil drawn up through the pickup tube is pressurized by the pump and routed through the full flow filter to the main oil gallery running the length of the cylinder block. Oil pickup, pump and check valve provide oil flow to the main oil gallery.

MAIN/ROD BEARINGS

A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from main bearing journals to connecting rod journals.

CAMSHAFT/HYDRAULIC LASH ADJUSTERS

A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up past a cylinder head bolt to an oil gallery running the length of the cylinder head. The camshaft journals are partially slotted to allow a predetermined amount of pressurized oil to pass into the bearing cap cavities with small holes directed to spray lubricate the camshaft lobes.

BALANCE SHAFTS

Balance shaft lubrication is provided through an oil passage from the number 1 main bearing cap through the balance shaft carrier support leg. This passage directly supplies oil to the front bearings and internal machined passages in the shafts that routes oil from front to rear shaft bearing journals

DESCRIPTION AND OPERATION (Continued)

SPLASH LUBRICATION

Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit and install gauge assembly C-3292.
(2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170/550 kPa (25/80 psi).
(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open or a clogged oil pickup screen.

SERVICE PROCEDURES

CYLINDER BORE AND SIZING PISTON

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 14 mm (9/16 inch.) from the bottom of the skirt as shown in (Fig. 3). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 2). Refer to for Cylinder Bore and Piston Specification Chart. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

Chrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).

FITTING PISTON RINGS

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 4). Refer to specification in Piston Ring Specification Chart.
(2) Check piston ring to groove side clearance (Fig. 5). Refer to specification in Piston Ring Specification Chart.

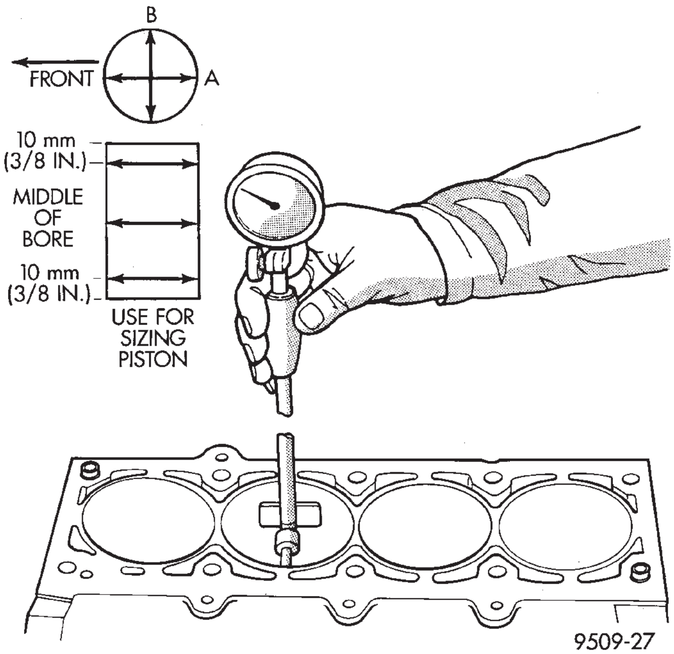


Fig. 2 Checking Cylinder Bore Size

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Maximum Out-Of-Round	Maximum Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
87.450 - 87.468 mm (3.4434 - 3.4441 in.)		
Piston To Bore Clearance		
0.024 - 0.057 mm (0.0009 - 0.0022 in.)		
Measurements taken at Piston Size Location.		

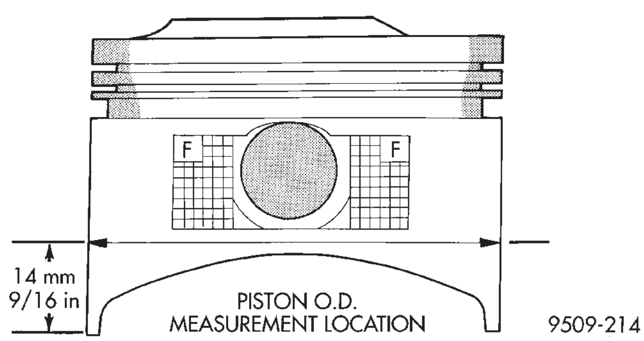


Fig. 3 Piston Measurement

SERVICE PROCEDURES (Continued)

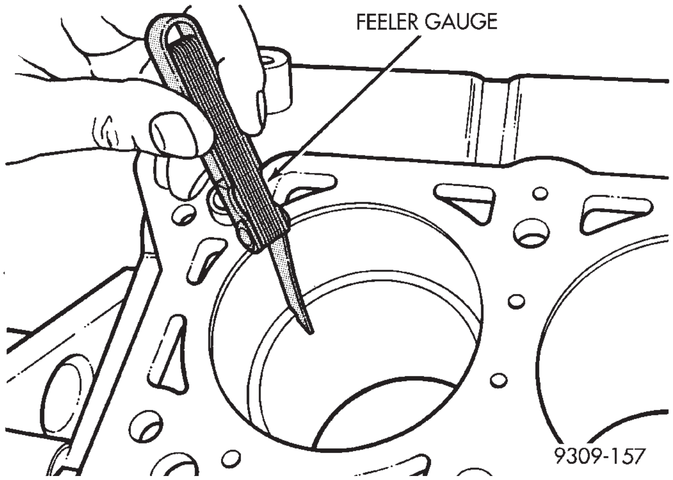


Fig. 4 Piston Ring Gap

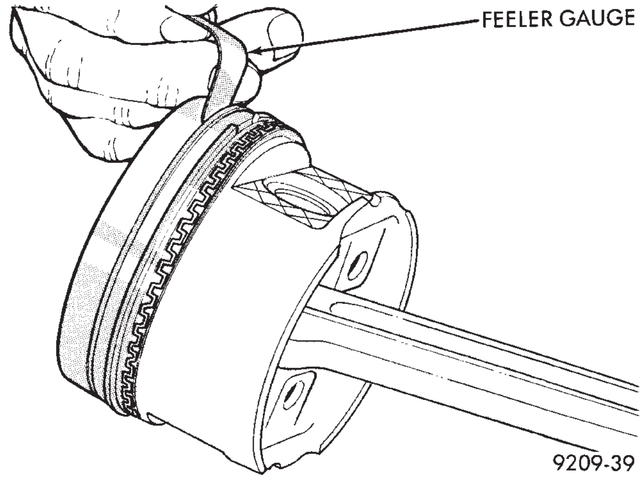


Fig. 5 Piston Ring Side Clearance

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Wear Limit
Upper Ring	0.025 to 0.51 mm (0.0098 to 0.020 in.)	0.8 mm (0.031 in.)
Intermediate Ring	0.23 to 0.48 mm (0.009 to 0.018 in.)	0.8 mm (0.031 in.)
Oil Control Ring	0.25 to 0.64 mm (0.0098 to 0.025 in.)	1.0 mm (0.039 in.)
Ring Position	**Groove Clearance**	**Max. Clearance**
Upper Ring	0.030 to 0.080 mm (0.0011 to 0.0031 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.025 to 0.065 mm (0.0010 to 0.0026 in.)	0.10 mm (0.004 in.)
Oil Control Ring - Three Piece. Oil Ring Side Rails Must Be Free To Rotate After Assembly.		

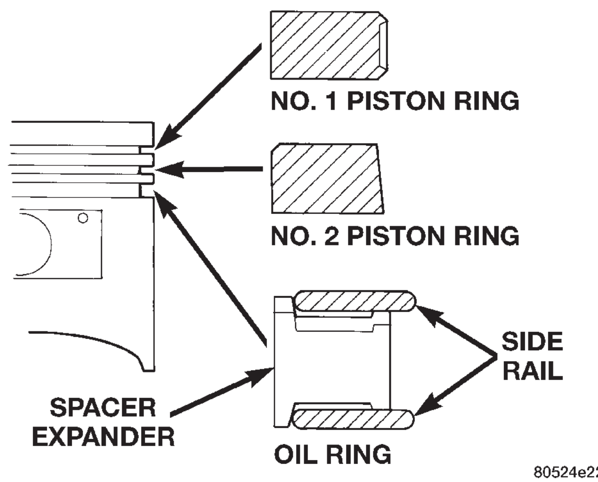


Fig. 6 Piston Ring Installation

PISTON RINGS—INSTALLATION

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 6).

CAUTION: Install piston rings in the following order:

a. Oil ring expander.
b. Upper oil ring side rail.
c. Lower oil ring side rail.
d. No. 2 Intermediate piston ring.
e. No. 1 Upper piston ring.

(2) Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander** (Fig. 7).

(3) Install upper side rail first and then the lower side rail.

(4) Install No. 2 piston ring and then No. 1 piston ring.

(5) Position piston ring end gaps as shown in (Fig. 8).

(6) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.

FITTING CONNECTING ROD BEARINGS

Engine connecting rod bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

SERVICE PROCEDURES (Continued)

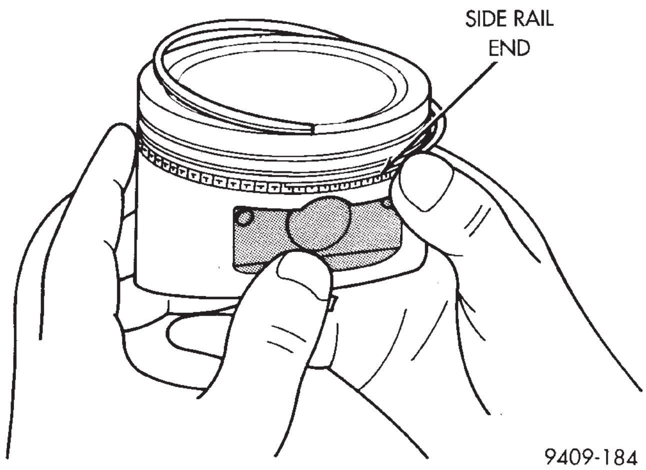


Fig. 7 Installing Side Rail

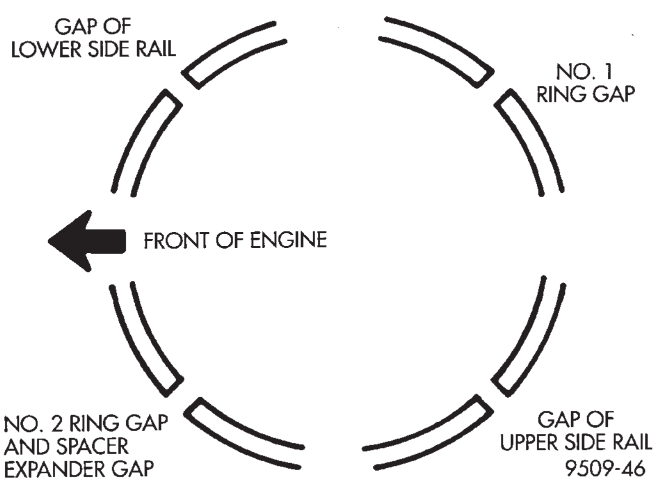


Fig. 8 Piston Ring End Gap Position

(1) Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.

(2) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from the oil hole (Fig. 9). In addition, suspect areas can be checked by placing plastigage in the suspect area.

(4) Before assembling the rod cap with Plastigage in place, the crankshaft must be rotated until the connecting rod being checked starts moving toward the top of the engine. Only then should the cap be assembled and torqued to specifications. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

(5) Remove the bearing cap and compare the width of the flattened Plastigage (Fig. 9) with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

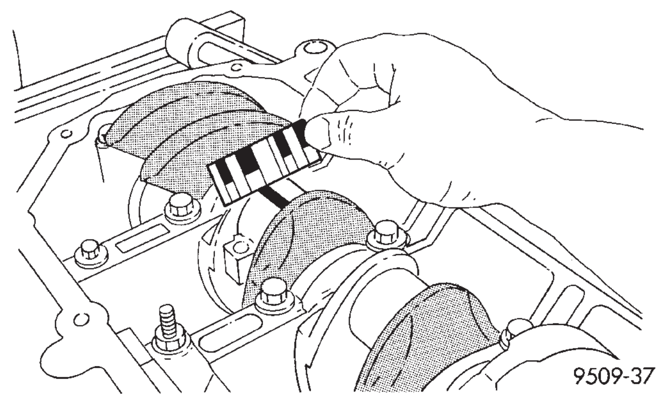


Fig. 9 Measuring Plastigage Width

(6) Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (.001-.003 in.) is usually the most appropriate for checking engine bearing proper specifications.

FITTING MAIN BEARINGS

Refer to the Engine General Information Section for Measuring Main Bearings. For Crankshaft specifications refer to Crankshaft Specification Chart.

CRANKSHAFT MAIN BEARINGS

The crankshaft is supported in five main bearings. All upper and lower bearing shells in the crankcase have oil grooves. The number three lower main thrust bearing is plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 10).

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine (Fig. 10). All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersized: 0.025 mm (0.001 in.) and 0.250 mm (0.010 in.). Never install an undersize bearing that will reduce clearance below specifications.

MAIN BEARING INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 11).

(2) Make certain oil holes in block line up with oil holes in bearings. Bearing tabs must seat in the block tab slots.

SERVICE PROCEDURES (Continued)

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play
New Part: 0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Wear Limit: 0.37 mm (0.015 in.)
Main Bearing Clearance
New Part: 0.018 - 0.058 mm (0.0007 - 0.0023 in.)
Connecting Rod Bearing Clearance
New Part: 0.025 - 0.071 mm (0.001 - 0.003 in.)
Wear Limit: 0.075 mm (0.003 in.)
Crankshaft Journal Sizes
Main Bearing Journal Diameter
Standard 60.000 ± 0.008 mm (2.3622 ± 0.0003 in.)
1st Undersize 59.975 ± 0.008 mm (2.361 ± 0.0003 in.)
Connecting Rod Journals
Standard 49.992 ± 0.008 mm (1.968 ± 0.0003 in.)
1st Undersize 49.967 ± 0.008 mm (1.967 ± 0.0003 in.)

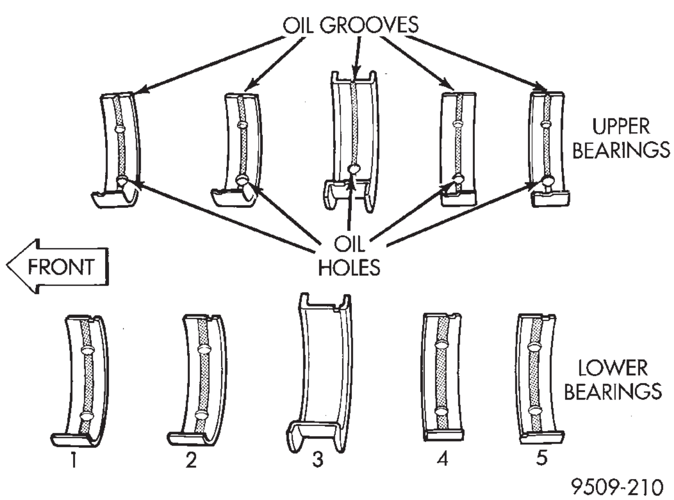


Fig. 10 Main Bearing Identification

CAUTION: Do not get oil on the bedplate mating surface. It will may effect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals and install crankshaft.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine. Ensure that both cylinder block and bedplate surfaces are clean.

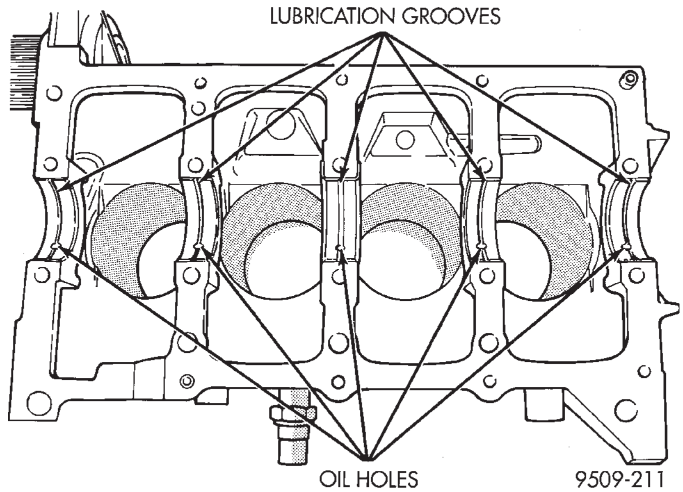


Fig. 11 Installing Main Bearing Upper Shell

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of anaerobic sealer Mopar® Torque Cure Gasket Maker to cylinder block as shown in (Fig. 12).

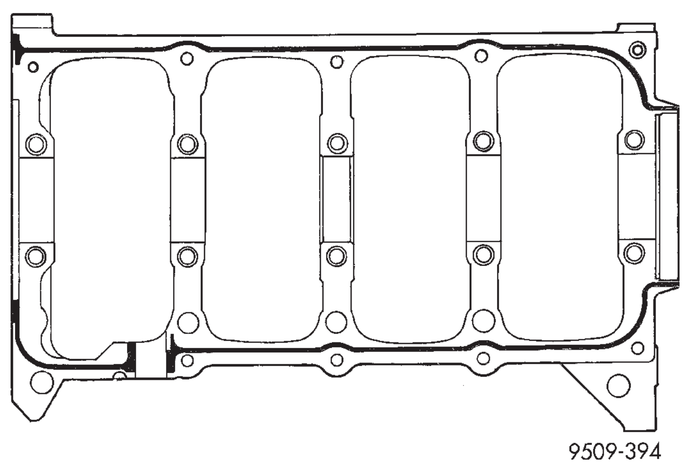


Fig. 12 Main Bearing Caps/Bedplate Sealing

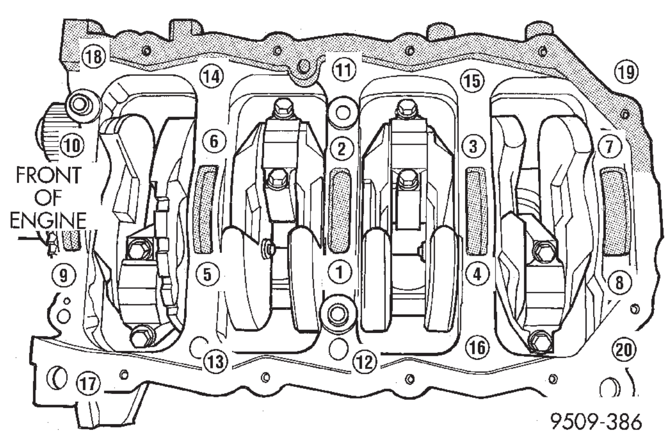


Fig. 13 Main Bearing Caps/Bedplate Torque Sequence

SERVICE PROCEDURES (Continued)

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(6) Before installing bolts, lubricate the threads with clean engine oil, wipe off any excess oil.

(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten these bolts down together until the bedplate contacts the cylinder block.

(8) To ensure correct thrust bearing alignment, perform the following steps:

- Step 1: Rotate crankshaft until number 4 piston is at TDC.
- Step 2: Move crankshaft rearward to limits of travel.
- Step 3: Then, move crankshaft forward to limits of travel.
- Step 4: Wedge an appropriate tool between the rear of the cylinder block **(NOT BED PLATE)** and the rear crankshaft counterweight. This will hold the crankshaft in it's furthest forward position.
- Step 5: Install and tighten bolts (1 – 10) in sequence shown in (Fig. 13) to 41 N·m (30 ft. lbs.).
- Step 6: Remove wedge tool used to hold crankshaft.

(9) Tighten bolts (1 – 10) again to 41 N·m (30 ft. lbs.) + 1/4 turn in sequence shown in (Fig. 13).

(10) Install main bearing bedplate to engine block bolts (11 through 20), and torque each bolt to 28 N·m (20 ft. lbs.) in sequence shown in (Fig. 13).

(11) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

CRANKSHAFT END PLAY

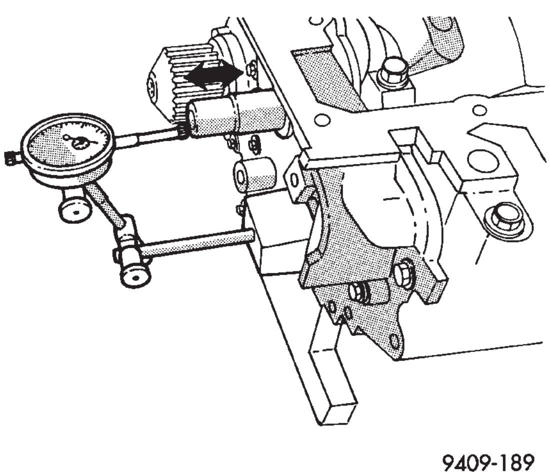


Fig. 14 Checking Crankshaft End Play—Typical

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 14).

(2) Move crankshaft all the way to the rear of its travel.

(3) Zero the dial indicator.

(4) Move crankshaft all the way to the front and read the dial indicator. Refer to Crankshaft Specification Chart for end-play specification.

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.09 - 0.24mm (0.0035 - 0.0094 in.)
Wear Limit:	0.37 mm (0.015 in.)

OPTIONAL CRANKSHAFT END PLAY CHECK

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. **DO NOT** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft **WITHOUT** cam follower assemblies. Install rear cam caps and tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 15).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.05 - 0.15 mm (0.002 - 0.010 in.).

(6) If end play is excessive check cylinder head and camshaft for wear; replace as necessary.

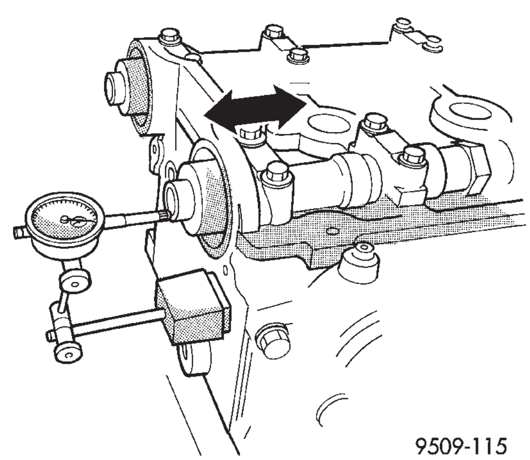


Fig. 15 Camshaft End Play

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT AND REAR

REMOVAL

FRONT MOUNT

(1) Raise vehicle on hoist.
(2) Remove through bolt at front mount (Fig. 17).
(3) Remove attaching bolts from mount to lower radiator support.

NOTE: It may be necessary to tilt engine for front mount removal clearance.

(4) Remove mount.

REAR MOUNT

(1) Raise vehicle on hoist.
(2) Remove through bolt (A) from rear engine mount and bracket (Fig. 18).
(3) Remove rear strut bracket and brace (Fig. 16).
(4) Remove bolts attaching rear mount to suspension crossmember.

NOTE: It may be necessary to tilt engine for rear mount removal clearance.

(5) Remove rear mount.

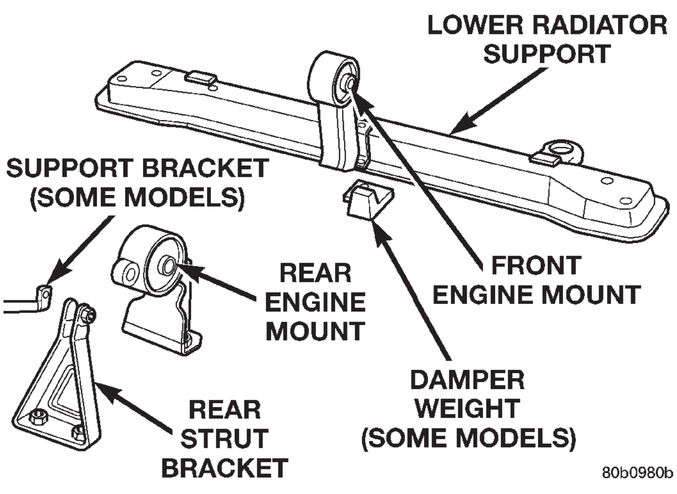


Fig. 16 Engine Mounting—Front and Rear

INSTALLATION

FRONT MOUNT

(1) Position front mount. Position damper weight (some models) and install front mount to lower radiator support crossmember attaching bolts. Tighten bolts to 61 N·m (45 ft. lbs.).
(2) Install through bolt and tighten to 61 N·m (45 ft. lbs.) (Fig. 17).
(3) Lower vehicle.

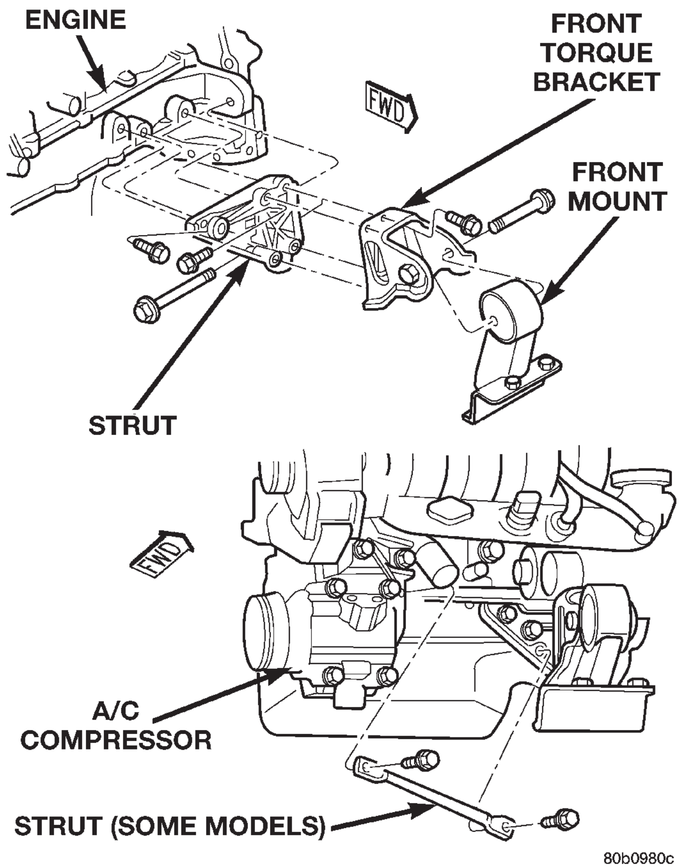
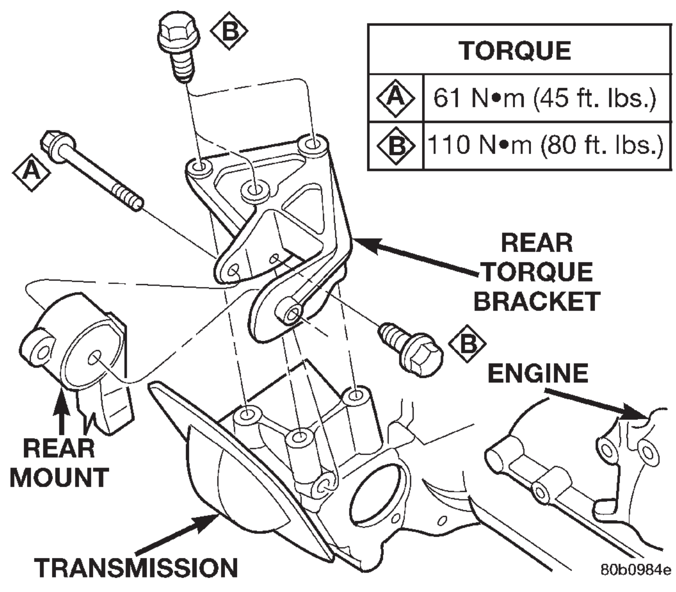


Fig. 17 Engine Mounting—Front 2.4L Engine



TORQUE	
A	61 N•m (45 ft. lbs.)
B	110 N•m (80 ft. lbs.)

Fig. 18 Engine Mounting—Rear 2.4L Engine

REAR MOUNT

(1) Position rear mount.
(2) Install bolts attaching rear mount to crossmember. Tighten bolts to 61 N·m (45 ft. lbs.).
(3) Install rear strut and support brackets (Fig. 16). Tighten bolts to the following torque values:

REMOVAL AND INSTALLATION (Continued)

• Bolts attaching strut bracket to front suspension crossmember: 61 N·m (45 ft. lbs.)
• Nut attaching support bracket to front suspension crossmember: 108 N·m (80 ft. lbs.)
• Bolt attaching support bracket to rear strut: 61 N·m (45 ft. lbs.)

(4) Tighten through bolt (A) at rear mount to 61 N·m (45 ft. lbs.) (Fig. 18).

(5) Lower vehicle.

ENGINE MOUNT—RIGHT/ENGINE SUPPORT BRACKET

NOTE: The right side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

(1) Raise vehicle on a hoist and remove inner splash shield. Remove the right engine support assembly vertical fasteners from frame rail (Fig. 19).

(2) Lower vehicle. Remove the load on the engine motor mounts by carefully supporting the engine assembly with a floor jack.

(3) Remove the three bolts attaching the engine support assembly to the engine bracket.

(4) Move the air conditioning dryer aside.

(5) Remove coolant recovery system tank. Refer to Group 7, Cooling System for procedure.

(6) Remove right engine support.

(7) Remove the three bolts attaching the engine support bracket to the cylinder block.

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

(8) Reverse removal procedure for installation. Refer to (Fig. 19) for torque specifications.

ENGINE MOUNT—LEFT

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

The left side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

REMOVAL

(1) Support the transmission with a transmission jack.

(2) Remove the three vertical bolts (A) from the mount to the transmission bracket (Fig. 20).

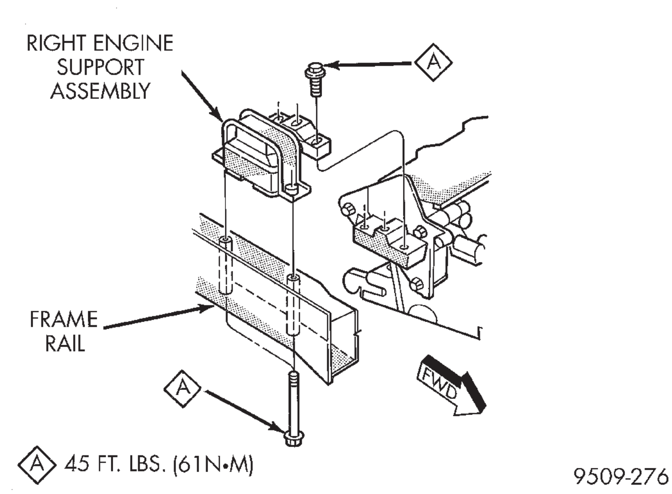


Fig. 19 Engine Mounting—Right Side

(3) Remove the mount to frame rail fasteners (B) and remove mount (Fig. 20).

INSTALLATION

(1) Install mount. Tighten mount to frame rail fasteners (B) to 33 N·m (24 ft. lbs.).

(2) Install mount to transmission bracket vertical bolts (A). Tighten to 61 N·m (45 ft. lbs.).

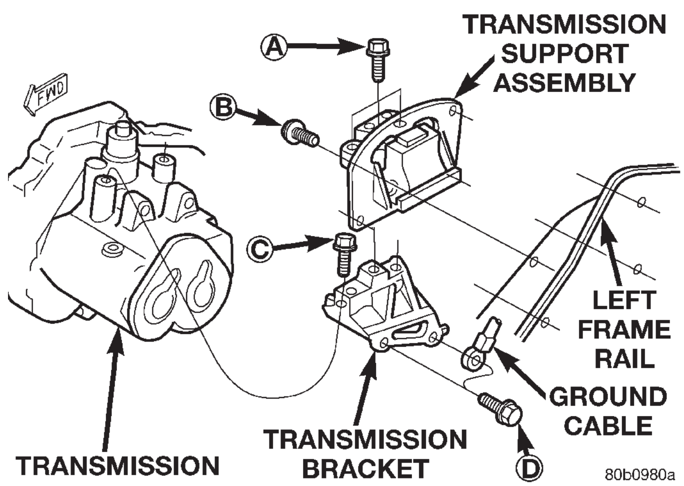


Fig. 20 Left Side Mount—Typical

ITEM	DESCRIPTION	TORQUE
A	Bolt	61 N·m (45 ft. lbs.)
B	Bolt	33 N·m (24 ft. lbs.)
C	Bolt	61 N·m (45 ft. lbs.)
D	Bolt	61 N·m (45 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect battery and remove air cleaner and hoses.

(3) Drain cooling system. Refer to Draining Cooling System in Group 7.

(4) Remove refrigerant from air conditioning system using a refrigerant recovery machine. Refer to Group 24, Heating and Air Conditioning for procedures.

(5) Disconnect automatic transmission cooler lines and plug, if equipped.

(6) Remove cooling module assembly (radiator, fan module, and condenser).

(7) Disconnect transmission shift linkage.

(8) Disconnect throttle body linkage.

(9) Disconnect engine and transmission wiring harness.

(10) Disconnect heater hoses.

(11) Hoist vehicle and remove right inner splash shield. Remove battery splash shield.

(12) Drain engine oil.

(13) Remove accessory drive belts. Refer to Accessory Drive Belt Removal in Group 7.

(14) Remove axle shafts.

(15) Disconnect exhaust pipe from manifold.

(16) Remove through bolts from front and rear engine mounts.

(17) Remove front and rear mount brackets from the engine and transmission.

(18) Remove collar. Remove converter bolts and mark converter for reassembly.

(19) Lower vehicle.

(20) Remove power steering pump, reservoir and hoses. Position components for engine removal.

(21) Remove A/C suction line at compressor. Cap suction port and line.

(22) Remove ground straps to body.

(23) Raise vehicle enough to allow engine dolly 6135 and cradle 6710 with posts 6848 to be installed under vehicle (Fig. 21).

(24) Loosen cradle engine mounts to allow movement for positioning onto engine locating holes on the engine bedplate, compressor and support bracket. Install adapters 6909 to the two post at rear of engine Lower vehicle and position cradle mounts until the engine is resting on mounts. Tighten mounts to cradle frame. This will keep mounts from moving when removing or installing engine and transmission.

(25) Lower vehicle so weight of the engine and transmission ONLY is on the cradle.

(26) Remove engine and transmission mount bolts.

(27) Raise vehicle slowly. It may be necessary to move the engine/transmission assembly on the cradle to allow for removal around body flanges.

INSTALLATION

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine and transmission.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right engine and left transmission mounts. Refer to procedures outlined in this section.

(3) Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135 and 6710.

(4) Install axle shafts.

(5) Install torque converter bolts and collar.

(6) Install through bolts to front and rear engine mounts.

(7) Connect exhaust system to manifold.

(8) Install power steering pump, reservoir and hoses.

(9) Install A/C suction line at compressor.

(10) Install accessory drive belts. Refer to Accessory Drive Belt Installation in Group 7.

(11) Install right inner splash shield and battery splash shield. Install wheels and tires.

(12) Install cooling module assembly (radiator, fan module, and condenser).

(13) Evacuate and charge air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedures.

(14) Connect automatic transmission cooler lines and shift linkage.

(15) Connect fuel line and heater hoses.

(16) Install ground straps. Connect engine and throttle body connections and harnesses.

(17) Connect throttle body linkage.

(18) Fill cooling system.

(19) Connect battery.

(20) Install air cleaner and hoses.

(21) Install oil filter. Fill engine crankcase with proper oil to correct level.

(22) Start engine and run until operating temperature is reached.

(23) Adjust transmission linkage, if necessary.

INTAKE MANIFOLD

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL AND INSTALLATION (Continued)

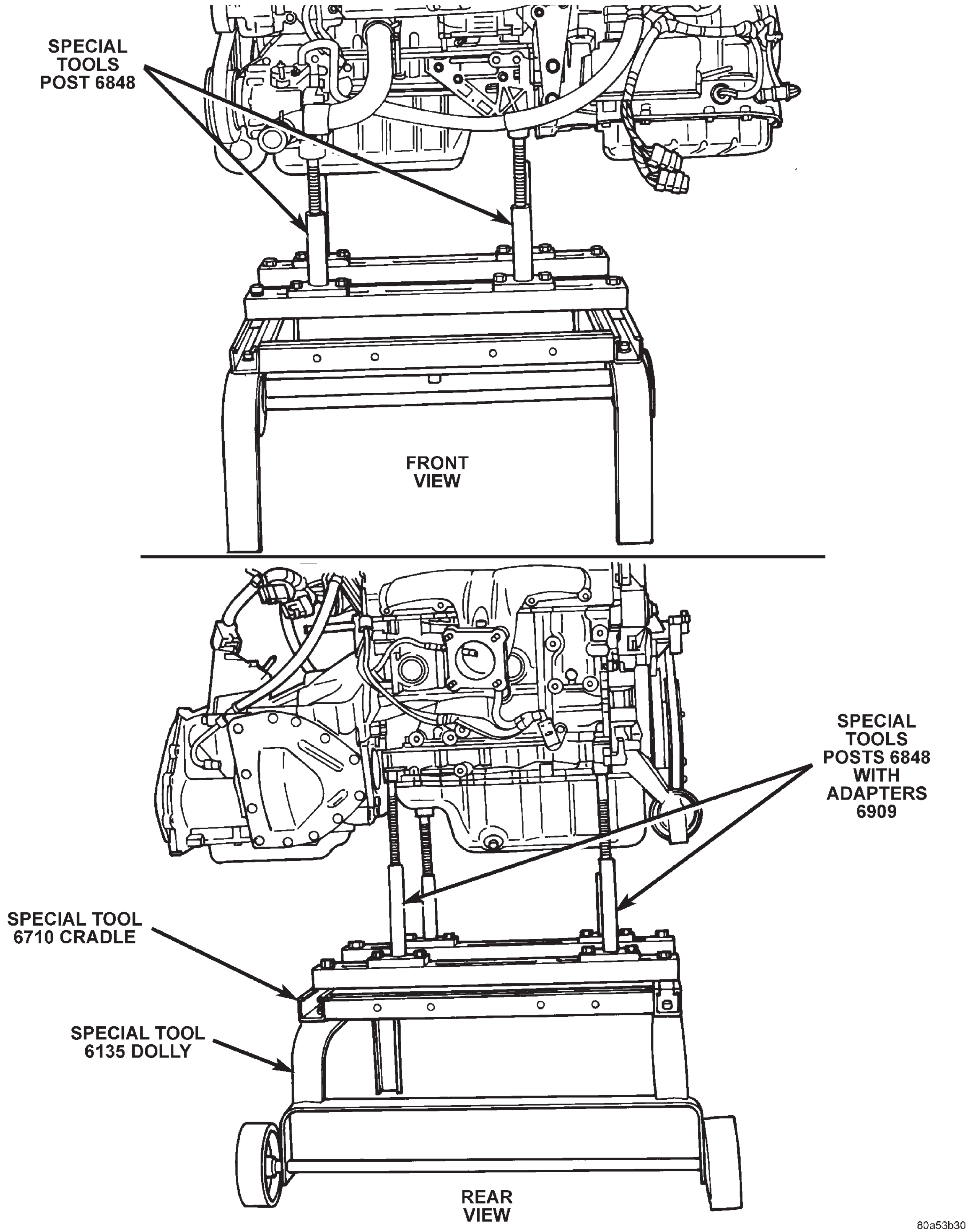


Fig. 21 Positioning Engine Cradle Support Post Mounts

REMOVAL AND INSTALLATION (Continued)

To release fuel pressure, refer to Group 14, Fuel System for procedure.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Disconnect negative cable from auxiliary jumper terminal (Fig. 22).

(3) Remove Air Inlet Resonator. Refer to Group 14, Fuel System for procedure.

(4) Disconnect the fuel supply line quick connect at the fuel rail assembly. Refer to Group 14, Fuel System for procedure.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

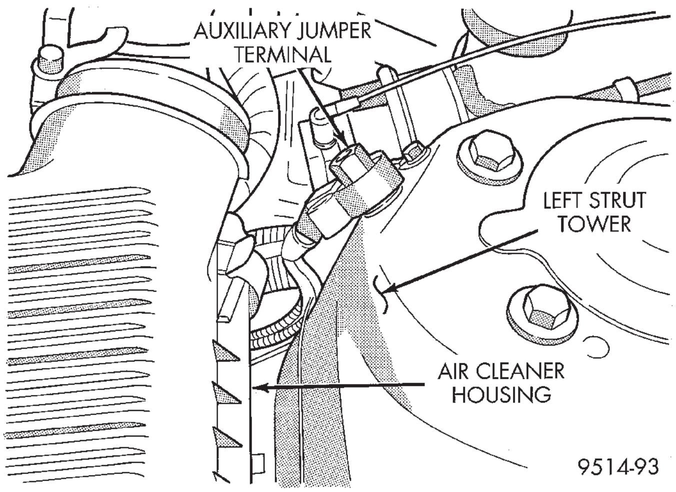


Fig. 22 Auxiliary Jumper Terminal

(5) Remove fuel rail assembly attaching screws and remove fuel rail assembly from engine. Cover injector holes with a suitable covering.

CAUTION: Do not set fuel injectors on their tips, as damage may occur to the injectors

(6) Remove throttle and speed control cables from throttle lever and bracket. Refer to Group 14, Fuel System for procedures.

(7) Disconnect idle air control (IAC) motor and throttle position sensor (TPS) wiring connectors (Fig. 23).

(8) Disconnect intake air temperature sensor, leak detection pump and PCV hoses (Fig. 24).

(9) Disconnect intake air temperature electrical connector. Disconnect leak detection pump and PCV hoses (Fig. 25).

(10) Remove transaxle to throttle body support bracket fasteners at the throttle body and loosen the fastener at the transaxle end.

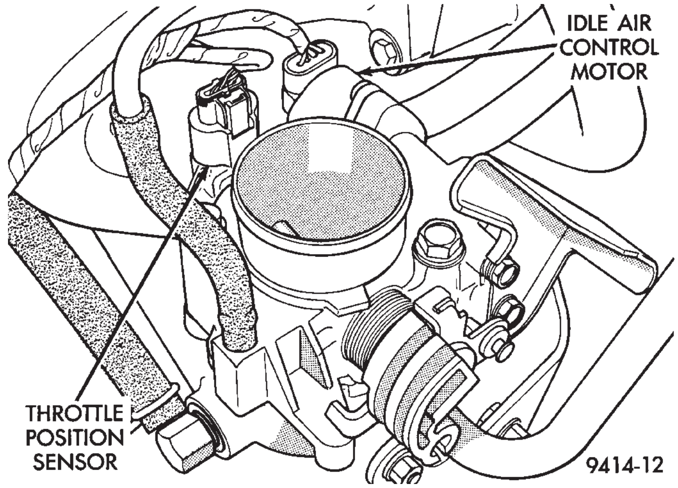


Fig. 23 Idle Air Control (IAC) Motor and Throttle Position Sensor (TPS) Wiring Connectors.

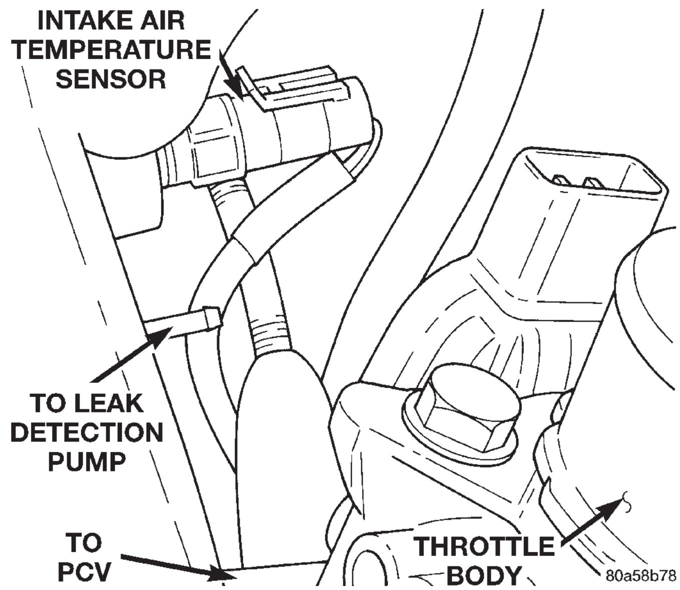


Fig. 24 Intake Air Temperature Sensor Connector, Leak Detection Pump Hose, and PCV Hose

(11) Remove EGR tube bolts at the valve and at the intake manifold (Fig. 26). Remove tube from engine and discard gaskets.

(12) Remove intake manifold fasteners (Fig. 27). Remove intake manifold.

INSTALLATION

(1) Install new intake manifold and gasket. Tighten fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 27).

(2) Remove covering from fuel injector holes and insure the holes are clean. Install fuel rail assembly to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(3) Inspect quick connect fittings for damage, replace if necessary. Refer to Group 14, Fuel System for procedure. Lubricate tube with clean engine oil.

REMOVAL AND INSTALLATION (Continued)

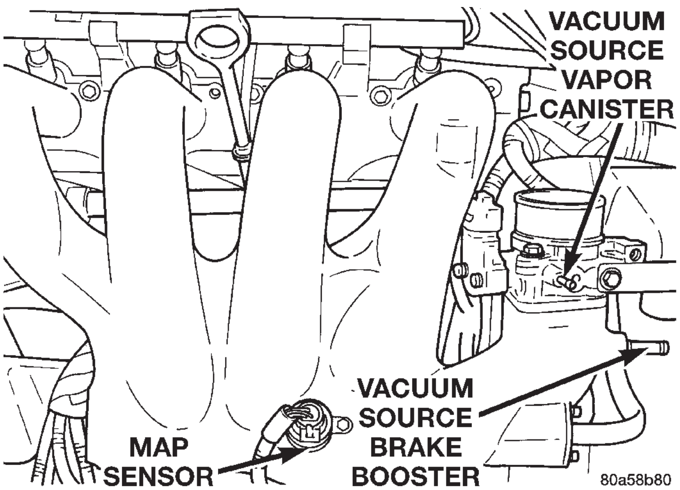


Fig. 25 Manifold Absolute Pressure (MAP), Vapor Canister Hose, and Brake Booster Hose

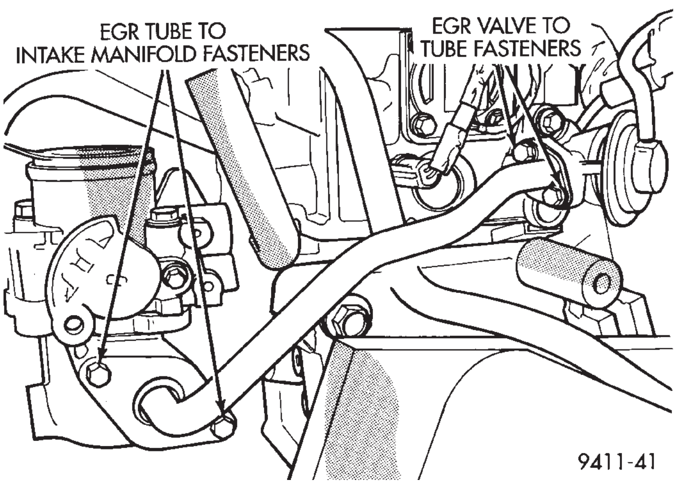


Fig. 26 Tube Assembly—Typical

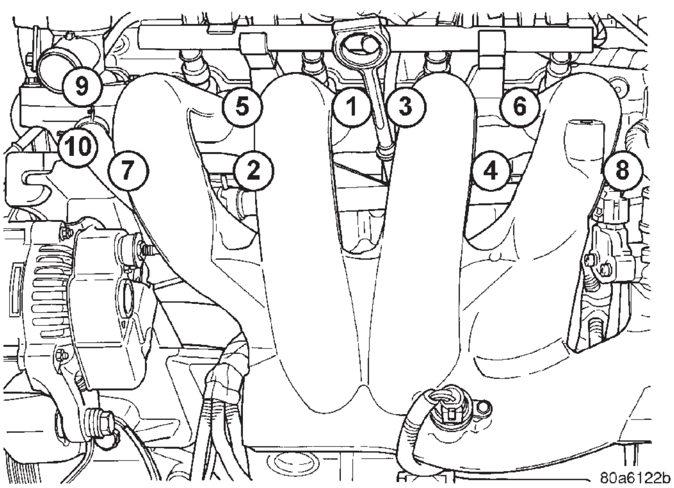


Fig. 27 Intake Manifold Tightening Sequence—2.4L Engine

Connect fuel supply hose to fuel rail assembly. Check connection by pulling on connector to insure it locked into position.

(4) Install throttle body. Tighten fastener to 22 N·m (200 in. lbs.). Install transaxle to throttle body support bracket and tighten to 12 N·m (105 in. lbs.) at the throttle body first. Next tighten the bracket at the transaxle.

(5) Connect PCV, leak detection pump hoses, and intake air temperature sensor wiring connectors (Fig. 24).

(6) Connect Manifold Absolute Pressure (MAP) electrical connector, vapor canister hose, and brake booster hose (Fig. 25).

(7) Connect knock sensor electrical and starter relay connectors. Connect wiring harness to intake manifold tab.

(8) Connect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors (Fig. 23).

(9) Install throttle and speed control cables to bracket. Connect cables to the throttle lever. Refer to Group 14, Fuel System Throttle Body Installation procedure.

(10) Position new EGR tube gaskets and loosely assemble the EGR tube onto valve and intake manifold (Fig. 26). First tighten tube fasteners at the EGR valve to 11 N·m (95 in. lbs.). Then, tighten the intake manifold side fasteners to 11 N·m (95 in. lbs.).

(11) Connect negative cable to auxiliary jumper terminal (Fig. 22).

(12) With the DRB scan tool use ASD Fuel System Test to pressurize system to check for leaks.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

EXHAUST MANIFOLD

REMOVAL

(1) Remove exhaust pipe from manifold. It may be necessary to remove the entire exhaust system. Refer to Group 11, Exhaust System for procedure.

(2) Remove exhaust manifold heat shield (Fig. 28).

(3) Remove 8 exhaust manifold retaining fasteners and remove exhaust manifold (Fig. 29).

INSTALLATION

(1) Install new manifold gasket. **DO NOT APPLY SEALER**.

(2) Position exhaust manifold in place. Tighten fasteners, starting at center and progressing outward in

REMOVAL AND INSTALLATION (Continued)

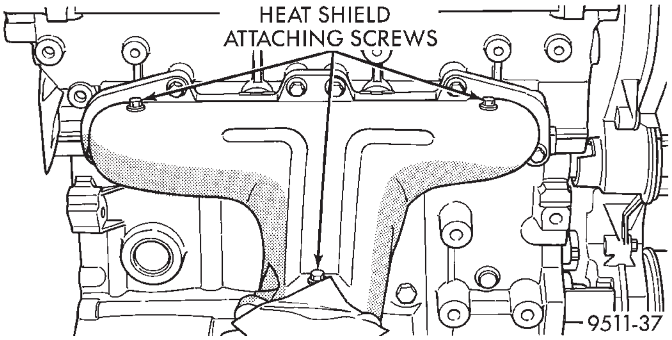


Fig. 28 Exhaust Manifold Heat Shield

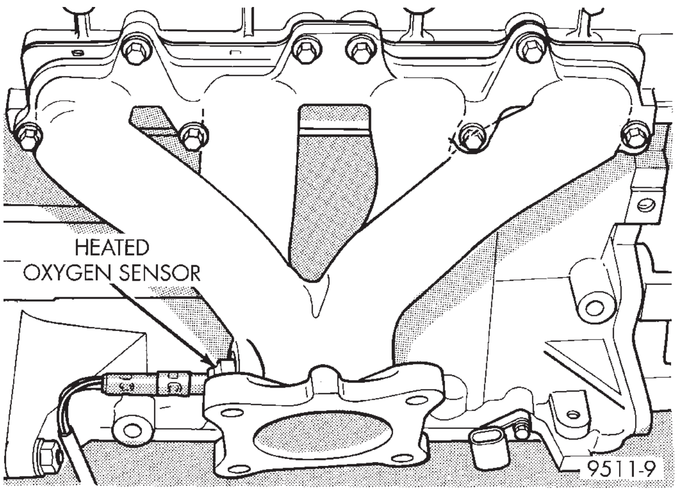


Fig. 29 Exhaust Manifold

both directions to 23 N·m (200 in. lbs.). Repeat this procedure until all fasteners are at specified torque.

(3) Install exhaust manifold heat shield.

(4) Attach exhaust pipe and tighten fasteners to 28 N·m (250 in. lbs.)

CYLINDER HEAD COVER

REMOVAL

(1) Remove ignition coil pack and plug wires (Fig. 30). Remove ground strap.

(2) Remove the cylinder head cover fasteners.

(3) Remove cylinder head cover from cylinder head.

INSTALLATION

NOTE: Replace spark plug well seals when installing a new cylinder head cover gasket.

(1) Install new cylinder head cover gaskets and spark plug seals (Fig. 31).

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

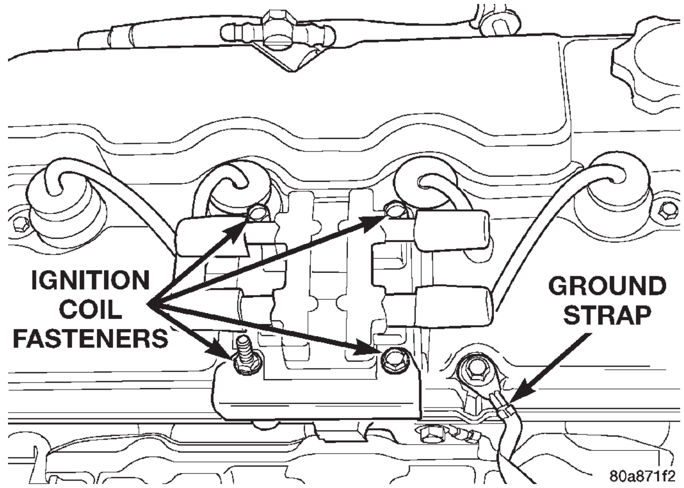


Fig. 30 Ignition Coil Pack and Ground Strap

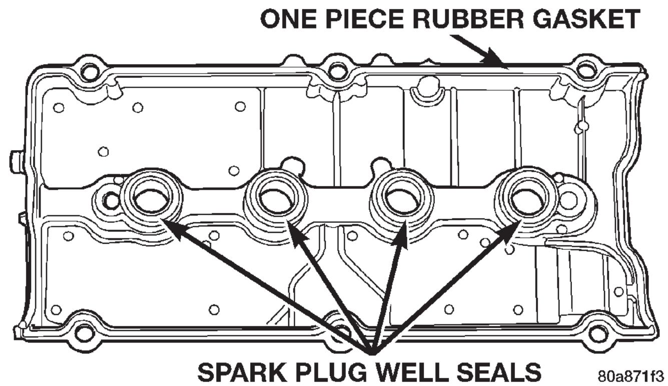


Fig. 31 Cylinder Head Cover Gasket and Spark Plug Seals

(2) Apply Mopar® Silicone Rubber Adhesive Sealant at the camshaft cap corners and at the top edge of the 1/2 round seal.

(3) Install cylinder head cover assembly to head and tighten fasteners in sequence shown in (Fig. 32). Using the 3 step torque method:

(a) Tighten all fasteners to 4.5 N·m (40 in. lbs.)

(b) Tighten all fasteners to 9.0 N·m (80 in. lbs.)

(c) Tighten all fasteners to 12 N·m (105 in. lbs.)

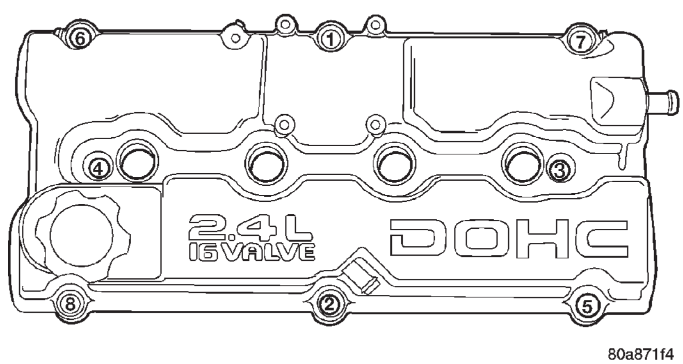


Fig. 32 Cylinder Head Cover Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

(4) Install ignition coil pack and plug wires. Tighten fasteners to 12 N·m (105 in. lbs.).

(5) Install ground strap.

CAMSHAFT

REMOVAL

(1) Remove cylinder head cover using procedure in this section.

(2) Remove timing belt, sprockets and covers. Refer to Timing Belt Service in this section.

(3) Bearing caps are identified for location. Remove the outside bearing caps first (Fig. 33).

(4) Loosen the camshaft bearing cap attaching fasteners in sequence shown (Fig. 34) one camshaft at a time.

CAUTION: Camshafts are not interchangeable. The intake cam number 6 thrust bearing face spacing is wider.

(5) Identify the camshafts before removing from the head. The camshafts are not interchangeable.

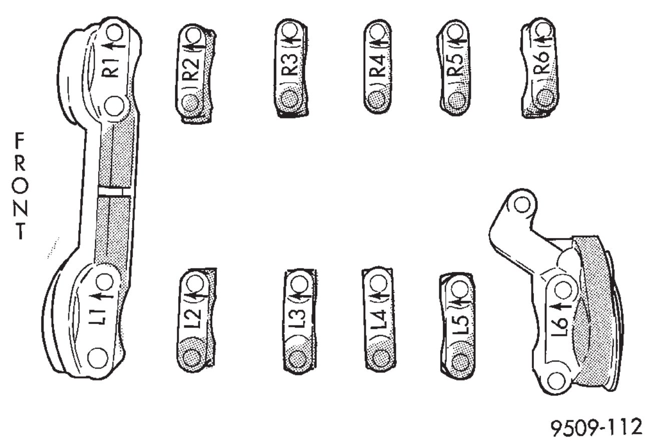


Fig. 33 Camshaft Bearing Cap Identification

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft **WITHOUT** cam follower assemblies. Install rear cam caps and tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 35).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.05–0.15 mm (0.002–0.010 in.).

(5) If end play is excessive check cylinder head and camshaft for wear; replace as necessary.

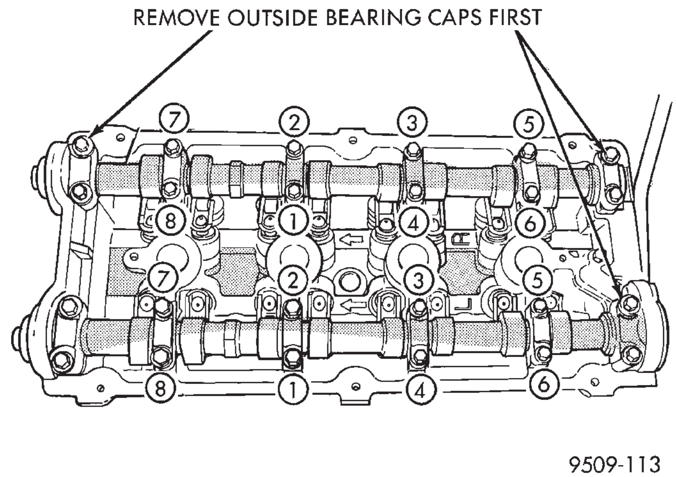


Fig. 34 Camshaft Bearing Cap—Removal

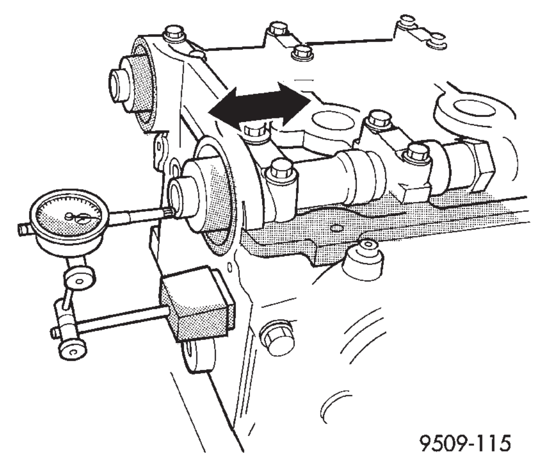


Fig. 35 Camshaft End Play

INSTALLATION

CAUTION: Ensure that NONE of the pistons are at top dead center when installing the camshafts.

(1) Remove camshaft retaining caps and lubricate bearing journals. Install cam followers and camshafts with clean oil. Install right and left camshaft bearing caps #2 thru #5 and right #6. Tighten M6 fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 36).

(2) Apply Mopar® Gasket Maker to No. 1 and No. 6 bearing caps (Fig. 37). Install bearing caps and tighten M8 fasteners to 28 N·m (250 in. lbs.).

(3) Bearing end caps must be installed before seals can be installed.

(4) Install timing belt, sprockets and covers. Refer to timing belt service in this section.

(5) Install cylinder head cover using procedure in this section.

REMOVAL AND INSTALLATION (Continued)

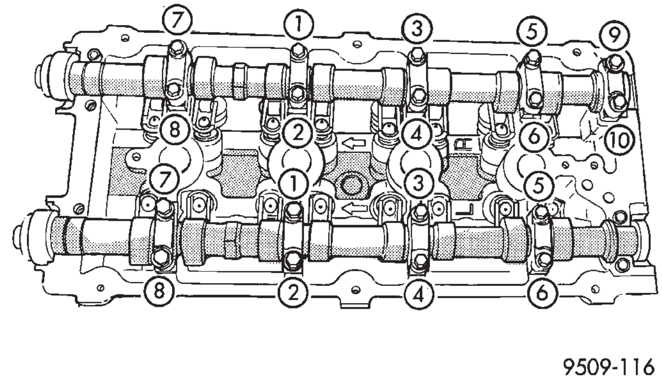


Fig. 36 Camshaft Bearing Cap Tightening Sequence

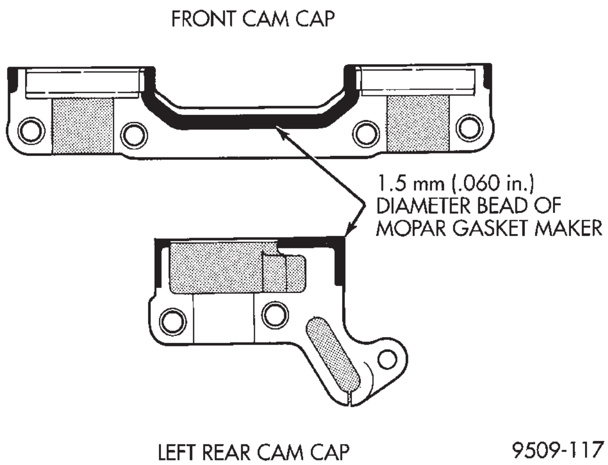


Fig. 37 Camshaft Bearing Cap Sealing

CAMSHAFT FOLLOWER

REMOVAL

(1) Remove cylinder head cover using procedure in this section.

(2) Remove timing belt, sprockets and covers using procedure in this section.

(3) Remove camshaft. Refer to procedure in this section.

CAUTION: If cam follower assemblies are to be reused, always mark position for reassembly in their original positions.

(4) Remove cam follower assemblies from cylinder head.

INSPECTION

Inspect the cam follower assembly for wear or damage (Fig. 38). Replace as necessary.

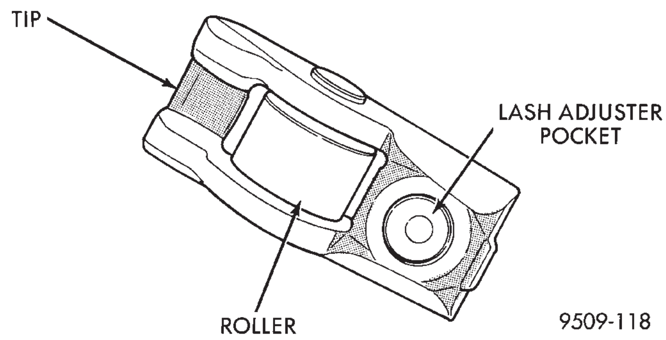


Fig. 38 Cam Follower Assembly

INSTALLATION

(1) Lubricate with clean oil and install cam follower assemblies in their original position on the hydraulic adjuster and valve stem (Fig. 39).

(2) Install the camshafts. Refer to procedure in this section.

(3) Install timing belt, sprockets and covers using procedures in this section.

(4) Install cylinder head cover using procedure in this section.

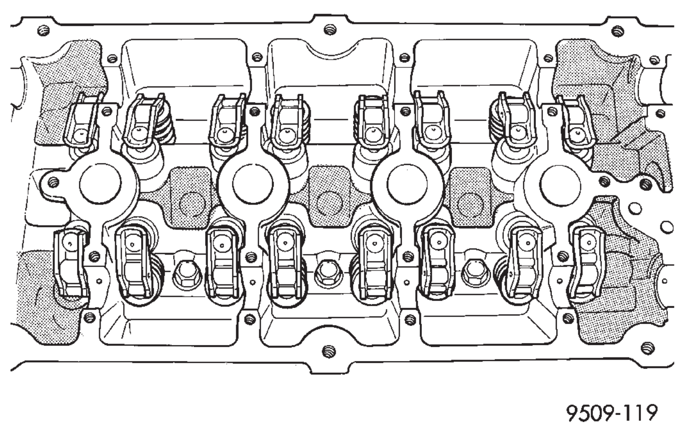


Fig. 39 Cam Follower Assemblies—Installation

BALANCE SHAFTS CARRIER ASSEMBLY

BALANCE SHAFTS

REMOVAL

(1) Drain engine oil and remove oil pan. Refer to procedures in this section.

(2) Remove chain cover, guide and tensioner (Fig. 40). Also see Carrier Assembly Removal for service procedures requiring only temporary relocation of assembly.

(3) Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears (Fig. 40).

REMOVAL AND INSTALLATION (Continued)

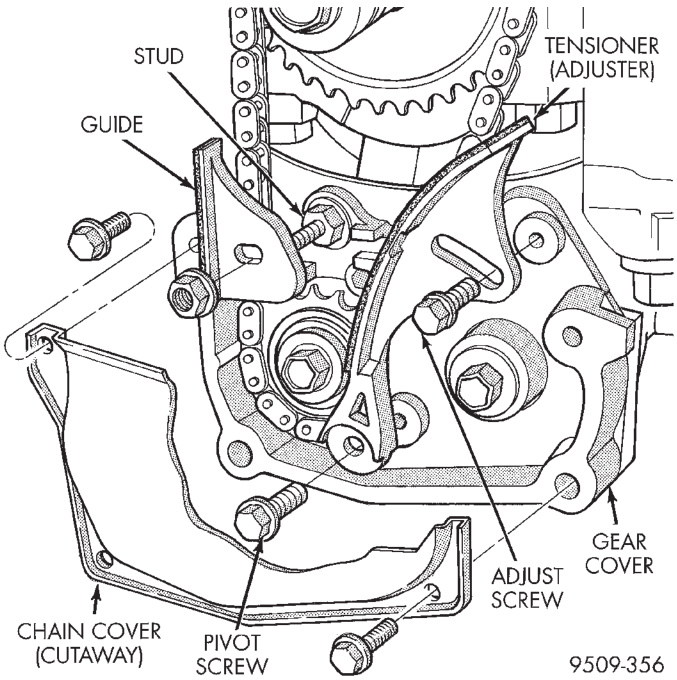


Fig. 40 Chain Cover, Guide and Tensioner

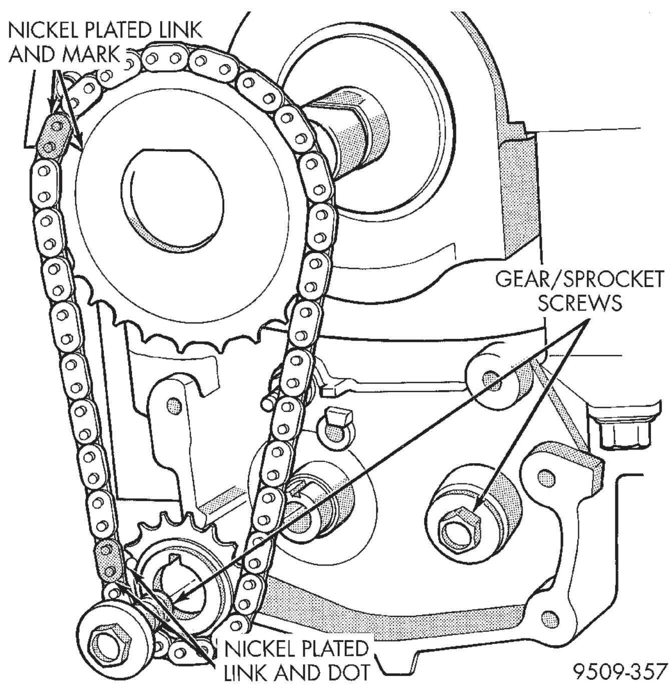


Fig. 41 Drive Chain and Sprockets

(4) Remove balance shaft gear and chain sprocket retaining screws and crankshaft chain sprocket. Remove chain and sprocket assembly (Fig. 41). Using two wide pry bars, work the sprocket back and forth until it is off the shaft.

(5) Remove carrier gear cover and balance shafts (Fig. 42).

(6) Remove four carrier to crankcase attaching bolts to separate carrier from engine bedplate.

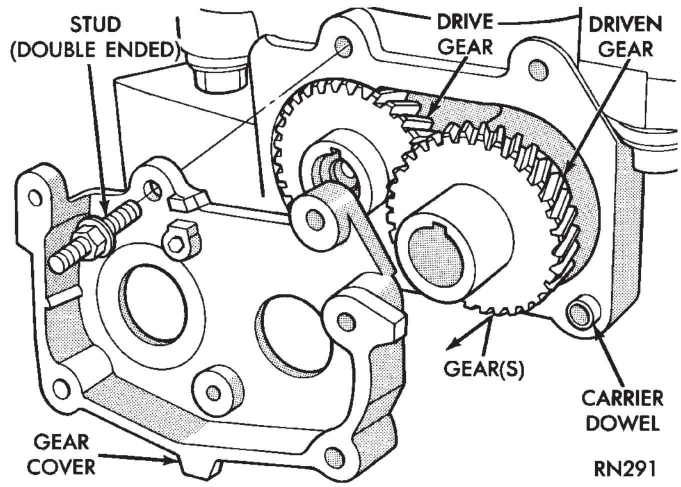


Fig. 42 Gear Cover and Gears

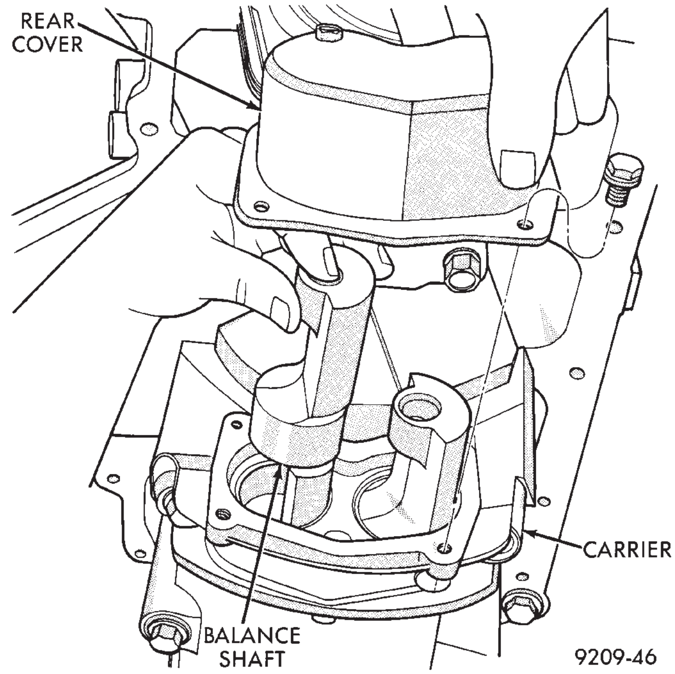


Fig. 43 Balance Shaft(s)—Removal/Installation

BALANCE SHAFT CARRIER

REMOVAL

The following components will remain intact during carrier removal. Gear cover, gears, balance shafts and the rear cover (Fig. 43).

(1) Remove chain cover and driven balance shaft chain sprocket screw.

(2) Loosen tensioner pivot and adjusting screws, move driven balance shaft inboard through driven chain sprocket. Sprocket will hang in lower chain loop.

(3) Remove carrier to crankcase attaching bolts to remove carrier.

REMOVAL AND INSTALLATION (Continued)

BALANCE SHAFT INSTALLATION

Balance shaft and carrier assembly installation is the reverse of the removal procedure. **During installation crankshaft to balance shaft timing must be established. Refer to Timing procedure in this section.**

BALANCE SHAFT TIMING

(1) With balance shafts installed in carrier (Fig. 43) position carrier on crankcase and install four attaching bolts and tighten to 54 N·m (40 ft. lbs.).

(2) Turn balance shafts until both shaft key ways are up Parallel to vertical centerline of engine. Install short hub drive gear on sprocket driven shaft and long hub gear on gear driven shaft. After installation gear and balance shaft keyways must be up with gear timing marks meshed as shown in (Fig. 44).

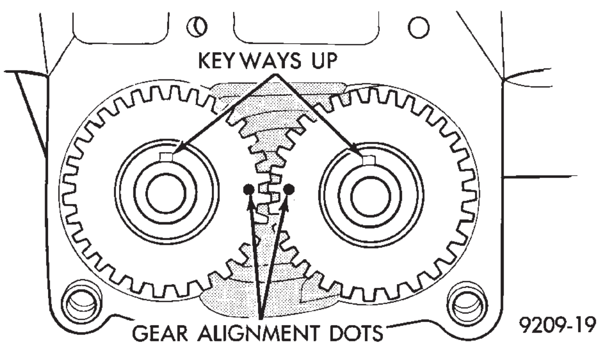


Fig. 44 Gear Timing

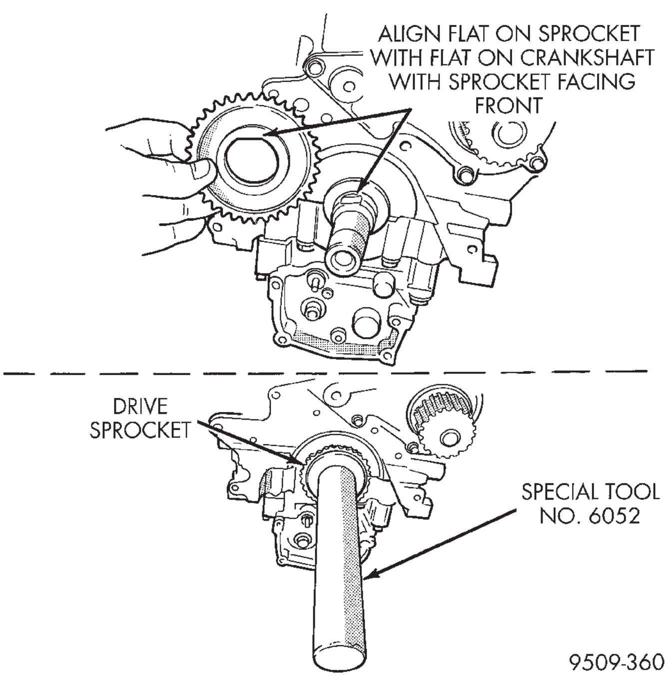


Fig. 45 Crankshaft Sprocket—Installation

(3) Install gear cover and tighten double ended stud/washer fastener to 12 N·m (105 in. lbs.).

(4) Install crankshaft sprocket using Special Tool 6052 (Fig. 45).

(5) Turn crankshaft until number one cylinder is at Top Dead Center (TDC). The timing marks on the chain sprocket should line up with the parting line on the left side of number one main bearing cap. (Fig. 46).

(6) Place chain over crankshaft sprocket so that the nickel plated link of the chain is over the number 1 cylinder timing mark on the crankshaft sprocket (Fig. 46).

(7) Place balance shaft sprocket into the timing chain (Fig. 46) so that the timing mark on the sprocket (yellow dot) mates with the (lower) nickel plated link on the chain.

(8) With balance shaft keyways pointing up (12 o'clock) slide the balance shaft sprocket onto the nose of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance.

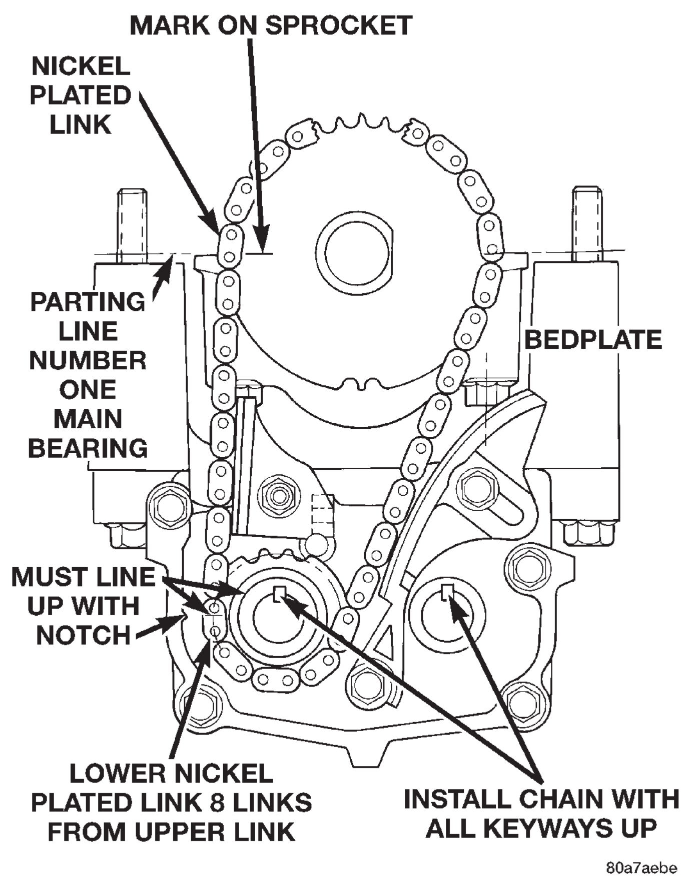


Fig. 46 Balance Shaft Timing

NOTE: THE TIMING MARK ON THE SPROCKET, THE (LOWER) NICKEL PLATED LINK, AND THE ARROW ON THE SIDE OF THE GEAR COVER SHOULD LINE UP WHEN THE BALANCE SHAFTS ARE TIMED CORRECTLY.

REMOVAL AND INSTALLATION (Continued)

(9) If the sprockets are timed correctly install the balance shaft bolts and tighten to 28 N·m (250 in. lbs.). A wood block placed between crankcase and crankshaft counterbalance will prevent crankshaft and gear rotation.

CHAIN TENSIONING

(1) Install chain tensioner loosely assembled.

(2) Position guide on double ended stud making sure tab on the guide fits into slot on the gear cover. Install and tighten nut/washer assembly to 12 N·m (105 in. lbs.).

(3) Place a shim 1 mm (0.039 in.) thick x 70 mm (2.75 in.) long or between tensioner and chain. Push tensioner and shim up against the chain. **Apply firm pressure (5.5 to 6.6 lbs.) directly behind the adjustment slot to take up all slack.** Chain must have shoe radius contact as shown in (Fig. 47).

(4) With the load applied, tighten top tensioner bolt first, then bottom pivot bolt. Tighten bolts to 12 N·m (105 in. lbs.). Remove shim.

(5) Install carrier covers and tighten screws to 12 N·m (105 in. lbs.).

(6) Install oil pan and fill engine crankcase with proper oil to correct level.

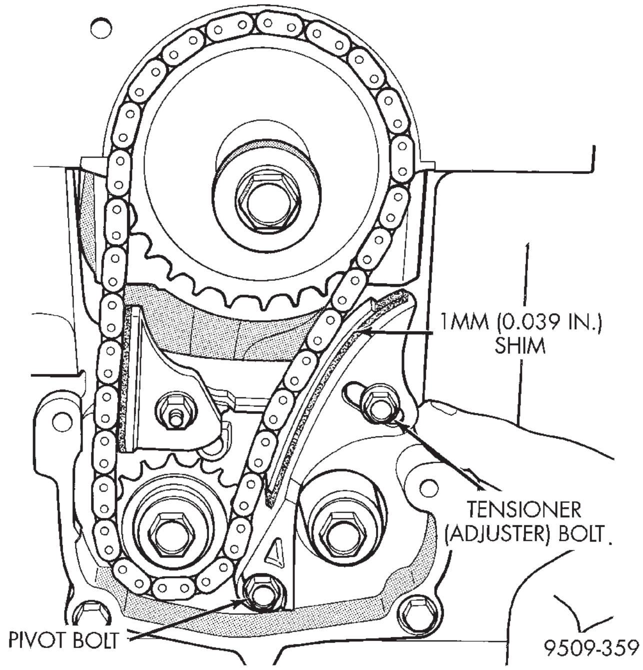


Fig. 47 Chain Tension Adjustment

HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove cylinder head cover. Refer to procedure in this section.

(2) Remove camshafts and cam follower assemblies. Refer to camshaft removal procedure in this section to gain access to cam followers and lash adjusters.

(3) Mark hydraulic lash adjusters for reassembly in their original position. Lash adjusters are serviced as an assembly.

INSTALLATION

(1) Install hydraulic lash adjuster assembly making sure adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed.

(2) Install following components following procedures in this section:

- cam follower assemblies
- camshafts
- cylinder head cover.

VALVE SPRINGS AND VALVE SEALS IN VEHICLE

REMOVAL

(1) Remove camshafts as previously outlined in this section.

(2) Rotate crankshaft until piston is at TDC on compression.

(3) With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.

(4) Using Special Tool MD-998772-A with adapter 6779 (Fig. 48) compress valve springs and remove valve locks.

(5) Remove valve spring.

(6) Remove valve stem seal by a using valve stem seal tool.

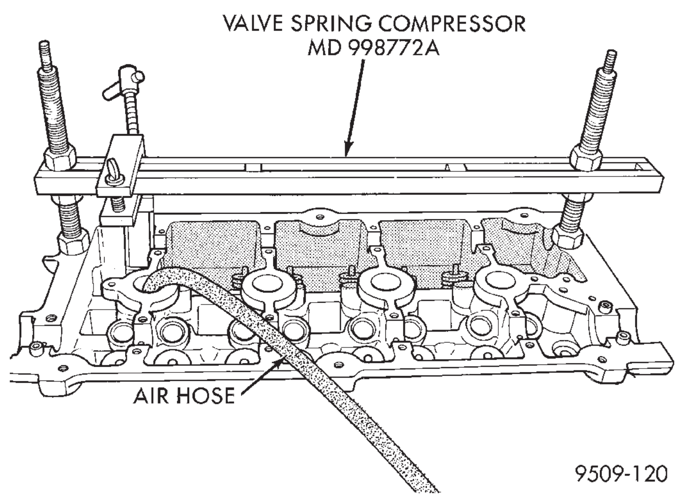


Fig. 48 Valve Spring—Removal/Installation

INSTALLATION

(1) Install valve seal/valve spring seat assembly (Fig. 49). Push the assembly down to seat it onto the valve guide.

REMOVAL AND INSTALLATION (Continued)

(2) Install valve spring and retainer, use Special Tool MD-998772-A with adapter 6779 to compress valve springs only enough to install locks (Fig. 48). Correct alignment of tool is necessary to avoid nicking valve stems.

(3) Remove air hose and install spark plugs.

(4) Install camshafts as previously outlined in this section.

(5) Install cylinder head cover as previously outlined in this section.

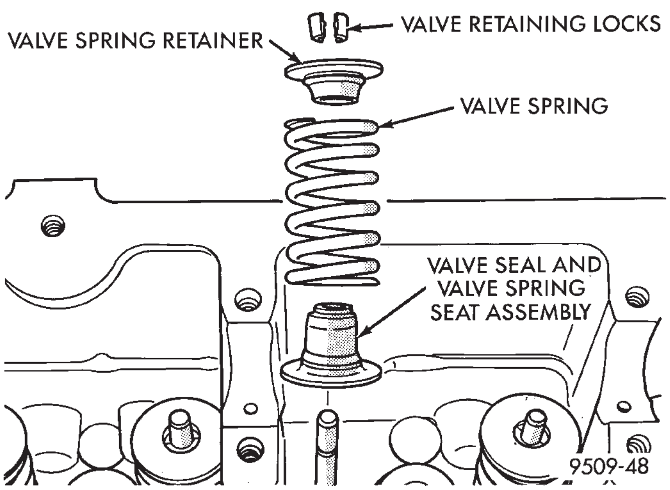


Fig. 49 Valve Stem Seal/Valve Spring Seat

CYLINDER HEAD

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.** Refer to Group 14, Fuel System for procedure.

(2) Disconnect negative cable from auxiliary jumper terminal.

(3) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(4) Remove air inlet tube and housing.

(5) Disconnect all vacuum lines, electrical wiring, ground straps, and fuel line.

(6) Remove throttle linkage. Refer to Group 14, Fuel System for procedures

(7) Remove throttle body support and intake manifold support brackets.

(8) Remove EGR tube.

(9) Remove heater tube support bracket from cylinder head.

(10) Disconnect upper radiator and heater hoses from intake manifold water outlet connections.

(11) Remove fastener attaching dipstick tube to cylinder head.

(12) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(13) Remove power brake vacuum hose from intake manifold.

(14) Raise vehicle and remove exhaust pipe from manifold.

(15) Remove power steering pump reservoir and line support bracket from cylinder head and set aside.

(16) Disconnect coil pack wiring connector and remove coil pack and plug wires from engine.

(17) Remove cam sensor and fuel injectors wiring connectors.

(18) Remove timing belt and camshaft sprockets. Refer to procedures in this section.

(19) Remove timing belt idler pulley and rear timing belt cover.

(20) Remove cylinder head cover using procedure in this section.

(21) Remove camshafts and cam followers. Refer to procedures in this section.

(22) Remove cylinder head bolts and remove cylinder head from engine block.

(23) Inspect and clean cylinder head. Refer to Cleaning and Inspection in this section for procedures.

INSTALLATION

NOTE: The Cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts should be replaced (Fig. 50).

Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale the bolt should be replaced.

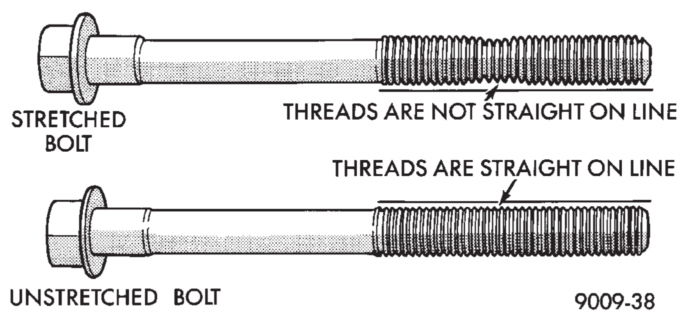


Fig. 50 Checking Bolts for Stretching (Necking)

(1) Before installing the bolts, the threads should be coated with engine oil.

(2) Tighten the cylinder head bolts in the sequence shown in (Fig. 51). Using the 4 step torque turn method, tighten according to the following values:

- First All to 34 N·m (25 ft. lbs.)
- Second All to 68 N·m (50 ft. lbs.)
- Third All to 68 N·m (50 ft. lbs.)

CAUTION: Do not use a torque wrench for the following step.

- Fourth Turn an additional 1/4 Turn,

REMOVAL AND INSTALLATION (Continued)

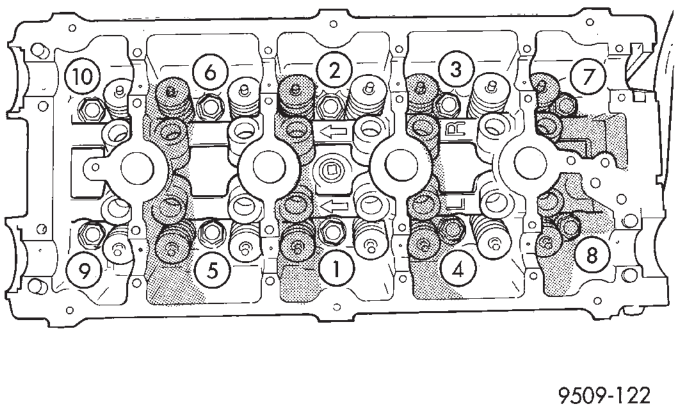


Fig. 51 Cylinder Head Tightening Sequence

(3) Install camshafts and cam followers. Refer to procedures in this section.

(4) Install cylinder head cover using procedure in this section.

(5) Install rear timing belt cover and timing belt idler pulley.

(6) Install timing belt and camshaft sprockets. Refer to procedures in this section.

(7) Install cam sensor and fuel injectors wiring connectors.

(8) Install coil pack and plug wires onto the engine. Connect coil pack wiring connector.

(9) Install power steering pump reservoir and line support bracket to cylinder head.

(10) Raise vehicle and install the exhaust pipe to the manifold.

(11) Install power brake vacuum hose to the intake manifold.

(12) Install accessory drive belts. Refer to Group 7, Cooling System for procedure.

(13) Install throttle body support and intake manifold support brackets.

(14) Install heater tube support bracket to cylinder head.

(15) Connect upper radiator and heater hoses to intake manifold water outlet connections.

(16) Install EGR tube and tighten fasteners to 11 N·m (95 in. lbs.).

(17) Install fastener attaching dipstick tube to cylinder head.

(18) Install throttle linkage. Refer to Group 14, Fuel System for procedures.

(19) Install air inlet tube and housing.

(20) Connect all vacuum lines, electrical wiring, ground straps and fuel line.

(21) Fill cooling system. Refer to Group 7, Cooling System for procedure.

(22) Connect negative cable to auxiliary jumper terminal.

VALVES AND VALVE SPRINGS

REMOVAL

(1) With cylinder head removed, compress valve springs using a universal valve spring compressor.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

(3) Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

(4) Inspect and clean the valves. Refer to Cleaning and Inspection outlined in this section for procedure.

INSTALLATION

(1) Coat valve stems with clean engine oil and insert in cylinder head.

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 52). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: When oversize valves are used, the corresponding oversize valve seal must also be used. Excessive guide wear may result if oversize seals are not used with oversize valves.

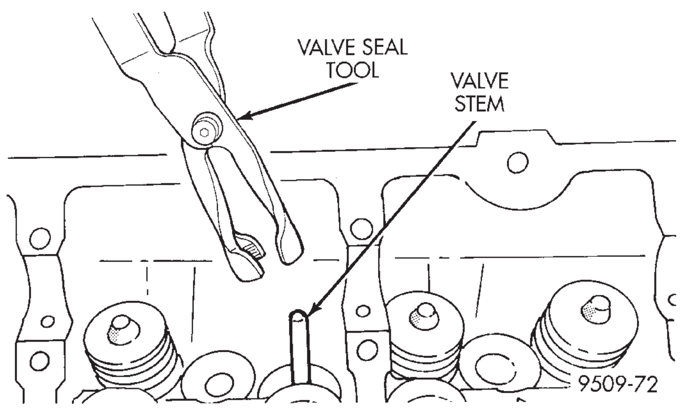


Fig. 52 Valve Stem Oil Seal Tool

(3) Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Ensure both locks are in the correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 53). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 38.75 mm (1.525 in.), install a .762 mm (0.030

REMOVAL AND INSTALLATION (Continued)

in.) spacer under the valve spring seat to bring spring height back within specification.

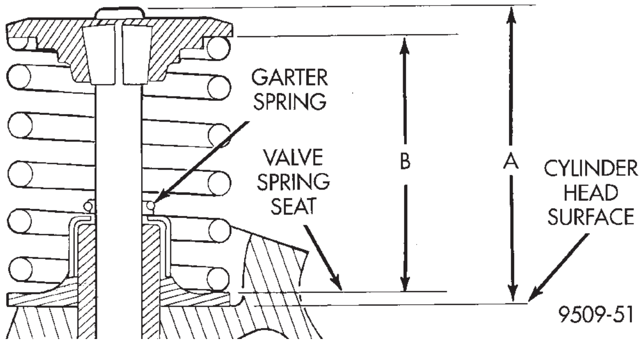


Fig. 53 Checking Spring Installed Height and Valve Tip Height Dimensions

CRANKSHAFT DAMPER

REMOVAL

Remove crankshaft damper bolt. Remove damper by using Special Tool 1026 and Insert 6827–A (Fig. 54).

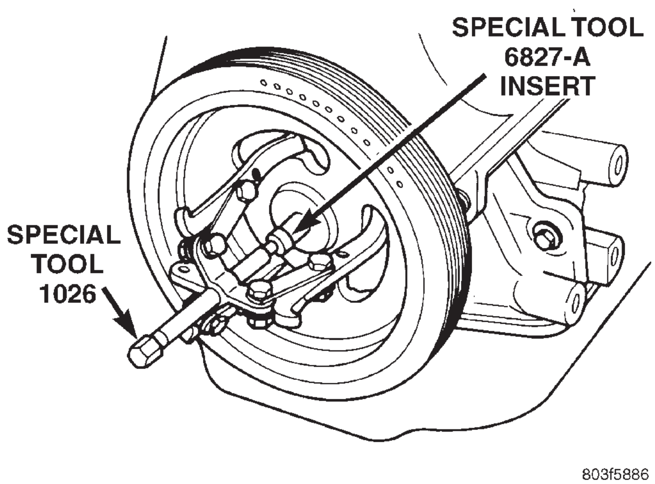


Fig. 54 Crankshaft Damper—Removal

INSTALLATION

Install crankshaft damper using M12 1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft vibration damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 55).

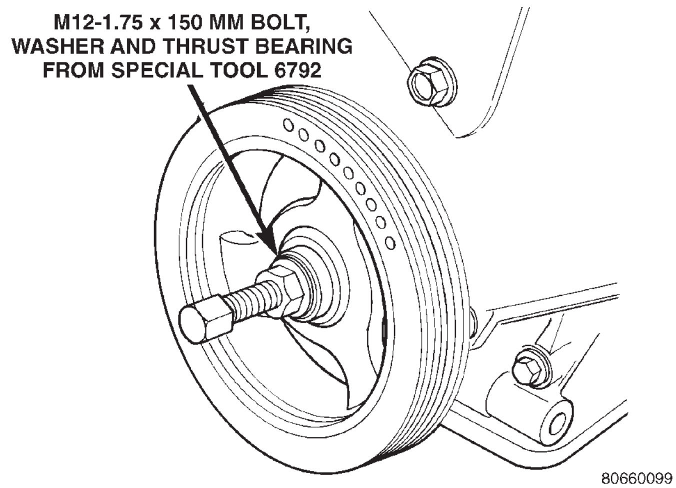


Fig. 55 Crankshaft Damper—Installation

TIMING BELT COVER

FRONT COVER

REMOVAL

(1) Remove crankshaft damper. Refer to procedure in this section.

(2) Remove generator belt idler pulley.

(3) Remove front timing belt cover fasteners (Fig. 56) and remove covers.

(4) Remove engine mount bracket (Fig. 56).

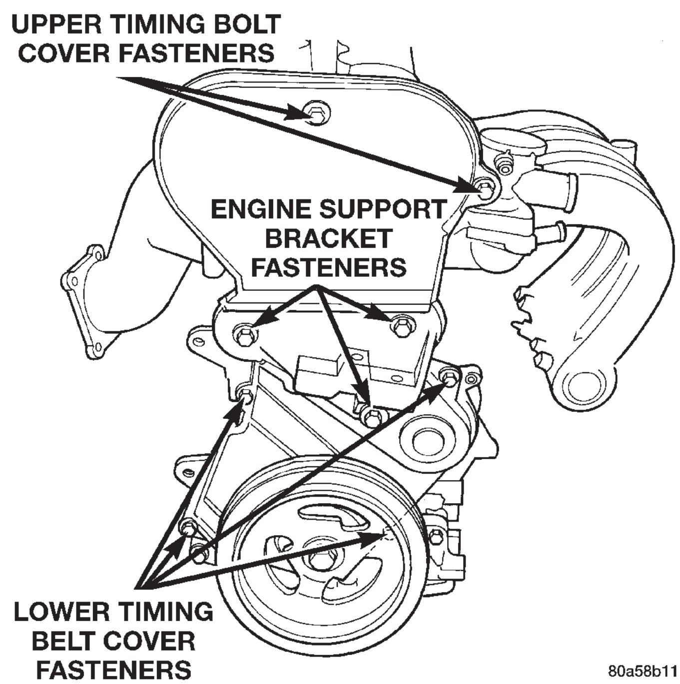


Fig. 56 Front Timing Belt Covers

INSTALLATION

(1) Install the engine mount bracket and front timing belt covers (Fig. 56).

(2) Install generator belt idler pulley and tighten bolt to 54 N·m (40 ft. lbs.).

(3) Install crankshaft damper. Refer to crankshaft damper installation for procedure.

REAR COVER

REMOVAL

(1) Remove front timing belt covers.

(2) Remove Timing Belt. Refer to procedure in this section.

REMOVAL AND INSTALLATION (Continued)

(3) Remove timing belt idler pulley.

(4) Remove both camshaft sprockets. Refer to procedure in the section.

(5) Remove rear timing belt fasteners and remove cover from engine (Fig. 57).

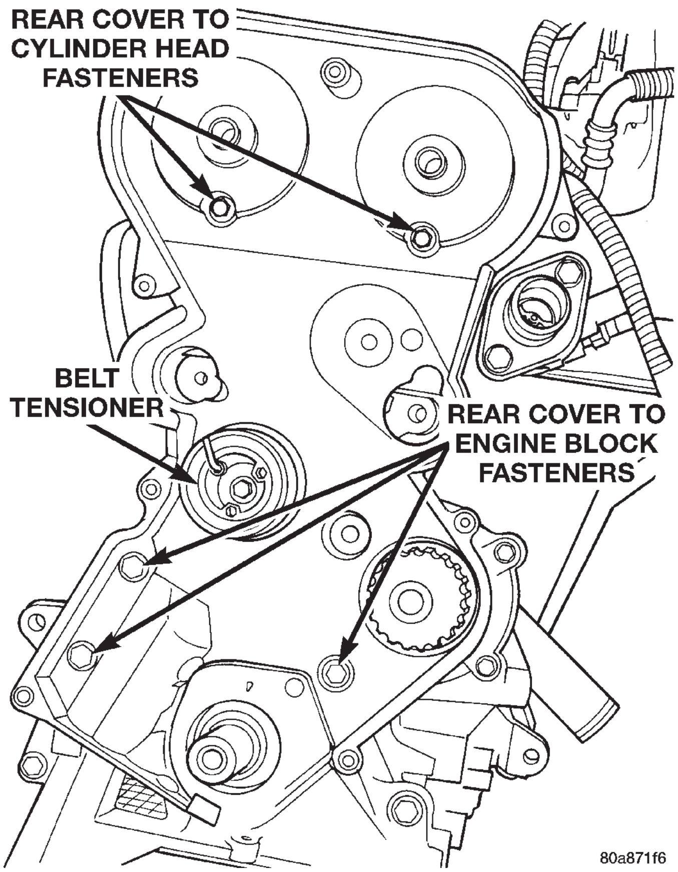


Fig. 57 Rear Timing Belt Cover Fasteners

INSTALLATION

(1) Install rear timing belt cover and fasteners (Fig. 57).

(2) Install timing belt idler.

(3) Install camshaft sprocket and timing belt. Refer to procedures in this section.

(4) Install engine mount bracket.

(5) Install front covers. Refer to Front Cover installation procedure in this section.

TIMING BELT

REMOVAL

(1) Raise vehicle on hoist. Remove right front wheel.

(2) Remove right inner splash shield.

(3) Remove accessory drive belts. Refer to Group 7, Cooling System.

(4) Remove crankshaft damper bolt, and remove damper. Refer to Removal and Installation procedure in this section.

(5) Remove generator belt idler pulley.

(6) Remove lower timing belt cover fasteners and remove cover (Fig. 58).

(7) Lower vehicle and remove upper timing belt cover fasteners and remove cover.

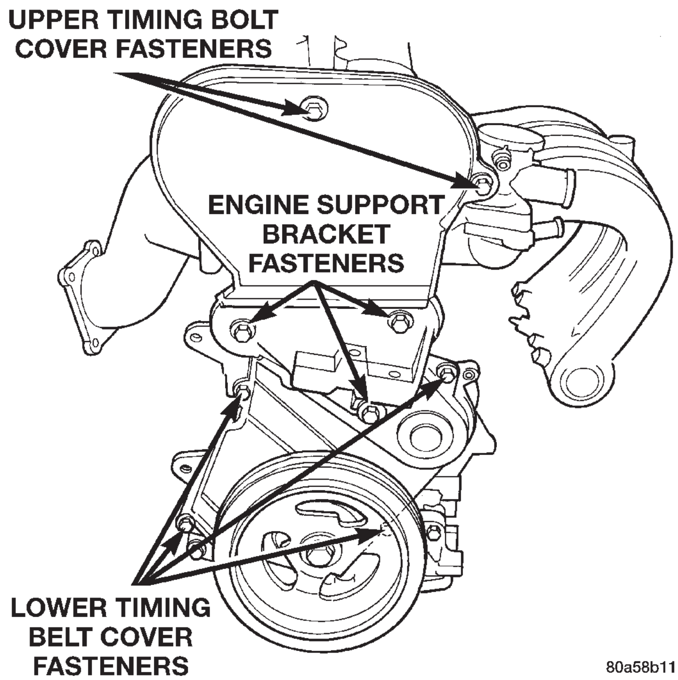


Fig. 58 Timing Belt Covers

(8) Remove right engine mount and support bracket. Refer to Removal and Installation procedure in this section.

CAUTION: When aligning crankshaft and camshaft timing marks always rotate engine from crankshaft. Camshaft should not be rotated after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

(9) Before the removal of the timing belt, rotate crankshaft until the TDC mark on oil pump housing aligns with the TDC mark on crankshaft sprocket (trailing edge of sprocket tooth) (Fig. 59).

NOTE: The crankshaft sprocket TDC mark is located on the trailing edge of the sprocket tooth. Failure to align trailing edge of sprocket tooth to TDC mark on oil pump housing will cause the camshaft timing marks to be misaligned.

(10) Install 6 mm Allen wrench into belt tensioner. Before rotating the tensioner, insert the long end of a 1/8" or 3 mm Allen wrench into the pin hole on the front of the tensioner (Fig. 60). While rotating the tensioner counterclockwise, push in lightly on the 1/8" or 3 mm Allen wrench, until it slides into the locking hole.

REMOVAL AND INSTALLATION (Continued)

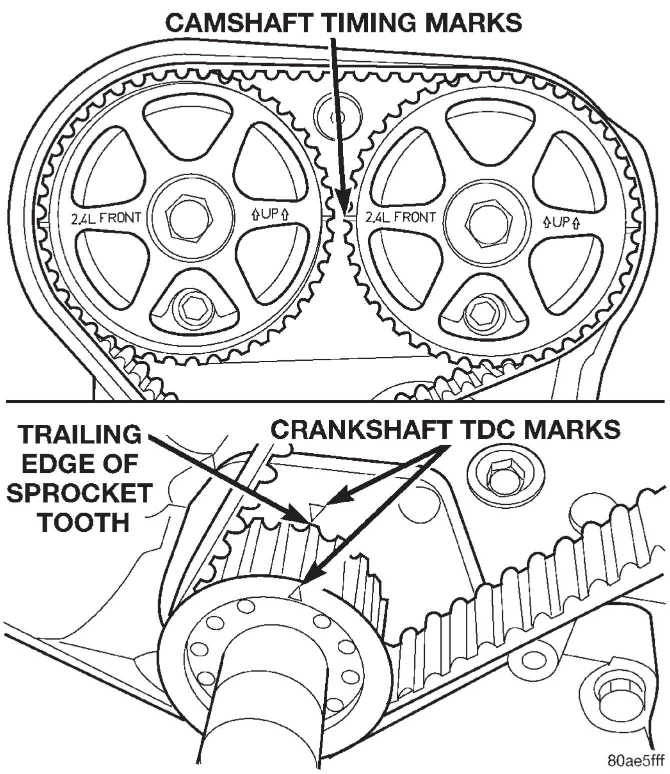


Fig. 59 Crankshaft and Camshaft Timing

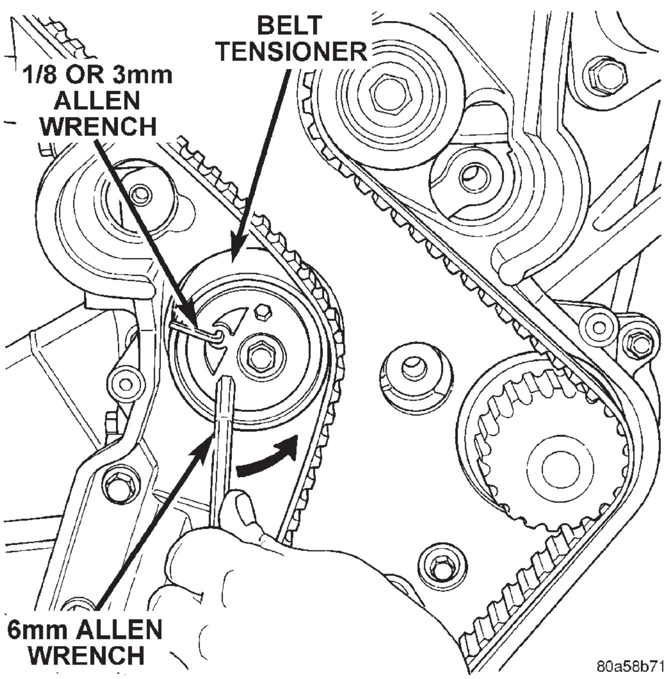


Fig. 60 Locking Timing Belt Tensioner

(11) Remove timing belt.

CAUTION: If timing belt was damaged due to incorrect tracking (alignment), the belt tensioner assembly must be replaced. Refer to Timing Belt Tensioner Assembly Removal and Installation procedure in this section.

INSTALLATION

(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing.

(2) Set camshafts timing marks so that the exhaust camshaft sprocket is a 1/2 notch below the intake camshaft sprocket (Fig. 61).

CAUTION: Ensure that the arrows on both camshaft sprockets are facing up.

(3) Install timing belt. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner (Fig. 62).

(4) Move the exhaust camshaft sprocket counterclockwise (Fig. 62) to align marks and take up belt slack.

NOTE: A new tensioner is held in the wound position by a pull pin.

(5) Remove the pull pin or Allen wrench from the belt tensioner.

(6) Once the timing belt has been installed and tensioner released, rotate the crankshaft two (2) complete revolutions. Verify that the TDC marks on crankshaft and timing marks on the camshafts are aligned as shown in (Fig. 63).

(7) Install right engine mount and support bracket. Refer to Removal and Installation procedure in this section.

(8) Install upper timing belt cover bolts 4.5 N·m (40 in. lbs.).

(9) Install the lower timing belt cover bolts 4.5 N·m (40 in. lbs.).

(10) Install generator belt idler pulley and tighten bolt to 54 N·m (40 ft. lbs.).

(11) Install crankshaft damper. Refer to procedure in this section.

(12) Install accessory drive belts. Refer to Group 7, Cooling System.

(13) Install right inner splash shield.

(14) Install right front wheel.

TIMING BELT TENSIONER ASSEMBLY

REMOVAL

(1) Remove timing belt. Refer to Removal and Installation procedure in this section.

(2) Remove timing belt idler pulley.

(3) Hold camshaft sprocket with Special Tool 6847 while removing bolt (Fig. 64). Remove both cam sprockets.

(4) Remove rear timing belt cover fasteners and remove cover from engine (Fig. 65).

REMOVAL AND INSTALLATION (Continued)

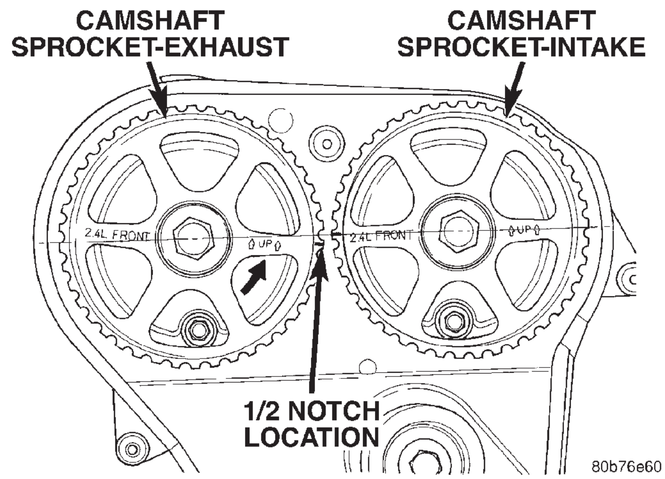


Fig. 61 Camshaft Sprocket Alignment For Timing Belt Installation

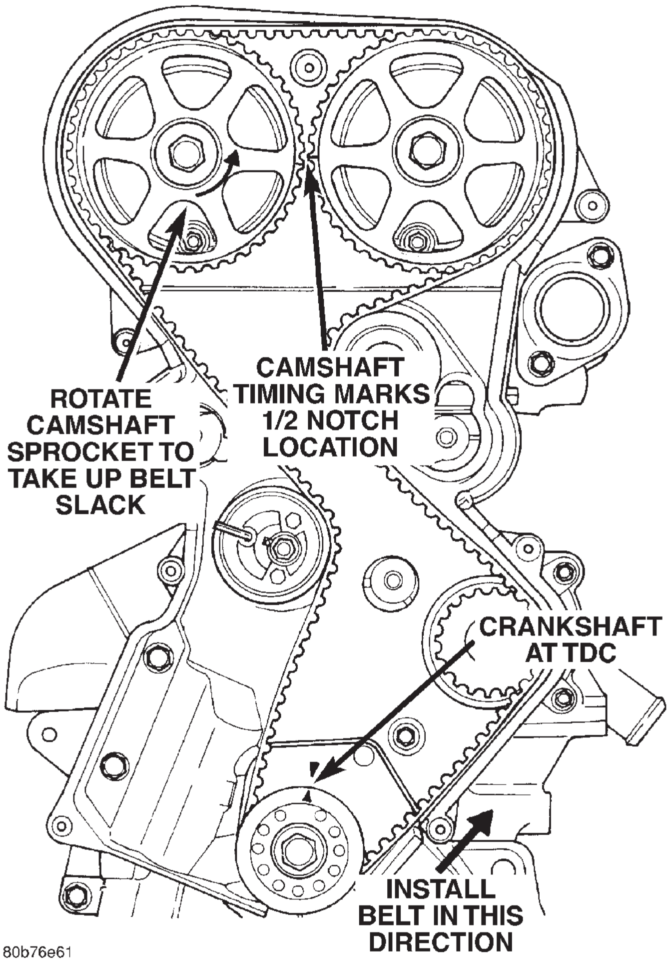


Fig. 62 Timing Belt—Installation

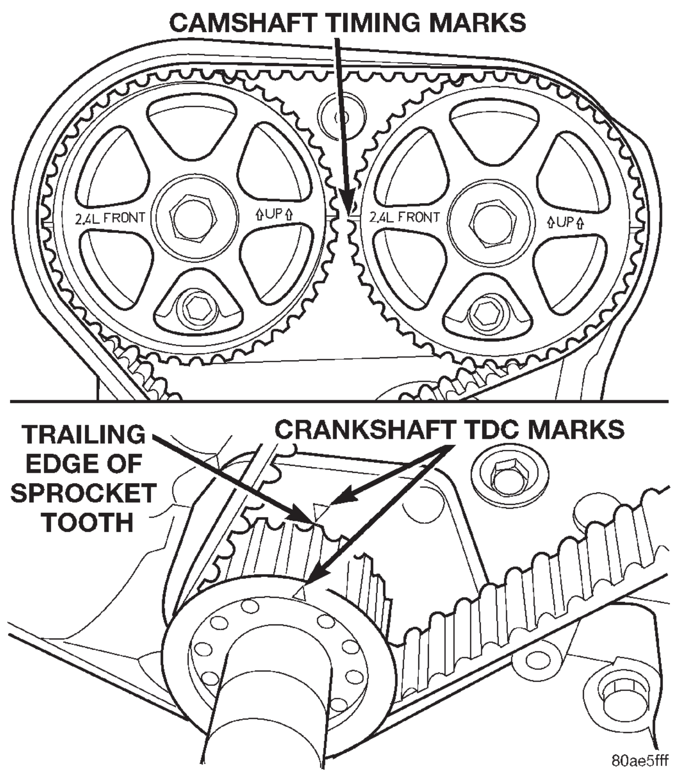


Fig. 63 Crankshaft and Camshaft Timing

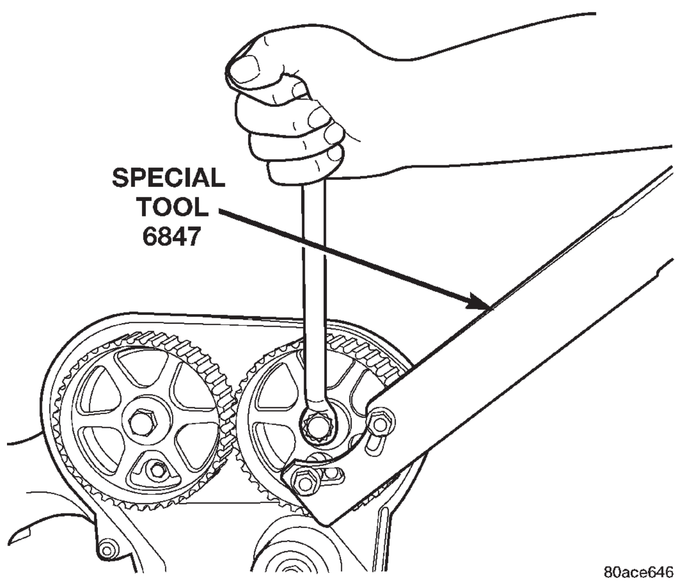


Fig. 64 Camshaft Sprockets—Removal/Installation

REMOVAL AND INSTALLATION (Continued)

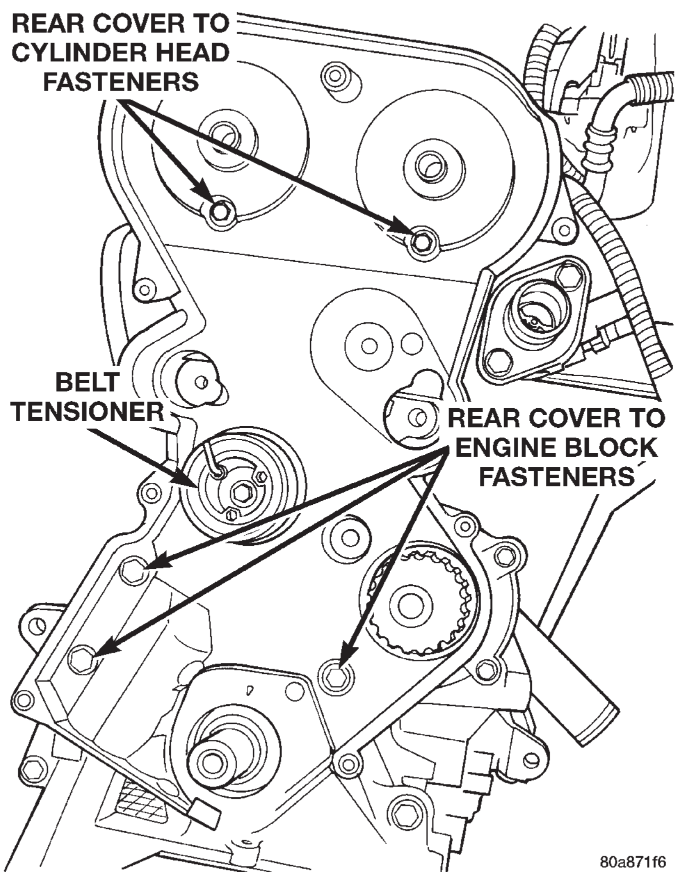


Fig. 65 Rear Timing Belt Cover Fasteners

(5) Remove lower bolt attaching timing belt tensioner assembly to engine and remove tensioner **as an assembly** (Fig. 66).

INSTALLATION

(1) Align timing belt tensioner assembly to engine and install lower mounting bolt **but do not tighten** (Fig. 66). To properly align tensioner assembly—install one of the engine bracket mounting bolts (M10) 5 to 7 turns into the tensioner's upper mounting location (Fig. 66).

(2) Torque the tensioner's lower mounting bolt to 61 N·m (45 ft. lbs.). Remove the upper bolt used for tensioner alignment.

(3) Install rear timing belt cover and fasteners.

(4) Install timing belt idler pulley and torque mounting bolt to 61 N·m (45 ft. lbs.).

(5) Install camshaft sprockets. Use Special Tool 6847 to hold sprockets (Fig. 64), torque bolts to 101 N·m (75 ft. lbs.).

(6) Install timing belt. Refer to procedure in this section.

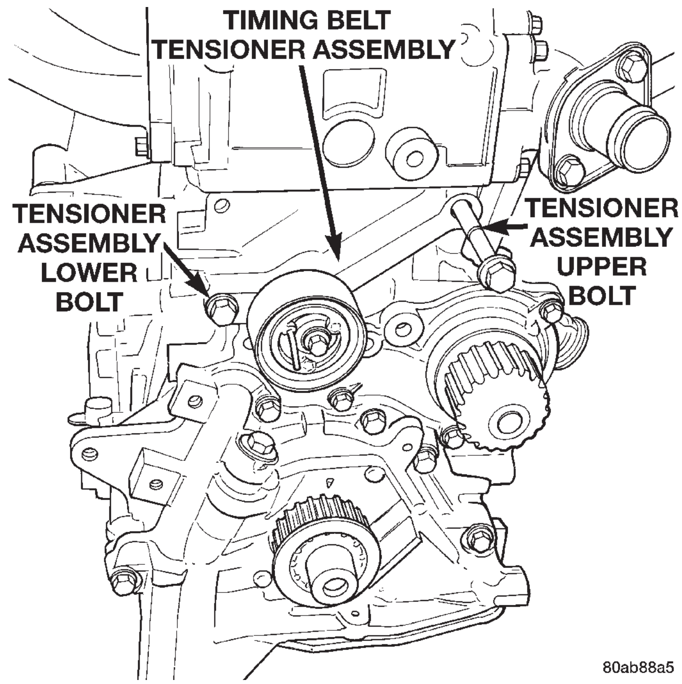


Fig. 66 Timing Belt Tensioner Assembly—Removal/Installation

OIL PAN

REMOVAL

(1) Raise vehicle on hoist and drain engine oil.

(2) Remove right inner splash shield.

(3) Remove bolts attaching dust shield to transaxle housing. Remove dust shield.

(4) Remove oil pan.

(5) Clean oil pan and all gasket surfaces.

INSTALLATION

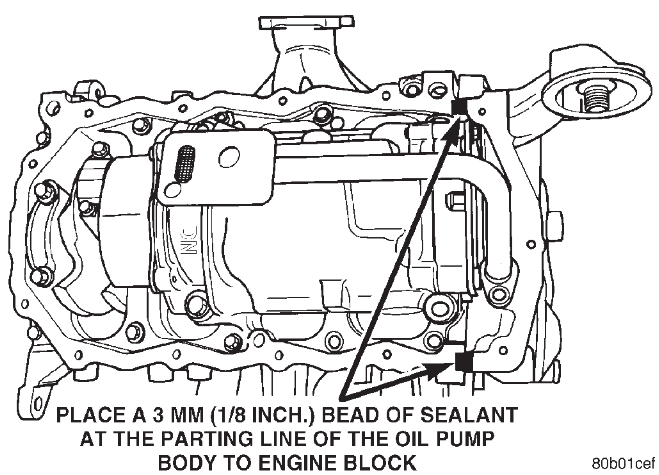


Fig. 67 Oil Pan Sealing

(1) Apply Mopar® Silicone Rubber Adhesive Sealant or equivalent at the oil pump to engine block parting line (Fig. 67).

REMOVAL AND INSTALLATION (Continued)

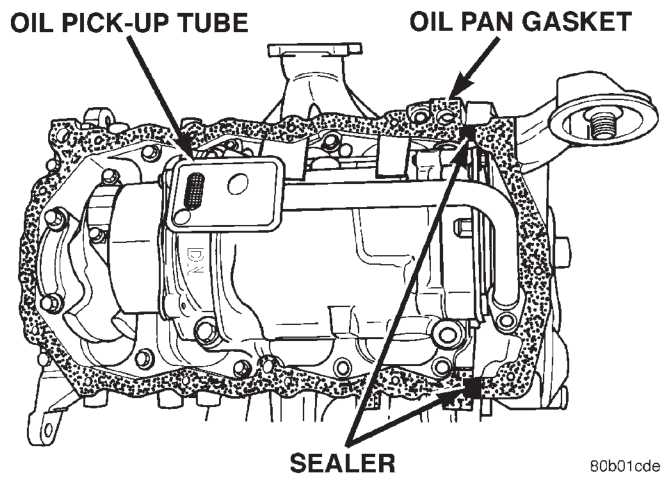


Fig. 68 Oil Pan Gasket Installation

(2) Install the oil pan gasket to the block (Fig. 68).

(3) Install pan and tighten the screws to 12 N·m (105 in. lbs.).

(4) Install dust shield.

(5) Lower vehicle and fill engine crankcase with proper oil to correct level.

CAMSHAFT OIL SEAL—FRONT

REMOVAL

(1) Remove front timing belt cover and timing belt. Refer to procedures in this section.

(2) Hold camshaft sprocket with Special Tool 6847 while removing center bolt (Fig. 69).

(3) Remove rear timing belt cover. Refer to procedure in this section.

(4) Remove camshaft seal using Special Tool C-4679-A (Fig. 70).

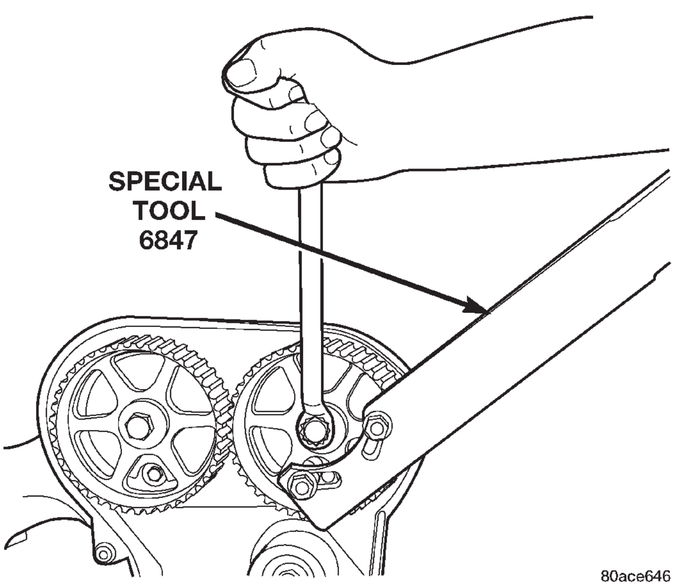


Fig. 69 Camshaft Sprocket—Removal/Installation

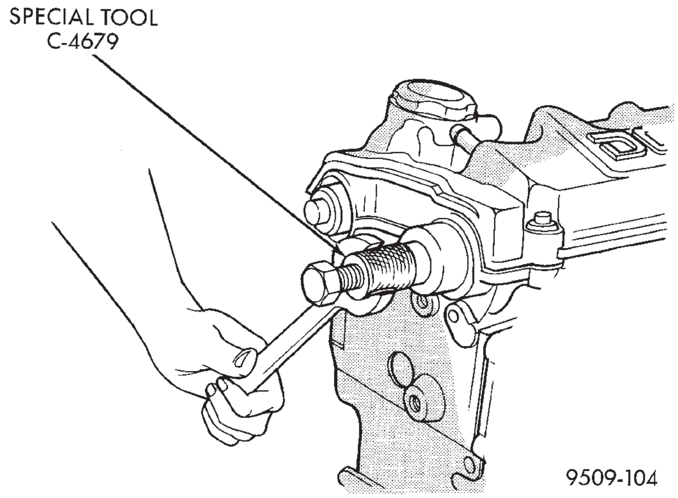


Fig. 70 Camshaft Oil Seal—Removal With C-4679–A

CAUTION: Do not nick shaft seal surface or seal bore

INSTALLATION

(1) Shaft seal surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

(2) Install camshaft seal into cylinder head using Special Tool MD-998306 until flush with head (Fig. 71).

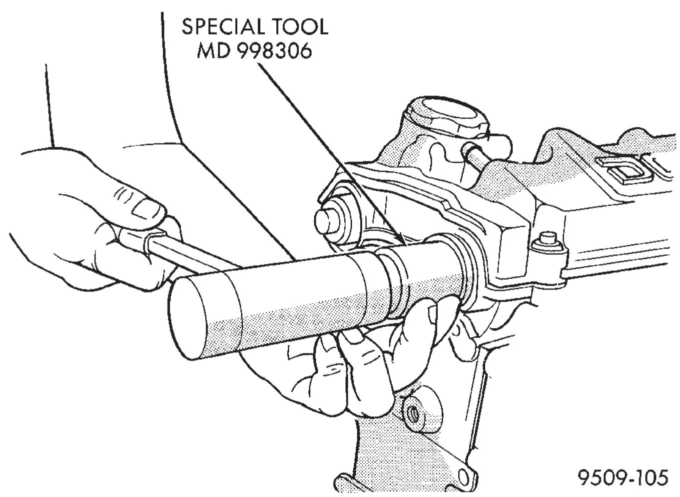


Fig. 71 Camshaft Seal—Installation

(3) Install rear timing belt cover. Refer to procedure in this section.

(4) Install camshaft sprocket. While holding sprocket with Special Tool 6847, tighten center bolt to 101 N·m (75 ft. lbs.) (Fig. 69).

(5) Install timing belt and front covers. Refer to procedures in this section.

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Using Special Tool 1026 and Insert 6827-A, remove crankshaft damper (Fig. 72).

(2) Remove timing belt. Refer to procedures in this section.

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 73).

CAUTION: Do not nick shaft seal surface or seal bore.

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 74). Be careful not to damage the seal surface of cover.

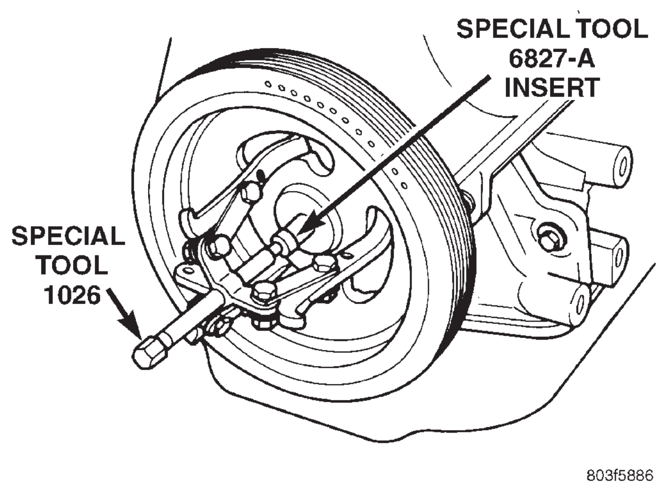


Fig. 72 Crankshaft Damper—Removal

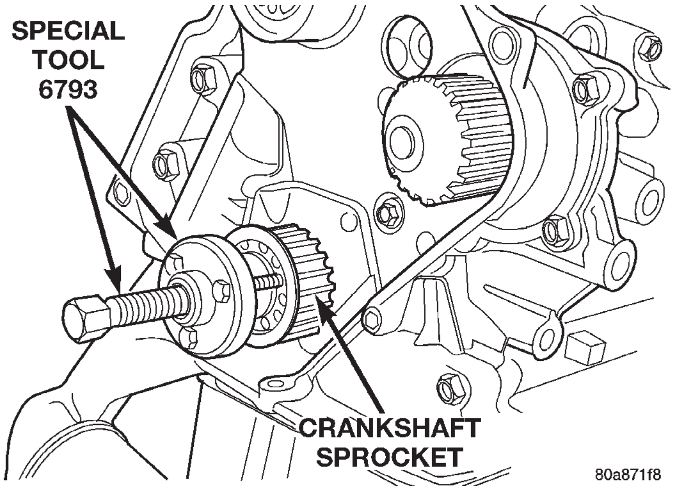


Fig. 73 Crankshaft Sprocket—Removal

INSTALLATION

(1) Install new seal by using Tool 6780 (Fig. 75).

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

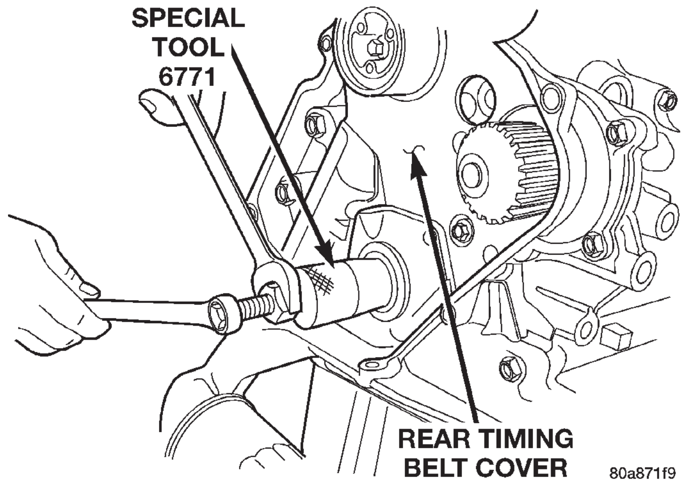


Fig. 74 Front Crankshaft Oil Seal—Removal

(3) Install crankshaft sprocket using Special Tool 6792 (Fig. 76).

(4) Install timing belt and timing belt covers. Refer to procedures in this section.

(5) Install crankshaft damper (Fig. 77). Use thrust bearing/washer and 12M 1.75 x 150 mm bolt from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.).

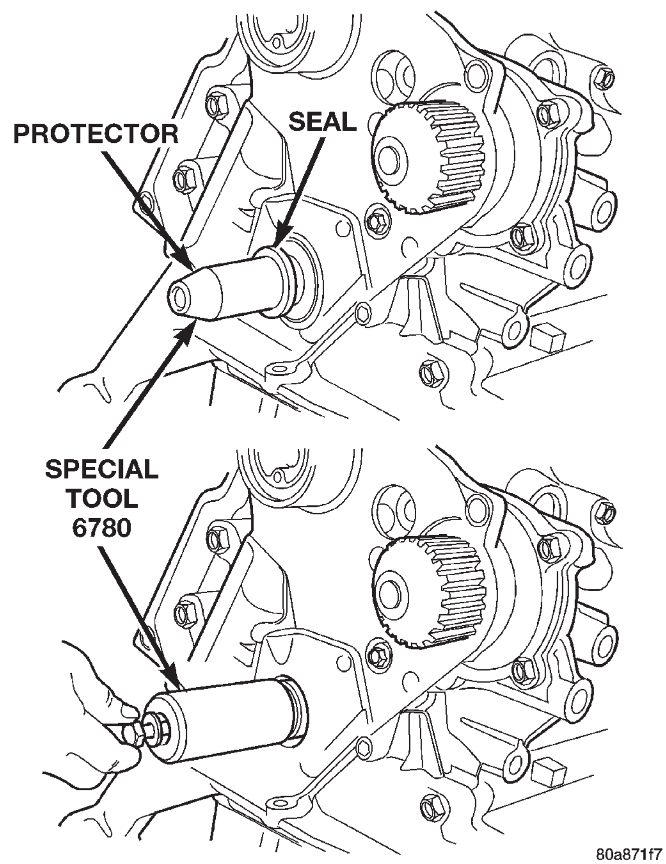


Fig. 75 Front Crankshaft Oil Seal—Installation

REMOVAL AND INSTALLATION (Continued)

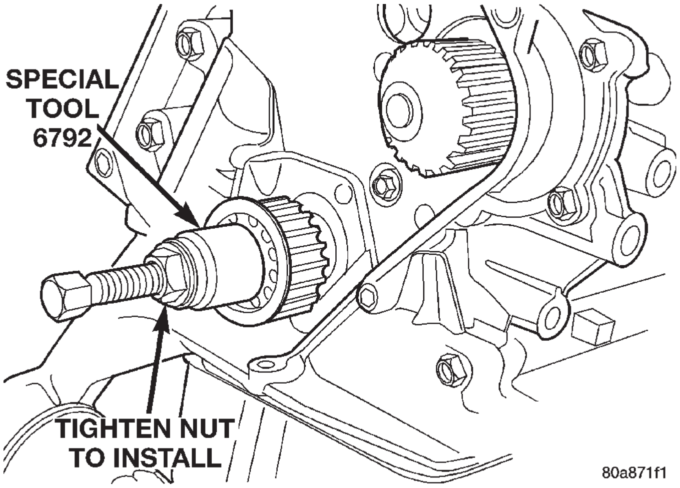


Fig. 76 Crankshaft Sprocket—Installation

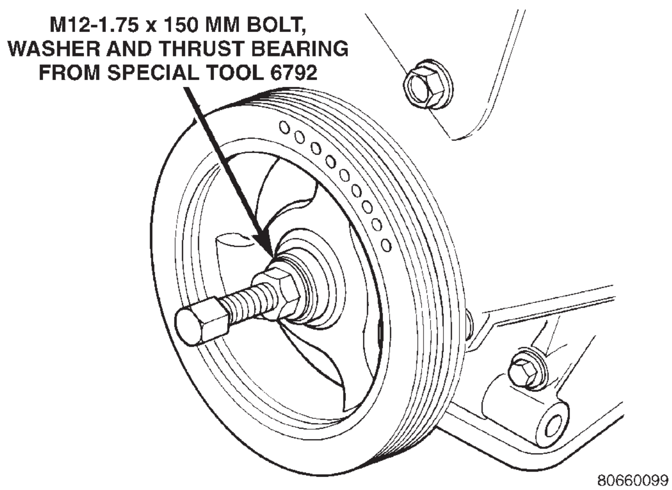


Fig. 77 Crankshaft Damper—Installation

CRANKSHAFT OIL SEAL—REAR

REMOVAL

(1) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 78) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.

INSTALLATION

CAUTION: If burr or scratch is present on the crankshaft edge (chamfer), cleanup with 400 grit sand paper to prevent seal damage during installation of new seal.

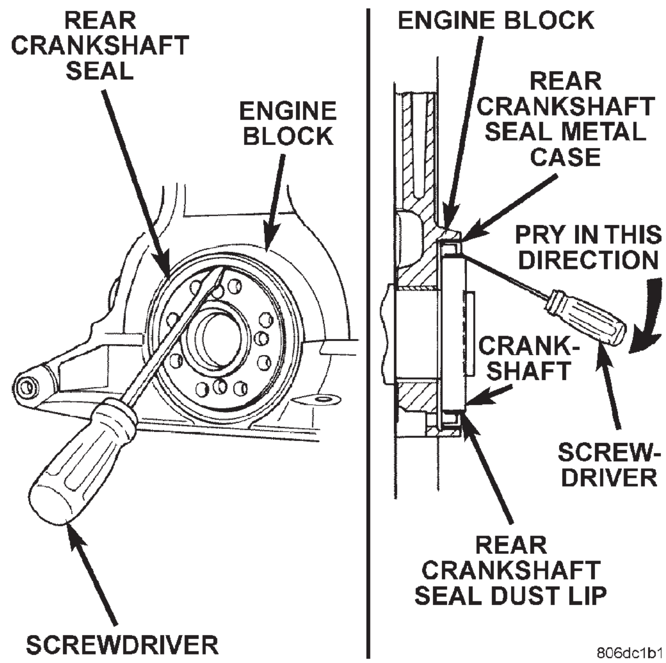


Fig. 78 Rear Crankshaft Oil Seal—Removal

NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 79).

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 79). Pilot tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 80) until the tool bottoms out against the block (Fig. 81).

CRANKSHAFT

REMOVAL

NOTE: Crankshaft can not be removed when engine is in vehicle.

(1) Remove engine assembly from vehicle. Refer to procedure in this section.

(2) Separate engine from transaxle.

(3) Remove drive plate and crankshaft rear oil seal.

(4) Mount engine on a repair stand.

(5) Remove oil filter and oil pan. Refer to procedure in this section.

REMOVAL AND INSTALLATION (Continued)

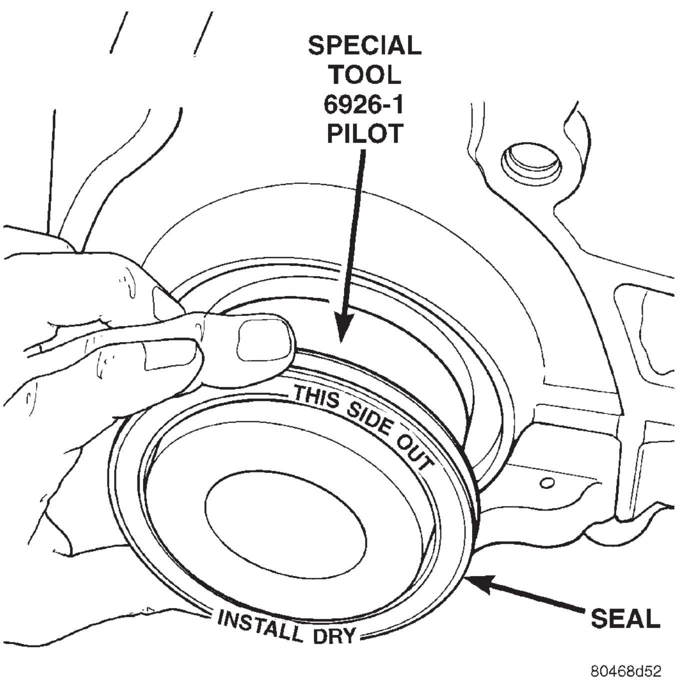


Fig. 79 Rear Crankshaft Seal and Special Tool 6926-1

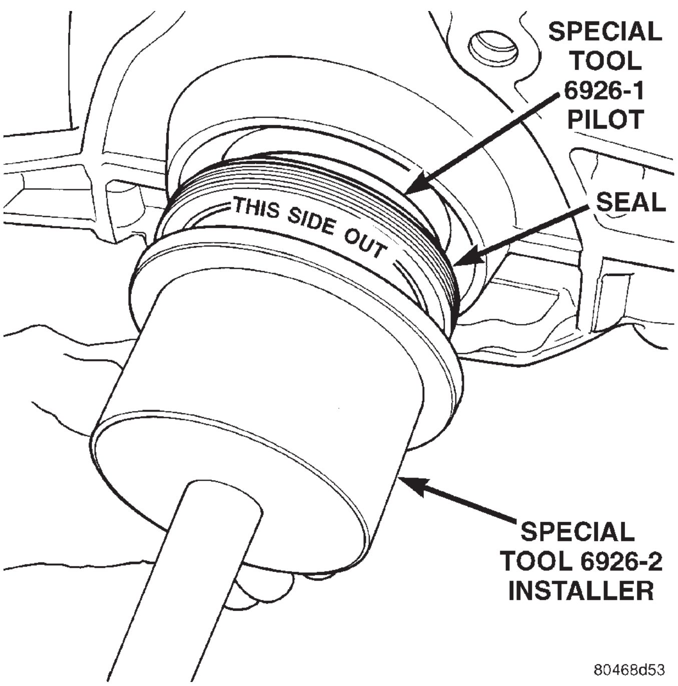


Fig. 80 Crankshaft Seal Special Tool 6926-2

(6) Remove Timing Belt Cover, Timing Belt and Oil Pump. Refer to procedure in this section.

(7) Remove Balance Shafts Assembly. Refer to procedure in this section.

(8) Remove all main bearing cap bedplate bolts from the engine block. Refer to procedure in this section.

(9) Using a mallet gently tap the bedplate loose from the engine block dowel pins.

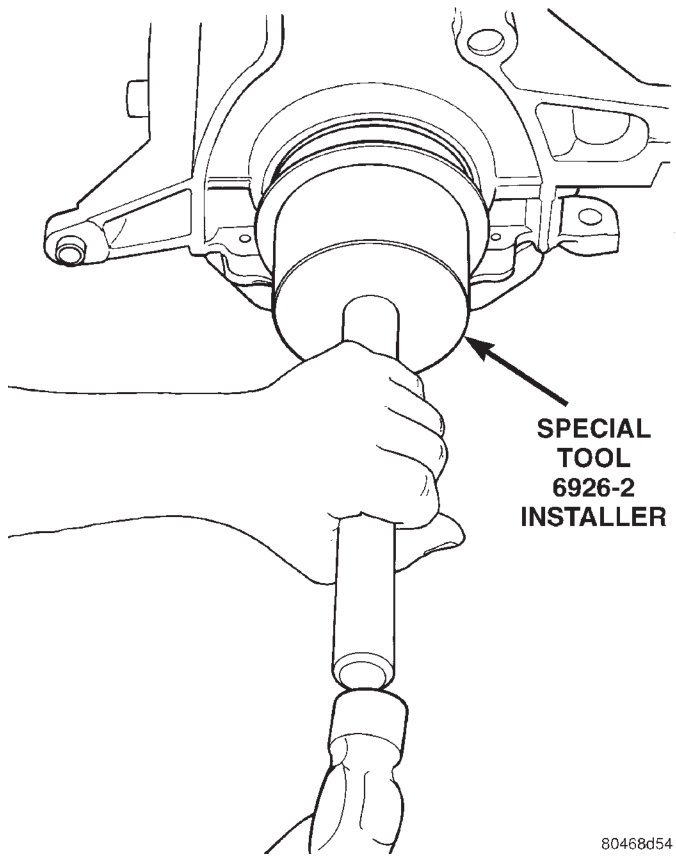


Fig. 81 Rear Crankshaft Seal—Installation

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block to bedplate alignment and thrust bearing.

(10) Bedplate should be removed evenly from the cylinder block dowel pins to prevent damage to the dowel pins and thrust bearing.

(11) Lift out crankshaft from cylinder block. Do not damage the main bearings or journals when removing the crankshaft.

INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 82).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

CAUTION: Do not get oil on the bedplate mating surface. It will may effect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals. Install crankshaft.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

REMOVAL AND INSTALLATION (Continued)

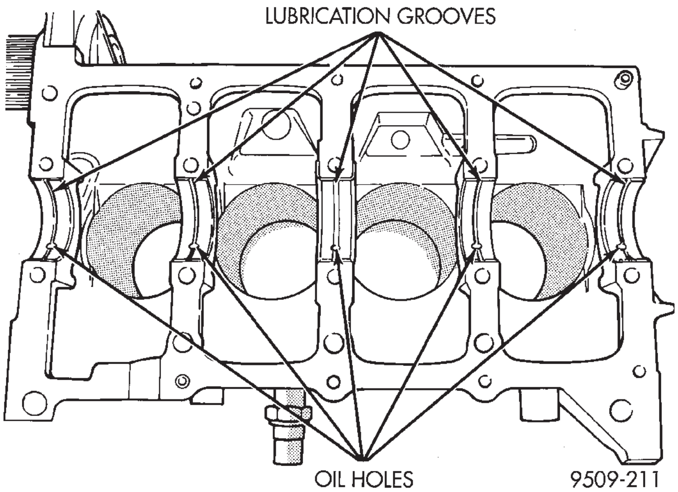


Fig. 82 Installing Main Bearing Upper Shell

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar® Torque Cure Gasket Maker to cylinder block as shown in (Fig. 83).

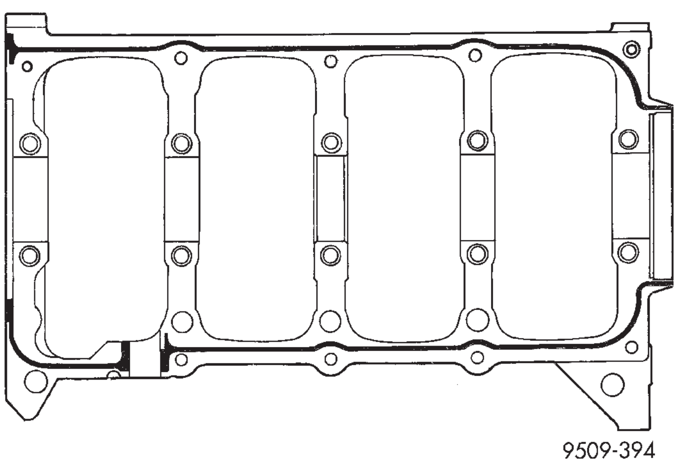


Fig. 83 Main Bearing Caps/Bedplate Sealing

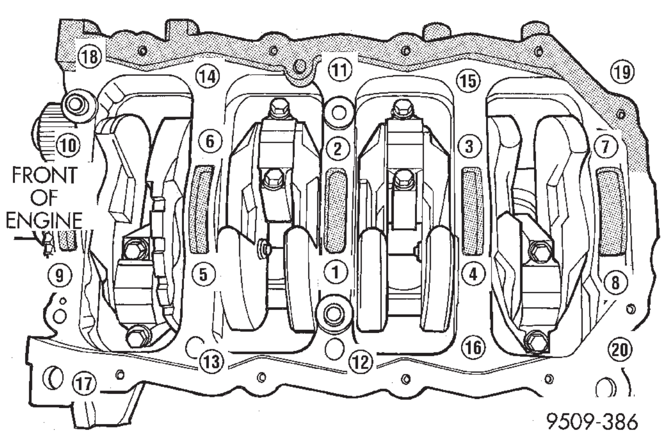


Fig. 84 Main Bearing Caps/Bedplate Torque Sequence

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(6) Before installing the bolts the threads should be oiled with clean engine oil, wipe off any excess oil.

(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten these bolts down together until the bedplate contacts the cylinder block.

(8) To ensure correct thrust bearing alignment, perform the following steps:

- Step 1: Rotate crankshaft until number 4 piston is at TDC.
- Step 2: Move crankshaft rearward to limits of travel.
- Step 3: Then, move crankshaft forward to limits of travel.
- Step 4: Wedge an appropriate tool between the rear of the cylinder block **(NOT BED PLATE)** and the rear crankshaft counterweight. This will hold the crankshaft in it's furthest forward position.
- Step 5: Install and tighten bolts (1 – 10) in sequence shown in (Fig. 84) to 41 N·m (30 ft. lbs.).
- Step 6: Remove wedge tool used to hold crankshaft.

(9) Tighten bolts (1 – 10) again to 41 N·m (30 ft. lbs.) +1/4 turn in sequence shown in (Fig. 84).

(10) Install main bearing bedplate to engine block bolts (11 through 20), and torque each bolt to 28 N·m (20 ft. lbs.) in sequence shown in (Fig. 84).

(11) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

(12) Install balance shaft assembly.

(13) Install oil pump, timing belt and covers.

(14) Install oil pan and oil filter.

(15) Install crankshaft rear oil seal. Refer to procedure in this section.

(16) Install drive plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).

(17) Attach transaxle to engine. Tighten attaching bolts to 101 N·m (75 ft. lbs.).

(18) Install engine assembly.

OIL FILTER

CAUTION: When servicing the oil filter avoid deforming the filter can by installing the remove/install tool band strap against the can to base lock seam. The lock seam joining the can to the base is reinforced by the base plate.

(1) Turn counterclockwise to remove.

(2) To install, lubricate new filter gasket. Check filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber. Screw filter on until the gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

OIL PUMP

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove Timing Belt. Refer to procedure in this section.

(3) Remove Oil Pan. Refer to procedure in this section.

(4) Remove Crankshaft Sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 85).

(5) Remove oil pick-up tube.

(6) Remove oil pump, (Fig. 86) and front crankshaft seal.

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

(2) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 87). Install oil ring into oil pump body discharge passage.

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

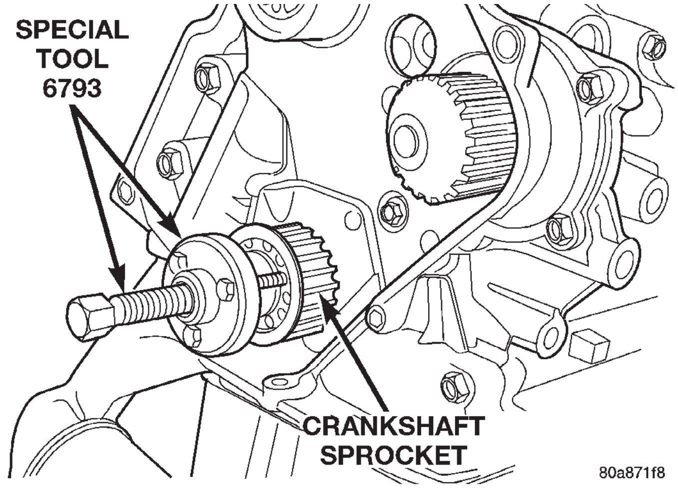


Fig. 85 Crankshaft Sprocket—Removal

(5) Install new front crankshaft seal using Special Tool 6780 (Fig. 88).

(6) Install crankshaft sprocket using Special Tool 6792 (Fig. 89).

(7) Install oil pump pick-up tube.

(8) Install oil pan. Refer to procedure in this section.

(9) Install Timing Belt. Refer to procedure in this section.

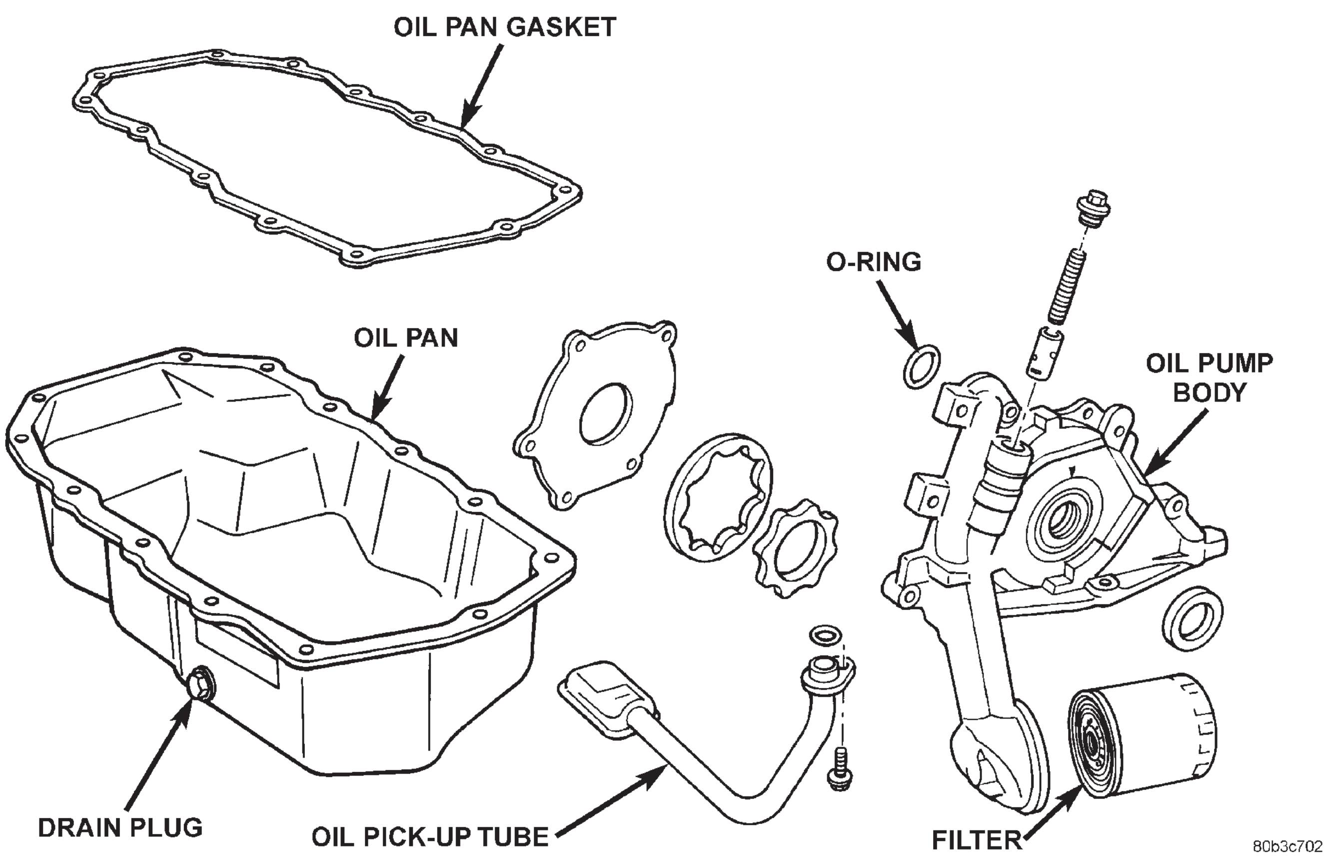


Fig. 86 Oil Pump and Pick-up Tube

REMOVAL AND INSTALLATION (Continued)

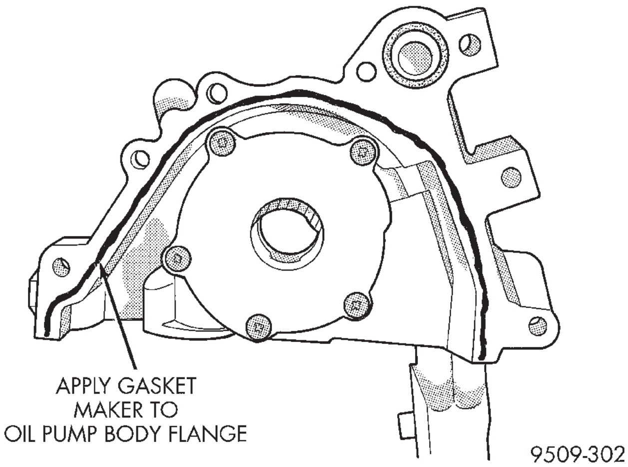


Fig. 87 Oil Pump Sealing

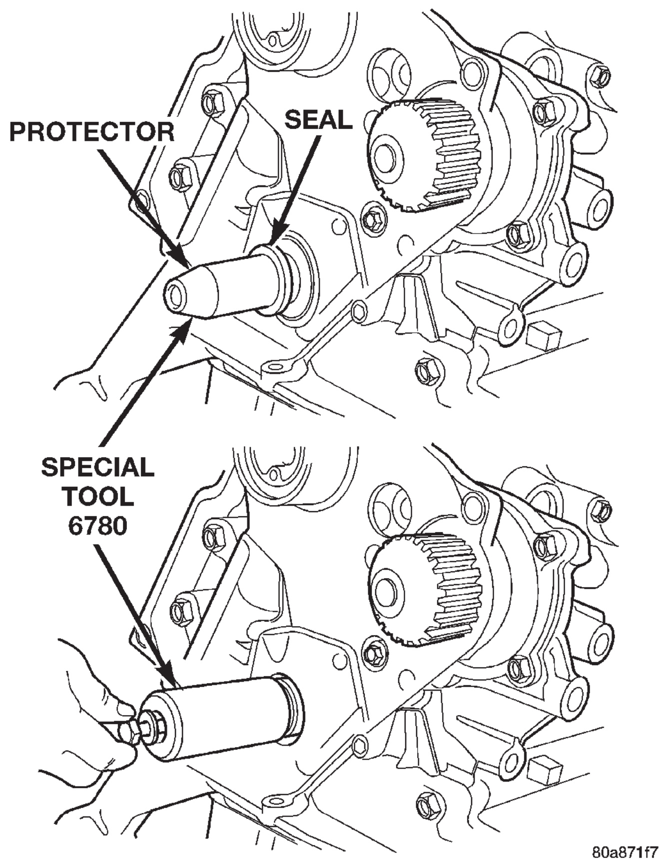


Fig. 88 Front Crankshaft Seal—Installation

PISTON AND CONNECTING ROD

REMOVAL

NOTE: Cylinder Head must be removed before Pistons and Rods. Refer to Cylinder Head Removal in this section.

(1) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation** . Mark piston with matching cylinder number (Fig. 90).

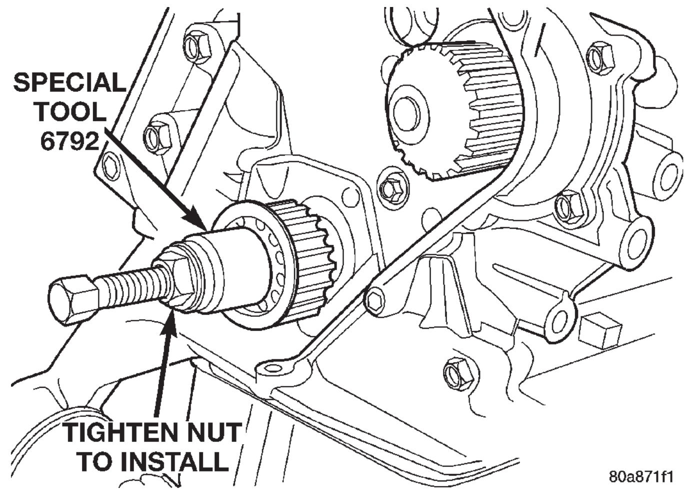


Fig. 89 Crankshaft Sprocket—Installation

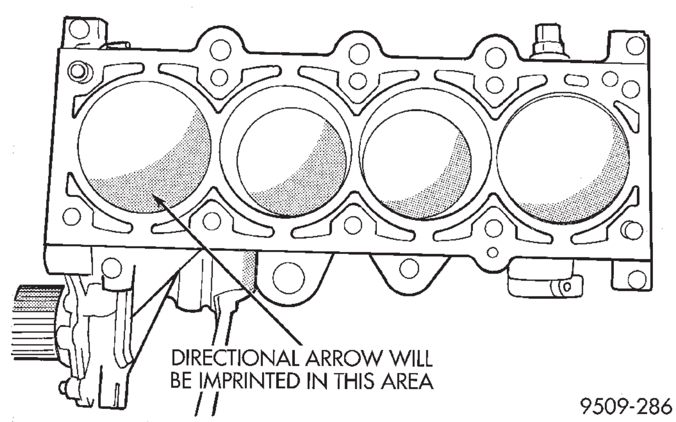


Fig. 90 Piston Markings

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 91) for identification.

(3) Pistons have a directional stamping in the front half of the piston facing towards the **front** of engine.

(4) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(5) Remove Balance Shaft Assembly. Refer to Balance Shaft Removal in this section.

(6) Remove connecting rod cap bolts. Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(7) After removal, install bearing cap on the mating rod.

(8) Piston and Rods are serviced as an assembly.

REMOVAL AND INSTALLATION (Continued)

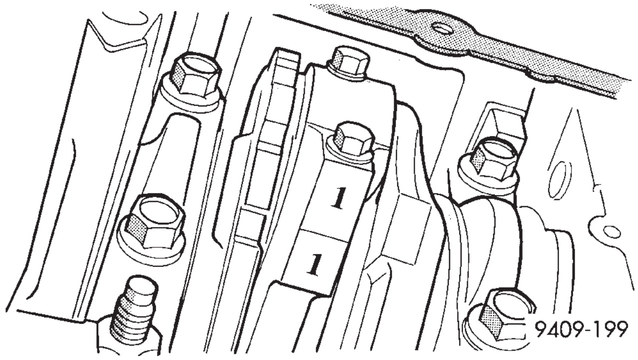


Fig. 91 Identify Connecting Rod to Cylinder

INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 92). As viewed from top.

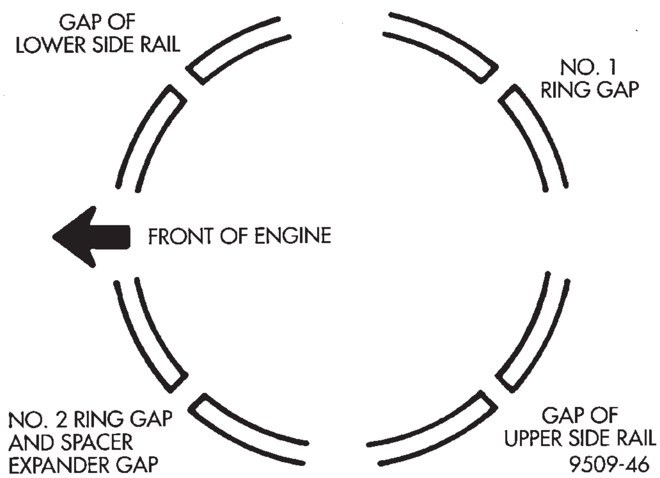


Fig. 92 Piston Ring End Gap Position

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 93). **Be sure position of rings does not change during this operation**.

(4) The directional stamp on the piston should face toward the front of the engine (Fig. 90).

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston assembly into cylinder bore and guide rod over the crankshaft journal.

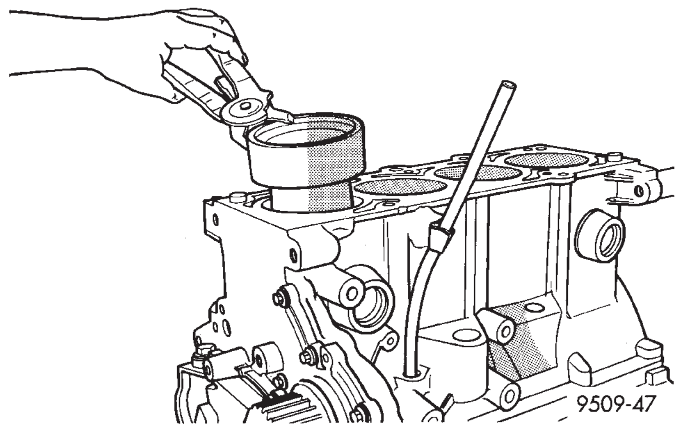


Fig. 93 Piston—Installation

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

NOTE: The connecting rod cap bolts should not be reused.

(7) Before installing the **NEW** bolts the threads should be coated with clean engine oil.

(8) Install each bolt finger tight than alternately torque each bolt to assemble the cap properly.

CAUTION: Do not use a torque wrench for second part of last step.

(9) Tighten the bolts to 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn).

(10) Using a feeler gauge, check connecting rod side clearance (Fig. 94).

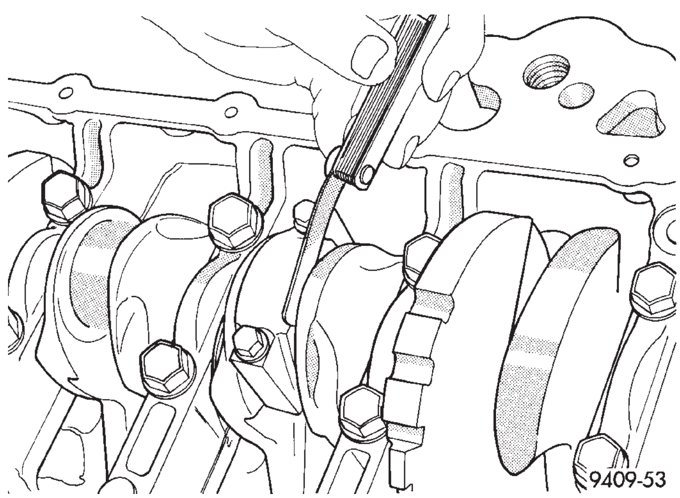


Fig. 94 Checking Connecting Rod Side Clearance

DISASSEMBLY AND ASSEMBLY

OIL PUMP

DISASSEMBLY

(1) To remove the relief valve, proceed as follows:

(a) Remove the threaded plug and gasket from the oil pump (Fig. 95).

(b) Remove spring and relief valve (Fig. 95)

(2) Remove oil pump cover screws, and lift off cover.

(3) Remove pump rotors.

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

ASSEMBLY

(1) Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**

(2) Prime oil pump before installation by filling rotor cavity with engine oil.

(3) Install cover and tighten screws to 12 N·m (105 in. lbs.).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 95) or serious damage may occur.

(4) Install relief valve, spring, gasket and cap as shown in (Fig. 95). Tighten cap to 41 N·m (30 ft. lbs.).

CLEANING AND INSPECTION

INTAKE MANIFOLD

(1) Discard gasket and clean all surfaces of manifold to cylinder head surfaces.

(2) Check manifold surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

(3) Inspect manifold for cracks or distortion. Replace manifold if necessary.

EXHAUST MANIFOLD

(1) Discard gasket and clean all surfaces of manifolds and cylinder head.

(2) Test manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

(3) Inspect manifolds for cracks or distortion. Replace manifold as necessary.

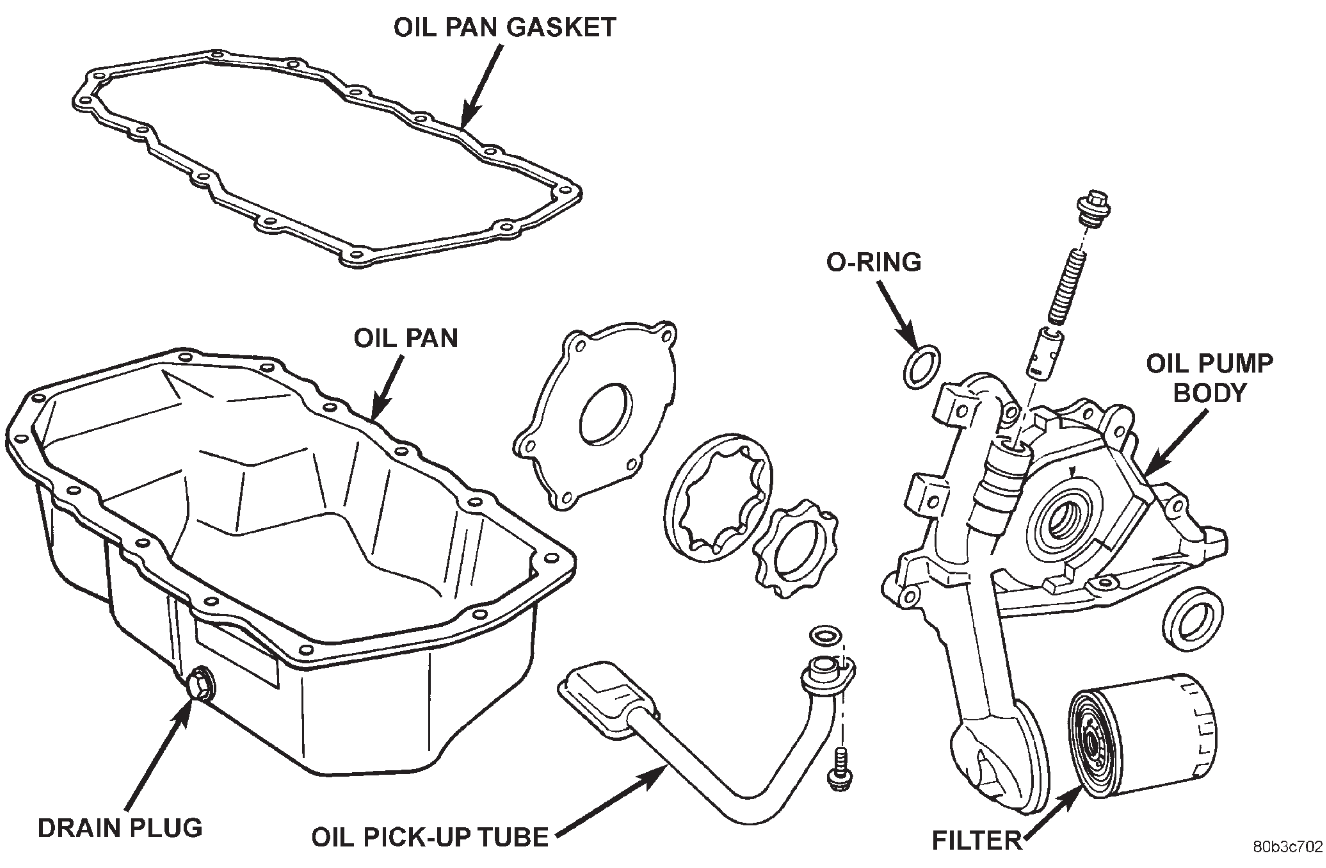


Fig. 95 Oil Pressure Relief Valve

CLEANING AND INSPECTION (Continued)

CYLINDER HEAD

CLEANING

Remove all gasket material from cylinder head and block. Be careful not to gouge or scratch the aluminum head sealing surface.

INSPECTION

(1) Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 96).

(2) Inspect camshaft bearing journals for scoring.

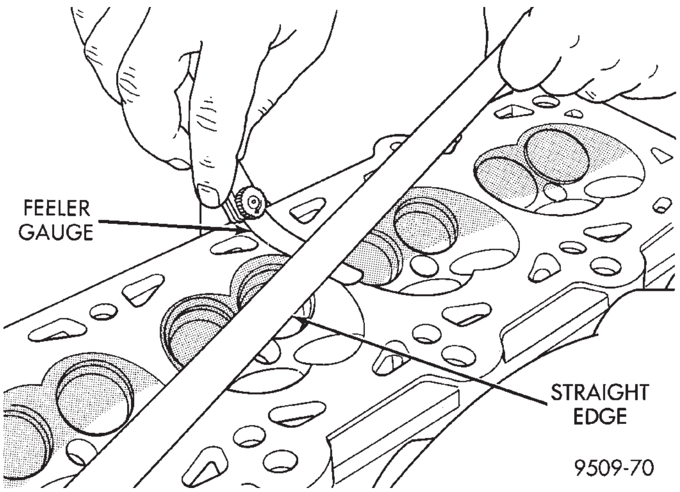


Fig. 96 Checking Cylinder Head Flatness

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 97). Refer to Valve Guide Specification Chart. Replace guides if they are not within specification.

(3) Check valve guide height (Fig. 98).

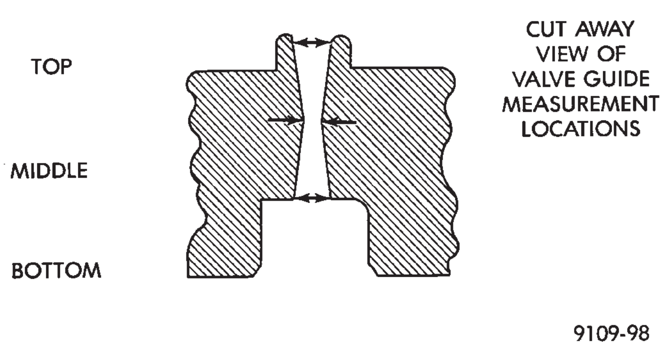


Fig. 97 Checking Wear on Valve Guide—Typical

VALVE AND VALVE SPRING

VALVES

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

VALVE GUIDE SPECIFICATION CHART

	Valve Guide Diameter	
Intake and Exhaust Valve:	5.975 - 6.000 mm (0.2352 - 0.2362 in.)	
	Valve Guide Clearance	
	New	Service Limit
Intake Valve:	0.048 - 0.066 mm (0.0018 - 0.0025 in.)	
		0.25 mm (0.010 in.)
Exhaust Valve:	0.0736 - 0.094 mm (0.0029 - 0.0037 in.)	

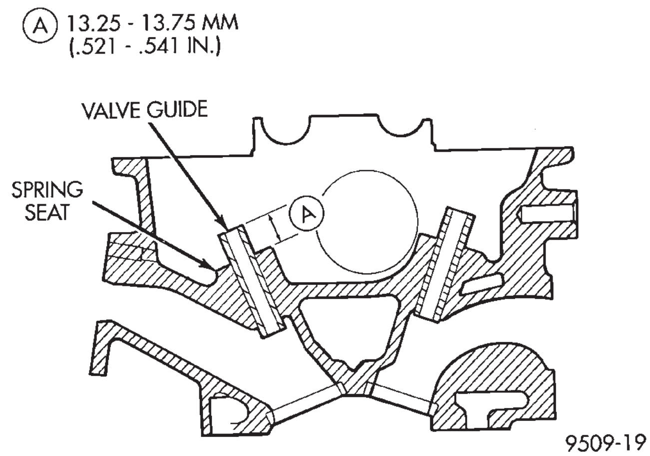


Fig. 98 Valve Guide Height

(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

(3) If valve stems are worn more than 0.05 mm (.002 in.), replace valve.

VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested for correct tension. Discard the springs that do not meet specifications. The following specifications apply to both intake and exhaust valves springs:

- Valve Closed Nominal Tension— 76 lbs. @ 38.0 mm (1.50 in.)
- Valve Open Nominal Tension— 136 lbs. @ 29.75 mm (1.17 in.)

(2) Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

CLEANING AND INSPECTION (Continued)

OIL PUMP

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth (Fig. 99). Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 100). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 9.40 mm (0.370 in.) or less (Fig. 101), or if the diameter is 79.95 mm (3.148 in.) or less, replace outer rotor.

(4) If inner rotor measures 9.40 mm (0.370 in.) or less replace inner rotor (Fig. 102).

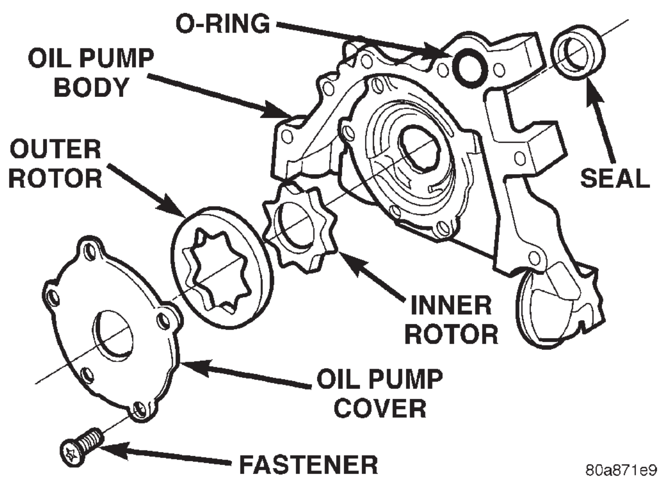


Fig. 99 Oil Pump

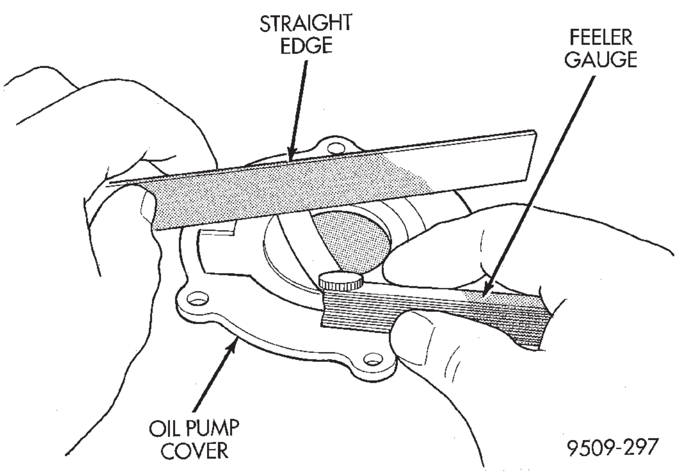


Fig. 100 Checking Oil Pump Cover Flatness

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 103). If measurement is 0.39 mm (0.015 in.) or more, replace housing only if outer rotor is in specification.

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 104) is 0.203 mm (0.008 in.) or more, replace both rotors.

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of 0.102 mm (0.004 in.), or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 105), **ONLY** if rotors are in specs.

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400 grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

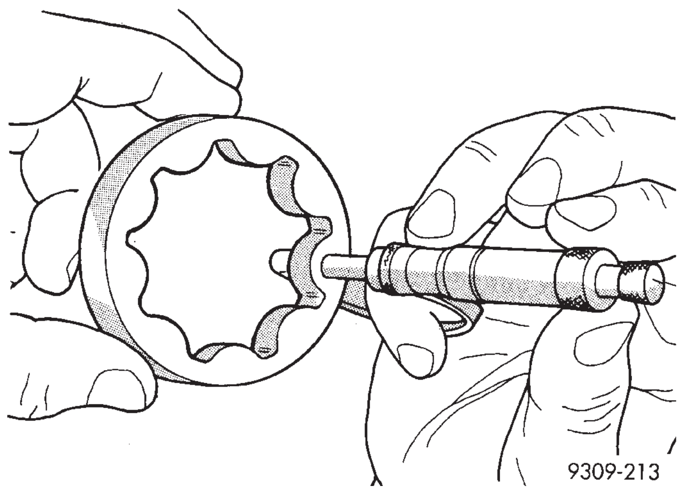


Fig. 101 Measuring Outer Rotor Thickness

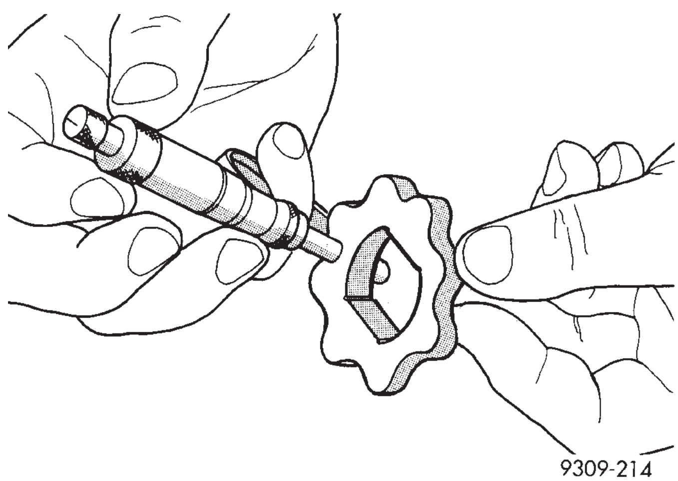


Fig. 102 Measuring Inner Rotor Thickness

CLEANING AND INSPECTION (Continued)

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

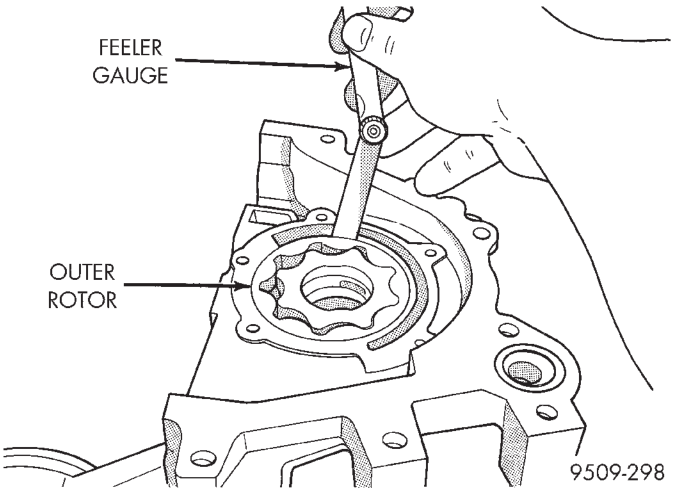


Fig. 103 Measuring Outer Rotor Clearance in Housing

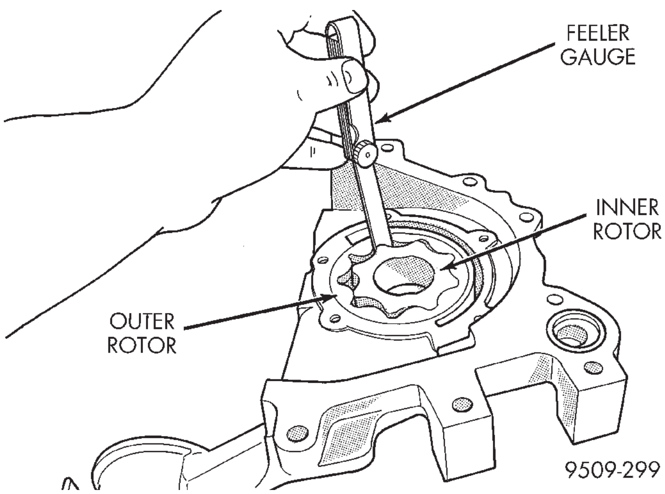


Fig. 104 Measuring Clearance Between Rotors

CRANKSHAFT

The crankshaft journals should be checked for excessive wear, taper and scoring (Fig. 106). Limits of taper or out of round on any crankshaft journals should be held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. DO NOT grind thrust faces of Number 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the nodular cast iron crankshafts used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

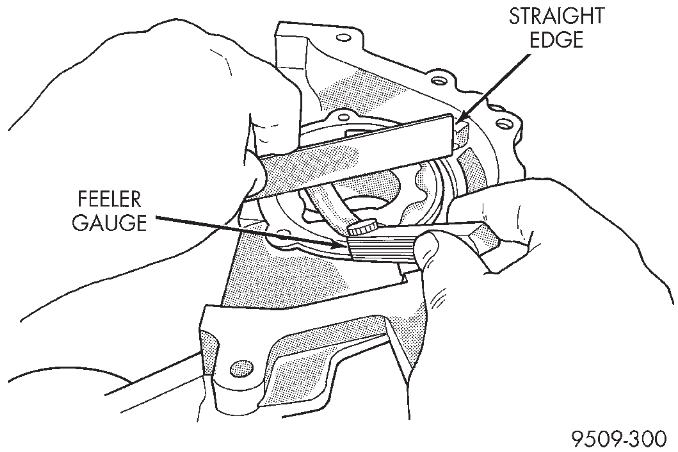


Fig. 105 Measuring Clearance Over Rotors

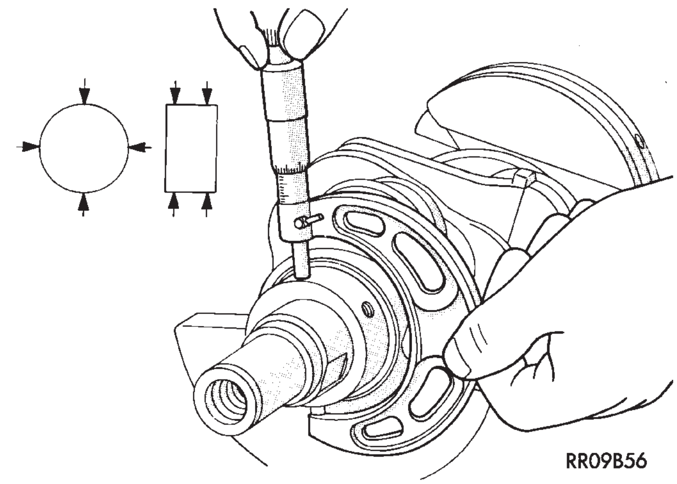


Fig. 106 Crankshaft Journal Measurements

CYLINDER BLOCK

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, refer to Engine Core Plugs outlined in this section.

(3) Examine block and cylinder bores for cracks or fractures.

CYLINDER BORE INSPECTION

The cylinder walls should be checked for out-of-round and taper with Tool C119 (Fig. 107). The cylinder bore out-of-round is 0.050 mm (0.002 in.) maximum and cylinder bore taper is 0.051 mm (0.002 in.) maximum. If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B (Fig. 107). Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from bottom of bore.

CLEANING AND INSPECTION (Continued)

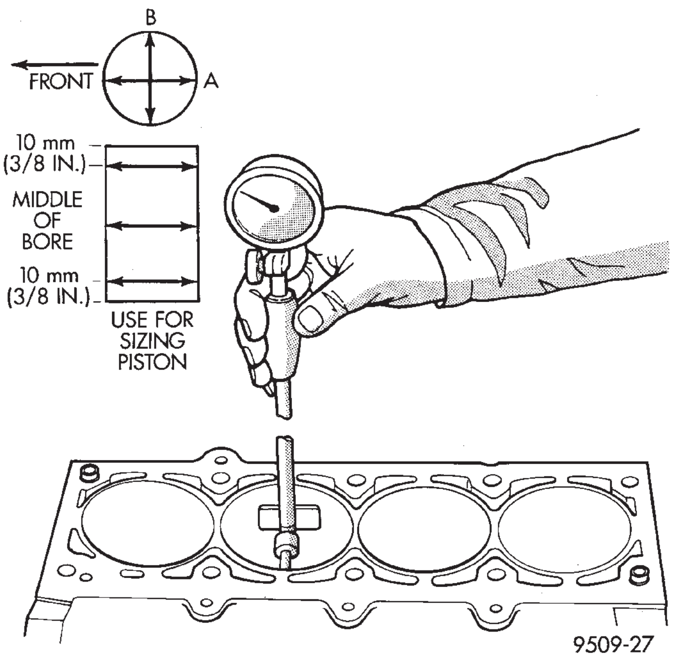


Fig. 107 Checking Cylinder Bore Size

Refer to Cylinder Bore and Piston Specification Chart.

CYLINDER BORE AND PISTON SPECIFICATION CHART

Standard Bore	Maximum Out-Of-Round	Maximum Taper
87.5 mm (3.445 in.)	0.051 mm (0.002 in.)	0.051 mm (0.002 in.)
Standard Piston Size		
87.450 - 87.468 mm (3.4434 - 3.4441 in.)		
Piston To Bore Clearance		
0.024 - 0.057 mm (0.0009 - 0.0022 in.)		
Measurements taken at Piston Size Location.		

CAMSHAFT FOLLOWER

Inspect the cam follower assembly for wear or damage (Fig. 108). Replace as necessary.

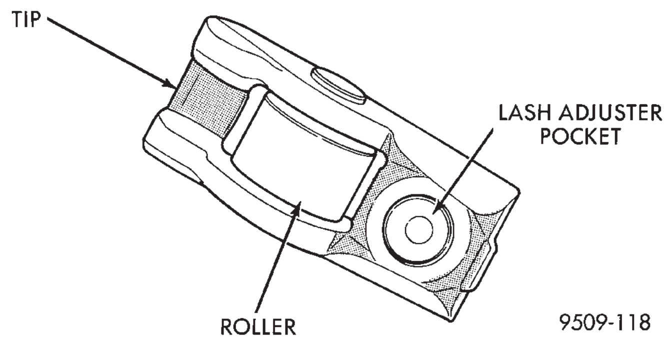


Fig. 108 Cam Follower Assembly

ADJUSTMENTS

ENGINE SUPPORT ADJUSTMENT

The right and left support assemblies are slotted to allow for right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right and left engine support assemblies as required. Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Group 2, Suspension and Driveshaft.
- Any front end structural damage (after repair).
- Support Assembly replacement.

ENGINE SUPPORT ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine support assembly vertical fasteners.

(3) Loosen the left engine support assembly vertical bolts.

(4) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshaft for driveshaft identification and related assembly length measuring.

(5) Tighten right engine support assembly vertical bolts to 61 N·m (45 ft. lbs.). and tighten left engine support assembly bolts to 61 N·m (45 ft. lbs.).

(6) Recheck drive shaft length.

SPECIFICATIONS

2.4L ENGINE

DESCRIPTION	SPECIFICATION
Type	In-Line OHV, DOHC
Number of Cylinder	4
Bore	87.5 mm (3.445 in.)
Stroke	101 mm (3.976 in.)
Compression Ratio	9.4:1
Displacement	2.4 Liters (148 Cubic Inches)
Firing Order	1, 3, 4, 2
Compression Pressure	1172-1551 kPa (170-225 psi)
Maximum Variation Between Cylinder	25 %
Lubrication	Pressure Feed-Full Flow Filtration (Direct Crankshaft Driven Pump)
Cylinder Block	
Cylinder Bore Diameter	87.4924 - 87.5076 mm (3.4446 - 3.4452 in.)
Out-of-Round (Max.)	0.051 mm (0.002 in.)
Taper (Max.)	0.051 mm (0.002 in.)
Pistons	
Clearance at 14 mm (9/16 in.) From Bottom of Skirt	0.024 - 0.057 mm (0.0009 - 0.0022 in.)
Weight	332 - 346 grams (11.85 - 12.20 oz.)
Top Land Clearance (Diametrical)	0.614 - 0.664 mm (0.024 - 0.026 in.)
Piston Length	60.30 mm (2.374 in.)
Piston Ring Groove Depth	
No. 1	4.640 - 4.784 mm (0.182 - 0.188 in.)
No. 2	4.575 - 4.719 mm (0.180 - 0.185 in.)
No.3	4.097 - 4.236 mm (0.161 - 0.166 in.)
Piston Pins	
Clearance in Piston	0.005 - 0.018 mm
In Rod (Interference)	0.018 - 0.043 mm (0.0007 - 0.0017 in.)
Diameter	21.998 - 22.003 mm (0.8660 - 0.8662 in.)
End Play	None
Length	72.75 - 73.25 mm (2.864 - 2.883 in.)
Piston Ring Gap	
Top Compression Ring	0.25 - 0.51 mm (0.0098 - 0.020 in.)
2nd Compression Ring	0.23 - 0.48 mm (0.009 - 0.018 in.)
Oil Control (Steel Rails)	0.25 - 0.64 mm (0.0098 - 0.025 in.)
Piston Ring Side Clearance	
Top and Second Compression Rings	0.030 - 0.080 mm (0.0011 - 0.0031 in.)

DESCRIPTION	SPECIFICATION
Oil Ring (Pack)	0.012 - 0.178 mm (0.0004 - 0.0070 in.)
Piston Ring Width	
Compression Rings	1.47 - 1.50 mm (0.057 - 0.059 in.)
Oil Ring (Pack)	2.72 - 2.88 mm (0.107 - 0.1133 in.)
Connecting Rod	
Bearing Clearance	0.025 - 0.071 mm (0.0009 - 0.0027 in.)
Piston Pin Bore Diameter	20.96 - 20.98 mm (0.8252 - 0.8260 in.)
Large End Bore Diameter	53.007 - 52.993 mm (2.0868 - 2.0863)
Side Clearance	0.013 - 0.0150 mm (0.0051 - 0.0150 in.)
Total Weight (Less Bearing)	565.8 grams (19.96 oz.)
Crankshaft	
Connecting Rod Journal Diameter	49.984 - 50.000 mm (1.967 - 1.9685 in.)
Out-of-Round (Max.)	0.0035 mm (0.0001 in.)
Taper (Max.)	0.0038 mm (0.0001 in.)
Main Bearing Diametrical Clearance No. 1 - 5	0.018 - 0.058 mm (0.0007 - 0.0023 in.)
End Play	0.09 - 0.24 mm (0.0035 - 0.0094 in.)
Main Bearing Journals	
Diameter	59.992 - 60.008 mm (2.361 - 2.3625 in.)
Out-of-Round (Max.)	0.0035 mm (0.0001 in.)
Taper (Max.)	0.0038 (0.0001 in.)
Hydraulic Lash Adjusters	
Body Diameter	15.901 - 15.913 mm (0.626 - 0.6264 in.)
Plunger Travel Minimum (Dry)	3.0 mm (0.118 in.)
Camshaft	
Bearing Bore Diameters No. 1–6	26.020 - 26.041 mm (1.024 - 1.025 in.)
Diametrical Bearing Clearance	0.069 - 0.071 mm (0.0027 - 0.003 in.)
End Play	0.050 - 0.170 mm (0.0019 - 0.0066 in.)
Bearing Journal Diameter No. 1–6	25.951 - 25.970 mm (1.021 - 1.022 in.)
Lift (Zero Lash) Intake	8.25 mm (0.324 in.)
Lift (Zero Lash) Exhaust	6.52 mm (0.256 in.)
Valve Timing – Intake Valve	
Closes (ABDC)	51°
Opens (BTDC)	1°
Duration	232°

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Valve Timing – Exhaust Valve	
Closes (ATDC)	8°
Opens (BBDC)	52°
Duration	240°
Valve Timing	
Valve Overlap	9°
Cylinder Head	
Material	Cast Aluminum
Gasket Thickness (Compressed)	1.15 mm (0.045 in.)
Cylinder Head Valve Seat	
Angle	45°
Runout (Max.)	0.050 mm (0.002 in.)
Width (Finish) Intake and Exhaust	0.9 - 1.3 mm (0.035 - 0.051 in.)
Guide Bore Diameter (Std)	11.0 - 11.02 mm (0.4330 - 0.4338 in.)
Finish Guide Bore ID	5.975 - 6.000 mm (0.235 - 0.236 in.)
Valves	
Face Angle	44-1/2° - 45°
Head Diameter Intake	34.67 - 34.93 mm (1.364 - 1.375 in.)
Head Diameter Exhaust	30.37 - 30.63 mm (1.195 - 1.205 in.)
Length–Intake (Overall)	112.76 - 113.32 mm (4.439 - 4.461 in.)
Length–Exhaust (Overall)	109.59 - 110.09 mm (4.314 - 4.334 in.)
Valve Margin–Intake	1.285 - 1.615 mm (0.050 - 0.063 in.)
Valve Margin–Exhaust	0.985 - 1.315 mm (0.038 - 0.051 in.)
Valve Stem Tip Height–Intake	48.04 mm (1.891 in.)
Valve Stem Tip Height–Exhaust	47.99 mm (1.889 in.)
Stem Diameter–Intake	5.934 - 5.952 mm (0.234 - 0.234 in.)
Stem Diameter–Exhaust	5.906 - 5.924 mm (0.233 - 0.233 in.)
Stem-to-Guide Clearance– Intake	0.048 - 0.066 mm (0.0018 - 0.0025 in.)
Stem-to-Guide Clearance– Exhaust	0.0736 - 0.094 mm (0.0029 - 0.0037 in.)
Max. Allowable Stem-to-Guide Clearance–Intake and Exhaust	0.025 mm (0.010 in.)
Valve Springs	
Free Length (Approx.)	48.4 mm (1.905 in.)
Spring Tension (Valve Closed)	338 N ±20 N 38.0 mm (75.98 lbs. ±4.5 lbs. @ 1.496 in.)
Spring Tension (Valve Open)	607 N ±30 N @ 29.75 mm (136 lbs. ±7 @ 1.172 in.)
Number of Coils	7.82
Wire Diameter	3.86 mm (0.151 in.)
Installed Spring Height	38.00 mm (1.496 in.)
Oil Pump	
Clearance Over Rotors (Max.)	0.10 mm (0.004 in.)
Cover Out-of-Flat (Max.)	0.025 mm (0.001 in.)
Inner Rotor Thickness (Min.)	9.40 mm (0.370 in.)
Outer Rotor (Oil Pump)	
Clearance (Max.)	0.39 mm (0.015 in.)
Diameter (Min.)	79.95 mm (3.148 in.)
Thickness (Min.)	9.40 mm (0.370 in.)
Tip Clearance Between Rotors (Max.)	0.20 mm (0.008 in.)
Oil Pressure	
At Curb Idle Speed *	25 kPa (4 psi)
At 3000 rpm	170 - 550 kPa (25 - 80 psi)

CAUTION: * If pressure is ZERO at curb Idle, DO NOT run engine at 3,000 rpm.

TORQUE CHART 2.4L

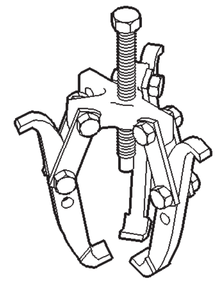
DESCRIPTION	TORQUE
Balance Shaft Carrier to Block	
Bolts	54 N·m (40 ft. lbs.)
Balance Shaft Gear Cover	
Double Ended Fastener	12 N·m (105 in. lbs.)
Balance Shaft Sprockets	
Bolts	28 N·m (250 in. lbs.)
Balance Shaft Chain Tensioner	
Bolts	12 N·m (105 in. lbs.)
Balance Shaft Carrier Cover	
Fasteners	12 N·m (105 in. lbs.)
Camshaft Sensor Pick Up	
Bolts	27 N·m (20 ft. lbs.)
Camshaft Sprocket	
Bolt	101 N·m (75 ft. lbs.)
Connecting Rod Cap	
Bolts	27 N·m (20 ft. lbs.) Plus 1/4 Turn
Crankshaft Main Bearing Cap/Bedplate	
M8 Bedplate Bolts	34 N·m (250 in. lbs.)
Main Cap Bolts M11	41 N·m (30 ft. lbs.) Plus 1/4 Turn

SPECIFICATIONS (Continued)

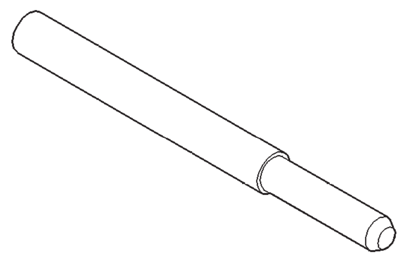
DESCRIPTION	TORQUE
Crankshaft Damper	
Bolt	135 N·m (100 ft. lbs.)
Cylinder Head	
Bolts	Refer To Cylinder Head Installation
Cylinder Head Cover	
Bolts	12 N·m (105 in. lbs.)
Drive Plate to Crankshaft	
Bolts	95 N·m (70 ft. lbs.)
Engine Mount Bracket—Right	
Bolts	61 N·m (45 ft. lbs.)
Engine Mount—Front & Rear	
Through Bolt	61 N·m (45 ft. lbs.)
Exhaust Manifold to Cylinder Head	
Bolts	23 N·m (200 in. lbs.)
Exhaust Manifold Heat Shield	
Bolts	12 N·m (105 in. lbs.)
Front Torque Bracket—2.4L Engine	
Bolts	33 N·m (24 ft. lbs.)
Front Powertrain Bending Strut—2.4L Engine	
Long Bolts	101 N·m (75 ft. lbs.)
Short Bolt	61 N·m (45 ft. lbs.)
Intake Manifold	
Bolts	23 N·m (200 in. lbs.)
Oil Filter	
Filter	20 N·m (15 ft. lbs.)
Oil Pan	
Bolts	12 N·m (105 in. lbs.)
Drain Plug	27 N·m (20 ft. lbs.)
Oil Pump Attaching	
Bolts	28 N·m (250 in. lbs.)
Oil Pump Cover Fastener	12 N·m (105 in. lbs.)
Oil Pump Pick-up Tube Bolt	28 N·m (250 in. lbs.)
Oil Pump Relief Valve Cap	41 N·m (30 ft. lbs.)
Rear Torque Bracket—2.4L Engine	
Bolts	110 N·m (80 ft. lbs.)
Spark Plugs	
Plugs	28 N·m (20 ft. lbs.)
Timing Belt Cover	
Outer to Inner Attaching Bolts M6	4.5 N·m (40 in. lbs.)
Inner Cover to Head/Oil Pump Bolts M6	12 N·m (105 in. lbs.)
Timing Belt Tensioner Assembly	
Bolts	61 N·m (45 ft. lbs.)
Thermostat Housing	
Bolts	23 N·m (200 in lbs.)
Water Pump Mounting	
Bolts	12 N·m (105 in. lbs.)

SPECIAL TOOLS

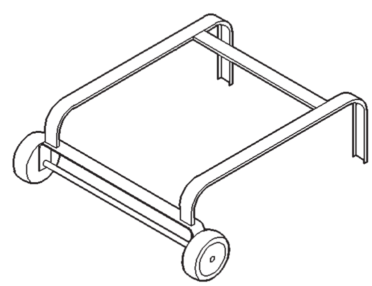
2.4L ENGINE



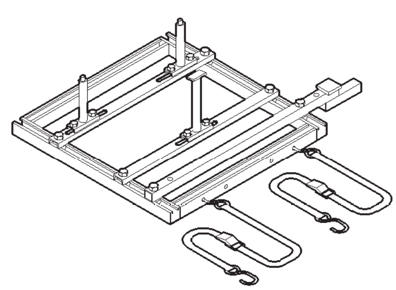
Puller 1026



Crankshaft Damper Removal Insert 6827-A

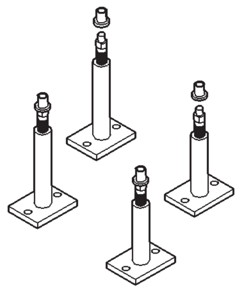


Dolly 6135

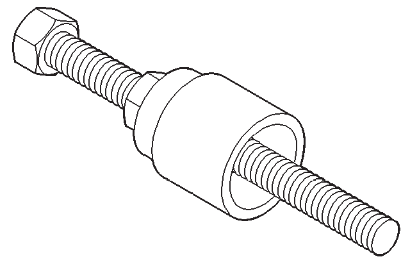


Cradle 6710

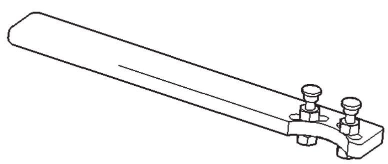
SPECIAL TOOLS (Continued)



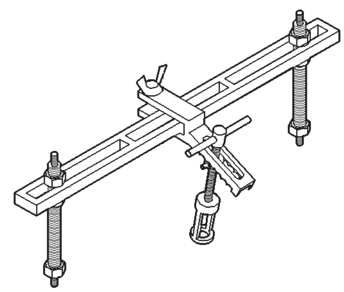
Post Kit Engine Cradle 6848



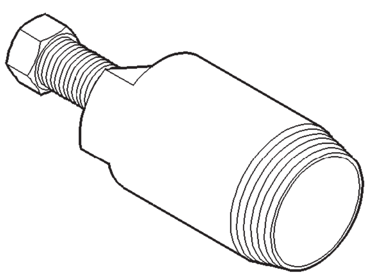
Crankshaft Damper Installer 6792



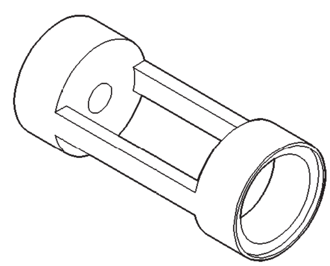
Camshaft Sprocket Holder 6847



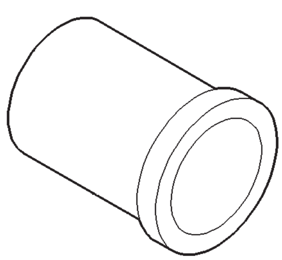
Valve Spring Compressor MD-998772-A



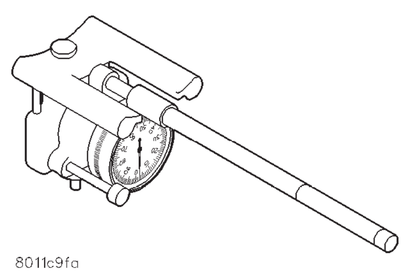
Camshaft Seal Remover C-4679-A



Valve Spring Compressor Adapter 6779

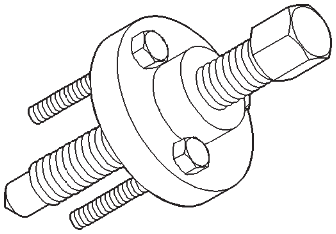


Camshaft Seal Installer MD-998306

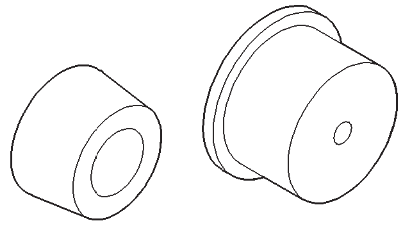


Cylinder Bore Gage C-119

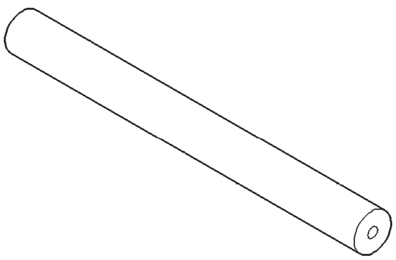
SPECIAL TOOLS (Continued)



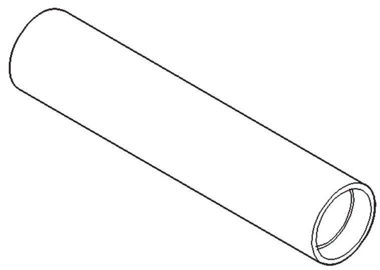
Crankshaft Sprocket Remover 6793



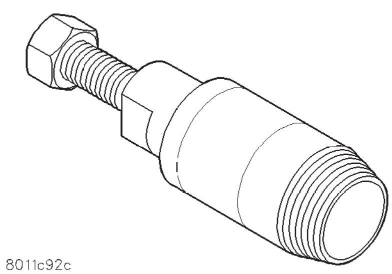
Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



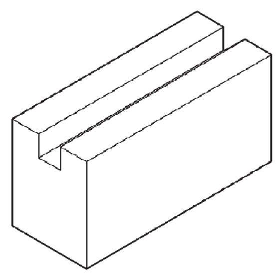
Crankshaft Sprocket Remover Insert C-4685-C2



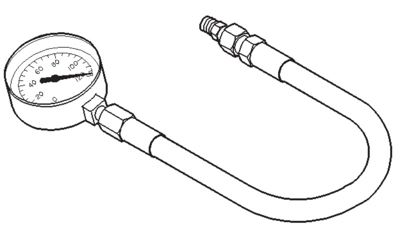
Balance Shaft Sprocket Installer 6052



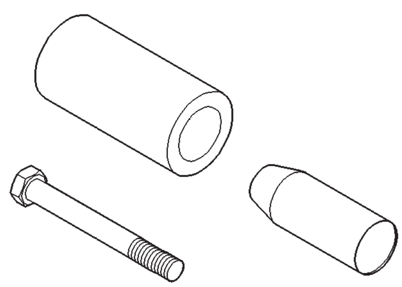
Crankshaft Seal Remover 6771



Post Adapter 8130



Oil Pressure Gage C-3292



Front Crankshaft Oil Seal Installer 6780

2.5L ENGINE

INDEX

DESCRIPTION AND OPERATION

ENGINE IDENTIFICATION

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 1).

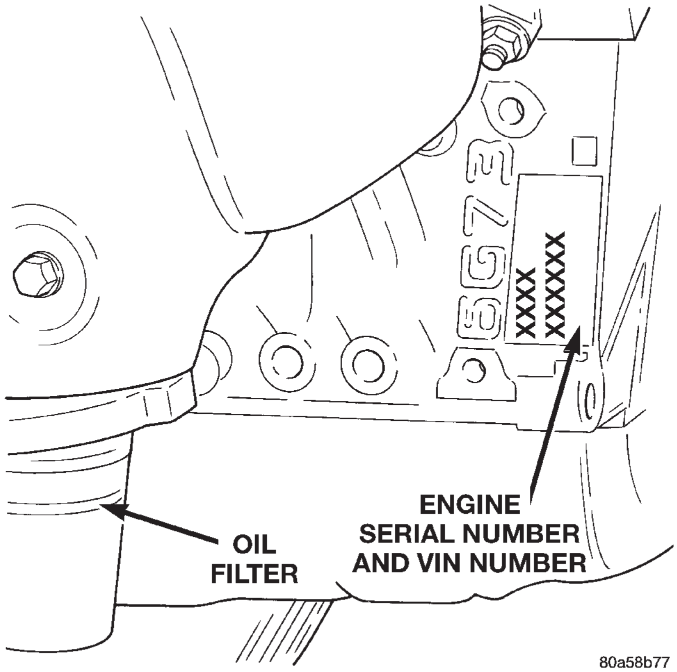
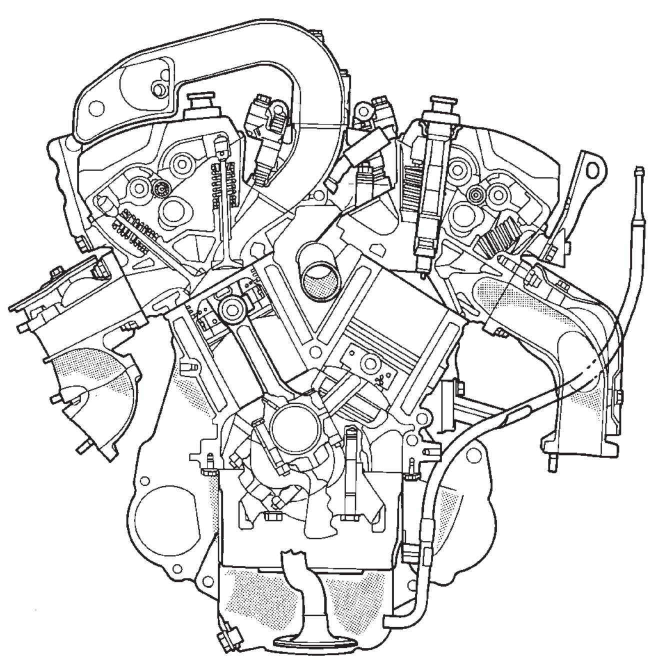


Fig. 1 Engine Identification

2.5L ENGINE



GENERAL SPECIFICATION

2.5L V-6 ENGINE

Type	60° V SOHC (Per Bank)
Bore	83.5 mm (3.29 in.)
Stroke	76.0 mm (2.992 in.)
Compression Ratio	9.4:1
Displacement	2.5 Liters (152 Cubic Inch)
Firing Order	1-2-3-4-5-6
Lubrication	Pressure Feed-Full Flow Filtration
Cooling System	Liquid Cooled-Forced Circulation (Pump-Timing Belt Driven)
Cylinder Block	Cast Iron
Crankshaft	Cast (Nodular Cast Iron)
Cylinder Head	Aluminum Alloy
Connecting Rods	Forged Steel
Pistons	Aluminum Alloy (w/Strut)

ENGINE COMPONENTS

BLOCK

The cylinder block is a partial open deck design to improve cooling and weight reduction. High rigidity is provided with ribs cast in the outer wall, and a monoblock or beam type main bearing cap system. This single unit four bearing cap is designed to control vibration of the cylinder block partition walls.

CRANKSHAFT

The crankshaft is made of nodular cast iron and has six individual throws with five counter weights, it is supported by four main bearings with number three being the thrust bearing. The six separate connecting rod throws pins reduce torque fluctuations

DESCRIPTION AND OPERATION (Continued)

while a dynamic damper is used to control torsional vibration of the crankshaft. Rubber lipped seals are used at front and rear. The front seal is retained in the oil pump case and the rear is retained in a die-cast aluminum block-mounted housing.

PISTONS

Are aluminum alloy with cast in steel struts at the pin bosses for autothermic control. The piston head is designed with valve recesses to provide for valve clearance. The piston rings consist of a chrome-plated, barrel faced design for the top ring, the second ring is a cast iron tapered face design and the oil ring is a chrome faced three piece design. Piston pins are press-fitted into place, to join the pistons to the forged steel connecting rods. The large end of the connecting rod has a oil jet hole for lubrication of the thrust side of the cylinder.

CYLINDER HEAD

The aluminum alloy cylinder heads feature a pent-roof design with four valves per cylinder. Valve guides are made of cast iron alloy and seat inserts are made of sintered alloy iron, these are pressed into the head. To improve combustion efficiency the chambers have a compact pent-roof design with a squish area. The cylinder heads are common to either cylinder bank.

CAMSHAFTS

Two overhead camshafts provide valve actuation, one left (radiator side of cylinder bank) and one right. The distributor is directly driven by the right camshaft. Both camshafts are supported by four bearing journals intregal with the head. A flange at the rear of the camshaft acts as a thrust collar. Right and Left camshaft driving sprockets are interchangeable. The sprockets and the engine water pump are driven by the timing belt.

ROCKER ARM SHAFTS

The shafts are retained by retaining caps and bolts. Four shafts are used, one for each intake and exhaust rocker arm assembly on each cylinder head. The hollow shafts provide a duct for lubricating oil flow from the cylinder head to the valve mechanisms. Rocker shaft springs are use on the intake shafts ONLY to obtain the proper clearance between the intake rocker arms and the spark plug tubes.

ROCKER ARMS

Are of light weight die-cast with roller type follower operating against the camshaft. The valve actuating end of the rocker arms are machined for hydraulic lash adjusters, eliminating the need for periodic valve lash adjustment.

VALVES

Four valves per cylinder are actuated by die-cast aluminum roller rocker arms and hydraulic lash adjusters assemblies which pivot on rocker arm shafts. All valves have 6 mm diameter chrome plated valve stems. The valve train has 33 mm (1.299 inch) diameter intake valves and 29 mm (1.141 inch) diameter exhaust valves. The valves have a carbo-nitriding finish for long life. Fluorcarbon valve stem seals are used on both valves. Stamped steel valve spring seat, Valve springs, spring retainers, and locks are conventional.

INTAKE MANIFOLD

This system is composed of a upper plenum (surge tank) and manifold. This aluminum alloy manifold has long runners to improve inertia. The plenum chamber (surge tank) absorbs air pulsations created during the suction phase of each cylinder. The lower intake manifold is machined for six injectors and fuel rail mounting.

EXHAUST MANIFOLDS

Both manifolds are made of cast nodular graphite iron for heat resistance. Exhaust gasses from the left cylinder bank, leave the left manifold through a stainless steel pipe and bellows routed under the engine to the right side manifold. The collected exhaust from both manifolds are combined, and exit to the exhaust pipe through a flex-joint.

ENGINE LUBRICATION SYSTEM

The lubrication system is a full flow filtration pressure feed type. Oil, stored in the oil pan, is taken in and discharged by a trochoid type oil pump directly coupled to the crankshaft and its pressure is regulated by a relief valve. The oil is fed through an oil filter and to the crankshaft journals from the oil gallery in the cylinder block. This gallery also feeds oil under pressure to the cylinder heads and camshaft journals. It then flows from the cylinder head passages to the rocker shafts to the rocker arm pivots and auto lash adjusters (Fig. 2).

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

Check oil pressure using gauge at oil pressure switch location. Oil pressure should be 41 kPa (6 psi.) at idle or 241 to 517 kPa (35 to 75 psi.) at 3000 RPM.

(1) Remove pressure sending unit and install oil pressure gauge.

DIAGNOSIS AND TESTING (Continued)

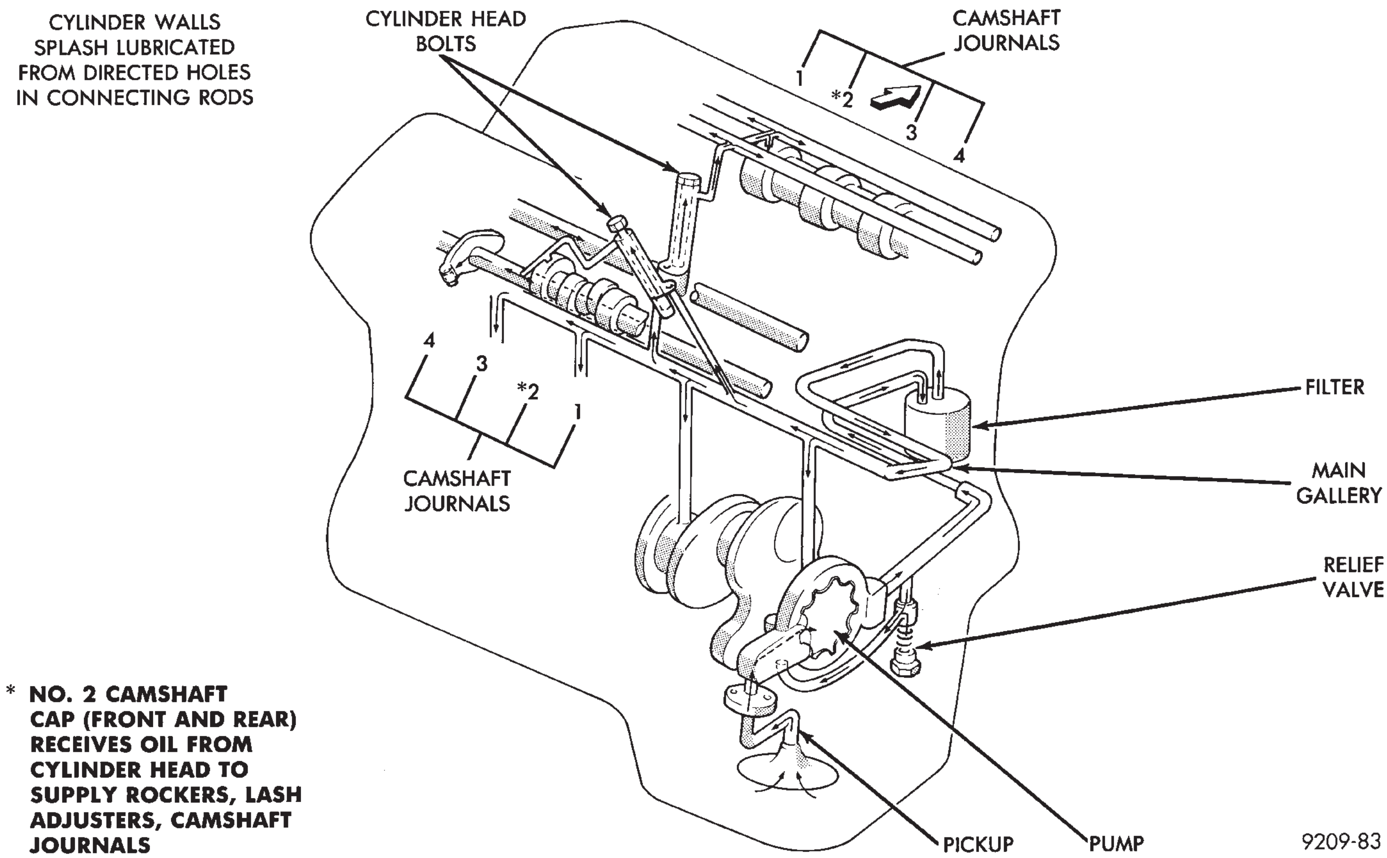


Fig. 2 Engine Oiling

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

(2) Warm engine at high idle until thermostat opens.

SERVICE PROCEDURES

BORING CYLINDER

Examine cylinder walls for scuffs, scoring and measure cylinder bore for out-of-round or taper. If defective, bore cylinder to oversize. Measure at points shown in (Fig. 3).

Four oversize pistons are available (0.25mm (.010 inch) 0.50mm (.020 inch) 0.75mm (.030 inch) and 1.0mm (.039 inch). Determine oversize piston on basis of largest cylinder bore.

(1) Bore to specified clearance between the piston O.D. and cylinder. The measuring point of the piston O.D. is shown in (Fig. 4).

(2) Based on measured piston O.D., calculate boring finish dimension. Boring finish dimension equals piston O.D. plus 0.03 to 0.05 mm (.0012 to .002 inch) (clearance between piston O.D. and cylinder) minus 0.02 mm which is the boring margin.

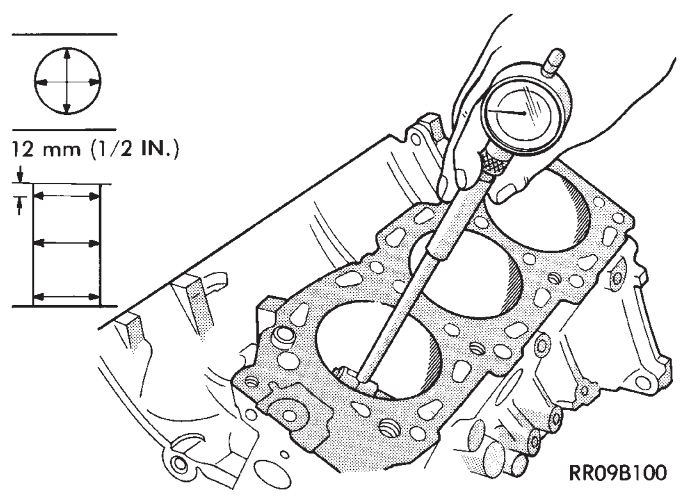


Fig. 3 Measure Cylinder Bore

(3) Bore all cylinders to calculated boring finish dimension. Then bore the final finish dimension (piston O.D. plus cylinder clearance).

(4) Check clearance between piston and cylinder, clearance should be 0.02 to 0.04 mm (0.0008 to 0.0016 inch).

SERVICE PROCEDURES (Continued)

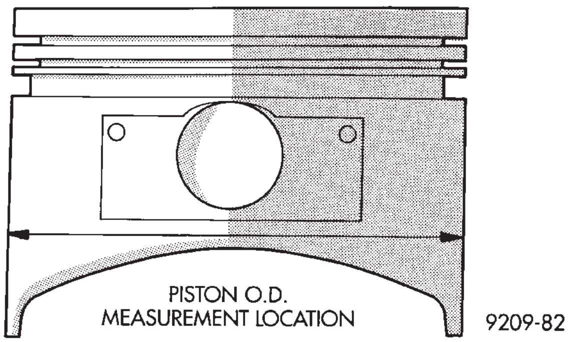


Fig. 4 Measure Piston

FITTING PISTONS

Measure approximately 2mm (.080 inch) above the bottom of the piston skirt and across the thrust face (Fig. 5). See Boring Cylinder Block.

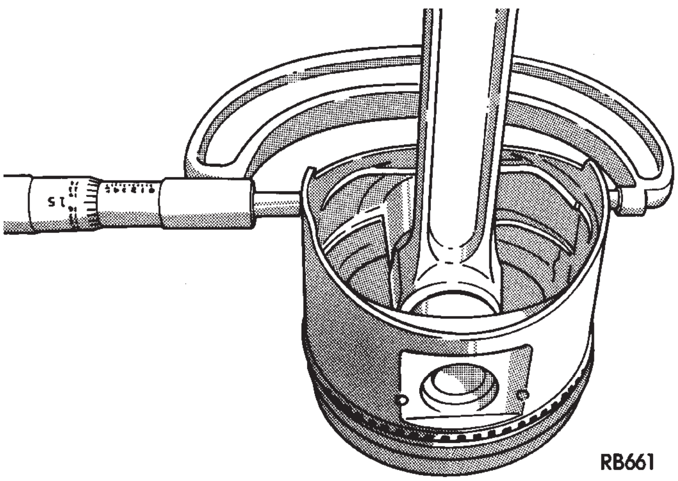


Fig. 5 Measuring Piston for Clearance and Wear

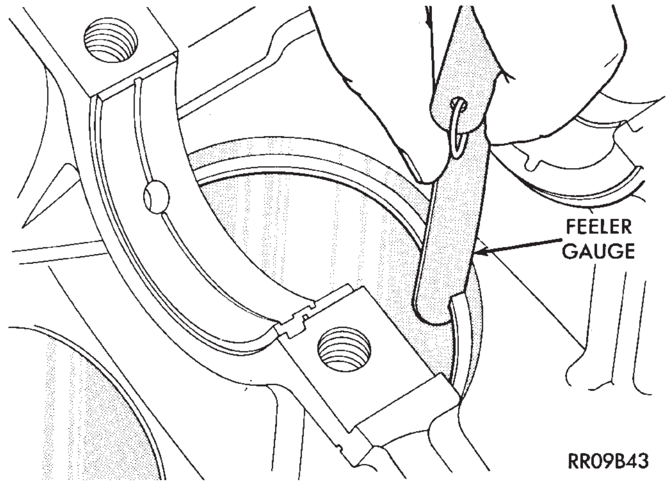


Fig. 6 Check Gap on Piston Rings

FITTING PISTON RINGS

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 16 mm (0.63 in.) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 6). Refer to Piston Ring Specification Chart.

PISTON RING SPECIFICATION CHART

Ring Position	Ring Gap	Ring Gap Wear Limit	Groove Clearance	Maximum Groove Clearance
Upper Ring	0.25 - 0.40 mm (0.010 - 0.016 in.)	0.8 mm (0.031 in.)	0.03 - 0.07 mm (0.0012 - 0.0028 in.)	0.10 mm (0.004 in.)
Intermediate Ring	0.40 - 0.55 mm (0.016 - 0.022 in.)	0.8 mm (0.031 in.)	0.02 - 0.06 mm (0.0007 - 0.0024 in.)	0.10 mm (0.004 in.)
Oil Control Ring	0.15 - 0.50 mm (0.006 - 0.019 in.)	1.0 mm (0.039 in.)	Oil Ring Side Rails Must Be Free To Rotate After Assembly	

SERVICE PROCEDURES (Continued)

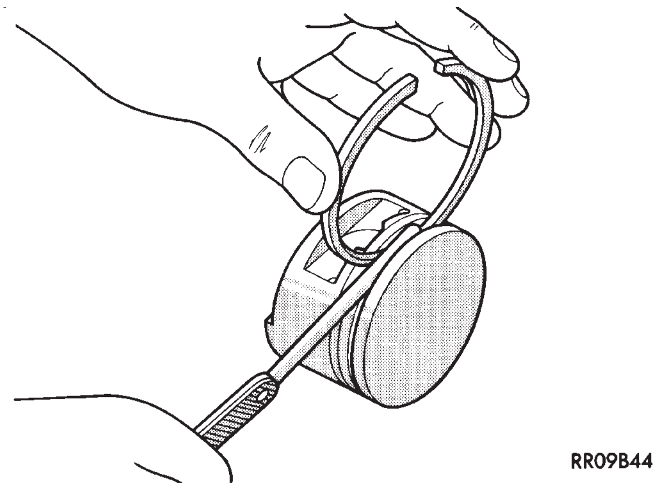


Fig. 7 Piston Ring Groove Clearance

(2) Check piston ring to groove clearance (Fig. 7); Refer to Piston Ring Specification Chart.

PISTON RINGS

(1) The No. 1 and No. 2 piston rings have a different cross section. Install rings with manufacturers mark and size mark facing up, to the top of the piston (Fig. 8).

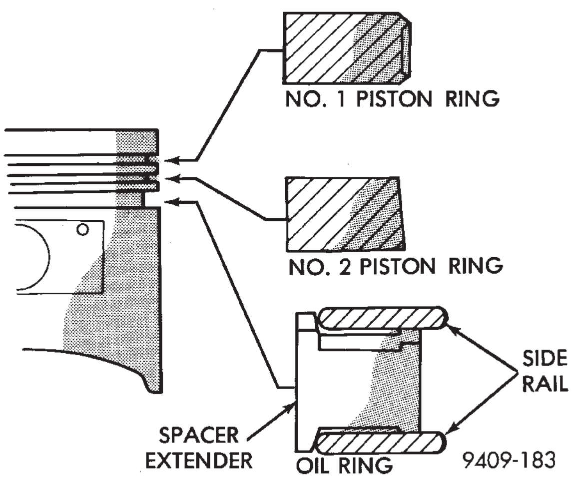


Fig. 8 Piston Ring—Installation

CAUTION: Install piston rings in the following order:

a. Oil ring expander.
b. Upper oil ring side rail.
c. Lower oil ring side rail.
d. No. 2 Intermediate piston ring.
e. No. 1 upper piston ring.

(2) Install the side rails (upper rail first, then lower rail) by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do Not use a piston ring expander** (Fig. 9).

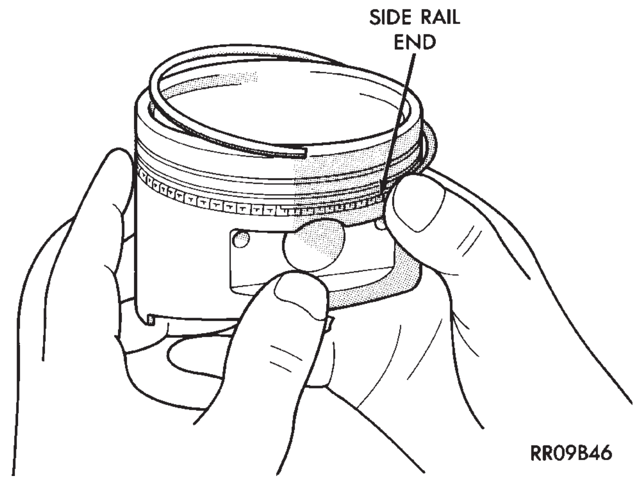


Fig. 9 Side Rail—Installation

(3) Using a piston ring expander, install No. 2 piston ring and then No. 1 piston ring (Fig. 10).

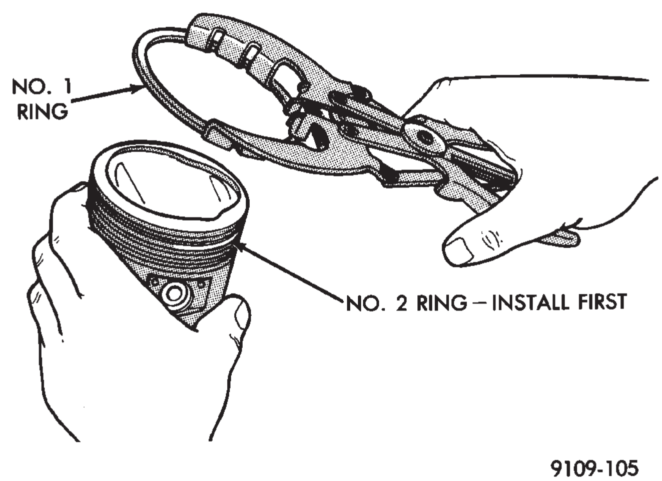


Fig. 10 Upper and Intermediate Rings—Installation

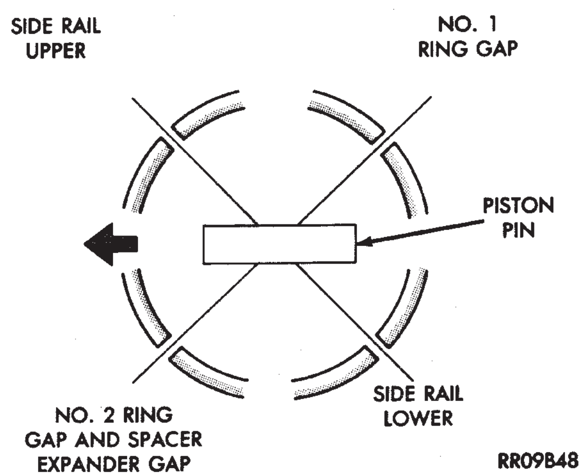


Fig. 11 Piston Ring End Gap Location

(4) Position piston ring end gaps as shown in (Fig. 11).

SERVICE PROCEDURES (Continued)

(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction.

CONNECTING ROD CLEARANCE

(1) Follow the procedures outlined in the Standard Service Procedures Section for Measuring Main Bearing and Connecting Rod Bearing Clearances. (Fig. 12). Refer to Connecting Rod Specification Chart.

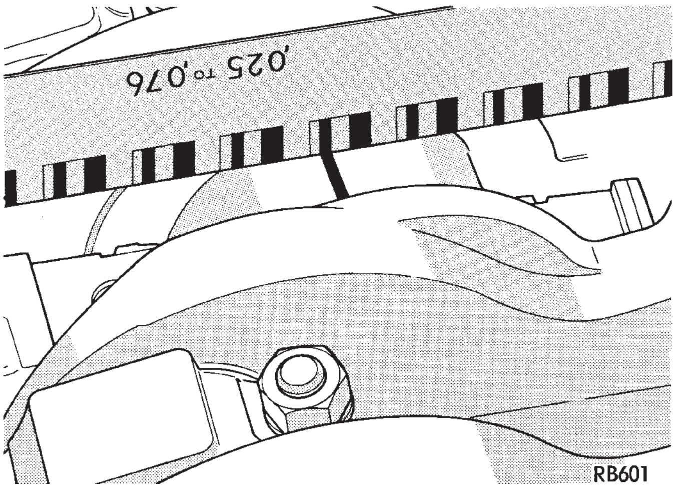


Fig. 12 Checking Connecting Rod Bearing Clearance

(2) Tighten nuts to 51 N·m (37 ft. lbs.).

(3) Remove connecting rod cap and measure Plastigage (Fig. 12).

CAUTION: Do not rotate crankshaft or the Plastigage may be smeared.

CONNECTING ROD SIDE CLEARANCE

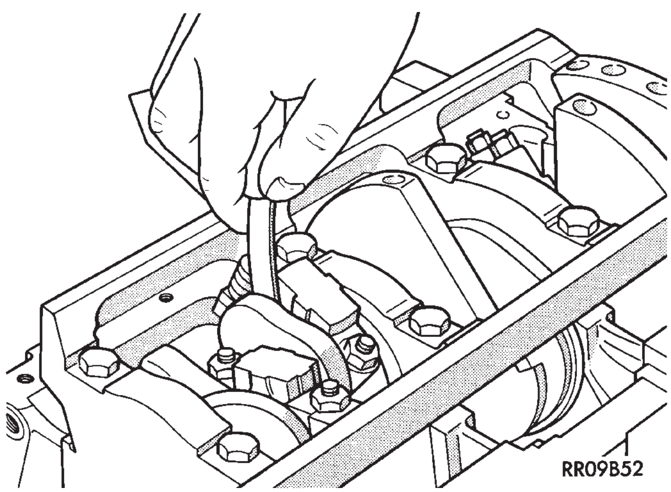


Fig. 13 Checking Connecting Rod Side Clearance

Using a feeler gauge, check connecting rod side clearance (Fig. 13). Refer to Connecting Rod Specification Chart.

CONNECTING ROD SPECIFICATION CHART

Connecting Rod Bearing Oil Clearance	
New Part:	0.016 - 0.046 mm (0.0006 - 0.0018 in.)
Connecting Rod Side Clearance	
New Part:	0.10 - 0.25 mm (0.004 - 0.010 in.)
Wear Limit:	0.4 mm (0.015 in.)

FITTING MAIN BEARINGS

MAIN BEARING JOURNAL MEASUREMENT

Measure the journal outside diameter (Fig. 14). If the clearance exceeds the specifications limit . Replace the main bearing(s) and if necessary replace the crankshaft.

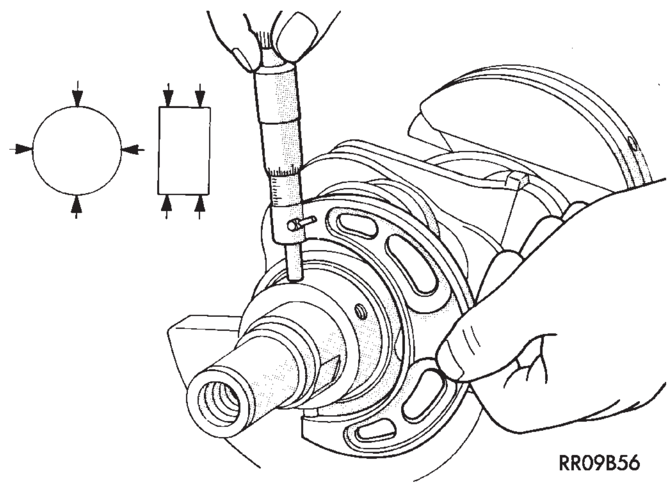


Fig. 14 Measure Crankshaft Journal O.D.

PLASTIGAGE MEASUREMENT

(1) Remove oil from journal and bearing shell.

(2) Install crankshaft.

(3) Cut plastigage to same length as width of the bearing and place it in parallel with the journal axis (Fig. 15).

(4) Install the main bearing cap carefully and tighten the bolts to specified torque.

CAUTION: Do not rotate crankshaft or the plastigage will be smeared.

(5) Carefully remove the bearing cap and measure the width of the plastigage at the widest part using the scale on the plastigage package (Fig. 16). Refer to Crankshaft Specification Chart for proper clearance. Also see Measuring Main and Connecting Rod Bearing Clearances in Standard Service Procedures.

SERVICE PROCEDURES (Continued)

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.05 - 0.25 mm (0.002 - 0.010 in.)
Wear Limit:	0.30 mm (0.012 in.)
Main Bearing Oil Clearance	
New Part:	0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Wear Part:	0.10 mm (0.0039 in.)
Crankshaft Main Bearing Journal	
Standard Diameter:	59.980 mm (2.361 in.)
Crankshaft Connecting Rod Journal	
Standard Diameter:	50.00 mm (1.968 in.)

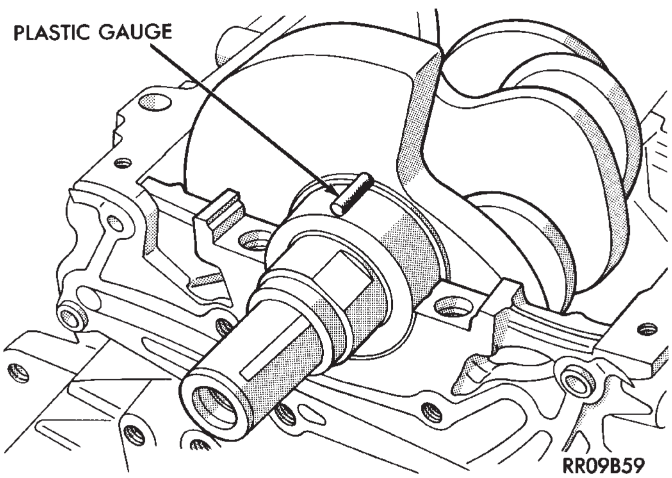


Fig. 15 Measure Oil Clearance with Plastigage

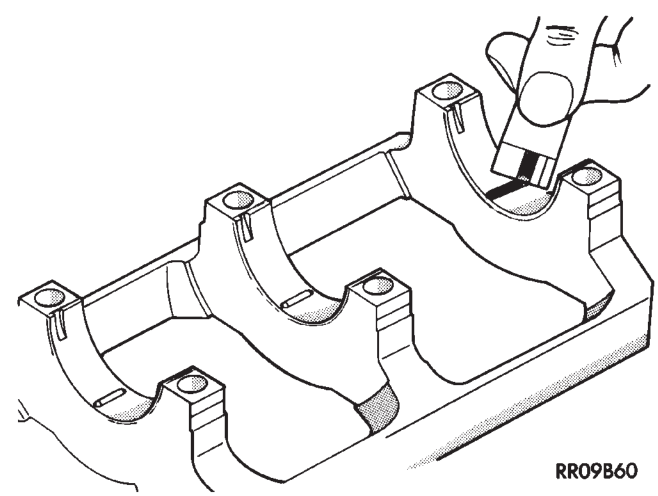


Fig. 16 Measuring Clearance

CRANKSHAFT BEARING INSTALLATION

When the bearings need replacing, select and install the proper bearing by the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the Crankshaft Size Classification Chart. In the case of a bearing supplied as a service part, its identification color is painted at the position show in (Fig. 18).

NOTE: Service Replacement parts have identification marks, but factory-assembled parts have no identification marks. Service crankshaft identification may have marks or paint at counterweights (Fig. 17).

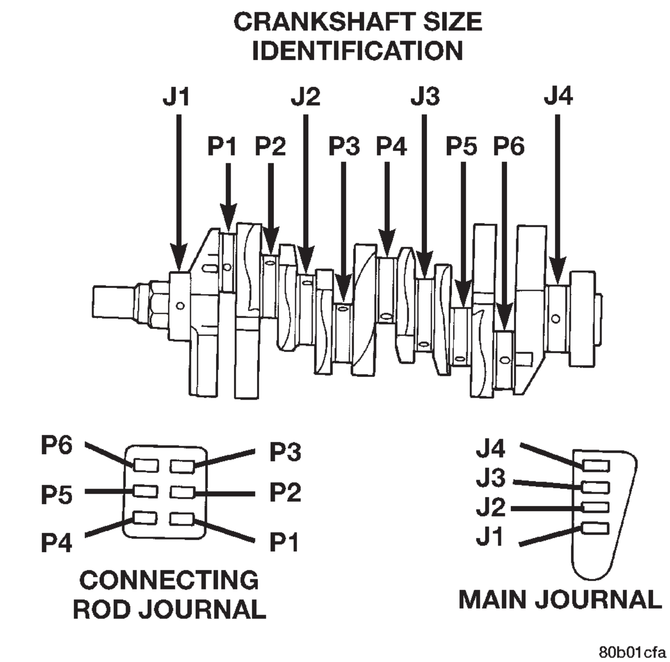


Fig. 17 Crankshaft Size Identification

SIZE	NEW	CURRENT
MAIN JOURNAL		
59.982 - 59.988 mm (2.3615 - 2.3617 in.)	2	WHITE ENAMEL
59.988 - 59.994 mm (2.3617 - 2.3620 in.)	1	NONE
59.994 - 60.000 mm (2.3620 - 2.3622 in.)	0	YELLOW ENAMEL
CONNECTING ROD JOURNAL		
49.980 - 49.985 mm (1.9677 - 1.9679 in.)	III	WHITE ENAMEL
49.985 - 49.995 mm (1.9679 - 1.9683 in.)	II	NONE
49.995 - 50.000 mm (1.9683 - 1.9685 in.)	I	YELLOW ENAMEL

SERVICE PROCEDURES (Continued)

CRANKSHAFT END PLAY

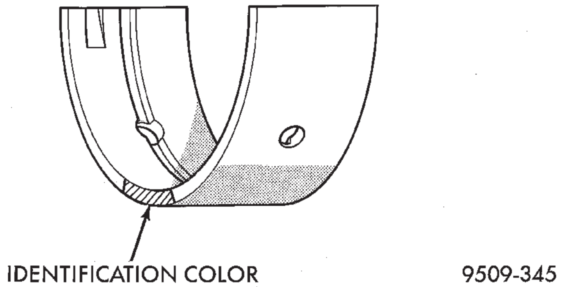


Fig. 18 Bearing Identification

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 19).

(2) Move crankshaft all the way to the rear of its travel.

(3) Zero the dial indicator.

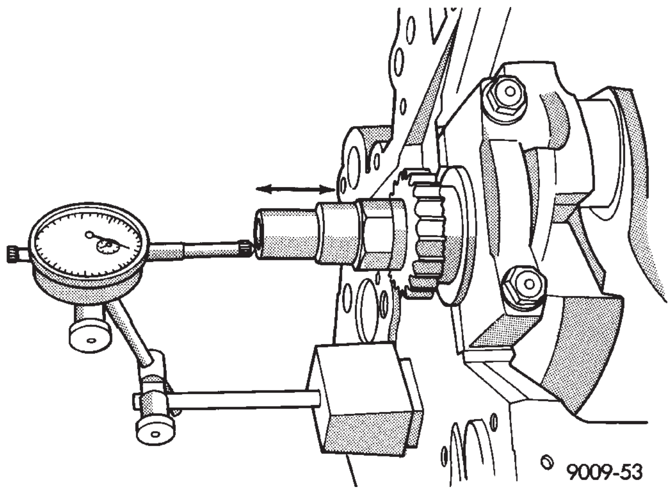


Fig. 19 Crankshaft End Play—Typical

(4) Move crankshaft all the way to the front and read the dial indicator. Refer to Crankshaft Specification Chart.

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft without rocker arm assemblies.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 20).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.1 - 0.2 mm (0.004 - 0.008 in.). Max. Travel: 0.4 mm (0.016 in.)

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.05 - 0.25 mm (0.002 - 0.010 in.)
Wear Limit:	0.30 mm (0.012 in.)
Main Bearing Oil Clearance	
New Part:	0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Wear Part:	0.10 mm (0.0039 in.)
Crankshaft Main Bearing Journal	
Standard Diameter:	59.980 mm (2.361 in.)
Crankshaft Connecting Rod Journal	
Standard Diameter:	50.00 mm (1.968 in.)

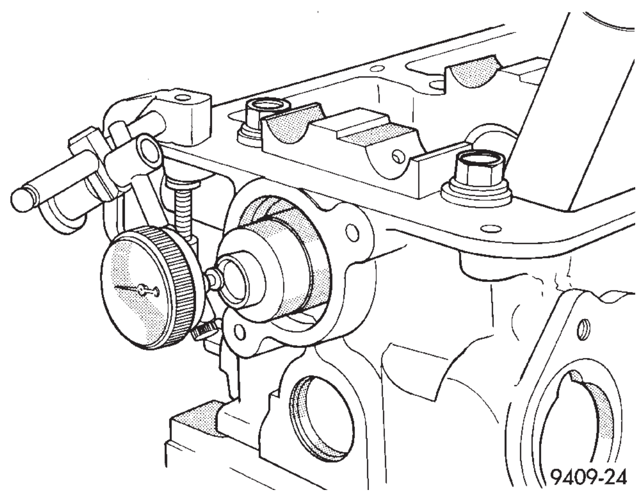


Fig. 20 Camshaft End Play

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT AND REAR

REMOVAL

FRONT MOUNT

(1) Raise vehicle on hoist.

(2) Remove through bolt (A) at front mount (Fig. 22).

(3) Remove attaching bolts from mount to lower radiator support crossmember.

NOTE: It may be necessary to tilt engine for front mount removal clearance.

(4) Remove front mount.

REMOVAL AND INSTALLATION (Continued)

REAR MOUNT

(1) Raise vehicle on hoist.

(2) Remove through bolt (A) from rear engine mount and bracket (Fig. 23).

(3) Remove rear strut bracket (Fig. 21).

(4) Remove bolts attaching rear mount to cross-member.

NOTE: It may be necessary to tilt engine for rear mount removal clearance.

(5) Remove rear mount.

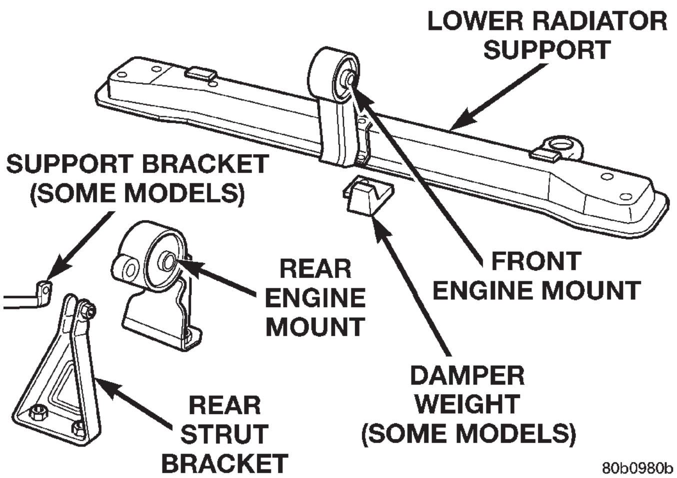


Fig. 21 Engine Mounting—Front and Rear

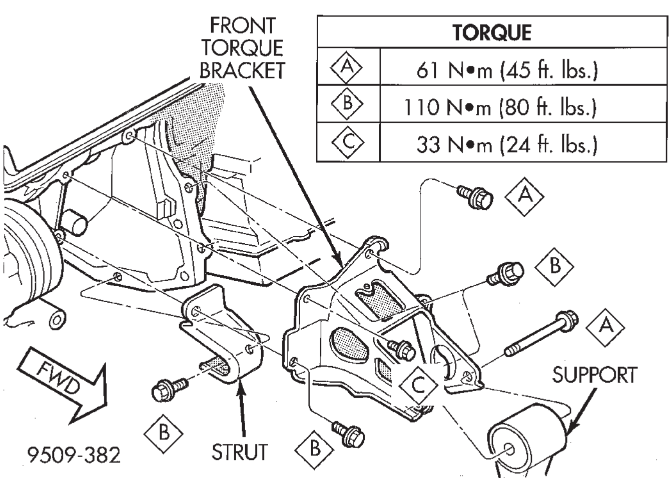


Fig. 22 Engine Mounting—Front 2.5L

INSTALLATION

FRONT MOUNT

(1) Position front mount. Install front mount to lower radiator support crossmember attaching bolts. Tighten bolts to 61 N·m (45 ft. lbs.).

(2) Install through bolt (A) (Fig. 22).

(3) Tighten front through bolt (A) to 61 N·m (45 ft. lbs.) (Fig. 22).

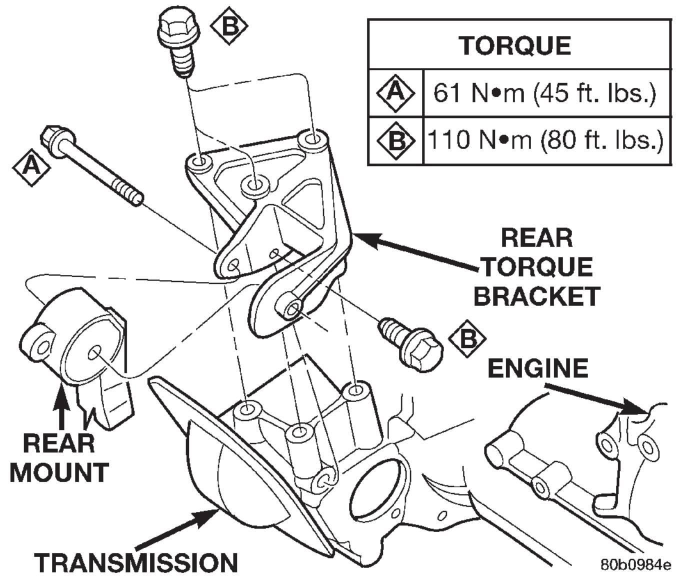


Fig. 23 Engine Mounting—Rear 2.5L

(4) Lower vehicle.

REAR MOUNT

(1) Position rear mount.

(2) Install bolts attaching rear mount to suspension crossmember. Tighten bolts to 61 N·m (45 ft. lbs.).

(3) Install rear strut bracket (Fig. 21). Tighten bolts to 61 N·m (45 ft. lbs.).

(4) Install through bolt (A) and tighten 61 N·m (45 ft. lbs.) (Fig. 23).

(5) Lower vehicle.

ENGINE MOUNT—RIGHT/ENGINE SUPPORT BRACKET

NOTE: The right side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

(1) Raise vehicle on a hoist and remove inner splash. Remove the right engine support assembly vertical fasteners from frame rail (Fig. 24).

(2) Lower vehicle. Remove the load on the engine motor mounts by carefully supporting the engine assembly with a floor jack.

(3) Remove the three bolts attaching the engine support assembly to the engine bracket.

(4) Move the air conditioning dryer aside.

(5) Remove coolant recovery system tank. Refer to Group 7, Cooling System for procedure.

(6) Remove right engine support.

(7) Remove the three bolts attaching the engine support bracket to the cylinder block.

REMOVAL AND INSTALLATION (Continued)

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

(8) Reverse removal procedure for installation. Refer to (Fig. 24) for bolt tightening specifications.

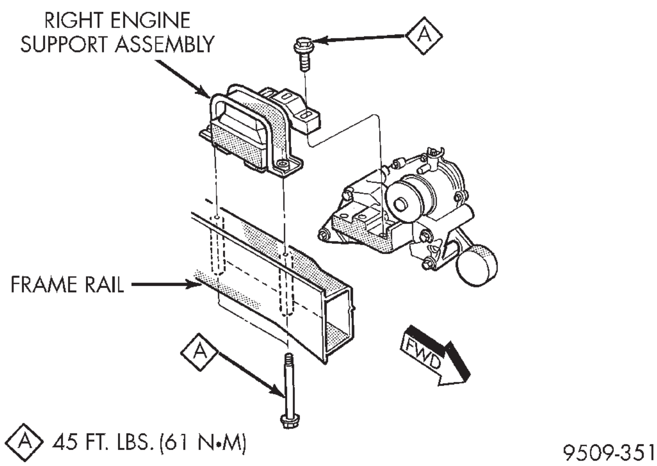


Fig. 24 Engine Mounting—Right Side 2.5L

ENGINE MOUNT—LEFT

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

The left side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

REMOVAL

(1) Support the transmission with a transmission jack.

(2) Remove the three vertical bolts (A) from the mount to the transmission bracket (Fig. 25).

(3) Remove the mount to frame rail fasteners (B) and remove mount (Fig. 25).

INSTALLATION

(1) Install mount. Tighten mount to frame rail fasteners (B) to 33 N·m (24 ft. lbs.).

(2) Install mount to transmission bracket vertical bolts (A). Tighten to 61 N·m (45 ft. lbs.).

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect negative cable from battery remote jumper terminal.

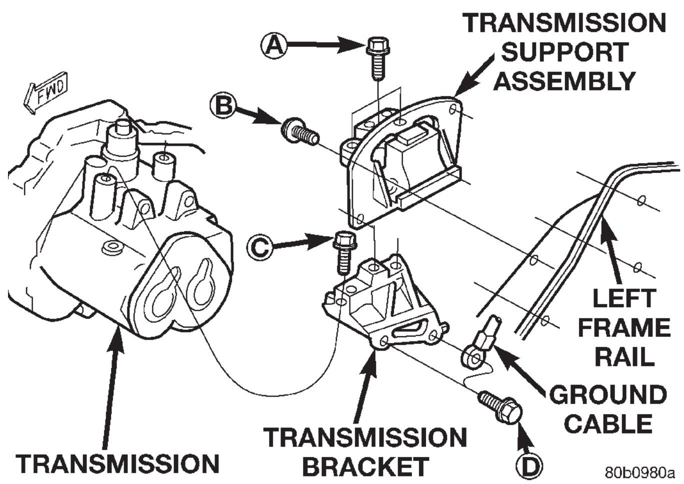


Fig. 25 Left Side Mount—Typical

ITEM	DESCRIPTION	TORQUE
A	Bolt	61 N·m (45 ft. lbs.)
B	Bolt	33 N·m (24 ft. lbs.)
C	Bolt	61 N·m (45 ft. lbs.)
D	Bolt	61 N·m (45 ft. lbs.)

(3) Remove Powertrain Control Module (PCM) attaching screws and set aside.

(4) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(5) Remove upper radiator hose, radiator and fan module. Refer to Group 7, Cooling System for procedure.

(6) Remove lower radiator hose.

(7) Disconnect automatic transaxle cooler lines and plug.

(8) Disconnect transaxle shift linkage.

(9) Disconnect throttle body linkage.

(10) Disconnect engine wiring harness.

(11) Disconnect heater hoses.

(12) Remove refrigerant from air conditioning system using a refrigerant recovery machine. Refer to Group 24, Air Conditioning for procedure.

(13) Hoist vehicle and remove right inner splash shield.

(14) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(15) Remove axle shafts. Refer to Group 2, Suspension and Driveshaft for procedure.

(16) Disconnect exhaust pipe from manifold.

(17) Remove front and rear engine mount through bolts.

(18) Lower vehicle. Remove air cleaner assembly.

REMOVAL AND INSTALLATION (Continued)

(19) Remove power steering pump and reservoir and set them aside.

(20) Remove A/C compressor.

(21) Remove ground straps to body.

(22) Mount Special Tool 6973 bracket, to the right side of the cylinder block (Fig. 26). Align the front adjustable post with the hole in the bracket.

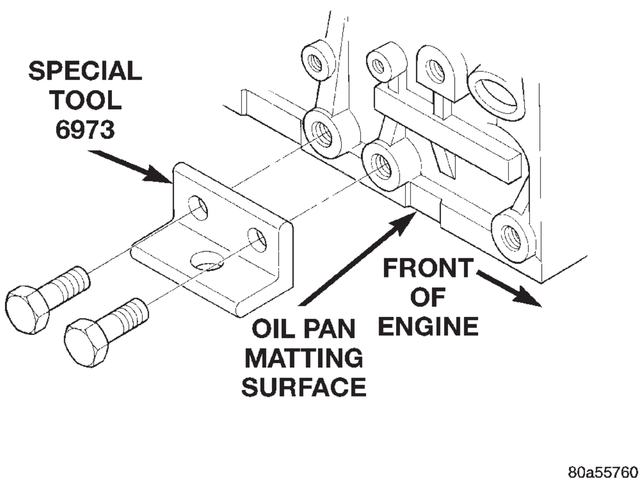


Fig. 26 Bracket for Cradle Post Support

(23) Raise vehicle enough to allow engine dolly and cradle Special Tools 6135 and 6710 to be installed under vehicle (Fig. 27).

(24) Loosen cradle engine mounts to allow movement for positioning onto engine locating holes on the engine bedplate. Lower vehicle and position cradle mounts until the engine is resting on mounts. Tighten mounts to cradle frame. This will keep mounts from moving when removing or installing engine and transaxle.

(25) Lower vehicle so weight of the engine and transaxle ONLY is on the cradle.

(26) Remove engine and transaxle mount bolts.

(27) Raise vehicle slowly. It may be necessary to move the engine/transaxle assembly on the cradle to allow for removal around body flanges.

INSTALLATION

(1) Position engine/transaxle assembly under vehicle and slowly lower the vehicle.

(2) Align engine and transaxle mounts to attaching points. Install mounting bolts at the right engine and left transaxle mounts. Refer to procedures outlined in this section.

(3) Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135 and 6710.

(4) Remove Special Tool 6973 bracket from engine.

(5) Install axle shafts. Refer to Group 2, Suspension and Driveshaft for procedure.

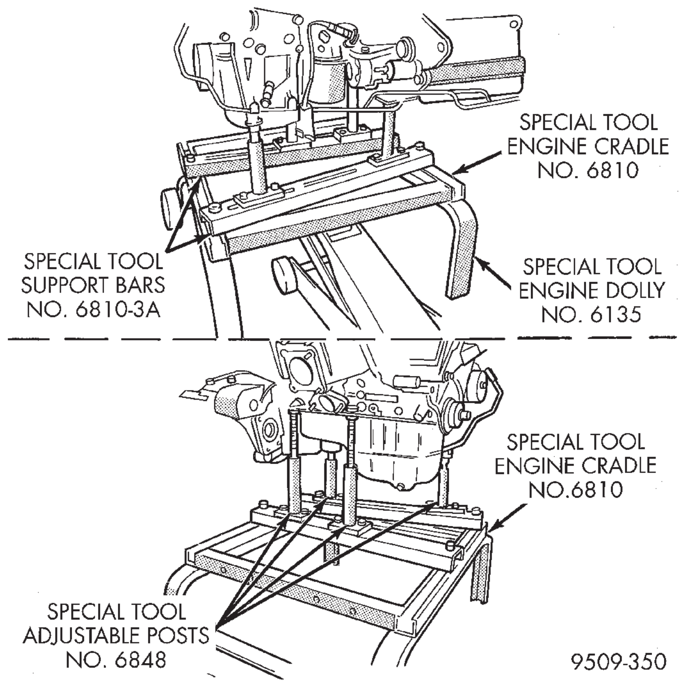


Fig. 27 Positioning Engine Cradle Support Post Mounts

(6) Install transaxle and engine braces.

(7) Connect exhaust system to manifold. Refer to Group 11, Exhaust System and Intake Manifold for procedure and torque specifications.

(8) Install power steering pump and reservoir. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(9) Install A/C compressor and hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(10) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(11) Install front and rear engine mounts. Refer to this section for procedure.

(12) Install inner splash shield. Install wheels and tires.

(13) Connect automatic transaxle cooler lines and shifter linkage. Refer to Group 21, Transaxle for procedures.

(14) Connect fuel line and heater hoses.

(15) Install ground straps. Connect engine and throttle body connections and wiring harnesses. Refer to Group 8, Electrical for procedure.

(16) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(17) Install radiator and shroud assembly . Install radiator hoses. Fill cooling system. See Group 7, Cooling System for filling procedure.

(18) Connect battery and install Powertrain Control Module (PCM) into place.

(19) Install air cleaner and hoses.

REMOVAL AND INSTALLATION (Continued)

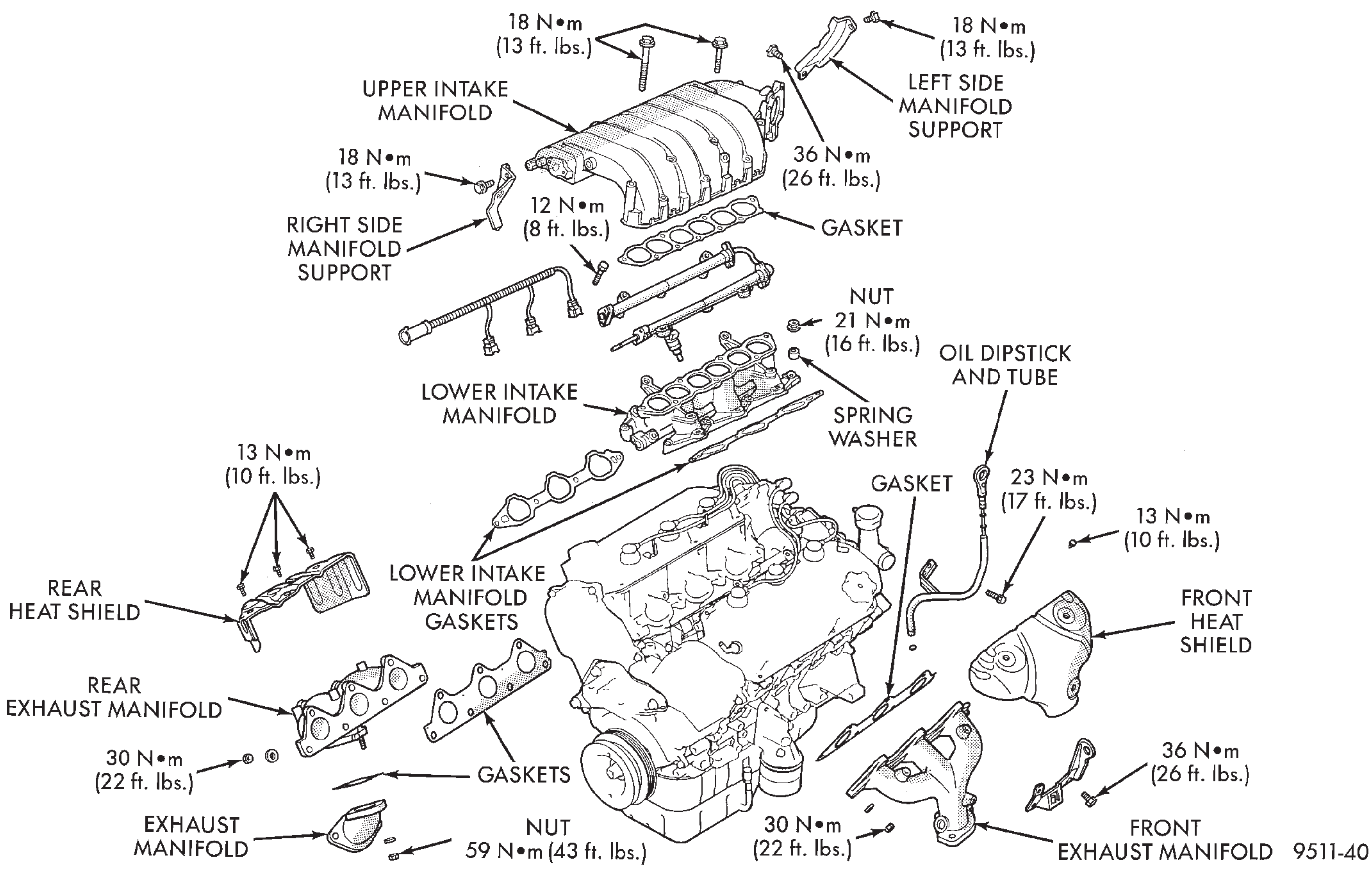


Fig. 28 Intake and Exhaust Manifolds—2.5L Engine

(20) Install oil filter. Fill engine crankcase with proper oil to correct level.

(21) Evacuate and charge air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedures.

(22) Start engine and run until operating temperature is reached.

(23) Adjust transaxle linkage, if necessary.

INTAKE MANIFOLD/PLENUM

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal (Fig. 29).

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(2) Release fuel system pressure. Refer to Fuel System Pressure Release procedure in this section.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

(3) Disconnect fuel supply tube from rail. Refer to Group 14, Fuel System for procedure.

(4) Unplug connectors from MAP and intake air temperature sensors (Fig. 31).

(5) Remove plenum support bracket bolt located rearward of MAP sensor (Fig. 31).

(6) Remove bolt holding air inlet resonator to intake manifold (Fig. 30).

(7) Loosen throttle body air inlet hose clamp.

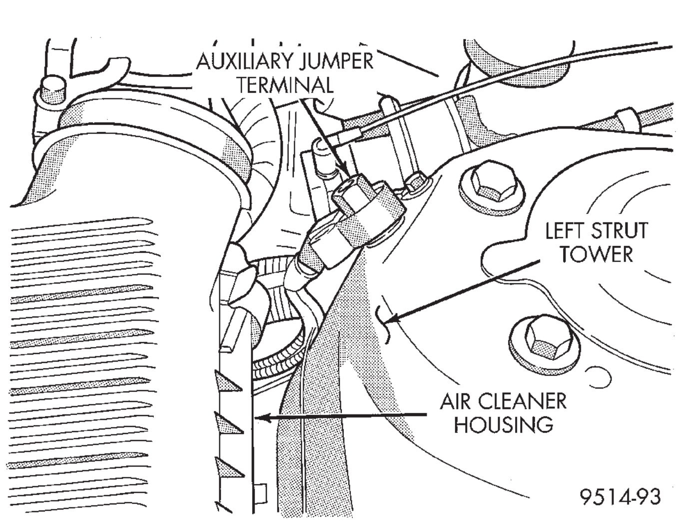


Fig. 29 Auxiliary Jumper Terminal

REMOVAL AND INSTALLATION (Continued)

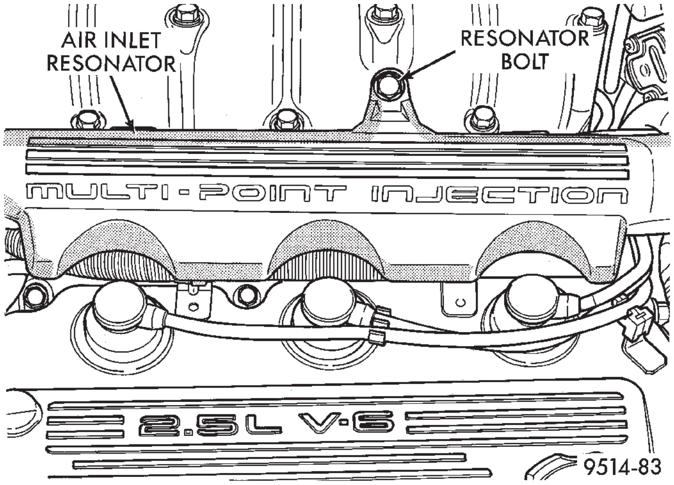


Fig. 30 Air Inlet Resonator

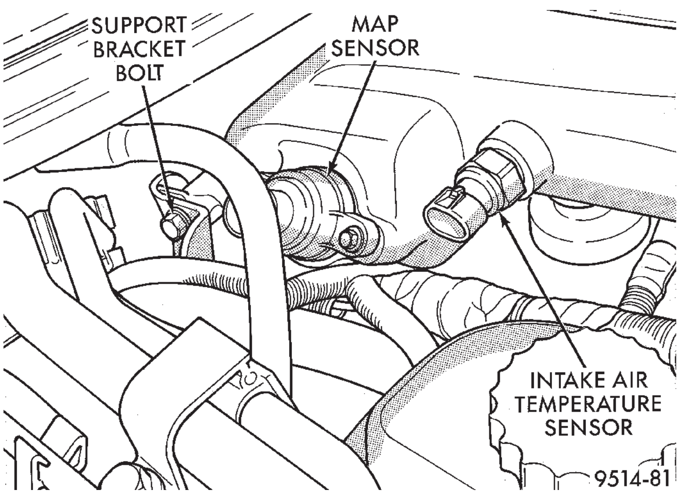


Fig. 31 Intake Manifold Sensors and Left Manifold Support Bolt

(8) Release snaps holding air cleaner housing cover to housing.

(9) Remove air cleaner cover and inlet hoses from engine.

(10) Unplug TPS and idle air control motor connectors (Fig. 32) and (Fig. 33).

(11) Squeeze retainer tab on throttle cable and slide cable out of bracket (Fig. 34).

(12) Slide speed control cable out of bracket, if equipped (Fig. 34).

(13) Remove EGR tube from intake manifold and discard gasket (Fig. 35).

(14) Remove plenum support bracket bolt located rearward of EGR tube (Fig. 35).

(15) Remove 7 bolts holding upper intake plenum and remove plenum (Fig. 28).

(16) Disconnect electrical connectors from fuel injectors.

(17) Remove 4 bolts holding fuel rail (Fig. 36).

(18) Lift fuel rail off engine. **There are spacers under each fuel rail bolt (Fig. 37).**

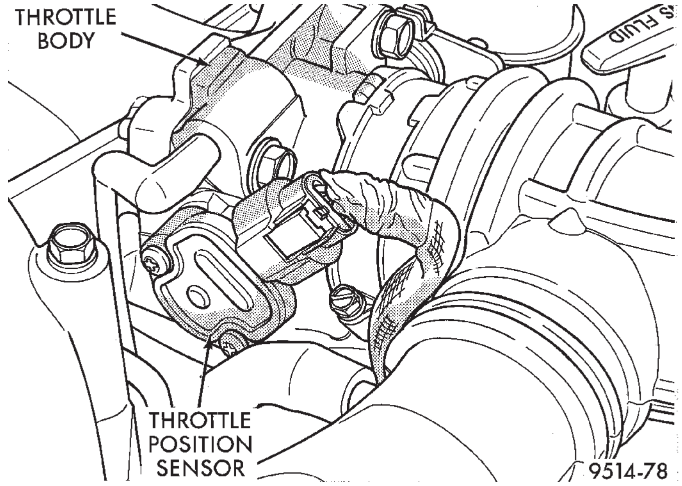


Fig. 32 Throttle Position Sensor

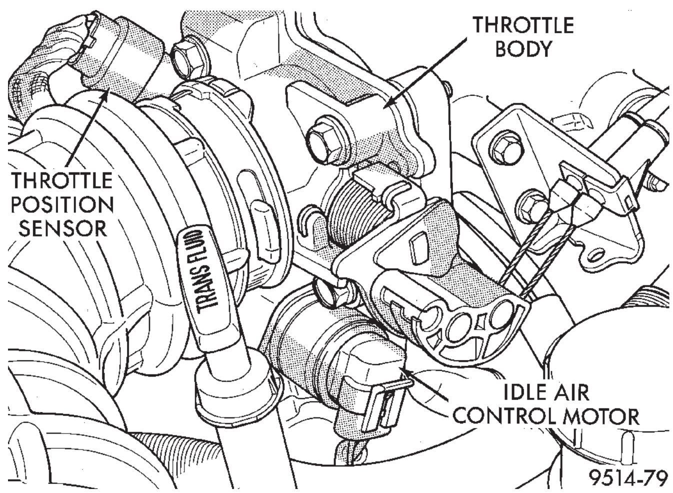


Fig. 33 Idle Air Control Motor

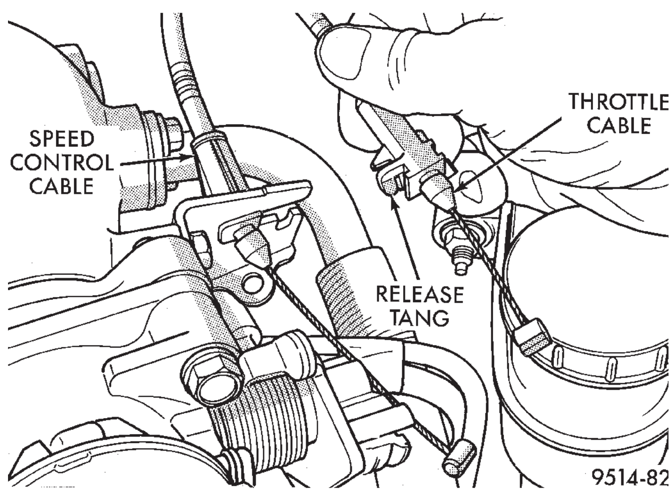


Fig. 34 Throttle Cable Attachment

(19) Remove lower intake manifold attaching bolts. Remove intake manifold.

REMOVAL AND INSTALLATION (Continued)

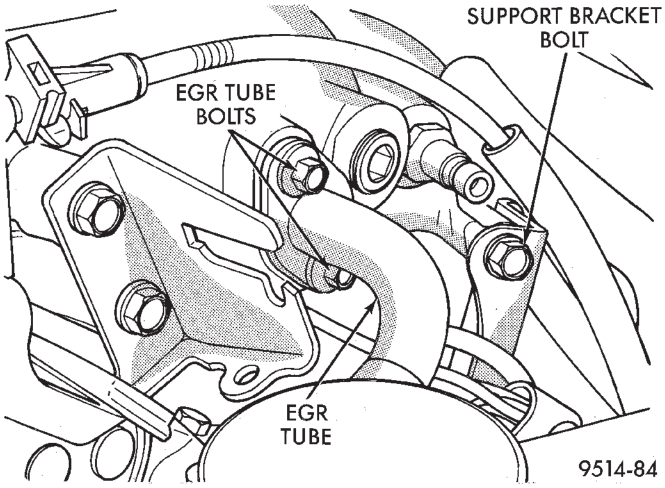


Fig. 35 EGR Tube and Right Manifold Support Bolt

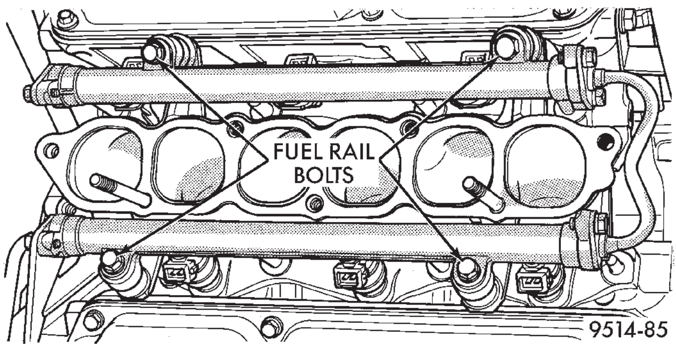


Fig. 36 Fuel Rail Attachment

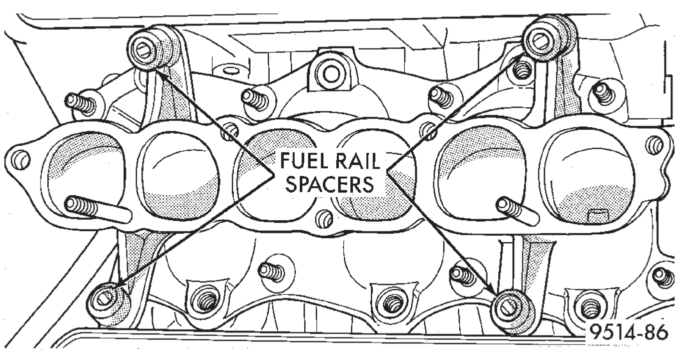


Fig. 37 Fuel Rail Spacers

INSTALLATION

(1) Install intake manifold with new gaskets. Tighten in sequence shown in (Fig. 38) to 21 N·m (185 in. lbs.).

(2) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

(3) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail bolts to 12 N·m (8 ft. lbs.).

(4) Attach electrical connectors to fuel injectors.

(5) Connect fuel supply tube to fuel rail. Refer to Group 14, Fuel System for procedure.

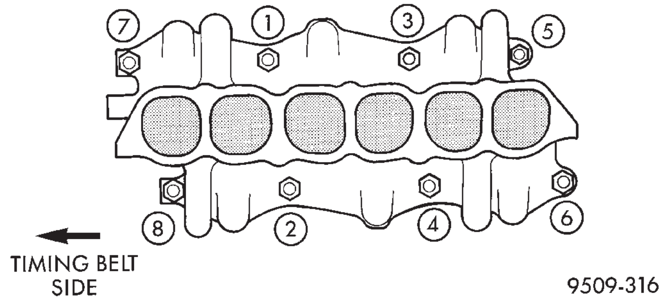


Fig. 38 Intake Manifold Tightening Sequence

(6) Install new gasket and position upper intake plenum to lower manifold. Install plenum bolts and tighten to 18 N·m (13 ft. lbs.).

(7) Install bolts at plenum support brackets. Tighten bolts to 18 N·m (13 ft. lbs.).

(8) Install EGR tube with new gasket to plenum. Tighten EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs.).

(9) Install throttle and speed control cables.

(10) Attach electrical connectors to sensors.

(11) Tighten air inlet tube clamps to 3 N·m ±1 (25 in. lbs. ±5).

(12) Connect negative cable to auxiliary jumper terminal.

EXHAUST MANIFOLDS

REMOVAL

(1) Raise vehicle and disconnect exhaust pipe from rear (cowl side) exhaust manifold at flex-joint. It may be necessary to remove the entire exhaust system. Refer to Group 11, Exhaust System for procedure.

(2) Remove bolts attaching cross-under pipe to manifolds (Fig. 39). Remove assembly.

(3) Remove heat shield from rear exhaust manifold (Fig. 40).

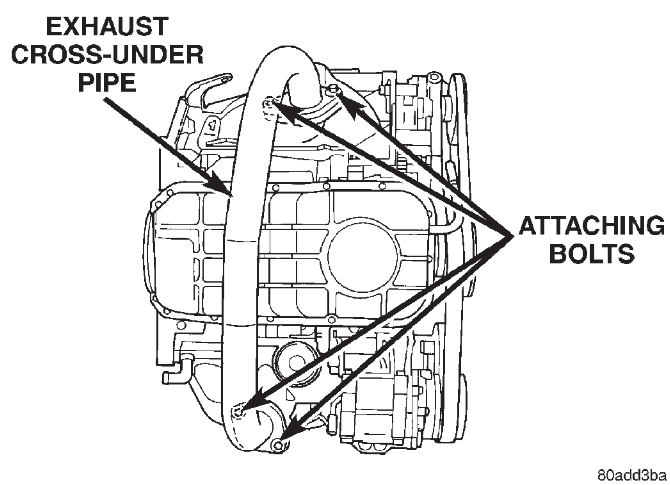


Fig. 39 Cross-Under Pipe Attaching Bolts

REMOVAL AND INSTALLATION (Continued)

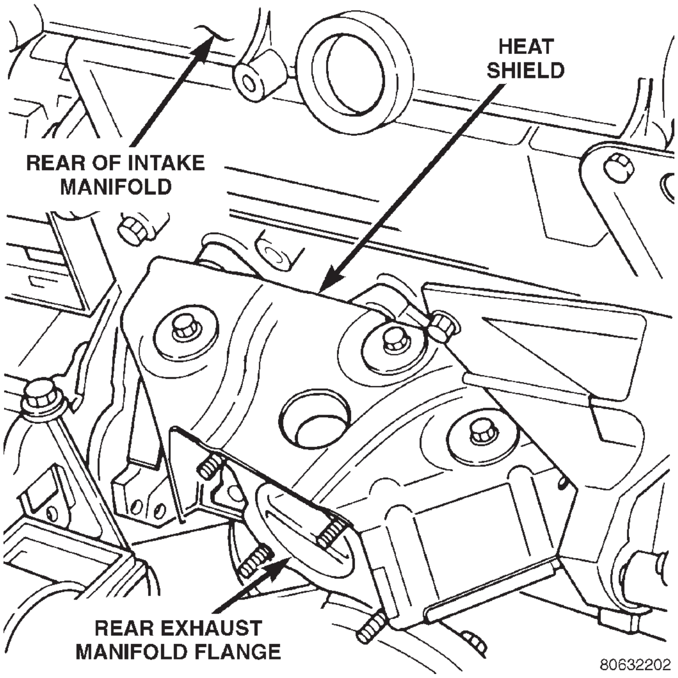


Fig. 40 Rear Exhaust Manifold—2.5L Engine

(4) Remove power steering pump bracket. Refer to Group 19, Steering for procedure.

(5) Remove nuts attaching rear manifold to cylinder head and remove manifold.

(6) Lower vehicle and remove screws attaching front heat shield to front manifold (Fig. 28).

INSTALLATION

(1) Position new exhaust manifold gasket onto rear cylinder head.

(2) Install the rear exhaust manifold and tighten attaching nuts to 30 N·m (22 ft. lbs.).

(3) Install rear exhaust manifold heat shield and tighten fastener to 13 N·m (115 in. lbs.).

(4) Install Power Steering Pump bracket to engine. Refer to Group 19, Steering for procedure.

(5) Attach the flex-joint to exhaust manifold and tighten fasteners to 28 N·m (250 in. lbs.).

(6) Connect rear heated oxygen sensor electrical connector.

(7) Attach cross-under pipe to exhaust manifold and tighten fasteners to 31 N·m (275 in. lbs.).

(8) Position new exhaust manifold gasket onto front cylinder head.

(9) Install front exhaust manifold and attach exhaust cross-under pipe tighten fastener to 31 N·m (275 in. lbs.).

(10) Install front manifold heat shield and tighten attaching screws to 15 N·m (130 in. lbs.).

CYLINDER HEAD COVERS

FRONT CYLINDER HEAD COVER

REMOVAL

(1) Disconnect and relocate spark plug cables and wiring harness.

(2) Remove cylinder head cover fasteners and remove cover (Fig. 41).

INSTALLATION

NOTE: Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

(1) Clean cylinder head and cover mating surfaces. Install new gasket.

(2) Install cover and tighten cover bolt washer and gasket assembly to 10 N·m (88 in. lbs.).

(3) Connect spark plug cables and wiring harness.

REAR CYLINDER HEAD COVER

REMOVAL

(1) Remove intake manifold plenum. Refer to procedure in this section.

(2) Cover lower intake manifold with a suitable cover during service.

(3) Disconnect and relocate spark plug cables.

(4) Remove cylinder head cover fasteners and remove cover (Fig. 41).

INSTALLATION

NOTE: Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

(1) Clean cylinder head and cover mating surfaces. Install new gasket.

(2) Install cover and tighten cover bolt washer and gasket assembly to 10 N·m (88 in. lbs.).

(3) Connect spark plug cables.

(4) Install intake manifold plenum. Refer to procedure in this section.

SPARK PLUG TUBE SEALS

The spark plug tube seals are located on the end of each tube (Fig. 42). These seals slide onto each tube to seal the cylinder head cover to spark plug tube. If these seals show signs of hardness and/or cracks they should be replaced.

REMOVAL AND INSTALLATION (Continued)

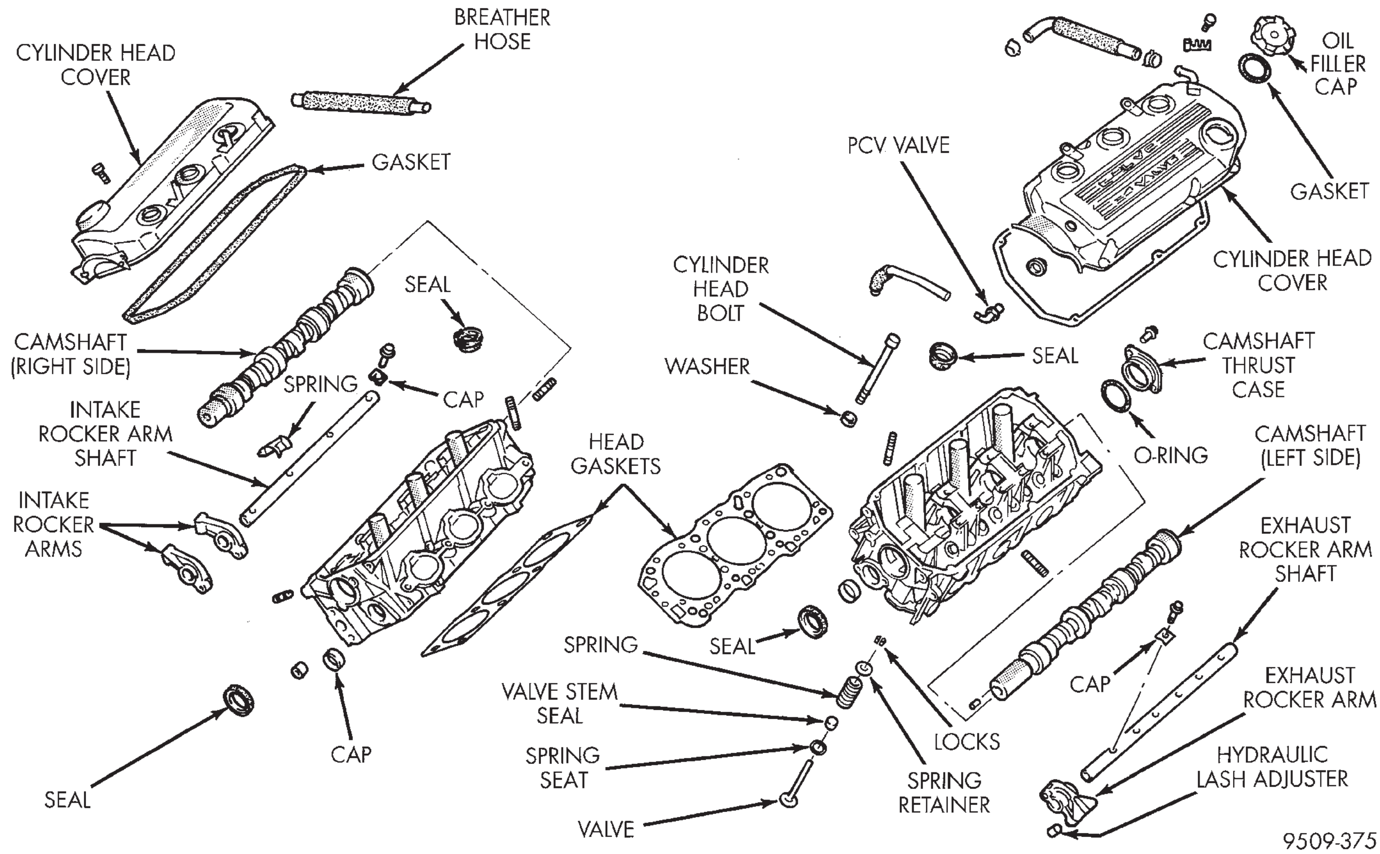


Fig. 41 Cylinder Head Components

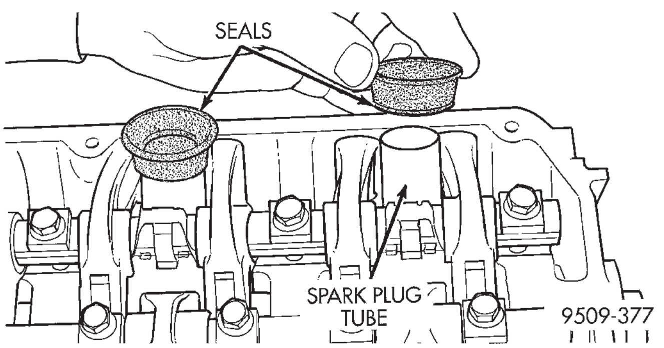


Fig. 42 Spark Plug Tube Seal

CYLINDER HEAD

REMOVAL

(1) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(2) Remove timing belt and camshaft sprockets. Refer to procedures in this section.

(3) Remove intake manifold/plenum assembly. Refer to procedure in this section.

(4) Remove cylinder head covers and rocker arm assemblies. Refer to procedure in this section.

(5) Remove distributor. Refer to Group 8D, Ignition System for procedure.

(6) Remove exhaust manifolds and cross-under pipe. Refer to procedure in this section.

(7) Remove cylinder head bolts and remove cylinder head(s).

INSTALLATION

CAUTION: When cleaning cylinder head surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground, Use ONLY a wooden or plastic scraper.

(1) Clean surfaces of cylinder head and block. Install new head gasket over locating dowels.

(2) Install cylinder head on locating dowels.

(3) Install 10 mm Allen hex head bolts with washers.

CAUTION: Attach the head bolt washer in the direction shown in (Fig. 43).

(4) Tighten bolts in the order shown in (Fig. 44). When tightening the cylinder head bolts, tighten gradually, working in two or three steps and finally tighten to specified torque of 108 N·m (80 ft. lbs.).

(5) Install exhaust cross-under pipe and connect exhaust system to manifold flange.

REMOVAL AND INSTALLATION (Continued)

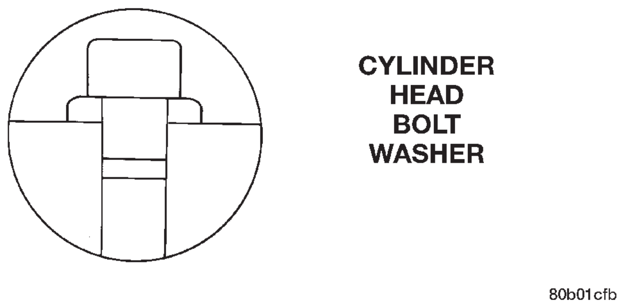


Fig. 43 Cylinder Head Bolt Washer

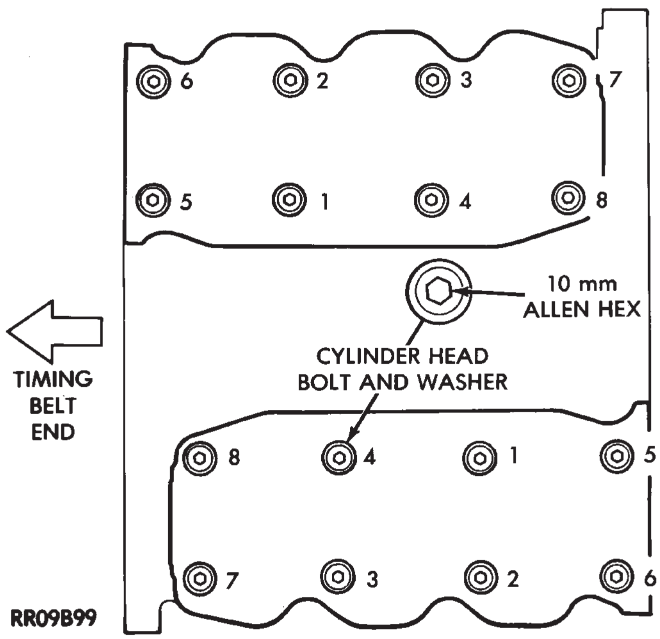


Fig. 44 Cylinder Head Bolt Tightening Sequence

(6) Install distributor. Refer to Group 8D, Ignition System for procedure.

(7) Install cylinder head covers. Refer to procedure in this section.

(8) Install intake manifold/plenum assembly. Refer to procedure in this section.

(9) Install camshaft sprockets and timing belt. Refer to procedures in this section.

(10) Fill cooling system. Refer to Group 7, Cooling System for procedure.

ROCKER ARM AND HYDRAULIC ADJUSTER

REMOVAL

(1) Remove cylinder head cover(s). Refer to procedure in this section.

(2) Identify the rocker arm shaft assemblies before removal.

(3) Install auto lash adjuster retainers, Special Tool MD-998443 onto rocker arms (Fig. 45). These

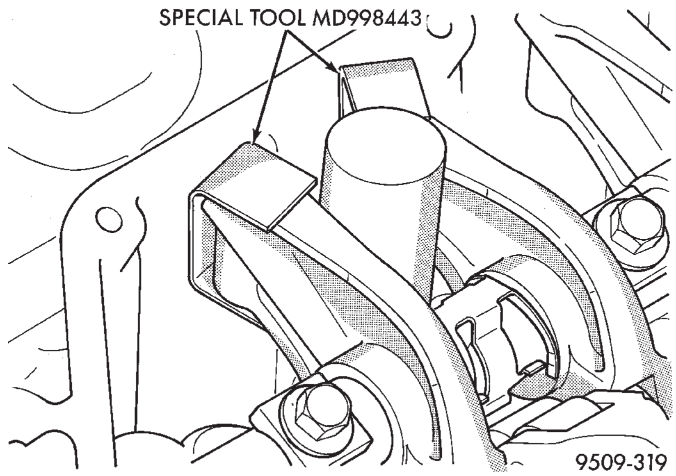


Fig. 45 Auto Lash Adjuster Retainers

retainers hold the lash adjusters into position when the rocker arms are serviced.

(4) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.

(5) Mark rocker arm/hydraulic lash adjuster assemblies for reassembly in their original position. Remove rocker arm/hydraulic lash adjuster assembly. Lash adjusters are serviced as an assembly with the rocker arm (Fig. 46).

NOTE: The automatic lash adjusters are precision units installed in machined openings in the valve actuating ends of the rocker arms. Do not disassemble the auto lash adjuster.

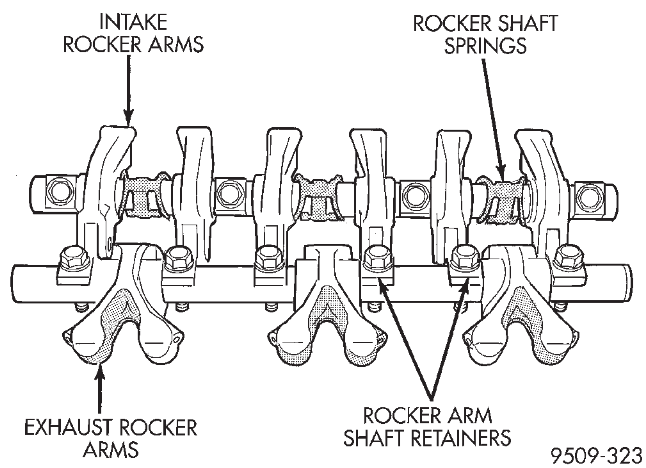


Fig. 46 Rocker Arm Shafts

INSTALLATION

(1) Install rocker arm and shafts with the FLAT on the shafts facing the timing belt side of the right cylinder head (Fig. 47). For the left cylinder head, install rocker arm and shafts with the FLAT on the shafts facing the transmission side of the engine.

REMOVAL AND INSTALLATION (Continued)

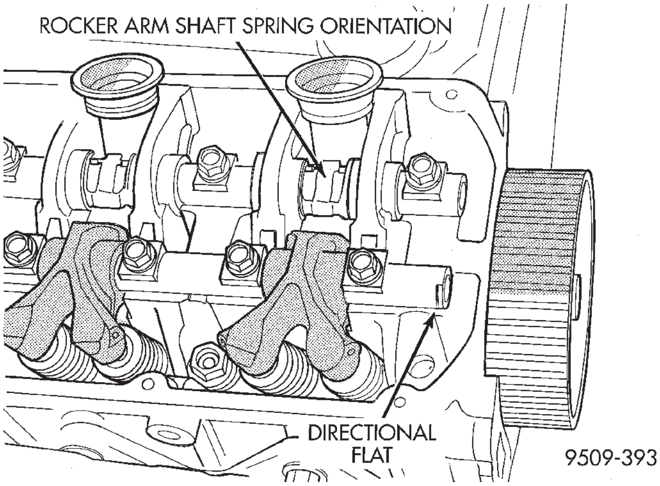


Fig. 47 Rocker Arm Shaft Flat

Install the retainers and spring clips in their original positions on the exhaust and intake shafts (Fig. 46).

(2) Tighten bolts to 31 N·m (276 in. lbs.) in sequence shown in (Fig. 48).

(3) Remove auto lash adjuster retainers Special Tool MD-998443 from rocker arms.

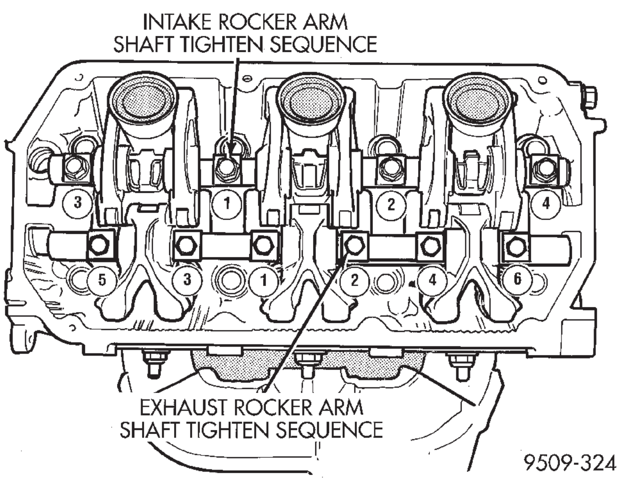


Fig. 48 Rocker Arm Shaft Tightening Sequence

(4) Install cylinder head cover(s). Refer to procedure in this section.

CAMSHAFT

REMOVAL

NOTE: Cylinder head must be removed for camshaft replacement.

(1) Remove intake manifold/plenum and cylinder head covers. Refer to procedures in this section.

(2) Install auto lash adjuster retainers Special Tool MD-998443 (Fig. 49). These retainers hold the lash adjuster into position when the rocker arms are serviced.

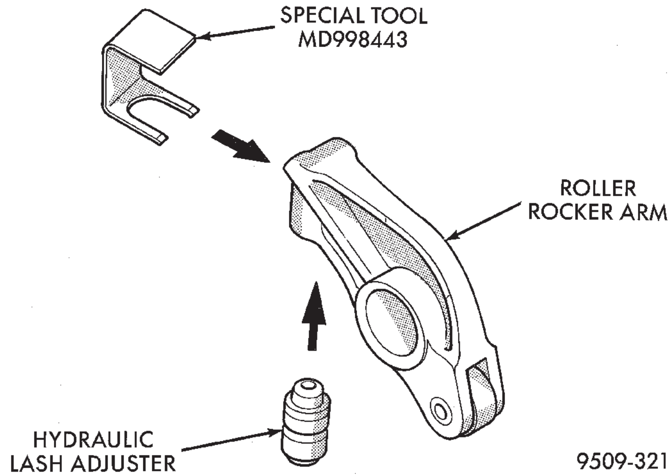


Fig. 49 Retainer Auto Lash Adjuster

(3) Mark rocker arm shaft assemblies for installation.

(4) Remove rocker arm shaft bolts. Refer to procedure in this section.

(5) Remove the timing belt and camshaft sprocket. Refer to procedures in this section.

(6) Remove cylinder head retaining bolts.

(7) Remove cylinder head(s) from vehicle.

(8) Remove thrust case from front (left side) cylinder head assembly. Remove camshaft from the rear of the head (Fig. 50).

(9) Remove distributor (if not previously removed) from rear (right side) cylinder head assembly. Remove camshaft from rear of the head (Fig. 50).

INSTALLATION

(1) Lubricate camshaft journals. Install camshaft(s) into the cylinder head(s) carefully (Fig. 50).

(2) Install thrust case on front (left side) cylinder head and tighten fasteners to 13 N·m (108 in. lbs.) (Fig. 50).

(3) Install camshaft seal(s). Camshaft must be installed before the camshaft seal is installed. Refer to procedure in this section.

(4) Install camshaft sprocket(s) and tighten to 88 N·m (65 ft. lbs.).

(5) Install timing belt. Refer to procedure in this section.

(6) Install rocker arm assemblies in correct order as removed. Tighten the rocker arm assemblies in sequence shown in (Fig. 51) to 31 N·m (276 in. lbs.).

(7) Remove Special Tools MD-998443, auto lash adjuster retainers.

(8) Install cylinder head covers and intake manifold/plenum. Refer to procedures in this section.

CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft without rocker arm assemblies.

REMOVAL AND INSTALLATION (Continued)

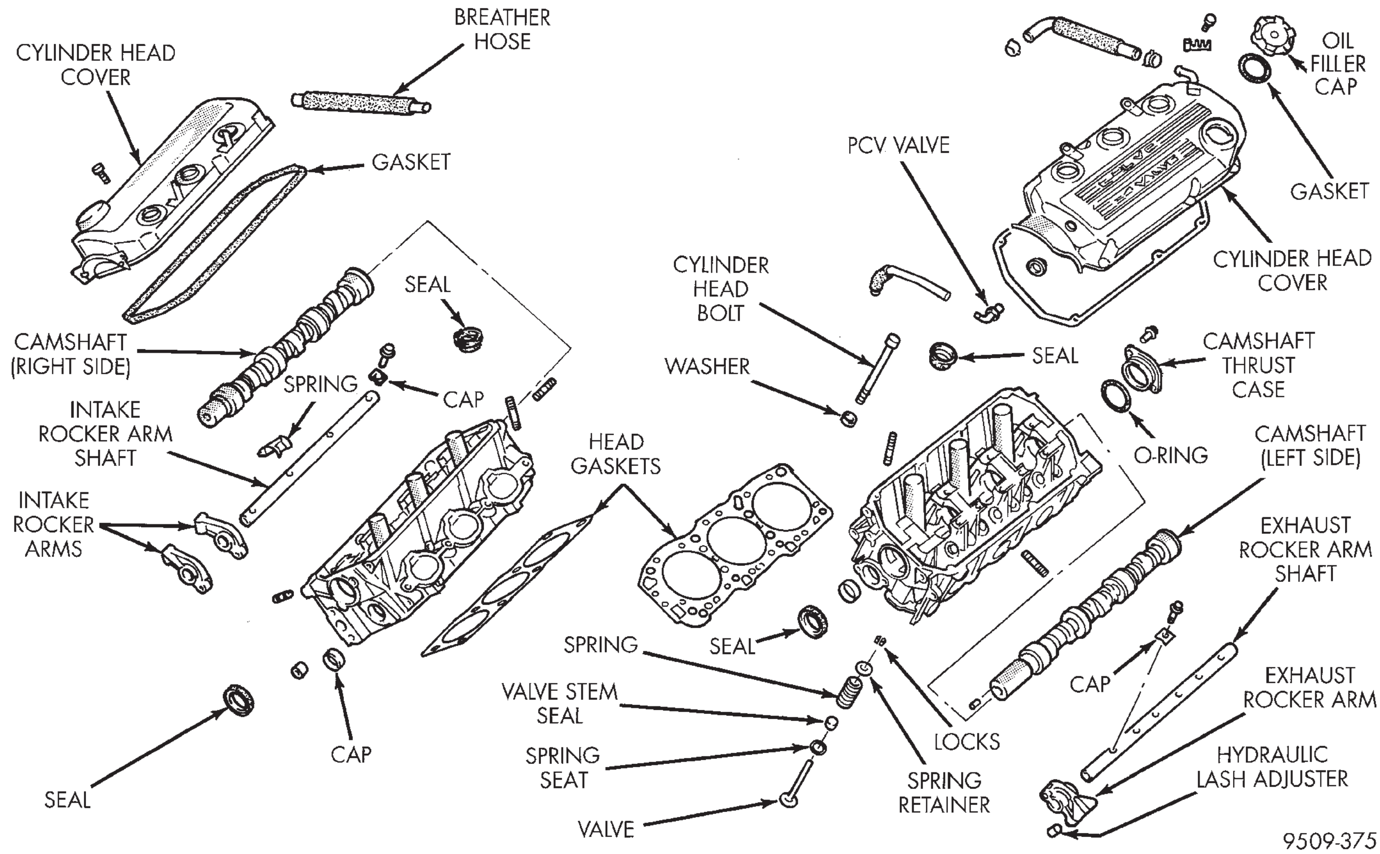


Fig. 50 Cylinder Head Components

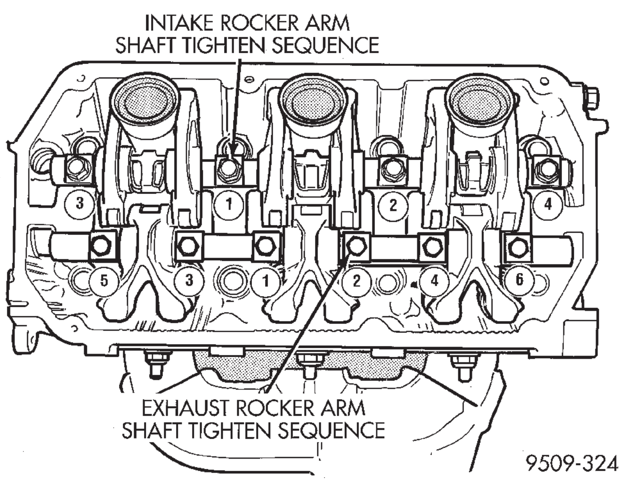


Fig. 51 Rocker Arm Shaft Tightening Sequence

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 52).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.1 - 0.2 mm (0.004 - 0.008 in.). Max. Travel: 0.4 mm (0.016 in.).

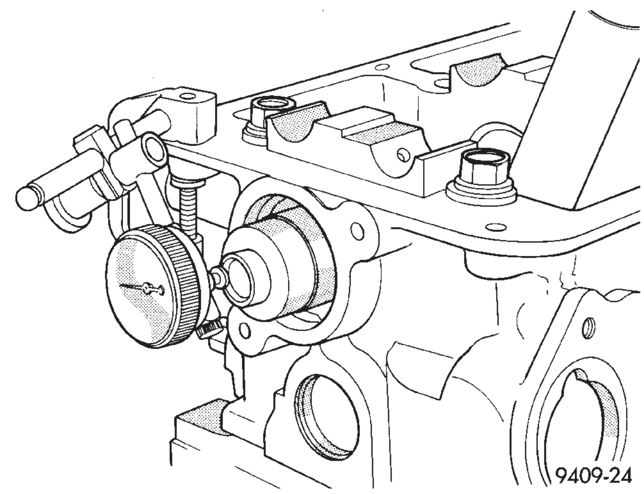


Fig. 52 Camshaft End Play

VALVE SPRINGS AND SEALS—IN VEHICLE SERVICE

REMOVAL

(1) Remove cylinder head cover(s). Refer to procedure in this section.

(2) Remove rocker arm shaft assemblies. Refer to procedure in this section.

REMOVAL AND INSTALLATION (Continued)

(3) Rotate crankshaft until piston is at TDC on compression stroke.

(4) Remove spark plug from applicable cylinder.

(5) Using a air hose attached to an adapter tool, install it into the spark plug hole. Apply 90-120 psi air pressure.

(6) Use Special Tool MD-998772A with Mounting Post 6886, Forcing Screw Arm 6887, Forcing Screw 6765 and Adapter 6885 (Fig. 53) to compress valve springs and remove valve locks.

(7) Remove valve spring.

(8) Remove valve stem seals with suitable tool (Fig. 54).

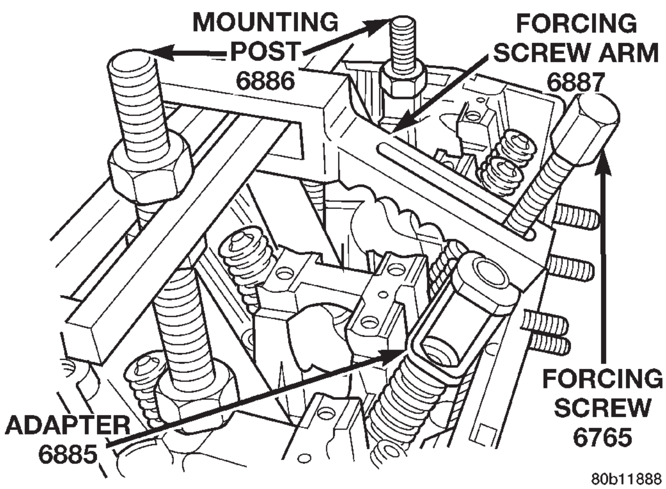


Fig. 53 Valve Springs—Removing and Installing

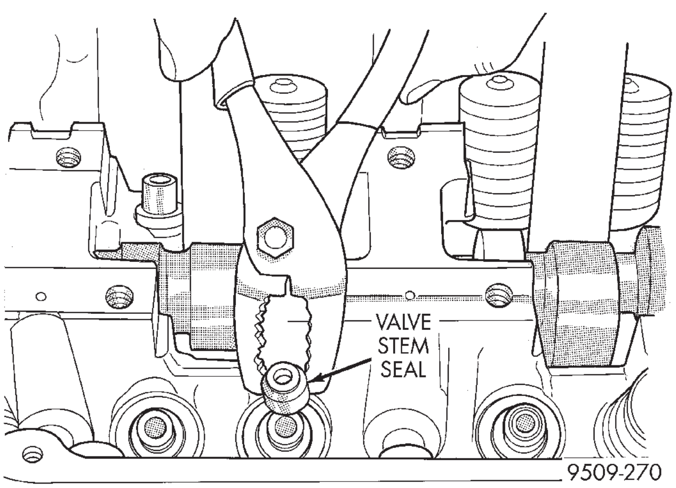


Fig. 54 Valve Stem Seal—Removal

INSTALLATION

(1) Install the silver valve seal onto the intake valve guide and the black seal onto the exhaust valve guide (Fig. 55).

(2) Using Special Tool MD-998774, install valve seal by tapping lightly until seal is in place (Fig. 56).

(3) Use Special Tool MD-998772A with Mounting Post 6886, Forcing Screw Arm 6887, Forcing Screw 6765 and Adapter 6885 (Fig. 53) to compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems.

(4) Repeat Removal Steps 3 through 7 and Installation Steps 1 through 3 until all necessary valve springs/seals are replaced.

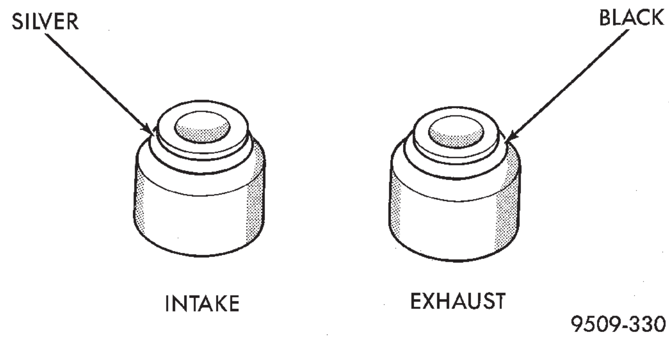


Fig. 55 Valve Stem Seal Identification

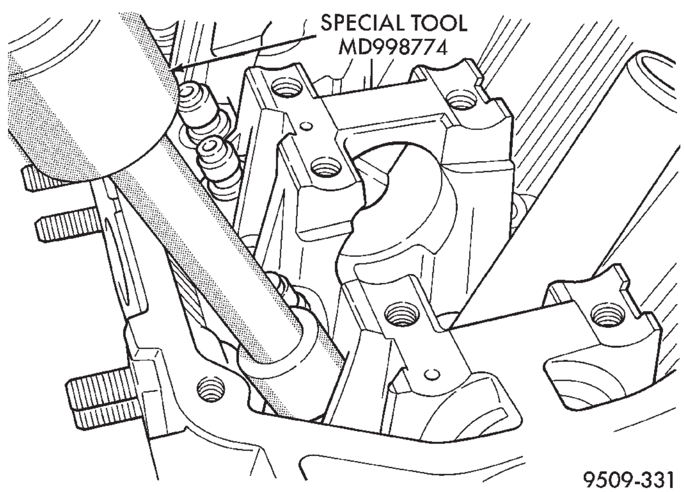


Fig. 56 Valve Stem Seal—Installation

(5) Install rocker arm shaft assemblies.

(6) Install cylinder head cover.

CRANKSHAFT DAMPER

REMOVAL

(1) Remove belt splash shield (Fig. 57).

(2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(3) Remove crankshaft center bolt (Fig. 58) and remove crankshaft damper.

INSTALLATION

(1) Install crankshaft damper.

(2) Install crankshaft bolt and tighten to 182 N·m (134 ft. lbs.) (Fig. 58).

(3) Install accessory drive belts. Refer to Group 7, Cooling System for procedures.

(4) Install belt shield (Fig. 57).

REMOVAL AND INSTALLATION (Continued)

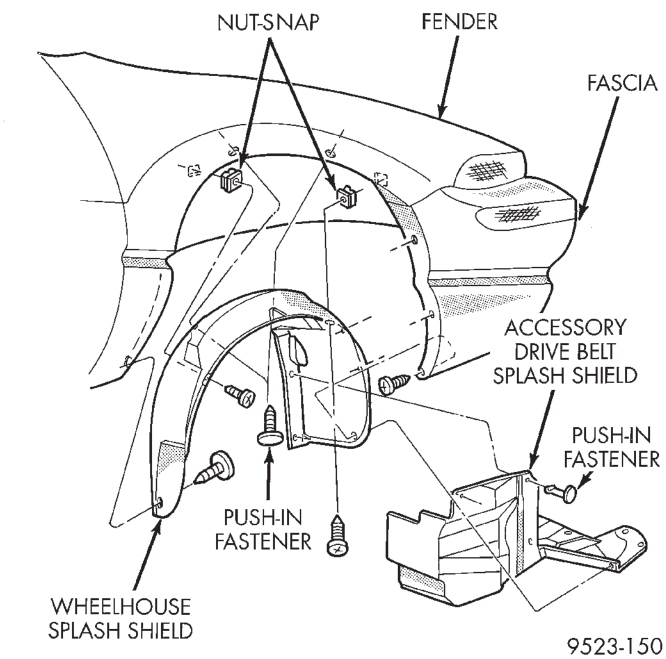


Fig. 57 Belt Splash Shield

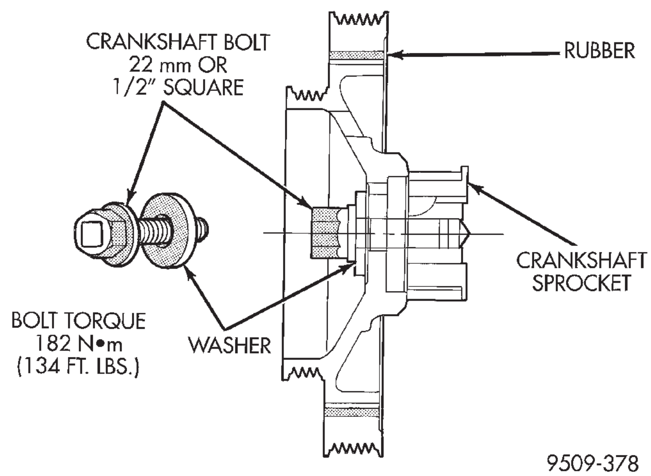


Fig. 58 Crankshaft Damper

TIMING BELT COVERS

REMOVAL

(1) Disconnect negative cable from battery remote jumper terminal.

(2) Remove drive belt splash shield. Refer to Group 23, Body for procedure.

(3) Remove the accessory drive belts. Refer to Group 7, Cooling System for service procedure.

(4) Support engine and remove right engine mount. Refer to Engine Mounts in this section for procedure.

(5) Remove crankshaft damper. Refer to procedure in this section.

NOTE: To remove engine mount bracket the lower timing belt cover must be removed first.

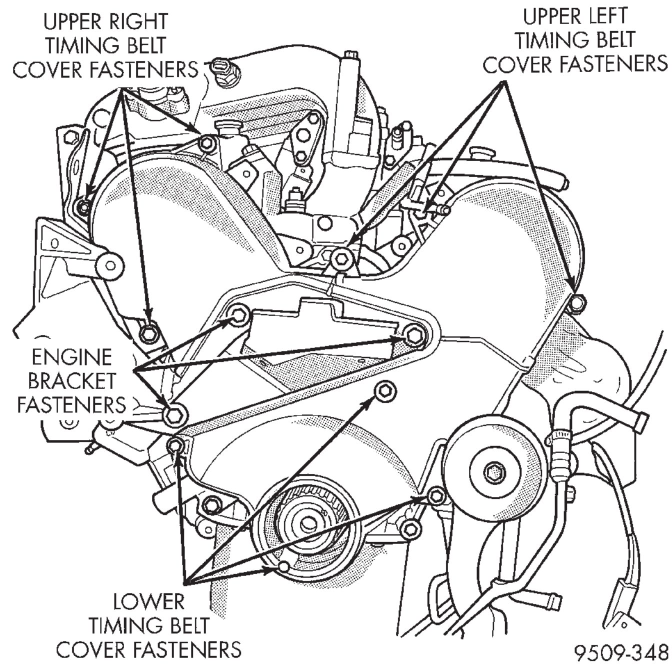


Fig. 59 Timing Belt Covers

(6) Remove power steering pump bracket. Refer to Group 19, Steering for procedure.

(7) Remove the timing belt covers (Fig. 59). Remove covers in this order:

a. Upper left cover.
b. Lower cover.
c. Upper right cover.

NOTE: To remove right/rear timing belt cover, the power steering pump bracket must be removed.

(8) Remove the engine mount bracket (Fig. 59).

INSTALLATION

(1) Install engine mount bracket (Fig. 59).

(2) Install timing belt covers (Fig. 59) in this order:

(a) Upper right cover.
(b) Lower cover.
(c) Upper left cover.

(3) Install power steering pump bracket. Refer to Group 19, Steering for procedure.

(4) Install crankshaft damper. Refer to procedure in this section.

(5) Install right engine mount. Refer to Engine Mounts in this section for procedure.

(6) Install accessory drive belts. Refer to Group 7, Cooling System for service procedure.

(7) Install drive belt splash shield. Refer to Group 23, Body for procedure.

(8) Connect negative cable from battery remote jumper terminal.

REMOVAL AND INSTALLATION (Continued)

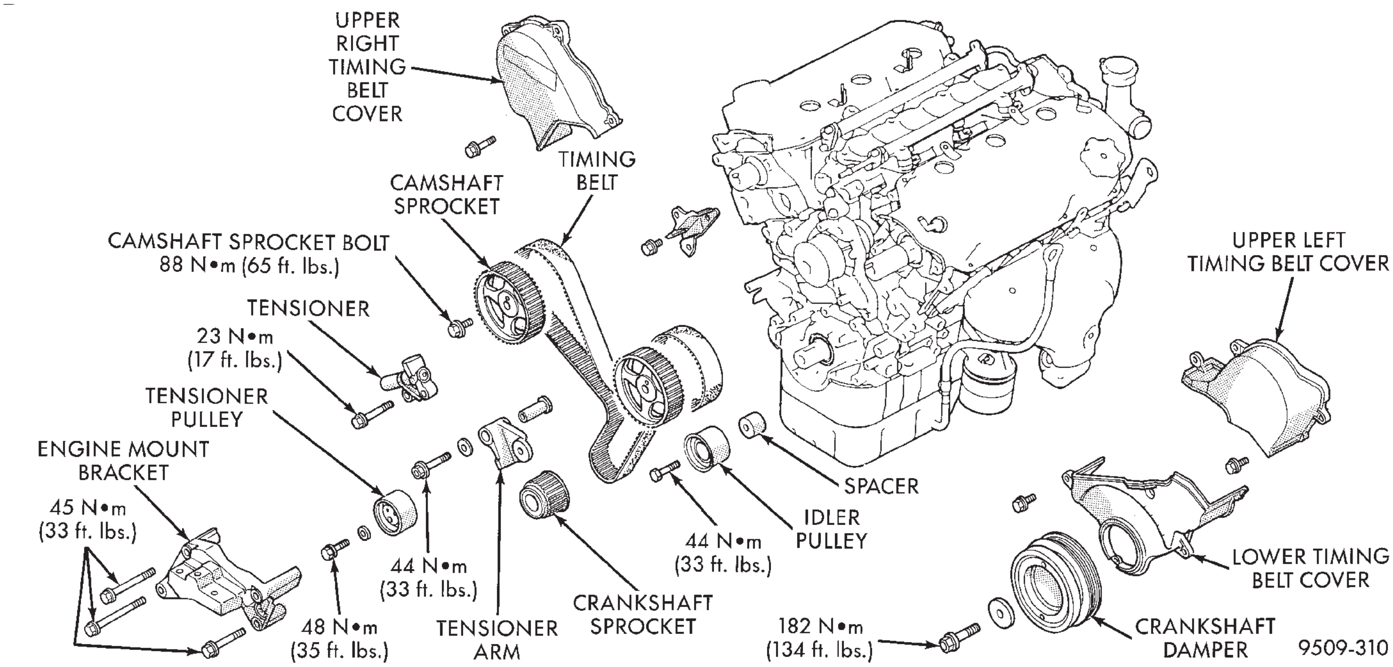


Fig. 60 Timing Belt System

TIMING BELT

CAUTION: The 2.5L engine is a Non-freewheeling design. When the timing belt is removed, DO NOT rotate the camshafts or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage

REMOVAL

(1) Remove timing belt covers. Refer to procedure in this section.

(2) Mark timing belt running direction for installation (Fig. 61).

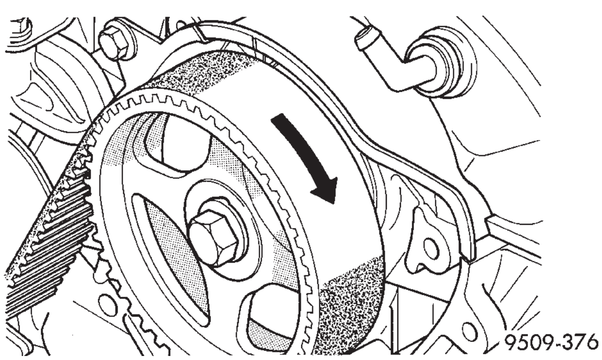


Fig. 61 Mark Direction of Timing Belt

(3) Loosen timing belt auto tensioner bolts (Fig. 62) and remove timing belt.

CAUTION: Coolant or oil leakage on timing belt will shorten its life drastically. If timing belt is seriously contaminated, it must be replaced. Clean all components and correct source of leak.

CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE

TIMING BELT TENSIONER

(1) When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

(2) Place the tensioner into a vise and slowly compress the plunger (Fig. 63).

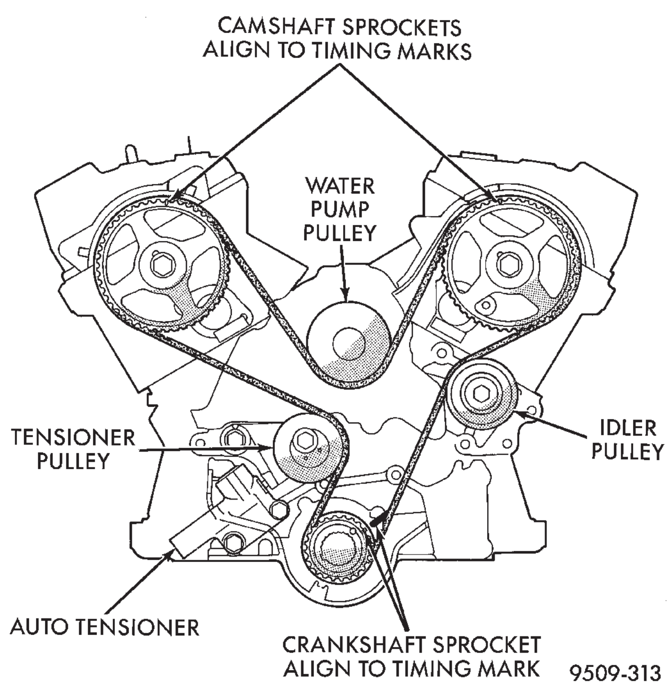


Fig. 62 Timing Belt Engine Sprocket Timing

REMOVAL AND INSTALLATION (Continued)

CAUTION: Index the tensioner in the vise the same way it is installed on the engine. This is to ensure proper locking pin orientation when tensioner is installed on the engine.

(3) When plunger is compressed into the tensioner body, install a locking pin through the body and plunger (Fig. 63).

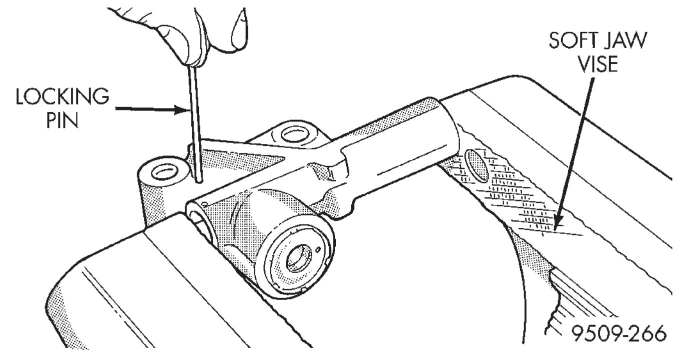


Fig. 63 Timing Belt Tensioner Compressing

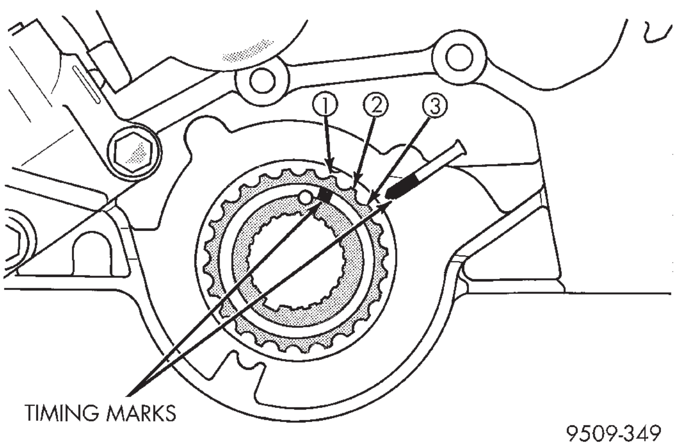


Fig. 64 Crankshaft Sprocket Timing

INSTALLATION

(1) Set crankshaft sprocket to TDC by aligning the sprocket mark with the mark on the oil pump housing. Then rotate crankshaft 3 notches before TDC (Fig. 64).

(2) Set camshaft sprockets to the aligning marks on the sprockets with the marks on the rear timing belt cover (Fig. 65).

(3) Install timing belt on right camshaft sprocket. Install a binder clip on the belt and sprocket so the belt will not slip out of position. Keeping the belt taught, install belt under the water pump pulley and then around the left camshaft sprocket. Install an additional binder clip on the left sprocket and belt.

(4) Rotate the crankshaft to TDC (Fig. 66). Continue routing the belt around the idler pulley, crankshaft sprocket, and tensioner pulley.

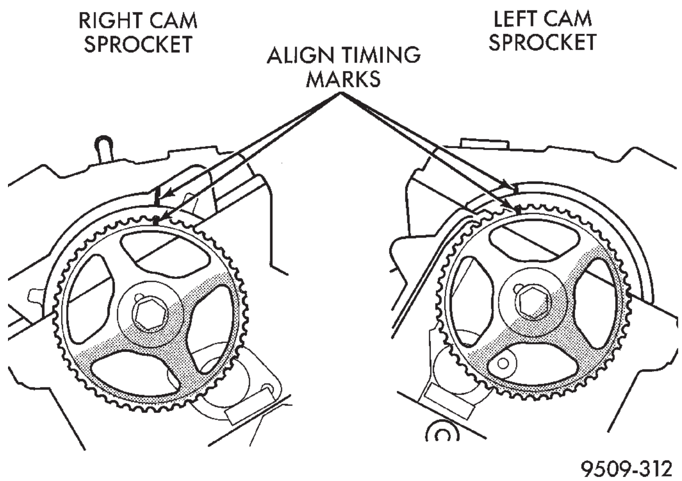


Fig. 65 Camshaft Sprocket Timing

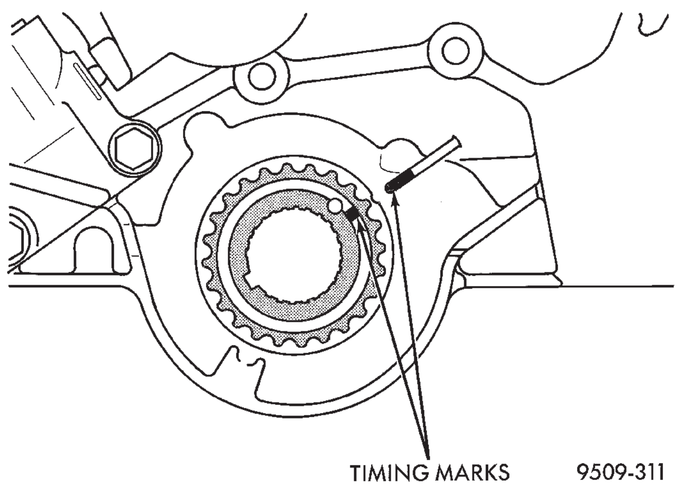


Fig. 66 Adjusting Crankshaft Sprocket for Timing Belt

(5) To tension belt perform the following:

(a) Apply rotating force to the crankshaft sprocket in the clockwise direction, check that all timing marks are aligned.

(b) Using Special Tool MD 998767 and a torque wrench on the tensioner pulley. Apply 4.4 N·m (38.9 in. lbs.) of torque to tensioner (Fig. 67). Tighten tensioner pulley bolt to 48 N·m (35 ft. lbs.).

(c) With torque being applied to the tensioner pulley install the tensioner to the tensioner pulley bracket and tighten fasteners to 23 N·m (205 in. lbs.).

(d) Pull tensioner plunger pin.

(6) Rotate crankshaft 2 revolutions in a clockwise direction ONLY and check the alignment of the timing marks (Fig. 62). Install tensioner pin into assembly. The pin should slide in and out without any resistance. If the pin does not slide freely, perform the procedure again.

(7) Install timing belt covers. Refer to procedure in this section.

REMOVAL AND INSTALLATION (Continued)

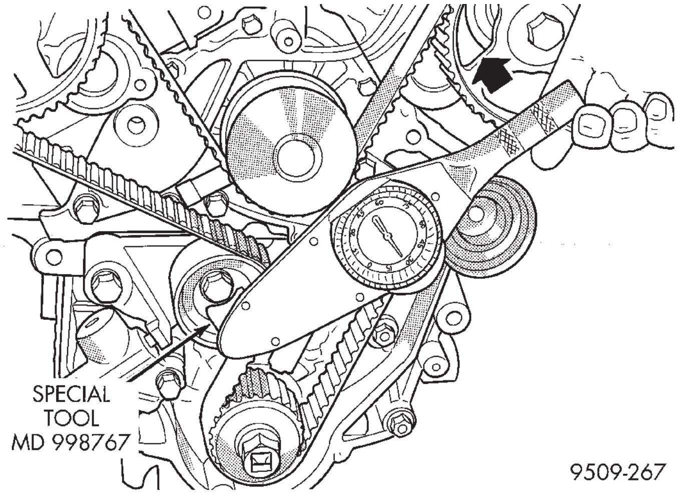


Fig. 67 Timing Belt Tension Adjustment

(8) Install right engine mount. Refer to procedure in this section.

(9) Install crankshaft damper and crankshaft damper bolt. Tighten to 182 N·m (134 ft. lbs.).

(10) Install accessory drive belts. Refer to Group 7, Cooling System for the procedure.

(11) Raise vehicle on hoist and install drive belt splash shield.

CAMSHAFT SPROCKETS

REMOVAL

(1) Remove timing belt. Refer to procedure in this section.

(2) Hold camshaft sprocket with Special Tool 6847. Loosen and remove bolt and washer (Fig. 68).

(3) Remove camshaft sprocket from camshaft.

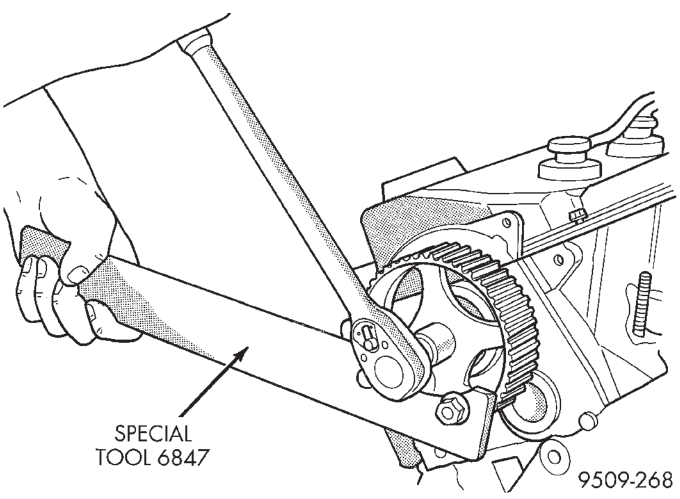


Fig. 68 Camshaft Sprockets—Removal and Installation

INSTALLATION

(1) Place camshaft sprocket on camshaft.

(2) Install bolt and washer to camshaft. Using Special Tool 6847, hold camshaft sprocket and torque bolt to 88 N·m (65 ft. lbs.) (Fig. 68).

(3) Install timing belt. Refer to procedure in this section.

CAMSHAFT OIL SEAL

REMOVAL

(1) Remove timing belt and camshaft sprocket(s). Refer to procedures in this section.

(2) Remove camshaft seal(s).

INSTALLATION

(1) Apply light coat of engine oil to the camshaft oil seal lip.

(2) Install the oil seal using Special Tool MD998713 or 6863 camshaft oil seal installers (Fig. 69) and (Fig. 70).

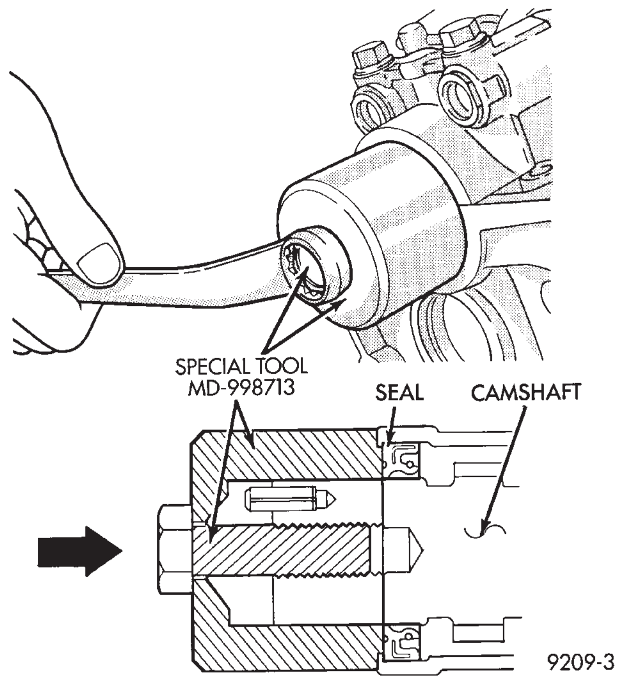


Fig. 69 Camshaft Oil Seal Installation—Right Cylinder Head

OIL PAN

REMOVAL

(1) Disconnect negative cable from remote battery jumper terminal (Fig. 71).

(2) Remove oil drain plug and drain oil (Fig. 72).

(3) Remove exhaust cross-under pipe. Refer to Exhaust Manifold, in this section for procedure.

(4) Remove drive belt splash shield.

(5) Remove dipstick tube.

(6) Remove starter motor. Refer to Group 8B, Battery/Starter/Generator Service for procedure.

REMOVAL AND INSTALLATION (Continued)

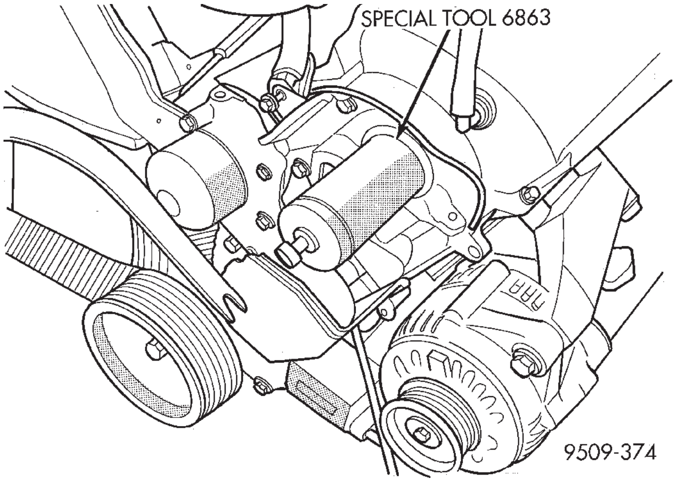


Fig. 70 Camshaft Oil Seal Installation—Left Cylinder Head

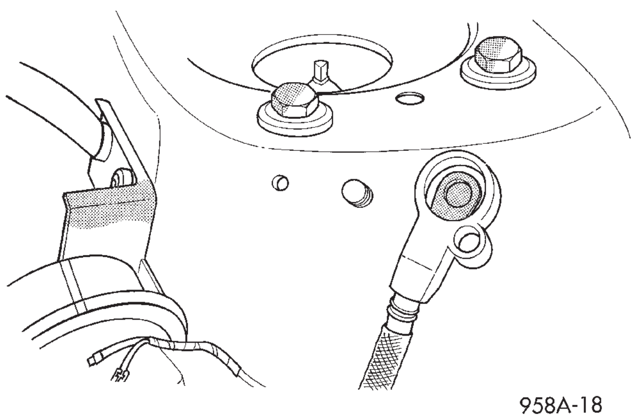


Fig. 71 Battery Negative Cable Remote Terminal Location

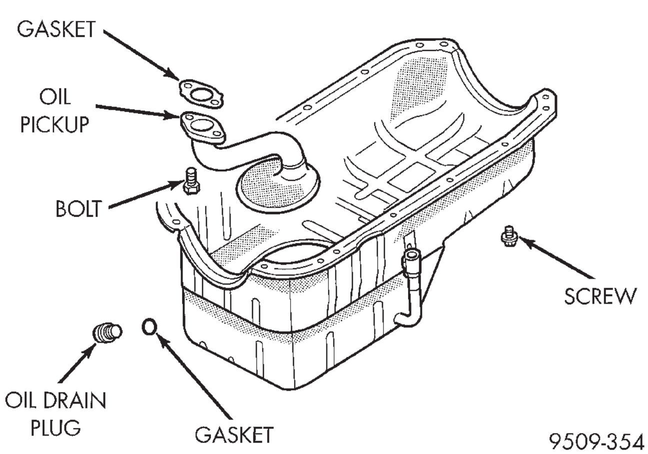


Fig. 72 Oil Pan

(7) Remove engine to transaxle struts/bending braces.

(8) Remove transaxle inspection cover.

(9) Remove oil pan.

INSTALLATION

NOTE: Oil pan to cylinder block sealing is provided with Mopar® Silicone Rubber Adhesive Sealant or equivalent gasket material. See Form-In-Place Gaskets in Standard Service Procedures.

(1) Apply sealant as shown in (Fig. 73).

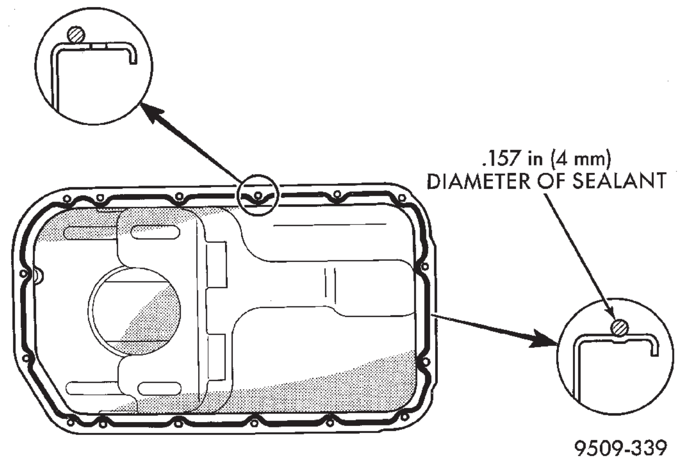


Fig. 73 Oil Pan Sealing

(2) Install pan and tighten screws to 6 N·m (50 in. lbs.).

(3) Install transaxle inspection cover.

(4) Install engine to transaxle struts/bending braces.

(5) Install exhaust cross-under pipe. Refer to Exhaust Manifold in this section for procedure.

(6) Install starter motor. Refer to Group 8B, Starting for procedure.

(7) Install drive belt splash shield.

(8) Inspect dipstick tube O-ring and replace as necessary.

(9) Install dipstick tube.

(10) Install correct amount of new oil.

(11) Connect negative cable to battery remote jumper terminal.

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Remove crankshaft damper. Refer to procedure in this section.

(2) Remove timing belt covers and timing belt. Refer to procedures in this section.

(3) Remove crankshaft sprocket and key.

REMOVAL AND INSTALLATION (Continued)

(4) Pry out the front seal with a flat tip screwdriver. Cover the end of the screwdriver with a shop towel.

CAUTION: Be careful not to nick or damage crankshaft flange surface or oil pump housing bore.

INSTALLATION

(1) Install front crankshaft seal into oil pump housing using Special Tool MD-998717 (Fig. 74).

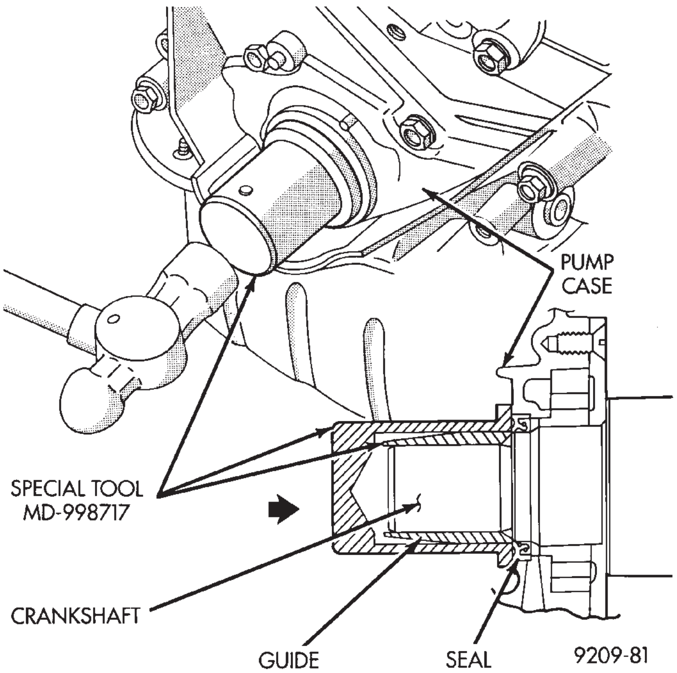


Fig. 74 Front Crankshaft Oil Seal

(2) Install crankshaft key and sprocket.
(3) Install timing belt and covers. Refer to procedures in this section.
(4) Install crankshaft damper. Refer to procedure in this section.

CRANKSHAFT

The crankshaft is supported in four main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells installed in the monoblock main bearing cap are plain. Crankshaft end play is controlled by thrust washers on the number three main bearing journal.

REMOVAL

(1) Remove engine assembly from vehicle. Refer to procedure in this section.
(2) Separate engine from transaxle and remove flex plate.
(3) Remove rear oil seal retainer and seal as an assembly (Fig. 77).
(4) Mount engine on a suitable engine repair stand.
(5) Remove oil pan.
(6) Remove front mounted oil pump assembly (Fig. 75) and (Fig. 76).
(7) Mark position of each connecting rod and cap. Remove connecting rod bearing caps.
(8) Release monoblock main bearing cap bolts evenly. Remove lower bearing shells and identify for reassembly.
(9) Lift out crankshaft and remove upper thrust washers from each side of number three main bearing in the crankcase (Fig. 75).

INSTALLATION

(1) Install upper main bearing shells making certain oil holes are in alignment, and bearing tabs seat in block tabs. All upper bearings have oil grooves (Fig. 78).
(2) **THRUST BEARINGS.** Crankshaft thrust bearings (washers) are installed at journal #3 separately from the radial bearings. Thrust bearings are different, one has end positioning tabs, while the other is plain. One **pair** of each thrust washers are installed into the block and one **pair** into the main bearing cap (Fig. 78).
(3) Apply a thin film of grease to plain side of thrust washers and position them on each side of number three main bearing. Grooved surface towards crankshaft.
(4) Oil the bearings and journals and install crankshaft.
(5) Install lower main bearing shells (without oil grooves) in monoblock cap.
(6) Install one pair of thrust washers in cap.
(7) Carefully install bearing cap with arrows (Fig. 79) toward timing belt end.
(8) Oil the bearing cap bolt threads, install and tighten bolts progressively in sequence shown in (Fig. 79) to 94 N·m (69 ft. lbs.).
(9) Check crankshaft end play by performing the following:
   (a) Mount a dial indicator to front of engine; locating probe on nose of crankshaft (Fig. 80).
   (b) Move crankshaft all the way to the rear of its travel.
   (c) Zero the dial indicator.
   (d) Move crankshaft all the way to the front and read the dial indicator. Refer to Crankshaft Specification Chart.
(10) Lubricate connecting rod bearings with engine oil. Install connecting rod caps in original position. Tighten connecting rod cap nuts to 52 N·m (38 ft. lbs.).
(11) Install oil pump assembly.
(12) Install oil pan.

REMOVAL AND INSTALLATION (Continued)

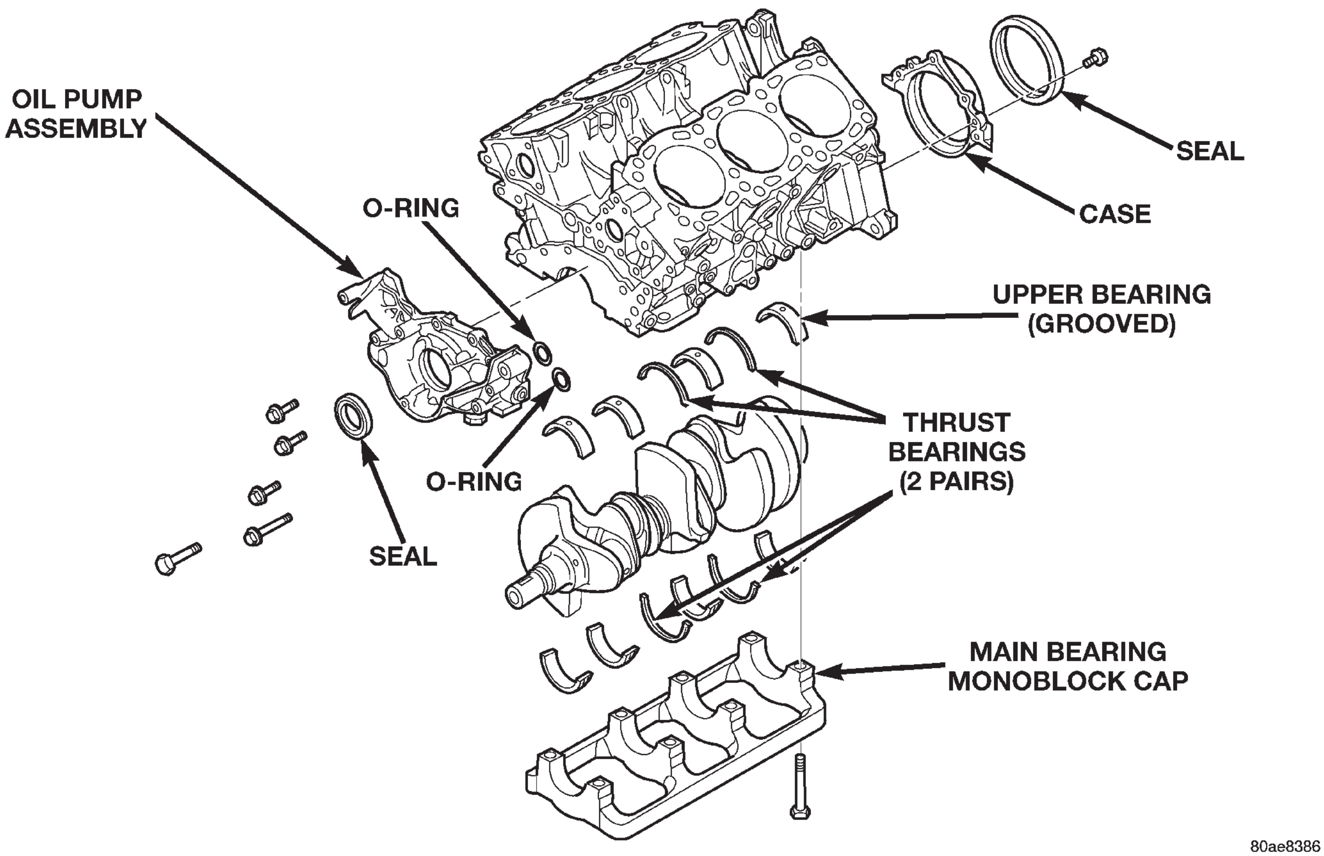


Fig. 75 Crankshaft and Cylinder Block

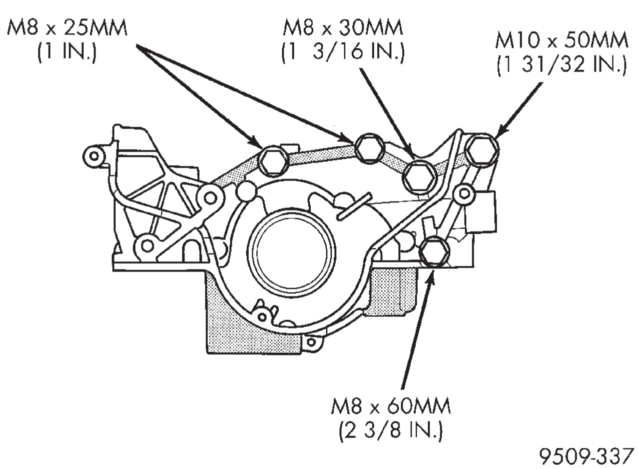


Fig. 76 Oil Pump

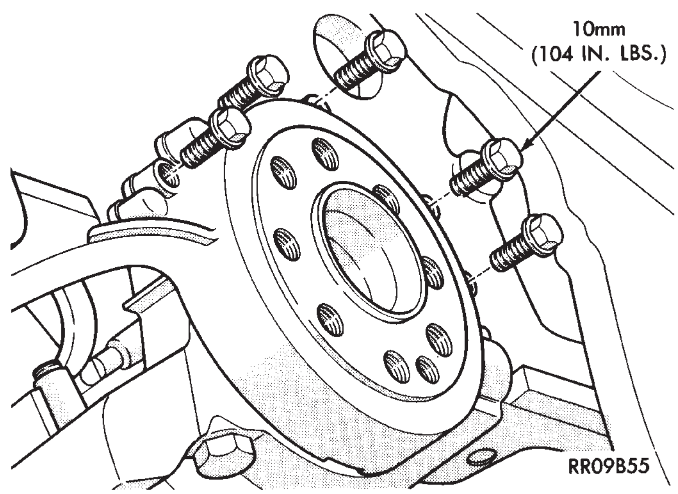


Fig. 77 Rear Seal Assembly

REMOVAL AND INSTALLATION (Continued)

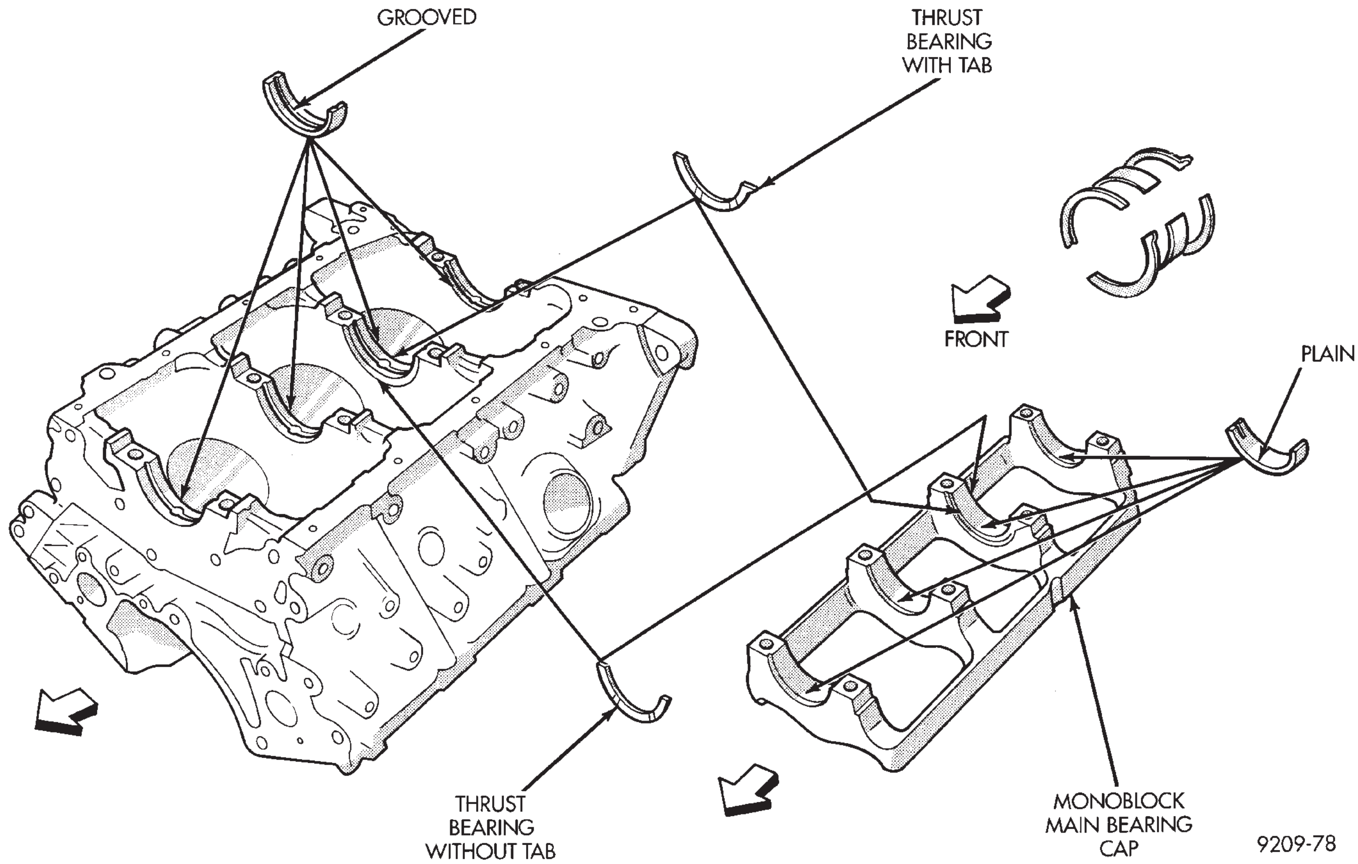


Fig. 78 Main Bearings Installation

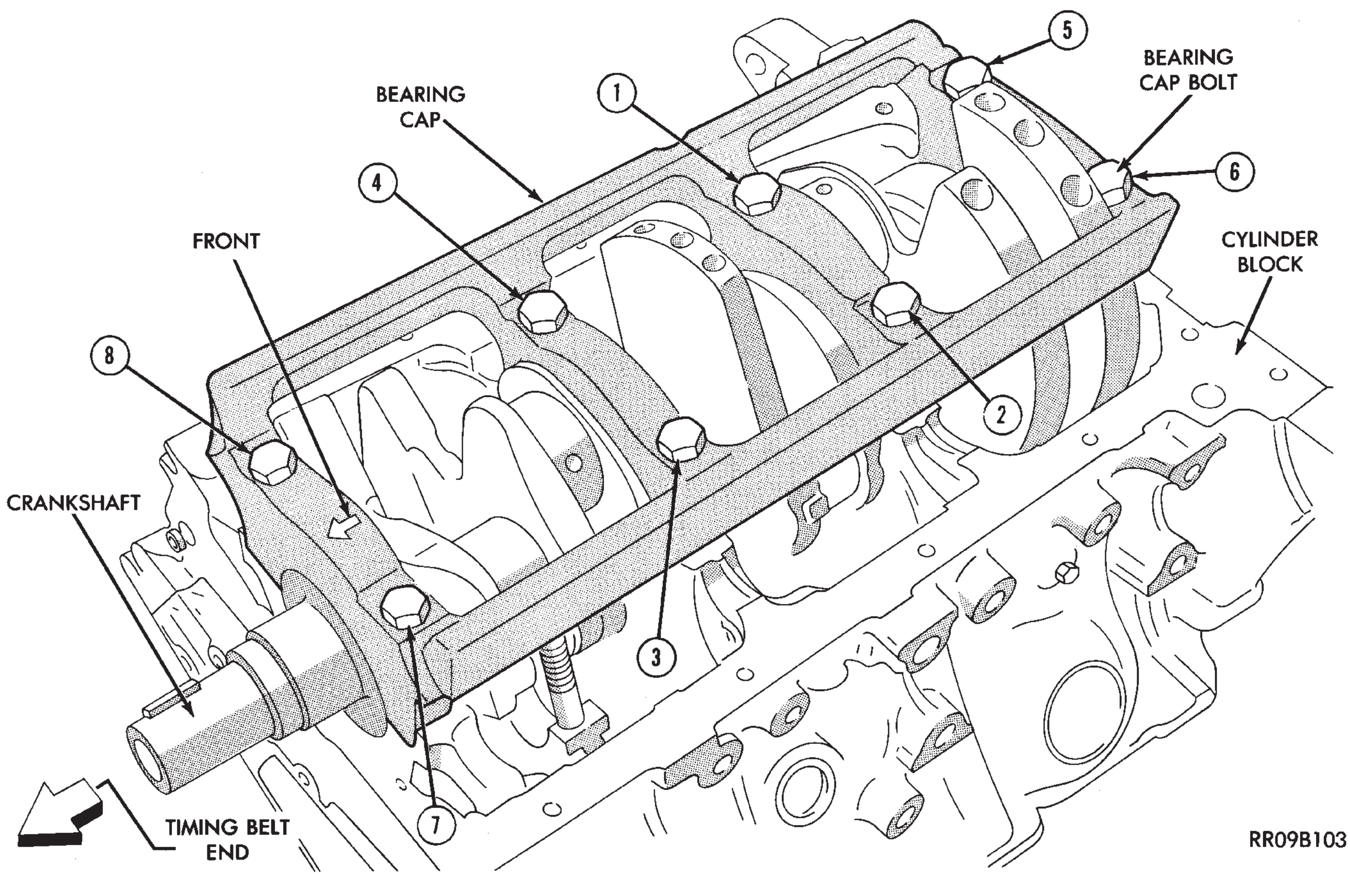


Fig. 79 Crankshaft Main Bearing Cap

REMOVAL AND INSTALLATION (Continued)

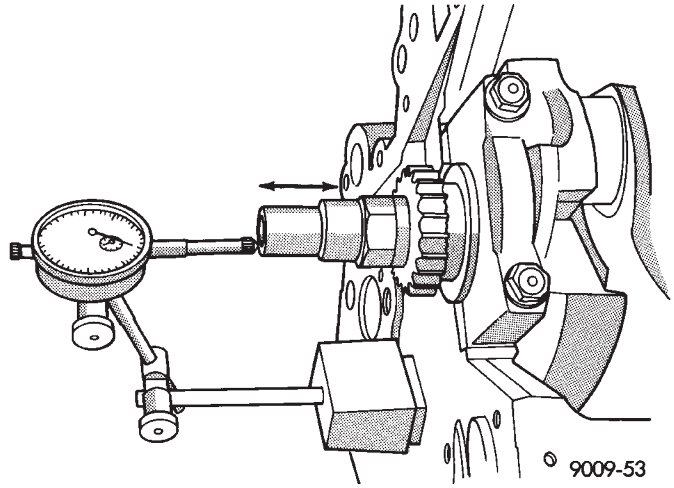


Fig. 80 Crankshaft End Play—Typical

(13) Install rear oil seal and retainer.

(14) Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).

(15) Install engine assembly.

CRANKSHAFT SPECIFICATION CHART

Crankshaft End-Play	
New Part:	0.05 - 0.25 mm (0.002 - 0.010 in.)
Wear Limit:	0.30 mm (0.012 in.)
Main Bearing Oil Clearance	
New Part:	0.018 - 0.036 mm (0.0007 - 0.0014 in.)
Wear Limit:	0.10 mm (0.0039 in.)
Crankshaft Main Bearing Journal	
Standard Diameter:	59.980 mm (2.361 in.)
Crankshaft Connecting Rod Journal	
Standard Diameter:	50.00 mm (1.968 in.)

CRANKSHAFT OIL SEAL AND RETAINER—REAR

REMOVAL

(1) Remove transaxle from vehicle. Refer to Group 21, Transaxle for procedure.

(2) Remove flex plate.

(3) Remove oil pan. Refer to procedure in this section.

(4) Remove bolts attaching oil seal retainer to cylinder block (Fig. 81).

(5) Remove oil seal and retainer.

(6) Remove oil seal from retainer.

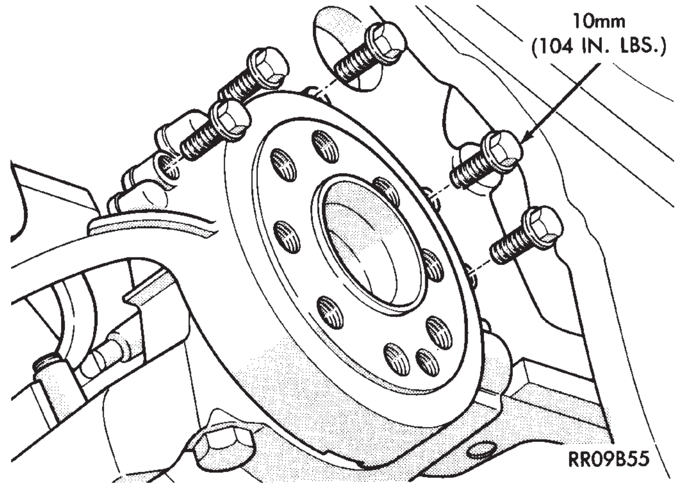


Fig. 81 Crankshaft Oil Seal Retainer—Rear

INSTALLATION

(1) Inspect and clean all sealing surfaces.

(2) Install rear crankshaft oil seal in housing with Special Tool MD-998718 (Fig. 82).

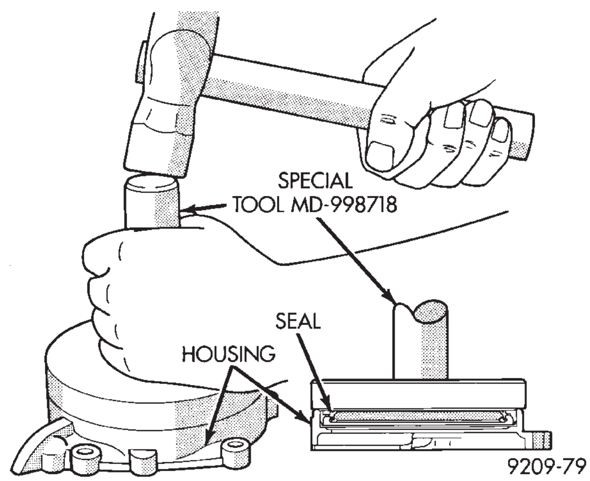


Fig. 82 Install Crankshaft Rear Oil Seal

(3) Apply Mopar® Silicone Rubber Adhesive Sealant to oil seal retainer housing (Fig. 83).

(4) Apply light coating of engine oil to the entire circumference of oil seal lip.

(5) Install seal assembly on cylinder block and tighten bolts to 11 N·m (104 in. lbs.).

(6) Install oil pan. Refer to procedure in this section.

(7) Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).

(8) Install transaxle. Refer to Group 21, Transaxle for procedure.

REMOVAL AND INSTALLATION (Continued)

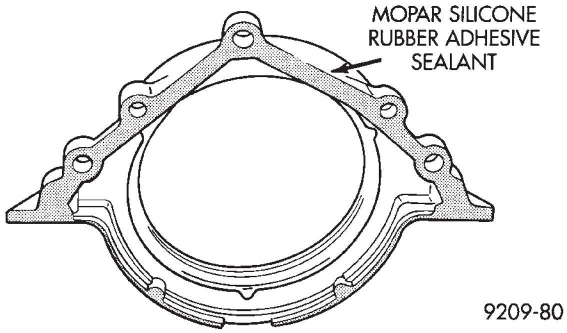


Fig. 83 Apply Sealant to Oil Seal Housing

OIL FILTER

CAUTION: When servicing the oil filter (Fig. 84) avoid deforming the filter can by installing the remove/install tool band strap against the can-to-base lockseam. The lockseam joining the can to the base is reinforced by the base plate.

(1) Turn filter counterclockwise to remove.

(2) To install; lubricate new filter gasket. Screw filter on until gasket contacts base. Tighten to 14 N·m (10 ft.lbs.).

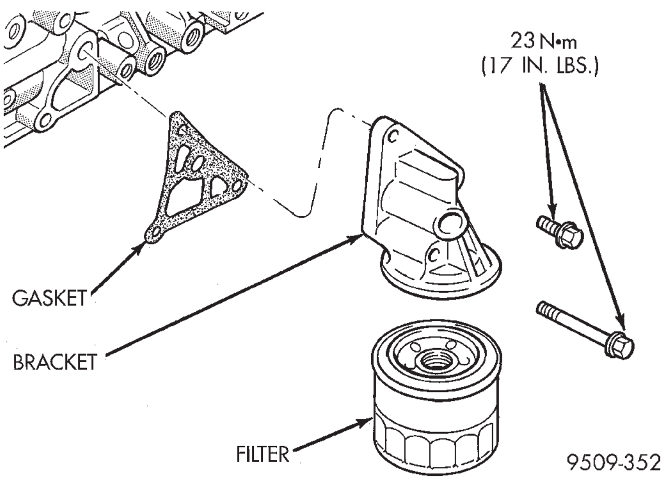


Fig. 84 Oil Filter and Bracket

OIL PUMP

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(2) Refer to procedures in this section for removing the following components:

- Oil Pan
- Crankshaft Damper
- Timing Belt Covers
- Timing Belt

(3) Remove crankshaft sprocket and key.

(4) Remove oil pickup tube.

(5) Remove bolts that attach oil pump to block (Fig. 85).

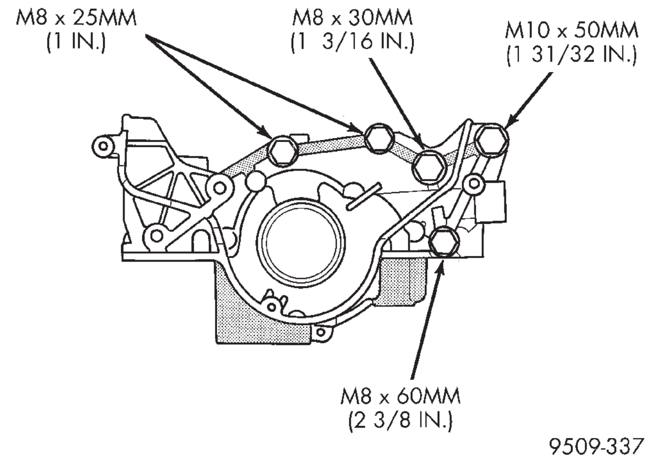


Fig. 85 Oil Pump Assembly

INSTALLATION

(1) Clean block and pump sealing surfaces.

(2) Prime oil pump before installation by filling rotor cavity with clean engine oil.

(3) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 86). Install oil-ring into the counter bore on the oil pump body discharge passage.

(4) Install oil pump slowly onto crankshaft until seated to engine block. Tighten fasteners to M8 bolts 14 N·m (10 ft. lbs.) M10 bolts 41 N·m (30 ft. lbs.). See (Fig. 85) for bolt location and length.

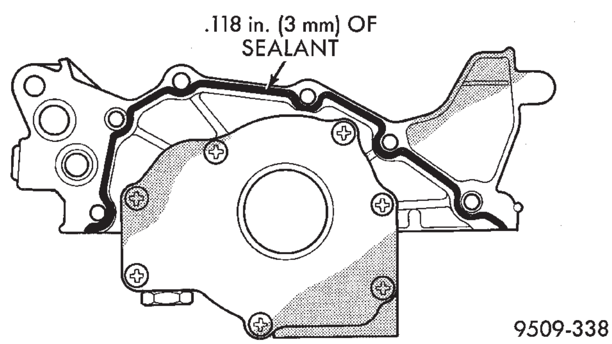


Fig. 86 Oil Pump Sealing

(5) Install oil pickup tube. Tighten fasteners to 19 N·m (168 in. lbs.).

(6) Install crankshaft sprocket and key.

(7) Refer to procedures in this section for installing the following components:

- Timing Belt
- Timing Belt Covers
- Crankshaft Damper
- Oil Pan

(8) Install accessory drive belts. Refer to Group 7, Cooling System for procedure.

REMOVAL AND INSTALLATION (Continued)

PISTON AND CONNECTING ROD

REMOVAL

(1) Remove oil pan and cylinder head(s). Refer to procedures in this section.

(2) Identify pistons with matching cylinder. **The pistons are not interchangeable from bank to bank** (Fig. 87). Pistons with the letter R and arrow toward the front of engine are to be installed in cylinders 1-3-5. Pistons with the letter L and arrow toward the front of engine are to be installed in cylinders 2-4-6.

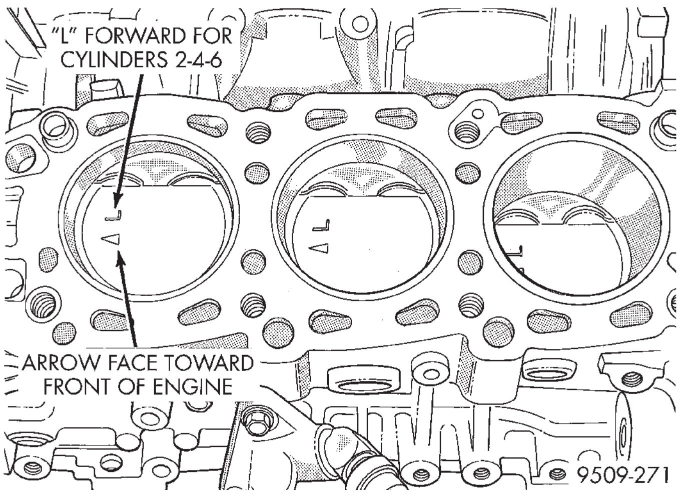


Fig. 87 Mark Pistons

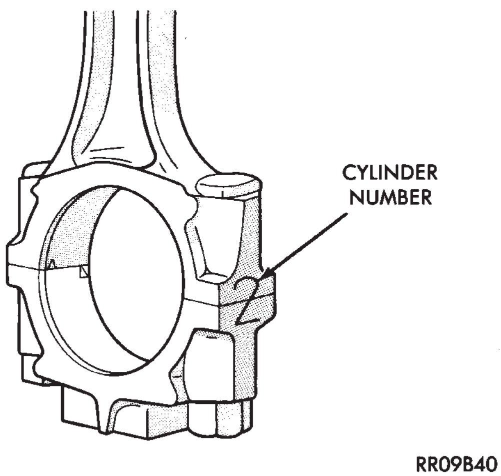


Fig. 88 Mark Matching Parts

(3) Mark connecting rod and cap with cylinder number (Fig. 88).

(4) Remove piston rings (Fig. 89).

INSTALLING PISTON RINGS

(1) The No. 1 and No. 2 piston rings have a different cross section. Install rings with manufacturers mark and size mark facing up, to the top of the piston (Fig. 90).

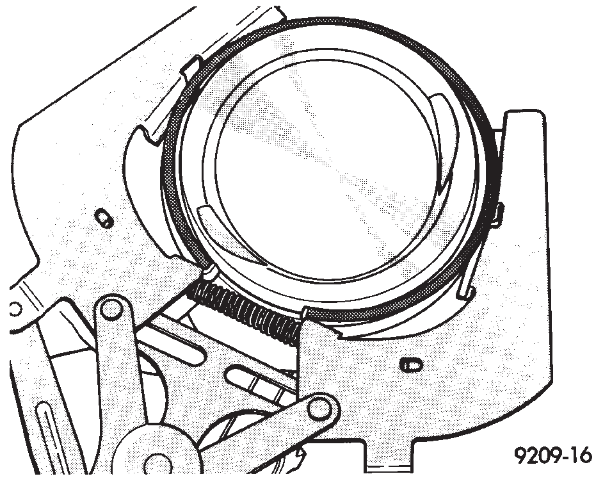


Fig. 89 Piston Ring—Removal

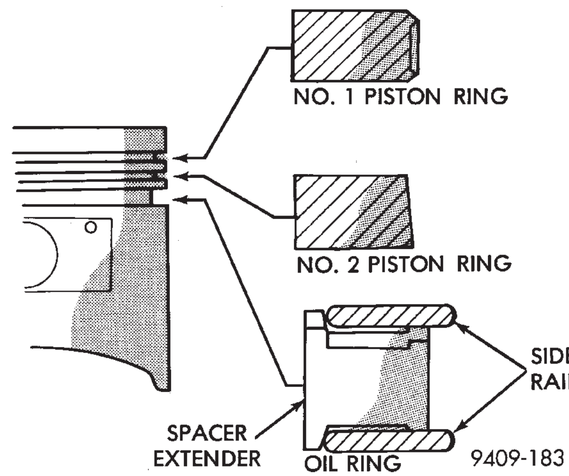


Fig. 90 Piston Ring—Installation

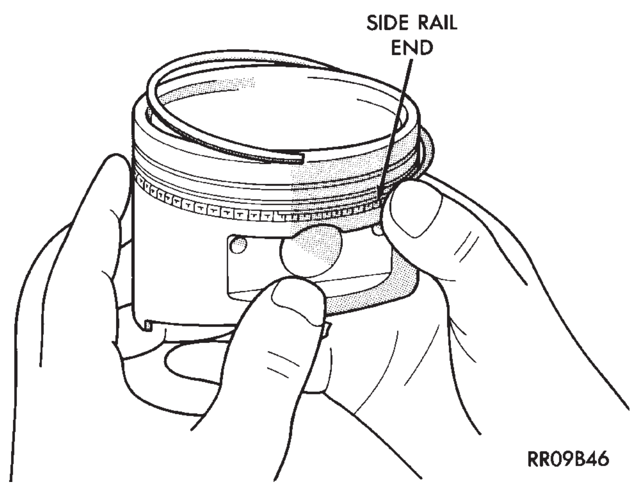


Fig. 91 Side Rail—Installation

REMOVAL AND INSTALLATION (Continued)

CAUTION: Install piston rings in the following order:

a. Oil ring expander.
b. Upper oil ring side rail.
c. Lower oil ring side rail.
d. No. 2 Intermediate piston ring.
e. No. 1 Upper piston ring.

(2) Install the side rails (upper rail first, then lower rail) by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do Not use a piston ring expander** (Fig. 91).

(3) Using a piston ring expander, install No. 2 piston ring and then No. 1 piston ring (Fig. 92).

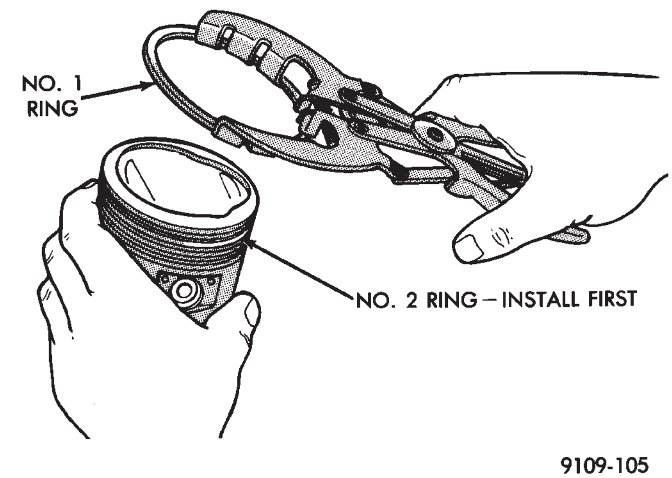


Fig. 92 Upper and Intermediate Ring—Installation

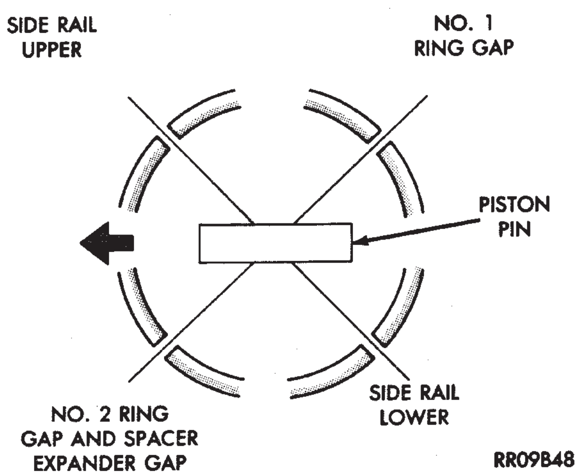


Fig. 93 Piston Ring End Gap Position

(4) Position piston ring end gaps as shown in (Fig. 93).

(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction.

INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 93).

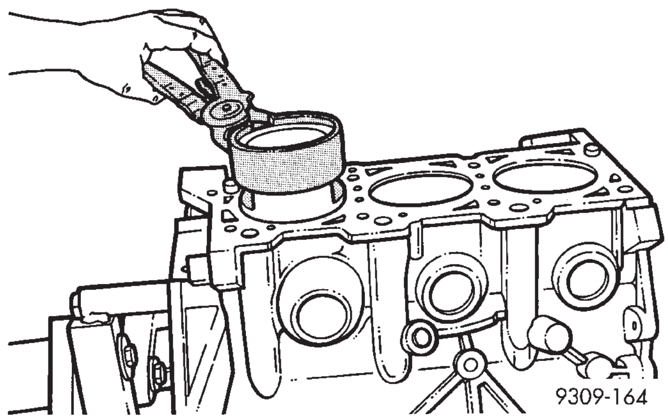


Fig. 94 Piston—Installation

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten. **Be sure position of rings does not change during this operation.**

(4) Install connecting rod bolt protectors on rod bolts.

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

(6) Install the piston and connecting rod assembly with the directional letter is located on the top of the piston with the arrow facing toward the camshaft sprocket.

(7) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal (Fig. 94).

(8) Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 52 N·m (38 ft. lb.).

CAUTION: Piston assemblies are not to be interchanged from bank to bank.

(9) Check alignment marks made during disassembly and that bearing position notches new or used are on the same side as shown in (Fig. 95).

(10) Install cylinder head(s) and oil pan. Refer to procedures in this section.

REMOVAL AND INSTALLATION (Continued)

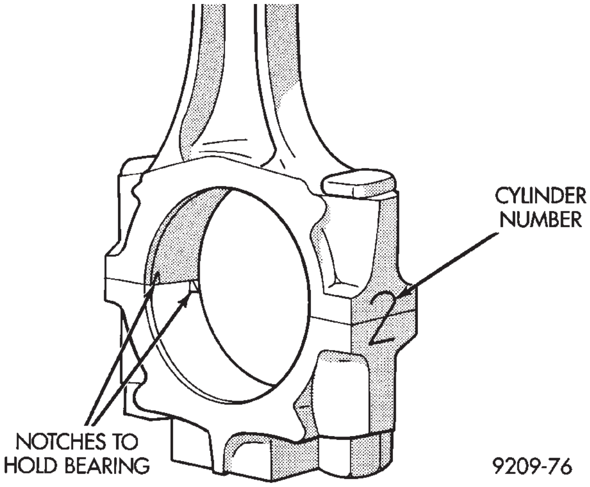


Fig. 95 Connecting Rod and Cap

DISASSEMBLY AND ASSEMBLY

CYLINDER HEAD

DISASSEMBLY

CAUTION: Before disassembly, mark each valve's position on the face of each valve being removed. The valves must be reinstalled into the same position.

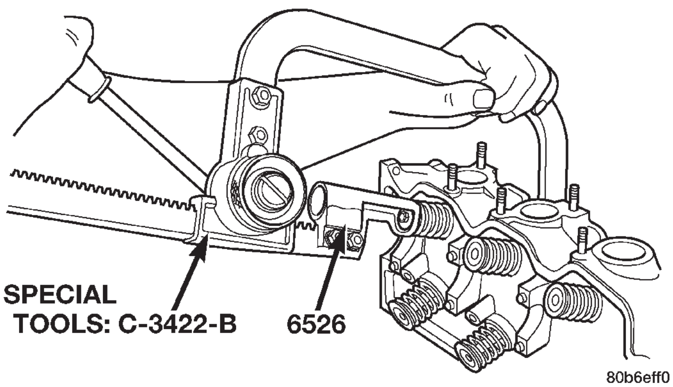


Fig. 96 Valve Removal

(1) With valve spring compressor Special Tool C-3422-B with adapter 6526 or equivalent, remove spring retainer locks, retainer, valve spring, and valve (Fig. 96).

(2) Remove valve stem seals with suitable tool (Fig. 97). Do not reuse valve stem seals.

ASSEMBLY

(1) Coat valve stems with clean engine oil and insert in cylinder head in original position, if being reused.

(2) Install valve spring seat.

(3) Install the silver valve seal onto the intake valve guide and the black seal onto the exhaust value

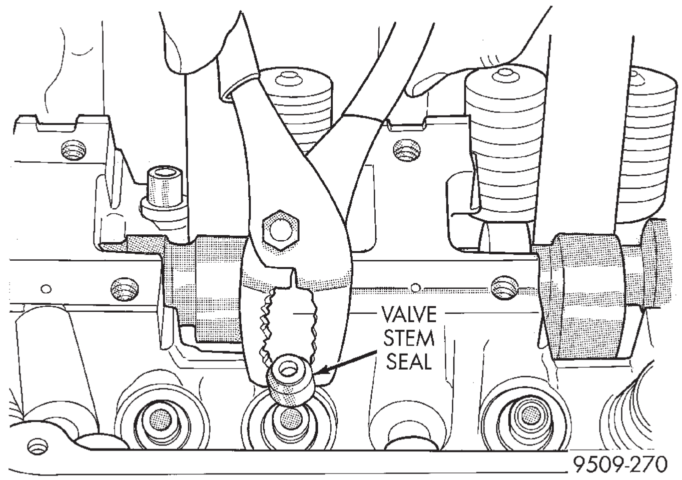


Fig. 97 Valve Stem Seals—Removal

guide (Fig. 98). Using Special Tool MD-998774 install seal by tapping lightly until seal is in place (Fig. 99).

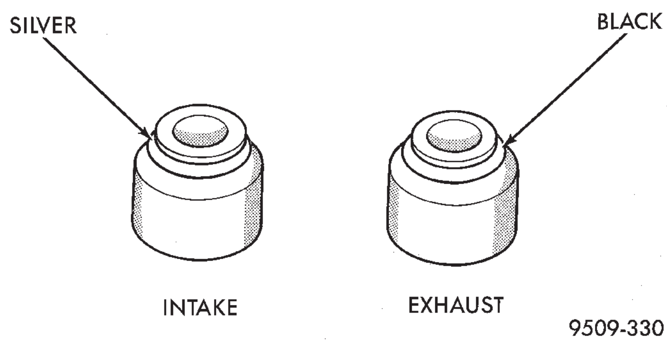


Fig. 98 Valve Stem Seals Identification

(4) Install valve spring with the enamelled ends

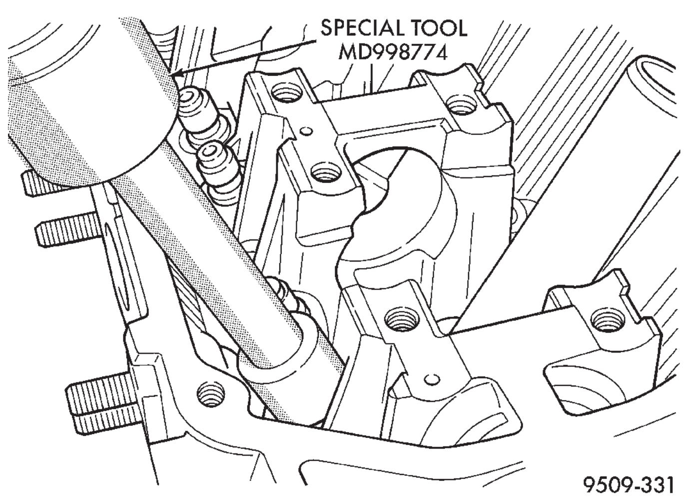


Fig. 99 Valve Stem Seals—Installed

facing the rocker arms (Fig. 100). Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may

DISASSEMBLY AND ASSEMBLY (Continued)

result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

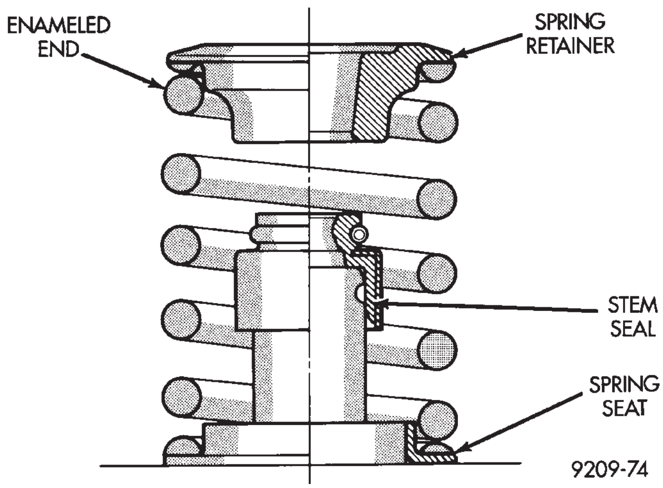


Fig. 100 Valve Spring Position—Installed

ROCKER ARMS

(1) Identify the rocker arms and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts and spring clips from the shaft (Fig. 101).

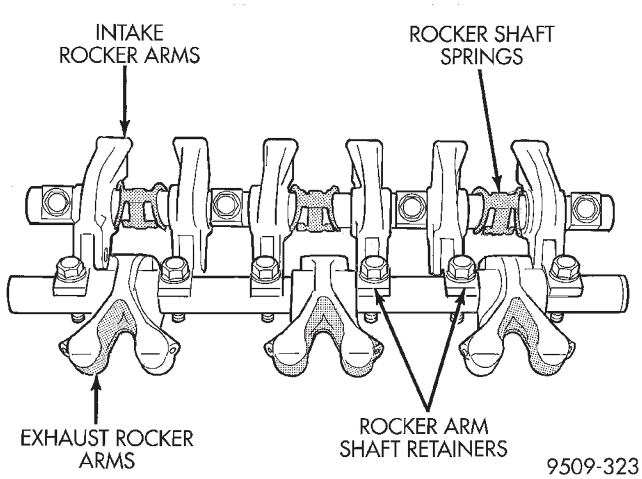


Fig. 101 Rocker Arm Shafts

(2) Slide the rocker arms off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

INSPECTION

Inspect the rocker arm for scoring, wear of the roller or damage to the rocker arm (Fig. 102). Replace as necessary.

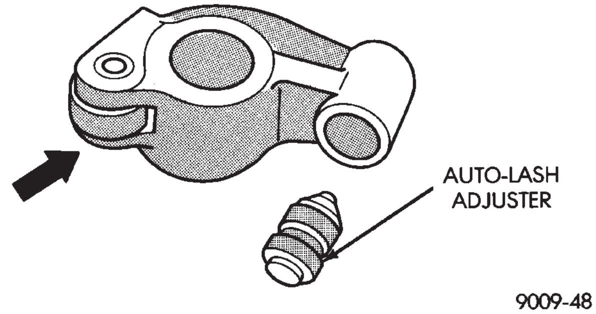


Fig. 102 Rocker Arm

ROCKER ARM SHAFTS

The rocker arm shafts is hollow and is used as a lubrication oil duct.

(1) Check the rocker arm mounting portion of the shafts for wear or damage. Replace if damaged or worn.

(2) Check oil holes for clogging with small wire, clean as required.

REASSEMBLY

Lubricate the rocker arms. Install onto shafts in their original position (Fig. 101).

OIL PUMP

(1) Assemble pump, using new parts as required with clean oil. Align marks on the inner and outer rotors when assembling (Fig. 103).

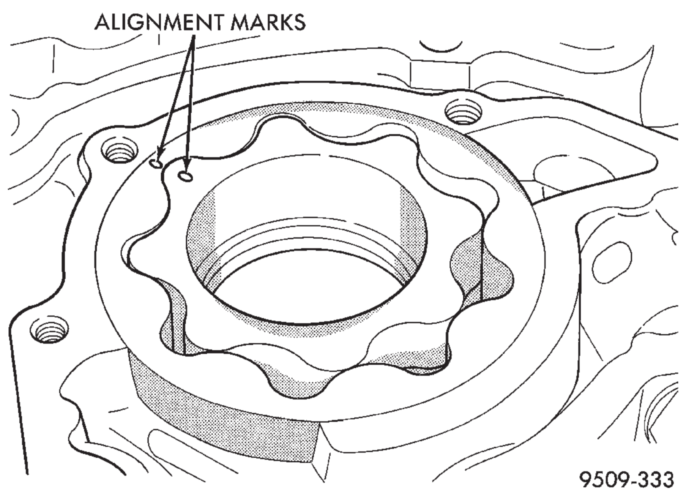


Fig. 103 Inner and Outer Rotor Alignment Marks

(2) Install cover and tighten screws to 10 N·m (85 in. lbs.).

(3) Install relief valve, spring, gasket and cap as shown in (Fig. 104). Tighten cap to 44 N·m (33 ft. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

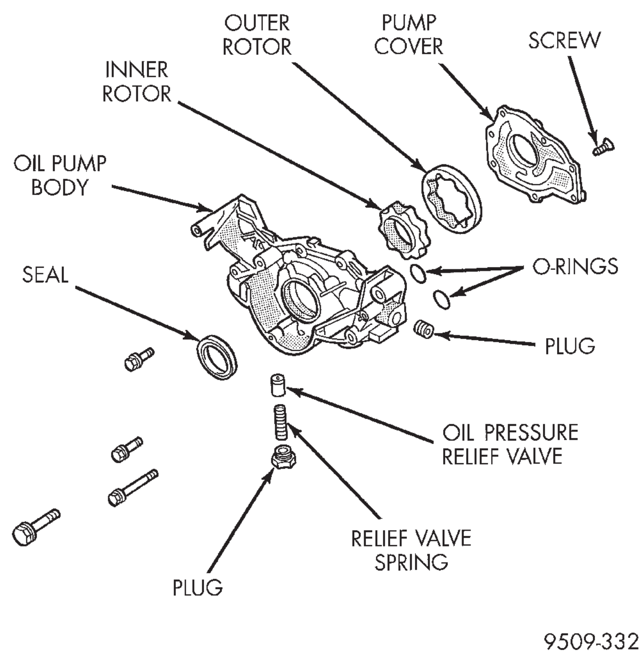


Fig. 104 Oil Pump

CLEANING AND INSPECTION

INTAKE MANIFOLD

(1) Discard gasket and clean all gasket surfaces of manifold to cylinder heads.

(2) Check upper and lower manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

(3) Inspect manifolds for cracks or distortion. Replace manifold if necessary.

EXHAUST MANIFOLD

Inspect exhaust manifolds for damage or cracks. Check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge.

CAMSHAFT INSPECTION

Check oil feed holes for blockage.

Inspect cylinder head journals for wear, Refer to **Cylinder Head Inspect** for Specifications.

Check camshaft bearing journals for scratches and worn areas (Fig. 105). If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm if worn or damaged. If

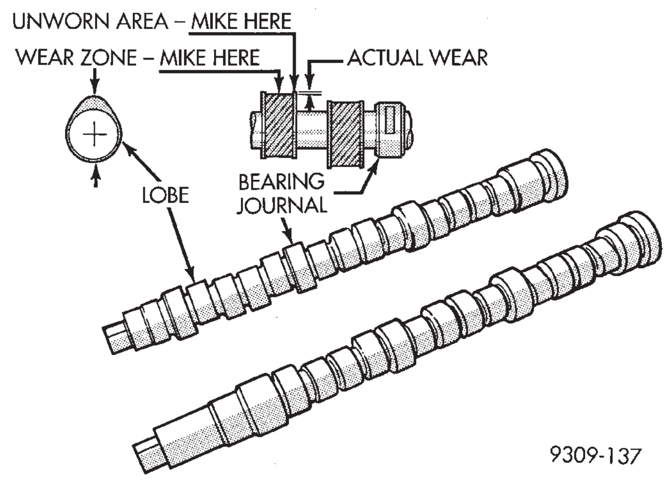


Fig. 105 Checking Camshafts for Wear

lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CYLINDER BORE AND BLOCK

(1) Measure the cylinder bore at three levels in directions A and B (Fig. 106). Top measurement should be 12 mm (0.50 in.) down and bottom measurement should be 10 mm (0.38 in.) up.

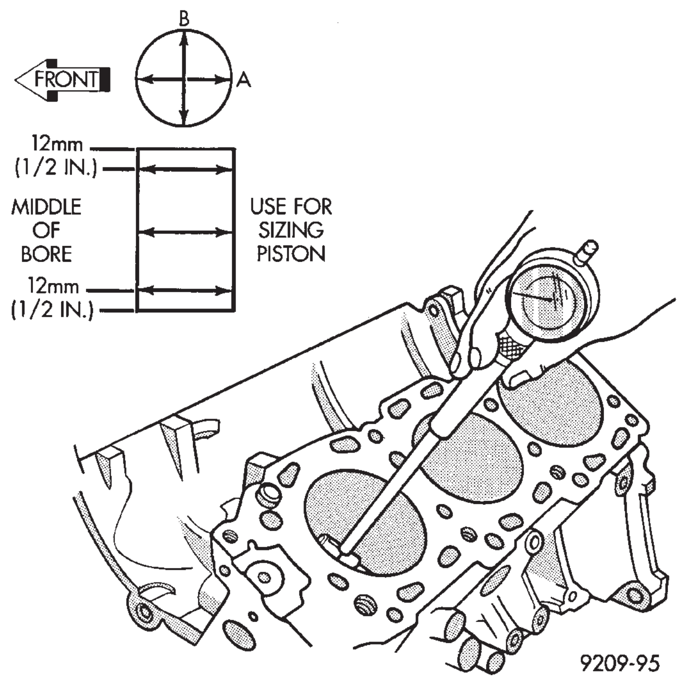


Fig. 106 Checking Cylinder Bore Size

(2) Standard bore dimension: 83.50 - 83.53 mm (3.2874- 3.2886 in.).

(3) Maximum out-of-round or taper: 0.01 mm (0.0004 in.).

CLEANING AND INSPECTION (Continued)

CYLINDER BLOCK

Inspect cylinder block for scratches, cracks and rust or corrosion, and repair or replace as required.

(1) Clean cylinder block and check top surface for distortion with a straight edge and thickness gauge (Fig. 107).

(2) Top surface must be flat within:

• Standard Value: 0.05 mm (0.002 in.)
• Service Limit 0.1 mm (0.0039 in.)

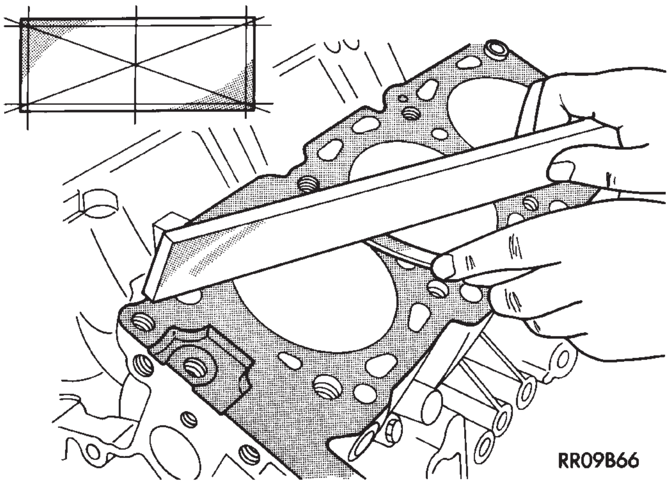


Fig. 107 Distortion Check

CYLINDER HEAD

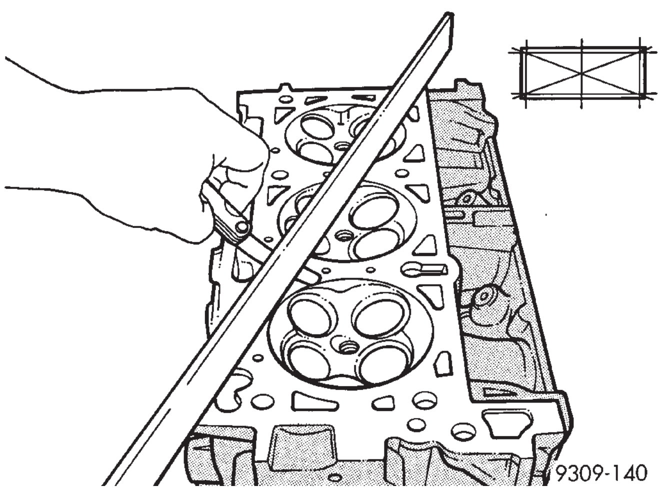


Fig. 108 Checking Cylinder Head Flatness

(1) Before cleaning, check for leaks, damage and cracks.

(2) Clean cylinder head and oil passages.

(3) Check cylinder head for flatness (Fig. 108).

(4) Cylinder head must be flat within:

• Standard dimension: less than 0.03 mm (0.0012 inch)
• Service Limit: 0.2 mm (0.008 inch)
• Grinding Limit: Maximum of 0.2 mm (0.008 inch) is permitted.

CAUTION: This is a combined total dimension of stock removal from cylinder head if any and block top surface is 0.2 mm (0.0079 in.).

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 109). Refer to Valve Specification Chart. Replace guides if they are not within specification.

(3) Check valve guide height (Fig. 110).

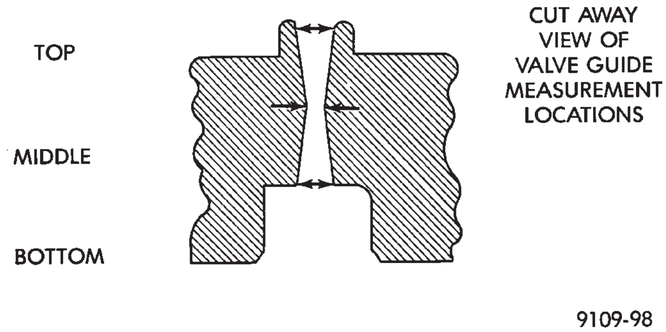


Fig. 109 Checking Wear on Valve Guide—Typical

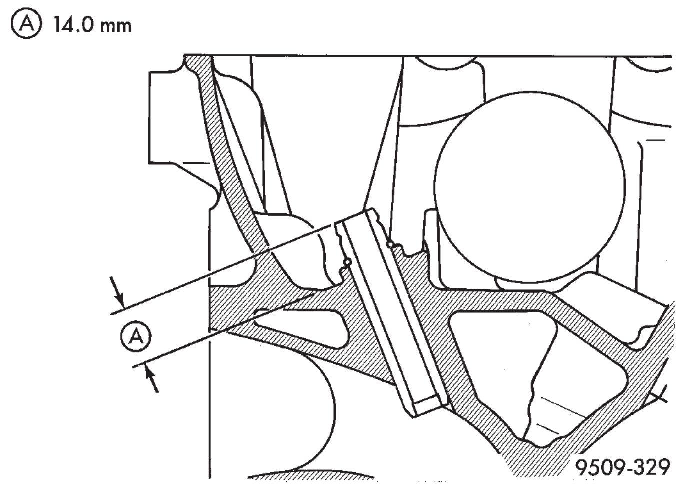


Fig. 110 Valve Guide Height

CYLINDER HEAD COVER

Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

AUTO LASH ADJUSTER

The automatic lash adjusters are precision units installed in machined openings in the valve actuating ends of the rocker arms. Do not disassemble the auto lash adjuster.

CLEANING AND INSPECTION (Continued)

VALVE SPECIFICATION CHART

Valve Dimensions		
INTAKE VALVE (MINIMUM)		
Stem Diameter:	6.00 mm (0.236 in.)	
Face Angle:	45°	
Valve Margin:	1.0 mm (0.039 in.)	
EXHAUST VALVE (MINIMUM)		
Stem Diameter:	6.00 mm (0.236 in.)	
Face Angle:	45°	
Valve Margin:	1.20 mm (0.047 in.)	
Valve Guide Clearance	**New**	**Service Limit**
Intake:	0.02 - 0.05 mm (0.0008 - 0.002 in.)	0.10 mm (0.004 in.)
Exhaust:	0.04 - 0.07 mm (0.0016 - 0.0028 in.)	0.15 mm (0.006 in.)
Valve Springs	**New**	**Service Limit**
Free Length:	51.0 mm (2.01 in.)	50.0 mm (1.971 in.)
Squarness:	2° Maximum	4° Maximum
Spring Tension:	27.2 Kg @ 44.2 mm (60 lbs. @ 1.74 in.)	

ROCKER ARM

Inspect the rocker arm/hydraulic lash adjuster assembly for wear or damage (Fig. 111). Replace assembly as necessary.

OIL FILTER BRACKET

(1) Check the oil filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber (Fig. 112).

(2) Check bracket for cracks and oil leaks.

OIL PUMP

(1) Check oil pump case for damage and remove rear cover.

(2) Remove pump rotors and inspect case for excessive wear (Fig. 113).

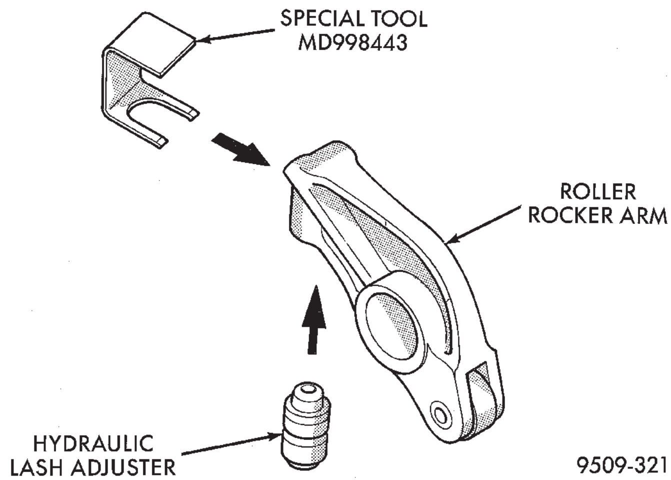


Fig. 111 Rocker Arm/Hydraulic Lash Adjuster Assemblies

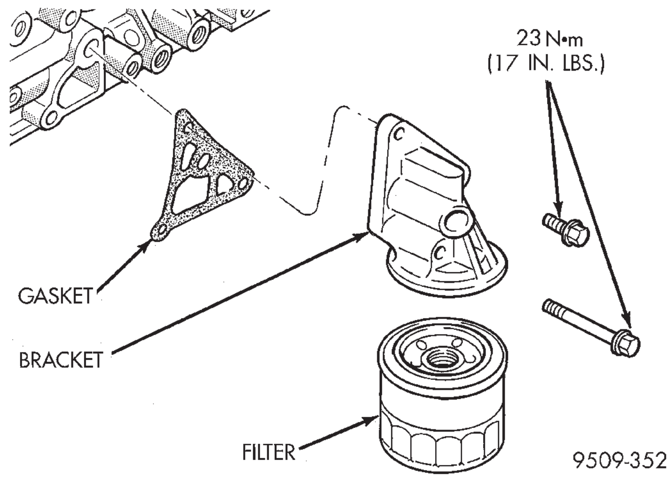


Fig. 112 Oil Filter and Bracket

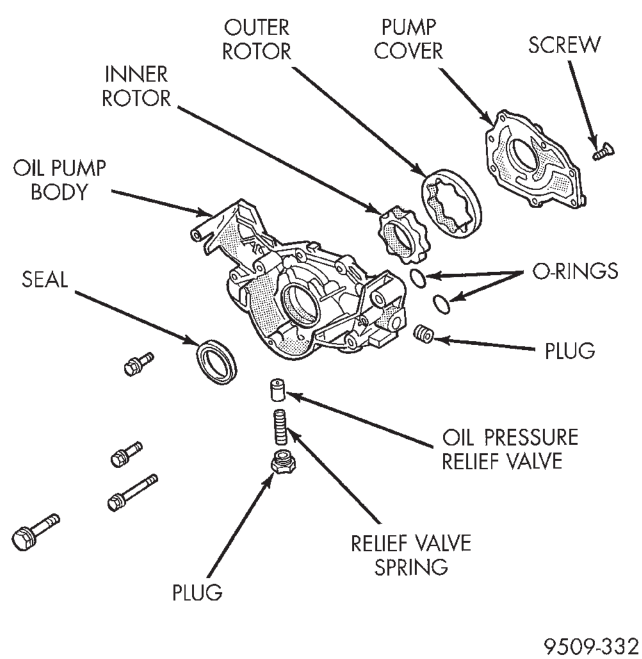


Fig. 113 Oil Pump Components

CLEANING AND INSPECTION (Continued)

(3) Insert the rotor into the oil pump case (Fig. 114) and measure clearance with a feeler gauge as indicated. Replace if out of limits.

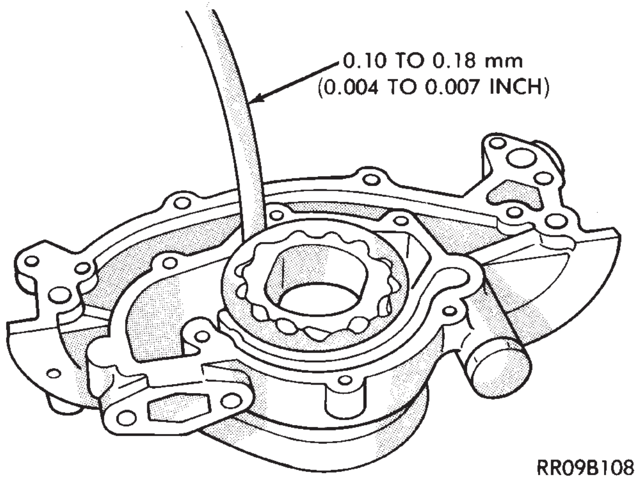


Fig. 114 Checking Clearance-Between Outer Rotor and Case

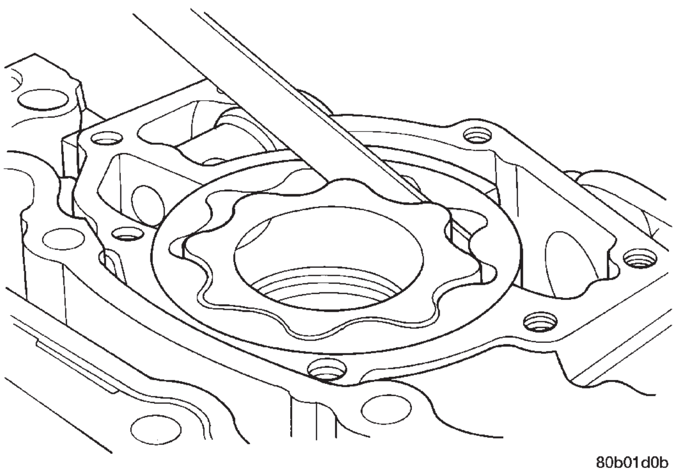


Fig. 115 Measuring Clearance Between Rotors

(4) Using a feeler gauge, measure clearance between inner rotor tip and outer rotor (Fig. 115). Clearance specification is: 0.06 - 0.18 mm (0.0024 - 0.0071 in.). Replace if out of limits.

(5) Place a straightedge across face of pump housing (Fig. 116). Clearance should be between 0.04 - 0.10 mm (0.0015 - 0.0039 in.). Replace if out of limits.

OIL RELIEF PLUNGER

(1) Check that the oil relief plunger slides smoothly (Fig. 113).

(2) Check for broken relief spring.

OIL PUMP ASSEMBLY

(1) Assemble pump, using new parts as required with clean oil. Align marks on the inner and outer rotors when assembling (Fig. 117).

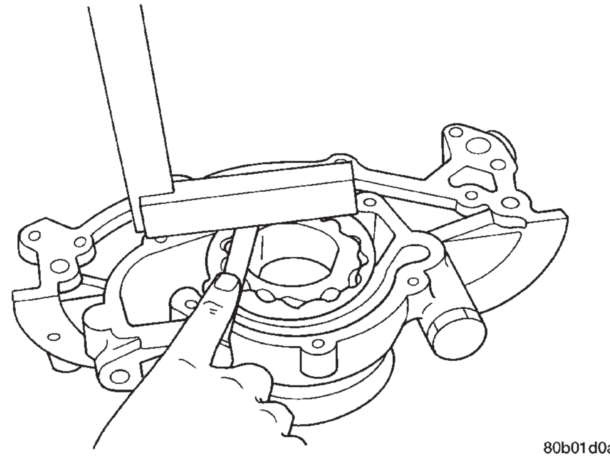


Fig. 116 Measuring Clearance Over Rotors

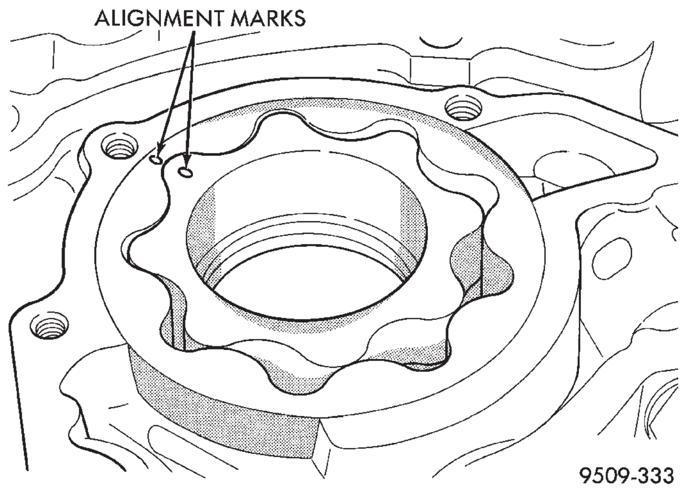


Fig. 117 Inner and Outer Rotor Alignment Marks

(2) Install cover and tighten screws to 12 N·m (105 in. lbs.).

(3) Install relief valve, spring, gasket and cap as shown in (Fig. 113). Tighten cap to 41 N·m (30 ft. lbs.).

TIMING BELT INSPECTION

(1) Remove the upper left timing belt cover (Fig. 118).

(2) Inspect both sides of the timing belt drive & back. Replace belt if any of the following conditions exist.

- Hardening of back rubber back side is glossy without resilience and leaves no indent when pressed with fingernail.
- Cracks on rubber back.
- Cracks or peeling of canvas.
- Cracks on rib root.
- Cracks on belt sides.
- Missing teeth.

CLEANING AND INSPECTION (Continued)

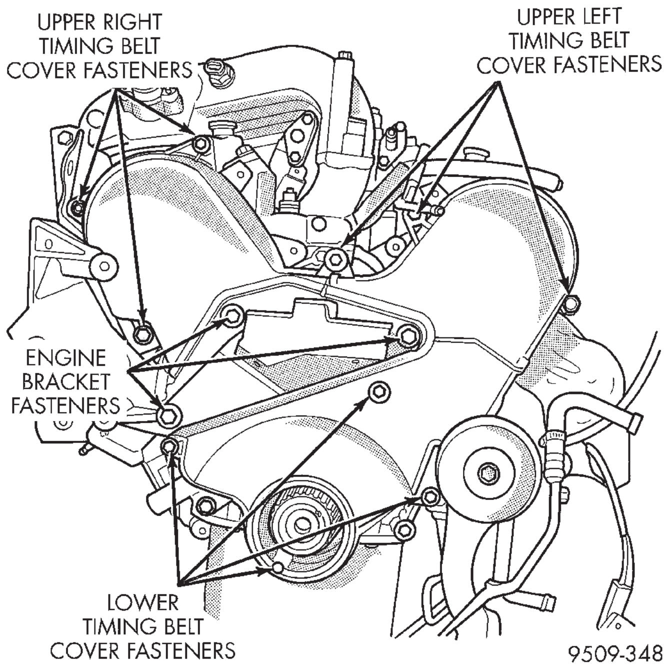


Fig. 118 Timing Belt Covers

• Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife (Fig. 119).

(3) If none of the above conditions are seen on the belt, the belt cover can be reinstalled.

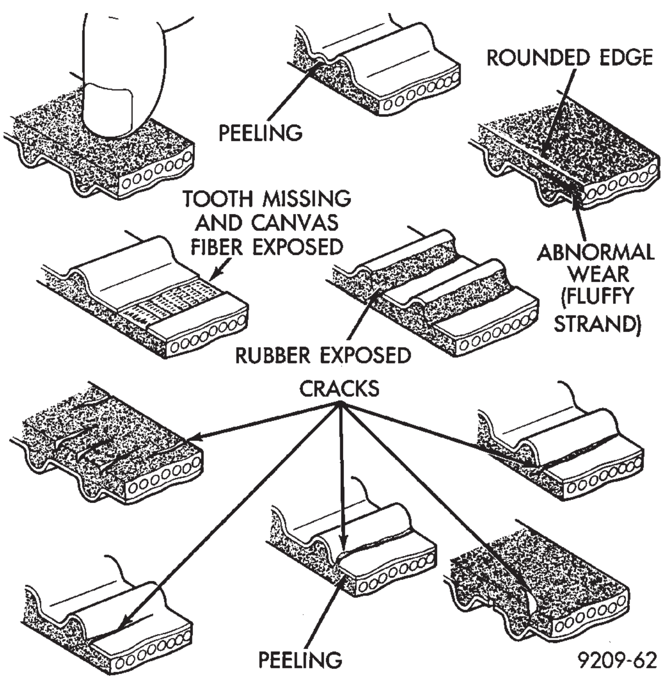


Fig. 119 Timing Belt Inspection

VALVES, SPRINGS, SEATS AND GUIDES

(1) Check valve stem tip for pitting or depression at point A (Fig. 120).

(2) Check for wear and ridge wear at Point B.

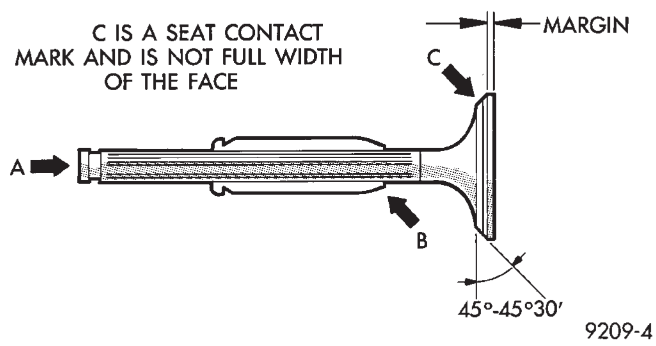


Fig. 120 Valve Inspection

(3) Measure the clearance between the valve guide and valve stem. If the service limit is exceeded, replace the valve guides, valves or both.

(4) Check for even contact (at face center) with valve seat, Point C.

(5) Check margin. Refer to Valve Specification Chart. Replace valve if margin is out of specification.

(6) Check valve guide height (Fig. 121).

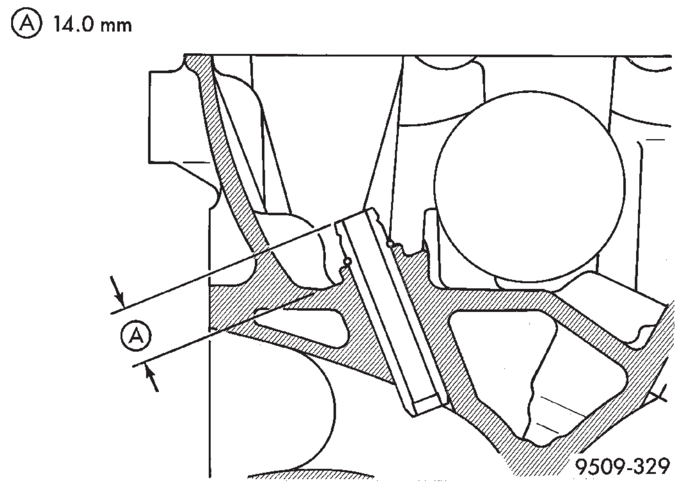


Fig. 121 Valve Guide Height

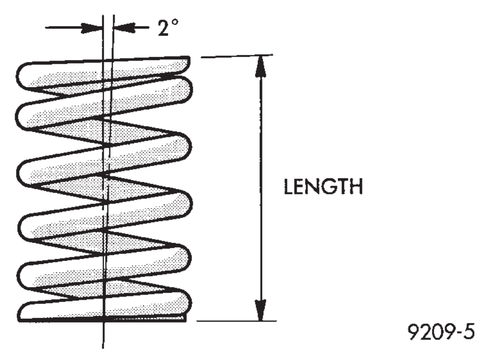


Fig. 122 Valve Spring

(7) Measure valve stem to guide clearance. Refer to Valve Specification Chart.

(8) Measure Valve spring free length and if the spring is square (Fig. 122). Refer to Valve Specification Chart.

CLEANING AND INSPECTION (Continued)

VALVE SPECIFICATION CHART

Valve Dimensions		
INTAKE VALVE (MINIMUM)		
Stem Diameter:	6.00 mm (0.236 in.)	
Face Angle:	45°	
Valve Margin:	1.0 mm (0.039 in.)	
EXHAUST VALVE (MINIMUM)		
Stem Diameter:	6.00 mm (0.236 in.)	
Face Angle:	45°	
Valve Margin:	1.20 mm (0.047 in.)	
Valve Guide Clearance	**New**	**Service Limit**
Intake:	0.02 - 0.05 mm (0.0008 - 0.002 in.)	0.10 mm (0.004 in.)
Exhaust:	0.04 - 0.07 mm (0.0016 - 0.0028 in.)	0.15 mm (0.006 in.)
Valve Springs	**New**	**Service Limit**
Free Length:	51.0 mm (2.01 in.)	50.0 mm (1.971 in.)
Squarness:	2° Maximum	4° Maximum
Spring Tension:	27.2 Kg @ 44.2 mm (60 lbs. @ 1.74 in.)	

VALVE SEAT INSPECTION

Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degree stone (Fig. 123).

ADJUSTMENTS

ENGINE SUPPORT ADJUSTMENT

The right and left support assemblies are slotted to allow for right/left drive train adjustment in relation to drive shaft assembly length.

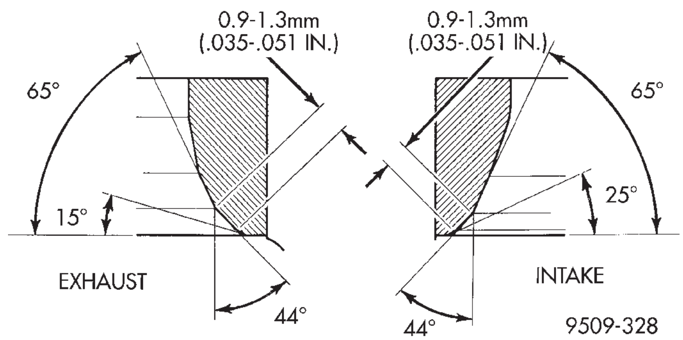


Fig. 123 Valve Seat Reconditioning

Check and reposition right and left engine support assemblies as required. Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Group 2, Suspension and Driveshaft.
- Any front end structural damage (after repair).
- Support Assembly replacement.

ENGINE SUPPORT ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine support assembly vertical fasteners.

(3) Loosen the left engine support assembly vertical bolts.

(4) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshaft for driveshaft identification and related assembly length measuring.

(5) Tighten right engine support assembly vertical bolts to 61 N·m (45 ft. lbs.). and tighten left engine support assembly bolts to 61 N·m (45 ft. lbs.).

(6) Recheck drive shaft length.

SPECIFICATIONS

2.5L ENGINE

DESCRIPTION **SPECIFICATION**

Valve Timing

Intake—Open . . . . 19° BTDC
Intake—Close . . . . 45° ABDC
Exhaust—Open . . . . 49° BBDC
Exhaust—Close . . . . 15°ATDC
Compression Pressure . . . . . . 178 psi @ 250 RPM
Maximum Variation Between Cylinders . . 97 kPa (14 PSI)
Service Limit 25%
Valve Clearance—Hot Engine . . . Hydraulic Lash Adjuster

SPECIFICATIONS (Continued)

DESCRIPTION **SPECIFICATION**

Cylinder Head

Flatness of Gasket Surface . . 0.03 mm (0.0012 in.)
Service Limit . . . . 0.2 mm (0.008 in.)
* Grinding Limit of Gasket Surface . . . . . 0.2 mm (0.008 in.)

Manifold—Flatness

Intake . . . . 0.10 mm (0.004 in.)
Service Limit . . . . 0.2 mm (0.008 in.)
Exhaust . . . . 0.15 mm (0.006 in.)
Service Limit . . . . 0.3 mm (0.012 in.)

Valves—Thickness of Valve Head (Margin)

Intake . . . . 1.0 mm (0.039 in.)
Service Limit . . . . 0.5 mm (0.019 in.)
Exhaust . . . . 1.2 mm (0.047 in.)
Service Limit . . . . 0.7 mm (0.028 in.)

Valve Stem to Guide Clearance

Intake . . . . . 0.02 to 0.05 mm (0.0008 to 0.002 in.)
Service Limit . . . . 0.10 mm (0.004 in.)
Exhaust . . . 0.04 to 0.07 mm (0.0016 to 0.0028 in.)
Service Limit . . . . 0.15 mm (0.006 in.)
Valve Face Angle . . . . 45° to 45-1/2°
Valve Stem Diameter
Intake and Exhaust . . . . 6.0 mm (0.236 in.)

Valve Guide

Height . . . . 14.0 mm (0.551 in.)
O.D. 11.0 mm (0.443 in.)
I.D. 6.0 mm (0.236 in.)

Valve Seat

Seat Surface Angle . . . . 44° to 44-1/2°
Contact Width . . . . 0.9 to 1.3 mm (0.035 to 0.051 in.)
Sinkage (Service Limit) . . . . . 0.2 mm (0.078 in.)

Valve Spring

Free Height . . . . 51.0 mm (2.01 in.)
Service Limit . . . . 50.0 mm (1.97 in.)
Loaded Height . . . . 44.2 mm at 267 N (1.74 in. at 60 lbs.)
Perpendicularity
Intake and Exhaust . . . . 2° Maximum
Service Limit . . . . 4° Maximum

Piston

O.D. . . . . 83.5 mm (3.29 in.)
Piston to Cylinder Clearance . . . . 0.02 - 0.04 mm (0.0008 - 0.0016 in.)

Piston Ring End Gap

No. 1 . . . . 0.25 - 0.40 mm (0.010 - 0.016 in.)
Service Limit . . . . 0.8 mm (0.031 in.)
No. 2 . . . . 0.40 - 0.55 mm (0.016 - 0.022 in.)
Service Limit . . . . 0.8 mm (0.031 in.)
Oil . . . . 0.15 - 0.50 mm (0.006 - 0.019 in.)
Service Limit . . . . 1.0 mm (0.039 in.)

Piston Ring Side Clearance

No. 1 . . . . . 0.030 - 0.070 mm (0.0012 - 0.0028 in.)
Service Limit . . . . 0.1 mm (0.004 in.)

DESCRIPTION **SPECIFICATION**

No. 2 . . . . . . 0.002 - 0.06 mm (0.0007 - 0.0024 in.)
Service Limit . . . . 0.1 mm (0.004 in.)

Connecting Rod

Length—Center to Center . . . . . 140.9 - 141.0 mm (5.547 - 5.551 in.)
Parallelism—Twist . . . . 0.05 mm (0.0019 in.)
Torsion . . . . 0.1 mm (0.0039 in.)
Big End Thrust Clearance . . . . . . 0.10 - 0.25 mm (0.004 - 0.010 in.)
Service Limit . . . . 0.4 mm (0.016 in.)

Crankshaft

End Play . . . . . . 0.05 - 0.25 mm (0.002 - 0.010 in.)
Service Limit . . . . 0.4 mm (0.016 in.)
Main Journal Diameter . . . . . 60.0 mm (2.362 in.)
Pin Diameter . . . . 50.0 mm (1.969 in.)
Bearing Surface Out-of-Round (Max.) . . . 0.03 mm (0.001 in.)
Bearing Surface Taper (Max.) . . . . 0.005 mm (0.0002 in.)
Bearing Oil Clearance . . . . 0.02 - 0.04 mm (0.0008 - 0.0016 in.)

Cylinder Block

I.D. (Bore) . . . . 83.50 - 83.53 mm (3.29 in.)
Flatness of Top Surface . . . . . 0.05 mm (0.002 in.)
Service Limit . . . . 0.1 mm (0.004 in.)
Grinding Limit of Top Surface . . . . 0.2 mm* (0.008 in.)*

Oil Pump

Relief Valve Opening Pressure . . . 5.0 - 6.0 kg/cm^2 (71.45 - 85.75 psi)
Outer Rotor to Case Clearance . . . 0.10 - 0.18 mm (0.004 - 0.007 in.)
Service Limit . . . . 0.35 mm (0.0138 in.)
Clearance Over Rotors
(End Clearance) . 0.04 - 0.10 (0.0015 - 0.0039 in.)
Clearance Between Rotors
(Inner Rotor Tip to Outer Rotor) . . 0.06 - 0.18 mm (0.003 - 0.007 in
Minimum Pressure, Engine
Fully Warmed Up @ Idle . . . . 41 kPa (6 psi)
@ 3000 RPM . . . . 241 - 517 kPa (35 - 75 psi)

NOTE: * Includes/Combined With Cylinder Head and Block Top Surface Grinding

TORQUE CHART 2.5L

DESCRIPTION **TORQUE**

Auto Tensioner

Bolt . . . . 23 N·m (17 ft. lbs.)

Camshaft Sprocket

Bolt . . . . 88 N·m (65 ft. lbs.)

Connecting Rod Cap

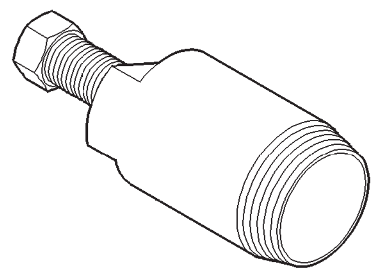
Nut . . . . 52 N·m (38 ft. lbs.)

SPECIFICATIONS (Continued)

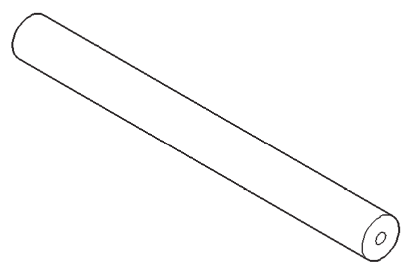
DESCRIPTION	TORQUE
Crankshaft Pulley	
Bolt	182 N·m (134 ft. lbs.)
Cylinder Head	
Bolt	108 N·m (80 ft. lbs.)
Cylinder Head Cover	
Bolt	3.5 N·m (31 in. lbs.)
Distributor	
Nut	13 N·m (115 in. lbs.)
Drive Plate to Crankshaft	
Bolts	95 N·m (70 ft. lbs.)
Exhaust Manifold	
Nut	44 N·m (33 ft. lbs.)
Exhaust Manifold Heat Shield	
Bolts	13 N·m (115 in. lbs.)
Engine Support Bracket	
Bolt	45 N·m (33 ft. lbs.)
Heater Pipe Assembly	
	19 N·m (168 in. lbs.)
Idler Pulley	
Bolt	44 N·m (33 ft. lbs.)
Intake Manifold Plenum	
Bolt	18 N·m (160 in. lbs.)
Intake Manifold Plenum Support	
M8 Bolt	18 N·m (160 in. lbs.)
M10 Bolt	36 N·m (26.5 ft. lbs.)
Intake Manifold	
Nut	21 N·m (186 in. lbs.)
Main Bearing Cap	
Bolt	94 N·m (69 ft. lbs.)
Oil Filter	
	14 N·m (124 in. lbs.)
Oil Filter Bracket	
Bolt	23 N·m (17 ft. lbs.)
Oil Pan	
Bolt	6 N·m (53 in. lbs.)
Oil Pan Drain	
Plug	40 N·m (29 ft. lbs.)
Oil Pick-up Tube	
Bolt	19 N·m (168 in. lbs.)
Oil Pump Case	
M8 Bolt	14 N·m (124 in. lbs.)
M10 Bolt	41 N·m (30 ft. lbs.)
Oil Pump Cover	
Bolt	10 N·m (88.5 in. lbs.)
Oil Seal Retainer	
Bolt	11 N·m (104 in. lbs.)
Rocker Arm & Shaft	
Bolt	31 N·m (23 ft. lbs.)
Spark Plug	
	25 N·m (18 ft. lbs.)
Tensioner Pulley	
Bolt	48 N·m (35 ft. lbs.)
Tensioner Arm Assembly	
Bolt	44 N·m (33 ft. lbs.)
Thermostat Housing	
Bolt	19 N·m (168 in. lbs.)
Thrust Case	
Bolt	13 N·m (115 in. lbs.)
Water Inlet Pipe	
Bolt	14 N·m (124 in. lbs.)
Water Pump	
Bolt	24 N·m (17 ft. lbs.)

SPECIAL TOOLS

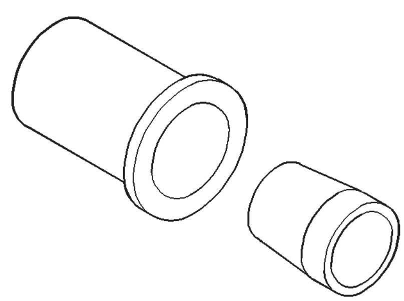
2.5L ENGINE



Remover C-4679-A

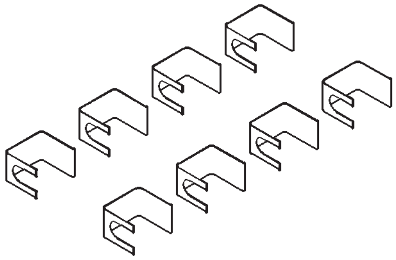


Insert C-4685-C2

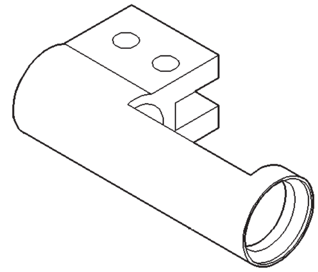


Installer MD-998717

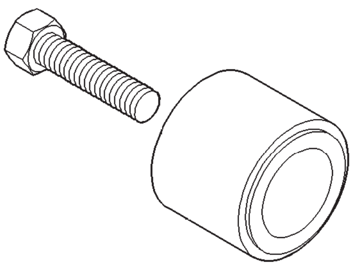
SPECIAL TOOLS (Continued)



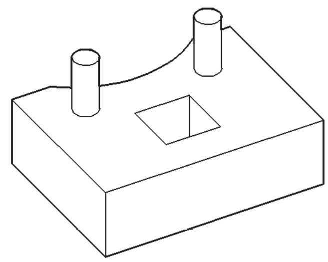
Holders MD-998443



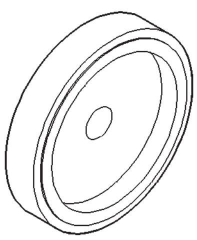
Adapter 6526



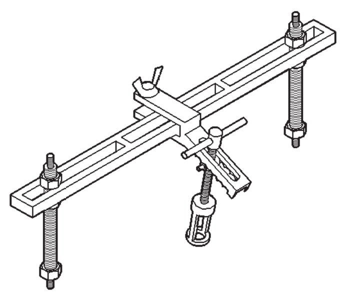
Installer MD-998713



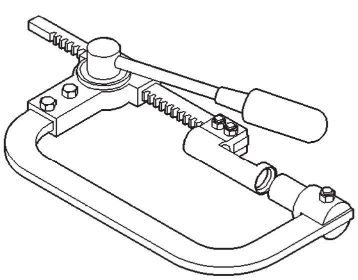
Wrench MD-998767



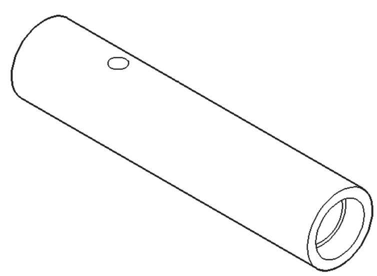
Installer MD-998718



Compressor MD-998772-A

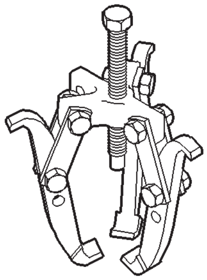


Compressor C-3422-B

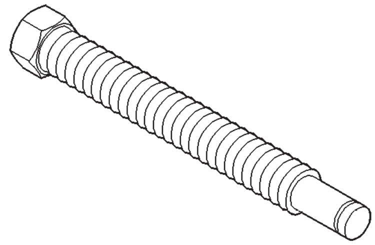


Installer MD-998774

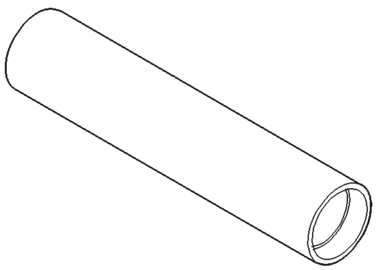
SPECIAL TOOLS (Continued)



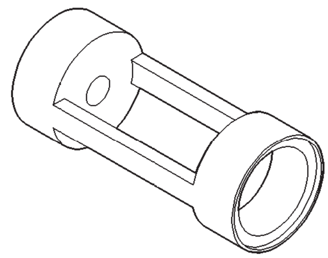
Puller 1026



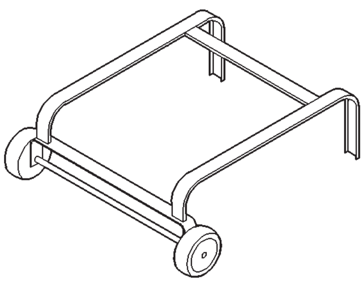
Screw 6765



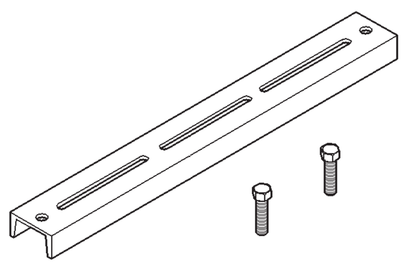
Installer 6052



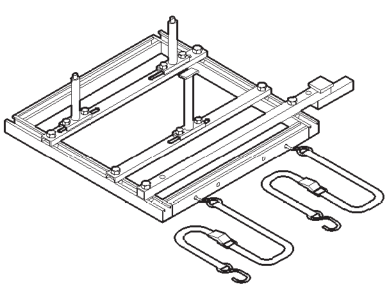
Adapter 6779



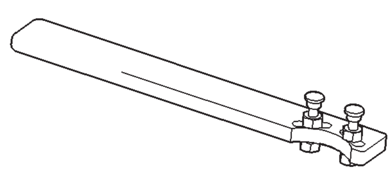
Dolly 6135



Support Bar Cradle 6710-3A

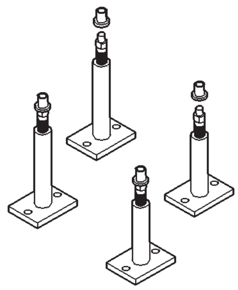


Fixture Engine 6710

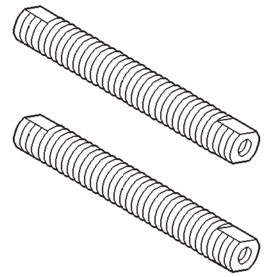


Holder 6847

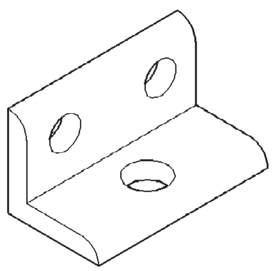
SPECIAL TOOLS (Continued)



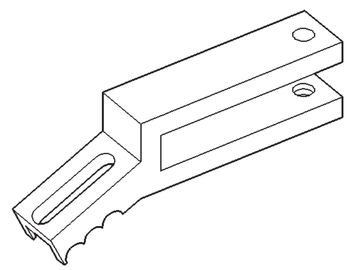
Engine Cradle Posts 6848



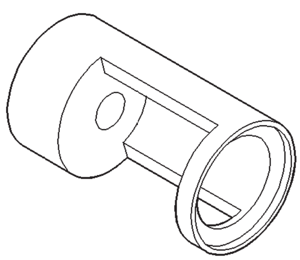
Posts 6886



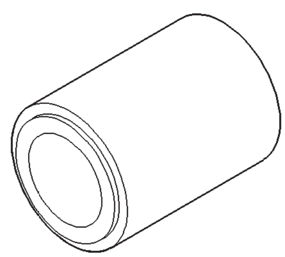
Bracket Cradle Post Support 6973



Adapter 6887



Adapter 6885



Camshaft Seal Installer 6863

EXHAUST SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

EXHAUST SYSTEM

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

The exhaust system is produced in one configuration (Fig. 1). The system has a front mounted catalytic converter, muffler and resonator. Tail pipes, mufflers, and resonators are tuned to each power-train combination. The 2.5L engine model has an oval exhaust tip.

CATALYTIC CONVERTERS

There is no regularly scheduled maintenance on the catalytic converter. If damaged, the converter must be replaced.

CAUTION: Due to exterior physical similarities of some catalytic converters with pipe assemblies, extreme care should be taken with replacement parts. There are internal converter differences required in some parts of the country (particularly vehicles built for States with strict emission requirements).

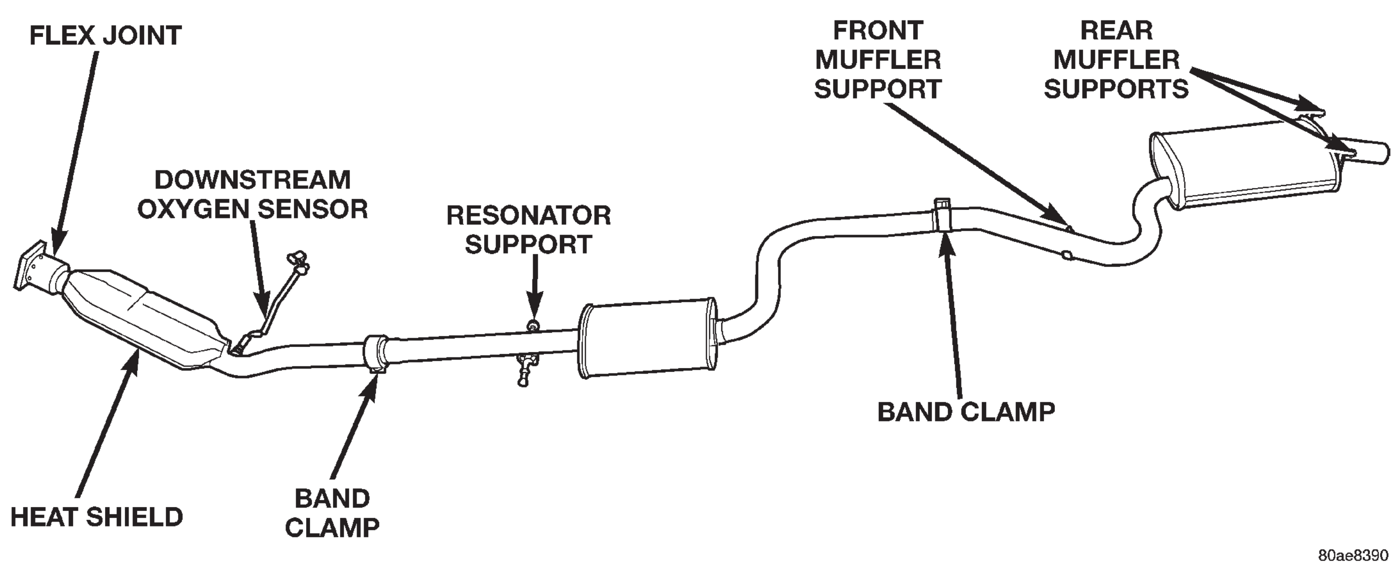


Fig. 1 Exhaust System

DESCRIPTION AND OPERATION (Continued)

EXHAUST GAS RECIRCULATION (EGR)

To assist in the control of oxides of nitrogen (NOx) in engine exhaust, all engines are equipped with an exhaust gas recirculation system. The use of exhaust gas to dilute incoming air/fuel mixtures lowers peak flame temperatures during combustion, thus limiting the formation of NOx.

Exhaust gases are taken from opening in the exhaust manifold passage to the intake manifold. Refer to Group 25, Emission Control Systems for a complete Description, Diagnosis, and Service Procedures on the exhaust gas recirculation system and components.

HEAT SHIELDS

Heat shields (Fig. 2) are needed to protect both the vehicle and the environment from the high temperatures developed near the catalytic converters. All engines are equipped with a heat shield crimped on the top of the convertor.

Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields on cars so equipped. Light over spray near the edges is permitted. Application of coating will greatly reduce the efficiency of the heat shields resulting in excessive floor pan temperatures and objectionable fumes.

The combustion reaction caused by the catalyst releases additional heat in the exhaust system. Causing temperature increases in the area of the catalytic convertor under severe operating conditions. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency. **Do not** remove spark plug wires from plugs or by any other means short out cylinders if exhaust system is equipped with catalytic converter. Failure of the catalytic converter can occur due to temperature increases caused by unburned fuel passing through the converter.

The use of the catalysts also involves some non-automotive problems. Unleaded gasoline must be used to avoid poisoning the catalyst core. Do not allow engine to operate at fast idle for extended periods (over 5 minutes). This condition may result in excessive exhaust system and floor pan temperatures.

EXHAUST SYSTEM GROUND STRAP

All vehicles are equipped with a ground strap on the exhaust system. The ground strap is attached from the rear muffler bracket to the body (Fig. 2). The ground strap is used to suppress radio frequency interference/static.

EXHAUST FLEX-JOINT COUPLING

A exhaust flex-joint coupling (Fig. 3) and (Fig. 4) is used to secure the catalytic converter to the engine manifold. This joint actually moves back and forth as the engine moves, preventing breakage that could occur from the back-and-forth motion of a transverse mounted engine.

The exhaust flex-joint is welded to the catalytic converter.

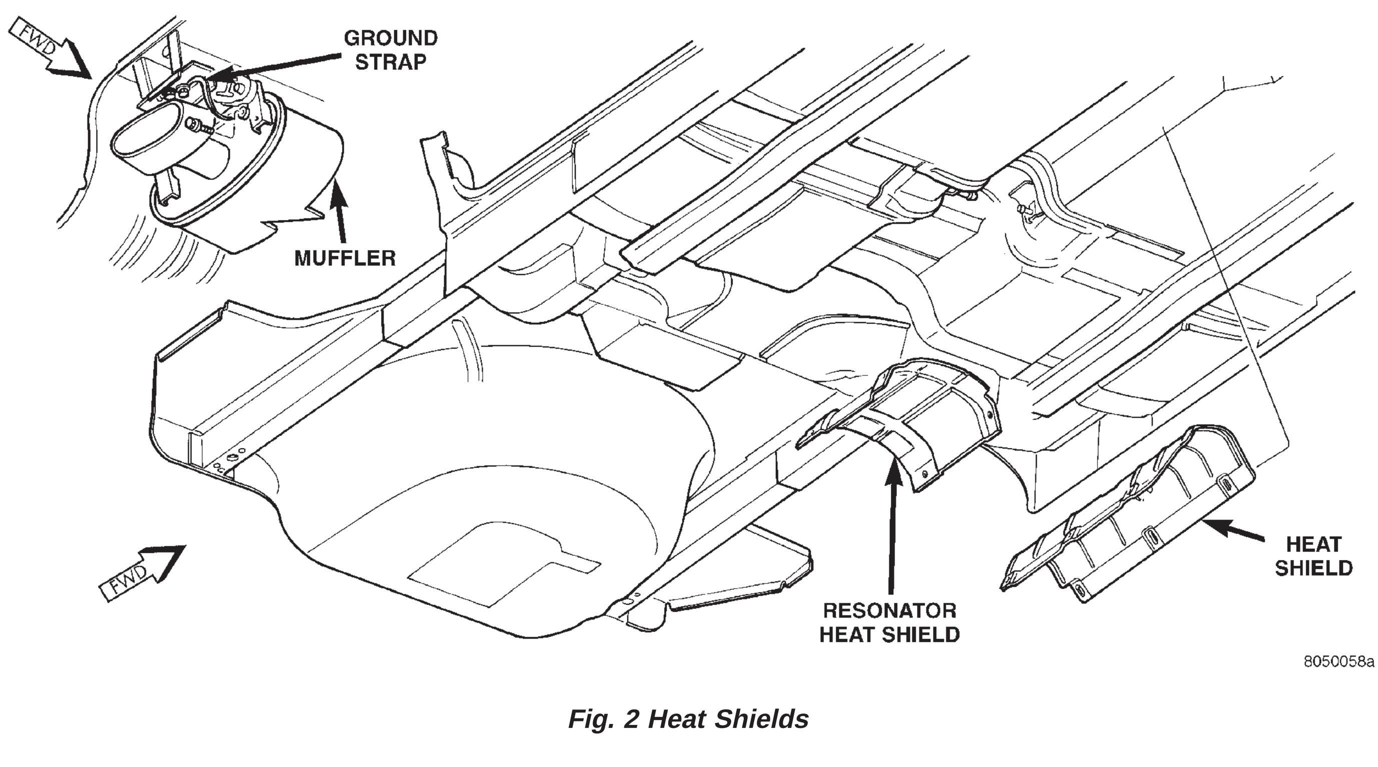


Fig. 2 Heat Shields

DESCRIPTION AND OPERATION (Continued)

CAUTION: When servicing, care must be exercised not to dent or bend the bellows or bellows cover of the flex-joint. Should this occur, the flex-joint will eventually fail and require the catalytic converter be replaced.

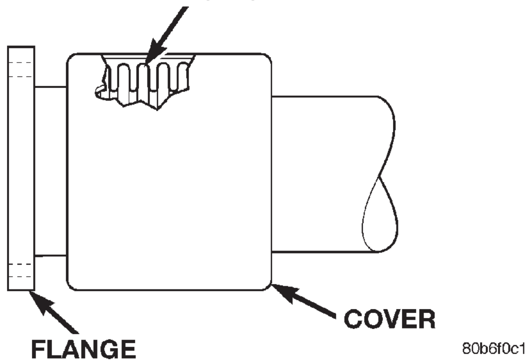


Fig. 3 Flex-Joint Coupling—2.0/2.4L

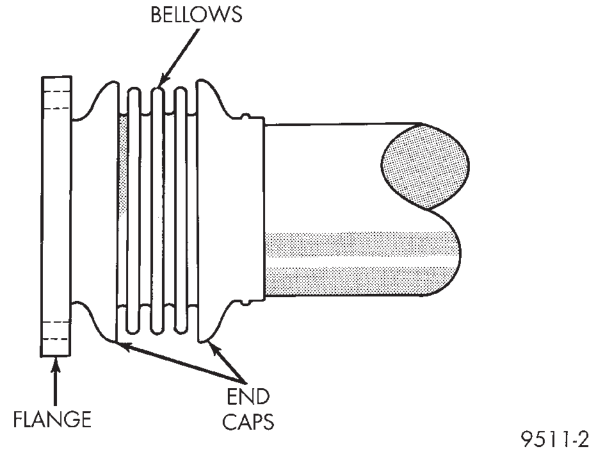


Fig. 4 Flex-Joint Coupling—2.5L

DIAGNOSIS AND TESTING

EXHAUST SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE EXHAUST NOISE (UNDER HOOD)	1. Exhaust manifold cracked or broken.	1. Replace manifold.
	2. Manifold to cylinder head leak.	2. Tighten manifold and/or replace gasket.
	3. EGR Valve to manifold gasket leakage.	3. Tighten fasteners or replace gasket.
	4. EGR Valve to EGR tube gasket leakage.	4. Tighten fasteners or replace gasket.
	5. EGR tube to manifold tube leakage.	5. Tighten tube nut.
	6. Exhaust flex-joint to manifold leak.	6. Tighten joint fasteners and/or replace gasket.
	7. Exhaust flex-joint.	7. Replace catalytic converter assembly.
	8. Pipe and shell noise from front exhaust pipe.	8. Characteristic of single wall pipe.
EXCESSIVE EXHAUST NOISE	1. Leak at exhaust pipe joints.	1. Tighten clamps at leaking joints.
	2. Burned or rusted out muffler assembly or exhaust pipe.	2. Replace muffler resonator tailpipe assembly or exhaust pipe with catalytic converter assembly.
	3. Burned or rusted out resonator.	3. Replace muffler resonator tailpipe assembly .
	4. Restriction in exhaust system.	4. Remove restriction, if possible, or replace as necessary.
	5. Converter material in muffler.	5. Replace muffler and converter assemblies. Check fuel injection and ignition systems for proper operation.

REMOVAL AND INSTALLATION

EXHAUST SYSTEM

REMOVAL

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

(1) Raise vehicle on hoist and apply penetrating oil to clamp nuts of component being removed (Fig. 5).

(2) Loosen clamp at muffler to resonator/pipe assembly (Fig. 5).

CAUTION: Do not use any tools to remove the rubber isolators—remove by hand only. Soapy water or silicone-based lubricant spray may be used to assist removal/installation of isolators. DO NOT use a petroleum-based lubricant on the isolators, as damage to the rubber material can occur.

(3) Remove support isolators from muffler supports.

(4) Remove ground strap from muffler (Fig. 7).

(5) Remove muffler assembly from resonator pipe.

(6) Remove clamp and supports at the resonator pipe to catalytic converter slip joint (Fig. 5). Separate at slip joint and remove the resonator assembly.

(7) Disconnect downstream heated oxygen sensor from the catalytic converter pipe (Fig. 1).

(8) Vehicle equipped with 2.5L engine disconnect upstream heated oxygen sensor.

(9) Remove catalytic converter to exhaust manifold attaching fasteners (Fig. 6). Remove catalytic converter from vehicle.

(10) Clean ends of pipes and/or muffler to assure mating of all parts. Discard broken or worn insulators, rusted clamps, supports and attaching parts.

NOTE: Band clamps are spot welded to exhaust system. If a band clamp must be replaced, the spot weld must be ground off the exhaust pipe.

NOTE: When replacement is required on any component of the exhaust system, it is most important that original equipment parts (or their equivalent) be used for the following reasons:

- To insure proper alignment with other parts in the system.
- Provide acceptable exhaust noise levels and does not change exhaust system back pressure that could affect emissions and performance.

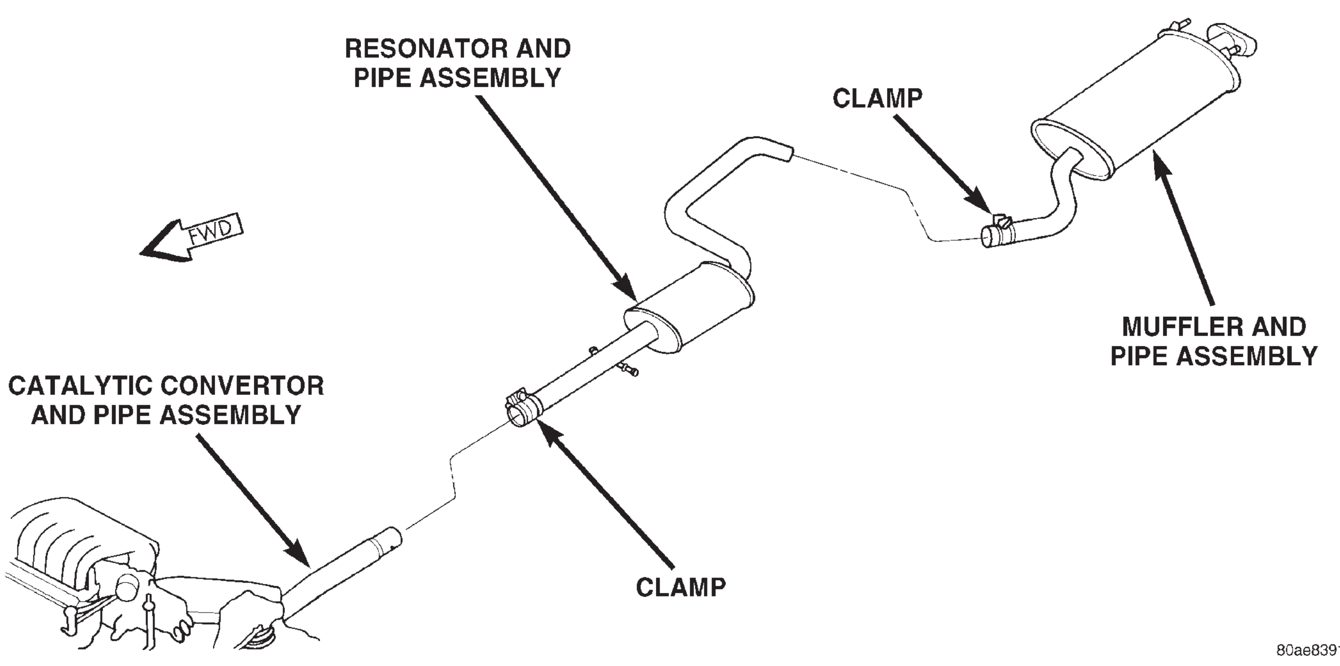


Fig. 5 Exhaust System Components

REMOVAL AND INSTALLATION (Continued)

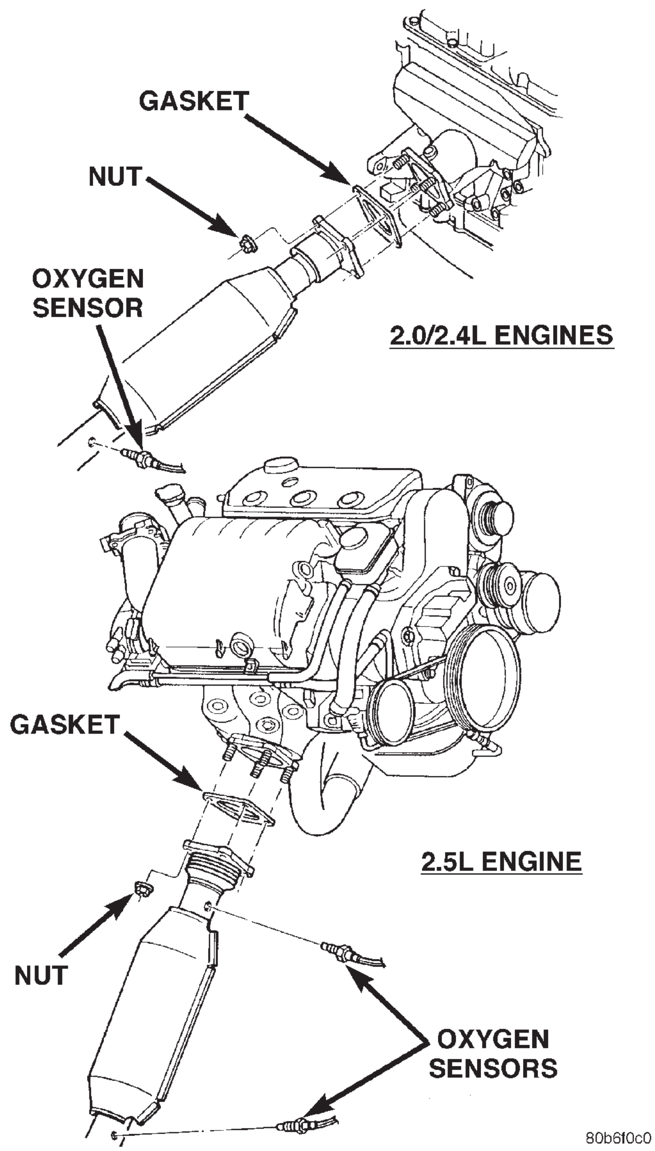


Fig. 6 Flex-Joint Connections

INSTALLATION

When assembling exhaust system **do not** tighten clamps until components are aligned and supports have equal load on them (Fig. 7).

(1) Assemble catalytic convertor to exhaust manifold connection (Fig. 6).

(2) Assemble resonator pipe to catalytic convertor. Attach isolators to the supports on the underbody (Fig. 7).

(3) Install the muffler to resonator pipe. Attach isolators to the supports on the underbody (Fig. 7).

NOTE: Always work from the front to rear of exhaust system when aligning and tightening exhaust system components.

(4) Align and tighten the catalytic convertor to exhaust manifold fasteners (Fig. 6). Tighten fasteners to 28 N·m (250 in. lbs.).

(5) Align each component to maintain position and proper clearance with underbody parts. Also, all supports should have equal load on them. Tighten clamps to 54 N·m (40 ft. lbs.) (Fig. 8).

(6) Connect ground strap.

(7) Connect the downstream heated oxygen sensor.

(8) Connect the upstream heated oxygen sensor (2.5L engine).

CLEANING AND INSPECTION

EXHAUST SYSTEM

Inspect the exhaust pipes, catalytic converters, muffler, and resonators for cracked joints, broken welds and corrosion damage that would result in a leaking exhaust system. Inspect the clamps, support brackets, and insulators for cracks and corrosion damage.

NOTE: Band clamps are spot welded to exhaust system. If a band clamp must be replaced, the spot weld must be ground off.

CLEANING AND INSPECTION (Continued)

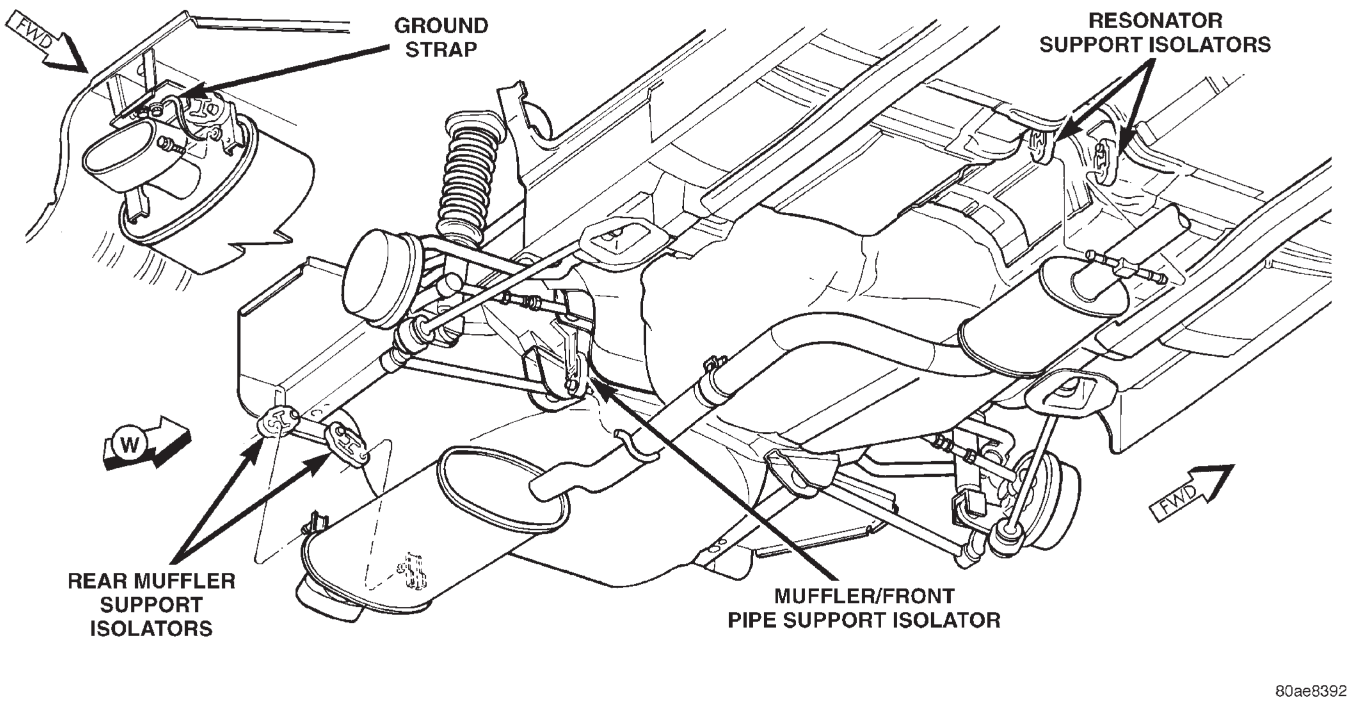


Fig. 7 Exhaust System Support Isolators—Typical

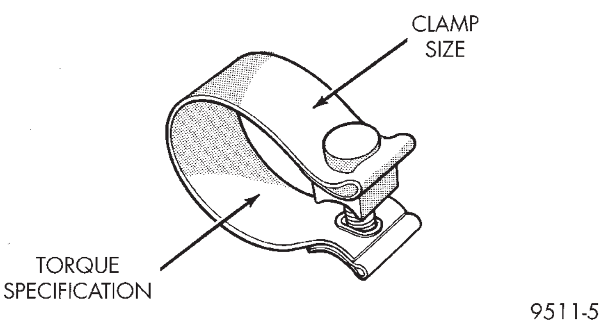


Fig. 8 Band Clamp

ADJUSTMENTS

EXHAUST SYSTEM ALIGNMENT

A misaligned exhaust system is usually indicated by a vibration, rattling noise, or binding of exhaust system components. These noises are sometimes hard to distinguish from other chassis noises. Inspect exhaust system for broken or loose clamps, heat shields, insulators, and brackets. Replace or tighten as necessary. It is important that exhaust system clearances and alignment be maintained.

Perform the following procedures to align the exhaust system:

(1) Loosen clamps and support brackets.

(2) Align the exhaust system starting at the front, working rearward.

(3) Tighten all clamps and brackets once alignment and clearances are achieved.

SPECIFICATIONS

TORQUE

DESCRIPTION	TORQUE
Band Clamp	
Fastener	54 N·m (40 ft. lbs.)
Body Heat Shields	
Fasteners	5 N·m (40 in. lbs.)
Cross-Under Pipe	
Fasteners	31 N·m (275 in. lbs.)
Exhaust Manifold Flange-2.0/2.4/2.5L	
Fasteners	28 N·m (250 in. lbs.)
Exhaust Manifold Heat Shield-2.5L	
Bolts	13 N·m (115 in. lbs.)

EXHAUST SYSTEM AND INTAKE MANIFOLD

CONTENTS

GENERAL INFORMATION

EXHAUST SYSTEM

The exhaust system is produced in two configurations (Fig. 1) (Fig. 2). Exhaust systems for vehicles operating on unleaded fuel have a front mounted catalytic converter, muffler and resonator. Exhaust systems for vehicles operating on leaded fuel do not use a catalytic converter. Tail pipes, mufflers, and resonators are tuned to each powertrain combination. Only the 2.5L engine model has an oval exhaust tip.

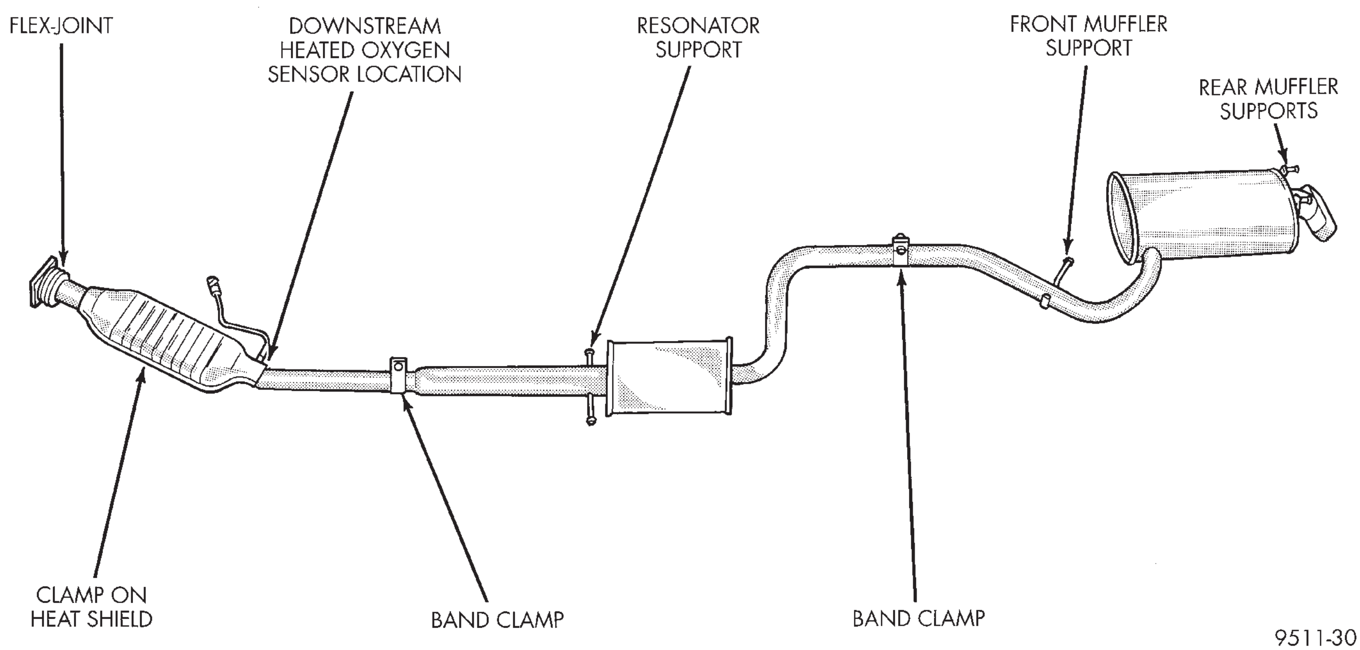


Fig. 1 Exhaust System—Unleaded Fuel

GENERAL INFORMATION (Continued)

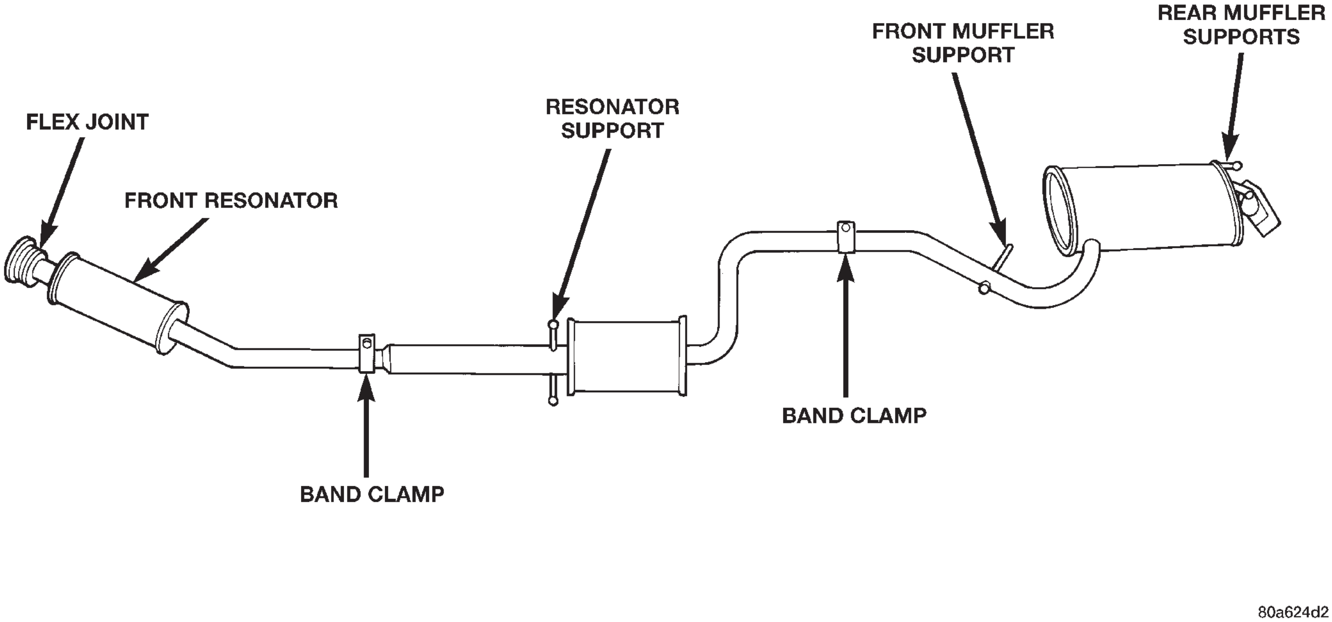


Fig. 2 Exhaust System—Leaded Fuel

FRAME AND BUMPERS

CONTENTS

BUMPERS

INDEX

REMOVAL AND INSTALLATION

FRONT BUMPER FASCIA

REMOVAL

(1) Release hood latch and open hood.
(2) Remove front wheelhouse splash shields as necessary to gain assess to fascia fasteners.
(3) Remove fasteners holding bottom of fascia to radiator closure panel.
(4) Disengage fog lamp wire connector from body harness, if equipped.
(5) Remove fasteners attaching fascia to front fenders. (Fig. 1).
(6) Remove fascia from vehicle.

INSTALLATION

(1) Place fascia on position on vehicle.
(2) Install fasteners to hold fascia to front fenders.
(3) Engage fog lamp wire connector to body wire harness, if equipped.
(4) Install fasteners to hold bottom of fascia to radiator closure panel.
(5) Install front wheelhouse splash shields.

REAR BUMPER FASCIA

REMOVAL

(1) Release trunk latch and open trunk.
(2) Remove left rear tail lamp and disengage license plate wire connector from tail lamp. Refer to Group 8L, Lamps, for proper procedures.
(3) On CP-model, remove right rear tail lamp. Refer to Group 8L, Lamps, for proper procedures.
(4) On CP-model, Remove push-in fasteners holding fascia to quarter panel inside tail lamp cavities (Fig. 2).
(5) Remove push-in fasteners holding trunk lid slam bumpers to top of fascia.
(6) Remove push-in fastener holding center of fascia to rear closure panel.
(7) Remove screws holding fascia to rear wheelhouse splash shields.
(8) Remove push-in fastener holding fascia to quarter panel at the wheelwell opening.
(9) Slide fascia rearward to disengage hooks holding fascia to bottom of quarter panel.
(10) Separate fascia from vehicle.

INSTALLATION

(1) Position fascia on vehicle.
(2) Slide fascia forward to engage hooks holding fascia to bottom of quarter panel.
(3) Install push-in fastener holding center of fascia to rear closure panel.
(4) Install push-in fasteners holding trunk lid slam bumpers to top of fascia.
(5) Install push-in fasteners holding fascia to quarter panel at wheelwell opening.
(6) Install screws holding fascia to rear wheelhouse splash shields.
(7) On CP–model, install push-in fasteners holding fascia to quarter panel inside tail lamp cavities.
(8) Engage license plate wire connector to left tail lamp.

REMOVAL AND INSTALLATION (Continued)

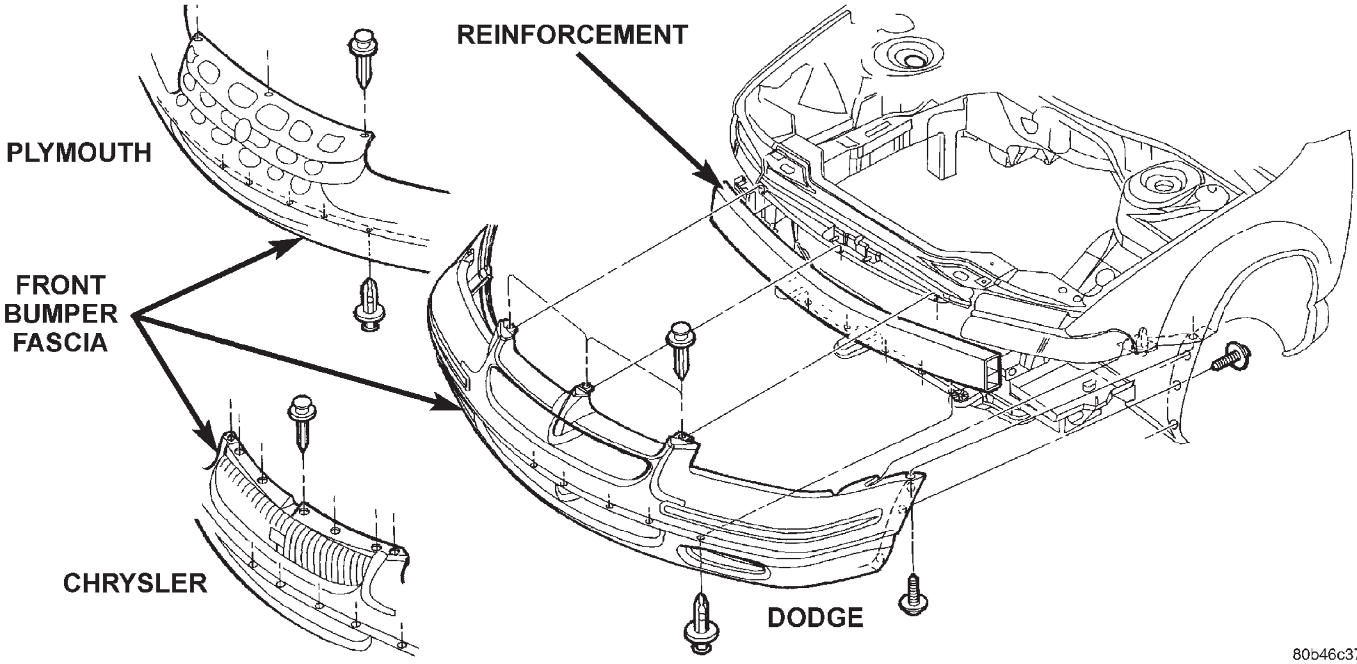


Fig. 1 Front Bumper Fascia

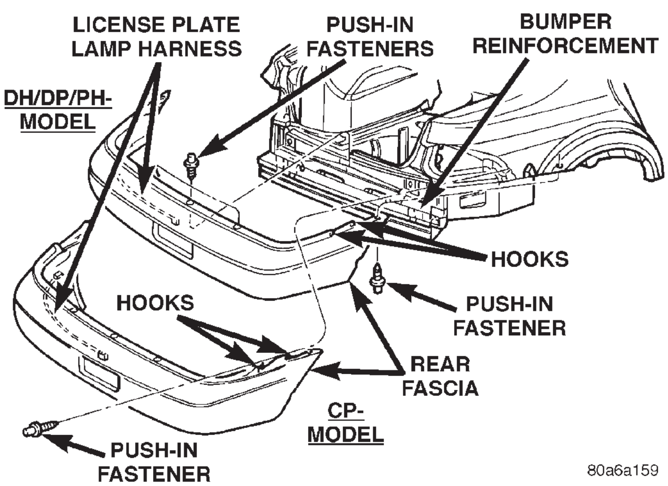


Fig. 2 Rear Bumper Fascia

(9) Install tail lamps. Refer to Group 8L, Lamps, for proper procedures.

REAR BUMPER REINFORCEMENT

REMOVAL

(1) Remove rear fascia.

(2) Support bumper reinforcement on a suitable lifting device.

(3) Mark position of nuts on reinforcement to aid in installation.

(4) Remove nuts holding rear bumper reinforcement to frame rail (Fig. 3).

(5) Separate bumper reinforcement from vehicle.

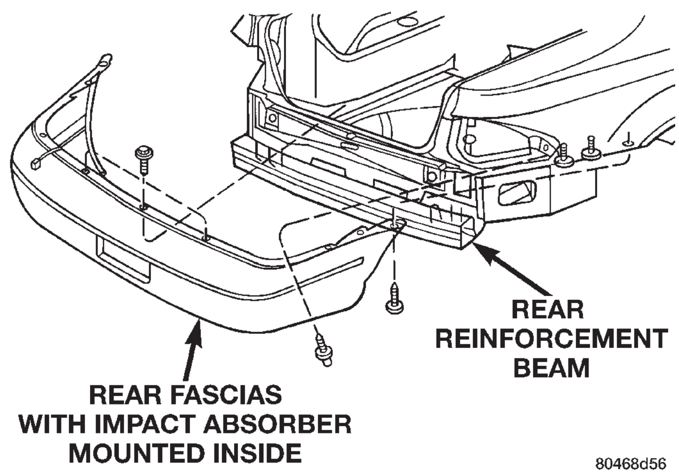


Fig. 3 Rear Bumper Reinforcement

INSTALLATION

(1) Position rear bumper reinforcement on vehicle.

(2) Install nuts holding bumper reinforcement to frame rail. Use marks made previously to properly position bumper reinforcement.

(3) Tighten nuts to 28 N·m (250 in. lbs.).

(4) Install rear fascia.

FRAME

INDEX

DESCRIPTION AND OPERATION

REAR SUSPENSION CROSSMEMBER

This vehicle is equipped with a bolt in type rear suspension crossmember. The crossmember on this vehicle is the same for all of the optional suspensions that are available on the vehicle.

REMOVAL AND INSTALLATION

FRONT SUSPENSION CROSSMEMBER

REMOVAL

(1) Hoist and support vehicle on safety stands. Refer to Group 0, Lubrication and Maintenance, for proper procedure.

(2) Place a suitable lifting device under front suspension crossmember.

(3) Remove bolts holding suspension strut to the lower control arm. Refer to Group 2, Suspension, for proper procedures.

(4) Disengage lower ball joints from lower control arms. Refer to Group 2, Suspension, for proper procedures.

(5) Remove bolts holding front of suspension crossmember to frame rails under upper control arms.

(6) Loosen bolts holding rear of suspension crossmember to frame rail torque boxes.

(7) Allow the front of the suspension crossmember to swing away from the frame rails.

(8) Remove bolts holding steering gear to top of suspension crossmember (Fig. 1).

CAUTION: Do not allow steering gear to hang by the pressure or return hoses, damage to hoses can result.

(9) Using mechanics wire, tie steering gear to structure above.

(10) Raise crossmember back into position.

(11) Remove bolts holding rear of crossmember to frame rail torque boxes.

(12) Lower front suspension crossmember away from bottom of vehicle.

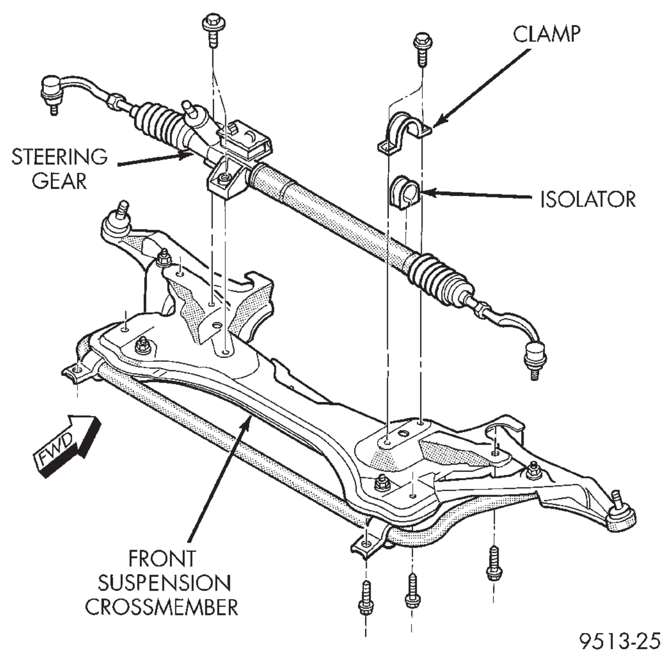


Fig. 1 Front Suspension Crossmember

INSTALLATION

(1) Raise front suspension crossmember into position on vehicle.

(2) Loosely install bolts holding rear of crossmember to frame rail torque boxes.

(3) Lower crossmember and install bolts holding steering gear to top of suspension crossmember.

(4) Raise crossmember into position.

(5) Tighten bolts holding rear of suspension crossmember to frame rail torque boxes.

(6) Install bolts holding front of suspension crossmember to frame rails under upper control arm.

(7) Engage lower ball joint to lower control arms. Refer to Group 2, Suspension, for proper procedures.

(8) Install bolts holding suspension strut to lower control arm. Refer to Group 2, Suspension, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

REAR SUSPENSION CROSSMEMBER

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove both rear wheel and tire assemblies from the vehicle.

(3) Remove the shock absorber clevis bracket to rear knuckle attaching bolt and nut on both sides of the vehicle (Fig. 2).

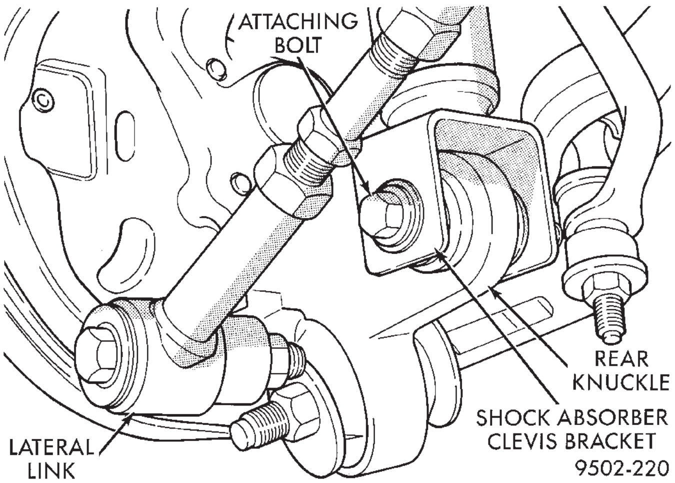


Fig. 2 Shock Absorber To Knuckle Attaching

(4) Remove muffler support bracket from rear frame rail (Fig. 3).

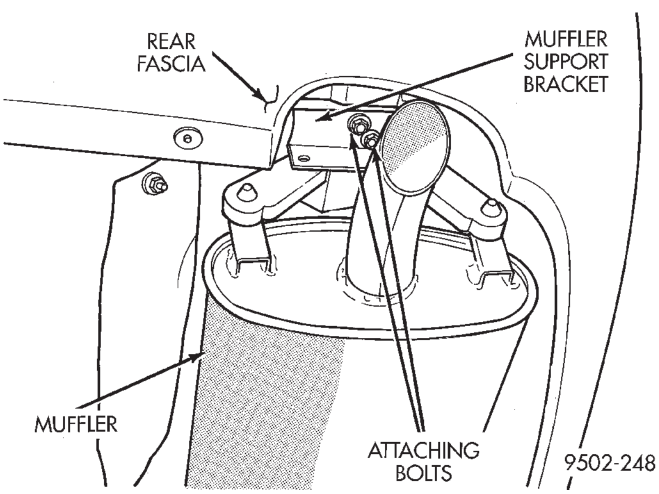


Fig. 3 Muffler Support Bracket

(5) Remove the rear exhaust pipe hanger from the rear suspension crossmember (Fig. 4). Let exhaust system drop down as far as possible.

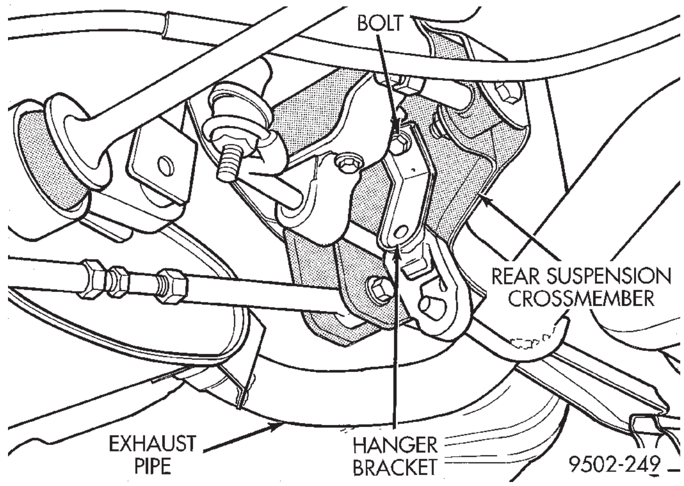


Fig. 4 Exhaust Pipe Hanger At Rear Suspension Crossmember

(6) Position a transmission jack and wooden block under the center of the rear suspension crossmember to support and lower crossmember during removal (Fig. 5).

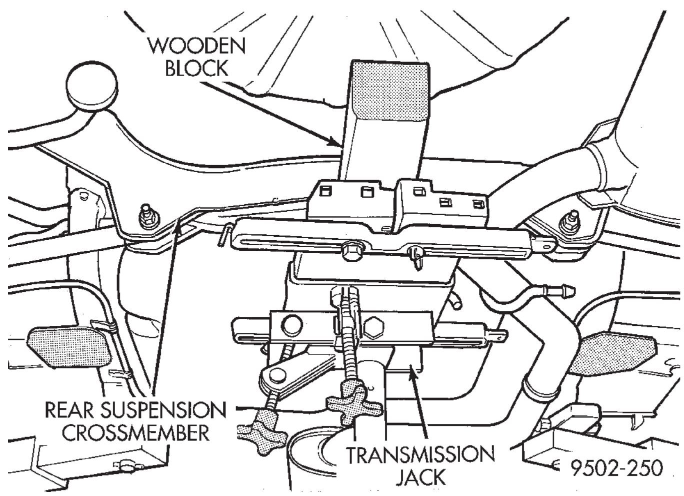


Fig. 5 Lowering And Supporting Rear Suspension Crossmember

REMOVAL AND INSTALLATION (Continued)

(7) If vehicle is equipped with antilock brakes, remove routing clips for wheel speed sensor cable from brackets on upper control arm (Fig. 6).

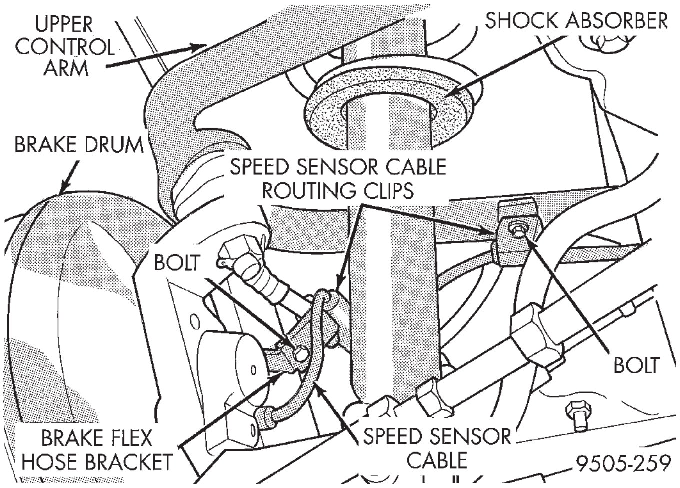


Fig. 6 Speed Sensor Cable Attachment To Control Arm

(8) Remove the nuts and bolts on each side of vehicle attaching the 4 lateral links to the knuckles.

(9) Remove the 4 bolts attaching the rear suspension crossmember to rear frame rails (Fig. 7).

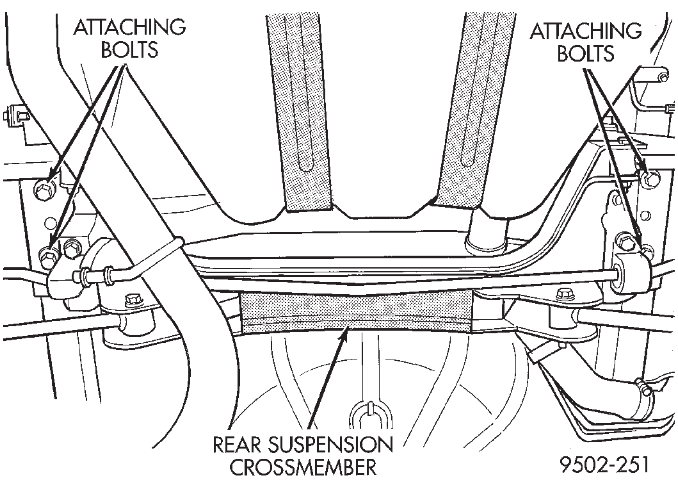


Fig. 7 Suspension Crossmember Attachment To Frame Rails

(10) Lower the rear suspension crossmember enough to access the upper control arm pivot bar to crossmember attaching bolts (Fig. 8). Remove the 4 bolts attaching the upper control arms to the suspension crossmember. Remove the control arms from the crossmember.

(11) Lower the rear suspension crossmember, lateral arms and stabilizer bar as far as possible using the transmission jack. Then with the aid of a helper remove rear suspension crossmember from the vehicle.

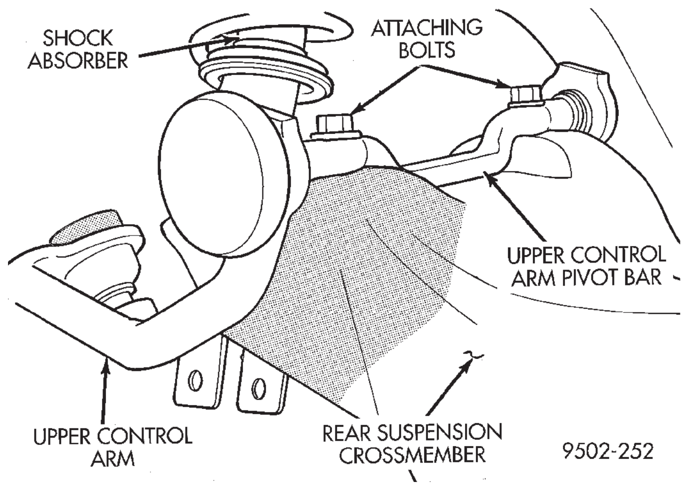


Fig. 8 Upper Control Arm Attachment To Crossmember

NOTE: When installing the lateral links on the crossmember, the lateral link attaching bolts must be installed as listed below. Install the forward lateral link to crossmember bolts so that the head of the bolt will be toward the front of the vehicle when the crossmember is installed. Install the rear lateral link to crossmember bolts so that the threaded end of the bolt will be facing toward the front of the vehicle when the crossmember is installed.

(12) Transfer the lateral links, stabilizer bar mounting brackets and the stabilizer bar and bushings to the replacement crossmember before installing the replacement crossmember in the vehicle. Tighten the stabilizer bar mounting bracket to rear crossmember mounting bolts to a torque of 27 N·m (20 ft. lbs.). Tighten the 4 lateral link to crossmember attaching bolts to a torque of 95 N·m (80 ft. lbs.).

INSTALL

(1) Install the rear suspension crossmember, lateral arms and rear stabilizer bar back into the vehicle as an assembly.

(2) With the aid of a helper position rear suspension crossmember back in vehicle and support it using the transmission jack.

(3) Align the upper control arm pivot bars with the mounting holes in the rear suspension crossmember. Install and tighten the 4 pivot bar to crossmember attaching bolts (Fig. 8) to a torque of 107 N·m (80 ft. lbs.).

(4) Using transmission jack, raise rear suspension crossmember up to the rear frame rails and loosely install the 4 attaching bolts.

REMOVAL AND INSTALLATION (Continued)

(5) Position a drift of the appropriate size into the positioning hole in each side of rear suspension crossmember and locating holes in the frame rail of the body. (Fig. 9). This is required to properly position rear suspension crossmember side-to-side and front-to-rear in the body of the vehicle. Then tighten the 4 crossmember to frame rail attaching bolts to 95 N·m (70 ft. lbs.). Remove drifts from rear suspension crossmember.

(6) Align lateral links with knuckles and install the lateral arm to knuckle attaching bolts. Tighten the 4 lateral arm to spindle attaching bolts to a torque of 95 N·m (70 ft. lbs.).

(7) Remove transmission jack supporting rear suspension crossmember.

(8) Install muffler support bracket on rear frame rail (Fig. 3). Install rear exhaust pipe hanger on rear suspension crossmember (Fig. 4).

(9) If vehicle is equipped with antilock brakes, install the wheel speed sensor cable routing clip on upper control arm mounting bracket (Fig. 6). Install and securely tighten attaching bolt.

(10) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(11) Lower vehicle to the ground.

(12) Check and reset if required, rear wheel alignment to meet the preferred specifications.

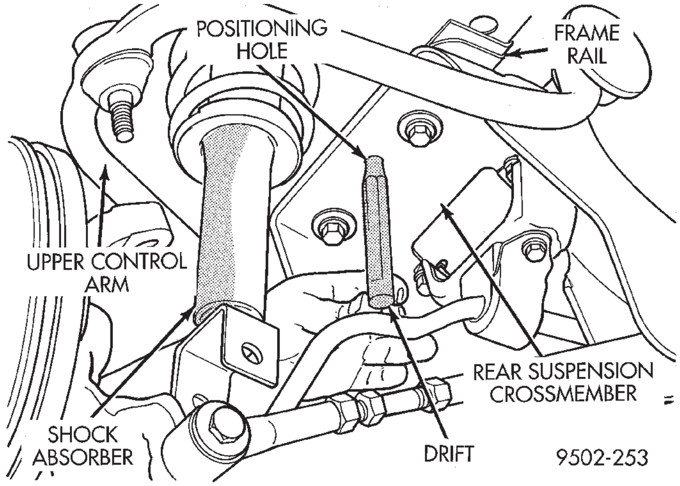


Fig. 9 Locating Rear Suspension Crossmember In Vehicle

SPECIFICATIONS

FRAME DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principal Locating Point (PLP), or from center to center of PLP and fastener location.

VEHICLE PREPARATION

Position the vehicle on a level work surface. Using screw or bottle jacks, adjust the vehicle PLP heights to the specified dimension above a level work surface. Vertical dimensions can be taken from the work surface to the locations indicated were applicable (Fig. 10), (Fig. 11), (Fig. 12), (Fig. 13), and (Fig. 14).

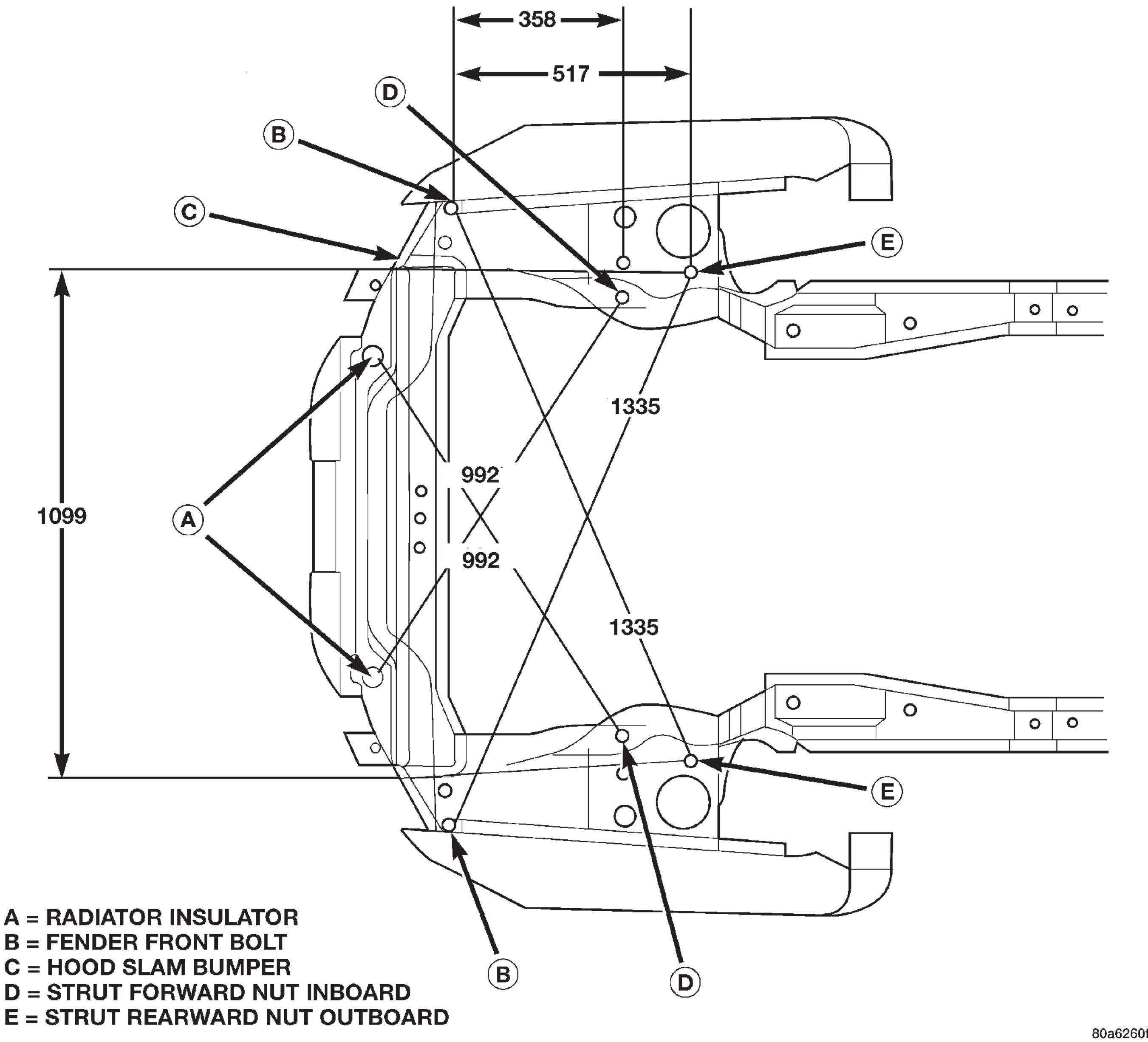


Fig. 10 Engine Compartment Top View

SPECIFICATIONS (Continued)

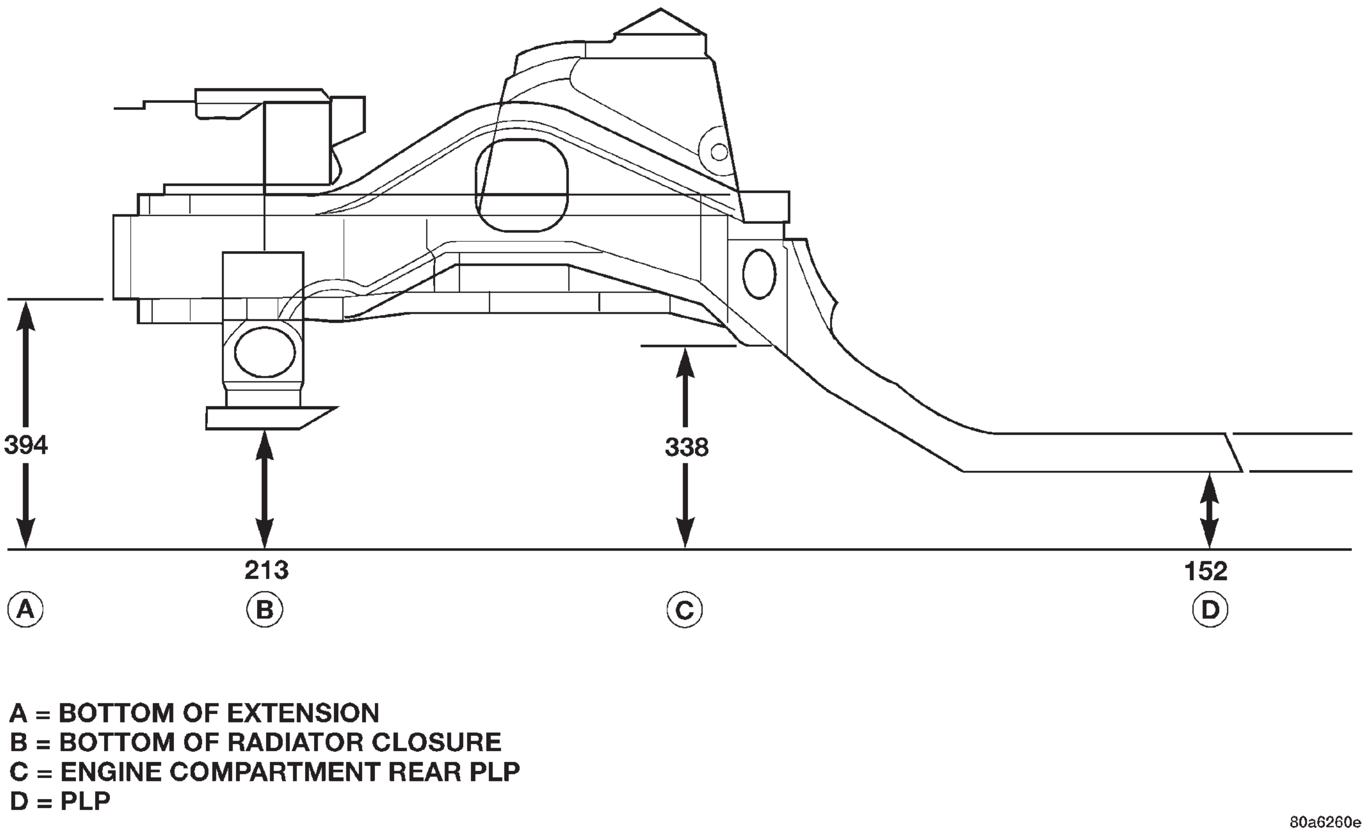


Fig. 11 Engine Compartment Side View

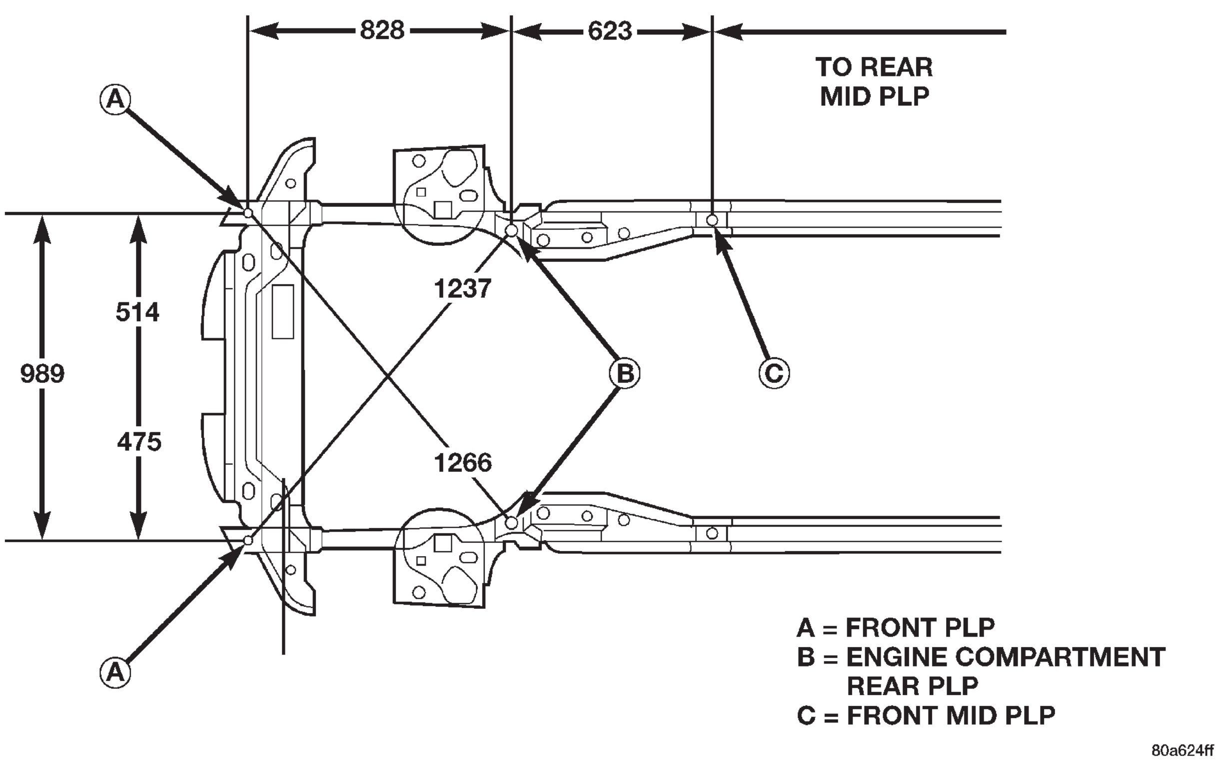


Fig. 12 Forward Frame Section Bottom View

SPECIFICATIONS (Continued)

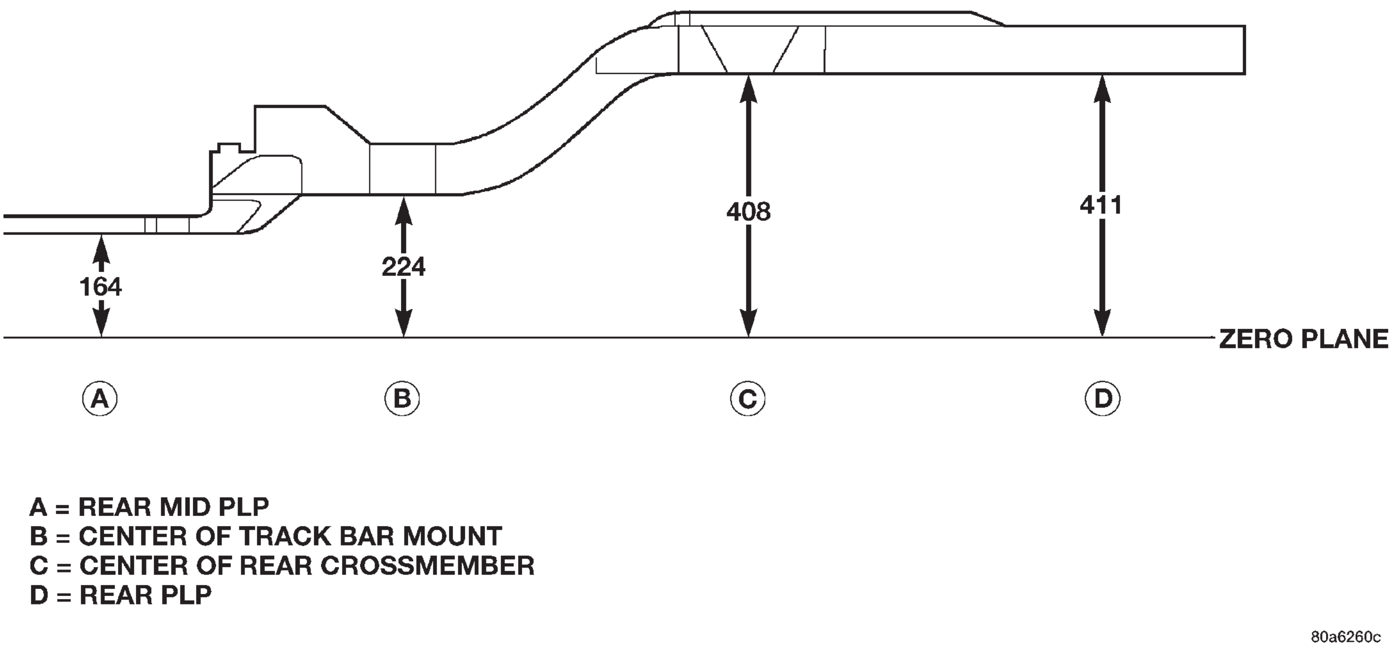


Fig. 13 Rear Frame Section Side View

SPECIFICATIONS (Continued)

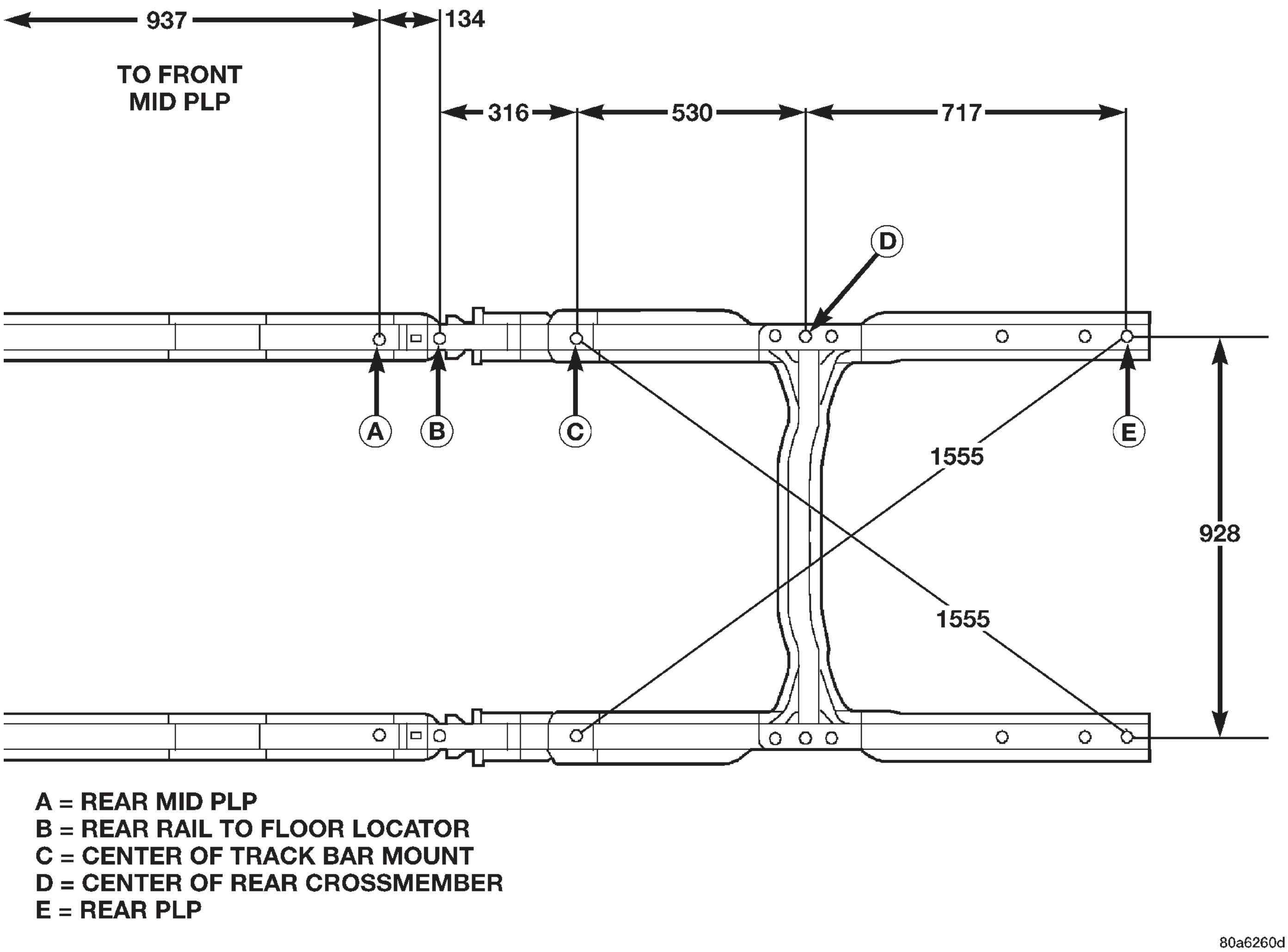


Fig. 14 Rear Frame Section Bottom View

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Rear Bumper Reinforcement	
Attaching Nut	28 N·m (21 ft. lbs.)
Front Suspension Crossmember	
Attaching Bolt Front	109 N·m (80 ft. lbs.)
Attaching Bolt Rear	102 N·m (75 ft. lbs.)
Radiator Support Crossmember	
Attaching Bolts	51 N·m (45 ft. lbs.)

FUEL SYSTEM

CONTENTS

FUEL DELIVERY SYSTEM

INDEX

DESCRIPTION AND OPERATION

FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded gasoline having an octane rating of 87. The use of premium gasoline is not recommended. The use of premium gasoline will provide no benefit over high quality regular gasoline, and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and immediate service is required. Engine damage resulting from operation with a heavy spark knock may not be covered by the new vehicle warranty.

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

The American Automobile Manufacturers Association, AAMA, has issued gasoline specifications to define the minimum fuel properties necessary to deliver enhanced performance and durability for your vehicle. Chrysler recommends the use of gasoline that meet the AAMA specifications if they are available.

REFORMULATED GASOLINE

Many areas of the country require the use of cleaner burning gasoline referred to as "reformulated" gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

Chrysler strongly supports the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.

MMT

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. Chrysler recommends that gasoline without MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

SULFUR IN GASOLINE

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with clean-burning, low-sulfur, California gasoline. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle's catalytic converter. This may cause the Check Engine or Service Engine Soon light to illuminate.

Illumination of either light while operating on high sulfur gasoline does not necessarily mean your emission control system is malfunctioning. Chrysler recommends that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

CAUTION: If the Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.

MATERIALS ADDED TO FUEL

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

FUEL SYSTEM CAUTIONS

CAUTION: Follow these guidelines to maintain your vehicle's performance:

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of Chrysler Corporation and may not be covered under the new vehicle warranty.

NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.

DESCRIPTION AND OPERATION (Continued)

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with materials that contain oxygen such as alcohol, MTBE (Methyl Tertiary Butyl Ether) and ETBE (Ethyl Tertiary Butyl Ether). Oxygenates are required in some areas of the country during winter months to reduce carbon monoxide emissions. The type and amount of oxygenate used in the blend is important.

The following are generally used in gasoline blends:

Ethanol - (Ethyl or Grain Alcohol) properly blended, is used as a mixture of 10 percent ethanol and 90 percent gasoline. Gasoline blended with ethanol may be used in your vehicle.

MTBE/ETBE - Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline and up to 15 percent MTBE. Gasoline and ETBE (Ethyl Tertiary Butyl Ether) are blends of gasoline and up to 17 percent ETBE. Gasoline blended with MTBE or ETBE may be used in your vehicle.

Methanol - Methanol (Methyl or Wood Alcohol) is used in a variety of concentrations blended with unleaded gasoline. You may encounter fuels containing 3 percent or more methanol along with other alcohols called cosolvents.

DO NOT USE GASOLINE CONTAINING METHANOL.

Use of methanol/gasoline blends may result in starting and driveability problems and damage critical fuel system components.

Problems that are the result of using methanol/gasoline blends are not the responsibility of Chrysler Corporation and may not be covered by the vehicle warranty.

Reformulated Gasoline

Many areas of the country are requiring the use of cleaner-burning fuel referred to as **Reformulated Gasoline**. Reformulated gasoline are specially blended to reduce vehicle emissions and improve air quality.

Chrysler Corporation strongly supports the use of reformulated gasoline whenever available. Although your vehicle was designed to provide optimum performance and lowest emissions operating on high quality unleaded gasoline, it will perform equally well and produce even lower emissions when operating on reformulated gasoline.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain active solvents of similar ingredients that can be harmful to fuel system gasket and diaphragm materials.

FUEL DELIVERY SYSTEM

DESCRIPTION

The front wheel drive car uses a plastic fuel tank located rear center of the vehicle.

The in-tank fuel pump module contains the fuel pump and pressure regulator. The pump is serviced as part of the fuel pump module. Refer to Fuel Pump Module.

The fuel delivery system consists of:

- the fuel pump module containing the electric fuel pump, fuel filter/fuel pressure regulator, fuel gauge sending unit (fuel level sensor) and a separate fuel filter located at bottom of pump module
- Fuel tubes/lines/hoses
- Quick-connect fittings
- Fuel injector rail
- Fuel injectors
- Fuel tank
- Fuel tank filler/vent tube assembly
- Fuel tank filler tube cap

The fuel delivery system contains a replaceable in-line filter. The filter attaches to the frame above the rear of the fuel tank.

OPERATION

A returnless fuel system is used on all vehicles. Fuel is returned through the fuel pump module and back to the fuel tank. A separate fuel return line from the tank to the engine is no longer used.

Relieve fuel system pressure before servicing fuel system components. Refer to the Fuel System Pressure Release Procedure and follow all Cautions and Warnings. Most fuel system components attach to the fuel lines with quick connect fittings. Refer to Quick Connect Fittings in this section.

FUEL PUMP MODULE

DESCRIPTION

The fuel pump module is installed in the top of the fuel tank (Fig. 1).

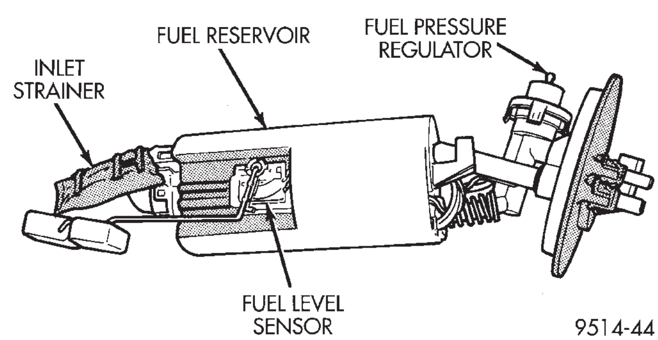


Fig. 1 Fuel Pump Module

DESCRIPTION AND OPERATION (Continued)

The fuel pump module contains the following:

- Electric fuel pump
- Fuel pump reservoir
- Inlet strainer
- Fuel pressure regulator
- Fuel gauge sending unit
- Fuel supply line connection

The inlet strainer, fuel pressure regulator and fuel level sensor are the only serviceable items. If the fuel pump or electrical wiring harness requires service, replace the fuel pump module.

The electric fuel pump is located in and is part of the fuel pump module. It is a positive displacement, gerotor type, immersible pump with a permanent magnet electric motor.

OPERATION

The pump draws fuel through a strainer and pushes it through the motor to the outlet. The pump contains one check valve. The check valve, in the pump outlet, maintains pump pressure during engine off conditions. The fuel pump relay provides voltage to the fuel pump.

The fuel pump has a maximum deadheaded pressure output of approximately 635 kPa (95 psi). The regulator adjusts fuel system pressure to approximately 338 kPa (49 psi).

FUEL PUMP ELECTRICAL CONTROL

Voltage to operate the electric pump is supplied through the fuel pump relay. For an electrical operational description of the fuel pump refer to fuel Pump Relay—PCM Output.

ELECTRICAL PUMP REPLACEMENT

The electric fuel pump is not serviceable. If the fuel pump or electrical wiring harness needs replacement, the complete fuel pump module must be replaced. Perform the Fuel System Pressure Release procedure before servicing the fuel pump.

FUEL LEVEL SENSOR

DESCRIPTION

The level sensor is attached to the side of the fuel pump module. The level sensor consists of a float, an arm, and a variable resistor.

OPERATION

As the fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the fuel gauge on the instrument panel to read full.

FUEL TANK

OPERATION

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

All models are equipped with either one or two rollover valves mounted into the top of the fuel tank (or pump module).

An evaporation control system is connected to the rollover valve(s) to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using a Leak Detection Pump (LDP). Refer to the Emission Control System for additional information.

FUEL INJECTORS

DESCRIPTION

The injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port (Fig. 2).

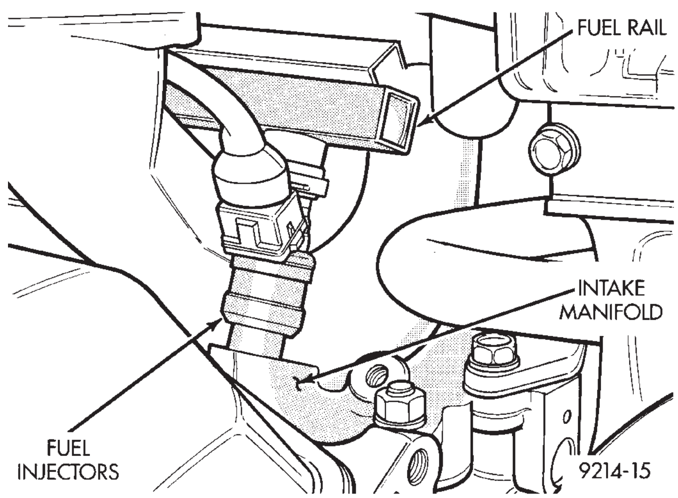


Fig. 2 Fuel Injector Location—Typical

OPERATION

The fuel injectors are 12 ohm electrical solenoids (Fig. 3). The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a hollow cone. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.

DESCRIPTION AND OPERATION (Continued)

Fuel injectors are not interchangeable between engines.

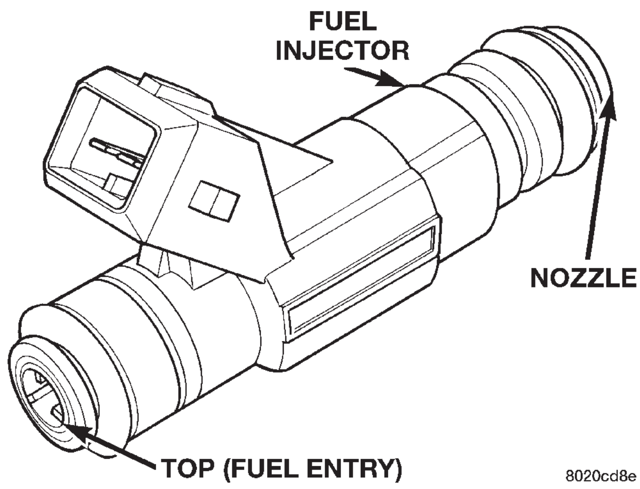


Fig. 3 Fuel Injector

FUEL PRESSURE REGULATOR

OPERATION

The fuel system uses a nonadjustable pressure regulator that maintains fuel system pressure at approximately 338 kPa (49 psi). The fuel pressure regulator contains a diaphragm, calibrated spring and a fuel return valve. The spring pushes down on the diaphragm and closes off the fuel return port. System fuel pressure reflects the amount of fuel pressure required to open the return port.

The pressure regulator is a mechanical device that is NOT controlled by the PCM or engine vacuum.

PRESSURE-VACUUM FILLER CAP

OPERATION

The loss of any fuel or vapor out of the filler tube neck is prevented by the use of a safety filler cap. The cap releases only under significant pressure 10.9 to 13.45 kPa (1.58 to 1.95 psi). The vacuum release for all gas caps is between .97 and 2.0 kPa (.14 and .29 psi). The cap must be replaced by a similar unit in order for the system to remain effective.

WARNING: REMOVE FUEL FILLER TUBE CAP TO RELIEVE TANK PRESSURE BEFORE REMOVING OR REPAIRING FUEL SYSTEM COMPONENTS.

ONBOARD REFUELING VAPOR RECOVERY

OPERATION

The emission control principle used in the ORVR system is that the fuel flowing into the filler tube (appx. 1” I.D.) creates an aspiration effect which draws air into the fill tube. During refueling, the fuel tank is vented to the vapor canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the canister, the vehicle’s computer controlled purge system draws vapor out of the canister for the engine to burn. The vapors flow is metered by the purge solenoid so that there is no or minimal impact on driveability or tailpipe emissions.

As fuel starts to flow through the fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve to the vapor canister. Vapor is absorbed in the canister until vapor flow in the lines stops, either following shut-off or by having the fuel level in the tank rise high enough to close the control valve. The control valve contains a float that rises to seal the large diameter vent path to the canister. At this point in the fueling of the vehicle, the tank pressure increase, the check valve closes (preventing tank fuel from spiting back at the operator), and fuel then rises up the filler tube to shut-off the dispensing nozzle.

If the engine is shut-off during the On-Board diagnostics test, low level tank pressure can be trapped in the fuel tank and fuel can not be added to the tank. This is due to the leak detection pump closing the vapor outlet from the top of the tank and the one-way check valve not allowing the tank to vent through the fill tube to atmosphere. Therefore, when fuel is added, it will back-up in the fill tube and shut off the dispensing nozzle. The pressure can be eliminated in two ways: 1. Vehicle purge must be activated and for a long enough period to eliminate the pressure. 2. The vacuum operated canister vent valve will quickly relieve the tank pressure to atmosphere when the engine is turned-off.

CONTROL VALVE/PRESSURE RELIEF

OPERATION

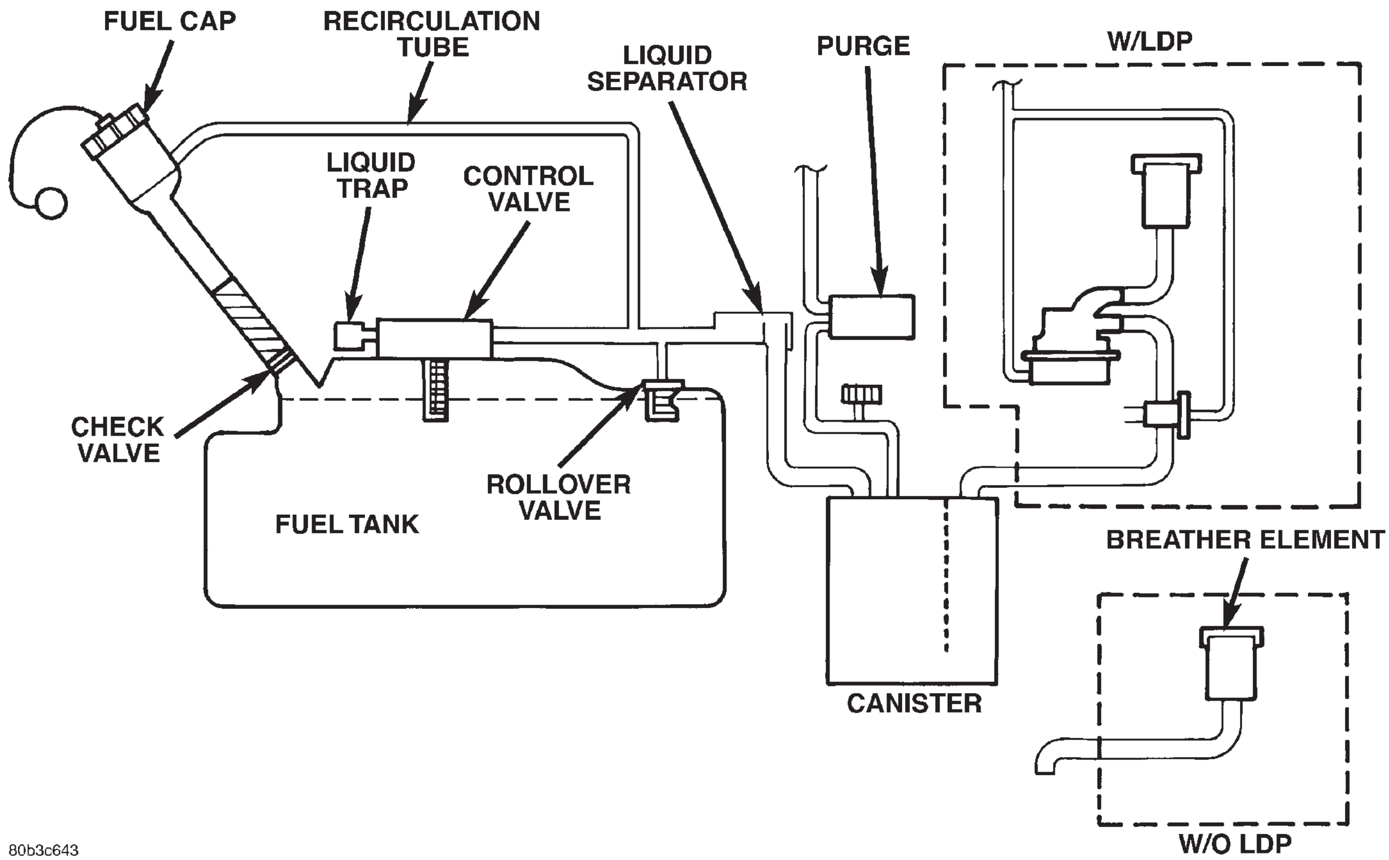
If the fuel tank should over-pressurize, the control valve incorporates a pressure relief port that allows pressure relief capability under extreme conditions. Example, if the canister vent line was to get pinched or obstructed, the relief valve would vent the pressure.

QUICK-CONNECT FITTINGS

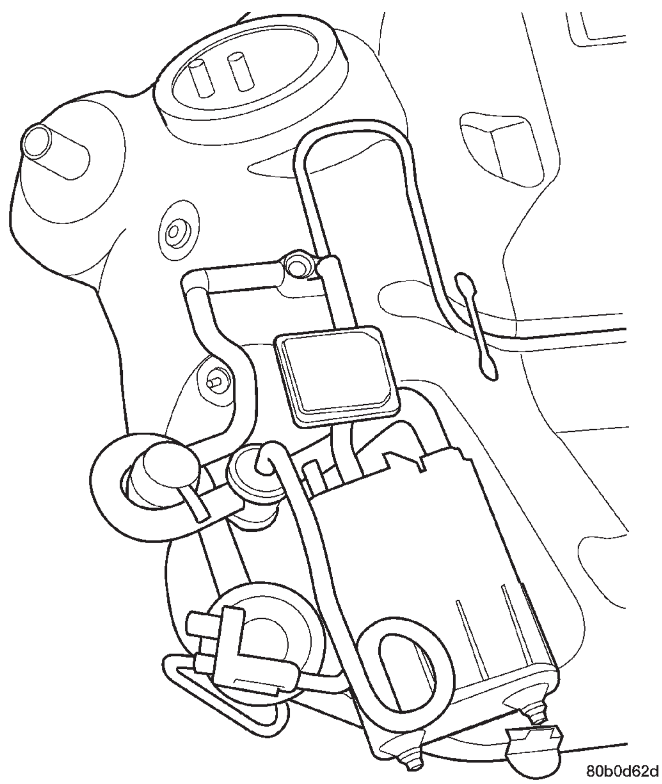
DESCRIPTION

Different types of quick-connect fittings are used to attach various fuel system components. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Refer to the Removal/Installation section for more information.

DESCRIPTION AND OPERATION (Continued)



ORVR System Schematic



ORVR System

CAUTION: The interior components (o-rings, spacers) of quick-connect fitting are not serviced separately. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

Fuel tubes connect fuel system components with plastic quick-connect fuel fittings. The fitting contains non-serviceable O-ring seals (Fig. 4).

CAUTION: Quick-connect fittings are not serviced separately. Do not attempt to repair damaged quick-connect fittings or fuel tubes. Replace the complete fuel tube/quick-connect fitting assembly.

The quick-connect fitting consists of the O-rings, retainer and casing (Fig. 4). When the fuel tube enters the fitting, the retainer locks the shoulder of the nipple in place and the O-rings seal the tube.

DESCRIPTION AND OPERATION (Continued)

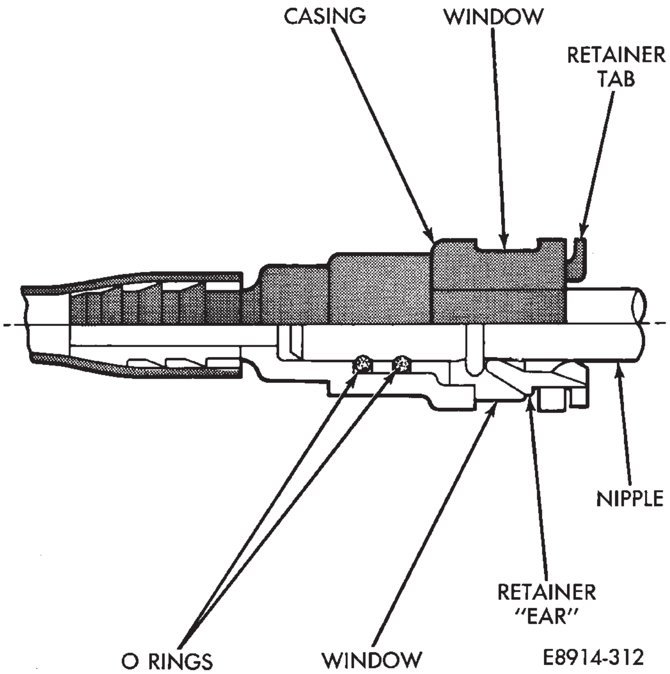


Fig. 4 Plastic Quick-Connect Fittings

ROLLOVER VALVES

DESCRIPTION

All vehicles have rollover valve(s) on top of the fuel tank.

OPERATION

The valves prevent fuel flow through the fuel tank vent valve hoses should the vehicle rollover.

The rollover valves on the fuel tank are not serviceable.

FUEL TUBES/LINES/HOSES AND CLAMPS

OPERATION

Also refer to Quick-Connect Fittings.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

Inspect all hose connections such as clamps, couplings and fittings to make sure they are secure and leaks are not present. The component should be replaced immediately if there is any evidence of degradation that could result in failure.

Never attempt to repair a plastic fuel line/tube. Replace as necessary.

Avoid contact of any fuel tubes/hoses with other vehicle components that could cause abrasions or scuffing. Be sure that the plastic fuel lines/tubes are properly routed to prevent pinching and to avoid heat sources.

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps. Tighten hose clamps to 3 N·m (25 in. lbs.) torque.

DIAGNOSIS AND TESTING

FUEL PUMP PRESSURE TEST—2.0/2.4L ENGINES

The fuel system operates at approximately 338 kPa (49 ±2 psi). Check fuel system pressure at the test port on the fuel rail.

(1) Remove cap from fuel pressure test port on fuel rail.

(2) Connect Fuel Pressure Gauge C-4799B to test port (Fig. 5).

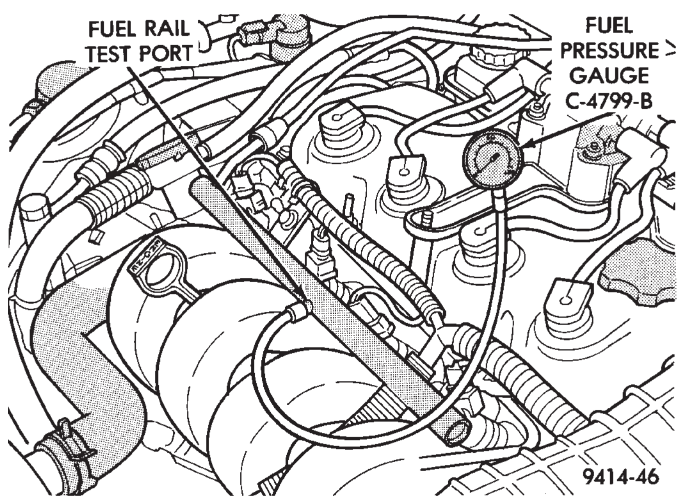


Fig. 5 Checking Fuel Pressure at Intake Manifold

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

DIAGNOSIS AND TESTING (Continued)

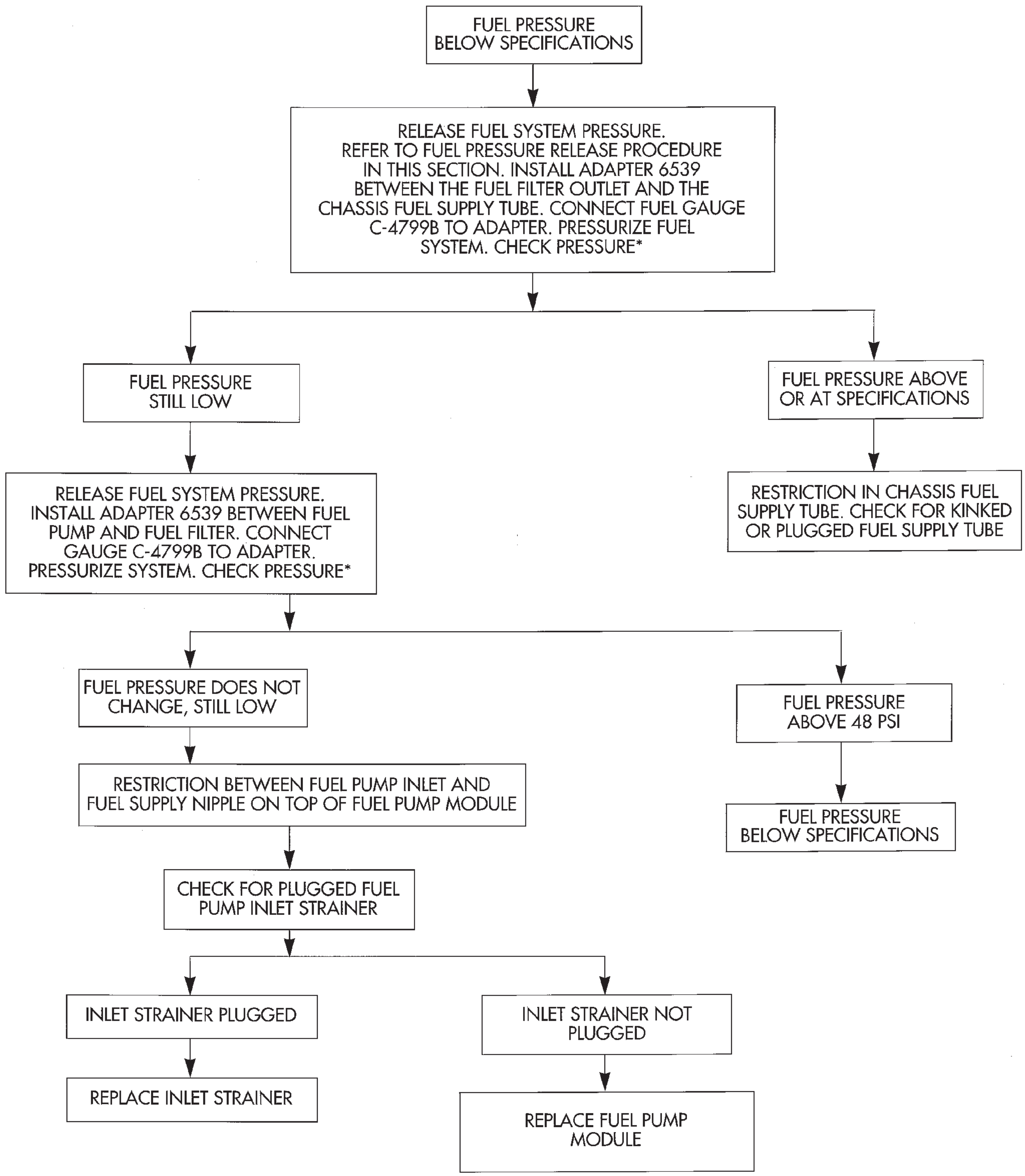
(3) Place ignition key in the ON position. Using DRB scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

- If the gauge reading equals 338 kPa (49 ±2 psi) further testing is not required. If pressure is not correct, record the pressure.
- If pressure is above specifications, check for a kinked or restricted fuel return tube (from filter to pump module). If the fuel return tube is not pinched or restricted, replace the fuel pressure regulator.
- If fuel pressure is below specifications, refer to the diagnosis chart for Fuel Pressure Below Specifications.

(4) **Replace Pressure test port cap when finished doing pressure test.**

DIAGNOSIS AND TESTING (Continued)

FUEL PRESSURE BELOW SPECIFICATIONS



*Pressure gauge should rise rapidly. If pressure rises slowly, inlet strainer is plugged enough to cause drive ability problems.

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DIAGNOSIS AND TESTING (Continued)

FUEL PUMP PRESSURE TEST—2.5L ENGINE

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE A FUEL SYSTEM HOSE OR COMPONENT IS DISCONNECTED.

The fuel system operates at approximately 338 kPa (49±2 psi).

(1) Perform fuel system pressure release procedure.

(2) Remove fuel supply hose quick connector from the chassis line (at the engine). Refer to Quick Connect Fittings in this section.

(3) Connect Fuel Pressure Gauge C-4799 to Fuel Pressure Test Adapter 6539 (Fig. 6). Install the adapter between fuel supply hose and chassis fuel line assembly.

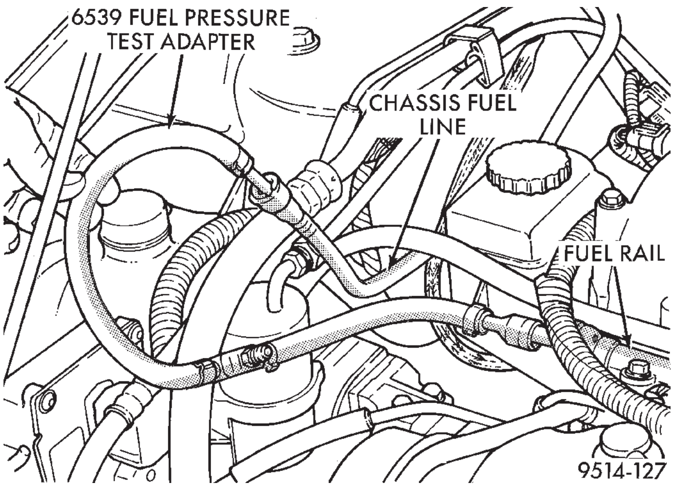


Fig. 6 Fuel Pressure Test Adapter

CAUTION: When using the ASD Fuel System Test, the ASD relay and fuel pump relay remain energized for 7 minutes or until the test is stopped, or until the ignition switch is turned to the Off position.

(4) Place the ignition key in the ON position. Using the DRB scan tool, access ASD Fuel System Test. The ASD Fuel System Test will activate the fuel pump and pressurize the system.

• If the gauge reading equals 338 kPa (49±2 psi) further testing is not required. If pressure is not correct, record the pressure.

• If pressure is above specifications, check for a kinked or restricted fuel return tube (from filter to pump module). If the fuel return tube is not pinched or restricted, replace the fuel pressure regulator.

• If pressure is below specifications, refer to Fuel Pressure Below Specifications chart.

FUEL LEVEL SENSOR

This procedure tests the resistance of the level sensor itself. It does not test the level sensor circuit. Refer to the Wiring Diagrams for circuit identification.

The level sensor is a variable resistor. Its resistance changes with the amount of fuel in the tank. The float arm attached to the sensor moves as the fuel level changes. To test the level sensor, connect an ohmmeter across the sensor signal and sensor ground terminals of the fuel pump module connector (Fig. 7). Move the float lever over the entire range to the positions shown in the resistance chart (Fig. 7). **Record the resistance at each end point. Replace the level sensor if the resistance is not within specifications, or an open circuit is noted during the entire range inspection.**

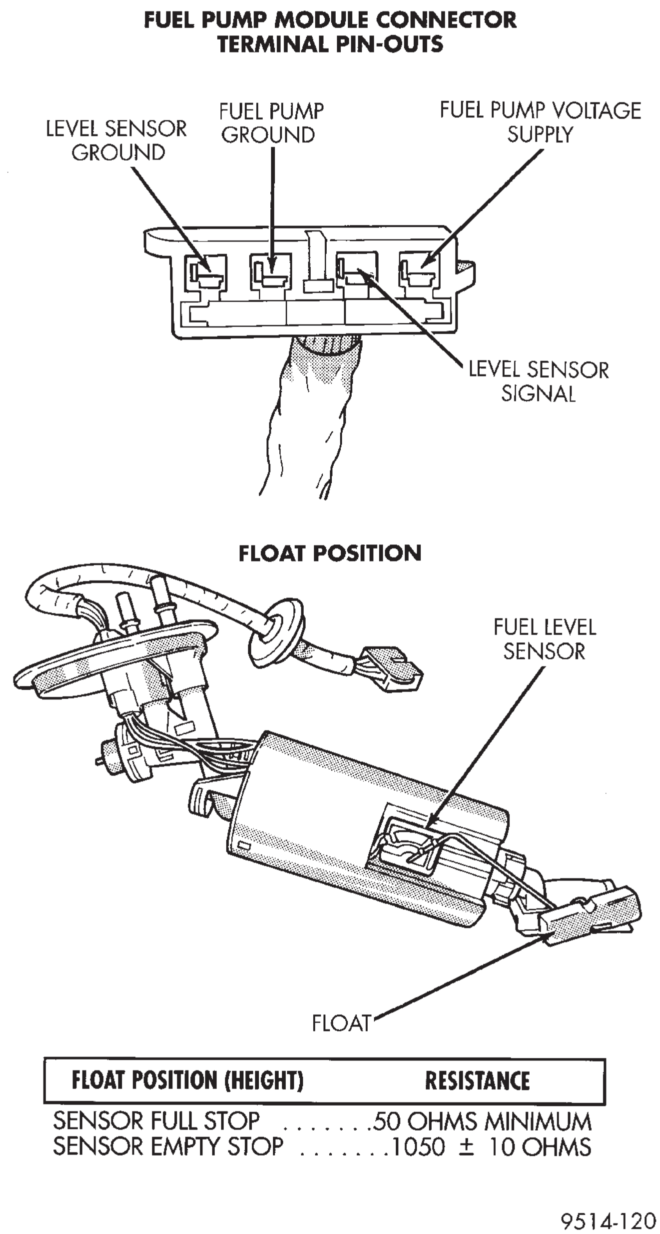
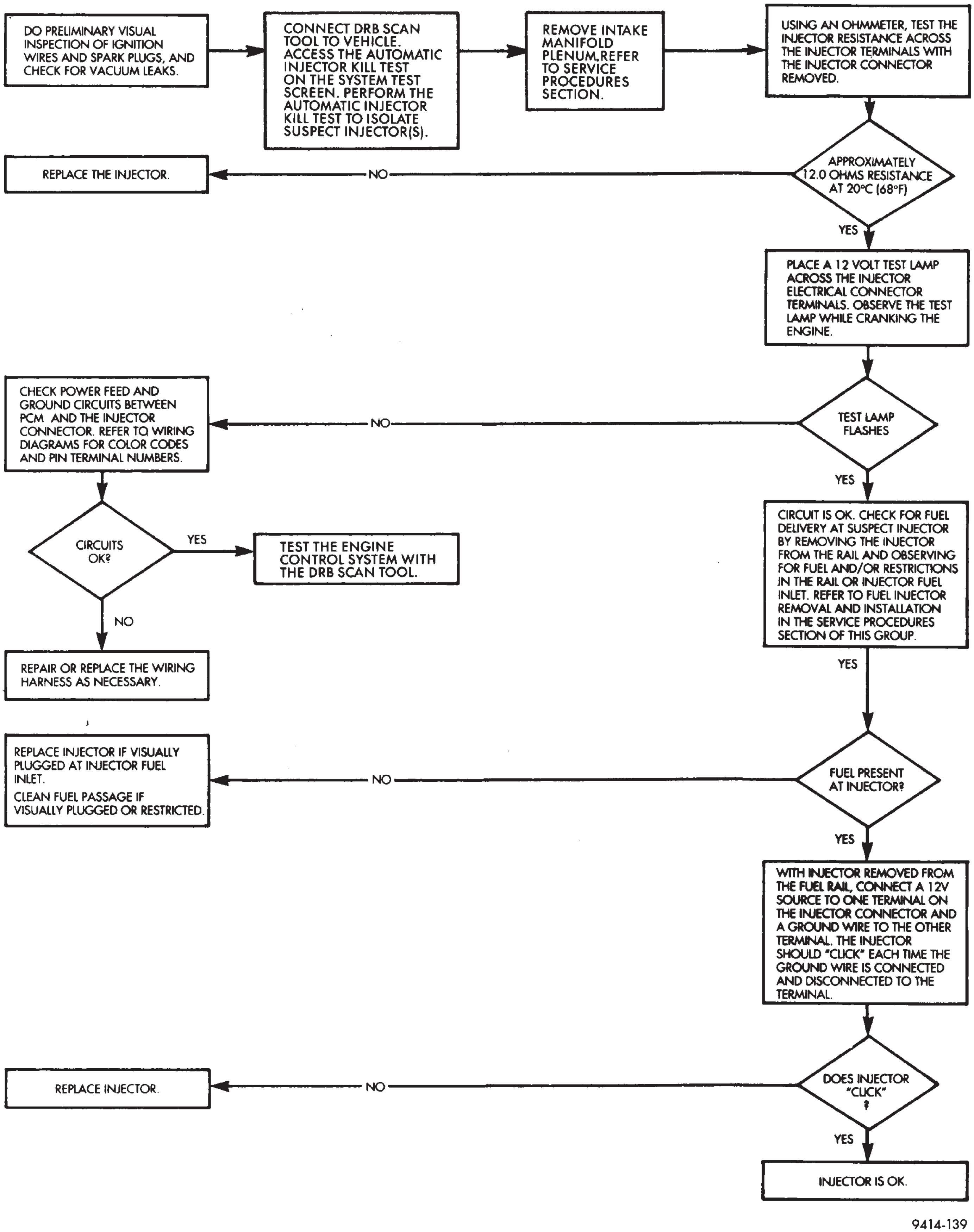


Fig. 7 Level Sensor Diagnosis

FUEL INJECTORS

For fuel injector diagnosis, refer to the Fuel Injector Diagnosis charts.

DIAGNOSIS AND TESTING (Continued)



FUEL INJECTOR DIAGNOSIS

DIAGNOSIS AND TESTING (Continued)

VEHICLE DOES NOT FILL

Pre-Mature Nozzle Shut-Off.	Defective fuel tank assembly components.	Fill tube improperly installed (sump).
		Fill tube hose pinched.
		Check valve stuck shut.
		Control valve stuck shut.
	Defective vapor/vent components.	Vent line from control valve to canister pinched
		Vent line from canister to vent filter pinched.
		Canister vent valve failure (Requires double failure, plugged to LDP and atmosphere).
		Leak detection pump failed closed.
		Leak detection pump filter plugged.
	On-Board diagnostics evaporative system leak test just conducted.	Canister vent valve vent plugged to atmosphere.
		Engine still running when attempting to fill (System designed not to fill).
	Defective fill nozzle.	
Fuel Spits Out Of Filler Tube.	During fill.	See Pre-Mature Shut-Off
	At conclusion of fill.	Defective fuel handling component. (Check valve stuck open).
		Defective vapor/vent handling component
		Defective fill nozzle

SERVICE PROCEDURES

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

(1) Remove Fuel Pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.

(2) Start and run engine until it stalls.

(3) Attempt restarting engine until it will no longer run.

(4) Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

(5) Place a rag or towel below fuel line quick-connect fitting at fuel rail.

(6) Return fuel pump relay to PDC.

(7) One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB scan tool must be used to erase a DTC.

FUEL TANK DRAINING

(1) Remove fuel cap slowly to release tank pressure.

(2) With vehicle on a hoist, drain fuel from tank.

(3) Position a fuel approved container, with a capacity of at least 16 gallons, under the drain plug located on the bottom left edge of the tank.

CAUTION: Use a Back-Up wrench on tank to remove drain plug.

(4) Remove drain plug and allow fuel to drain (Fig. 8).

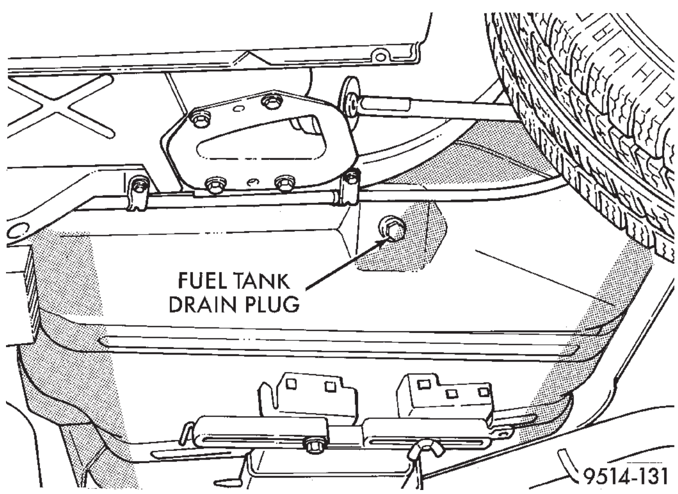


Fig. 8 Fuel Tank Drain Plug

SERVICE PROCEDURES (Continued)

WARNING: DRAIN PLUG MUST BE INSTALLED AT THIS TIME AS THERE WILL BE 1 TO 2 GALLONS OF FUEL LEFT IN THE TANK.

(5) When tank is no longer draining, install drain plug. Tighten plug to 32 in. lbs.

HOSES AND CLAMPS

Inspect all hose connections (clamps and quick connect fittings) for completeness and leaks. Replace cracked, scuffed, or swelled hoses. Replace hoses that rub against other vehicle components or show sign of wear.

Fuel injected vehicles use specially constructed hoses. When replacing hoses, only use hoses marked EFM/EFI.

When installing hoses, ensure that they are routed away from contact with other vehicle components that could rub against them and cause failure. Avoid contact with clamps or other components that cause abrasions or scuffing. Ensure that rubber hoses are properly routed and avoid heat sources.

The hose clamps have rolled edges to prevent the clamp from cutting into the hose. Only use clamps that are original equipment or equivalent. Other types of clamps may cut into the hoses and cause high pressure fuel leaks. Tighten hose clamps to 1 N·m (10 in. lbs.) torque.

QUICK-CONNECT FITTINGS

REMOVAL

When disconnecting a quick-connect fitting, the retainer will remain on the fuel tube nipple.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

(1) Disconnect negative cable from battery or auxiliary jumper terminal.

(2) Perform Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.

(3) Squeeze retainer tabs together and pull fuel tube/quick-connect fitting assembly off of fuel tube nipple. The retainer will remain on fuel tube.

INSTALLATION

CAUTION: Never install a quick-connect fitting without the retainer being either on the fuel tube or already in the quick-connect fitting. In either case, ensure the retainer locks securely into the quick-connect fitting by firmly pulling on fuel tube and fitting to ensure it is secured.

(1) Using a clean lint free cloth, clean the fuel tube nipple and retainer.

(2) Prior to connecting the fitting to the fuel tube, coat the fuel tube nipple with clean 30 weight engine oil.

(3) Push the quick-connect fitting over the fuel tube until the **retainer seats and a click is heard.**

(4) The plastic quick-connect fitting has windows in the sides of the casing. When the fitting completely attaches to the fuel tube, the retainer locking ears and the fuel tube shoulder are visible in the windows. If they are not visible, the retainer was not properly installed (Fig. 9). **Do not rely upon the audible click to confirm a secure connection.**

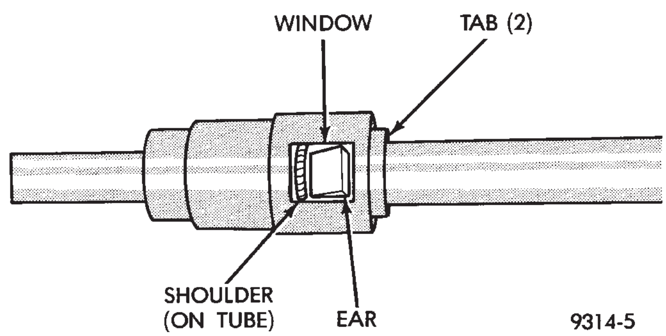


Fig. 9 Plastic Quick-Connect Fitting/Fuel Tube Connection

(5) Connect negative cable to battery or auxiliary jumper terminal.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) Relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

(6) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

TWO-TAB TYPE FITTING

This type of fitting is equipped with tabs located on both sides of the fitting (Fig. 10). These tabs are supplied for disconnecting the quick-connect fitting from component being serviced.

CAUTION: The interior components (O-rings, spacers) of this type of quick-connect fitting are not serviced separately, but new plastic retainers are available. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

SERVICE PROCEDURES (Continued)

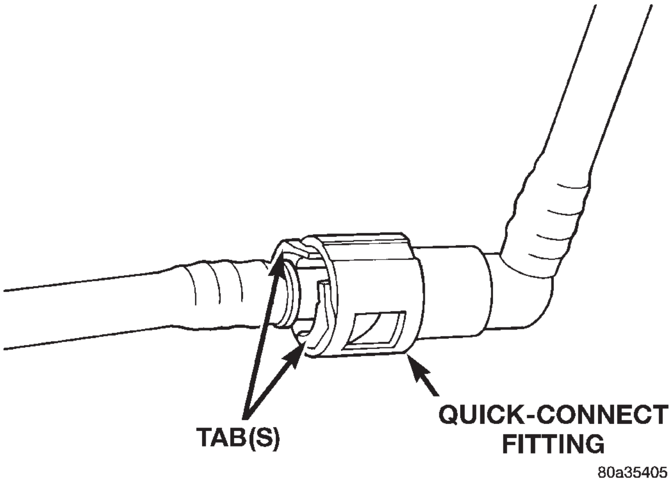


Fig. 10 Typical Two-Tab Type Quick-Connect Fitting

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE IN THIS GROUP.

DISCONNECTION/CONNECTION

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure in this group.

(2) Disconnect negative battery cable from battery or auxiliary jumper terminal.

(3) Clean fitting of any foreign material before disassembly.

(4) To disconnect quick-connect fitting, squeeze plastic retainer tabs (Fig. 10) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer. Pull fitting from fuel system component being serviced. The plastic retainer will remain on component being serviced after fitting is disconnected. The O-rings and spacer will remain in quick-connect fitting connector body.

(5) Inspect quick-connect fitting body and component for damage. Replace as necessary.

CAUTION: When the quick-connect fitting was disconnected, the plastic retainer will remain on the component being serviced. If this retainer must be removed, very carefully release the retainer from the component with two small screwdrivers. After removal, inspect the retainer for cracks or any damage.

(6) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(7) Insert quick-connect fitting to component being serviced and into plastic retainer. When a connection is made, a click will be heard.

(8) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(9) Connect negative cable to battery or auxiliary jumper terminal.

(10) Start engine and check for leaks.

PLASTIC RETAINER RING TYPE FITTING

This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 11) usually black in color.

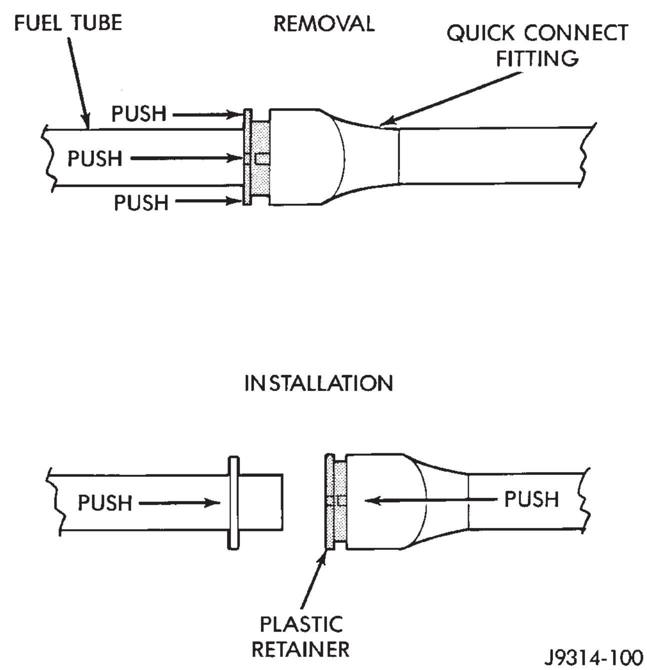


Fig. 11 Plastic Retainer Ring Type Fitting

CAUTION: The interior components (O-rings, spacers, retainers) of this type of quick-connect fitting are not serviced separately. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

DISCONNECTION/CONNECTION

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure in this section.

SERVICE PROCEDURES (Continued)

(2) Disconnect negative battery cable from battery or auxiliary jumper terminal.

(3) Clean fitting of any foreign material before disassembly.

(4) To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (Fig. 11). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

(5) After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

(6) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

(7) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(8) Insert quick-connect fitting into component being serviced until a click is felt.

(9) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(10) Connect negative battery cable to battery or auxiliary jumper terminal.

(11) Start engine and check for leaks.

REMOVAL AND INSTALLATION

AUTOMATIC SHUTDOWN RELAY

The relay is located in the Power Distribution Center (PDC) (Fig. 12). For the location of the relay within the PDC, refer to the PDC cover for location. Check electrical terminals for corrosion and repair as necessary.

FUEL PUMP RELAY

The fuel pump relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

FUEL PUMP MODULE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

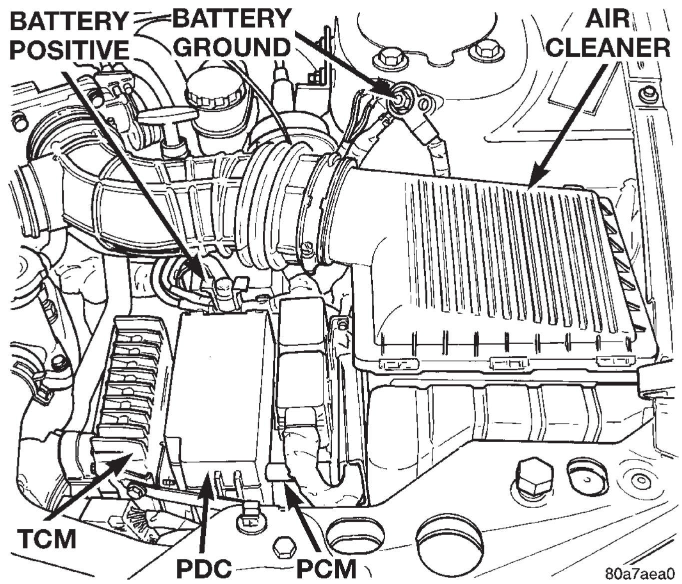


Fig. 12 Power Distribution Center (PDC)

REMOVAL

(1) Remove fuel filler cap and perform Fuel System Pressure Release procedure.

(2) Disconnect negative cable from auxilary jumper terminal.

(3) Remove fuel tank.

(4) Disconnect fuel filter lines from fuel pump module.

(5) Clean top of tank to remove loose dirt and debris.

(6) Using Special Tool #6856 Fuel Pump Module Ring Spanner, remove locknut to release pump module (Fig. 13).

WARNING: THE FUEL RESERVOIR OF THE FUEL PUMP MODULE DOES NOT EMPTY OUT WHEN THE TANK IS DRAINED. THE FUEL IN THE RESERVOIR MAY SPILL OUT WHEN THE MODULE IS REMOVED.

(7) Remove fuel pump module and O-ring from tank (Fig. 14). Discard O-ring.

INSTALLATION

(1) Wipe seal area of tank clean. Place a new O-ring on the ledge between the tank threads and the pump module opening.

(2) Position fuel pump module in tank. Make sure the alignment tab on the underside of the pump module flange sits in the corresponding notch in the fuel tank.

CAUTION: Over tightening the pump lock ring may result in a leak.

(3) While holding the pump module in position, install locknut. Tighten locknut to 74.5 N·m (55 ft. lbs) torque using special tool #6856.

REMOVAL AND INSTALLATION (Continued)

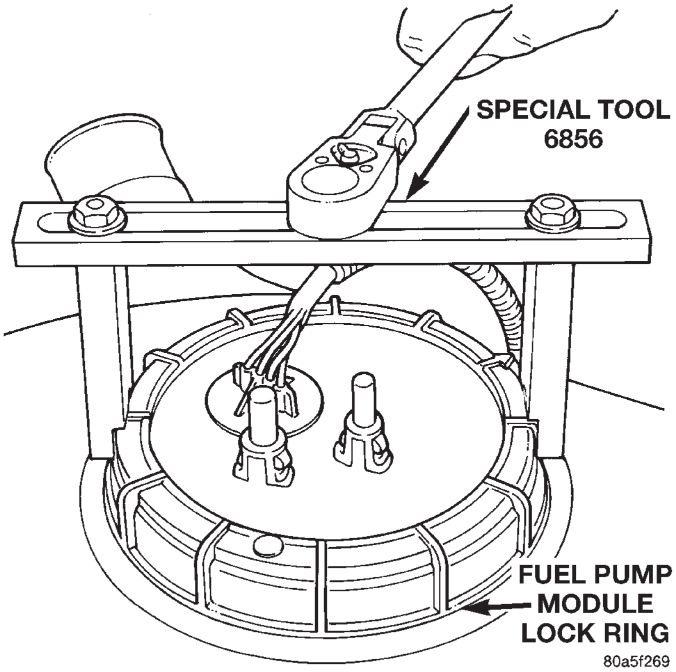


Fig. 13 Fuel Pump Module Locknut

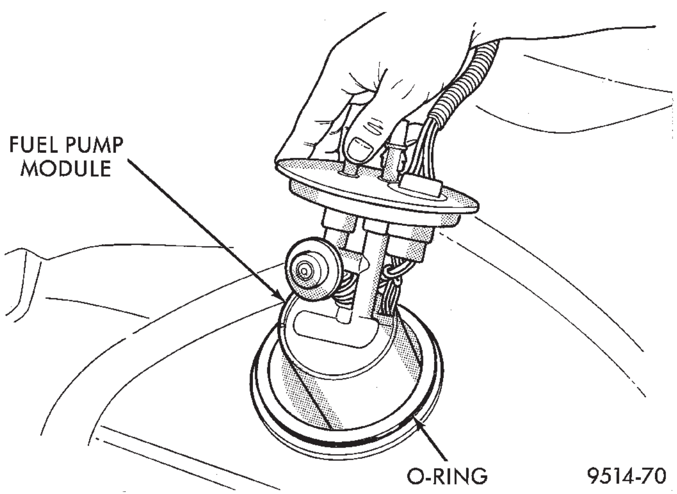


Fig. 14 Fuel Pump Module Removal

(4) Install fuel tank and fuel filter.

(5) Fill fuel tank with clean fuel. Check for leaks.

(6) Install negative cable to auxiliary jumper terminal.

FUEL FILTER

The fuel filter mounts to the frame above the rear of the fuel tank. The inlet and outlet tubes are permanently attached to the filter.

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING QUICK- CONNECT FITTINGS AT FUEL FILTER AND FUEL PUMP MODULE. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE

(1) Remove rear seat.

(2) Disconnect fuel pump electrical connector. Push grommet out and feed jumper completely through hole in body.

(3) Remove fuel cap slowly to release tank pressure.

(4) With vehicle on a hoist, drain fuel from tank. Refer to Fuel Tank Draining in this section.

(5) Remove driver's side fuel tank strap. Loosen, do not remove, passenger side fuel tank strap allowing fuel tank fill neck to touch rear suspension crossmember.

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(6) Disconnect fuel lines from fuel pump module (Fig. 15). These are quick connect fittings. Refer to Quick Connect Fittings in this section.

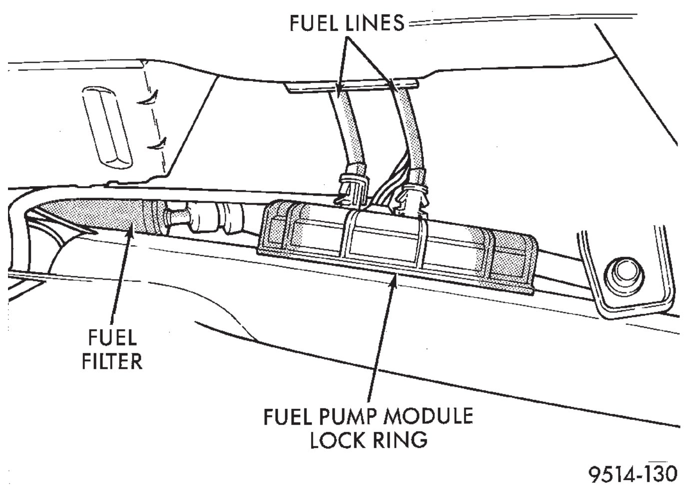


Fig. 15 Fuel Lines at Fuel Pump Module

(7) Disconnect fuel supply line from the fuel brake module.

(8) Remove fuel filter (Fig. 16).

INSTALLATION

The fuel supply (to filter) tube, return tube (to pump module) are permanently attached to the fuel filter. The ends of the fuel supply and return tubes have different size quick-connect fittings. The larger quick-connect fitting connects to the large nipple (supply side) on the fuel pump module. The smaller quick-connect fitting attaches to the small nipple (return side) on the fuel pump module.

(1) Apply a light coating of clean 30 weight engine oil to the fuel filter nipples. Install fuel tubes. Refer to Fuel Tubes and Quick-Connect Fittings in this section.

REMOVAL AND INSTALLATION (Continued)

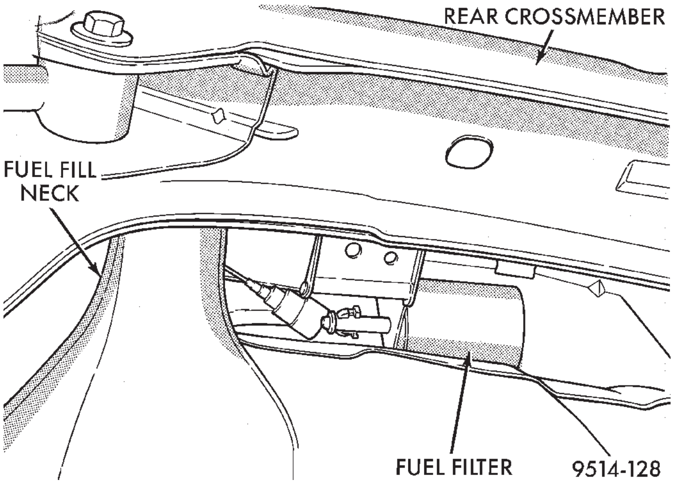


Fig. 16 Fuel Filter

(2) Install fuel tank, filter and tank straps, install the front bolts first and then the rear bolts. Torque tank strap bolts to 23 N·m (250. in. lbs.). **Make sure pump module harness grommet is installed in body as tank is raised into position.**

(3) Lower vehicle and connect pump module connector.

(4) Install rear seat.

(5) Fill tank with fuel.

(6) Connect negative cable to auxiliary jumper terminal.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is part of the fuel pump module (Fig. 17). Remove the fuel pump module from the fuel tank to access the fuel pressure regulator. Refer to the Fuel Pump Module removal in this section.

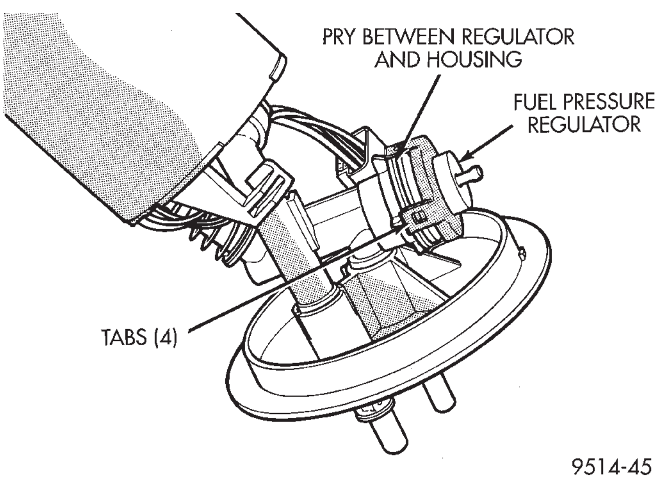


Fig. 17 Fuel Pressure Regulator

WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE SERVICING ANY FUEL SYSTEM COMPONENT. PERFORM THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

REMOVAL

(1) Spread tangs on pressure regulator retainer (Fig. 17).

(2) Pry fuel pressure regulator out of housing.

(3) Ensure both upper and lower O-rings were removed with regulator.

INSTALLATION

(1) Lightly lubricate the O-rings with clean engine oil and place them into opening in pump module (Fig. 18).

(2) Push regulator into opening in pump module.

(3) Fold tangs on regulator retainer over tabs on housing.

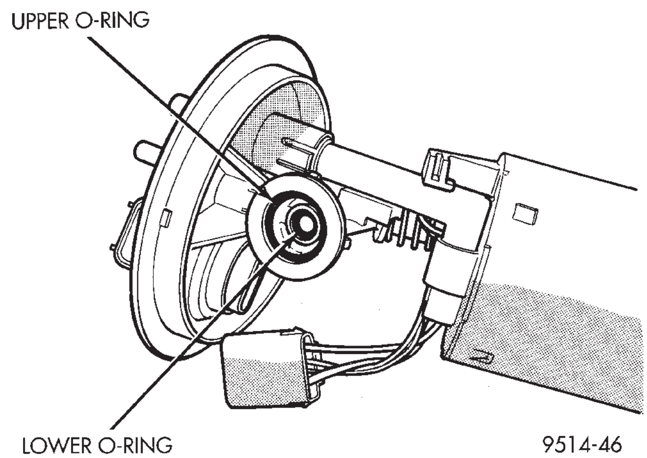


Fig. 18 Fuel Pressure Regulator O-rings

FUEL PUMP INLET STRAINER

REMOVAL

(1) Remove fuel pump module. Refer to Fuel Pump Module Removal in this section.

(2) Using a thin straight blade screwdriver, carefully pry back the locking tabs on fuel pump reservoir and remove the strainer (Fig. 19).

(3) Remove strainer O-ring from the fuel pump reservoir body.

(4) Remove any contaminants by washing the inside of the fuel tank.

INSTALLATION

(1) Lubricate the strainer O-ring with clean motor oil.

(2) Insert strainer O-ring into outlet of strainer so that it sits evenly on the step inside the outlet.

(3) Push strainer onto the inlet of the fuel pump reservoir body. Make sure the locking tabs on the reservoir body lock over the locking tangs on the strainer.

(4) Install fuel pump module. Refer to Fuel Pump Module Installation in this section.

REMOVAL AND INSTALLATION (Continued)

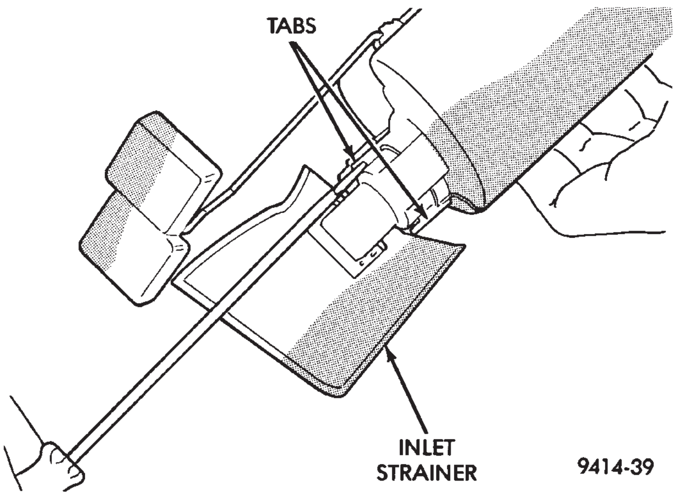


Fig. 19 Inlet Strainer Removal

FUEL LEVEL SENSOR

REMOVAL

Remove fuel pump module. Refer to Fuel Pump Module in this section.

(1) Depress retaining tab and remove the fuel pump/level sensor connector from the **BOTTOM** of the fuel pump module electrical connector (Fig. 20).

NOTE: The pump module harness on TOP of flange is not serviceable or removable.

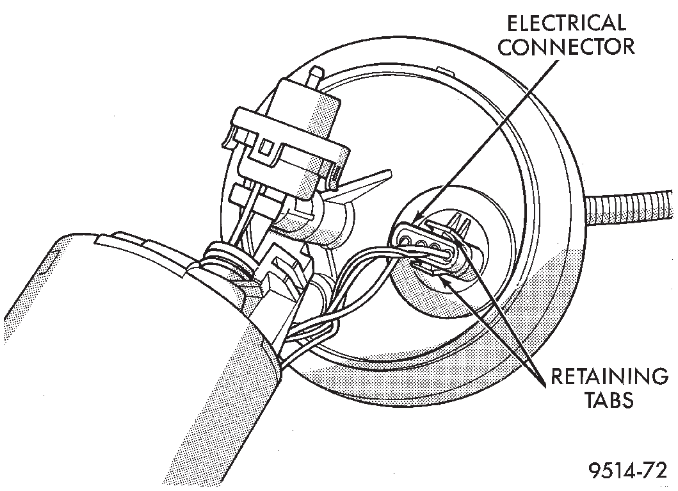


Fig. 20 Fuel Pump/Level Sensor Electrical Connector

(2) Using Special Tool C-4334 terminal remover or equivlant, remove terminals from level sensor connector (Fig. 21).

(3) Insert a screwdriver between the fuel pump module and the top of the level sensor housing (Fig. 22). Push level sensor down slightly.

(4) Slide level sensor wires through opening fuel pump module (Fig. 23).

(5) Slide level sensor out of channel in module.

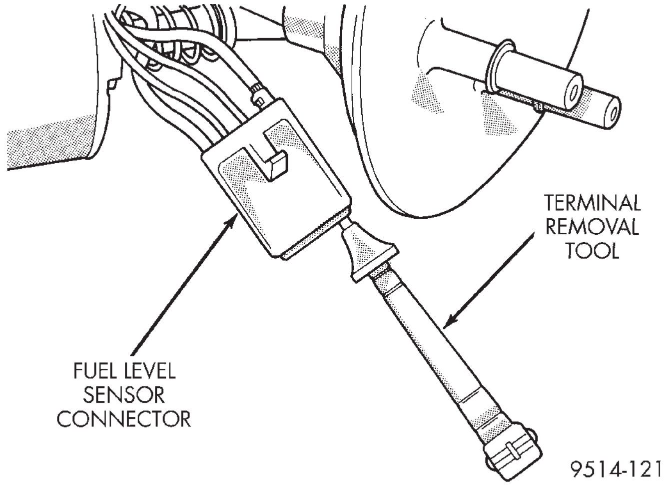


Fig. 21 Terminal Removal Tool

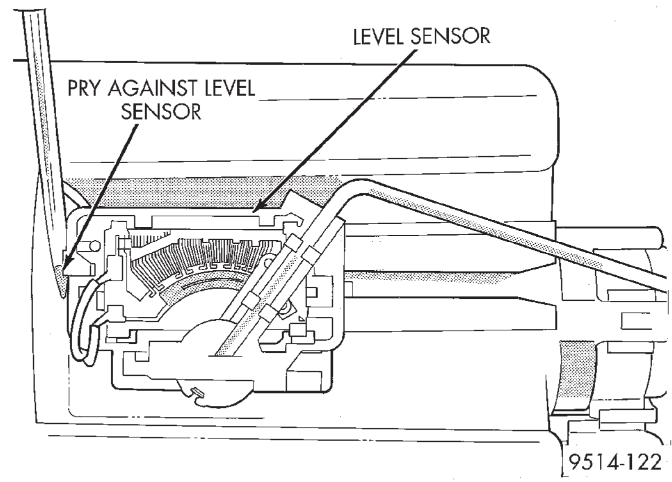


Fig. 22 Loosening Level Sensor

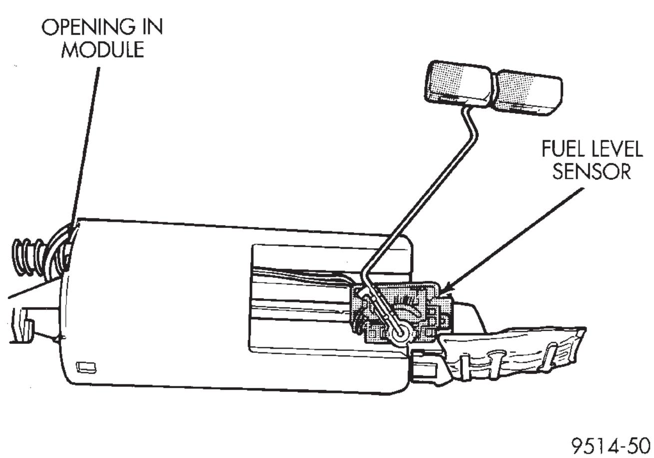


Fig. 23 Level Sensor Removal/Installation

INSTALLATION

(1) Insert level sensor wires into bottom of opening in module.

REMOVAL AND INSTALLATION (Continued)

(2) Wrap wires into groove in back of level sensor (Fig. 24).

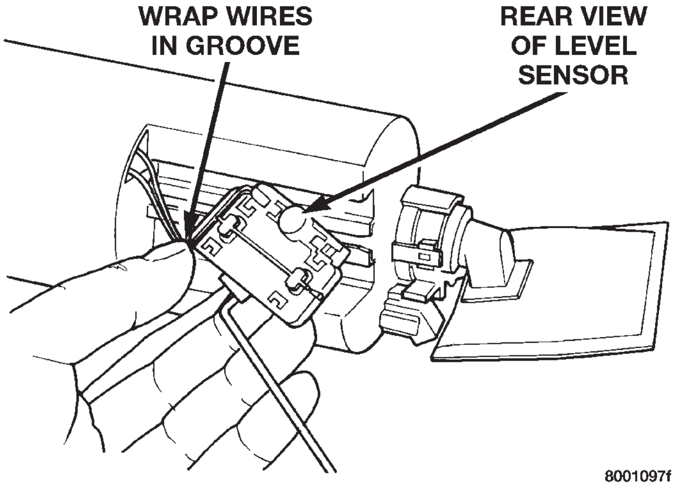


Fig. 24 Groove in Back Side of Level Sensor

(3) While feeding wires into guide grooves, slide level sensor up into channel until it snaps into place (Fig. 25). Ensure tab at bottom of sensor locks in place.

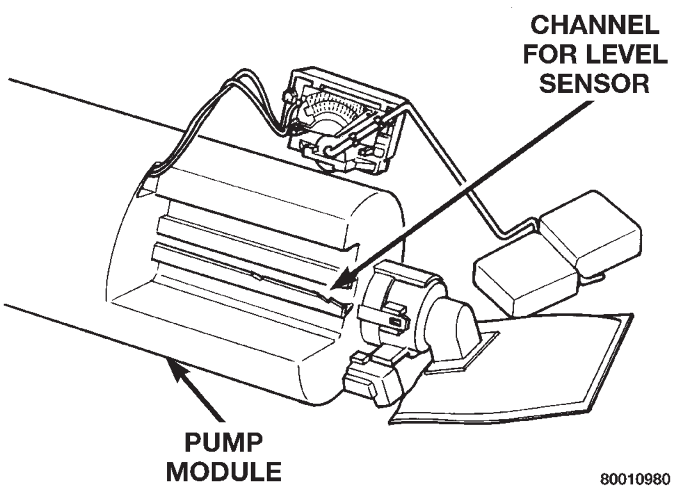


Fig. 25 Installation Channel

(4) Install level sensor wires in connector. Push the wires up through the connector and then pull them down until they lock in place. Ensure signal and ground wires are installed in the correct position (Fig. 26).

(5) Install locking wedge on connector.

(6) Push connector up into bottom of fuel pump module electrical connector.

(7) Install fuel pump module. Refer to Fuel Pump Module in this section.

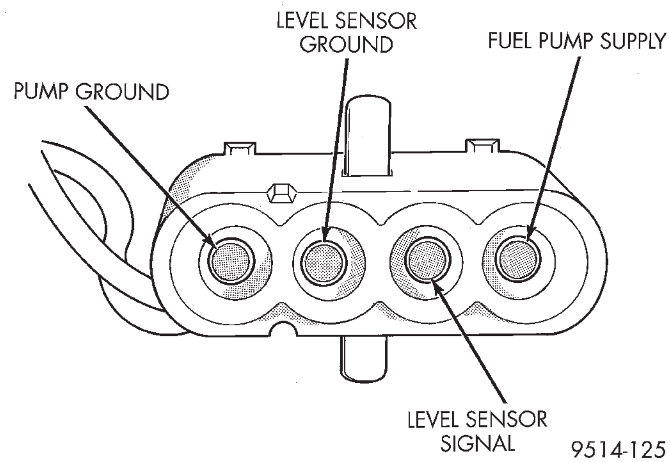


Fig. 26 Fuel/Pump/Level Sensor Electrical Connector

FUEL RAIL—2.0/2.4L

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(2) Release fuel system pressure. Refer to Fuel System Pressure Release procedure in this section.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

(3) Disconnect fuel supply tube from rail. Refer to Quick-Connect Fittings in this section.

(4) Disconnect electrical connectors from fuel injectors (Fig. 27).

(5) Remove fuel rail mounting screws.

(6) Lift rail off of intake manifold. Cover the fuel injector openings in the intake manifold.

INSTALLATION

(1) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

(2) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail mounting screws to 22.5 N·m ± 3 N·m (200±30 in. lbs.).

(3) Attach electrical connectors to fuel injectors.

(4) Connect fuel supply tube to fuel rail. Refer to Quick Connect Fittings in this section.

(5) Connect negative cable to auxiliary jumper terminal.

REMOVAL AND INSTALLATION (Continued)

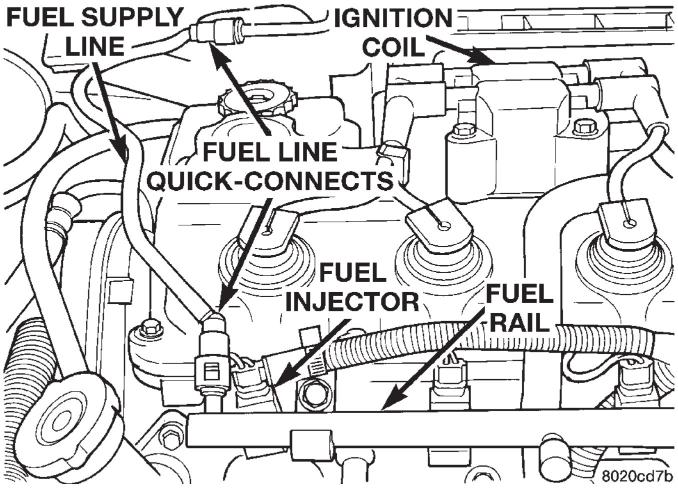


Fig. 27 Fuel Rail and Injectors

FUEL RAIL—2.5L

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal.

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(2) Release fuel system pressure. Refer to Fuel System Pressure Release procedure in this section.

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

(3) Disconnect fuel supply tube from rail. Refer to Quick-Connect Fittings in this section.
(4) Remove the Intake Manifold, refer to the Engine section.
(5) Disconnect electrical connectors from fuel injectors.
(6) Remove 4 bolts holding fuel rail (Fig. 28).

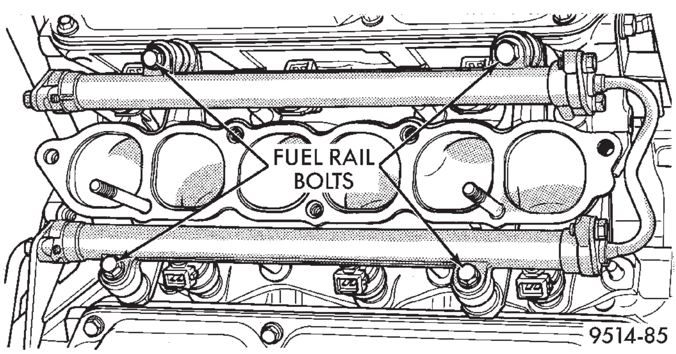


Fig. 28 Fuel Rail Attachment

(7) Lift fuel rail off engine. **There are spacers under each fuel rail bolt (Fig. 29).**

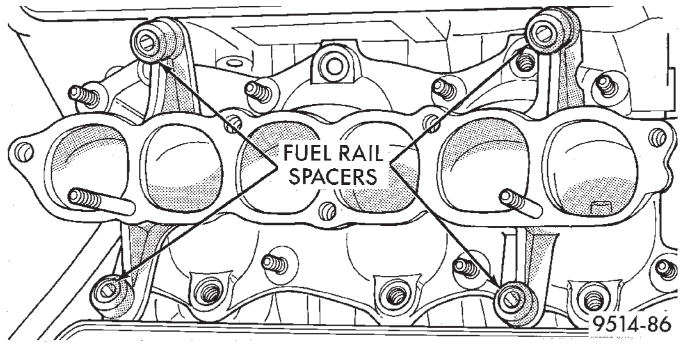


Fig. 29 Fuel Rail Spacers

INSTALLATION

(1) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

CAUTION: Make sure spacers are located under each fuel rail mounting position.

(2) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail bolts to 12 N·m (8 ft. lbs.).
(3) Attach electrical connectors to fuel injectors.
(4) Connect fuel supply tube to fuel rail. Refer to Quick Connect Fittings in the Fuel Delivery section
(5) Install Intake Manifold, refer to the Engine section.
(6) Install throttle cables.
(7) Attach electrical connectors to sensors.
(8) Tighten air inlet tube clamps to 3 N·m ±1 (25 in. lbs. ±5) torque.
(9) Connect negative terminal to auxiliary jumper terminal.

FUEL INJECTORS

REMOVAL

(1) Remove fuel rail. Refer to appropriate Fuel Rail Removal in this section.
(2) Remove fuel injector clip (Fig. 30) or (Fig. 31).
(3) Pull injector out of fuel rail. Replace fuel injector O-rings.

INSTALLATION

(1) Reverse procedure for installation.

FUEL TANK

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

REMOVAL AND INSTALLATION (Continued)

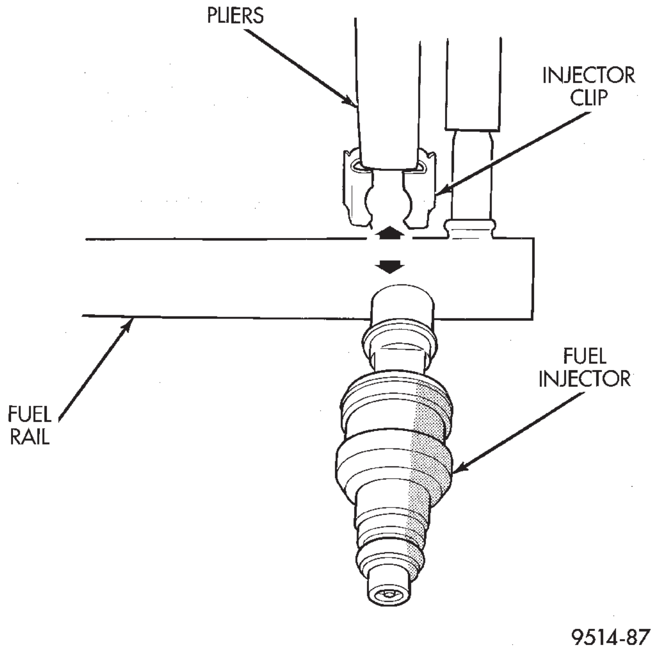


Fig. 30 Fuel Injector Clip—2.0/2.4L Engines

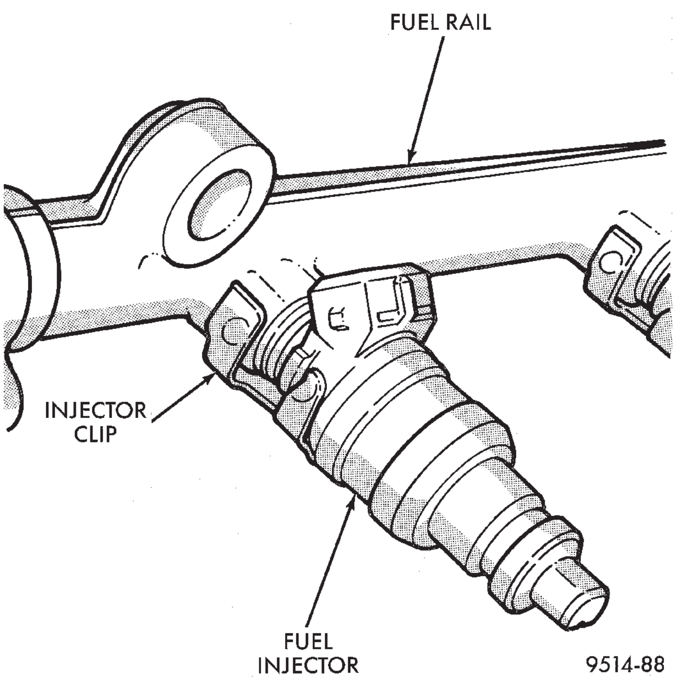


Fig. 31 Fuel Injector Clip—2.5L Engine

REMOVAL

(1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure in this section.

(2) Disconnect negative cable from auxiliary jumper terminal.

(3) Remove lower rear seat cushion, disconnect pump wiring jumper from main body harness. Locate body grommet for jumper near base of rear seat. Push grommet out and feed jumper completely through hole in body.

(4) Remove fuel cap slowly to release tank pressure.

(5) With vehicle on a hoist, drain fuel from tank. Support fuel tank with a support such as a transmission jack stand.

(6) Position a fuel approved container, with a capacity of at least 16 gallons, under the drain plug located on the bottom left edge of the tank.

CAUTION: Use a Back-Up wrench on tank to remove drain plug.

(7) Remove drain plug and allow fuel to drain (Fig. 32).

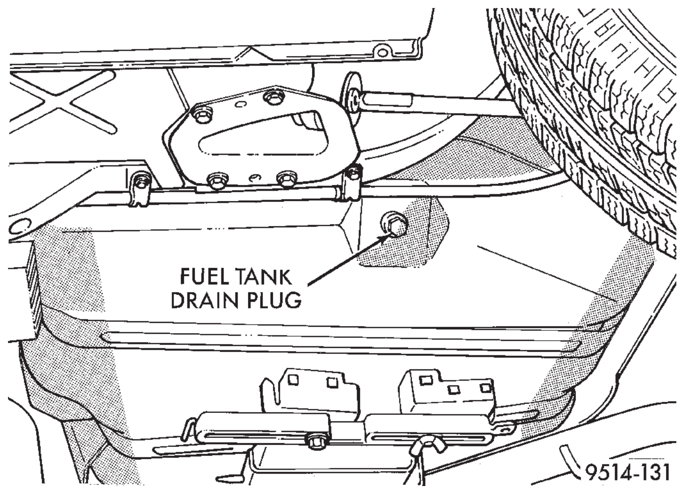


Fig. 32 Fuel Tank Drain Plug

WARNING: DRAIN PLUG MUST BE INSTALLED AT THIS TIME AS THERE WILL BE 1 TO 2 GALLONS OF FUEL LEFT IN THE TANK.

(8) When tank is no longer draining, install drain plug. Tighten plug to 32 in. lbs.

WARNING: There may be fuel in the fill tube. Remove hose carefully to reduce fuel splash.

(9) Disconnect fuel tank from rubber fill hose (Fig. 33).

WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.

(10) Remove bolts and fuel tank straps. Passenger side first.

(11) Lower fuel tank and remove the purge line (Fig. 34).

(12) Disconnect fuel lines from fuel pump module. These are quick connect fittings (Fig. 35).

(13) Remove hoses from EVAP canister.

REMOVAL AND INSTALLATION (Continued)

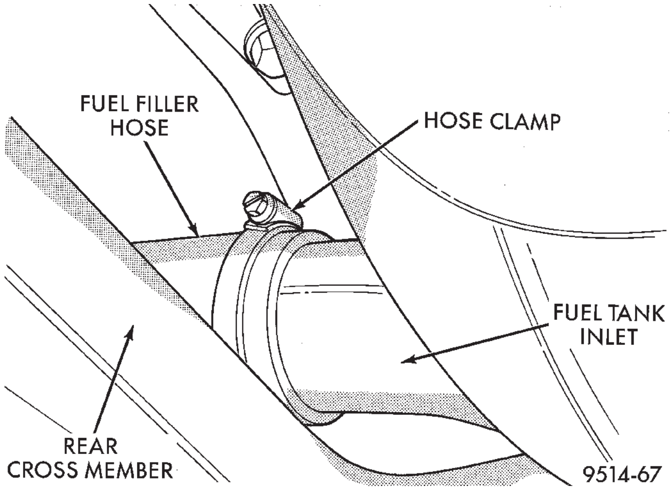


Fig. 33 Fuel Filler Hose Clamp

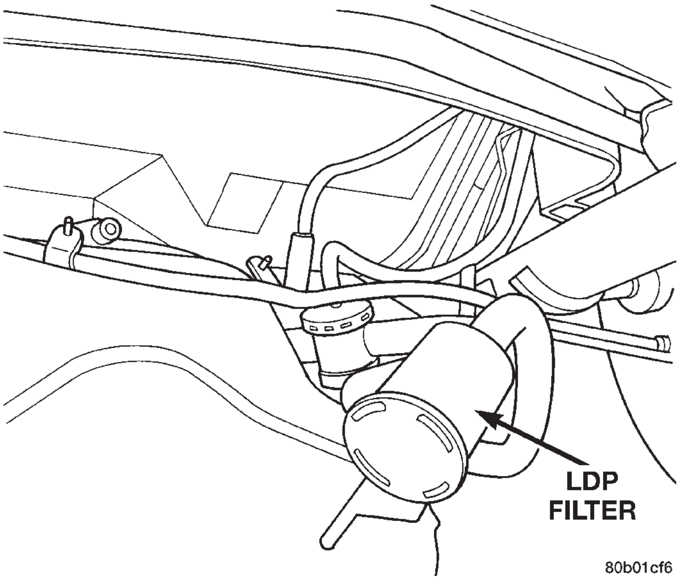


Fig. 34 Evap Components

(14) Remove tank from vehicle. Slide tank forward during removal to allow fill neck to clear suspension cross-member.

INSTALLATION

(1) Position fuel tank on transmission jack.
(2) Raise tank into position.
(3) Connect vapor line to rollover valve.
(4) Install EVAP hoses and lines.
(5) Connect fuel pump electrical connector.
(6) Install pump module harness grommet into body.
(7) Connect chassis fuel tube to fuel filter. Refer to Quick Connect Fittings in this section.
(8) Connect fuel fill tube to tank inlet. Tighten hose clamp to 3.5 N·m (31 in. lbs.) torque.

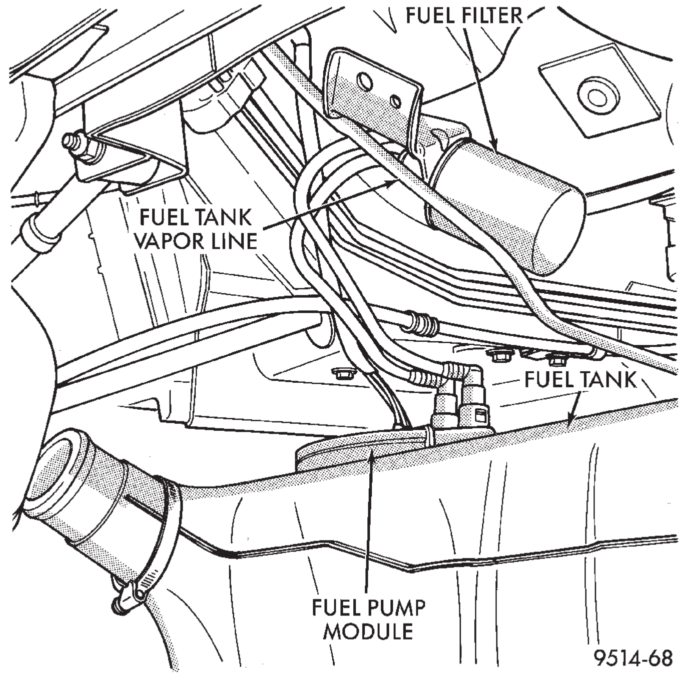


Fig. 35 Fuel Tank Removal

(9) Position fuel filter and fuel tank straps. Install the front bolts first and then the rear bolts. Tighten fuel tank strap bolts to 23 N·m (250 in. lbs.) torque. Remove transmission jack. Ensure straps are not twisted or bent.
(10) Lower vehicle.
(11) Connect fuel pump module connector, inside of vehicle. Install rear seat cushion.
(12) Fill fuel tank, install filler cap, and connect battery cable.

CAUTION: When using the ASD Fuel System Test, the ASD relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

(13) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

FUEL FILLER NECK

REMOVAL

(1) Loosen fuel filler tube cap.
(2) Remove fuel filler neck screws (Fig. 36).
(3) Disconnect Ground strap from body.
(4) Disconnect fuel filler tube hose from fuel tank neck. Remove fuel filler tube assembly.

INSTALLATION

(1) Reverse for installation.

REMOVAL AND INSTALLATION (Continued)

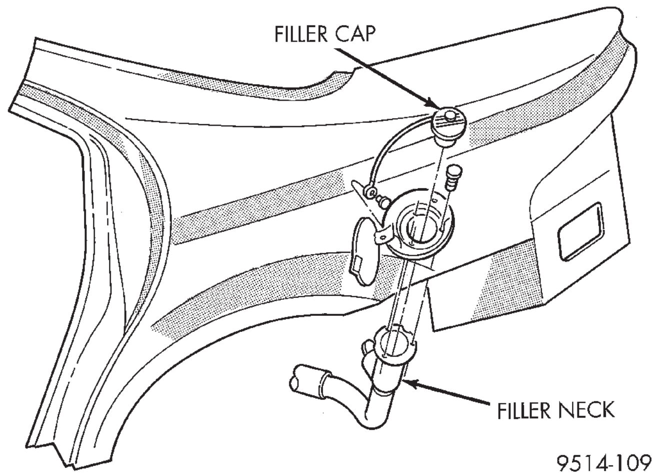


Fig. 36 Fuel Filler Neck Removal/Installation

ACCELERATOR PEDAL

REMOVAL

(1) Remove the throttle cable from the throttle body cam as described in Throttle Cable of this section.

(2) Reach behind the top of the pedal shaft and push the retainer toward rear of vehicle (Fig. 37). It may be necessary to squeeze retainer ears together on dash side of pedal shaft.

(3) Lift cable up through slot in top of pedal shaft.

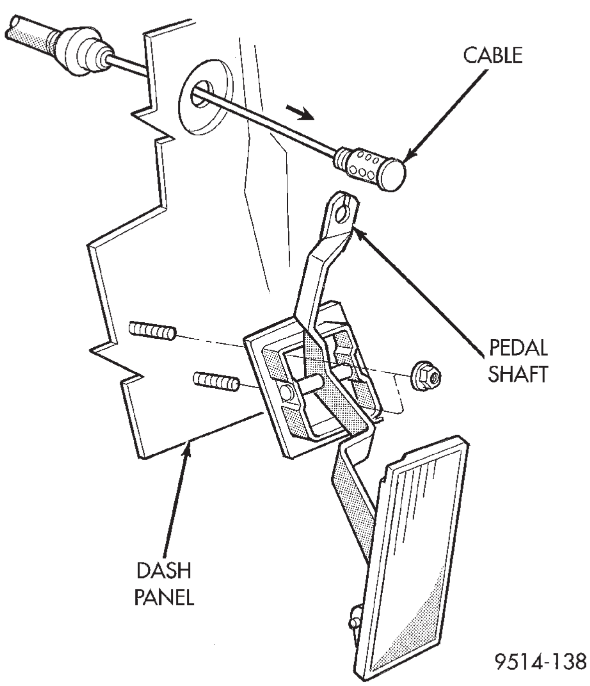


Fig. 37 Accelerator Pedal and Throttle Cable

(4) Remove nuts from accelerator pedal assembly studs. Remove assembly from vehicle.

INSTALLATION

(1) Position accelerator pedal assembly on dash panel. Install retaining nuts. Tighten retaining nuts to 12 N·m (105 in. lbs.) torque.

(2) Place cable through slot in top of pedal shaft.

(3) Step on pedal and retainer will snap into place.

(4) Hold the throttle body lever in the wide open position and install the throttle cable.

THROTTLE CABLE—2.0/2.4L

REMOVAL

(1) Working from the engine compartment, remove the throttle cable from the throttle body lever (Fig. 38) and (Fig. 39).

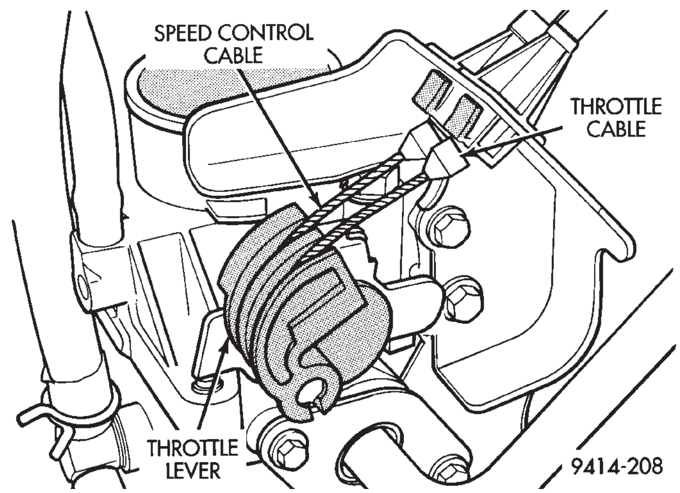


Fig. 38 Throttle Cable Attachment to Throttle Body

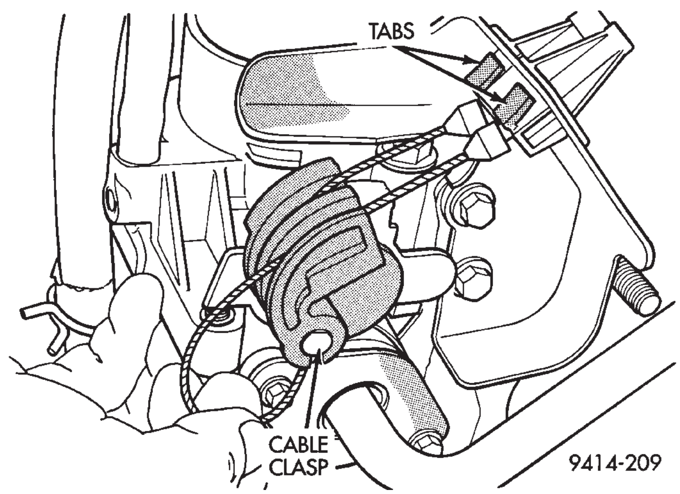


Fig. 39 Disconnecting Throttle Cable

(2) Compress the retaining tabs on the cable and slide cable out of bracket (Fig. 39).

(3) From inside vehicle, reach behind the top of the pedal shaft and push the retainer toward rear of vehicle. It may be necessary to squeeze retainer ears together on dash side of pedal shaft.

REMOVAL AND INSTALLATION (Continued)

(4) Lift cable up through slot in top of pedal shaft.
(5) From the engine compartment, pull the throttle cable and grommet out of the dash panel.

INSTALLATION

(1) From the engine compartment, push the cable end fitting and grommet into the dash panel.
(2) Install cable housing (throttle body end) into the cable mounting bracket on the engine.
(3) Place cable through slot in top of pedal shaft.
(4) Step on pedal and retainer will snap into place.

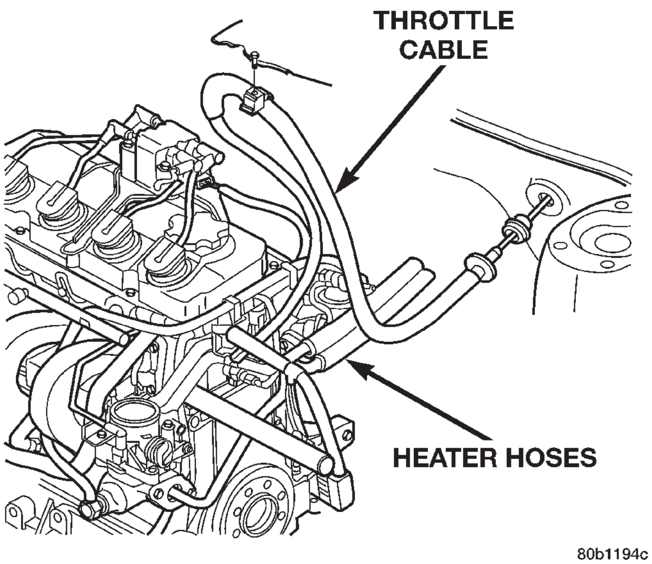


Fig. 40 Cable Routing 2.0L

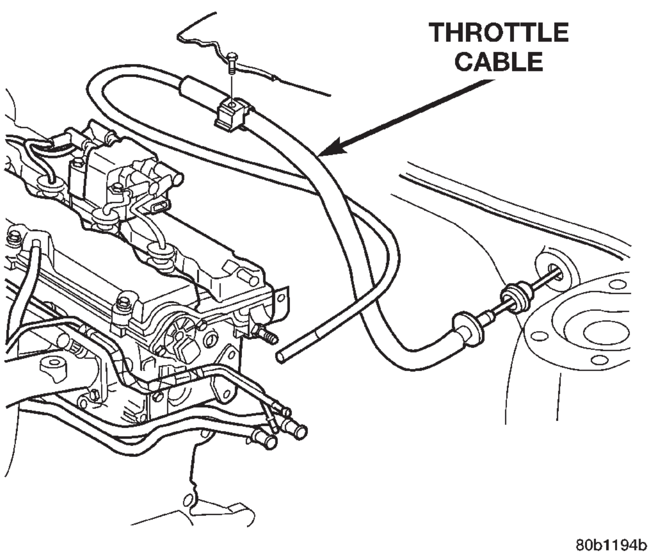


Fig. 41 Cable Routing 2.4L

(5) From the engine compartment, rotate the throttle lever forward to the wide open position and install cable clasp (Fig. 39).

THROTTLE CABLE—2.5L

REMOVAL

(1) Working from the engine compartment, remove throttle cable from the throttle body lever (Fig. 42).

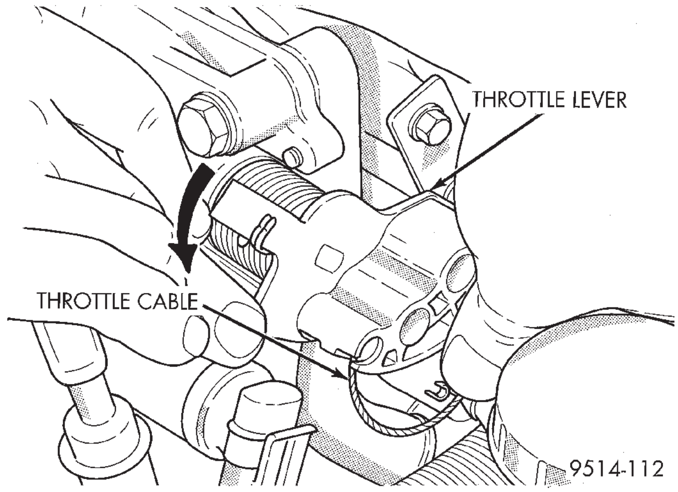


Fig. 42 Throttle Cable Attachment to Throttle Body

(2) Push release tang toward dash panel on throttle cable and slide cable out of bracket (Fig. 43).

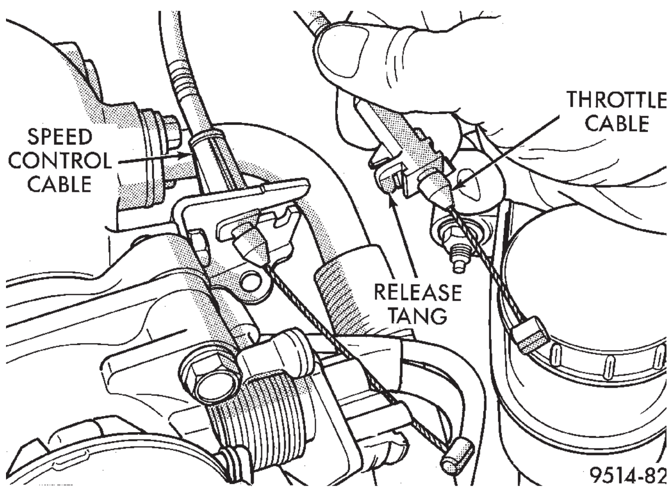


Fig. 43 Throttle Cable Attachment

(3) From inside the vehicle, reach behind the top of the pedal shaft and push the retainer toward rear of vehicle. It may be necessary to squeeze retainer ears together on dash side of pedal shaft.
(4) Lift cable up through slot in top of pedal shaft.
(5) From the engine compartment, pull the throttle cable and grommet out of the dash panel.

INSTALLATION

(1) From the engine compartment, push the cable end fitting and grommet into the dash panel.
(2) Install cable housing (throttle body end) into the cable mounting bracket on the engine.

REMOVAL AND INSTALLATION (Continued)

(3) Place cable through slot in top of pedal shaft.

(4) Step on pedal and retainer will snap into place.

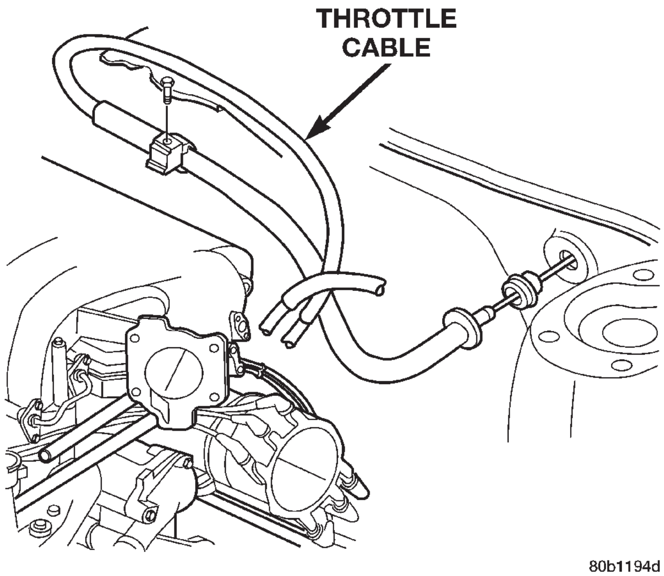


Fig. 44 Cable Routing 2.5L

(5) From the engine compartment, rotate the throttle lever forward to the wide open position and install cable clasp.

SPECIFICATIONS

TORQUE

DESCRIPTION	TORQUE
Accelerator Pedal to Dash Nuts	12 N·m (105 in. lbs.)
Fuel Filter Mounting Screw	12 N·m (110 in. lbs.)
Fuel Pump Module Locknut	74.5 N·m (55 ft. lbs.)
Fuel Tank strap Bolts	28.2 N·m (250 in. lbs.)
Fuel Rail Bolts—2.0/2.4L	22.5 N·m (200 in. lbs.)
Fuel Rail Bolts—2.5L	12 N·m (106 in. lbs.)
Ignition Coil Mounting Bolts	12 N·m (105 in. lbs.)

FUEL TANK CAPACITY

Vehicle	Liters	U.S. Gallons
JA	60	16
Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		

FUEL INJECTION SYSTEM

INDEX

DESCRIPTION AND OPERATION

INJECTION SYSTEM

All engines used in this section have a sequential Multi-Port Electronic Fuel Injection system. The MPI system is computer regulated and provides precise air/fuel ratios for all driving conditions. The Powertrain Control Module (PCM) operates the fuel injection system.

The PCM regulates:

- Ignition timing
- Air/fuel ratio
- Emission control devices
- Cooling fan
- Charging system
- Idle speed
- Vehicle speed control

Various sensors provide the inputs necessary for the PCM to correctly operate these systems. In addition to the sensors, various switches also provide inputs to the PCM.

All inputs to the PCM are converted into signals. The PCM can adapt its programming to meet changing operating conditions.

Fuel is injected into the intake port above the intake valve in precise metered amounts through electrically operated injectors. The PCM fires the injectors in a specific sequence. Under most operating conditions, the PCM maintains an air fuel ratio of 14.7 parts air to 1 part fuel by constantly adjusting injector pulse width. Injector pulse width is the length of time the injector is open.

The PCM adjusts injector pulse width by opening and closing the ground path to the injector. Engine RPM (speed) and manifold absolute pressure (air density) are the primary inputs that determine injector pulse width.

PCM REPLACEMENT

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW PCM WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

MODES OF OPERATION

OPERATION

As input signals to the PCM change, the PCM adjusts its response to output devices. For example, the PCM must calculate a different injector pulse width and ignition timing for idle than it does for Wide Open Throttle (WOT). There are several different modes of operation that determine how the PCM responds to the various input signals.

There are two different areas of operation, OPEN LOOP and CLOSED LOOP.

During OPEN LOOP modes the PCM receives input signals and responds according to preset PCM programming. Inputs from the upstream and downstream heated oxygen sensors are not monitored during OPEN LOOP modes, except for heated oxygen sensor diagnostics (they are checked for shorted conditions at all times).

During CLOSED LOOP modes the PCM monitors the inputs from the upstream and downstream heated oxygen sensors. The upstream heated oxygen sensor input tells the PCM if the calculated injector pulse width resulted in the ideal air-fuel ratio of 14.7 to one. By monitoring the exhaust oxygen content through the upstream heated oxygen sensor, the PCM can fine tune injector pulse width. Fine tuning injector pulse width allows the PCM to achieve optimum fuel economy combined with low emissions.

For the PCM to enter CLOSED LOOP operation, the following must occur:

(1) Engine coolant temperature must be over 35°F.

- If the coolant is over 35° the PCM will wait 44 seconds.
- If the coolant is over 50°F the PCM will wait 38 seconds.
- If the coolant is over 167°F the PCM will wait 11 seconds.

(2) For other temperatures the PCM will interpolate the correct waiting time.

(3) O2 sensor must read either greater than 0.745 volts or less than 0.1 volt.

(4) The multi-port fuel injection systems has the following modes of operation:

- Ignition switch ON (Zero RPM)
- Engine start-up
- Engine warm-up
- Cruise
- Idle
- Acceleration
- Deceleration
- Wide Open Throttle
- Ignition switch OFF

(5) The engine start-up (crank), engine warm-up, deceleration with fuel shutoff and wide open throttle modes are OPEN LOOP modes. Under most operating conditions, the acceleration, deceleration (with A/C on), idle and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes.

IGNITION SWITCH ON (ZERO RPM) MODE

When the ignition switch activates the fuel injection system, the following actions occur:

- The PCM monitors the engine coolant temperature sensor and throttle position sensor input. The

DESCRIPTION AND OPERATION (Continued)

PCM determines basic fuel injector pulse width from this input.

- The PCM determines atmospheric air pressure from the MAP sensor input to modify injector pulse width.

When the key is in the ON position and the engine is not running (zero rpm), the Auto Shutdown (ASD) and fuel pump relays de-energize after approximately 1 second. Therefore, battery voltage is not supplied to the fuel pump, ignition coil, fuel injectors and heated oxygen sensors.

ENGINE START-UP MODE

This is an OPEN LOOP mode. If the vehicle is in park or neutral (automatic transaxles) or the clutch pedal is depressed (manual transaxles) the ignition switch energizes the starter relay. The following actions occur when the starter motor is engaged.

- If the PCM receives the camshaft position sensor and crankshaft position sensor signals, it energizes the Auto Shutdown (ASD) relay and fuel pump relay. If the PCM does not receive both signals within approximately one second, it will not energize the ASD relay and fuel pump relay. The ASD and fuel pump relays supply battery voltage to the fuel pump, fuel injectors, ignition coil and heated oxygen sensors.
- The PCM energizes the injectors (on the 69° degree falling edge) for a calculated pulse width until it determines crankshaft position from the camshaft position sensor and crankshaft position sensor signals. The PCM determines crankshaft position within 1 engine revolution.
- After determining crankshaft position, the PCM begins energizing the injectors in sequence. It adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.
- When the engine idles within ±64 RPM of its target RPM, the PCM compares current MAP sensor value with the atmospheric pressure value received during the Ignition Switch On (zero RPM) mode. If the PCM does not detect a minimum difference between the two values, it sets a MAP diagnostic trouble code into memory.

Once the ASD and fuel pump relays have been energized, the PCM determines injector pulse width based on the following:

- Battery voltage
- Engine coolant temperature
- Engine RPM
- Intake air temperature (IAT)
- Throttle position
- The number of engine revolutions since cranking was initiated

During Start-up the PCM maintains ignition timing at 9° BTDC.

ENGINE WARM-UP MODE

This is an OPEN LOOP mode. The following inputs are received by the PCM:

- Engine coolant temperature
- Manifold Absolute Pressure (MAP)
- Intake air temperature (IAT)
- Crankshaft position (engine speed)
- Camshaft position
- Knock sensor
- Throttle position
- A/C switch
- Battery voltage
- Power steering pressure switch
- Vehicle speed
- Speed control
- O2 sensors
- All diagnostics

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts ignition timing and engine idle speed. Engine idle speed is adjusted through the idle air control motor.

CRUISE OR IDLE MODE

When the engine is at operating temperature this is a CLOSED LOOP mode. During cruising or idle the following inputs are received by the PCM:

- Intake air temperature
- Engine coolant temperature
- Manifold absolute pressure
- Crankshaft position (engine speed)
- Camshaft position
- Knock sensor
- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Power steering pressure switch
- Battery voltage
- Vehicle speed

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts engine idle speed and ignition timing. The PCM adjusts the air/fuel ratio according to the oxygen content in the exhaust gas (measured by the upstream and downstream heated oxygen sensor).

The PCM monitors for engine misfire. During active misfire and depending on the severity, the PCM either continuously illuminates or flashes the malfunction indicator lamp (Check Engine light on

DESCRIPTION AND OPERATION (Continued)

instrument panel). Also, the PCM stores an engine misfire DTC in memory.

The PCM performs several diagnostic routines. They include:

- Oxygen sensor monitor
- Downstream heated oxygen sensor diagnostics during open loop operation (except for shorted)
- Fuel system monitor
- EGR monitor
- Purge system monitor
- All inputs monitored for proper voltage range.
- All monitored components (refer to the Emission section for On-Board Diagnostics).

The PCM compares the upstream and downstream heated oxygen sensor inputs to measure catalytic convertor efficiency. If the catalyst efficiency drops below the minimum acceptable percentage, the PCM stores a diagnostic trouble code in memory.

During certain idle conditions, the PCM may enter a variable idle speed strategy. During variable idle speed strategy the PCM adjusts engine speed based on the following inputs.

- A/C sense
- Battery voltage
- Battery temperature
- Engine coolant temperature
- Engine run time
- Power steering pressure switch
- Vehicle mileage

ACCELERATION MODE

This is a CLOSED LOOP mode. The PCM recognizes an abrupt increase in Throttle Position sensor output voltage or MAP sensor output voltage as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased fuel demand.

DECELERATION MODE

This is a CLOSED LOOP mode. During deceleration the following inputs are received by the PCM:

- A/C pressure transducer
- A/C sense
- Battery voltage
- Intake air temperature
- Engine coolant temperature
- Crankshaft position (engine speed)
- Exhaust gas oxygen content (upstream heated oxygen sensor)
- Knock sensor
- Manifold absolute pressure
- Power steering pressure switch
- Throttle position
- IAC motor control changes in response to MAP sensor feedback

The PCM may receive a closed throttle input from the Throttle Position Sensor (TPS) when it senses an abrupt decrease in manifold pressure. This indicates a hard deceleration. In response, the PCM may momentarily turn off the injectors. This helps improve fuel economy, emissions and engine braking.

If decel fuel shutoff is detected, downstream oxygen sensor diagnostics is performed.

WIDE-OPEN-THROTTLE MODE

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are received by the PCM:

- Intake air temperature
- Engine coolant temperature
- Engine speed
- Knock sensor
- Manifold absolute pressure
- Throttle position

When the PCM senses a wide-open-throttle condition through the Throttle Position Sensor (TPS) it de-energizes the A/C compressor clutch relay. This disables the air conditioning system.

The PCM does not monitor the heated oxygen sensor inputs during wide-open-throttle operation except for downstream heated oxygen sensor and both shorted diagnostics. The PCM adjusts injector pulse width to supply a predetermined amount of additional fuel.

IGNITION SWITCH OFF MODE

When the operator turns the ignition switch to the OFF position, the following occurs:

- All outputs are turned off, unless 02 Heater Monitor test is being run. Refer to the Emission section for On-Board Diagnostics.
- No inputs are monitored except for the heated oxygen sensors. The PCM monitors the heating elements in the oxygen sensors and then shuts down.

SYSTEM DIAGNOSIS

OPERATION

The PCM can test many of its own input and output circuits. If the PCM senses a fault in a major system, the PCM stores a Diagnostic Trouble Code (DTC) in memory.

For DTC information see On-Board Diagnostics.

POWER DISTRIBUTION CENTER

DESCRIPTION

The Power Distribution Center (PDC) is located next to the PCM (Fig. 1).

DESCRIPTION AND OPERATION (Continued)

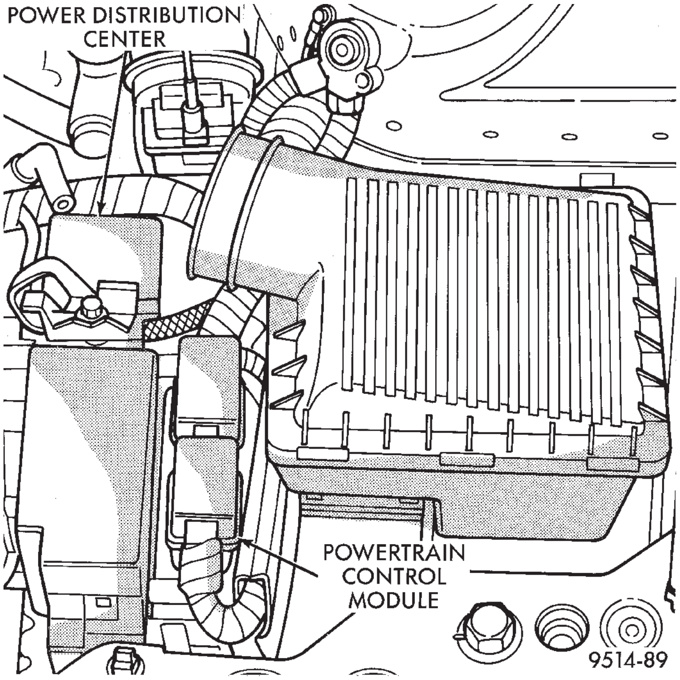


Fig. 1 Power Distribution Center and Powertrain Control Module

OPERATION

The PDC contains the starter relay, radiator fan relay, A/C compressor clutch relay, auto shutdown relay, fuel pump relay and several fuses.

CCD BUS

OPERATION

Various modules exchange information through a communications port called the CCD Bus. The Powertrain Control Module (PCM) transmits the Malfunction Indicator Lamp (Check Engine) On/Off signal and engine RPM on the CCD Bus. The PCM receives the Air Conditioning select input, transaxle gear position input and speed control engage inputs over the CCD Bus. The PCM also receives the air conditioning evaporator temperature signal from the CCD Bus.

The following components access or send information on the CCD Bus.

- Instrument Panel
- Body Control Module
- Air Bag System Diagnostic Module
- Full ATC Display Head
- ABS Module
- Transmission Control Module
- Powertrain Control Module
- Overhead Travel Module

POWERTRAIN CONTROL MODULE

OPERATION

The Powertrain Control Module (PCM) is a digital computer containing a microprocessor. The PCM receives input signals from various switches and sensors that are referred to as PCM Inputs. Based on these inputs, the PCM adjusts various engine and vehicle operations through devices that are referred to as PCM Outputs.

NOTE: PCM Inputs:

- Air Conditioning Controls
- Battery Voltage
- Battery Temperature Sensor
- Brake Switch
- Camshaft Position Sensor
- Crankshaft Position Sensor
- CCD Bus
- Engine Coolant Temperature Sensor
- Fuel Level Sensor
- Ignition Switch
- Intake Air Temperature Sensor
- Knock Sensor (2.0/2.4L only)
- Leak Detection Pump
- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensors
- Power Steering Pressure Switch
- SCI Receive
- Speed Control Switches
- Throttle Position Sensor
- Transmission Park/Neutral Switch (automatic transmission)
- Vehicle Speed Sensor

NOTE: PCM Outputs:

- Air Conditioning Clutch Relay
- Auto Shutdown (ASD) Relay
- Charging Indicator Lamp
- CCD Bus
- SCI Transmit
- Proportional Purge Solenoid
- EGR Solenoid
- Fuel Injectors
- Fuel Pump Relay
- Generator Field
- Idle Air Control Motor
- Ignition Coils
- Malfunction Indicator (Check Engine) Lamp
- Radiator Fan Relays
- Speed Control Solenoids

DESCRIPTION AND OPERATION (Continued)

Based on inputs it receives, the PCM adjusts fuel injector pulse width, idle speed, ignition spark advance, ignition coil dwell and EVAP canister purge operation. The PCM regulates the cooling fan, air conditioning and speed control systems. The PCM changes generator charge rate by adjusting the generator field. The PCM also performs diagnostics.

The PCM adjusts injector pulse width (air-fuel ratio) based on the following inputs.

- Battery voltage
- Coolant temperature
- Exhaust gas content (oxygen sensor)
- Engine speed (crankshaft position sensor)
- Intake air temperature
- Manifold absolute pressure
- Throttle position

The PCM adjusts ignition timing based on the following inputs.

- Coolant temperature
- Engine speed (crankshaft position sensor)
- Knock sensor
- Manifold absolute pressure
- Throttle position
- Transmission gear selection (park/neutral switch)
- Intake air temperature

The PCM also adjusts engine idle speed through the idle air control motor based on the following inputs.

- Air conditioning sense
- Battery voltage
- Battery temperature
- Brake switch
- Coolant temperature
- Engine speed (crankshaft position sensor)
- Engine run time
- Manifold absolute pressure
- Power steering pressure switch
- Throttle position
- Transmission gear selection (park/neutral switch)
- Vehicle distance (speed)

The Auto Shutdown (ASD) and fuel pump relays are located in the Power Distribution Center (PDC).

The camshaft position sensor (distributor pick-up signal 2.5L) and crankshaft position sensor signals are sent to the PCM. If the PCM does not receive the signal within approximately 1 second of engine cranking, it deactivates the ASD relay and fuel pump relay. When these relays are deactivated, power is shut off from the fuel injectors, ignition coils, oxygen sensor heating elements and fuel pump.

The PCM contains a voltage converter that changes battery voltage to a regulated 9 volts direct current to power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5 volt direct current supply for the manifold absolute pressure sensor, throttle position sensor, and A/C pressure switch.

AIR CONDITIONING PRESSURE TRANSDUCER—PCM INPUT

OPERATION

The Powertrain Control Module (PCM) monitors the A/C compressor discharge (high side) pressure through the air conditioning pressure transducer. The transducer supplies an input to the PCM. The PCM engages the A/C compressor clutch if pressure is sufficient for A/C system operation.

AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT

OPERATION

The ASD sense circuit informs the PCM when the ASD relay energizes. A 12 volt signal at this input indicates to the PCM that the ASD has been activated. This input is used only to sense that the ASD relay is energized.

When energized, the ASD relay supplies battery voltage to the fuel injectors, ignition coils and the heating element in each oxygen sensor. If the PCM does not receive 12 volts from this input after grounding the ASD relay, it sets a Diagnostic Trouble Code (DTC).

BATTERY VOLTAGE—PCM INPUT

OPERATION

The PCM monitors the battery voltage input to determine fuel injector pulse width and generator field control.

If battery voltage is low the PCM will increase injector pulse width (period of time that the injector is energized).

BATTERY TEMPERATURE SENSOR—PCM INPUT

OPERATION

The PCM uses the temperature of the battery area to control the charge rate. The signal is used to regulate the system voltage. The system voltage is higher at cold temperatures and is gradually reduced as temperature around the battery increases.

DESCRIPTION AND OPERATION (Continued)

BRAKE SWITCH—PCM INPUT

OPERATION

When the brake switch is activated, the PCM receives an input indicating that the brakes are being applied. After receiving this input the PCM maintains idle speed to a scheduled RPM through control of the idle air control motor. The brake switch is mounted on the brake pedal support bracket.

CAMSHAFT POSITION SENSOR—PCM INPUT

OPERATION

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

Refer to the Wiring section, Camshaft Position Sensor for more information.

2.0/2.4L ENGINES

The camshaft position sensor attaches to the rear of the cylinder head (Fig. 2) and (Fig. 3).

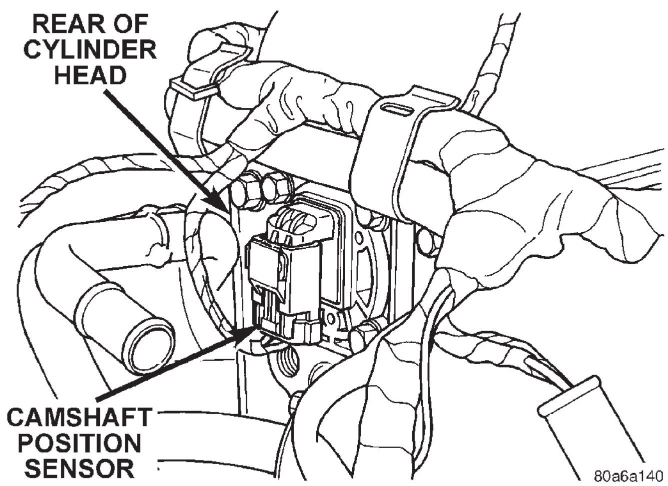


Fig. 2 Camshaft Position Sensor—2.0L

The sensor also acts as a thrust plate to control camshaft endplay.

2.5L ENGINE

The 2.5L engine is equipped with a camshaft driven mechanical distributor. The distributor is also equipped with an internal camshaft position (fuel sync) sensor (Fig. 4).

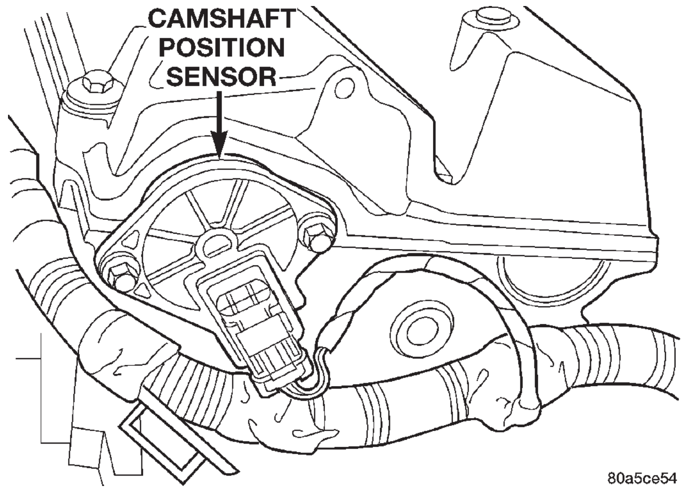


Fig. 3 Camshaft Position Sensor—2.4L

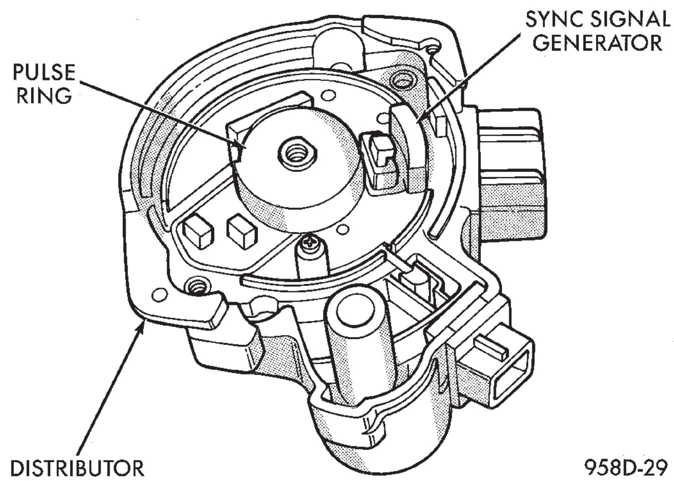


Fig. 4 Camshaft Position Sensor—2.5L

CRANKSHAFT POSITION SENSOR—PCM INPUT

DESCRIPTION

The 2.0/2.4L crankshaft position sensor mounts to the engine block behind the generator, just above the oil filter (Fig. 5).

The 2.5L crankshaft position sensor is located in the transaxle housing, above the vehicle speed sensor (Fig. 6).

OPERATION

The PCM determines what cylinder to fire from the crankshaft and camshaft position sensor input. It is also used to synchronize the fuel injectors with their respective cylinders.

DESCRIPTION AND OPERATION (Continued)

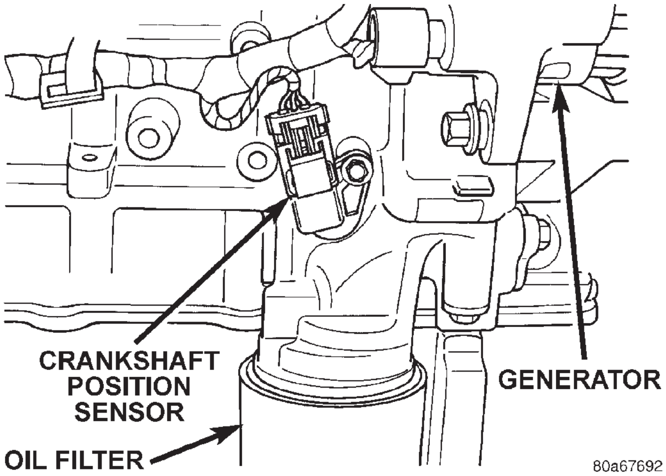


Fig. 5 Crankshaft Position Sensor—2.0/2.4L Engines

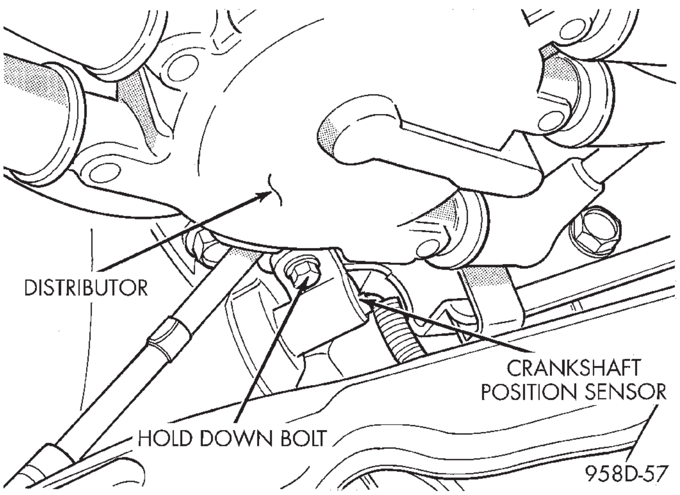


Fig. 6 Crankshaft Position Sensor—2.5L Engine

Refer to Wiring section - Crankshaft Position Sensor for more information.

On 2.0/2.4L engines, the second crankshaft counterweight has two sets of four timing reference notches including a 60 degree signature notch (Fig. 7). From the crankshaft position sensor input the PCM determines engine speed and crankshaft angle (position).

On a 2.5L engine, this sensor is a hall effect device that detects notches in the flexplate.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

DESCRIPTION

The coolant sensor threads into the rear of the cylinder head 2.0L (Fig. 8), front of the cylinder head 2.4L (Fig. 9); next to the coolant fill neck 2.5L (Fig. 10). New sensors have sealant applied to the threads.

OPERATION

The PCM determines engine coolant temperature from the coolant temperature sensor.

The coolant temperature sensor has one element. The element supplies coolant temperature signal to the PCM. The PCM supplies coolant temperature information on the CCD Bus to the Body Control Module (BCM) for the instrument panel gauge cluster.

As coolant temperature varies, the coolant temperature sensor resistance changes resulting in a different current draw from the PCM.

When the engine is cold, the PCM will provide slightly richer air- fuel mixtures and higher idle speeds until normal operating temperatures are reached.

FUEL LEVEL SENSOR—PCM INPUT

OPERATION

The fuel level sensor (fuel gauge sending unit) sends a signal to the PCM to indicate fuel level. The purpose of this feature is to prevent a false setting of misfire and fuel system monitor trouble codes if the fuel level is less than approximately 15 percent of its rated capacity. It is also used to send a signal for fuel gauge operation via the PCI bus circuits.

HEATED OXYGEN SENSORS—PCM INPUT

DESCRIPTION

The upstream oxygen sensor threads into the outlet flange of the exhaust manifold (Fig. 11) or (Fig. 12).

The downstream heated oxygen sensor threads into the outlet pipe at the rear of the catalytic convertor (Fig. 13).

OPERATION

As vehicles accumulate mileage, the catalytic convertor deteriorates. The deterioration results in a less efficient catalyst. To monitor catalytic convertor deterioration, the fuel injection system uses two heated oxygen sensors. One sensor upstream of the catalytic convertor, one downstream of the convertor. The PCM compares the reading from the sensors to calculate the catalytic convertor oxygen storage capacity and converter efficiency. Also, the PCM uses the upstream heated oxygen sensor input when adjusting injector pulse width.

When the catalytic converter efficiency drops below emission standards, the PCM stores a diagnostic trouble code and illuminates the malfunction indicator lamp (MIL).

DESCRIPTION AND OPERATION (Continued)

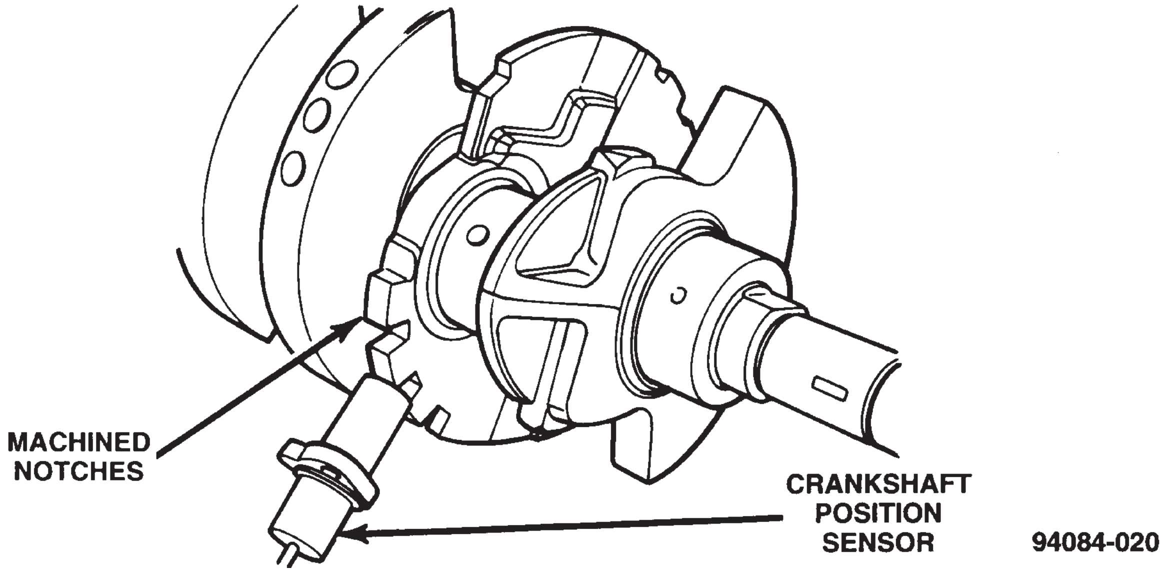


Fig. 7 Timing Reference Notches

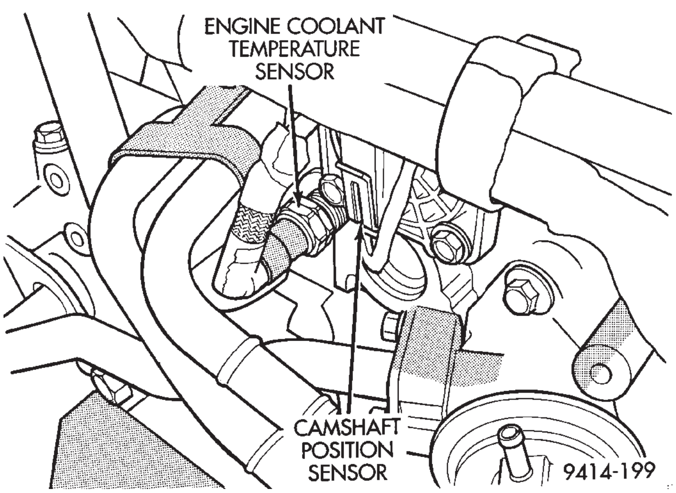


Fig. 8 Engine Coolant Temperature Sensor—2.0L

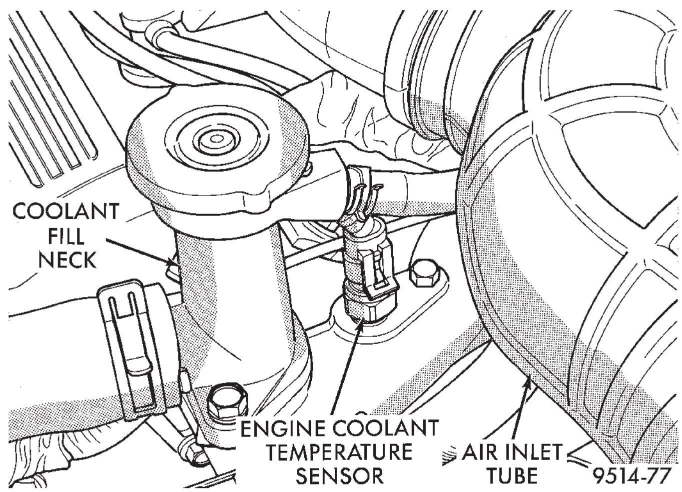


Fig. 10 Engine Coolant Temperature Sensor—2.5L

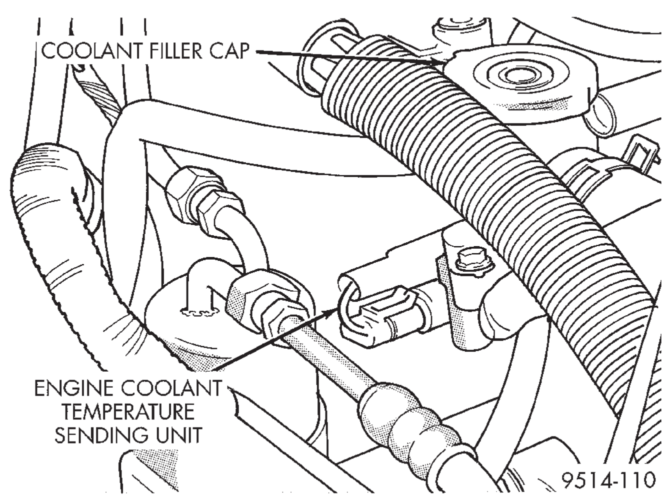


Fig. 9 Engine Coolant Temperature Sensor—2.4L

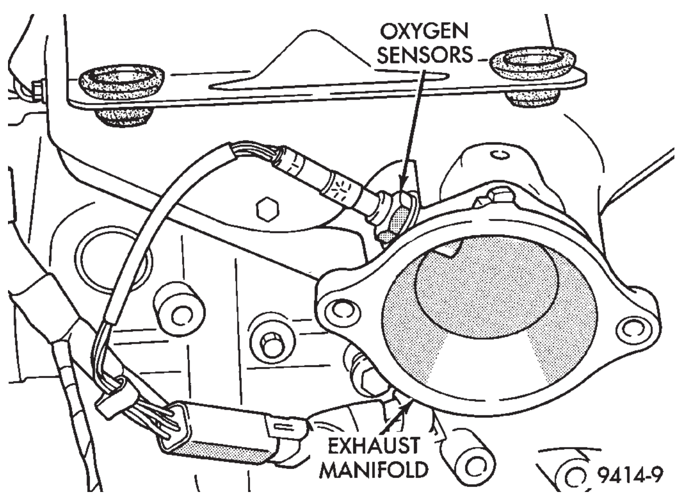


Fig. 11 Oxygen Sensor 1/1 Upstream—2.0/2.4L Engines

DESCRIPTION AND OPERATION (Continued)

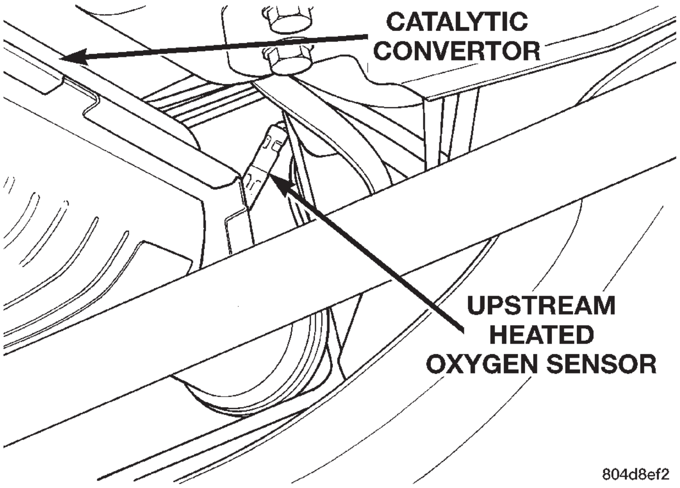


Fig. 12 Oxygen Sensor 1/1 Upstream—2.5L

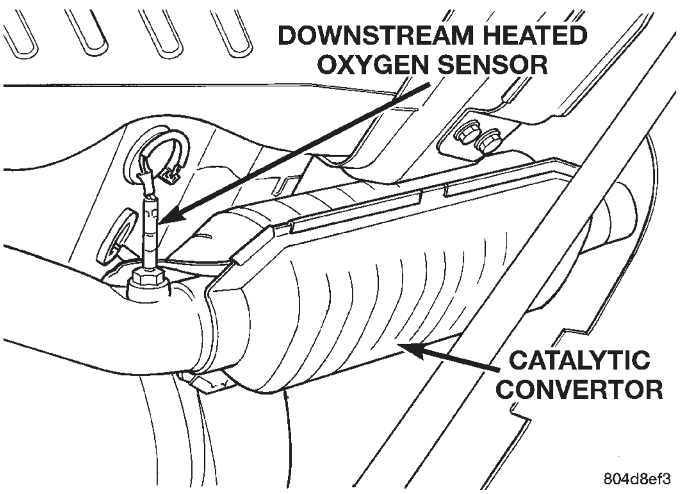


Fig. 13 Oxygen Sensor 1/2 Downstream

The automatic shutdown relay supplies battery voltage to both the upstream and downstream heated oxygen sensors. The oxygen sensors are equipped with a heating element. The heating elements reduce the time required for the sensors to reach operating temperature.

OXYGEN SENSOR 1/1 UPSTREAM

The input from the upstream heated oxygen sensor tells the PCM the oxygen content of the exhaust gas. Based on this input, the PCM fine tunes the air-fuel ratio by adjusting injector pulse width.

The sensor input switches from 0 to 1 volt, depending upon the oxygen content of the exhaust gas in the exhaust manifold. When a large amount of oxygen is present (caused by a lean air-fuel mixture), the sensor produces voltage as low as 0.1 volt. When there is a lesser amount of oxygen present (rich air-fuel mixture) the sensor produces a voltage as high as 1.0 volt. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

The heating element in the sensor provides heat to the sensor ceramic element. Heating the sensor allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop, the PCM adjusts injector pulse width based on the upstream heated oxygen sensor input along with other inputs. In Open Loop, the PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

OXYGEN SENSOR 1/2 DOWNSTREAM

The downstream heated oxygen sensor input is used to detect catalytic convertor deterioration. As the convertor deteriorates, the input from the downstream sensor begins to match the upstream sensor input except for a slight time delay. By comparing the downstream heated oxygen sensor input to the input from the upstream sensor, the PCM calculates catalytic convertor efficiency.

IGNITION SENSE—PCM INPUT

OPERATION

The ignition sense input informs the Powertrain Control Module (PCM) that the ignition switch is in the crank or run position.

INTAKE AIR TEMPERATURE SENSOR—PCM INPUT

DESCRIPTION

The IAT sensor and Manifold Absolute Pressure (MAP) sensor are a combined sensor that attach to the intake manifold (Fig. 14) for 2.0L engine.

The IAT sensor threads into the intake manifold (Fig. 15) or (Fig. 16) for the 2.4/2.5L engines.

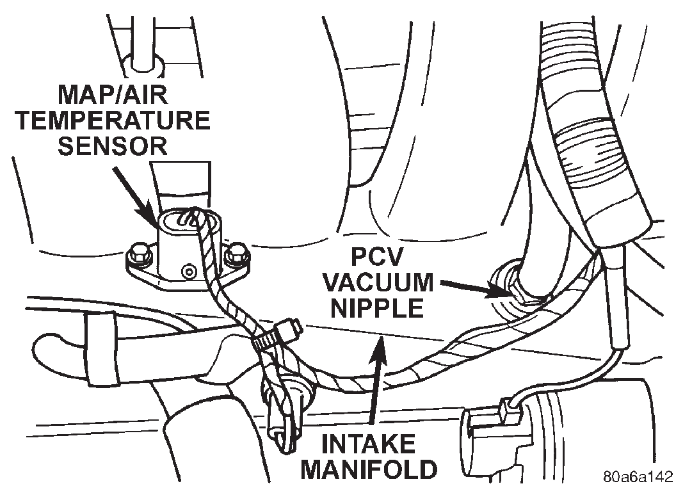


Fig. 14 Intake Air Temperature Sensor and MAP Sensor—2.0L

DESCRIPTION AND OPERATION (Continued)

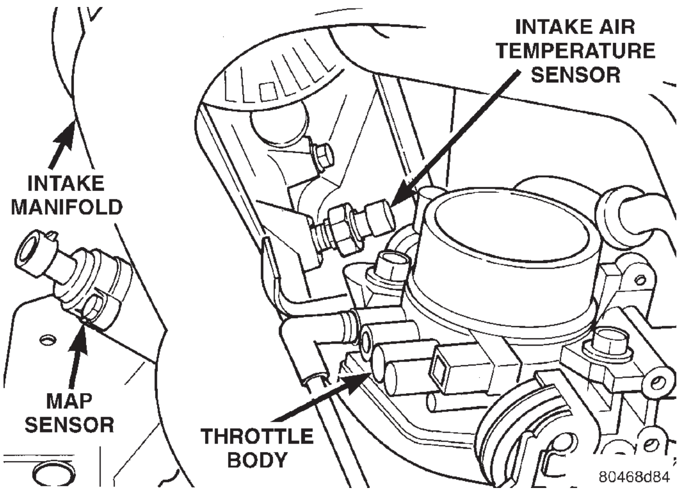


Fig. 15 Intake Air Temperature Sensor and MAP Sensor—2.4L

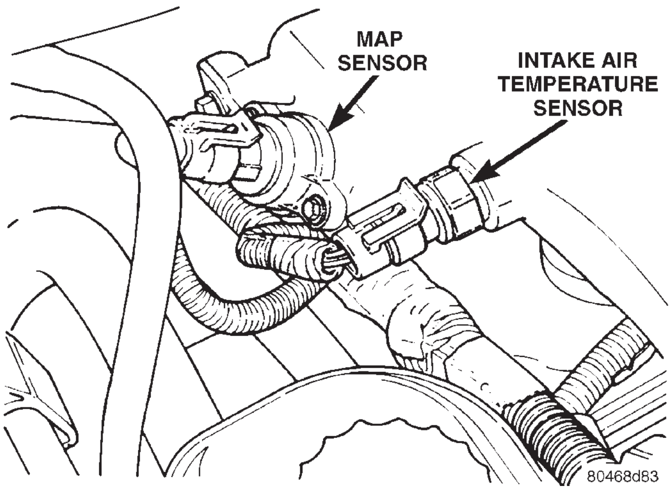


Fig. 16 Intake Air Temperature Sensor and MAP Sensor—2.5L

OPERATION

The Intake Air Temperature (IAT) sensor measures the temperature of the intake air as it enters the engine. The sensor supplies one of the inputs the PCM uses to determine injector pulse width and spark advance.

KNOCK SENSOR—PCM INPUT (2.0L/2.4L ENGINES)

DESCRIPTION

The knock sensor threads into the side of the cylinder block in front of the starter (Fig. 17).

OPERATION

When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

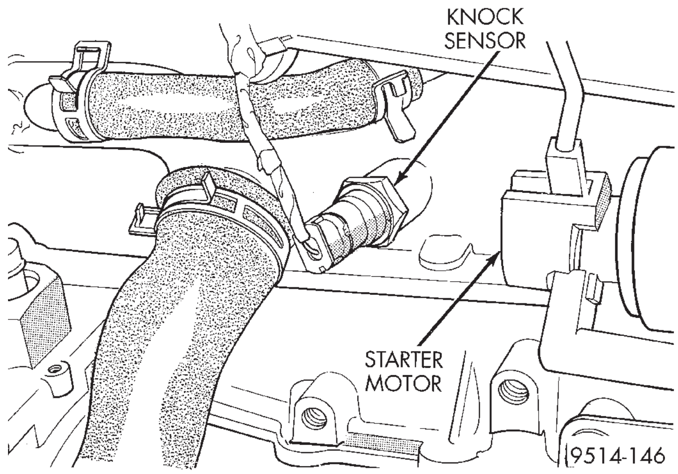


Fig. 17 Knock Sensor

Knock sensors contain a piezoelectric material which sends an input voltage (signal) to the PCM. As the intensity of the engine knock vibration increases, the knock sensor output voltage also increases.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

DESCRIPTION

The MAP sensor mounts to the intake manifold (Fig. 14), (Fig. 15), and (Fig. 16).

OPERATION

The PCM supplies 5 volts direct current to the MAP sensor. The MAP sensor converts intake manifold pressure into voltage. The PCM monitors the MAP sensor output voltage. As vacuum increases, MAP sensor voltage decreases proportionately. Also, as vacuum decreases, MAP sensor voltage increases proportionately.

At key on, before the engine is started, the PCM determines atmospheric air pressure from the MAP sensor voltage. While the engine operates, the PCM determines intake manifold pressure from the MAP sensor voltage. Based on MAP sensor voltage and inputs from other sensors, the PCM adjusts spark advance and the air/fuel mixture.

POWER STEERING PRESSURE SWITCH—PCM INPUT

DESCRIPTION

A pressure sensing switch is located on the power steering gear.

DESCRIPTION AND OPERATION (Continued)

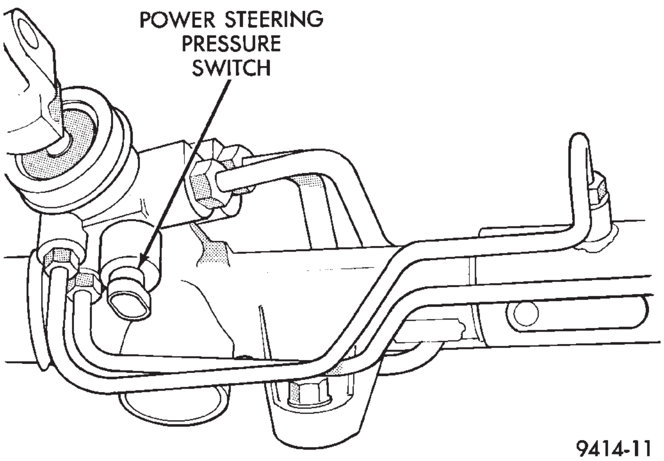


Fig. 18 Power Steering Pressure Switch

OPERATION

The switch (Fig. 18) provides an input to the PCM during periods of high pump load and low engine RPM; such as during parking maneuvers.

When power steering pump pressure exceeds 4137 kPa (600 psi), the switch is open. The PCM increases idle air flow through the IAC motor to prevent engine stalling. When pump pressure is low, the switch is closed.

SENSOR RETURN—PCM INPUT

OPERATION

The sensor return circuit provides a low electrical noise ground reference for all of the systems sensors. The sensor return circuit connects to internal ground circuits within the Powertrain Control Module (PCM).

SPEED CONTROL—PCM INPUT

OPERATION

The speed control system provides five separate voltages (inputs) to the Powertrain Control Module (PCM). The voltages correspond to the ON, OFF, SET, RESUME, CANCEL, and DECEL.

The speed control ON voltage informs the PCM that the speed control system has been activated. The speed control SET voltage informs the PCM that a fixed vehicle speed has been selected. The speed control RESUME voltage indicates the previous fixed speed is requested. The speed control CANCEL voltage tells the PCM to deactivate but retain set speed in memory (same as depressing the brake pedal). The speed control DECEL voltage informs the PCM to coast down to a new desired speed. The speed control OFF voltage tells the PCM that the speed control system has deactivated. Refer to the Speed Control section for more speed control information.

SCI RECEIVE—PCM INPUT

OPERATION

SCI Receive is the serial data communication receive circuit for the DRB scan tool. The Powertrain Control Module (PCM) receives data from the DRB through the SCI Receive circuit.

TRANSAXLE PARK/NEUTRAL SWITCH—PCM INPUT

DESCRIPTION

The park/neutral switch is located on the transaxle housing (Fig. 19).

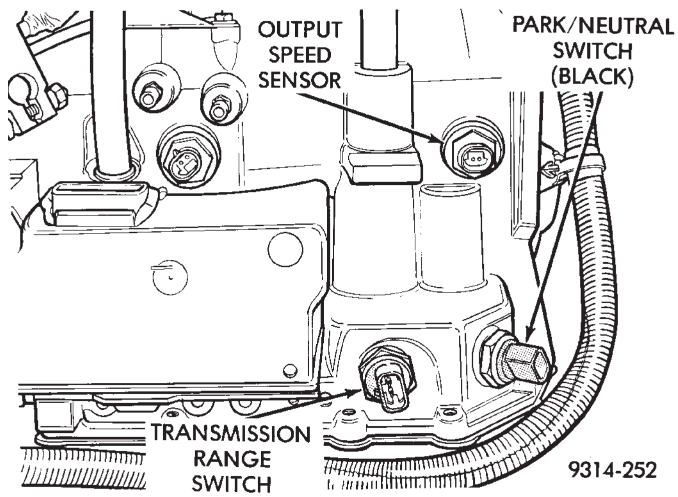


Fig. 19 Park Neutral Switch—4-Speed Electronic Automatic Transaxle—Typical

OPERATION

It provides an input to the PCM indicating whether the automatic transaxle is in Park or Neutral. This input is used to determine idle speed (varying with gear selection) and ignition timing advance. The park neutral switch is sometimes referred to as the neutral safety switch.

THROTTLE POSITION SENSOR—PCM INPUT

DESCRIPTION

The throttle position sensor mounts to the side of the throttle body (Fig. 20) or (Fig. 21).

OPERATION

The Throttle Position Sensor (TPS) connects to the throttle blade shaft. The TPS is a variable resistor that provides the PCM with an input signal (voltage). The signal represents throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.

DESCRIPTION AND OPERATION (Continued)

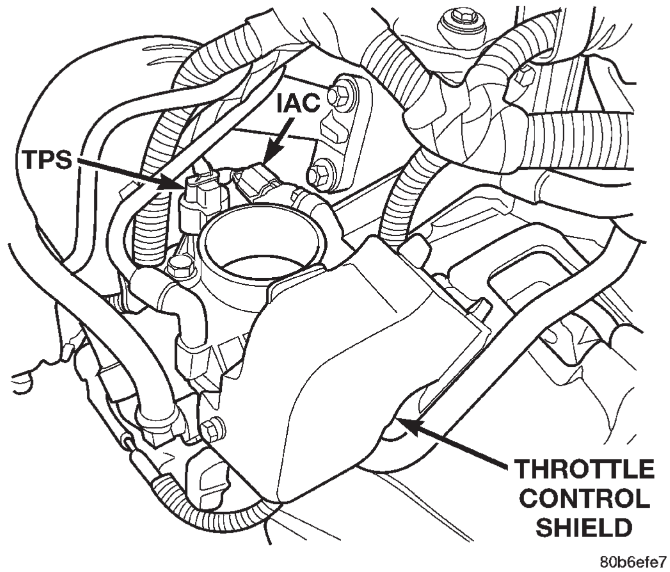


Fig. 20 Throttle Position Sensor—2.0/2.4L Engines

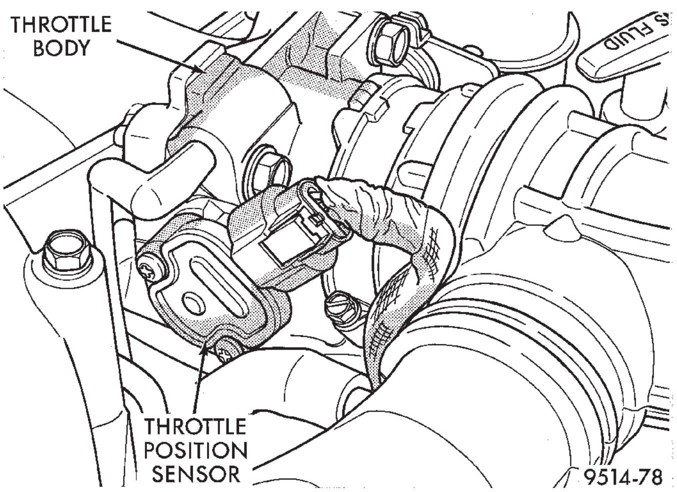


Fig. 21 Throttle Position Sensor—2.5L Engine

The PCM supplies approximately 5 volts DC to the TPS. The TPS output voltage (input signal to the PCM) represents throttle blade position. The TPS output voltage to the PCM varies from approximately 0.5 volt at minimum throttle opening (idle) to a maximum of 3.7 volts at wide open throttle.

Along with inputs from other sensors, the PCM uses TPS input to determine current engine operating conditions. The PCM also adjusts fuel injector pulse width and ignition timing based on these inputs.

VEHICLE SPEED SIGNAL—PCM INPUT

DESCRIPTION

The vehicle speed sensor is located in the transmission extension housing (Fig. 22).

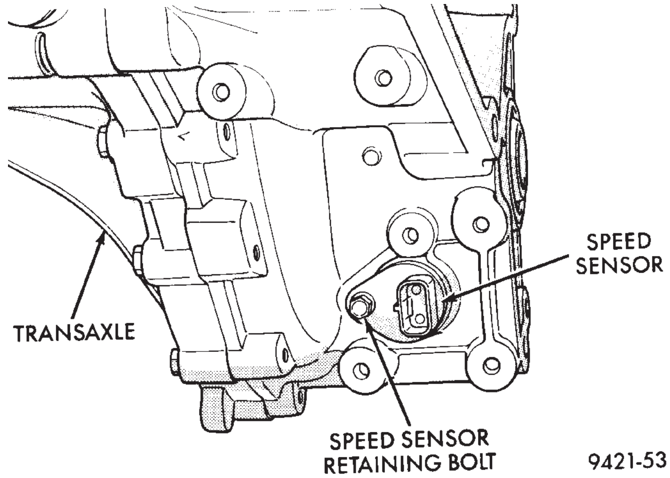


Fig. 22 Vehicle Speed Sensor—Manual Transmission

OPERATION

AUTOMATIC

The transaxle control module (TCM) supplies the vehicle speed signal to the PCM based on the output shaft speed. The PCM sends a 5 volt signal to the TCM. The TCM switches this signal to a ground, and then opens the circuit at a rate of 8000 pulses per mile. When the PCM counts 8000 pulses, the PCM assumes the vehicle has traveled one mile. The output speed sensor is located on the side of the transaxle (Fig. 19).

The speed and distance signals, along with a closed throttle signal from the TPS, determine if a closed throttle deceleration or normal idle condition (vehicle stopped) exists. Under deceleration conditions, the PCM adjusts the idle air control motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the idle air control motor to maintain a desired engine speed.

MANUAL

The sensor input is used by the PCM to determine vehicle speed and distance traveled.

The vehicle speed sensor generates 8 pulses per sensor revolution. These signals, in conjunction with a closed throttle signal from the throttle position sensor, indicate a closed throttle deceleration to the PCM. Under deceleration conditions, the PCM adjusts the Idle Air Control (IAC) motor to maintain a desired MAP value.

When the vehicle is stopped at idle, a closed throttle signal is received by the PCM (but a speed sensor signal is not received). Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

The vehicle speed sensor signal is also used to operate the following functions or systems:

DESCRIPTION AND OPERATION (Continued)

- Speedometer
- Speed control
- Daytime Running Lights (Canadian Vehicles only).

AIR CONDITIONING CLUTCH RELAY—PCM OUTPUT

DESCRIPTION

The air conditioning clutch relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

OPERATION

The PCM controls the air conditioning clutch relay ground circuit. The A/C clutch relay coil side contains a 10 amp fuse between the buss bar in the Power Distribution Center (PDC) and the relay. The power side of this relay is fused with a 40 amp fuse. When the PCM receives an air conditioning input, it grounds the A/C compressor clutch relay and the radiator fan relay.

When the PCM senses low idle speeds or wide open throttle through the throttle position sensor, it removes the ground for the A/C compressor clutch relay. When the relay de-energizes, the contacts open preventing air conditioning clutch engagement. Also, if the PCM senses a part throttle launch condition, it disables the A/C compressor clutch for several seconds.

AUTOMATIC SHUTDOWN RELAY—PCM OUTPUT

DESCRIPTION

The ASD relay and fuel pump relay are located in the Power Distribution Center (PDC) near the Air Cleaner (Fig. 23). The inside top of the PDC cover has a label showing relay and fuse location.

OPERATION

The PCM operates the Automatic Shut Down (ASD) relay and fuel pump relays. The PCM operates them by switching the ground path for the solenoid side of the relays on and off.

The ASD relay connects battery voltage to the fuel injectors and ignition coil. The fuel pump relay connects battery voltage to the fuel pump.

A buss bar in the Power Distribution Center (PDC) supplies voltage to the coil side and contact side of the relay. The ASD relay power circuit contains a 20 amp fuse between the buss bar in the PDC and the relay. The fuses are located in the PDC. Refer to the Wiring Diagrams for circuit information.

The PCM controls the relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position unless the 02 Heater Monitor test is being run. When the ignition switch is in the Run or Start position, the PCM monitors the crankshaft position sensor and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive the crankshaft position sensor and camshaft position sensor signals when the ignition switch is in the Run position, it will de-energize the ASD relay.

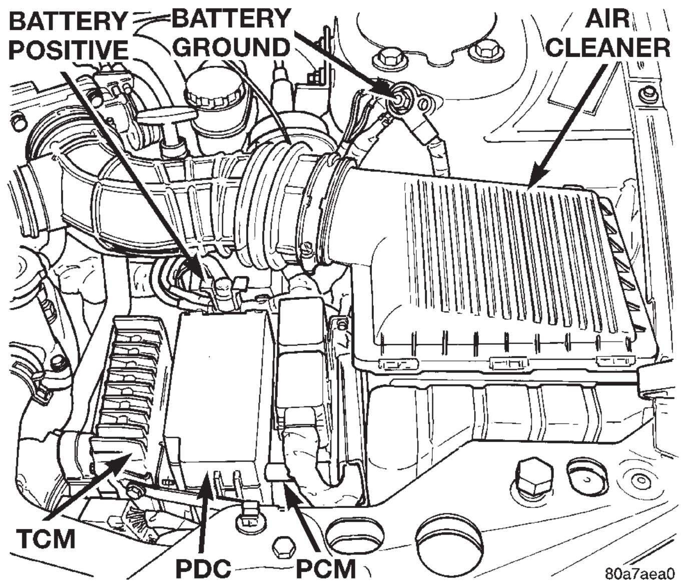


Fig. 23 Power Distribution Center (PDC)

PROPORTIONAL PURGE SOLENOID—PCM OUTPUT

DESCRIPTION

The solenoid attaches to a bracket near the front engine mount (Fig. 24). To operate correctly, the solenoid must be installed with the electrical connector on top.

OPERATION

The EVAP purge solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged.

The proportional purge solenoid operates at a frequency of 200 hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

DESCRIPTION AND OPERATION (Continued)

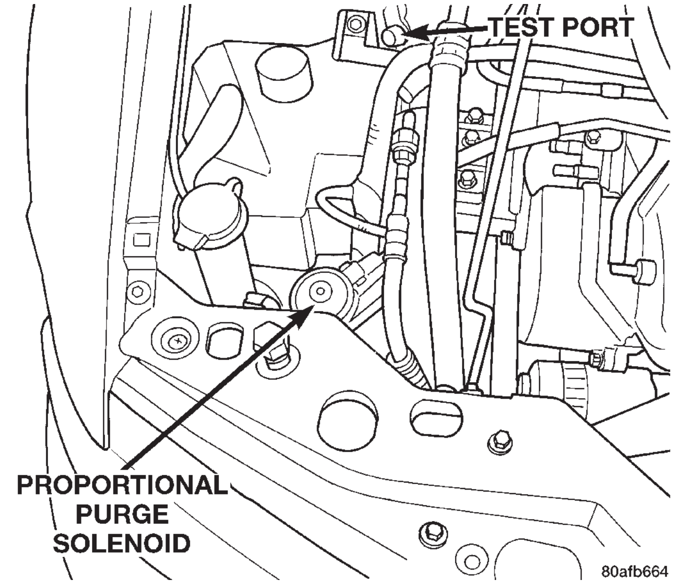


Fig. 24 Proportional Purge Solenoid

ELECTRIC EGR TRANSDUCER—PCM OUTPUT— 2.4/2.5L ENGINES

DESCRIPTION

The solenoid/transducer and EGR valve mount to the rear of the cylinder head (Fig. 25) or (Fig. 26).

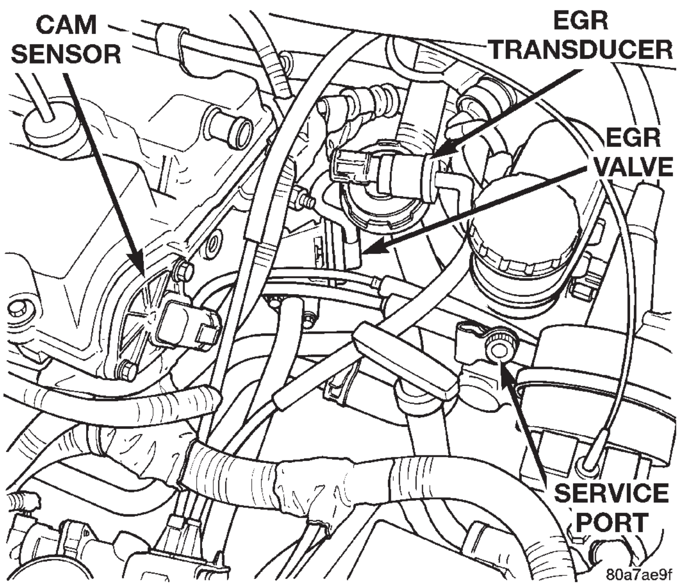


Fig. 25 Electric EGR Transducer—2.4L Engine

OPERATION

The Electric EGR Transducer contains an electrically operated solenoid and a back-pressure controlled vacuum transducer (Fig. 27). The PCM operates the solenoid based on inputs from the multiport fuel injection system. The solenoid/transducer and EGR valve are serviced as an assembly.

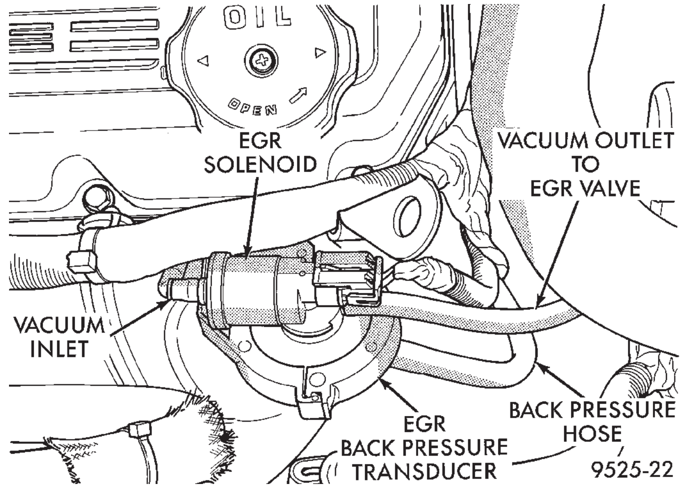


Fig. 26 EGR Control Valve—2.5L Engine

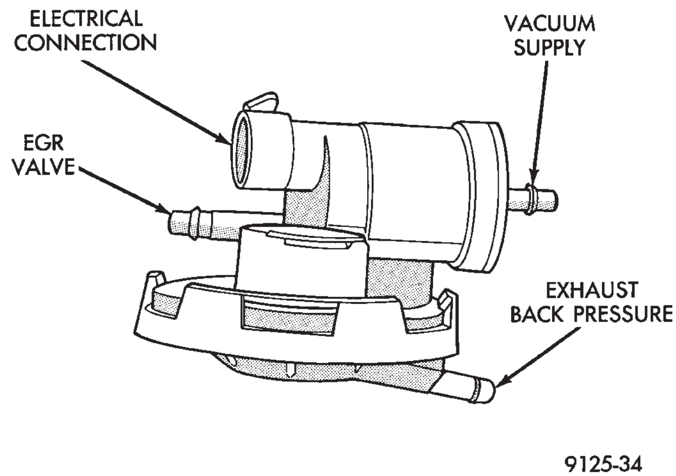


Fig. 27 Electronic EGR Transducer

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the vacuum transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of the vacuum signal applied to the EGR valve. Varying the strength of the vacuum signal changes the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

GENERATOR FIELD—PCM OUTPUT

OPERATION

The PCM regulates the charging system voltage within a range of 12.9 to 15.0 volts. Refer to the Battery section for information and refer to the Charging section for information.

DESCRIPTION AND OPERATION (Continued)

IDLE AIR CONTROL MOTOR—PCM OUTPUT

DESCRIPTION

The Idle Air Control (IAC) motor is mounted on the throttle body. The PCM operates the idle air control motor (Fig. 28) or (Fig. 29).

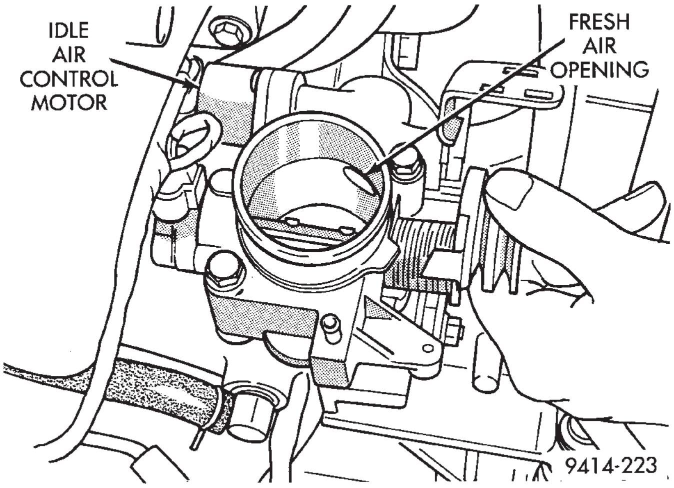


Fig. 28 Idle Air Control Motor Air Bypass Passage—2.0/2.4L

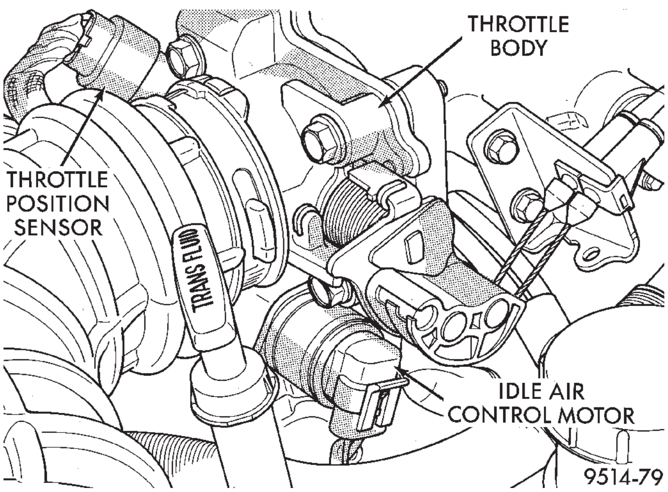


Fig. 29 Idle Air Control Motor Air Bypass Passage—2.5L

OPERATION

The PCM adjusts engine idle speed through the idle air control motor to compensate for engine load, coolant temperature or barometric pressure changes.

The throttle body has an air bypass passage that provides air for the engine during closed throttle idle. The idle air control motor pintle protrudes into the air bypass passage and regulates air flow through it.

The PCM adjusts engine idle speed by moving the IAC motor pintle in and out of the bypass passage. The adjustments are based on inputs the PCM receives. The inputs are from the throttle position sensor, crankshaft position sensor, coolant temperature sensor, MAP sensor, vehicle speed sensor and various switch operations (brake, park/neutral, air conditioning).

DATA LINK CONNECTOR

DESCRIPTION

The data link connector is located inside the vehicle, under the instrument panel, at the driver's kick panel (Fig. 30).

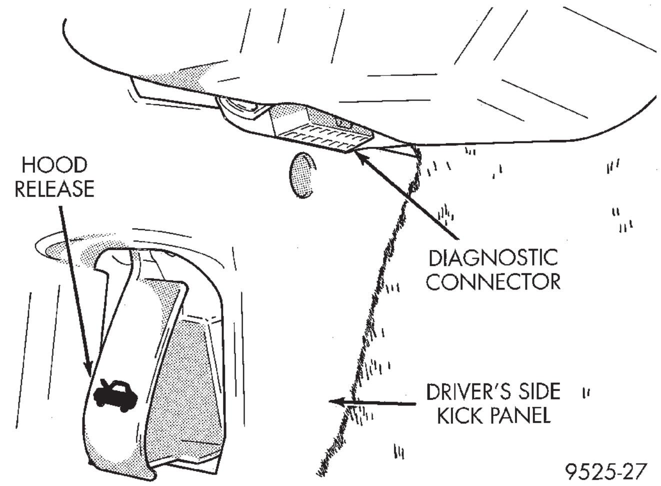


Fig. 30 Data Link (Diagnostic) Connector

OPERATION

The data link connector (diagnostic connector) links the DRB scan tool with the Powertrain Control Module (PCM). Refer to On-Board Diagnostics in the Emission Control section.

FUEL INJECTORS—PCM OUTPUT

DESCRIPTION

All engines use electrically operated top feed fuel injectors (Fig. 31).

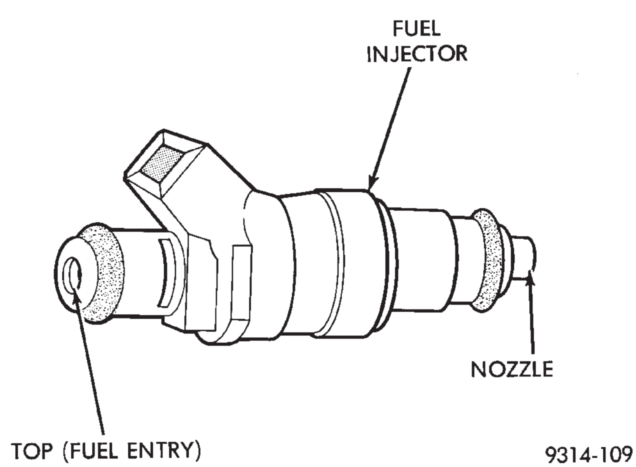


Fig. 31 Fuel Injector

DESCRIPTION AND OPERATION (Continued)

OPERATION

The Automatic Shutdown (ASD) relay supplies battery voltage to the fuel injectors. The PCM controls the ground path for each injector in sequence. By switching the ground paths on and off, the PCM fine-tunes injector pulse width. Injector pulse width refers to the amount of time an injector operates.

The PCM determines injector synchronization from the camshaft position sensor and crankshaft position sensor inputs. The PCM grounds the ASD and fuel pump relays when the ignition switch is initially rotated to the run position . The PCM will de-energize the ASD and fuel relays if it does not receive the camshaft position sensor and crankshaft position sensor inputs.

The PCM energizes the injectors in a sequential order during all engine operating conditions except start-up. For the first injector pulse width during start-up, all injectors are energized at the same time. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.

IGNITION COIL—PCM OUTPUT

DESCRIPTION

The coil assembly consists of independent coils molded together (Fig. 32) or (Fig. 33) or (Fig. 34).

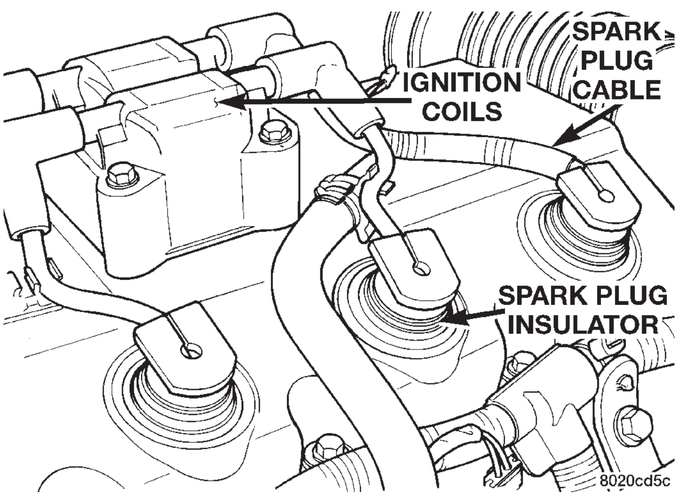


Fig. 32 Ignition Coil—2.0L

OPERATION

The coil assembly is mounted on the intake manifold. High tension leads route to each cylinder from the coil. The coil fires two spark plugs every power stroke. One plug is the cylinder under compression, the other cylinder fires on the exhaust stroke. The PCM determines which of the coils to charge and fire at the correct time.

The Automatic Shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil. When the PCM breaks the contact, the energy in the coil primary transfers to the secondary causing the spark. The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs. Refer to Automatic Shutdown (ASD) Relay—PCM Output in this section for relay operation.

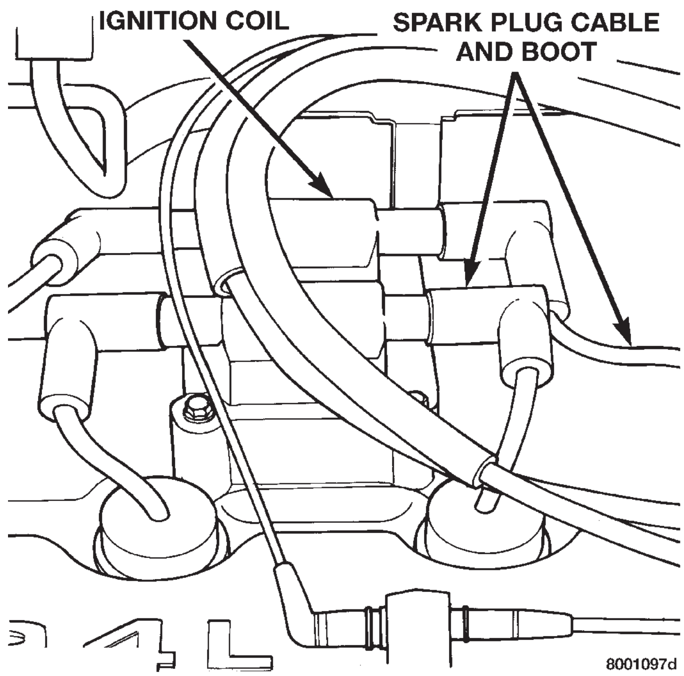


Fig. 33 Ignition Coil—2.4L

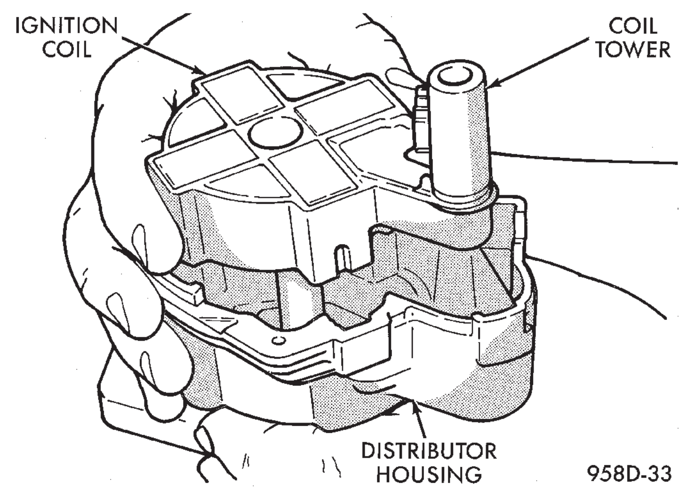


Fig. 34 Ignition Coil—2.5L

MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT

OPERATION

The PCM supplies the malfunction indicator (check engine) lamp on/off signal to the instrument panel through the CCD Bus. The CCD Bus is a communi-

DESCRIPTION AND OPERATION (Continued)

cations port. Various modules use the CCD Bus to exchange information.

The Check Engine lamp comes on each time the ignition key is turned ON and stays on for 3 seconds as a bulb test.

The Malfunction Indicator Lamp (MIL) stays on continuously, when the PCM has entered a Limp-In mode or identified a failed emission component. During Limp-in Mode, the PCM attempts to keep the system operational. The MIL signals the need for immediate service. In limp-in mode, the PCM compensates for the failure of certain components that send incorrect signals. The PCM substitutes for the incorrect signals with inputs from other sensors.

If the PCM detects active engine misfire severe enough to cause catalyst damage, it flashes the MIL. At the same time the PCM also sets a Diagnostic Trouble Code (DTC).

For signals that can trigger the MIL (Check Engine Lamp) refer to the On-Board Diagnostics Chart.

RADIATOR FAN RELAYS—PCM OUTPUT

DESCRIPTION

The radiator fan relays are located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

OPERATION

The PCM energizes the radiator fans through either the low or high speed radiator fan relay. The PCM controls the ground circuit for the coil side of the relay. Power for both relay coils is supplied through a 10 amp fuse in the PDC. Power for both relay contacts is supplied power through a 40 amp fuse in the PDC. Refer to the Wiring Diagrams for circuit information.

The PCM monitors the A/C compressor discharge (high side) pressure through the air conditioning pressure transducer. Depending on engine coolant temperature and A/C system high side pressure, both fans operate at either low or high speed.

SPEED CONTROL SERVOS—PCM OUTPUT

OPERATION

The PCM controls operation of the vacuum and vent solenoids inside the speed control servo. When the operator presses the on switch, the PCM provides power through the brake switch to the servo. When the speed control system is engaged following a set or resume, the PCM supplies a ground to the vacuum and or vent solenoids inside the servo as needed to maintain the selected vehicle speed. Refer to the Speed Control section for more information.

TACHOMETER—PCM OUTPUT

OPERATION

The tachometer receives its information across the CCD Bus from the Body Control Module (BCM). Information on engine RPM is transmitted from the Powertrain Control Module (PCM) across the CCD Bus to the BCM. The BCM calculates the position of the tachometer pointer based on the input from the PCM and adjusts the position of the gauge pointer to the necessary position. This signal is sent over the CCD Bus to the instrument cluster.

5 VOLT SUPPLY—PCM OUTPUT

OPERATION

The PCM supplies 5 volts to the following sensors:

- A/C pressure transducer
- Engine coolant temperature sensor
- Manifold absolute pressure sensor
- Throttle position sensor
- Linear EGR solenoid

8-VOLT SUPPLY—PCM OUTPUT

OPERATION

The PCM supplies 8 volts to the crankshaft position sensor, camshaft position sensor.

THROTTLE BODY

DESCRIPTION

The throttle body mounts to the intake manifold. The throttle position sensor and idle air control motor attach to the throttle body (Fig. 35), (Fig. 36), or (Fig. 37).

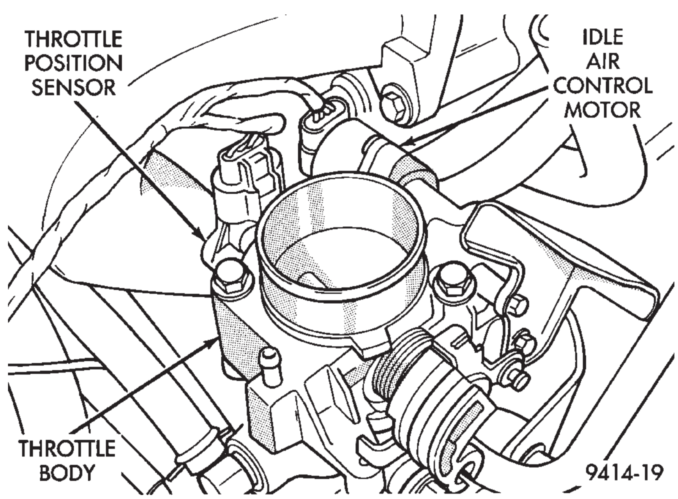


Fig. 35 Throttle Body—2.0L Engines

DESCRIPTION AND OPERATION (Continued)

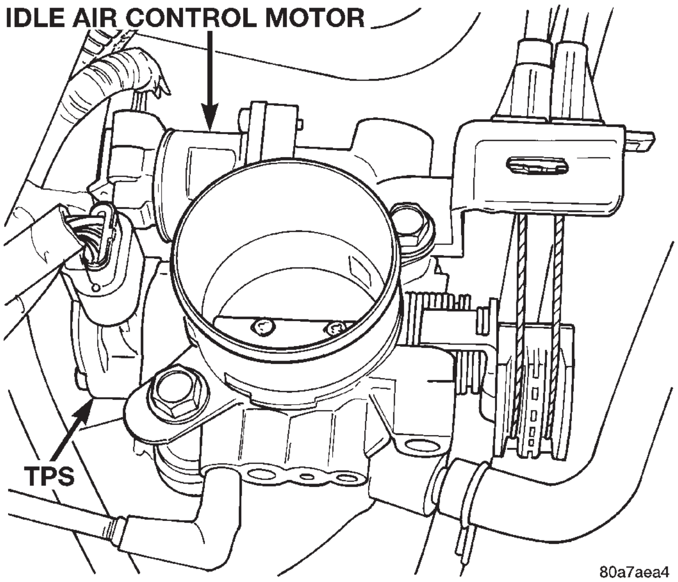


Fig. 36 Throttle Body—2.4L Engine

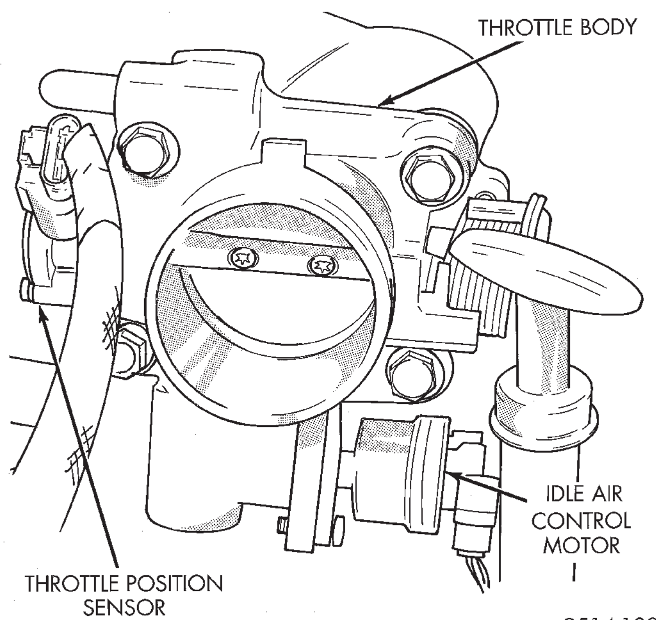


Fig. 37 Throttle Body—2.5L Engine

OPERATION

At above idle conditions, air flow through the throttle body is controlled by a cable operated throttle blade. During closed throttle idle conditions, the idle air control motor control air flow. Refer to Idle Air Control Motor in this section.

DIAGNOSIS AND TESTING

VISUAL INSPECTION

Before diagnosing or servicing the fuel injection system, perform a visual inspection for loose, disconnected, or misrouted wires and hoses. A thorough visual inspection that includes the following checks saves unnecessary test and diagnostic time.

(1) Inspect remote battery cable connections. Be sure they are clean and tight. Clean corroded terminals (Fig. 38).

(2) Verify that the PCM's 2 40-way connectors are fully inserted into their sockets on the PCM (Fig. 38).

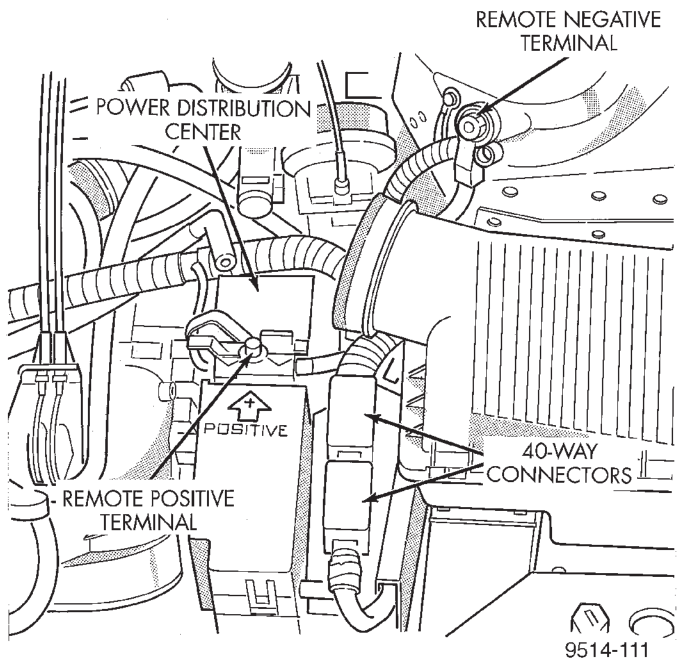


Fig. 38 Remote Battery Terminals and PCM Connectors

(3) Open the Power Distribution Center (PDC). Check for blown fuses. Ensure the relays and fuses are fully seated in the PDC (Fig. 38). A label on the underside of the PDC cover shows the locations of each relay and fuse.

(4) Inspect accelerator cable, and cruise control cable (if equipped) connections. Check their connections to the throttle arm of the throttle body for any binding or restrictions.

(5) Check the electrical connections at the idle air control motor and throttle position sensor (Fig. 35), (Fig. 36), or (Fig. 37).

DIAGNOSIS AND TESTING (Continued)

(6) Check hose connections between the PCV valve, vacuum port-intake manifold (Fig. 39), (Fig. 40) or (Fig. 41).

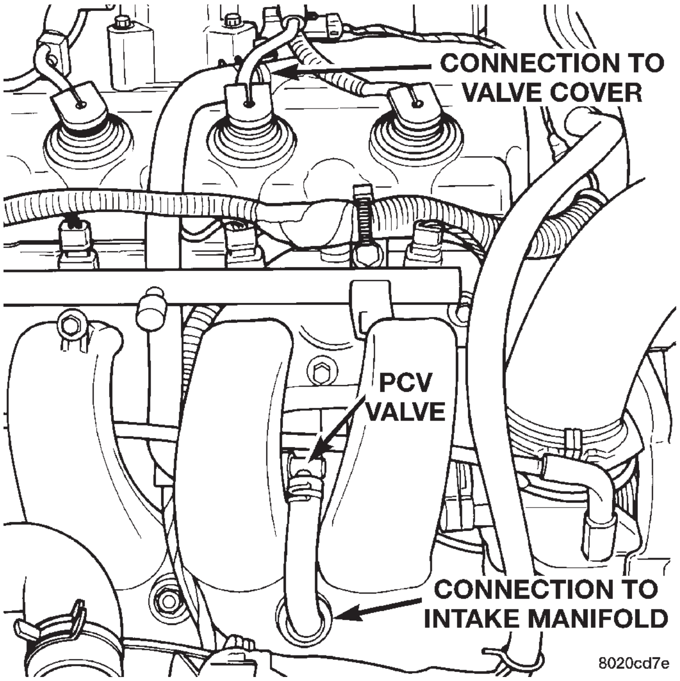


Fig. 39 PCV Valve—2.0L Engine

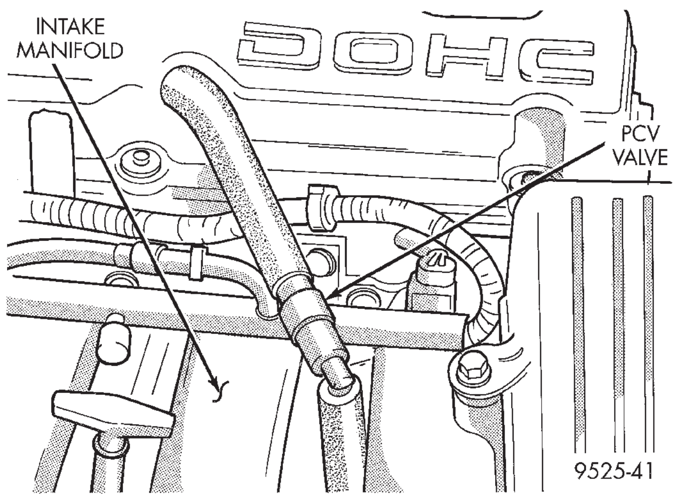


Fig. 40 PCV Valve—2.4L Engine

(7) Inspect the electrical connections at the intake air temperature sensor and the MAP sensor (Fig. 42), (Fig. 43) or (Fig. 44).

(8) Inspect the fuel injector electrical connections (Fig. 45). Use the DRB Scan Tool to verify connection on a 2.5L engine.

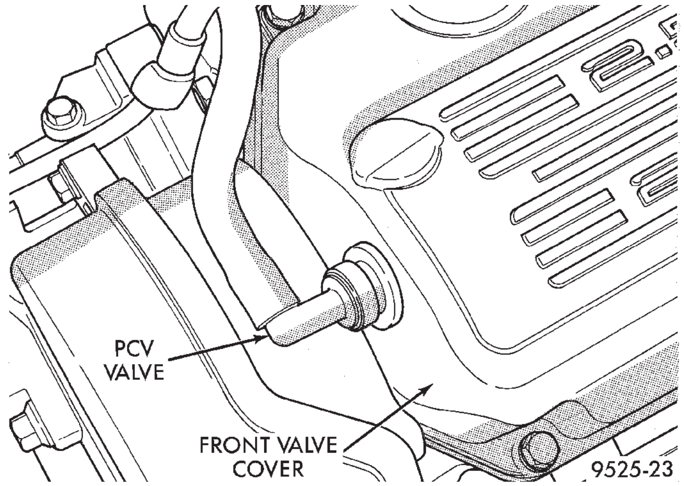


Fig. 41 PCV Valve—2.5L Engine

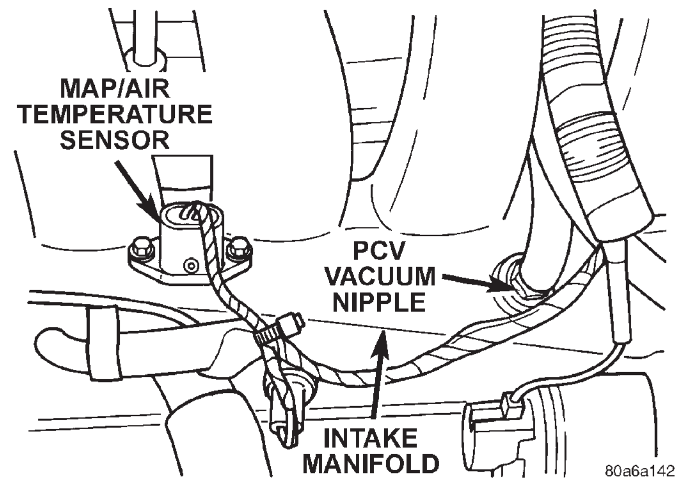


Fig. 42 MAP/ Air Temperature Sensor—2.0L Engine

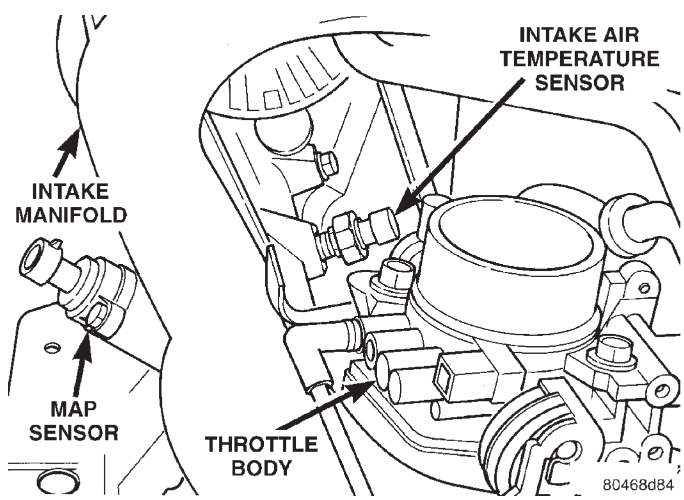


Fig. 43 MAP Sensor and Intake Air Temperature Sensor—2.4L Engine

DIAGNOSIS AND TESTING (Continued)

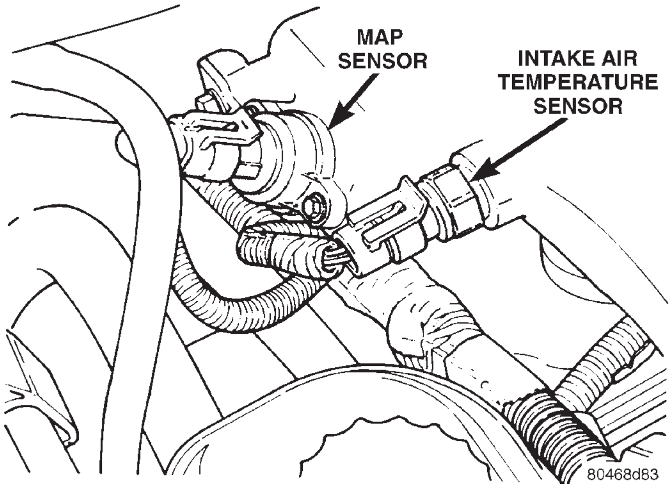


Fig. 44 MAP Sensor and Intake Air Temperature Sensor—2.5L Engine

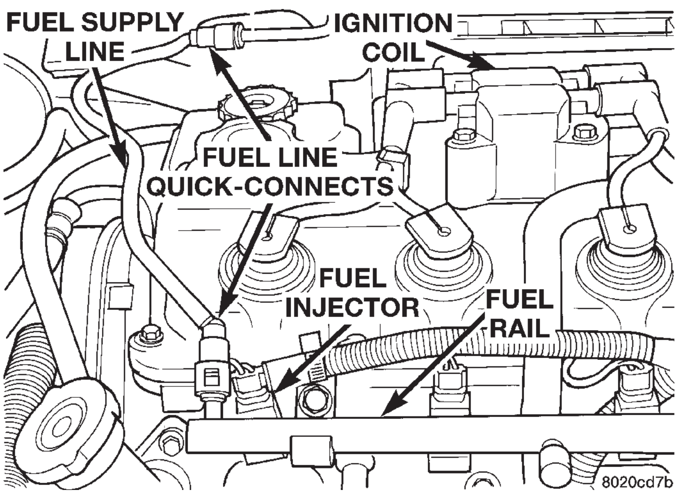


Fig. 45 Fuel Injectors—2.0/2.4L Engines

2.0/2.4L

(a) Inspect the ignition coil electrical connector. Ensure the spark plug insulators are firmly seated over the spark plugs (Fig. 46).

2.5L

(a) Inspect distributor connectors (Fig. 47) and spark plug cables at distributor.

(11) Inspect the electrical and hose connections at the proportional purge solenoid (Fig. 48).

(12) Check electrical connection to the radiator fan.

(13) Inspect system body grounds for loose or dirty connections. Refer to the Wiring Diagrams for ground locations.

(14) Inspect air cleaner filter element. Replace as necessary. Check air induction system for restrictions.

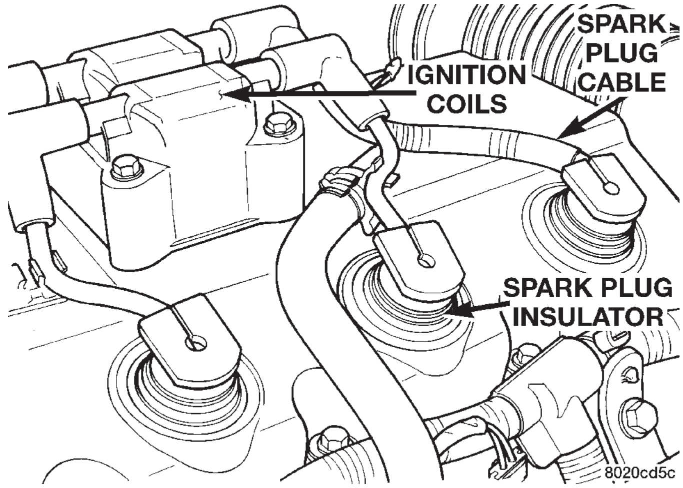


Fig. 46 Ignition Coil and Spark Plugs

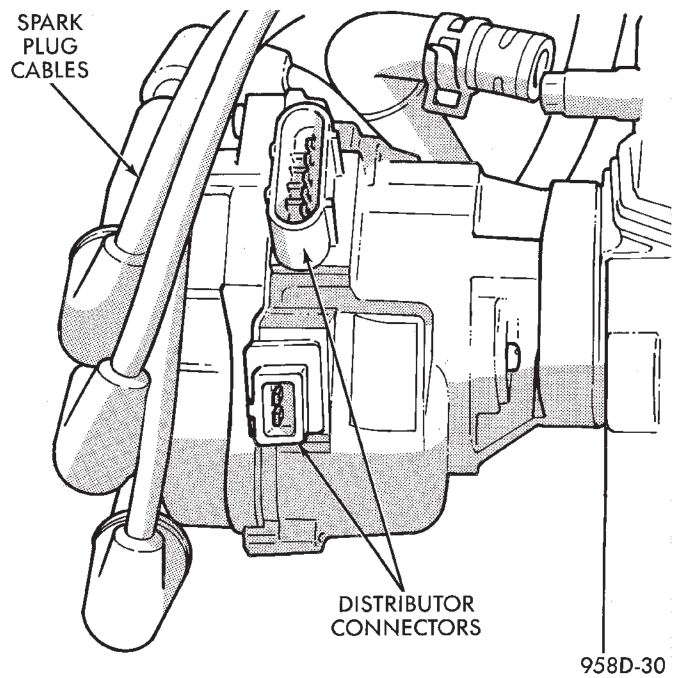


Fig. 47 Distributor Electrical Connectors-Viewed From Rear of Distributor

(15) Check electrical connection at the knock sensor (Fig. 49), 2.0/2.4L engines only.

(16) Check electrical connections at the camshaft position sensor (Fig. 50) or (Fig. 51).

(17) Check electrical connections at the engine coolant temperature sensor (Fig. 50), (Fig. 52) or (Fig. 53).

DIAGNOSIS AND TESTING (Continued)

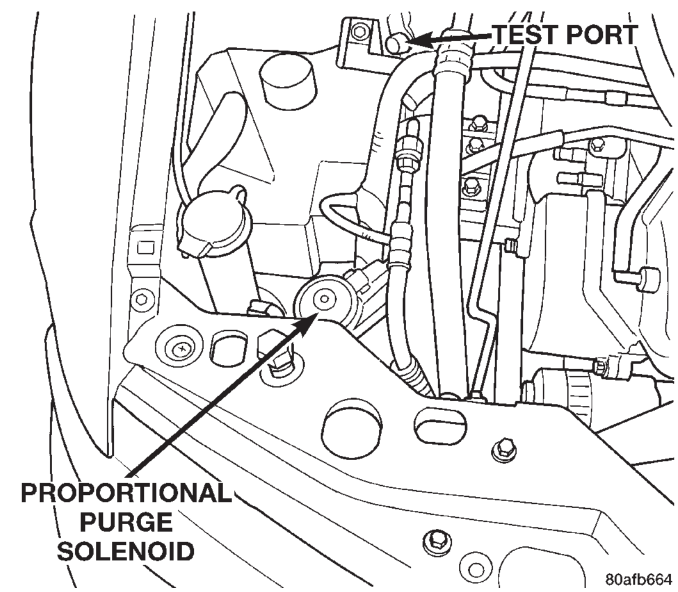


Fig. 48 Proportional Purge Solenoid

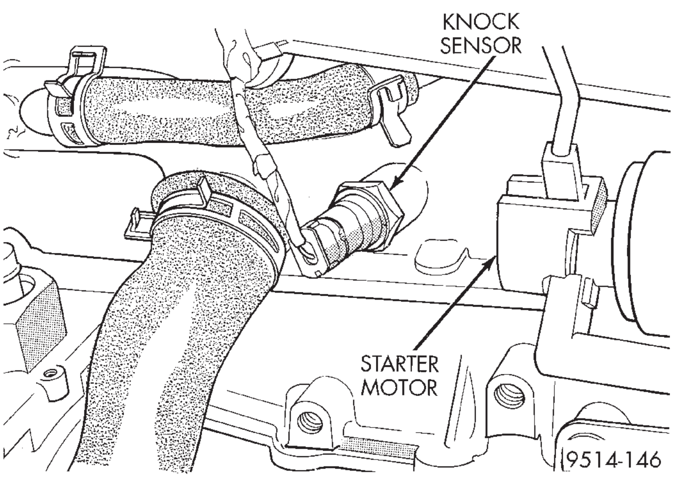


Fig. 49 Knock Sensor—2.0/2.4L

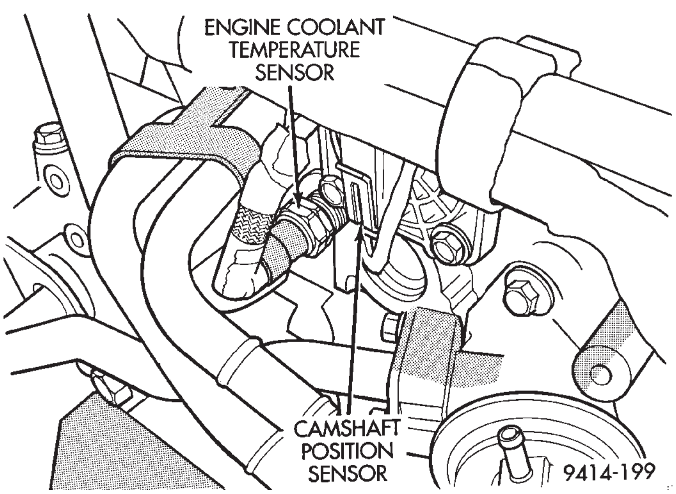


Fig. 50 Camshaft Position Sensor and Engine Coolant Temperature Sensor—2.0L Engine

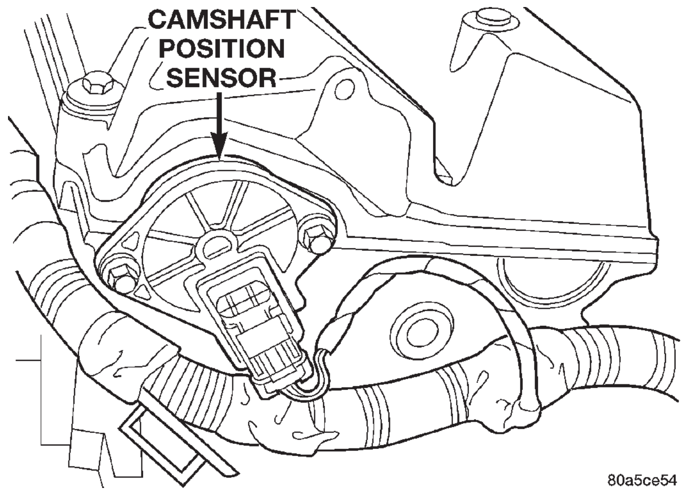


Fig. 51 Camshaft Position Sensor—2.4L Engine

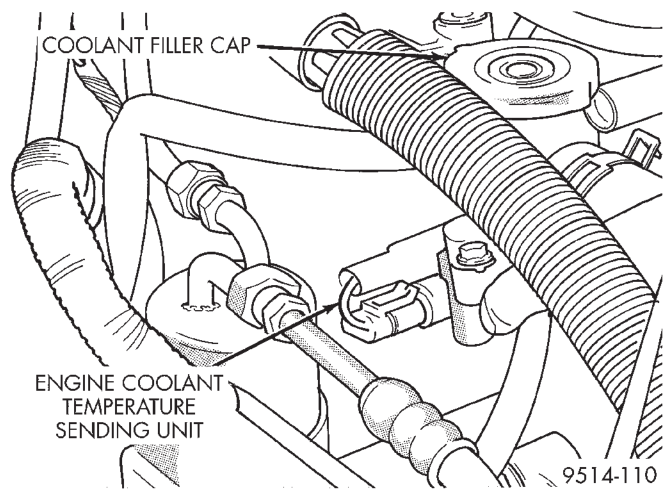


Fig. 52 Engine Coolant Temperature Sensor—2.4L Engine

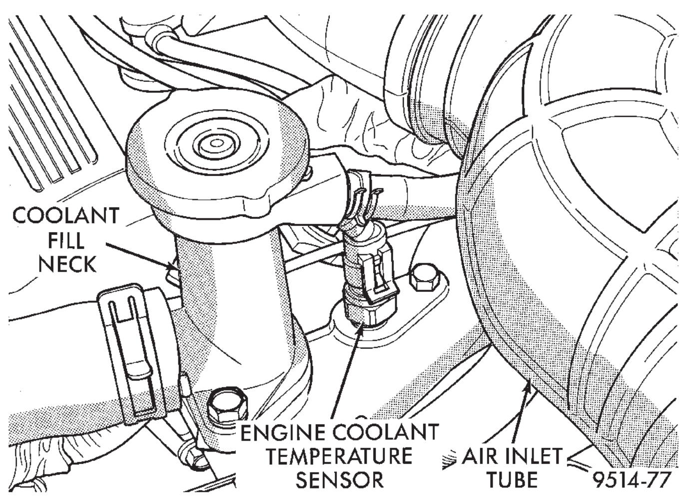


Fig. 53 Engine Coolant Temperature Sensor—2.5L Engine

DIAGNOSIS AND TESTING (Continued)

(18) Check electrical connector at Electronic EGR Transducer. Inspect vacuum and back pressure hoses at the solenoid and transducer for leaks (Fig. 54) or (Fig. 55).

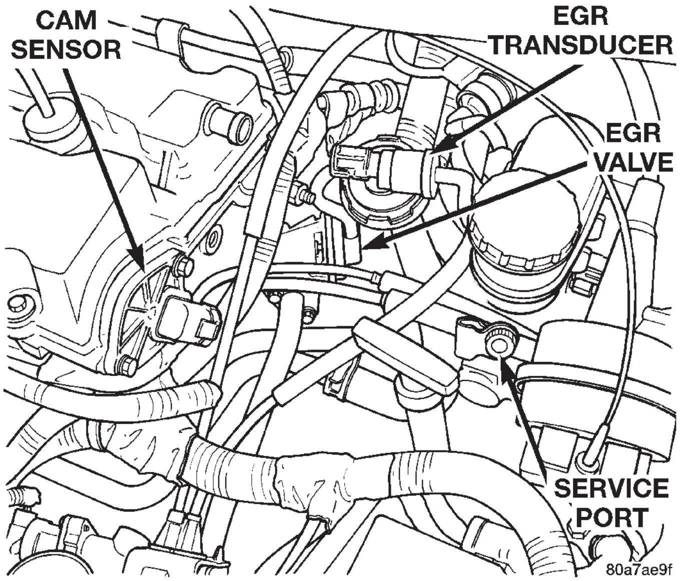


Fig. 54 Electronic EGR Transducer—2.4L Engine

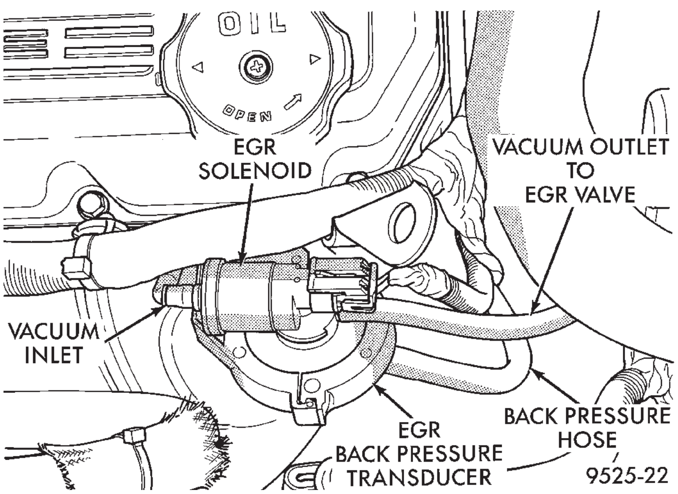


Fig. 55 Electronic EGR Transducer—2.5L Engine

(19) Inspect electrical connections at the generator. Check the generator belt for glazing or damage.

(20) Inspect electrical connector at the crankshaft position sensor (Fig. 56) or (Fig. 57).

(21) Check electrical connection at the vehicle speed sensor (Fig. 58) or (Fig. 59).

(22) Check electrical connection at the power steering pressure switch on the power steering gear housing (Fig. 60).

(23) On vehicles with automatic transaxles, check the electrical connections at the Transmission Range Sensor (TRS).

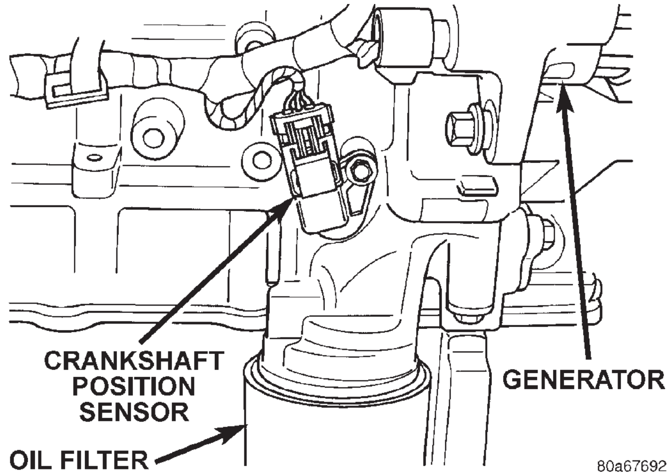


Fig. 56 Crankshaft Position Sensor—2.0/2.4L Engines-Typical

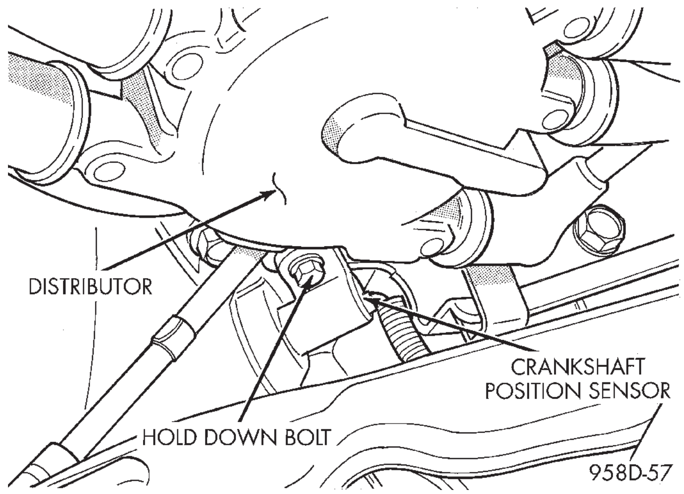


Fig. 57 Crankshaft Position Sensor—2.5L Engine

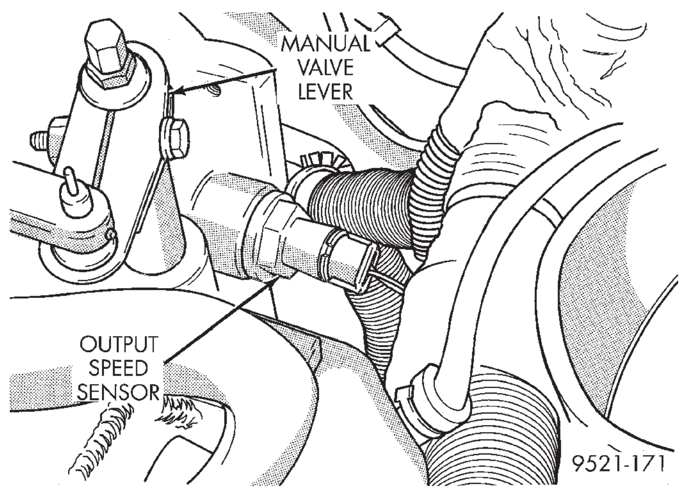


Fig. 58 Output Speed Sensor—Automatic Transmission

DIAGNOSIS AND TESTING (Continued)

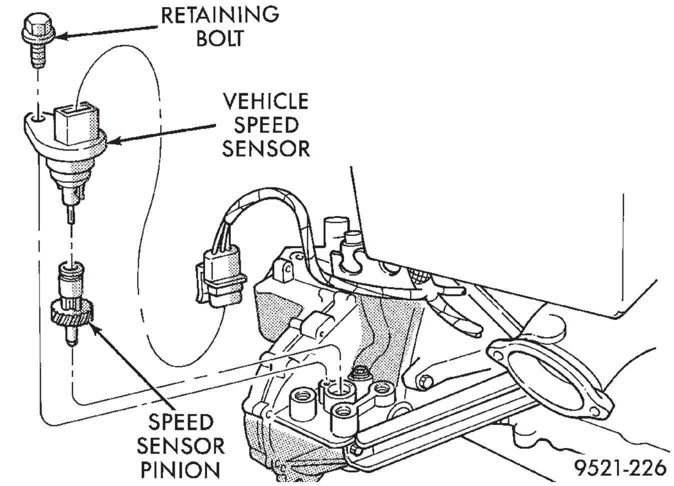


Fig. 59 Vehicle Speed Sensor—Manual Transmission

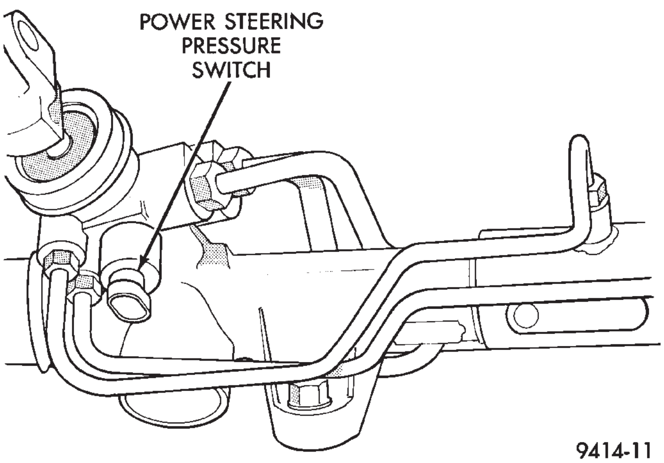


Fig. 60 Power Steering Pressure Switch

(24) Inspect the electrical connections at the upstream and downstream heated oxygen sensors (Fig. 61), or (Fig. 62), and (Fig. 63).

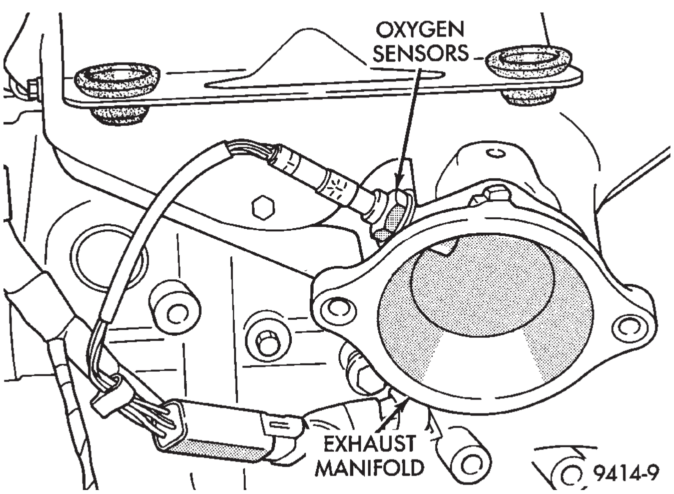


Fig. 61 Upstream Heated Oxygen Sensor—2.0/2.4L Engines

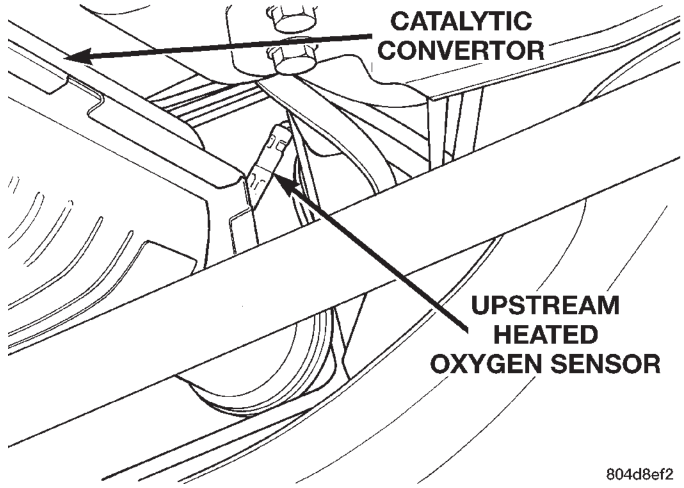


Fig. 62 Upstream Heated Oxygen Sensor—2.5L Engine

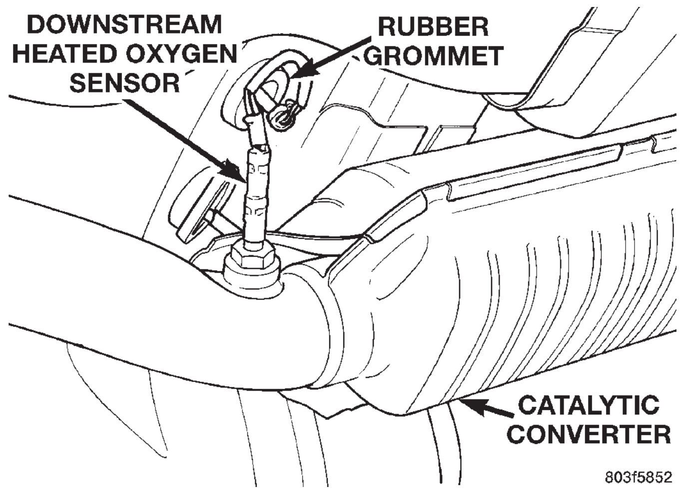


Fig. 63 Rear Heated Oxygen Sensor

(25) Inspect the fuel pump module electrical connection in the trunk for corrosion or damage (Fig. 64).

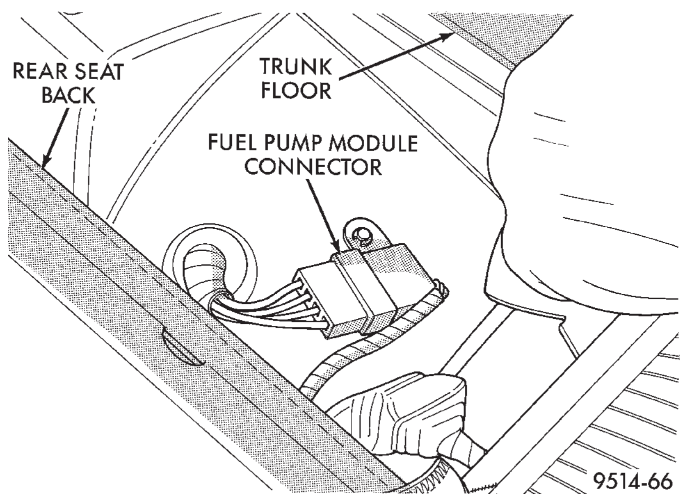


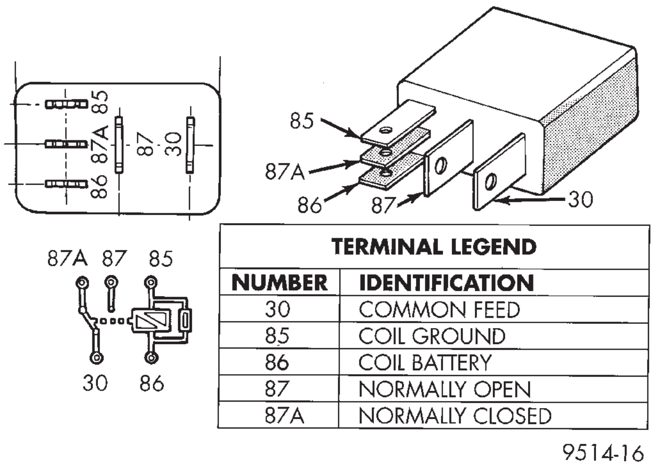
Fig. 64 Fuel Pump Module Electrical Connector

DIAGNOSIS AND TESTING (Continued)

(26) Inspect the connections to the speed control servo, if equipped. Refer to the Vehicle Speed Control section.

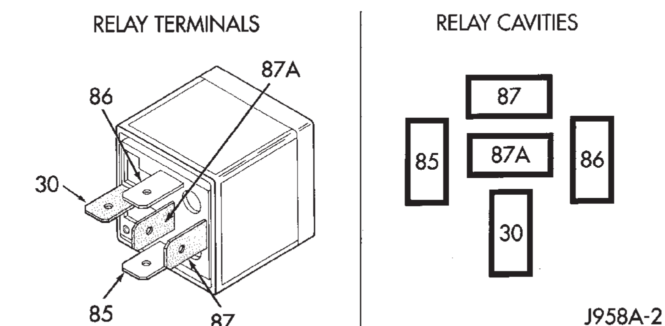
ASD AND FUEL PUMP RELAYS

The following description of operation and tests apply only to the Automatic Shutdown (ASD) and fuel pump relays . The terminals on the bottom of each relay are numbered (Fig. 65) or (Fig. 66).



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 65 ASD and Fuel Pump Relay Terminals



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 66 ASD and Fuel Pump Relay Terminals

OPERATION

• Terminal number 30 is connected to battery voltage. For both the ASD and fuel pump relays, terminal 30 is connected to battery voltage at all times.

• The PCM grounds the coil side of the relay through terminal number 85.

• Terminal number 86 supplies voltage to the coil side of the relay.

• When the PCM de-energizes the ASD and fuel pump relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay.

• When the PCM energizes the ASD and fuel pump relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

TESTING

The following procedure applies to the ASD and fuel pump relays.

(1) Remove relay from connector before testing.

(2) With the relay removed from the vehicle, use an ohmmeter to check the resistance between terminals 85 and 86. The resistance should be between 75 ±5 ohms.

(3) Connect the ohmmeter between terminals 30 and 87A. The ohmmeter should show continuity between terminals 30 and 87A.

(4) Connect the ohmmeter between terminals 87 and 30. The ohmmeter should not show continuity at this time.

(5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 85. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or smaller) to the power side of the 12 volt power source. **Do not attach the other end of the jumper wire to the relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST.

(7) Attach the other end of the jumper wire to relay terminal 86. This activates the relay. The ohmmeter should now show continuity between relay terminals 87 and 30. The ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

(9) Replace the relay if it did not pass the continuity and resistance tests. If the relay passed the tests, it operates properly. Check the remainder of the ASD and fuel pump relay circuits. Refer to the Wiring Diagrams.

ENGINE COOLANT TEMPERATURE SENSOR

To perform a complete test of this sensor and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

(1) With the key off, disconnect wire harness connector from coolant temperature sensor.

(2) Connect one lead of a high input impedance (digital) volt- ohmmeter to one terminal of sensor.

(3) Connect the other ohmmeter lead to remaining terminal of sensor. The ohmmeter should read as follows:

DIAGNOSIS AND TESTING (Continued)

- Engine/Sensor at normal operating temperature around 200°F should read approximately 700 to 1,000 ohms.
- Engine/Sensor at room temperature around 70°F ohmmeter should read approximately 7,000 to 13,000 ohms.

(4) Test the resistance of the wire harness between the PCM connector terminal 26 and the sensor harness connector. Also check for continuity between connector terminal 43 and the sensor harness connector. Refer to the Wiring diagrams for circuit information. If the resistance is greater than 1 ohm, repair the wire harness as necessary.

HEATED OXYGEN SENSOR

Use an ohmmeter to test the heating element of the oxygen sensors. Disconnect the electrical connector from each oxygen sensor. The white wires in the sensor connector are the power and ground circuits for the heater. Connect the ohmmeter test leads to terminals of the white wires in the heated oxygen sensor connector. Replace the heated oxygen sensor if the resistance is not between 4 and 7 ohms.

IDLE AIR CONTROL (IAC) MOTOR TEST

To preform a complete test of IAC motor and its circuitry, refer to DRB scan tool and the appropriate Powertrain Diagnostics Procedures manual.

KNOCK SENSOR

The engine knock sensor is affected by a number of factors. A few of these are: ignition timing, cylinder pressure, fuel octane, etc. The knock sensor generates an AC voltage whose amplitude increases with the increase of engine knock. The knock sensor can be tested with a digital voltmeter. The RMS voltage starts at about 20mVac (at about 700 rpm) and increases to approximately 600 mVac (5000 rpm). If the output falls outside of this range a DTC will be set.

MANIFOLD ABSOLUTE PRESSURE SENSOR

To perform a complete test of the MAP sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the MAP sensor only, refer to the following:

(1) Test the MAP sensor output voltage at the MAP sensor connector between terminals 1or A and 3 or D (Fig. 67) or (Fig. 68). With the ignition switch ON and the engine not running, output voltage should be 4 to 5 volts. The voltage should drop to 1.5 to 2.1 volts with a hot, neutral idle speed condition. If OK, go to next step. If not OK, go to step 3.

(2) Test PCM terminal 36 for the same voltage described in the previous step to verify wire harness condition. Repair as required.

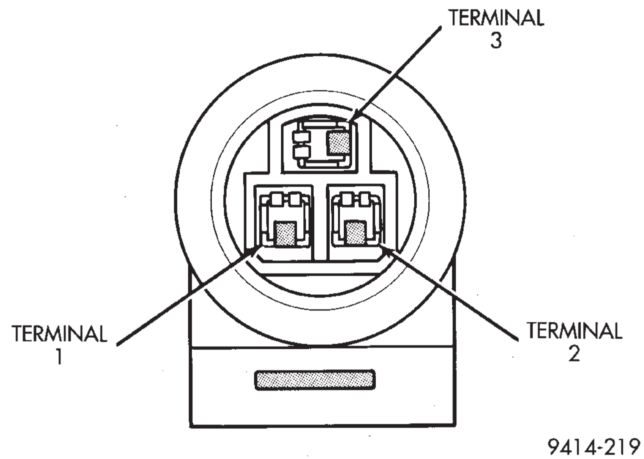
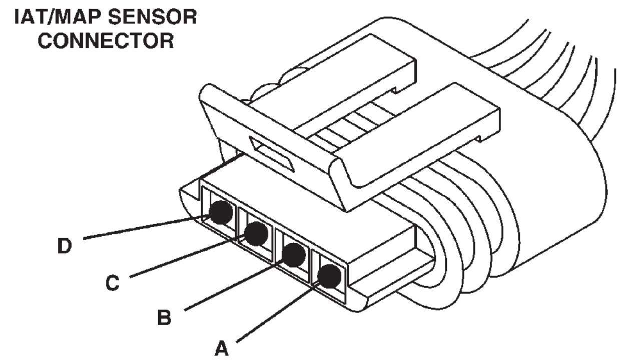


Fig. 67 MAP Sensor Connector 2.4/2.5L



CAV	COLOR	FUNCTION
A	BK/LB	SENSOR GROUND
B	BK/RD	INTAKE AIR TEMP SENSOR SIGNAL
C	VT/WT	5V SUPPLY
D	DG/RD	MAP SENSOR SIGNAL

80531038

Fig. 68 MAP Sensor Connector 2.0L

(3) Test the MAP sensor ground circuit at sensor connector terminal 1 or A and PCM terminal 43. If OK, go to next step. If not OK, repair as required.

(4) Test MAP sensor supply voltage between sensor connector terminals 2 or C and 1 or A with the key ON. The voltage should be approximately 5 volts (±.5V). Five volts (±.5V) should also be at terminal 61 of the PCM. If OK, replace MAP sensor. If not OK, repair or replace the wire harness as required.

THROTTLE POSITION SENSOR

To perform a complete test of the this sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the throttle position sensor only, refer to the following:

The Throttle Position Sensor (TPS) can be tested with a digital voltmeter. The center terminal of the sensor is the output terminal.

DIAGNOSIS AND TESTING (Continued)

With the ignition switch in the ON position, check the output voltage at the center terminal wire of the connector. Check the output voltage at idle and at wide-open-throttle (WOT). At idle, TPS output voltage should be greater than 0.6 volts. At wide open throttle, TPS output voltage should be less than 4.5 volts. The output voltage should gradually increase as the throttle plate moves slowly from idle to WOT.

Check for spread terminals at the sensor and PCM connections before replacing the TPS.

THROTTLE BODY MINIMUM AIR FLOW

(1) Turn ignition key to Off.

(2) Disconnect the PCV valve hose from the intake manifold nipple. Cap the PCV vacuum nipple.

(3) Disconnect purge hose from the nipple on the throttle body (Fig. 69) or (Fig. 70).

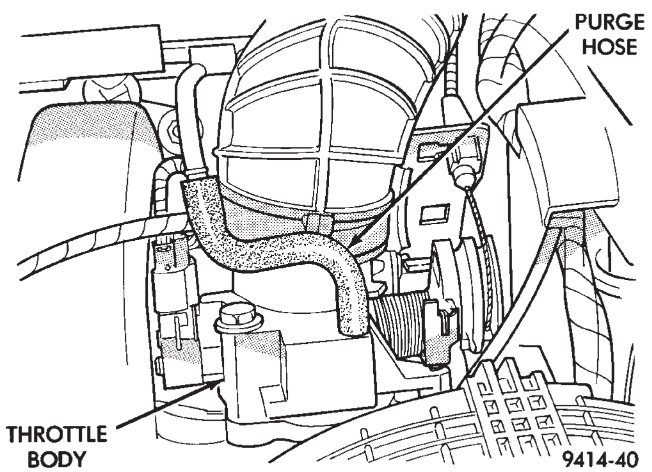


Fig. 69 Purge Hose—2.0/2.4L Engines

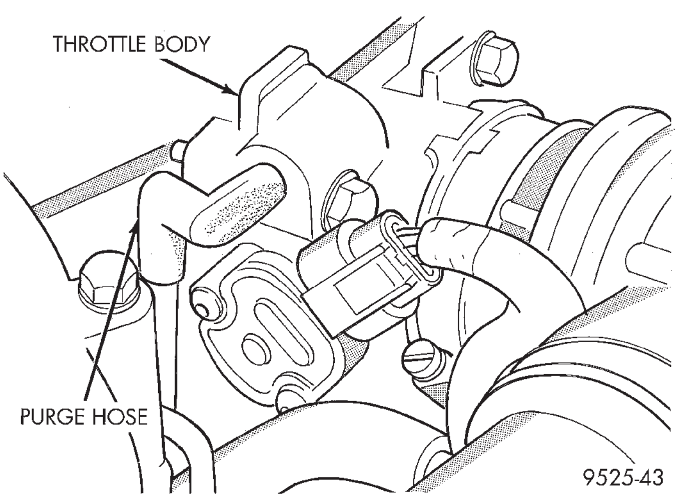


Fig. 70 Purge Hose—2.5L Engine

(4) Use a piece of hose to attach Air Metering Orifice 6457 (0.125 in. orifice) to the purge nipple on the throttle body (Fig. 71) or (Fig. 72).

(5) Ensure that all accessories are off.

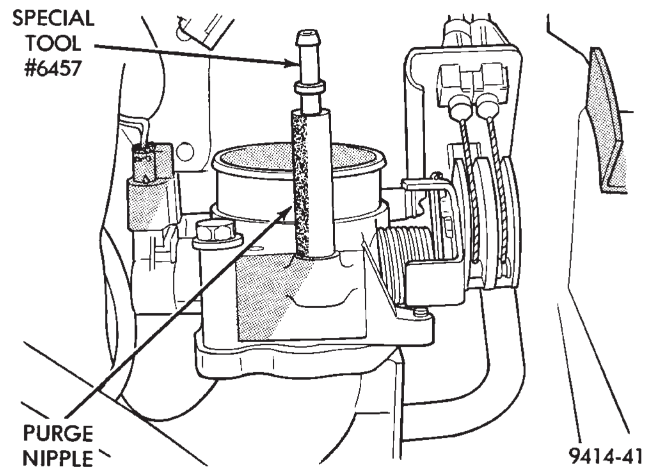


Fig. 71 Orifice 6457 Attached to Purge Nipple—2.0/2.4L Engines

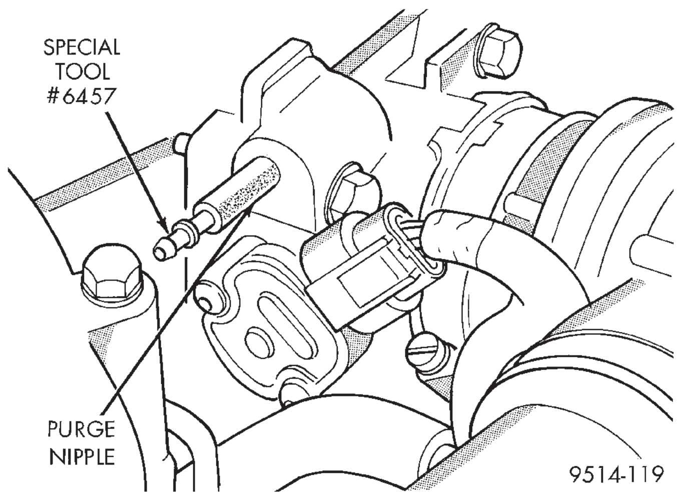


Fig. 72 Orifice 6457 Attached to Purge Nipple—2.5L Engine

(6) Connect the DRB scan tool to the data link connector inside the passenger compartment.

(7) Run engine in Park or Neutral until the cooling fan has cycled on and off at least once (180°F).

(8) Using the DRB scan tool, access Minimum Airflow Idle Speed.

(9) The following will then occur:

- Idle air control motor will fully close
- Idle spark advance will become fixed
- PCM will go open loop enriched
- DRB scan tool displays engine RPM

(10) If idle RPM is within the range shown in the Idle Specification chart, throttle body minimum airflow is set correctly.

(11) If idle RPM is above specifications, use the DRB scan tool to check idle air control motor operation. If idle air control motor is OK, replace throttle body. If idle air flow is below specification, shut off the engine and clean the throttle body as follows:

DIAGNOSIS AND TESTING (Continued)

2.0/2.4L MINIMUM AIR FLOW IDLE

Odometer	Idle RPM
Below 1000 Miles	550-1300 RPM
Above 1000 Miles	600-1300 RPM

2.5L MINIMUM AIR FLOW IDLE

Odometer	Idle RPM
Below 1000 Miles	450-1100 RPM
Above 1000 Miles	500-1100 RPM

WARNING: CLEAN THROTTLE BODY IN A WELL VENTILATED AREA. WEAR RUBBER OR BUTYL GLOVES, DO NOT LET MOPAR PARTS CLEANER COME IN CONTACT WITH EYES OR SKIN. AVOID INGESTING THE CLEANER. WASH THOROUGHLY AFTER USING CLEANER.

(a) Remove the throttle body from engine.

(b) While holding the throttle open, spray the entire throttle body bore and the manifold side of the throttle plate with Mopar Parts Cleaner. **Only use Mopar Parts Cleaner to clean the throttle body.**

(c) Using a soft scuff pad, clean the top and bottom of throttle body bore and the edges and manifold side of the throttle blade. **The edges of the throttle blade and portions of the throttle bore that are closest to the throttle blade when is closed, must be free of deposits.**

(d) Use compressed air to dry the throttle body.

(e) Inspect throttle body for foreign material.

(f) Install throttle body on manifold.

(g) Repeat steps 1 through 10. If the minimum air flow is still not within specifications, the problem is not caused by the throttle body.

(12) Shut off engine.

(13) Remove Air Metering Orifice 6457. Install purge hose.

(14) Remove cap from PCV valve. Connect hose to PCV valve.

(15) Remove DRB scan tool.

VEHICLE SPEED SENSOR

To perform a complete test of the sensor and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures Manual.

REMOVAL AND INSTALLATION

THROTTLE BODY—2.0/2.4L ENGINES

REMOVAL

(1) Remove air inlet resonator as described in this section.

(2) Remove the throttle control shield.

(3) Remove throttle cable from the throttle body lever (Fig. 73) and (Fig. 74).

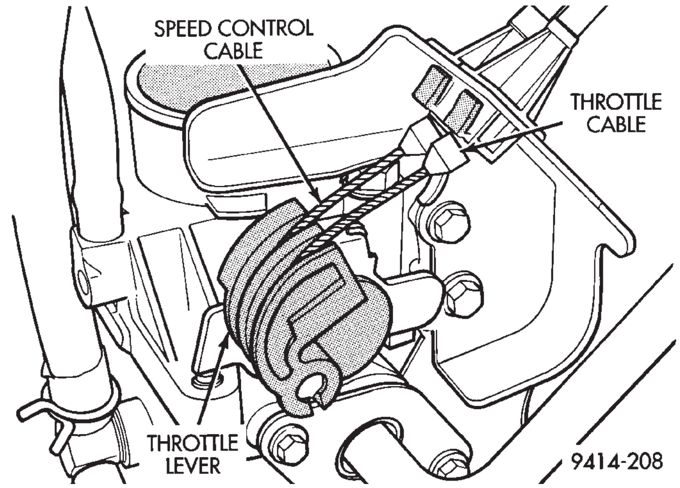


Fig. 73 Throttle Cable Attachment to Throttle Body

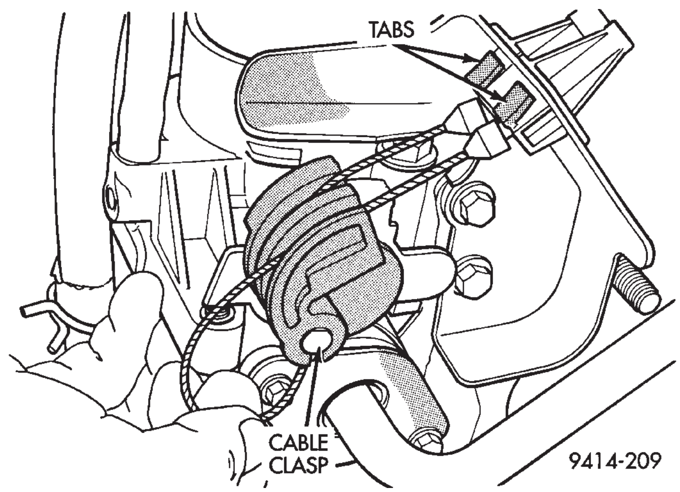


Fig. 74 Disconnecting Throttle Cable

(4) Compress the retaining tabs on the cable and slide cable out of bracket.

(5) If equipped with speed control, remove speed control cable from throttle lever by sliding clasp out hole used for throttle cable.

(6) Remove EVAP purge hose from nipple on throttle body.

(7) Remove 2 screws holding cable mounting bracket and support bracket.

(8) Remove throttle body mounting bolts.

REMOVAL AND INSTALLATION (Continued)

(9) Lift throttle body far enough to remove connectors from the throttle position sensor and idle air control motor. Remove throttle body.

(10) **2.0L** The rubber O-ring gasket on the intake manifold is reusable. Wipe the O-ring clean before installing throttle body (Fig. 75) **2.4L** Requires a new paper gasket.

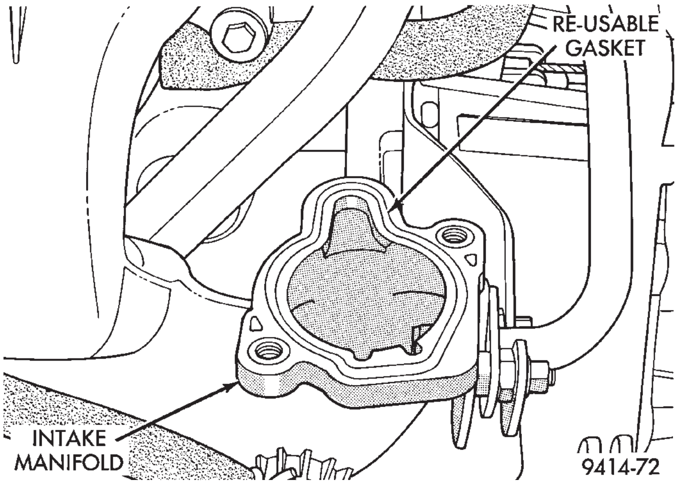


Fig. 75 Re-Usable Throttle Body Gasket

INSTALLATION

(1) Attach electrical connectors to idle air control motor and throttle position sensor.

(2) **2.4L** Install new paper gasket.

(3) Position throttle body on intake and install mounting bolts. Do Not tighten bolts at this time.

(4) Install throttle cable bracket. Do Not tighten bolts at this time.

(5) Tighten throttle body bolts to 22.5 ±3 N·m (200 ±25 in. lbs.) torque.

(6) Tighten throttle cable bracket bolts to 11.75 ±2.25 N·m (105 ±20 in. lbs.) torque.

(7) Install EVAP purge hose to throttle body nipple.

(8) Install cable housing(s) retainer tabs into bracket.

(9) Install throttle body cables by rotating the throttle lever forward to the wide open position.

(10) Install air inlet resonator as described in this section.

(11) Install throttle control shield. Tighten screw to 5.6 N·m (50 in. lbs.).

THROTTLE BODY—2.5L ENGINE

REMOVAL

(1) Remove air tube from throttle body.

(2) Remove throttle cable from the throttle body lever (Fig. 76).

(3) Push release tang toward dash panel on throttle cable and slide cable out of bracket (Fig. 77).

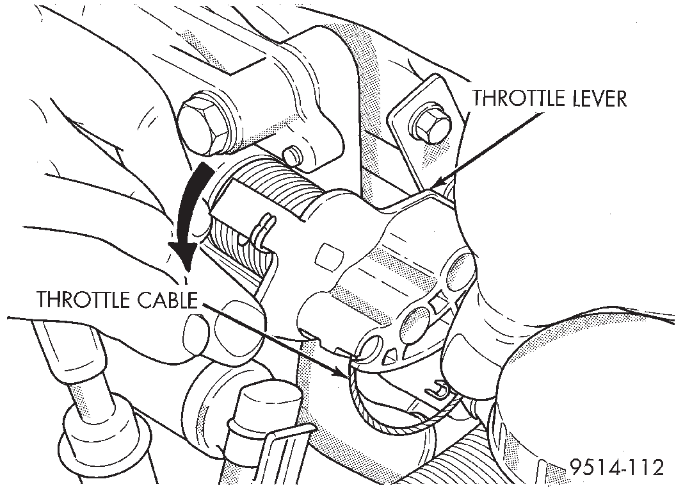


Fig. 76 Throttle Cable Attachment to Throttle Body

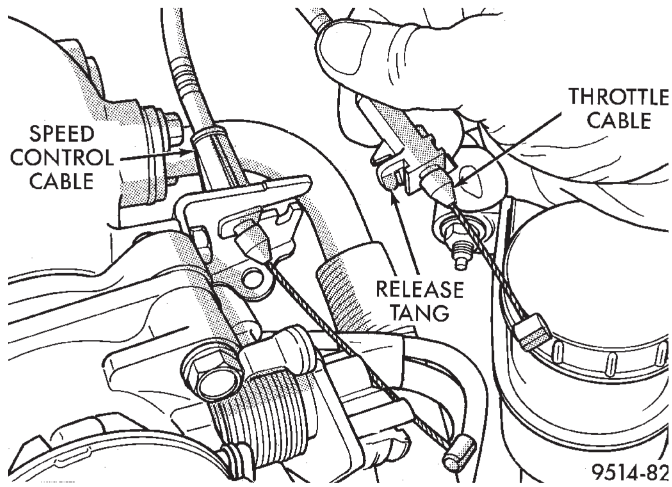


Fig. 77 Throttle Cable Attachment

(4) Slide speed control cable out of bracket, if equipped (Fig. 77).

(5) Remove EVAP purge hose from nipple on throttle body.

(6) Remove connectors from throttle position sensor and idle air control motor.

(7) Remove bolts holding throttle body to intake manifold. Remove throttle body.

INSTALLATION

(1) Attach electrical connectors to idle air control motor and throttle position sensor.

(2) Install new gasket.

(3) Position throttle body on intake and install mounting bolts. Tighten bolts to 28.25 N·m (250 in. lbs.).

(4) Install speed control cable (if equipped) and throttle cable into throttle lever.

(5) Install cables into cable bracket.

(6) Install air inlet tube. Tighten clamps to 3±.5 N·m (25±5 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

THROTTLE POSITION SENSOR (TPS)—2.0/2.4L

The throttle position sensor attaches to the side of the throttle body (Fig. 78).

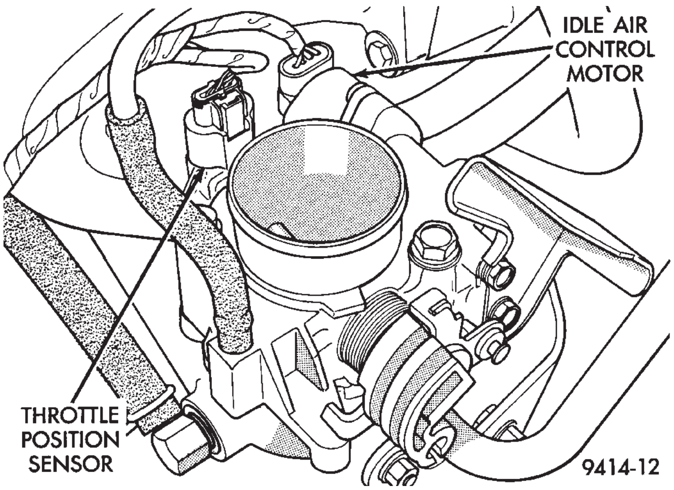


Fig. 78 Throttle Position Sensor and Idle Air Control Motor

REMOVAL

(1) Remove throttle body. Refer to Throttle Body in this section.

(2) Disconnect electrical connector from idle air control motor and throttle position sensor.

(3) Remove throttle position sensor mounting screws.

(4) Remove throttle position sensor.

INSTALLATION

(1) The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 79). The socket has two tabs inside it. The throttle shaft rests against the tabs. When indexed correctly, the TPS can rotate clockwise a few degrees to line up the mounting screw holes with the screw holes in the throttle body. The TPS has slight tension when rotated into position. If it is difficult to rotate the TPS into position, install the sensor with the throttle shaft on the other side of the tabs in the socket. Tighten mounting screws to 2 N·m (17 in. lbs.) torque.

(2) After installing the TPS, the throttle plate should be closed. If the throttle plate is open, install the sensor on the other side of the tabs in the socket.

(3) Attach electrical connectors to idle air control motor and throttle position sensor.

(4) Install throttle body. Refer to Throttle Body in this section.

THROTTLE POSITION SENSOR (TPS)—2.5L

The TPS attaches to the side of the throttle body (Fig. 80).

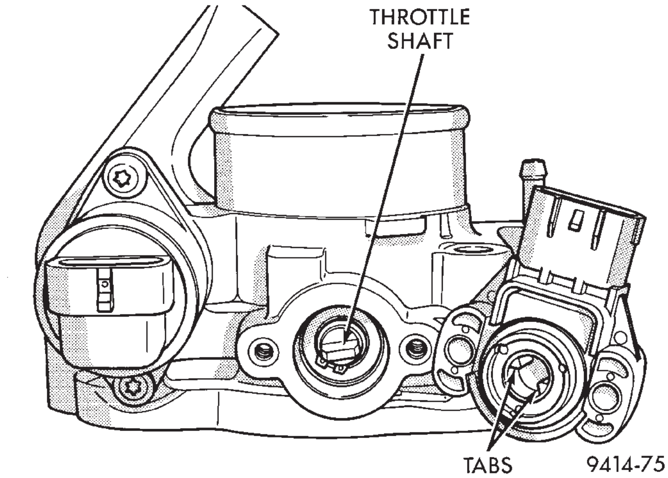


Fig. 79 Throttle Position Sensor Installation

REMOVAL

(1) Remove throttle body. Refer to Throttle Body in this section.

(2) Remove TPS mounting screws.

(3) Remove throttle position sensor.

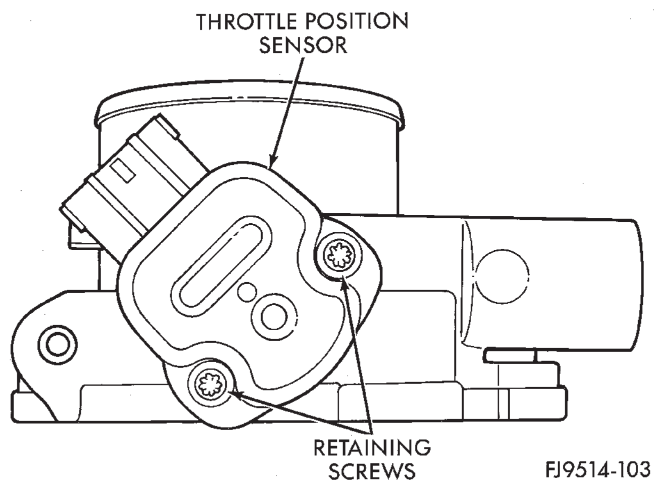


Fig. 80 Throttle Position Sensor—2.5L Engine

INSTALLATION

(1) The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 81). The socket has two tabs inside it. The throttle shaft rests against the tabs. When indexed correctly, the TPS can rotate a few degrees to line up the mounting screw holes with the screw holes in the throttle body. The TPS has slight tension when rotated into position. If it is difficult to rotate the TPS into position, install the sensor with the throttle shaft on the other side of the tabs in the socket. Tighten mounting screws to 2 N·m (17 in. lbs.) torque.

(2) After installing the TPS, the throttle plate should be closed. If the throttle plate is open, install the sensor on the other side of the tabs in the socket.

REMOVAL AND INSTALLATION (Continued)

(3) Attach electrical connectors to idle air control motor and throttle position sensor.

(4) Install throttle body to intake manifold. Refer to throttle body in this section.

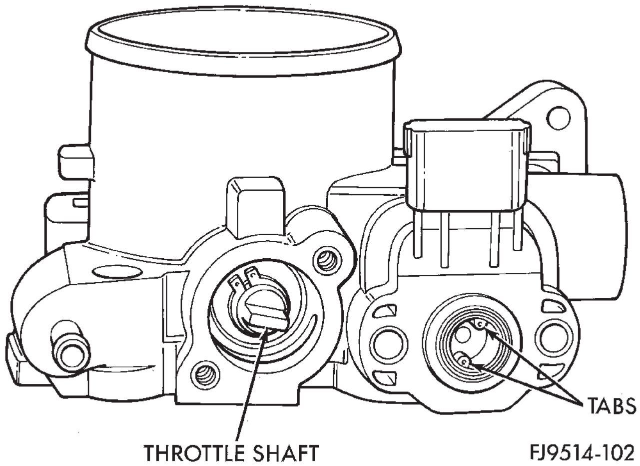


Fig. 81 Indexing Throttle Position Sensor—2.5L Engine

IDLE AIR CONTROL MOTOR—2.0/2.4/2.5L

The idle air control motor attaches to the side of the throttle body (Fig. 82) or (Fig. 83) or (Fig. 84).

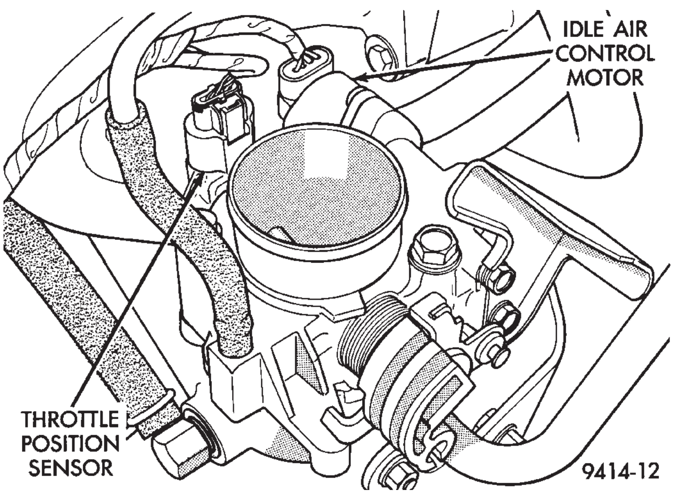


Fig. 82 Throttle Position Sensor and Idle Air Control Motor—2.0L

REMOVAL

(1) Remove throttle body. Refer to Throttle Body in this section.

(2) Disconnect electrical connector from idle air control motor and throttle position sensor.

(3) Remove idle air control motor mounting screws.

(4) Remove idle air control motor. Ensure O-ring is removed with the motor.

INSTALLATION

(1) The new idle air control motor has a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRB AIS Motor Open/Close Test to retract the pintle (battery must be connected.)

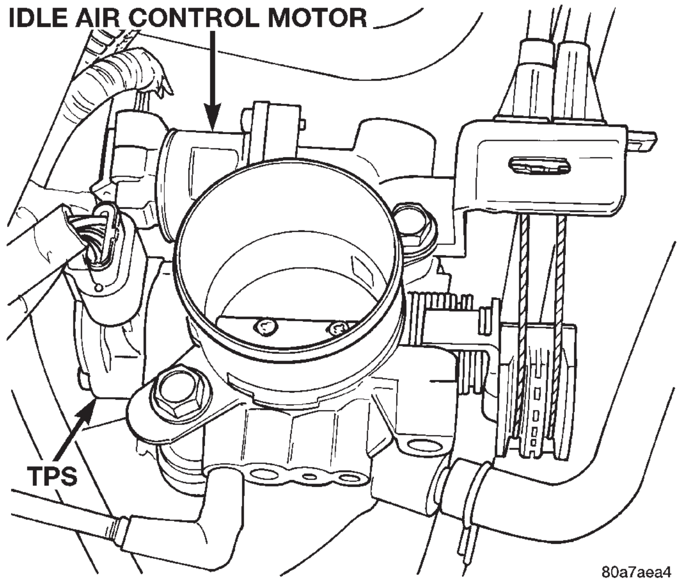


Fig. 83 Throttle Position Sensor and Idle Air Control Motor—2.4L

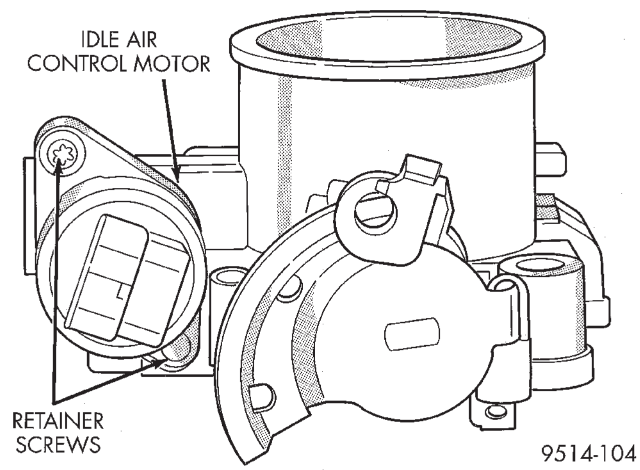


Fig. 84 Throttle Position Sensor and Idle Air Control Motor—2.5L

(2) Carefully place idle air control motor into throttle body.

(3) Install mounting screws. Tighten screws to 3 N·m (25 in. lbs.) torque.

(4) Attach electrical connectors to idle air control motor and throttle position sensor.

(5) Install throttle body. Refer to Throttle Body in this section.

INTAKE AIR TEMPERATURE SENSOR—2.4L

The intake air temperature sensor threads into the intake manifold plenum (Fig. 86).

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove air inlet resonator.

(2) Reaching through intake manifold from throttle body end, disconnect sensor connector.

(3) Remove sensor.

INSTALLATION

(1) Install sensor. Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Install air inlet resonator.

INTAKE AIR TEMPERATURE SENSOR—2.5L

The intake air temperature sensor threads into the intake manifold plenum (Fig. 87).

REMOVAL

(1) Disconnect electrical connector from sensor.

(2) Remove sensor.

INSTALLATION

(1) Install sensor. Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Attach electrical connector to sensor.

MAP/IAT SENSOR—SOHC

The MAP/IAT sensor attaches to the intake manifold plenum (Fig. 85).

REMOVAL

(1) Disconnect the electrical connector from the MAP/IAT sensor.

(2) Remove sensor mounting screws.

(3) Remove sensor.

INSTALLATION

(1) Insert sensor into intake manifold while making sure not to damage O-ring seal.

(2) Tighten mounting screws to 2 N·m (20 in. lbs) torque for plastic manifold and 3 N·m (30 in. lbs.) for aluminum manifold.

(3) Attach electrical connector to sensor.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

2.4L

The MAP sensor attaches to the intake manifold plenum (Fig. 86).

2.5L

The MAP sensor attaches to the intake manifold plenum (Fig. 87).

REMOVAL

(1) Disconnect electrical connector from MAP sensor.

(2) Remove sensor mounting screws.

(3) Remove sensor.

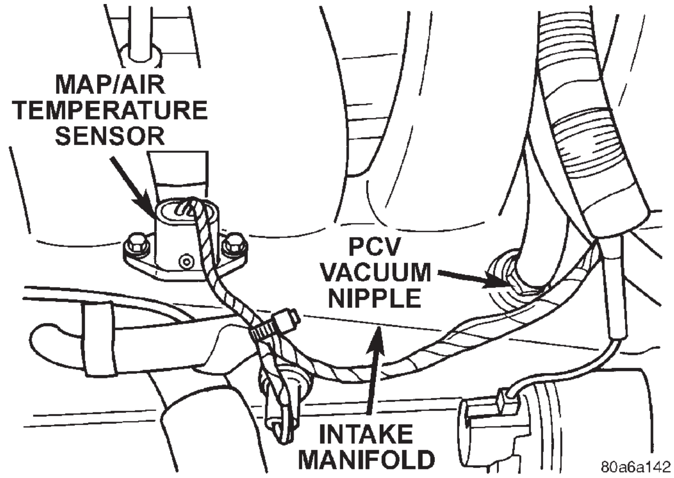


Fig. 85 MAP/IAT Sensor—SOHC

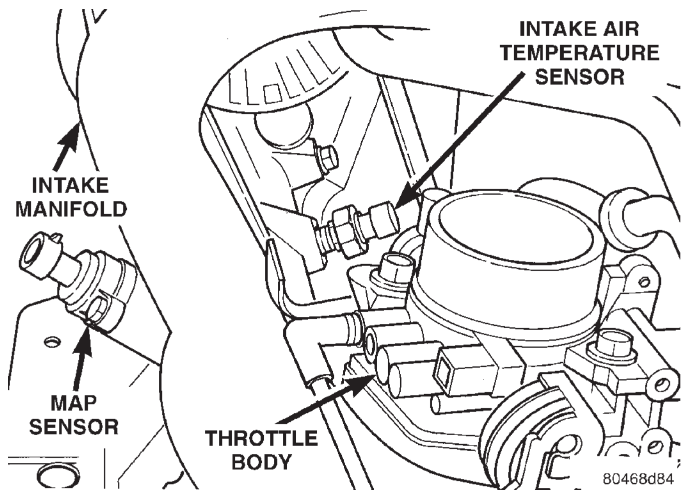


Fig. 86 Intake Air Temperature Sensor and MAP Sensor—2.4L

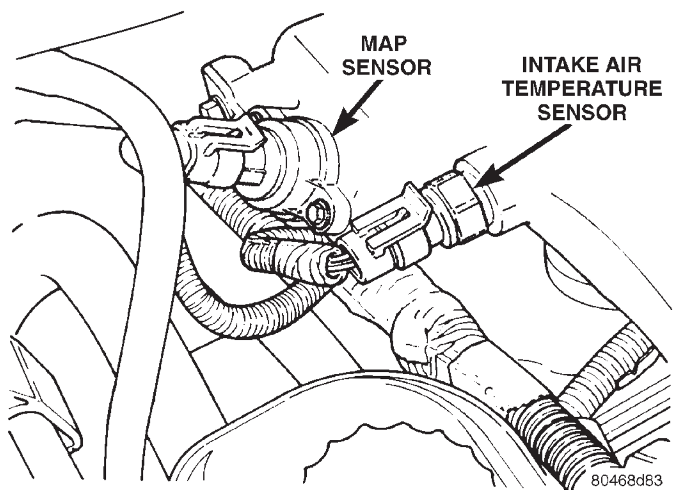


Fig. 87 Intake Air Temperature Sensor and MAP Sensor—2.5L

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Insert sensor into intake manifold while making sure not to damage O-ring seal.

(2) Tighten mounting screws to:

2.4L

(3) 2 N·m (20 in. lbs.) torque.

2.5L

(4) 3.4 N·m (30 in. lbs) torque.

(5) Attach electrical connector to sensor.

POWERTRAIN CONTROL MODULE

The PCM engine control strategy prevents reduced idle speeds until after the engine operates for 320 km (200 miles). If the PCM is replaced after 320 km (200 miles) of usage, update the mileage and vehicle identification number (VIN) in the new PCM. Use the DRB scan tool to change the millage and VIN in the PCM. If this step is not done a Diagnostic Trouble Code (DTC) may be set. Refer to the appropriate Powertrain Diagnostic Manual and the DRB scan tool.

The PCM attaches to a bracket between the air cleaner housing and Power Distribution Center (PDC).

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal (Fig. 88).

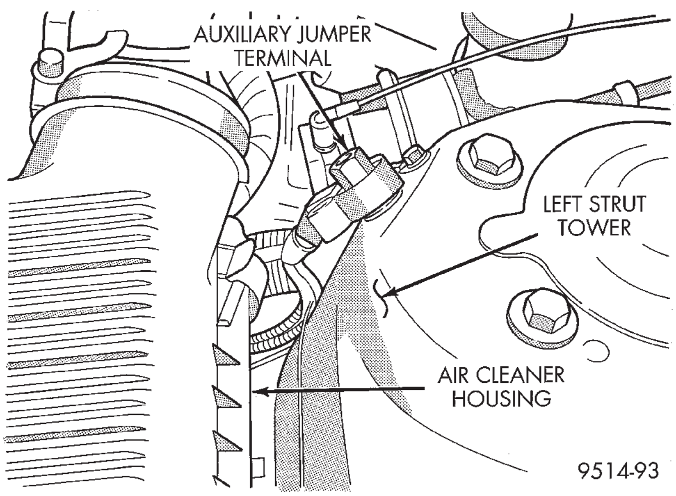


Fig. 88 Auxiliary Jumper Terminal

(2) Disconnect both 40-way connectors from PCM.

(3) Remove screws attaching PCM to bracket (Fig. 89).

(4) Lift PCM up to remove it from vehicle.

INSTALLATION

(1) Install PCM. Tighten mounting screws.

(2) Attach both 40-way connectors to PCM.

(3) Connect negative cable to auxiliary jumper terminal.

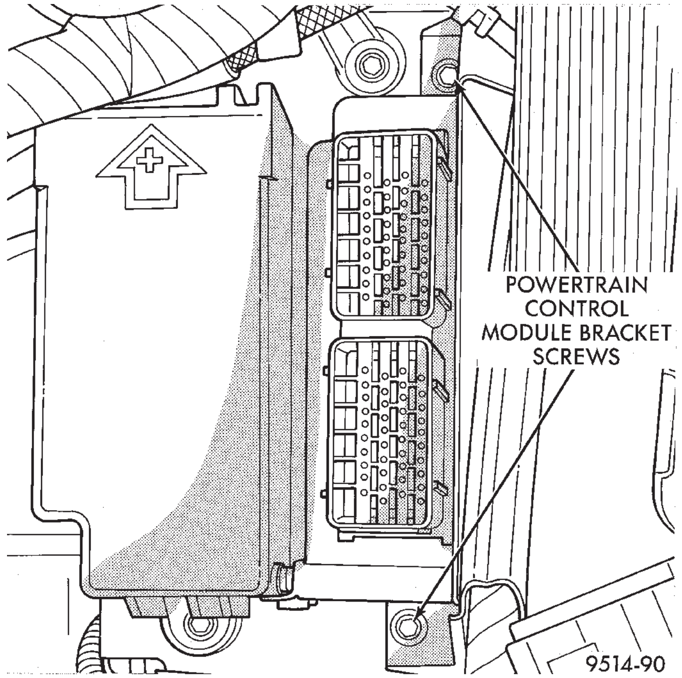


Fig. 89 PCM Bracket Screws

OXYGEN SENSOR 1/1 UPSTREAM—2.0/2.4L

REMOVAL

(1) Raise and support vehicle.

(2) Disconnect electrical connector from sensor.

(3) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 90).

INSTALLATION

(1) After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite® 771-64 or equivalent. New sensors have compound on the threads and do not require an additional coating. Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect electrical connector to sensor.

(3) Lower vehicle.

OXYGEN SENSOR 1/1 UPSTREAM—2.5L

REMOVAL

(1) Raise and support vehicle.

(2) Disconnect electrical connector from sensor.

(3) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 91).

INSTALLATION

(1) After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor

REMOVAL AND INSTALLATION (Continued)

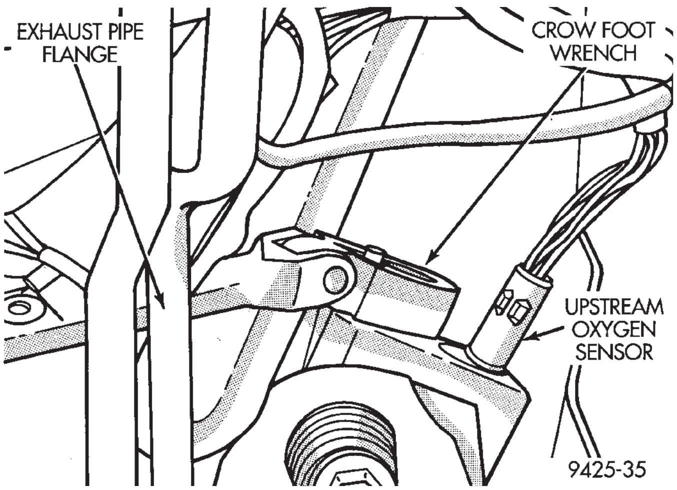


Fig. 90 Oxygen Sensor 1/1 Upstream

threads with an anti-seize compound such as Loctite® 771-64 or equivalent. New sensors have compound on the threads and do not require an additional coating. Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect electrical connector to sensor.

(3) Lower vehicle.

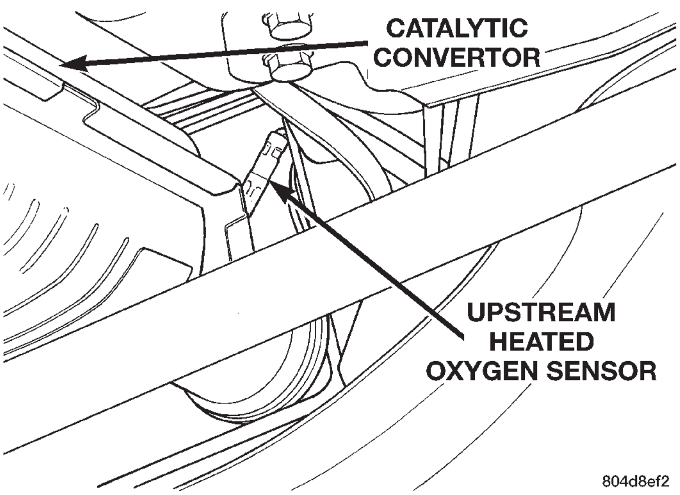


Fig. 91 Oxygen Sensor 1/1 Upstream

OXYGEN SENSOR 1/2 DOWNSTREAM

The downstream heated oxygen sensor threads into the exhaust pipe behind the catalytic convertor.

REMOVAL

(1) Raise vehicle.

(2) Disconnect electrical connector from sensor.

(3) Disconnect sensor electrical harness from clips along body.

(4) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 92).

INSTALLATION

(1) After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite® 771-64 or equivalent. New sensors have compound on the threads and do not require an additional coating. Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect sensor electrical harness to clips along body.

(3) Connect electrical connector to sensor.

(4) Lower vehicle.

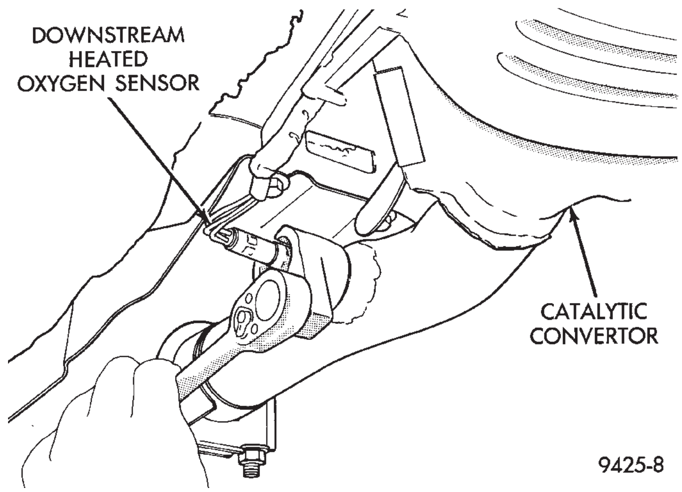


Fig. 92 Oxygen Sensor 1/2 Downstream

AIR INLET RESONATOR

2.0L

REMOVAL

(1) Loosen screw holding resonator to throttle body (Fig. 93).

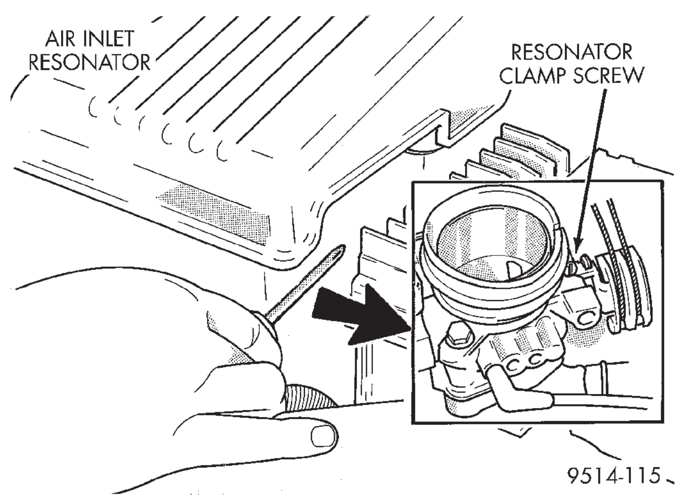


Fig. 93 Air Inlet Resonator Attachment to Throttle Body

REMOVAL AND INSTALLATION (Continued)

(2) Loosen clamp holding resonator to air inlet tube. Remove resonator.

INSTALLATION

(1) Install air inlet resonator to throttle body.
(2) Install air inlet tube to resonator.
(3) Tighten clamps to 3±.5 N·m (25±5 in. lbs.) torque.

2.4L

REMOVAL

(1) Remove bolt holding air inlet resonator to intake manifold.
(2) Loosen screw holding resonator to throttle body (Fig. 93).
(3) Loosen clamp holding resonator to air inlet tube. Remove resonator.

INSTALLATION

(1) Install air inlet resonator to throttle body.
(2) Install air inlet tube to resonator.
(3) Tighten clamps to 3±.5 N·m (25±5 in. lbs.) torque.
(4) Install bolt and tighten.

2.5L

REMOVAL

(1) Remove bolt holding resonator to intake manifold (Fig. 94).

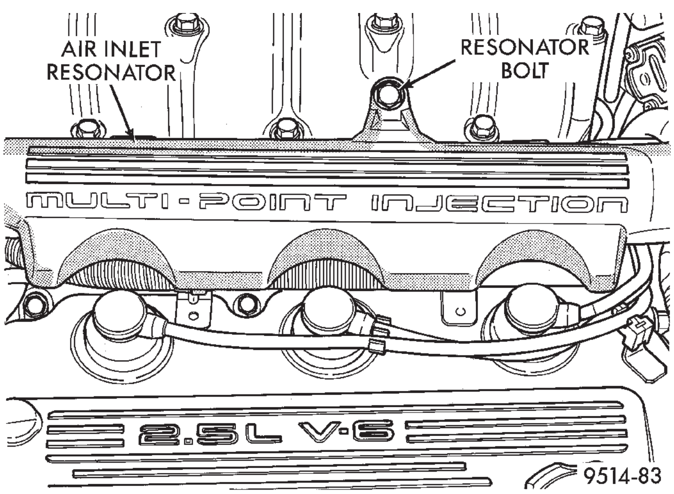


Fig. 94 Air Inlet Resonator

(2) Loosen clamp holding resonator to air inlet tube. Remove resonator.

INSTALLATION

(1) Install air inlet tube to resonator.
(2) Tighten clamp to 3±.5 N·m (25±5 in. lbs.) torque.
(3) Install bolt holding resonator to intake manifold. Tighten to 5±.5 N·m (45±5 in. lbs.) torque.

AIR CLEANER

The air cleaner housing attaches to the inner fender in front of the driver's side strut tower (Fig. 95). An ambient air duct supplies underhood air for the engine.

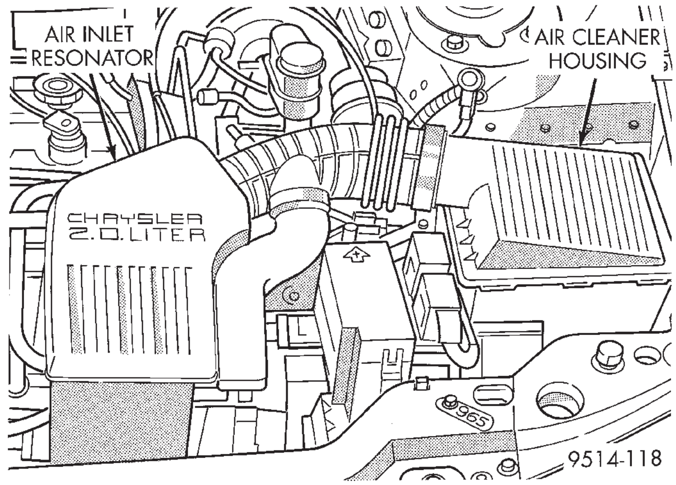


Fig. 95 Air Inlet System

FILTER ELEMENT REPLACEMENT

REMOVAL

(1) Unfasten clasps on rear of air cleaner housing cover. Lift cover off air cleaner housing (Fig. 96).

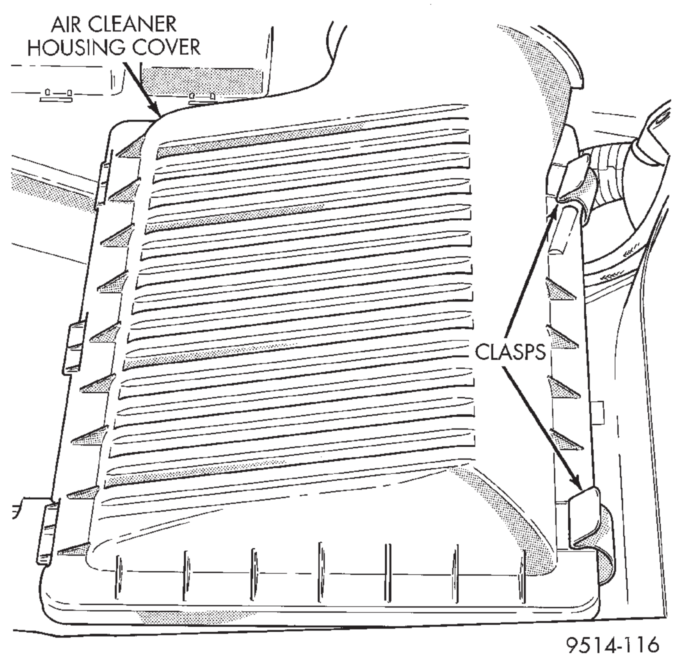


Fig. 96 Air Cleaner Cover Clasps

REMOVAL AND INSTALLATION (Continued)

(2) Remove filter element (Fig. 97).

(3) If necessary, clean the inside of the air cleaner housing.

INSTALLATION

(1) Install new filter element.

(2) Place cover over air cleaner housing. Snap clasps in place.

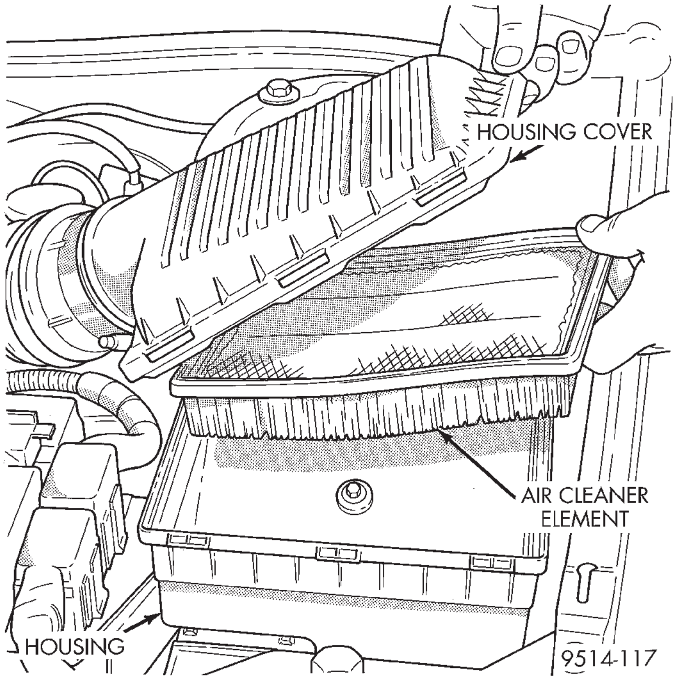


Fig. 97 Air Cleaner Housing and Element

ENGINE COOLANT TEMPERATURE SENSOR

2.0L

The engine coolant temperature sensor threads into the rear of the cylinder head (Fig. 98).

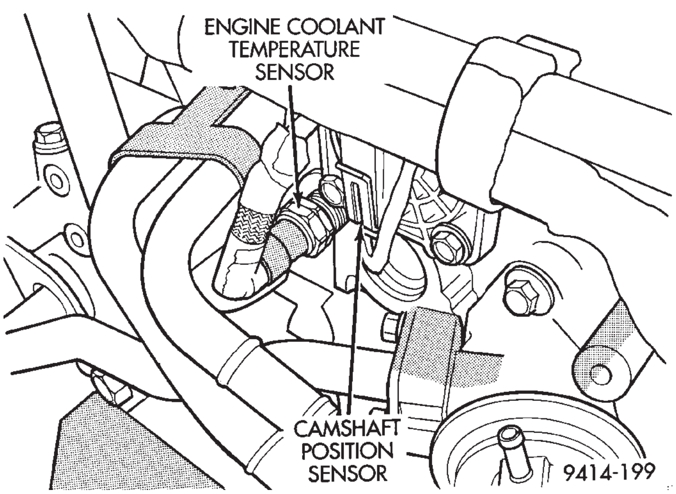


Fig. 98 Engine Coolant Temperature Sensor—2.0L Engine

2.4L

The engine coolant temperature sensor threads into the front of the cylinder head (Fig. 99).

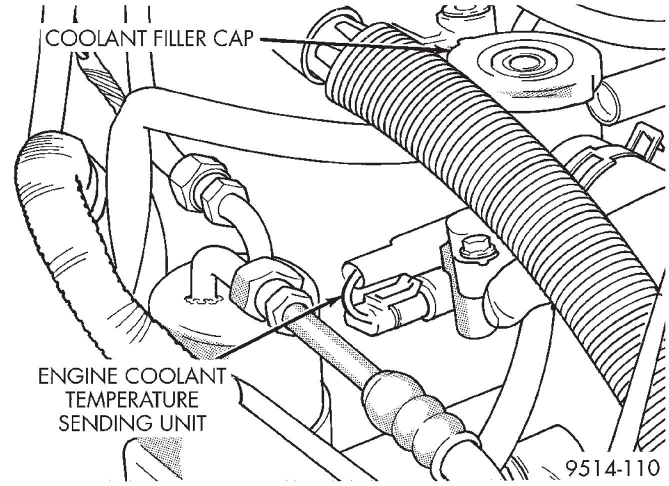


Fig. 99 Engine Coolant Temperature Sensor—2.4L Engine

2.5L

The engine coolant temperature sensor is located next to the fill neck (Fig. 100).

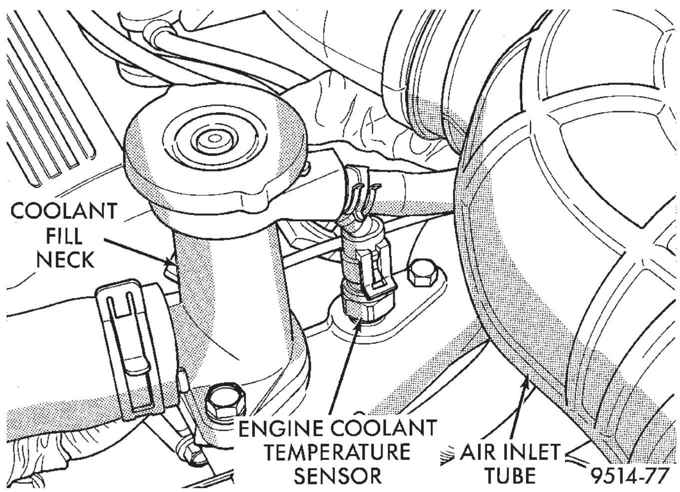


Fig. 100 Engine Coolant Temperature Sensor—2.5L Engine

REMOVAL

(1) With the engine cold, drain coolant until level drops below sensor level. Refer to the Cooling System section.

(2) Disconnect coolant sensor electrical connector.

(3) Remove coolant sensor.

INSTALLATION

(1) Install coolant sensor. Tighten sensor to:

2.0/2.5L 7 N·m (60 in. lbs.) torque.

2.4L 27 N·m (20 ft. lbs.) torque.

(2) Attach electrical connector to sensor.

(3) Fill cooling system. Refer to the Cooling System section.

REMOVAL AND INSTALLATION (Continued)

VEHICLE SPEED SENSOR

The vehicle speed sensor is located in the transmission extension housing (Fig. 101).

REMOVAL

(1) Disconnect electrical connector from sensor.
(2) Remove the sensor mounting bolt.
(3) Lift the sensor out of the transaxle extension housing. Ensure the O-ring was removed with the sensor.

INSTALLATION

The speed sensor gear meshes with a gear on the output shaft.
(1) With O-ring in place, install sensor.
(2) Install mounting bolt.
(3) Connect electrical connector to sensor.

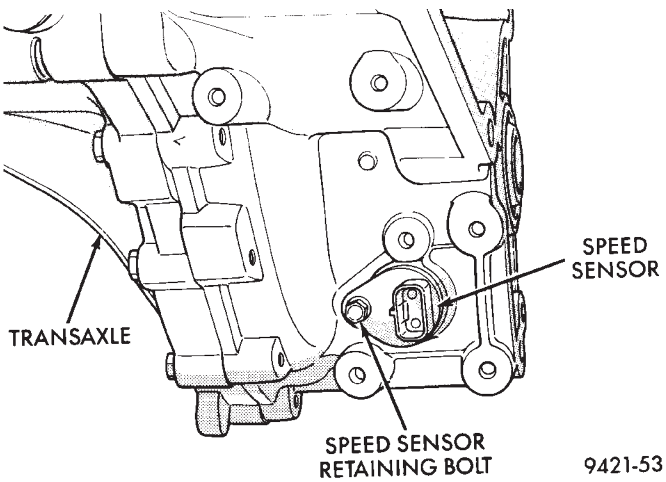


Fig. 101 Vehicle Speed Sensor

SPECIFICATIONS

VECI LABEL

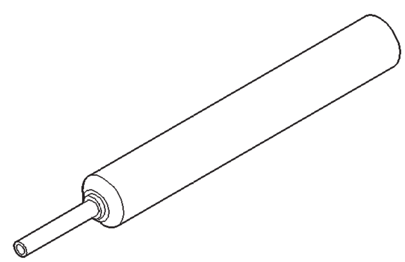
Always use the information found on the Vehicle Emission Control Information (VECI) label. The VECI label is located in the engine compartment.

TORQUE

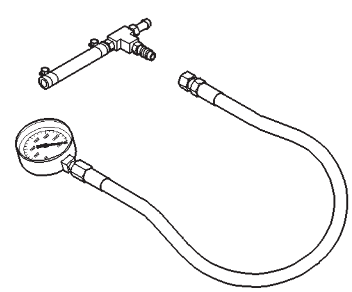
DESCRIPTION	TORQUE
Camshaft Position Semsor	12 N·m (105 in. lbs.)
Crankshaft Position Sensor	12 N·m (105 in. lbs.)
Engine Coolant Temperature Sensor	28 N·m (20 ft. lbs.)
IAC Motor-To-Throttle Body Bolts	3 N·m (25 in. lbs.)
MAP Sensor Mounting Screws	3 N·m (25 in. lbs.)
Oxygen Sensor	28 N·m (20 ft. lbs.)
Powertrain Control Module (PCM) Mounting Screws	4 N·m (35 in. lbs.)
Throttle Body Mounting Bolts	26 N·m (19 ft. lbs.)
Throttle Position Sensor	3 N·m (25 in. lbs.)
Throttle Shield Bolt	4.5 N·m (40 in. lbs.)

SPECIAL TOOLS

FUEL

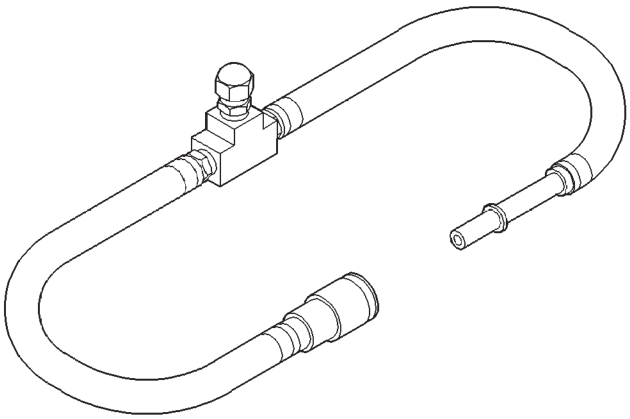


Extractor C–4334

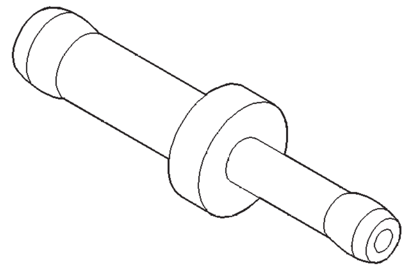


Pressure Gauge Assembly C–4799–B

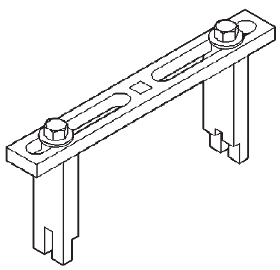
SPECIAL TOOLS (Continued)



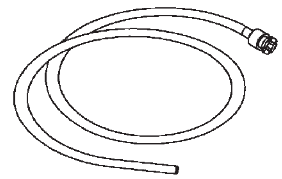
Fuel Pressure Test Adapter 6539



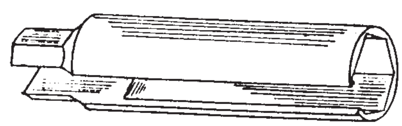
Metering Orifice



Spanner Wrench 6856



Fuel Line Adapter 1/4



O2S (Oxygen Sensor) Remover/Installer—C-4907

STEERING

CONTENTS

POWER STEERING

INDEX

DESCRIPTION AND OPERATION

POWER STEERING SYSTEM AND COMPONENTS

Turning of the steering wheel is converted into linear travel through the meshing of the helical pinion teeth with the rack teeth. Power assist steering is provided by an open center, rotary type control valve. It is used to direct oil from the power steering pump to either side of the integral steering rack piston.

Road feel is controlled by the diameter of a torsion bar which initially steers the vehicle. As steering effort increases as in a turn, the torsion bar twists, causing relative rotary motion between the rotary valve body and valve spool. This movement directs oil behind the integral rack piston, which in turn builds up hydraulic pressure and assists in the turning effort.

This vehicle is equipped with either standard power steering or an optional speed-sensitive variable-assist power steering.

The optional speed-sensitive variable-assist power steering is built into the power steering pump. It provides full power steering assist at engine idle. As engine speed is increased, power assist is gradually reduced to provide a firm, responsive feel to the steering system at higher vehicle speeds.

The power steering system consists of these major components:

- POWER STEERING PUMP
- POWER STEERING GEAR
- POWER STEERING FLUID RESERVOIR
- POWER STEERING FLUID SUPPLY HOSE
- POWER STEERING FLUID PRESSURE HOSE
- POWER STEERING FLUID RETURN HOSE
- POWER STEERING FLUID COOLER
- POWER STEERING FLUID COOLER TUBES

For information on the first two components, refer to their respective sections within this service man-

DESCRIPTION AND OPERATION (Continued)

ual group. Information on the third component can be found in POWER STEERING PUMP. Information on all other components, and all diagnosis and testing can be found in this section of this service manual group.

POWER STEERING FLUID PRESSURE SWITCH

On vehicles equipped with power steering, a power steering pressure switch (Fig. 1) is used to improve the vehicle's idle quality. The pressure switch improves vehicle idle quality, by maintaining required engine idle speed when necessary, do to increased pressure in the power steering system. This increased pressure will slow down the power steering pump which will decrease engine idle speed.

The pressure switch functions by signaling the power train control module that the power steering system is putting additional load on the engine. This type of condition exists when turning the front tires of the vehicle when the vehicle is stationary and the engine is at idle speed. When this condition is sensed by the power train control module, through a signal from the power steering pressure switch, engine idle speed will be maintained. The maintained engine idle speed compensates for the additional load, thus maintaining the require engine idle speed and idle quality.

The power steering pressure switch is mounted directly to the power steering gear (Fig. 1).

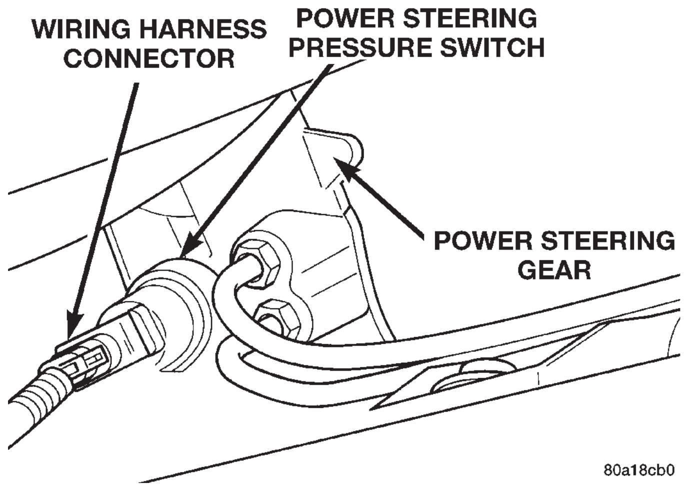


Fig. 1 Power Steering Pressure Switch Location On Steering Gear

DIAGNOSIS AND TESTING

STEERING DIAGNOSIS CHARTS

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at standstill parking. Hiss is a very high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every valve and results from high velocity fluid passing over the edges of the valve orifice. There is no relationship between this noise and the performance of the vehicles steering system. Hiss may be expected when the steering wheel is at the end of its travel or slowly turning when the vehicle is at a standstill.

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONABLE HISS OR WHISTLE	1. Damaged or mispositioned steering column coupler to dash panel seal.	1. Check for proper seal between steering column coupler and dash seal.
	2. Noisy valve in power steering gear.	2. Replace steering gear assembly.
RATTLE OR CLUNK	1. Steering gear loose on front suspension crossmember.	1. Check steering gear to front suspension crossmember mounting bolts. Tighten to specified torque if found to be loose.
	2. Front suspension crossmember to frame bolts or studs loose.	2. Tighten the front suspension crossmember attaching bolts or studs to the specified torque.

DIAGNOSIS AND TESTING (Continued)

	3. Tie rod is loose (outer or inner).	3. Check tie rod pivot points for wear. Replace worn/loose parts as required.
	4. Loose lower control arm to front suspension crossmember bolts.	4. Tighten control arm mounting bolts to the specified torques.
	5. Loose upper control arm/ shock absorber mounting bracket to body attaching bolts.	5. Check mounting bracket to body attaching bolts for looseness. If required tighten to the specified torques.
	6. Power steering fluid pressure hose touching the body of the vehicle.	6. Adjust hose to proper position by loosening, repositioning, and tightening fitting to specified torque. Do not bend tubing.
	7. Noise internal to power steering gear.	7. Replace power steering gear.
	8. Damaged front suspension crossmember.	8. Replace front suspension crossmember.
POPPING NOISE	1. Noisy outer tie rod.	1. Replace outer tie rod.
CHIRP OR SQUEAL (in the area of the power steering pump). Particularly noticeable at full wheel travel and during standstill parking.	1. Loose power steering pump drive belt.	1. Adjust power steering pump drive belt to specified tension.

CONDITION	POSSIBLE CAUSES	CORRECTION
Power steering pump growl results from the development of high pressure fluid flow. Normally this noise should not be high enough to be objectionable. Abnormal situations, such as a low oil level causing aeration or hose touching the vehicle body, can create a noise level that could bring complaints.		
WHINE OR GROWL (PUMP NOISE)	1. Low fluid level.	1. Fill power steering fluid reservoir to proper level and perform leakage diagnosis. (Recheck fluid level after power steering fluid is free of air.)
	2. Power steering hose touching vehicle body or frame.	2. Reposition power steering hose. Replace hose if tube ends are bent.
	3. Extreme wear of power steering pump internal parts.	3. Replace power steering pump and flush system.
SUCKING AIR SOUND	1. Loose clamp on power steering fluid low pressure hose.	1. Tighten or replace hose clamp.
	2. Missing O-Ring on power steering pressure hose connection.	2. Inspect connection and replace O-Ring as required.
	3. Low power steering fluid level	3. Fill power steering fluid reservoir to proper level and perform leakage diagnosis.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Air leak between power steering fluid reservoir and power steering pump.	4. Inspect and/or replace power steering fluid reservoir or supply hose as required.
SQUEAK OR RUBBING SOUND	1. Sound coming from steering column.	1A. Inspect for contact between shrouds, couplings, column, and steering wheel. Realign if necessary.
		1B. Check for lack of grease on steering column dash panel to lower coupler seal.
		1C. Check steering column for noise without clockspring installed, and without the steering column couplings connected to eliminate possible noise from these components. See items 2 and 3 below.
	2.Clockspring	2. Remove clockspring, reinstall steering wheel and turn wheel. If noise is gone, replace Clockspring
	3. Sound internal to steering gear.	3. Disconnect steering couplings. Turn steering column.* If noise is gone, replace steering gear.
		* Note: Remove clockspring before disconnecting the couplings to avoid damage to the clockspring. Recenter clockspring as necessary upon assembly.
SCRUBBING OR KNOCKING SOUND	1. Incorrect tire size.	1. Verify that tire size on vehicle is the same as originally supplied.
	2. Check clearance between tires and other vehicle components, through the full travel of the suspension.	2. Correct as necessary.
	3. Check for interference between steering gear and other components.	3.Correct as necessary.
	4.Incorrect steering gear supplied.	4. Replace steering gear with correct steering gear for specific vehicle.

BINDING STICKING SEIZED

CONDITION	POSSIBLE CAUSES	CORRECTION
CATCHES, STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN.	1. Low power steering fluid level.	1. Fill power steering fluid reservoir to specified level and perform leakage diagnosis.
	2. Tires not inflated to specified pressure.	2. Inflate tires to the specified pressure.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	3. Lack of lubrication in front suspension control arm ball joints.	3. Lubricate ball joints if ball joints are not a lubricated for life type ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm.
	4. Worn upper or lower ball joint.	4. Replace the upper or lower control arm.
	5. Lack of lubrication in front suspension outer tie rod ends.	5. Lubricate tie rod ends if they are not a lubricated for life type. If tie rod end is a lubricated for life type, replace tie rod end.
	6. Loose power steering pump drive belt.	6. Tighten the power steering pump drive belt to the specified tension. See accessory drive in service manual.
	7. Faulty power steering pump flow control. (Verify cause using Power Steering Pump Test Procedure.)	7. Replace power steering pump.
	8. Excessive friction in steering column or intermediate shaft.	8. Correct condition. (See Steering Column Service Procedure)
	9. Steering column coupler binding.	9. Realign the steering column to eliminate the binding condition.
	10. Binding upper or lower ball joint.	10. Replace the upper or the lower control arm.
	11. Excessive friction in steering gear.	11. Replace steering gear assembly.

SHAKE SHUDDER VIBRATION

CONDITION	POSSIBLE CAUSES	CORRECTION
VIBRATION OF THE STEERING WHEEL AND/OR DASH DURING DRY PARK OR LOW SPEED STEERING MANEUVERS.	1. Air in the fluid of the power steering system.	1. Steering shudder can be expected in new vehicles and vehicles with recent steering system repairs. Shudder should improve after the vehicle has been driven several weeks.
	2. Tires not properly inflated.	2. Inflate tires to the specified pressure.
	3. Excessive engine vibration.	3. Ensure that the engine is running properly.
	4. Loose tie rod end.	4. Check inner and outer tie rods, and jam nut for excessive free play. If the outer tie rod is loose, replace it. If the inner tie rod is loose, replace the steering gear. If the jam nut is loose tighten it to its specified torque.
	5.Overcharged air conditioning system.	5.Check air conditioning pump head pressure. (See Air Conditioning Refrigerant System Diagnosis)

DIAGNOSIS AND TESTING (Continued)

LOW ASSIST, NO ASSIST, HARD STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
STIFF, HARD TO TURN, SURGES, MOMENTARY INCREASE IN EFFORT WHEN TURNING.	1. Tires not properly inflated.	1. Inflate tires to specified pressure.
	2. Low power steering fluid level.	2. Add power steering fluid as required to power steering fluid reservoir to obtain proper level. Perform leakage diagnosis on power steering system.
	3. Loose power steering pump drive belt.	3. Tighten the power steering pump drive belt to the specified tension. If drive belt is defective replace and correctly tension.
	4. Lack of lubrication in control arm ball joints.	4. Lubricate ball joints if ball joints are not a lubricated for life type ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm.
	5. Worn upper or lower ball joint.	5. Replace the upper and/or lower control arm.
	6. Low power steering pump pressure.	6. Verify cause using the Power Steering System Test Procedure. Replace the power steering pump or steering gear as necessary.
	7. High internal leak in steering gear assembly.	7. Check steering system using the Power Steering System Test Procedure. If steering gear is defective replace steering gear.

POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION.	1. Tires not inflated to specified pressure.	1. Inflate tires to specified pressure.
	2. Improper front wheel alignment.	2. Check and adjust as necessary.
	3. Lack of lubrication in front suspension control arm ball joints.	3. Lubricate ball joints if ball joints are not a lubricated for life type of ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm.
	4. Steering column U-joints misaligned.	4. Realign steering column U-joints.
	5. Mispositioned dash cover.	5. Reposition dash cover.
		To evaluate items 6 and 7, disconnect the intermediate shaft. Turn the steering wheel and feel or listen for internal rubbing in steering column.
	6. Steering wheel rubbing.	6. Adjust steering column shrouds to eliminate rubbing condition.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	7. Damaged, mis-positioned or un-lubricated steering column coupler to dash seal.	7. Determine condition which exists and correct.
	8. Binding upper strut bearing.	8. Correct binding condition in strut bearing.
	9. Tight shaft bearing in steering column assembly.	9. Replace the steering column assembly.
	10. Excessive friction in steering column coupler.	10. Replace steering column coupler.
	11. Excessive friction in steering gear.	11. Replace steering gear.

LOOSE STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE STEERING WHEEL KICKBACK OR TO MUCH STEERING WHEEL FREE PLAY.	1. Air in the fluid of the power steering system.	1. Fill power steering fluid reservoir to the specified level. Perform procedure to bleed the air out of the power steering system. Perform leakage diagnosis.
	2. Steering gear loose on front suspension crossmember.	2. Check steering gear to front suspension crossmember mounting bolts. Tighten to specified torque if found to be loose.
	3. Worn, broken or loose steering column to steering gear coupler.	3. Check for worn universal joint, broken isolator or loose fasteners.
	4. Free play in steering column.	4.Check components of the steering system and repair or replace as required.
	5. Loose front suspension control arm ball joints.	5. Check and or replace the ball joint or control arm as required.
	6. Loose steering knuckle to ball joint stud pinch bolt.	6. Check pinch bolts and tighten if required to specified torque.
	7. Front wheel bearings loose or worn.	7. Tighten hub nut to specified torque or replace with new parts as necessary.
	8. Loose outer tie rod ends.	8. Check free play of outer tie rod ends and replace if required.
	9. Loose inner tie rod ends.	9. Replace steering gear assembly.
	10 Defective steering gear rotary valve.	10. Replace steering gear assembly.

DIAGNOSIS AND TESTING (Continued)

VEHICLE LEADS TO THE SIDE

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT WANT TO RETURN TO THE CENTER POSITION.	1. Radial tire lead.	1. Rotate tires as recommended in the Tire And Wheel Group of this service manual.
	2. Front suspension misaligned.	2. Align the front suspension as required. Refer to the Wheel Alignment Procedure in the Suspension Group of this service manual for the required wheel alignment procedure.
	3. Wheel braking.	3. Check for dragging brakes. Refer to the procedures in the Brake Group of this service manual.
	4. Unbalanced steering gear valve. (If this is the cause, the steering efforts will be very light in direction of lead and heavier in the opposite direction.	4. Replace steering gear.
STEERING WHEEL HAS FORE AND AFT LOOSENESS.	1. Steering wheel to steering column shaft retaining nut not properly tightened and torqued.	1. Tighten the retaining nut to its specified torque specification.
	2. Steering column lower bearing spring retainer slipped on steering column shaft.	2. Replace steering column.

POWER STEERING FLUID LEAK

CONDITION	POSSIBLE CAUSES	CORRECTION
LOW FLUID LEVEL WITH: NO VISIBLE SIGNS OF A LEAK ON THE STEERING GEAR, POWER STEERING PUMP, FLOOR OR ANYWHERE ELSE.	1. Overfilled power steering pump fluid reservoir.	1. Adjust the power steering fluid fill to the correct level.
LOW FLUID LEVEL WITH: VISIBLE LEAK ON STEERING GEAR, POWER STEERING PUMP, FLOOR OR ANYWHERE ELSE.	2. Power steering hose connections at the power steering pump or steering gear.	2. Check for loose fittings and if found, tighten the fitting to its specified torque. If fittings are tight examine the fittings for damaged or missing O-ring seals and replace as required.
	3. Power steering pump or power steering gear leaking.	3. Identify the location of the leak and repair or replace the component as required. Refer to Power Steering Pump and/or Power Steering Gear in this group of the service manual for required procedures.

DIAGNOSIS AND TESTING (Continued)

FOAMY OR MILKY POWER STEERING FLUID

CONDITION	POSSIBLE CAUSES	CORRECTION
AERATION AND OVERFLOW OF FLUID.	1. Air leaks.	1. Check for an air leak into the power steering system as described under Sucking Air Diagnosis and correct condition.
	2. Low fluid level.	2. Extremely cold temperatures may cause power steering fluid aeration if the power steering fluid is low. Add power steering fluid as required to bring level up to specification.
	3. Cracked power steering pump housing.	3. Remove power steering pump from vehicle and inspect the power steering pump housing for cracks. If a defect in the housing is found, replace the power steering pump.
	4. Water contamination.	4. Drain the power steering fluid from the system if there is evidence of contamination. Then refill the system with fresh clean power steering fluid.

POWER STEERING SYSTEM FLOW AND PRESSURE TEST

The following procedure is to be used to test the operation of the power steering system on this vehicle. This test will provide the flow rate of the power steering pump along with the maximum relief pressure. This test is to be performed any time a power steering system problem is present to determine if the power steering pump or power steering gear is not functioning properly. The following flow and pressure test is performed using the Power Steering Analyzer Kit, Special Tool 6815 (Fig. 2), hoses, Special Tools 6905 and 6959, adapters, Special Tool's 6972 and 8354, and fittings from adapter kit, Special Tool 6893.

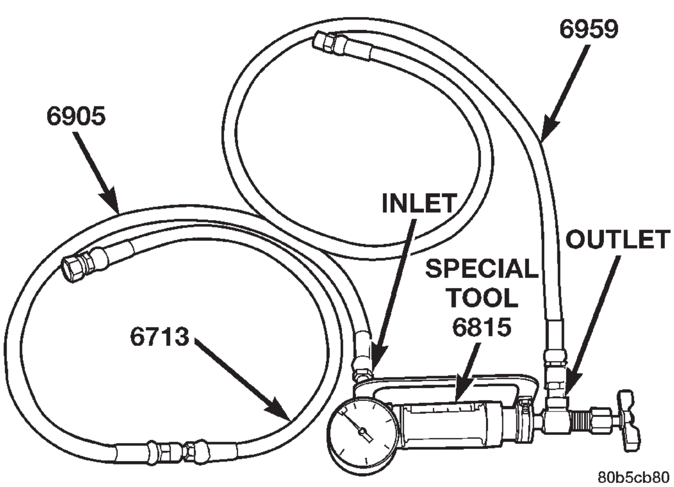


Fig. 2 Power Steering Analyzer With Hoses Installed

(1) Assemble hoses on Power Steering Analyzer, Special Tool 6815, as shown. Install Pressure Hose, Special Tool 6905 (in 6893 kit), in the inlet fitting on Power Steering Analyzer. Install Pressure Hose, Special Tool 6713 (in 6815 kit) on Pressure Hose, Special Tool 6905. Install Pressure Hose, Special Tool 6959, in the outlet fitting on Power Steering Analyzer.

CAUTION: To prevent personal injury, safety goggles should be worn at all times when performing any test procedures on the power steering system.

VEHICLES WITHOUT VARIABLE-ASSIST POWER STEERING

Install the following adapters from Adapter Set, Special Tool 6893 (Fig. 3), on the analyzer hose ends:

- Install Adapter Fitting, Special Tool 6844, on Pressure Hose, Special Tool 6713. Install Adapter Fitting, Special Tool 6826, on Pressure Hose, Special Tool 6959.

(1) Disconnect the power steering fluid pressure hose from the power steering pump (Fig. 4).

(2) Connect Adapter Fitting, Special Tool 6844, attached to pressure hose from inlet (gauge end) of Power Steering Analyzer to the pressure fitting on the power steering pump.

(3) Connect vehicle power steering fluid pressure hose to Adapter Fitting, Special Tool 6826, which should be already installed in the outlet hose (valve end) of Power Steering Analyzer.

DIAGNOSIS AND TESTING (Continued)

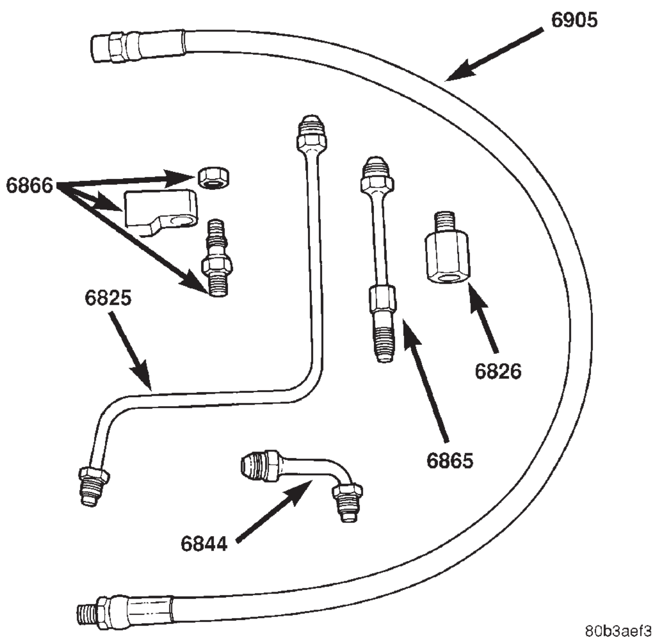


Fig. 3 Power Steering Analyzer Adapters 6893

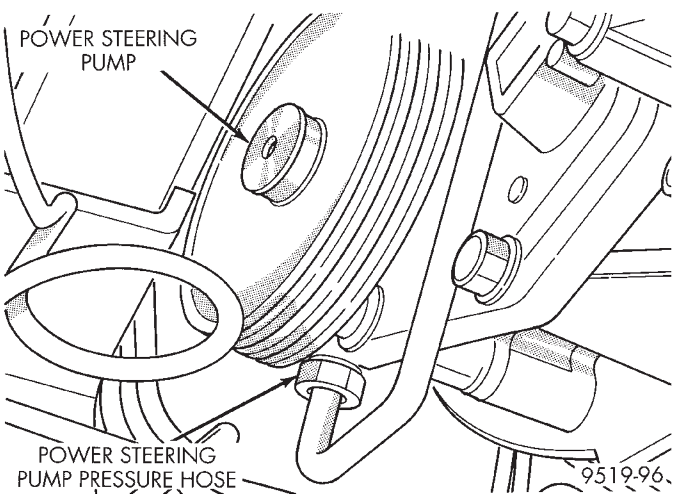


Fig. 4 Power Steering Pump Pressure Hose

(4) Follow the test procedure listed after VEHICLES WITH VARIABLE-ASSIST POWER STEERING.

VEHICLES WITH VARIABLE-ASSIST POWER STEERING

Install the following adapters from Adapter Set, Special Tool 6893, and Special Tool 8354, on the analyzer hose ends:

- Install Adapter Fitting (Banjo Fitting), Special Tool 6866, on Pressure Hose and Adapter Fitting, Special Tool 6713. Install Adapter Fitting Quick Connect for Special Tool 6972 on Pressure Hose, Special Tool 6959.

(1) Disconnect the power steering fluid pressure hose from the power steering pump (Fig. 5).

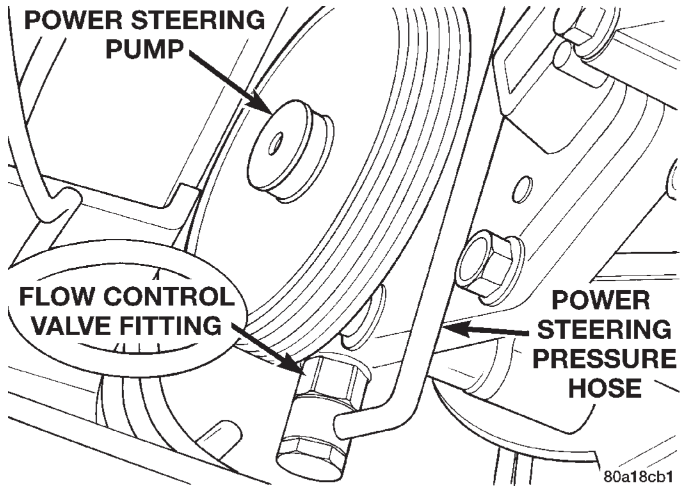


Fig. 5 Power Steering Pump Pressure Hose

(2) Install Adapter, Special Tool 6972-1 in the pressure fitting on the power steering pump. Install Adapter Fitting Banjo Fitting, Special Tool 6866, attached to the analyzer, on Special Tool 6972-1. Install the supplied nut and tighten.

(3) Attach Adapter, Special Tool 8354, to the banjo fitting on the power steering fluid pressure hose. Connect the Adapter Fitting Quick Connect for Special Tool 6972 (attached to the analyzer) onto Special Tool 8354.

(4) Follow the test procedure below.

TEST PROCEDURE

(1) Check belt tension and adjust as necessary.

(2) Completely open valve on Power Steering Analyzer.

(3) Start engine and let idle long enough to circulate power steering fluid through the analyzer and hoses, until the air is out of the fluid. Shut off engine.

(4) Check power steering fluid level and add fluid as necessary. Start engine again and let idle.

(5) The analyzer gauge should read below 862 kPa (125 psi). If above, inspect the hoses for restrictions and repair as necessary. The initial pressure should be in the range of 345-552 kPa (50-80 psi). The flow meter should read between 1.3 and 1.6 GPM.

CAUTION: The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than five seconds as the pump could be damaged.

(6) Close valve fully three times and record highest pressure indicated each time. **All three read-**

DIAGNOSIS AND TESTING (Continued)

ings must be above specifications and within 345 kPa (50 psi) of each other.

NOTE: Power steering pump maximum relief pressure is 8240 to 8920 kPa (1195 to 1293 psi.).

- Power steering pump pressure's are above specifications, but not within 345 kPa (50 psi) of each other, replace pump.
- Pressure's are within 345 kPa (50 psi) of each other, but below specifications, replace pump.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 4 seconds at a time because, pump damage will result.

(7) Completely open the valve on the Power Steering Analyzer. Turn the steering wheel to the extreme left until the stop in the steering gear is met, then turn the steering wheel to the right until the right stop is met. Record the highest indicated pressure at each position. Compare the recorded readings to the specifications. If the highest output pressures are not the same against either stop, the steering gear is leaking internally and must be replaced.

SERVICE PROCEDURES

POWER STEERING FLUID LEVEL CHECK

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING PARTS.

CAUTION: Do not use automatic transmission fluid in the power steering system.

Before removing the power steering filler cap, wipe the reservoir filler cap free of dirt and debris. Remove the cap and check the fluid level on its dipstick. The dipstick should indicate COLD when the fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F). Do not overfill the power steering system. Use only Mopar Power Steering Fluid, or an equivalent.

REMOVAL AND INSTALLATION

POWER STEERING FLUID PRESSURE SWITCH

REMOVE

(1) Disconnect the negative cable from the battery. Be sure cable is isolated from negative post on battery.

(2) Raise vehicle.

(3) Locate power steering pressure switch (Fig. 6) on back side of power steering gear.

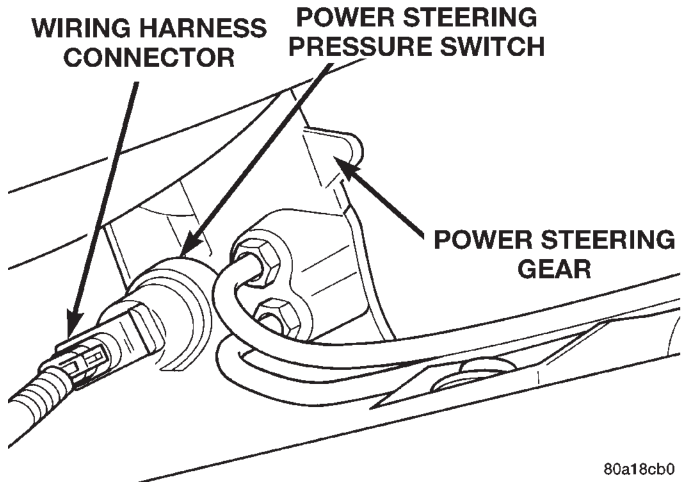


Fig. 6 Power Steering Pressure Switch Location On Steering Gear

(4) Remove the wiring harness connector (Fig. 6) from the power steering pressure switch.

(5) Using a crow foot and long extension, remove power steering pressure switch, from power steering gear.

INSTALL

CAUTION: When tightening the power steering pressure switch after installation in steering gear, do not exceed the torque specification shown in step 1 below. Over-tightening may result in stripping the threads out of the pressure switch port on the steering gear.

(1) Install power steering pressure switch into power steering gear by hand until fully seated. Then using a crow foot and extension, tighten power steering pressure switch to a torque of 16 N·m (12 ft. lbs.).

(2) Install wiring harness connector on power steering pressure switch. Be sure latch on wiring harness connector is fully engaged with locking tab on power steering pressure switch.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(3) Fill power steering reservoir to correct fluid level.

(4) Connect negative cable back on negative post of battery.

(5) Start engine and turn steering wheel several times from stop to stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. See Checking Fluid Level.

REMOVAL AND INSTALLATION (Continued)

POWER STEERING FLUID SUPPLY HOSE (2.0L/2.4L ENGINE)

REMOVAL

(1) Using a siphon pump, remove as much power steering fluid as possible from the remote power steering fluid reservoir.

CAUTION: Care must be used when removing the power steering fluid supply hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

(2) Remove the tie-strap (Fig. 7) holding the power steering fluid supply hose to the power steering pressure hose.

(3) Remove hose clamp, attaching power steering fluid supply hose to power steering fluid reservoir (Fig. 7). Then remove power steering fluid supply hose from power steering fluid reservoir.

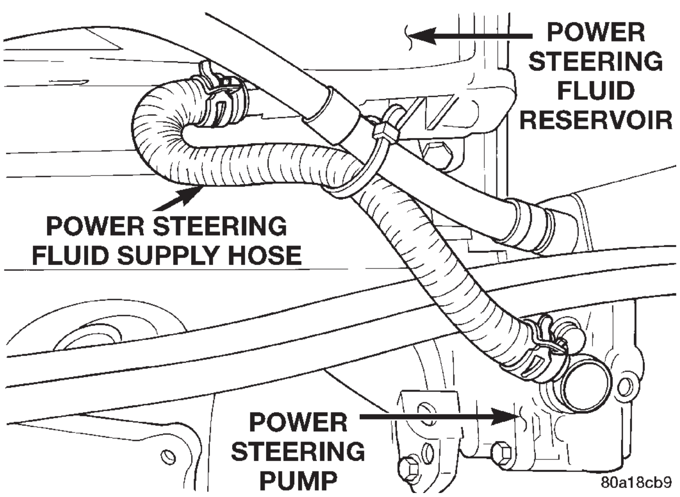


Fig. 7 Power Steering Fluid Supply Hose 2.0 And 2.4 Liter Engine

(4) Remove hose clamp, attaching power steering fluid supply hose to the power steering pump. Then remove power steering fluid supply hose from power steering pump fitting.

(5) Remove power steering fluid supply hose from engine.

INSTALLATION

(1) Install power steering fluid supply hose back on engine making sure it is correctly routed.

CAUTION: Care must be used when installing power steering fluid supply hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

(2) Install power steering fluid supply hose on power steering fluid reservoir fitting. Install hose clamp on power steering fluid supply hose at power steering fluid reservoir (Fig. 7). **Be sure hose clamp is installed on return hose past upset bead on power steering fluid reservoir.**

(3) Install power steering fluid supply hose on power steering pump fitting. Install hose clamp on power steering fluid supply hose at power steering pump fitting (Fig. 7). **Be sure hose clamp is installed on power steering fluid supply hose past upset bead on power steering pump fitting.**

CAUTION: The tie strap must be installed on the power steering pressure hose and supply hose to ensure proper routing of the hoses.

(4) Install the tie-strap (Fig. 7) holding the power steering fluid supply hose to the power steering pressure hose.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(5) Fill power steering fluid reservoir.

(6) Start the engine and let run for a few seconds. Then turn the engine off.

(7) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(8) Raise front wheels of vehicle off the ground.

(9) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(10) Add power steering fluid if necessary.

(11) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(12) Stop the engine. Check the fluid level and refill as required.

(13) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(14) After hose is installed, check for leaks at all hose connections.

POWER STEERING FLUID SUPPLY HOSE (2.5L ENGINE)

REMOVAL

(1) Using a siphon pump, remove as much power steering fluid as possible from the remote power steering fluid reservoir.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Care must be used when removing the power steering fluid supply hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

(2) Remove hose clamp, attaching power steering fluid supply hose to the power steering fluid reservoir. Then remove power steering fluid supply hose from power steering fluid reservoir (Fig. 8).

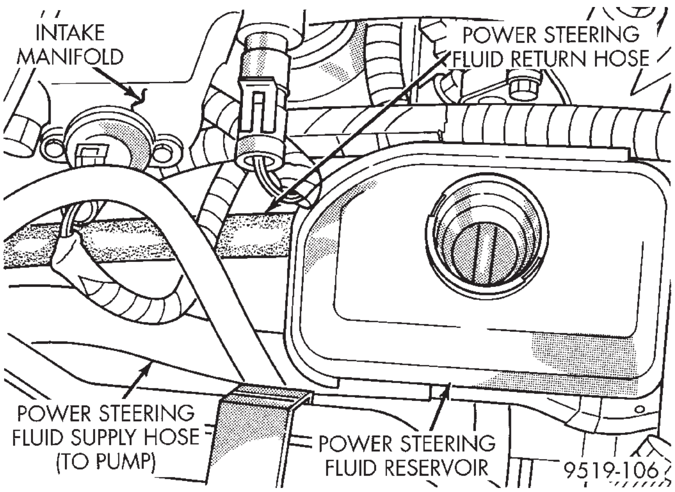


Fig. 8 Power Steering Fluid Supply Hose At Reservoir

(3) Raise vehicle.

(4) Remove hose clamp, attaching power steering fluid supply hose to the power steering pump. Then remove power steering fluid supply hose from power steering pump fitting (Fig. 9).

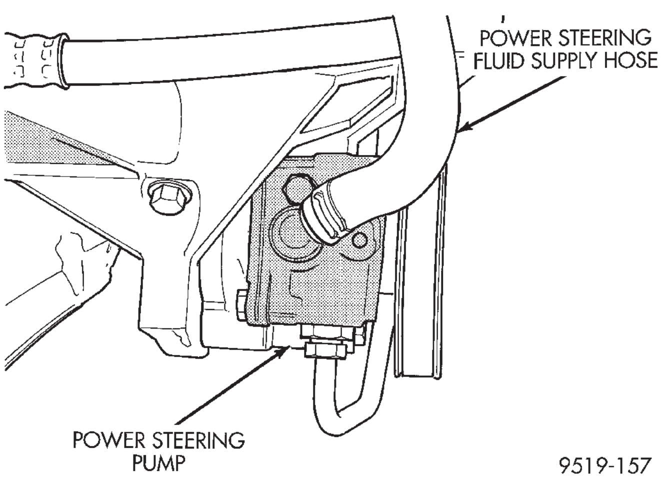


Fig. 9 Fluid Supply Hose At Power Steering Pump

INSTALLATION

(1) Install power steering fluid supply hose on power steering pump fitting, making sure it is correctly routed up to the power steering fluid reservoir. Install hose clamp on power steering fluid supply hose at power steering pump fitting (Fig. 9). **Be sure hose clamp is installed on power steering fluid supply hose past upset bead on power steering pump fitting.**

(2) Lower vehicle.

CAUTION: Care must be used when installing power steering fluid supply hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

(3) Install power steering fluid supply hose on power steering fluid reservoir fitting (Fig. 8). Install hose clamp on power steering fluid supply hose at power steering fluid reservoir. **Be sure hose clamp is installed on return hose past upset bead on power steering fluid reservoir.**

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(4) Fill power steering fluid reservoir.

(5) Start the engine and let run for a few seconds. Then turn the engine off.

(6) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(7) Raise front wheels of vehicle off the ground.

(8) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(9) Add power steering fluid if necessary.

(10) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(11) Stop the engine. Check the fluid level and refill as required.

(12) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(13) After hose is installed, check for leaks at all hose connections.

POWER STEERING FLUID PRESSURE HOSE

Service all power steering hoses with the vehicle raised on a hoist. Cap all open ends of hoses, power steering pump fittings and steering gear ports to prevent the entry of foreign material into the components.

REMOVAL AND INSTALLATION (Continued)

WARNING: POWER STEERING OIL, ENGINE PARTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

REMOVAL

NOTE: To service the power steering pressure hose on this vehicle, the front suspension crossmember and steering gear will need to be lowered away from the body and frame of the vehicle. This is required for access to the power steering hose connections on the side of the steering gear. Refer to the steering gear service procedure in this group of the service manual for the required procedure for removal of the front suspension crossmember.

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section in this manual, for the required lifting procedure to be used for this vehicle.

CAUTION: When lowering the front suspension crossmember, its installed position on the vehicle's body must be marked on the crossmember before it is lowered. Use procedure for the removal and replacement of the steering gear that is in this group of the service manual for the required procedure to locate and lower crossmember.

(2) Lower the front suspension crossmember far enough to gain access to the high and low pressure ports on the steering gear.

(3) Disconnect the power steering pressure hose (Fig. 10) at the power steering gear. Drain power steering fluid from power steering pump and hose through open end of hose.

(4) **If vehicle is equipped with a 2.0 or 2.4 liter engine,** remove power steering pressure hose routing bracket from the power steering return hose bracket on rear of engine (Fig. 11). Then remove the nut attaching the power steering pressure hose routing bracket to stud on side of cylinder head (Fig. 12).

(5) **If vehicle is equipped with a 2.5 liter engine,** remove the 2 routing brackets (Fig. 13) attaching the power steering return hose to the power steering pressure hose routing brackets. Then remove the 2 bolts attaching the power steering pressure hose routing brackets to the cylinder head (Fig. 13).

(6) Remove the tie-strap (Fig. 11) holding the power steering fluid supply hose to the power steering pressure hose.

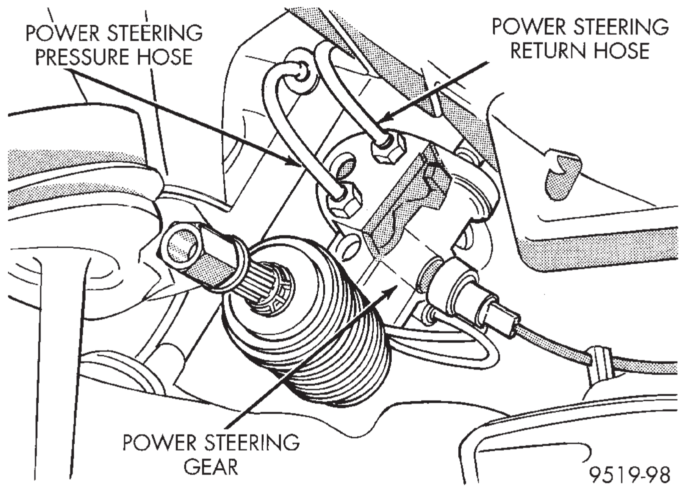


Fig. 10 Power Steering Hose Connections At Steering Gear

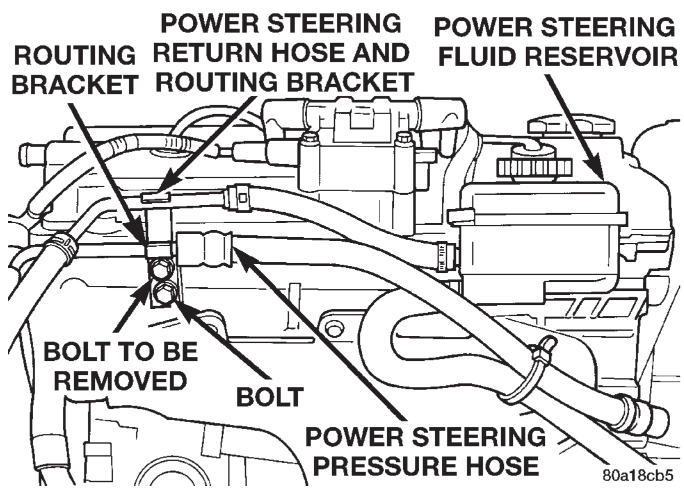


Fig. 11 2.0 And 2.4 Liter Power Steering Hose Routing

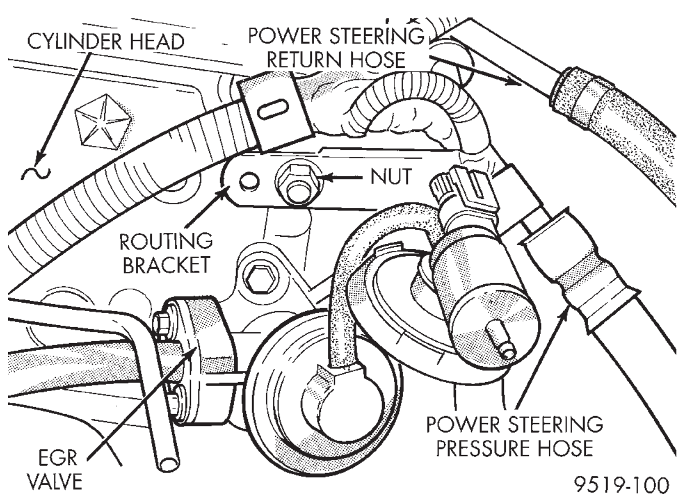


Fig. 12 Power Steering Hose Routing Bracket Attachment To Cylinder Head

REMOVAL AND INSTALLATION (Continued)

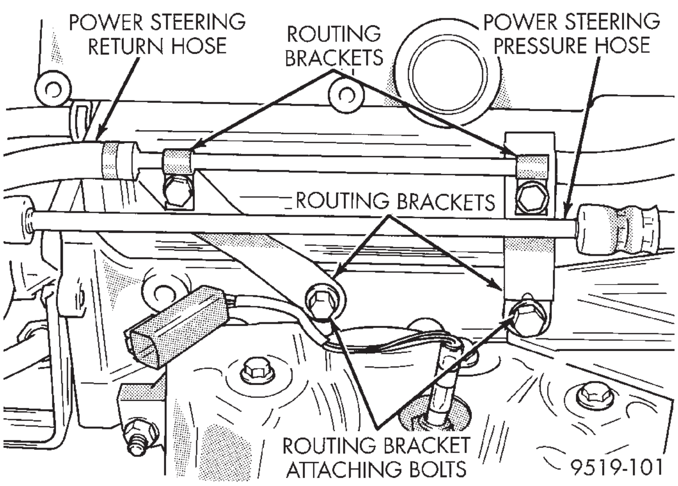


Fig. 13 2.5 Liter Power Steering Hose Routing

(7) Remove the power steering pressure hose from the pressure fitting on the power steering pump (Fig. 14) (Fig. 15). On vehicles with speed-sensitive variable assist power steering, be careful not to loose the copper sealing washers on each side of the fitting (Fig. 16).

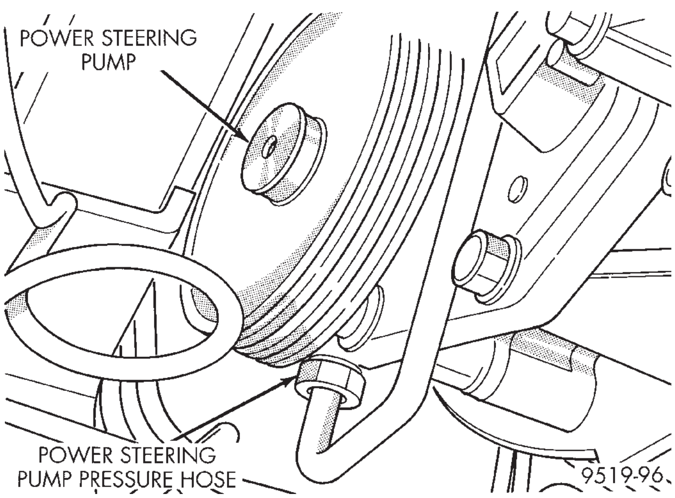


Fig. 14 Power Steering Pump Pressure Fitting W/O Variable Assist Power Steering

(8) Power steering fluid pressure hose is removed from the vehicle from the bottom rear of engine compartment.

(9) Discard all used O-rings located at ends of power steering pressure hose fittings.

INSTALLATION

(1) Install power steering pressure hose in vehicle from bottom of engine compartment using the reverse order of removal.

(2) Using a lint free towel, wipe clean all open power steering hose ends, and the power steering pump and steering gear ports.

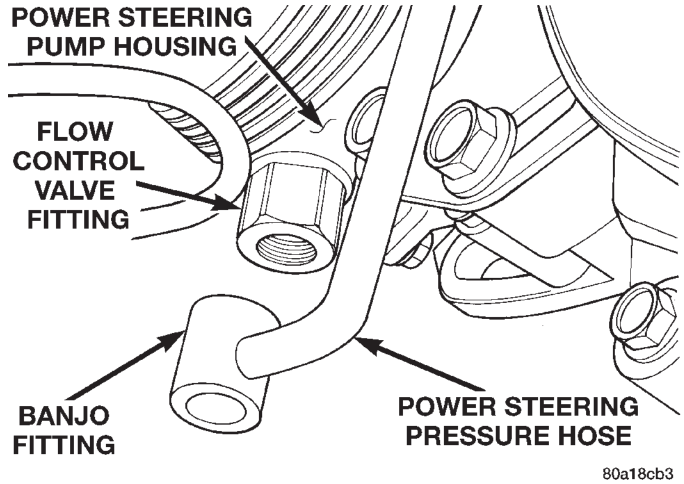


Fig. 15 Power Steering Pump Pressure Fitting With Variable Assist Power Steering

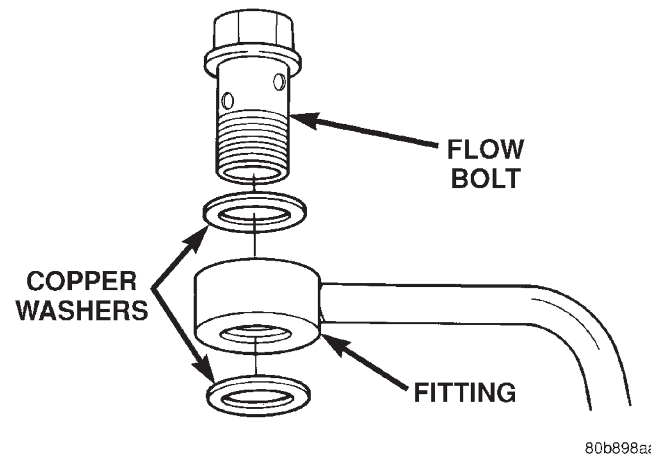


Fig. 16 Pressure Fitting And Washers

(3) On vehicles without speed-sensitive variable-assist steering install new O-rings on the power steering pressure hose fittings. Lubricate O-rings using fresh clean power steering fluid.

(4) On vehicles with speed-sensitive variable-assist steering, install a copper washer on each side of the fitting, then place the flow bolt through the fitting (Fig. 16).

(5) Attach the power steering pressure hose to outlet fitting on the power steering pump. **Do not tighten or torque pressure fitting at this time.**

CAUTION: Hoses must remain away from exhaust system, vehicle components and unfriendly surfaces causing possible damage to power steering hoses.

(6) Correctly route power steering pressure hose avoiding tight bends or kinking of the hose. Install power steering pressure hose routing brackets and

REMOVAL AND INSTALLATION (Continued)

attaching bolts on engine (Fig. 11), (Fig. 12) and (Fig. 13).

(7) Route power steering pressure hose to pressure port on power steering gear. Install power steering pressure hose, on steering gear and loosely install tube nut into steering gear. Then using a crow foot, (Fig. 17) tighten the power steering pressure hose tube nut to a torque of 31 N·m (275 in. lbs.).

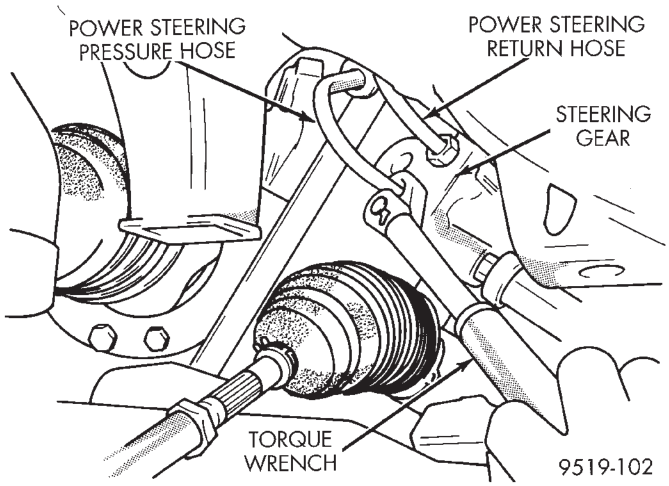


Fig. 17 Power Steering Pressure Hose Tube Nut

CAUTION: When installing the front suspension crossmember, it must be installed back in the same location on the vehicle's body as when it was originally installed when the vehicle was built. Use procedure for installing the steering gear that is in this group of the service manual for the required procedure to install and locate crossmember.

(8) Raise the front suspension crossmember and steering gear back up into the vehicle. Refer to the steering gear service procedure in this group of the service manual for the required procedure to install the front suspension crossmember.

(9) Install power steering fluid pressure hose on flow control valve fitting (Fig. 14) or (Fig. 15). Tighten the tube nut (Fig. 14) to a torque of 31 N·m (275 in. lbs.). Tighten the banjo fitting flow bolt (Fig. 16) to a torque of 47 N·m (35 ft. lbs.).

CAUTION: The tie strap must be installed on the power steering pressure hose and supply hose to ensure proper routing of the hoses.

(10) Install the tie-strap (Fig. 11) holding the power steering fluid supply hose to the power steering pressure hose.

(11) Lower vehicle.

(12) Start the engine and let run for a few seconds. then turn the engine off.

(13) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(14) Raise front wheels of vehicle off the ground.

(15) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(16) Add power steering fluid if necessary.

(17) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(18) Stop the engine. Check the fluid level and refill as required.

(19) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(20) After hose is installed, check for leaks at all hose connections.

POWER STEERING FLUID RETURN HOSE

Service all power steering hoses with the vehicle raised on a hoist. Cap all open ends of hoses, power steering pump fittings and steering gear ports to prevent the entry of foreign material into the components.

WARNING: POWER STEERING OIL, ENGINE PARTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

REMOVE

NOTE: To remove the power steering return hose on this vehicle, the front suspension crossmember and steering gear will need to be lowered away from the body of the vehicle. This is required for access to the power steering hose connections on the side of the steering gear. Refer to the steering gear service procedure in this group of the service manual for the required procedure to remove the front suspension crossmember.

(1) Siphon all power steering fluid from the power steering fluid reservoir.

CAUTION: Care must be used when removing power steering fluid return hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

REMOVAL AND INSTALLATION (Continued)

(2) Remove power steering fluid return hose from nipple on power steering fluid reservoir (Fig. 18) and (Fig. 19).

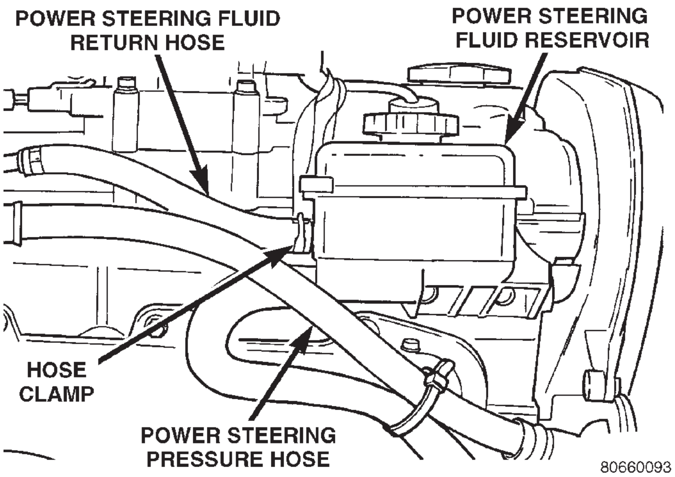


Fig. 18 Power Steering Fluid Return Hose At Reservoir 2.4 Liter

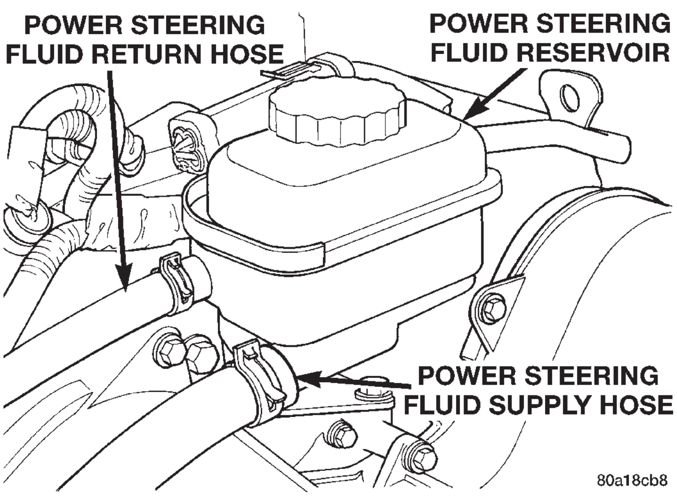


Fig. 19 Power Steering Fluid Return Hose At Reservoir 2.5 Liter

(3) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section in this manual, for the required lifting procedure to be used for this vehicle.

CAUTION: When lowering the front suspension crossmember, its installed position on the vehicle's body must be marked on the crossmember before it is lowered. Use procedure for the removal and replacement of the steering gear that is in this group of the service manual for the required procedure to locate and lower crossmember.

(4) Lower the front suspension crossmember far enough to gain access to the high and low pressure ports on the steering gear.

(5) Disconnect power steering fluid return hose at power steering cooler line (Fig. 20). Drain power steering fluid from hose.

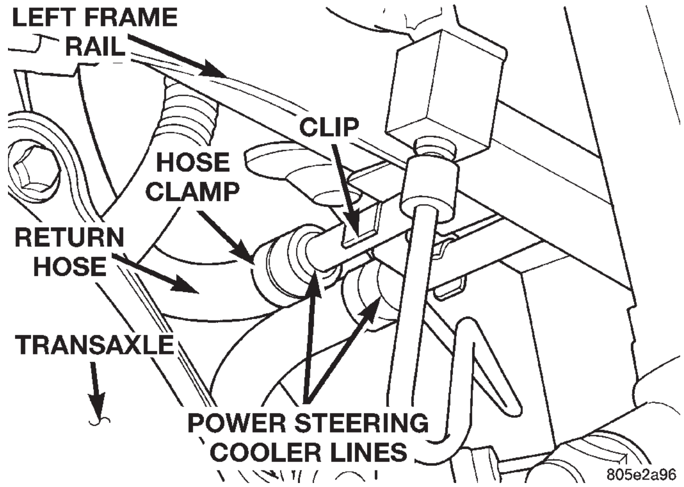


Fig. 20 Power Steering Hose Connections At Cooler Lines

(6) **If vehicle is equipped with a 2.4 liter engine,** remove power steering pressure hose routing bracket from the power steering return hose routing bracket on rear of engine (Fig. 21). Then remove the bolt (Fig. 21) attaching the power steering pressure hose routing bracket to the cylinder head.

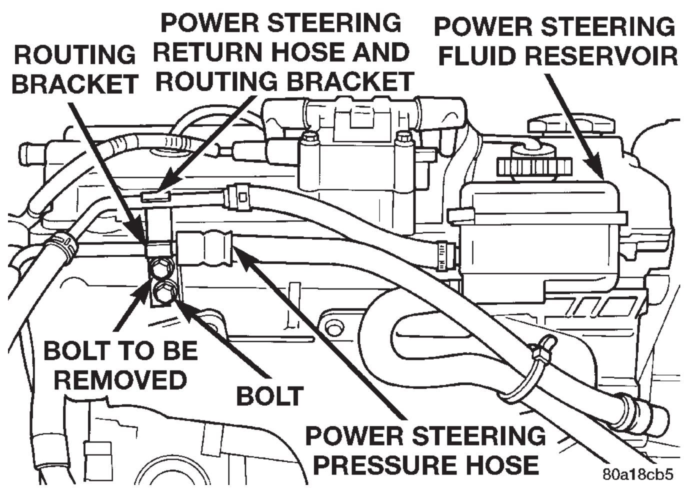


Fig. 21 2.4 Liter Power Steering Hose Routing

(7) **If vehicle is equipped with a 2.5 liter engine,** remove the 2 routing brackets (Fig. 22) attaching the power steering return hose to the power steering pressure hose routing brackets.

(8) Remove the power steering return hose from the vehicle. The power steering return hose is removed from the bottom of the engine compartment.

INSTALL

(1) Install power steering return hose on vehicle. Power steering return hose is installed from the bot-

REMOVAL AND INSTALLATION (Continued)

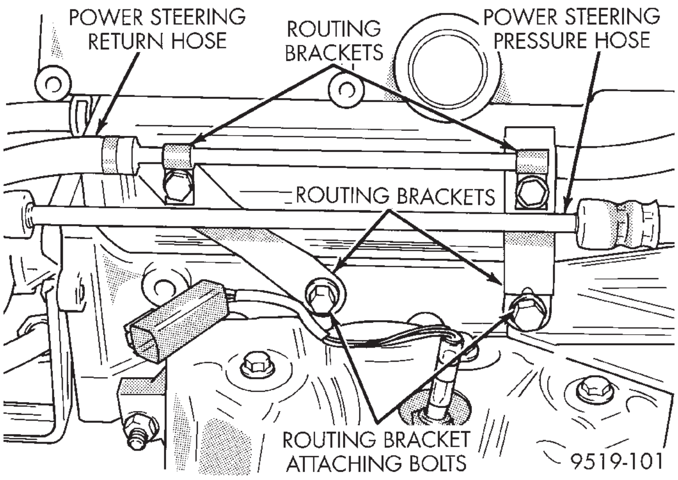


Fig. 22 2.5 Liter Power Steering Hose Routing

tom of the vehicles engine compartment using the reverse steps of removal.

(2) Using a lint free towel, wipe clean all open power steering hose ends, and the power steering gear port.

(3) Install a new O-ring on the power steering return hose to steering gear fitting.

(4) Lubricate O-ring using fresh clean power steering fluid.

(5) Install the power steering return hose, on the cooler lines (Fig. 20).

CAUTION: Hoses must remain away from exhaust system, vehicle components and unfriendly surfaces causing possible damage to power steering hoses.

(6) Correctly route power steering return hose up to the power steering fluid reservoir, avoiding tight bends or kinking of the hose.

(7) **If vehicle is equipped with a 2.4 liter engine,** install power steering return hose routing bracket on rear of cylinder head (Fig. 21) and securely tighten bolt. Then install the power steering pressure hose routing bracket on the return hose routing bracket (Fig. 21) and securely tighten attaching bolt.

(8) **If vehicle is equipped with a 2.5 liter engine,** install the 2 routing brackets (Fig. 22) attaching the power steering return hose to the power steering pressure hose routing brackets.

CAUTION: When installing the front suspension crossmember, it must be installed back in the same location on the vehicle's body as when it was originally installed when the vehicle was built. Use procedure for installing the steering gear that is in this group of the service manual for the required procedure to install and locate crossmember.

(9) Raise the front suspension crossmember and steering gear back up into the vehicle. Refer to the steering gear service procedure in this group of the service manual for the required procedure to install the front suspension crossmember.

(10) Lower vehicle.

CAUTION: Care must be used when installing power steering fluid return hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

(11) Install power steering return hose on power steering fluid reservoir fitting. Install hose clamp on power steering return hose at power steering fluid reservoir (Fig. 18) and (Fig. 19). **Be sure hose clamp is installed on return hose past upset bead on power steering fluid reservoir.**

(12) Start the engine and let run for a few seconds. Then turn the engine off.

(13) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(14) Raise front wheels of vehicle off the ground.

(15) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(16) Add power steering fluid if necessary.

(17) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(18) Stop the engine. Check the fluid level and refill as required.

(19) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(20) After hose is installed, check for leaks at all hose connections.

POWER STEERING FLUID COOLER

REMOVAL

(1) Raise vehicle using a frame contact type hoist or supported as required using jack stands. See Hoisting in the Lubrication And Maintenance group of this service manual for the required hoisting or jacking procedure to be used for this vehicle.

(2) Remove the front fascia and the grill as an assembly from the vehicle. Refer to Front Bumper/Fascia in Group 13 of this service manual for the proper procedure.

(3) Remove the crimp clamps (Fig. 23) from the power steering fluid hoses. Drain power steering fluid from the hoses and the power steering fluid cooler.

REMOVAL AND INSTALLATION (Continued)

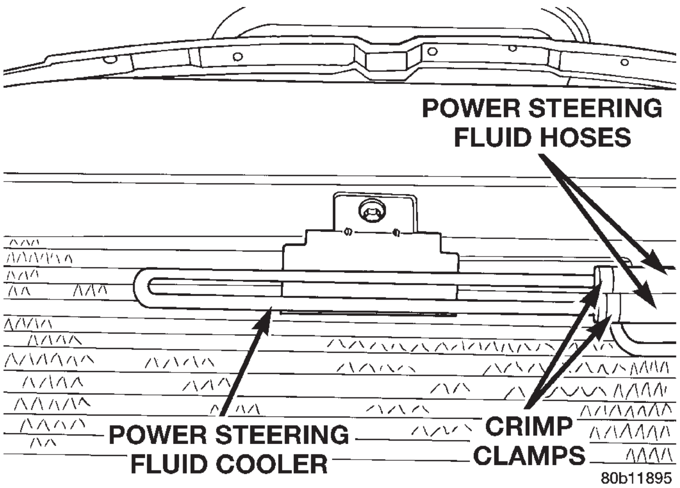


Fig. 23 Hose Clamps At Power Steering Fluid Cooler

(4) Remove bolt (Fig. 24) attaching the power steering fluid cooler to the bumper reinforcement (Fig. 24).

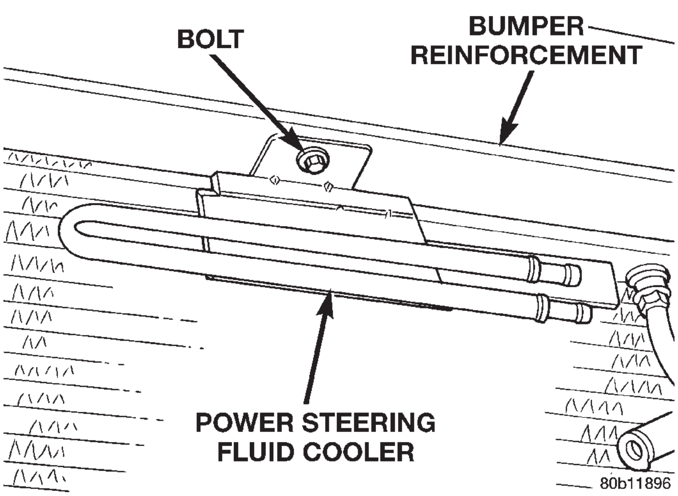


Fig. 24 Power Steering Fluid Cooler Attachment

INSTALLATION

(1) Install the power steering fluid cooler on the bumper reinforcement as shown in (Fig. 24).

(2) Install bolt (Fig. 24) attaching the power steering fluid cooler to the bumper reinforcement. Tighten the attaching bolt to a torque of 7 N·m (60 in. lbs.).

(3) Install power steering fluid hoses on the power steering fluid cooler. Install **NEW** crimp style hose clamps (Fig. 23) on the power steering fluid hoses. **Be sure hose clamps are installed on hose past the upset bead on the power steering oil cooler.**

(4) Install the front fascia and grill on the vehicle. Refer to Front Bumper/Fascia in Group 13 of this service manual for the proper procedure.

(5) Lower the vehicle to a point where front tires are just off the ground.

(6) Start the engine and let run for a few seconds. Then turn the engine off.

(7) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(8) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(9) Add power steering fluid if necessary.

(10) Stop the engine. Check the fluid level and refill as required.

(11) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

POWER STEERING FLUID COOLER LINES

REMOVE

(1) Remove intermediate steering shaft coupler (Fig. 25) from the steering gear shaft.

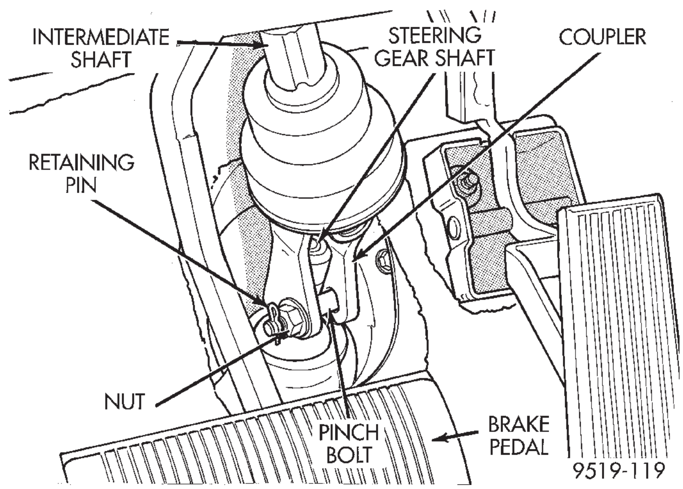


Fig. 25 Intermediate Shaft Coupler Attachment To Steering Gear

(2) Siphon as much power steering fluid as possible from the power steering fluid reservoir.

(3) Raise the vehicle using a frame contact type hoist or supported as required using jack stands. See Hoisting in the Lubrication and Maintenance group of this service manual for the required hoisting or jacking procedure to be used for this vehicle.

(4) Remove the left front wheel/tire.

(5) Remove the front fascia and the grill as an assembly from the vehicle. Refer to Front Bumper/Fascia in Group 13 of this service manual for the proper procedure.

(6) Remove the hose clamps (Fig. 26) from the power steering fluid hoses. Drain power steering fluid from the hoses and the power steering fluid cooler.

(7) Remove the bracket attaching the power steering fluid cooler lines to the left front frame rail (Fig. 27).

REMOVAL AND INSTALLATION (Continued)

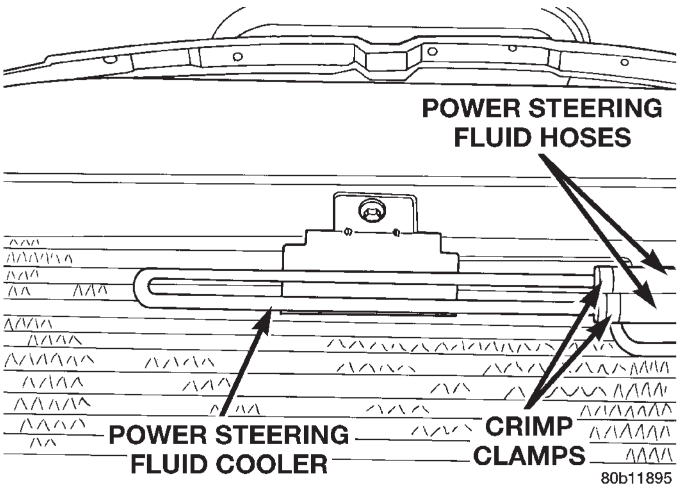


Fig. 26 Hose Clamps At Power Steering Fluid Cooler

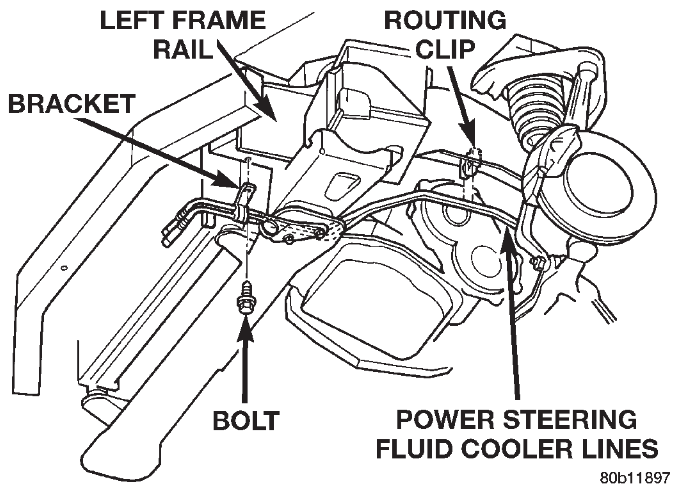


Fig. 27 Power Steering Cooler Line Attachment

(8) Lower the front suspension crossmember. Refer to the steering gear service procedures in this group of the service manual for the required procedure for the removal of the front suspension crossmember.

(9) Remove the clip (Fig. 28) holding the power steering fluid cooler lines together.

(10) Remove the hose clamp (Fig. 28) attaching the power steering fluid return hose from the engine, (Fig. 28) to the power steering fluid cooler lines.

(11) Remove the power steering fluid return hose (Fig. 29) from the power steering gear.

(12) Remove the power steering fluid cooler lines from the routing clip on the left front frame rail (Fig. 27).

(13) Separate the power steering cooler line assembly into 2 separate pieces.

(14) Remove each cooler line separately from the vehicle. The cooler lines are removed out through the front of the vehicle in the area between the radiator and the closure panel.

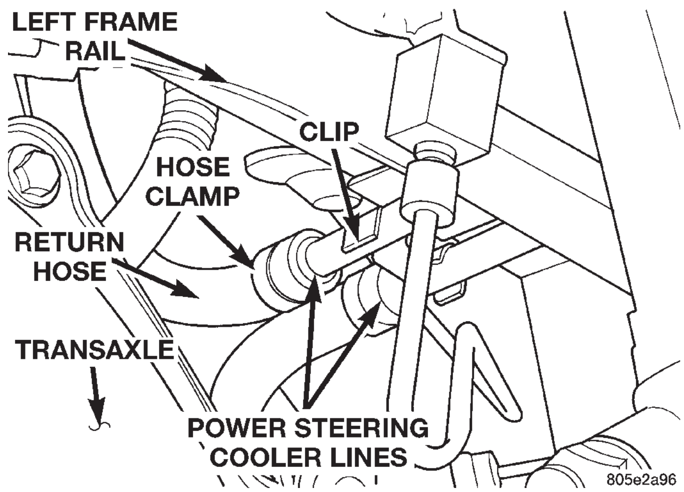


Fig. 28 Power Steering Cooler Line Clip

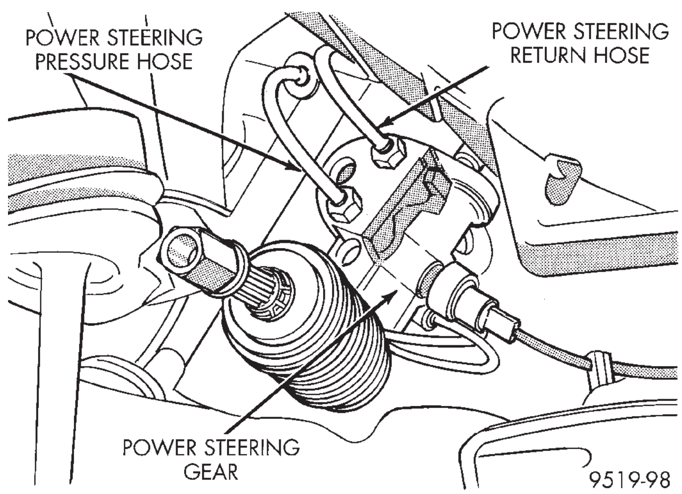


Fig. 29 Power Steering Hose Connections At Steering Gear

INSTALL

(1) Install the cooler lines individually using the reverse procedure of their removal.

(2) Install the cooler lines in the routing clip on the left frame rail (Fig. 27).

(3) Install the power steering fluid return hose coming from the engine on the power steering cooler line (Fig. 28). Install the hose clamp on the power steering fluid hose. **Be sure hose clamp is installed on hose past the upset bead on the power steering cooler line.**

(4) Install the power steering fluid return hose on the steering gear. Then using a crow foot and torque wrench (Fig. 30) tighten the tube nut to a torque of 31 N·m (275 in. lbs.).

(5) Install the clip (Fig. 28) holding the 2 power steering fluid cooler lines together.

(6) Install the front suspension crossmember. Refer to the steering gear service procedures in this group

REMOVAL AND INSTALLATION (Continued)

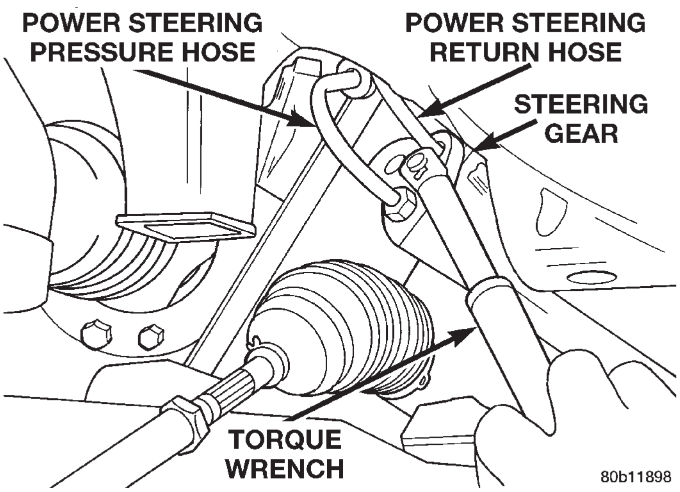


Fig. 30 Torquing Power Steering Fluid Hose Tube Nuts

of the service manual for the required procedure for the installation of the front suspension crossmember.

(7) Install the left front wheel/tire.

(8) Install the bracket attaching the power steering cooler lines to the left frame rail (Fig. 27). Install bracket attaching bolt and tighten to a torque of 7 N·m (60 in. lbs.).

(9) Install power steering fluid hoses on the power steering fluid cooler (Fig. 26). Install the hose clamps on the power steering fluid hoses. **Be sure hose clamps are installed on hose past the upset bead on the power steering oil cooler.**

(10) Install the front fascia and grill on the vehicle. Refer to Front Bumper/Fascia in Group 13 of this service manual for the proper procedure.

(11) Lower the vehicle to a point where front tires are just off the ground.

(12) Connect the steering column intermediate shaft on the shaft of the steering gear (Fig. 25). Install **a new** coupler retaining pinch bolt and tighten to a torque of 27 N·m (240 in. lbs.). **Be sure to install the coupler retaining pinch bolt retention pin (Fig. 25).**

(13) Start the engine and let run for a few seconds. Then turn the engine off.

(14) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(15) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(16) Add power steering fluid if necessary.

(17) Stop the engine. Check the fluid level and refill as required.

(18) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

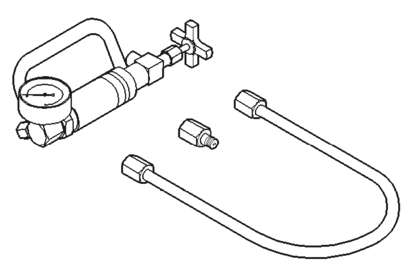
SPECIFICATIONS

POWER STEERING FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
POWER STEERING PUMP:	
Discharge Fitting	75 N·m (55 ft. lbs.)
Rear Bracket Mounting Bolts	54 N·m (40 ft. lbs.)
Front Bracket Mounting Bolts	54 N·m (40 ft. lbs.)
Bracket To Engine Mounting Bolts	54 N·m (40 ft. lbs.)
POWER STEERING FLUID HOSES:	
Hose Tube Nuts	31 N·m (275 in. lbs.)
Banjo Fitting Flow Bolt	47 N·m (33 ft. lbs.)
Return Hose Bracket To Head (Except 2.5L)	28 N·m (21 ft. lbs.)
Pressure Hose To Return Hose Bracket (Except 2.5L)	9 N·m (75 in. lbs.)
Pressure Hose To Cylinder Head (2.5L)	54 N·m (40 ft. lbs.)
Return Hose To Pressure Hose Bracket (2.5L)	9 N·m (75 in. lbs.)
POWER STEERING FLUID RESERVOIR:	
Reservoir To Mounting Bracket Or Engine	28 N·m (21 ft. lbs.)
Reservoir Bracket To Engine	28 N·m (21 ft. lbs.)

SPECIAL TOOLS

POWER STEERING



Power Steering Analyzer 6815

POWER STEERING PUMP

INDEX

DESCRIPTION AND OPERATION

POWER STEERING PUMP OPERATION

On all vehicles equipped with power steering, the hydraulic pressure for operation of the power steering gear is provided by a belt driven power steering pump (Fig. 1).

Vehicles that are equipped with the standard non-variable power steering use a constant flow rate and displacement vane type power steering pump.

Vehicles that are equipped with variable assist power steering use a droop flow power steering pump. The droop flow power steering pump is a constant displacement but a variable flow rate vane type power steering pump. This power steering pump provides the speed-sensitive variable-assist power steering.

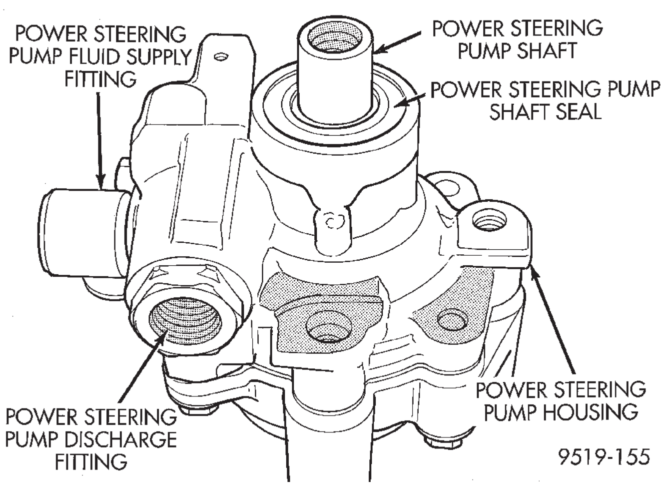


Fig. 1 Power Steering Pump

In the event of a power steering pump drive belt failure, manual steering control of the vehicle can still be maintained. However, under these conditions, steering effort will be significantly increased.

All vehicles equipped with power steering use a remote mounted reservoir for the power steering fluid. The power steering fluid remote reservoir on the 2.0 ltr. and 2.4 ltr. engine is mounted to the rear of the cylinder head on the passenger side of the vehicle. The power steering fluid remote reservoir on the 2.5 ltr. engine is mounted to the front side of the engine between the cylinder heads.

The service procedures for the TTA power steering pump are limited to the areas and components listed below. **No repair procedures are to be done on internal components of the TTA power steering pumps.**

- Repair of power steering fluid leaks from areas of the power steering pump sealed by O-rings is allowed (See Pump Leak Diagnosis). However power steering pump shaft seal leakage will require replacement of the pump.
- Power steering fluid reservoirs, related components and attaching hardware.
- Power steering fluid reservoir filler cap/dipstick assemblies.

Because of unique shaft bearings, flow control levels or pump displacements, power steering pumps may be used only on specific vehicle applications. Be sure that all power steering pumps are only replaced with a pump that is the correct replacement for that specific application.

Hydraulic pressure is provided for operation of the power steering gear by the belt driven power steering pump. The power steering pump is connected to the steering gear by a power steering fluid pressure hose, return hose, power steering fluid cooler and remote power steering fluid reservoir.

DESCRIPTION AND OPERATION (Continued)

Rectangular pumping vanes in the shaft driven rotor, move power steering fluid from the intake to the cam ring pressure cavities of the power steering pump. As the rotor begins to turn, centrifugal force throws the vanes against the inside surface of the cam ring to pickup residual oil. This oil is then forced into the high pressure area. As more oil is picked up by the vanes, the additional oil is forced into the cavities of the thrust plate through two crossover holes in the cam ring and pressure plate. The crossover holes empty into the high pressure area between the pressure plate and the housing end cover.

As the high pressure area is filled, oil flows under the vanes in the rotor slots, forcing the vanes to follow the inside surface of the cam ring. As the vanes reach the restricted area of the cam ring, oil is forced out from between the vanes. When excess oil flow is generated during high-speed operation, a regulated amount of oil returns to the pump intake side through a flow control valve. The flow control valve reduces the power required to drive the pump and holds down temperature build-up.

When steering conditions exceed maximum pressure requirements, such as when the wheels are turned against the stops. The pressure built up in the steering gear exerts pressure on the spring end of the flow control valve. The high pressure lifts the relief valve ball from its seat and allows oil to flow through a trigger orifice located in the outlet fitting. This reduces pressure on the spring end of the flow control valve which then opens and allows the oil to return to the intake side of the pump. This action limits maximum pressure output of the power steering pump.

Under normal power steering pump operating conditions, pressure requirements of the pump are below maximum, causing the pressure relief valve to remain closed.

SERVICE PROCEDURES

POWER STEERING PUMP INITIAL OPERATION

CAUTION: The fluid level should be checked with engine off to prevent injury from moving components. Use only Mopar® Power Steering Fluid. Do not use automatic transmission fluid. Do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **FULL COLD** when the fluid is at normal temperature of approximately 21°C to 27°C (70°F to 80°F).

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(2) Start the engine and let run for a few seconds. Then turn the engine off.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(6) Add power steering fluid if necessary.

(7) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(8) Stop the engine. Check the fluid level and refill as required.

(9) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

REMOVAL AND INSTALLATION

POWER STEERING PUMP (2.0L/2.4L ENGINE)

NOTE: This vehicle is equipped with two different power steering pumps. The type of power steering pump used depends on what type of power steering system the vehicle is equipped with. The standard steering system uses a constant flow rate power steering pump. The variable-assist power steering system uses a variable flow rate power steering pump. The external difference between the two power steering pumps is the type of fitting used on the power steering fluid pressure hose connection to the power steering pump. The constant flow rate power steering pump uses a standard tube nut fitting at the power steering pump. The variable flow rate power steering pump uses a banjo type fitting at the power steering pump. The removal and installation procedures for both power steering pumps though is the same.

WARNING: POWER STEERING OIL, ENGINE COMPONENTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES, OR ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

REMOVAL

(1) Remove battery cable from (-) negative post on battery and isolate cable.

(2) Siphon as much power steering fluid as possible out of the remote power steering fluid reservoir.

(3) Raise vehicle.

(4) Remove right front tire and wheel.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the accessory drive splash shield (Fig. 2).

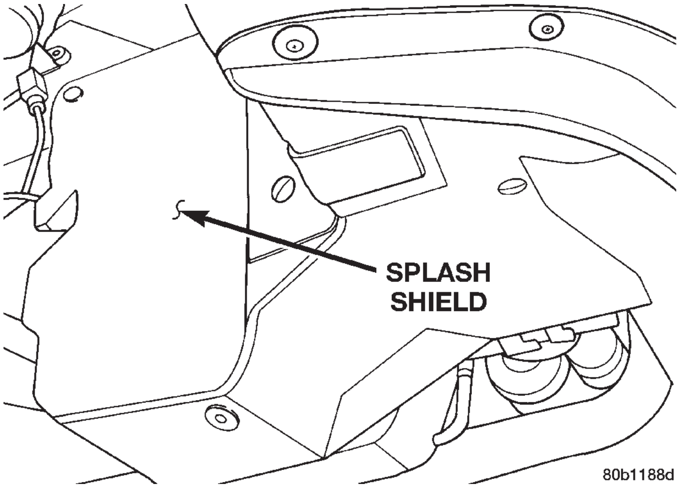


Fig. 2 Accessory Drive Splash Shield

(6) Remove power steering fluid pressure hose from pressure fitting on power steering pump (Fig. 3) or (Fig. 4). Let power steering fluid drain out of the power steering fluid supply hose, power steering pump and power steering fluid pressure hose. **After power steering fluid has drained out of pump and hose, install a cap on the power steering pressure hose and a plug in the power steering pump pressure fitting.**

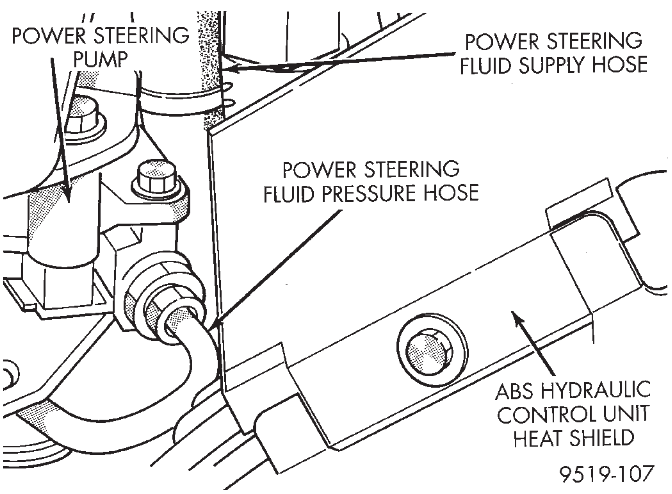


Fig. 3 Power Steering Pressure Hose Attachment To Pump W/O Variable-Assist Steering

(7) Remove hose clamp, attaching power steering fluid supply hose to the power steering pump suction fitting (Fig. 3) or (Fig. 4). Then remove power steering fluid supply hose from fitting. **Install a cap on suction fitting of power steering pump.**

(8) Remove the heat shield for the antilock brakes hydraulic control unit (Fig. 3) or (Fig. 4).

(9) Remove bolt at adjustment slot, (Fig. 5) which attaches power steering pump front mounting bracket to the cast aluminum accessory drive bracket on engine.

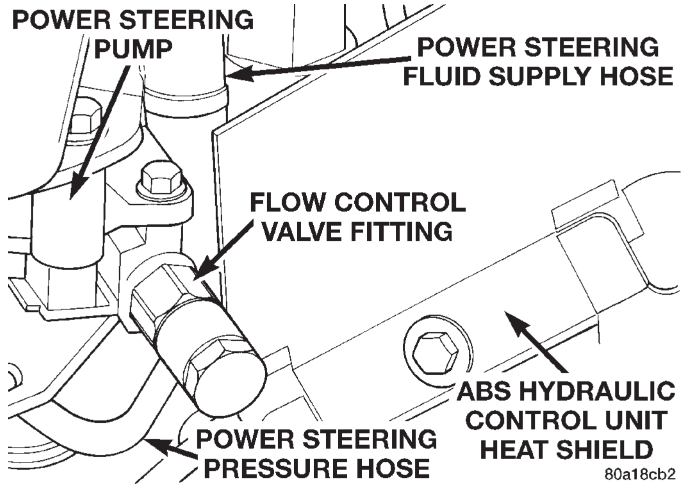


Fig. 4 Power Steering Pressure Hose Attachment To Pump With Variable-Assist Steering

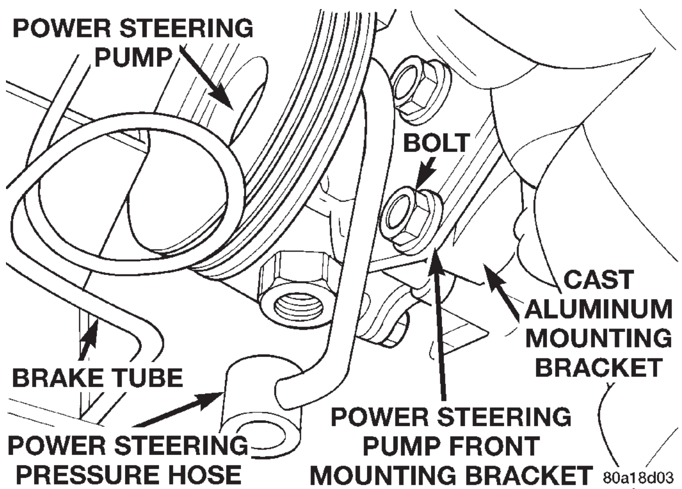


Fig. 5 Power Steering Pump Front Bracket Attachment (Typical)

(10) Remove bolt (Fig. 6) attaching back of power steering pump to the cast aluminum mounting bracket.

(11) Remove retainer for wheel speed sensor cable grommet (Fig. 7) from right inner fender.

(12) Remove speed sensor cable sealing grommet from inner fender (Fig. 8). Disconnect the wheel speed sensor cable from the vehicle wiring harness (Fig. 8). Push vehicle wiring harness back through hole in inner fender.

(13) If vehicle is not equipped with antilock brakes, just a sealing plug will be installed in the wheel speed sensor cable routing hole (Fig. 9). Remove the sealing plug from the hole.

(14) Remove bolt attaching top of power steering pump front bracket to the cast aluminum mounting bracket (Fig. 10). Access to the top bolt is through the wheel speed sensor cable routing hole (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

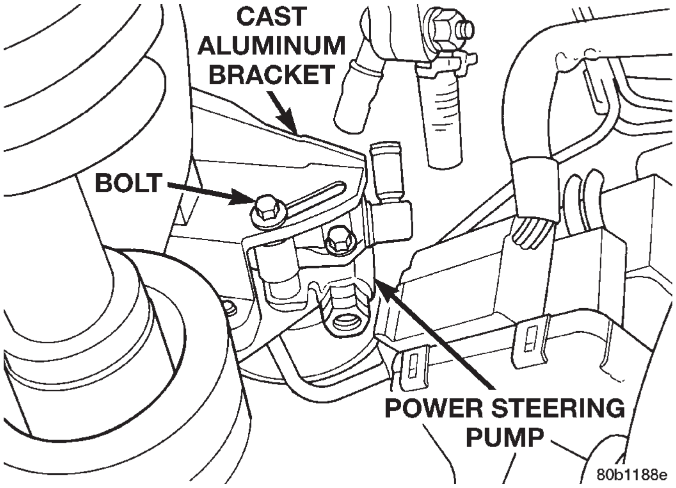


Fig. 6 Power Steering Pump Attachment To Rear Mounting Bracket

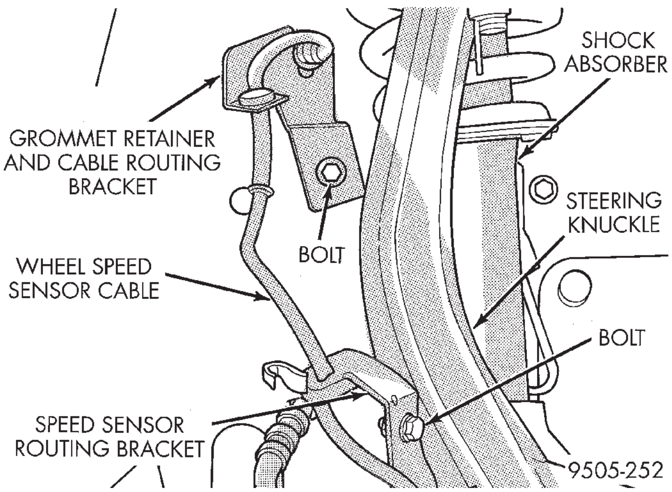


Fig. 7 Wheel Speed Sensor Cable Grommet Retainer

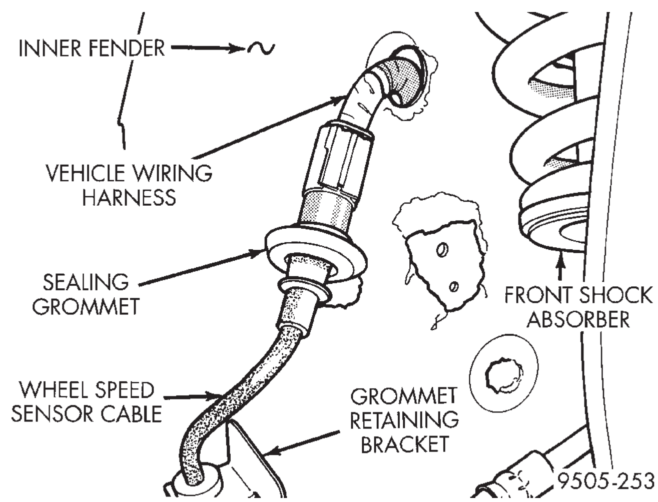


Fig. 8 Wheel Speed Sensor Cable Connection To Vehicle Wiring Harness

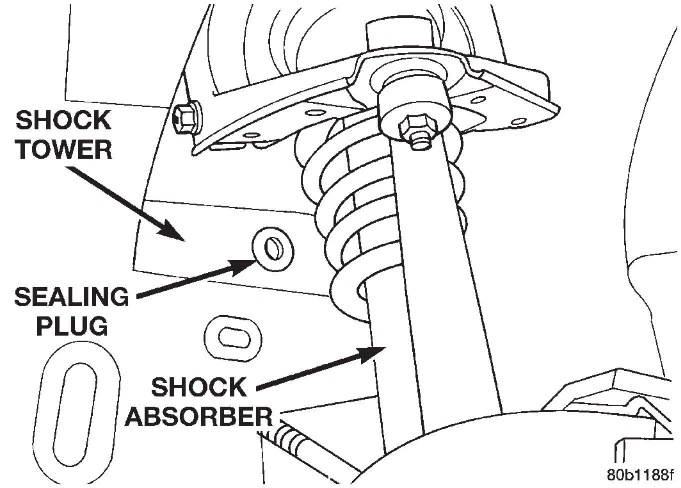


Fig. 9 Cable Routing Hole Sealing Plug

To access the bolt use a long extension and a 15 mm flex socket.

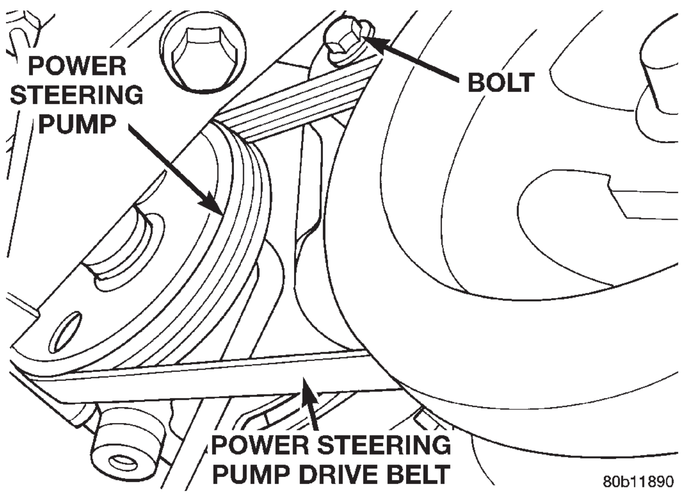


Fig. 10 Power Steering Pump Mounting Bolt

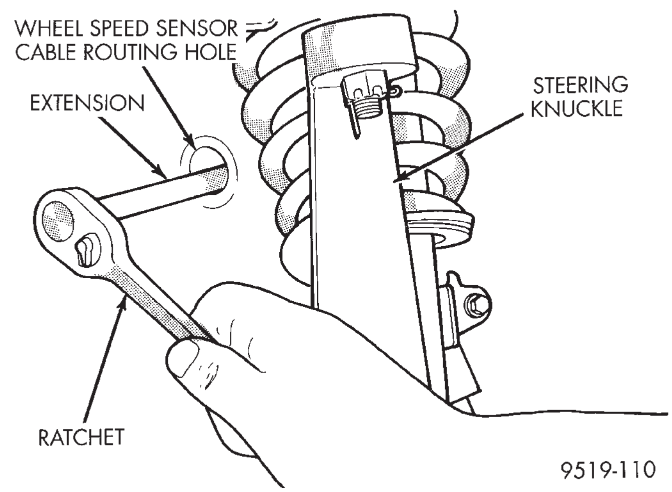


Fig. 11 Access To Top Mounting Bolt For Power Steering Pump

REMOVAL AND INSTALLATION (Continued)

(15) Remove power steering pump drive belt (Fig. 10) from power steering pump pulley.

NOTE: The power steering pump can not be removed from the vehicle without first removing the power steering pump mounting bracket (Fig. 12) from the engine.

(16) Remove power steering pump and its front mounting bracket as an assembly from the engine mounted power steering pump mounting bracket. Place the power steering pump on top of the antilock brakes hydraulic control unit.

(17) Remove the power steering pump mounting bracket (Fig. 12) from the rear of the engine.

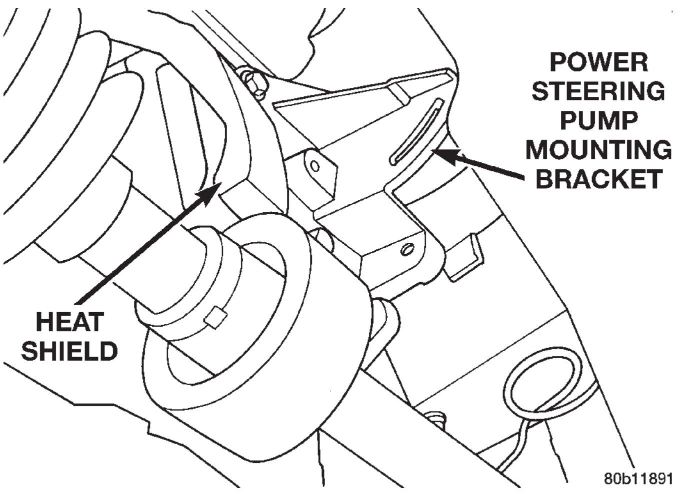


Fig. 12 Power Steering Pump Mounting Bracket

(18) Remove power steering pump and front mounting bracket as an assembly from the engine and vehicle. Pump and mounting bracket is removable by bringing it out through the area between frame, rear of engine, driveshaft and front suspension crossmember (Fig. 13).

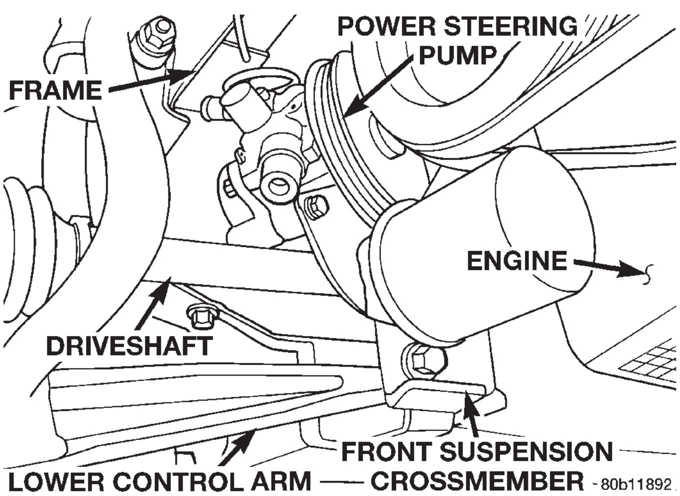


Fig. 13 Power Steering Pump Removal

(19) Transfer required parts from removed power steering pump, to replacement power steering pump.

INSTALLATION

(1) Install power steering pump and mounting bracket as an assembly back in vehicle, using reverse order of removal (Fig. 13).

(2) Place the power steering pump on top of the antilock brakes hydraulic control unit.

(3) Install the power steering pump mounting bracket on the rear of the engine (Fig. 12). Tighten the mounting bracket attaching bolts to a torque of 54 N·m (40 ft. lbs.).

(4) Install power steering pump and front bracket on the cast aluminum engine bracket (Fig. 5). Loosely install the bolt at the adjusting slot (Fig. 5).

(5) Loosely install the bolt mounting the power steering pump to its rear mounting bracket (Fig. 6).

(6) Loosely install bolt attaching top of power steering pump front bracket to the cast aluminum accessory drive bracket (Fig. 10). Access to install the bolt is through the wheel speed sensor cable routing hole (Fig. 11).

(7) Using a lint free towel, wipe clean all open power steering hose ends, and power steering pump fittings.

(8) If the vehicle is not equipped with variable-assist power steering, install a new O-ring on end of power steering pressure hose fitting. Lubricate all O-rings using fresh clean power steering fluid.

(9) If vehicle is equipped with variable-assist power steering, install a copper washer on each side of the power steering pressure hose banjo fitting, then loosely install the flow bolt through the center (Fig. 14).

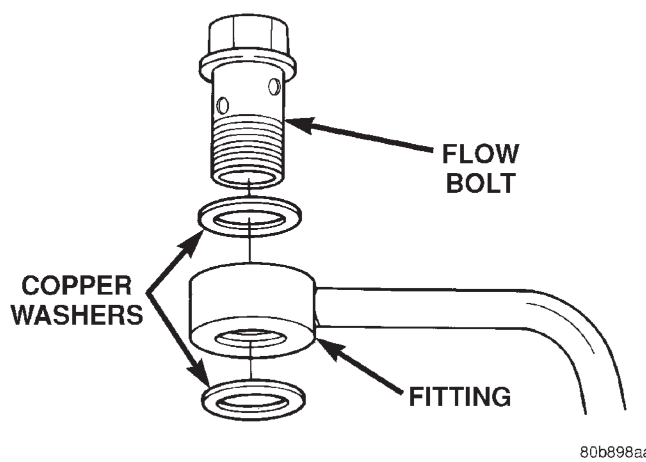


Fig. 14 Pressure Fitting And Washers

(10) Install the power steering pressure hose on the power steering pump pressure fitting. Loosely install tube nut into pressure fitting on power steering pump. **Pressure hose must be installed**

REMOVAL AND INSTALLATION (Continued)

between the front bracket of the power steering pump and power steering pump pulley.

(11) Install power steering pump drive belt on power steering pump pulley.

(12) Install a 1/2 in. breaker bar in the square adjusting hole in the front power steering pump mounting bracket (Fig. 15). Then using breaker bar rotate power steering pump to obtain the correct drive belt tension. See Accessory Drive Belts in Group 7 Cooling System of this service manual for the correct drive belt tension specification. When correct drive belt tension is obtained first tighten the bottom 2 adjusting slot bolts at the power steering pump cast mounting bracket to a torque of 54 N·m (40 ft. lbs.). Then tighten the power steering pump mounting bracket top pivot bolt to a torque of 54 N·m (40 ft. lbs.). Access to tighten and torque the bolt is through the wheel speed sensor cable routing hole (Fig. 11).

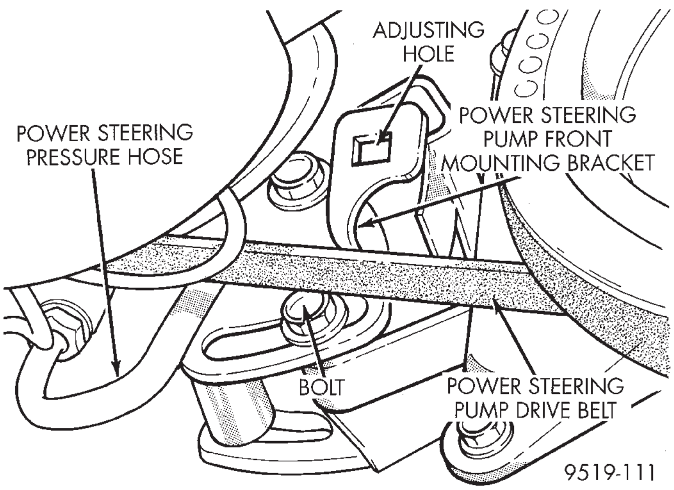


Fig. 15 Power Steering Pump Front Mounting Bracket Adjusting Hole

(13) Position power steering pressure hose, so hose is not contacting the power steering pump pulley or the drive belt.

(a) If vehicle is equipped with a standard tube nut on the power steering fluid pressure hose tighten the tube nut to a torque of 31 N·m (275 in. lbs.).

(b) If vehicle is equipped with a banjo fitting on the power steering fluid pressure hose tighten the banjo fitting bolt a torque of 47 N·m (35 ft. lbs.).

(14) Install power steering fluid supply hose on power steering pump suction fitting (Fig. 3) or (Fig. 4). Install hose clamp on hose. Be sure hose clamp is installed on hose past upset bead on suction fitting.

(15) Install heat shield on hydraulic control unit for the antilock brake system (Fig. 3) or (Fig. 4).

(16) Route the wiring harness connector for the wheel speed sensor cable through hole in inner fender. Connect vehicle wiring harness to wheel speed sensor cable (Fig. 8).

(17) On a vehicle equipped with antilock brakes, install wheel speed sensor cable sealing grommet in routing hole. Install retainer for wheel speed sensor cable grommet (Fig. 7) on right inner fender.

(18) On a vehicle not equipped with antilock brakes, install sealing plug back in routing hole (Fig. 9).

(19) Install accessory drive splash shield (Fig. 2).

(20) Install wheel and tire. Tighten the wheel lug nuts in proper sequence until all lug nuts are torqued to half specification. Then repeat tightening sequence to full specified torque of 129 N·m (95 ft. lbs.).

(21) Lower vehicle.

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(22) Fill power steering reservoir to correct fluid level.

(23) Connect negative cable back on negative post of battery.

(24) Start the engine and let run for a few seconds. Then turn the engine off.

(25) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(26) Raise front wheels of vehicle off the ground.

(27) Start engine, then slowly turn steering wheel right and left several times until lightly contacting the wheel stops. Then turn the engine off.

(28) Add power steering fluid if necessary.

(29) Lower the vehicle. Start engine again and turn the steering wheel slowly from lock to lock.

(30) Stop the engine. Check the fluid level and refill as required.

(31) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(32) After power steering pump is installed, check for leaks at all hose connections and power steering pump fittings.

POWER STEERING PUMP (2.5L ENGINE)

WARNING: POWER STEERING OIL, ENGINE COMPONENTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES, OR ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove battery cable from (-) negative post on battery and isolate cable.

(2) Siphon as much power steering fluid as possible out of the remote power steering fluid reservoir.

(3) Remove the power steering fluid supply hose from the power steering fluid reservoir (Fig. 16). Fluid supply hose will be removed with the power steering pump.

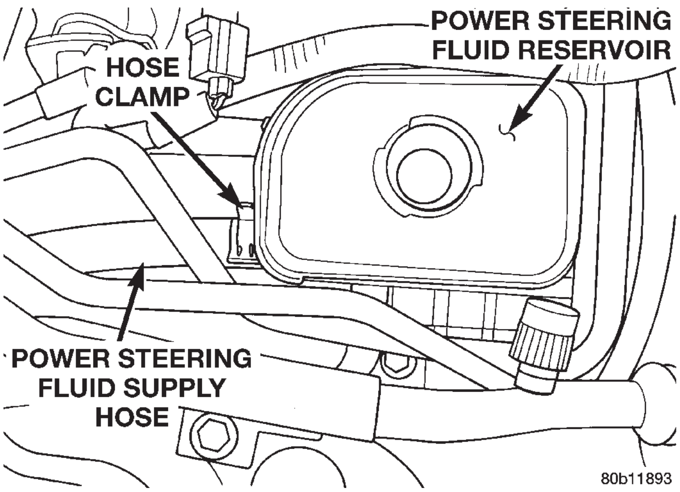


Fig. 16 Supply Hose At Power Steering Fluid Reservoir

(4) Raise vehicle.

(5) Remove right front tire from vehicle.

(6) Remove accessory drive splash shield (Fig. 17).

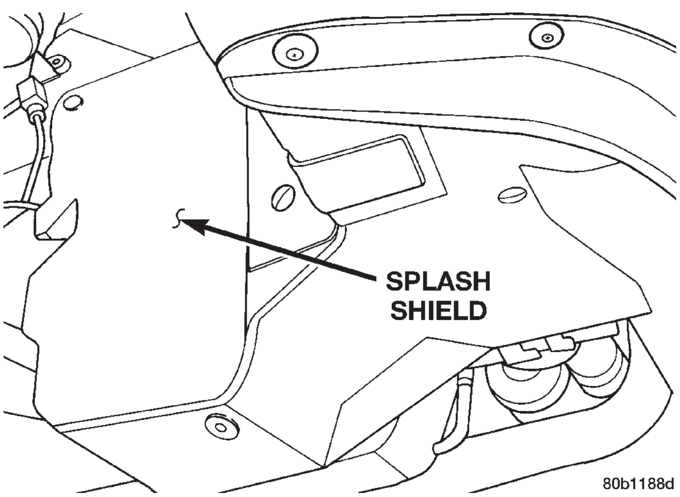


Fig. 17 Accessory Drive Splash Shield

(7) Remove the heat shield for the antilock brakes hydraulic control unit (Fig. 18).

(8) Loosen bolt at adjusting slot in accessory drive mounting bracket, (Fig. 19) attaching back of power steering pump to the bracket.

(9) Loosen bolt (Fig. 20) at top of power steering pump front mounting bracket, attaching it to the accessory drive bracket.

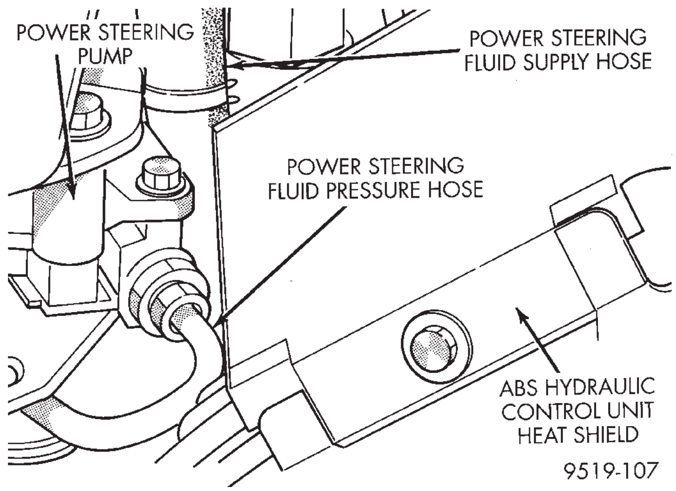


Fig. 18 Hydraulic Control Unit Heat Shield

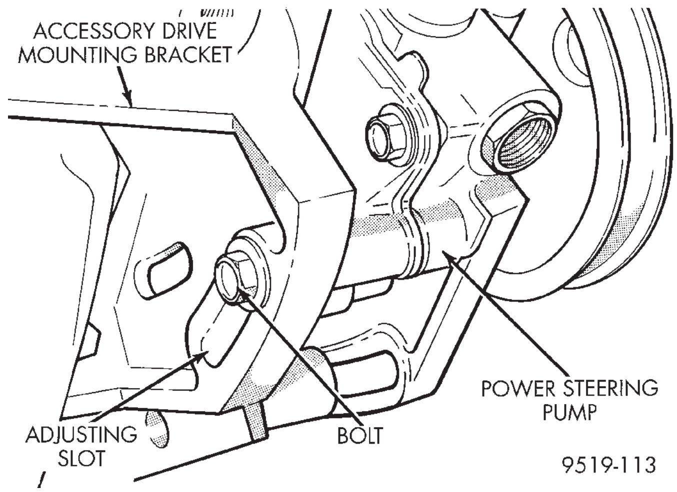


Fig. 19 Power Steering Pump Rear Mounting Bolt

(10) Loosen bolt at adjustment slot, (Fig. 20) attaching the power steering pump front mounting bracket to cast aluminum accessory drive bracket on engine.

(11) Move the power steering pump toward the engine as far as possible.

(12) Remove the power steering fluid pressure hose from pressure fitting on power steering pump (Fig. 21). Be careful not to loose the copper sealing washers on both sides of the hose banjo fitting once the flow bolt is removed. Let the remaining power steering fluid drain out of the power steering fluid supply hose, power steering pump and power steering fluid pressure hose. **After power steering fluid has drained out of pump and hose, install a cap on the power steering pressure hose and a plug in the power steering pump pressure fitting.**

(13) Remove the power steering pump drive belt from power steering pump pulley.

(14) Remove bolt at adjusting slot in accessory drive mounting bracket, (Fig. 19) attaching back of power steering pump to the bracket.

REMOVAL AND INSTALLATION (Continued)

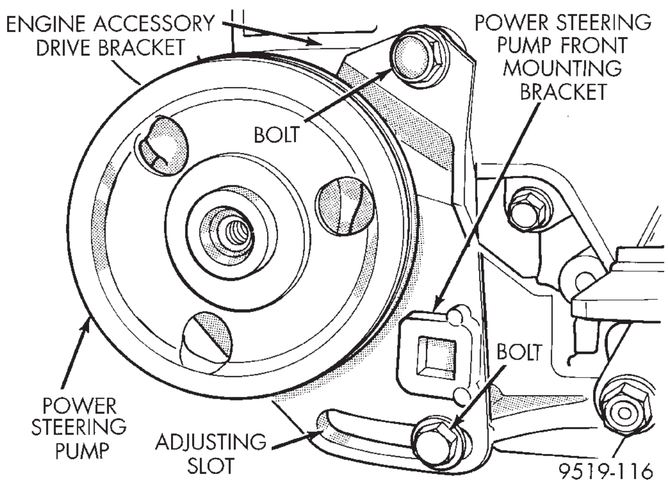


Fig. 20 Power Steering Pump Front Bracket Attachment

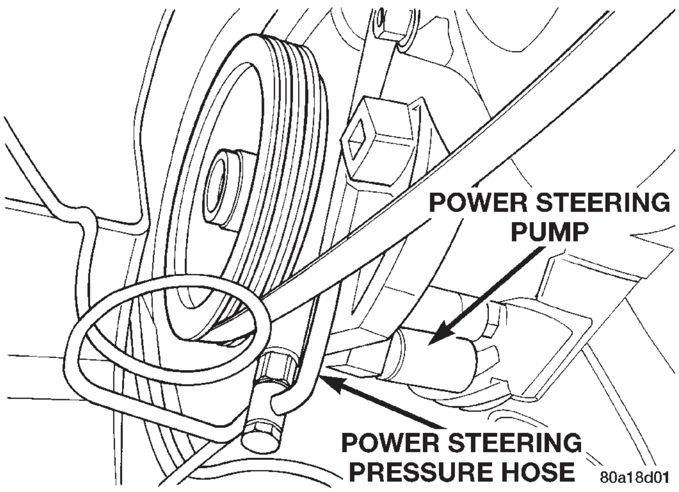


Fig. 21 Power Steering Pressure Hose Attachment To Pump

(15) Remove bolt at adjustment slot, (Fig. 20) attaching the power steering pump front mounting bracket to cast aluminum accessory drive bracket on engine. Then remove bolt (Fig. 20) at top of power steering front mounting bracket, attaching it to the accessory drive bracket.

(16) Remove power steering pump, supply hose and its front mounting bracket as an assembly from the engine mounted power steering pump mounting bracket. Place the power steering pump on top of the antilock brakes hydraulic control unit.

NOTE: The power steering pump can not be removed from the vehicle without first removing the power steering pump mounting bracket from the engine.

(17) Remove the 4 bolts mounting the power steering pump mounting bracket to the engine.

(18) Remove the power steering pump mounting bracket from the engine. Position the power steering pump mounting bracket where it will not be in the way when removing power steering pump from the vehicle.

(19) Remove power steering pump, fluid supply hose and front mounting bracket as an assembly from the engine and vehicle. Pump, fluid supply hose and mounting bracket is removable by bringing it out through area between rear of engine, frame driveshaft and front suspension crossmember (Fig. 22).

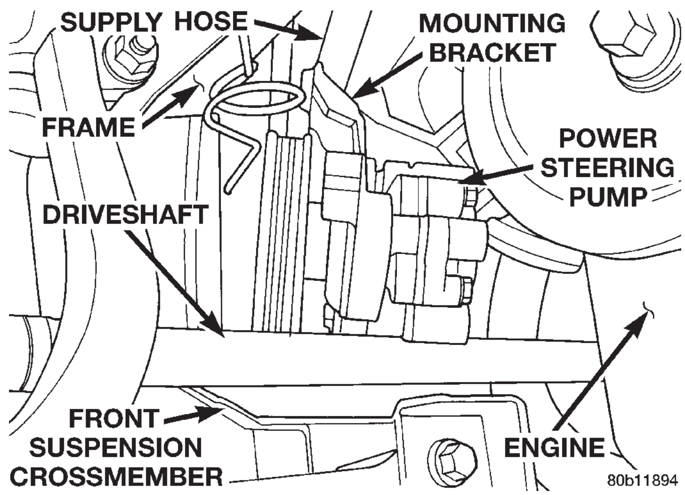


Fig. 22 Power Steering Pump Removal/Installation

(20) Transfer required parts from removed power steering pump, to replacement power steering pump.

INSTALLATION

(1) Install power steering pump, mounting bracket and fluid supply hose as an assembly back in vehicle, using the reverse of the removal procedure. **Be sure power steering fluid supply hose is correctly routed up to the power steering fluid reservoir when installing power steering pump.**

(2) Place the power steering pump on top of the antilock brakes hydraulic control unit.

(3) Install the power steering pump mounting bracket on the rear of the engine. Tighten the mounting bracket attaching bolts to a torque of 54 N·m (40 ft. lbs.).

(4) Install power steering pump and front bracket on engine mounted power steering pump mounting bracket. Loosely install bolt at adjusting slot and top of power steering pump front bracket (Fig. 20) mounting pump bracket to accessory drive bracket.

(5) Loosely install the bolt mounting power steering pump to its rear mounting bracket (Fig. 19).

(6) Using a lint free towel, wipe clean all open power steering hose ends, and power steering pump fittings.

REMOVAL AND INSTALLATION (Continued)

(7) Install a copper washer on each side of the power steering pressure hose banjo fitting, then install the flow bolt through the center (Fig. 23).

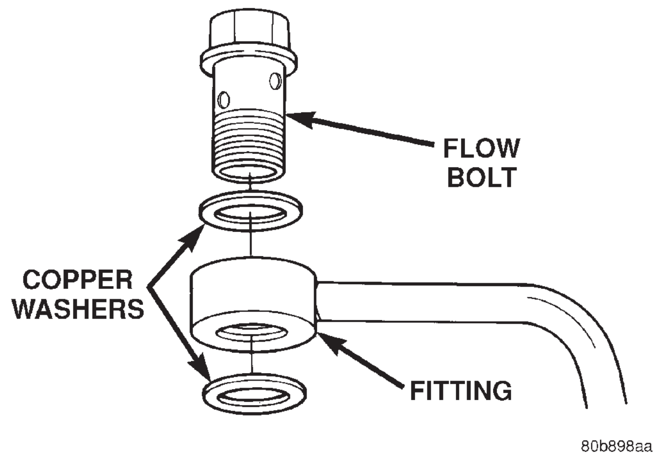


Fig. 23 Pressure Fitting And Washers

(8) Install the power steering pressure hose to the power steering pump pressure fitting. Loosely install the flow bolt into the power steering pump. **Pressure hose must be installed between the front bracket of the power steering pump and the back side of the power steering pump pulley.**

(9) Install power steering pump drive belt on power steering pump pulley.

(10) Install a 1/2 in. breaker bar in the square adjusting hole in the front power steering pump mounting bracket (Fig. 24) Then rotate pump to obtain the correct drive belt tension. See Accessory Drive Belts in Group 7 Cooling System of this service manual for the correct drive belt tension specification. When correct drive belt tension is obtained first tighten the bottom 2 adjusting slot bolts at the power steering pump cast mounting bracket to a torque of 54 N·m (40 ft. lbs.). Then tighten the power steering pump mounting bracket top pivot bolt to a torque of 54 N·m (40 ft. lbs.).

(11) Position power steering pressure hose, so hose is not contacting the power steering pump pulley or the drive belt. Tighten the banjo fitting flow bolt to a torque of 47 N·m (35 ft. lbs.).

(12) Install heat shield on hydraulic control unit (Fig. 18).

(13) Install accessory drive splash shield (Fig. 17).

(14) Install wheel and tire. Tighten the wheel lug nuts in proper sequence until all lug nuts are torqued to half specification. Then repeat tightening sequence to full specified torque of 129 N·m (95 ft. lbs.).

(15) Lower vehicle.

(16) Install power steering fluid supply hose (Fig. 16) on power steering fluid reservoir fitting. Install hose clamp on hose. Be sure hose clamp is installed on hose past upset bead on power steering fluid reservoir.

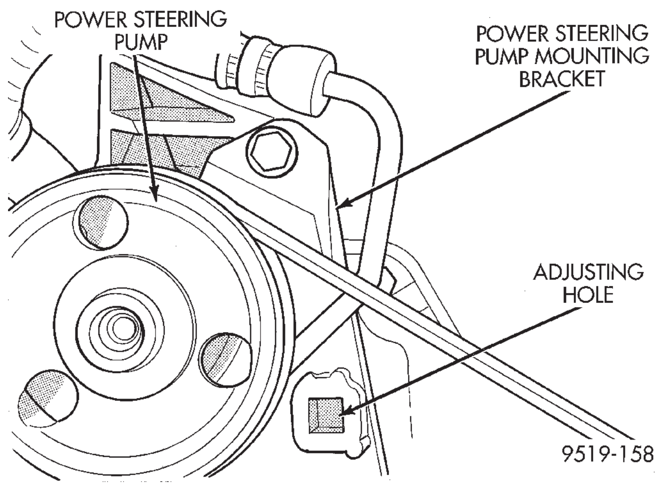


Fig. 24 Power Steering Pump Front Mounting Bracket Adjusting Hole

CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

(17) Fill power steering reservoir to correct fluid level.

(18) Connect negative cable back on negative post of battery.

(19) Start the engine and let run for a few seconds. Then turn the engine off.

(20) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(21) Raise front wheels of vehicle off the ground.

(22) Start engine, then slowly turn steering wheel right and left several times until lightly contacting the wheel stops. Then turn the engine off.

(23) Add power steering fluid if necessary.

(24) Lower the vehicle. Start engine again and turn the steering wheel slowly from lock to lock.

(25) Stop the engine. Check the fluid level and refill as required.

(26) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(27) After power steering pump is installed, check for leaks at all hose connections and power steering pump fittings.

POWER STEERING FLUID RESERVOIR

REMOVAL

(1) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

REMOVAL AND INSTALLATION (Continued)

(2) Raise vehicle.

(3) Remove hose clamp attaching power steering fluid supply hose to fitting on power steering pump. Let power steering fluid drain from supply hose and power steering fluid reservoir, until reservoir is empty.

(4) Lower vehicle.

CAUTION: Care must be used when removing and installing power steering fluid hoses on the power steering fluid reservoir. If excessive force is used when trying to remove or install hoses on nipples of power steering fluid reservoir, nipples can be broken off the reservoir.

(5) Remove power steering fluid return and supply hose, from power steering fluid reservoir.

(6) Remove bolts attaching power steering fluid reservoir to engine (Fig. 25) or (Fig. 26).

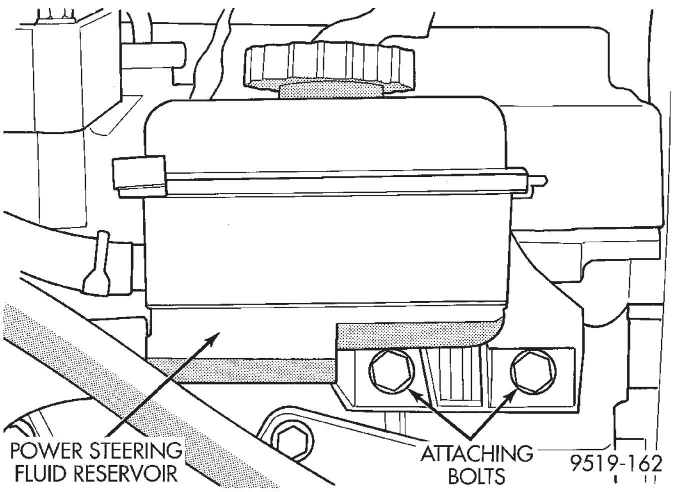


Fig. 25 Power Steering Fluid Reservoir Mounting 2.0 And 2.4 Ltr. Engine

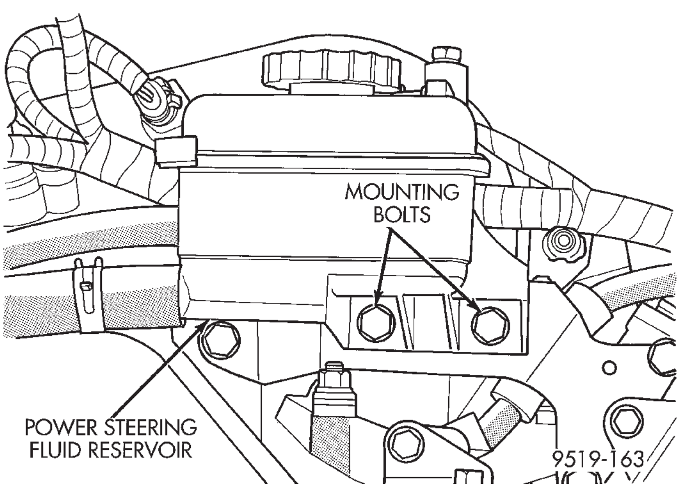


Fig. 26 Power Steering Fluid Reservoir Mounting 2.5 Liter Engine

(7) Remove power steering fluid reservoir from vehicle.

INSTALLATION

(1) Install power steering fluid reservoir on cylinder head. Install and securely tighten the power steering fluid reservoir attaching bolts (Fig. 25) or (Fig. 26).

(2) Install power steering fluid return and supply hose, on power steering fluid reservoir fittings. **Be sure both hose clamps are installed on hose past upset bead on power steering reservoir fittings.**

(3) Raise vehicle.

(4) Install power steering supply hose, on suction fitting of the power steering pump. **Be sure hose clamp is installed on hose past upset bead on power steering gear steel tube.**

(5) Fill power steering pump fluid reservoir to the proper level.

(6) Start the engine and let run for a few seconds. Then turn the engine off.

(7) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(8) Raise front wheels of vehicle off the ground.

(9) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(10) Add power steering fluid if necessary.

(11) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(12) Stop the engine. Check the fluid level and refill as required.

(13) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

DISASSEMBLY AND ASSEMBLY

POWER STEERING PUMP DRIVE PULLEY

The power steering pump must be removed from the vehicle for removal of the power steering pump pulley. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual.

DISASSEMBLE

(1) Remove power steering pump from engine. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Mount Puller, Special Tool C-4333 or C-4068 on power steering pump pulley. Mount power steering pump and puller in a vise (Fig. 27) to keep shaft of power steering pump from turning when removing pulley.

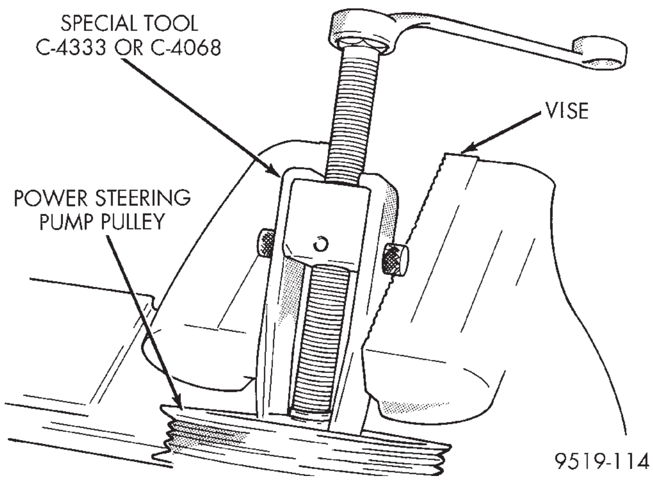


Fig. 27 Removing Pulley From Power Steering Pump Shaft

(3) Remove the drive pulley from the shaft of the power steering pump.

(4) Replace power steering pump pulley if bent, cracked, or loose.

ASSEMBLE

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(1) Mount power steering pump in a vise using the power steering pump mounting bracket.

(2) Place power steering pump pulley squarely on end of power steering pump shaft (Fig. 28).

(3) Place Installation Spacer, Special Tool 6936, (Fig. 29) on top of the power steering pump pulley.

(4) Mount Installer, Special Tool C-4063 in internal threads of the power steering pump shaft and against Special Tool 6936 on power steering pump pulley (Fig. 30).

(5) Ensuring that special tool and pulley remain aligned with pump shaft, force pulley onto power steering pump shaft until Special Tool 6936 is against the end of the power steering pump shaft. **When Special Tool 6936 is against the shaft of the power steering pump Special Tool C-4063 will no longer be able to be turned.**

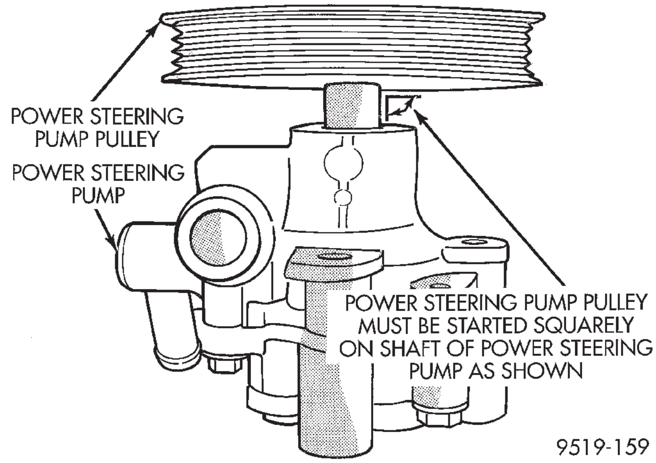


Fig. 28 Pulley Positioned On Shaft Of Power Steering Pump

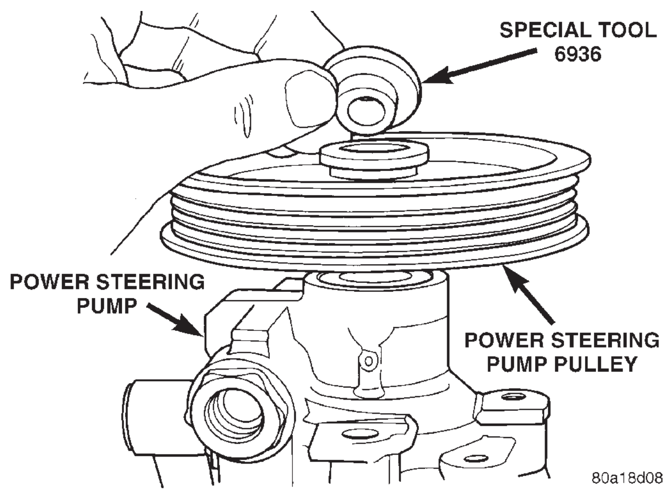


Fig. 29 Special Tool 6936 Correctly Installed On Power Steering Pump Pulley

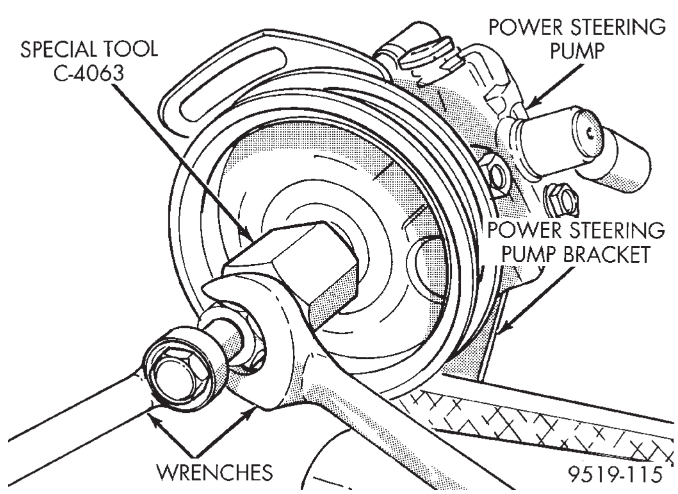


Fig. 30 Installing Pulley On Shaft Of Power Steering Pump

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Remove Installer, Special Tool C-4063 from power steering pump.

(7) Install power steering pump and mounting bracket back on engine. Refer to Power Steering Pump Installation in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

POWER STEERING PUMP MOUNTING BRACKET

DISASSEMBLE

(1) Remove power steering pump from engine. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Mount Puller, Special Tool C-4333 or C-4068 on power steering pump pulley. Mount power steering pump and puller in a vise (Fig. 31) to keep shaft of power steering pump from turning when removing pulley.

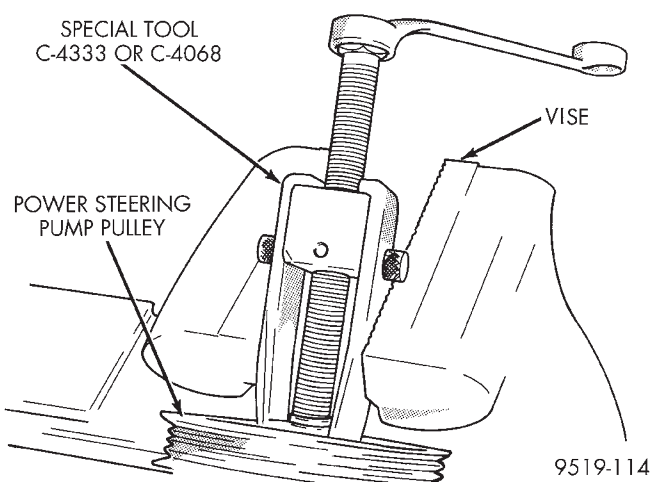


Fig. 31 Removing Pulley From Power Steering Pump Shaft

(3) Remove the drive pulley from the shaft of the power steering pump.

(4) Remove bolts attaching power steering pump to mounting bracket.

(5) Remove power steering pump from mounting bracket.

ASSEMBLE

(1) Install power steering pump on mounting bracket. Install the power steering pump to mounting bracket attaching bolts. Torque the mounting bolts to 54 N·m (40 ft. lbs).

CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Place power steering pump pulley squarely on end of power steering pump shaft (Fig. 32).

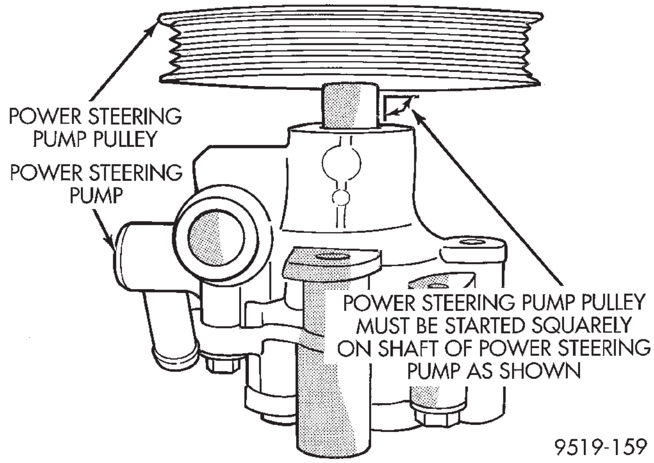


Fig. 32 Pulley Positioned On Shaft Of Power Steering Pump

(3) Place Installation Spacer, Special Tool 6936 on top of the power steering pump pulley (Fig. 33).

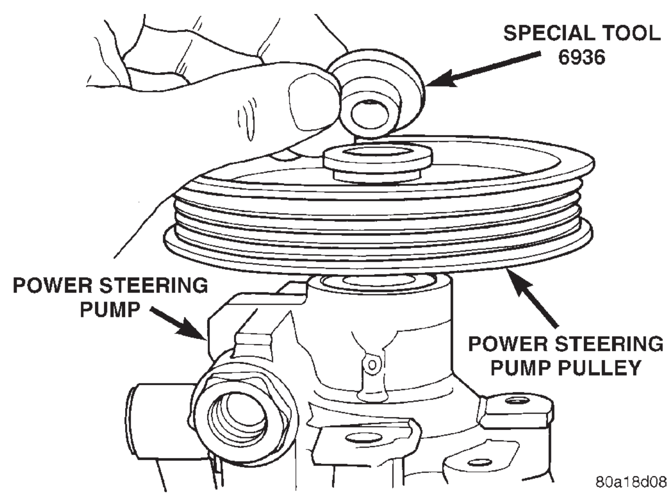


Fig. 33 Spacer Correctly Installed On Power Steering Pump Pulley

(4) Mount Installer, Special Tool C-4063 in internal threads of the power steering pump shaft and against Special Tool 6936 on power steering pump pulley (Fig. 34).

(5) Ensuring that special tool and pulley remain aligned with pump shaft, force pulley onto power steering pump shaft until Special Tool 6936 is against the end of the shaft. **When Special Tool**

DISASSEMBLY AND ASSEMBLY (Continued)

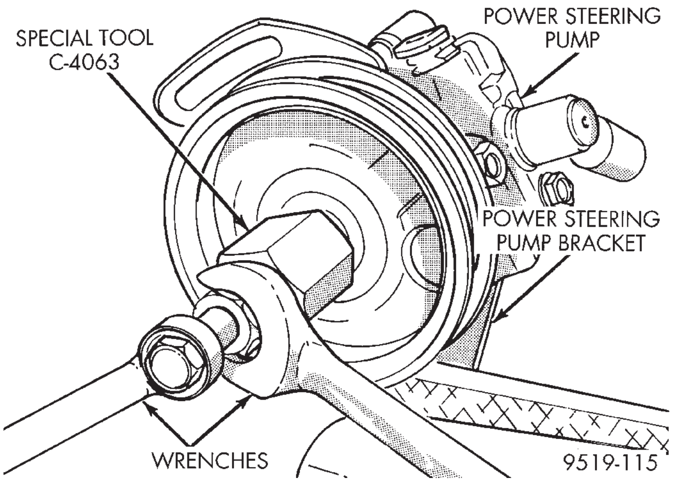


Fig. 34 Installing Pulley On Shaft Of Power Steering Pump

6936 is against the shaft of the power steering pump, Special Tool C-4063 will no longer be able to be turned.

(6) Remove Installer, Special Tool C-4063 from power steering pump.

(7) Install power steering pump and bracket assembly back on engine. Refer to Power Steering Pump Installation in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

SPECIFICATIONS

POWER STEERING PUMP FLOW SPECIFICATIONS

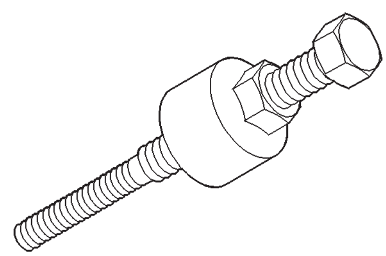
Flow At 1500 RPM And Minimum
Pressure . . . . 4.9 to 5.3 Liters/Min (1.3 to 1.4 GPM)
Control Valve Pressure Relief . . . 8240 to 8920 kPa (1195 to 1293 psi)

POWER STEERING PUMP FASTENER TORQUE SPECIFICATIONS

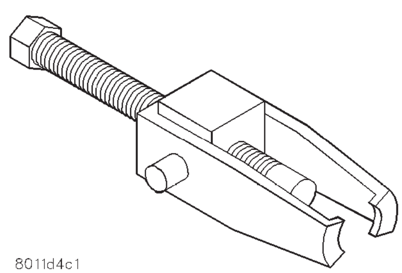
DESCRIPTION	TORQUE
POWER STEERING PUMP:	
Discharge Fitting	75 N·m (55 ft. lbs.)
To Rear Bracket Mounting Bolts	54 N·m (40 ft. lbs.)
To Front Bracket Mounting Bolts	54 N·m (40 ft. lbs.)
Bracket To Engine Mounting Bolts	54 N·m (40 ft. lbs.)
POWER STEERING FLUID HOSES:	
Hose Tube Nuts	31 N·m (275 in. lbs.)
Pressure Hose Banjo Fitting Flow Bolt	47 N·m (35 ft. lbs.)
Return Hose Bracket To Head 2.0 / 2.4L	28 N·m (21 ft. lbs.)
Pressure Hose To Return Hose Bracket	9 N·m (75 in. lbs.)
Pressure Hose To Cylinder Head 2.5L	54 N·m (40 ft. lbs.)
Return Hose To Pressure Hose Bracket 2.5L	9 N·m (75 in. lbs.)
POWER STEERING FLUID RESERVOIR:	
Reservoir To Mounting Bracket Or Engine	28 N·m (21 ft. lbs.)
Reservoir Bracket To Engine	28 N·m (21 ft. lbs.)

SPECIAL TOOLS

POWER STEERING PUMP



Installer C-4063B



Puller C-4333

POWER STEERING GEAR

INDEX

DESCRIPTION AND OPERATION

POWER STEERING GEAR

The power steering system consists of these six major components. Power steering gear, (Fig. 1) power steering pump, power steering fluid reservoir, power steering fluid supply hose, power steering fluid pressure hose, power steering fluid return hose and cooler. Turning of the steering wheel is converted into linear travel through the meshing of the helical pinion teeth with the rack teeth. Power assist steering is provided by an open center, rotary type control valve which directs oil from the pump to either side of the integral rack piston.

Road feel is controlled by the diameter of a torsion bar which initially steers the vehicle. This movement directs oil behind the integral rack piston, which, in turn, builds up hydraulic pressure and assists in the turning effort.

The drive tangs on the pinion of the power steering pump mate loosely with a stub shaft. This is to permit manual steering control to be maintained if the drive belt on the power steering pump should break. However, under these conditions, steering effort will be increased.

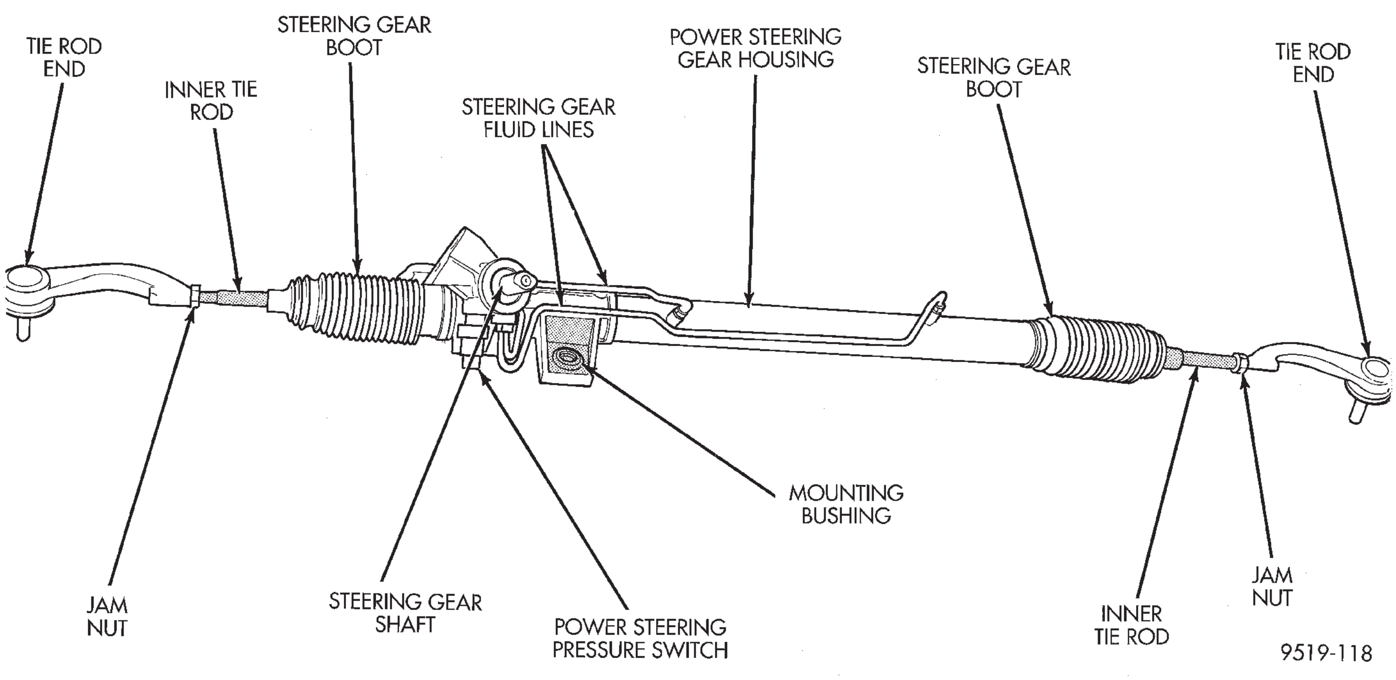


Fig. 1 Power Steering Gear Assembly

REMOVAL AND INSTALLATION

POWER STEERING GEAR

REMOVAL

(1) Remove remote ground cable (Fig. 2) from ground stud on shock tower. Then correctly isolate ground cable from vehicle by installing isolator on stud (Fig. 3).

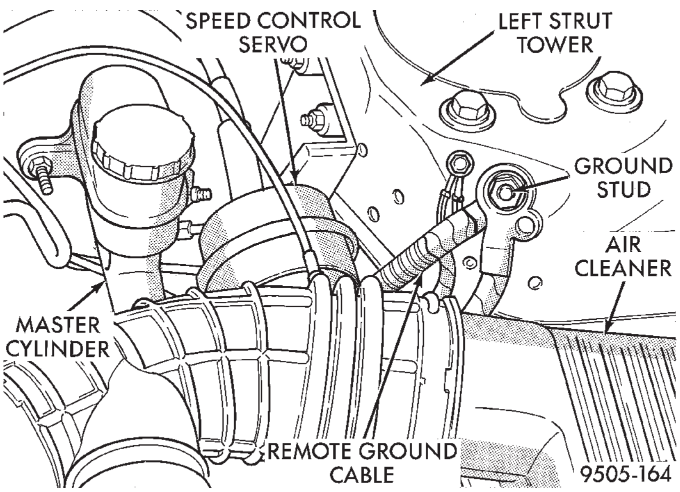


Fig. 2 Remote Ground Cable At Shock Tower

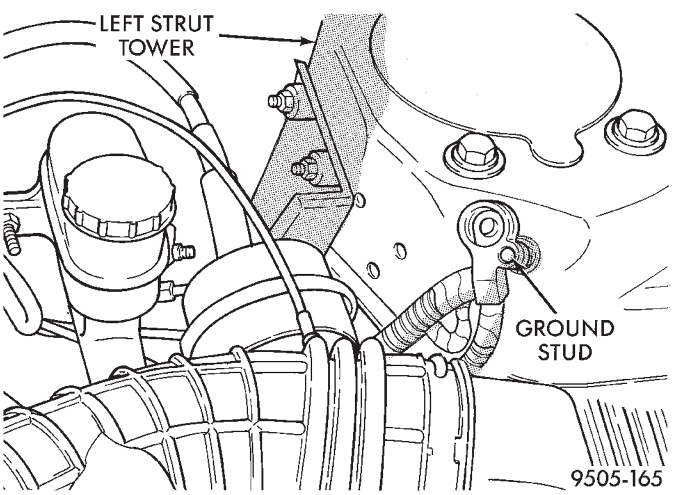


Fig. 3 Correctly Isolated Remote Ground Cable

(2) Siphon as much power steering fluid as possible from the remote power steering fluid reservoir.

(3) From interior of vehicle, remove the retaining pin from the intermediate shaft coupler pinch bolt (Fig. 4). Then remove the pinch bolt (Fig. 4) from the intermediate shaft coupler and the separate intermediate shaft coupler, from steering gear shaft.

(4) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

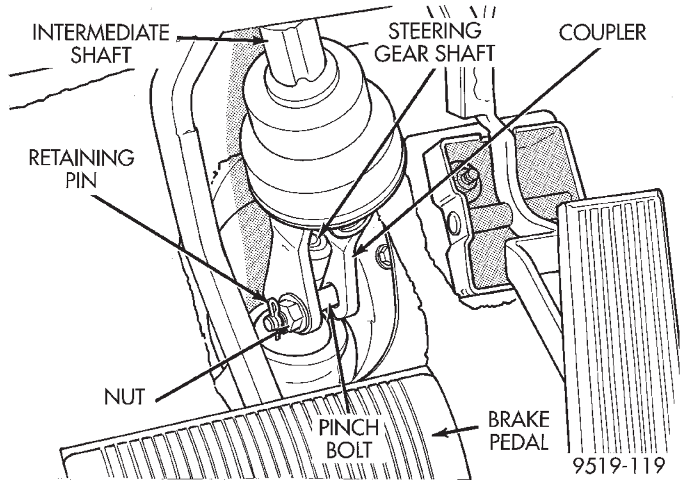


Fig. 4 Intermediate Shaft Coupler To Steering Gear Attachment

(5) Remove both front wheel and tire assemblies from the vehicle.

(6) Remove nuts attaching both outer tie rod ends to the steering knuckles (Fig. 5). **Nuts are to be removed from tie rod ends using the following procedure, hold tie rod end stud with an 11/32 socket, while loosening and removing nut with wrench (Fig. 5).**

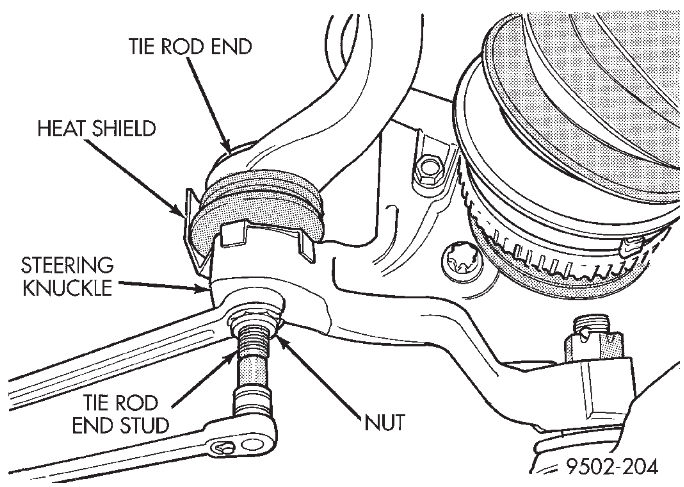


Fig. 5 Removing Tie Rod End Nut

(7) Remove both tie rod end studs, from the steering knuckles, using Remover, Special Tool MB-991113 (Fig. 6).

REMOVAL AND INSTALLATION (Continued)

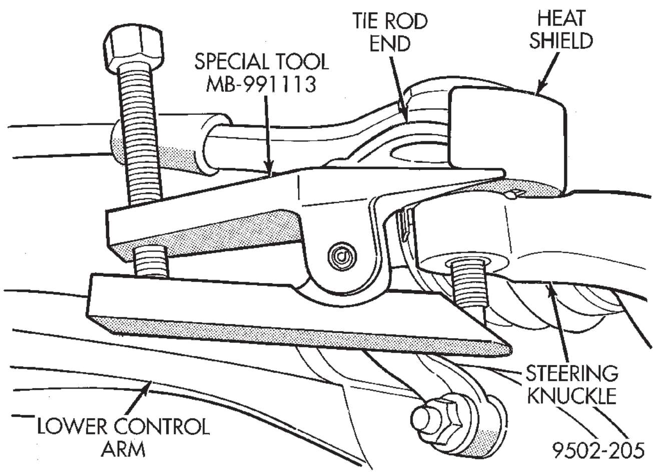


Fig. 6 Tie Rod End Removal From Steering Knuckle

CAUTION: This vehicles is designed and assembled using NET BUILD front suspension alignment settings. This means that front suspension alignment settings are determined as the vehicle is designed by the location of front suspension components in relation to the vehicle body. This process is carried out when building the vehicle, by accurately locating the front suspension crossmember to master gage holes located in the underbody of the vehicle. With this method of designing and building a vehicle, it is no longer necessary or possible to adjust a vehicles front suspension alignment settings. Consequently, whenever the front suspension crossmember is removed from a vehicle, it MUST be replaced in the same location on the body of the vehicle it was removed from. Front suspension Toe settings though are still adjustable by the outer tie rod ends.

CAUTION: Before removing the front suspension crossmember from the vehicle, locating marks for the front suspension crossmember MUST be scribed on the front suspension crossmember and body of vehicle. This must be done so front suspension crossmember can be located against body of vehicle, in the same location when it is installed back in vehicle. If location of front suspension crossmember to body of vehicle is not maintained when vehicle is assembled, NET BUILD front suspension alignment settings will not be obtained. This may lead to handling and or tire wear problems.

NOTE: Use the following procedure to mark the side to side and front to back installed location of the front suspension crossmember to the body of the vehicle.

(8) Using an awl, scribe a line on the body (Fig. 7) and (Fig. 8) marking the front to back installed location where the front suspension crossmember is mounted against the body of the vehicle. The line should be scribed at both the front and back of where the crossmember is mounted to the vehicle and on each side of the vehicle. In (Fig. 7) and (Fig. 8) the left side of the vehicle is shown.

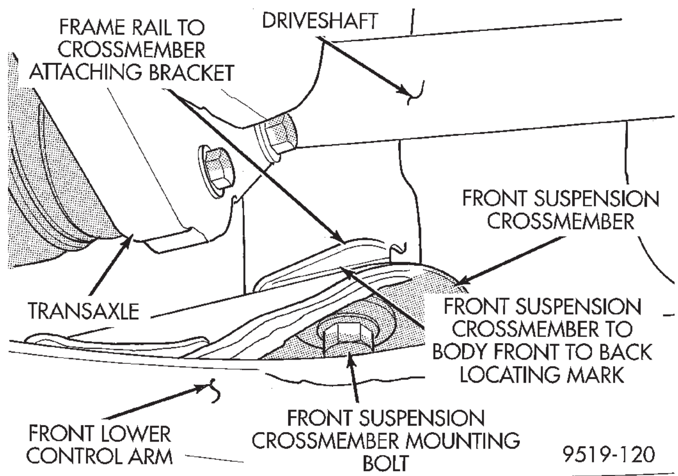


Fig. 7 Front Suspension Crossmember Front To Back Locating Mark (Left Side Front)

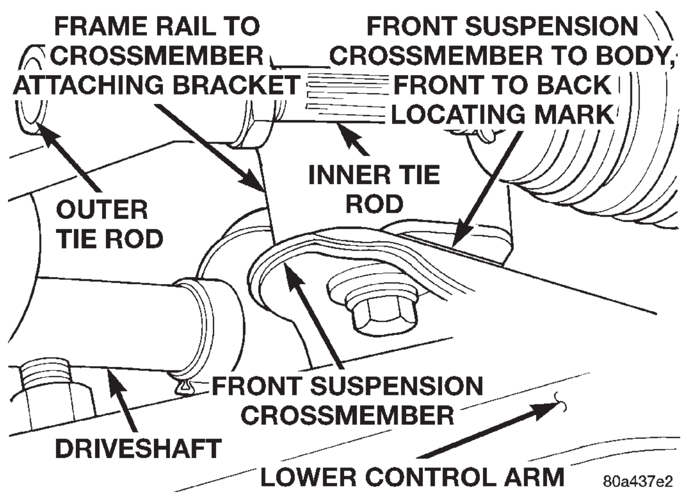


Fig. 8 Front Suspension Crossmember Front To Back Locating Mark (Left Side Rear)

(9) Using an awl, scribe a line on the front suspension crossmember (Fig. 9) marking the side to side installed location where front suspension crossmember is mounted against the body of the vehicle. The line should be scribed at the side of the frame rail bracket (Fig. 9) where the crossmember is mounted to the vehicle. The locating mark is to be marked the same on each side of the vehicle. In (Fig. 9) the left side of the vehicle is shown.

(10) Remove the stabilizer bar bushing clamp to body attaching bolts only (Fig. 10). The sway bar

REMOVAL AND INSTALLATION (Continued)

bushing clamp to front suspension crossmember bolts (Fig. 10) do not need to be removed.

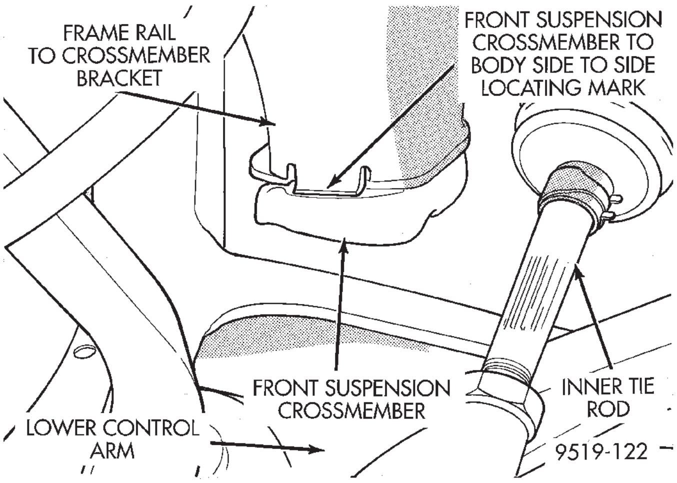


Fig. 9 Front Suspension Crossmember Side To Side Locating Mark

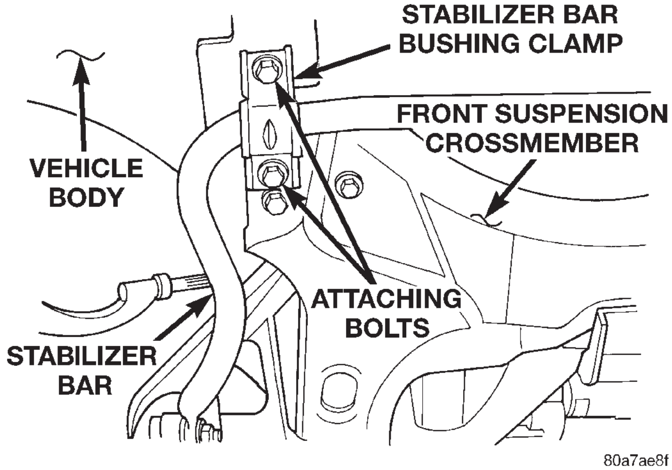


Fig. 10 Stabilizer Bar Bushing Clamp Attaching Bolts

(11) **If vehicle is equipped with antilock brakes, the hydraulic control unit can not hang from the brake tubes when lowering front suspension crossmember. Using wire, tie the antilock brakes hydraulic control unit to the body and engine so the wire will support it when the crossmember is lowered.**

(12) If vehicle is equipped with antilock brakes, remove the 3 bolts attaching the antilock brakes hydraulic control unit to the front suspension crossmember.

(13) Remove the bolts attaching the shock absorber clevis to the left and right lower control arms (Fig. 11).

(14) Remove the 2 bolts attaching the under engine support bracket (Fig. 12) to the front edge of the front suspension crossmember.

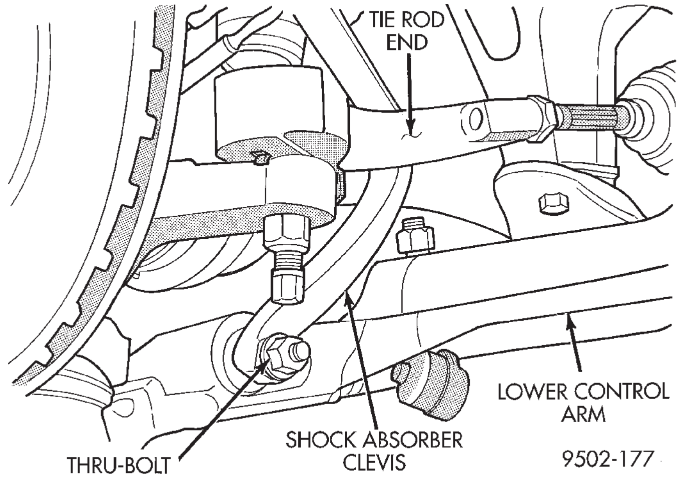


Fig. 11 Shock Clevis To Lower Control Arm Bolts

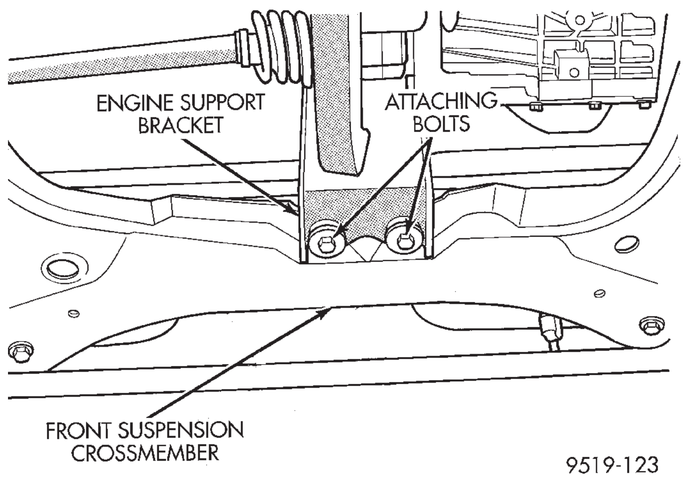


Fig. 12 Engine Support Bracket To Crossmember Attaching Bolts

(15) Remove the 2 attaching bolts from the rear support bracket (Fig. 13) at the rear of the front suspension crossmember.

(16) Remove bolt (Fig. 14) attaching engine support bracket to the transaxle mounting bracket.

(17) Position a transmission jack under the center of the front suspension crossmember. Transmission jack is used to lower, support and raise front suspension crossmember when removing steering gear assembly.

(18) From each side of the vehicle, remove the 2 bolts attaching the front and rear of the front suspension crossmember to the frame rails of vehicle (Fig. 15).

(19) Using transmission jack, lower front suspension crossmember enough to allow steering gear to be removed from crossmember. **When lowering front suspension crossmember, do not let crossmember hang from lower control arms, weight of crossmember must be supported by the transmission jack.**

REMOVAL AND INSTALLATION (Continued)

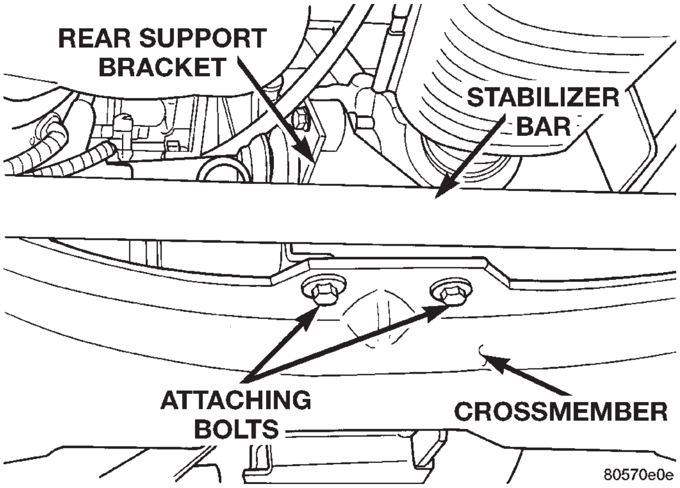


Fig. 13 Rear Support Bracket Attachment To Crossmember

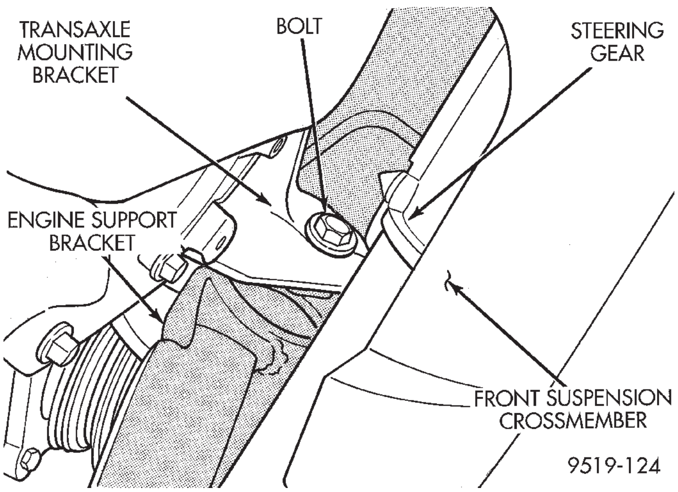


Fig. 14 Engine Support Bracket To Transaxle Bracket Bolt

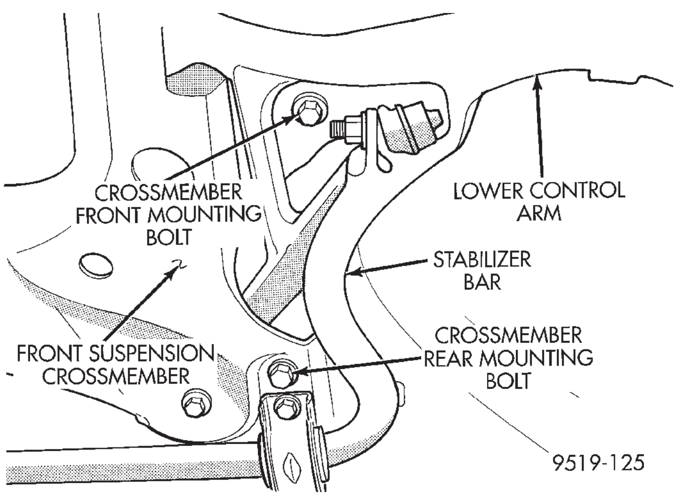


Fig. 15 Crossmember To Body Attaching Bolts

(20) Remove power steering fluid, pressure and return hoses from the power steering gear assembly (Fig. 16).

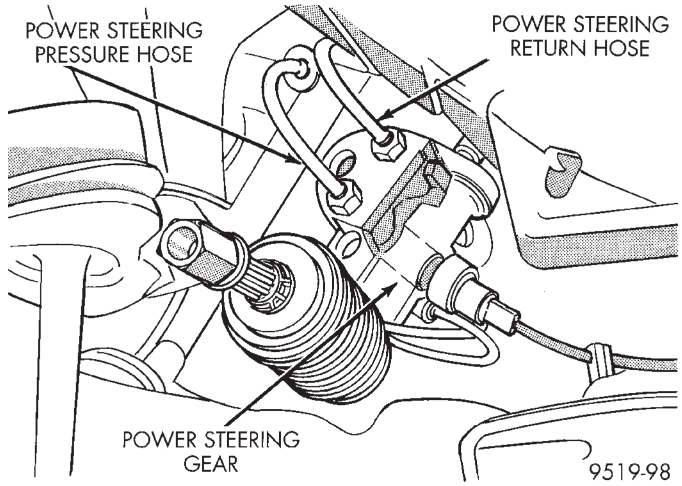


Fig. 16 Power Steering Pressure And Return Hose At Steering Gear

(21) Remove wiring harness connector, (Fig. 16) from the power steering fluid pressure switch.

(22) Remove the 2 bolts, at the isolators (Fig. 17) and (Fig. 18) attaching the steering gear assembly to front suspension crossmember. Then remove the 2 bolts attaching the steering gear saddle bracket (Fig. 19) to the front suspension crossmember. Remove the steering gear assembly from the front suspension crossmember.

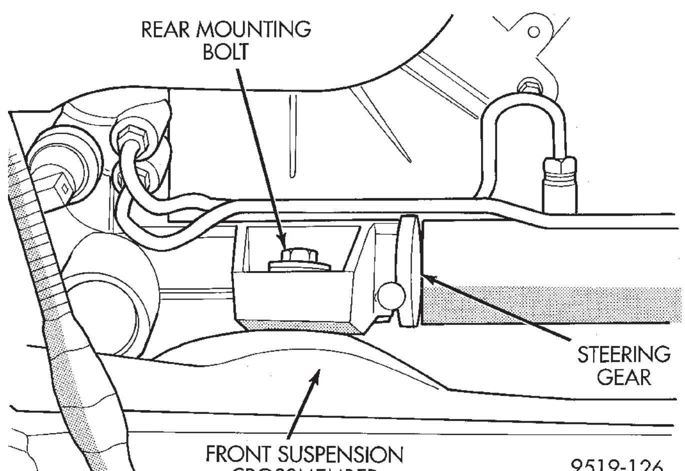


Fig. 17 Steering Gear Rear Mounting Isolator Bolt

(23) Transfer required parts from removed steering gear assembly to the replacement steering gear, if a new steering gear is being installed.

INSTALLATION

(1) Install steering gear assembly on front suspension crossmember. Install the 2 long steering gear assembly to front crossmember mounting bolts (Fig.

REMOVAL AND INSTALLATION (Continued)

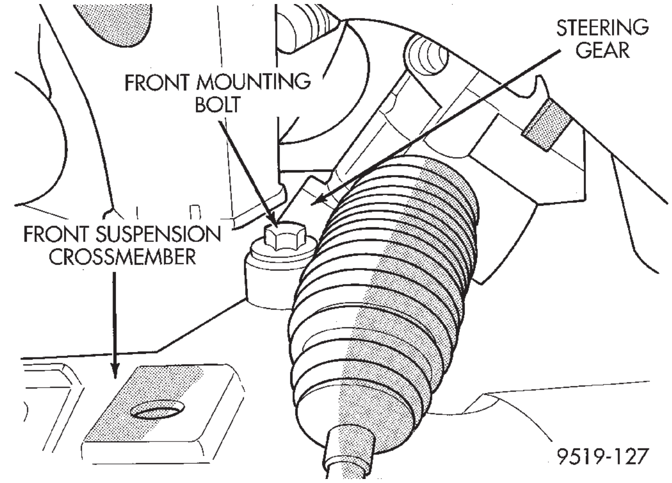


Fig. 18 Steering Gear Front Mounting Bolt

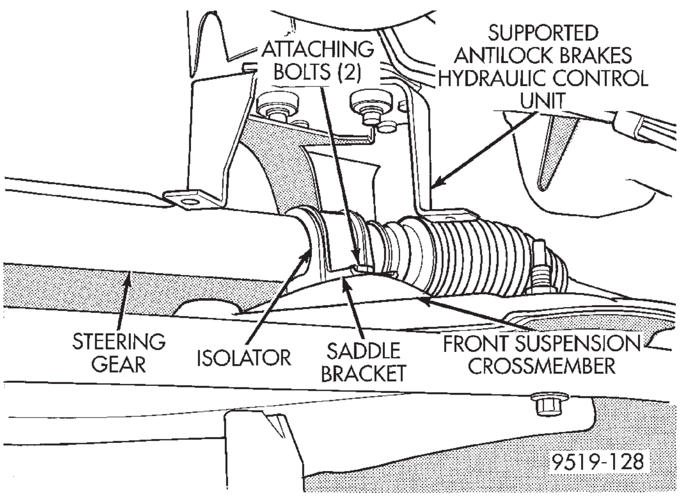


Fig. 19 Steering Gear Saddle Bracket Mounting Bolts

17) and (Fig. 18) into the mounting isolators. Then install the 2 short bolts (Fig. 19) into the saddle bracket. Tighten the 4 steering gear mounting bolts to a torque of 68 N·m (50 ft. lbs.).

(2) Install the power steering fluid pressure and return lines on the ports of the power steering gear (Fig. 16). Tighten power steering fluid pressure and return lines to steering gear tube nuts (Fig. 16) to a torque of 31 N·m (275 in. lbs.).

(3) Using transmission jack, raise front suspension crossmember and steering gear against body of vehicle. Start the 2 rear bolts (Fig. 15) into tapping plates, attaching front suspension crossmember to body of vehicle. Then install the 2 front bolts, (Fig. 15) attaching front suspension crossmember to frame rails of vehicle. Tighten the 4 mounting bolts evenly, until front suspension crossmember is against body of vehicle at the 4 mounting points. Then torque the 4 mounting bolts to 2 N·m (20 in. lbs.) to hold front suspension crossmember in position.

CAUTION: When front suspension crossmember is installed back in vehicle, crossmember MUST be aligned with positioning marks previously scribed into body of vehicle. This MUST be done to maintain NET BUILD front suspension alignment settings.

(4) Using a soft face hammer, tap front suspension crossmember into position, until it is aligned with the previously scribed positioning marks on body of vehicle (Fig. 7), (Fig. 8) and (Fig. 9). When front suspension crossmember is correctly positioned, torque the 2 rear crossmember mounting bolts to 163 N·m (120 ft. lbs.). Then torque the 2 front crossmember to frame rail attaching bolts to 163 N·m (120 ft. lbs.).

(5) Install the engine support bracket on the front of the front suspension crossmember (Fig. 12). Install the 2 support bracket to suspension crossmember attaching bolts and tighten to a torque of 75 N·m (55 ft. lbs.).

(6) Install bolt (Fig. 14) attaching engine support bracket to transaxle mounting bracket. Tighten bolt to a torque of 75 N·m (55 ft. lbs.).

(7) Install the 2 bolts attaching the rear support bracket, for the under engine support bracket (Fig. 13), to the rear of the front suspension crossmember. Tighten bolts to a torque of 75 N·m (55 ft. lbs.).

(8) Install vehicle wiring harness connector (Fig. 16) onto power steering fluid pressure switch on steering gear assembly. **Be sure locking tab on wiring harness connector is securely latched to pressure switch.**

(9) Install the antilock brakes hydraulic control unit mounting bracket on the front suspension crossmember. Install the 3 mounting bracket to crossmember attaching bolts and tighten to a torque of 28 N·m (250 in. lbs.).

(10) Loosely install the 2 shock absorber clevis to lower control arm attaching nuts and bolts (Fig. 11).

(11) Install tie rod seal boot heat shield (Fig. 6) on tie rod end.

(12) Install tie rod end into steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 6). Then using a crowfoot and 11/32 socket, torque tie rod end attaching nut to 61 N·m (45 ft. lbs.) (Fig. 20).

(13) Install the 2 stabilizer bar bushing clamp to body attaching bolts (Fig. 10) and securely tighten.

CAUTION: When supporting lower control arm with jack stand, do not position jack stand under the ball joint cap on the lower control arm. Position in area of lower control arm shown in (Fig. 21).

REMOVAL AND INSTALLATION (Continued)

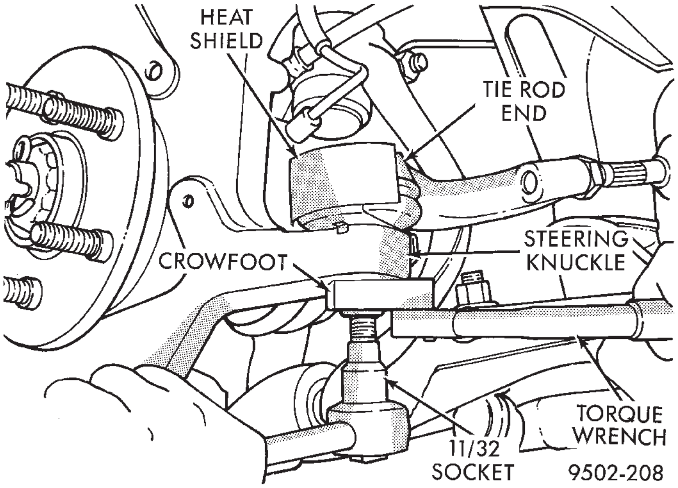


Fig. 20 Torquing Tie Rod End Attaching Nut

(14) Lower vehicle to the ground with a jack stand positioned under the lower control arm (Fig. 21). Continue to lower vehicle so the total weight of the vehicle is supported by the jack stand and lower control arm.

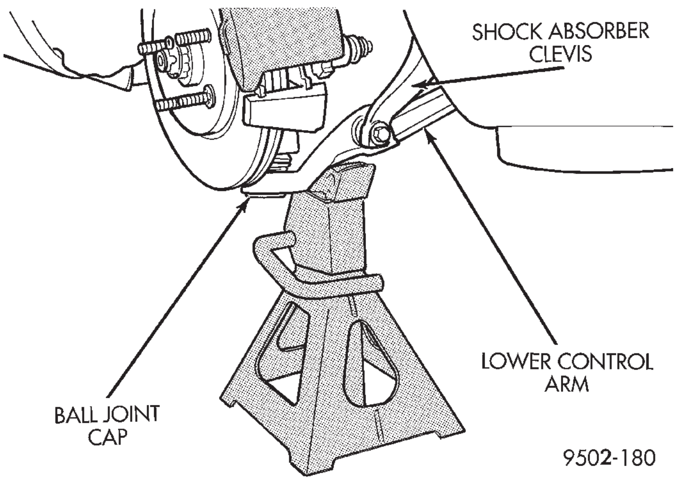


Fig. 21 Lower Control Arm Correctly Supported By Jack Stand

(15) Tighten the shock absorber clevis to lower control arm bushing thru-bolt (Fig. 11) to a torque of 92 N·m (68 ft. lbs.).

(16) Install the wheel and tire assemblies back on vehicle. Tighten the wheel nuts in proper sequence to a torque of 129 N·m (95 ft. lbs.) torque.

CAUTION: Before connecting steering column intermediate shaft coupler onto steering gear shaft, front wheels must be pointed straight ahead and steering wheel must be in center position.

(17) From interior of vehicle, reconnect the steering column intermediate shaft coupler on the steering gear shaft (Fig. 4). Install **a new** steering gear coupler retaining pinch bolt and torque to 27 N·m (240 in. lbs.). **Be sure to install the upper to lower steering coupler retaining bolt, retention pin.**

CAUTION: Do not use automatic transmission fluid.

(18) Fill power steering pump fluid reservoir to the (Full-Cold) proper level.

(19) Start the engine and let run for a few seconds. Then turn the engine off.

(20) Add fluid if necessary.

(21) Raise front wheels of vehicle off the ground.

(22) Start engine and turn steering wheel several times from stop to stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. **Fill pump reservoir to correct level with Mopar®, Power Steering Fluid, or equivalent.** See Checking Fluid Level.

(23) Lower front wheels of vehicle back on the ground.

CAUTION: During this procedure do not allow the steering gear inner tie rod boots to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(24) Check front alignment and adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

(25) Tighten tie rod jam nut to 74 N·m (55 ft.lbs.) torque.

(26) Adjust steering gear to tie rod boots at tie rods.

DISASSEMBLY AND ASSEMBLY

POWER STEERING GEAR MOUNTING BOLT ISOLATOR

The removal and installation of the mounting bolt isolator must be performed with the steering gear assembly removed from the vehicle.

The steering gear mounting bolt isolators (Fig. 22) are a serviceable component of the steering gear assembly. Both isolator bushing are serviced using the same procedure listed below but only the rear mounting bushing is shown.

DISASSEMBLY

(1) Using a screwdriver, pry the sleeve out of the mounting bolt isolator (Fig. 22).

(2) Pry the mounting bolt isolator bushing from the steering gear mounting bracket.

DISASSEMBLY AND ASSEMBLY (Continued)

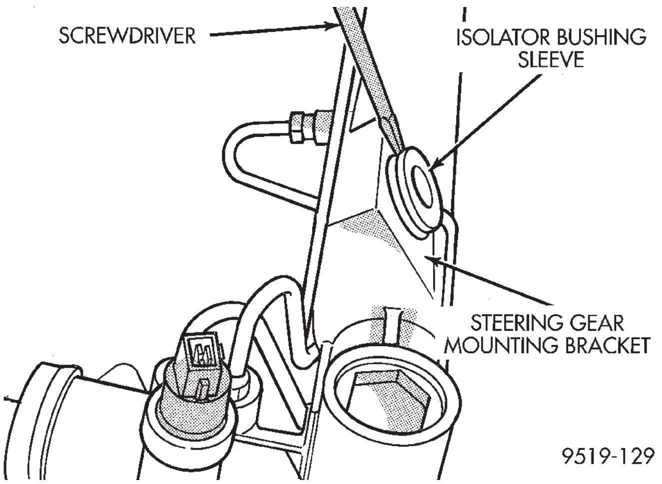


Fig. 22 Mounting Bolt Isolator Sleeve Removal

ASSEMBLY

(1) Lubricate replacement mounting bolt isolator bushing using Mopar, Silicone Spray Lube or an equivalent.

(2) Install the mounting bolt isolator bushing into the steering gear mounting bracket from the bottom side of the bracket (Fig. 23).

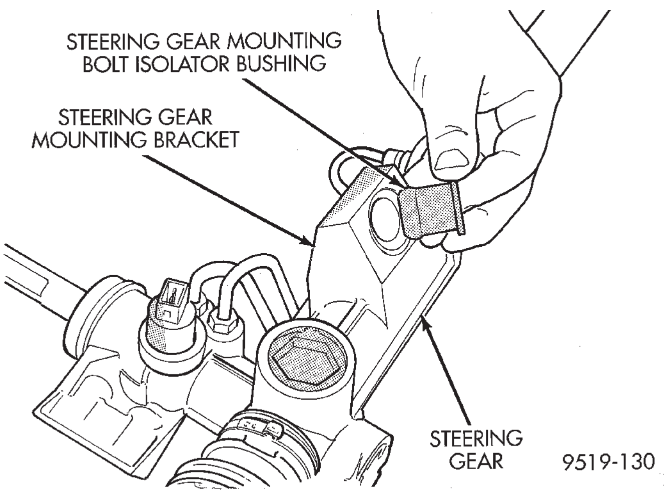


Fig. 23 Installing Mounting Bolt Isolator Bushing

(3) Install mounting bolt isolator bushing sleeve into isolator bushing by pressing the sleeve into the bushing by hand (Fig. 24).

OUTER TIE ROD END

DISASSEMBLE

(1) Loosen inner tie rod to outer tie rod jam nut (Fig. 25).

(2) Remove nut attaching outer tie rod end to steering knuckle (Fig. 26). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench.**

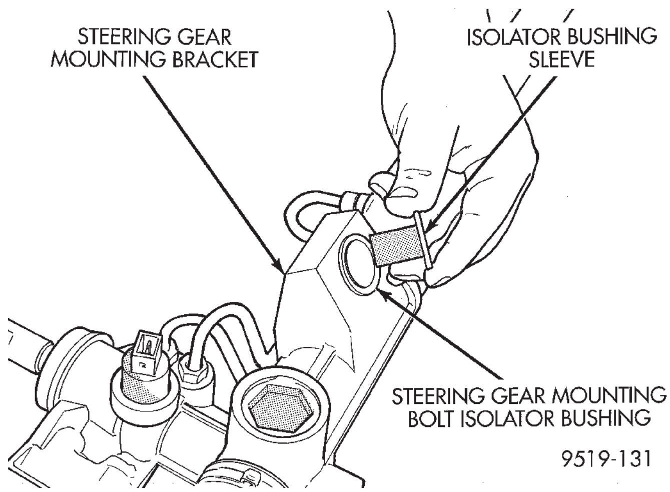


Fig. 24 Mounting Bolt Isolator Sleeve Installation

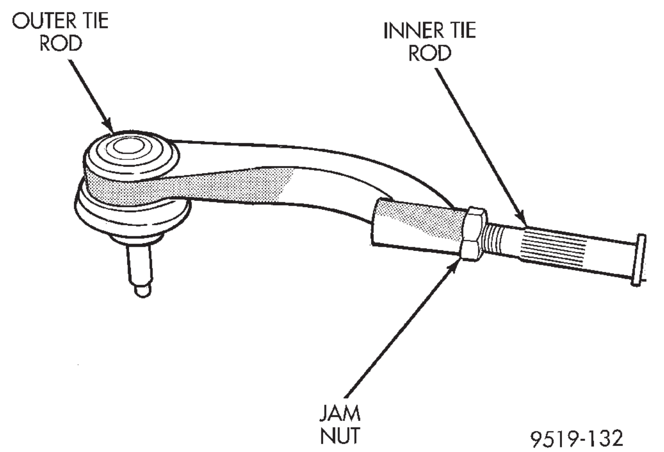


Fig. 25 Inner To Outer Tie Rod Jam Nut

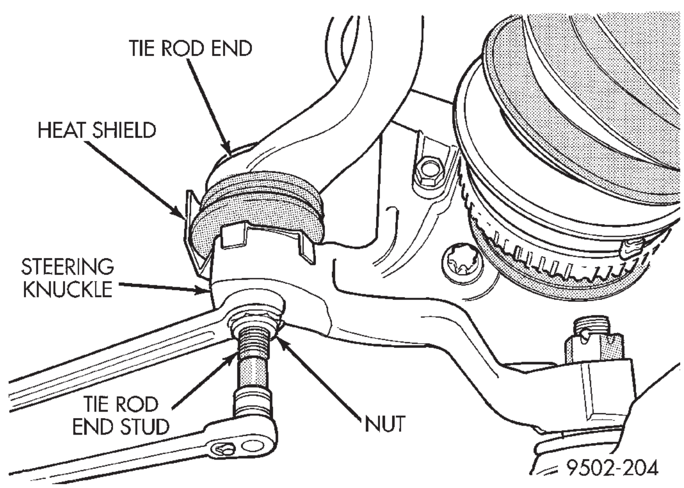


Fig. 26 Removing Tie Rod End Nut

(3) Remove tie rod end stud, from steering knuckle, using Remover, Special Tool MB-991113 (Fig. 27).

(4) Remove outer tie rod end from inner tie rod by un-threading it from the inner tie rod.

DISASSEMBLY AND ASSEMBLY (Continued)

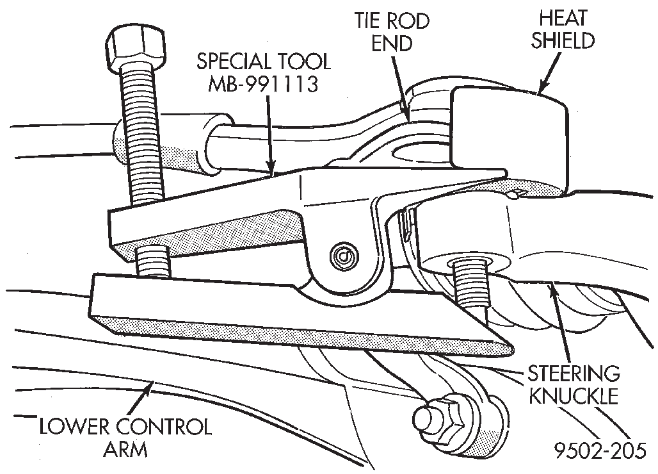


Fig. 27 Tie Rod End Removal From Steering Knuckle

ASSEMBLE

(1) Install outer tie rod onto inner tie rod. **Make sure jam nut is on inner tie rod.**

(2) Do not tighten jam nut.

(3) Install tie rod end seal boot heat shield (Fig. 26) on the tie rod end.

(4) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 26). Then using a crowfoot and 11/32 socket, (Fig. 28) torque tie rod end attaching nut to 61 N·m (45 ft. lbs.).

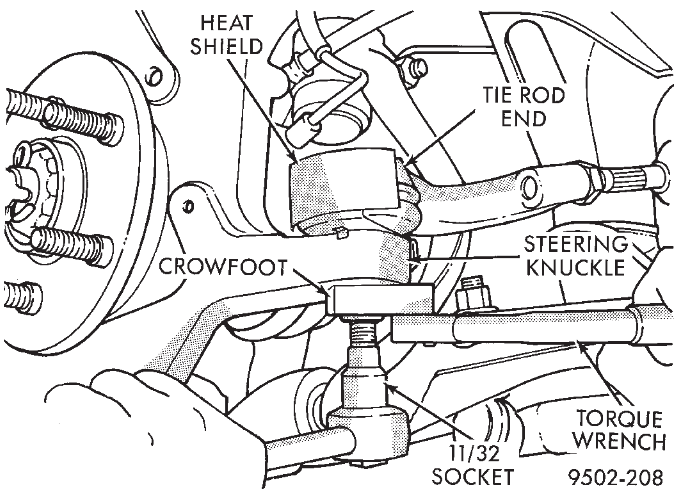


Fig. 28 Torquing Tie Rod End Attaching Nut

CAUTION: During this procedure do not allow the steering gear boot to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(5) Adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

(6) Tighten tie rod jam nut (Fig. 25) to 75 N·m (55 ft. lbs.) torque.

(7) Adjust the steering gear to inner tie rod boots at inner tie rod if they became twisted during Toe adjustment.

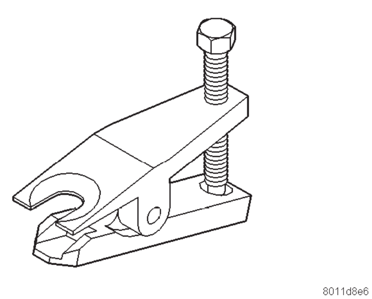
SPECIFICATIONS

STEERING GEAR FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
STEERING GEAR:	
To Crossmember Bolts	68 N·m (50 ft. lbs.)
Tie Rod To Steering Knuckle Nut	61 N·m (45 ft. lbs.)
Outer To Inner Tie Rod Jam Nut	75 N·m (55 ft. lbs.)
Power Steering Hose Tube Nuts	31 N·m (275 in. lbs.)

SPECIAL TOOLS

POWER STEERING GEAR



Remover Tie Rod End MB–990635

STEERING COLUMN

INDEX

DESCRIPTION AND OPERATION

STEERING COLUMN

The steering column used in this vehicle (Fig. 1) has been designed to be serviced only as a complete assembly if it is determined to be defective. The replaceable components mounted on the steering column assembly are the key cylinder, ignition switch, multi-function switch, clockspring, speed control switches, lock cylinder trim ring, SKIM module, trim shrouds, driver airbag and steering wheel. These replaceable components of the steering column can be serviced without requiring removal of the steering column from the vehicle.

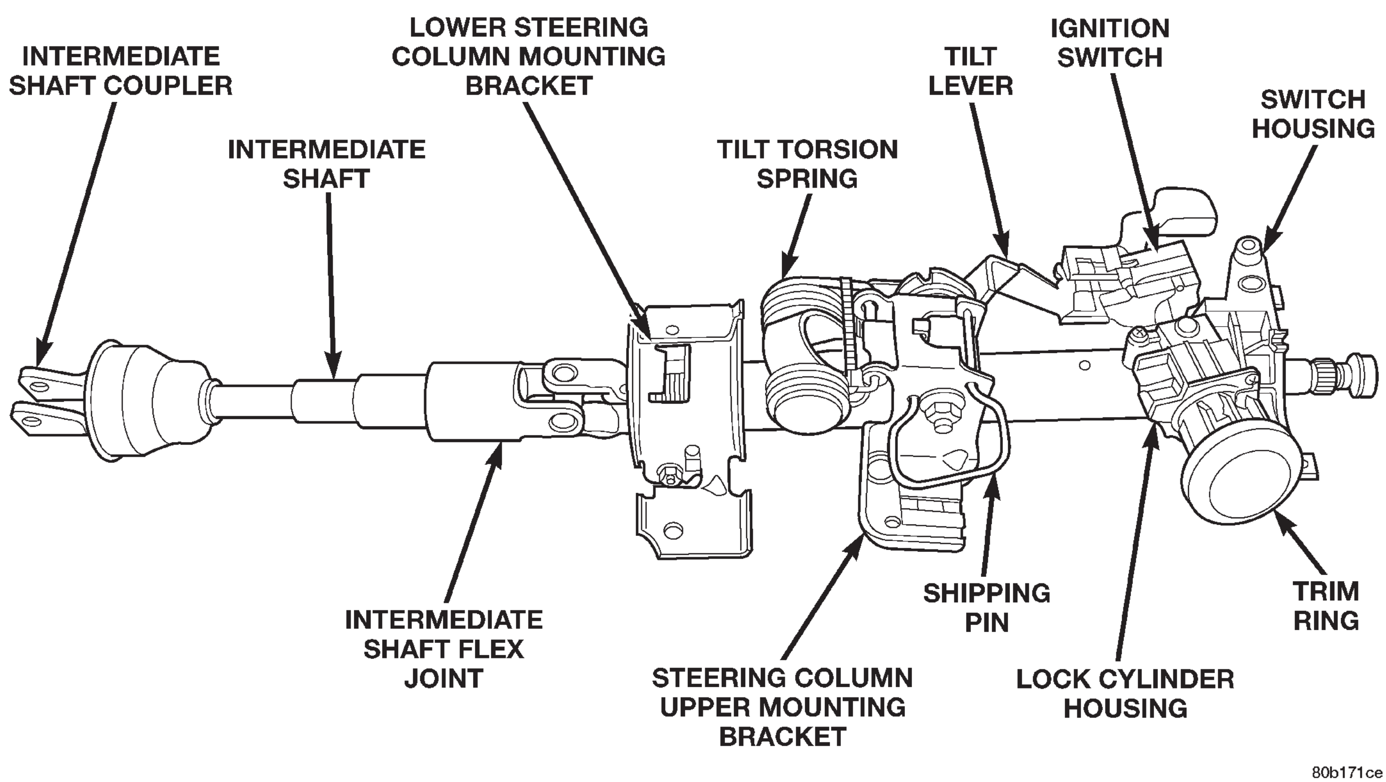


Fig. 1 Steering Column

DIAGNOSIS AND TESTING

STEERING COLUMN

For diagnosis of conditions relating to the steering column, refer to the STEERING SYSTEM DIAGNOSIS CHARTS in DIAGNOSIS AND TESTING in the POWER STEERING section of this service manual group.

STEERING GEAR TO STEERING COLUMN INTERMEDIATE COUPLER

The steering column coupler **MUST** be inspected whenever a vehicle is involved in an impact or whenever any of the following conditions exist.

(1) The steering column coupler must be inspected whenever a vehicle is involved in a collision which deploys the air bag, regardless of the extent of damage done to the vehicle.

(2) If a vehicle is involved in an impact of the vehicles front suspension or under carriage, which results in any type of damage to the front suspension crossmember.

(3) Under any conditions which result in the steering column assembly or steering column shaft receiving a force great enough to move the steering column or shaft forward of rearward in a vehicle.

STEERING COLUMN SHAFT FLEX COUPLER

If the steering column shaft flex coupler is diagnosed to be defective due to any of the following conditions: seized bearing, loose bearing stake or a bearing not fully seated in the yoke of the coupler assembly, the coupler can be serviced as a separate component of the steering column assembly.

The steering column assembly needs to be removed from the vehicle for replacement of the steering column shaft flex coupler assembly.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

WARNING: BEFORE BEGINNING ANY SERVICE PROCEDURES THAT INVOLVES REMOVING THE AIR BAG. REMOVE AND ISOLATE THE NEGATIVE (-) BATTERY CABLE (GROUND) FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIR BAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIR BAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIR BAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIR BAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS. BEFORE SERVICING A STEERING COLUMN EQUIPPED WITH AN AIR BAG, REFER TO GROUP 8M, ELECTRICAL FOR PROPER AND SAFE SERVICE PROCEDURES.

WARNING: SAFETY GOGGLES SHOULD BE WORN AT ALL TIMES WHEN WORKING ON STEERING COLUMNS.

CAUTION: Disconnect negative (ground) cable from the battery, before servicing any column component.

CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Damage will occur.

STEERING COLUMN

WARNING: SAFETY GOGGLES SHOULD BE WORN AT ALL TIMES WHEN WORKING ON STEERING COLUMNS.

REMOVE

(1) Remove remote ground cable (Fig. 2) from ground stud on shock tower. Then correctly isolate ground cable from vehicle by installing isolator on stud (Fig. 3).

(2) **Wait for a minimum of 2 minutes before starting to remove air bag from steering wheel. This will allow the airbag system capacitor to de-energize.**

(3) Before beginning removal of steering column assembly from vehicle, be sure front wheels of vehicle are in the **straight ahead** position.

(4) Remove fuse panel cover from left end of instrument panel (Fig. 4). Then remove the screw behind fuse panel cover, attaching the instrument panel top cover (Fig. 4).

REMOVAL AND INSTALLATION (Continued)

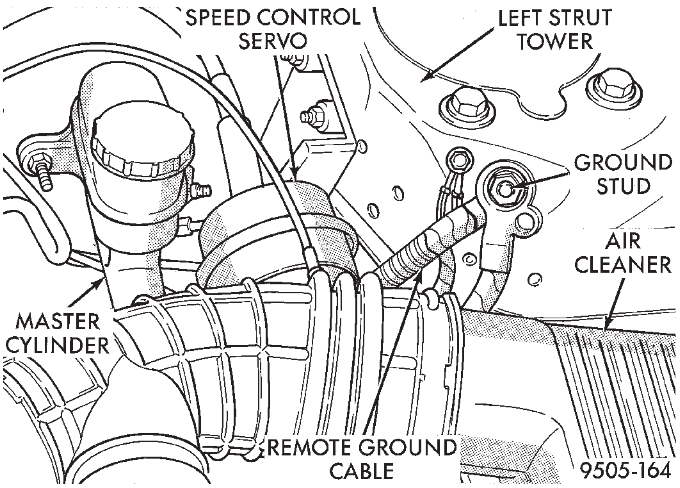


Fig. 2 Remote Ground Cable At Shock Tower

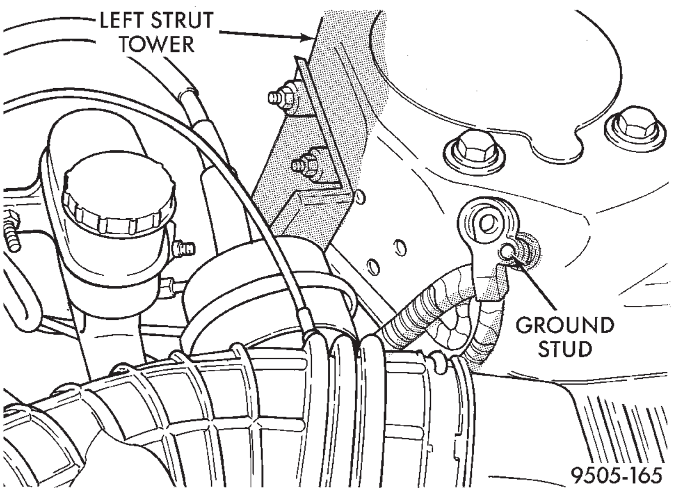


Fig. 3 Correctly Isolated Remote Ground Cable

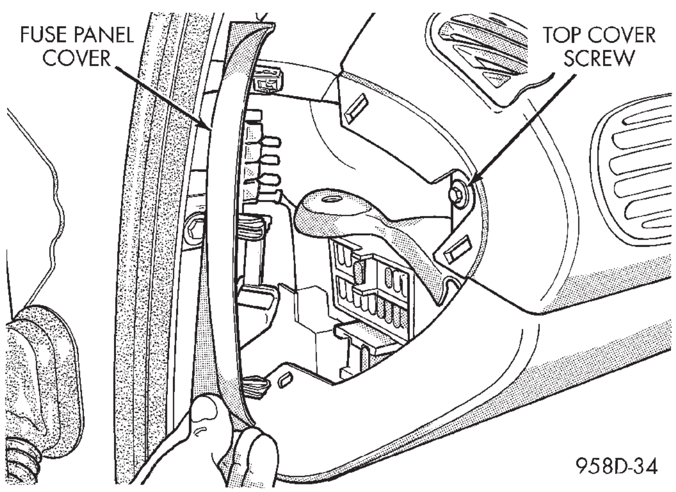


Fig. 4 Instrument Panel Top Cover Attaching Screw

(5) Remove center bezel surrounding radio and climate control panel from top cover of instrument panel (Fig. 5).

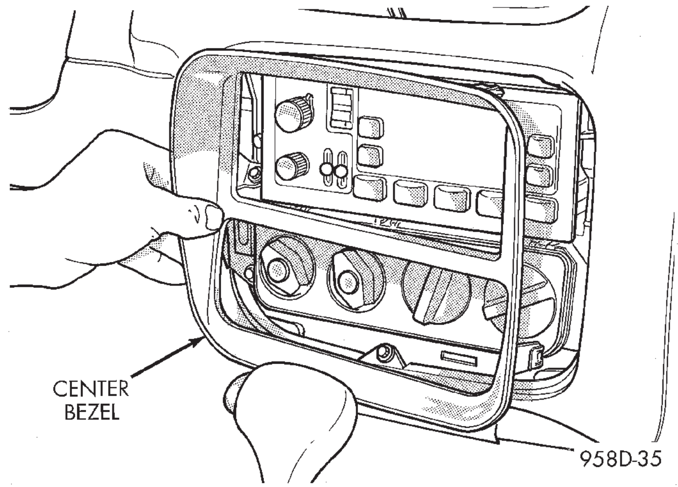


Fig. 5 Center Bezel

(6) Remove screws attaching the instrument panel top cover to the instrument panel (Fig. 6).

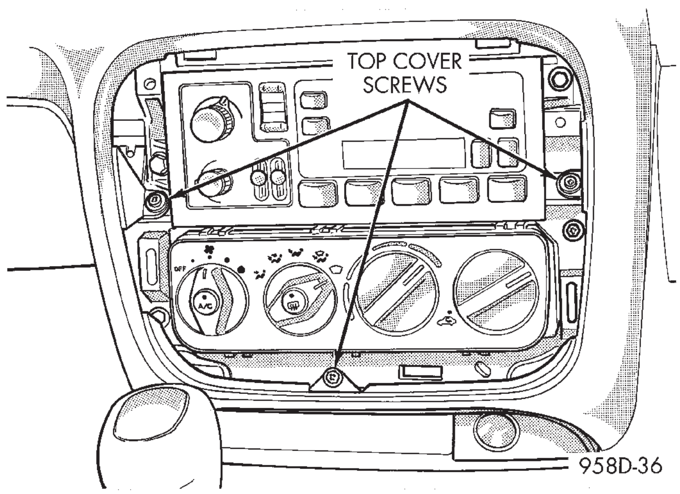


Fig. 6 Instrument Panel Top Cover Attaching Screws

(7) Remove top cover from instrument panel to gain access to knee bolster attaching screws.

(8) Remove screws attaching the knee bolster to the instrument panel (Fig. 7).

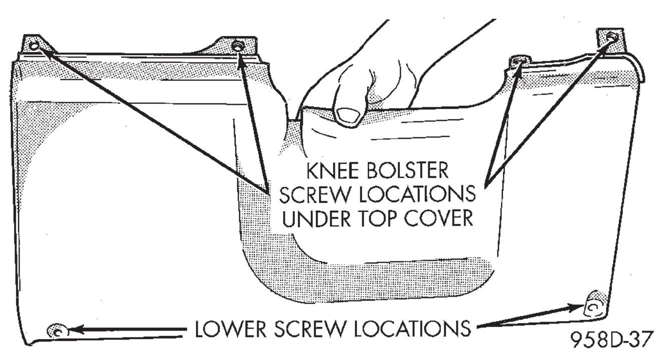


Fig. 7 Knee Bolster Attaching Screw Locations

REMOVAL AND INSTALLATION (Continued)

WARNING: WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES, THEN BEGIN AIR BAG REMOVAL.

(9) Remove the 2 Torx-Head fasteners, 1 on each side of steering wheel, attaching air bag module to steering wheel.

WARNING: WHEN HANDLING AN UNDEPLOYED AIR BAG MODULE DURING SERVICING OF THE STEERING COLUMN THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED. AT NO TIME SHOULD ANY SOURCE OF ELECTRICITY BE PERMITTED NEAR THE INFLATOR ON THE BACK OF THE AIR BAG MODULE. WHEN CARRYING A LIVE MODULE, THE TRIM COVER SHOULD BE POINTED AWAY FROM THE BODY TO MINIMIZE INJURY IF MODULE ACCIDENTLY DEPLOYS. IF AIR BAG MODULE IS PLACED ON A BENCH OR OTHER SURFACE, PLASTIC COVER SHOULD BE FACE UP TO MINIMIZE MOVEMENT IN CASE OF ACCIDENTAL DEPLOYMENT.

(10) Remove air bag module from center of steering wheel.

(11) Remove lock from clockspring air bag electrical lead connector (Fig. 8). Then disconnect clockspring electrical lead connector from the back of the air bag module (Fig. 8).

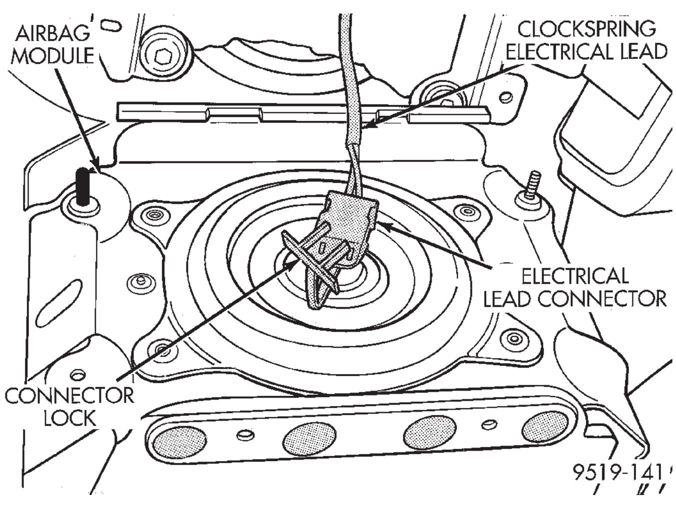


Fig. 8 Air Bag Module Electrical Lead

(12) Remove the screws on rear of steering wheel attaching the speed control switches to the steering wheel. Then remove speed control switches from steering wheel.

(13) Disconnect the clockspring, horn ground wire from airbag mounting bracket in steering wheel (Fig. 9).

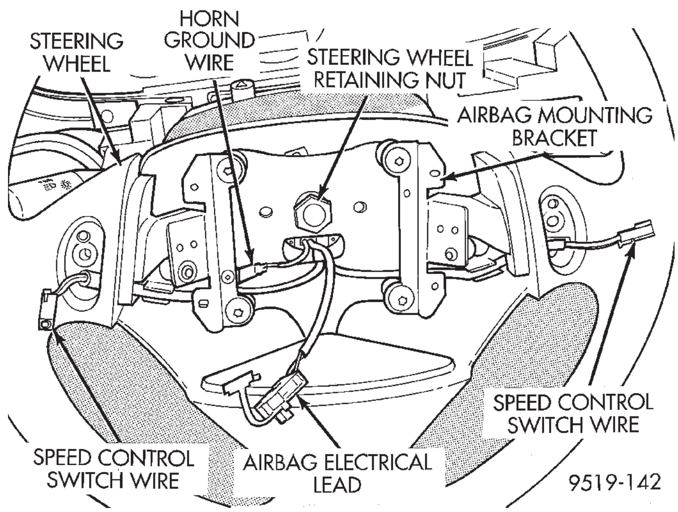


Fig. 9 Steering Wheel Wire Routing And Retaining Nut

(14) Remove the steering wheel retaining nut (Fig. 9).

CAUTION: When installing Puller, Special Tool C-3428-B on steering wheel, be sure puller bolts are fully seated in the threaded puller holes in steering wheel. If bolts are not fully seated in threaded holes, threads may be stripped out of steering wheel when puller is tightened to remove steering wheel.

(15) Install Puller, Snap-On CJ2001P or an equivalent on steering wheel (Fig. 10).

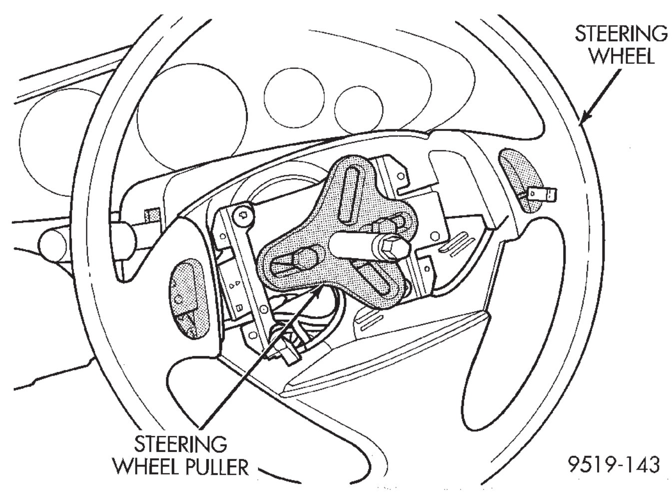


Fig. 10 Puller Installed On Steering Wheel

CAUTION: Do not bump or hammer on steering wheel or steering column shaft when removing steering wheel from steering column.

(16) Remove steering wheel assembly from steering column shaft using Puller, Snap-On CJ2001P or an equivalent.

REMOVAL AND INSTALLATION (Continued)

(17) Remove the 2 screws attaching the upper and lower shrouds to the steering column (Fig. 11). First remove upper shroud from steering column, then release tilt lever and tilt steering column to its highest point. Then remove lower shroud from steering column.

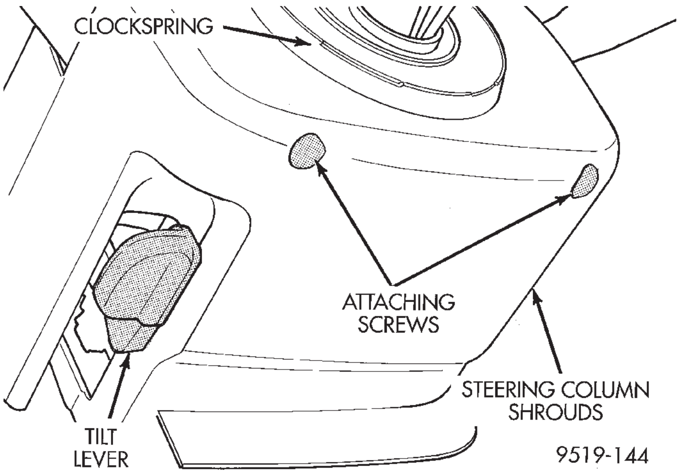


Fig. 11 Steering Column Shroud Attaching Screws

(18) Remove the 2 wiring harness connectors from the clockspring (Fig. 12).

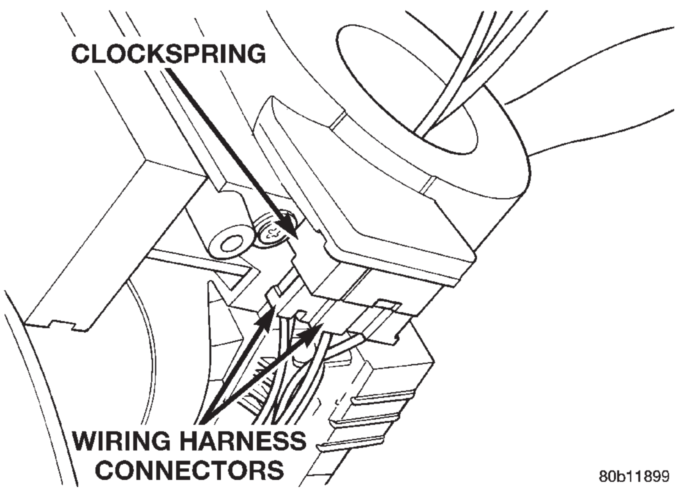


Fig. 12 Wiring Harness Connection To Clock Spring

(19) Remove the multi and 2 wire wiring harness connectors from the back of the ignition switch (Fig. 13). Then remove the 2 wiring harness connector from the multi function switch (Fig. 13) and (Fig. 14).

(20) If vehicle is equipped with an automatic transaxle, rotate the key cylinder to the off position. Depress locking tab on shifter/ignition interlock cable (Fig. 15) and remove the cable from the key lock housing.

(21) Remove routing clip holding wiring harness to jacket of steering column.

(22) Remove retaining pin in steering column coupler pinch bolt (Fig. 16). Loosen the upper to lower

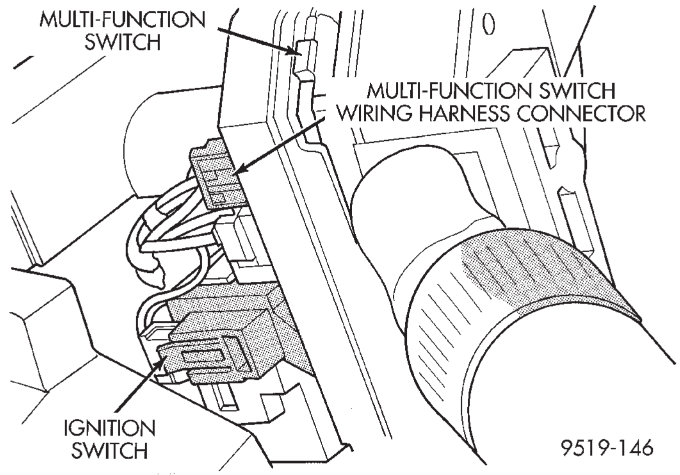


Fig. 13 Wiring Harness Connections To Ignition And Multi-Function Switch

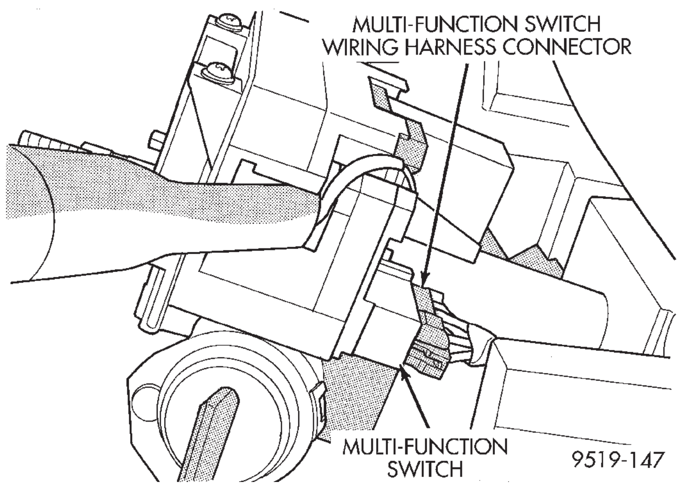


Fig. 14 Wiring Harness Connection To Multi-Function Switch

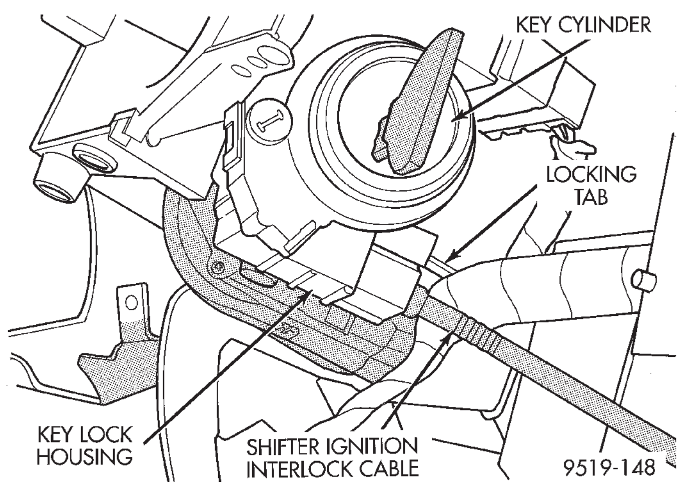


Fig. 15 Shifter/Ignition Cable At Lock Cylinder Housing

steering coupler pinch bolt retaining nut and remove pinch bolt from steering coupler (Fig. 16). **Pinch**

REMOVAL AND INSTALLATION (Continued)

bolt nut is caged to coupler and is not removable. Then separate steering coupler from steering gear.

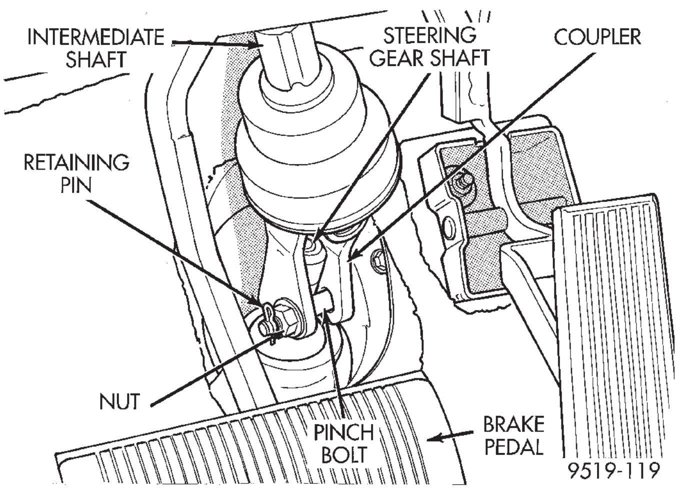


Fig. 16 Intermediate Shaft Coupler To Steering Gear Shaft

CAUTION: Before loosening the upper and lower steering column mounting bracket attaching nuts, the following procedure to lock upper steering column mounting bracket from moving must be done. If upper steering column mounting bracket is not locked in its proper position before loosening the mounting nuts, the tilt steering column will not operate correctly when installed back in car. This is due to the alignment of the upper mounting bracket assembly slipping when the mounting bolts are loosened.

(23) Place steering column so it is positioned in the middle of its tilt range. Place the steering column assembly tilt lever in its fully locked position. Then insert a 5/32 inch drill bit in each locking pin hole on the upper steering column mounting bracket (Fig. 17).

(24) Remove the 2 upper steering column assembly mounting bracket to support bracket nuts. Then remove the 2 lower steering column assembly mounting bracket to support bracket nuts (Fig. 18).

(25) Remove steering column assembly from vehicle through the drivers door of the passenger compartment. Use care to avoid damaging the paint or interior trim.

INSTALL

(1) Install steering column on the studs in the steering column support bracket. Loosely install the 4 steering column assembly attaching nuts.

(2) Tighten the 2 lower steering column assembly mounting nuts to hold the steering column in place. Be sure both breakaway capsules are still fully seated in the slots of the upper steering column

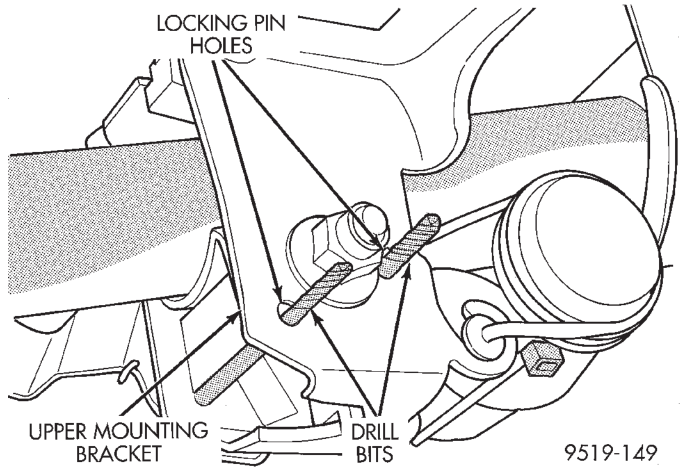


Fig. 17 Locking Pins Installed In Steering Column Bracket

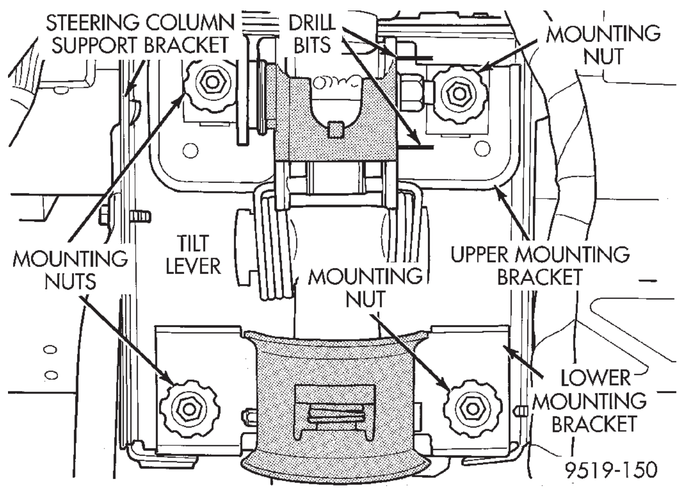


Fig. 18 Steering Column Upper And Lower Mounting Bracket Nuts

mounting bracket and the mounting studs are centered for and aft in the plastic capsules (Fig. 19). Then equally tighten both steering column mounting nuts, until upper steering column mounting bracket is seated against support bracket. Tighten the 4 steering column bracket to support bracket nuts to 12 N·m (105 in. lbs.).

CAUTION: Be sure drill bits are removed from steering column upper mounting bracket.

(3) Remove the 2 drill bits (Fig. 17) from the steering column upper mounting bracket. **If a new steering column is being installed in the vehicle, remove the shipping (grenade) pin from steering column upper mounting bracket.**

(4) Ensure front wheels of vehicle are positioned straight-ahead, and steering wheel master serration in steering column shaft is positioned at 12 O Clock. Assemble the lower intermediate shaft coupler to the

REMOVAL AND INSTALLATION (Continued)

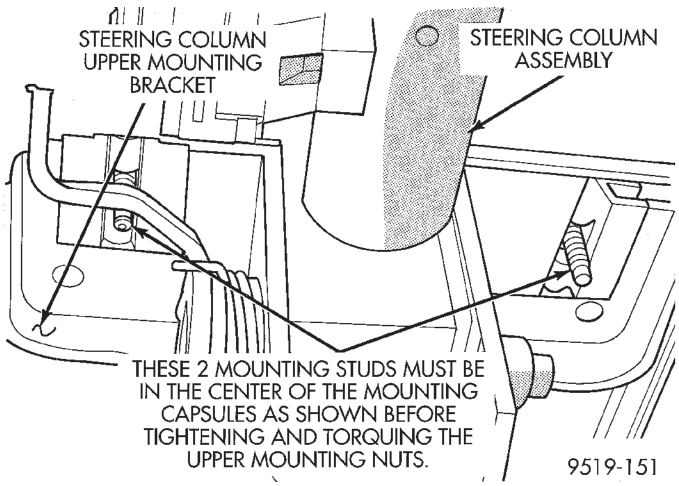


Fig. 19 Mounting Studs Correctly Positioned In Plastic Capsules

steering gear input shaft. Install **a new** pinch bolt in the coupler. Tighten the coupler pinch bolt nut to a torque of 27 N·m (240 in. lbs.). **Be sure to install steering coupler pinch bolt retaining pin (Fig. 16).**

(5) If vehicle is equipped with an automatic transaxle, install the shifter/ignition interlock cable (Fig. 15) in the lock cylinder housing.

(6) Route wiring harness on steering column and install routing clip in bottom of steering column jacket.

(7) Install multi and 2 wire wiring harness connectors on the back of the ignition switch (Fig. 13). Then install the 2 wiring harness connectors on the multi function switch (Fig. 13) and (Fig. 14).

(8) Install clockspring on switch housing. Install the 2 wiring harness connectors on the clockspring (Fig. 12). Then install wiring harness connector on lock housing halo light (Fig. 12).

(9) Install the upper and lower steering column shrouds onto the lock housing of the steering column assembly. Install and securely tighten the 2 upper to lower steering column shroud to lock housing attaching screws (Fig. 11).

CAUTION: Clockspring centering procedure MUST be performed prior to installing steering wheel assembly. If clockspring is not centered it may be overextended, causing clockspring assembly to become inoperative. The yellow centering indicator must be present in the centering window of the clockspring and the arrow on the clockspring rotor must be pointing at the centering window.

(10) Center the clock spring using the following procedure.

• Depress the 2 plastic locking pins to disengage clockspring locking mechanism.

• Keeping locking mechanism disengaged, rotate the clockspring rotor in the CLOCKWISE DIRECTION to the end of the travel. Do not apply excessive torque.

• From the end of clockwise travel, slowly rotate the rotor in the counterclockwise direction until yellow appears in the centering window of clockspring. When yellow appears in the centering window the arrow on the clockspring rotor will be pointing at yellow window on clock spring.

• Engage the clockspring locking mechanism.

CAUTION: Do not install steering wheel onto shaft of steering column assembly by driving it onto the shaft. Pull steering wheel down onto steering column shaft using ONLY the steering wheel retaining nut.

(11) Feed clockspring wiring leads through hole in steering wheel (Fig. 9). Position steering wheel on shaft of steering column assembly, making sure to fit flats on hub of steering wheel with formations on inside of clockspring.

(12) Connect the horn ground wire from the clockspring on the airbag mounting bracket in steering wheel (Fig. 9).

(13) Install steering wheel to steering column shaft retaining nut and tighten until steering wheel is fully installed on shaft. Tighten steering wheel retaining nut to a torque of 61 N·m (45 ft. lbs.).

(14) Correctly route the speed control switch wiring leads from the clockspring to switch openings in steering wheel (Fig. 9).

(15) Connect the clockspring electrical leads to the speed control switches. Install the speed control switches in the steering wheel. Install and securely tighten screws attaching the speed control switches to the steering wheel.

(16) Push the speed control wires into the wire retaining channels on the steering wheel (Fig. 9).

(17) Install air bag electrical lead from clock spring, into connector on back of air bag module. Insert locking tab into back of air bag connector (Fig. 8). **Be sure electrical connector from clockspring is securely latched into air bag module connector.**

CAUTION: The fasteners, screws, and bolts, originally used for the air bag components are specifically designed for the air bag system. They must never be replaced with any substitutes. Anytime a new fastener is needed, replace only with correct fasteners provided in service packages or fasteners listed in the parts book.

(18) Install air bag module into center of steering wheel. Align air bag module locating pins with the

REMOVAL AND INSTALLATION (Continued)

mating hole and slot in the steering wheel. Install **only the 2 original or correct replacement** air bag module attaching bolts. Torque the 2 air bag module attaching bolts to 10 N·m (90 in. lbs.).

(19) Install key lock cylinder into lock housing. Key lock cylinder is installed by positioning key cylinder in the run position so retaining tab can be depressed and the pushing key cylinder into lock housing until retaining tab locks into key lock cylinder.

(20) Install lower instrument panel knee bolster onto the lower instrument panel. Install and securely tighten the knee bolster to instrument panel attaching screws (Fig. 7).

(21) Install the instrument panel top cover.

(22) Install screw behind fuse panel cover holding instrument panel top cover (Fig. 4). Install fuse panel cover on left end of instrument panel.

(23) Install screws holding instrument panel top cover to center of instrument panel (Fig. 6).

(24) Install center bezel surrounding radio and climate control panel from top cover of instrument panel (Fig. 5).

CAUTION: When reconnecting battery on a vehicle that has had the air bag module removed, ensure no occupants are in the vehicle and the following procedure is used.

(25) Reconnecting of the battery negative cable is to be done using the steps in the procedure listed below.

• Remove forward console or cover as necessary.

• Connect DRB scan tool to ASDM diagnostic 6-way connector, located at right side of the ASDM module.

• Turn ignition key to ON position. Exit vehicle with the DRB scan tool. Install the latest version of the proper diagnostic cartridge into the DRB scan tool.

• Ensuring that their are no occupants in the vehicle, connect negative cable to negative post of the battery.

• Using the DRB scan tool read and record active fault codes. Also read and record any stored fault codes. Refer to the Passive Restraint Diagnostic Test Manual if any faults are found.

• Erase stored faults if there are no active fault codes. If problems remain, fault codes will not erase.

• From the passenger side of the vehicle, turn ignition key to OFF and then ON observing instrument cluster air bag lamp. It should go on for six to eight seconds, then go out. This will indicate that the air bag system is functioning normally.

(26) **If air bag warning lamp fails to light, blinks on and off or goes on and stays on, there is an air bag system malfunction.** Refer to the Passive Restraint Diagnostic Test Manual to diagnose the system malfunction.

(27) Test the operation of the horn, lights and any other functions that are steering column operated. If applicable reset the radio and the clock.

(28) Road test vehicle to ensure proper operation of the steering system and the speed control system.

STEERING COLUMN INTERMEDIATE SHAFT

The steering column assembly will need to be removed from the interior of the vehicle to allow for replacement of the steering column shaft coupler assembly.

REMOVAL

(1) Remove steering column assembly from vehicle. Refer to STEERING COLUMN in this section for the required removal procedure.

(2) Install Remover/Installer, Special Tool 6831-A, through center of roll pin in intermediate shaft's flex joint and install knurled nut (Fig. 20).

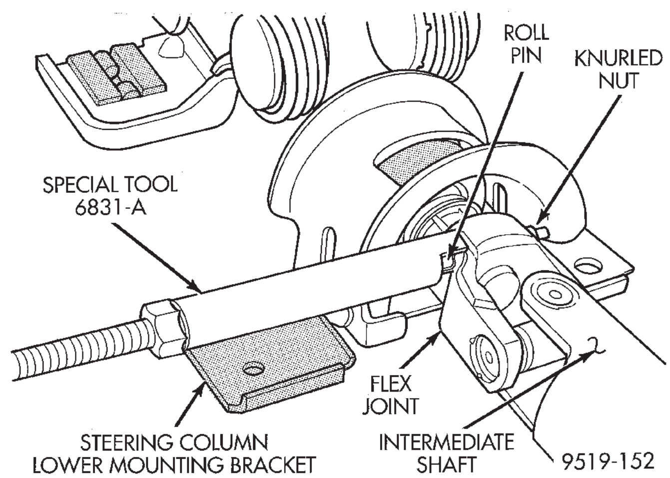


Fig. 20 Removing Roll Pin From Flex Joint

(3) While holding hex on end threaded rod, tighten the nut on threaded rod of Remover/Installer. This will pull the roll pin out of the intermediate shaft's flex joint.

(4) Using a screwdriver inserted between the shaft's flex joint and the steering column lower mounting bracket (Fig. 21), pry intermediate shaft off steering column shaft.

INSTALLATION

(1) Start roll pin into flex joint prior to installing intermediate shaft on steering column shaft. Install roll pin into just far enough to square roll pin to hole in flex joint. If roll pin is installed too far, flex joint will not slid onto steering column shaft.

(2) Install intermediate shaft on steering shaft until correctly positioned to allow roll pin to be installed in coupler.

REMOVAL AND INSTALLATION (Continued)

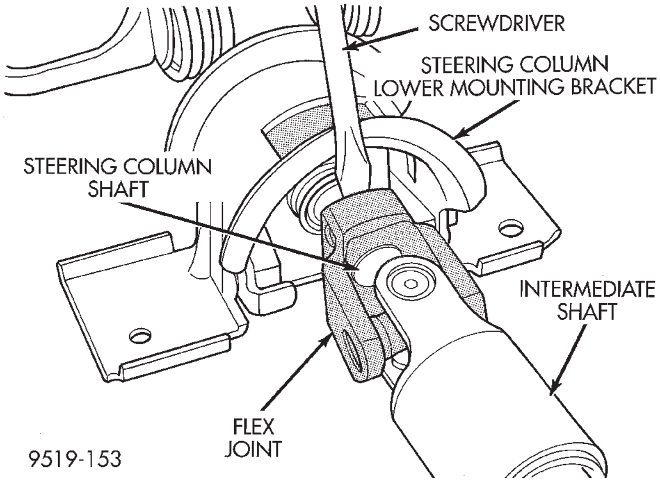


Fig. 21 Removing Intermediate Shaft

(3) Install Remover/Installer, Special Tool 6831-A, through center of roll pin and install knurled nut as shown (Fig. 22).

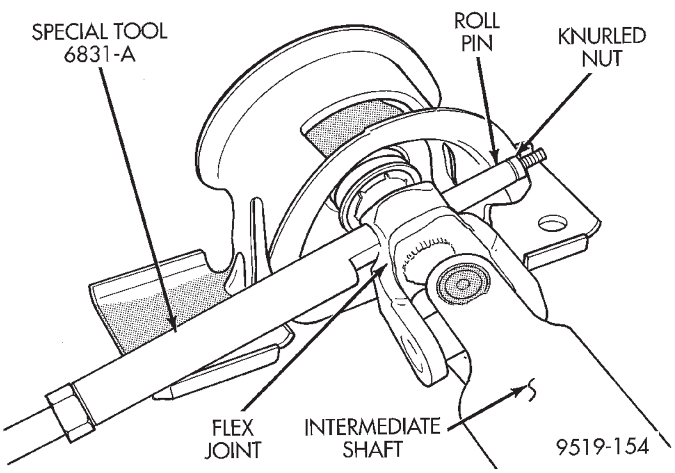


Fig. 22 Tool Set-Up For Installing Roll Pin

(4) Using Remover/Installer (Fig. 22), install roll pin into the coupler until roll pin is fully and evenly installed through both sides of the coupler assembly.

(5) Reinstall steering column as necessary back in vehicle. Refer to STEERING COLUMN in this section for the required procedure.

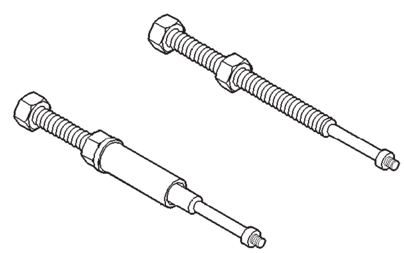
SPECIFICATIONS

STEERING COLUMN FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
STEERING WHEEL:	
Retaining Nut	61 N·m (45 ft. lbs.)
STEERING COLUMN ASSEMBLY:	
Mounting Bracket Attaching Nuts	12 N·m (105 in. lbs.)
Flex Coupler Pinch Bolt	27 N·m (240 in. lbs.)
Airbag Module Attaching Nuts	10 N·m (90 in. lbs.)

SPECIAL TOOLS

STEERING COLUMN



Remover / Installer Steering Shaft Roll Pin 6831A

TRANSAXLE

CONTENTS

NV T350 (A-578) MANUAL TRANSAXLE

INDEX

GENERAL INFORMATION

NV T350 MANUAL TRANSAXLE

NOTE: Safety goggles should be worn at all times when working on these transaxles.

This five speed is a constant-mesh manual transaxle. All gear ranges, except reverse, are synchronized. The reverse gear utilizes a brake and blocking ring for shifting ease. The reverse idler gear is supported on a sliding spindle idler shaft. The transaxle case is aluminum with a steel end–plate bearing cover. It is housed in a die-cast aluminum case featuring a two–piece, middle split design (Fig. 1).

The NV T350 (A-578) transaxle internal components can be serviced only by separating the gear case from the bellhousing case.

GENERAL INFORMATION (Continued)

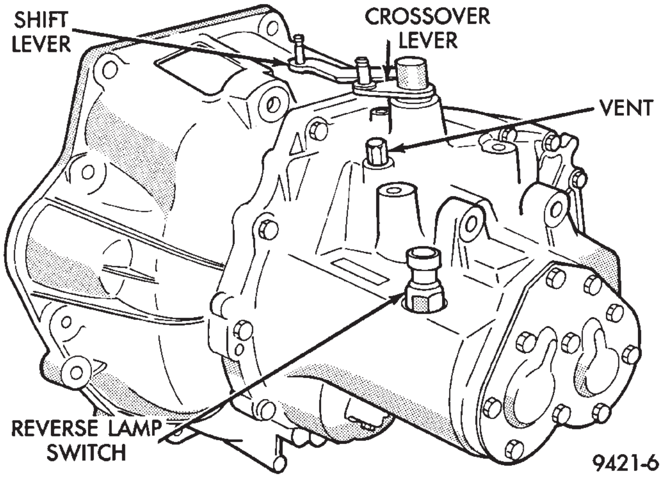


Fig. 1 External Transaxle Components

CAUTION: The transaxle output shaft is serviced as a unit. No disassembly and reassembly is possible. Damage to the transaxle may result.

TRANSAXLE IDENTIFICATION INFORMATION

The transaxle model, assembly number, and build date are on a metal I.D. tag that is attached to the end cover of the transaxle (Fig. 2). This information is also shown on a bar code label that is attached to the front of the transaxle (Fig. 3).

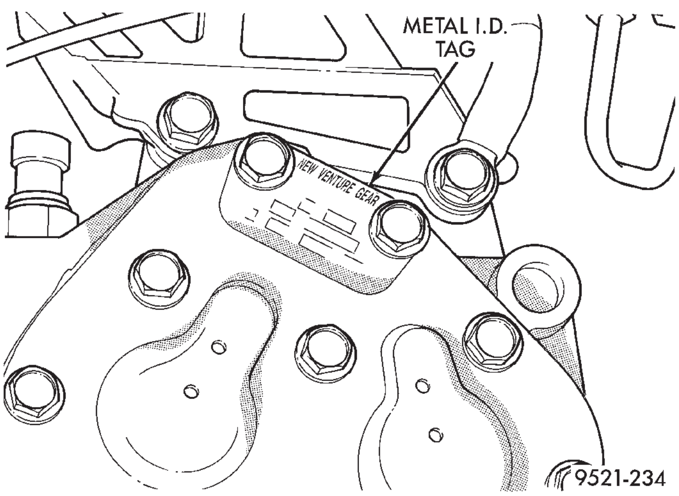


Fig. 2 Metal I.D. Tag

NOTE: Transaxles use various final drive gear ratios in different vehicle applications. Therefore, it is necessary that the correct transaxle assembly number is used when ordering service parts.

The last eight digits of the Vehicle Identification Number (V.I.N.) are stamped on the case, below the back–up lamp switch.

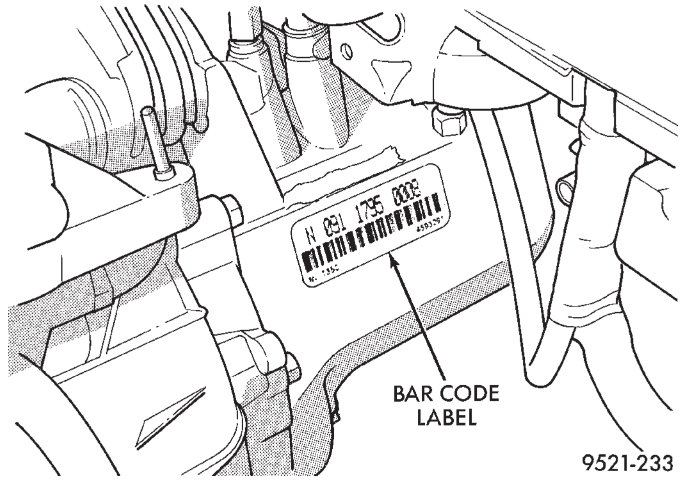


Fig. 3 Bar Code Label

NOTE: There are four different versions of this transaxle. There are no external differences between the models. Refer to the identification tag on the transaxle to determine which transaxle the vehicle is equipped with.

SELECTION OF LUBRICANT

NV T350 (A-578) transaxles use Mopar® Type M.S. 9417 Manual Transaxle Fluid. **Hypoid gear lube, engine oil, and/or automatic transmission fluid should not be used in this transaxle.** Hard shifting effort, bearing, gear, and/or synchronizer failure may occur if incorrect fluid is used.

SPECIAL ADDITIVES

The addition of any fluids to the transaxle, other than the fluid listed above, is not recommended. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

SEALANTS

The sealant used to seal the transaxle case halves and input bearing is Mopar® Gasket Maker, Loctite® 518, or equivalent. The sealant used for the bearing end plate cover is Mopar® RTV.

GEAR RATIOS

CAUTION: All gears and shafts must not be interchanged with other transaxles; they will not function correctly.

The differential is a conventional arrangement of gears that is supported by tapered roller bearings. The final output gear turns the ring gear and differential assembly, thereby turning the drive axle shafts.

GENERAL INFORMATION (Continued)

All JA transaxles have a torque capacity of 136 lb. ft. The gear ratios of each transaxle are shown in the following chart. The chart also shows which transaxles are available with the reverse–input shaft brake. This brake allows easier shifting into reverse and helps eliminate reverse gear clash.

GEAR	
1st	3.54
2nd	2.13
3rd	1.36
4th	1.03
5th	0.72
FINAL DRIVE	3.94
REVERSE BRAKE	YES
CLUTCH RELEASE SYSTEM	CABLE

GEARSHIFT PATTERN

The NV T350 (A-578) transaxle shift pattern is a modified H–pattern (Fig. 4). Overdrive fifth and reverse gears are in–line and outboard of the first through fourth gear positions.

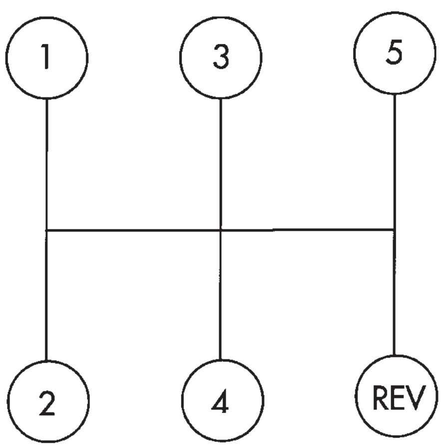


Fig. 4 NV T350 (A-578) Shift Pattern

DESCRIPTION AND OPERATION

GEARSHIFT LEVERS

The shift levers are serviceable in the vehicle. The shift levers are different from each other and do not interchange.

AXLE SEALS

The axle shaft seals are identical for both sides of the differential and will interchange.

DIAGNOSIS AND TESTING

COMMON PROBLEM CAUSES

The majority of transaxle malfunctions are a result of:

- Insufficient lubrication
- Incorrect lubricant
- Misassembled or damaged internal components
- Improper operation

HARD SHIFTING

Hard shifting may be caused by a misadjusted crossover cable. If hard shifting is accompanied by gear clash, synchronizer clutch and stop rings or gear teeth may be worn or damaged.

Misassembled synchronizer components also cause shifting problems. Incorrectly installed synchronizer sleeves, struts, or springs can cause shift problems.

NOISY OPERATION

Transaxle noise is most often a result of worn or damaged components. Chipped, broken gear or synchronizer teeth, and brinnelled, spalled bearings all cause noise.

Abnormal wear and damage to the internal components is frequently the end result of insufficient lubricant.

SLIPS OUT OF GEAR

Transaxle disengagement may be caused by misaligned or damaged shift components, or worn teeth on the drive gears or synchronizer components. Incorrect assembly also causes gear disengagement.

LOW LUBRICANT LEVEL

Insufficient transaxle lubricant is usually the result of leaks, or inaccurate fluid level check or refill method. Leakage is evident by the presence of oil around the leak point. If leakage is not evident, the condition is probably the result of an underfill.

If air–powered lubrication equipment is used to fill a transaxle, be sure the equipment is properly calibrated. Equipment out of calibration can lead to an underfill condition.

CLUTCH PROBLEMS

Worn, damaged, or misaligned clutch components can cause difficult shifting, gear clash, and noise.

A worn or damaged clutch disc, pressure plate, or release bearing can cause hard shifting and gear clash.

SERVICE PROCEDURES

FLUID DRAIN AND FILL

All NV T350 (A-578) transaxles are equipped with a fill plug. The fill plug is located on the left side of the transaxle differential area (Fig. 5). The fluid level should be within 3/16 inch from the bottom of the transaxle fill hole (vehicle must be level when checking).

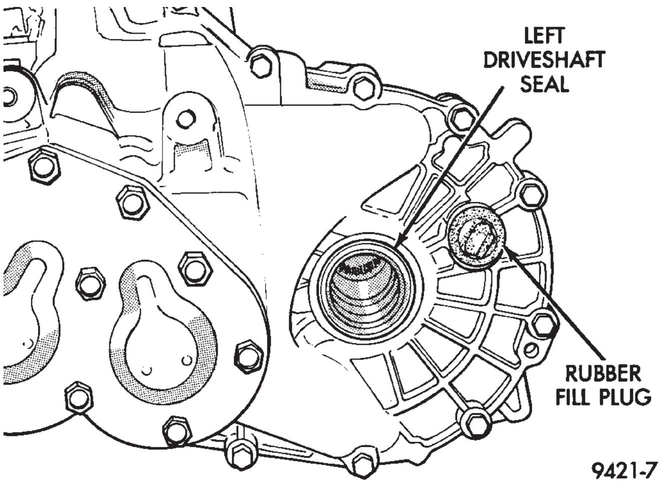


Fig. 5 Fill Plug Location

All NV T350 (A-578) transaxles are equipped with a drain plug. The drain plug is located on the lower right side of the transaxle differential housing (Fig. 6). Tighten drain plug to 28 N·m (250 in. lbs.)

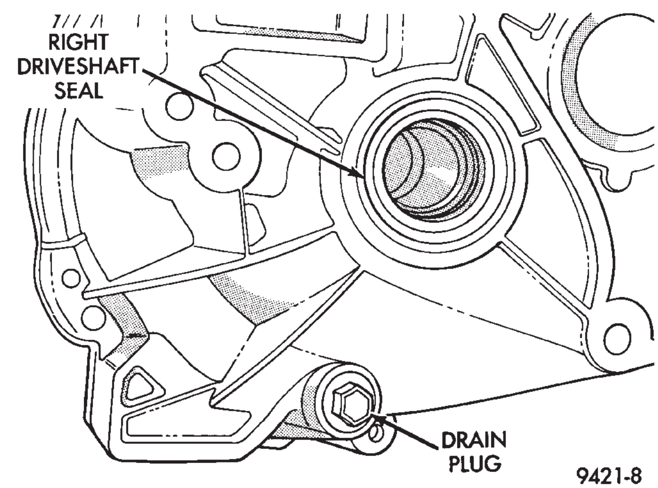


Fig. 6 Drain Plug Location

Dry fill lubricant capacity is approximately 1.9-2.2 liters (4.0-4.6 pints). Wipe the outside of the transaxle if any lubricant spills.

REMOVAL AND INSTALLATION

GEARSHIFT KNOB

REMOVAL

(1) Pull shifter boot down and away from shifter roll pin.

(2) Pry legs of shift knob away from shift lever roll pin using a flat blade pry tool (Fig. 7).

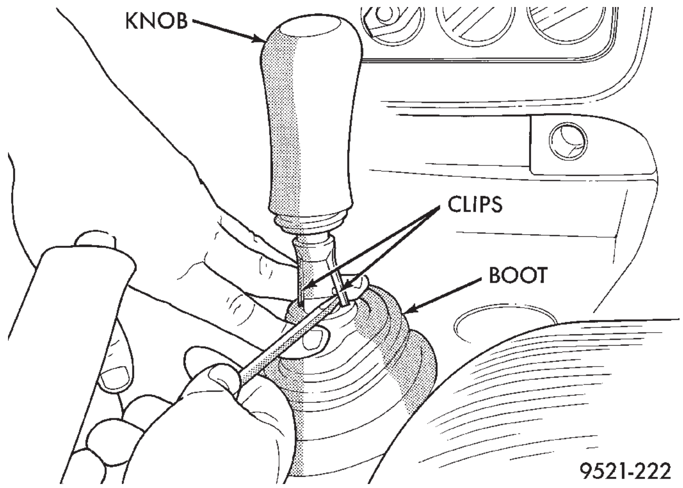


Fig. 7 Gearshift Knob

(3) Remove knob from shifter handle (Fig. 8).

INSTALLATION

(1) For installation, reverse removal procedure.

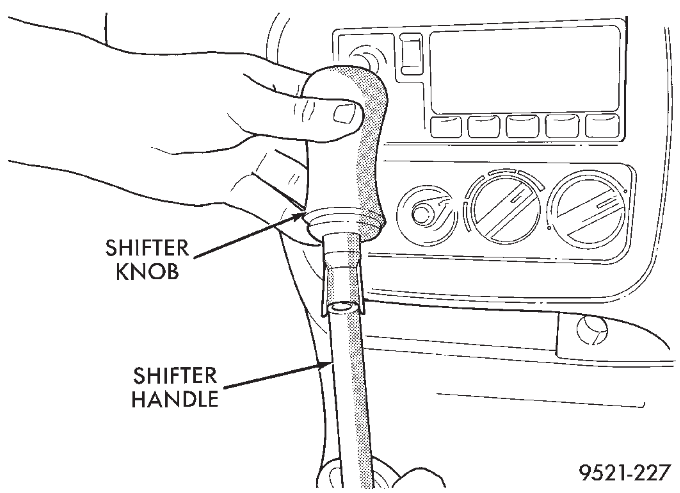


Fig. 8 Knob Removal

GEARSHIFT BOOT

REMOVAL

(1) Remove shifter knob. Refer to gearshift knob removal.

(2) Squeeze together the boot bezel at base. Pull up on boot and remove (Fig. 9).

REMOVAL AND INSTALLATION (Continued)

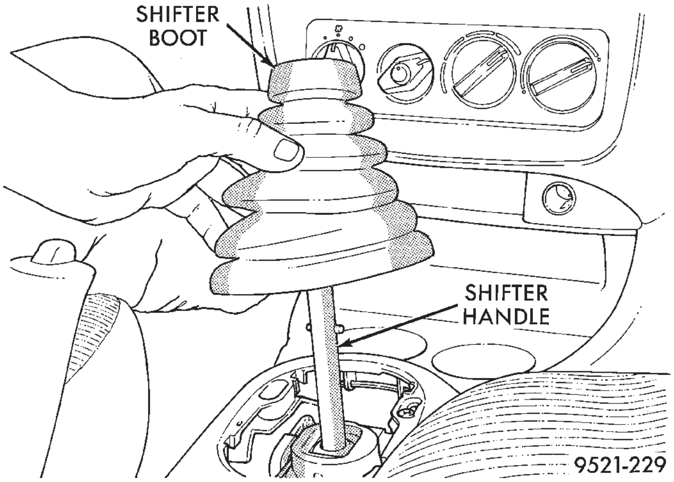


Fig. 9 Boot Removal

INSTALLATION

(1) For installation, reverse removal procedure.

GEARSHIFT CABLES

REMOVAL

(1) Disconnect battery negative cable at shock tower.

(2) Remove air cleaner assembly.

(3) Disconnect gear shift cable ends from transaxle shift levers (Fig. 10).

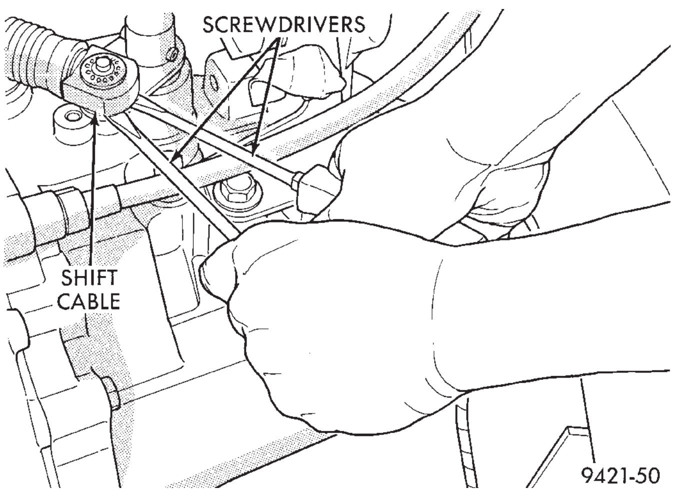


Fig. 10 Shift Cable Removal

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushings to avoid damaging cable isolator bushings.

(4) Remove cable to bracket retaining clips at transaxle.

CAUTION: It is recommended that new cable retaining clips be used for reinstallation.

(5) Pull cables up out of transaxle bracket.

(6) Remove gearshift knob and boot. Refer to Knob and Boot Removal in this section.

(7) Remove console front screws (Fig. 11). Remove console rear screws (Fig. 12).

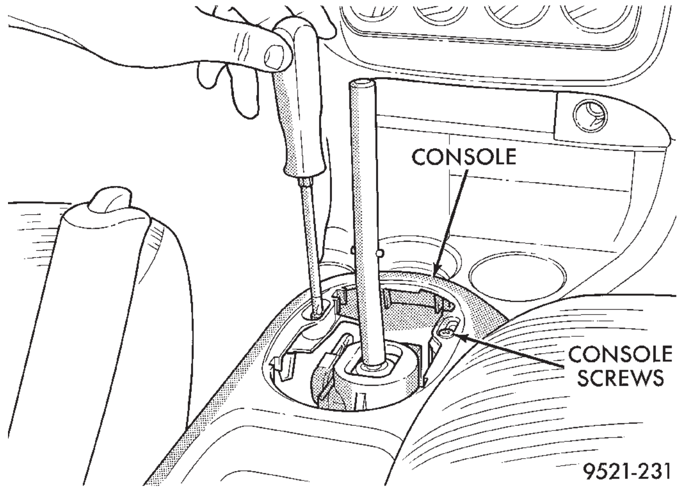


Fig. 11 Console Front Screws

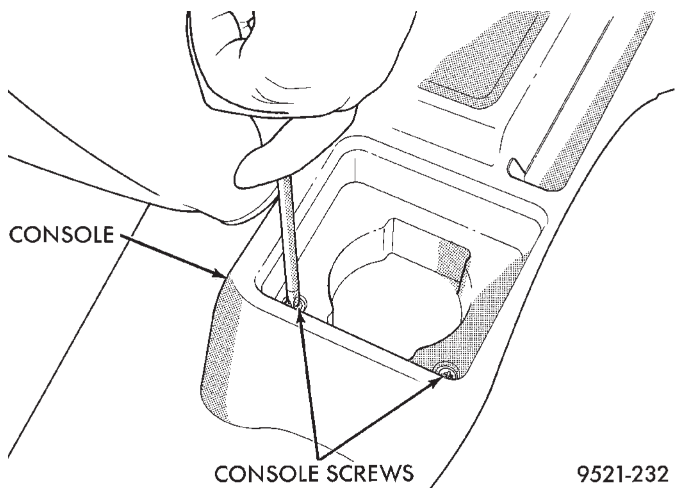


Fig. 12 Console Rear Screws

(8) Pull up on parking brake handle. Pull up on rear of console and remove console.

(9) Remove floor pan grommet from floor pan.

(10) Remove cable retaining clips at shifter (Fig. 13).

CAUTION: It is recommended that new cable retaining clips be used for reinstallation.

(11) Disconnect shift cables from shifter. Pry with equal force on both sides of shifter cable isolator bushings to avoid damaging bushings.

(12) Lift vehicle on hoist. Pry shift cable grommet from floor pan.

(13) Detach cables from cable support clips.

(14) Remove shift cables from vehicle.

REMOVAL AND INSTALLATION (Continued)

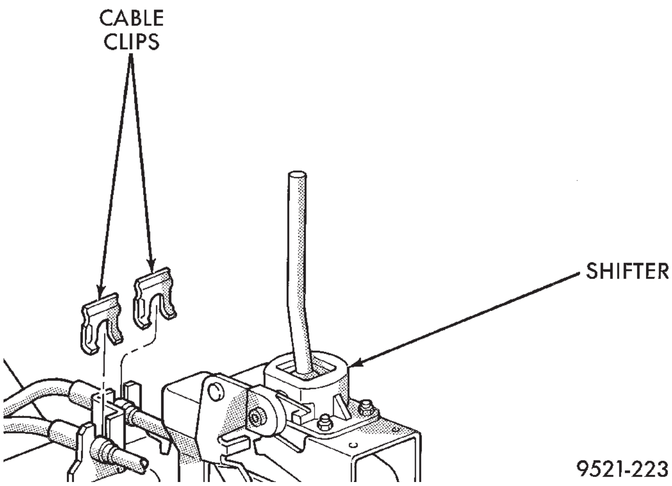


Fig. 13 Cable Retaining Clips

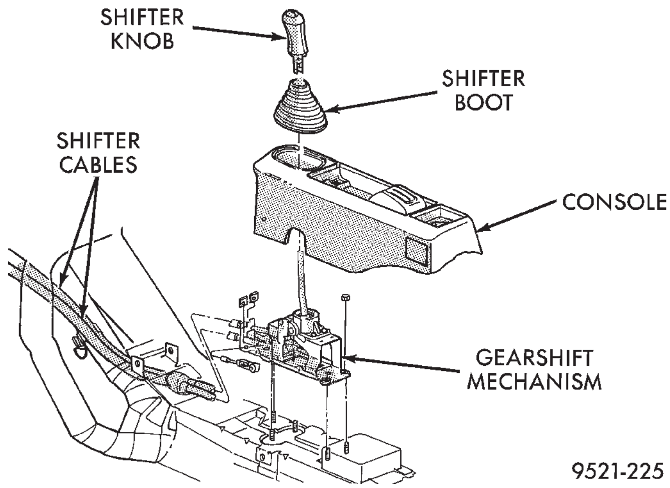


Fig. 14 Gearshift Mechanism

INSTALLATION

(1) To install, reverse removal procedure. After cables have been replaced, cable adjustment should be checked. Refer to cable adjustment procedure in this section.

CAUTION: Gearshift cable bushings must not be lubricated or the bushings will swell and split.

CAUTION: Only the crossover cable is adjustable. The selector cable does not have any adjustment capabilities.

GEARSHIFT MECHANISM REPLACEMENT

REMOVAL

(1) Remove shifter knob and boot. refer to Shifter Knob And Boot Removal procedure in this section.

(2) Remove console assembly. Refer to Console Removal procedure in this section.

(3) Disconnect gearshift cables at shifter end. Refer to Gearshift Cable Removal in this section

(4) Remove retaining nuts at the base of the gearshift mechanism (Fig. 14). Remove shifter.

INSTALLATION

(1) For installation, reverse removal procedure.

VEHICLE SPEED SENSOR DRIVE GEAR

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove wiring connector from speed sensor (Fig. 15).

CAUTION: Clean area around speed sensor before removing. This will prevent the possibility of dirt from entering the transaxle during speed sensor removal.

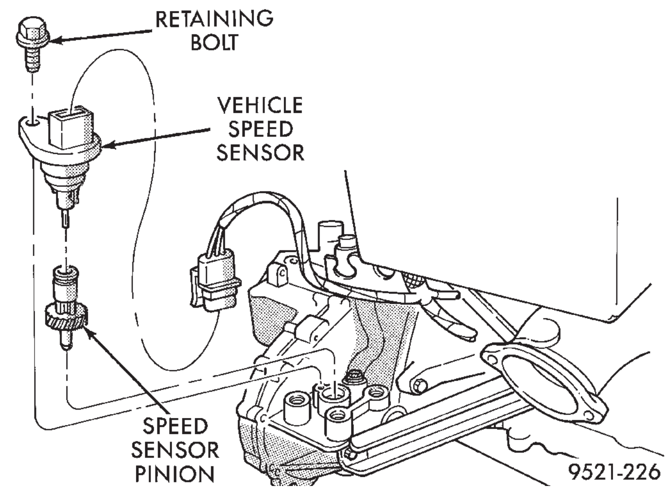


Fig. 15 Vehicle Speed Sensor

(3) Remove speed sensor retaining bolt (Fig. 16).

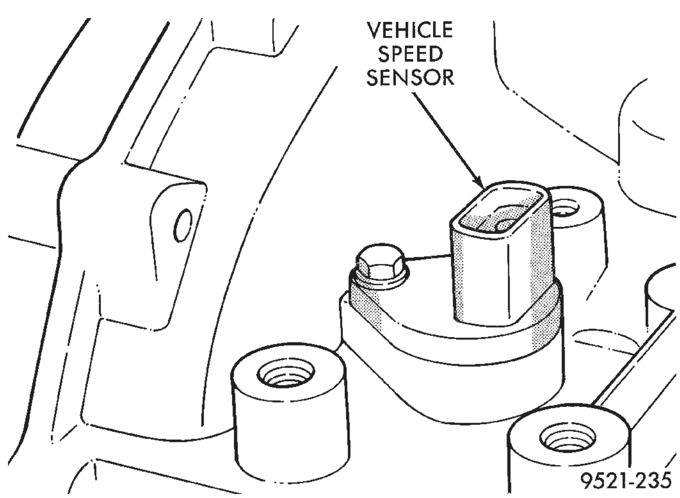


Fig. 16 Vehicle Speed Sensor Retaining Bolt

REMOVAL AND INSTALLATION (Continued)

(4) Remove speed sensor from transaxle.

CAUTION: Carefully remove vehicle speed sensor so that sensor drive gear does not fall into transaxle. Should sensor drive gear fall into the transaxle during sensor removal, drive gear must be reattached to sensor.

(5) Remove speed sensor drive gear from speed sensor.

INSTALLATION

(1) To install, reverse removal procedure.
(2) Confirm vehicle speedometer is functioning properly following installation.

BACK-UP LAMP SWITCH

The back-up lamp switch is located on the top left front side of the transaxle case (Fig. 17).

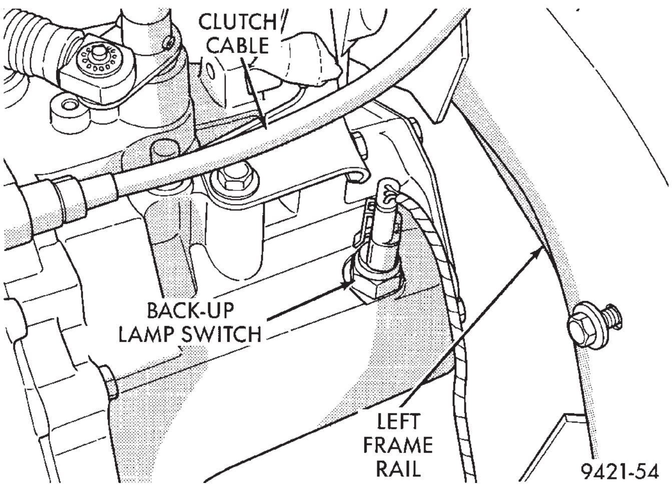


Fig. 17 Back-up Lamp Switch

REMOVAL

(1) Lift vehicle on hoist.
(2) From bottom side of vehicle, remove wiring connector from switch.
(3) Unscrew switch from transaxle.

INSTALLATION

(1) To install, reverse removal procedure. Teflon tape or equivalent must be used on switch threads.

CAUTION: Do not overtighten switch.

(2) Confirm back-up lamps are functioning properly following installation.

CROSSOVER LEVER

REMOVAL

(1) Remove crossover cable. Refer to Gearshift Cable removal.
(2) Using a pin punch, remove the crossover roll pin from lever.
(3) Pull up and remove the crossover lever from the transaxle crossover shaft.

INSTALLATION

(1) For installation, reverse removal procedure. Replace the roll pin that was removed with a new one.

SELECTOR LEVER

REMOVAL

(1) Remove the selector cable. Refer to Gearshift Cable removal.
(2) Using a pin punch, remove the roll pin from the lever.
(3) Pull up and remove the selector lever from the transaxle selector shaft.

INSTALLATION

(1) For installation, reverse removal procedure. Replace the roll pin with a new one.

AXLE SEALS

The axle shaft seals are identical for both sides of the differential and will interchange.

REMOVAL

(1) Remove axle shaft. Refer to Group 2, Suspension and Driveshafts for service procedures.
(2) Insert a flat–blade pry tool at outer edge of axle shaft seal (Fig. 18).
(3) Tap on the pry tool with a small hammer and remove axle shaft seal.

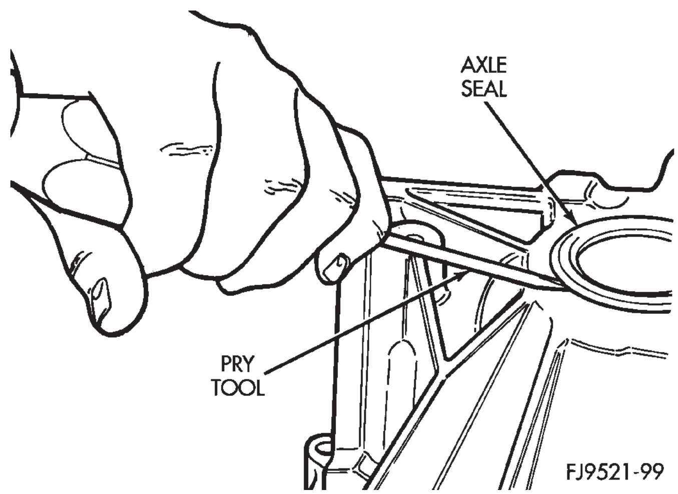


Fig. 18 Axle Shaft Seal Removal

INSTALLATION

(1) Clean axle shaft seal bore of any excess sealant.

REMOVAL AND INSTALLATION (Continued)

(2) Align axle shaft seal with axle shaft seal bore.
(3) Install axle seal on tool #6709 and C-4171 and insert into axle shaft seal bore.
(4) Tap seal into position.

SHIFT SHAFT SEALS

It is **not** necessary to remove the shift shafts from the transaxle to service the shift shaft seals.

REMOVAL

(1) Using a pick tool, pry up on the shift shaft seal and remove seal from bore.

INSTALLATION

(1) Position new shift shaft seal in bore.
(2) Install shift shaft seal into bore using an appropriate size deep–well socket.

TRANSAXLE

REMOVAL

NOTE: The transaxle can be removed from the vehicle without having to remove the engine.

Most transaxle components are serviced with the transaxle out of the vehicle. The components that are serviceable in the vehicle are:

- Selector shaft seal
- Crossover shaft seal
- End plate
- Axle shaft seals
- Shift levers
- Back up lamp switch
- Vehicle speed sensor

(1) Disconnect the battery negative cable at strut tower.
(2) Remove air cleaner at throttle body base inlet.
(3) Remove clutch housing vent cap, exposing the clutch cable end and clutch release lever. Then remove clutch cable from transaxle bellhousing (Fig. 19).

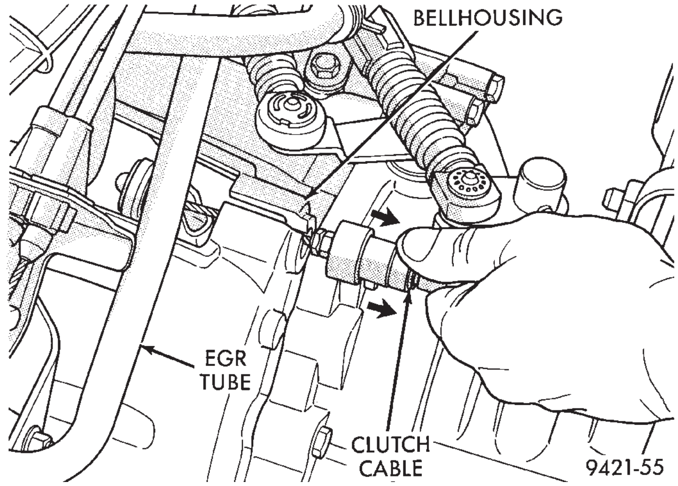


Fig. 19 Clutch Cable Removal

CAUTION: Pry up with equal force on both sides of shifter cable isolator bushings to avoid damaging cable isolator bushing.

(4) Remove selector lever cable at transaxle (Fig. 20).
(5) Remove crossover lever cable at transaxle (Fig. 20).
(6) Remove shift cable mounting bracket (Fig. 21).

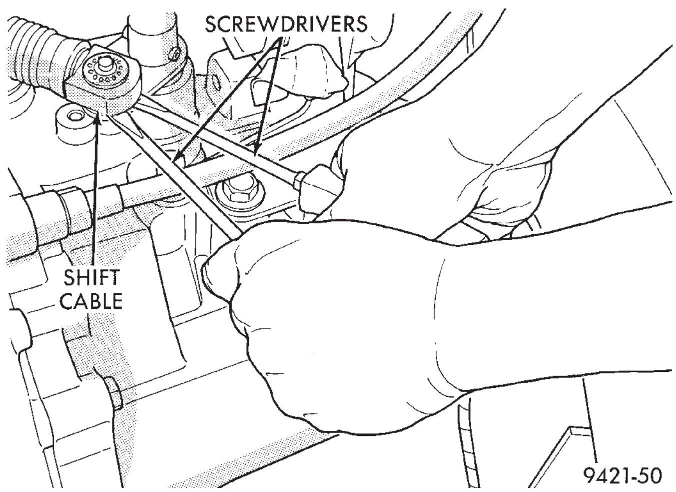


Fig. 20 Shift Cables

REMOVAL AND INSTALLATION (Continued)

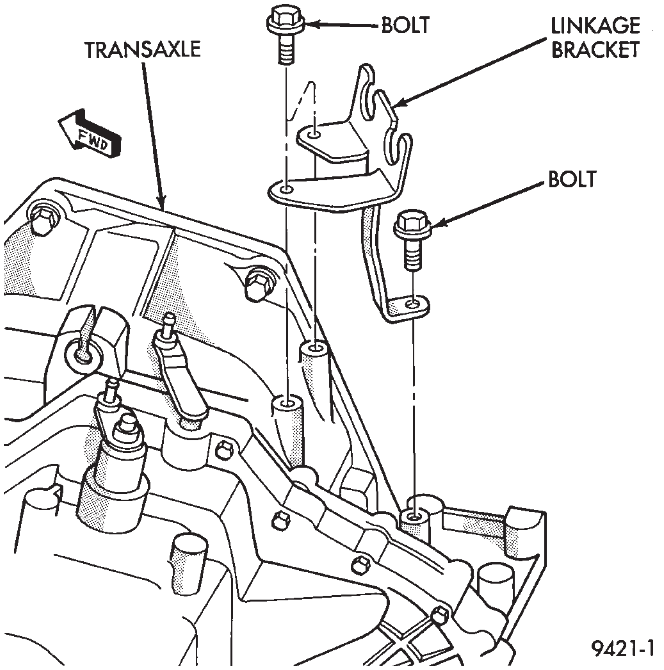


Fig. 21 Linkage Bracket Bolts

(7) Disconnect accelerator cables ends from throttle body (Fig. 22).

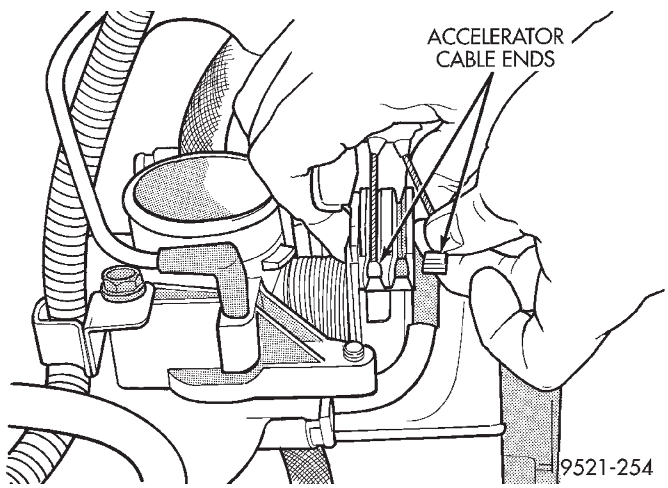


Fig. 22 Accelerator Cable Ends

(8) Remove accelerator cable bracket at throttle body (Fig. 23).

(9) Remove upper starter bolt and upper bellhousing stud nut at bellhousing (Fig. 24). Remove throttle body support bracket (Fig. 25).

(10) Remove left transaxle mount upper bolts (Fig. 26).

(11) Remove upper bellhousing bolts (Fig. 27).

(12) Remove vehicle speed sensor.

(13) Remove back up lamp wiring at transaxle.

(14) Install engine bridge fixture and support engine (Fig. 28).

(15) Lift vehicle on hoist and remove front wheels.

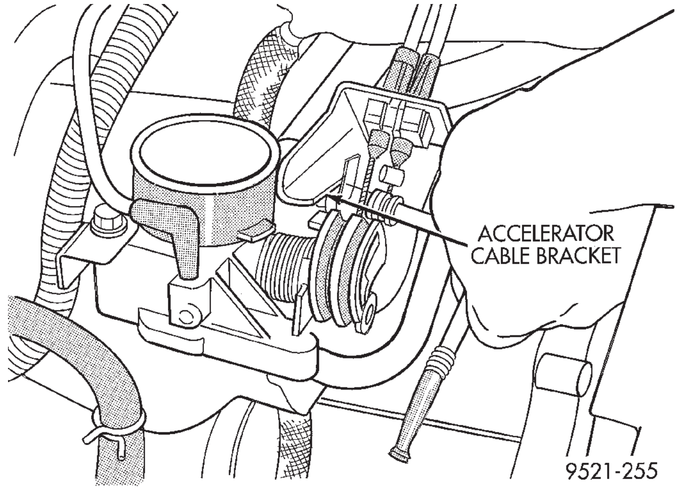


Fig. 23 Accelerator Cable Bracket

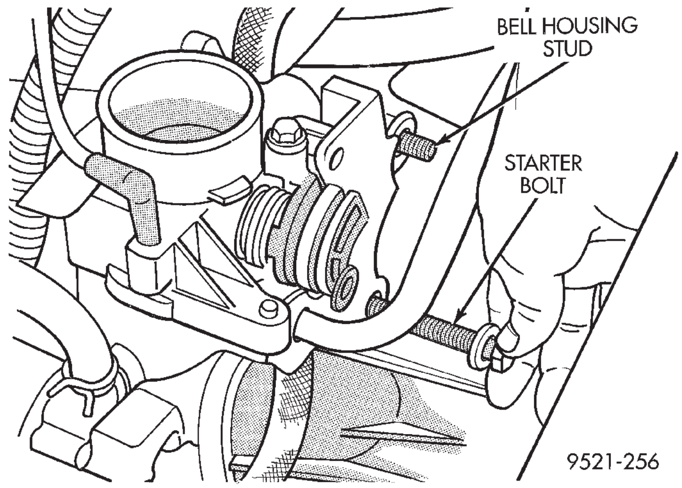


Fig. 24 Upper Starter Bolt and Bellhousing Stud Nut

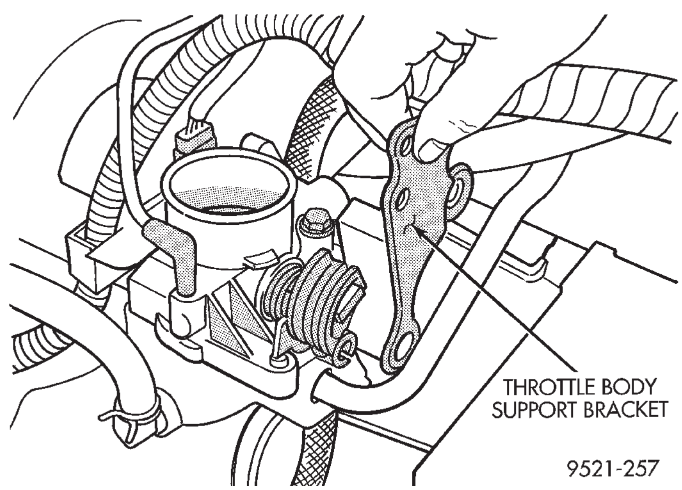


Fig. 25 Throttle Body Support Bracket

(16) Drain fluid from transaxle.

(17) Remove both front driveshafts. Refer to Group 2, Suspension for procedure.

REMOVAL AND INSTALLATION (Continued)

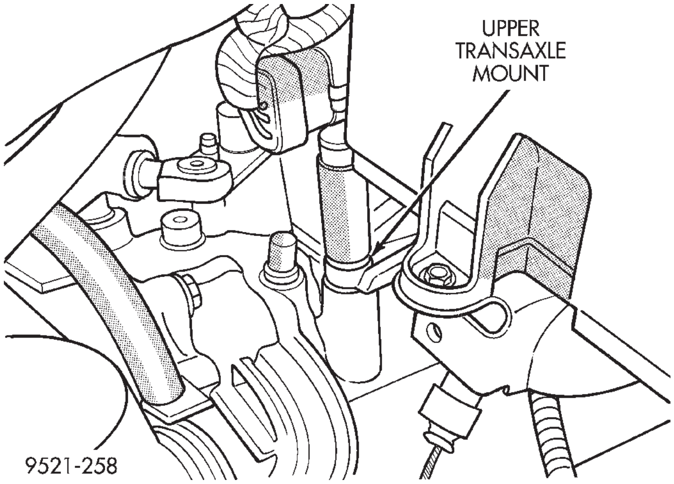


Fig. 26 Left Mount Upper Bolts

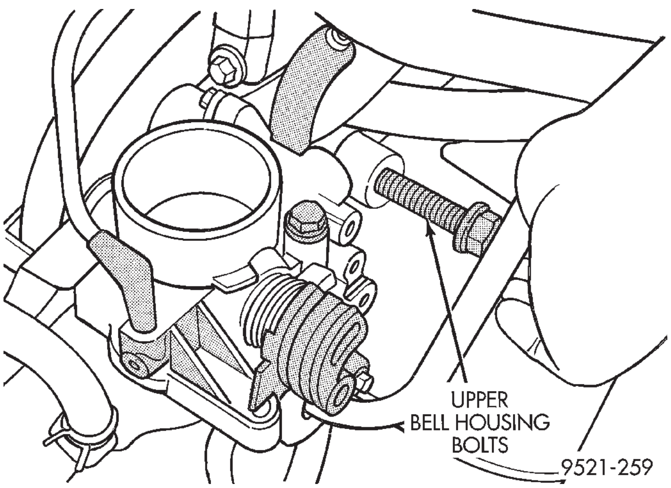


Fig. 27 Upper Bellhousing Bolts

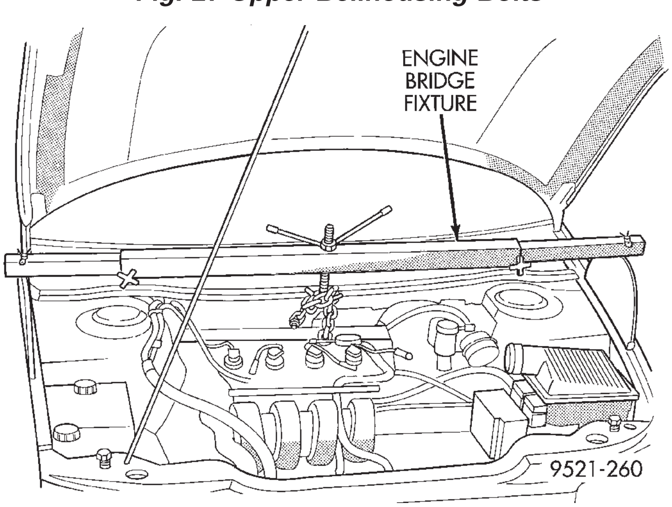


Fig. 28 Engine Bridge Fixture

CAUTION: When reinstalling driveshafts, new driveshaft retaining clips must be used. Do not reuse old clips. Failure to use new clips may result in disengagement of inner constant velocity joint.

(18) Remove left lower splash shield/battery cover.

(19) Remove left transaxle mount lower bracket bolts (Fig. 29).

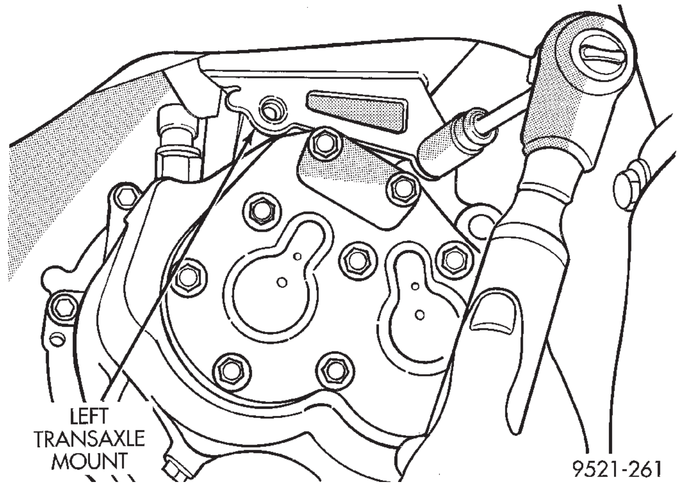


Fig. 29 Left Mount Lower Bolts

(20) Remove bolts retaining engine lower crossbar (Fig. 30) (Fig. 31).

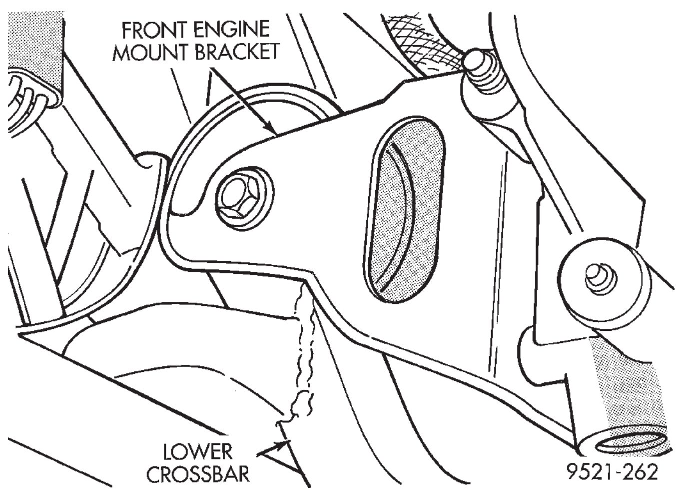


Fig. 30 Lower Crossbar Front Bolts

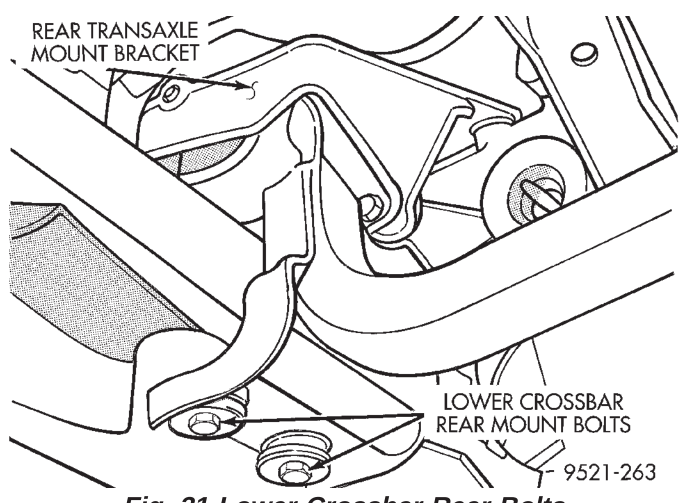


Fig. 31 Lower Crossbar Rear Bolts

(21) Remove front steel engine mount bracket.

REMOVAL AND INSTALLATION (Continued)

(22) Remove (3) bolts on front engine mount bracket (aluminum) (Fig. 32).

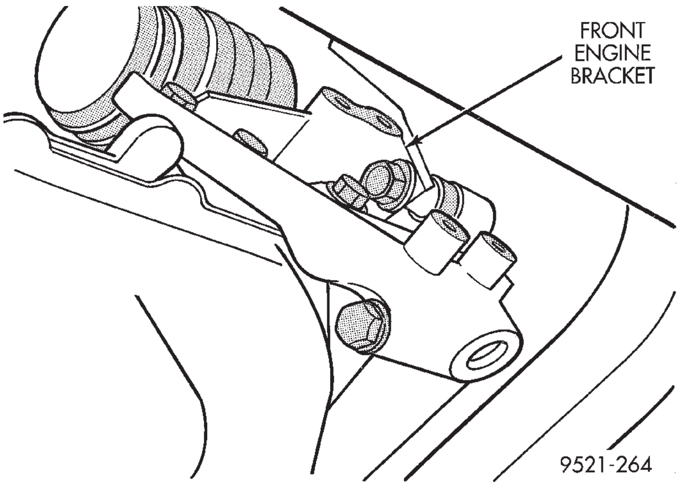


Fig. 32 Front Engine Mount Bracket (Aluminum)

(23) Remove lower starter bolt (Fig. 33).

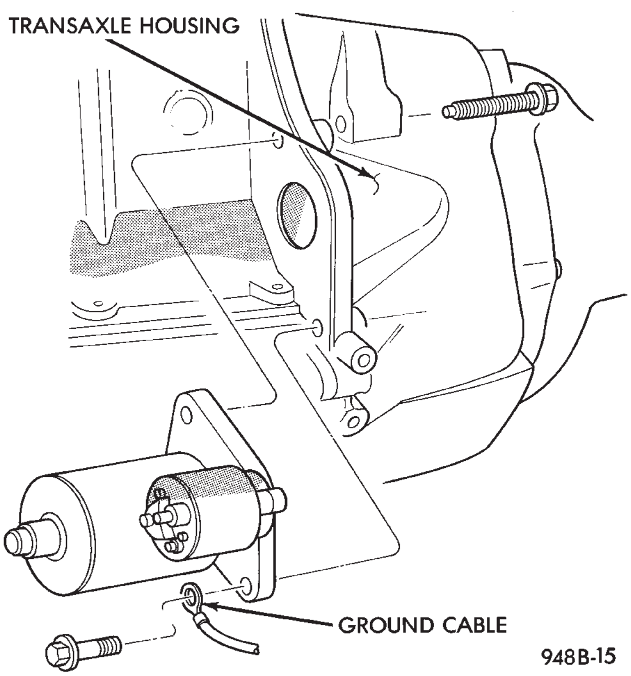


Fig. 33 Starter Bolts

(24) Remove rear transaxle mount bracket (Fig. 34).

(25) Remove transaxle to rear lateral bending strut from engine and transaxle (Fig. 35).

(26) Remove lower dust shield screw.

(27) Support transaxle with a transmission jack.

(28) Rotate engine clockwise to gain access to driveplate clutch bolts (Fig. 36). Remove driveplate clutch bolts (Fig. 37).

(29) Remove lower transaxle to engine bellhousing bolts (Fig. 38).

(30) Remove transaxle from vehicle.

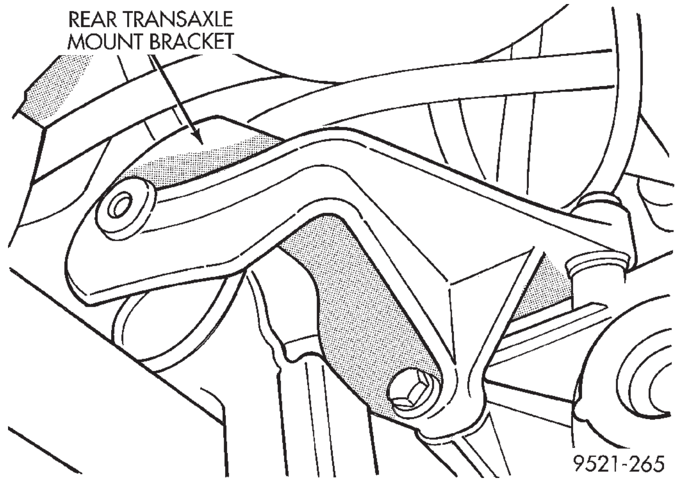


Fig. 34 Rear Transaxle Mount Bracket

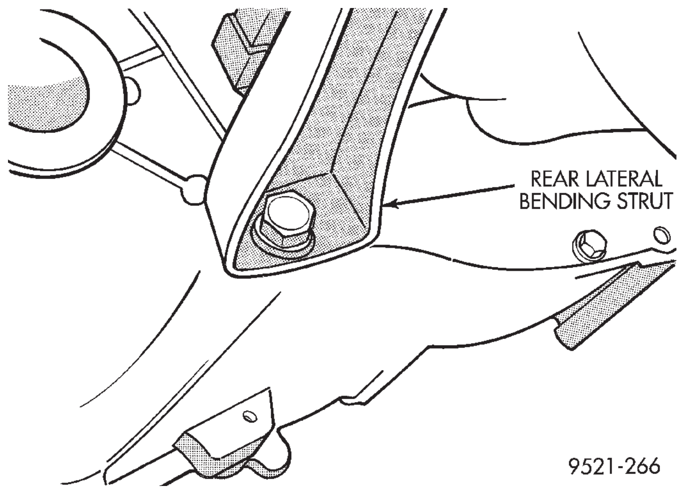


Fig. 35 Bracket Removal

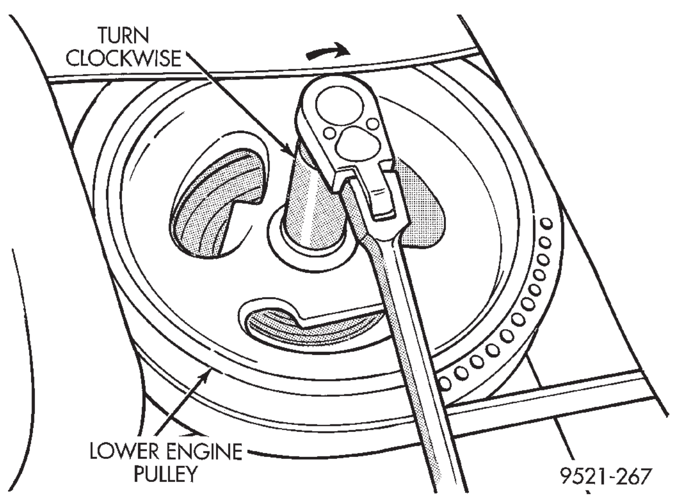


Fig. 36 Rotate Engine Clockwise

INSTALLATION

(1) To install transaxle, reverse removal procedure.

(2) After installing transaxle, fill transaxle to bottom of fill plug hole (vehicle level on hoist). Fill tran-

REMOVAL AND INSTALLATION (Continued)

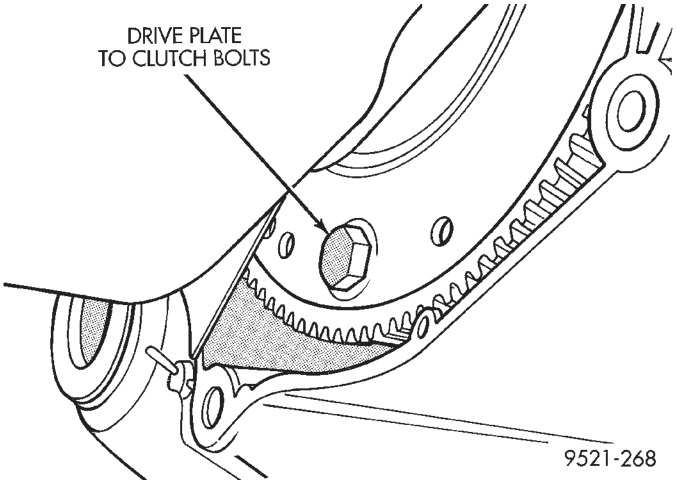


Fig. 37 Driveplate to Modular Clutch Bolts

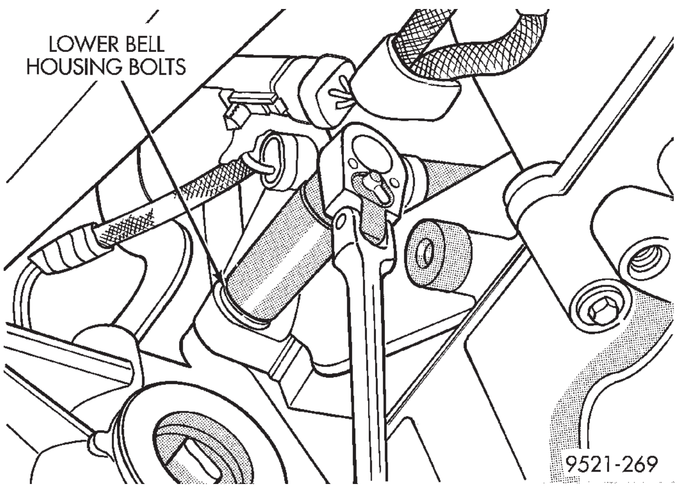


Fig. 38 Lower Bellhousing Bolts

saxle with Mopar® Type M.S.9417 Manual Transaxle Fluid before lowering vehicle to floor.

(3) Verify that vehicle's back-up lights and speedometer are functioning properly. Crossover cable adjustment procedure is required after installing transaxle in car to assure proper shifter adjustment. Road test vehicle for proper transaxle function.

DISASSEMBLY AND ASSEMBLY

TRANSAXLE

The NV T350 (A-578) transaxle internal components can be serviced only by separating the gear case from the bellhousing case.

CAUTION: The transaxle output shaft is serviced as a unit. No disassembly and reassembly is possible. Damage to the transaxle may result.

DISASSEMBLY

(1) Place transaxle on bench.

(2) Remove shift levers. Remove transaxle case half bolts (Fig. 39).

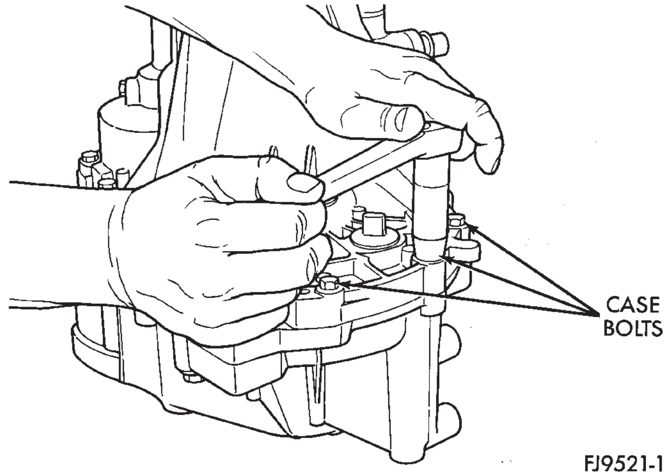


Fig. 39 Case Bolts

(3) Place two screwdrivers into the slots provided in the case halves near the dowels (Fig. 40). Separate the case halves (Fig. 41).

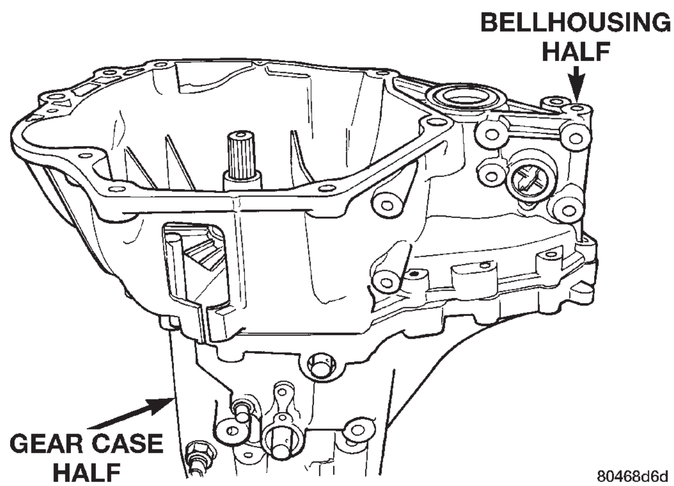


Fig. 40 Transaxle Case Halves

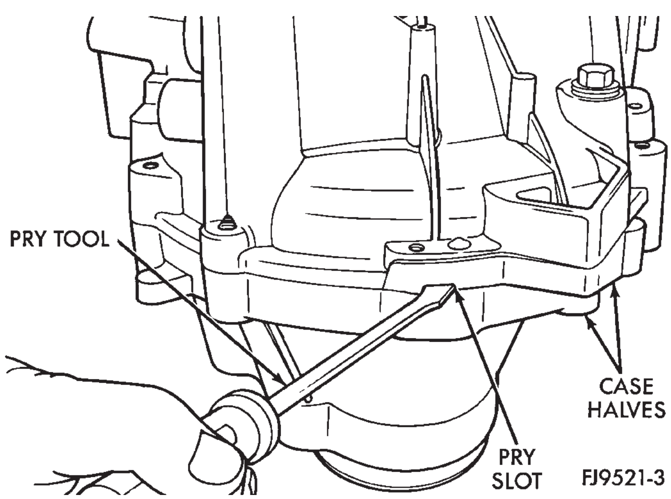


Fig. 41 Separate Case Halves

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Remove bellhousing half from gear case half (Fig. 42).

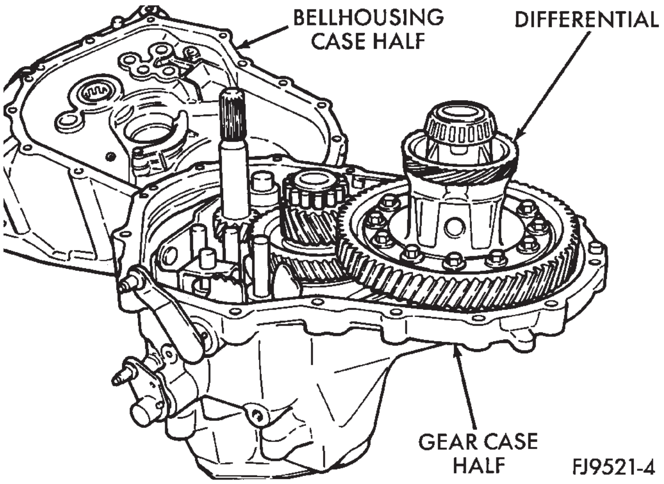


Fig. 42 Bellhousing Case Half Removal

(5) Remove output shaft roller bearing from output shaft.

(6) Remove differential assembly (Fig. 43).

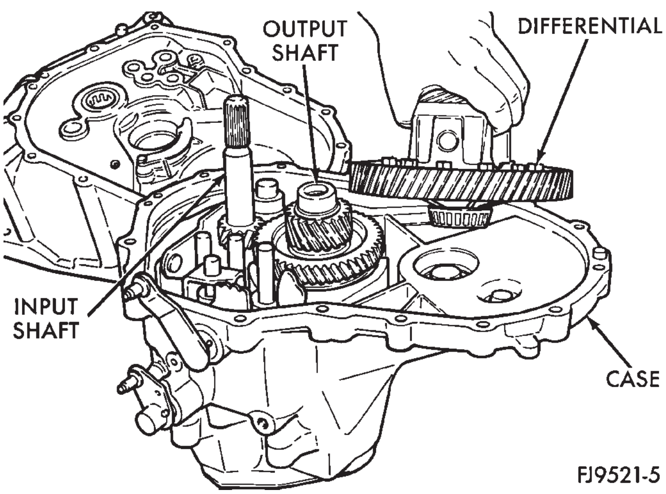


Fig. 43 Differential Assembly Removal

(7) Remove reverse idler shaft bolt (Fig. 44). Remove reverse idler gear (Fig. 45).

(8) Remove two screws retaining reverse fork bracket (Fig. 46). Remove reverse fork bracket and reverse cam blockout assembly (Fig. 47).

(9) Using snap–ring pliers, remove selector shaft spacer (Fig. 48).

(10) Pull the selector shaft shift pin out of the slot in the blocker assembly. Turn selector shaft up and out of the way (Fig. 49).

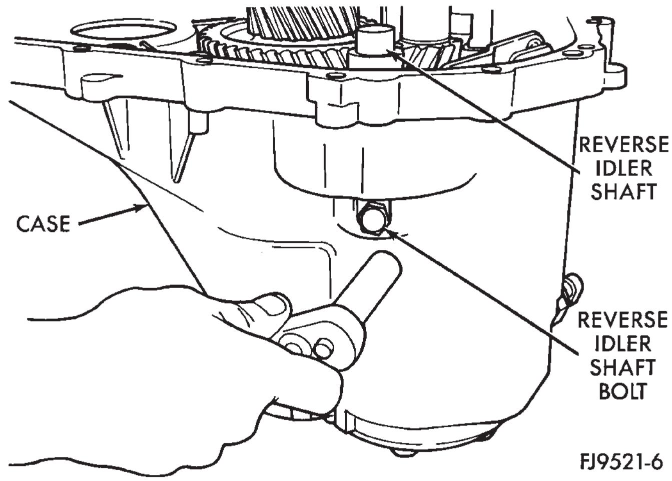


Fig. 44 Reverse Idler Shaft Bolt Removal

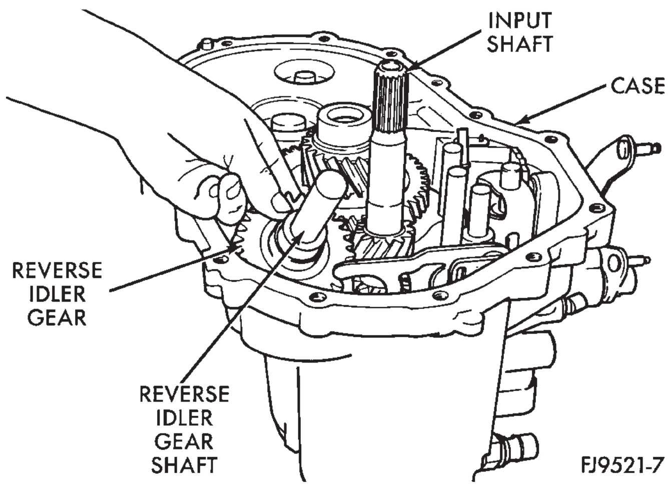


Fig. 45 Reverse Idler Gear Removal

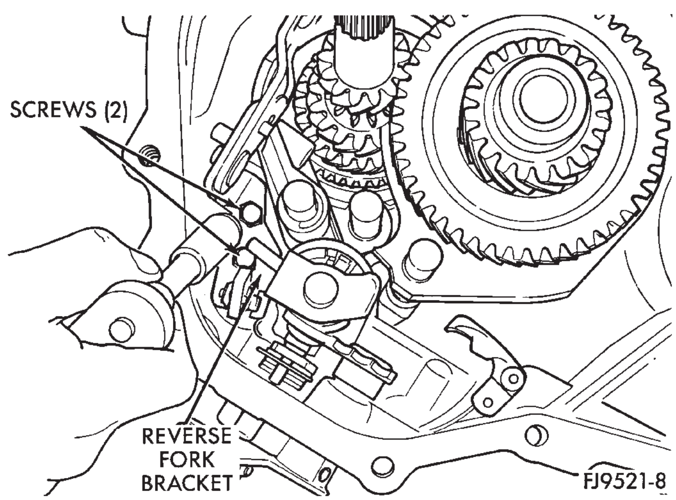


Fig. 46 Screws Retaining Reverse Fork Bracket

DISASSEMBLY AND ASSEMBLY (Continued)

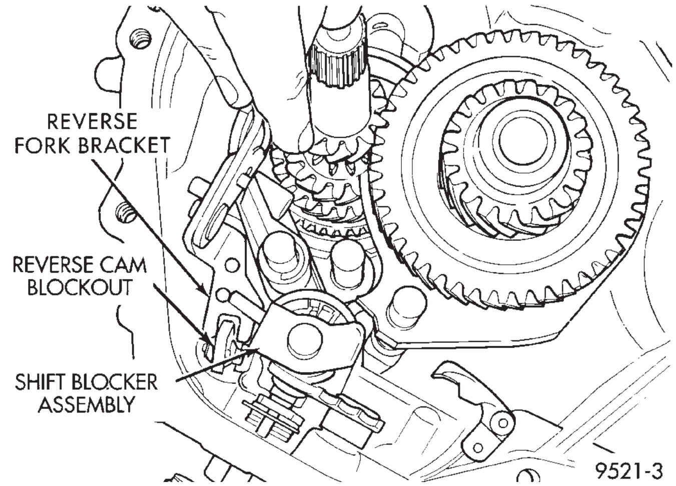


Fig. 47 Remove Reverse Fork Bracket

(11) Remove transaxle end cover (Fig. 50) (Fig. 51).

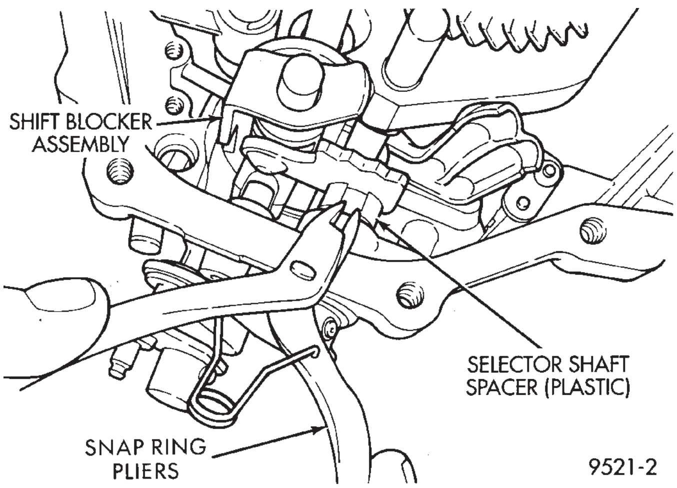


Fig. 48 Remove Selector Shaft Spacer

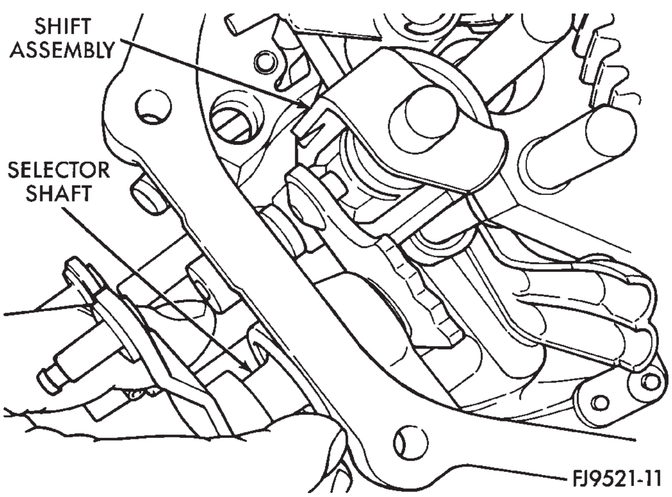


Fig. 49 Selector Shaft

(12) Remove two snap rings retaining the output shaft and the input shaft to the bearings (Fig. 52).

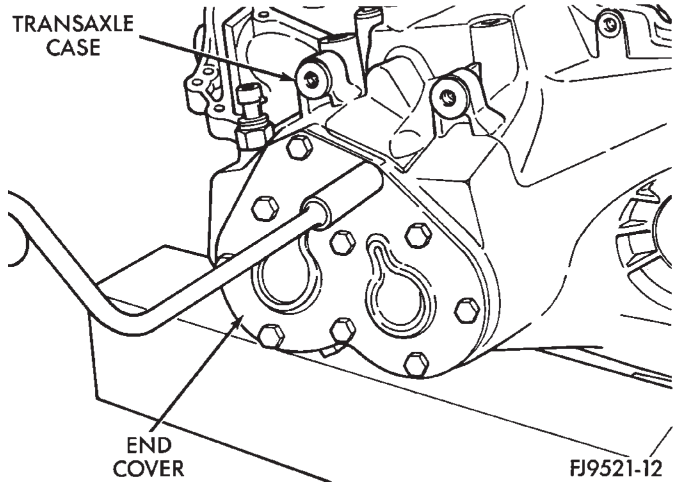


Fig. 50 Transaxle Cover Removal

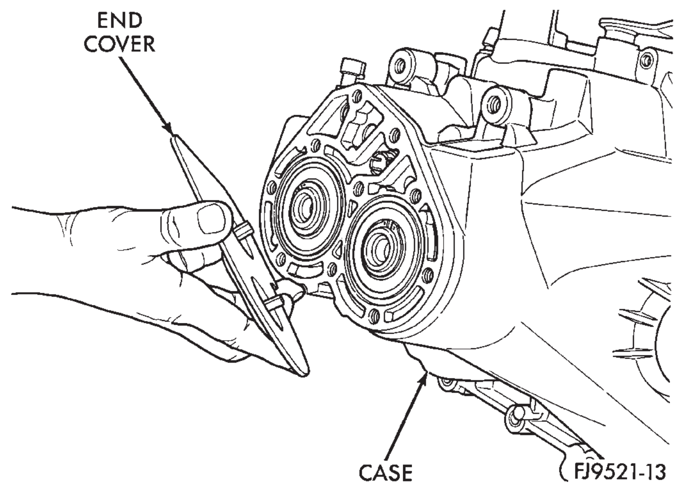


Fig. 51 End Cover

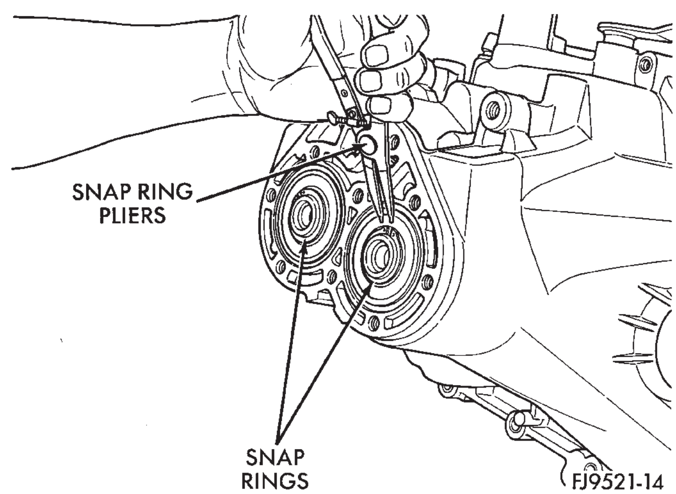


Fig. 52 Snap Rings Retaining Bearings

(13) Using bench fixture and shims provided (Miller tools # 6785, 6785-1, and 6785-2), turn transaxle over. Install transaxle onto bench fixture (Fig. 53).

DISASSEMBLY AND ASSEMBLY (Continued)

Verify shim spacers are in position on bench fixture. Install transaxle into shop press.

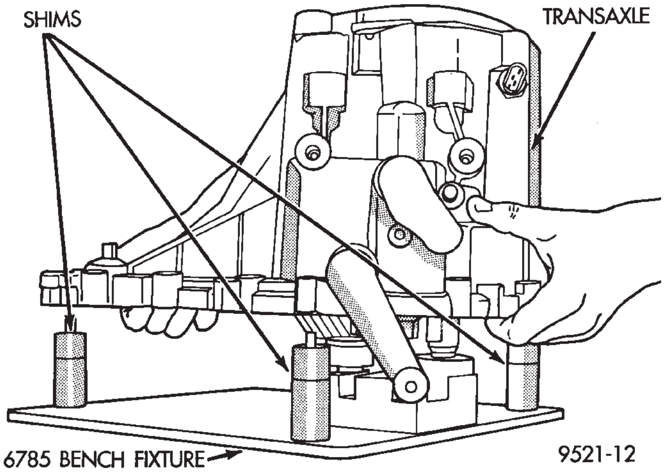


Fig. 53 Bench Fixture

(14) Install bearing fixture Miller tool #6768 onto transaxle end bearings (Fig. 54). Verify tool is properly aligned to input and output shafts.

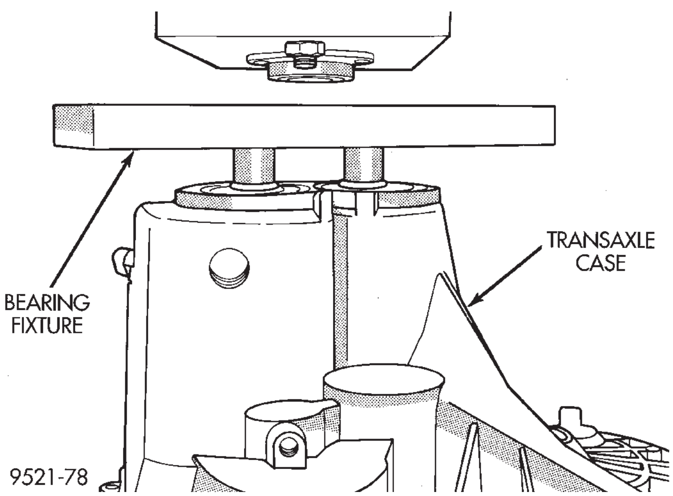


Fig. 54 Bearing Fixture

CAUTION: The oil dams in the input and output shafts can be damaged while pressing on the shafts if the bearing fixture is not used properly.

(15) Install transaxle gear case into shop press. Press output and input shaft assemblies out of case (Fig. 55).

(16) Remove transaxle from press.

(17) Carefully remove transaxle case from the shaft assemblies and bench fixture (Fig. 56). Be sure the oil–feed trough to the end bearings is not damaged (Fig. 57).

(18) **TRANSAXLE W/REVERSE BRAKE:** Remove the reverse brake blocking ring, shim, reverse brake friction cone, bearing and race from the input shaft assembly (Fig. 58) (Fig. 59) (Fig. 60)

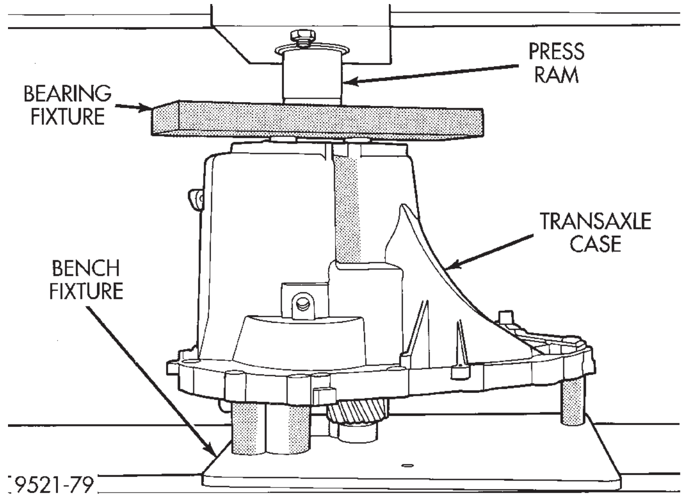


Fig. 55 Pressing Gears Out of Case

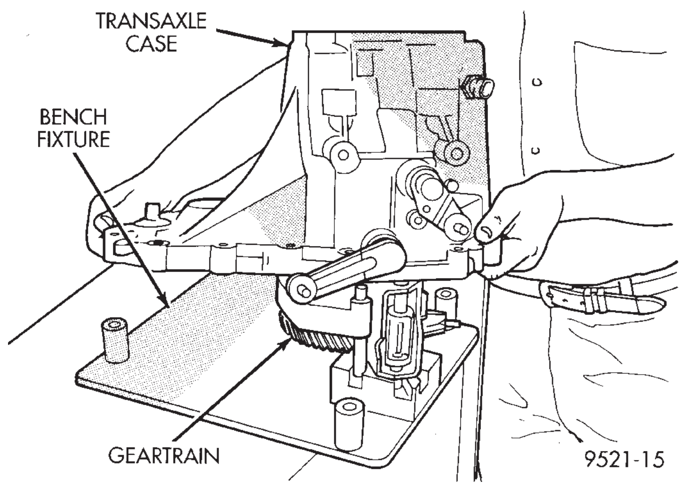


Fig. 56 Transaxle Case Removal

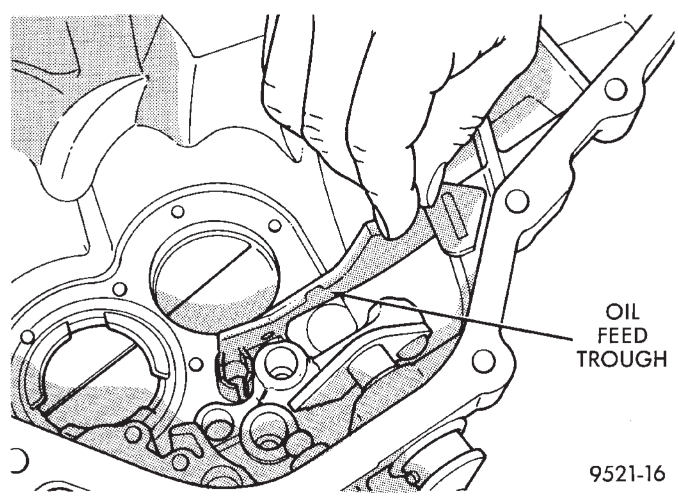


Fig. 57 Oil Feed Trough

(Fig. 61) (Fig. 62). **TRANSAXLE W/O REVERSE BRAKE:** Remove plastic spacer from the input shaft assembly.

DISASSEMBLY AND ASSEMBLY (Continued)

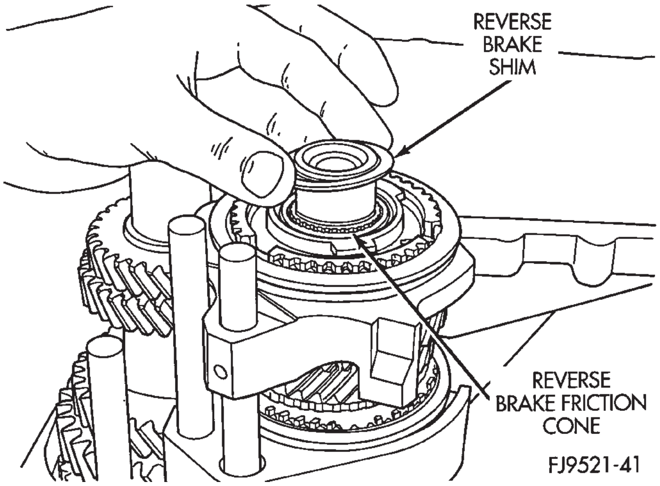


Fig. 58 Reverse Brake Shim

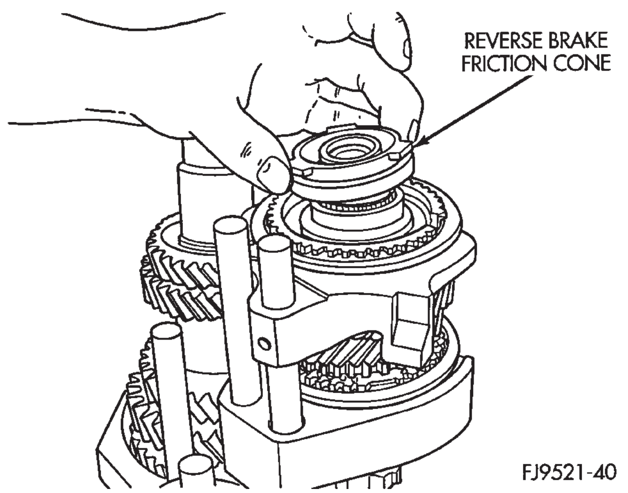


Fig. 59 Reverse Brake Friction Cone

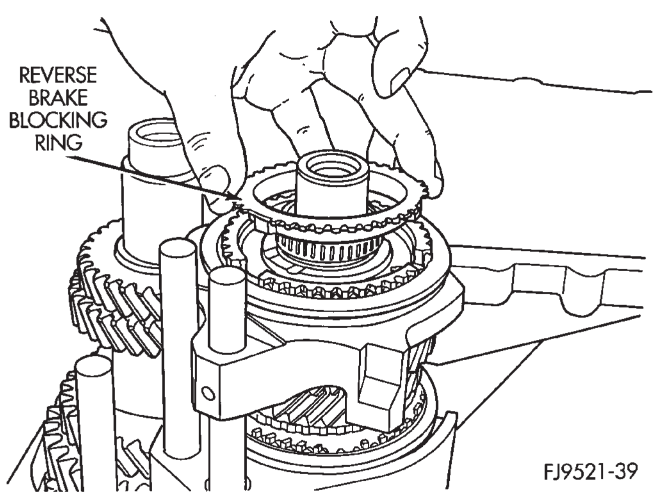


Fig. 60 Reverse Brake Blocking Ring

(19) Remove the shift blocker assembly from the bench fixture (Fig. 63).

(20) Remove the 1-2 shift fork from the output shaft (Fig. 64).

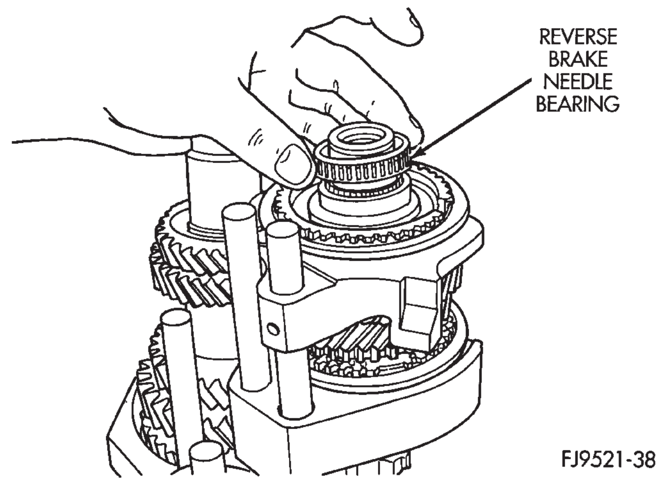


Fig. 61 Reverse Brake Needle Bearing

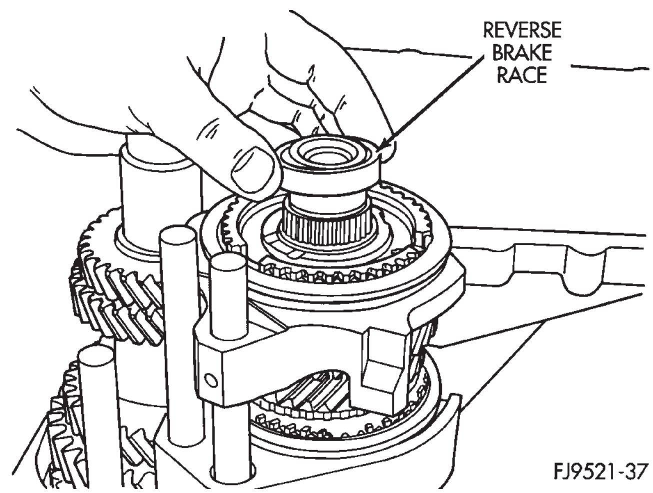


Fig. 62 Reverse Brake Race

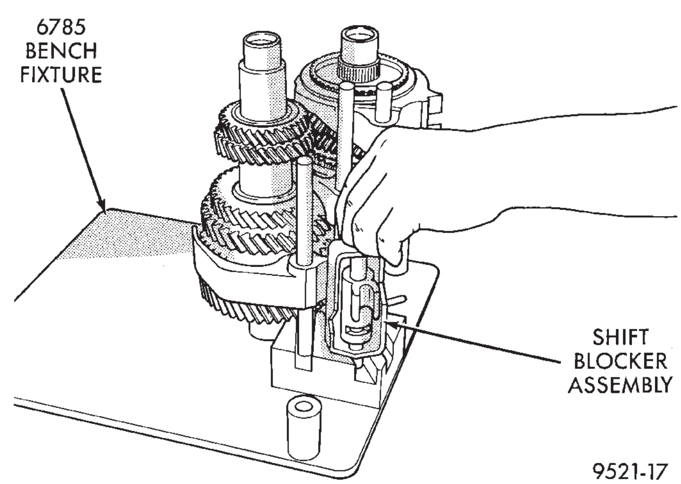


Fig. 63 Shift Blocker Removal

(21) Remove input and output shaft assemblies from bench fixture (Fig. 65).

DISASSEMBLY AND ASSEMBLY (Continued)

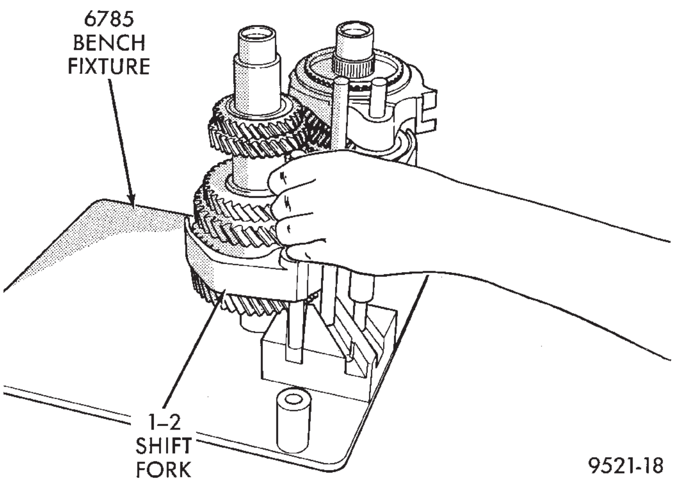


Fig. 64 1–2 Shift Fork Removal

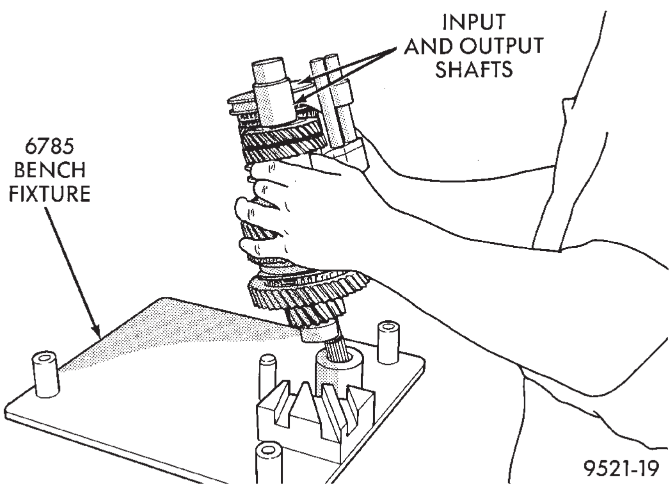


Fig. 65 Gear Train Removal

CAUTION: The output shaft assembly is serviced as an assembly. Do not try to repair any component on the output shaft. If the 1-2 synchronizer or gear fails, it is necessary to replace the complete output shaft assembly.

ASSEMBLY

The sealant used to seal the transaxle case halves is Mopar® Gasket Maker, Loctite® 518, or equivalent. The sealant used for the bearing end plate cover is Mopar® RTV.

(1) Verify bench fixture shims are removed from bench fixture. Install output and input shafts into bench fixture (Miller tool #6785) (Fig. 66).

(2) Install shift rails and forks into bench fixture (Fig. 67).

(3) Install shift blocker assembly into bench fixture (Fig. 68).

(4) Install reverse brake race onto input shaft (Fig. 69).

(5) Install reverse brake needle bearing (Fig. 70).

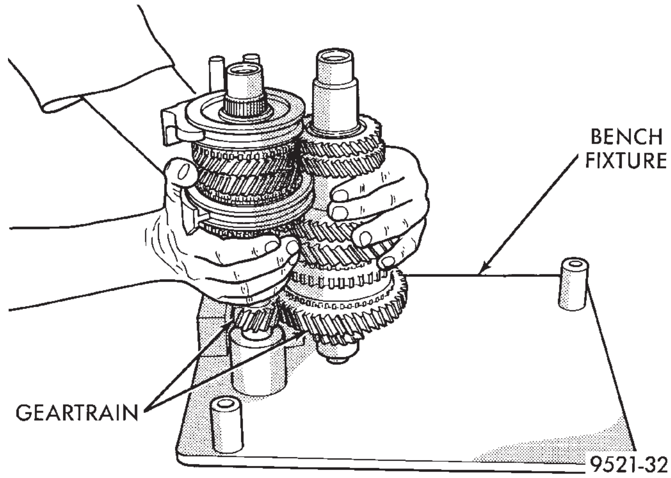


Fig. 66 Bench Fixture

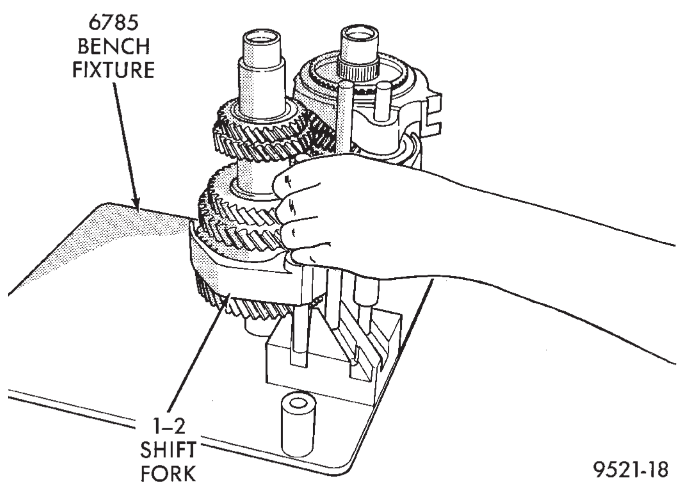


Fig. 67 Shift Rail Installation

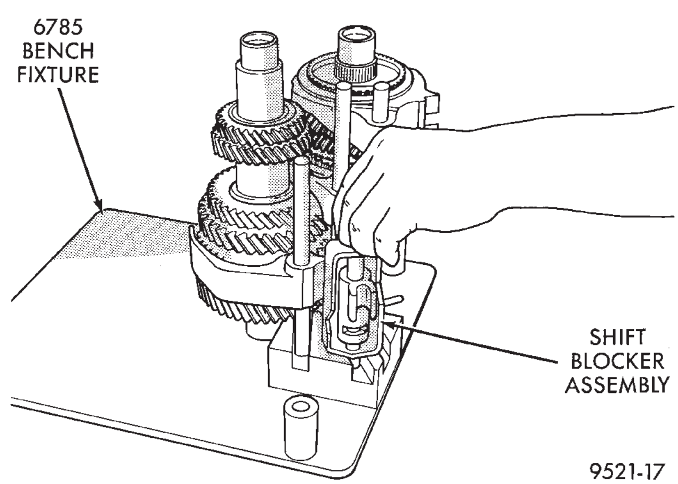


Fig. 68 Shift Blocker Installation

(6) Install reverse brake blocking ring (Fig. 71).

(7) Install reverse brake friction cone (Fig. 72).

(8) Install reverse brake shim (Fig. 73). Apply petroleum jelly to shim to hold in place.

DISASSEMBLY AND ASSEMBLY (Continued)

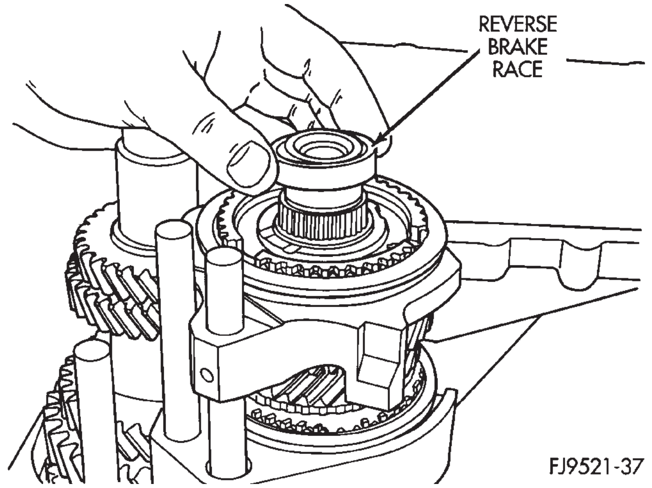


Fig. 69 Reverse Brake Race Installation

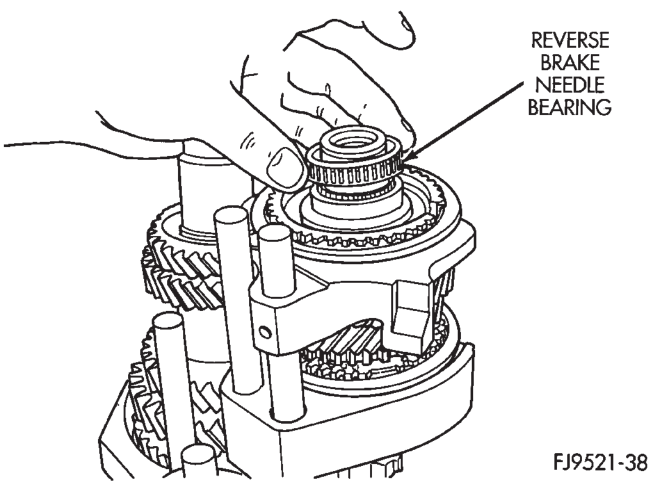


Fig. 70 Reverse Brake Needle Bearing

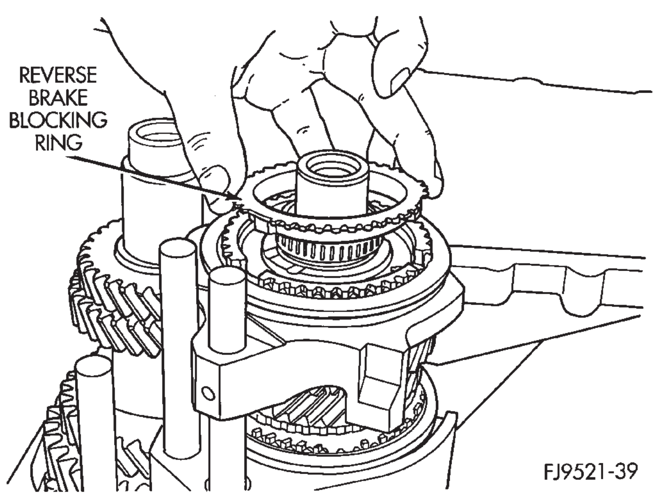


Fig. 71 Reverse Brake Blocking Ring Installation

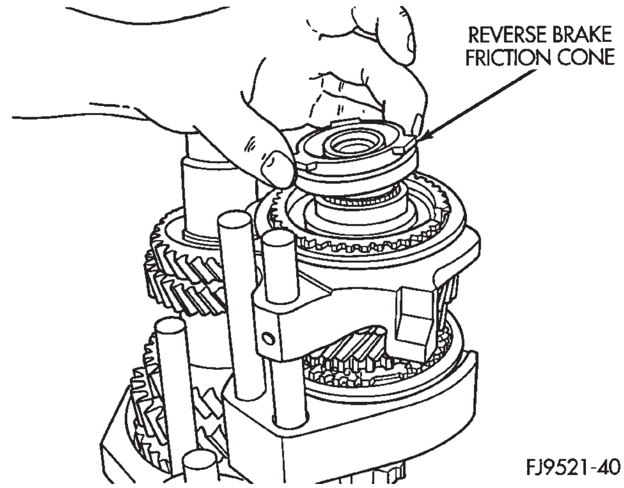


Fig. 72 Reverse Brake Friction Cone Installation

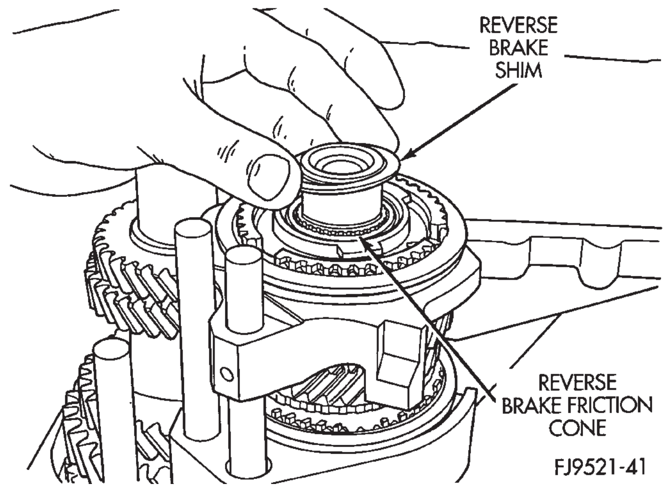


Fig. 73 Reverse Brake Shim

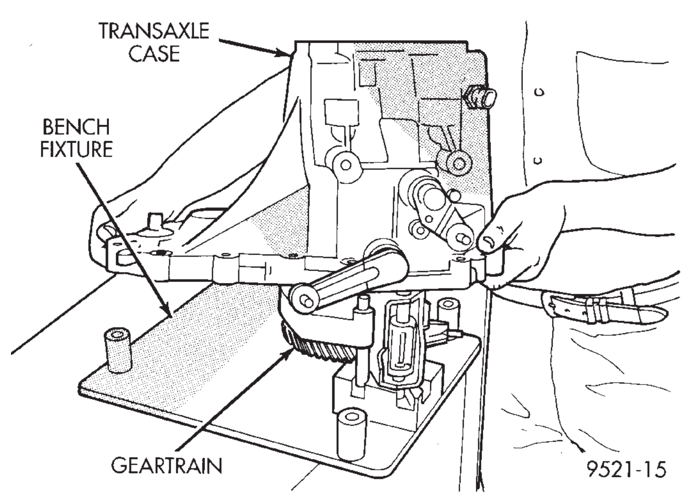


Fig. 74 Gear Case Half

(9) Install gear–case half over bench fixture (Fig. 74). Line up shift finger over 3-4 lug.

(10) Line up reverse brake friction cone lugs to the slots in the gear case (Fig. 75). Verify reverse brake shim is in position.

DISASSEMBLY AND ASSEMBLY (Continued)

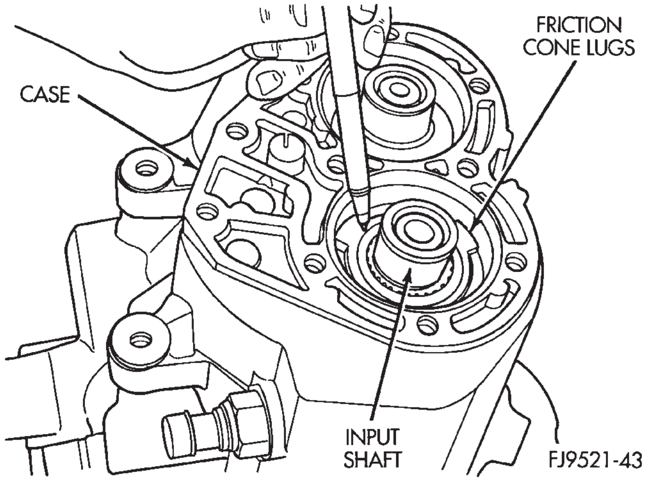


Fig. 75 Friction Cone Lugs

(11) Position input and output bearings on the shafts. Using Miller tool C-4992-1, press on input and output shaft bearings until they bottom into the case and against the shafts (Fig. 76).

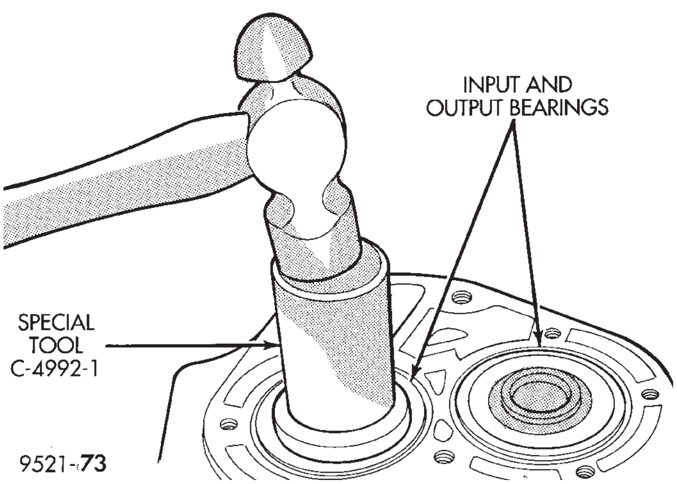


Fig. 76 Installing Input and Output Bearings

(12) Install shaft snap rings at input and output bearings (Fig. 77).

(13) Apply Mopar® RTV sealant to end–cover outer edge and around bolt holes. Install end–cover onto gear case. Tighten end cover bolts to 29 N·m (21 ft. lbs.) torque (Fig. 78).

(14) Remove gear case from bench fixture.

(15) Install gear case in a holding fixture with end cover facing down.

(16) Turn selector shaft into slot on blocker assembly (Fig. 79).

(17) Push selector shaft spacer clip onto selector shaft. Install shift levers.

(18) Install reverse idler gear and shaft. Install bolt into shaft. Tighten bolt on shaft to 26 N·m (19 ft. lbs.) torque (Fig. 80) (Fig. 81).

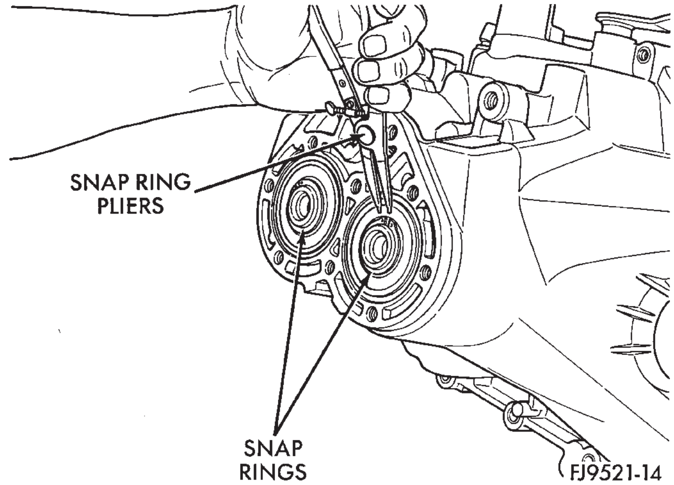


Fig. 77 Snap Rings Retaining Bearings

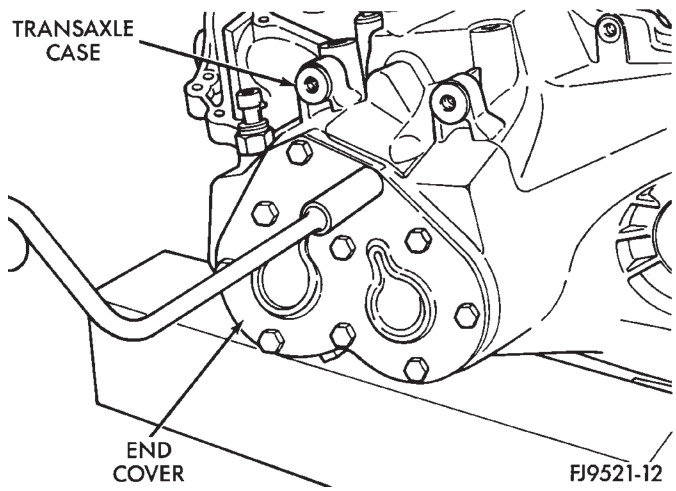


Fig. 78 Transaxle End Cover

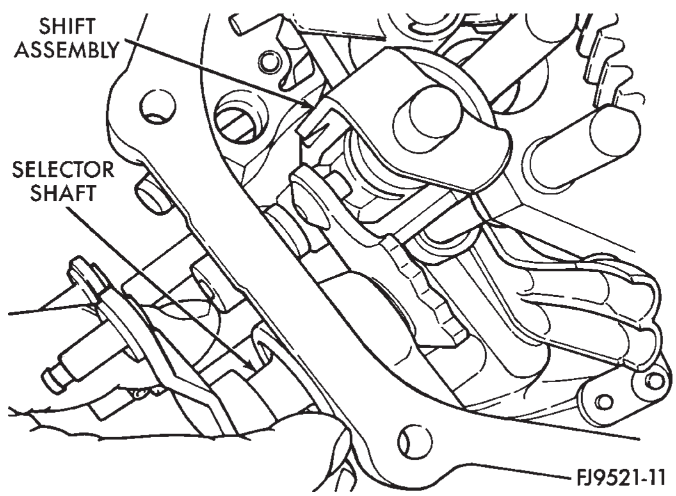


Fig. 79 Selector Shaft

(19) Install reverse fork bracket and reverse lockout. Tighten screws to 11 N·m (96 in. lbs.) torque (Fig. 82) (Fig. 83).

(20) Install differential into gear case (Fig. 84).

DISASSEMBLY AND ASSEMBLY (Continued)

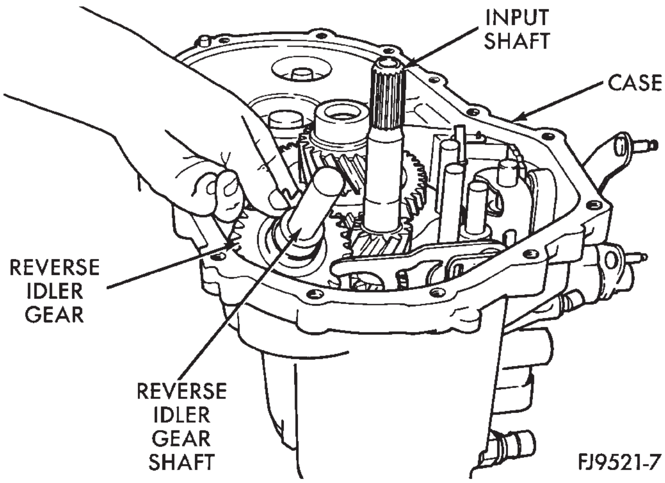


Fig. 80 Reverse Idler Gear

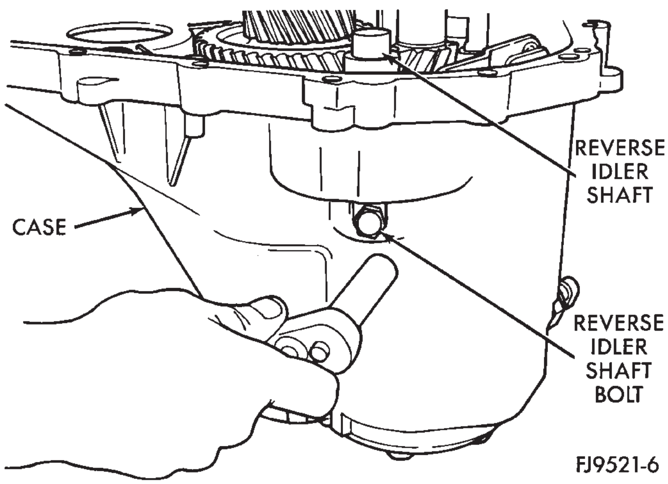


Fig. 81 Reverse Idler Shaft Bolt

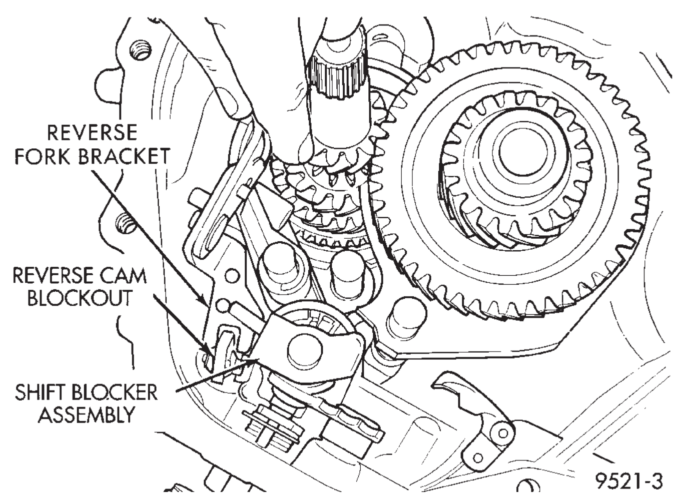


Fig. 82 Reverse Fork Bracket

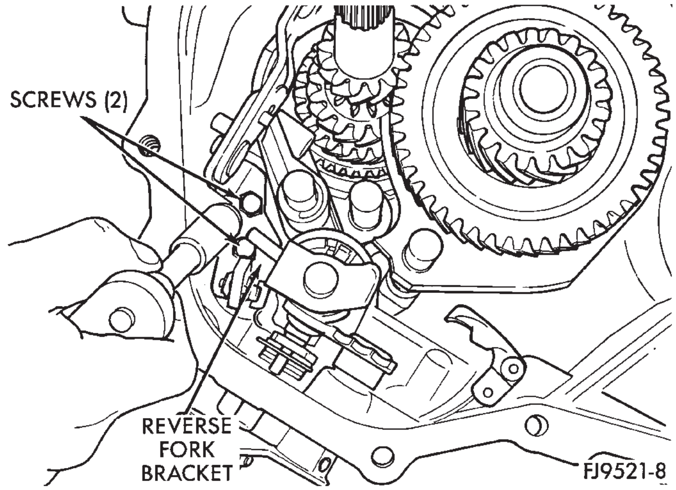


Fig. 83 Reverse Fork Screws

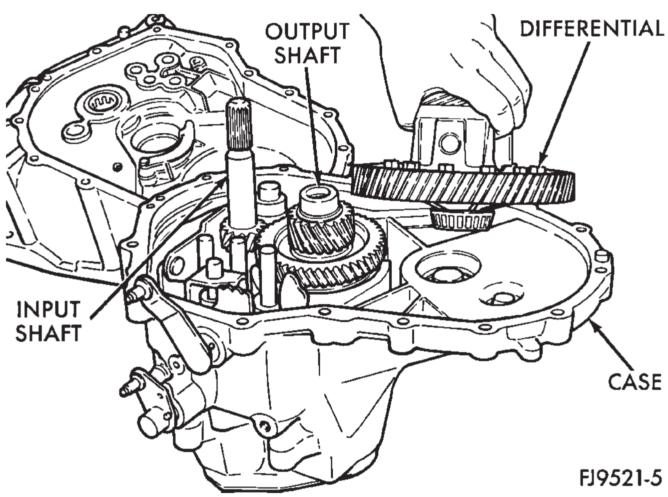


Fig. 84 Differential Assembly

BEARING ADJUSTMENT PROCEDURE

(1) Use extreme care when removing and installing bearing cups and cones. Use only an arbor press for installation, as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat gives a false end–play reading while gauging for proper shims. Improperly seated bearing cups and cones are subject to low–mileage failure.

(2) Bearing cups and cones should be replaced if they show signs of pitting or heat distress. If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

(3) Bearing preload and drag torque specifications must be maintained to avoid premature bearing failures. Used (original) bearings may lose up to 50% of the original drag torque after break–in. All bearing adjustments must be made with no other component interference or gear intermesh.

(4) Replace bearings as a pair: If one differential bearing is defective, replace both differential bearings, if one input shaft bearing is defective, replace both input shaft bearings.

(5) Bearing cones must not be reused if removed.

(6) Turning–torque readings should be obtained while smoothly rotating in either direction.

DISASSEMBLY AND ASSEMBLY (Continued)

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

NOTE: True bearing turning–torque readings can be obtained only with the geartrain removed from the case.

(1) Remove bearing cup and existing shim from clutch bellhousing case.

(2) Press in new bearing cup into bellhousing case (or use a cup that has been ground down on the outer edge for ease of measurement).

(3) Press in new bearing cup into gear case side.

(4) Oil differential bearings with Mopar® type M.S. 9417 Manual Transaxle Fluid. Install differential assembly in transaxle gear case. Install clutch bellhousing over gear case. Install and torque case bolts to 29 N·m (21 ft. lbs.).

(5) Position transaxle with bellhousing facing down on workbench with C-clamps. Position dial indicator.

(6) Apply a medium load to differential with Tool C-4995 and a T-handle, in the downward direction. Roll differential assembly back and forth a number of times. This will settle the bearings. Zero the dial indicator. To obtain end play readings, apply a medium load in an upward direction while rolling differential assembly back and forth (Fig. 85). Record end play.

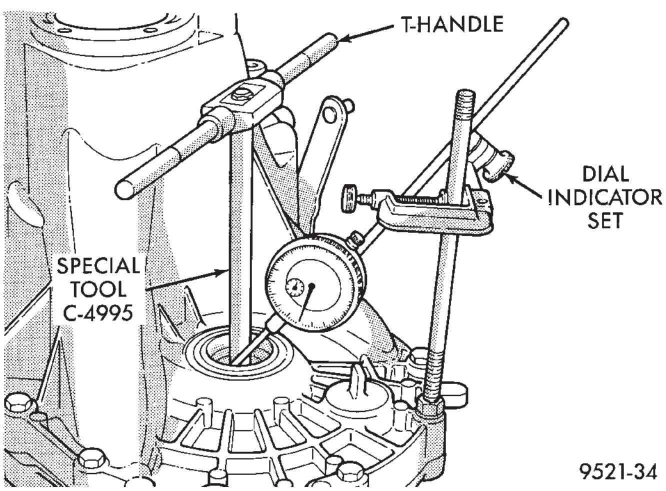


Fig. 85 Checking Differential Bearing End Play To Determine Shim Thickness

(7) The shim required for proper bearing preload is the **total of end play, plus (constant) preload of 0.18mm (0.007 in.).** Never combine shims to obtain the required preload.

(8) Remove case bolts. Remove clutch bellhousing differential bearing cup. Install shim(s) selected in Step Step 7. Then press the bearing cup into clutch bellhousing.

(9) Install clutch bellhousing. Install and torque case bolts to 26 N·m (19 ft. lbs.).

(10) Using Special Tool C-4995 and an inch-pound torque wrench, check turning torque of the differential assembly (Fig. 86). **The turning torque should be 6 to 12 in. lbs. If the turning torque is too high, install a 0.05mm (0.002 inch) thinner shim. If the turning torque is too low, install a 0.05mm (0.002 inch) thicker shim.**

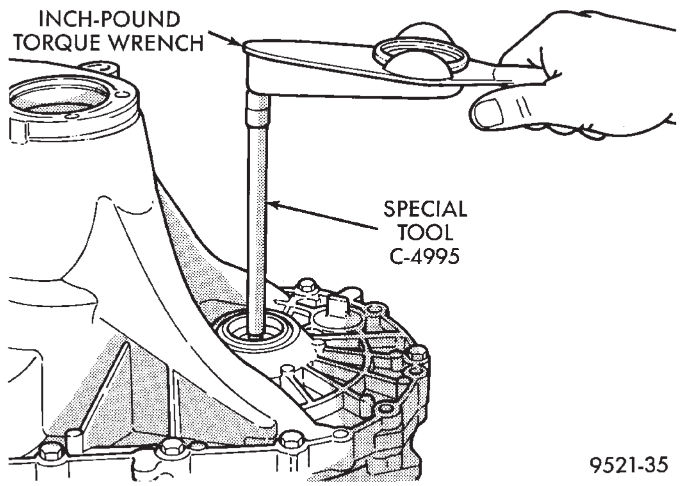


Fig. 86 Checking Differential Bearing Turning Torque

(11) Recheck turning torque. Repeat Step Step 10 until the proper turning torque is obtained.

Once proper turning torque has been established, place gear case on the end plate. Draw a bead of Mopar® Gasket Maker, Loctite® 518, or equivalent, on the flat surface of the case mating flange. Install clutch bellhousing onto gear case. Install and tighten case bolts to 29 N·m (21 ft. lbs.).

INPUT SHAFT

DISASSEMBLY

Before disassembly of the input shaft, it is necessary to check the synchronizer stop ring gap. Use a feeler gauge to measure the gaps between the stop rings and the speed gears. The correct gaps are listed below:

- 1st—1.04-1.72 mm (0.041-0.069 in).
- 2nd—0.94-1.72 mm (0.038-0.069 in).
- 3rd—1.37-1.93 mm (0.054-0.076 in).
- 4th—1.41-1.97 mm (0.056-0.078 in).
- 5th—1.37-1.93 mm (0.054-0.076 in).

If a stop ring gap does not fall within the specifications, it must be inspected for wear and replaced. If the 1st or 2nd synchronizer stop ring is worn beyond specifications, the complete output shaft assembly must be replaced.

The input shaft incorporates the 3rd, 4th, and 5th speed gears and synchronizers on the assembly (Fig. 87).

DISASSEMBLY AND ASSEMBLY (Continued)

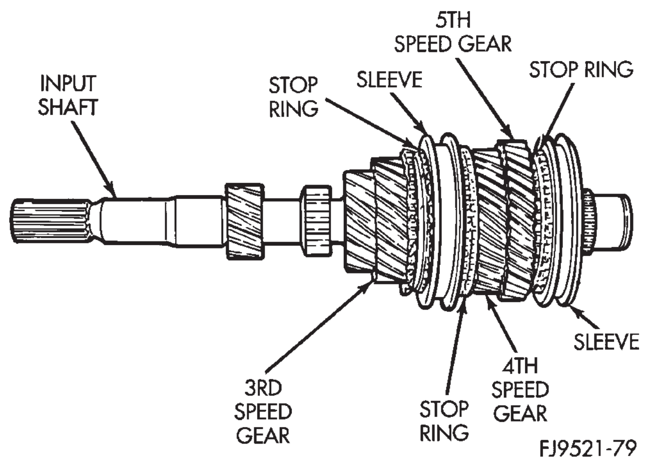


Fig. 87 Input Shaft

(1) Install bearing splitter behind 5th speed gear. Remove snap ring at 5th synchronizer hub on input shaft (Fig. 88).

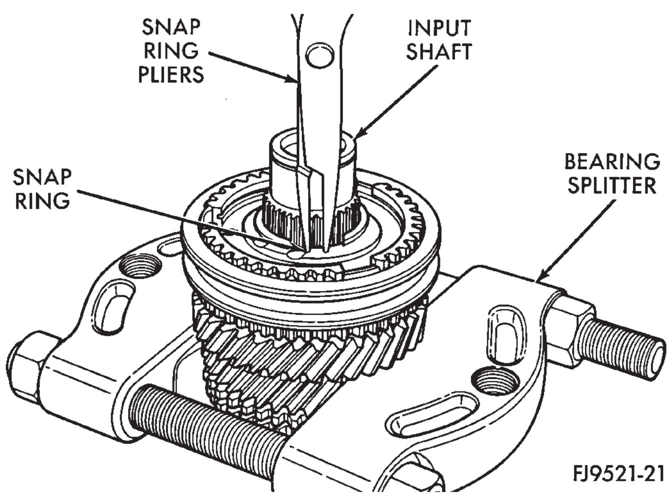


Fig. 88 5th Synchro and Hub Snap Ring Removal

(2) Remove synchronizer and gear using shop press (Fig. 89).

(3) Remove caged needle bearing (Fig. 90).

(4) Remove 4-5 gears split thrust washer ring (Fig. 91).

(5) Remove split thrust washer (Fig. 92).

(6) Remove split thrust washer separation pin (Fig. 93).

(7) Remove 4th gear (Fig. 94).

(8) Remove 4th gear caged needle bearing (Fig. 95). Check the caged needle bearing for a broken retention spring.

(9) Remove blocking ring. Remove 3-4 synchronizer hub retaining snap ring (Fig. 96).

(10) Install input shaft in shop press. Using bearing splitter, remove 3-4 synchronizer and 3rd gear (Fig. 97).

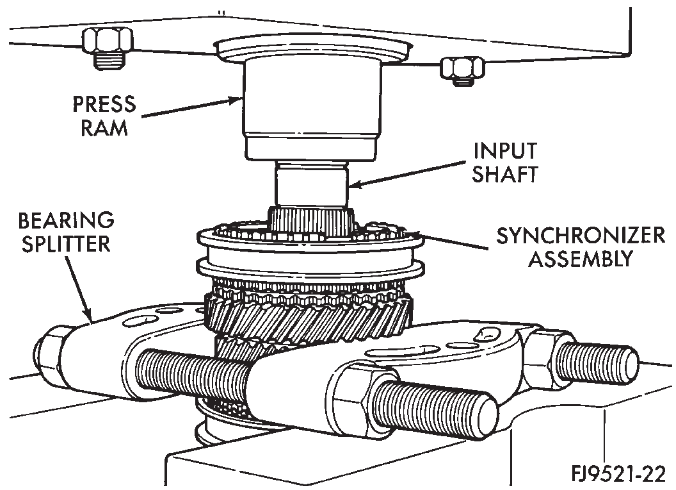


Fig. 89 Remove Synchronizer Using Shop Press

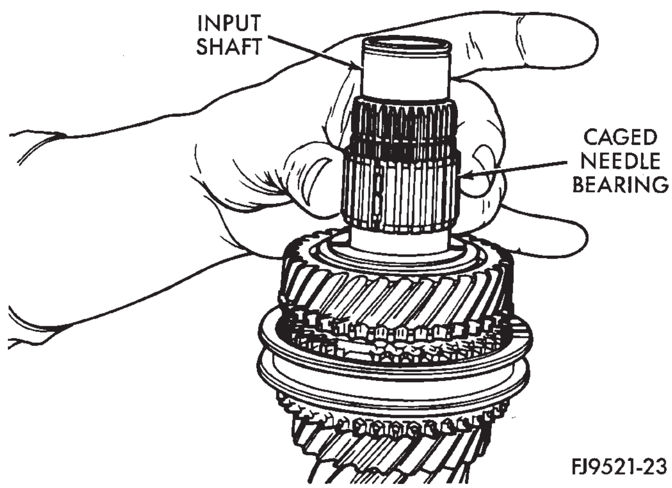


Fig. 90 Caged Needle Bearing Removal

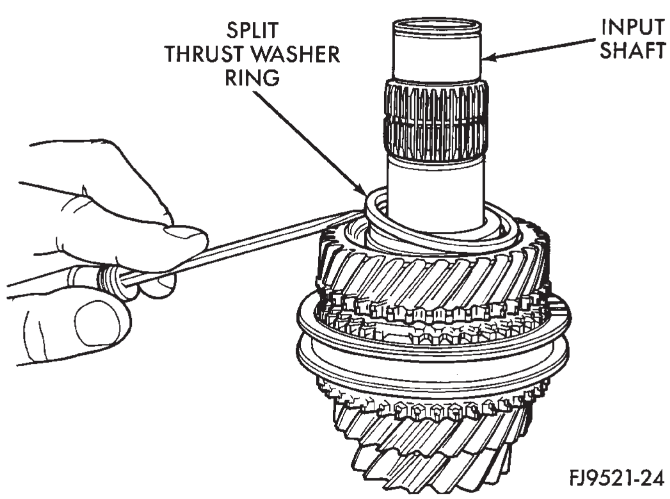


Fig. 91 Split Thrust Washer Ring Removal

(11) Remove 3rd gear caged needle bearing (Fig. 98). Check the caged needle bearing for a broken retention spring.

DISASSEMBLY AND ASSEMBLY (Continued)

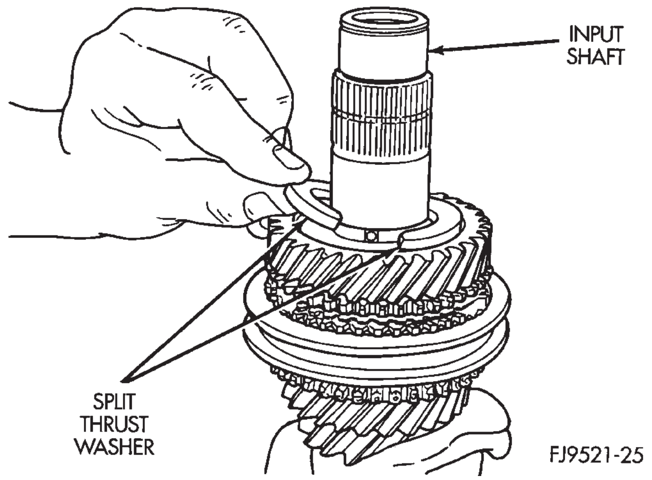


Fig. 92 Split Thrust Washer Removal

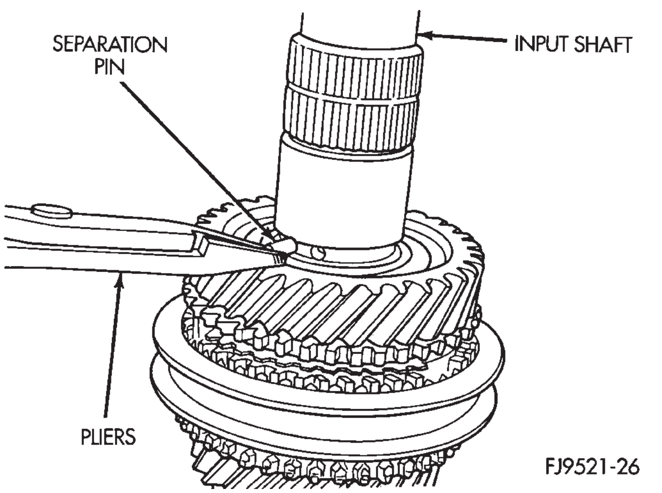


Fig. 93 Split Thrust Washer Separation Pin

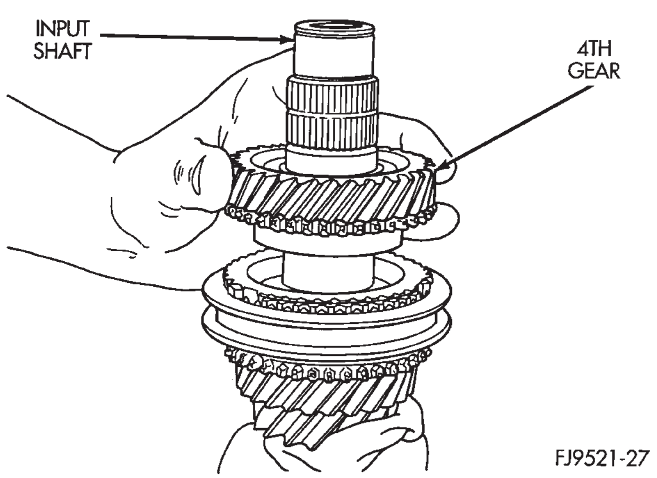


Fig. 94 4th Gear Removal

(12) Inspect the input shaft for worn or damaged bearing races or chipped gear teeth. Replace as necessary.

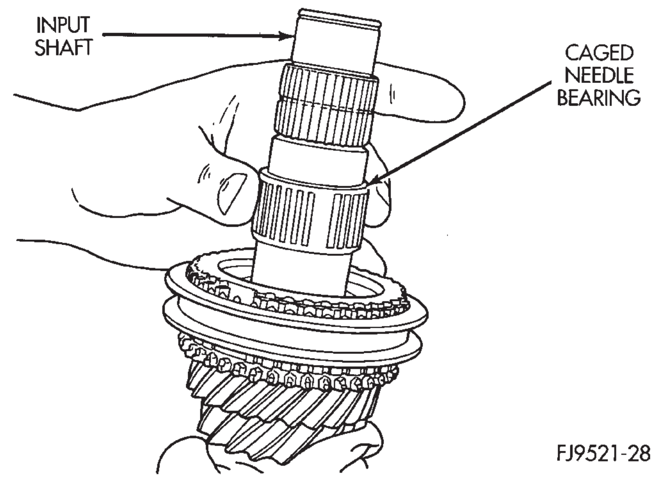


Fig. 95 Caged Needle Bearing Removal

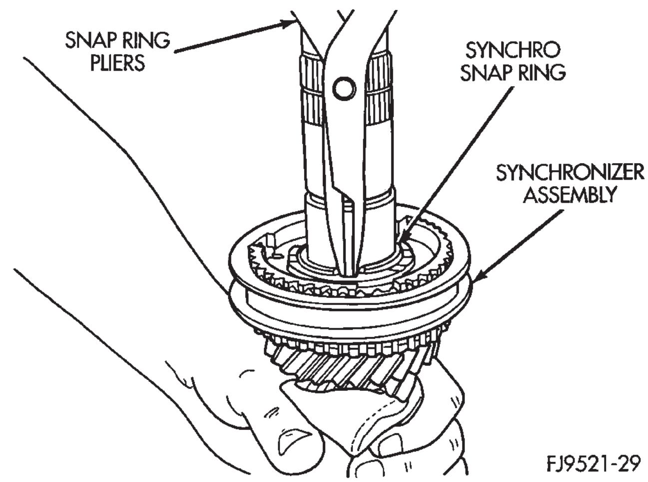


Fig. 96 3-4 Synchronizer Hub Snap Ring

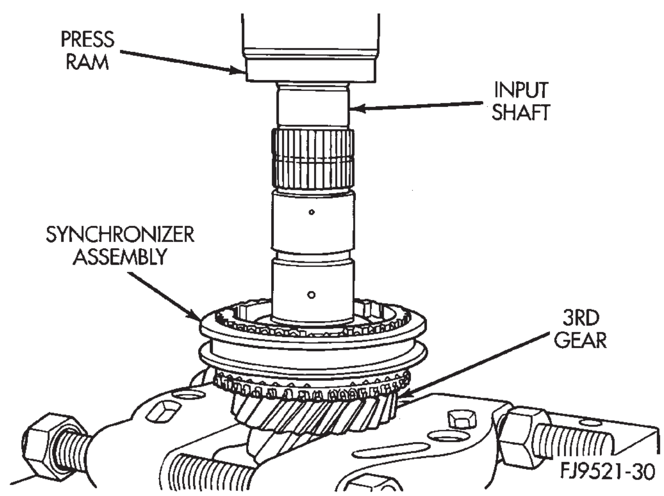


Fig. 97 3rd Gear Removal

ASSEMBLY

The snap rings that are used on the input shaft are available in select fit sizes. Use the thickest snap ring that fits in each snap ring groove.

DISASSEMBLY AND ASSEMBLY (Continued)

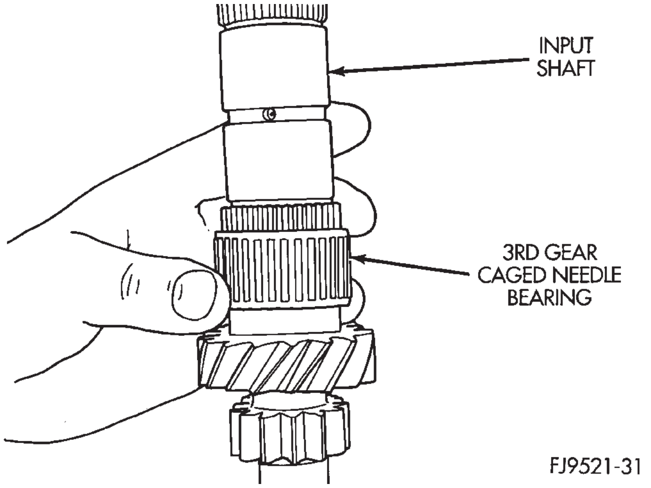


Fig. 98 3rd Gear Caged Needle Bearing

(1) Place input shaft into shop press.

(2) Install 3rd gear caged needle bearing on input shaft.

(3) Install 3rd gear and 3-4 synchronizer onto input shaft. Install Tool #C-3717 over input shaft and press on synchronizer hub and 3rd gear (Fig. 99). The synchronizer hub has the letter **U** stamped on the top face of the hub. This designates that the hub must be installed with the **U** facing upward.

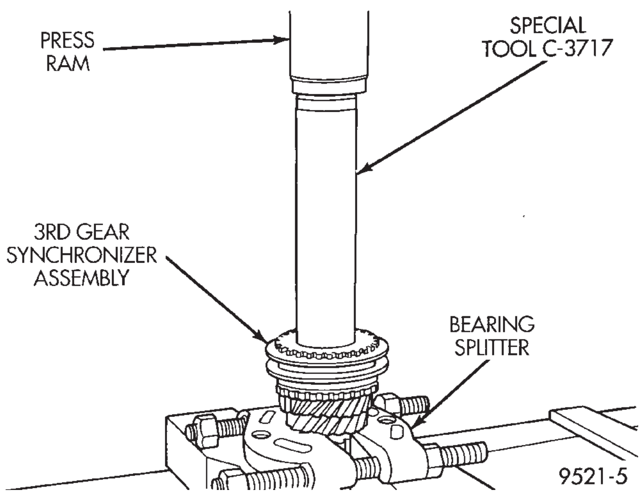


Fig. 99 Press On 3rd Gear Synchronizer Hub

(4) Install 3-4 synchronizer snap ring into slot on input shaft.

(5) Install blocking ring into 3-4 synchronizer. Install 4th gear caged needle bearing.

(6) Install 4th gear onto input shaft.

(7) Install 4-5 split thrust washer separation pin (Fig. 100).

(8) Install split thrust washer onto input shaft (Fig. 101).

(9) Install split thrust washer retaining ring (Fig. 102).

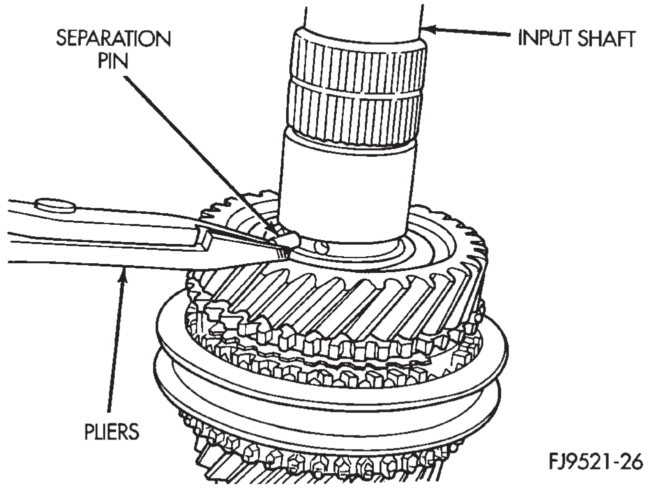


Fig. 100 Split Thrust Washer Separation Pin Installation

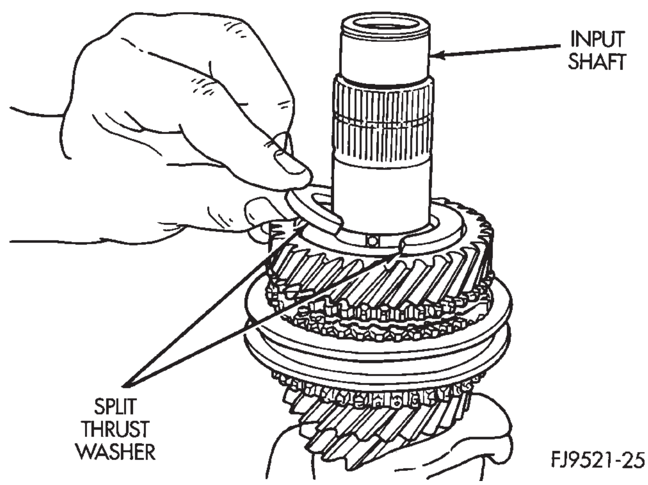


Fig. 101 Split Thrust Washer Installation

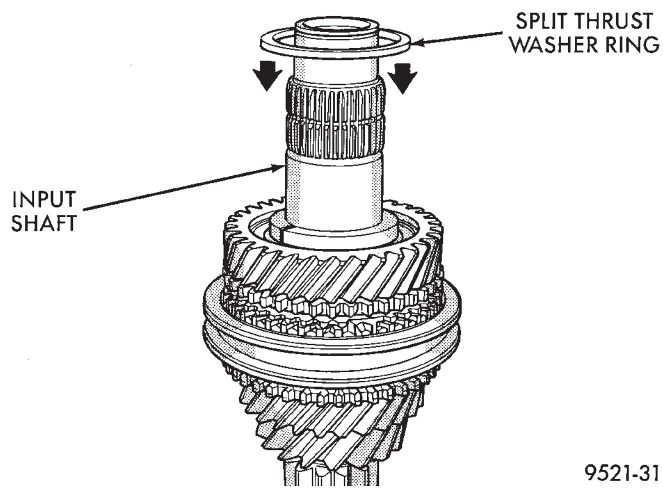


Fig. 102 Retaining Ring Installation

(10) Install 5th gear caged needle bearing (Fig. 103).

DISASSEMBLY AND ASSEMBLY (Continued)

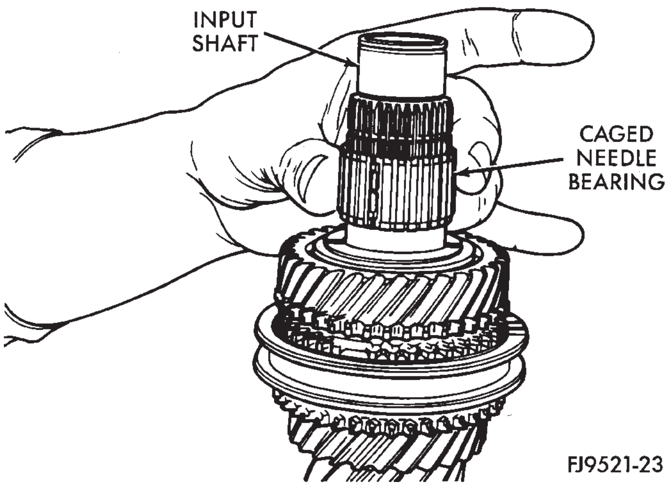


Fig. 103 Caged Needle Bearing Installation

(11) Using special tool #C-3717, install 5th speed gear and synchronizer (Fig. 104). The 5th gear synchronizer hub has the letter **S** stamped on the top face of the hub. This designates that the hub must be installed with the **S** facing upward.

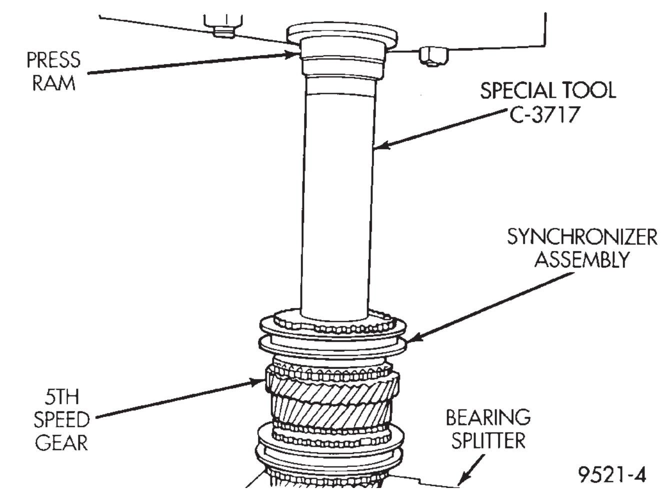


Fig. 104 5th Speed Gear Installation

(12) Install 5th gear synchronizer snap ring (Fig. 105).

OUTPUT SHAFT

CAUTION: The output shaft is serviced as an assembly. Do not try to repair any component on the output shaft. If the 1-2 synchronizer or gear fails, it is necessary to replace the output shaft assembly.

It is necessary to check the synchronizer stop ring gap. Use a feeler gauge to measure the gaps between the stop rings and the speed gears. The correct gaps are listed below:

- 1st—1.04-1.72 mm (0.041-0.069 in).
- 2nd—0.94-1.72 mm (0.038-0.069 in).

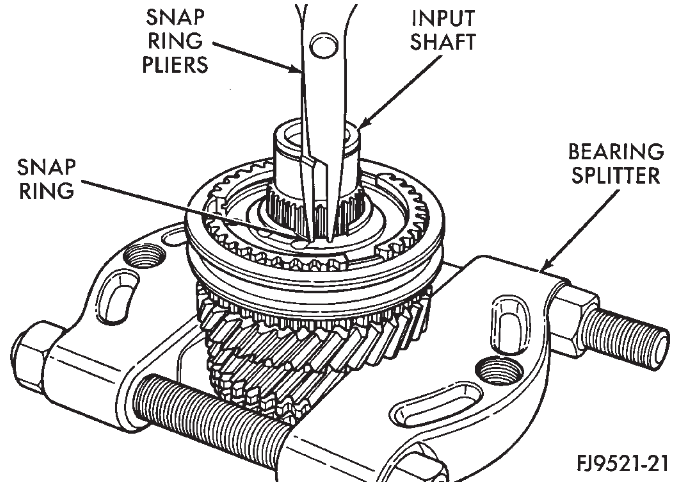


Fig. 105 5th Gear Synchronizer Snap Ring Installation

- 3rd—1.37-1.93 mm (0.054-0.076 in).
- 4th—1.41-1.97 mm (0.056-0.078 in).
- 5th—1.37-1.93 mm (0.054-0.076 in).

If a stop ring gap does not fall within the specifications it must be inspected for wear and replaced. If the 1st or 2nd synchronizer stop ring is worn beyond specifications, the complete output shaft assembly must be replaced.

The output shaft incorporates the 1st and 2nd gears and synchronizers on the assembly (Fig. 106).

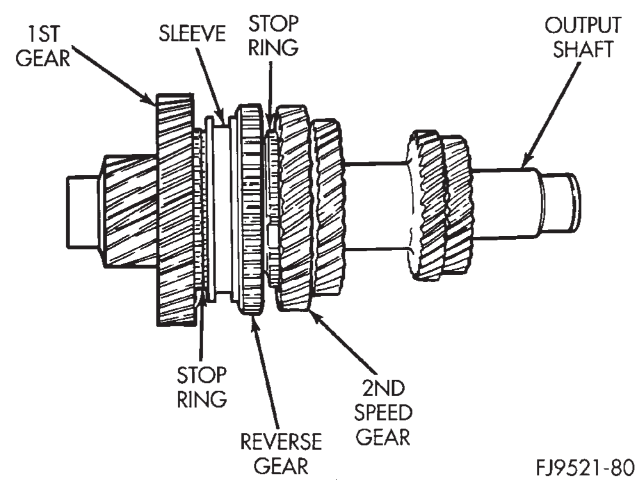


Fig. 106 Output Shaft

DIFFERENTIAL

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle gear case
- Clutch bellhousing case
- Differential case
- Differential bearings

Refer to **Bearing Adjustment Procedure** in the Adjustments section at the end of this section to determine proper shim thickness. This will provide correct bearing preload and proper bearing turning torque.

DISASSEMBLY AND ASSEMBLY (Continued)

DIFFERENTIAL BEARINGS

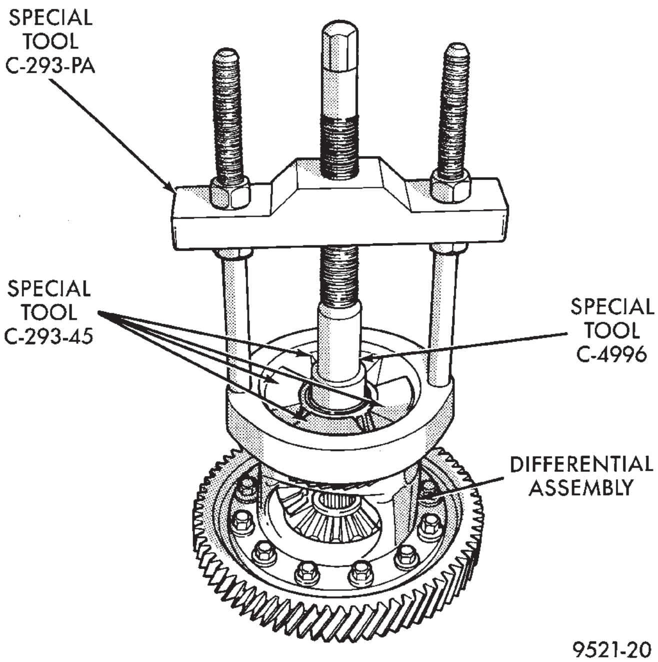


Fig. 107 Remove Differential Bearing Cone

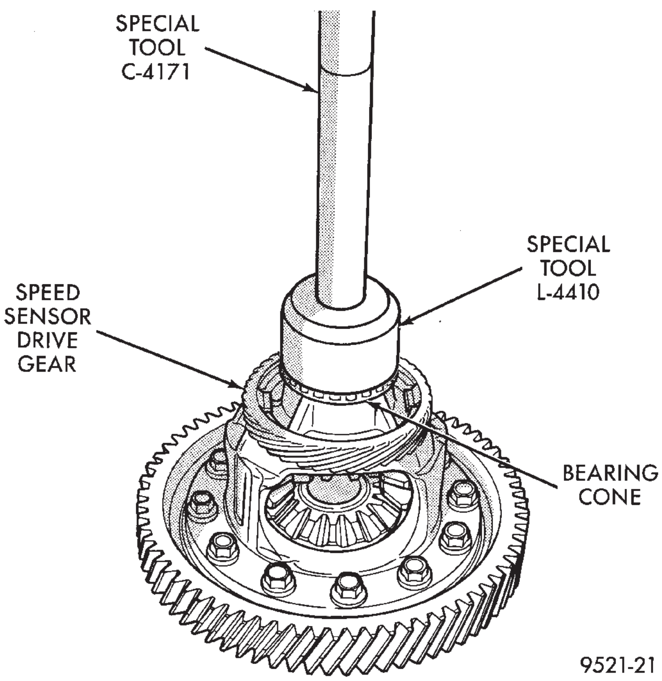


Fig. 108 Install Differential Bearing Cone

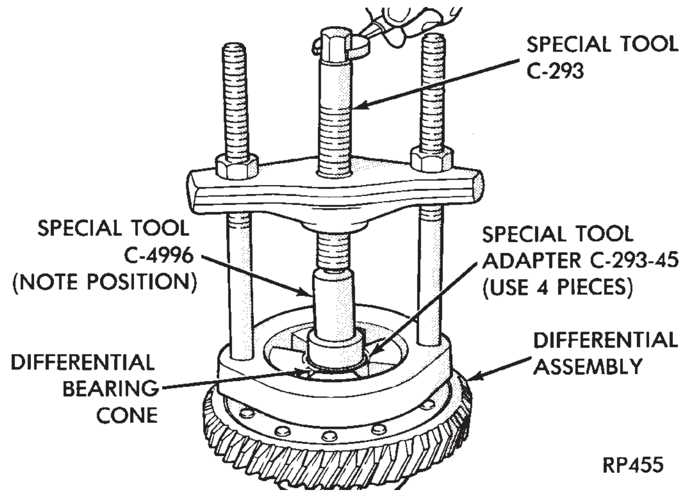


Fig. 109 Remove Differential Bearing Cone

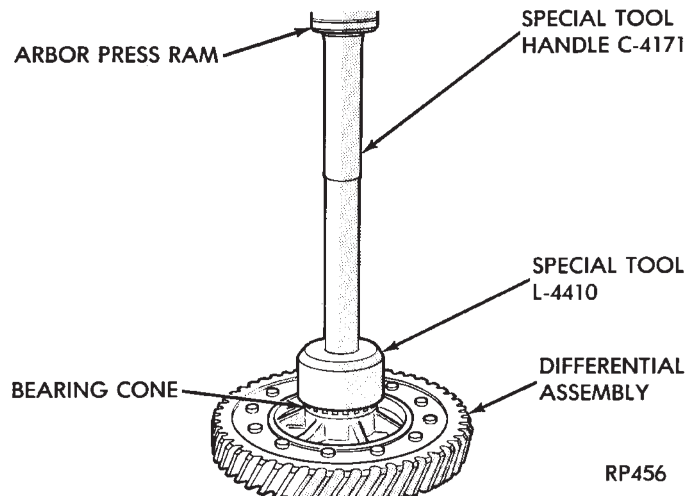


Fig. 110 Install Differential Bearing Cone

RING GEAR

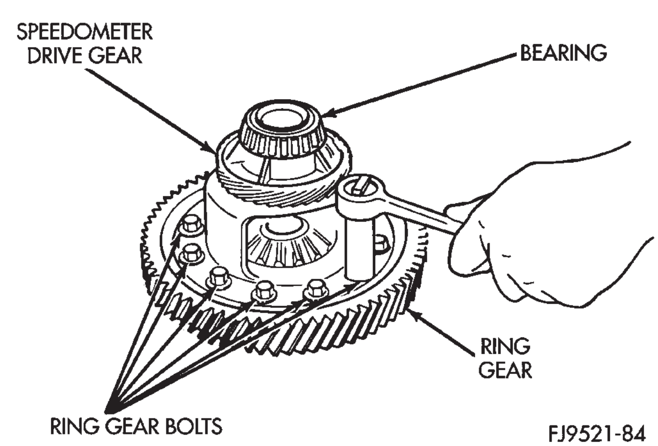


Fig. 111 Remove or Install Ring Gear Bolts and Ring Gear

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Always install new ring gear bolts. Tighten ring gear bolts to 81 N·m (60 ft. lbs.) torque.

SPEEDOMETER DRIVE GEAR

NOTE: The plastic speedometer drive gear must be removed from the differential case in order to service the differential gears

REMOVAL

(1) Pry the plastic speedometer drive gear off of the differential case using a flat blade pry tool (Fig. 112) (Fig. 113).

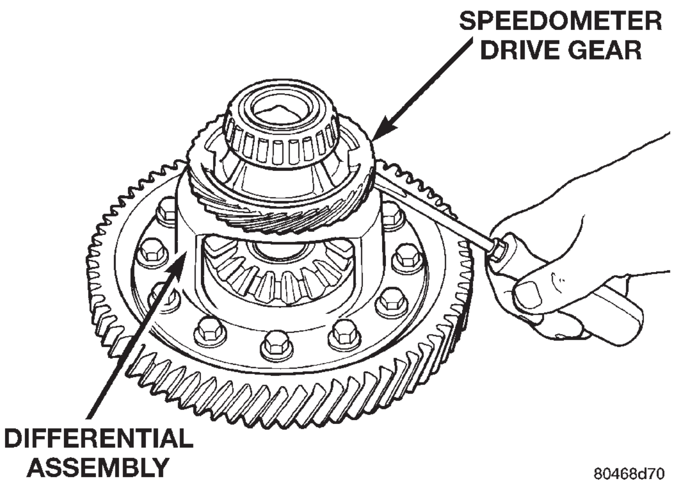


Fig. 112 Pry Off Speedometer Drive Gear

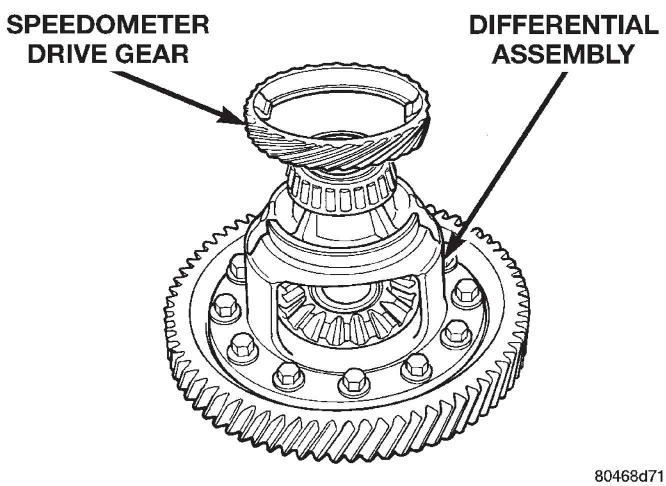


Fig. 113 Speedometer Drive Gear Removed

INSTALLATION

NOTE: A new speedometer drive gear must be installed on differential assembly. The lip on the speedometer drive gear must be positioned downward when installing onto differential assembly.

(1) Position speedometer drive gear onto differential assembly (Fig. 114).

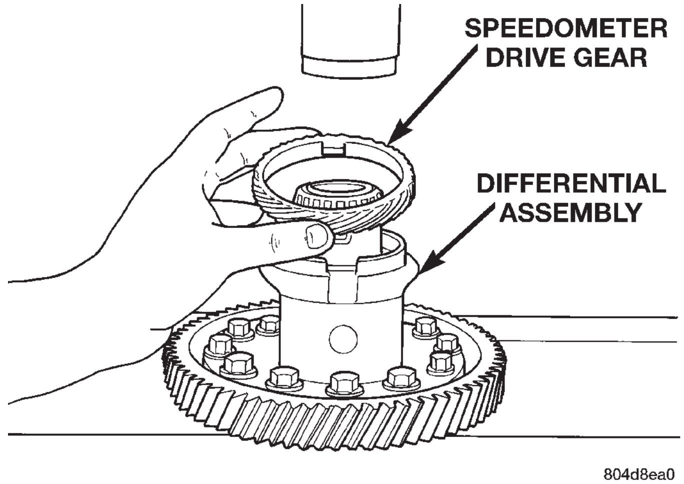


Fig. 114 Speedometer Drive Gear

(2) Using Miller Tool # L-4440 and steel stock, press speedometer drive gear onto differential (Fig. 115) (Fig. 116). Do not use a hammer.

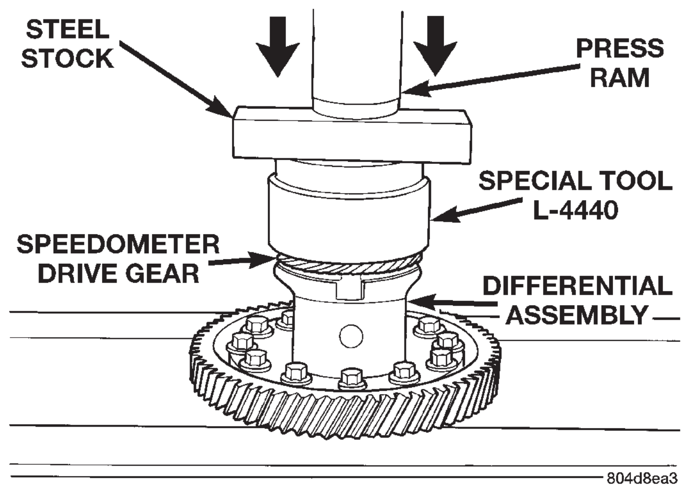


Fig. 115 Press Gear onto Diferential

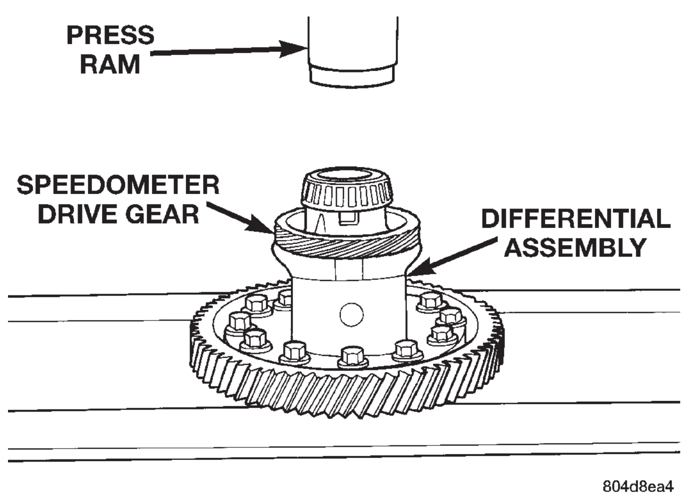


Fig. 116 Drive Gear Pressed onto Differential

DISASSEMBLY AND ASSEMBLY (Continued)

DIFFERENTIAL GEARS

NOTE: The plastic speedometer drive gear must be removed from the differential case in order to service the differential gears. Refer to Speedometer Drive Gear for service information.

REMOVAL

(1) Remove pinion shaft retaining pin (Fig. 117) (Fig. 118).

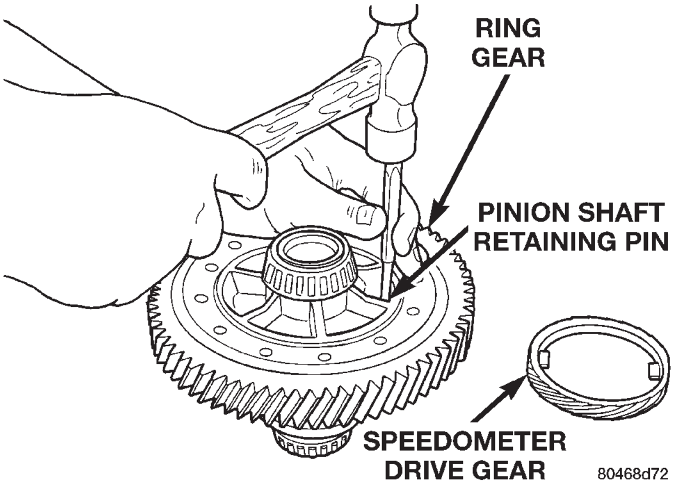


Fig. 117 Remove Pinion Shaft Retaining Pin

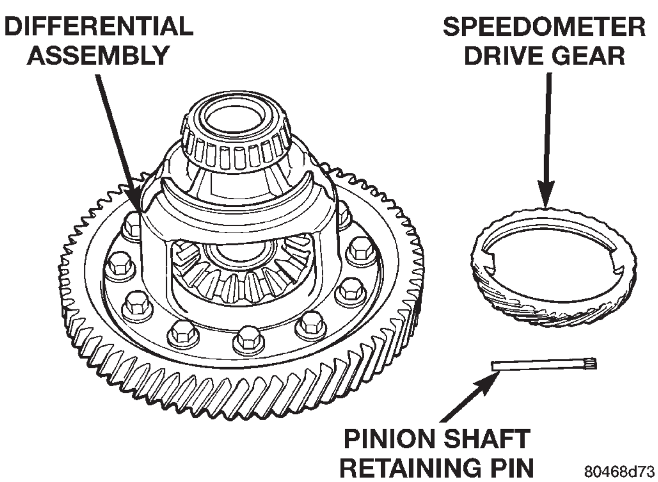


Fig. 118 Retaining Pin Removed

(2) Remove pinion shaft (Fig. 119).

(3) Rotate side gears to opening in differential (Fig. 120).

(4) Remove differential gears (Fig. 121).

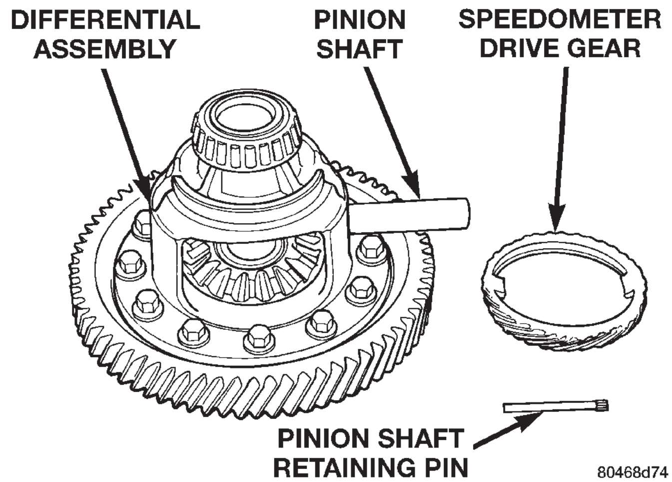


Fig. 119 Pinion Shaft Removal

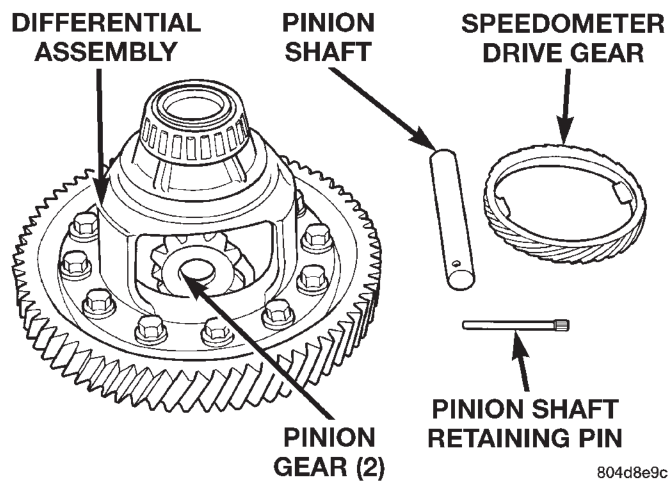


Fig. 120 Remove Pinion Gears, Side Gears, and Thrust Washers by Rotating Side Gears to Opening in Case

INSTALLATION

(1) Assemble the differential side gears, pinion gears and pinion gears with the pinion gear washers.

(2) Install pinion shaft retaining pin (Fig. 122).

DISASSEMBLY AND ASSEMBLY (Continued)

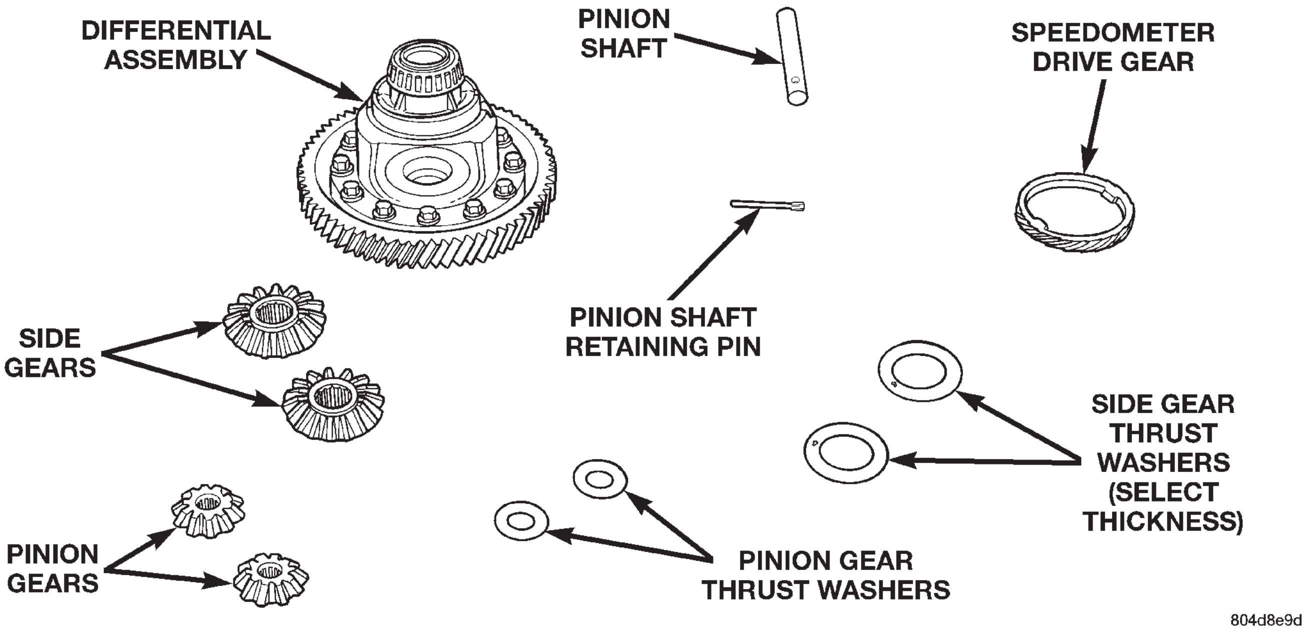


Fig. 121 Differential Gears

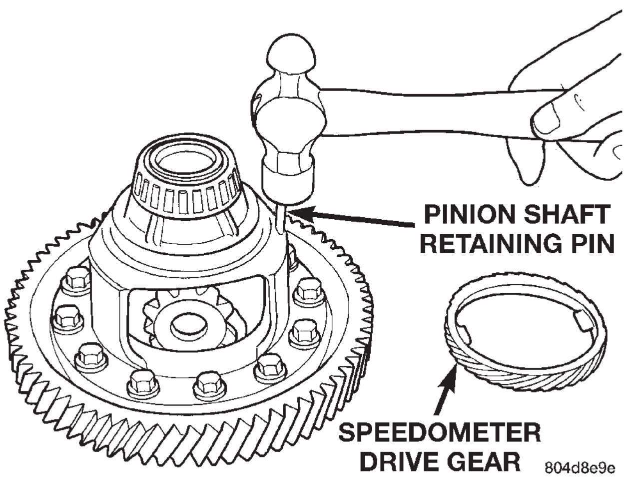


Fig. 122 Install Retaining Pin

(3) Stake pinion shaft retaining pin with a suitable chisel (Fig. 123).

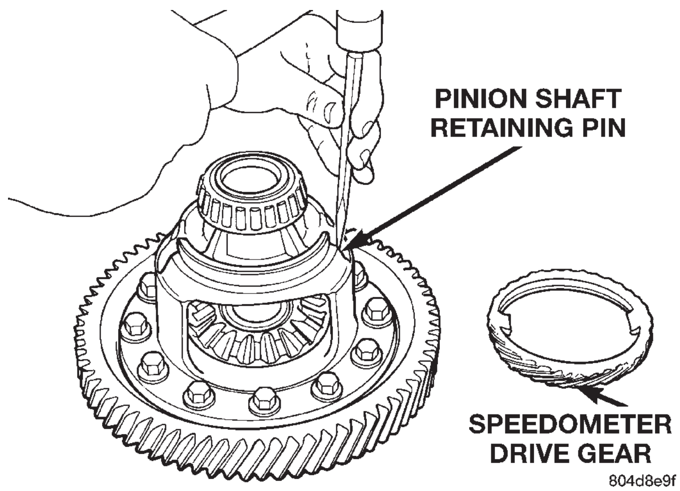


Fig. 123 Staking Retaining Pin

(4) Rotate the assembly two full revolutions both clockwise and counterclockwise.

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Set up dial indicator as shown and record end play (Fig. 124) (Fig. 125). Rotate side gear 90 degrees and record another end play. Again, rotate side gear 90 degrees and record a final end play.

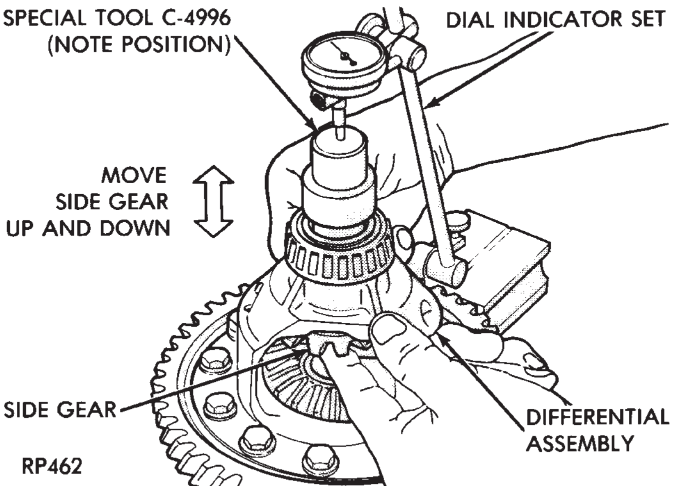


Fig. 124 Checking Side Gear End Play (Typical)

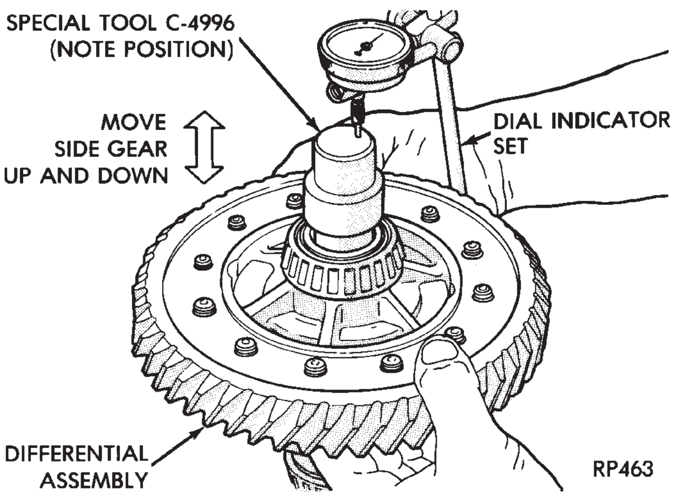


Fig. 125 Checking Side Gear End Play (Typical)

(6) Using the smallest end play recorded, shim that side gear to within 0.001 to 0.013 inch. The other side gear should be checked using the same procedure.

CAUTION: Side gear end play must be within 0.001 to 0.013 inch. Five select thrust washers are available: 0.027, 0.032, 0.037, 0.042, and 0.047 inch.

(7) After the end play is measured and adjusted, replace speedometer drive gear with a new one. Install drive gear lip downward. For service information, refer to Speedometer Drive Gear service in this section.

SYNCHRONIZER

DISASSEMBLY

Place synchronizer in a clean shop towel and wrap. Press on inner hub. Carefully open up shop towel and remove springs, balls, keys, hub, and sleeve.

ASSEMBLY

(1) Position synchronizer hub onto a suitable holding fixture (input shaft). The synchronizer hubs are directional. The hubs must be installed with the **U** facing upward.

(2) Install springs into hub slot (Fig. 126).

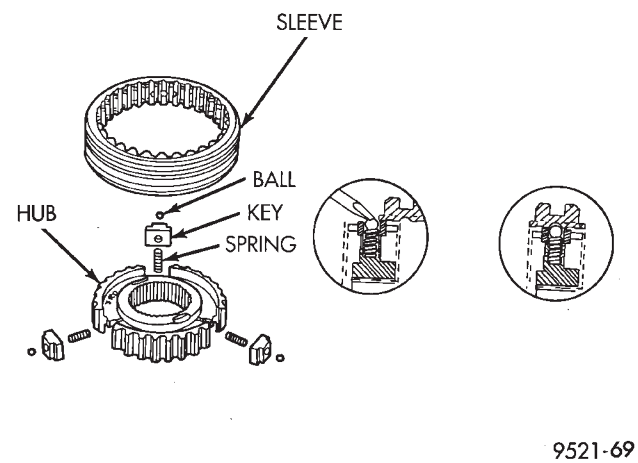


Fig. 126 Synchronizer Assembly

(3) Insert key into hub and spring.

(4) Apply petroleum jelly to the hole in the key. Insert balls into each key (Fig. 127).

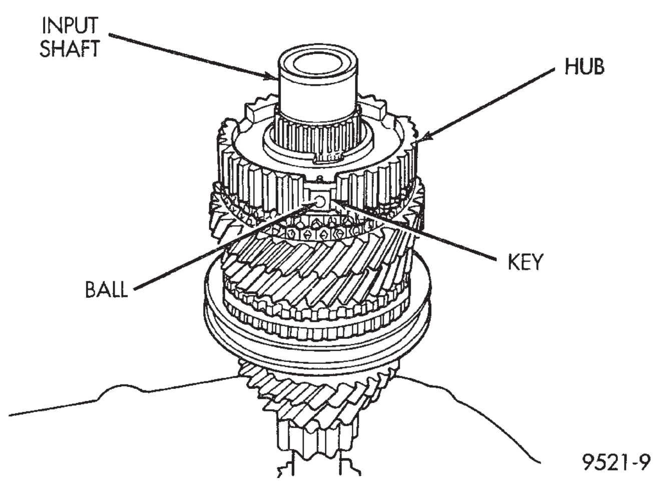


Fig. 127 Synchronizer Balls

(5) Slide sleeve over the hub and depress balls as you carefully slip the sleeve into position (Fig. 128).

(6) Line up stop ring tang over the keys in the hub (Fig. 129). Install stop rings. Center the keys and balls by pushing on both stop rings.

DISASSEMBLY AND ASSEMBLY (Continued)

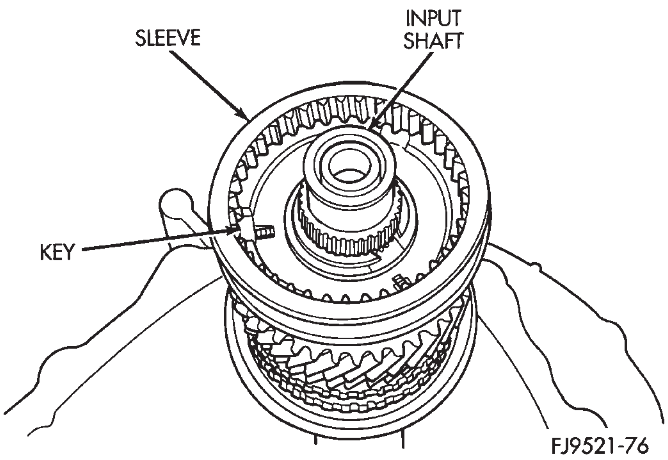


Fig. 128 Synchronizer Sleeve

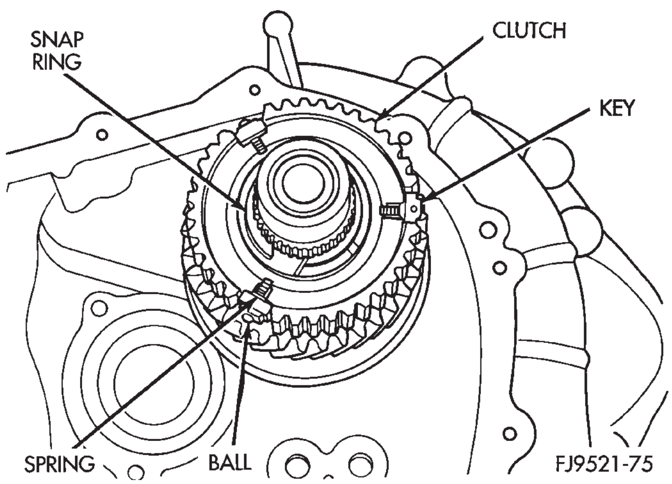


Fig. 129 Keys in Hub

SHIFT RAILS OVERHAUL

(1) Remove shift rails from the geartrain.

(2) To service the 5-R shift rail, remove the C-clip retaining the reverse shift lever arm. Remove the 5th shift fork roll pin and remove the 5th shift fork. Remove the shift lug roll pin and remove the shift lug. Replace parts as necessary.

(3) To service the 3-4 shift rail, remove the roll pin retaining the 3-4 shift fork. Remove the shift fork. Remove the shift lug roll pin and remove the shift lug. Replace parts as necessary.

(4) To service the 1-2 shift rail, remove the roll pin retaining the 1-2 shift fork. Remove the shift fork and replace parts as necessary.

TRANSAXLE CASE OVERHAUL

The sealant used to seal the transaxle case halves is Mopar® Gasket Maker, Loctite® 518, or equivalent. The sealant used for the bearing end–plate cover is Mopar® RTV.

The components that are left in the gear cases when the gear train is pulled out are the:

- Axle shaft seals
- Output bearing race and retainer
- Input bearing and sleeve
- Differential bearing cones
- Shift rail bushings
- Shift shafts
- Shift shaft seals
- Shift shaft bushings
- Rear bearing oil feed trough

AXLE SHAFT SEALS

REMOVAL

(1) Insert a flat–blade pry tool at outer edge of axle shaft seal (Fig. 130).

(2) Tap on the pry tool with a small hammer and remove axle shaft seal.

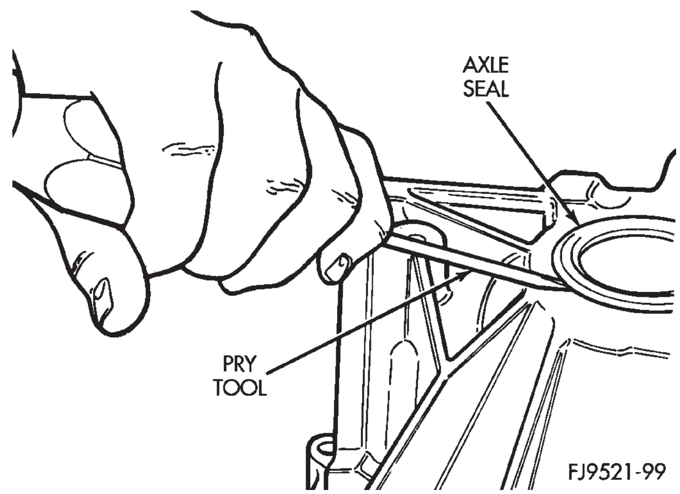


Fig. 130 Axle Shaft Seal Removal

INSTALLATION

(1) Clean axle shaft seal bore of any excess sealant.

(2) Align axle shaft seal with axle shaft seal bore.

(3) Install axle seal on tool #6709 with C-4171 and insert into axle shaft seal bore.

(4) Tap seal into position (Fig. 131).

OUTPUT BEARING

REMOVAL

NOTE: The position of the output shaft bearing is critical. The bearing is not identical end–to–end. Install bearing with larger diameter cage ring facing out.

(1) Remove caged roller bearing from output bearing race (Fig. 132).

(2) Remove screws at output bearing retainer strap (Fig. 133).

DISASSEMBLY AND ASSEMBLY (Continued)

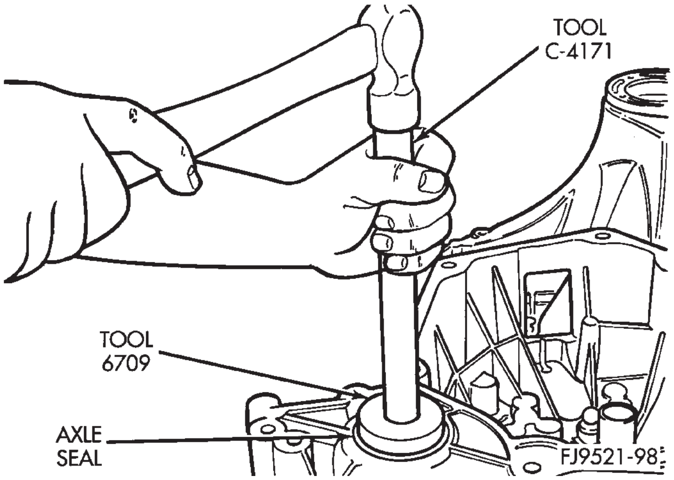


Fig. 131 Axle Seal Installation

(3) Install tool #6787 and slide hammer (Fig. 134). Tighten tool to output bearing race.

(4) Using slide hammer, remove output bearing race.

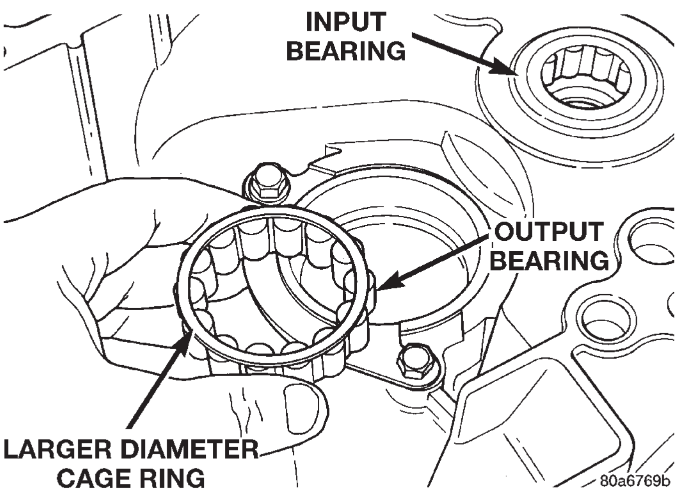


Fig. 132 Output Roller Bearing

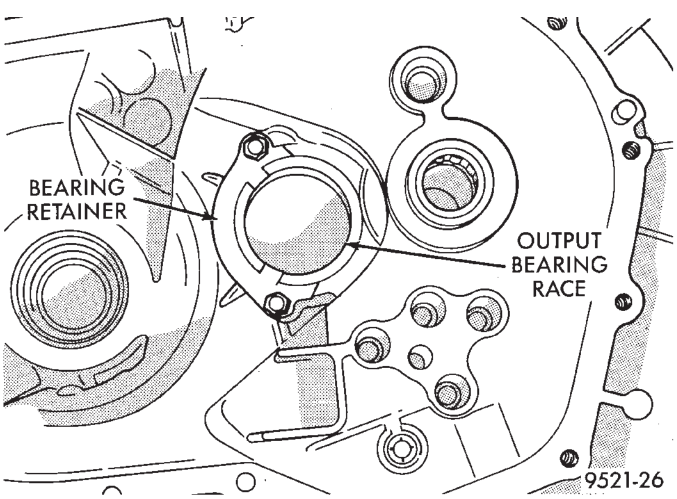


Fig. 133 Output Bearing Strap

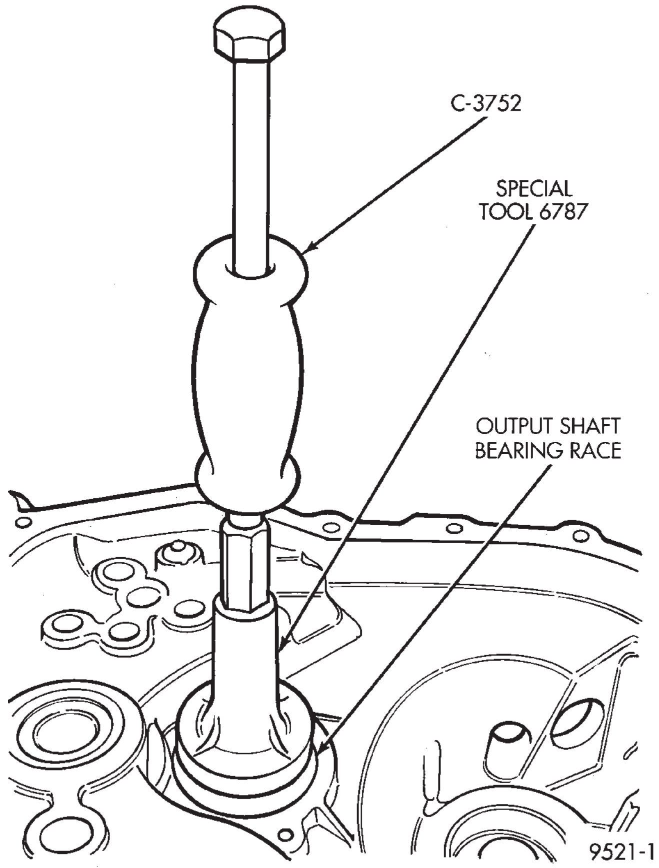


Fig. 134 Output Bearing Race Removal

INSTALLATION

(1) Line up output bearing race to race bore.

(2) Insert tool #4628 with C-4171 into output bearing race (Fig. 135). Tap race into bore. Install output bearing into race. Verify that the larger diameter cage is facing outward. Position bearing retaining strap. Tighten bolts to 11 N·m (96 in. lbs.).

INPUT BEARING AND SLEEVE

The input bearing is a one–piece bearing and sleeve unit (Fig. 136). The sleeve is the slide point for the clutch–release bearing and lever.

REMOVAL

(1) Install tool #6342 over input bearing on the gear case side of the transaxle clutch housing.

(2) Press the input bearing out of the housing (Fig. 137).

INSTALLATION

(1) Apply coating of Loctite® sealant on bearing outer diameter. Position sleeve and bearing assembly at input bearing bore.

(2) Install tool #C-4680-1 over input bearing (Fig. 138).

DISASSEMBLY AND ASSEMBLY (Continued)

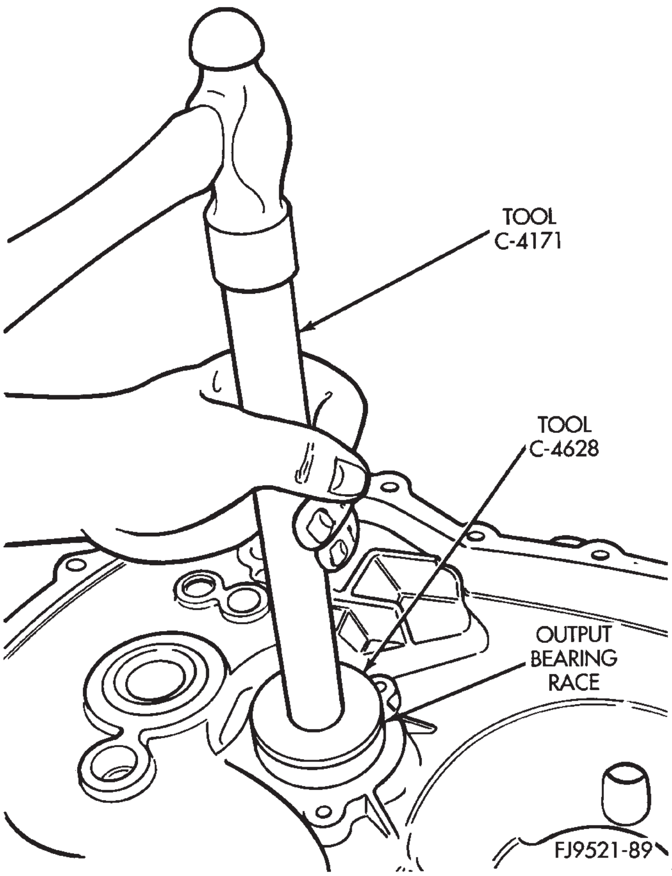


Fig. 135 Output Bearing Race Installation

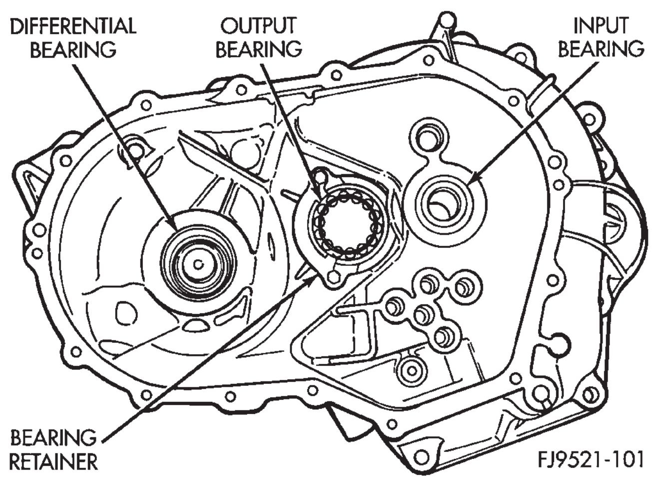


Fig. 136 Input Bearing And Sleeve

(3) Using the spacer tool #4894 and shop press, install input bearing into bore until it is fully seated (Fig. 139).

DIFFERENTIAL BEARING CUPS

REMOVAL

(1) Remove differential assembly from gear case using the procedure outlined in this group.

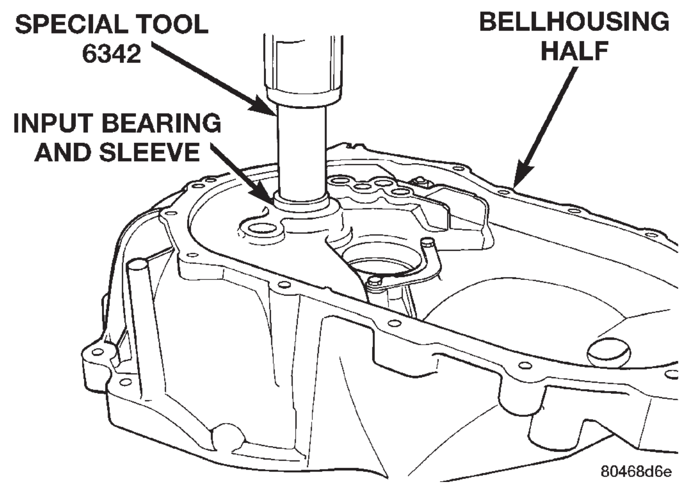


Fig. 137 Input Bearing Removal

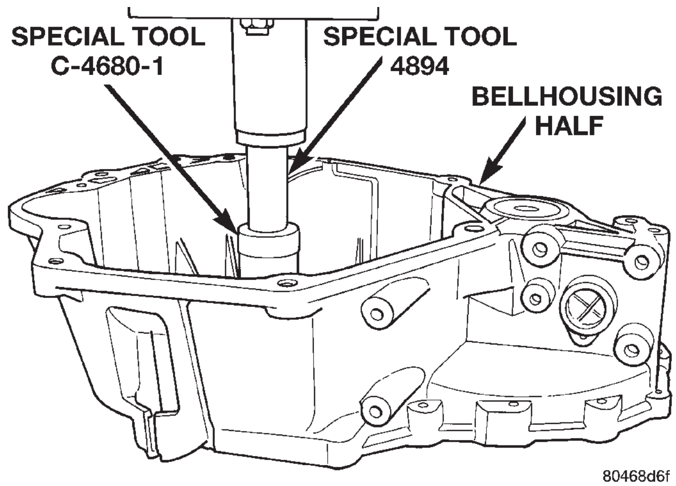


Fig. 138 Input Bearing Tool

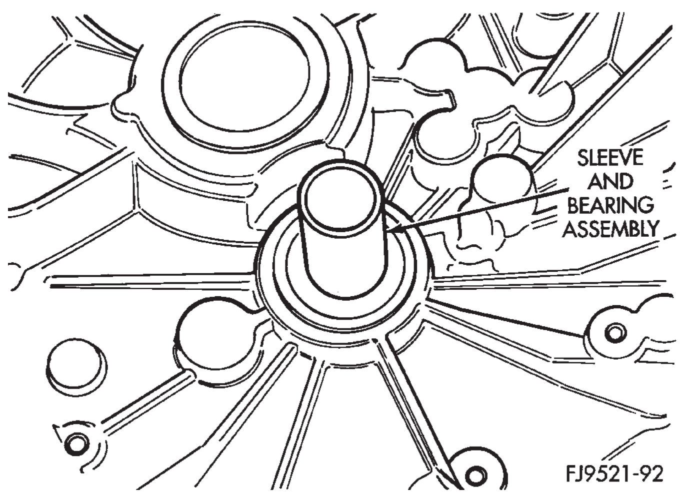


Fig. 139 Input Bearing Installed

(2) Install Miller tool #L-4518 into the differential bearing cup (Fig. 140).

(3) Install the tool cup over the tool (Fig. 141).

DISASSEMBLY AND ASSEMBLY (Continued)

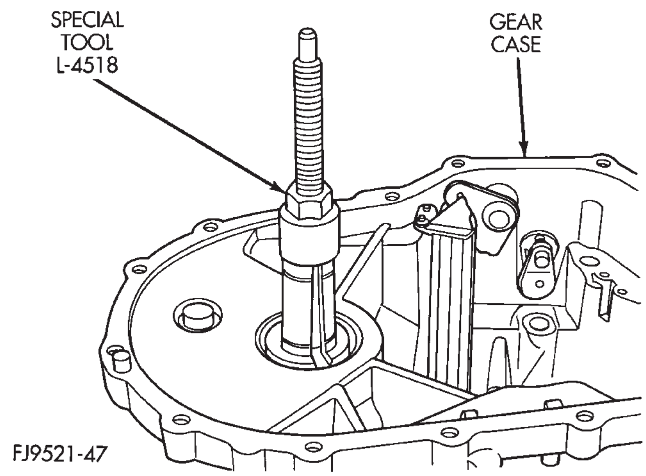


Fig. 140 Tool Installed in Bearing

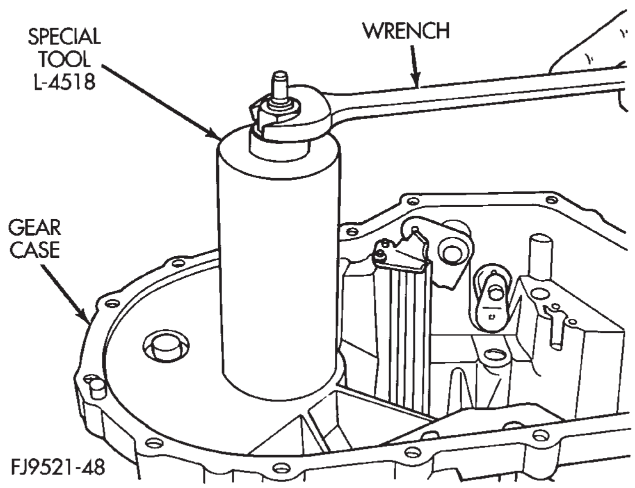


Fig. 141 Tool Cup Installed

(4) Tighten the tool until the race is removed from the case.

INSTALLATION

(1) Position the bearing cup into the case.

(2) Install the bearing cup onto Miller tool #L-4520.

(3) Using Miller tool #L-4520 and C-4171 driver, install differential bearing cup into the transaxle case.

SHIFT RAIL BUSHINGS

REMOVAL

(1) Thread tool #6786 into shift rail bushing.

(2) Install slide hammer #3752 onto tool.

(3) Remove bushing using slide hammer and tool assembly (Fig. 142).

INSTALLATION

(1) Line up replacement bushing in bore.

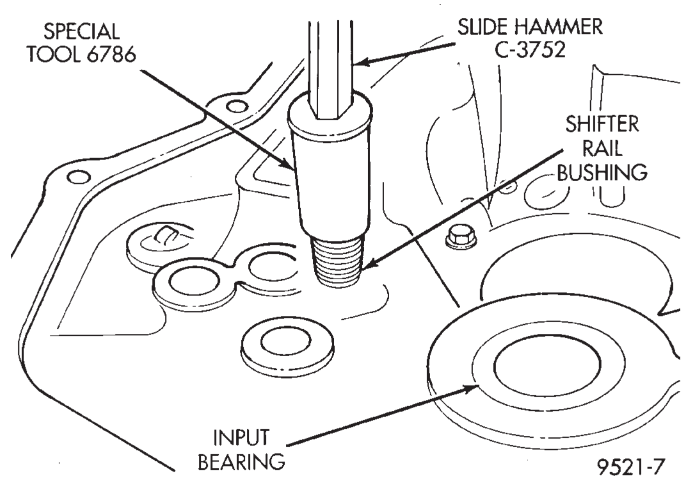


Fig. 142 Shift Rail Bushing Removal

(2) Using tool #MD998343, tap bushing into bore until flush with the chamfer in the case.

SHIFT SHAFT SEALS

It is not necessary to remove the shift shafts from the transaxle to service the shift shaft seals.

REMOVAL

(1) Using a pick tool, pry up on the shift shaft seal and remove seal from bore.

INSTALLATION

(1) Position new shift shaft seal in bore.

(2) Install shift shaft seal into bore using an appropriate size deep-well socket.

SHIFT SELECTOR SHAFT

REMOVAL

(1) Disassemble transaxle using the procedure outlined in this group.

(2) With the transaxle disassembled, remove the selector shaft by pushing on the shaft from the outside. Pull shaft out from the inside.

INSTALLATION

(1) Reverse removal procedure to install selector shaft.

SHIFT CROSSOVER SHAFT

REMOVAL

(1) Disassemble transaxle using the procedure outlined in this group.

(2) With the transaxle disassembled, remove the crossover shaft seal.

(3) Using snap–ring pliers, remove the snap ring at the crossover shaft bore (Fig. 143).

DISASSEMBLY AND ASSEMBLY (Continued)

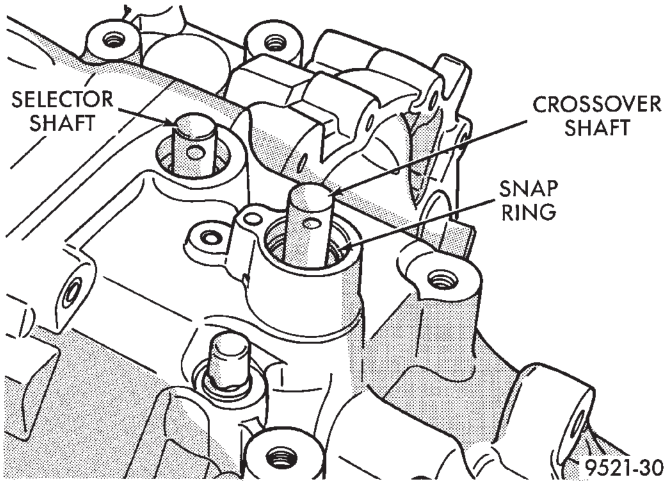


Fig. 143 Crossover Shaft Snap Ring

(4) Push the crossover shaft in the case and remove the crossover assembly.

INSTALLATION

(1) Reverse removal procedure to install crossover shaft.

SHIFT SELECTOR SHAFT BUSHING

REMOVAL

(1) Remove selector shaft using procedure in this group.

(2) Thread tool #6786 into bushing.

(3) Install slide hammer #3752 onto tool and remove bushing using slide hammer (Fig. 144).

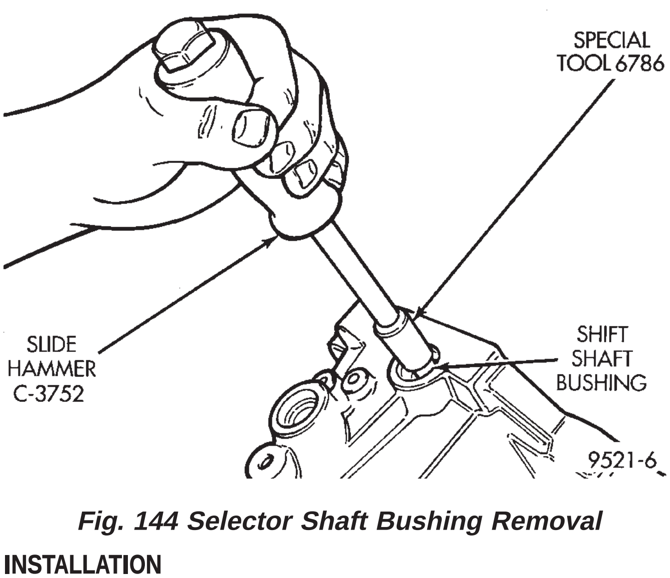


Fig. 144 Selector Shaft Bushing Removal

INSTALLATION

(1) Position replacement bushing over selector shaft bore.

(2) Using an appropriate size deep–well socket, install bushing in selector shaft bore (Fig. 145).

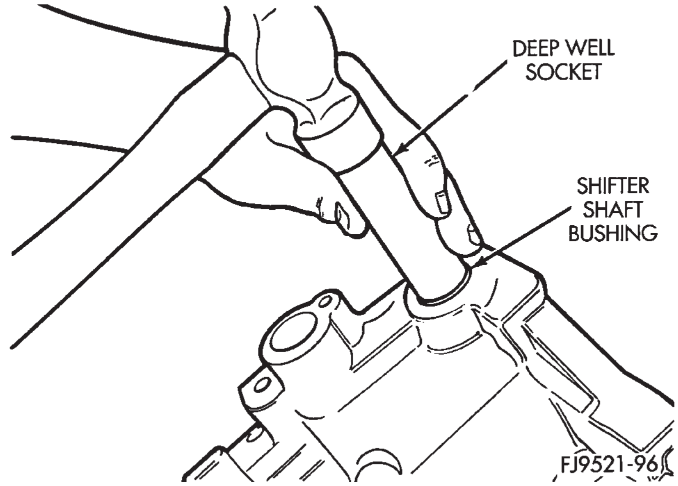


Fig. 145 Selector Shaft Bushing Installation

SHIFT CROSSOVER SHAFT BUSHING

REMOVAL

(1) Install slide hammer #3752 through the crossover bushing.

(2) Thread nut and washer onto slide hammer.

(3) Using the slide hammer, remove the crossover shaft bushing (Fig. 146).

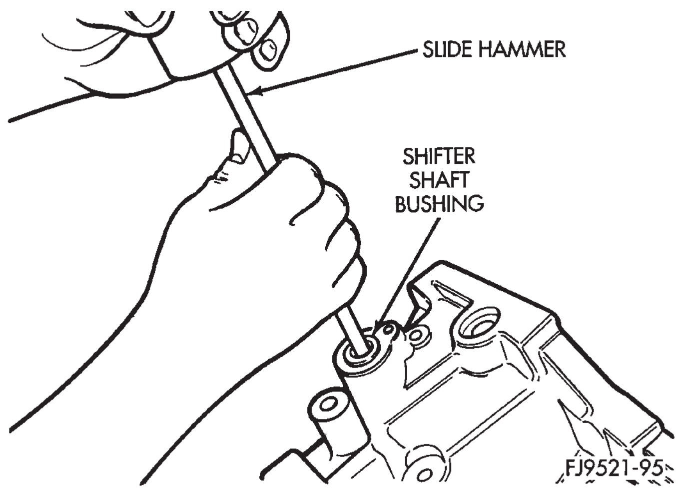


Fig. 146 Crossover Shaft Bushing Removal

INSTALLATION

(1) Position the replacement crossover shaft bushing over the crossover shaft bushing bore.

(2) Using an appropriate size deep–well socket, install the crossover shaft bushing into the bushing bore.

REAR BEARING OIL FEED TROUGH

The bearing oil feed trough is retained in the case by a pin that is molded into the case and clips that are part of the trough (Fig. 147).

DISASSEMBLY AND ASSEMBLY (Continued)

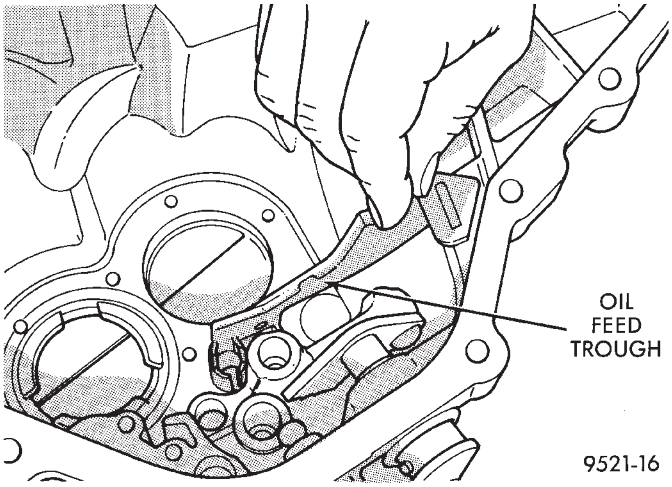


Fig. 147 Oil Feed Trough

REMOVAL

(1) Using light plier pressure, squeeze the clips together at the rear of the trough.

(2) Slide the trough over the retaining pin that locates the trough in the case.

INSTALLATION

(1) Reverse removal procedure to install oil feed trough.

CLEANING AND INSPECTION

TRANSAXLE

Clean the gears, bearings, shafts, synchronizers, thrust washers, oil feeder, shift mechanism, gear case, and bellhousing with solvent. Dry all parts except the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

Inspect the gears, bearings, shafts and thrust washers. Replace the bearings and cups if the rollers are worn, chipped, cracked, flat spotted, or brinnelled, or if the bearing cage is damaged or distorted. Replace the thrust washers if cracked, chipped, or worn. Replace the gears if the teeth are chipped, cracked, or worn thin. Inspect the synchronizers. Replace the sleeve if worn or damaged in any way. Replace the stop rings if the friction material is burned, flaking off, or worn. Check the condition of the synchro keys and springs. Replace these parts if worn, cracked, or distorted.

SYNCHRONIZER

CLEAN

Do not attempt to clean the blocking rings in solvent. The friction material will become contaminated. Place synchronizer components in a suitable holder and clean with solvent. Air dry.

INSPECT

Proper inspection of components involve:

- Teeth, for wear, scuffed, nicked, burred, or broken teeth
- Keys, for wear or distortion
- Balls and springs, for distortion, cracks, or wear

If any of these conditions exist in these components, replace as necessary.

ADJUSTMENTS

GEARSHIFT CROSSOVER CABLE ADJUSTMENT

(1) Remove shift console from vehicle.

(2) Loosen adjusting screw on crossover cable at shifter (Fig. 148) (Fig. 149).

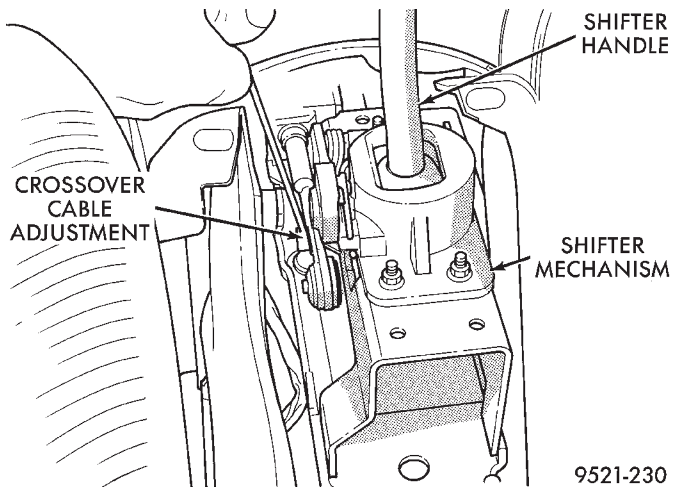


Fig. 148 Loosen Crossover Cable Adjustment Screw

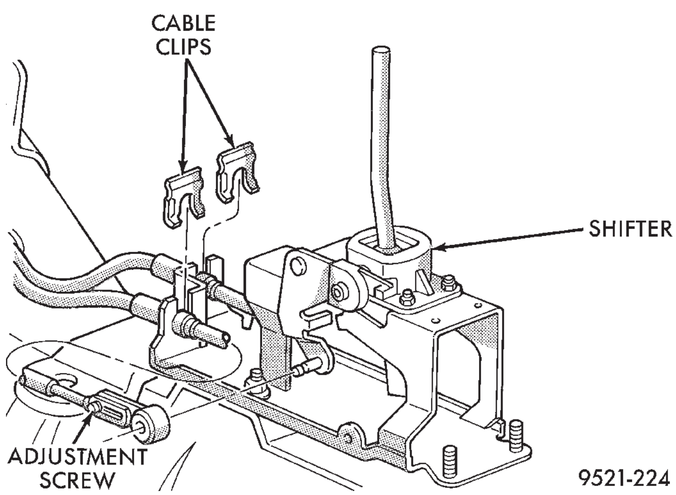


Fig. 149 Crossover Cable Adjustment Screw

(3) Pin transaxle crossover lever in 3-4 neutral position using a 1/4 inch drill bit. Align hole in crossover lever with the hole in the boss on the transaxle case (Fig. 150). Make sure drill bit goes into transaxle case at least one half inch.

(4) The shifter is spring loaded and self centering. Allow shifter to rest in its neutral position. Torque

ADJUSTMENTS (Continued)

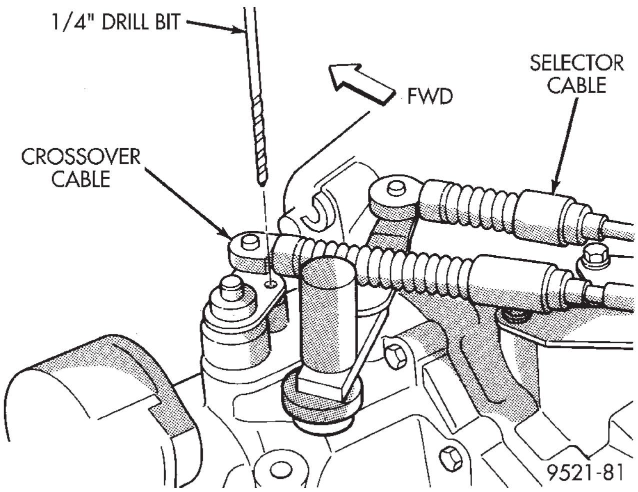


Fig. 150 Crossover Lever Pin Procedure

adjustment screw to 8 N·m (70 in. lbs.). Care must be taken to avoid moving the shift mechanism off-center during screw tightening.

(5) Remove drill bit from transaxle case and perform functional check by shifting transaxle into all gears.

(6) Reinstall console. Reinstall boot and knob.

BEARING ADJUSTMENT PROCEDURE

GENERAL RULES ON SERVICING BEARINGS

(1) Use extreme care when removing and installing bearing cups and cones. Use only an arbor press for installation, as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat will give a false end play reading while gauging for proper shims. Improperly seated bearing cups and cones are subject to low–mileage failure.

(2) Bearing cups and cones should be replaced if they show signs of pitting or heat distress. If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

(3) Bearing preload and drag torque specifications must be maintained to avoid premature bearing failures. Used (original) bearings may lose up to 50% of their original drag torque after break in. All bearing adjustments must be made with no other component interference or gear intermesh.

(4) Replace bearings as a pair: If one differential bearing is defective, replace both differential bearings, if one input shaft bearing is defective, replace both input shaft bearings.

(5) Bearing cones must not be reused if removed.

(6) Turning torque readings should be obtained while smoothly rotating in either direction.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

NOTE: True bearing turning torque readings can be obtained only with the geartrain removed from the case.

(1) Remove bearing cup and existing shim from clutch bellhousing case.

(2) Press in new bearing cup into bellhousing case (or use a cup that has been ground down on the outer edge for ease of measurement).

(3) Press in new bearing cup into gear case side.

(4) Oil differential bearings with Mopar® type M.S. 9417 Manual Transaxle Fluid. Install differential assembly in transaxle gear case. Install clutch bellhousing over gear case. Install and torque case bolts to 29 N·m (21 ft. lbs.).

(5) Position transaxle with bellhousing facing down on workbench with C-clamps. Position dial indicator.

(6) Apply a medium load to differential with Tool C-4995 and a T-handle, in the downward direction. Roll differential assembly back and forth a number of times. This will settle the bearings. Zero the dial indicator. To obtain end play readings, apply a medium load in an upward direction while rolling differential assembly back and forth (Fig. 151). Record end play.

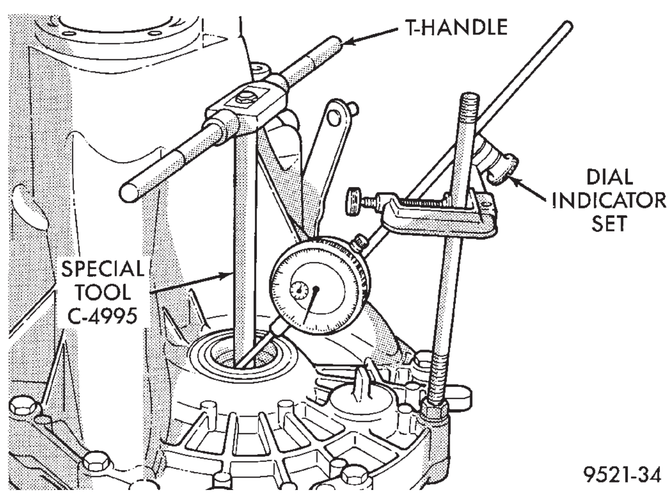


Fig. 151 Checking Differential Bearing End Play to Determine Shim Thickness

(7) The shim required for proper bearing preload is the **total of end play, plus (constant) preload of 0.18mm (0.007 in.).** Never combine shims to obtain the required preload.

(8) Remove case bolts. Remove clutch bellhousing differential bearing cup. Install shim(s) selected in Step 7. Then press the bearing cup into clutch bellhousing.

ADJUSTMENTS (Continued)

(9) Install clutch bellhousing. Install and torque case bolts to 26 N·m (19 ft. lbs.).

(10) Using Special Tool C-4995 and an inch-pound torque wrench, check turning torque of the differential assembly (Fig. 152). **The turning torque should be 6 to 12 in. lbs. If the turning torque is too high, install a 0.05mm (0.002 inch) thinner shim. If the turning torque is too low, install a 0.05mm (0.002 inch) thicker shim.**

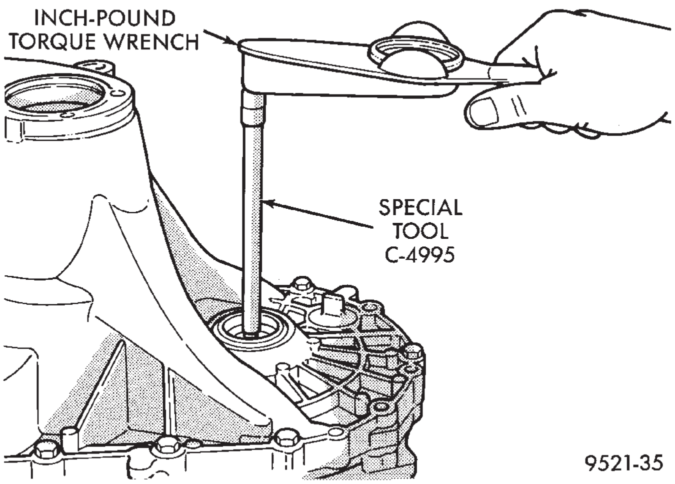


Fig. 152 Checking Differential Bearing Turning Torque

(11) Recheck turning torque. Repeat Step 10 until the proper turning torque is obtained.

SPECIFICATIONS

NV T350 (A-578)

DESCRIPTION	TORQUE
Back-up Lamp Switch	24 N·m (18 ft. lbs.)
Crossover Cable Adj. Screw	8 N·m (70 in. lbs.)
Drain Plug	30 N·m (267 in. lbs.)
Differential Ring Gear Bolts	81 N·m (60 ft. lbs.)
Dust Shield to Transaxle	12 N·m (105 in. lbs.)
End Plate Cover Bolts	29 N·m (21 ft. lbs.)
Front Engine Mount to Trans	108 N·m (80 ft. lbs.)
Front Mount Through Bolt	61 N·m (45 ft. lbs.)
Front Mount to Engine Bolt	54 N·m (40 ft. lbs.)
Lateral Bending Strut to Engine	54 N·m (40 ft. lbs.)
Lateral Bending Strut to Trans.	54 N·m (40 ft. lbs.)
Left Mount Through Bolt	108 N·m (80 ft. lbs.)
Left Mount to Transaxle	54 N·m (40 ft. lbs.)
Output Bearing Race Ret. Strap	11 N·m (96 in. lbs.)
Power Hop Damper Bkt. to Trans.	54 N·m (40 ft. lbs.)
Power Hop Damper to Frame Bkt.	54 N·m (40 ft. lbs.)
Power Hop Damper to Trans. Bkt.	54 N·m (40 ft. lbs.)
Reverse Fork Bracket	11 N·m (96 in. lbs.)
Reverse Idler Shaft Bolt	26 N·m (19 ft. lbs.)
Shift Cable Bracket to Transaxle	28 N·m (250 in. lbs.)
Transaxle Case Bolts	29 N·m (21 ft. lbs.)
Transaxle to Engine Bolt	95 N·m (70 ft. lbs.)
Trans. to Eng. Intake Bkt. Bolts	95 N·m (70 ft. lbs.)
Vehicle Speed Sensor	7 N·m (60 in. lbs.)
Vertical Bending Strut to Engine	108 N·m (80 ft. lbs.)
Vertical Bending Strut to Trans.	108 N·m (80 ft. lbs.)

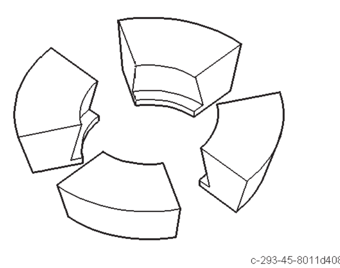
NOTE: Bolts that have thread sealer or torque lock patches should not be reused. Always install new bolts in these applications.

NV T350 (A-578) MANUAL TRANSAXLE FLUID FILL

TRANSAXLE	METRIC MEASURE	U.S. MEASURE
NV T350	1.9-2.2 Liters	2.0-2.3 Quarts

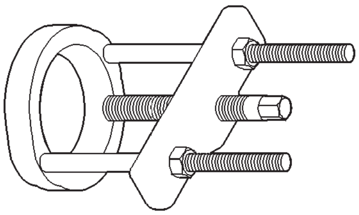
SPECIAL TOOLS

NV T350 (A-578) MANUAL TRANSAXLE

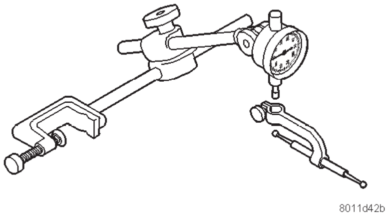


Adapter Blocks C-293–45

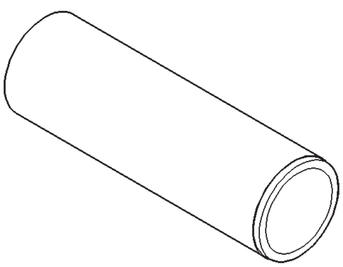
SPECIAL TOOLS (Continued)



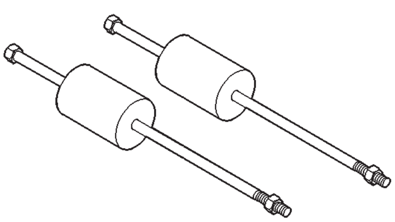
Puller Press C-293–PA



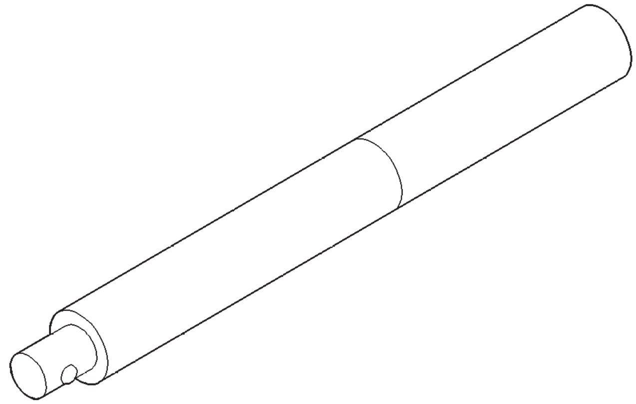
Dial Indicator C-3339



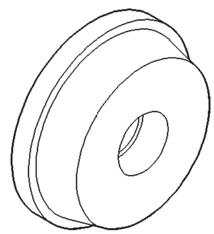
Sleeve C-3717



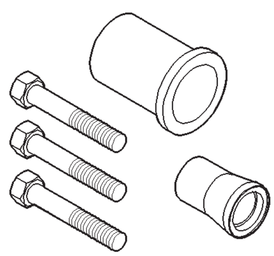
Slide Hammer C-3752



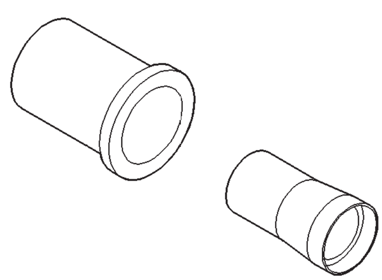
Universal Handle C-4171



Bearing Installer C-4628

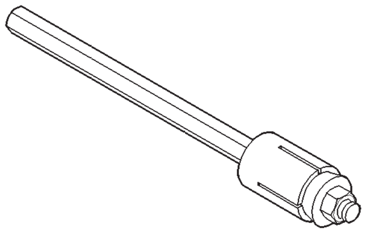


Seal Remover C-4680

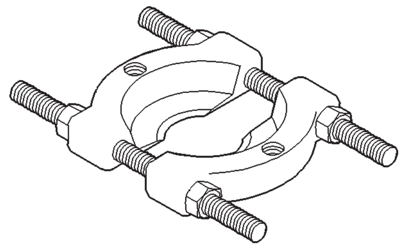


Seal Installer C-4992

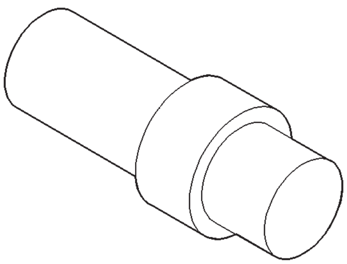
SPECIAL TOOLS (Continued)



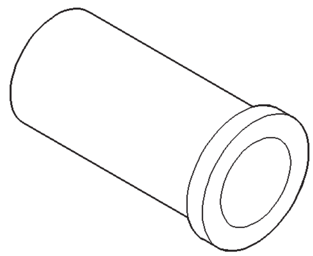
Torque Tool C-4995



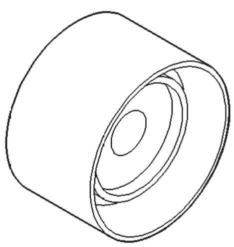
Bearing Splitter 1130



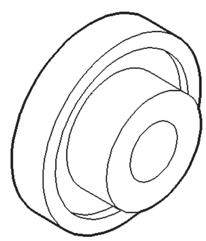
Adapter C-4996



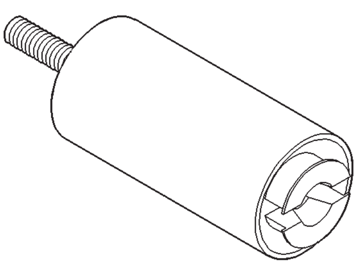
Driver 6342



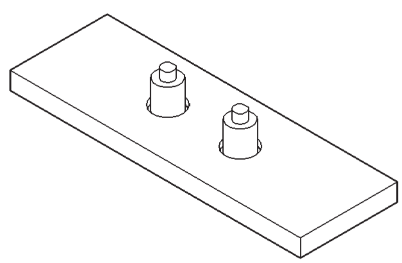
Installer L-4410



Seal Installer 6709

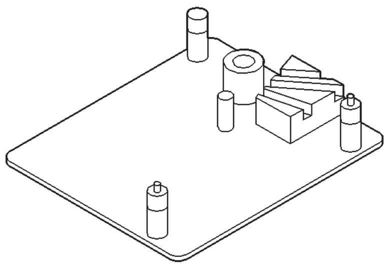


Special Jaw Set L-4518

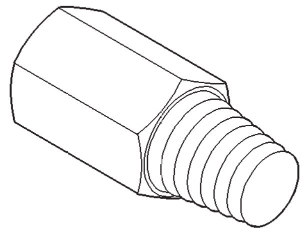


Bearing Remover 6768

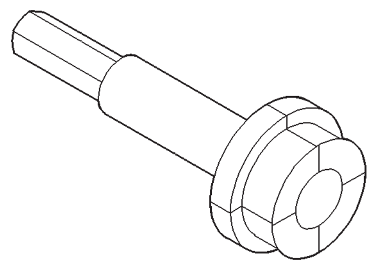
SPECIAL TOOLS (Continued)



Bench Fixture 6785



Remover 6786



Remover 6787

41TE TRANSAXLE

INDEX

GENERAL INFORMATION

41TE TRANSAXLE IDENTIFICATION

The 41TE transaxle identification code is a series of digits printed on a bar-code label that is fixed to the transaxle case as shown in (Fig. 1).

For example, the identification code K 821 1125 1316 can be broken down as follows:

- K = Kokomo Transmission Plant
- 821 = Last three digits of the transaxle part number
- 1125 = Build date
- 1316 = Build sequence number

GENERAL INFORMATION (Continued)

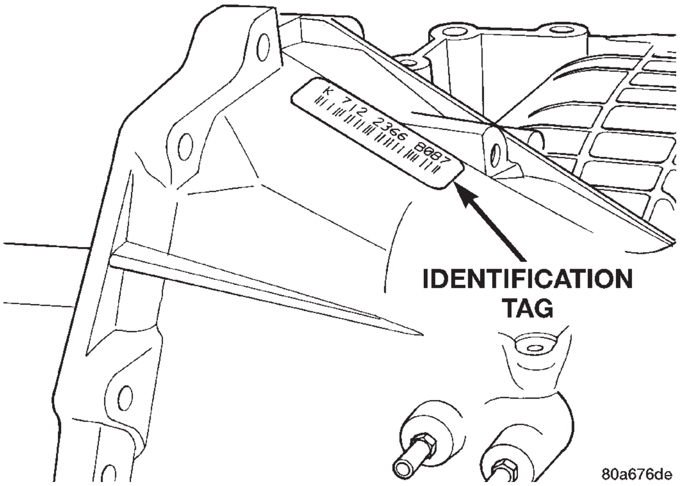


Fig. 1 Transaxle Identification Label

If the tag is not legible or missing, the "PK" number (stamped into the transaxle case) can be referred to for identification. This number differs slightly in that it contains the entire transaxle part number, rather than the last three digits.

IN-VEHICLE SERVICE

The following components are serviceable in the vehicle without transaxle removal:

- Valve Body Assembly
- Solenoid Pack
- Transmission Range Sensor (TRS)
- Input Speed Sensor
- Output Speed Sensor
- Transfer Gears

Refer to Removal and Installation in this group for applicable procedures.

FLUID REQUIREMENTS

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

NOTE: The transmission and differential sump have a common oil sump with an opening between the two.

TRANSMISSION/DIFFERENTIAL

Mopar® ATF+3 (Automatic Transmission Fluid-Type 7176) is required in this transaxle. Substitute fluids can induce torque converter clutch shudder.

FLUID ADDITIVES

Other than fluorescent leak detection dye, the use of any fluid additives (transmission or differential) is not recommended in this transaxle.

DESCRIPTION AND OPERATION

41TE TRANSAXLE

The 41TE is a four speed transaxle that is a conventional hydraulic/mechanical assembly with adaptive electronic controls and monitors. Adaptive electronic controls take transmission wear and driver habits into consideration to provide smooth shifting for the life of the transaxle. An input clutch assembly which houses the underdrive, overdrive, and reverse clutches is used. It also utilizes separate holding clutches: 2nd/4th gear and Low/Reverse. Transmission output is directed to an integral differential by a transfer gear system in the following input-to-output ratios:

First . . . . 2.84 : 1
Second . . . . 1.57 : 1
Third . . . . 1.00 : 1
Overdrive . . . . 0.69 : 1
Reverse . . . . 2.21 : 1

Final Drive Ration is dependent on which engine option is selected:

2.0L . . . . 4.08 FDR
2.4L . . . . 3.91 FDR
2.5L . . . . 3.91 FDR

HYDRAULICS

The hydraulic portion of the transaxle consists of the transaxle fluid, fluid passages, hydraulic valves, and various line pressure control components.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, and SECOND gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in "limp-in" mode) in the event of a failure of the electronic control system, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transaxle.

MECHANICAL

The primary mechanical components of the transaxle consist of the following:

- Three multiple disc input clutches
- Two multiple disc holding clutches
- Four hydraulic accumulators
- Two planetary gear sets
- Hydraulic oil pump
- Valve body
- Solenoid pack

ELECTRONICS

Control of the transaxle is accomplished by fully adaptive electronics. Optimum shift scheduling is accomplished through continuous real-time sensor

DESCRIPTION AND OPERATION (Continued)

feedback information provided to the Transmission Control Module (TCM).

The TCM is the “heart” or “brain” of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC’s, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRBIII scan tool.

TRANSMISSION CONTROL MODULE & SYSTEM OPERATION

DESCRIPTION

The Transmission Control Module (TCM) is located in the engine compartment on the left (driver’s) side next to the Power Distribution Center (PDC) (Fig. 2).

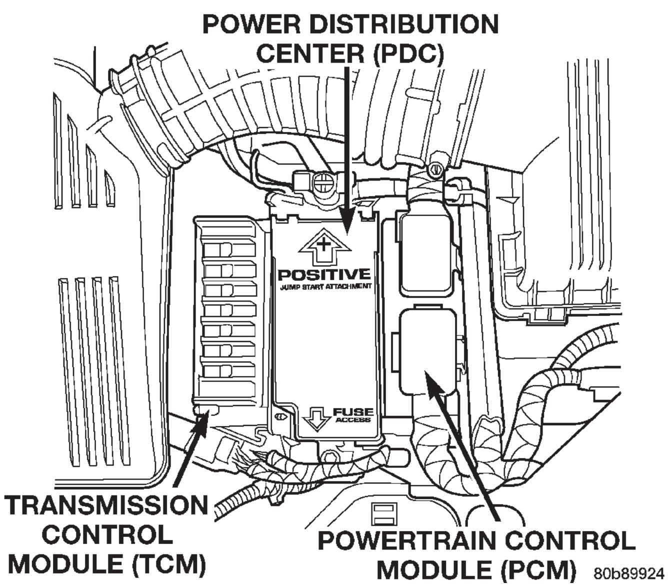


Fig. 2 Transmission Control Module Location (Typical)

OPERATION

The TCM is the controlling unit for all electronic operations of the transaxle. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transaxle. Direct inputs are hardwired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the PCI bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor (CKP)
- Transmission Range Sensor (TRS)
- Pressure Switches (L/R, 2/4, OD)
- Transmission Temperature Sensor (Integral to TRS)
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- TRS Hall Effect Switch (Autostick)

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Speed Control ON/OFF Switch
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Brake Switch Status
- DRB Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids (L/R, 2/4, OD and UD)
- Vehicle Speed (to PCM)
- Torque Reduction Request (to PCM)

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)
- Autostick Display (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with DRB III scan tool)

NOTE: If the TCM has been replaced, the “Quick Learn Procedure” must be performed. Refer to “Quick Learn Procedure” in Service Procedures of this group.

CLUTCH VOLUME INDEXES

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

DESCRIPTION AND OPERATION (Continued)

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transaxle gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur (Fig. 3).

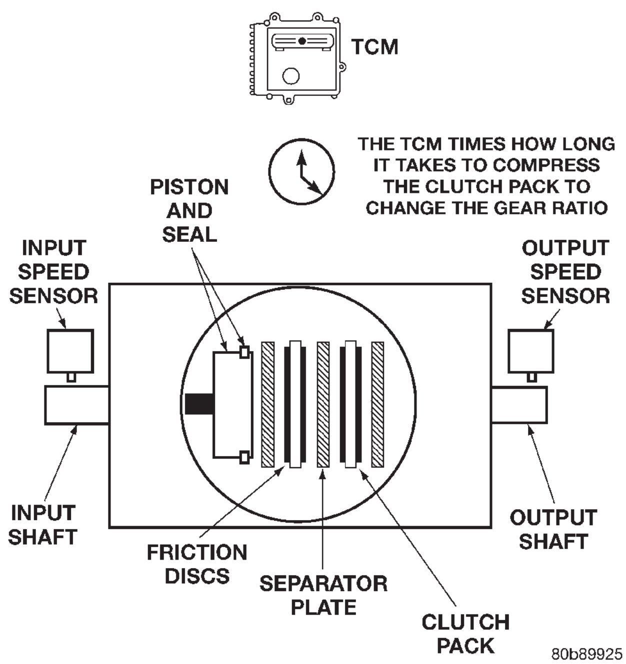


Fig. 3 Example of CVI Calculation

Gear ratios can be determined by using the DRB III Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly (broken return springs, out of position snap rings, excessive clutch pack clearance, improper assembly, etc.) can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

CLUTCH VOLUMES		
Clutch	**When Updated**	**Proper Clutch Volume**
L/R	2-1 or 3-1 coast downshift	35 to 83
2/4	1-2 shift	20 to 77
OD	2-3 shift	48 to 150
UD	4-3 or 4-2 shift	24 to 70

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

DESCRIPTION AND OPERATION (Continued)

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature at start-up below -16° F	Park, Reverse, Neutral and 2nd gear only (prevents shifting which may fail a clutch with frequent shifts)
Cold	Oil temperature at start-up above -12° F and below 36° F	– Delayed 2-3 upshift (approximately 22-31 mph) – Delayed 3-4 upshift (45-53 mph) – Early 4-3 costdown shift (approximately 30 mph) – Early 3-2 coastdown shift (approximately 17 mph) – High speed 4-2, 3-2, 2-1 kickdown shifts are prevented – No EMCC
Warm	Oil temperature at start-up above 36° F and below 80 degree F	– Normal operation (upshift, kickdowns, and coastdowns) – No EMCC
Hot	Oil temperature at start-up above 80° F	– Normal operation (upshift, kickdowns, and coastdowns) – Full EMCC, no PEMCC except to engage FEMCC (except at closed throttle at speeds above 70-83 mph)
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	– Delayed 2-3 upshift (25-32 mph) – Delayed 3-4 upshift (41-48 mph) – 3rd gear FEMCC from 30-48 mph – 3rd gear PEMCC from 27-31 mph
Super Overheat	Oil temperature above 260° F	– All ″Overheat″ shift schedule features apply – 2nd gear PEMCC above 22 mph – Above 22 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

DESCRIPTION AND OPERATION (Continued)

SOLENOID AND PRESSURE SWITCH ASSEMBLY

DESCRIPTION

The solenoid and pressure switch assembly is external to the transaxle and mounted to the valve body assembly. The assembly consists of four solenoids that control hydraulic pressure to four of the five friction elements (transaxle clutches), and the torque converter clutch. The solenoid assembly also contains pressure switches that feed information to the TCM.

OPERATION

The solenoids within the assembly are supplied voltage by the Transmission Control Relay. The solenoids are energized when the TCM grounds the return wire for the solenoid that is needed. The pressure switches simply tell the TCM whether or not pressure exists within a clutch circuit. Refer to “Pressure Switches” in this group for more information regarding pressure switches.

BATTERY FEED (TCM)

A fused, direct battery feed to the TCM is used for continuous power. The battery feed is spliced and also fed to the contact side of the Transmission Control Relay. This battery voltage is necessary to retain adaptive learn values in the TCM’s RAM (Random Access Memory). When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

TRANSMISSION CONTROL RELAY

The transmission control relay is located in the Power Distribution Center (PDC) on the left side of the engine compartment (Fig. 4). The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset (ignition key turned to the “run” position or after cranking engine), the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoidpack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

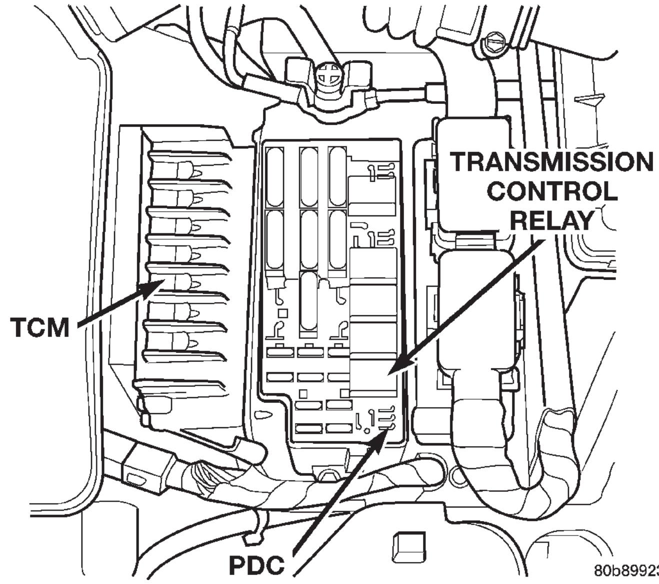


Fig. 4 Transmission Control Relay Location (Typical)

PRESSURE SWITCHES

The pressure switches are located inside the solenoid pack assembly and are only serviced by replacing the assembly.

The TCM relies on three pressure switches to monitor fluid pressure in the L/R, 2/4, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at 23 psi and open at 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

The TCM also tests the 2/4 and OD pressure switches when they are normally off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 2rd gear). The test simply verifies that they are operational, by looking for a closed state when the corresponding element is applied. Immediately after a shift into 1st, 2nd, or 3rd gear with the engine speed above 1000 rpm, the TCM momentarily turns on element pressure to the 2/4 and/or OD clutch circuits to identify that the appropriate switch has closed. If it doesn't close, it is tested again. If the switch fails to close the second time, the appropriate Diagnostic Trouble Code (DTC) will set.

INPUT/OUTPUT SPEED SENSOR

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are threaded into the transaxle case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier park pawl lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

THROTTLE POSITION SENSOR

The Transmission Control Module (TCM) receives the throttle position signal and its ground from the Throttle Position Sensor (TPS). The TPS has a 5 volt pull up supplied by the engine controller. The throttle signal is checked by the TCM for out-of-range as well as intermittence (excessive signal changes).

TRANSMISSION RANGE SENSOR

DESCRIPTION

The Transmission Range Sensor (TRS) is mounted to the top of the valve body inside the transaxle and can only be serviced by removing the valve body. The electrical connector extends through the transaxle case.

The Transmission Range Sensor (TRS) has four switch contacts that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply ground to the Backup Lamp Relay in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transaxle temperature to the TCM and PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transaxle gear position and shift schedule.

Since there are four switches, there are 16 possible combinations of open and closed switches (codes). Seven of these codes are related to gear position and three are recognized as “between gear” codes. This results in six codes which should **never occur** . These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

The TRS has an integrated thermistor that the TCM uses to monitor the transmission's sump temperature. This temperature is used to determine which shift schedule the TCM is to use. If the thermistor circuit fails, the TCM will revert to calculated oil temperature usage.

TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS). It can only be serviced by TRS replacement.

OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in.

The PCM also monitors this temperature data so it can energize the vehicle cooling fan(s) when a transmission “overheat” condition exists.

Calculated Temperature

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a pre-

DESCRIPTION AND OPERATION (Continued)

dicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

SOLENOIDS

DESCRIPTION

Solenoids are used to control the L/R, 2/4, OD, and UD friction elements. The reverse clutch is controlled by line pressure from the manual valve in the valve body. The solenoids are contained within the Solenoid and Pressure Switch Assembly, and cannot be serviced individually. They can only be serviced by replacing the assembly.

OPERATION

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid needed. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The 2/4 and UD solenoids are normally vented to allow transaxle limp-in (P,R,N,2) in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. It no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

VEHICLE SPEED SIGNAL

The vehicle speed signal is taken from the Output Speed Sensor. The TCM converts this signal into a pulse per mile signal and sends it to the PCM. The Pcm, in turn, sends the vehicle speed message across the PCI Bus to the BCM. The BCM sends this signal to the Instrument Cluster to display vehicle speed to the driver. The vehicle speed signal pulse is roughly 8000 pulses per mile.

SHIFT POSITION INDICATOR

DESCRIPTION

The shift position indicator is located in the instrument cluster. It indicates the position of the manual valve lever by illuminating an LED located under the P, R, N, D, 3, or L gear symbol.

OPERATION

The Transmission Range Sensor (TRS) sends a signal to the Transmission Control Module (TCM) regarding the position of the manual valve lever. The TCM converts this signal into a Shift Lever Position (SLP) and sends the information to the BCM (Body Control Module) and the instrument cluster.

To replace the shift position indicator, refer to Group 8E, Instrument Panel And Gauges.

SOLENOID SWITCH VALVE

DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the valve body controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

ELECTRONICALLY MODULATED CONVERTER CLUTCH

Torque converter clutch (TCC) operation is controlled by the TCM through the solenoid and pressure switch assembly and valve body. When the transaxle is in 2nd, 3rd, or 4th gear, the TCC can be energized when certain conditions are met.

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

DESCRIPTION AND OPERATION (Continued)

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with fine control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transaxle or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for an actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transaxle input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

SHIFTER/IGNITION INTERLOCK

The ignition interlock system connects the automatic transmission shifter and the ignition lock system. With the ignition key in the LOCK or ACCESSORY position, the interlock system prevents the transmission from being shifted out of park. When the key is in the OFF or RUN position the shifter unlocks and can be moved to any gear position. The system also prevents the operator from turning the ignition key to the LOCK or ACCESSORY positions.

NOTE: If the vehicle has column shift, install a new interlock cassette (column shift) when replacing the ignition lock cylinder. Adjust the system after replacing the cassette. Refer to procedure in this group.

NOTE: If the vehicle has floor shift, adjust the interlock cable after replacing the lock cylinder.

AUTOSTICK

OPERATION

Autostick is a driver–interactive transaxle feature that offers manual gear shifting capability. When the shifter is moved into the Autostick position, the transaxle remains in whatever gear it was using before Autostick was activated. Moving the shifter to the left (towards the driver) causes a downshift and moving to the right (towards the passenger) causes an upshift. The instrument cluster will illuminate the selected gear. The vehicle can be launched in 1st, 2nd, or 3rd gear while in the Autostick mode. The speed control is operable in 3rd and 4th gear Autostick mode. Speed control will be deactivated if the transaxle is shifted to 2nd gear. Shifting into OD position cancels the Autostick mode, and the transaxle resumes the OD shift schedule.

AUTOMATIC OVERRIDES

For safety, durability, and driveability, some shifts are executed automatically or prevented.

AUTOMATIC SHIFTS WILL OCCUR UNDER THE FOLLOWING CONDITIONS

TYPE OF SHIFT	APPROXIMATE SPEED
4-3 coast downshift	13 mph
3-2 coast downshift	9 mph
2-1 coast downshift	5 mph
1-2 upshift	6300 engine rpm
2-3 upshift	6300 engine rpm
4-3 kickdown shift	13-47 mph w/sufficient throttle

DESCRIPTION AND OPERATION (Continued)

MANUAL SHIFTS ARE NOT PERMITTED UNDER THE FOLLOWING CONDITIONS

TYPE OF SHIFT	APPROXIMATE SHIFT POINT
3-4 upshift	Below 15 mph
3-2 downshift	Above 74 mph @ closed throttle or 70 mph otherwise
2-1 downshift	Above 41 mph @ closed throttle or 38 mph otherwise

DIAGNOSIS AND TESTING

41TE TRANSAXLE GENERAL DIAGNOSIS

CAUTION: Before attempting any repair on a 41TE four speed automatic transaxle, check for Diagnostic Trouble Codes with the DRBIII scan tool. Always use the Powertrain Diagnostic Test Procedure Manual.

Transaxle malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

ROAD TEST

Prior to performing a road test, verify that the fluid level, fluid condition, and linkage adjustment have been approved.

During the road test, the transaxle should be operated in each position to check for slipping and any variation in shifting.

If the vehicle operates properly at highway speeds, but has poor acceleration, the converter stator overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed to maintain highway speeds, the converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter and thorough transaxle cleaning.

An engine miss could be attributed to a cracked drive plate. A cracked drive plate could cause the camshaft position sensor and crankshaft position sensor signals to be out of synchronization. This could cause a no-start condition.

A slipping clutch may set a DTC and can be determined by operating the transaxle in all selector positions. Then comparing which internal units are applied in those positions. The Elements in Use Chart provides a basis for road test analysis.

The process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. Road test analysis can diagnose slipping units, but the cause of the malfunction cannot be determined. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most hydraulic transaxle problems.

Before performing pressure tests, be certain that fluid level and condition, and shift cable adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows front wheels to turn, and position tachometer so it can be read.

Attach 150 psi gauges to ports required for test being conducted. A 300 psi gauge (C-3293) is required for reverse pressure test.

Test port locations are shown in (Fig. 6).

TEST ONE-SELECTOR IN LOW 1st GEAR

(1) Attach pressure gauge to the low/reverse clutch tap.

(2) Move selector lever to the (L) position.

(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed to 20 mph.

(4) Low/reverse clutch pressure should read 115 to 145 psi.

(5) This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.

DIAGNOSIS AND TESTING (Continued)

Shift Lever Position	Start Safety	Park Sprag	CLUTCHES				
			Underdrive	Overdrive	Reverse	2/4	Low/ Reverse
P — PARK	X	X					X
R — REVERSE					X		X
N — NEUTRAL	X						X
OD — OVERDRIVE First			X				X
Second			X			X	
Direct			X	X			
Overdrive				X		X	
D — DRIVE* First			X				X
Second			X			X	
Direct			X	X			
L — LOW* First			X				X
Second			X			X	
Direct			X	X			

*Vehicle upshift and downshift speeds are increased when in these selector positions.

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Fig. 5 ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER

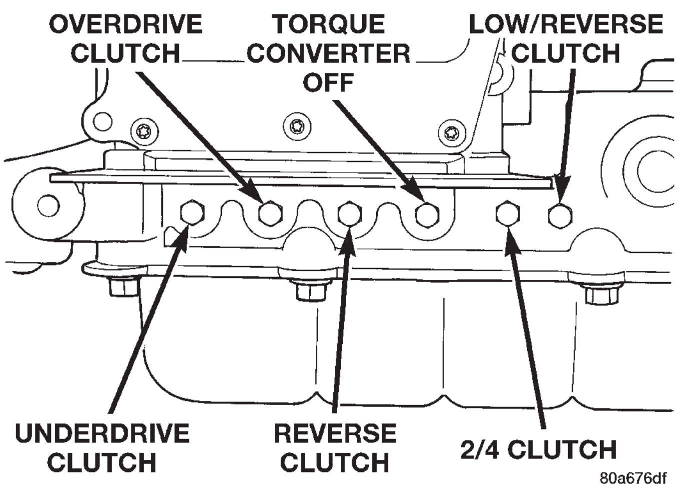

Fig. 6 Pressure Taps

TEST TWO-SELECTOR IN DRIVE 2nd GEAR

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

(1) Attach gauge to the underdrive clutch tap.
(2) Move selector lever to the 3 position.
(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.
(4) In second gear the underdrive clutch pressure should read 110 to 145 psi.

TEST 2A–SELECTOR IN OD

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

(1) Attach gauge to the UD clutch tap.
(2) Move selector lever to the OD position.
(3) Allow wheels to rotate freely and increase throttle opening to achieve an indicated speed of 40 mph.
(4) Underdrive clutch pressure should read below 5 psi. If not, than either the solenoid assembly or TCM is at fault.

TEST THREE-OVERDRIVE CLUTCH CHECK

(1) Attach gauge to the overdrive clutch tap.
(2) Move selector lever to the (Circle D) position.
(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 20 mph.
(4) Overdrive clutch pressure should read 74 to 95 psi.
(5) Move selector lever to the (3) position and increase indicated vehicle speed to 30 mph.
(6) The vehicle should be in second gear and overdrive clutch pressure should be less than 5 psi.
(7) This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.

DIAGNOSIS AND TESTING (Continued)

TEST FOUR-SELECTOR IN CIRCLE DRIVE, OVERDRIVE GEAR

(1) Attach gauge to the 2/4 clutch tap.

(2) Move selector lever to the (Circle D) position.

(3) Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.

(4) The 2/4 clutch pressure should read 75 to 95 psi.

(5) This test checks the 2/4 clutch hydraulic circuit.

TEST FIVE-SELECTOR IN CIRCLE DRIVE, OVERDRIVE

(1) Attach gauge to the torque converter clutch off pressure tap.

(2) Move selector lever to the (Circle D) position.

(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph.

CAUTION: Both wheels must turn at the same speed.

(4) Torque converter clutch off pressure should be less than 5 psi.

(5) This test checks the torque converter clutch hydraulic circuit.

TEST SIX-SELECTOR IN REVERSE

(1) Attach gauge to the reverse and LR clutch tap.

(2) Move selector lever to the reverse position.

(3) Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.

(4) Reverse and LR clutch pressure should read 165 to 235 psi.

(5) This test checks the reverse clutch hydraulic circuit.

TEST RESULT INDICATIONS

(1) If proper line pressure is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

(3) Clutch circuit leaks are indicated if pressures do not fall within the specified pressure range.

(4) If the overdrive clutch pressure is greater than 5 psi in Step 4 of Test Three, a worn reaction shaft seal ring or a defective solenoid assembly is indicated.

(5) If the underdrive clutch pressure is greater than 5 psi in Step 4 of Test 2A, a defective solenoid assembly or TCM is the cause.

ALL PRESSURE SPECIFICATIONS ARE PSI

(on hoist, with front wheels free to turn)

Gear Selector Position	Actual Gear	PRESSURE TAPS: Under-Drive Clutch	Over-Drive Clutch	Reverse Clutch	Torque Converter Clutch Off	2/4 Clutch	Low/Reverse Clutch
PARK * 0 mph	PARK	0-2	0-5	0-2	60-110	0-2	115-145
REVERSE * 0 mph	REVERSE	0-2	0-7	165-235	50-100	0-2	165-235
NEUTRAL * 0 mph	NEUTRAL	0-2	0-5	0-2	60-110	0-2	115-145
L # 20 mph	FIRST	110-145	0-5	0-2	60-110	0-2	115-145
3 # 30 mph	SECOND	110-145	0-5	0-2	60-110	115-145	0-2
3 # 45 mph	DIRECT	75-95	75-95	0-2	60-90	0-2	0-2
OD # 30 mph	OVERDRIVE	0-2	75-95	0-2	60-90	75-95	0-2
OD # 50 mph	OVERDRIVE WITH TCC	0-2	75-95	0-2	0-5	75-95	0-2

***Engine speed at 1500 rpm**
#CAUTION: Both front wheels must be turning at same speed.

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PRESSURE CHECK SPECIFICATIONS

CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure (Fig. 7) (Fig. 8). The clutches may be tested by applying air pressure to their respective passages. The valve body must be removed and Tool 6056 installed. To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

Remove oil pan and valve body. See Valve body removal.

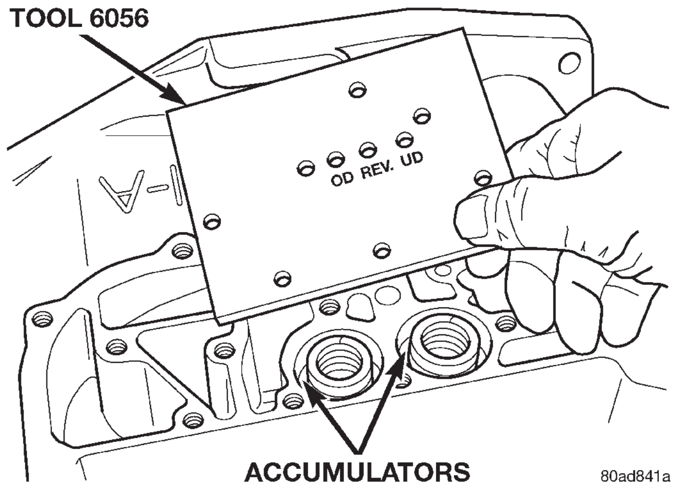


Fig. 7 Air Pressure Test Plate

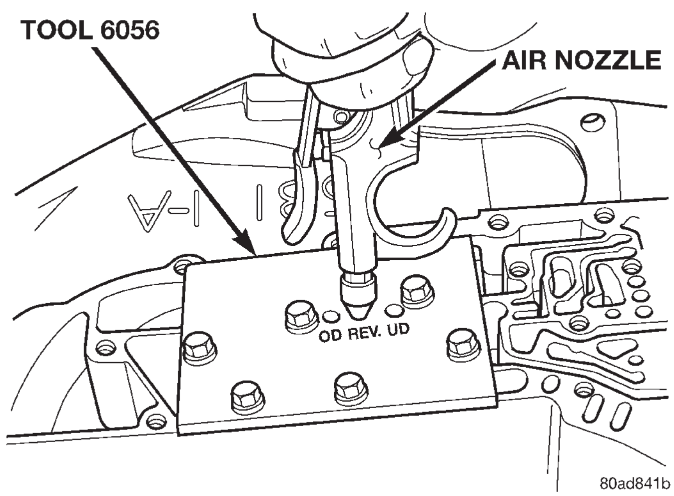


Fig. 8 Testing Reverse Clutch

OVERDRIVE CLUTCH

Apply air pressure to the overdrive clutch apply passage and watch for the push/pull piston to move forward. The piston should return to its starting position when the air pressure is removed.

REVERSE CLUTCH

Apply air pressure to the reverse clutch apply passage and watch for the push/pull piston to move rearward. The piston should return to its starting position when the air pressure is removed.

2/4 CLUTCH

Apply air pressure to the feed hole located on the 2/4 clutch retainer. Look in the area where the 2/4 piston contacts the first separator plate and watch carefully for the 2/4 piston to move rearward. The piston should return to its original position after the air pressure is removed.

LOW/REVERSE CLUTCH

Apply air pressure to the low/reverse clutch feed hole (rear of case, between 2 bolt holes). Then, look in the area where the low/reverse piston contacts the first separator plate. Watch carefully for the piston to move forward. The piston should return to its original position after the air pressure is removed.

UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Air pressure is applied to the low/reverse and the 2/4 clutches. This locks the output shaft. Use a piece of rubber hose wrapped around the input shaft and a pair of clamp-on pliers to turn the input shaft. Next apply air pressure to the underdrive clutch. The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.

FLUID LEAKAGE-TORQUE CONVERTER HOUSING AREA

(1) Check for source of leakage.

(2) Fluid leakage at or around the torque converter area may originate from an engine oil leak. The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.

(3) Prior to removing the transaxle, perform the following checks:

(4) When leakage is determined to originate from the transaxle, check fluid level prior to removal of the transaxle and torque converter.

(5) High oil level can result in oil leakage out the vent in the manual shaft. If the fluid level is high, adjust to proper level.

(6) After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle. This will determine if the torque converter or transaxle is leaking.

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

DIAGNOSIS AND TESTING (Continued)

- Torque converter weld leaks at the outside (peripheral) weld.
- Torque converter hub weld.

NOTE: Hub weld is inside and not visible. Do not attempt to repair. Replace torque converter.

INTERLOCK SYSTEM OPERATION CHECK

If the interlock system operates in any way other than as described below, repair of the system is required.

(1) Place shifter in gated PARK and place ignition key in the LOCK or ACCESSORY position. The shifter SHOULD NOT be able to move out of gated park.

(2) Rotate the ignition key to OFF or RUN/ON. The shifter SHOULD BE able to move into ANY gear position.

(3) Place shifter in the DRIVE position. The ignition key SHOULD NOT be able to rotate into the LOCK or ACCESSORY position.

SHIFT POSITION INDICATOR

The transmission range sensor (on the valve body) sends a signal to the TCM on the position of the transaxle manual valve lever. The TCM receives the switch signal and processes the data. The TCM sends the Shift Lever Position (SLP) information to the BCM via the CCD bus. The BCM then outlines the appropriate shifter position indicator in the instrument cluster.

If a problem arises with the shifter position indicator, consult the following chart for diagnostic information. If the malfunction cannot be corrected using the chart, consult the proper diagnostic manual.

To replace the shifter position indicator, refer to Group 8E, Instrument Panel And Gauges.

AUTOSTICK

The autostick feature will be deactivated if one of the following conditions occur:

- DTC P0705–Check Shifter Signal–usually accompanied by all PRNDL lights turning on in Park and Neutral. This will result in a DTC P0705 if three such errors are detected after any one “key–on”.
- DTC P1796–Autostick Input Circuit
- DTC P1797–Manual Shift Overheat–(Transmission oil temperature 275° F) or (Engine coolant temperature 255° F).

Acceptable powertrain temperature must be achieved to reactivate Autostick after a high temperature fault:

- Transmission Oil Temperature <255° F
- Engine Coolant Temperature <240° F

CONDITION	POSSIBLE CAUSE
ALL PRND3L DISPLAY LIGHTS ″ON″ IN P&N GEAR POSITIONS	Check wiring and connectors
	Faulty trans. range sensor
	Faulty manual lever
ALL DISPLAY LIGHTS ″ON″ IN ALL GEAR POSITIONS	Check wiring & connectors
	Faulty trans. range sensor
	Faulty manual lever
	CCD communication malfunction
ALL DISPLAY LIGHTS ″OFF″	Normal transient condition between P&R and R&N gear positions
	Check shift lever linkage
	Body controller malfunction
	Check wiring and connectors
	Faulty cluster
ALL DISPLAY LIGHTS ″OFF″ ACCOMPANIED BY A ″NO BUS″ MESSAGE	CCD communication malfunction
DISPLAY LIGHTS OUT OF SEQUENCE WITH SHIFT LEVER	Check wiring and connectors
	Faulty trans. range sensor
	Faulty manual lever
	CCD communication malfunction

SERVICE PROCEDURES

FLUID LEVEL AND CONDITION CHECK

NOTE: The transmission and differential utilize the same fluid sump, which require Automatic Transmission Fluid (ATF+3/Type 7176).

NOTE: The transmission fluid level should be inspected at least every six months.

SERVICE PROCEDURES (Continued)

FLUID LEVEL CHECK

The transmission sump has a dipstick to check oil similar to most automatic transmissions. It is located on the left side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the P Park and N Neutral positions. Place the selector lever in P Park to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator (Fig. 9). The fluid level will be approximately one-quarter inch above the lower hole of the dipstick at 70° F fluid temperature.

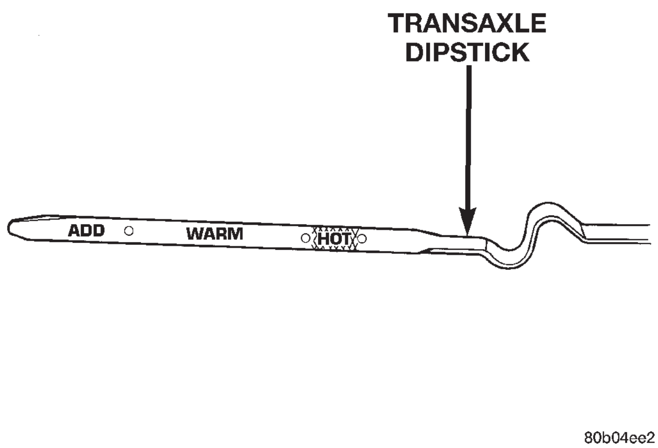


Fig. 9 Dipstick Markings

FLUID LEVEL CHECK USING DRB

NOTE: Engine and Transaxle should be at normal operating temperature before performing this procedure.

(1) Start engine and apply parking brake.

(2) Hook up DRBIII scan tool and select transmission.

(3) Select sensors.

(4) Read the transmission temperature value.

(5) Compare the fluid temperature value with the chart.

(6) Adjust transmission fluid level shown on the dipstick according to the chart.

(7) Check transmission for leaks.

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transaxle has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transaxle recondition is needed. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

FLUID AND FILTER SERVICE—TRANSMISSION

NOTE: Refer to Group 0, Lubrication and Maintenance, or the vehicle owner's manual, for the recommended maintenance (fluid/filter change) intervals for this transaxle.

NOTE: Only fluids of the type labeled Mopar® ATF+3 (Automatic Transmission Fluid) Type 7176 should be used. A filter change should be made at the time of the transmission oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.

NOTE: If the transaxle is disassembled for any reason, the fluid and filter should be changed.

FLUID/FILTER SERVICE (RECOMMENDED)

(1) Raise vehicle on a hoist (See Lubrication, Group 0). Place a drain container with a large opening, under transaxle oil pan.

(2) Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.

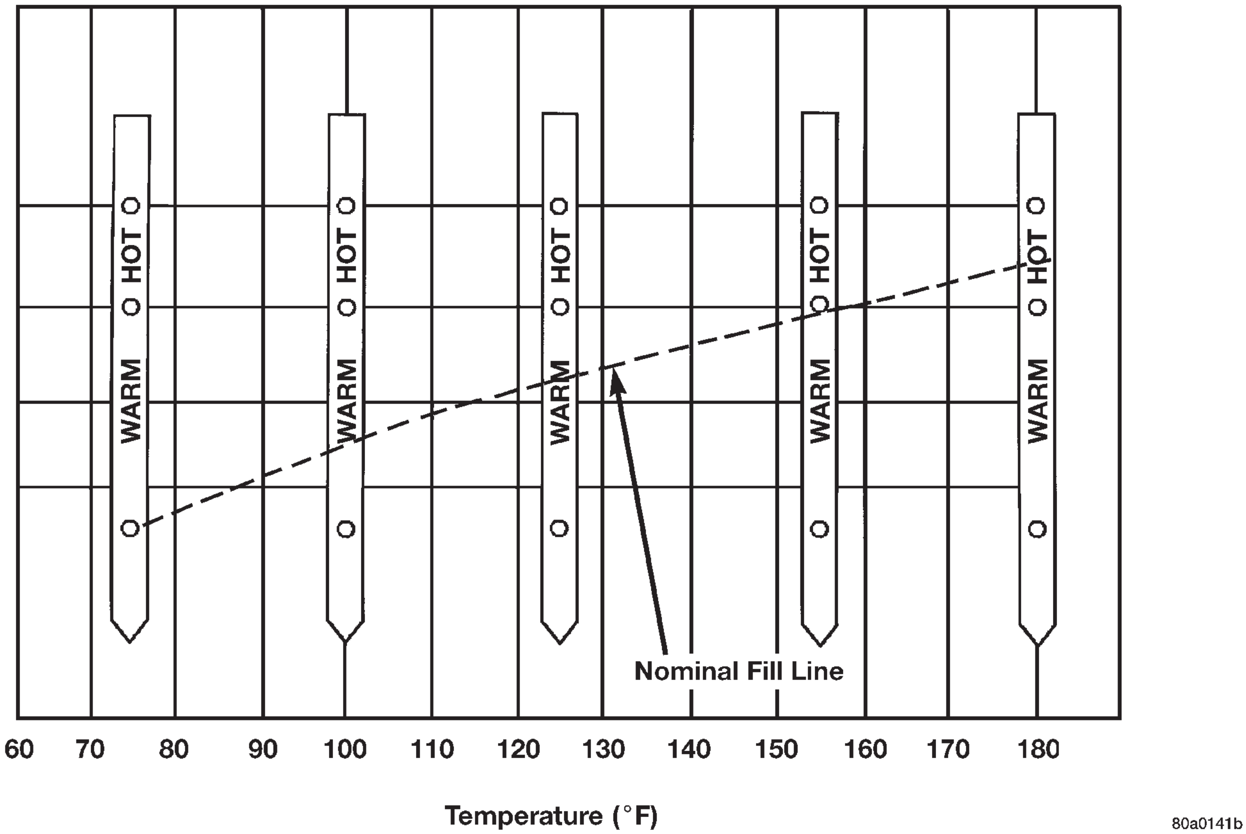
(3) Install a new filter and o-ring on bottom of the valve body and tighten retaining screws to 5 N·m (40 in. lbs.).

(4) Clean the oil pan and magnet. Reinstall pan using new Mopar Silicone Adhesive sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).

(5) Pour four quarts of Mopar® ATF+3 (Automatic Transmission Fluid) Type 7176 through the dipstick opening.

(6) Start engine and allow to idle for at least one minute. Then, with parking and service brakes

SERVICE PROCEDURES (Continued)



Transmission Fluid Temperature Chart

applied, move selector lever momentarily to each position, ending in the park or neutral position.

(7) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the "ADD" mark on the dipstick (Fig. 10).

(8) Recheck the fluid level after the transaxle has reached normal operating temperature (180°F.).

(9) To prevent dirt from entering transaxle, make certain that dipstick is fully seated into the dipstick opening.

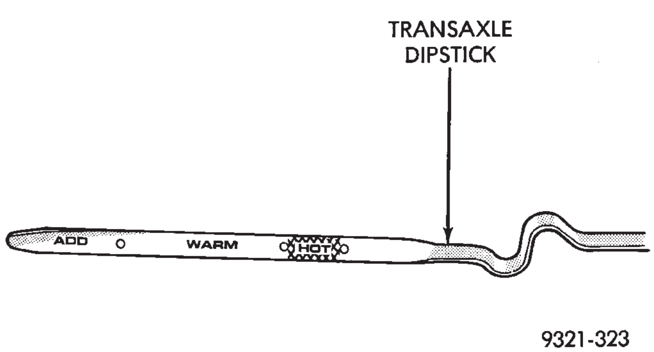


Fig. 10 Dipstick Markings

ALTERNATIVE SERVICE METHODS (FLUID ONLY)

TRANSAXLE FLUID EXCHANGER METHOD

CAUTION: The use of any fluid exchanger that introduces additives into the transaxle is not recommended.

(1) To perform the transaxle fluid exchange, the transaxle must be at operating temperature. Drive the vehicle until it reaches full operating temperature.

(2) Obtain a suitable transaxle fluid exchanger and verify the tank is clean and dry.

(3) Fill the tank to the recommended fill capacity with Mopar® ATF+3 Type 7176.

(4) Connect the machine to the vehicle following the manufacturers instructions. Perform the exchange procedure following the instructions provided with the machine.

(5) Once machine has completed the fluid exchange. Check the fluid level and condition and fill to proper level with Mopar® ATF+3 Type 7176. Refer to Fluid Level and Condition Check in this group for the proper fluid "top-off" procedure.

SERVICE PROCEDURES (Continued)

NOTE: Verify that the transaxle cooler lines are tightened to proper specifications. Cooler line torque specification is 2 N•m (18 in. lbs.).

DIPSTICK TUBE FLUID SUCTION METHOD

(1) When performing the fluid suction method, make sure the transaxle is at full operating temperature.

(2) To perform the dipstick tube fluid suction method, use a suitable fluid suction device (Vacula™ or equivalent).

(3) Insert the fluid suction line into the dipstick tube.

NOTE: Verify that the suction line is inserted to the lowest point of the transaxle oil pan. This will ensure complete evacuation of the fluid in the pan.

(4) Follow the manufacturers recommended procedure and evacuate the fluid from the transaxle.

(5) Remove the suction line from the dipstick tube.

(6) Pour four quarts of Mopar® ATF+3 (Automatic Transmission Fluid) Type 7176 through the dipstick opening.

(7) Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.

(8) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the “ADD” mark on the dipstick (Fig. 10).

(9) Recheck the fluid level after the transaxle has reached normal operating temperature (180°F.).

(10) To prevent dirt from entering transaxle, make certain that dipstick is fully seated into the dipstick opening.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transaxle case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

FLUSHING COOLERS AND TUBES

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed. The cooler bypass valve in the transaxle must be replaced also. The torque converter must also be replaced with an exchange unit. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transaxle.

The recommended procedure for flushing the transaxle cooler is to use Tool 6906A Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906A

(1) Remove cover plate filler plug on Tool 6906A. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906A.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line.

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

SERVICE PROCEDURES (Continued)

(11) Place CLEAR suction line into a one quart container of Mopar® ATF PLUS 3 Type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

OIL PUMP VOLUME CHECK

After the new or repaired transmission has been installed, fill to the proper level with Mopar ATF PLUS 3 (Type 7176) automatic transmission fluid. The volume should be checked using the following procedure:

(1) Disconnect the **From cooler** line at the transmission and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed** , with the shift selector in neutral.

(3) If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF, disconnect the **To Cooler** line at the transaxle.

(4) Refill the transaxle to proper level and recheck pump volume.

(5) If flow is found to be within acceptable limits, replace the cooler. Then fill transmission to the proper level, using Mopar ATF PLUS 3 (Type 7176) automatic transmission fluid.

(6) If fluid flow is still found to be inadequate, check the line pressure using the Transaxle Hydraulic Pressure Test procedure.

(7) Check the cooler for debris on the external surfaces. Clean as necessary.

TRANSAXLE QUICK LEARN PROCEDURE

The quick learn procedure requires the use of the DRBIII scan tool.

This program allows the electronic transaxle system to recalibrate itself. This will provide the best possible transaxle operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transaxle Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRBIII indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

(1) Plug the DRBIII scan tool into the data link connector. The connector is located under the instrument panel.

(2) Go to the Transmission screen.

(3) Go to the Miscellaneous screen.

(4) Select Quick Learn Procedure. Follow the instructions of the DRBIII to perform the Quick Learn Procedure.

PINION FACTOR PROCEDURE

The vehicle speed readings for the speedometer are taken from the output speed sensor. The TCM must be calibrated to the different combinations of equipment available. A procedure has been developed called Pinion Factor. It allows the technician to set the Transmission Control Module initial setting so that the speedometer readings will be correct.

Failure to perform this procedure will cause a No Speedometer Operation condition.

This procedure must be performed if the Transmission Control Module has been replaced.

To properly read or reset the Pinion Factor, it is necessary to use a DRBIII scan tool. Perform the following steps with the DRBIII scan tool to read or reset the Pinion Factor:

(1) Plug the DRBIII scan tool into the data link connector located under the instrument panel.

(2) Select the Transmission menu.

(3) Select the Miscellaneous menu.

(4) Select Pinion Factor. Then follow the instructions on the DRBIII scan tool screen.

REMOVAL AND INSTALLATION

GEARSHIFT CABLE

REMOVAL

(1) Place transaxle in PARK.

(2) Disconnect battery negative cable at left strut tower.

(3) Remove air cleaner assembly.

(4) Remove battery positive cable.

(5) Remove Transmission Control Module (TCM) connector. Remove TCM.

REMOVAL AND INSTALLATION (Continued)

(6) Pull Power Distribution Center (PDC) up and out of the way.

(7) Using a pry tool, pry up on cable at manual valve lever and remove cable from lever (Fig. 11).

(8) Remove the screw from the cable bracket at the transaxle (Fig. 11).

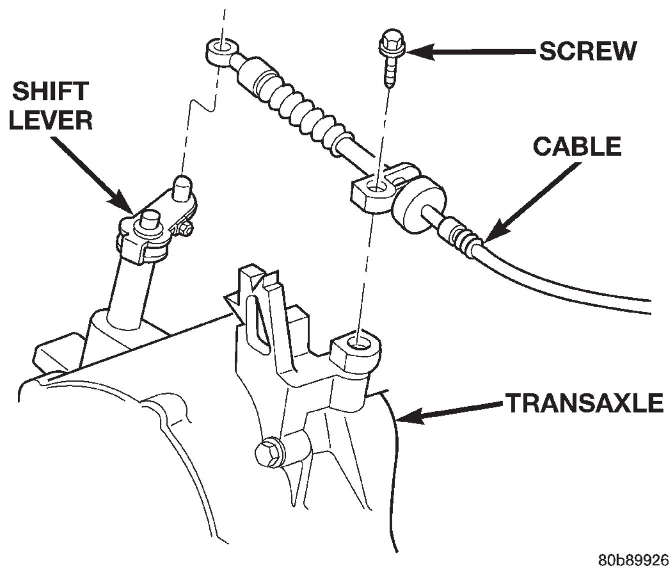


Fig. 11 Gearshift Cable at Transaxle

(9) Remove the gearshift knob set screw and knob.

(10) Remove the rear half of the floor console. Refer to Group 23, Body.

(11) Remove the front half of the floor console. Refer to Group 23, Body.

(12) Loosen nut on shift cable adjust lever (Fig. 12).

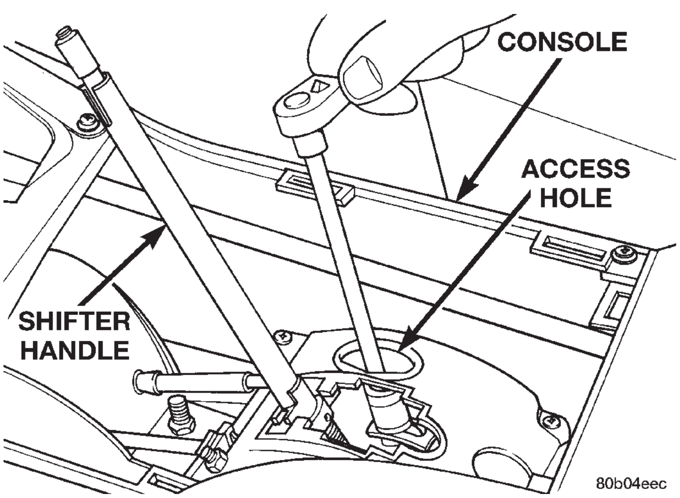


Fig. 12 Shift Cable Adjust Lever Nut

(13) Using a flat blade pry tool, remove the shifter cable core end from the shift lever pin (Fig. 13).

(14) Using a flat blade pry tool, pry the cable conduit clip up from the shifter bracket. Pull up on the cable conduit and remove from bracket (Fig. 13).

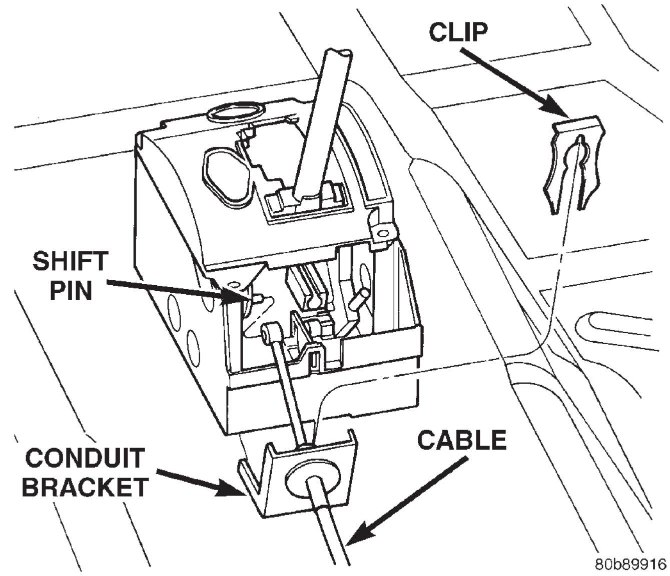


Fig. 13 Gearshift Cable at Floor Shifter

(15) Hoist vehicle. Refer to Group 0, Lubrication and Maintenance.

(16) Remove the cable grommet from the floor pan area (Fig. 14).

(17) Carefully remove the cable from the underbody by unfolding the cable retainer clip (Fig. 14) as you go along.

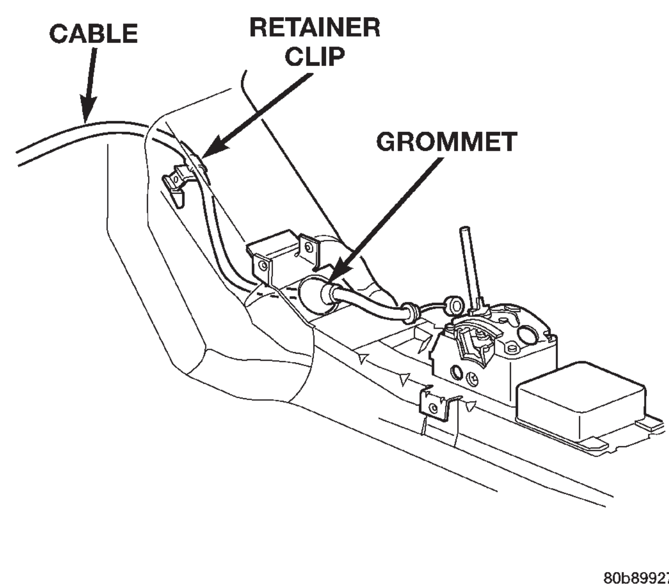


Fig. 14 Gearshift Cable Routing

INSTALLATION

(1) Install cable assy. into floor pan tunnel hole and secure grommet. If necessary, use a synthetic based lubricant to aid in grommet installation.

(2) Position cable into retainer clip (Fig. 14) and tighten clip to secure cable.

(3) Install cable to transaxle and tighten screw to 14 N·m (125 in. lbs.) (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

(4) Install cable to transaxle shift lever (Fig. 11).
(5) Lower vehicle.
(6) Connect cable to shifter conduit bracket and shift pin. Install cable retaining clip (Fig. 13).
(7) Verify transaxle shift lever and floor shifter lever are in the PARK position.
(8) Tighten cable adjuster nut (Fig. 12).
(9) Reinstall front and rear floor consoles.
(10) Install gearshift handle.

GEARSHIFT MECHANISM

REMOVAL

(1) Disconnect battery and isolate cable.
(2) Remove the gearshift knob set screw and knob.
(3) Remove console assembly. Refer to Group 23, Body.
(4) Using a flat blade pry tool, remove the shifter cable end from the gearshift pin (Fig. 15).
(5) Pry the cable retaining clip up and off of the gearshift mechanism. Remove the gearshift cable from the gearshift mechanism (Fig. 15).

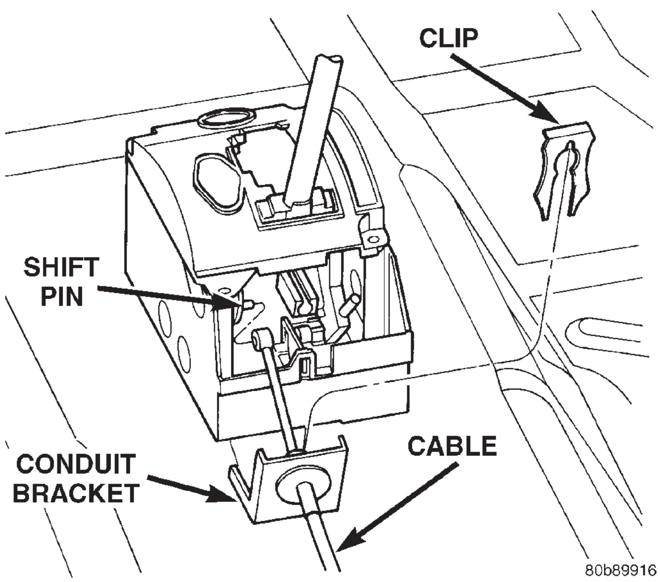


Fig. 15 Gearshift Cable at Floor Shifter Assembly

(6) Pry up the adjuster lock on the shifter/ignition interlock cable (Fig. 16). Unsnap the shifter/ignition interlock cable end fitting from the groove in the gearshift mechanism.
(7) Remove the nuts at the base of the gearshift mechanism (Fig. 17). Remove the shifter assy. and cable bracket.

INSTALLATION

(1) Install shifter assy and bracket (Fig. 17). Tighten the nuts to 17 N·m (150 in. lbs.).
(2) Install gearshift cable into conduit bracket and onto shift pin. Install retainer clip (Fig. 15).

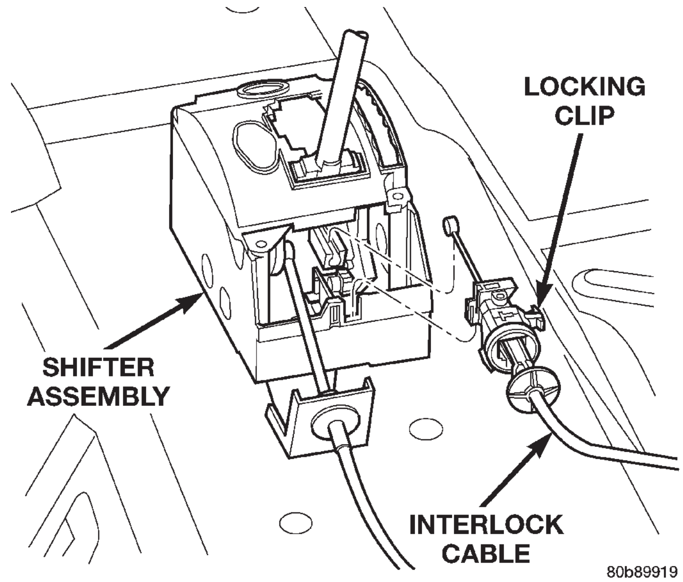


Fig. 16 Interlock Cable at Floor Shifter Assembly

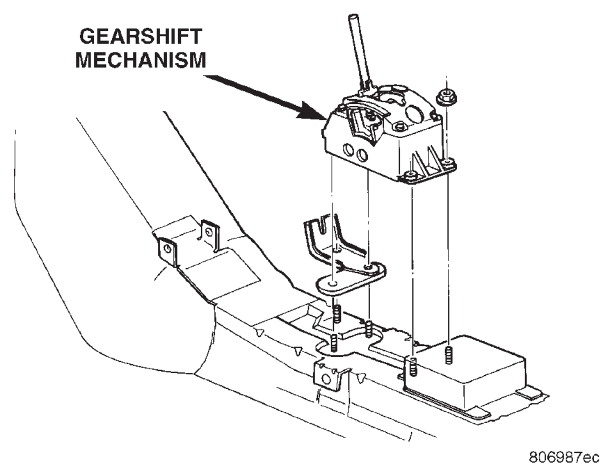


Fig. 17 Gearshift Mechanism

(3) Slip interlock cable core wire into interlock adjustment lever groove. Make sure the interlock cable slug is seated in the groove (Fig. 16).
(4) Slip interlock cable conduit end fitting into base and snap into place (Fig. 16).
(5) Adjust the gearshift and interlock cables. Refer to Adjustments in this group.

NOTE: Gearshift and Interlock cables MUST be adjusted. Refer to the Adjustments section in this group for the correct procedures.

(6) If equipped with Autostick, connect the Autostick connector.
(7) Install the console assembly. Refer to Group 23, Body for the correct procedures.
(8) Install the gearshift knob and tighten the set screw.
(9) Connect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

AUTOSTICK

The autostick switch mechanism is incorporated into the gearshift mechanism. If the switch needs to be replaced, the gearshift mechanism must be replaced. To replace the autostick switch, refer to Gearshift Mechanism Replacement in this section.

SHIFTER IGNITION INTERLOCK CABLE

REMOVAL

(1) Disconnect and isolate, the battery negative (-) cable at the left side strut tower.

(2) Remove the gearshift knob set screw and knob.

(3) Remove console assembly. Refer to Group 23, Body.

(4) Remove the interlock cable from the shifter housing. Slide the cable out of the groove in the interlock lever (Fig. 18).

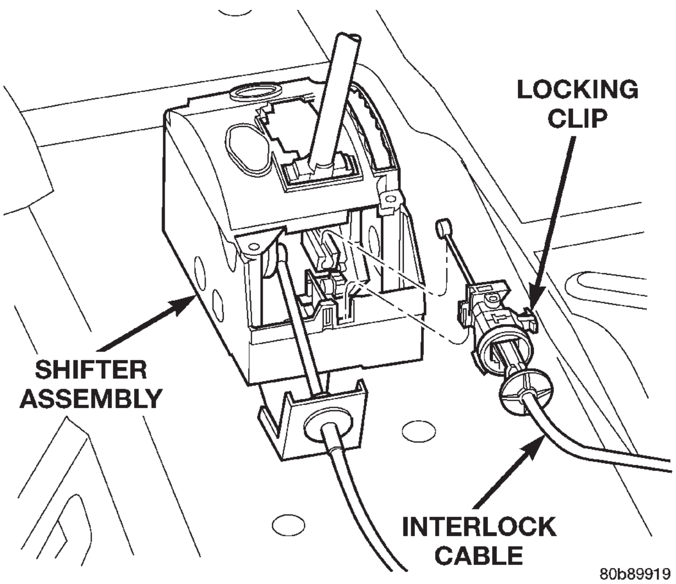


Fig. 18 Shifter/Ignition Interlock Cable

(5) Pull cable up and out of the gearshift mechanism.

(6) Remove fuse panel cover from left end of instrument panel. Remove screw holding end of instrument panel top cover (Fig. 19).

(7) Pull center bezel off (Fig. 20).

(8) Remove screws holding instrument panel top cover to center of instrument panel (Fig. 21).

(9) Pull instrument panel top cover up enough to gain access to knee bolster screws (Fig. 22).

(10) Remove lower knee bolster screws and knee bolster.

(11) Remove screws from lower steering column shroud (Fig. 23).

(12) Pull lower shroud to clear ignition cylinder (Fig. 24).

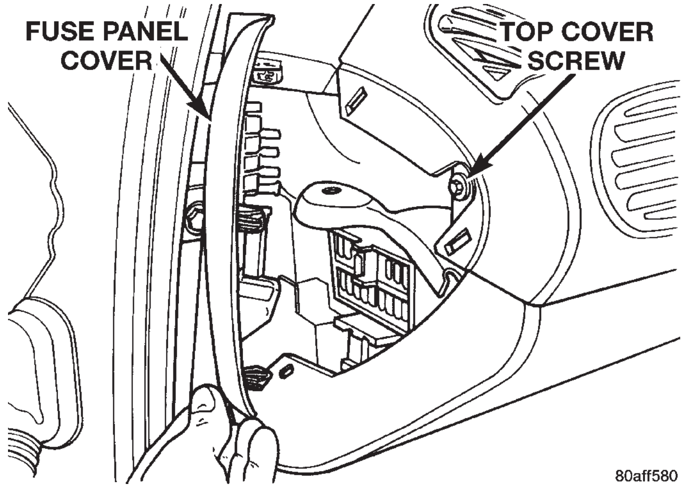


Fig. 19 Instrument Panel Top Cover–Left Side

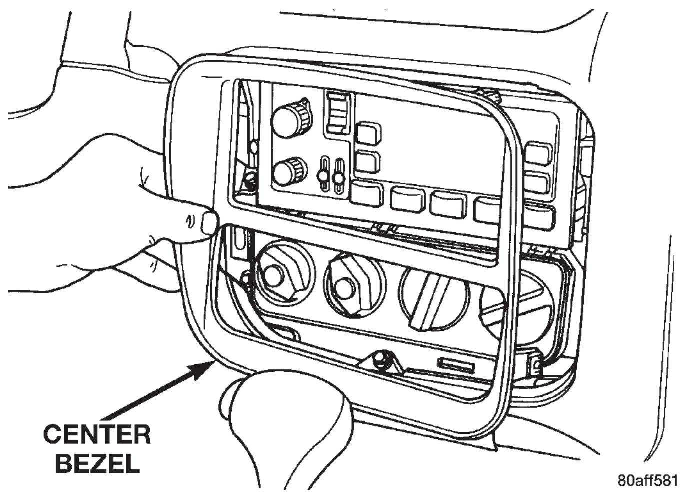


Fig. 20 Center Bezel

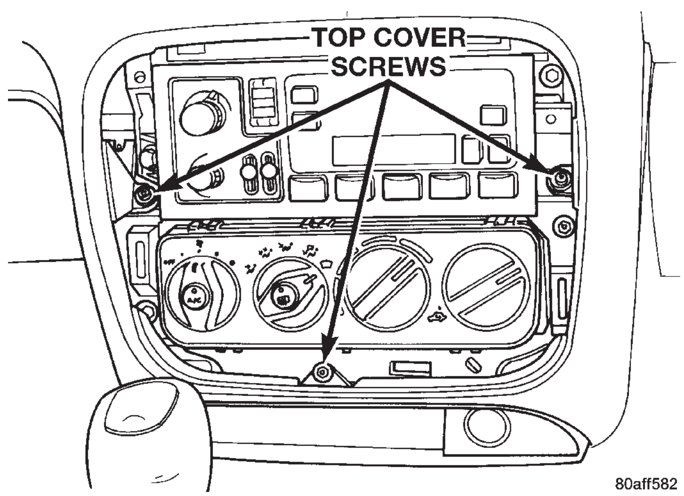


Fig. 21 Instrument Panel Top Cover–Center

(13) Hold tilt wheel lever down and slide lower shroud forward to remove it from column (Fig. 25).

(14) Tilt wheel to full down position and remove upper steering column shroud.

REMOVAL AND INSTALLATION (Continued)

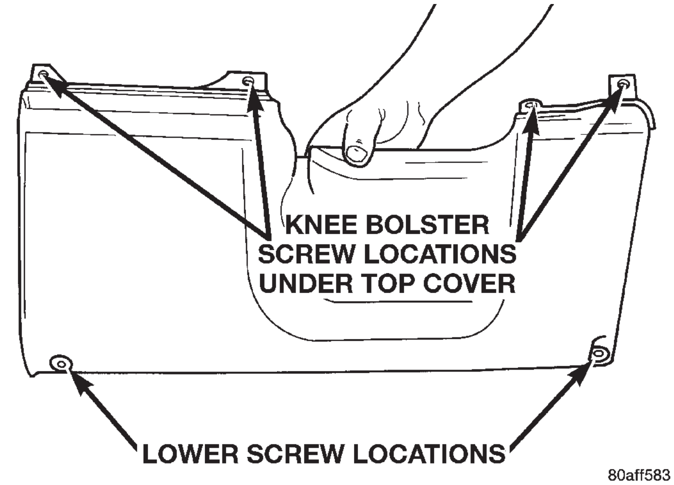


Fig. 22 Knee Bolster Attaching Points

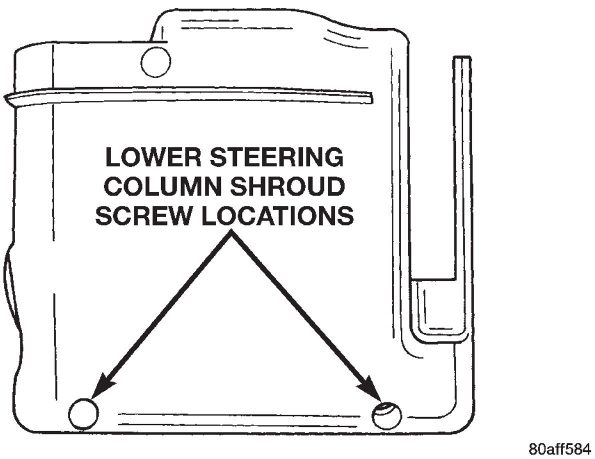


Fig. 23 Lower Steering Column Shroud Screw Locations

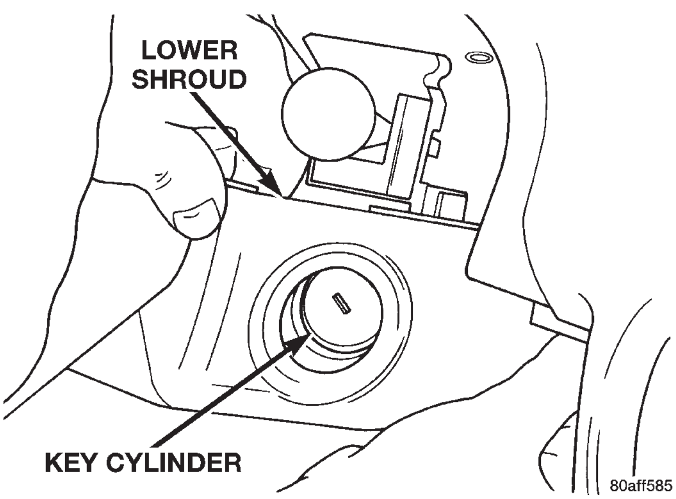


Fig. 24 Remove Lower Shroud From Ignition Cylinder

(15) Place the ignition key in the ON/RUN position (Fig. 26). Grasp the interlock cable clip and connector. Remove the cable from the interlock housing (Fig. 27).

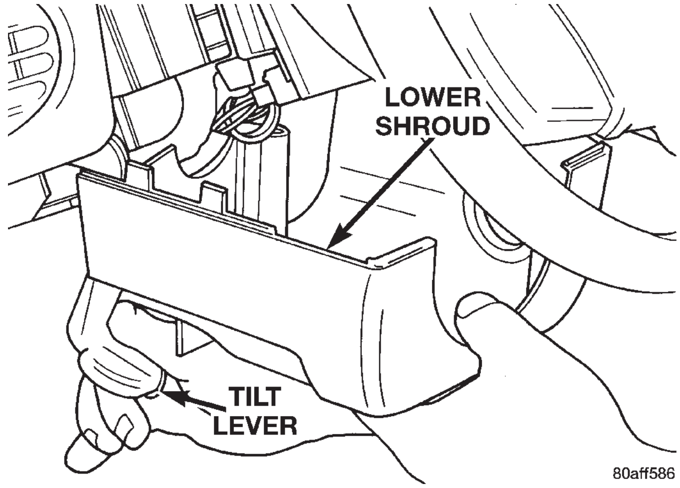


Fig. 25 Lower Shroud Removal

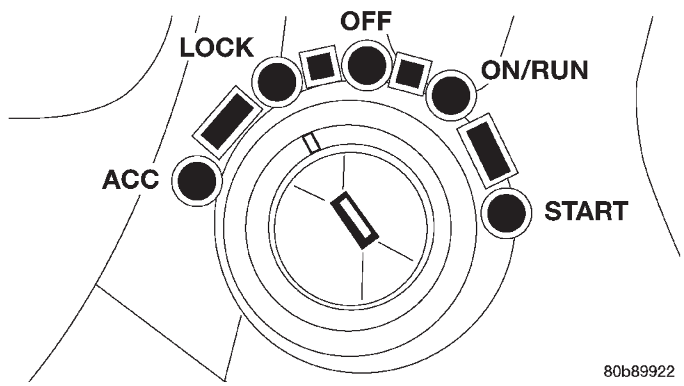


Fig. 26 Ignition Key/Switch Positions

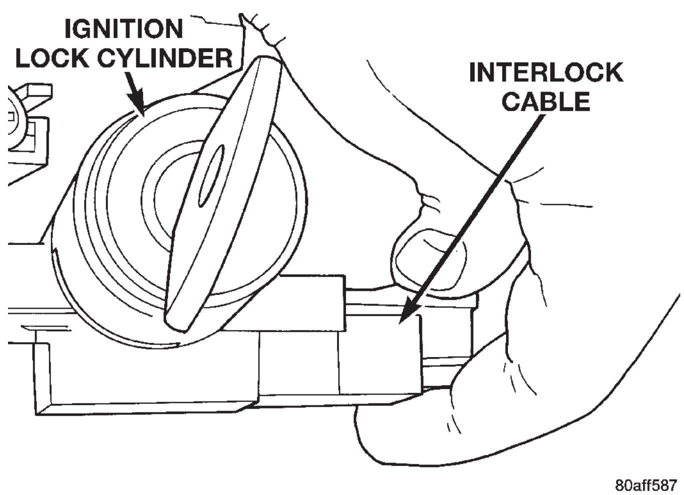


Fig. 27 Interlock Cable and Connector

(16) Unclip the cable retaining clip located along the cable housing.

(17) Remove interlock cable from underside of instrument panel.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: When installing interlock cable assembly, care must be taken not to bend exposed cable wire and slug at shifter end of cable.

(1) Route interlock cable into lower dash panel.

(2) Turn the ignition switch to the ON/RUN position (Fig. 26).

(3) Install the interlock cable into the interlock housing at the steering column (Fig. 28). Verify the cable snaps into the housing.

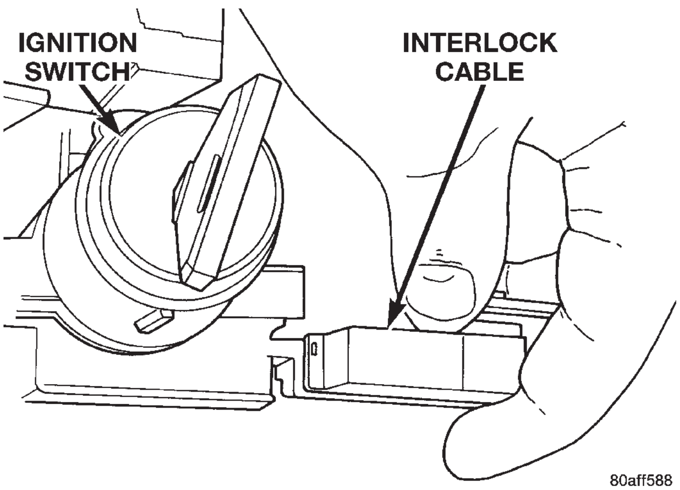


Fig. 28 Interlock Cable At Housing

(4) Install interlock cable into routing clip located along cable housing.

(5) Route interlock cable to the console.

(6) Snap the shifter/ignition interlock cable end fitting into the groove in the gearshift mechanism (Fig. 18).

(7) Adjust the Shifter/Ignition Interlock System. See Interlock System Adjustment, in this section of service manual.

NOTE: The Interlock Cable MUST be adjusted. Refer to Interlock System Adjustment, in this group.

(8) Install console assembly. Refer to Group 23, Body.

(9) Install the gearshift knob set screw and knob.

(10) Tilt wheel to full down position and install upper steering column shroud.

(11) Hold tilt wheel lever down and slide lower shroud in at column.

(12) Install screws at lower steering column shroud.

(13) Install lower knee bolster screws and knee bolster.

(14) Install screws holding instrument panel top cover to center of instrument panel.

(15) Install center bezel.

(16) Install screw holding end of instrument panel top cover. Install fuse panel cover from left end of instrument panel.

(17) Reconnect the battery negative (-) cable to the vehicle battery.

INTERLOCK MECHANISM

REMOVAL

(1) Remove the lower column covers, knee bolster and shrouds. Refer to Interlock Cable Replacement.

(2) Grasp the interlock cable and connector firmly. Remove the interlock cable.

(3) Remove the two interlock mechanism to steering column attaching screws (Fig. 29). Remove the interlock housing.

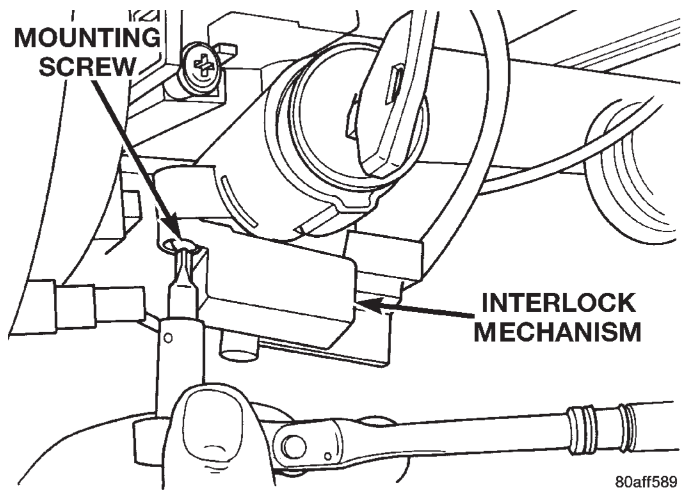


Fig. 29 Interlock Mechanism

INSTALLATION

(1) Position the interlock housing at steering column. Install the two interlock mechanism to steering column attaching screws. Torque screws to 3 N·m (21 in. lbs.).

(2) Snap the interlock cable into the housing.

(3) Install the lower column covers, shrouds and knee bolster. Refer to Interlock Cable Replacement.

MANUAL VALVE LEVER (SHIFT LEVER)

REMOVAL

(1) Remove shift cable from lever.

(2) Loosen the lever mounting bolt. Do not remove bolt (not necessary).

(3) Pull up on lever and remove.

INSTALLATION

(1) For installation, reverse removal procedure.

REMOVAL AND INSTALLATION (Continued)

SOLENOID ASSEMBLY-REPLACE

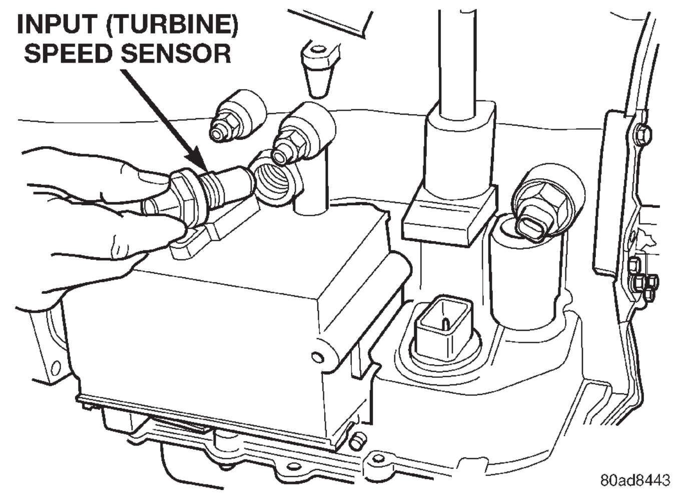


Fig. 30 Remove Input Speed Sensor

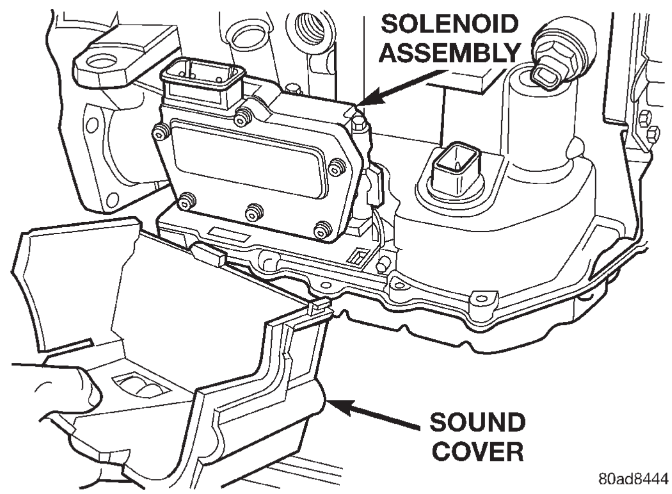


Fig. 31 Remove Sound Cover

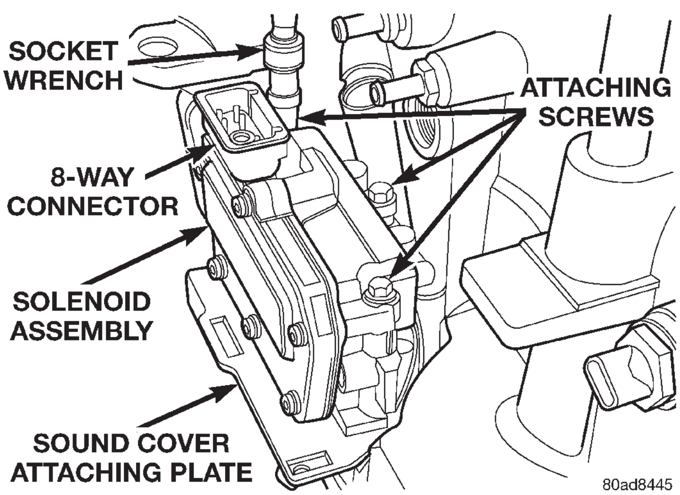


Fig. 32 Remove Attaching Screws

To install solenoid assembly, reverse removal procedure. Tighten screws to 12 N·m (105 in. lbs.).

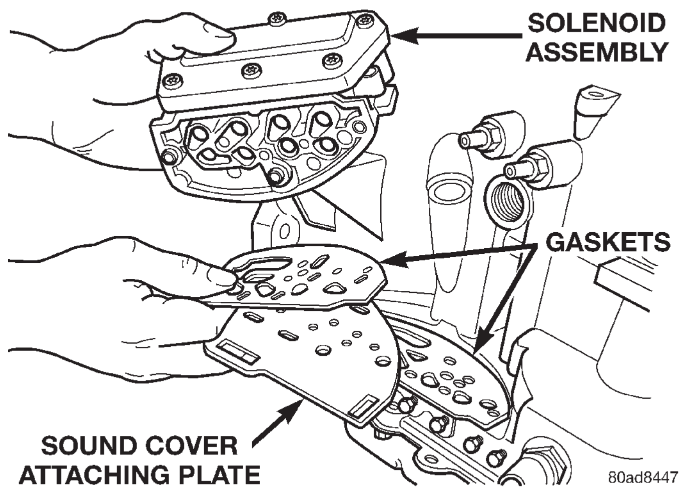


Fig. 33 Remove Solenoid Assembly

TRANSMISSION RANGE SENSOR

The transmission range sensor is located within the transaxle. To remove the TRS the transaxle oil pan and valve body must be removed.

REMOVAL

(1) Disconnect battery negative cable.
(2) Remove engine air cleaner and tube.
(3) Remove gearshift cable.
(4) Remove manual valve lever.
(5) Disconnect transmission range sensor connector.
(6) Hoist vehicle.
(7) Carefully remove transaxle oil pan and drain fluid.
(8) Remove transaxle oil filter. Let transaxle oil drain fully.
(9) Remove valve body retaining bolts.
(10) Extract park rod from guide bracket and remove valve body from transaxle.
(11) Place valve body on workbench (Fig. 34).
(12) Remove TRS retaining screw (Fig. 35).
(13) Remove manual shaft seal (Fig. 36).
(14) Slide Transmission Range Sensor up the manual shaft and remove (Fig. 37).

INSTALLATION

(1) For installation, reverse removal procedure. Tighten TRS retaining screw to 5 N·m (45 in. lbs.) Reseal transaxle oil pan using RTV.

SPEED SENSOR-INPUT

CAUTION: When disconnecting speed sensor connector, be sure that the weather seal does not fall off or remain in old sensor.

The input speed sensor is located to the left of the manual shift lever (Fig. 38).

REMOVAL AND INSTALLATION (Continued)

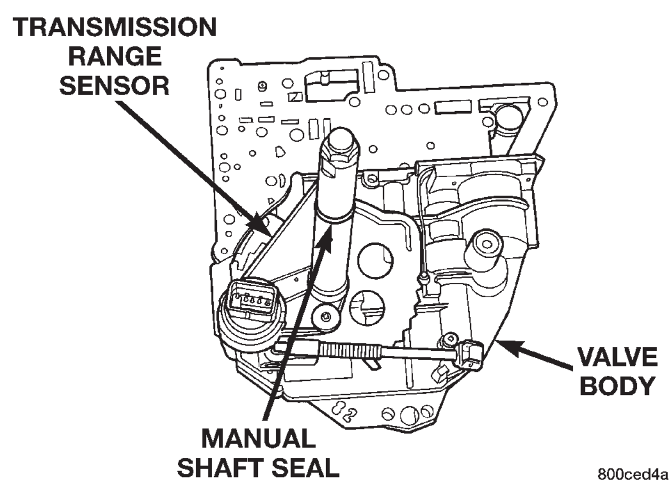


Fig. 34 Valve Body W/TRS

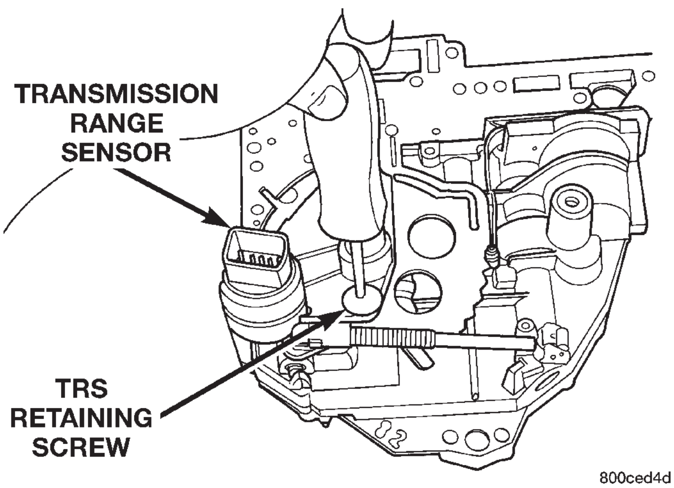


Fig. 35 Remove Retaining Screw

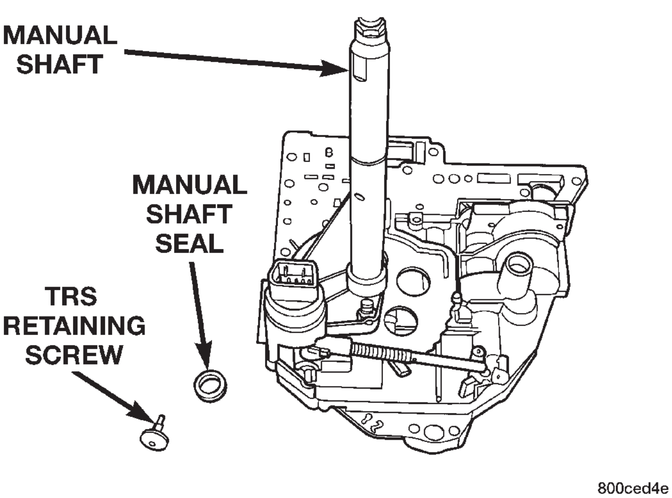


Fig. 36 Remove Manual Shaft Seal

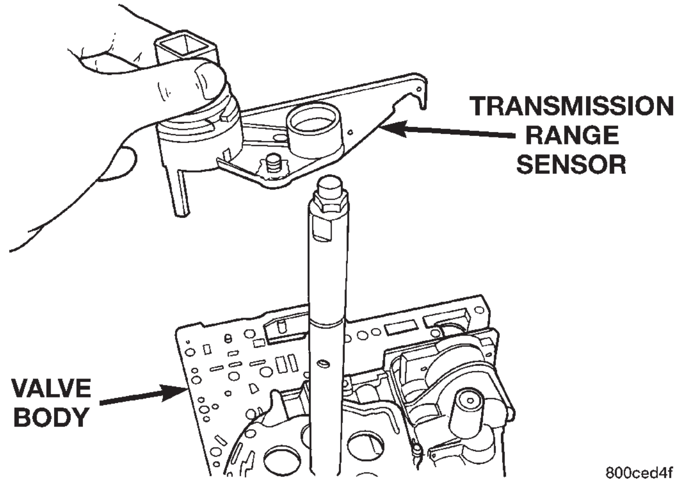


Fig. 37 Remove Transmission Range Sensor

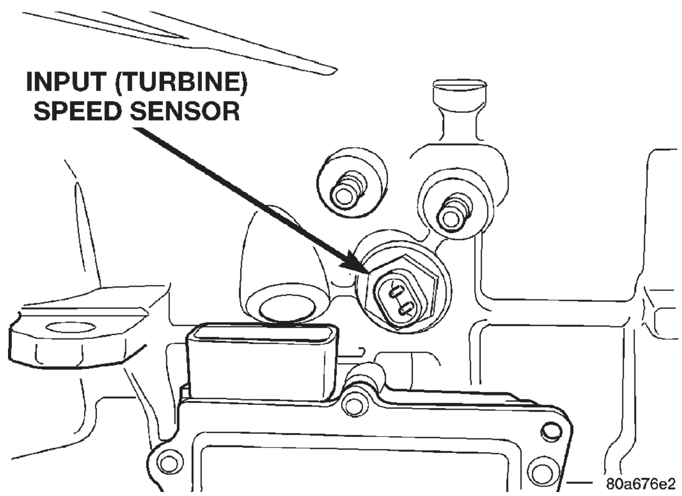


Fig. 38 Input (Turbine) Speed Sensor

SPEED SENSOR-OUTPUT

CAUTION: When disconnecting speed sensor connector, be sure that the weather seal does not fall off or remain in old sensor.

The output speed sensor is located to the right of the manual shift lever (Fig. 39).

TRANSMISSION CONTROL MODULE

Do not interchange transmission control modules with previous year transmission control modules. If a same year TCM is being used from a different vehicle, the following procedures must be performed:

- Quick Learn Procedure
- Electronic Pinion Procedure

The transmission control module is next to the battery on the left side of vehicle, in the engine compartment. It is held in place by three mounting screws.

REMOVAL AND INSTALLATION (Continued)

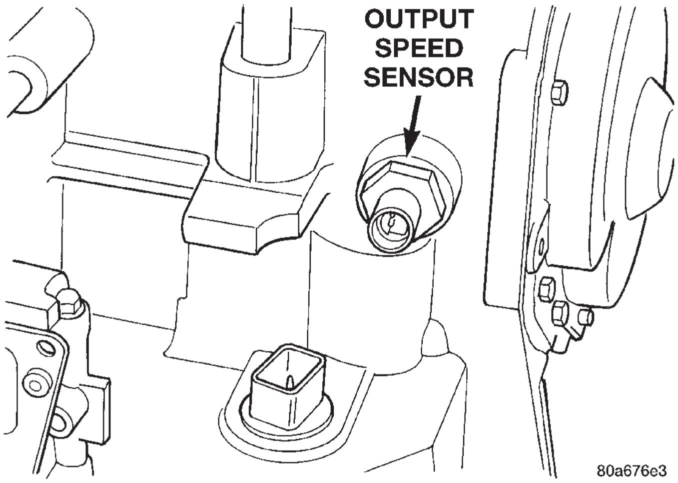


Fig. 39 Output Speed Sensor

NOTE: If the transmission control module has been replaced, the following procedures must be performed:

• Quick Learn Procedure: This procedure will allow the transmission control module to learn the characteristics of the vehicle.

• Electronic Pinion Factor Procedure: This procedure will reprogram the TCM to compensate for different tire sizes and final drive ratios.

2.4 LITER ENGINE

REMOVAL

(1) Disconnect battery negative cable at the left strut tower.
(2) Remove air cleaner clamps and air cleaner.
(3) Remove TCM 60 way connector.
(4) Remove three mounting screws.
(5) Remove TCM (Fig. 40).

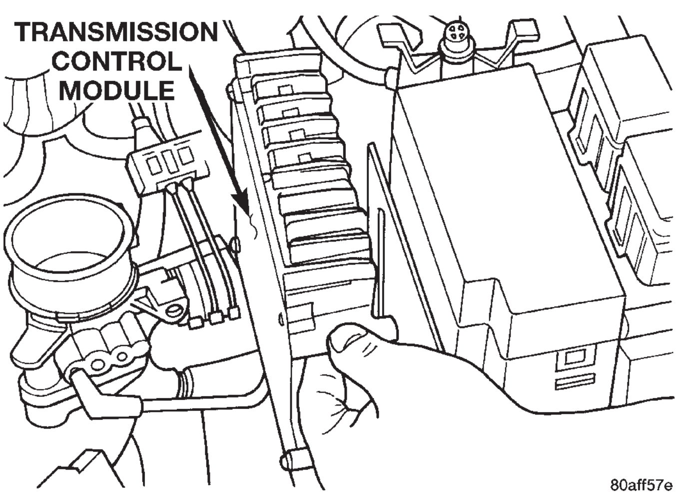


Fig. 40 Transmission Control Module

INSTALLATION

(1) For installation, reverse removal procedure.

2.5 LITER ENGINE

REMOVAL

(1) Disconnect battery negative cable at the left strut tower.
(2) Remove TCM 60 way connector.
(3) Remove three mounting screws.
(4) Remove TCM.

INSTALLATION

(1) For installation, reverse removal procedure.

VALVE BODY

REMOVAL

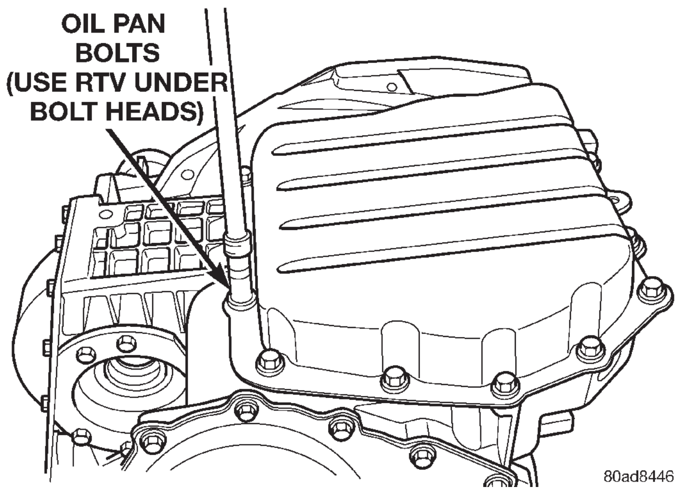


Fig. 41 Remove Oil Pan Bolts

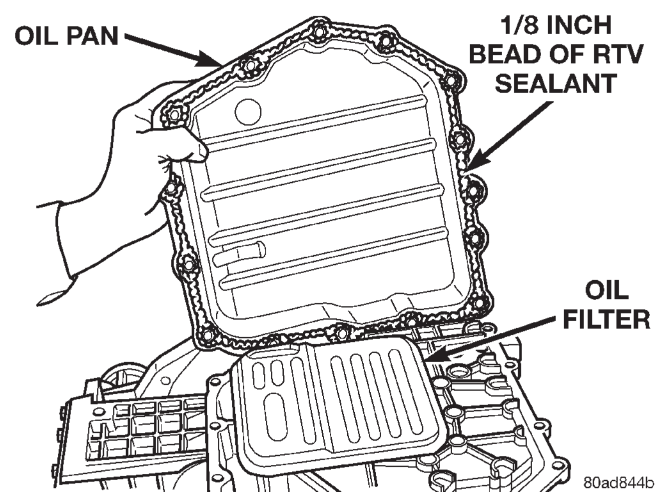


Fig. 42 Remove Oil Pan

NOTE: To ease removal of the valve body, turn the manual valve lever fully clockwise.

REMOVAL AND INSTALLATION (Continued)

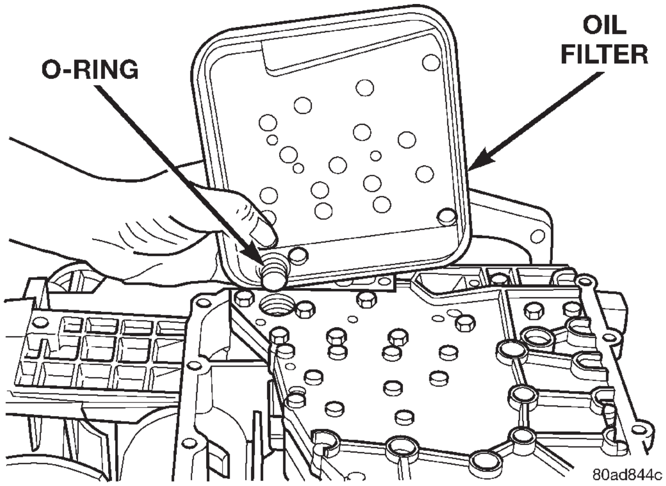


Fig. 43 Remove Oil Filter

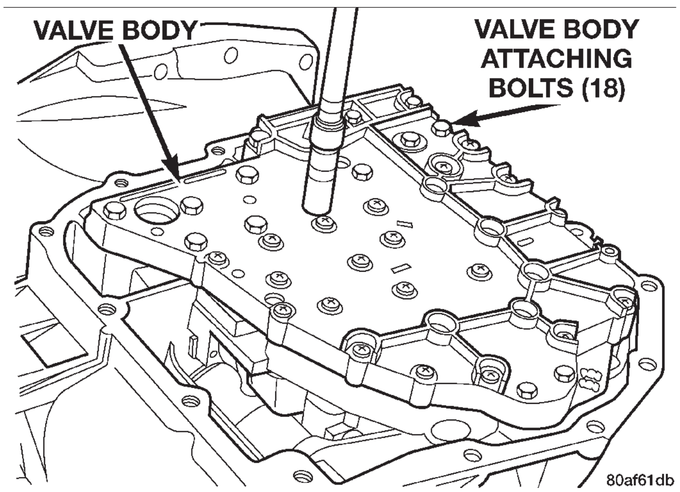


Fig. 44 Remove Valve Body Attaching Bolts

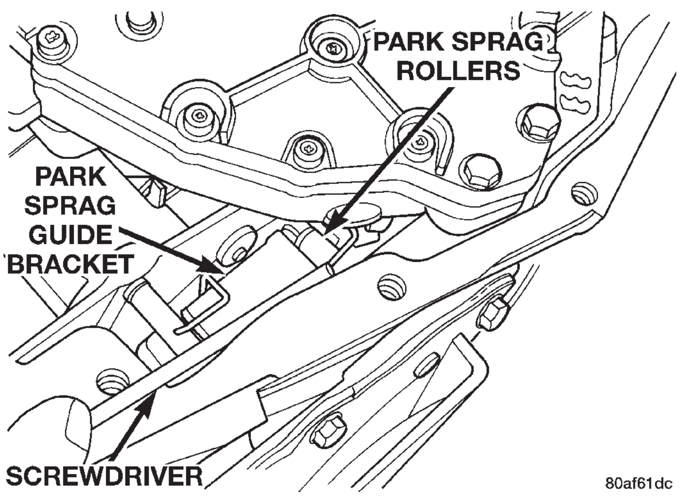


Fig. 45 Push Park Rod Rollers from Guide Bracket

INSTALLATION

To install valve body, reverse removal procedure.

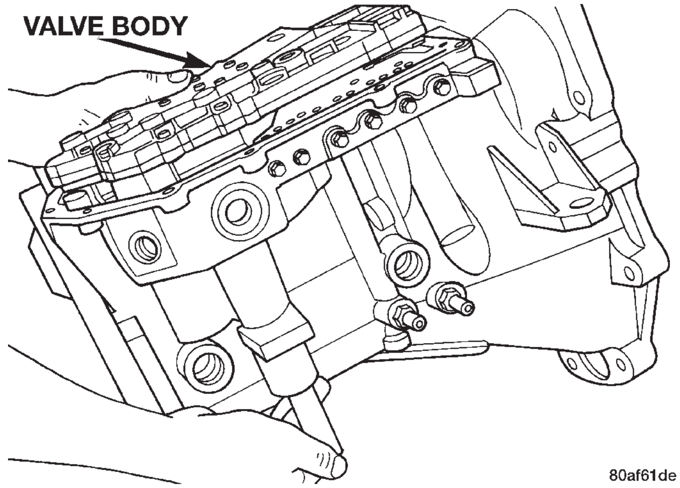


Fig. 46 Remove Valve Body

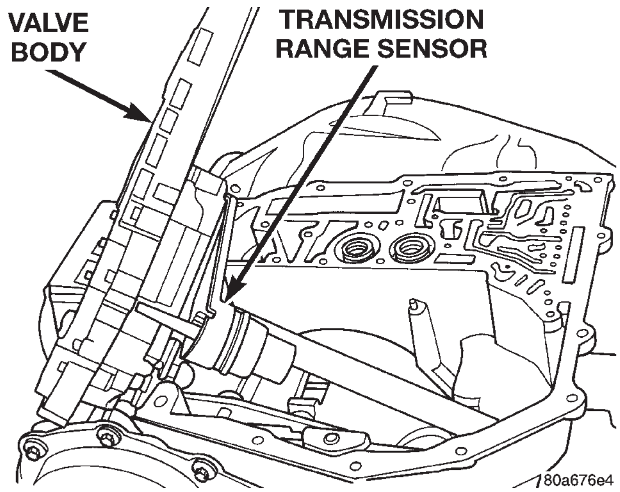


Fig. 47 Valve Body Removed

CAUTION: The valve body manual shaft pilot may distort and bind the manual valve if the valve body is mishandled or dropped.

NOTE: To ease installation of the valve body, turn the manual valve lever fully clockwise.

Guide park rod rollers into guide bracket, while shifting manual lever assembly out of the installation position.

TRANSAXLE

REMOVAL

Transaxle removal does NOT require engine removal.

The transaxle and torque converter must be removed as an assembly; otherwise, the torque converter drive plate, pump bushing or oil seal may be damaged. The drive plate will not support a load;

REMOVAL AND INSTALLATION (Continued)

therefore, none of the weight of the transaxle should be allowed to rest on the drive plate during removal.

(1) Disconnect battery negative cable at left strut tower (Fig. 48).

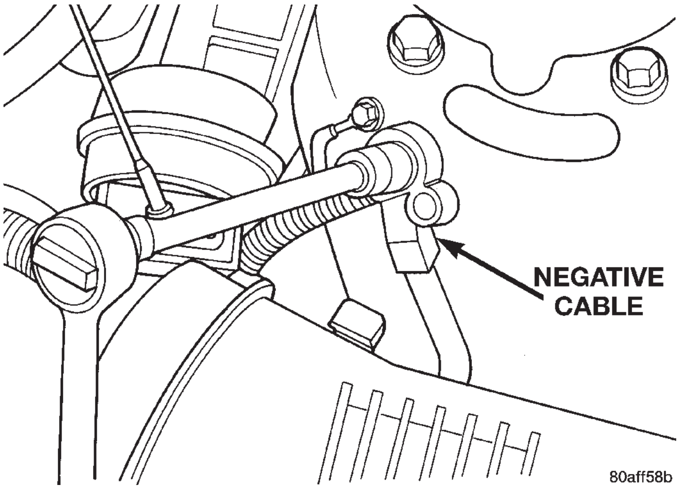


Fig. 48 Negative Cable

(2) Remove air cleaner duct.

(3) Remove transmission control module (TCM) and wiring (Fig. 49).

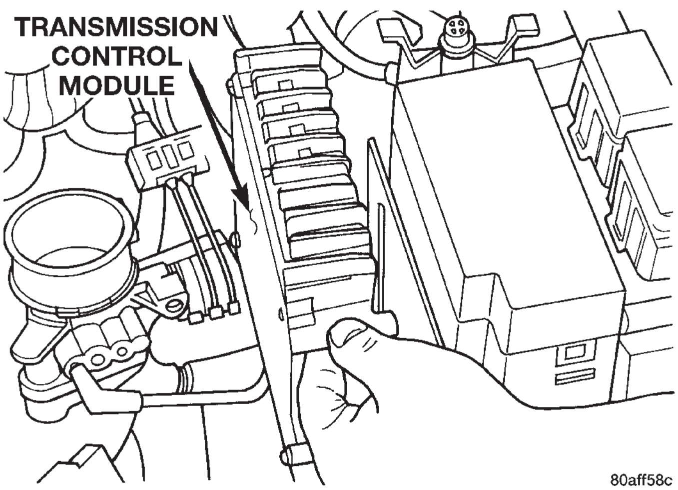


Fig. 49 Transmission Control Module

(4) Remove solenoid pack connector (Fig. 50).

(5) Remove dipstick tube.

(6) Remove transaxle cooler lines (Fig. 51).

(7) Remove shift cable at lever and at clamp on transaxle (Fig. 52) (Fig. 53).

(8) Install engine support fixture and support engine (Fig. 54).

(9) Remove left upper transaxle mount top bolts (Fig. 55).

(10) Raise vehicle. Remove front wheels. Refer to Group 2, Suspension to remove wheel hub nuts and both drive shafts.

(11) Remove left and right side lower splash shields (Fig. 56).

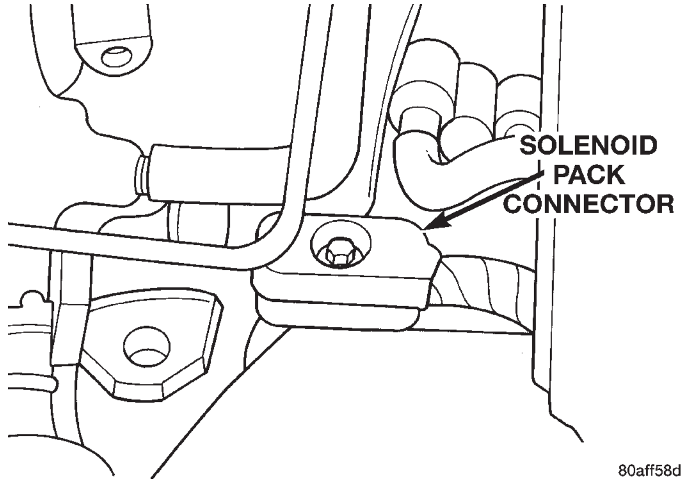


Fig. 50 Solenoid Pack Connector

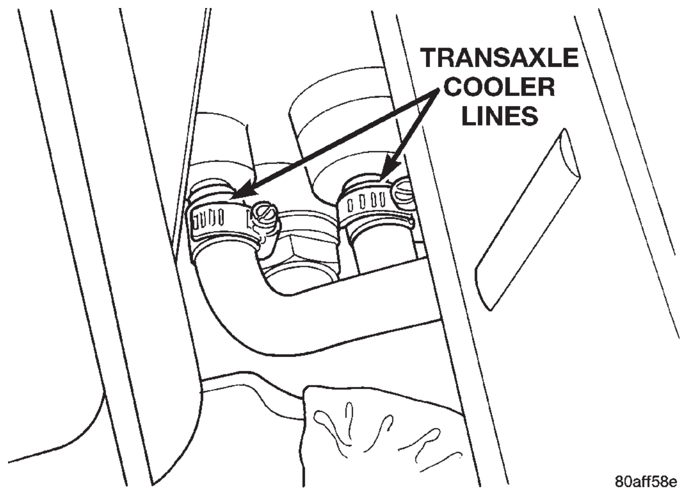


Fig. 51 Transaxle Cooler Lines

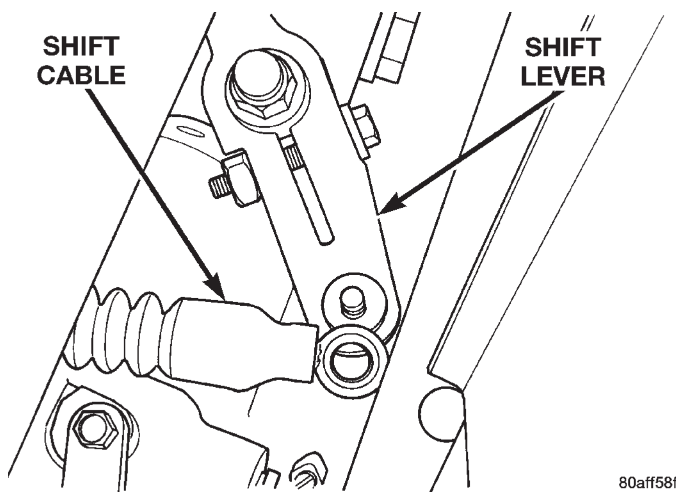


Fig. 52 Shift Cable at Lever

CAUTION: The exhaust flex joint must be disconnected from the exhaust manifold anytime the engine is lowered. If the engine is lowered while the flex pipe is attached, damage will occur.

REMOVAL AND INSTALLATION (Continued)

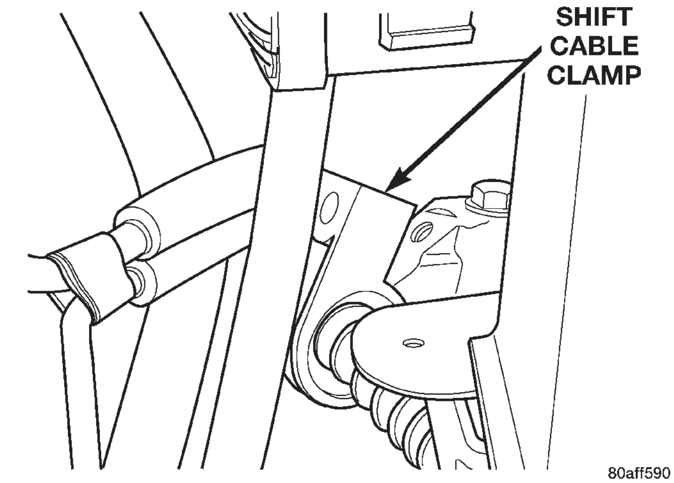


Fig. 53 Shift Cable Clamp

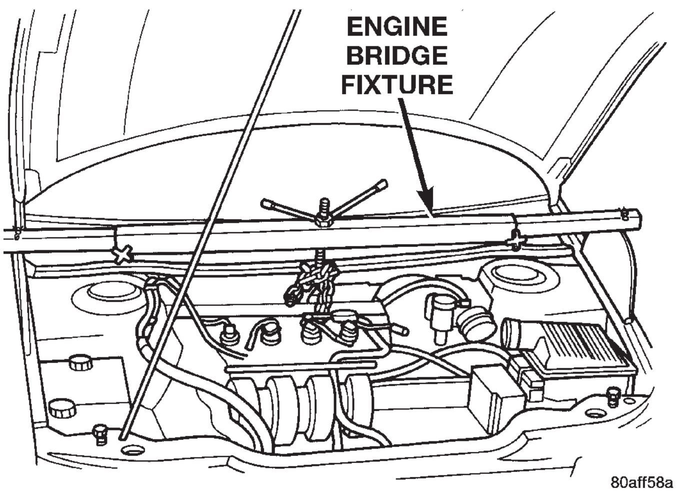


Fig. 54 Engine Support Fixture (Typical)

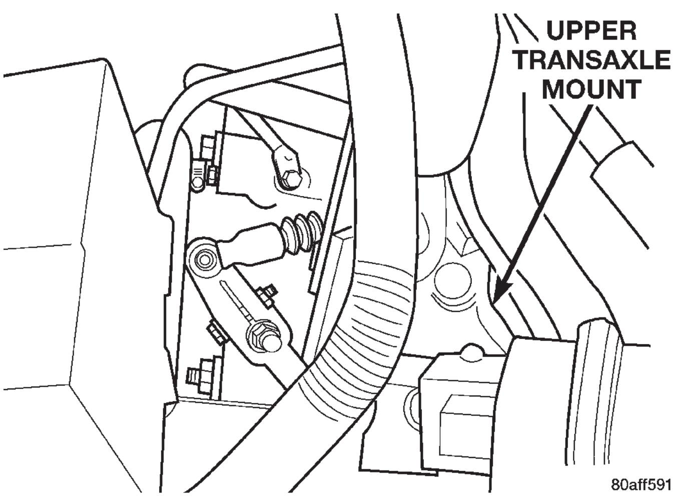


Fig. 55 Upper Transaxle Mount

(12) Remove bolts securing exhaust flex joint to exhaust manifold. Disconnect exhaust pipe from manifold.

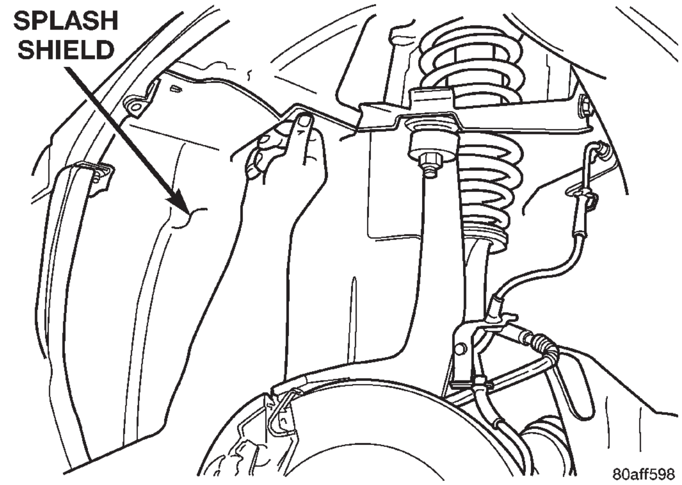


Fig. 56 Lower Splash Shields

(13) Remove remaining left upper mount bolts (Fig. 57).

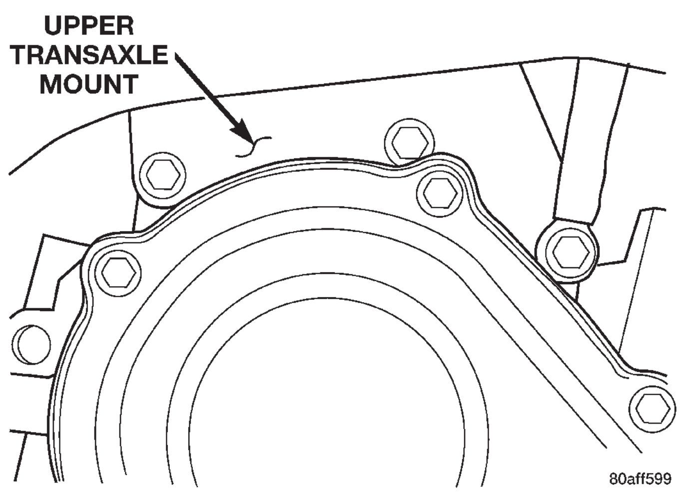


Fig. 57 Left Mount Bolts

(14) Remove engine oil filter.
(15) Remove starter and wiring (Fig. 58).

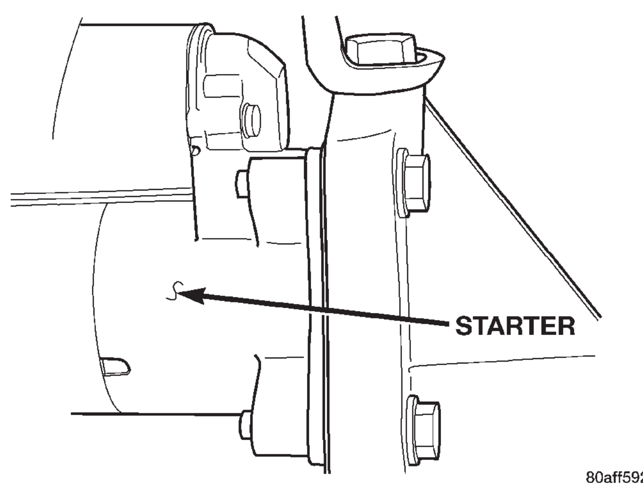


Fig. 58 Starter

REMOVAL AND INSTALLATION (Continued)

(16) Remove front motor mount bracket.

(17) Remove rear mount bracket through-bolt.

(18) Remove center member bolts.

(19) Remove rear mount bracket bolts, and remove rear mount bracket.

(20) Remove radiator lower crossmember.

(21) Remove lateral bending strut brackets (front and rear).

NOTE: The 2.4 liter engine has an oil pan collar bracket attached to the transaxle bell housing. Refer to Group 9–Engine, for the proper Removal and Installation procedure.

(22) Remove flex plate cover.

(23) Rotate engine clockwise to line up converter bolts (Fig. 59). Remove converter bolts (Fig. 60). Mark converter for reassembly ease.

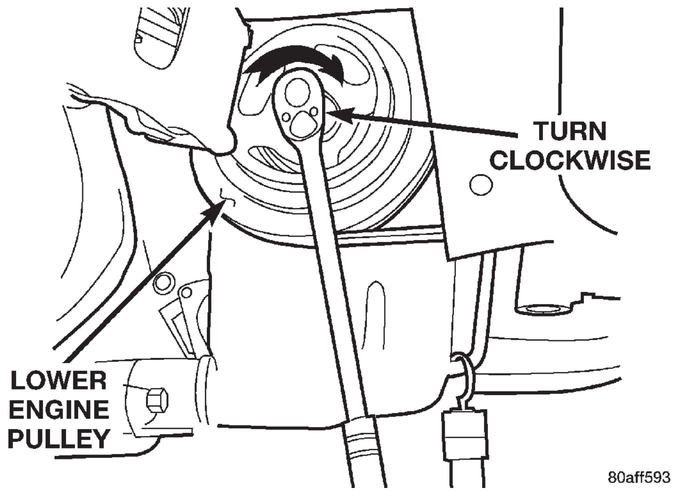


Fig. 59 Rotate Engine Clockwise

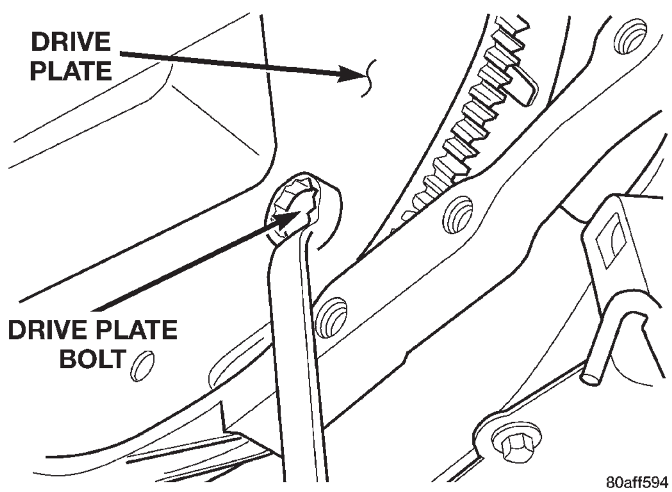


Fig. 60 Converter Bolts

(24) Remove crank position sensor (if equipped).

(25) Remove transaxle wiring.

(26) Loosen right side steering gear bolts. Loosen right side K-frame bolts.

(27) Remove left side steering gear bolts. Remove left side K-frame bolts (Fig. 61).

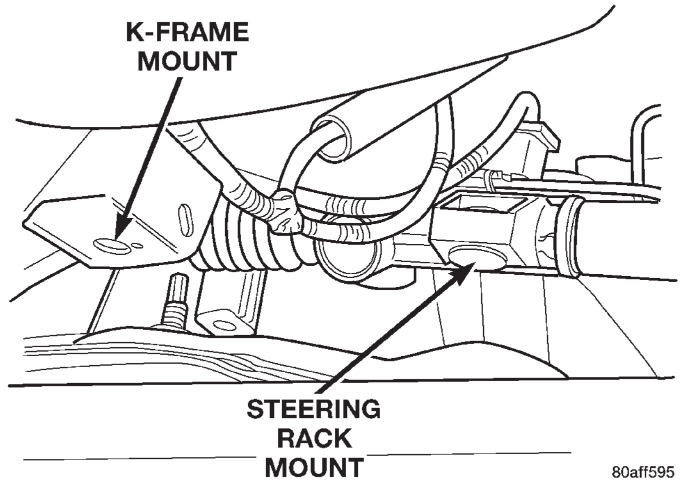


Fig. 61 Steering Gear and K-frame Bolts

(28) Remove sway bar mounts (Fig. 62).

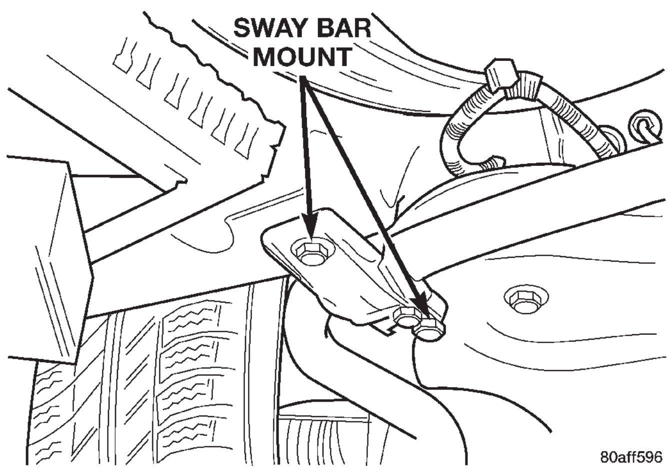


Fig. 62 Sway Bar Mounts

(29) Position transmission jack under transaxle and support with safety chain (Fig. 63).

(30) Remove upper and lower transaxle bell housing bolts.

(31) Move K-frame rearward and carefully lower the transaxle assembly from vehicle.

INSTALLATION

(1) For installation of transaxle, reverse the above procedure.

(2) Check and/or adjust gear shift cable.

(3) Refill transaxle with MOPAR® ATF PLUS 3 (Automatic Transmission Fluid) Type 7176.

REMOVAL AND INSTALLATION (Continued)

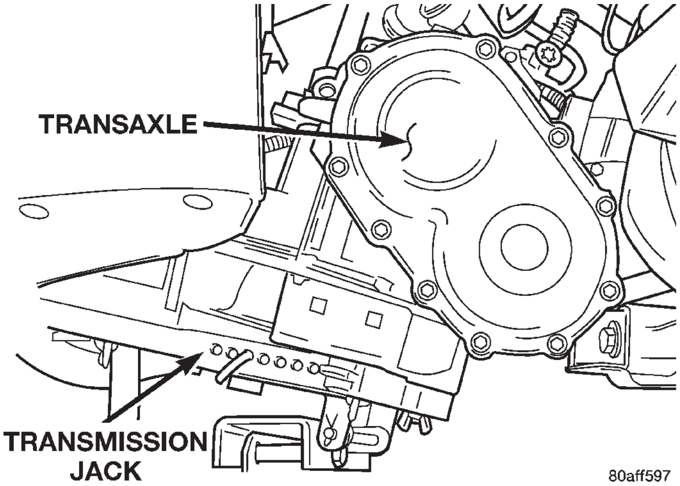


Fig. 63 Transmission Jack

OIL PUMP SEAL

REMOVAL

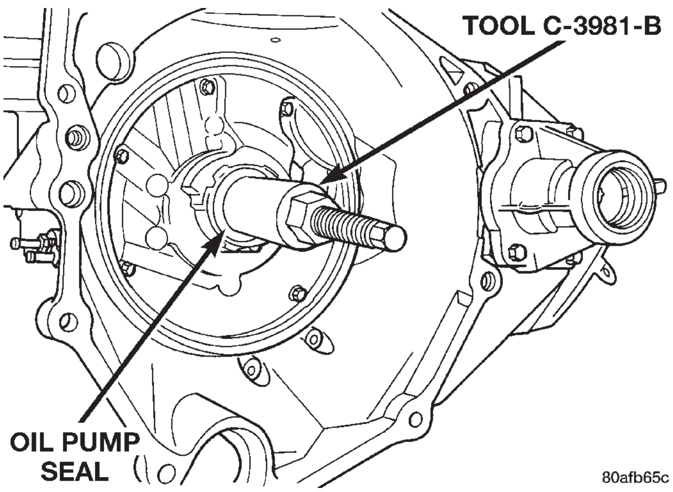


Fig. 64 Remove Oil Pump Seal

INSTALLATION

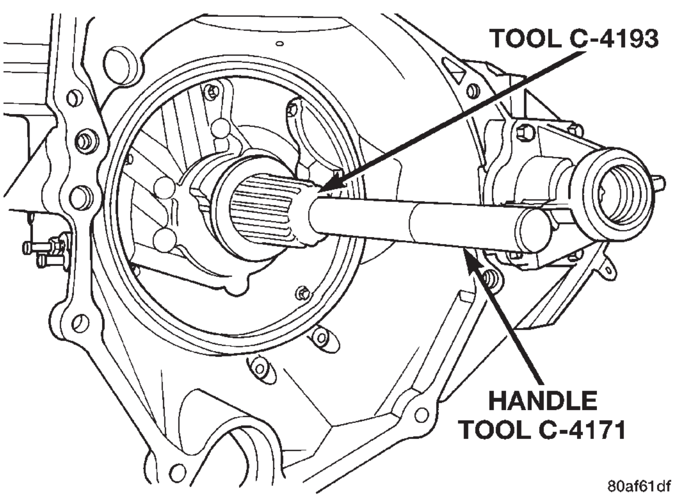


Fig. 65 Install Oil Pump Seal

DISASSEMBLY AND ASSEMBLY

VALVE BODY RECONDITION

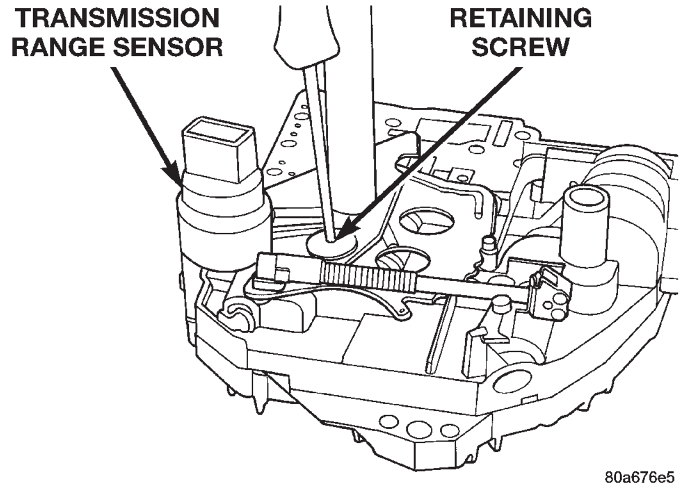


Fig. 66 Transmission Range Sensor Screw

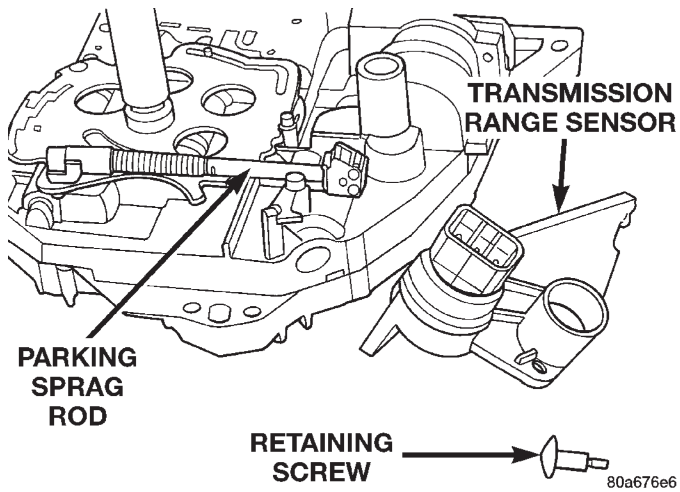


Fig. 67 Transmission Range Sensor Removed

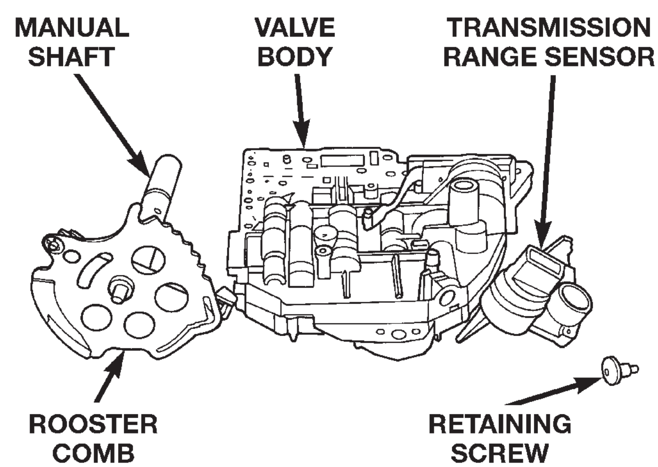


Fig. 68 Manual Shaft and Rooster Comb

DISASSEMBLY AND ASSEMBLY (Continued)

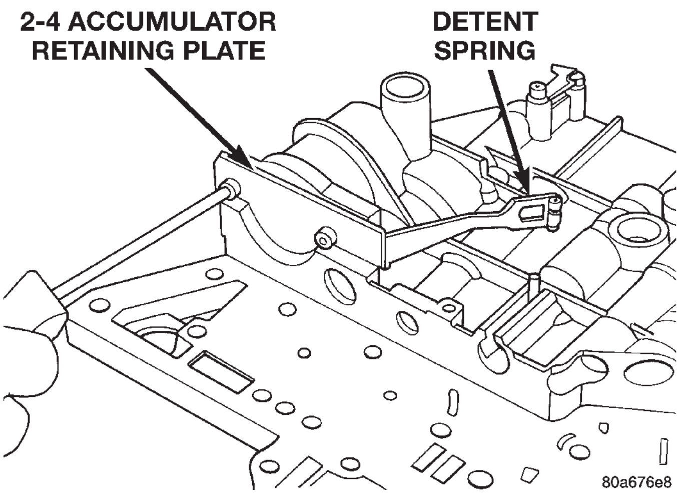


Fig. 69 2-4 Accumulator Plate

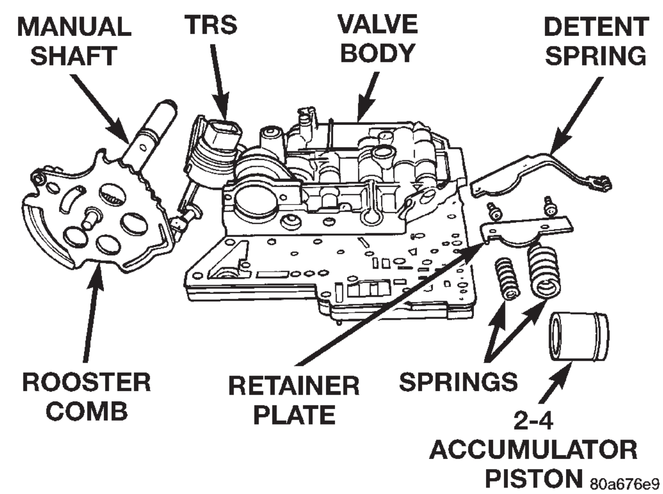


Fig. 70 TRS, Manual Shaft, and 2-4 Accumulator

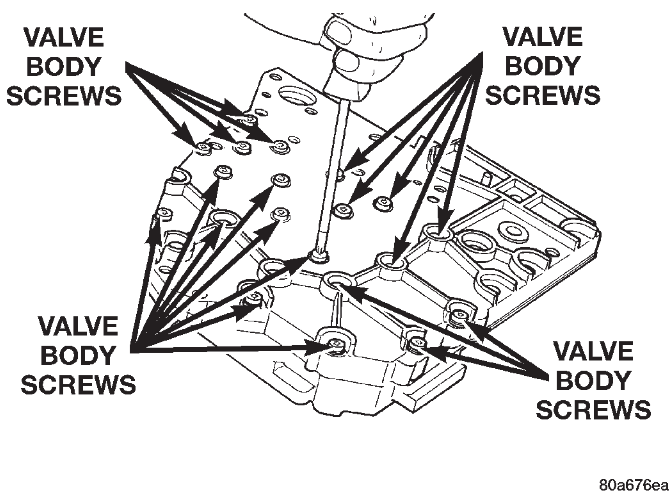


Fig. 71 Valve Body Screws

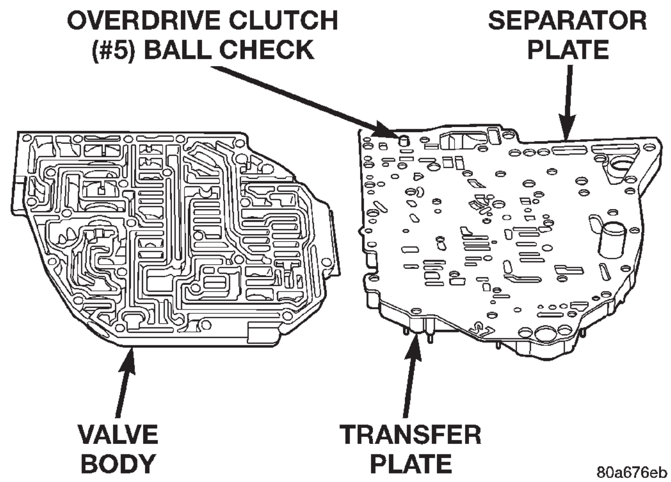


Fig. 72 Valve Body and Transfer Plate

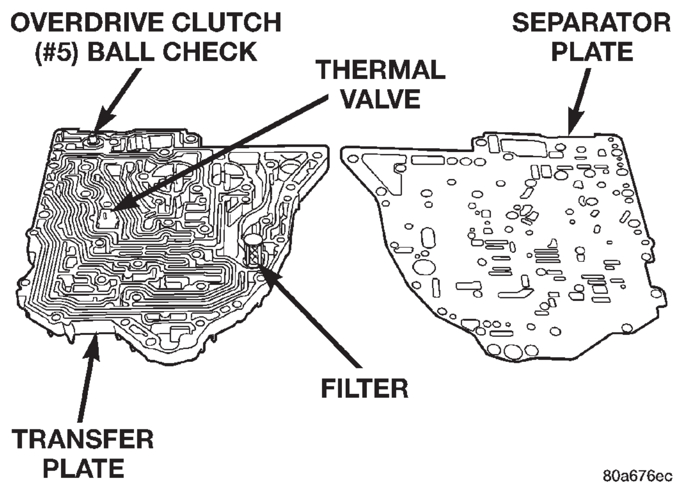


Fig. 73 Transfer Plate and Separator Plate

DISASSEMBLY AND ASSEMBLY (Continued)

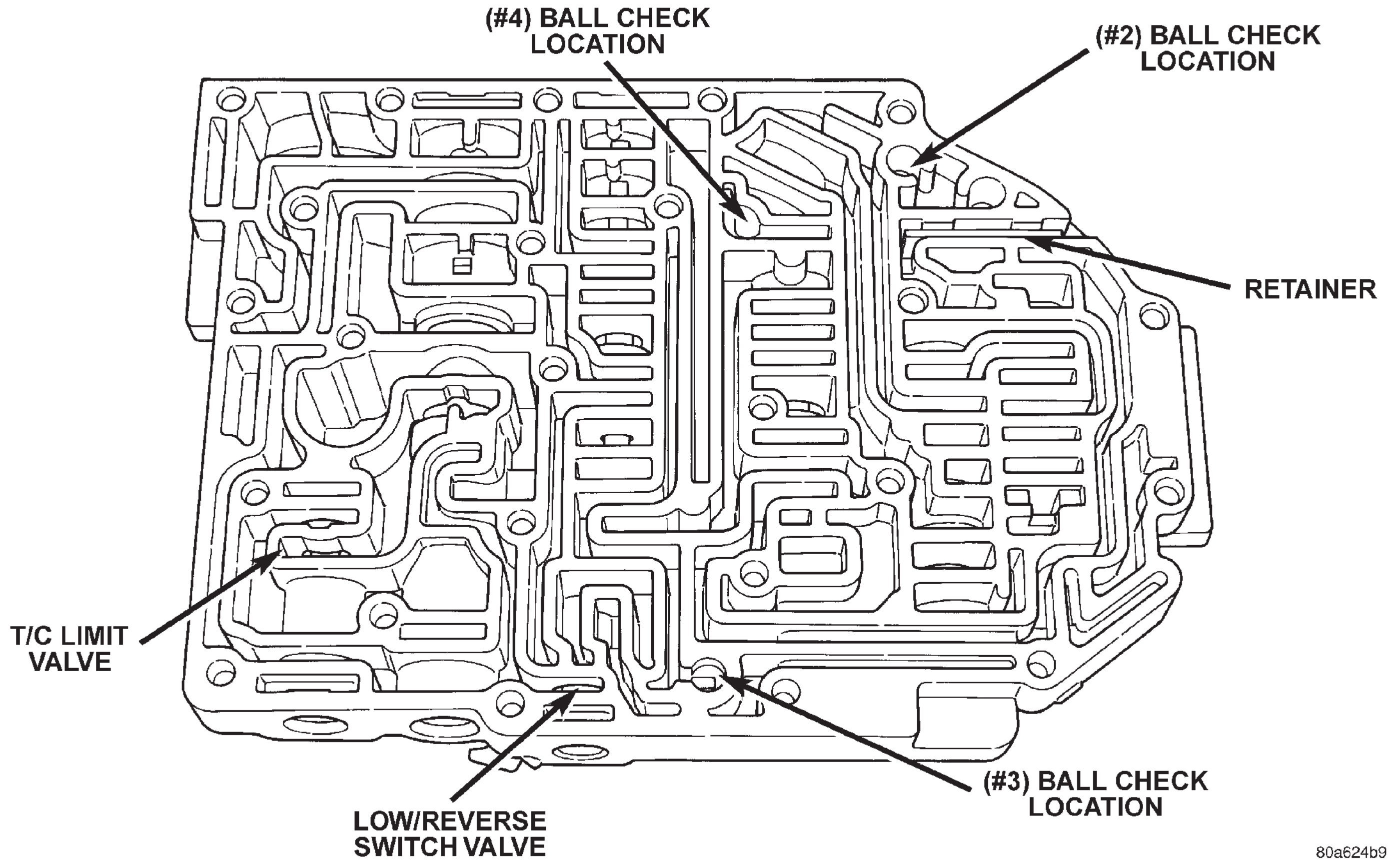


Fig. 74 Ball Check Location

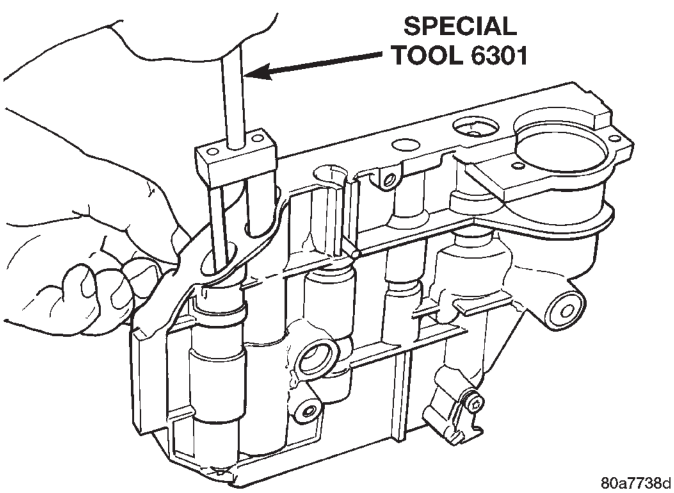


Fig. 75 Remove Dual Retainer Plate

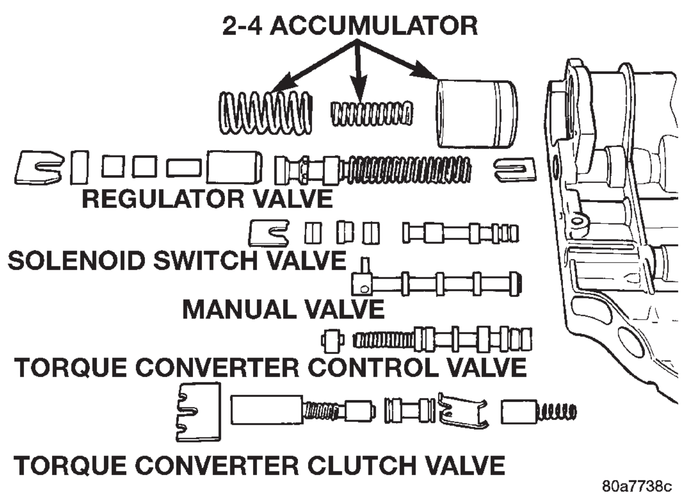


Fig. 76 Springs and Valves Location

DISASSEMBLY AND ASSEMBLY (Continued)

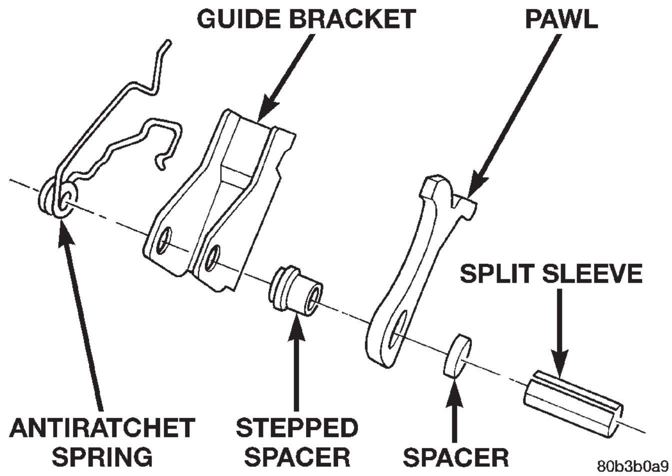


Fig. 77 Low/Reverse Switch Valve And T/C Limit Valve

TRANSAXLE—DISASSEMBLY

NOTE: Tag all clutch pack assemblies, as they are removed, for reassembly identification.

CAUTION: Do not intermix clutch discs or plates as the unit might then fail.

(1) Remove input and output speed sensors.
(2) Remove transaxle solenoid pack (Fig. 78).

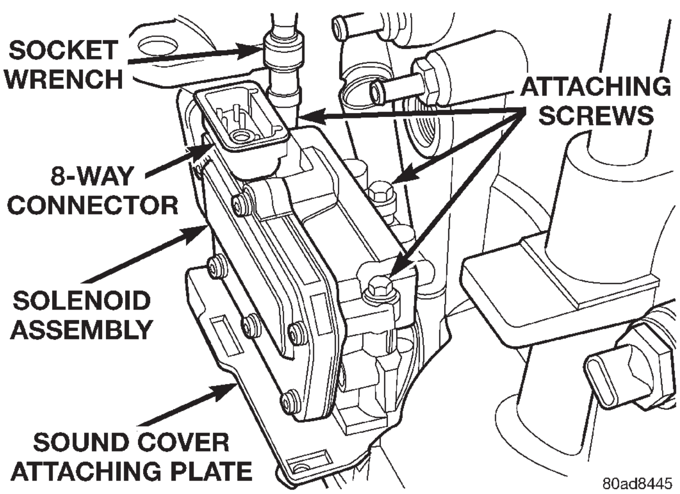


Fig. 78 Remove Solenoid Pack

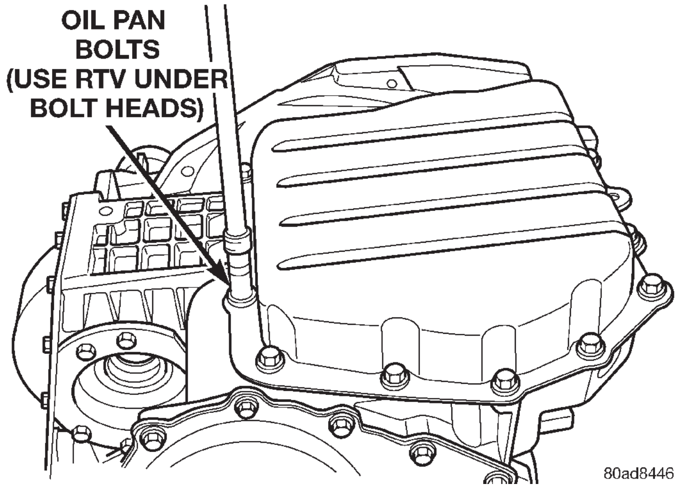


Fig. 79 Remove Oil Pan Bolts

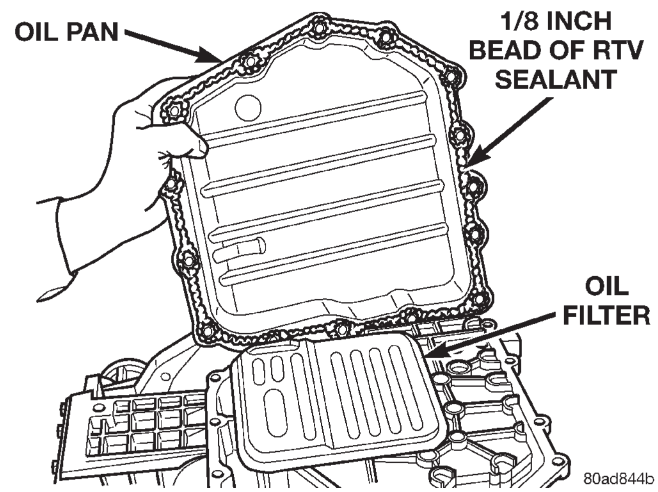


Fig. 80 Remove Oil Pan

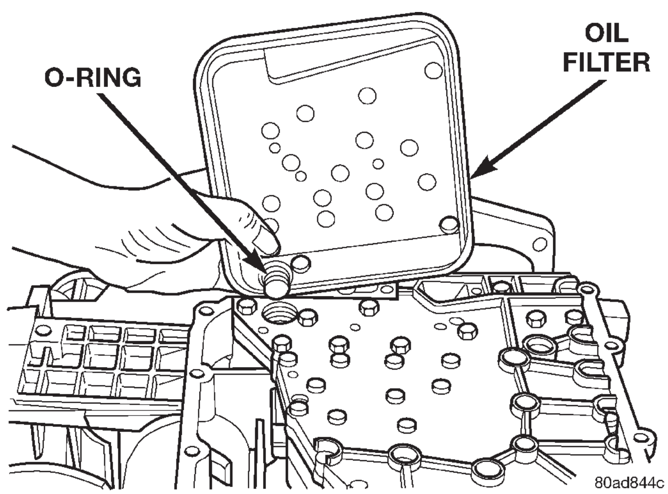


Fig. 81 Remove Oil Filter

DISASSEMBLY AND ASSEMBLY (Continued)

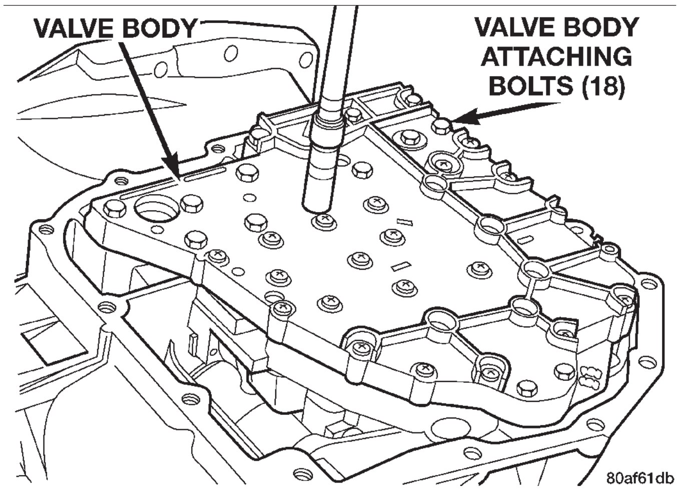


Fig. 82 Remove Valve Body Attaching Bolts

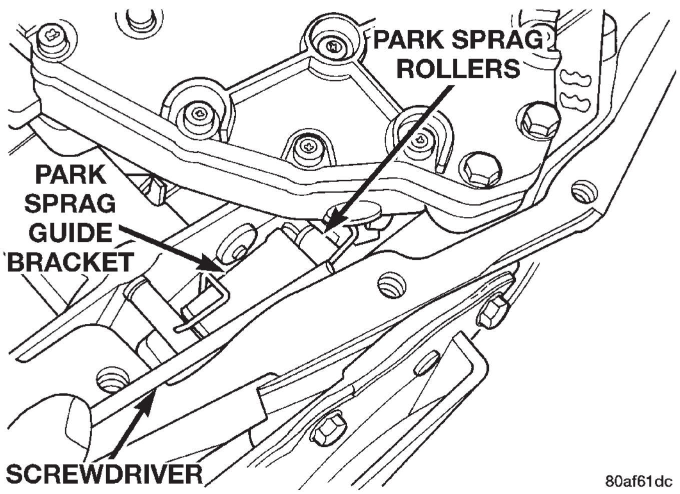


Fig. 83 Push Park Rod Rollers from Guide Bracket

NOTE: To ease removal of the valve body, turn the manual valve fully clockwise.

CAUTION: Do not handle the valve body from the manual valve. Damage could result.

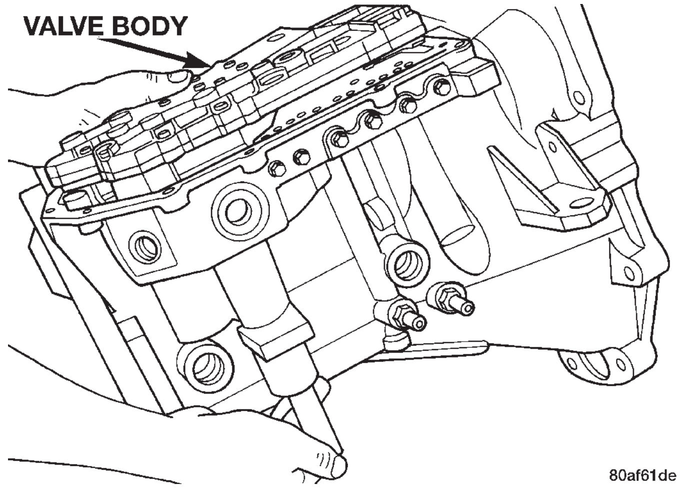


Fig. 84 Remove Valve Body

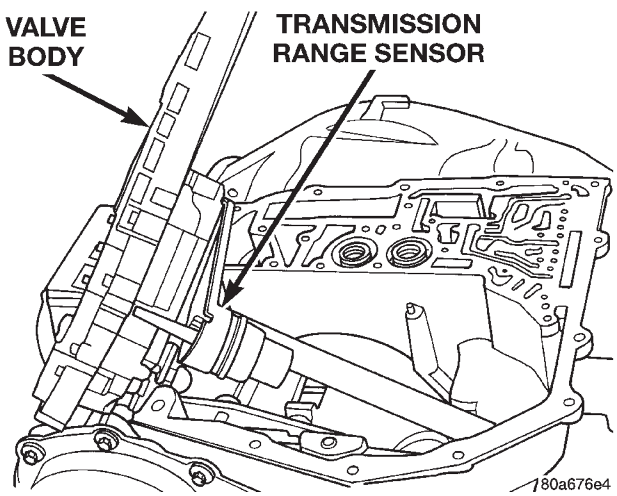


Fig. 85 Valve Body Removed

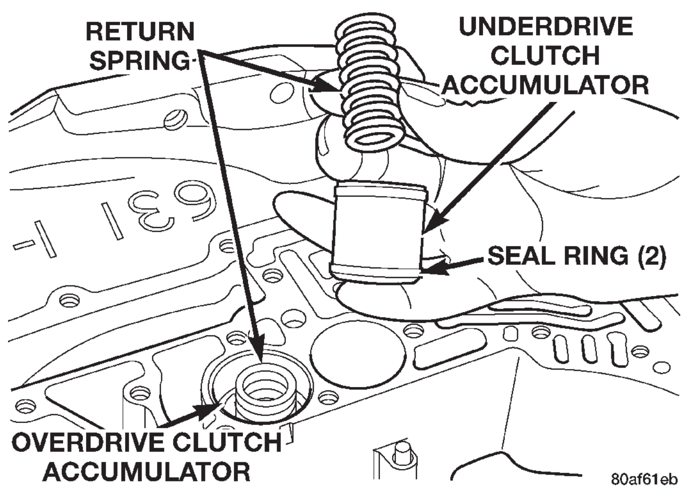


Fig. 86 Remove Accumulators

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Dependent on engine application, some accumulators will have two springs and others will have one spring. The springs are color coded according to application and year. When disassembling, mark accumulator spring location to ease assembly.

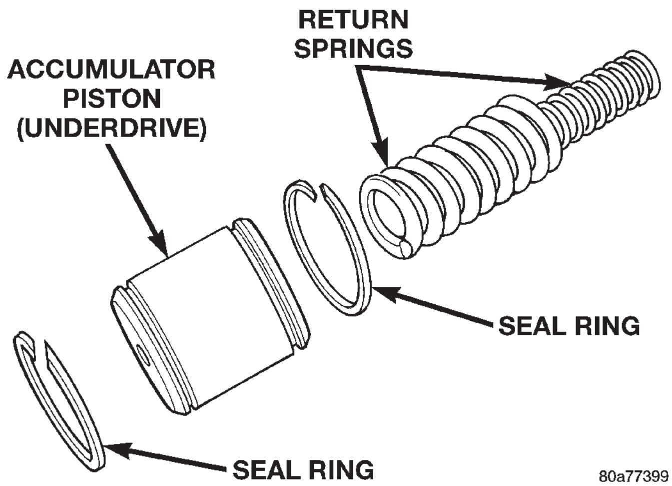


Fig. 87 Accumulator (Underdrive)

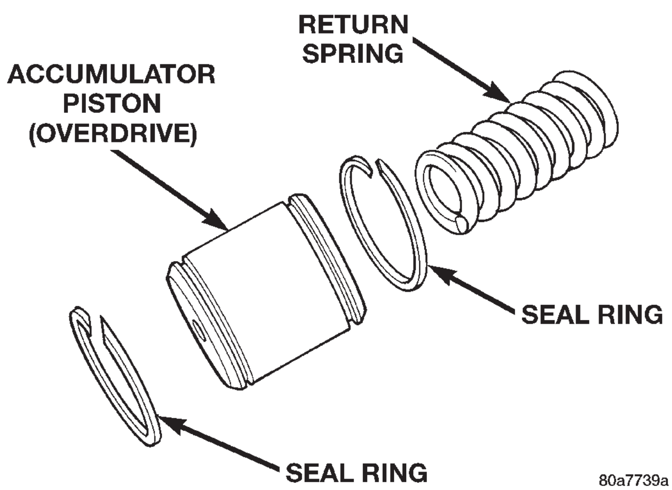


Fig. 88 Accumulator (Overdrive)

Measure the input shaft end play with the transaxle in the vertical position. This will ensure that the measurement will be accurate.

Measuring input shaft end play before disassembly will usually indicate when a #4 thrust plate change is required. The #4 thrust plate is located behind the overdrive clutch hub.

Attach a dial indicator to transaxle bell housing with its plunger seated against end of input shaft (Fig. 93).

Move input shaft in and out to obtain end play reading. End play specifications are .13 to .64 mm (.005 to .025 inch).

Record indicator reading for reference when reassembling the transaxle.

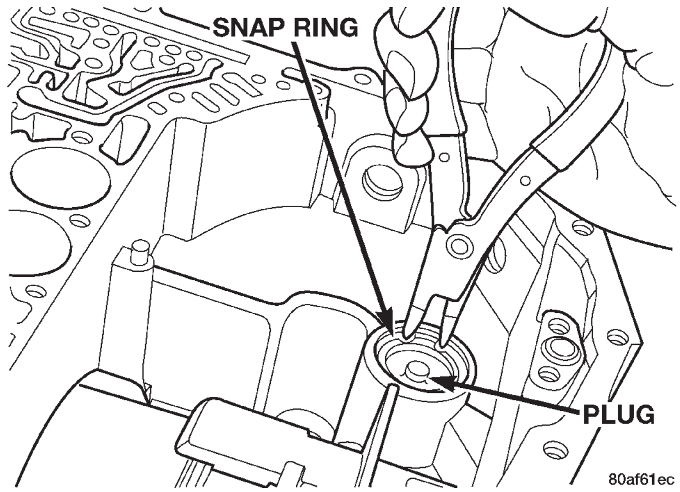


Fig. 89 Remove Low/Reverse Accumulator Snap Ring

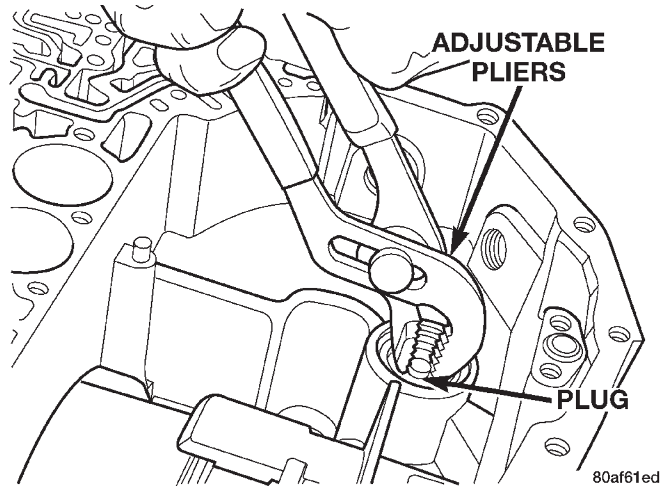


Fig. 90 Remove Low/Reverse Accumulator Plug (Cover)

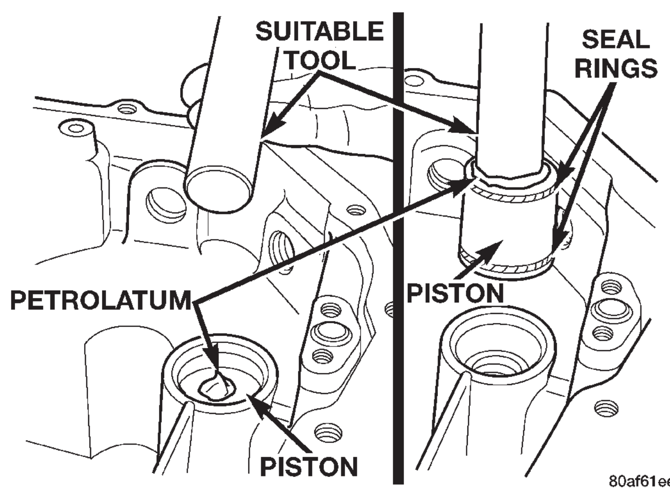


Fig. 91 Remove Low/Reverse Accumulator Piston

DISASSEMBLY AND ASSEMBLY (Continued)

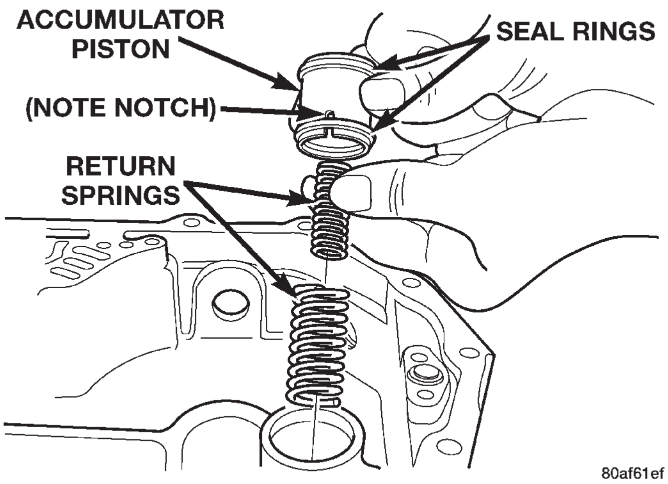


Fig. 92 Remove Low/Reverse Accumulator

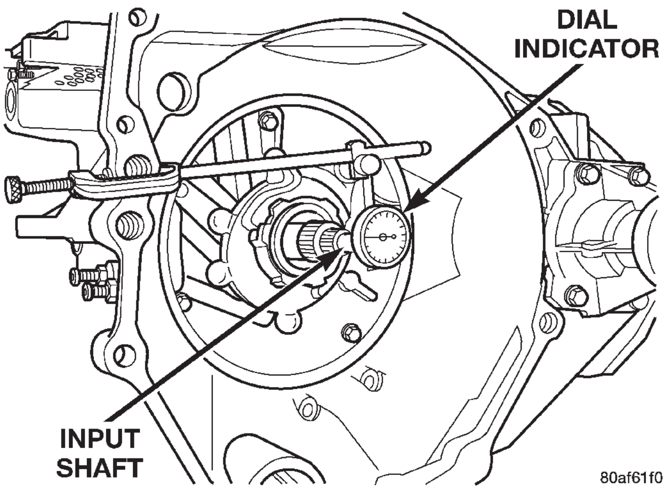


Fig. 93 Measure Input Shaft End Play

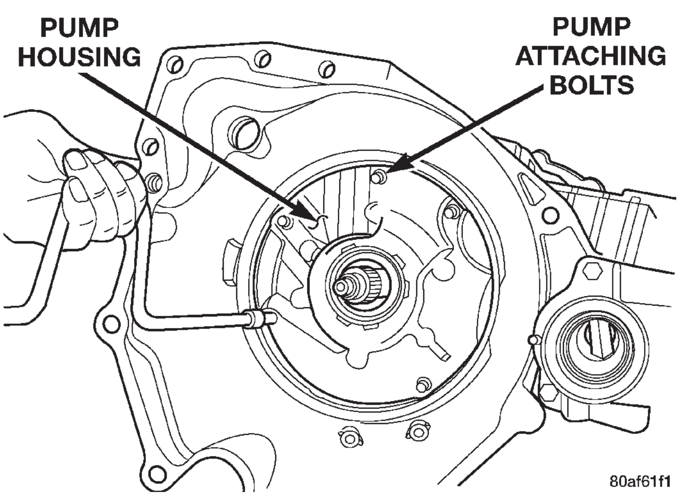


Fig. 94 Remove Pump Attaching Bolts

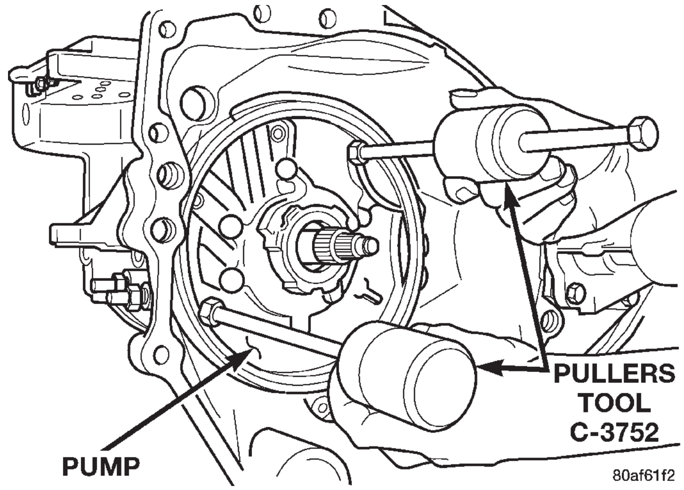


Fig. 95 Install Tool C-3752

CAUTION: Be sure input speed sensor is removed before removing oil pump.

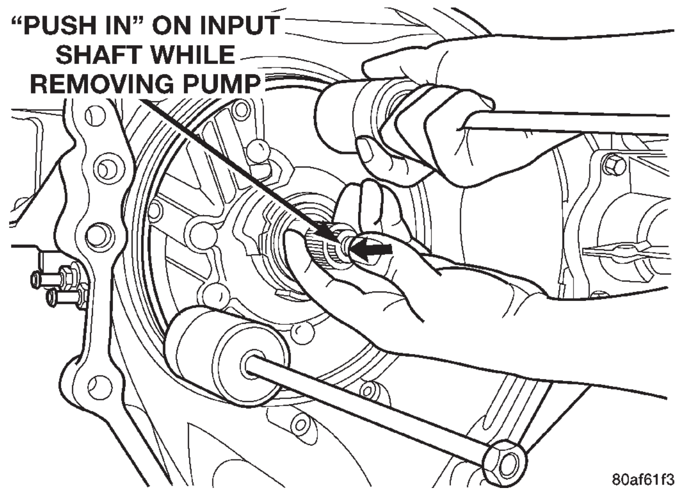


Fig. 96 Remove Oil Pump

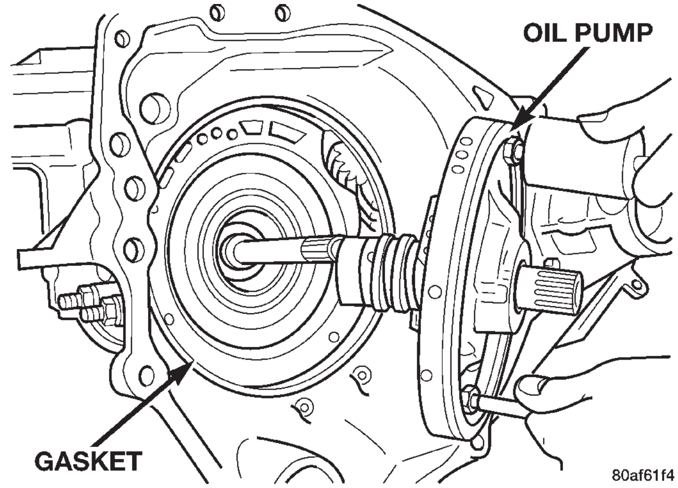


Fig. 97 Oil Pump Removed

DISASSEMBLY AND ASSEMBLY (Continued)

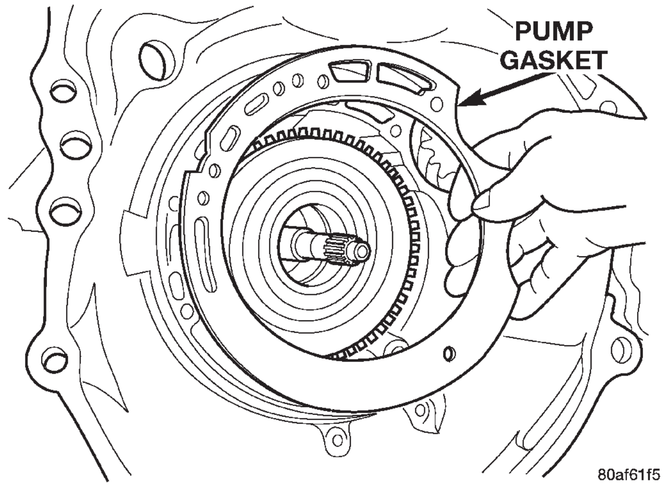


Fig. 98 Remove Oil Pump Gasket

OIL PUMP INSPECTION

When disassembling the transaxle it is necessary to inspect the oil pump for wear and damage.

(1) Remove the reaction shaft support bolts.

(2) Remove reaction shaft support from pump housing (Fig. 99).

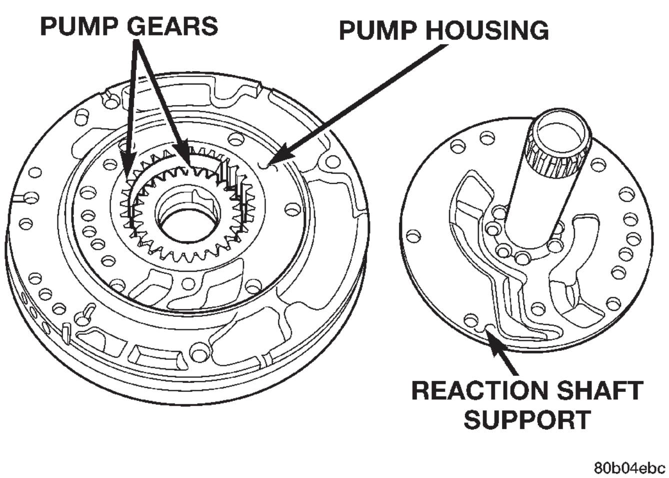


Fig. 99 Reaction Shaft Support

(3) Remove the pump gears and check for wear and damage.

(4) Install the gears and check clearances.

(5) Measure the clearance between the outer gear and the pump pocket (Fig. 100). Clearance should be 0.045-0.141mm (0.0018-0.0056 in.)

(6) Position an appropriate piece of Plastigage across both pump gears.

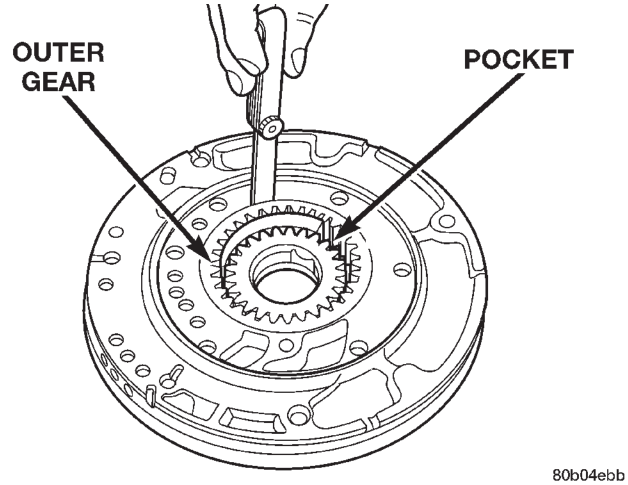


Fig. 100 Measure Outer Gear to Pocket

(7) Align the Plastigage to a flat area on the reaction shaft support housing.

(8) Install the reaction shaft to the pump housing. Tighten the bolts to 27 N.M (20 ft. lbs.)

(9) Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.

(10) Clearance between outer gear side and the reaction shaft support should be 0.020-0.046mm (0.008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046mm (0.008-0.0018 in.).

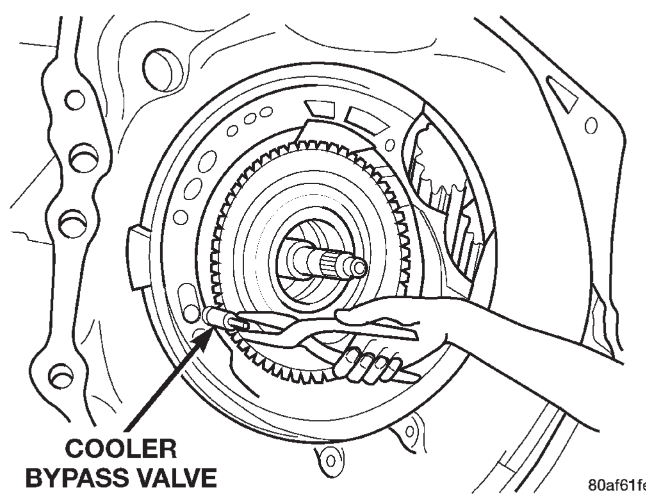


Fig. 101 Remove Bypass Valve

CAUTION: The cooler bypass valve must be replaced if a transaxle failure has occurred. Do not reuse old valve or attempt to clean old valve. When installing bypass valve, insert with O-ring end towards rear of case.

DISASSEMBLY AND ASSEMBLY (Continued)

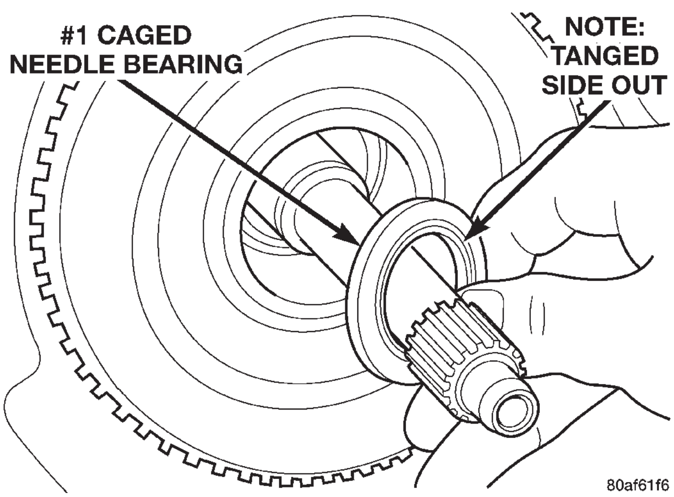


Fig. 102 Remove Caged Needle Bearing

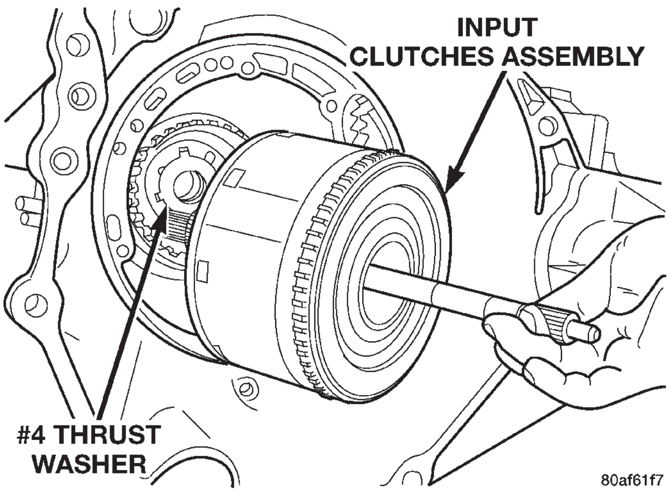


Fig. 103 Remove Input Clutches Assembly

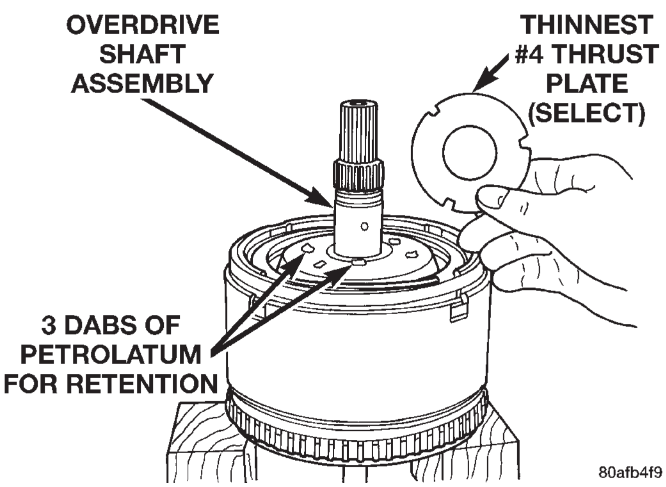


Fig. 104 No. 4 Thrust Plate

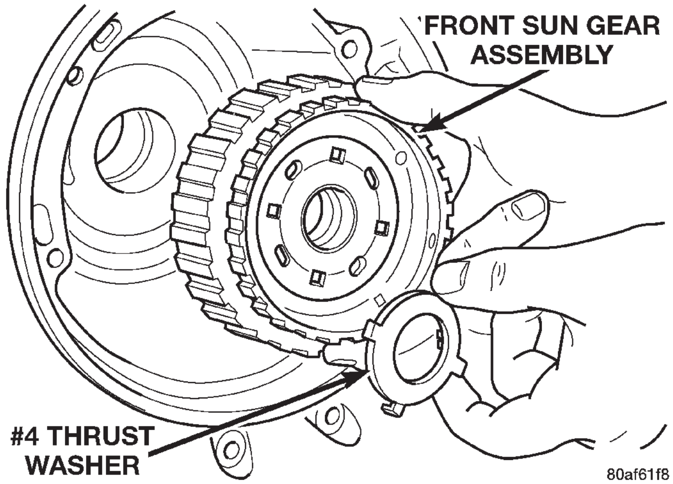


Fig. 105 Remove Front Sun Gear Assembly

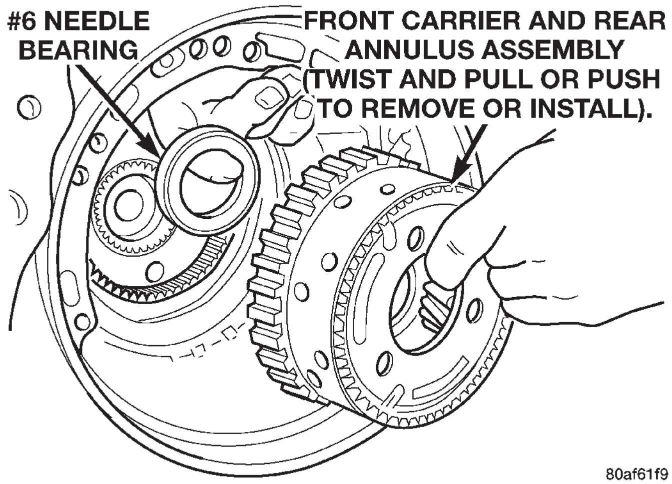


Fig. 106 Remove Front Carrier and Rear Annulus Assembly

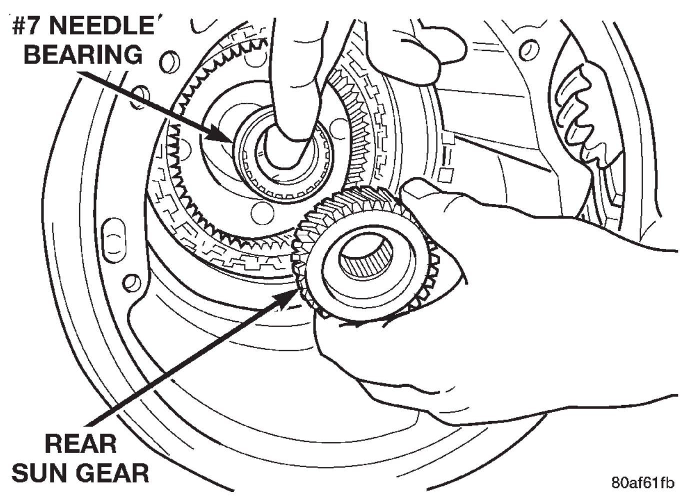


Fig. 107 Remove Rear Sun Gear

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Verify that Miller Tool 5058 is centered properly to the 2/4 clutch retainer before depressing the tool.

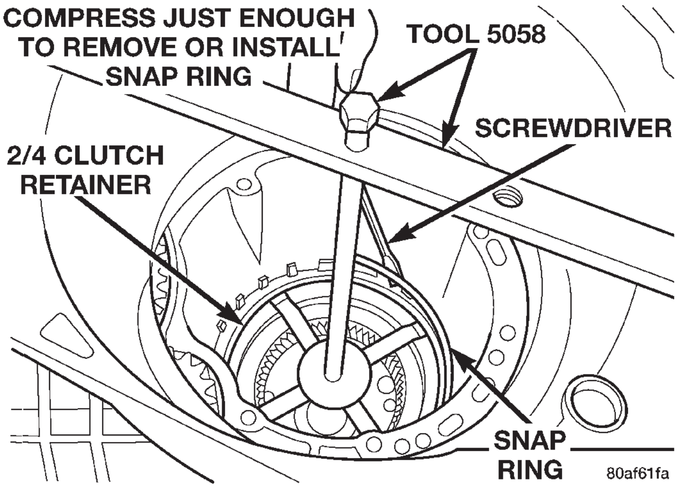


Fig. 108 Remove 2/4 Clutch Retainer Snap Ring

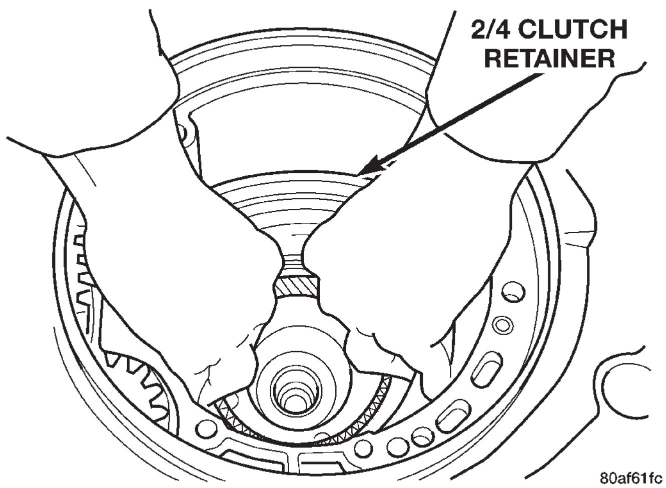


Fig. 109 Remove 2/4 Clutch Retainer

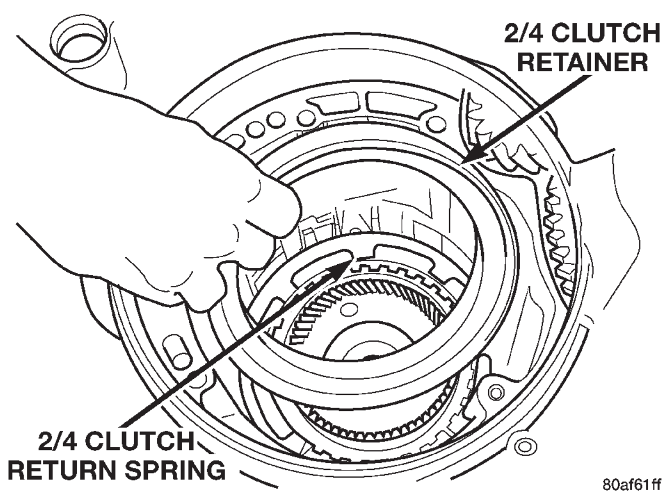


Fig. 110 2/4 Clutch Retainer

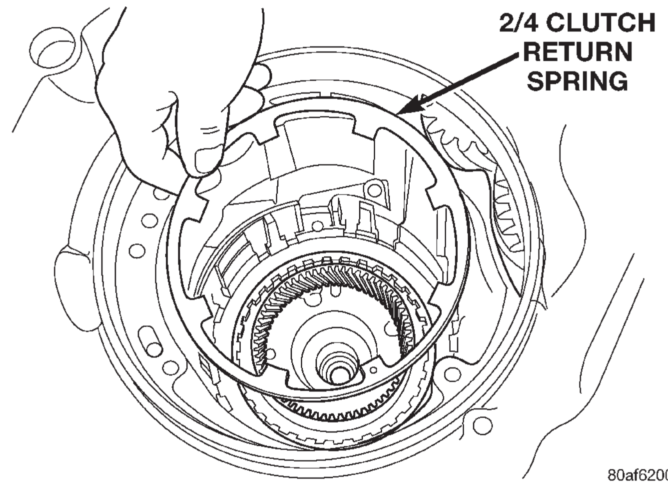


Fig. 111 Remove 2/4 Clutch Return Spring

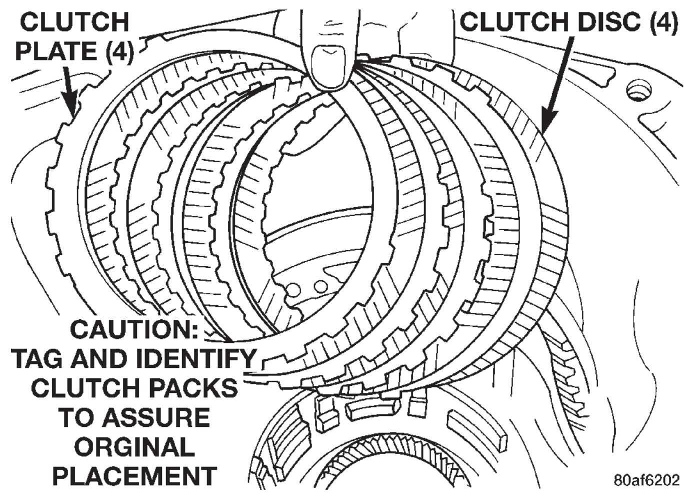


Fig. 112 Remove 2/4 Clutch Pack

NOTE: Tag 2/4 clutch pack for reassembly identification.

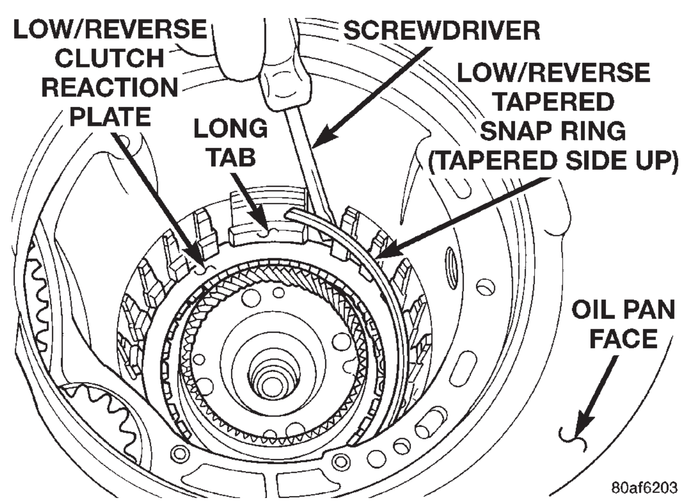


Fig. 113 Remove Tapered Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

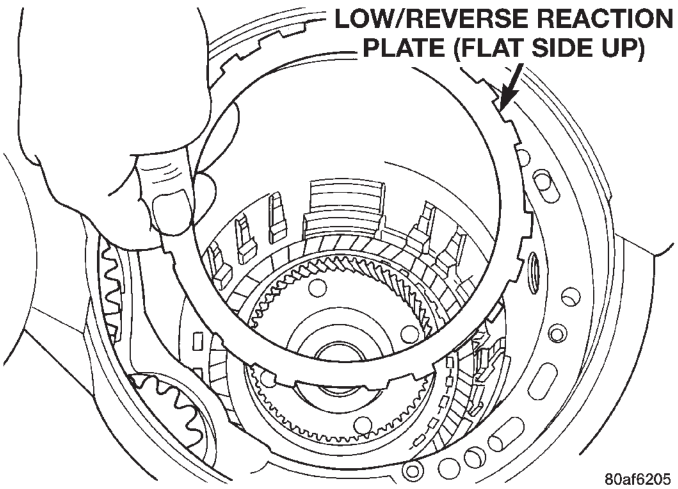


Fig. 114 Remove Low/Reverse Reaction Plate

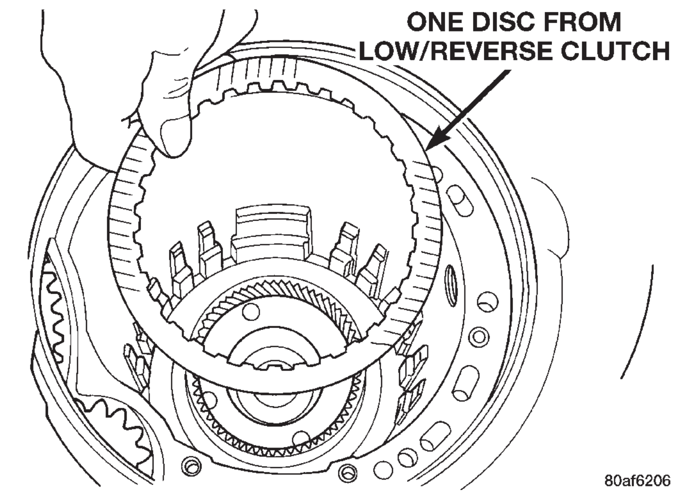


Fig. 115 Remove One Disc

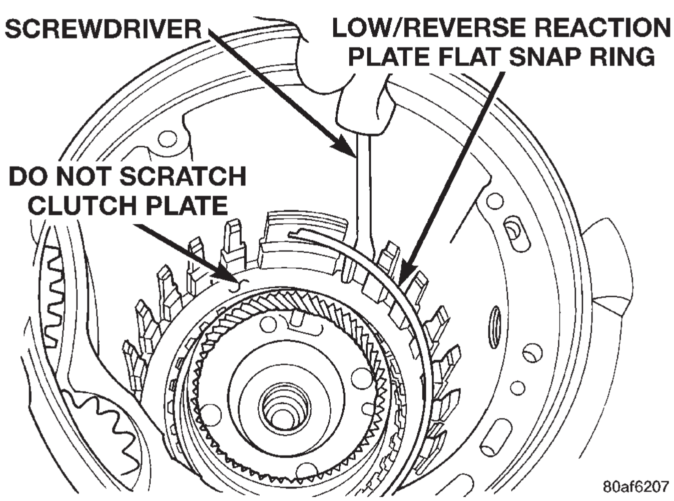


Fig. 116 Remove Low/Reverse Reaction Plate Snap Ring

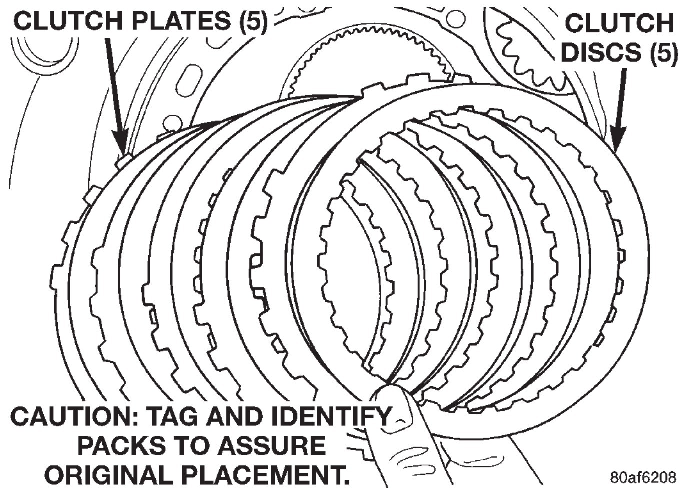


Fig. 117 Remove Low/Reverse Clutch Pack

NOTE: Tag low/reverse clutch pack for reassembly identification.

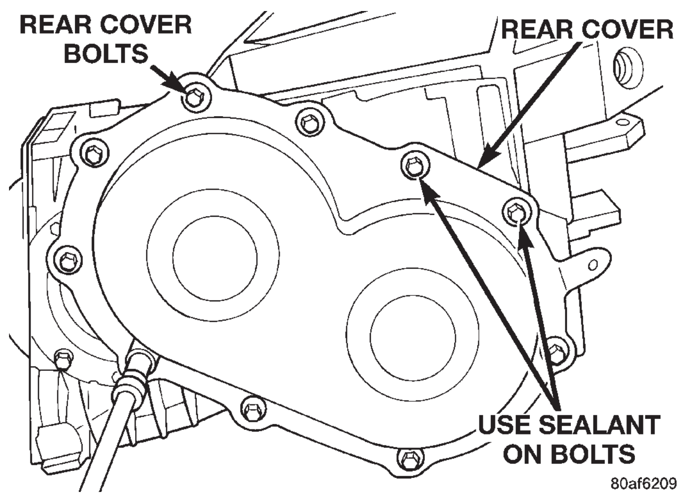


Fig. 118 Remove Rear Cover Bolts

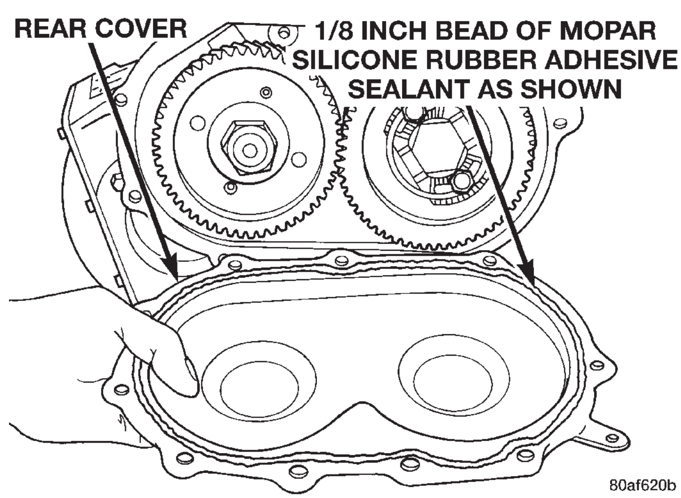


Fig. 119 Remove Rear Cover

DISASSEMBLY AND ASSEMBLY (Continued)

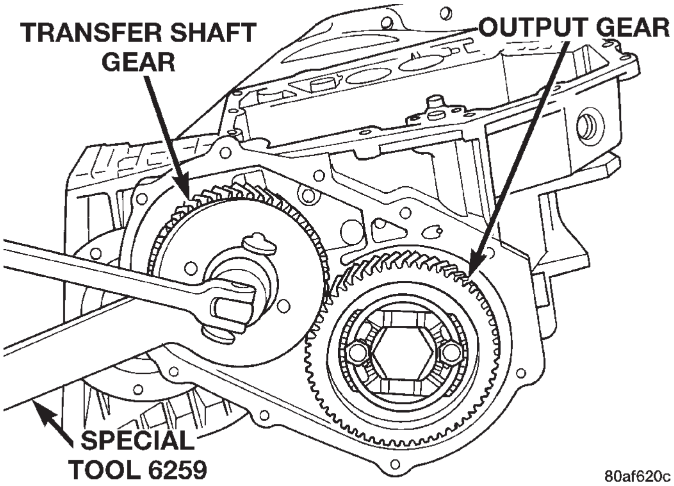


Fig. 120 Remove Transfer Shaft Gear Nut

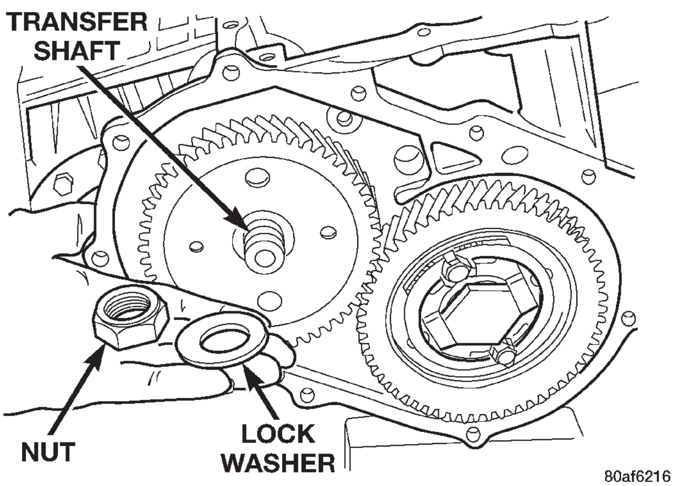


Fig. 121 Transfer Shaft Gear Nut and Coned Washer

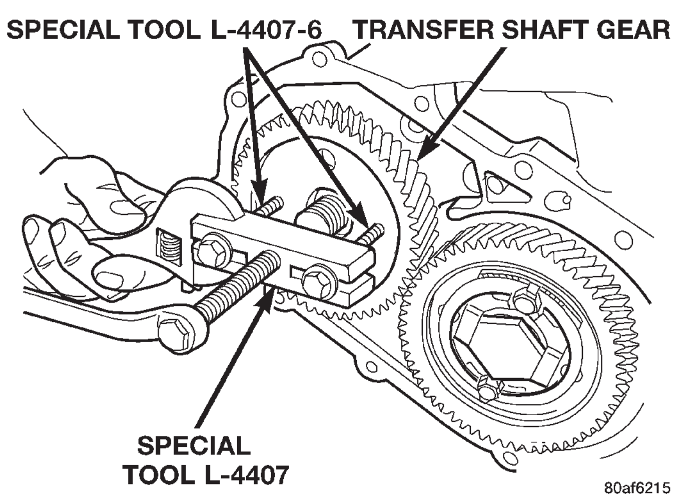


Fig. 122 Remove Transfer Shaft Gear

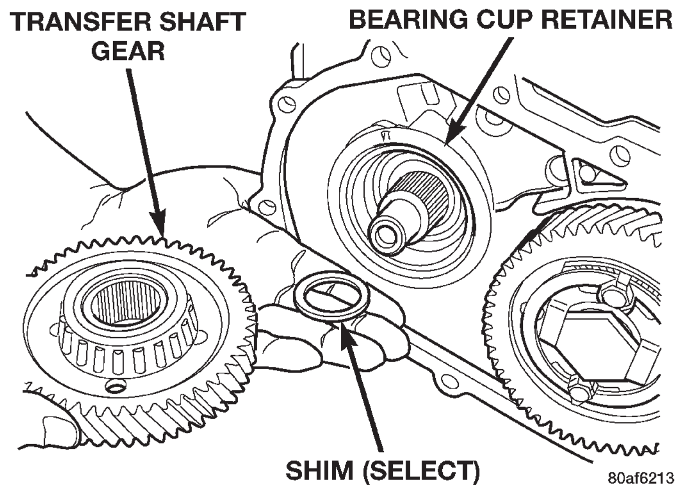


Fig. 123 Remove Transfer Shaft Gear and (Select) Shim

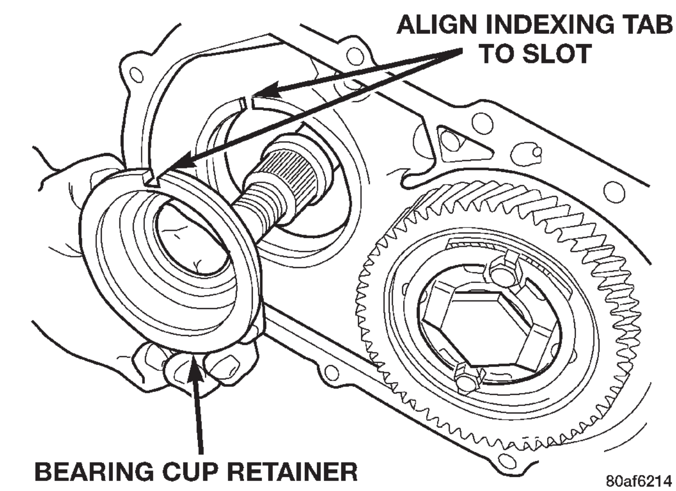


Fig. 124 Remove Bearing Cup Retainer

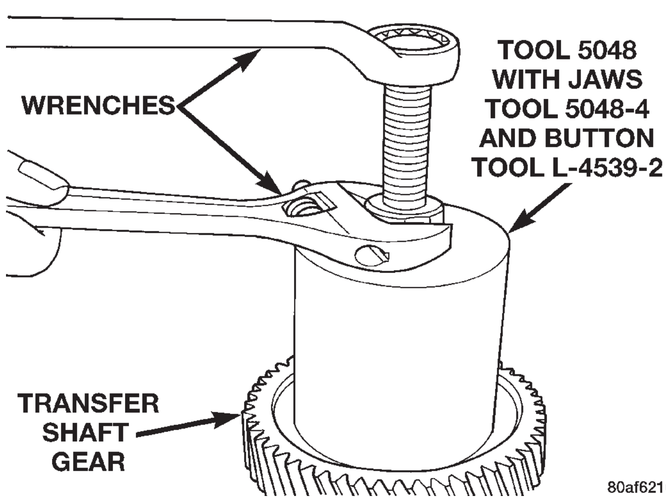


Fig. 125 Remove Transfer Gear Bearing Cone

DISASSEMBLY AND ASSEMBLY (Continued)

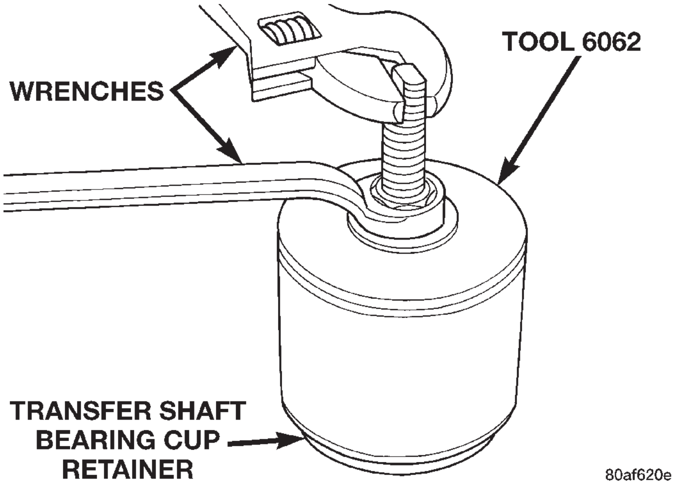


Fig. 126 Remove Transfer Shaft Bearing Cup

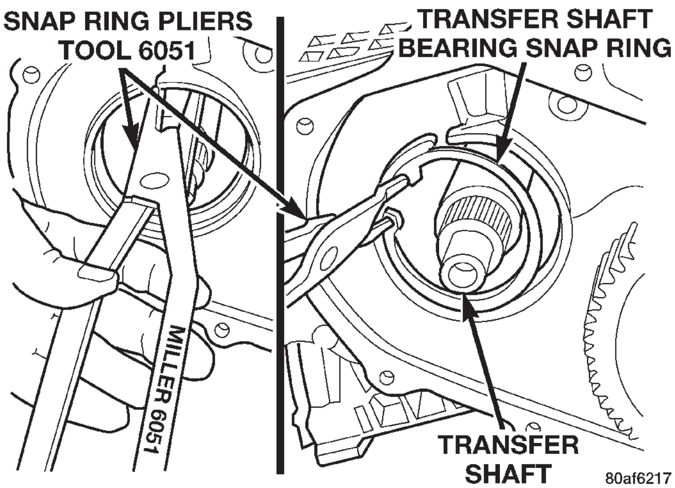


Fig. 127 Remove Transfer Shaft Bearing Snap Ring

NOTE: Screw Tool 5049-A onto transfer shaft. Remove transfer shaft.

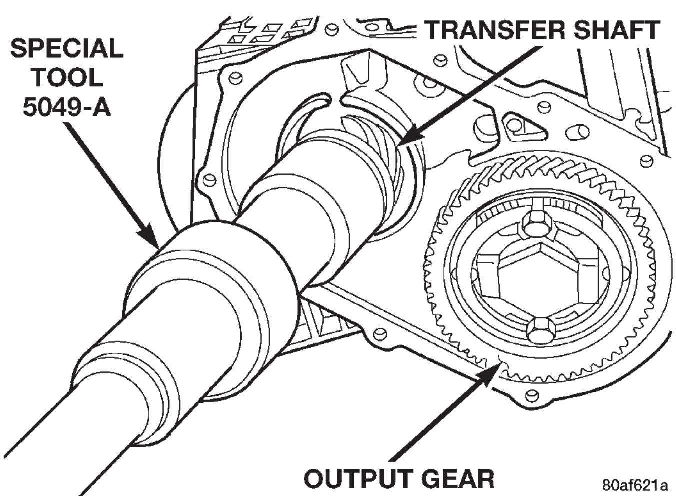


Fig. 128 Remove Transfer Shaft

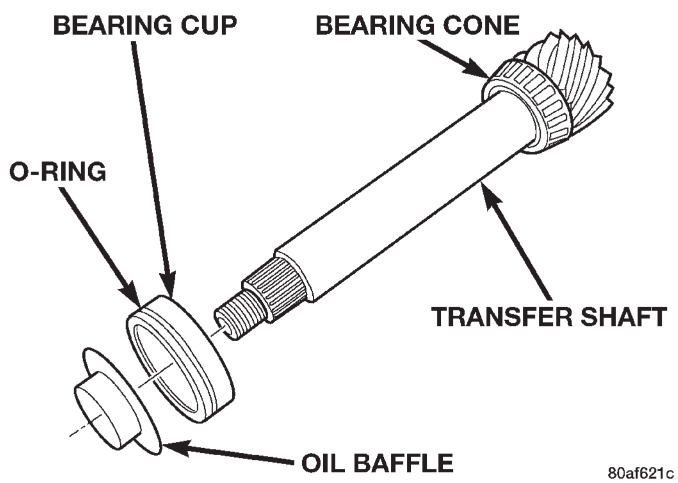


Fig. 129 Bearing Cup Removed

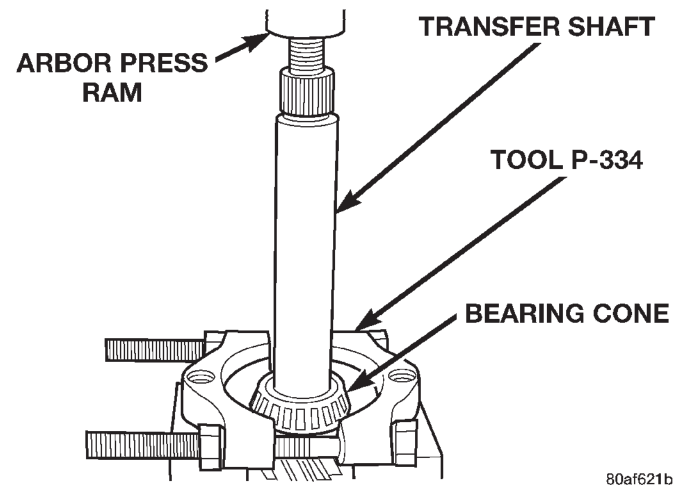


Fig. 130 Remove Transfer Shaft Bearing Cone

NOTE: Remove output gear stirrup and strap bolts.

All transaxles utilize a stirrup and retaining strap that is attached to the output gear. The stirrup prevents the output gear retaining bolt from turning and backing out of the rear carrier. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.

DISASSEMBLY AND ASSEMBLY (Continued)

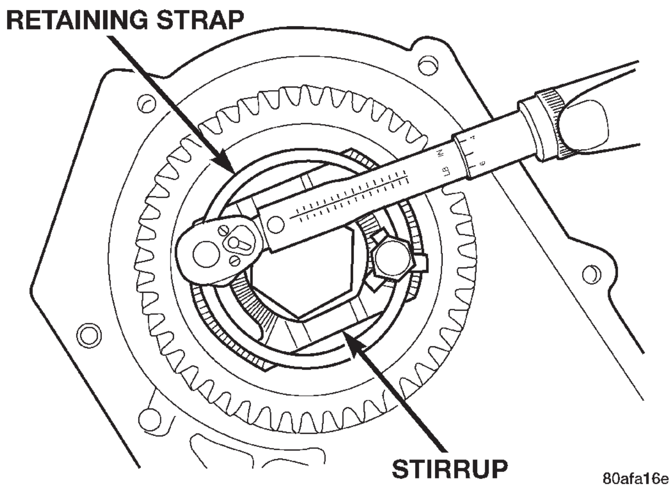


Fig. 131 Loosen Stirrup Strap Bolts

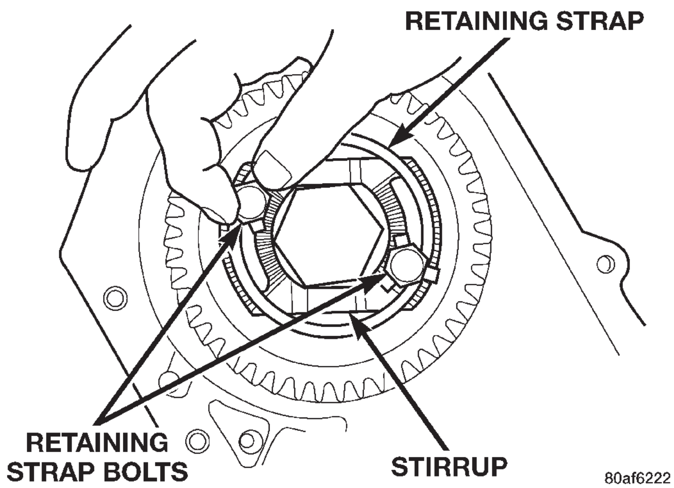


Fig. 132 Remove Strap Bolts

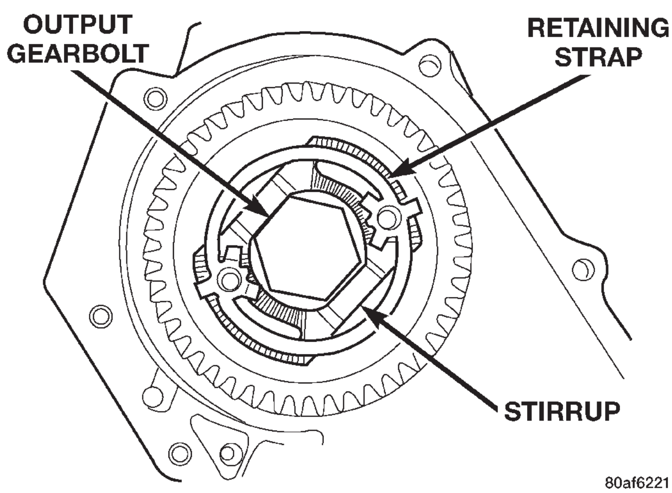


Fig. 133 Remove Stirrup Strap

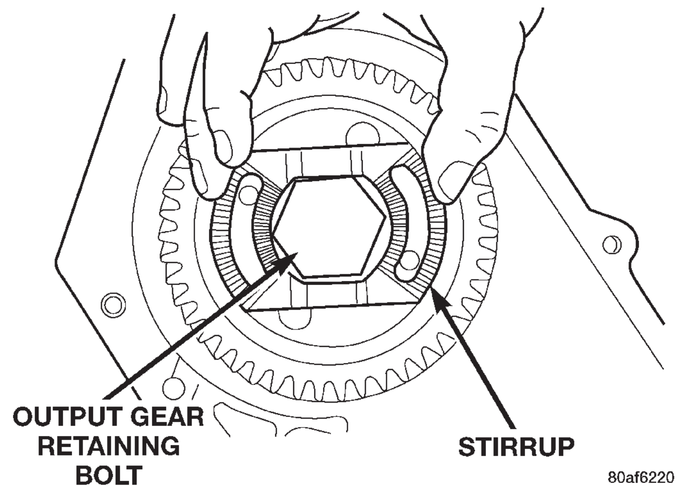


Fig. 134 Remove Stirrup

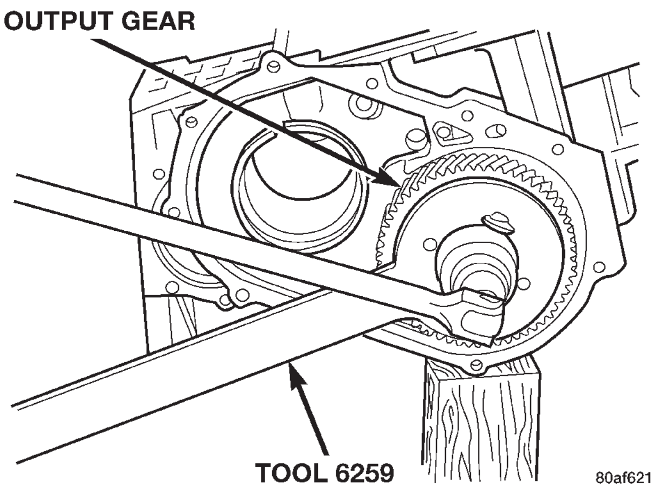


Fig. 135 Remove Output Gear Bolt

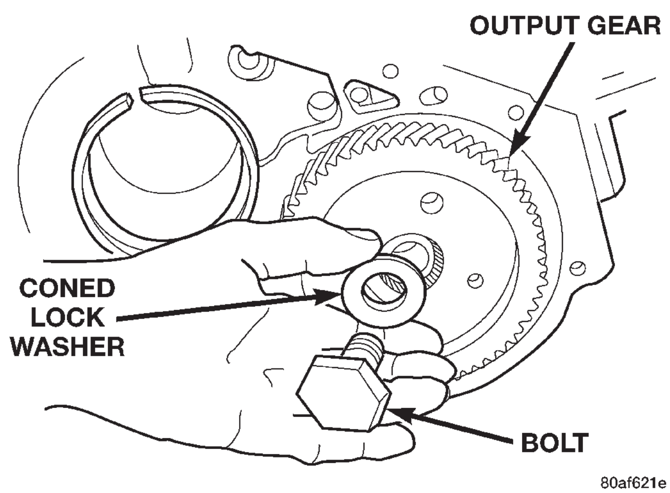


Fig. 136 Output Gear Bolt and Washer

DISASSEMBLY AND ASSEMBLY (Continued)

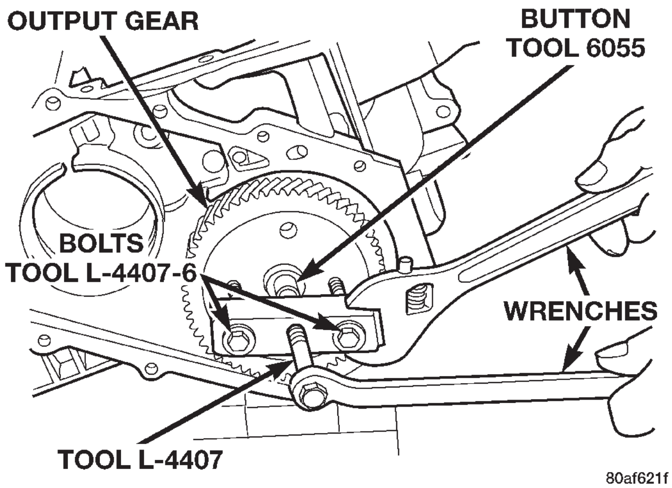


Fig. 137 Remove Output Gear

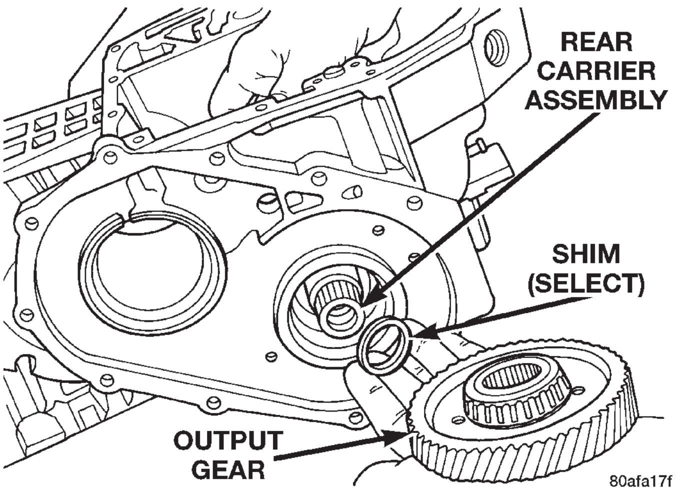


Fig. 138 Output Gear and (Select) Shim

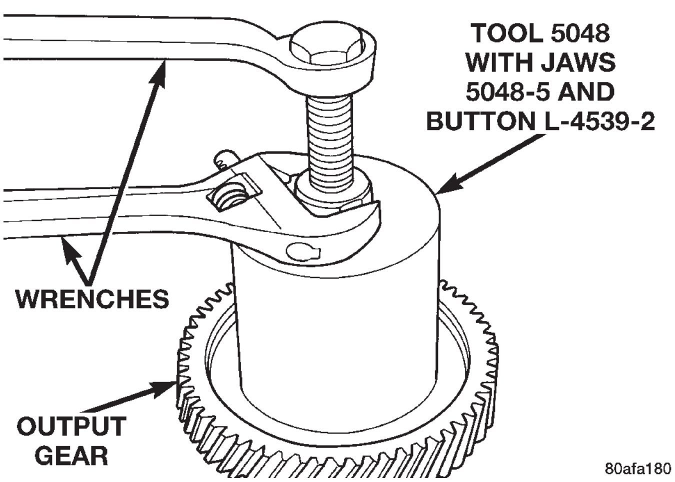


Fig. 139 Remove Bearing Cone

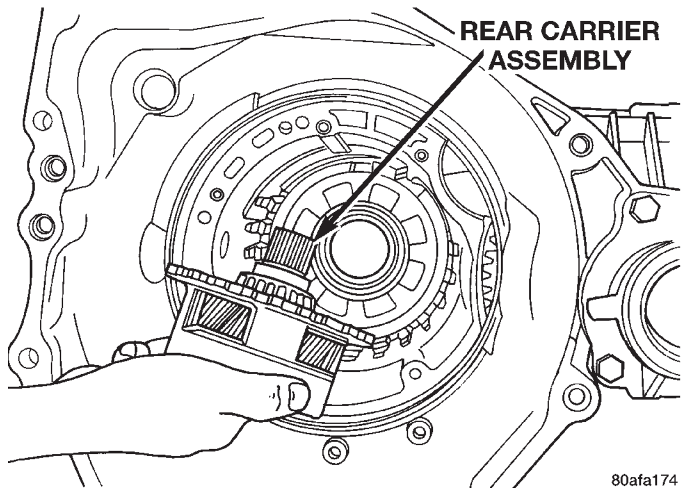


Fig. 140 Remove Rear Carrier Assembly

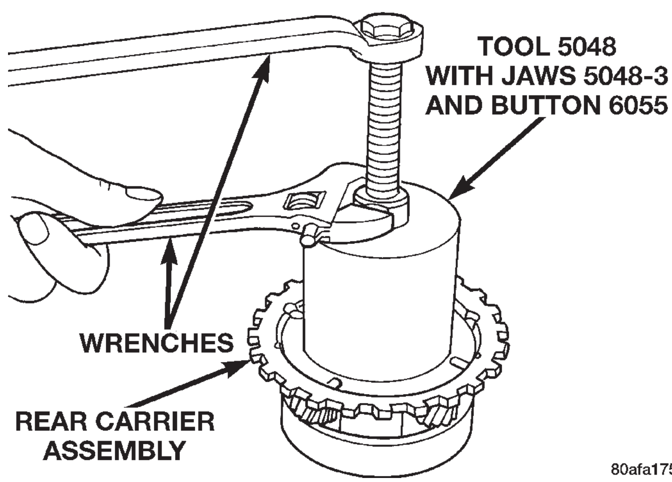


Fig. 141 Remove Rear Carrier Bearing Cone

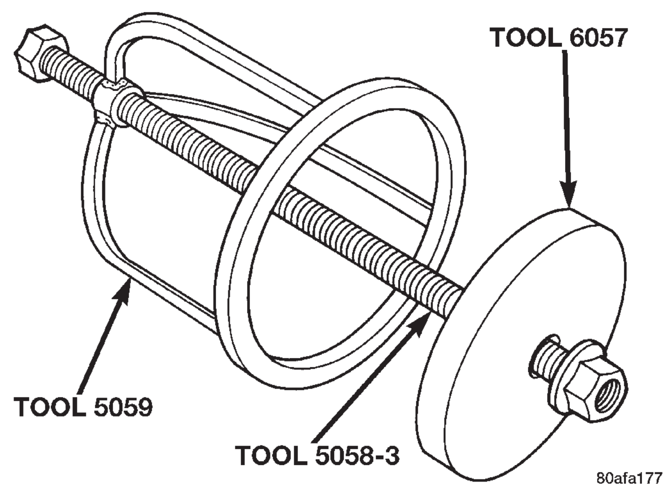


Fig. 142 Low/Reverse Spring Compressor Tool

DISASSEMBLY AND ASSEMBLY (Continued)

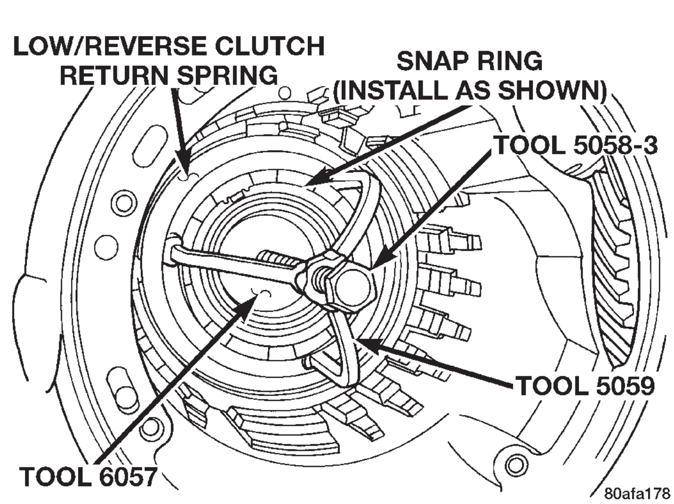


Fig. 143 Compressor Tool in Use

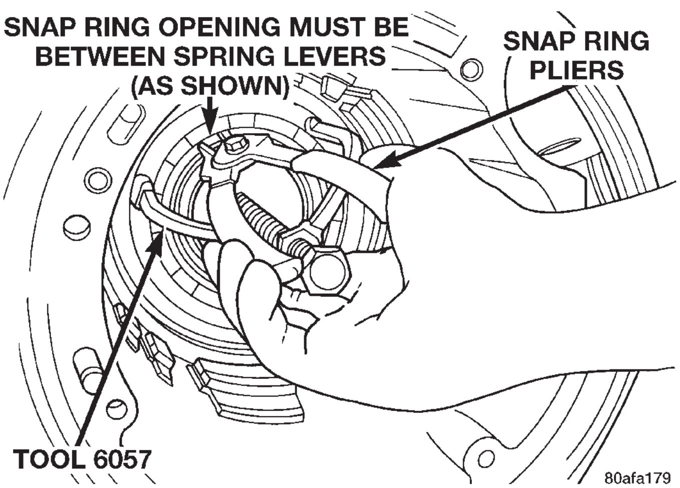


Fig. 144 Remove Snap Ring

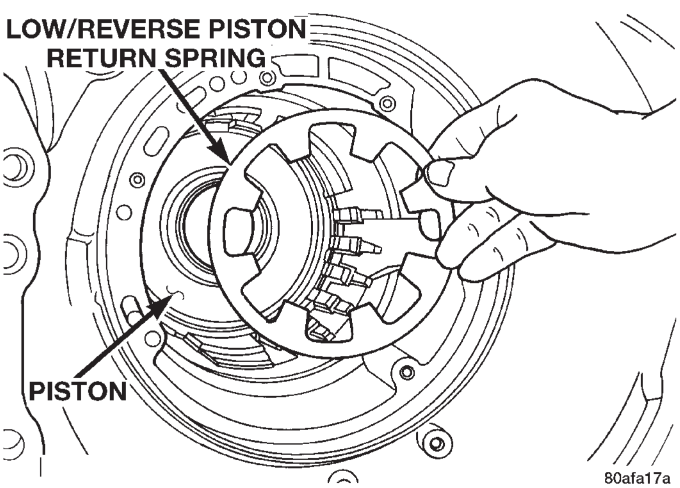


Fig. 145 Low/Reverse Piston Return Spring

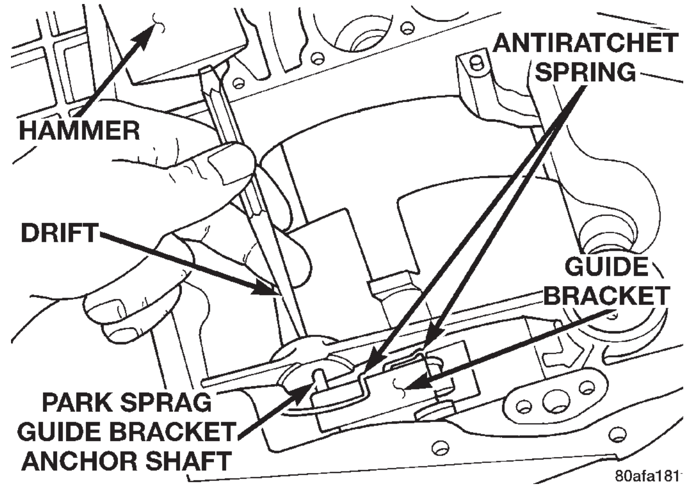


Fig. 146 Drive Out Anchor Shaft

CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.

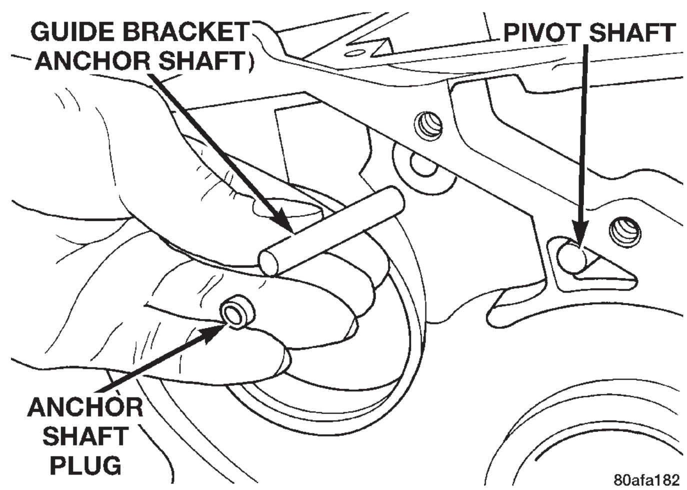


Fig. 147 Remove Anchor Shaft and Plug

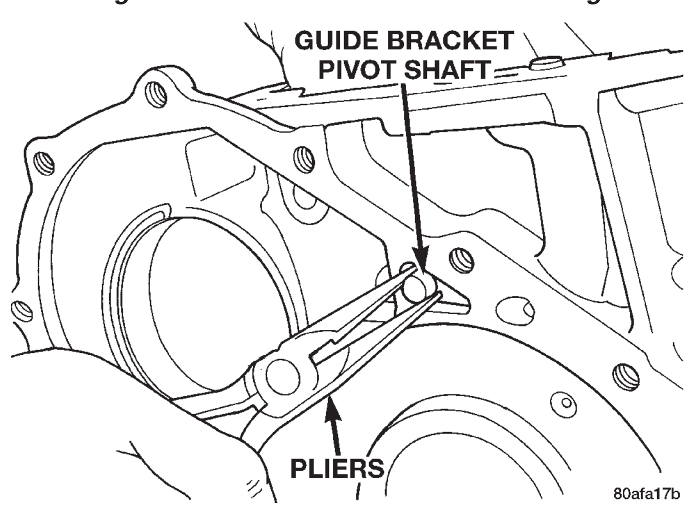


Fig. 148 Remove Guide Bracket Pivot Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

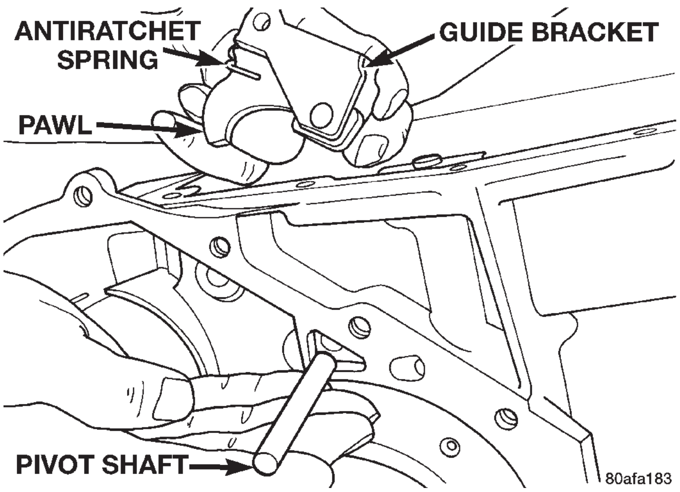


Fig. 149 Pivot Shaft and Guide Bracket

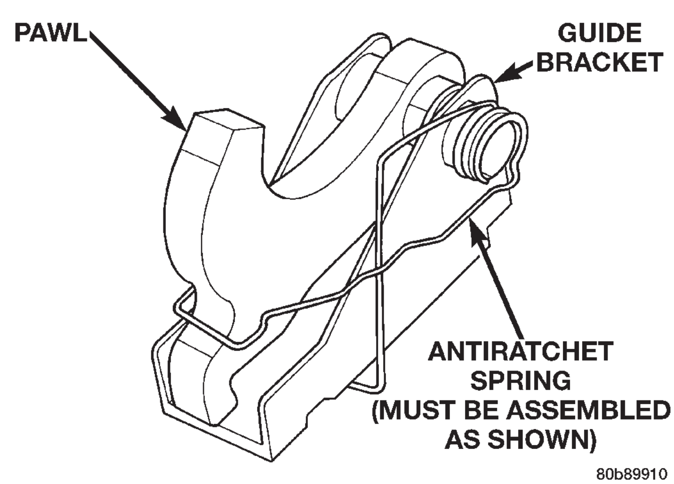


Fig. 150 Guide Bracket

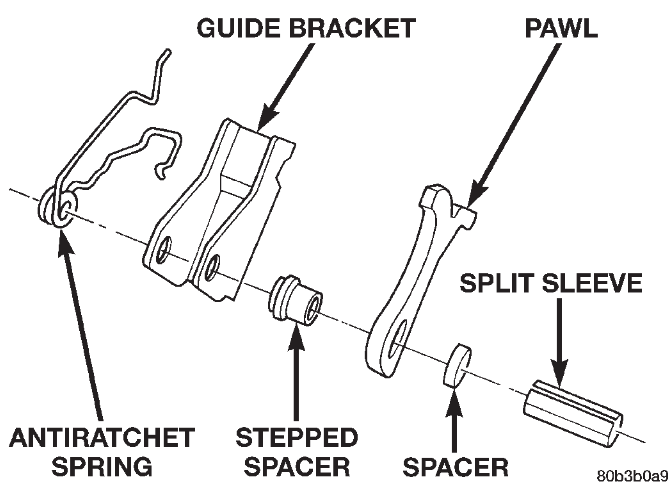


Fig. 151 Guide Bracket Disassembled

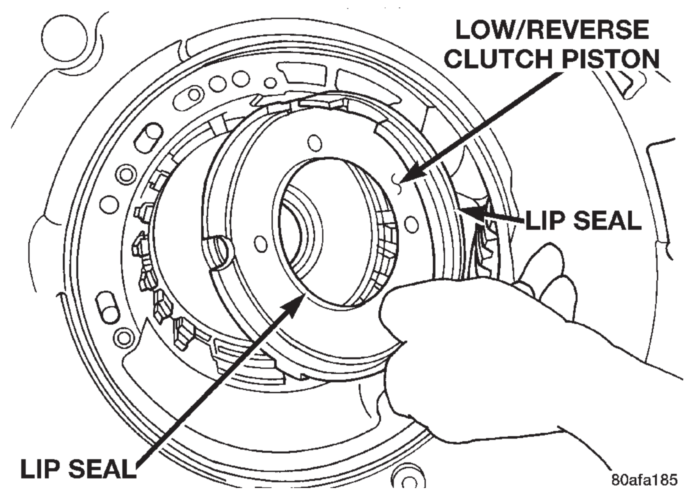


Fig. 152 Remove Low/Reverse Clutch Piston

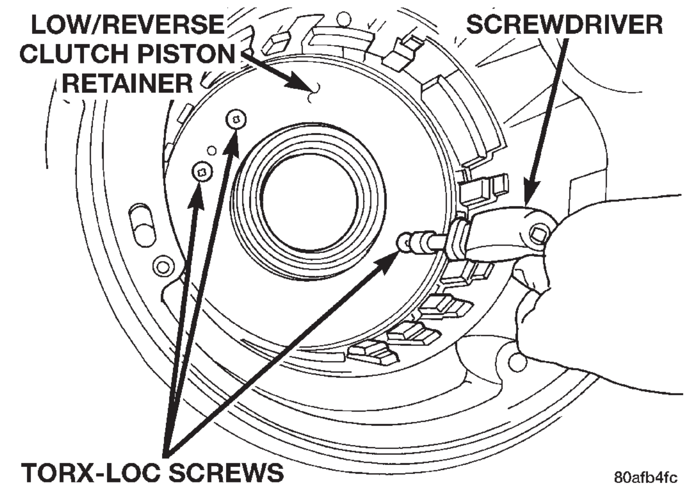


Fig. 153 Remove Piston Retainer Attaching Screws

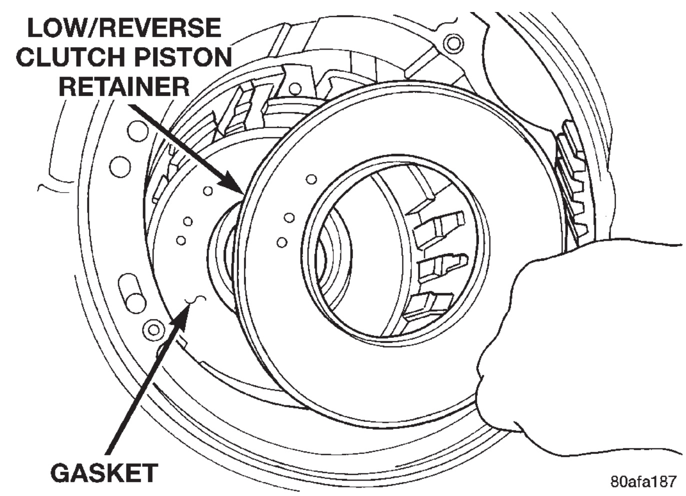


Fig. 154 Remove Piston Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

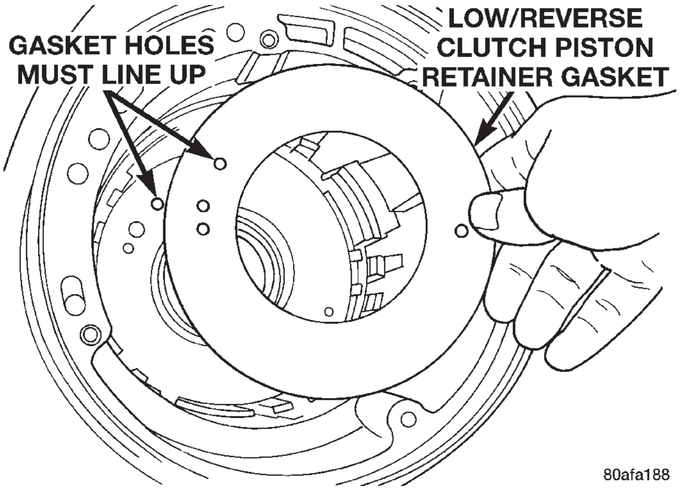


Fig. 155 Remove Piston Retainer Gasket

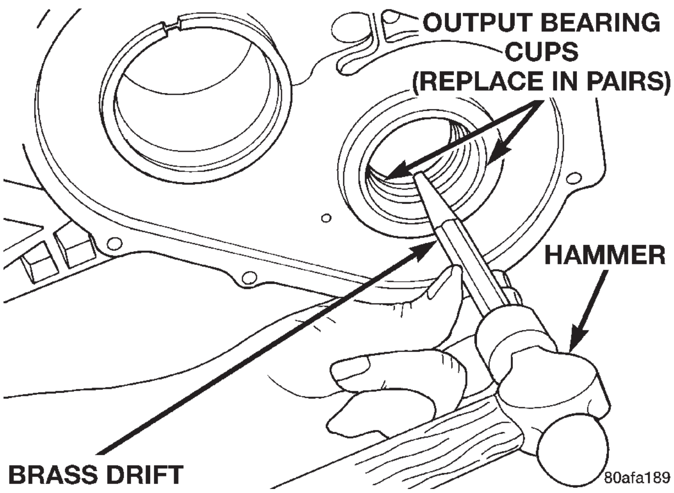


Fig. 156 Remove Output Bearing Inner Cup

CAUTION: Drift bearing cup all the way around.

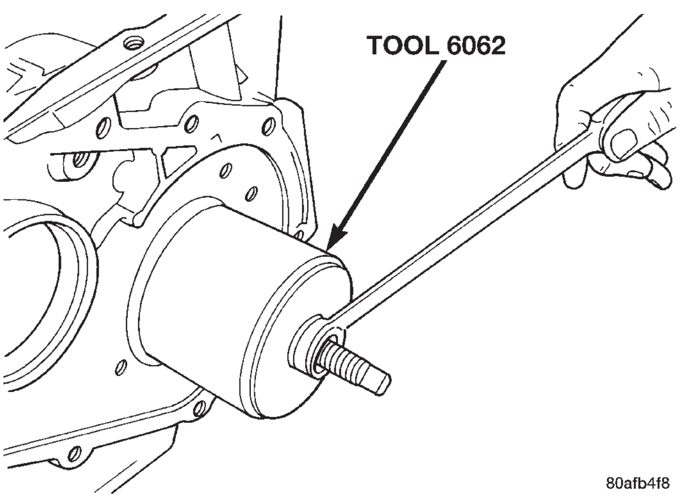


Fig. 157 Remove Output Bearing Outer Cup

This concludes the disassemble of the transaxle centerline. To disassemble the input clutch assembly, refer to Input Clutches-Recondition.

INPUT CLUTCHES-RECONDITION

DISASSEMBLY

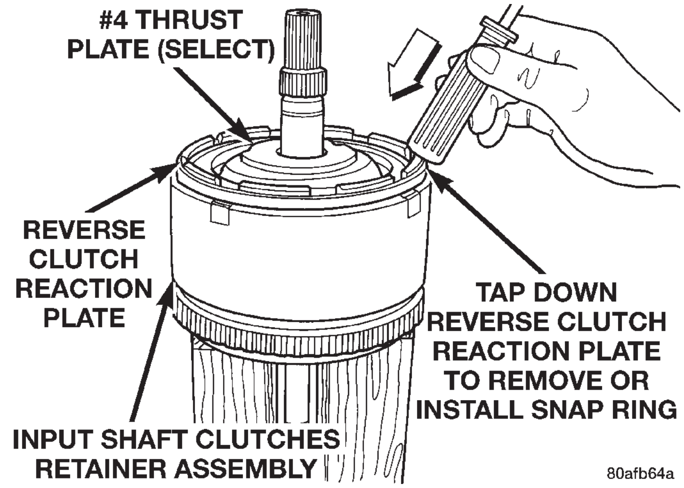


Fig. 158 Tapping Reaction Plate

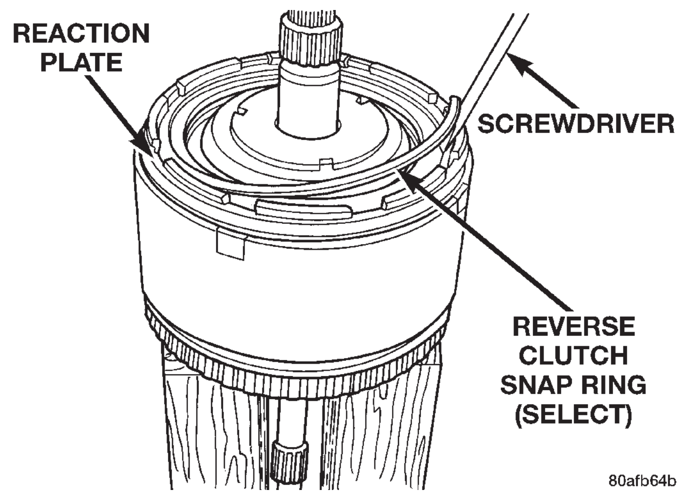


Fig. 159 Reverse Clutch Snap Ring

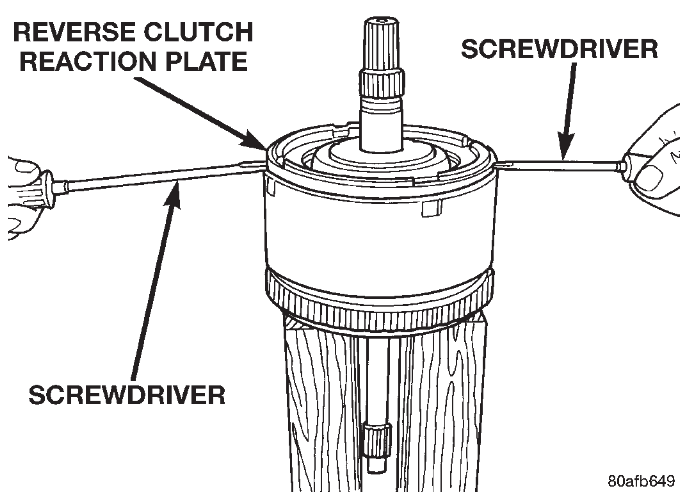


Fig. 160 Pry Reverse Clutch Reaction Plate

DISASSEMBLY AND ASSEMBLY (Continued)

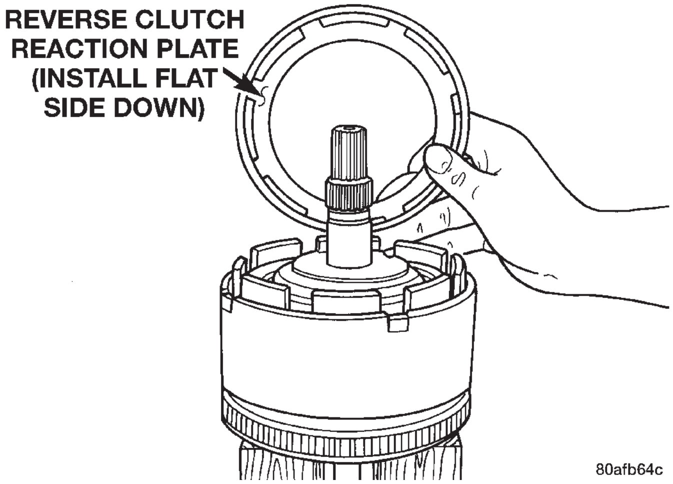


Fig. 161 Reverse Clutch Reaction Plate

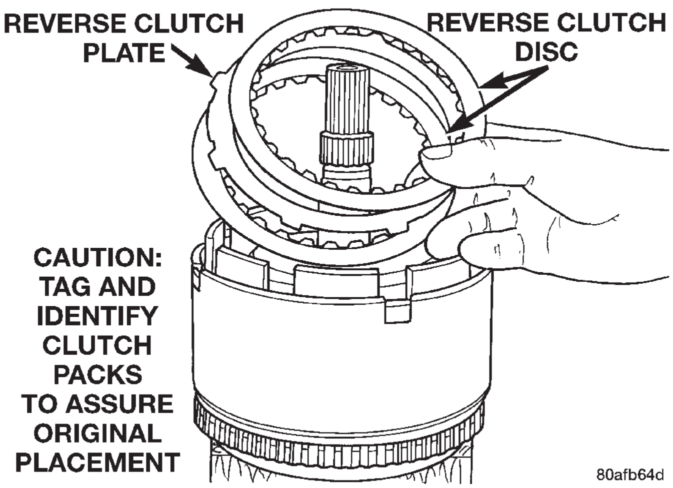


Fig. 162 Reverse Clutch Pack

NOTE: Tag reverse clutch pack for reassembly identification.

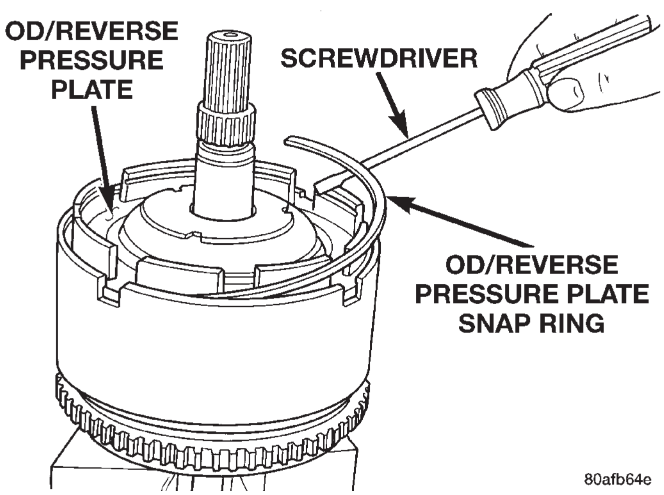


Fig. 163 OD/Reverse Pressure Plate Snap Ring

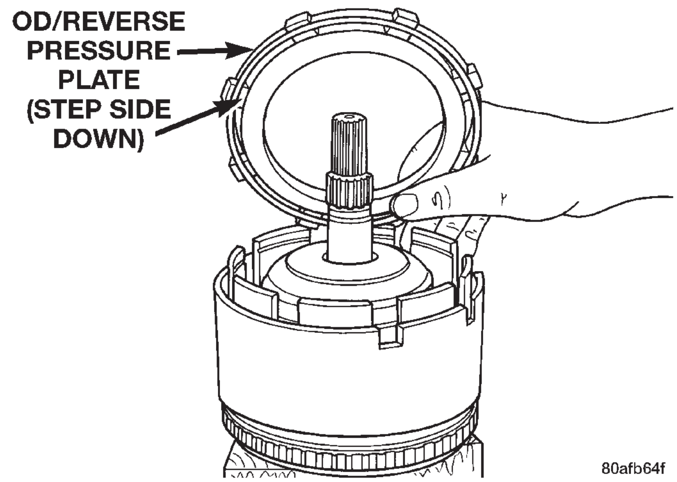


Fig. 164 OD/Reverse Pressure Plate

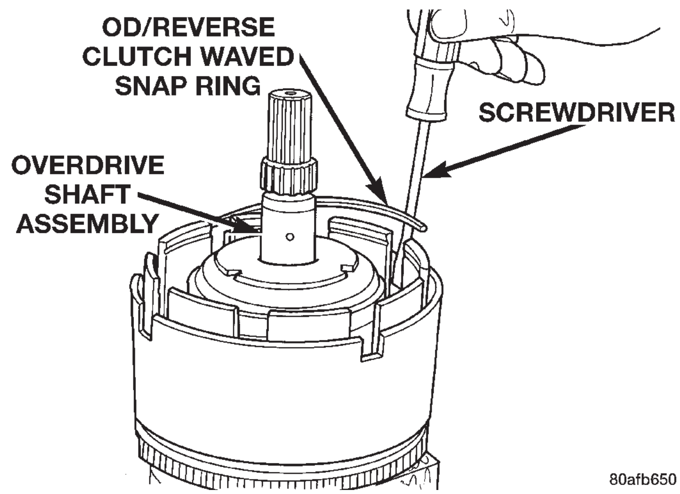


Fig. 165 Waved Snap Ring

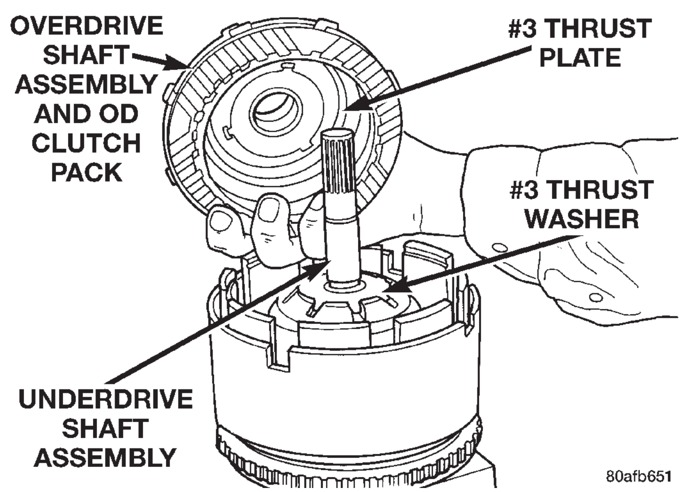


Fig. 166 Remove OD Clutch Pack

DISASSEMBLY AND ASSEMBLY (Continued)

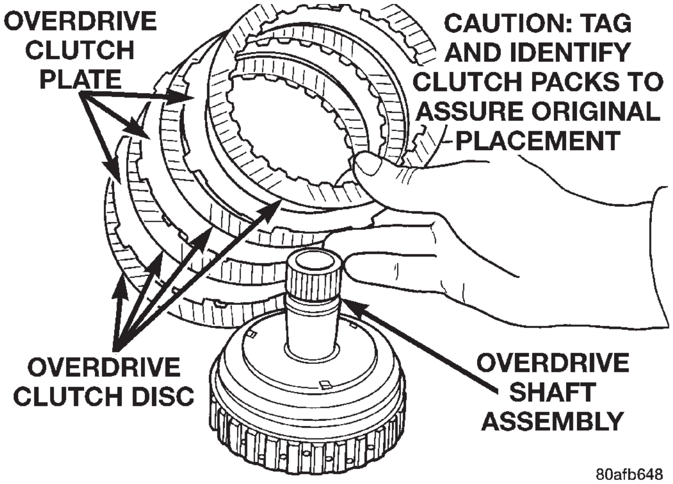


Fig. 167 Overdrive Clutch Pack

NOTE: Tag overdrive clutch pack for reassembly identification.

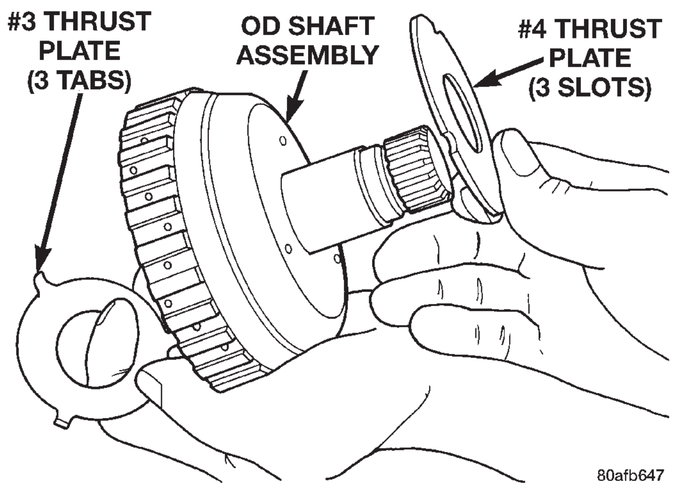


Fig. 168 Overdrive Shaft Assembly

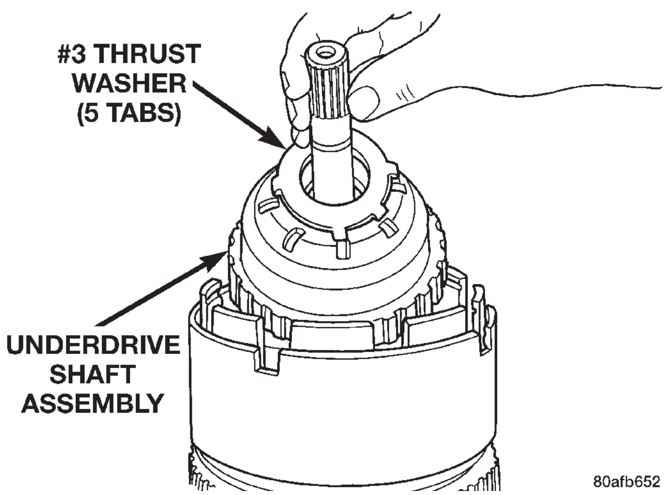


Fig. 169 Underdrive Shaft Assembly

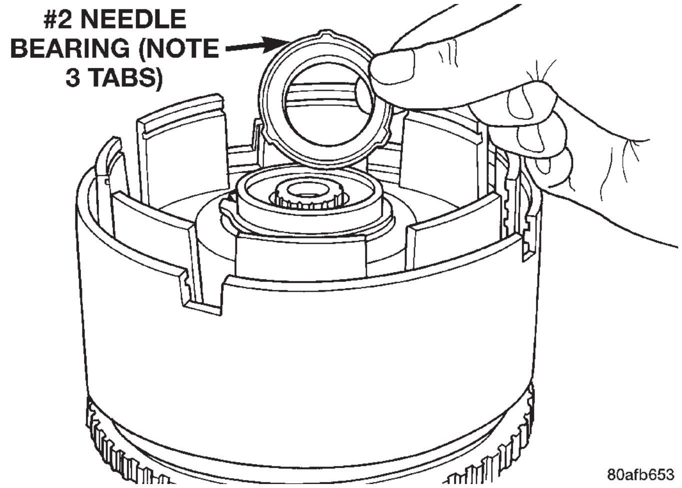


Fig. 170 No. 2 Needle Bearing

NOTE: The OD/UD Reaction Plate, Snap Rings, and Input Clutches Retainer is not interchangeable with previous year 41TE components. The snap rings are thicker and the position of the ring lands have changed.

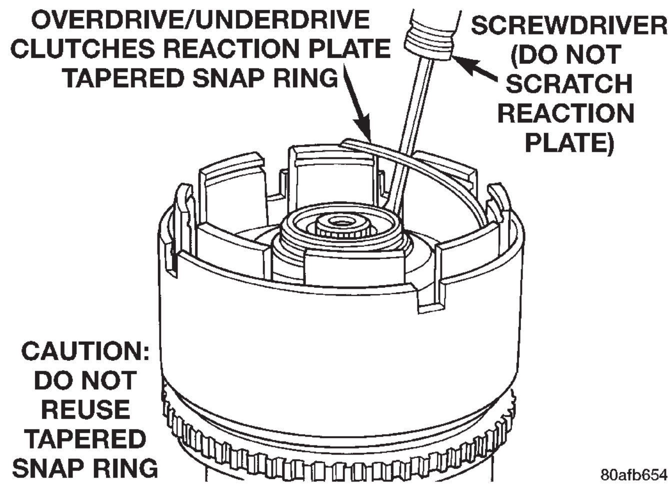


Fig. 171 OD/UD Reaction Plate Tapered Snap Ring

NOTE: The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

DISASSEMBLY AND ASSEMBLY (Continued)

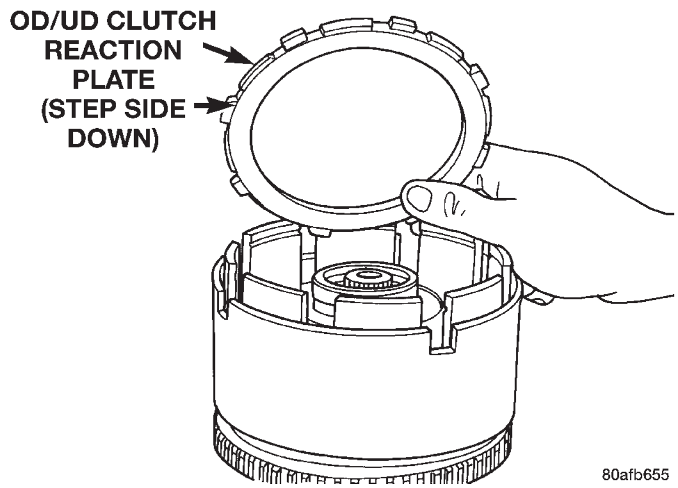


Fig. 172 OD/UD Reaction Plate

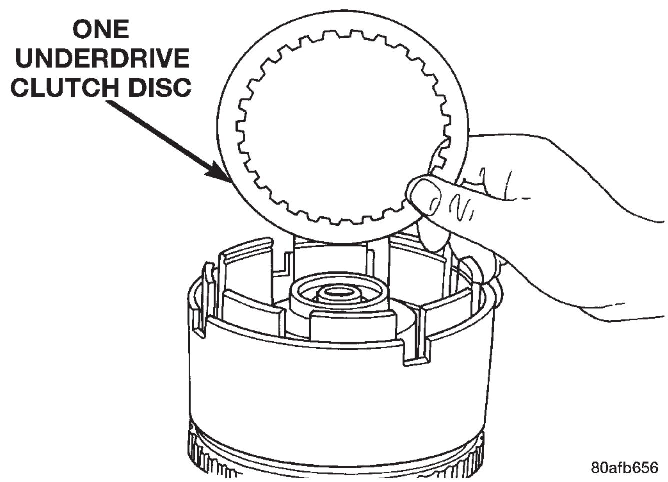


Fig. 173 Remove One UD Clutch Disc

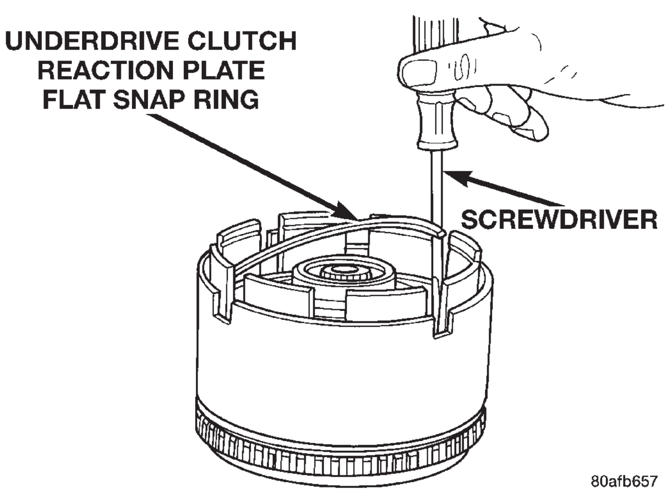


Fig. 174 UD Clutch Flat Snap Ring

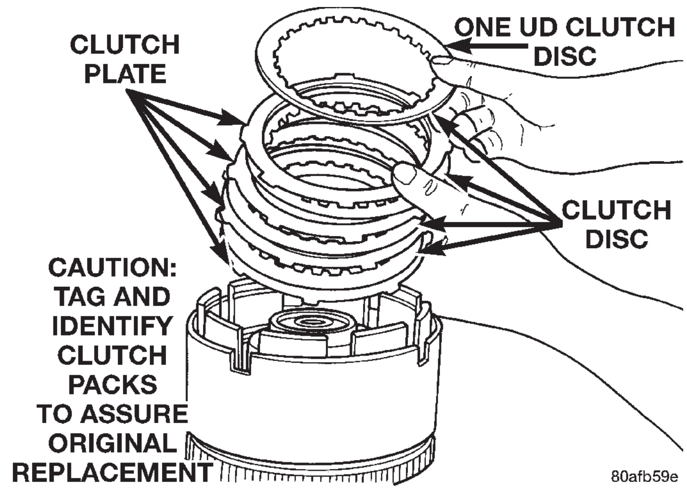


Fig. 175 Underdrive Clutch Pack

NOTE: Tag underdrive clutch pack for reassembly identification.

CAUTION: Compress return spring just enough to remove or install snap ring.

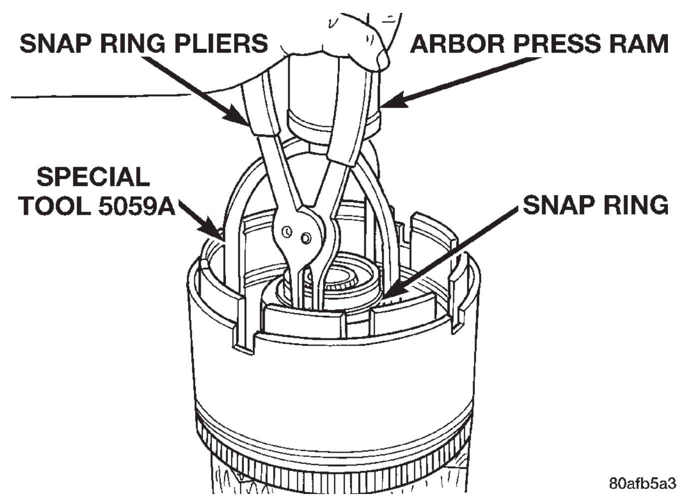


Fig. 176 UD Spring Retainer Snap Ring

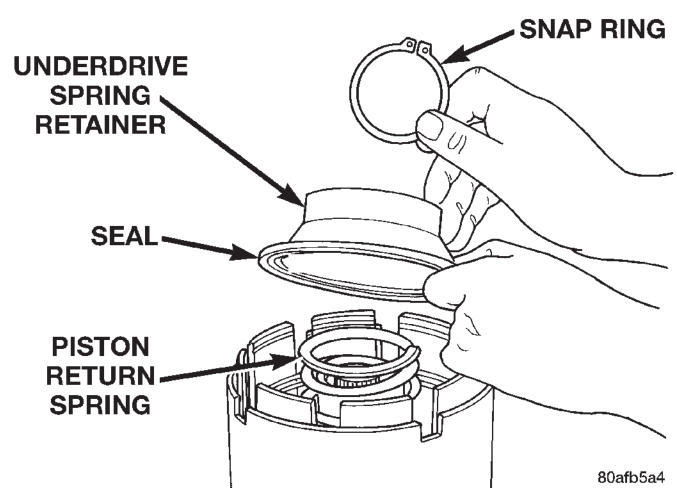


Fig. 177 UD Return Spring and Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

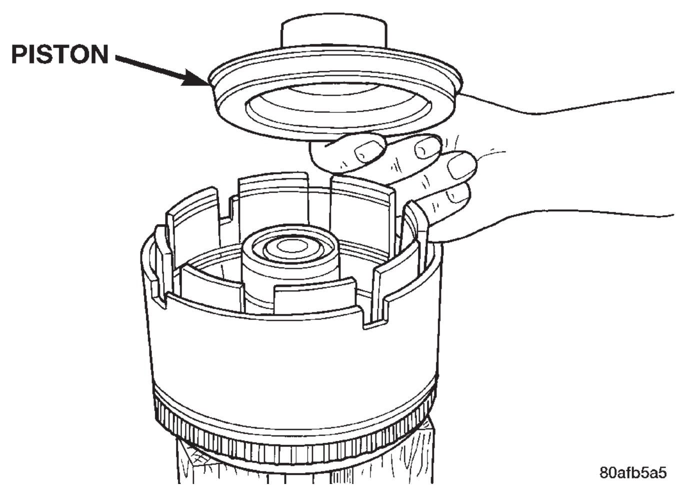


Fig. 178 Underdrive Clutch Piston

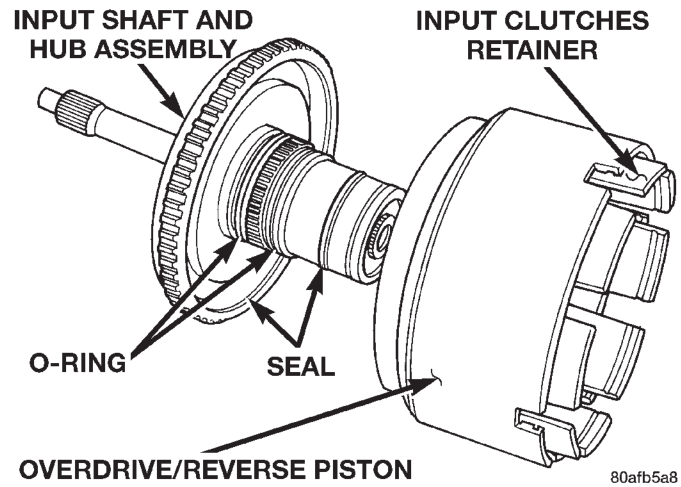


Fig. 181 Input Hub Removed

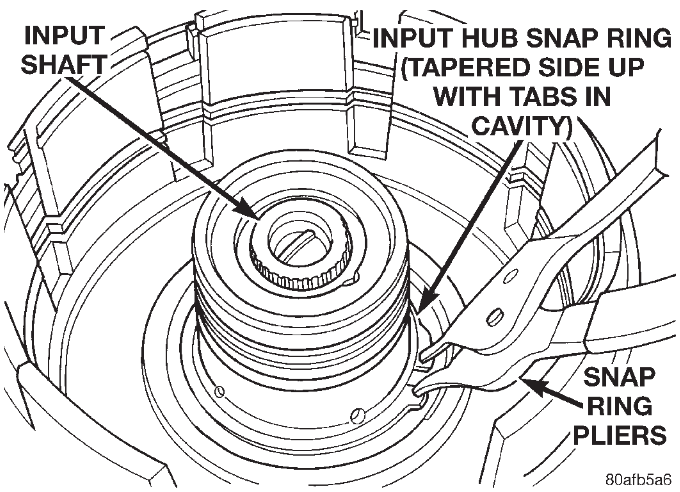


Fig. 179 Input Hub Tapered Snap Ring

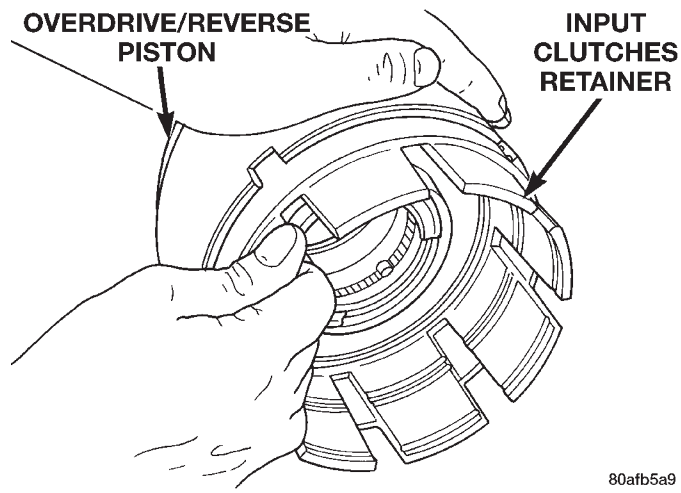


Fig. 182 Pull Retainer from Piston

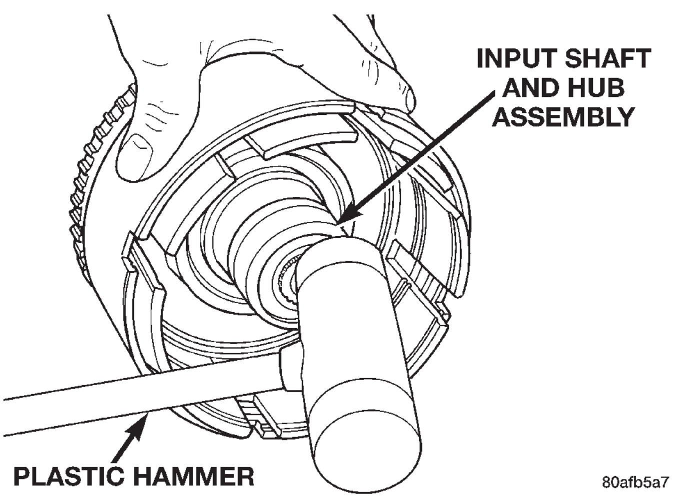


Fig. 180 Tap on Input Hub

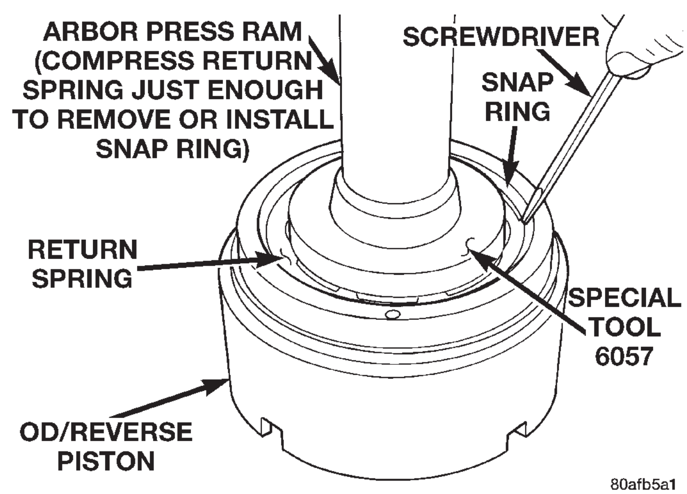


Fig. 183 Remove Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

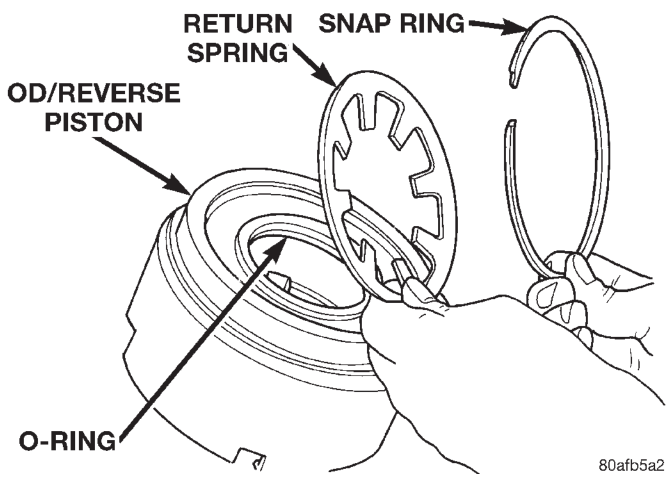


Fig. 184 Snap Ring and Return Spring

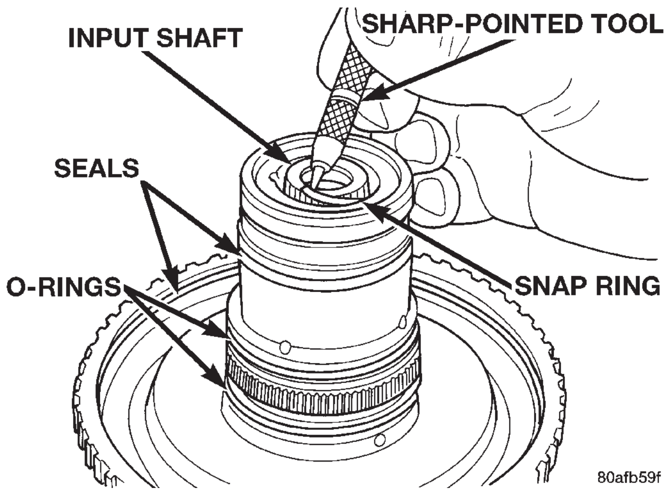


Fig. 185 Remove Input Shaft Snap Ring

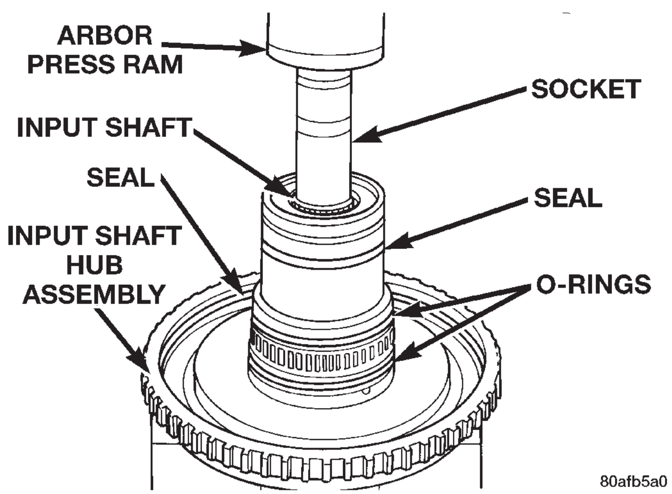


Fig. 186 Remove Input Shaft

ASSEMBLY

Use petrolatum on all seals to ease assembly of components.

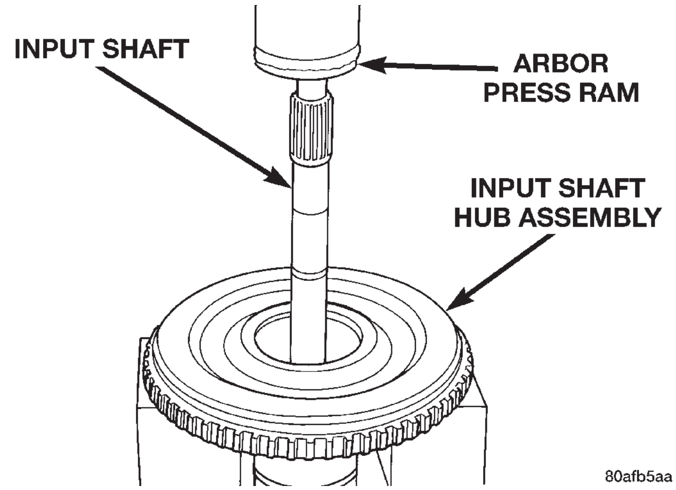


Fig. 187 Install Input Shaft

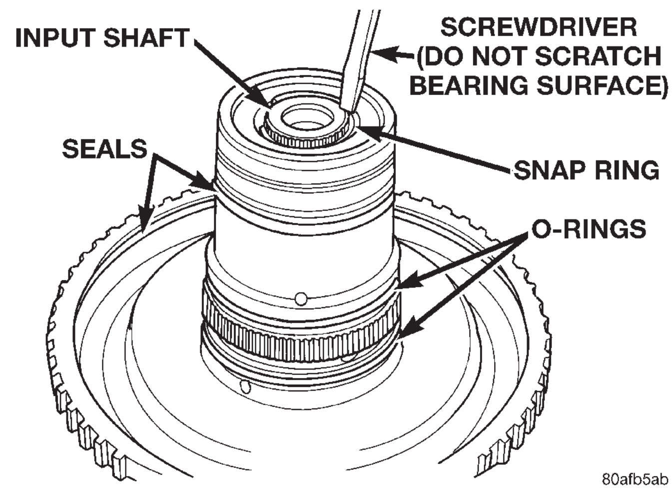


Fig. 188 Install Input Shaft Snap Ring

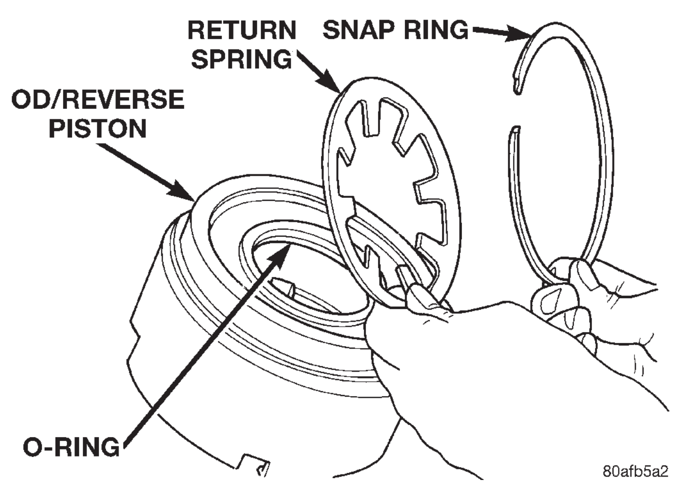


Fig. 189 Return Spring and Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

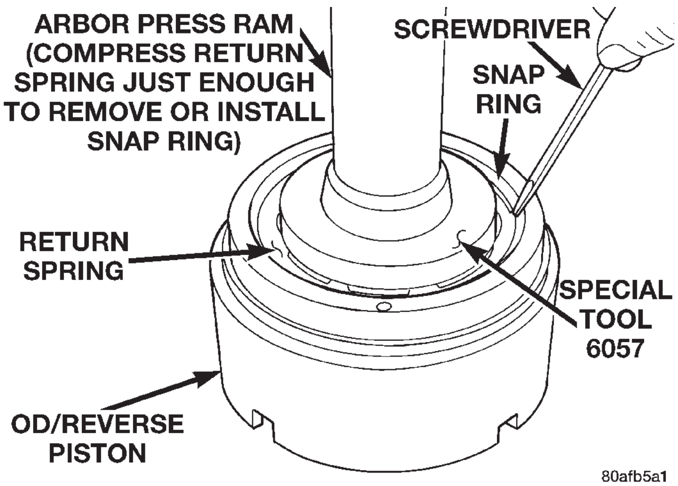


Fig. 190 Install Snap Ring

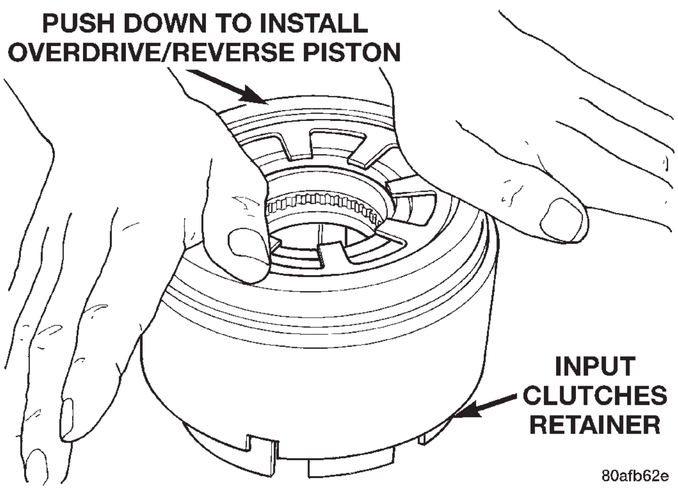


Fig. 191 Install OD/Reverse Piston

NOTE: The OD/UD Reaction Plate, Snap Rings, and Input Clutches Retainer is not interchangeable with previous year 41TE components. The snap rings are thicker and the position of the ring lands have changed.

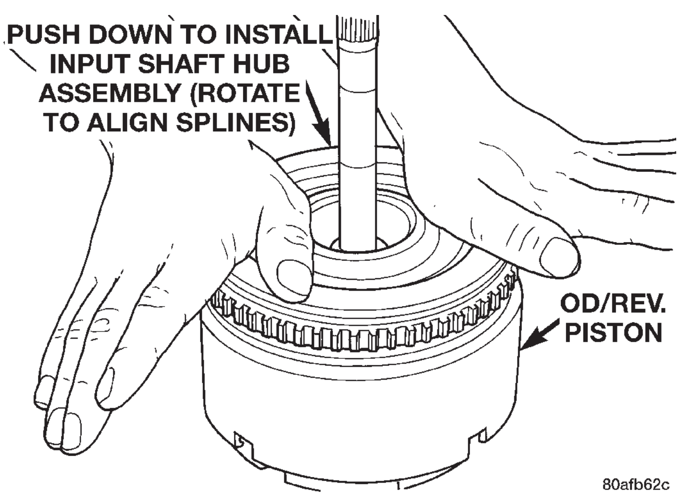


Fig. 192 Install Input Shaft Hub Assembly

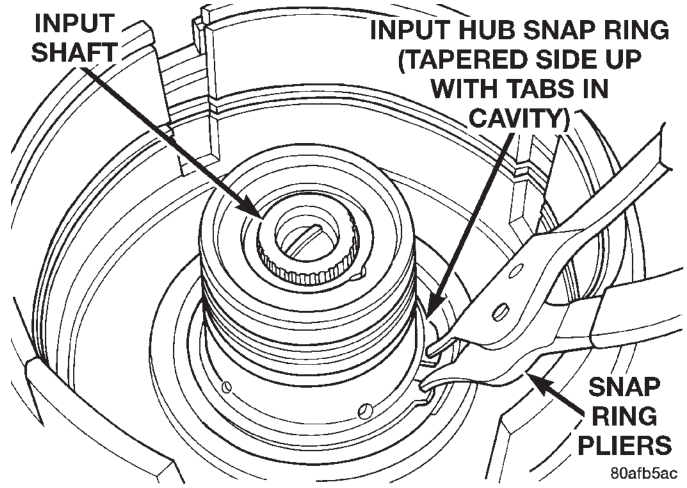


Fig. 193 Install Input Hub Tapered Snap Ring

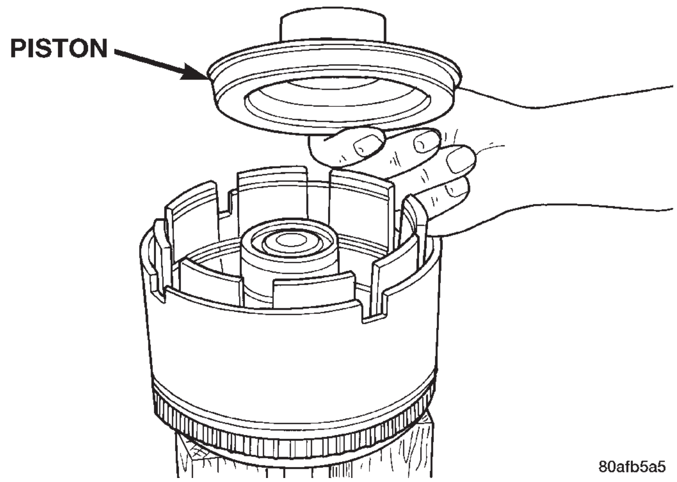


Fig. 194 Underdrive Clutch Piston

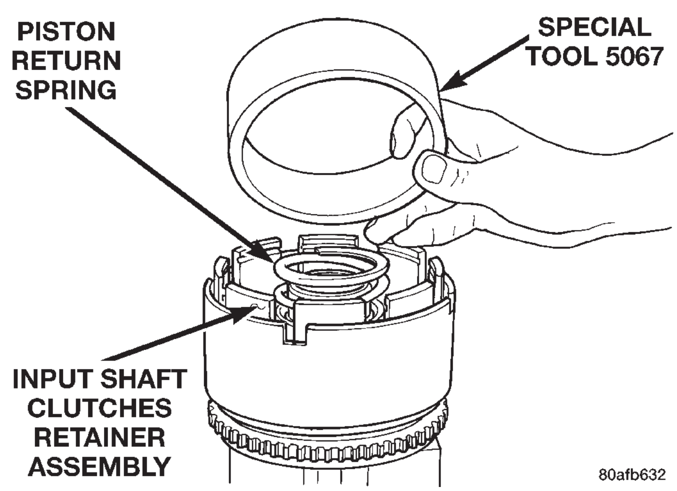


Fig. 195 Seal Compressor Special Tool 5067

DISASSEMBLY AND ASSEMBLY (Continued)

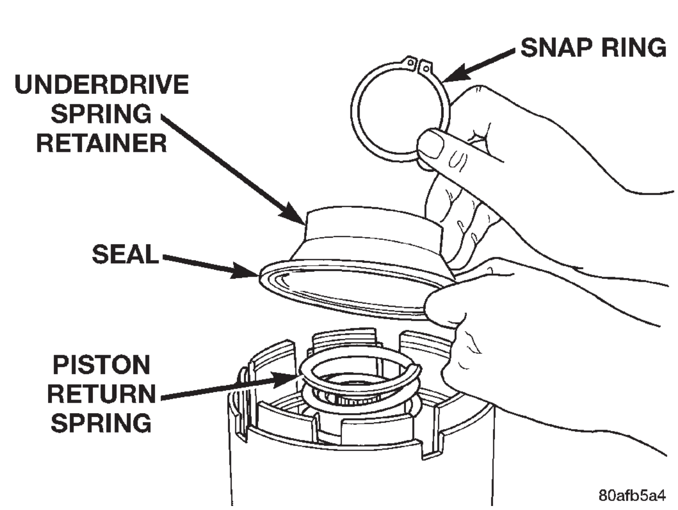


Fig. 196 UD Return Spring and Retainer

CAUTION: Compress return spring just enough to remove or install snap ring.

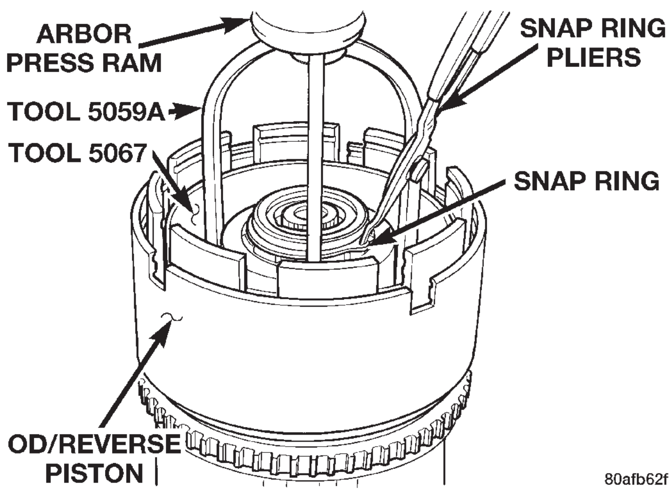


Fig. 197 Install UD Spring Retainer and Snap Ring

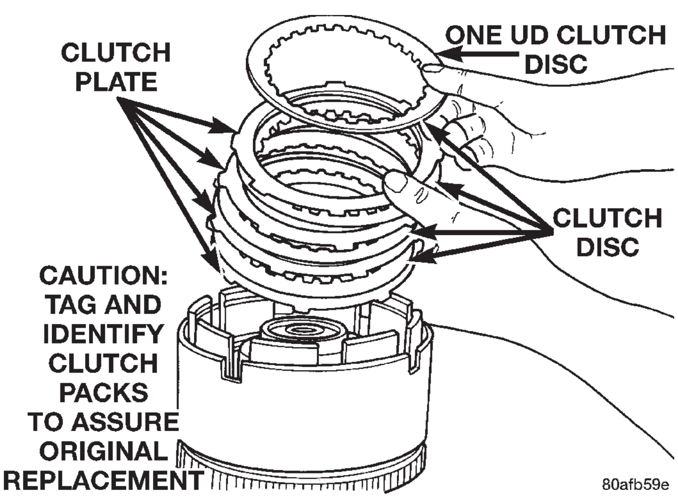


Fig. 198 Underdrive Clutch Pack

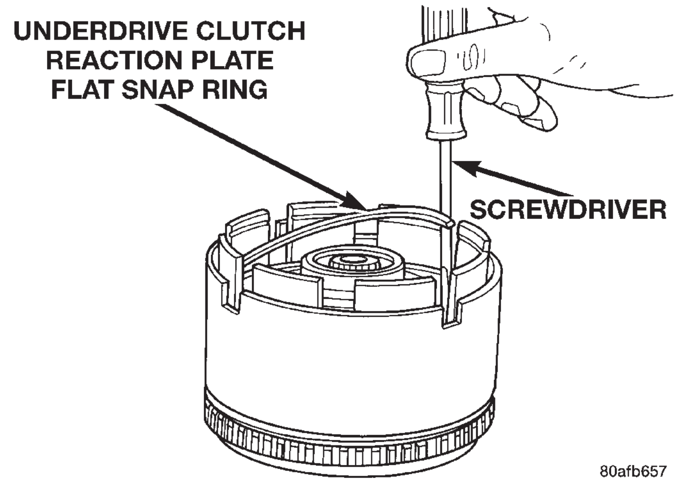


Fig. 199 UD Clutch Flat Snap Ring

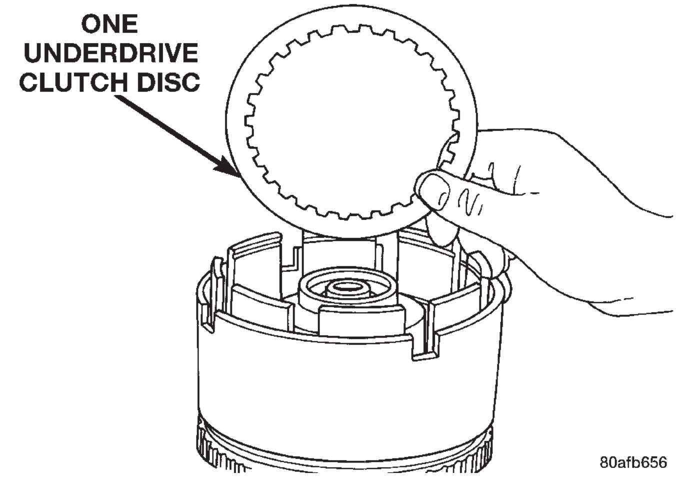


Fig. 200 Install Last UD Clutch Disc

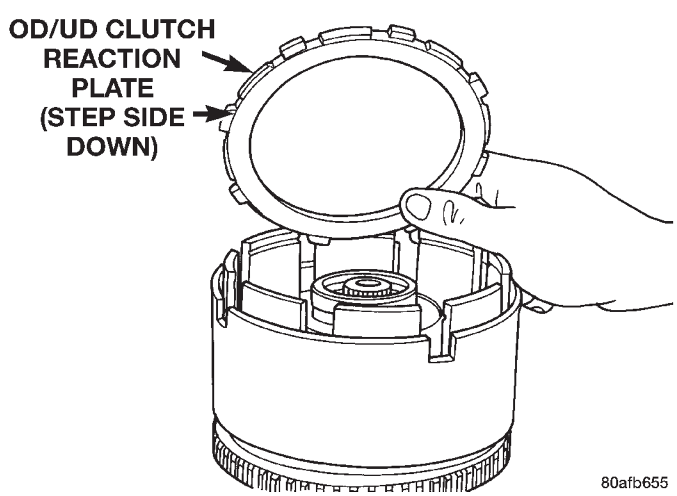


Fig. 201 OD/UD Reaction Plate

DISASSEMBLY AND ASSEMBLY (Continued)

The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

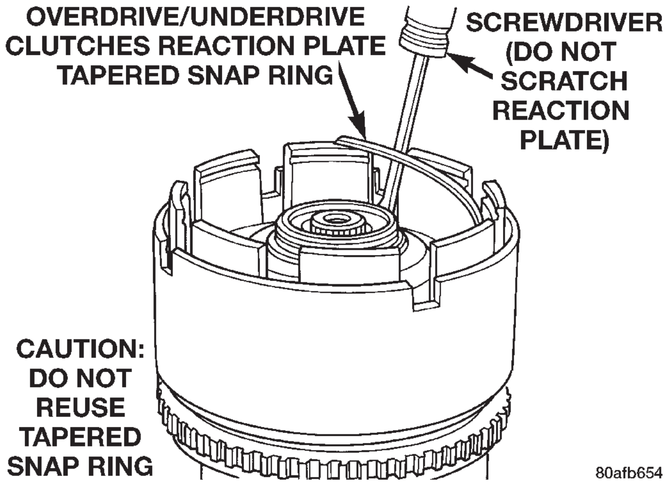


Fig. 202 Tapered Snap Ring

NOTE: Snap ring ends must be located within one finger of the input clutch hub. Be sure that snap ring is fully seated, by pushing with screwdriver, into snap ring groove all the way around.

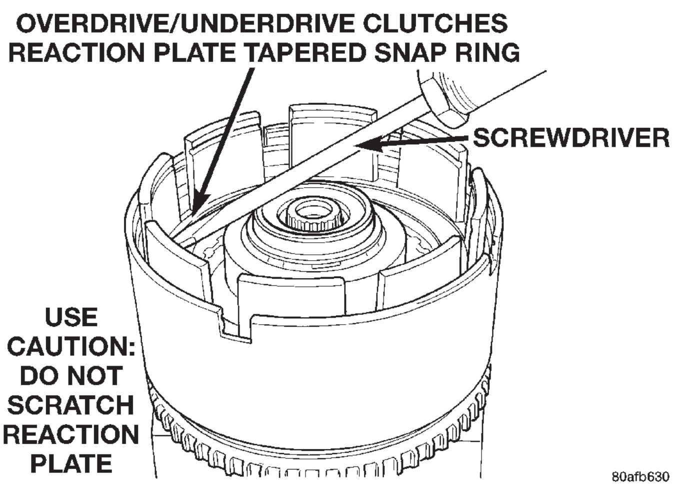


Fig. 203 Seating Tapered Snap Ring

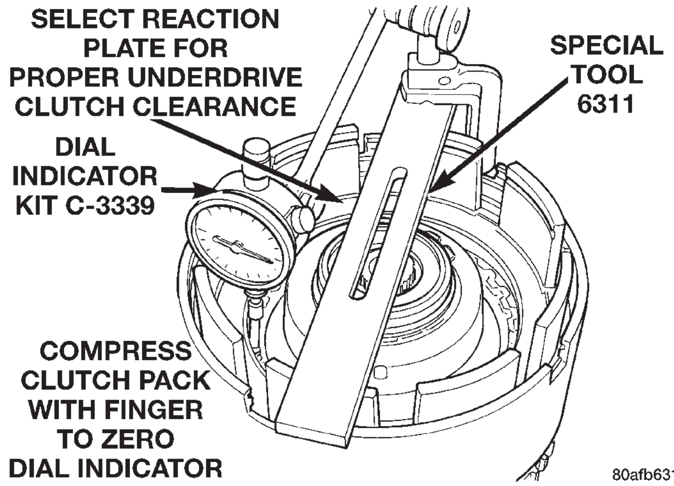


Fig. 204 Set Up Dial Indicator for Clutch Clearance

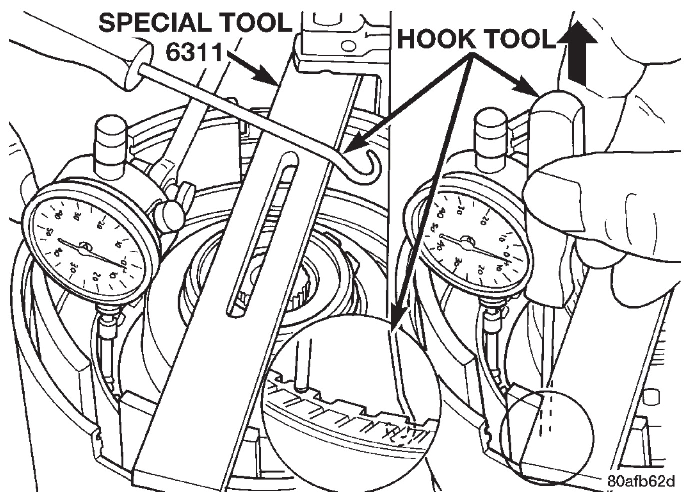


Fig. 205 Use Hook Tool to Raise One Clutch Disc

Underdrive clutch pack clearance must be 0.91 to 1.47 mm (.036 to .058 inch). Select the proper reaction plate to achieve specifications:

UNDERDRIVE REACTION PLATE THICKNESS
6.03 mm (.237 in.)
6.34 mm (.250 in.)
6.65 mm (.262 in.)

DISASSEMBLY AND ASSEMBLY (Continued)

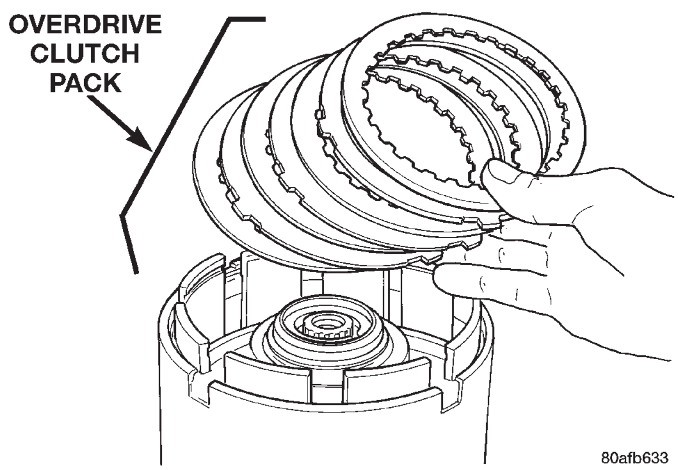


Fig. 206 Install OD Clutch Pack

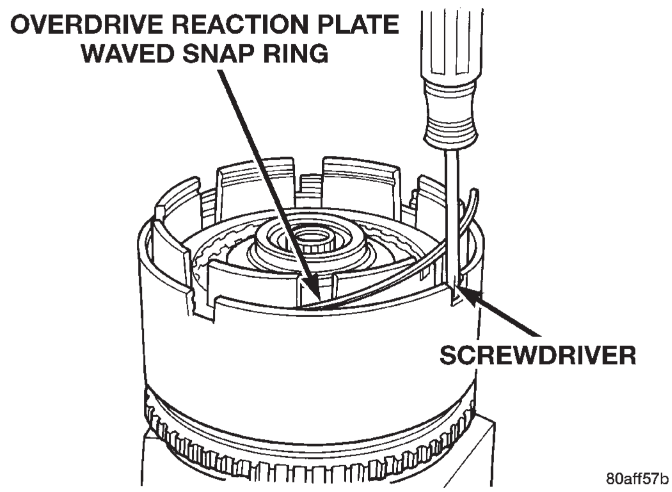


Fig. 207 Install Waved Snap Ring

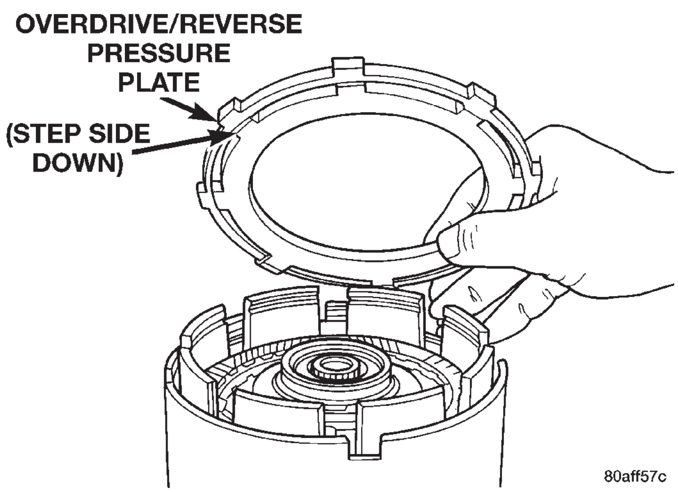


Fig. 208 OD/Reverse Pressure Plate

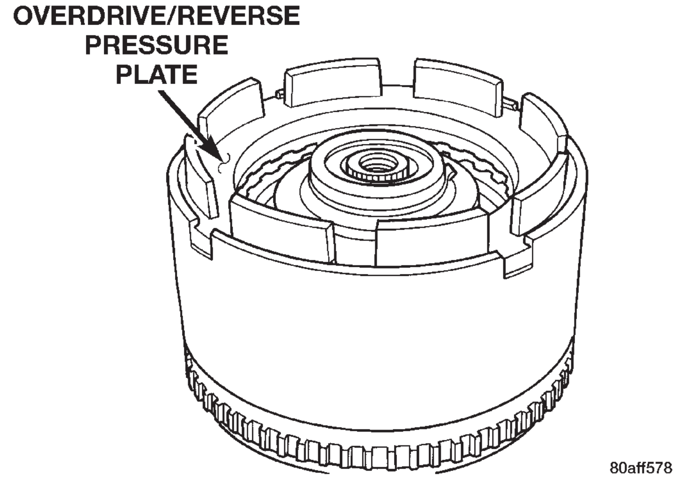


Fig. 209 Pressure Plate Installed

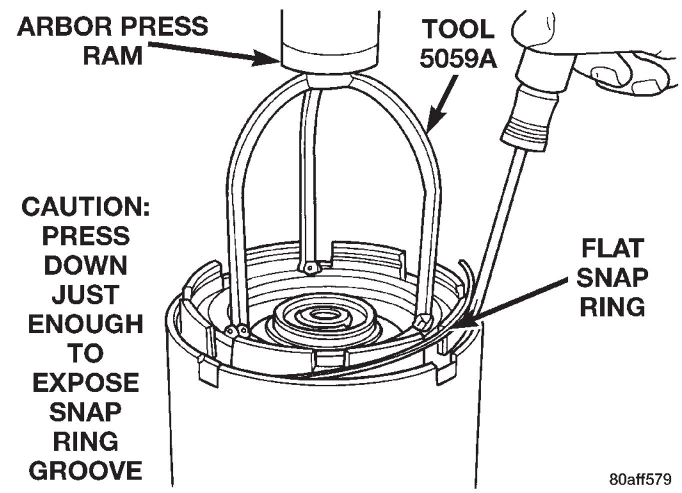


Fig. 210 Install Flat Snap Ring

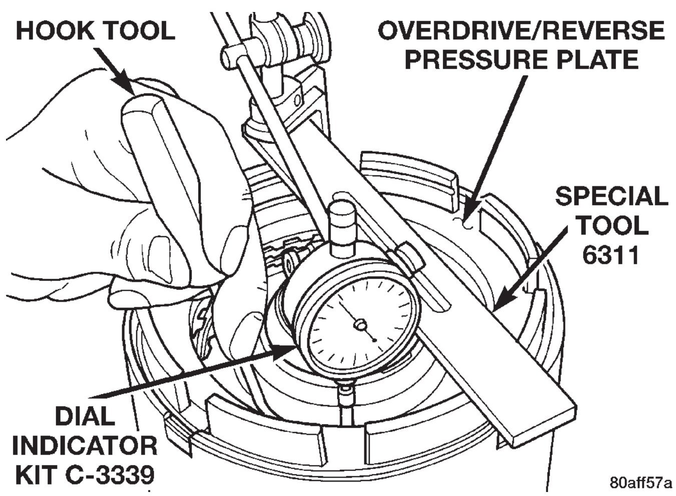


Fig. 211 Check OD Clutch Pack Clearance

DISASSEMBLY AND ASSEMBLY (Continued)

The overdrive (OD) clutch pack clearance is 1.355 to 3.188 mm (.053 to .125 inch). If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.

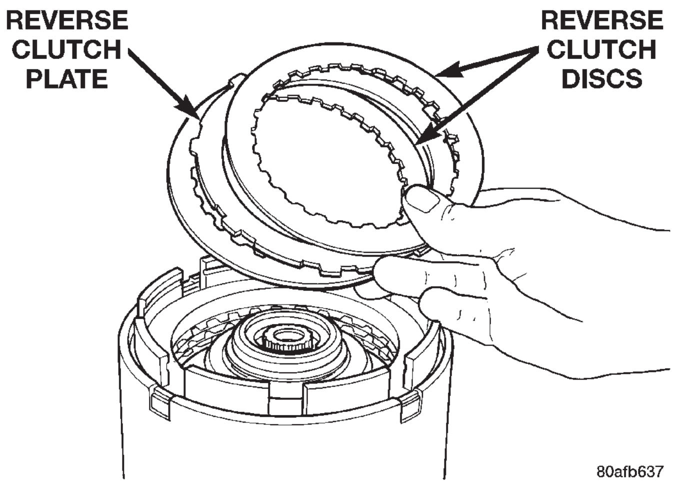


Fig. 212 Install Reverse Clutch Pack

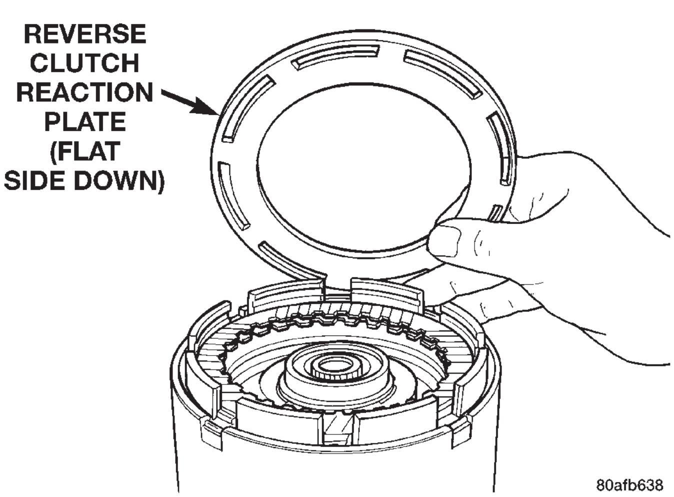


Fig. 213 Install Reaction Plate

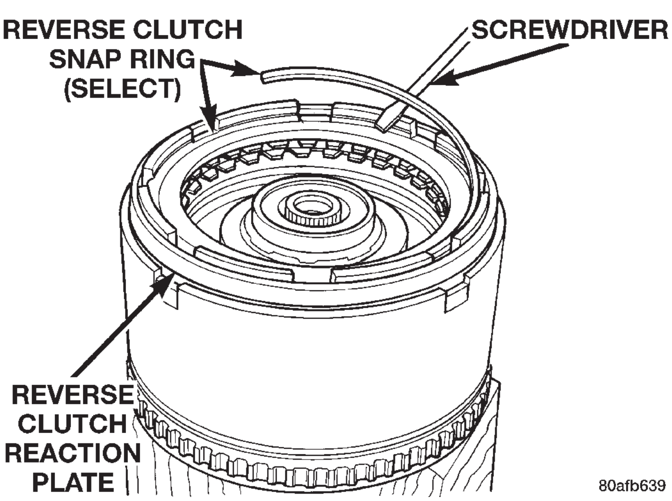


Fig. 214 Install Reverse Clutch Snap Ring

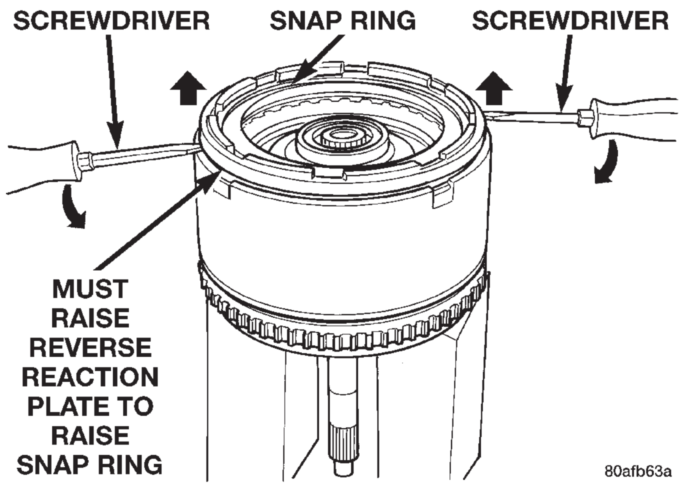


Fig. 215 Seating Snap Ring to Determine Reverse Clutch Clearance

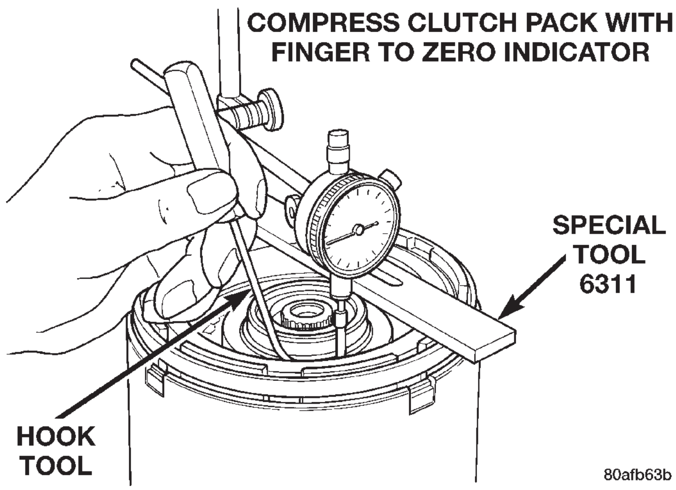


Fig. 216 Check Reverse Clutch Pack Clearance

The reverse clutch pack clearance is 0.76 to 1.24 mm (.030 to .049 inch). Select the proper reverse clutch snap ring to achieve specifications:

THICKNESS
1.56 mm (.061 in.)
1.80 mm (.071 in.)
2.05 mm (.081 in.)
2.30 mm (.090 in.)

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REVERSE CLUTCH SNAP RING CHART

All clutch clearances in the input clutch retainer have now been checked and approved.

To complete the assembly of the input clutch retainer, the reverse clutch and the overdrive clutch must be removed from the retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Do not intermix clutch parts. Keep in exact same order.

Now proceed with the next phase of the assembly:

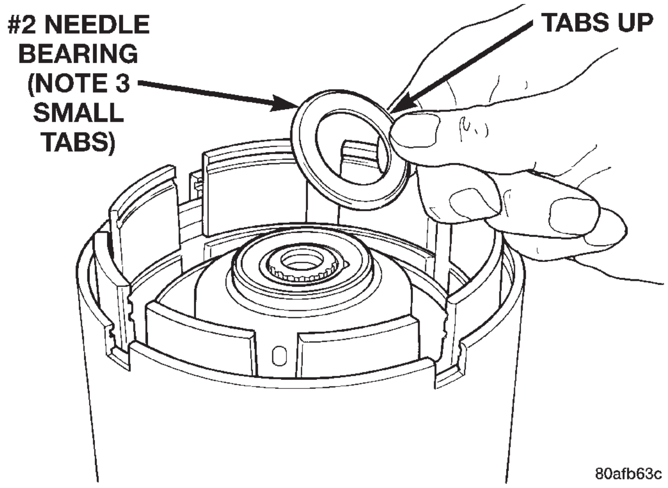


Fig. 217 Install No. 2 Needle Bearing

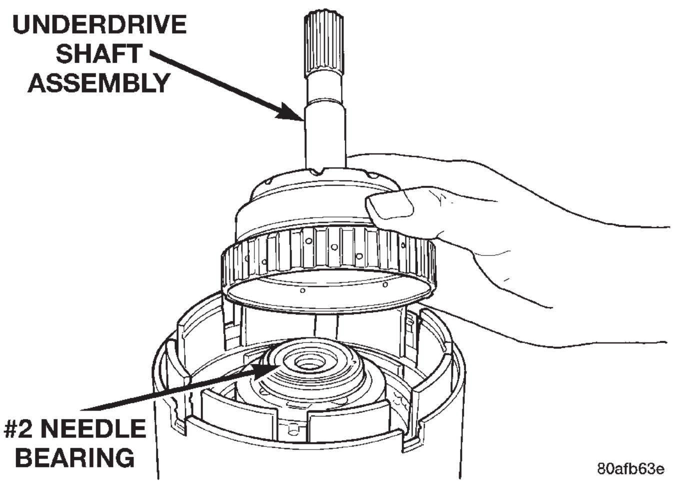


Fig. 218 Install Underdrive Shaft Assembly

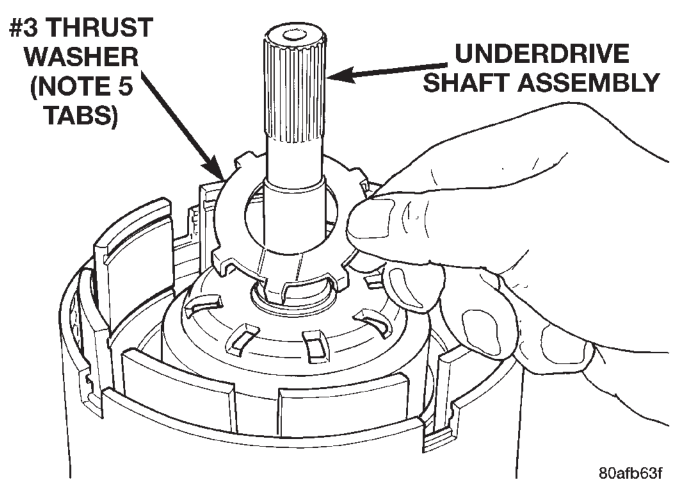


Fig. 219 Install No. 3 Thrust Washer

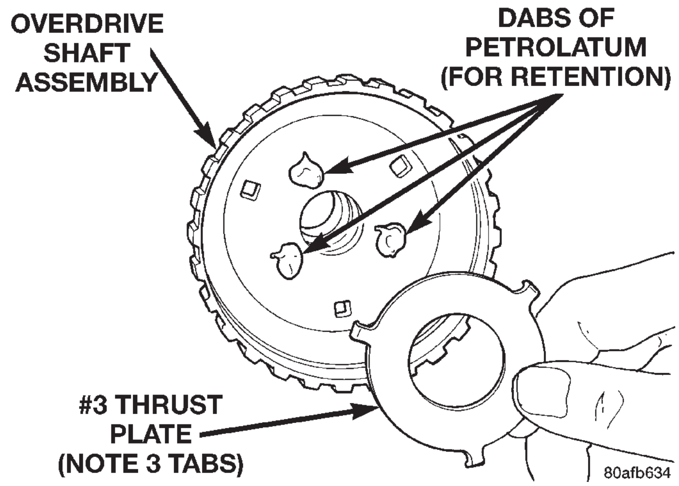


Fig. 220 Install No. 3 Thrust Plate

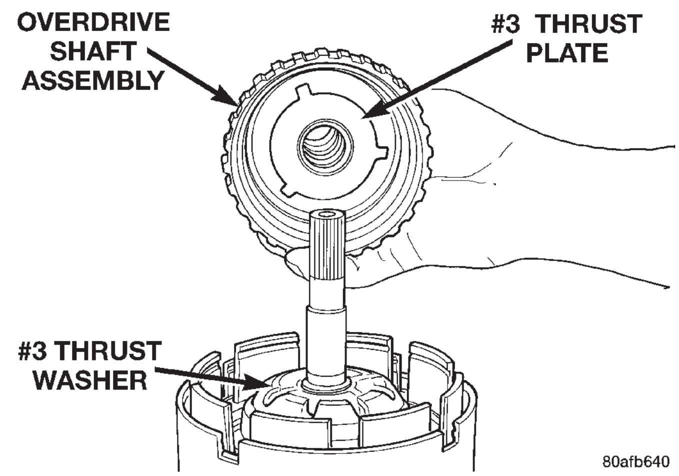


Fig. 221 Install Overdrive Shaft Assembly

Reinstall overdrive clutch and reverse clutch as shown. **Rechecking these clutch clearances is not necessary, as they were set and approved previously.**

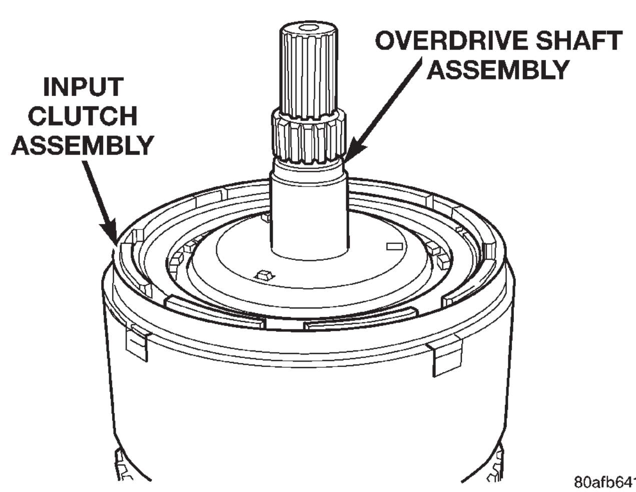


Fig. 222 Input Clutch Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

TRANSAXLE—ASSEMBLY

To assemble the transaxle centerline, refer to the following procedures.

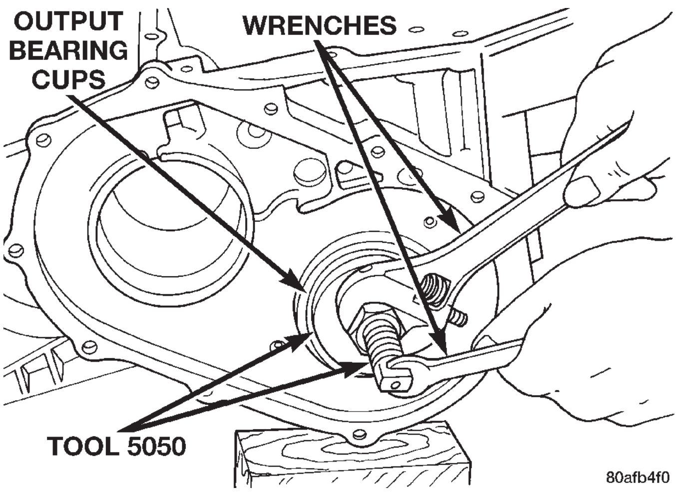


Fig. 223 Install Both Output Bearing Cups

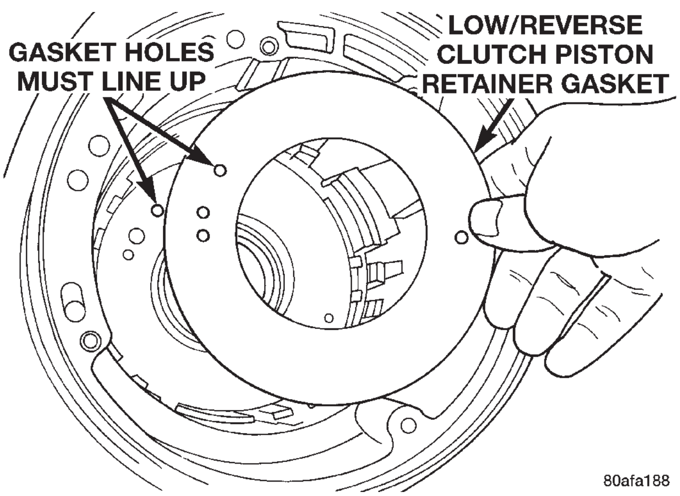


Fig. 224 Install Piston Retainer Gasket

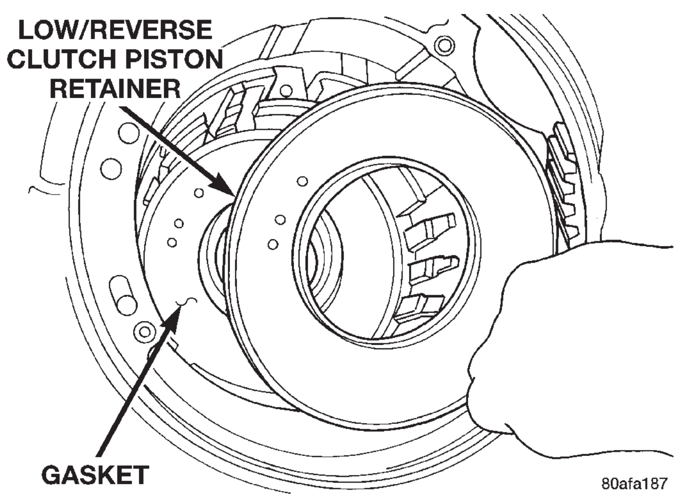


Fig. 225 Install Piston Retainer

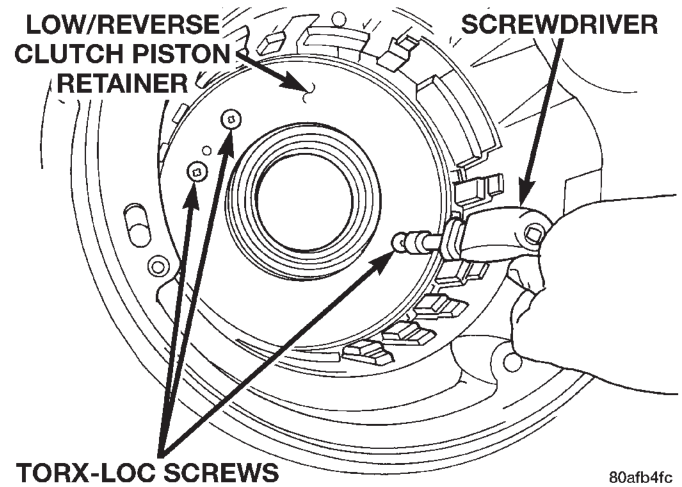


Fig. 226 Install Retainer Attaching Screws

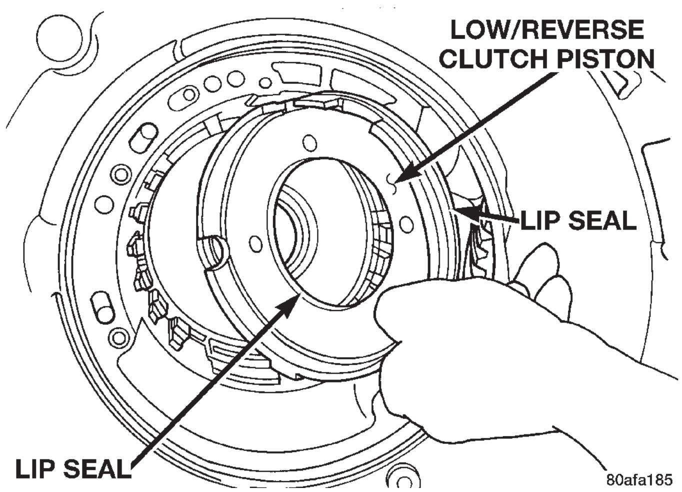


Fig. 227 Install Low/Reverse Clutch Piston

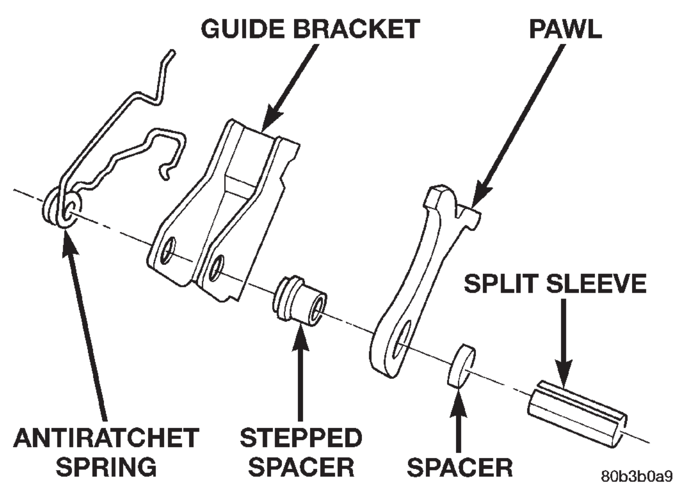


Fig. 228 Guide Bracket Disassembled

DISASSEMBLY AND ASSEMBLY (Continued)

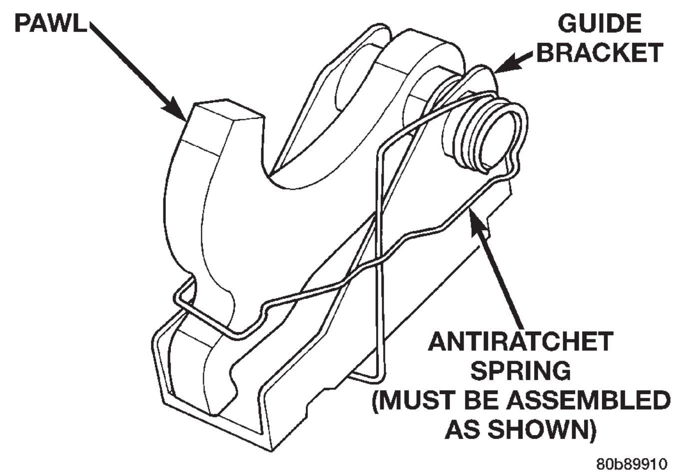


Fig. 229 Guide Bracket

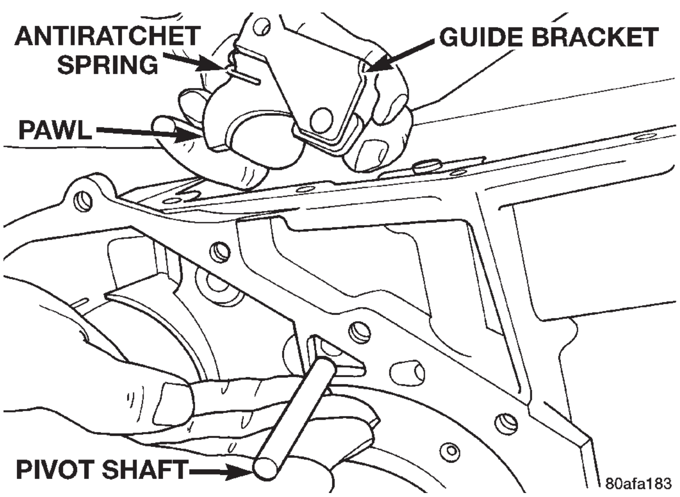


Fig. 230 Pivot Shaft and Guide Bracket

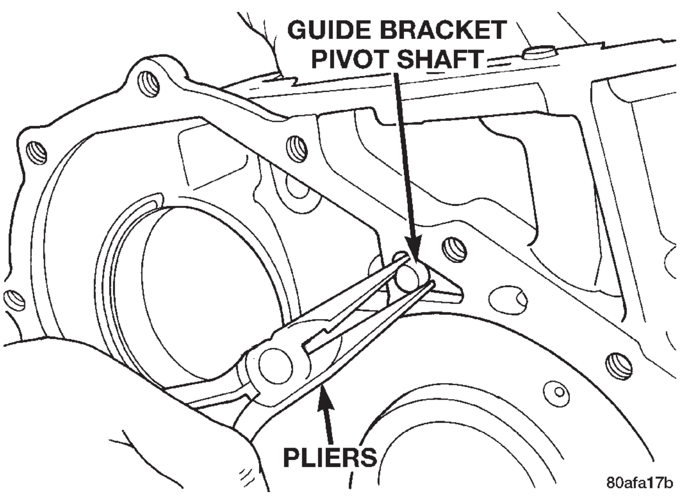


Fig. 231 Install Guide Bracket Pivot Shaft

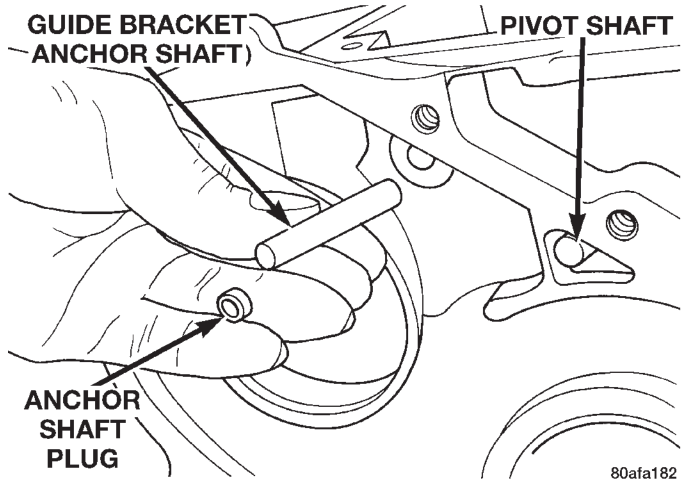


Fig. 232 Install Anchor Shaft and Plug

CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.

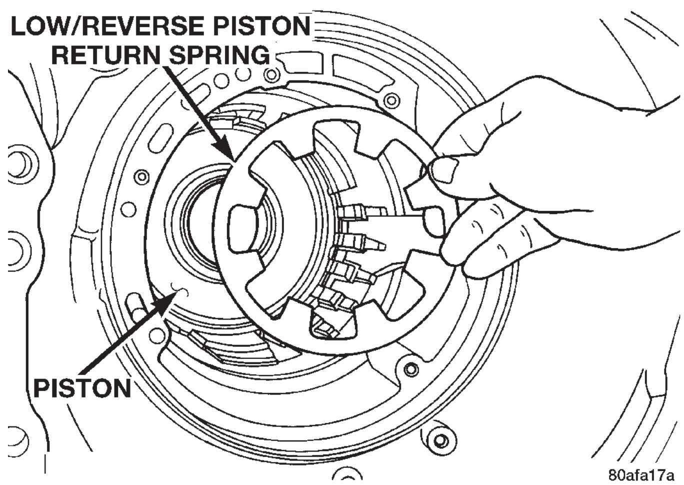


Fig. 233 Install Low/Reverse Piston Return Spring

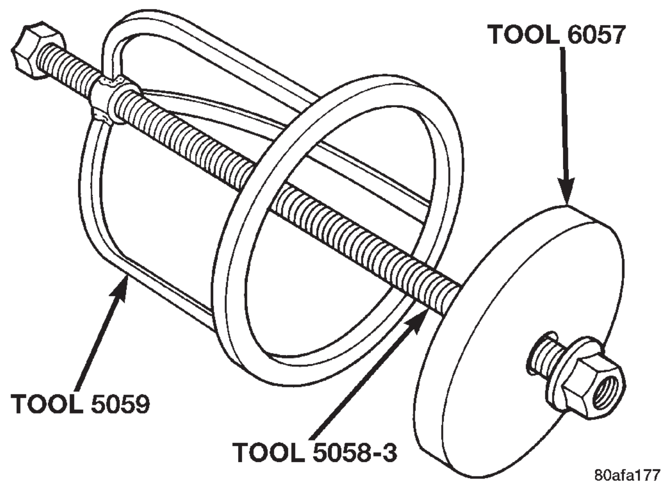


Fig. 234 Low/Reverse Spring Compressor Tool

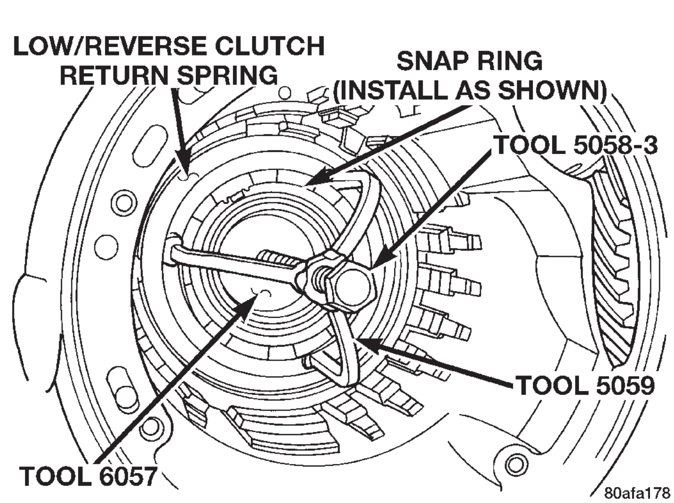


Fig. 235 Compressor Tool in Use

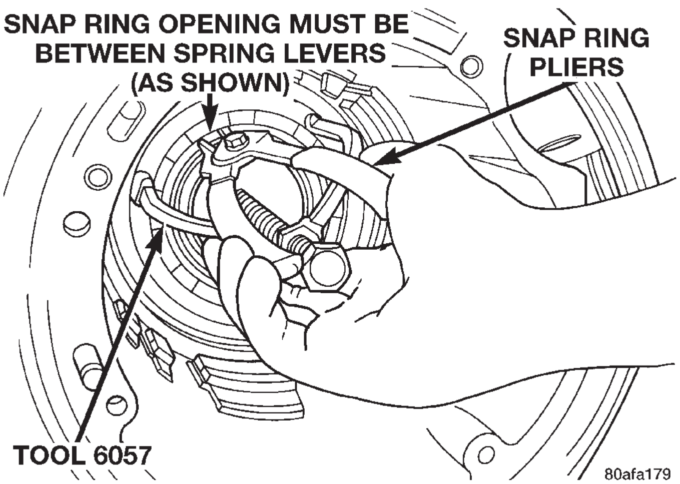


Fig. 236 Install Snap Ring

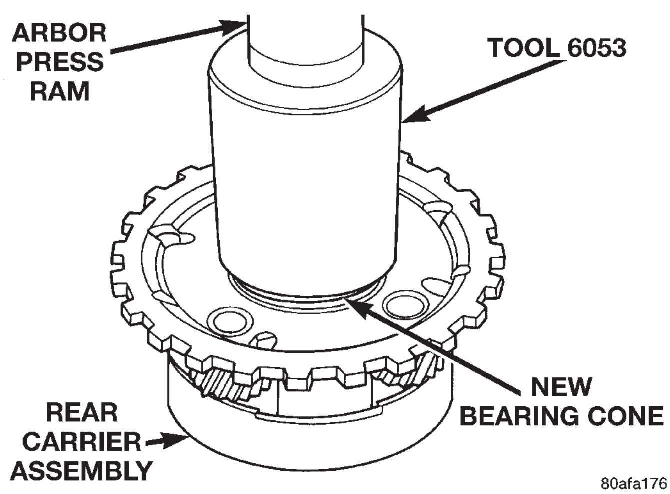


Fig. 237 Install Rear Carrier Bearing Cone

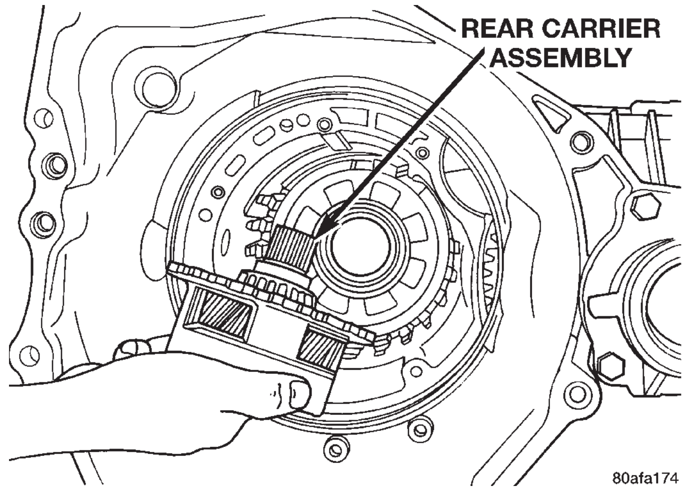


Fig. 238 Install Rear Carrier Assembly

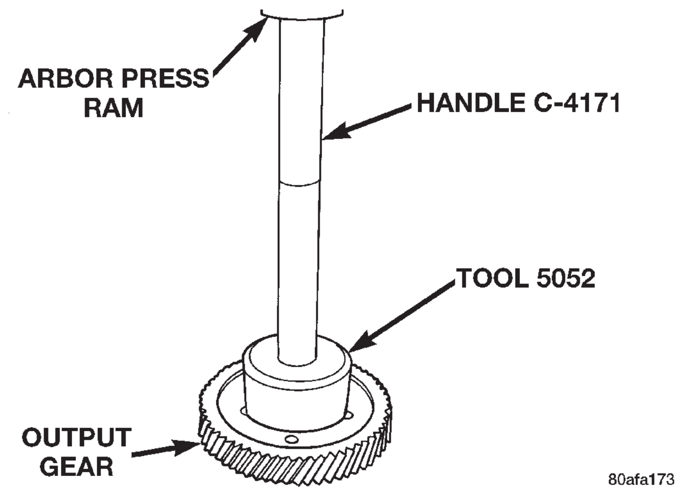


Fig. 239 Install Output Gear Bearing Cone

OUTPUT GEAR BEARING ADJUSTMENT

(1) With output gear removed: install a 4.50 mm (0.177 inch) gauging shim on the rear carrier assembly hub, using grease to hold the shim in place.

(2) Using Tool 6259, install output gear and bearing assembly. Torque to 271 N·m (200 ft. lbs.).

To measure bearing end play:

(3) Attach Tool L-4432 to the gear.

(4) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.

(5) Using a dial indicator, mounted to the transaxle case, measure output gear end play (Fig. 240).

(6) Refer to the output gear bearing shim chart for the required shim to obtain proper bearing setting.

DISASSEMBLY AND ASSEMBLY (Continued)

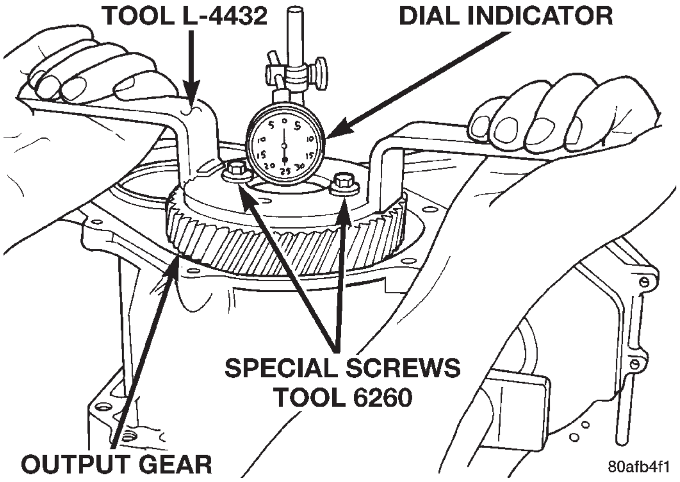


Fig. 240 Checking Output Gear Bearings End Play

OUTPUT GEAR BEARING SHIM CHART

End Play	Shim Needed	Part Number	End Play	Shim Needed	Part Number
.05mm .002 in.	4.42mm .174 in.	4412830	.53mm .021 in.	3.94mm .155 in.	4412818
.08mm .003 in.	4.38mm .172 in.	4412829	.56mm .022 in.	3.90mm .154 in.	4412817
.10mm .004 in.	4.38mm .172 in.	4412829	.58mm .023 in.	3.90mm .154 in.	4412817
.13mm .005 in.	4.34mm .171 in.	4412828	.61mm .024 in.	3.86mm .152 in.	4412816
.15mm .006 in.	4.30mm .169 in.	4412827	.64mm .025 in.	3.82mm .150 in.	4412815
.18mm .007 in.	4.30mm .169 in.	4412827	.66mm .026 in.	3.82mm .150 in.	4412815
.20mm .008 in.	4.26mm .168 in.	4412826	.69mm .027 in.	3.78mm .149 in.	4412814
.23mm .009 in.	4.22mm .166 in.	4412825	.71mm .028 in.	3.74mm .147 in.	4412813
.25mm .010 in.	4.22mm .166 in.	4412825	.74mm .029 in.	3.74mm .147 in.	4412813
.28mm .011 in.	4.18mm .165 in.	4412824	.76mm .030 in.	3.70mm .146 in.	4412812
.30mm .012 in.	4.14mm .163 in.	4412823	.79mm .031 in.	3.66mm .144 in.	4412811
.33mm .013 in.	4.14mm .163 in.	4412823	.81mm .032 in.	3.66mm .144 in.	4412811
.36mm .014 in.	4.10mm .161 in.	4412822	.84mm .033 in.	3.62mm .143 in.	4412810
.38mm .015 in.	4.10mm .161 in.	4412822	.86mm .034 in.	3.62mm .143 in.	4412810
.41mm .016 in.	4.06mm .160 in.	4412821	.89mm .035 in.	3.58mm .141 in.	4412809
.43mm .017 in.	4.02mm .158 in.	4412820	.91mm .036in.	3.54mm .139 in.	4412808
.46mm .018 in.	4.02mm .158 in.	4412820	.94mm .037 in.	3.54mm .139 in.	4412808
.48mm .019 in.	3.98mm .157 in.	4412819	.97mm .038 in.	3.50mm .138 in.	4412807
.51mm .020 in.	3.94mm .155 in.	4412818			

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Use Tool 6259 to remove the retaining bolt and washer. To remove the output gear, use Tool L-4407.

(8) Remove the gauging shim and install the proper shim (Fig. 241). Use grease to hold the shim in place. Install the output gear and bearing assembly (Fig. 242).

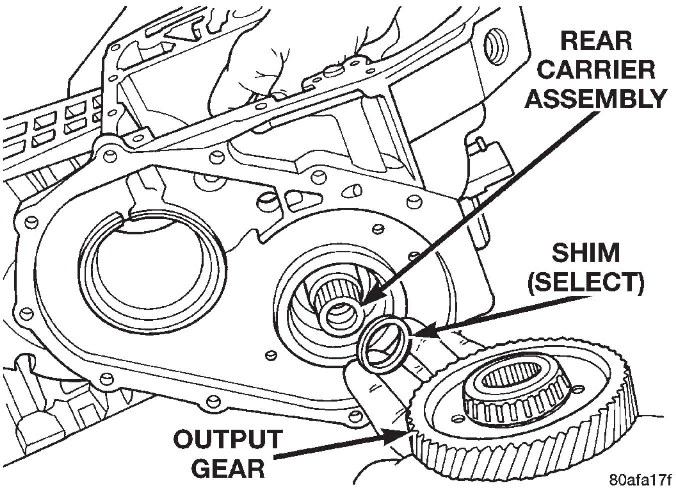


Fig. 241 Output Gear and (Select) Shim

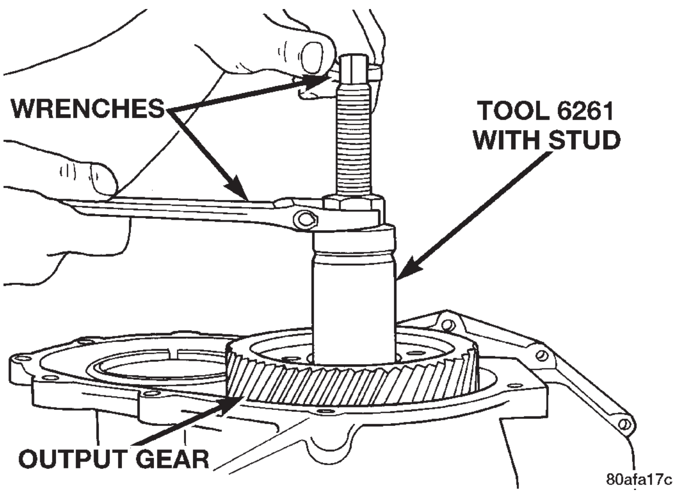


Fig. 242 Install Output Gear

CAUTION: Always use new retaining bolt, old retaining bolt may not be reused.

(9) Install the new retaining bolt and washer (Fig. 243). Tighten to 271 N·m (200 ft. lbs.) (Fig. 244).

(10) Using an inch-pound torque wrench, check the turning torque (Fig. 245). **The torque should be between 3 and 8 inch-pounds.**

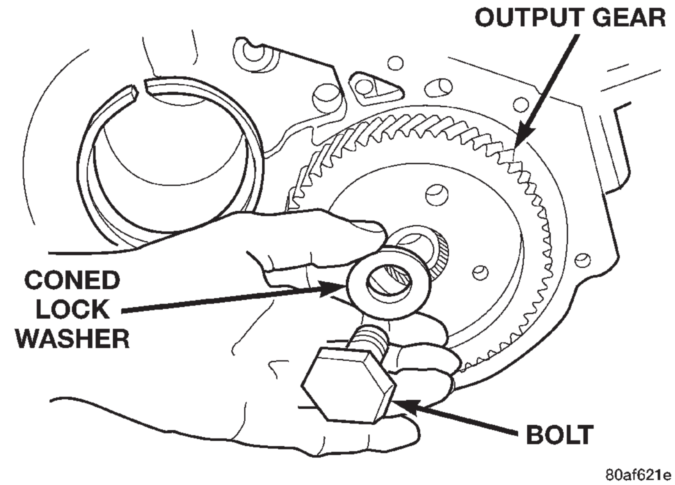


Fig. 243 Install Output Gear Bolt and Washer

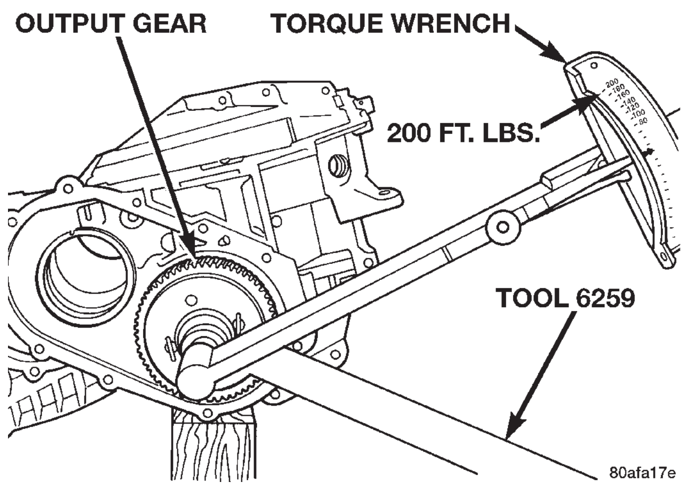


Fig. 244 Tighten Output Gear to 271 N•m (200 ft. lbs.)

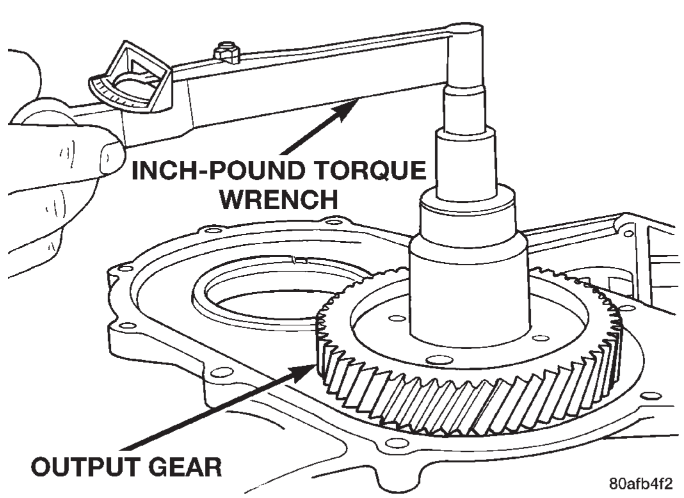


Fig. 245 Check Output Gear Bearings Turning Torque

DISASSEMBLY AND ASSEMBLY (Continued)

If the turning torque is too high, install a .04 mm (.0016 inch) thicker shim. If the turning torque is too low, install a .04 mm (.0016 inch) thinner shim. Repeat until the proper turning torque is 3 to 8 inch pounds.

NOTE: Install output gear stirrup and strap bolts.

All transaxles utilize a stirrup and retaining strap that is attached to the output gear. The stirrup prevents the output gear retaining bolt from turning and backing out of the rear carrier. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.

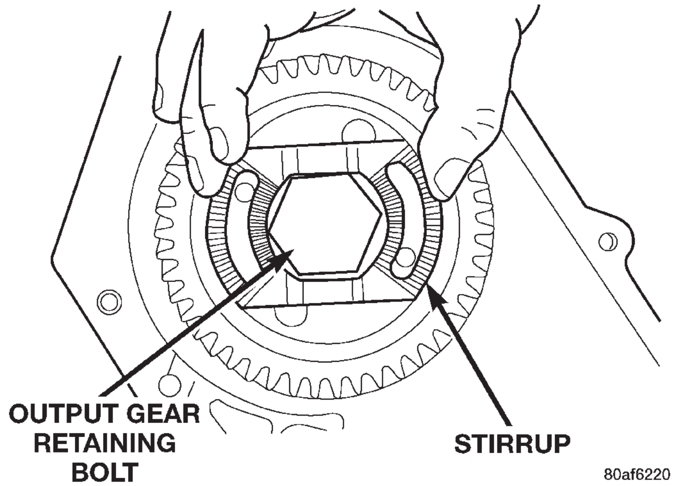


Fig. 246 Output Gear Retaining Bolt Stirrup (Serration Side Out)

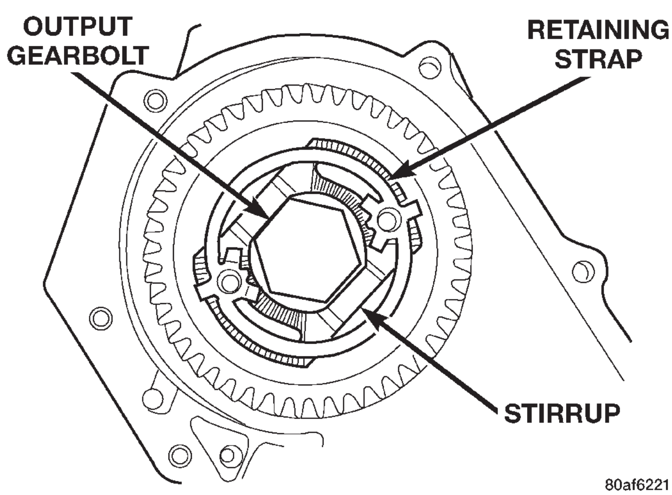


Fig. 247 Stirrup Strap (Align Strap Holes With Tapped Gear Holes)

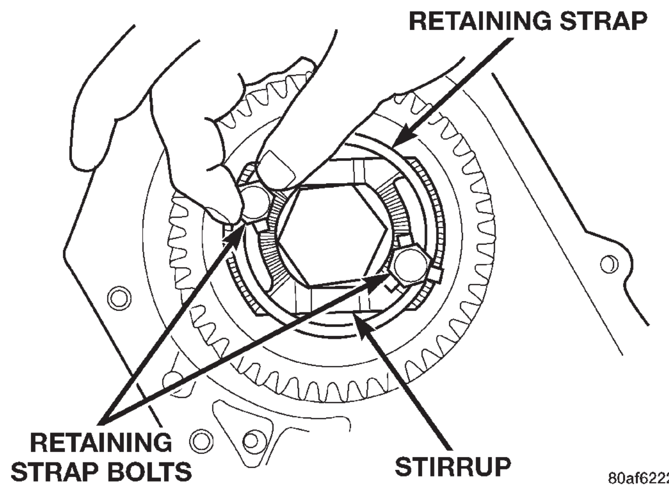


Fig. 248 Install Strap Bolts

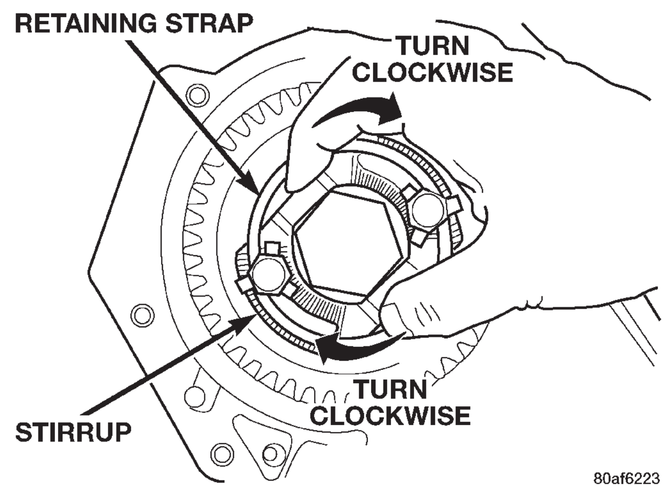


Fig. 249 Turn Stirrup Clockwise Against Flats Of Output Gear Retaining Bolt

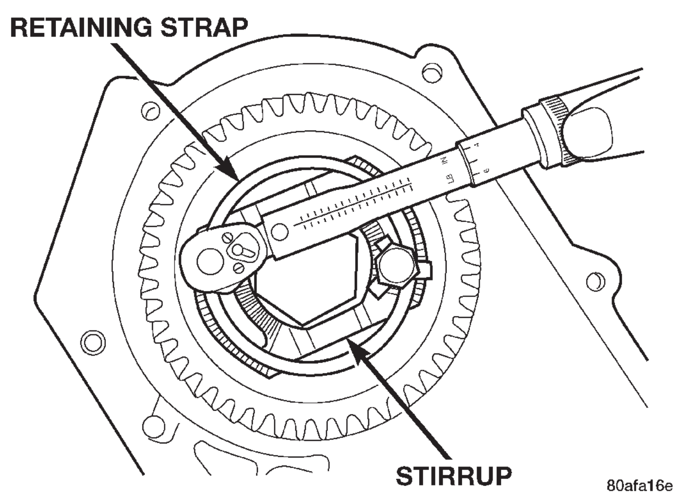


Fig. 250 Tighten Stirrup Strap Bolts To 23 N·m (200 in. lbs.)

DISASSEMBLY AND ASSEMBLY (Continued)

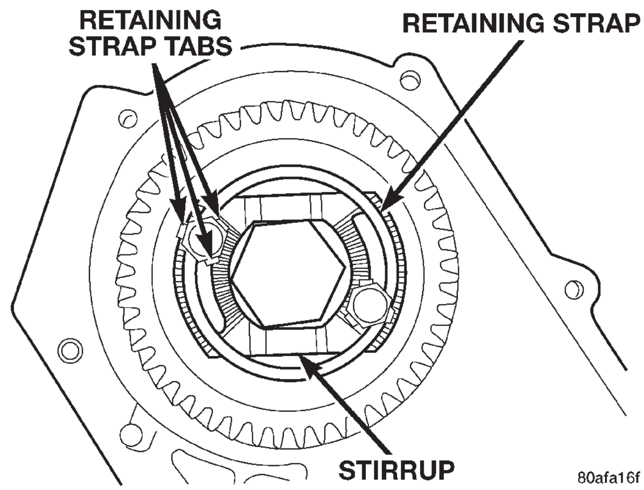


Fig. 251 Bend Tabs On Strap Up Against Flats Of Bolts

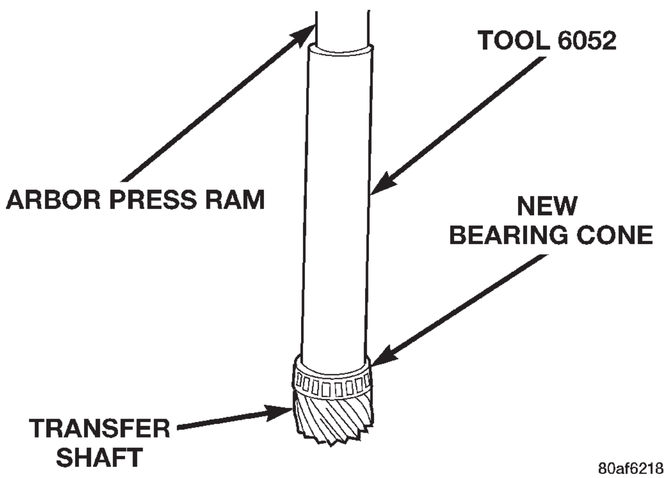


Fig. 252 Install Transfer Shaft Bearing Cone

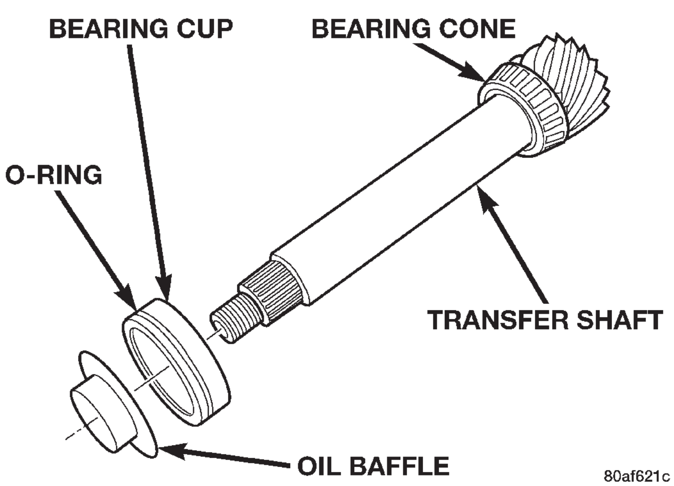


Fig. 253 Install Bearing Cup To Shaft

NOTE: Screw Tool 5049-A onto transfer shaft. Install transfer shaft.

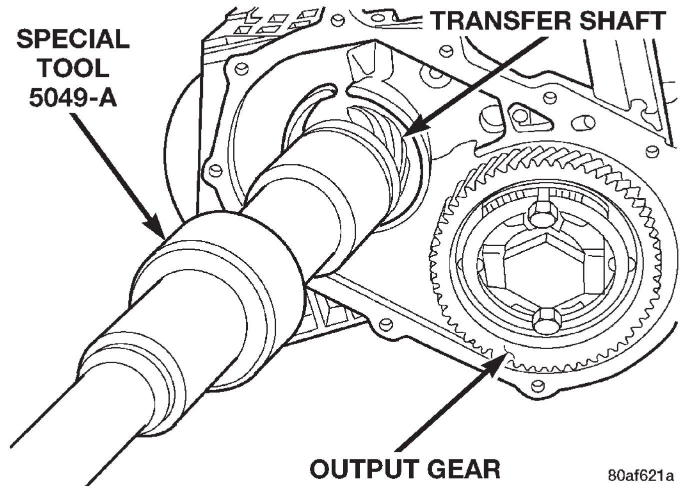


Fig. 254 Install Transfer Shaft

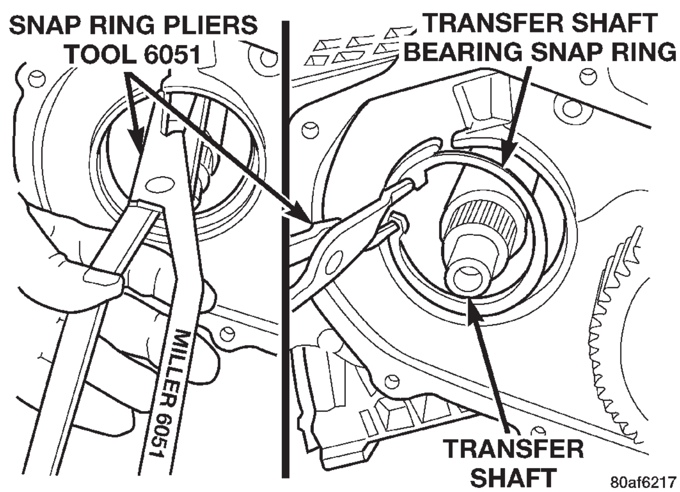


Fig. 255 Install Transfer Shaft Bearing Snap Ring

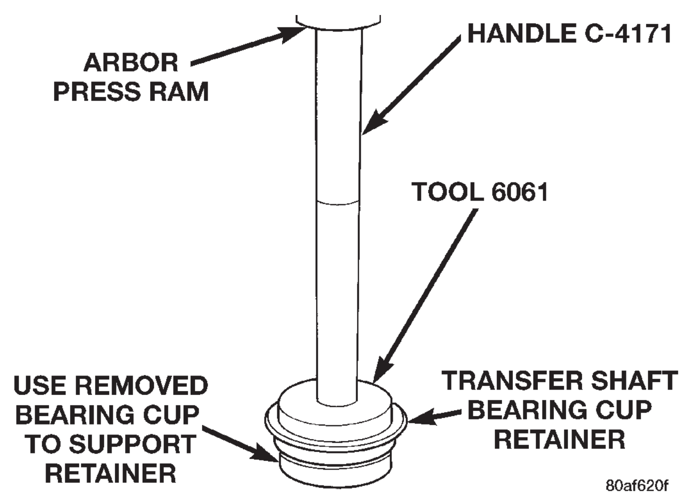


Fig. 256 Install Transfer Shaft Bearing Cup Into Retainer

DISASSEMBLY AND ASSEMBLY (Continued)

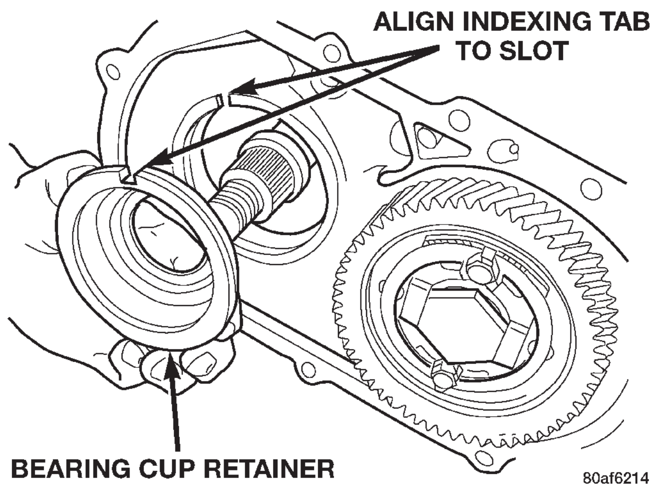


Fig. 257 Install Bearing Cup Retainer

TRANSFER SHAFT BEARING

(1) Install a 4.66 mm (.184 inch) gauging shim on the transfer shaft.

(2) Install transfer shaft gear and bearing assembly and torque the nut to 271 N·m (200 ft. lbs.).

To measure bearing end play:

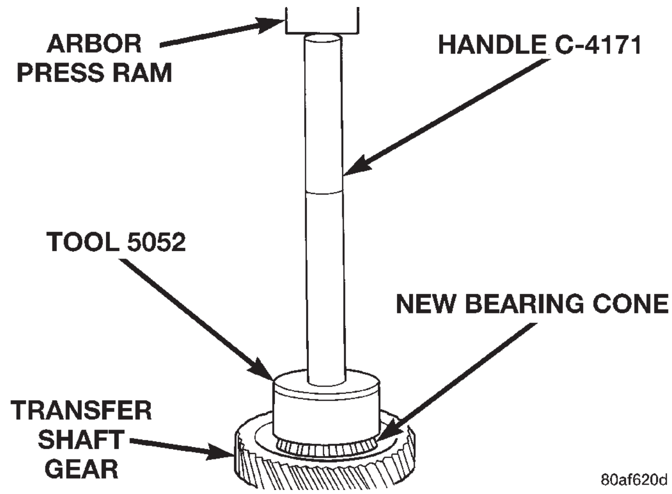


Fig. 258 Install Transfer Gear Bearing Cone

- Attach Tool L-4432 to the transfer gear.
- Mount a steel ball with grease into the end of the transfer shaft.
- Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.
- Using a dial indicator, measure transfer shaft end play.

TRANSFER SHAFT BEARING SHIM CHART

End Play	Shim Needed	Part Number	End Play	Shim Needed	Part Number
.05mm .002 in.	4.66mm .183 in.	4505588	.76mm .030 in.	3.94mm .155 in.	4412818
.08mm .003 in.	4.62mm .182 in.	4412835	.79mm .031 in.	3.90mm .154 in.	4412817
.10mm .004 in.	4.58mm .180 in.	4412834	.81mm .032 in.	3.90mm .154 in.	4412817
.13mm .005 in.	4.58mm .180 in.	4412834	.84mm .033 in.	3.86mm .152 in.	4412816
.15mm .006 in.	4.54mm .178 in.	4412833	.86mm .034 in.	3.82mm .150 in.	4412815
.18mm .007 in.	4.50mm .177 in.	4412832	.89mm .035 in.	3.82mm .150 in.	4412815
.20mm .008 in.	4.50mm .177 in.	4412832	.91mm .036 in.	3.78mm .149 in.	4412814
.23mm .009 in.	4.46mm .175 in.	4412831	.94mm .037 in.	3.74mm .147 in.	4412813
.25mm .010 in.	4.46mm .175 in.	4412831	.97mm .038 in.	3.74mm .147 in.	4412813
.28mm .011 in.	4.42mm .174 in.	4412830	.99mm .039 in.	3.70mm .146 in.	4412812
.30mm .012 in.	4.38mm .172 in.	4412829	1.02mm .040 in.	3.66mm .144 in.	4412811
.33mm .013 in.	4.38mm .172 in.	4412829	1.04mm .041 in.	3.66mm .144 in.	4412811
.36mm .014 in.	4.34mm .171 in.	4412828	1.07mm .042 in.	3.62mm .143 in.	4412810
.38mm .015 in.	4.30mm .169 in.	4412827	1.08mm .043 in.	3.62mm .143 in.	4412810
.41mm .016 in.	4.30mm .169 in.	4412827	1.12mm .044 in.	3.58mm .141 in.	4412809
.43mm .017 in.	4.26mm .168 in.	4412826	1.14mm .045 in.	3.54mm .139 in.	4412808
.46mm .018 in.	4.22mm .166 in.	4412825	1.17mm .046 in.	3.54mm .139 in.	4412808
.48mm .019 in.	4.22mm .166 in.	4412825	1.19mm .047 in.	3.50mm .138 in.	4412807
.50mm .020 in.	4.18mm .165 in.	4412824	1.22mm .048 in.	3.46mm .136 in.	4412806
.53mm .021 in.	4.18mm .165 in.	4412824	1.24mm .049 in.	3.46mm .136 in.	4412806
.56mm .022 in.	4.14mm .163 in.	4412823	1.27mm .050 in.	3.42mm .135 in.	4412805

DISASSEMBLY AND ASSEMBLY (Continued)

End Play	Shim Needed	Part Number	End Play	Shim Needed	Part Number
.58mm .023 in.	4.10mm .161 in.	4412822	1.30mm .051 in.	3.38mm .133 in.	4412804
.61mm .024 in.	4.10mm .161 in.	4412822	1.32mm .052 in.	3.38mm .133 in.	4412804
.64mm .025 in.	4.06mm .160 in.	4412821	1.35mm .053 in.	3.34mm .132 in.	4412803
.66mm .026 in.	4.02mm .158 in.	4412820	1.37mm .054 in.	3.34mm .132 in.	4412803
.69mm .027 in.	4.02mm .158 in.	4412820	1.40mm .055 in.	3.30mm .130 in.	4412802
.71mm .028 in.	3.98mm .157 in.	4412819	1.45mm .057 in	3.26mm .128 in.	4412801
.74mm .029 in.	3.94mm .155 in.	4412818	1.47mm .058 in.	2.22mm .127 in.	4505570

(3) Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

(4) Use Tool 6259 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407.

(5) Remove the gauging shim and install the correct shim (Fig. 259). Install the transfer gear and bearing assembly (Fig. 260).

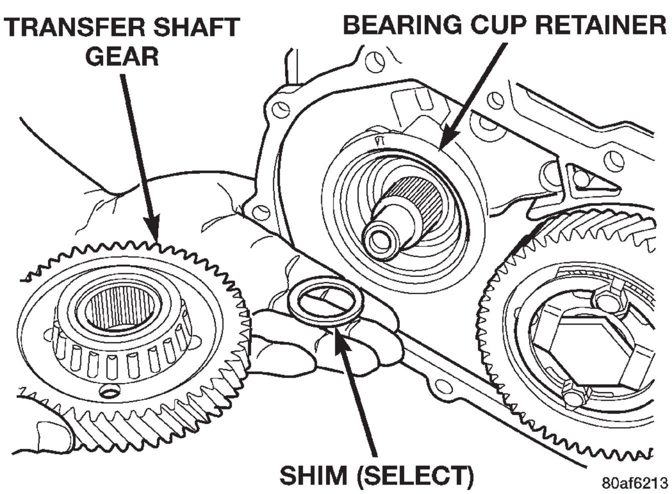


Fig. 259 Transfer Shaft Gear and (Select) Shim

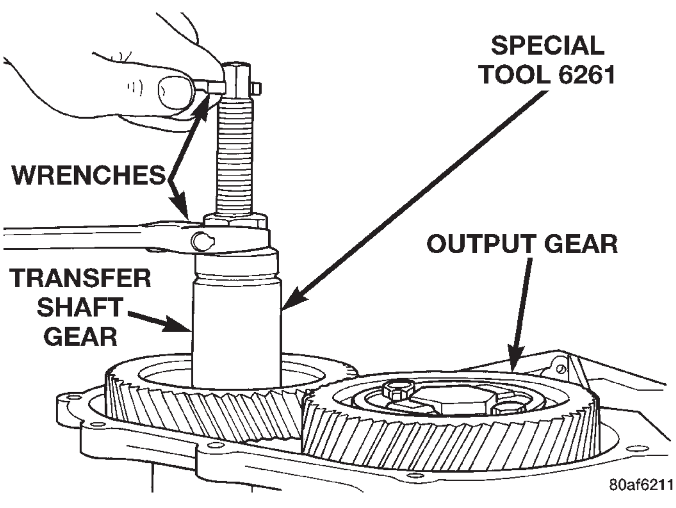


Fig. 260 Install Transfer Shaft Gear

CAUTION: Original retaining nut may not be reused. Always use a new retaining nut when reassembling.

(6) Install the new retaining nut and washer and torque to 271 N·m (200 ft. lbs.) (Fig. 261). **Measure transfer shaft end play, end play should be .05 to .10 mm (.002 to .004 inch).**

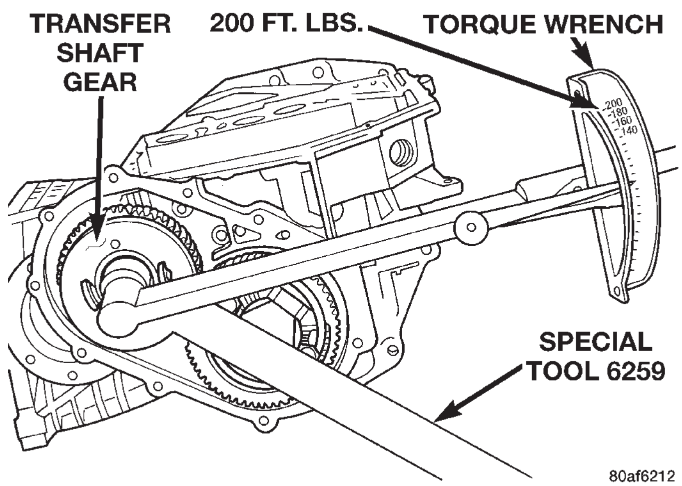


Fig. 261 Tighten Nut to 271 N·m (200 ft. lbs.)

(7) Measure bearing end play as outlined in Step 3. End play should be between .05 mm and .10 mm (.002 to .004 inch).

NOTE: If end play is too high, install a .04 mm (.0016 inch) thinner shim. If end play is too low, install a .04 mm (.0016 inch) thicker shim combination. Repeat until .05 to .10 mm (.002 to .004 inch) end play is obtained.

DISASSEMBLY AND ASSEMBLY (Continued)

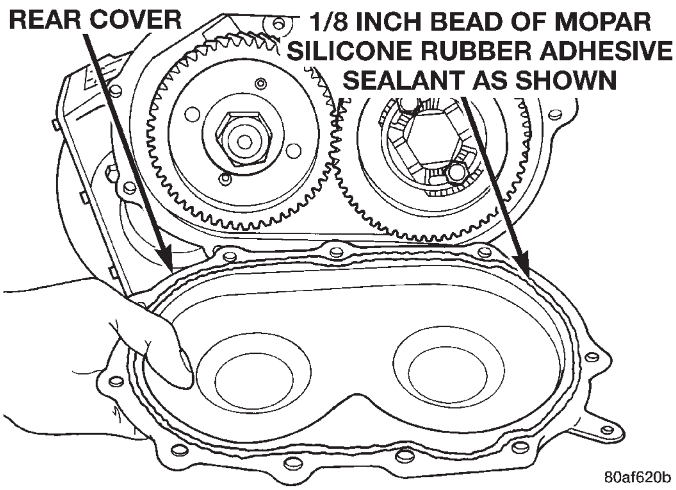


Fig. 262 Install Rear Cover

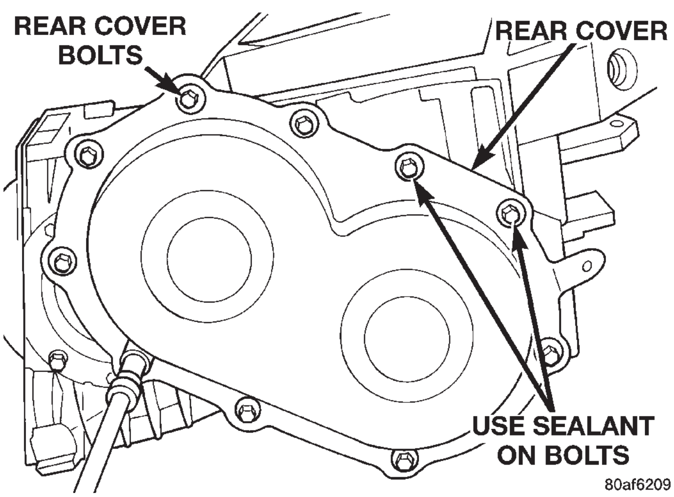


Fig. 263 Install Rear Cover Bolts

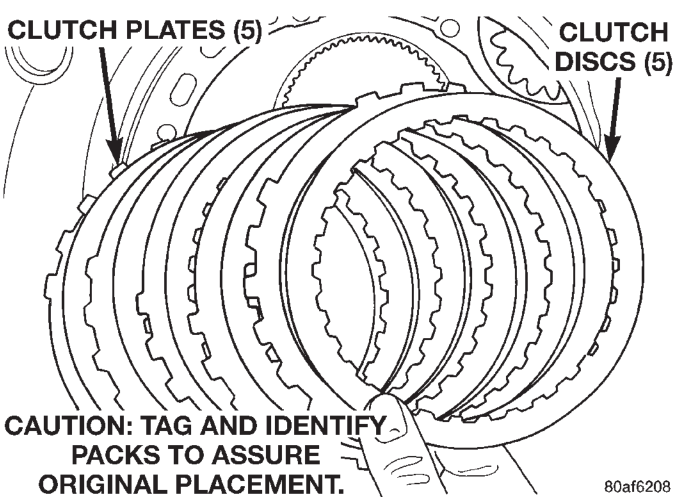


Fig. 264 Install Low/Reverse Clutch Pack

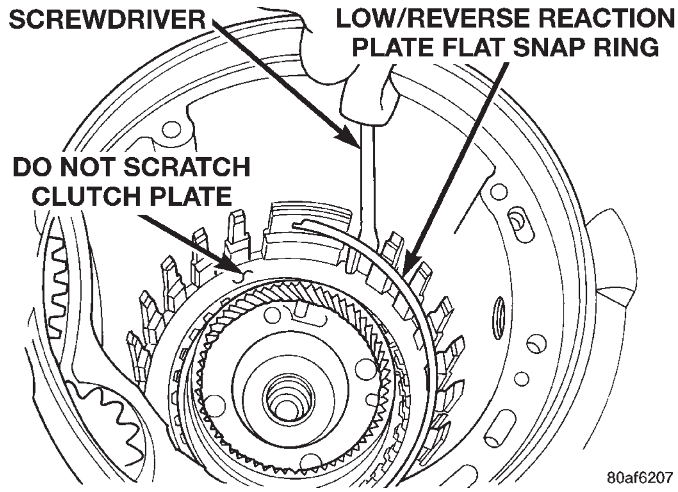


Fig. 265 Install Low/Reverse Reaction Plate Snap Ring

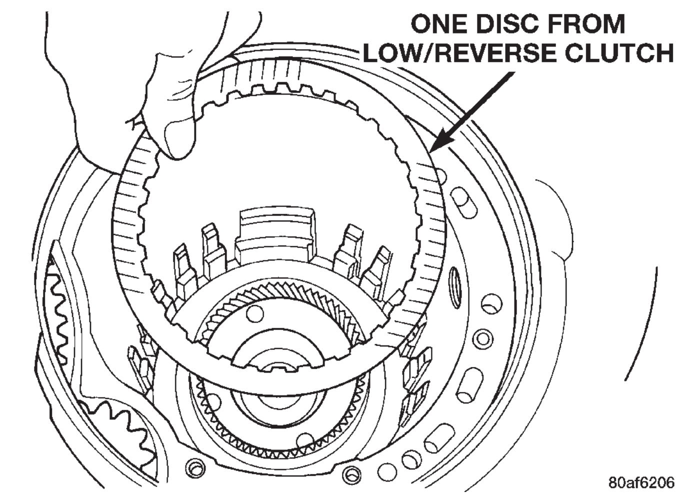


Fig. 266 Install One Disc

NOTE: Install the low/reverse reaction plate stepped side up.

DISASSEMBLY AND ASSEMBLY (Continued)

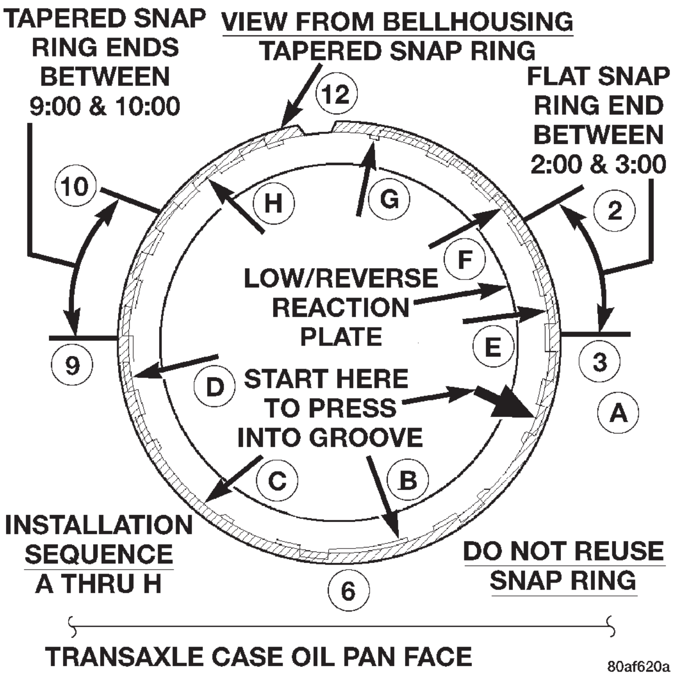


Fig. 267 Tapered Snap Ring Instructions

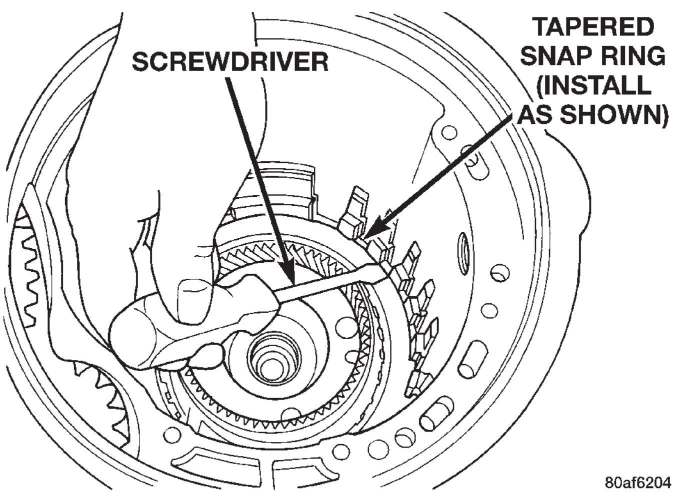


Fig. 268 Snap Ring Installed

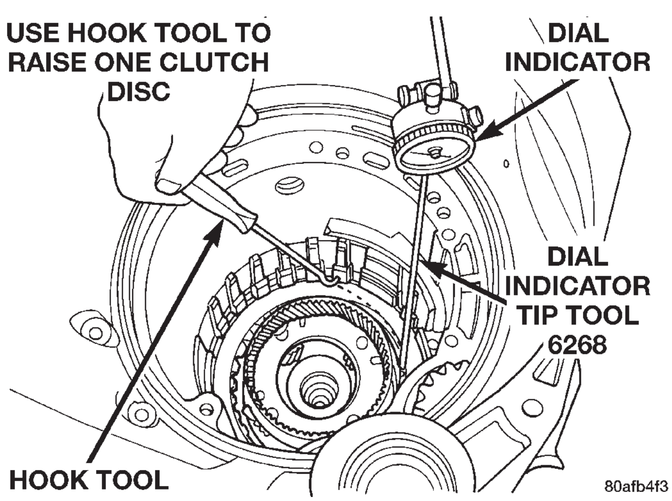


Fig. 269 Check Low/Reverse Clutch Clearance

Press down clutch pack with finger and zero dial indicator. **Low/Reverse clutch pack clearance is 0.89 to 1.04 (.035 to .042 inch).**

Select the proper low/reverse reaction plate to achieve specifications:

LOW/REVERSE REACTION PLATE CHART

PART NUMBER	THICKNESS
4799846	5.88 mm (.232 in.)
4799847	6.14 mm (.242 in.)
4799848	6.40 mm (.252 in.)
4799849	6.66 mm (.262 in.)
4799855	6.92 mm (.273 in.)

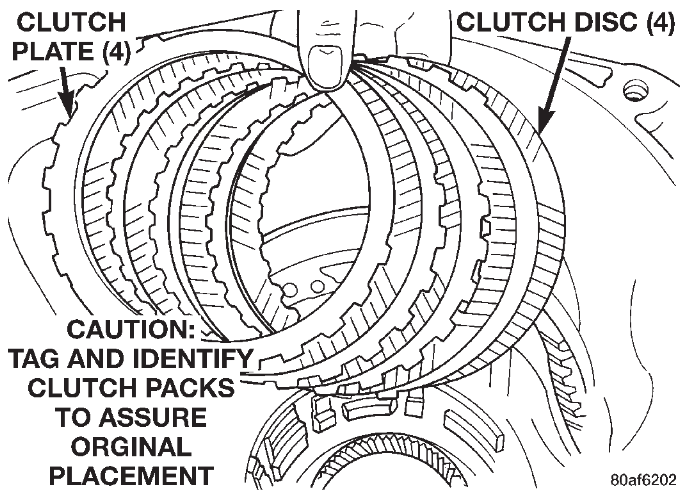


Fig. 270 Install 2/4 Clutch Pack

NOTE: When installing the 2-4 clutch plates and discs, the orientation should be alternated so the pilot pads of adjacent plates do not align, refer to (Fig. 271).

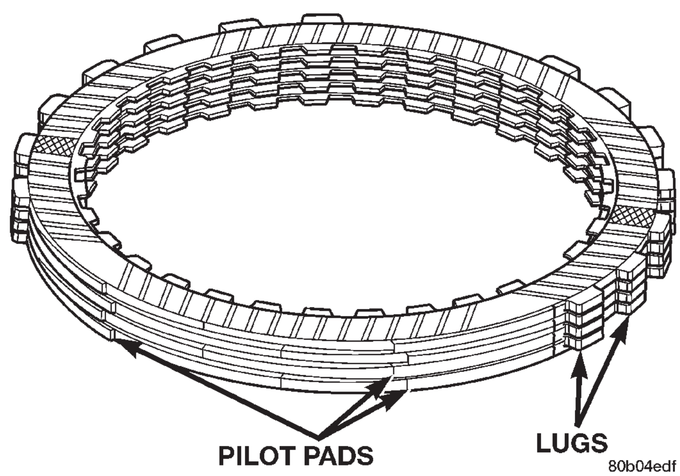


Fig. 271 Stagger 2/4 Clutch Plate Pads

DISASSEMBLY AND ASSEMBLY (Continued)

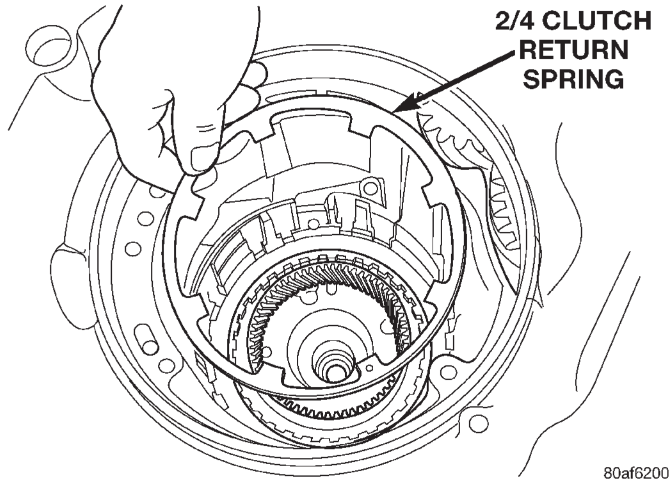


Fig. 272 Install 2/4 Clutch Return Spring

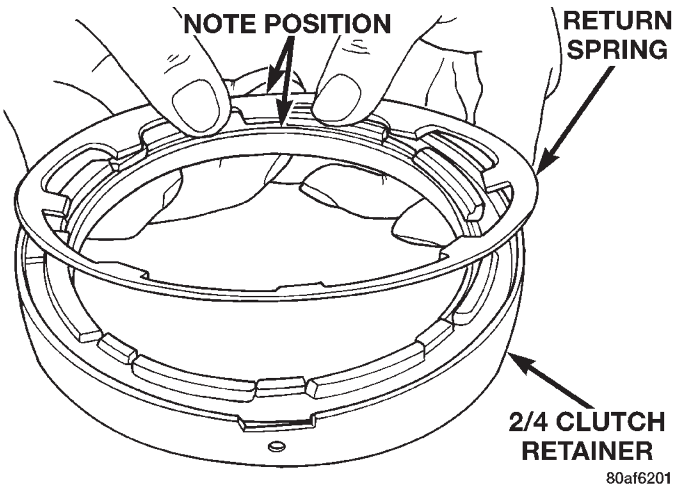


Fig. 273 Proper Orientation of 2/4 Clutch Retainer and Spring

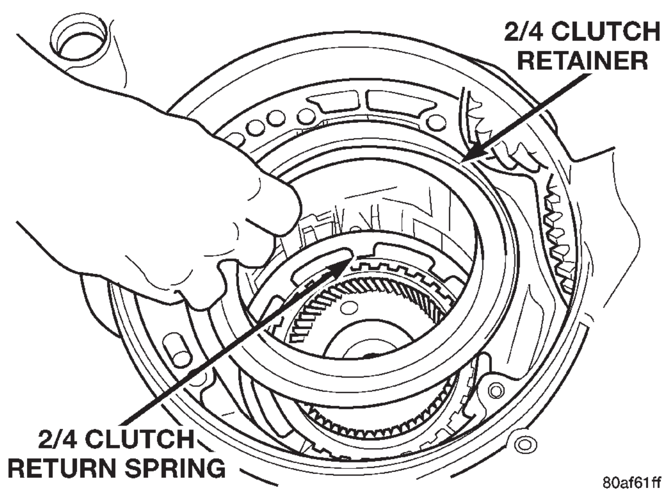


Fig. 274 Install 2/4 Clutch Retainer

NOTE: Verify that Miller Tool 5058 is centered properly to the 2/4 clutch retainer before depressing the tool.

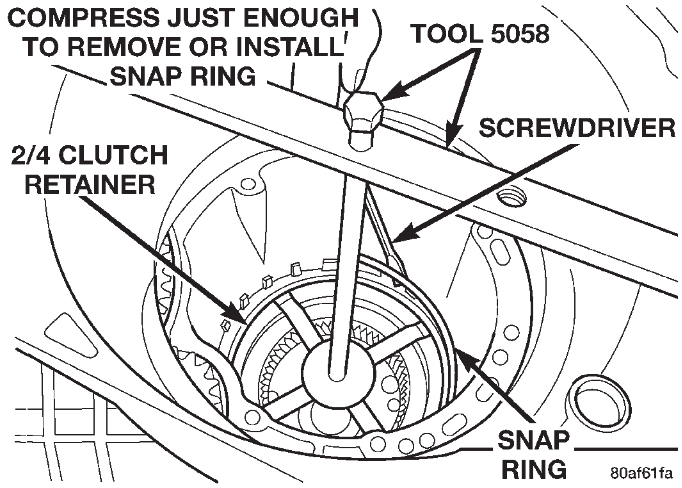


Fig. 275 Install 2/4 Clutch Retainer Snap Ring

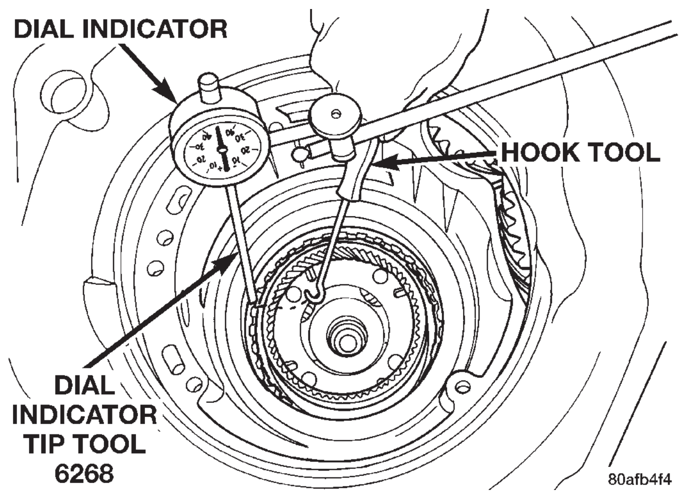


Fig. 276 Check 2/4 Clutch Clearance

Press down clutch pack with finger and zero dial indicator. **The 2/4 clutch pack clearance is 0.76 to 2.64mm (.030 to .104 inch).** If not within specifications, the clutch is not assembled properly. **There is no adjustment for the 2/4 clutch clearance.**

DETERMINING No. 4 THRUST PLATE THICKNESS—INPUT SHAFT END PLAY

To determine the proper thickness of the No. 4 thrust plate, select the thinnest No. 4 thrust plate. Using petrolatum (Fig. 280) to hold thrust plate in position, install input clutch assembly. Be sure the input clutch assembly is completely seated (Fig. 281).

CAUTION: If view through input speed sensor hole is not as shown above, the input clutches assembly is not seated properly.

DISASSEMBLY AND ASSEMBLY (Continued)

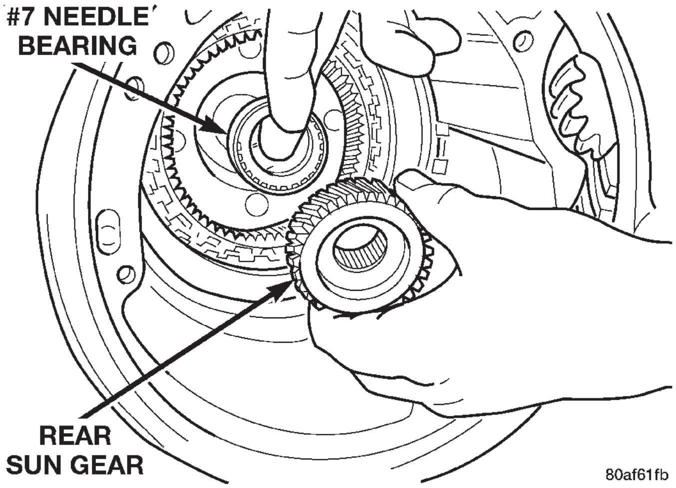


Fig. 277 Install Rear Sun Gear

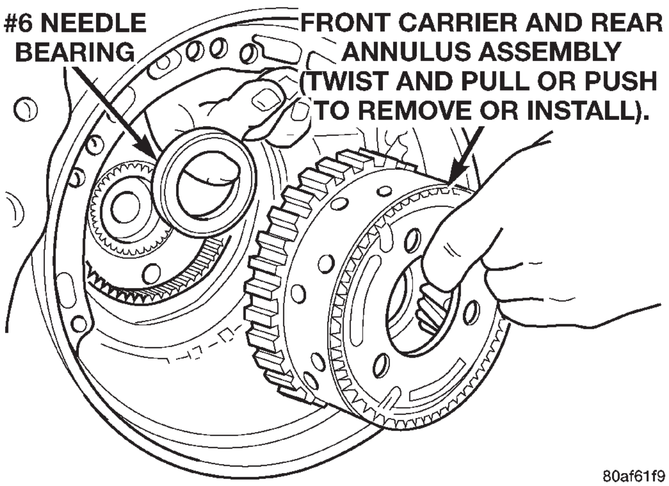


Fig. 278 Install Front Carrier and Rear Annulus Assembly

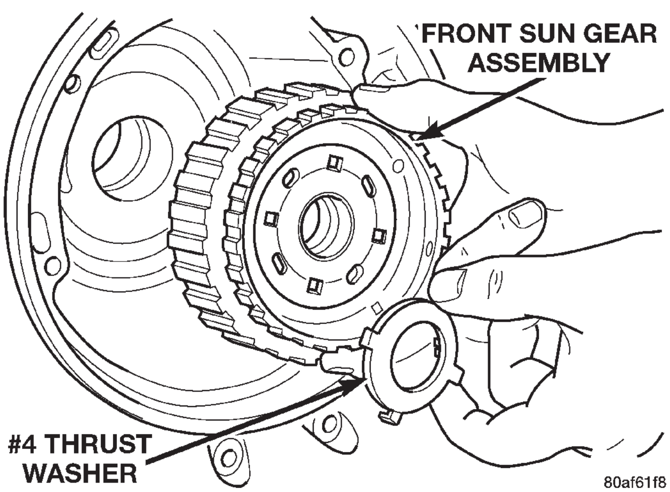


Fig. 279 Install Front Sun Gear Assembly

Remove the oil pump O-ring (Fig. 282). You will be able to install and remove the oil pump and gasket very easily to select the proper No. 4 thrust plate.

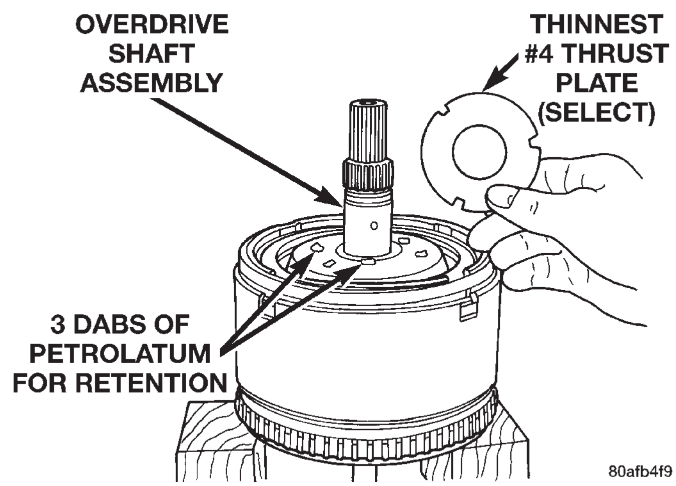


Fig. 280 Select Thinnest No. 4 Thrust Plate

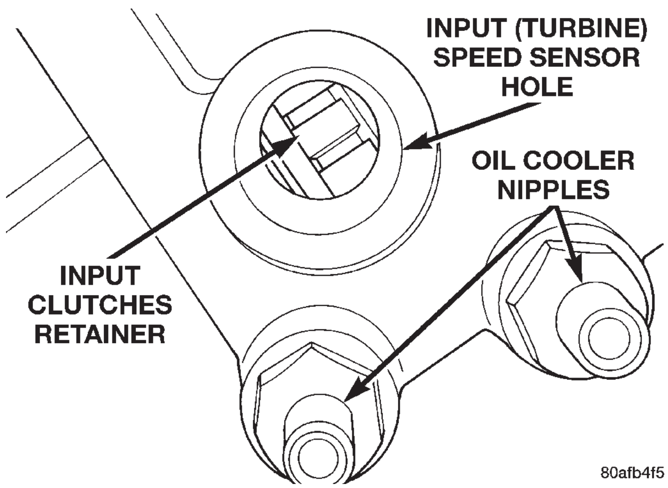


Fig. 281 View Through Input Speed Sensor Hole

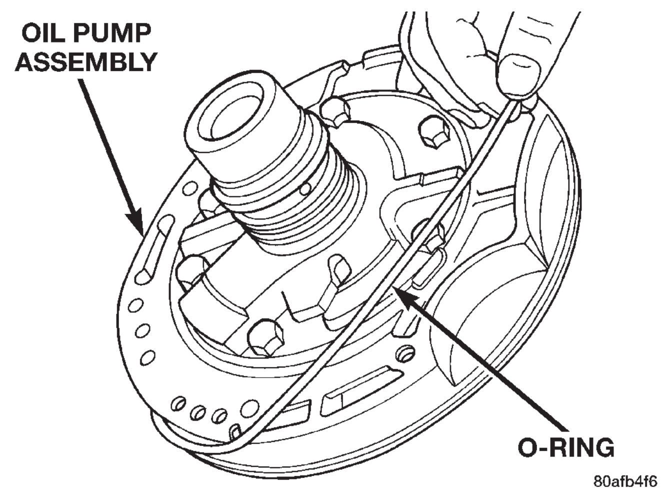


Fig. 282 Remove Oil Pump O-Ring

NOTE: Use screw-in dowels or phillips-head screw-drivers to align pump to case.

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.

Measure the input shaft end play with the transaxle in the vertical position. This will ensure that the measurement will be accurate.

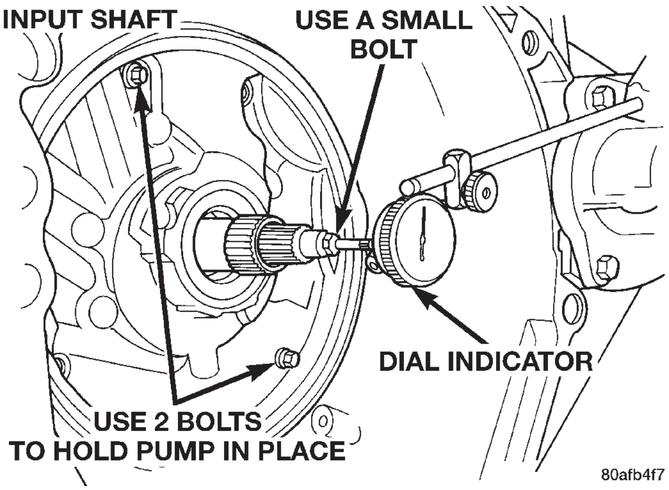


Fig. 283 Measure Input Shaft End Play

NOTE: Input shaft end play must be .005 to .025 inch.

For example, if end play reading is .055 inch, select No. 4 Thrust Plate which is .071 to .074 thick. This should provide an input shaft end play reading of .020 inch which is within specifications.

See chart to select the proper No. 4 thrust plate.

NO. 4 THRUST PLATE CHART

PART NUMBER	THICKNESS
4431662	.91mm (.036 in.)
4431663	1.14mm (.045 in.)
4431664	1.37mm (.054 in.)
4431665	1.60mm (.063 in.)
3836237	1.73mm (.068 in.)
4431666	1.80mm (.071 in.)
3836238	1.96mm (.077 in.)
4431667	2.03mm (.080 in.)
3836239	2.16mm (.085 in.)
4431668	2.24mm (.088 in.)
3836240	2.39mm (.094 in.)
4431669	2.46mm (.097 in.)
3836241	2.62mm (.103 in.)
4446670	2.67mm (.105 in.)
4446671	2.90mm (.114 in.)
4446672	3.15mm (.124 in.)
4446601	3.38mm (.133 in.)

Reinstall the input clutches assembly with the selected thrust plate.

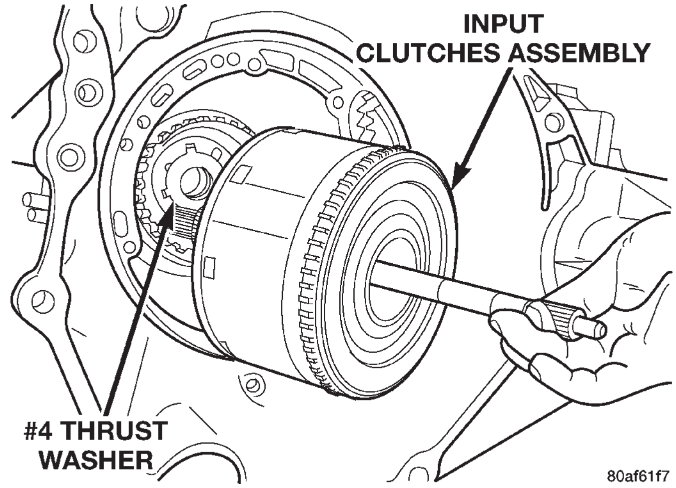


Fig. 284 Install Input Clutches Assembly

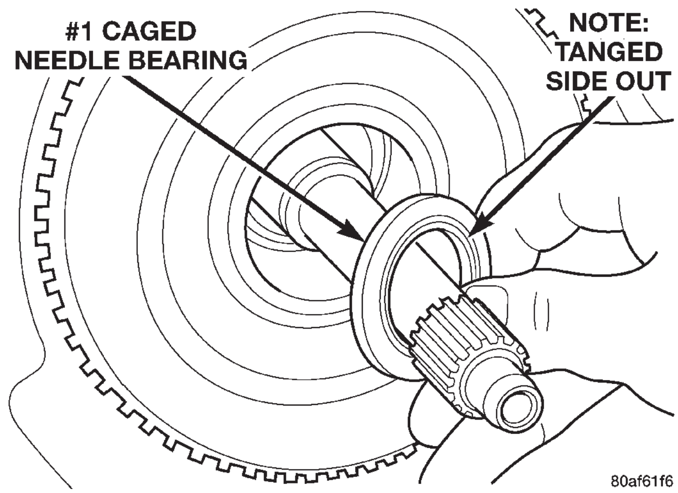


Fig. 285 Install Caged Needle Bearing

CAUTION: The cooler bypass valve must be replaced if a transaxle failure has occurred. Do not reuse old valve or attempt to clean old valve. When installing bypass valve, insert with O-ring end towards rear of case.

DISASSEMBLY AND ASSEMBLY (Continued)

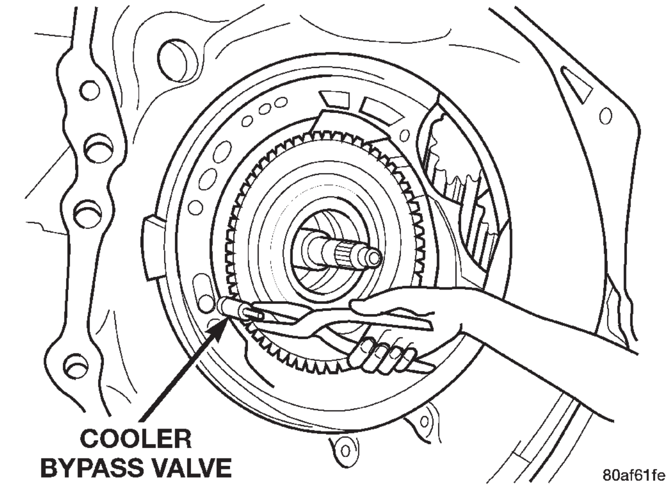


Fig. 286 Install Bypass Valve

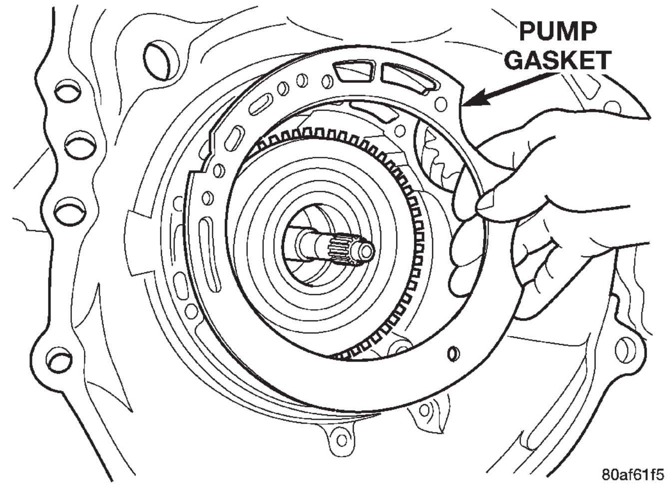


Fig. 287 Install Oil Pump Gasket

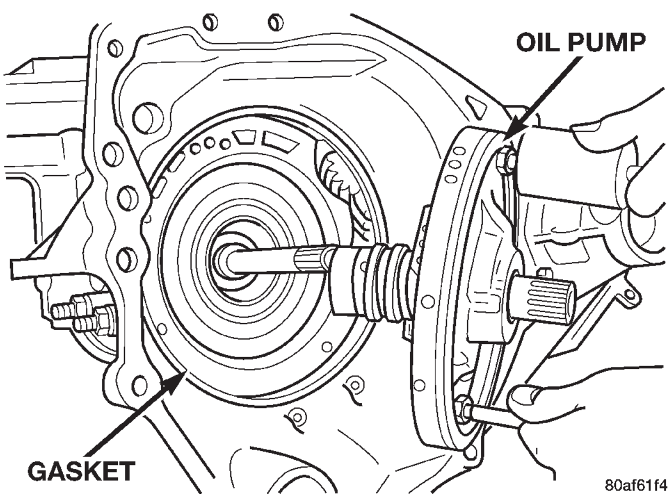


Fig. 288 Install Oil Pump

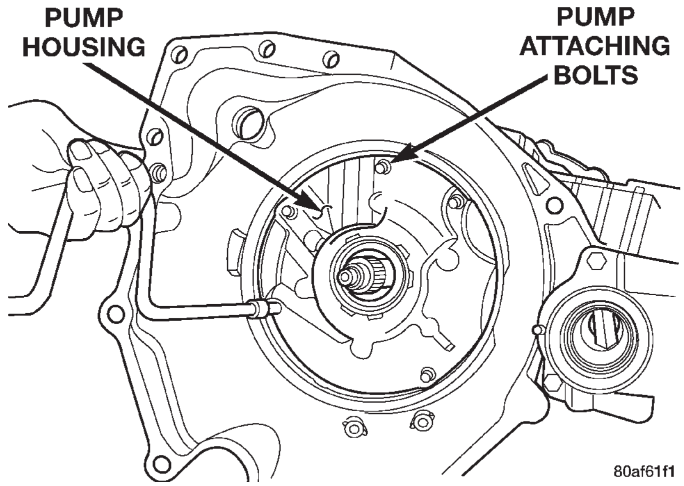


Fig. 289 Install Pump Attaching Bolts

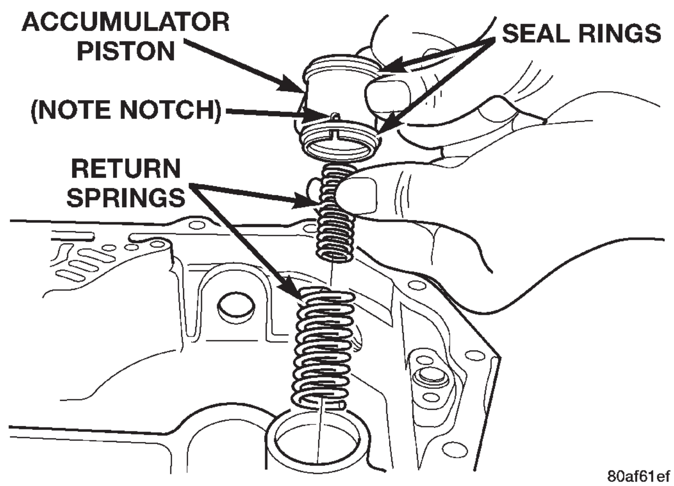


Fig. 290 Install Low/Reverse Accumulator

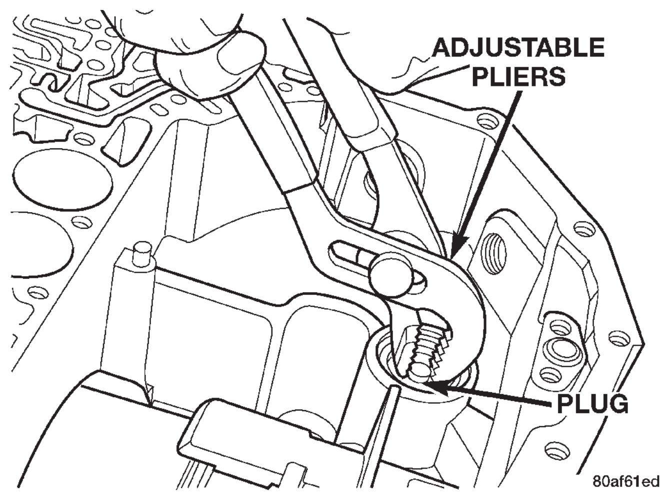


Fig. 291 Install Low/Reverse Accumulator Plug (Cover)

DISASSEMBLY AND ASSEMBLY (Continued)

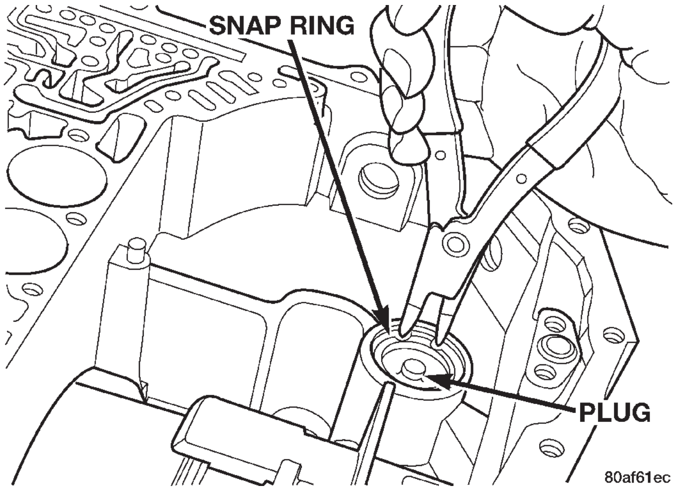


Fig. 292 Install Low/Reverse Accumulator Snap Ring

NOTE: Dependent on engine application, some accumulators will have two springs and others will have one spring. The springs are color coded for application and year.

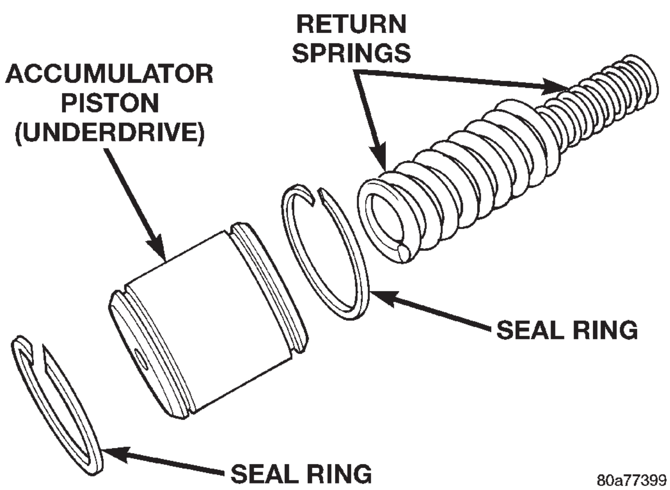


Fig. 293 Accumulator (Underdrive)

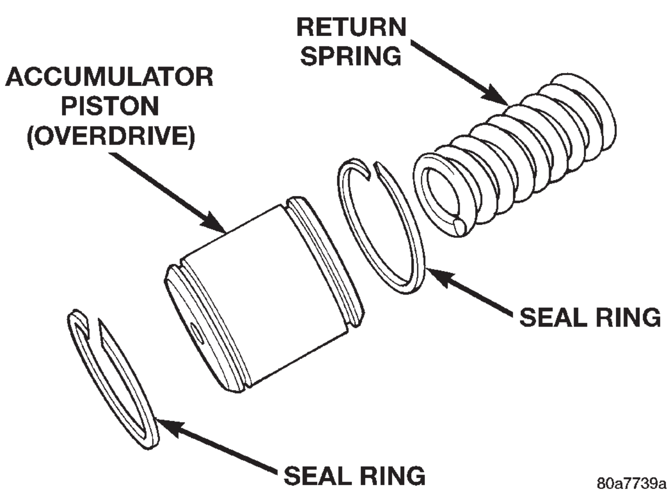


Fig. 294 Accumulator (Overdrive)

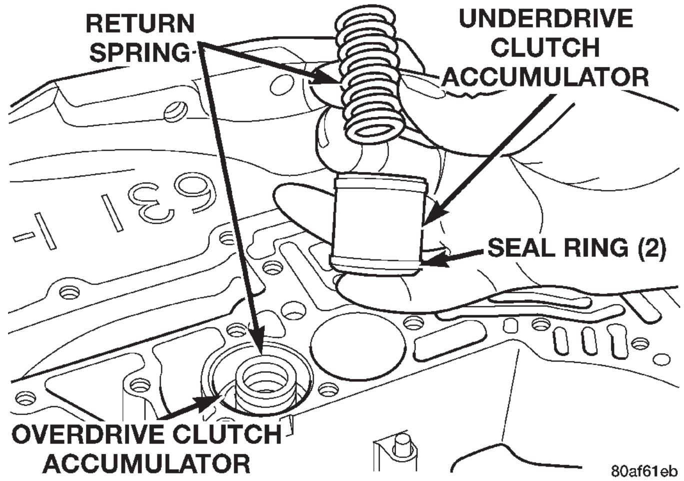


Fig. 295 Install Accumulators

NOTE: To ease installation of the valve body, turn the manual valve fully clockwise.

CAUTION: Do not handle the valve body from the manual valve. Damage could result.

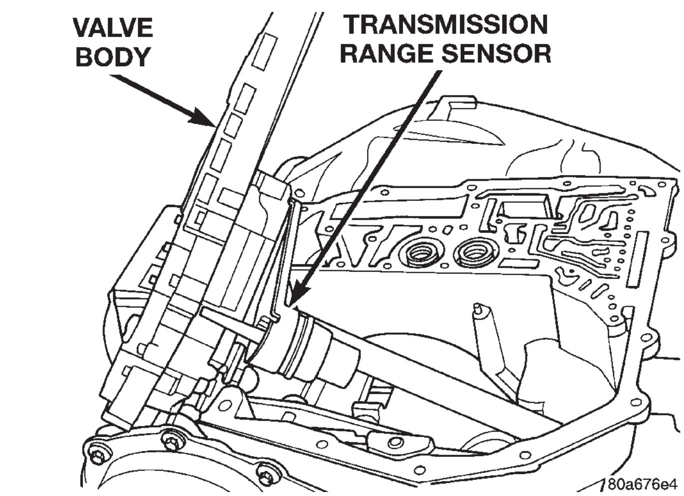


Fig. 296 Install Valve Body

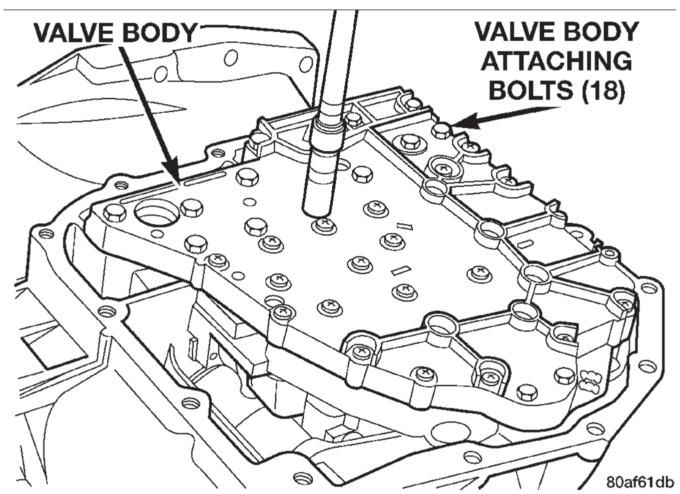


Fig. 297 Install Valve Body Attaching Bolts

DISASSEMBLY AND ASSEMBLY (Continued)

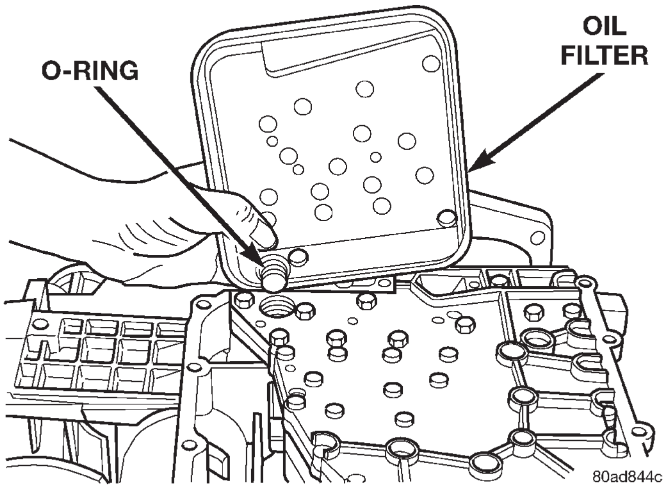


Fig. 298 Install Oil Filter

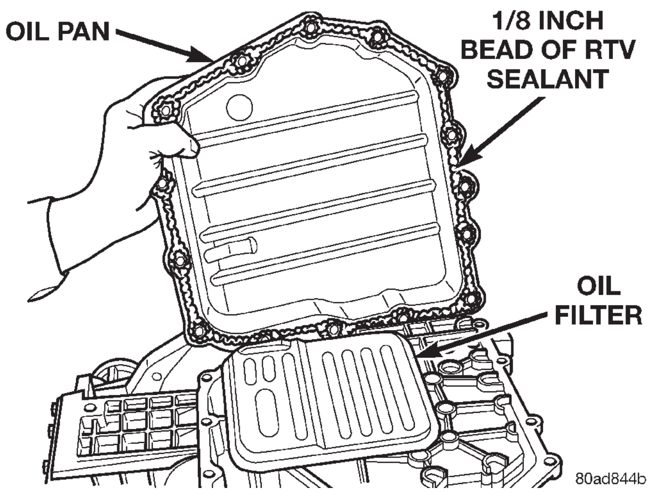


Fig. 299 Install Oil Pan

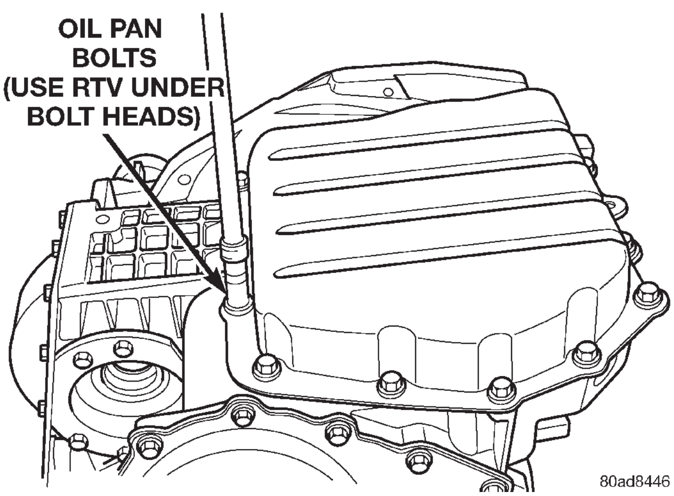


Fig. 300 Install Pan Bolts

(1) Install transaxle solenoid pack (Fig. 301).
(2) Install input and output speed sensors.

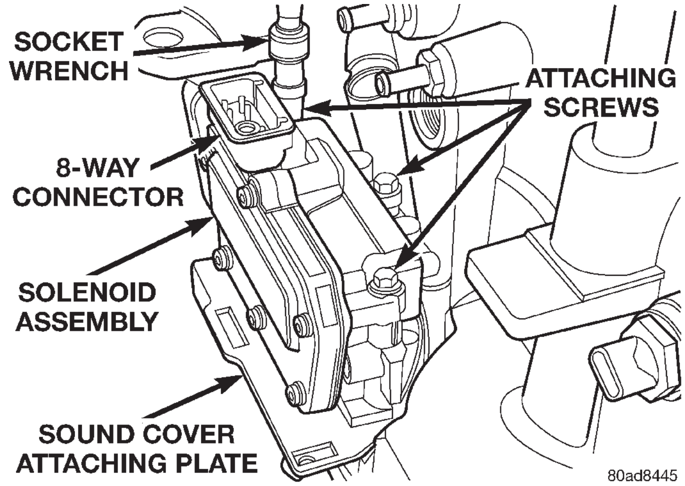


Fig. 301 Install Solenoid Pack

This concludes the assembly of the transaxle centerline.

DIFFERENTIAL REPAIR

NOTE: The differential is serviced as an assembly. The only parts that are serviceable within the differential are the differential bearing cups and cones. If any other part fails within the differential, you must replace the differential assembly along with the transfer shaft.

DISASSEMBLE

The transfer shaft should be removed for differential repair and bearing turning torque checking.

(1) Remove the differential cover and bolts (Fig. 302) (Fig. 303).

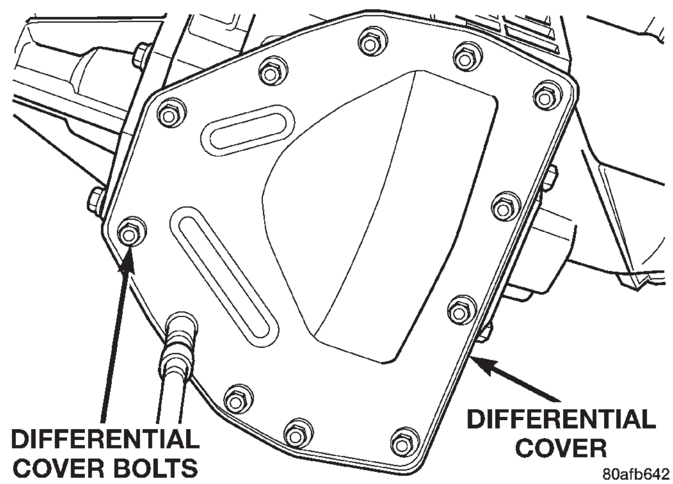


Fig. 302 Differential Cover Bolts

(2) Remove the differential bearing retainer and bolts (Fig. 304) (Fig. 305).

DISASSEMBLY AND ASSEMBLY (Continued)

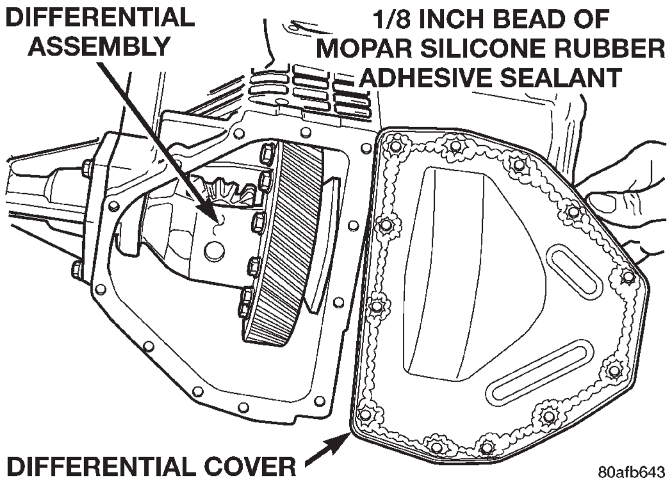


Fig. 303 Remove Differential Cover

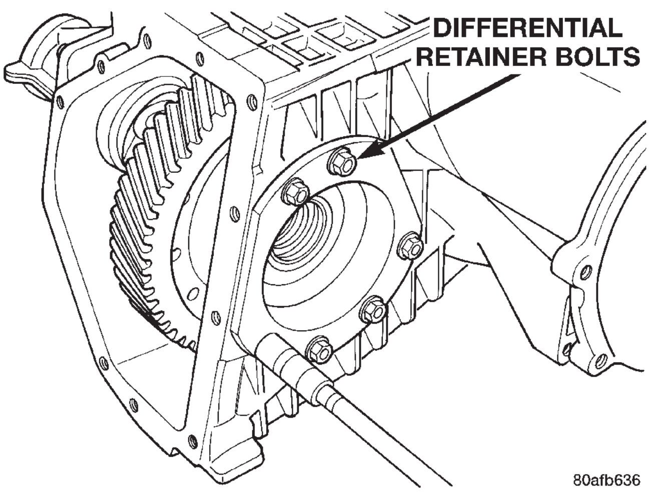


Fig. 304 Differential Retainer Bolts

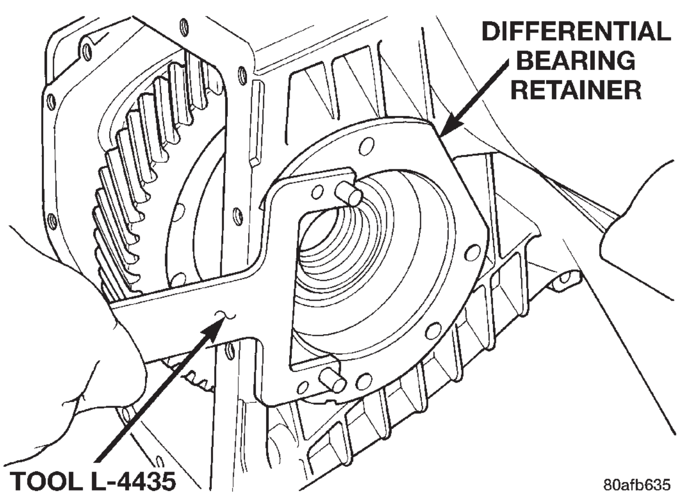


Fig. 305 Remove Bearing Retainer

(3) Using a plastic hammer, remove extension housing/adapter plate on the right side of the transaxle.

WARNING: HOLD ONTO DIFFERENTIAL ASSEMBLY TO PREVENT IT FROM ROLLING OUT OF HOUSING.

(4) Use Miller Special Tool 5048, 5048-3 Collets, and L-4539-2 Button to remove the differential bearing cone on the extension housing side.

(5) Use Miller Special Tool 5048, 5048-4 Collets, and L-4539-2 Button to remove the differential bearing cone on the bearing retainer side (Fig. 306) (Fig. 307) (Fig. 308).

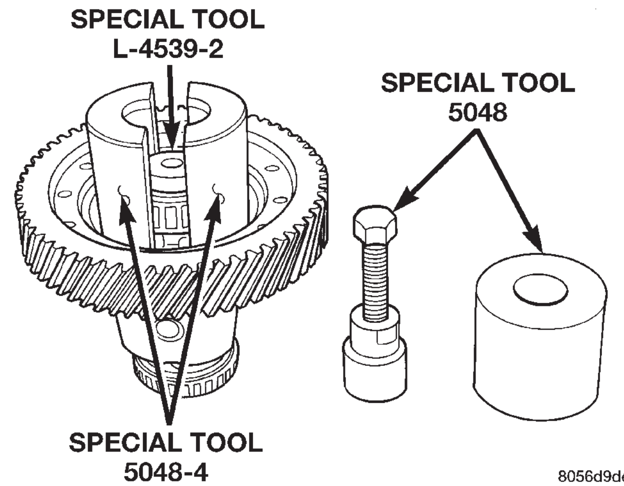


Fig. 306 Position Button and Collets Onto Differential and Bearing (Ring Gear Side)

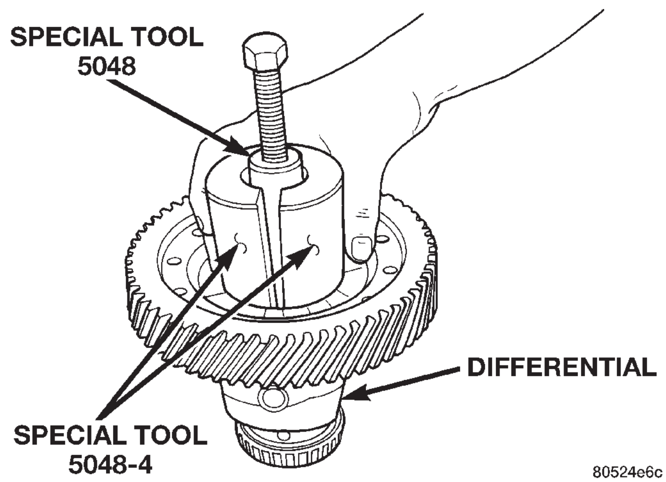


Fig. 307 Position Tool 5048 Over Button and Collets at Differential Bearing (Ring Gear Side)

(6) Using Miller Special Tool L-4518, remove the differential bearing race from the extension housing.

(7) Using Miller Special Tool 6062A, remove the differential bearing race from the bearing retainer (Fig. 309) (Fig. 310).

CHECKING SIDE GEAR END PLAY

Check side gear end play whenever the differential is removed for service.

DISASSEMBLY AND ASSEMBLY (Continued)

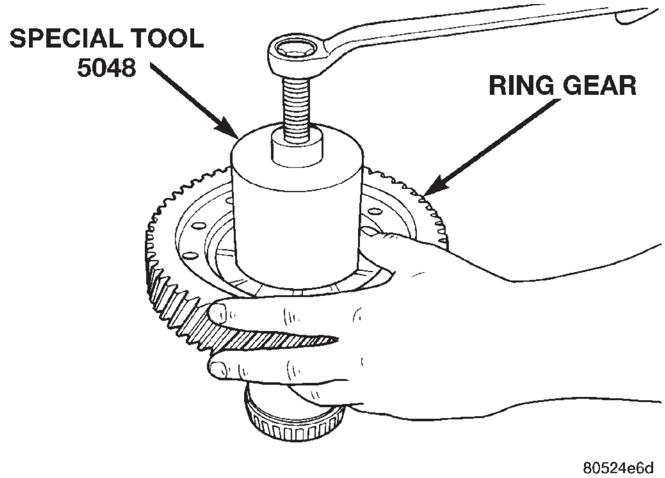


Fig. 308 Remove Differential Bearing Cone (Ring Gear Side)

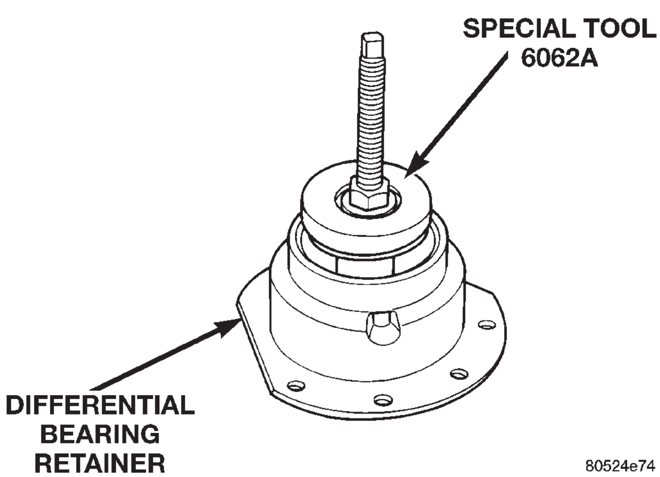


Fig. 309 Position Bearing Cup Remover Tool in Retainer

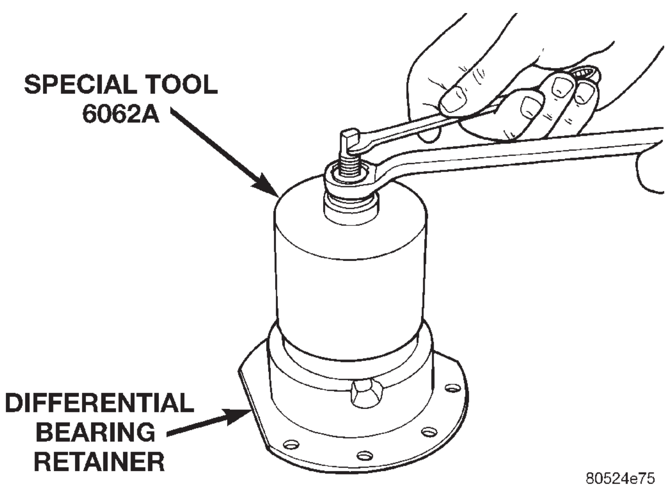


Fig. 310 Remove Bearing Cup

NOTE: Side gear end play must be BETWEEN 0.001 to 0.013 inch.

DIFFERENTIAL SERVICE TOOLS

COMPONENT	REMOVER	INSTALLER
Diff. Bear. On Retainer Side	5048, 5048-4 Collets, L-4539-2 Button	5052, C-4171
Diff. Bear. On Ext. Hous. Side	5048, 5048-3 Collets, L-4539-2 Button	L-4410, C-4171
Diff. Race. On Retainer Side	6062-A	6061, C-4171
Diff. Race. On Ext. Hous. Side	L-4518	L-4520, C-4171
Extension Housing Seal	7794-A, C-637 Slide Hammer	L-4520, C-4171
Bearing Retainer Seal	794-A, C-637 Slide Hammer	L-4520, C-4171

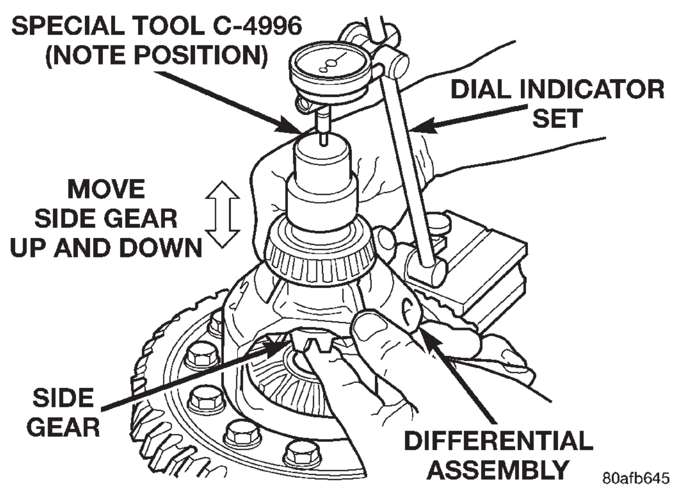


Fig. 311 Checking Side Gear End Play (Extension Housing Side)

ASSEMBLE

NOTE: Use Mopar® Silicone Rubber Adhesive Sealant, or equivalent, on retainer and extension housing/adapter plate to seal to case.

(1) Using Miller Special Tool L-4410, and C-4171, install differential bearing to differential (extension housing side) (Fig. 313).

(2) Using Miller Special Tool 5052 and C-4171, install differential bearing to differential (bearing retainer side).

DISASSEMBLY AND ASSEMBLY (Continued)

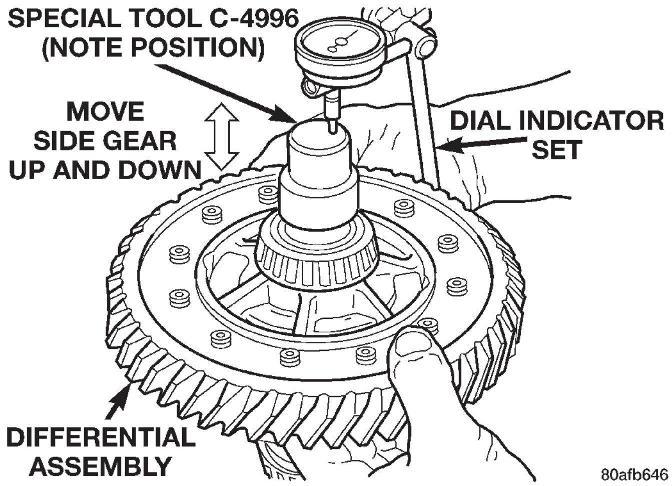


Fig. 312 Checking Side Gear End Play (Bearing Retainer Side)

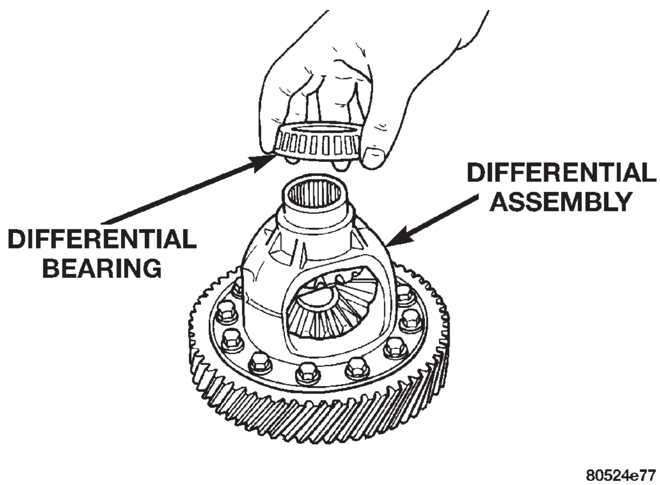


Fig. 313 Position Bearing Cone Onto Differential

(3) Using Miller Special Tool 6061 and C-4171, install differential bearing race to bearing retainer (Fig. 314).

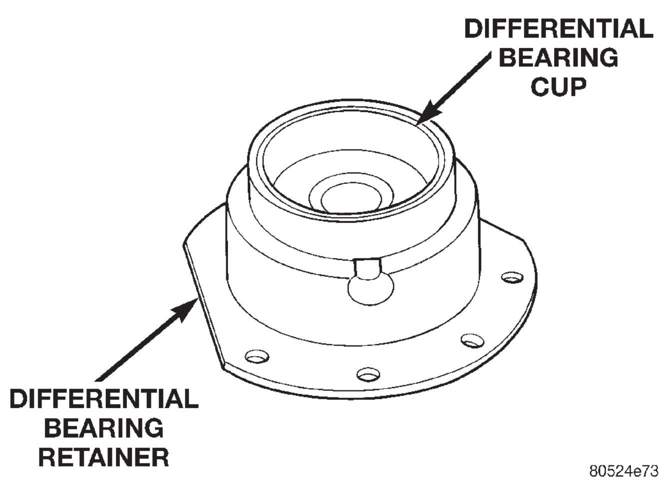


Fig. 314 Differential Bearing Retainer

(4) Using Miller Special Tool L–4520 and C-4171, install differential bearing to extension housing.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT

NOTE: Perform all differential bearing preload measurements with the transfer shaft and gear removed.

DIFFERENTIAL BEARING PRELOAD ADJUSTMENT USING EXISTING SHIM

(1) Position the transaxle assembly vertically on the support stand, differential bearing retainer side up.

(2) Install Tool L-4436A into the differential and onto the pinion mate shaft (Fig. 315).

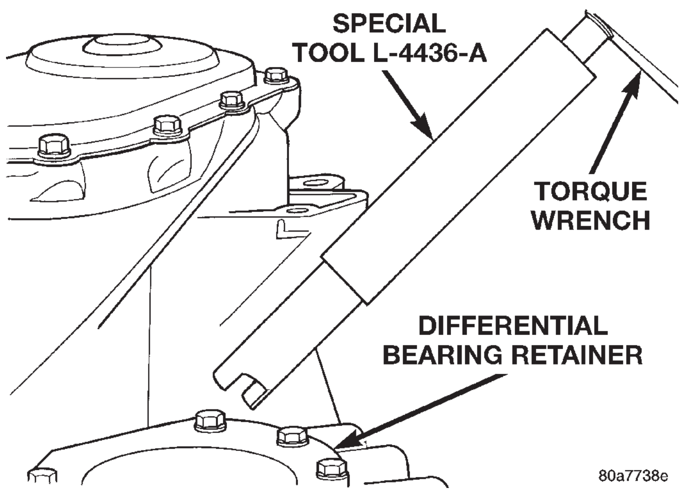


Fig. 315 Tool L-4436 and Torque Wrench

(3) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(4) Using Tool L-4436A and an inch-pound torque wrench, check the turning torque of the differential (Fig. 316). **The turning torque should be between 5 and 18 inch-pounds.**

(5) If the turning torque is within specifications, remove tools. Setup is complete.

(6) If turning torque is not within specifications proceed with the following steps.

(a) Remove differential bearing retainer from the transaxle case.

(b) Remove the bearing cup from the differential bearing retainer using Tool 6062A.

(c) Remove the existing shim from under the cup.

(d) Measure the existing shim.

DISASSEMBLY AND ASSEMBLY (Continued)

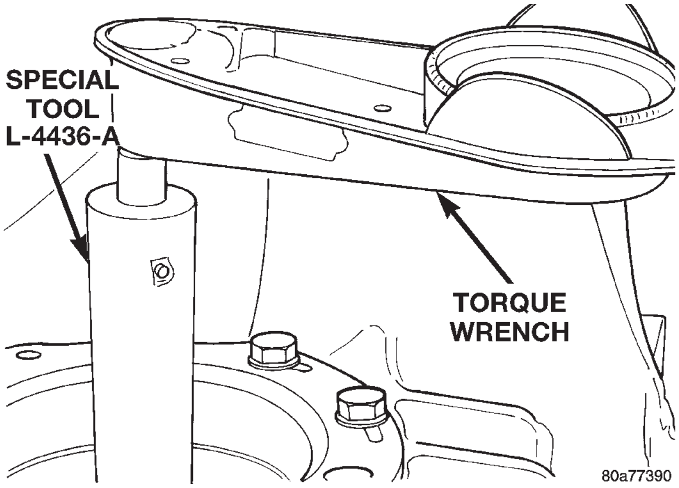


Fig. 316 Checking Differential Bearings Turning Torque

NOTE: If the turning torque was too high when measured, install a .05 mm (.002 inch) thinner shim. If the turning torque is was too low, install a .05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained.

Oil Baffle is not required to be installed when making shim selection.

(f) Install the proper shim under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(g) Install the differential bearing retainer using Tool 5052 and C-4171. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N·m (250 in. lbs.).

(7) Using Tool L-4436A and an inch-pound torque wrench, recheck the turning torque of the differential (Fig. 316). **The turning torque should be between 5 and 18 inch-pounds.**

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Differential carrier
- Differential bearing retainer
- Extension housing
- Differential bearing cups and cones

DIFFERENTIAL BEARING SHIM CHART

PART NUMBER	SHIM THICKNESS	
	MM	INCH
4659257	.980	0.0386
4659258	1.02	0.0402
4659259	1.06	0.0418
4659260	1.10	0.0434
4659261	1.14	0.0449
4659262	1.18	0.0465
4659263	1.22	0.0481
4659264	1.26	0.0497
4659265	1.30	0.0512
4659266	1.34	0.0528
4659267	1.38	0.0544
4659268	1.42	0.0560
4659269	1.46	0.0575
4659270	1.50	0.0591
4659271	1.54	0.0607
4659272	1.58	0.0623
4659273	1.62	0.0638
4659274	1.66	0.0654
4659275	1.70	0.0670
4659283	2.02	0.0796
4659284	2.06	0.0812

DISASSEMBLY AND ASSEMBLY (Continued)

PRELOAD ADJUSTMENT W/O SHIM

(1) Remove the bearing cup from the differential bearing retainer using Miller special Tool 6062A.

(2) Remove existing shim from under bearing cup.

(3) Reinstall the bearing cup into the retainer using Miller Special Tool 6061, and C-4171.

NOTE: Oil baffle is not required when making the shim calculation.

(4) Install the bearing retainer into the case. Torque bolts to 28 N·m (250 in. lbs.).

(5) Position the transaxle assembly vertically on the support stand and install Miller Special Tool L-4436-A into the bearing retainer.

(6) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(7) Attach a dial indicator to the case and zero the dial. Place the tip on the end of Special Tool L-4436-A.

(8) Place a large screwdriver to each side of the ring gear and lift. Check the dial indicator for the amount of end play.

CAUTION: Do not damage the transaxle case and/or differential retainer sealing surface.

(9) Using the end play measurement that was determined, add .18mm (.007 inch). This should give you between 5 and 18 inch pounds of bearing preload. Refer to the Differential Bearing Shim Chart to determine which shim to use.

(10) Remove the differential bearing retainer. Remove the bearing cup.

(11) Install the oil baffle. Install the proper shim combination under the bearing cup.

(12) Install the differential bearing retainer. Seal the retainer to the housing with Mopar® Silicone Rubber Adhesive Sealant. Torque bolts to 28 N·m (250 in. lbs.).

(13) Using Miller Special Tool L-4436-A and an inch-pound torque wrench, check the turning torque of the differential (Fig. 316). The turning torque should be between 5-18 inch-pounds.

NOTE: If turning torque is too high install a .05mm (.002 inch) thicker shim. If the turning torque is too low, install a .05mm (.002 inch) thinner shim. Repeat until 5-18 inch-pounds of turning torque is obtained.

CLEANING AND INSPECTION

CLEANING VALVE BODY

Prior to removing any transaxle parts, plug all openings and clean unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the transaxles are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

NOTE: Tag all springs, as they are removed, for reassembly identification.

ADJUSTMENTS

GEARSHIFT LINKAGE ADJUSTMENT

Normal operation of the Park/Neutral Position Switch provides a quick check to confirm proper linkage adjustment.

Move the selector level slowly forward until it clicks into the (P) Park position. The starter should operate.

After checking the (P) position, move selector slowly toward the (N) Neutral position until lever is in the (N) position. If the starter will also operate at this point the gearshift linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

ADJUSTMENT

(1) Set parking brake.

(2) Remove the gearshift knob set screw and knob.

(3) Remove gearshift selector bezel and lamp wiring.

(4) Install the gearshift knob set screw and knob.

(5) Place gearshift lever in the (P) (PARK) position.

(6) Loosen the gearshift cable adjuster nut at the shifter assembly (Fig. 317).

(7) Move the gearshift lever on the transaxle to the park position.

(8) Verify the shift lever and transaxle are in park position. Tighten the gearshift cable adjuster nut at the shifter assembly. The gearshift linkage should now be properly adjusted.

(9) Check adjustment as follows:

- Detent position for neutral and drive should be within limits of hand lever gate stops.
- Key start must occur only when shift lever is in park or neutral positions.

ADJUSTMENTS (Continued)

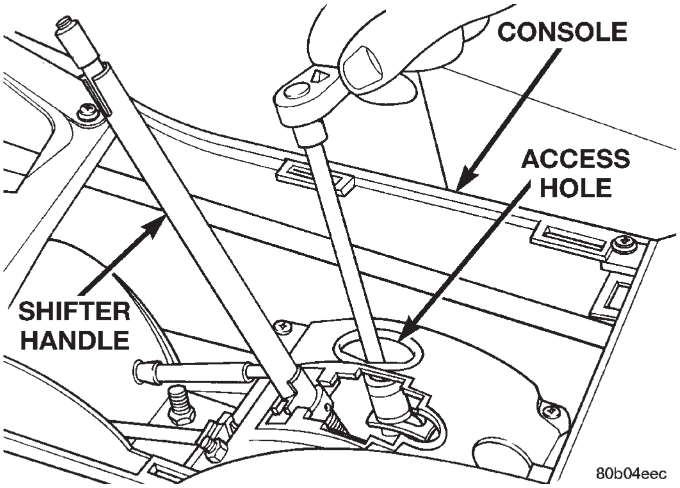


Fig. 317 Shift Cable Adjust Lever Nut

AUTOSTICK

The autostick switch is serviced as an assembly with the gearshift mechanism. The switch is not adjustable. If a problem occurs with the switch, refer to the Diagnosis and Testing section.

INTERLOCK SYSTEM ADJUSTMENT

If ignition switch cannot be turned to the LOCK position, with shifter in PARK, an adjustment of the Interlock System may be required. To adjust Shifter/Ignition Interlock System, follow procedure listed below.

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove the gearshift knob set screw and knob.

(3) Remove console assembly. Refer to Group 23, Body.

(4) Install the gearshift knob set screw and knob.

(5) Place the shift lever in PARK. Move the Ignition key to the LOCK position (Fig. 319) and remove the key.

NOTE: Do not adjust the interlock cable at the location shown in (Fig. 318).

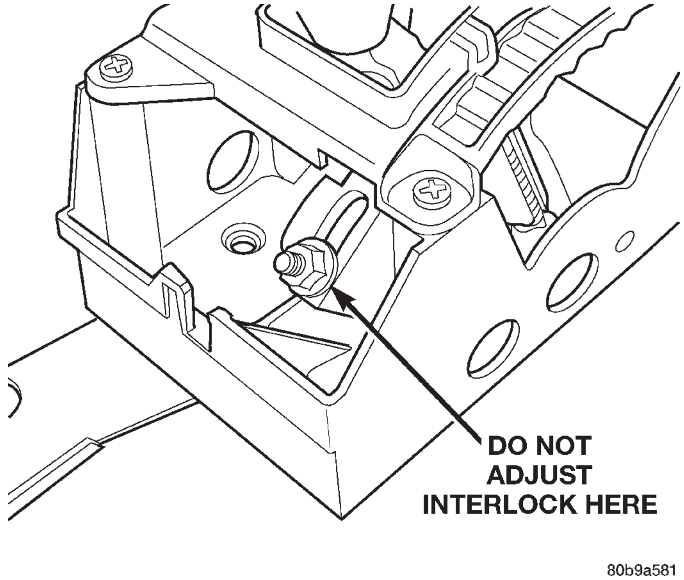


Fig. 318 Do Not Adjust Interlock Cable Here

(6) If the interlock cable is being replaced, remove the lock pin (Fig. 320). This will allow the cable to "self adjust" to the correct position. Tighten the locking clip by pushing it down (Fig. 320).

(7) If the intelock cable **is not** being replaced, the lock pin will not exist. Pull outward on cable locking clip (Fig. 320) to allow cable to self adjust.

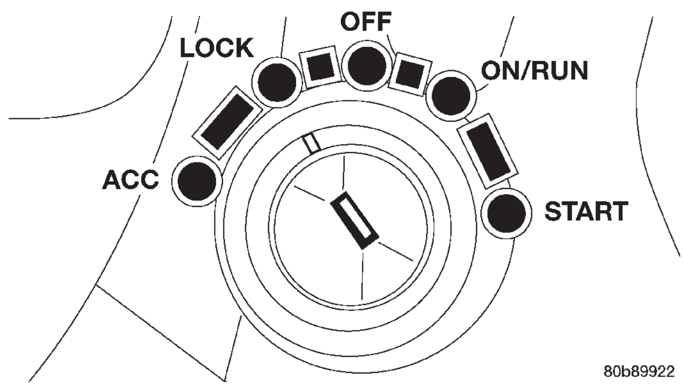


Fig. 319 Ignition Key/Switch Position

ADJUSTMENTS (Continued)

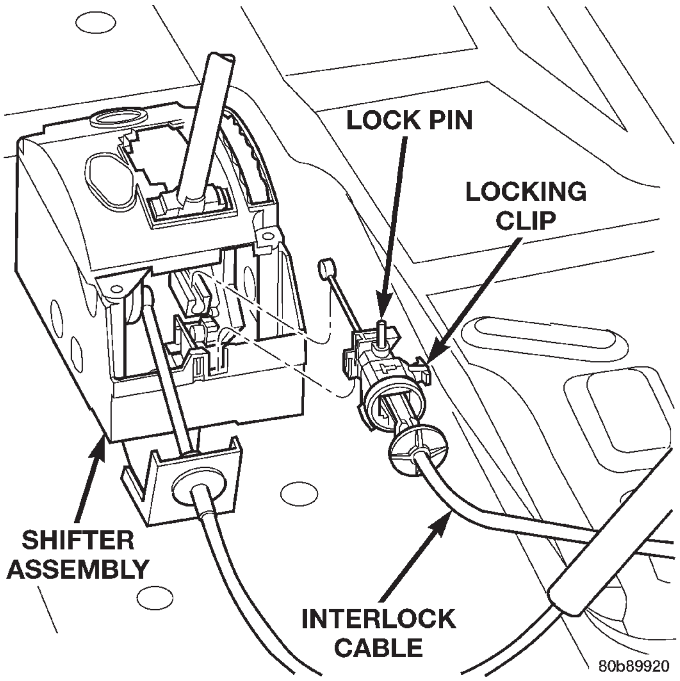


Fig. 320 Interlock Cable and Locking Clip

(8) **Verify interlock system operation:**

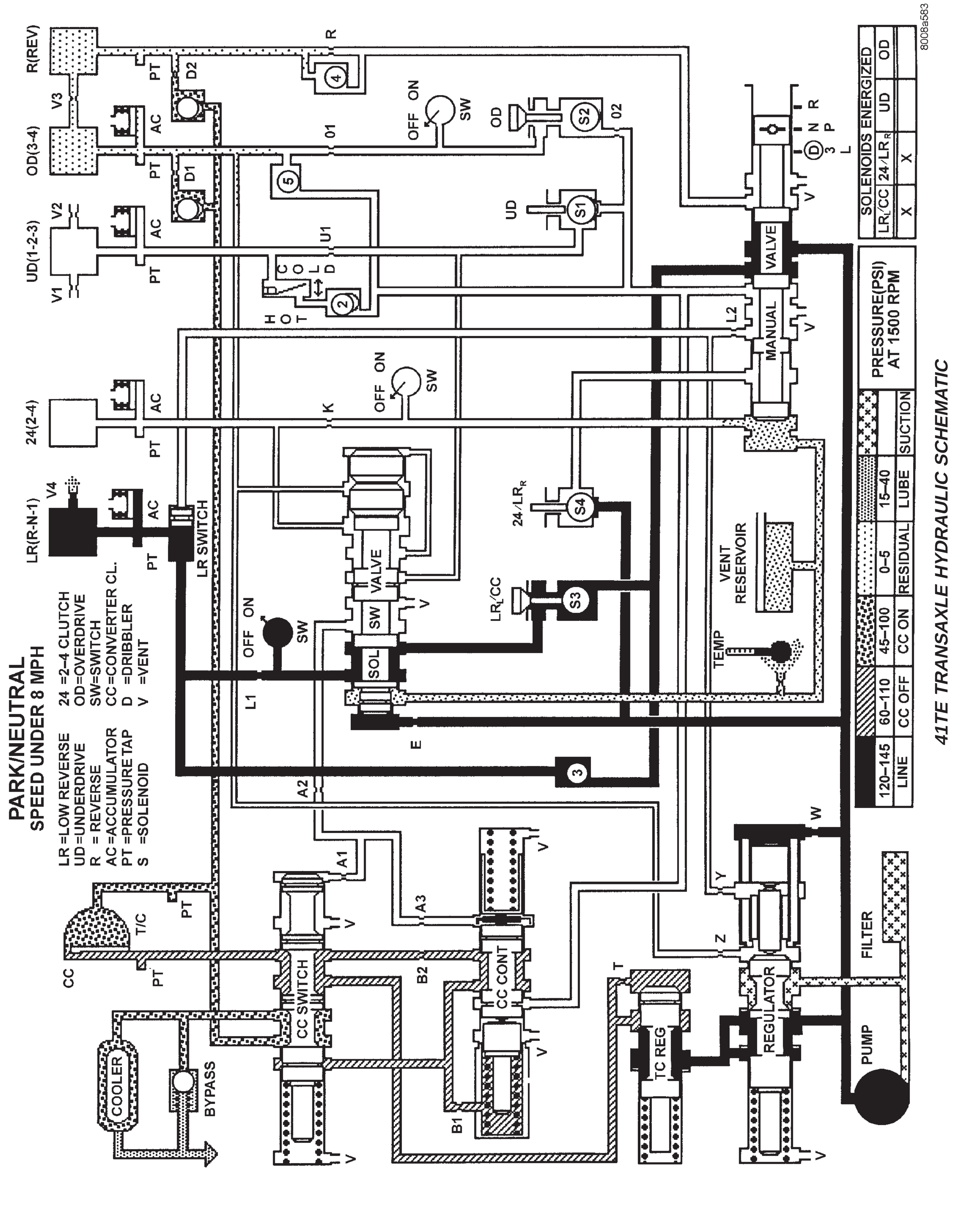
- With the lock cylinder in LOCK position (Fig. 319) and the ignition key removed, the shifter SHOULD NOT be able to move out of PARK.
- With the ignition key in the ON/RUN position (Fig. 319), the shifter SHOULD be able to move out of PARK and into ANY gear range.
- Place the shifter in DRIVE. The ignition key SHOULD NOT be able to be removed.
- Return the shifter to PARK. The ignition key SHOULD be able to return to LOCK (Fig. 319) and be removed.
- Any failure to meet these correct system responses requires system repair.

(9) Install the bezel on the shifter console.

(10) Install shifter handle.

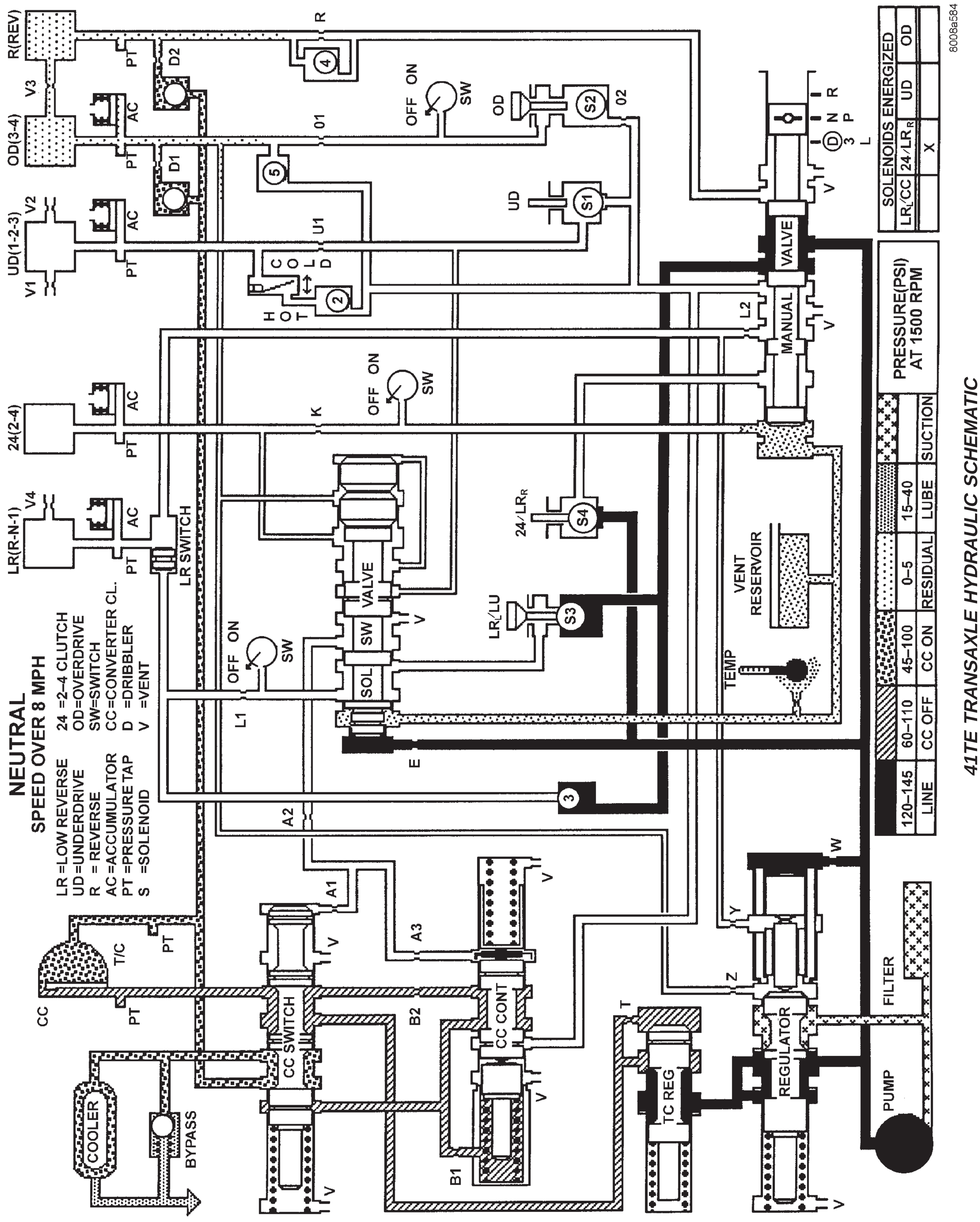
SCHEMATICS AND DIAGRAMS

41TE TRANSAXLE HYDRAULIC SCHEMATICS



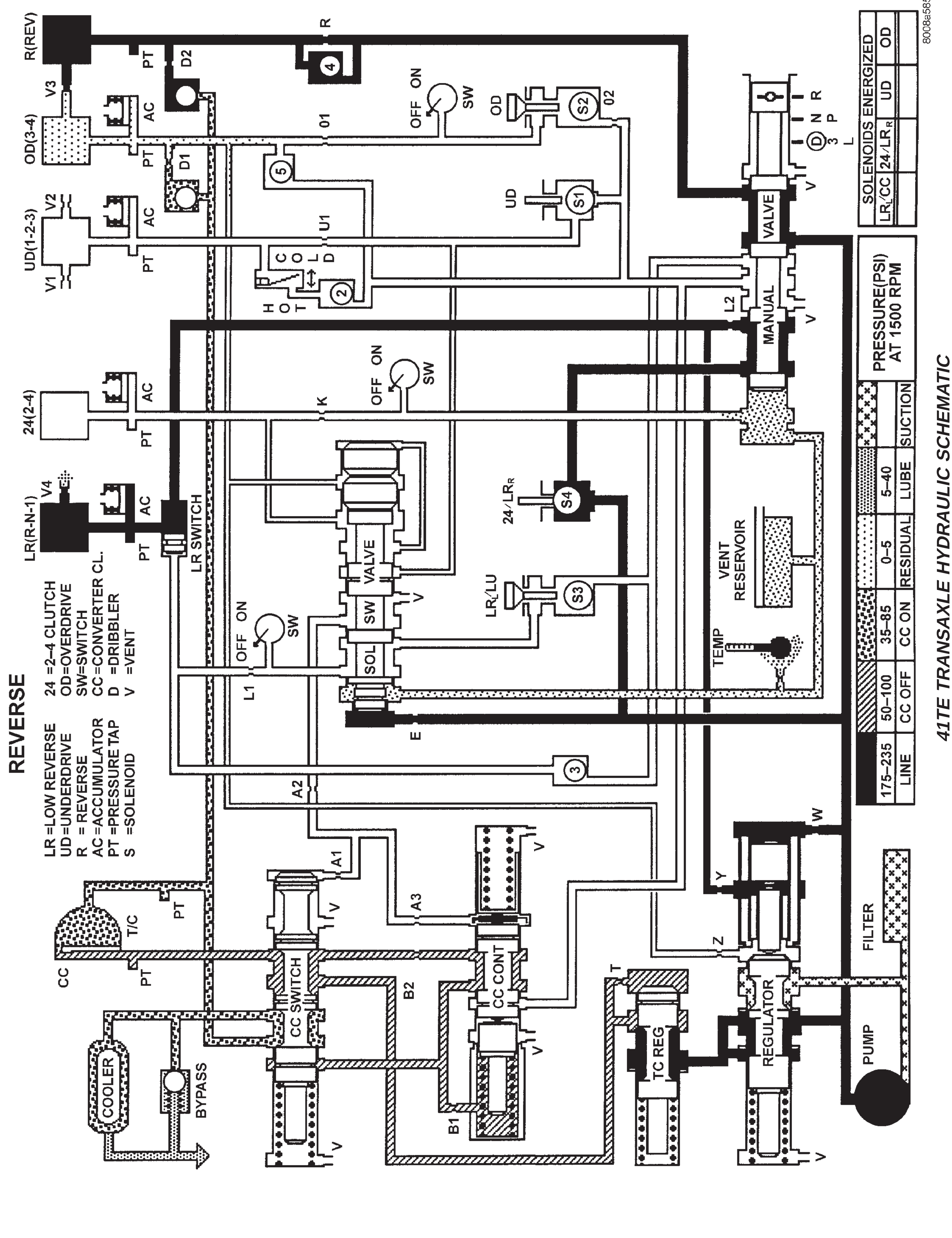
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

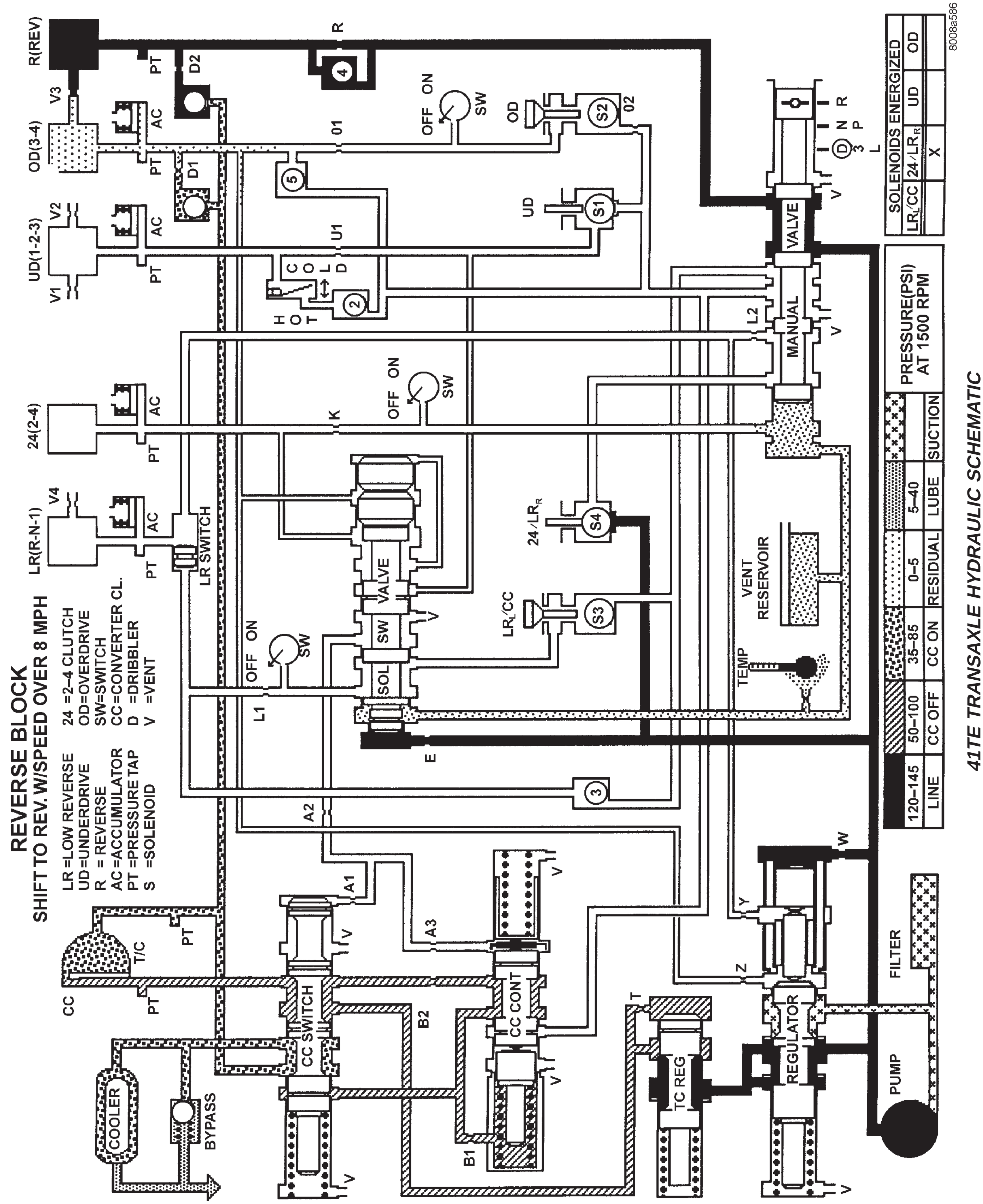


41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

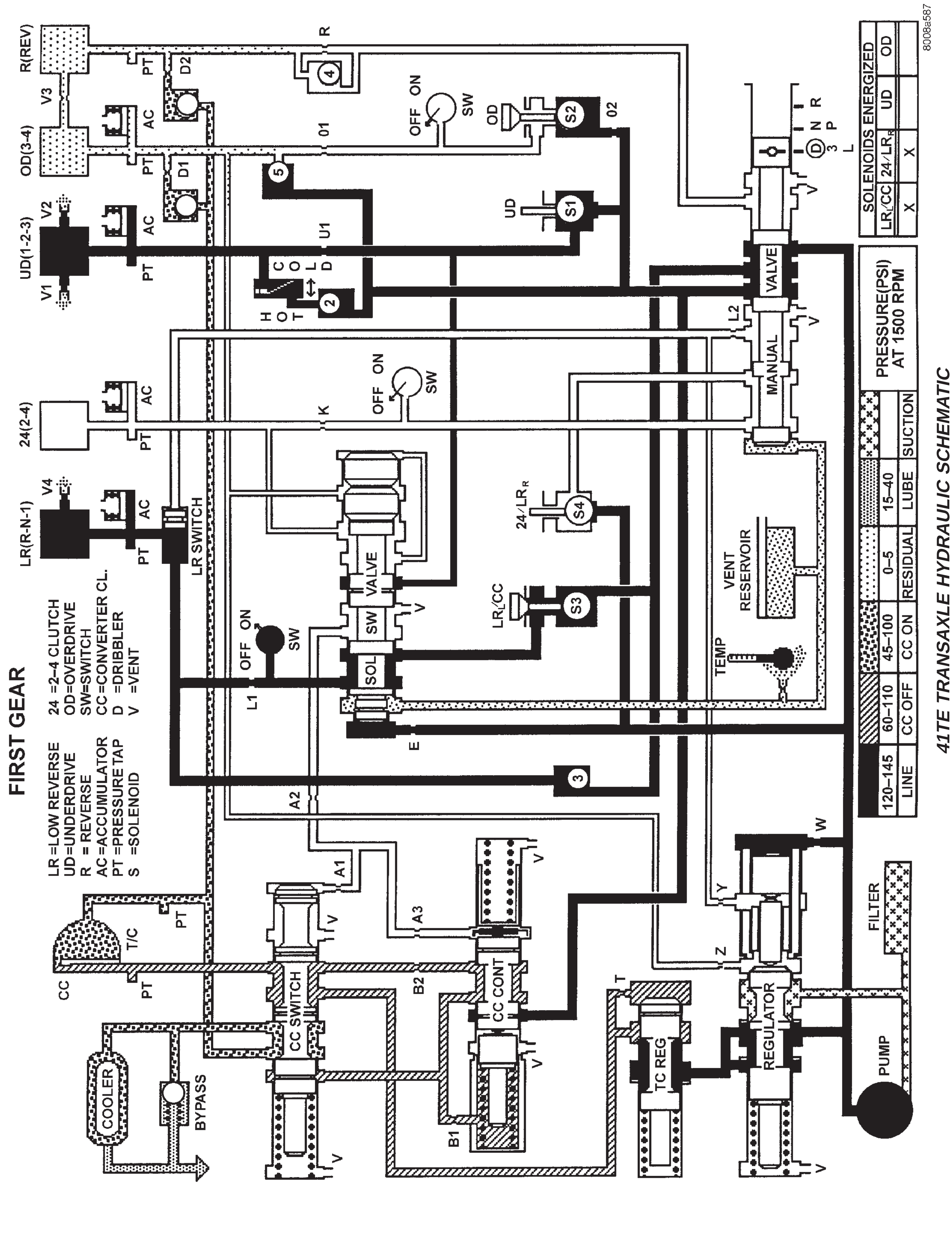


SCHEMATICS AND DIAGRAMS (Continued)



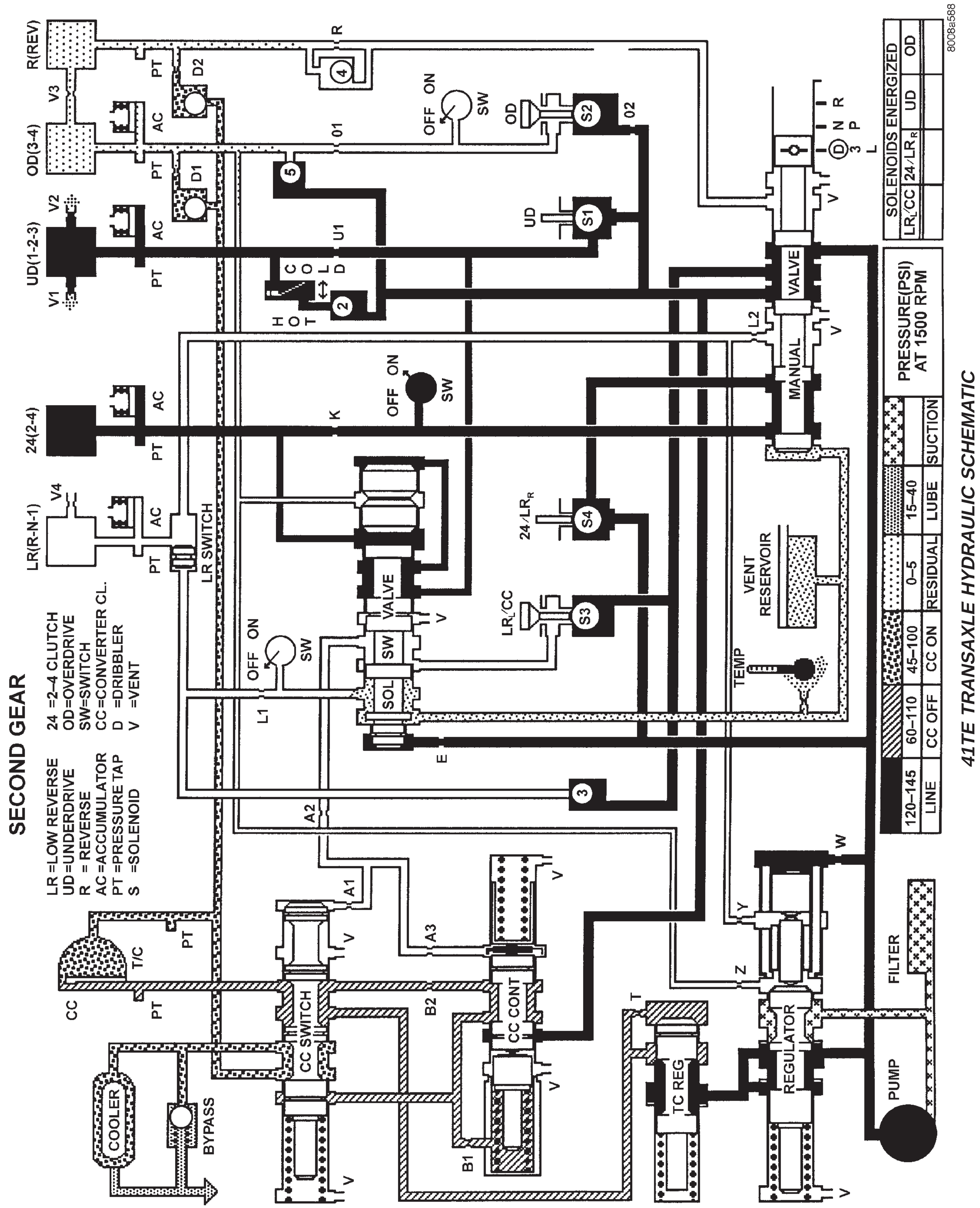
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



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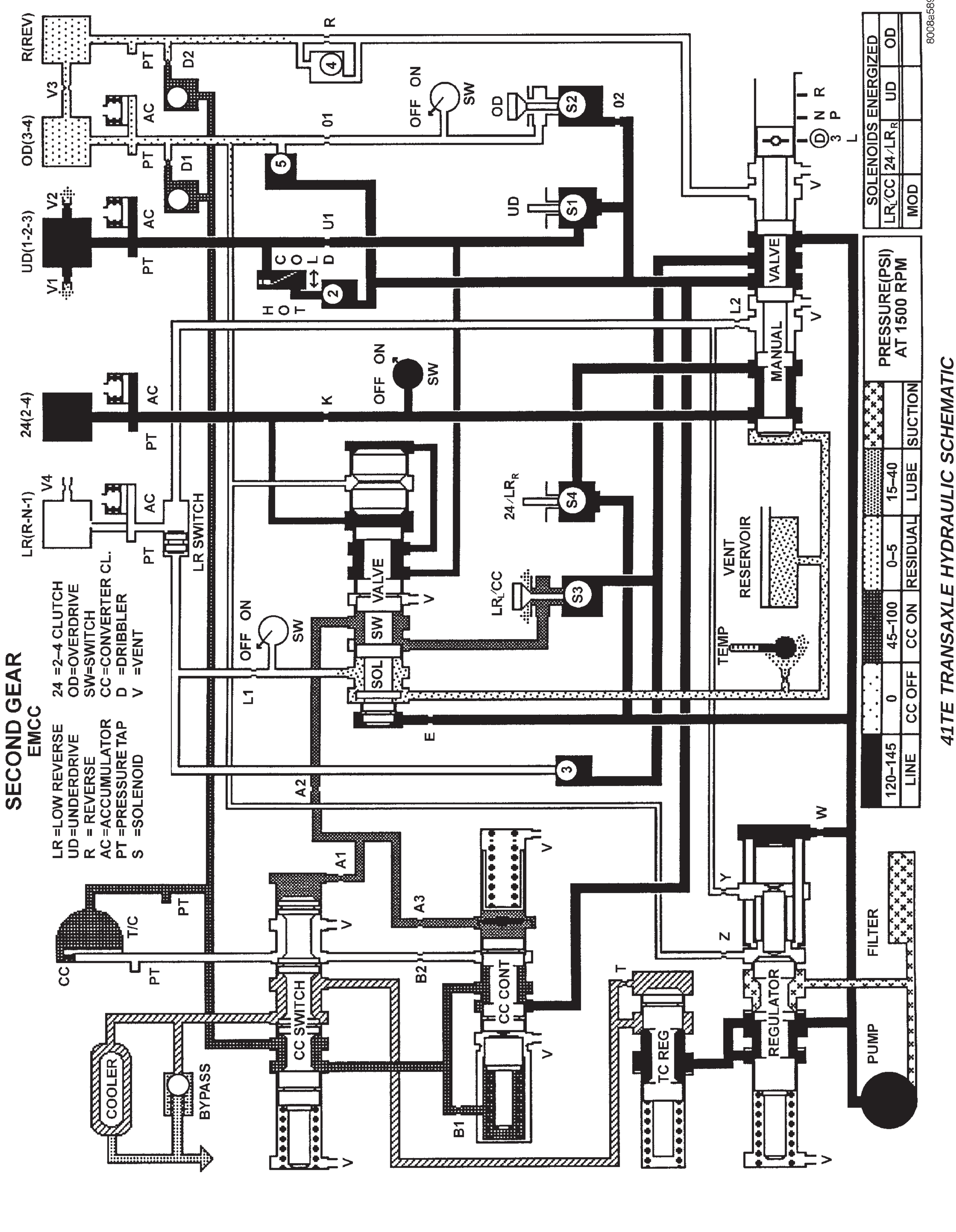

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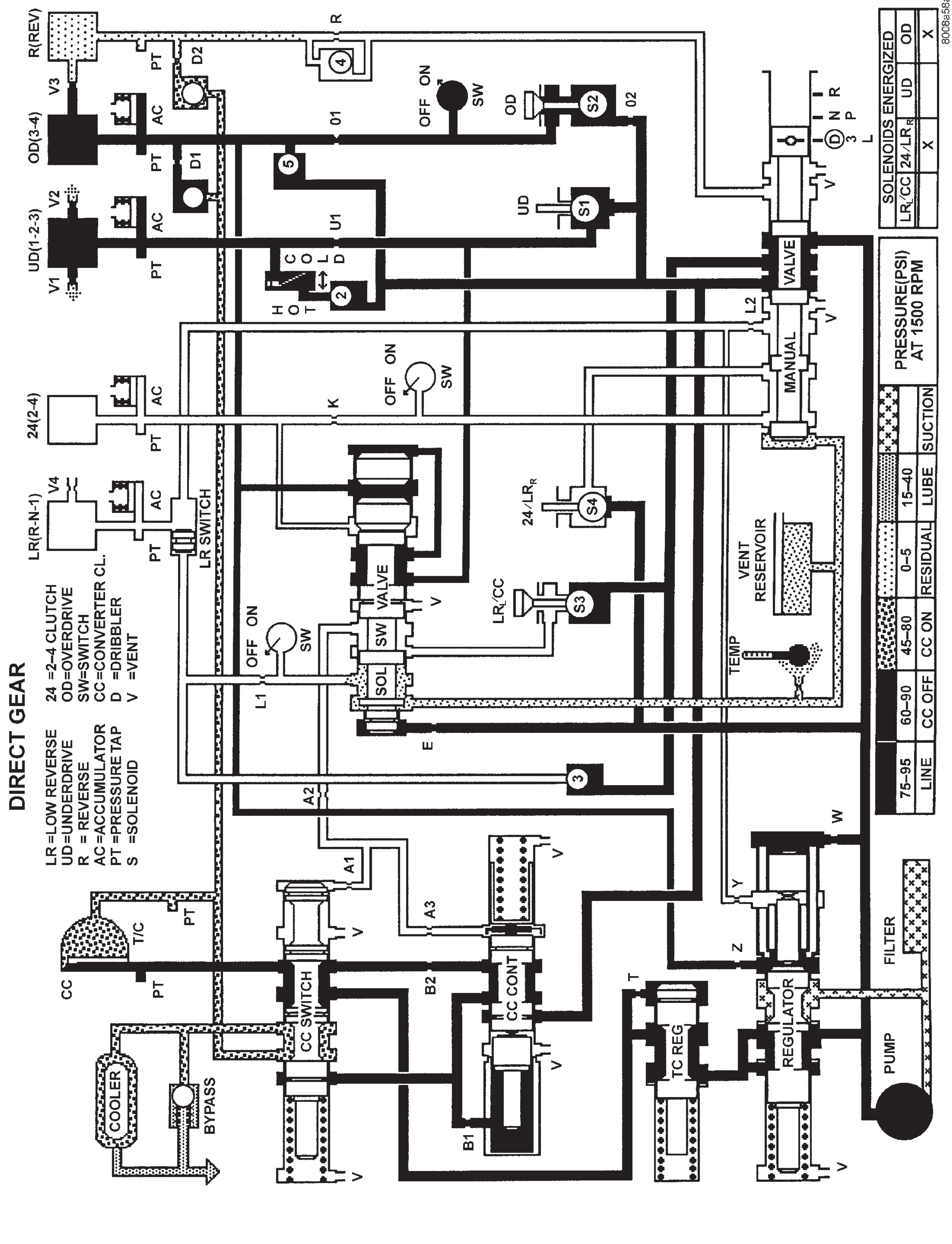

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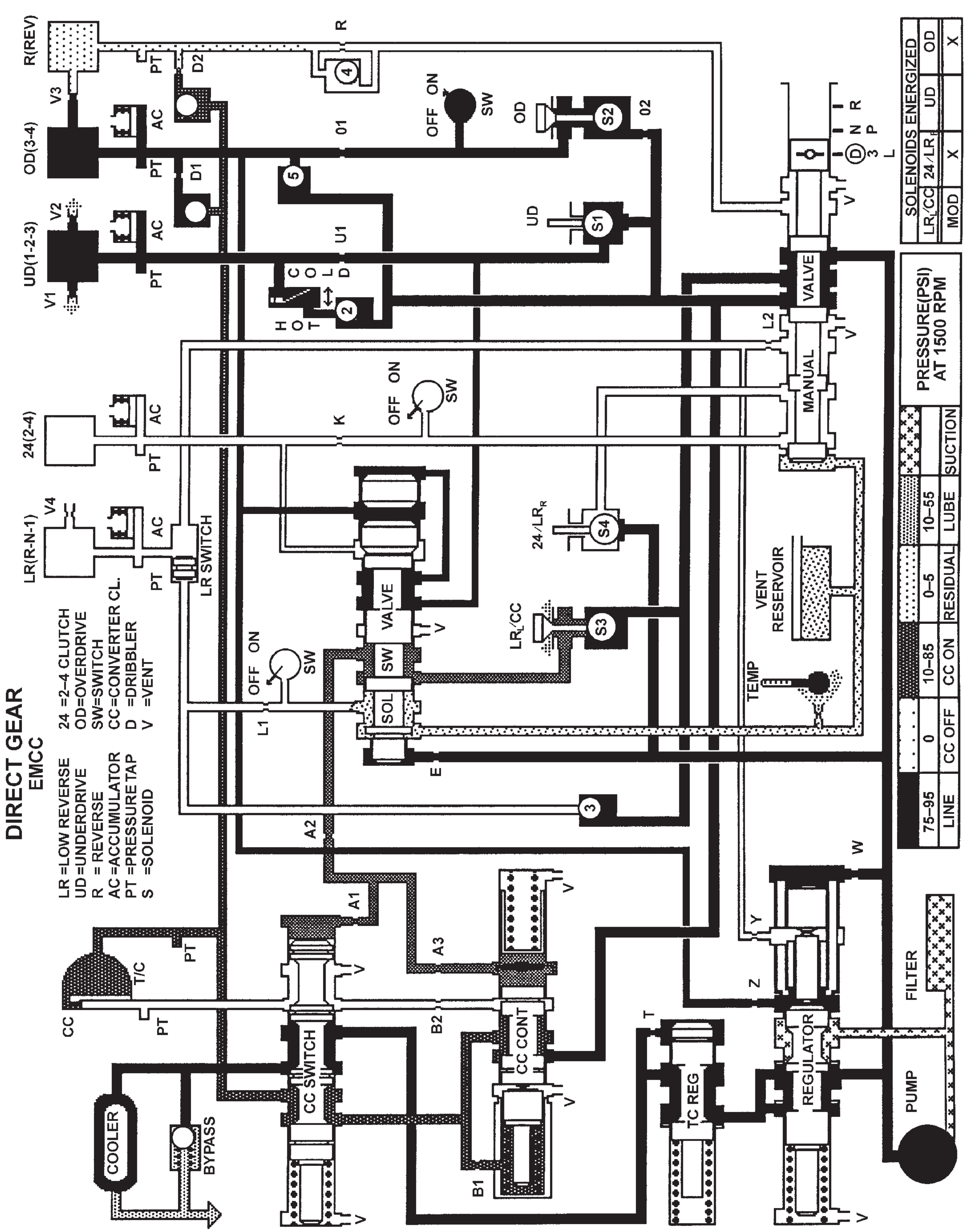
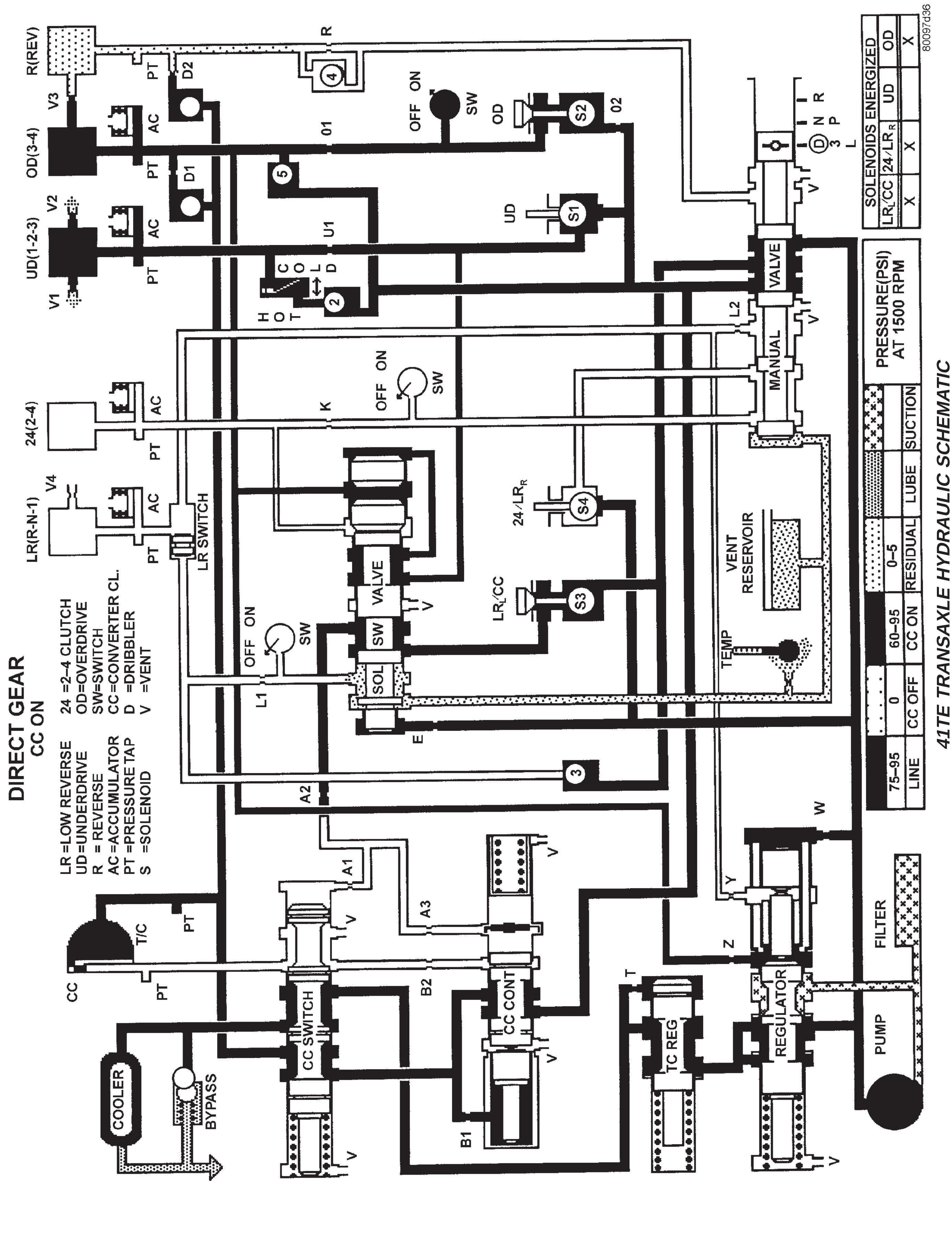
SCHEMATICS AND DIAGRAMS (Continued)



41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



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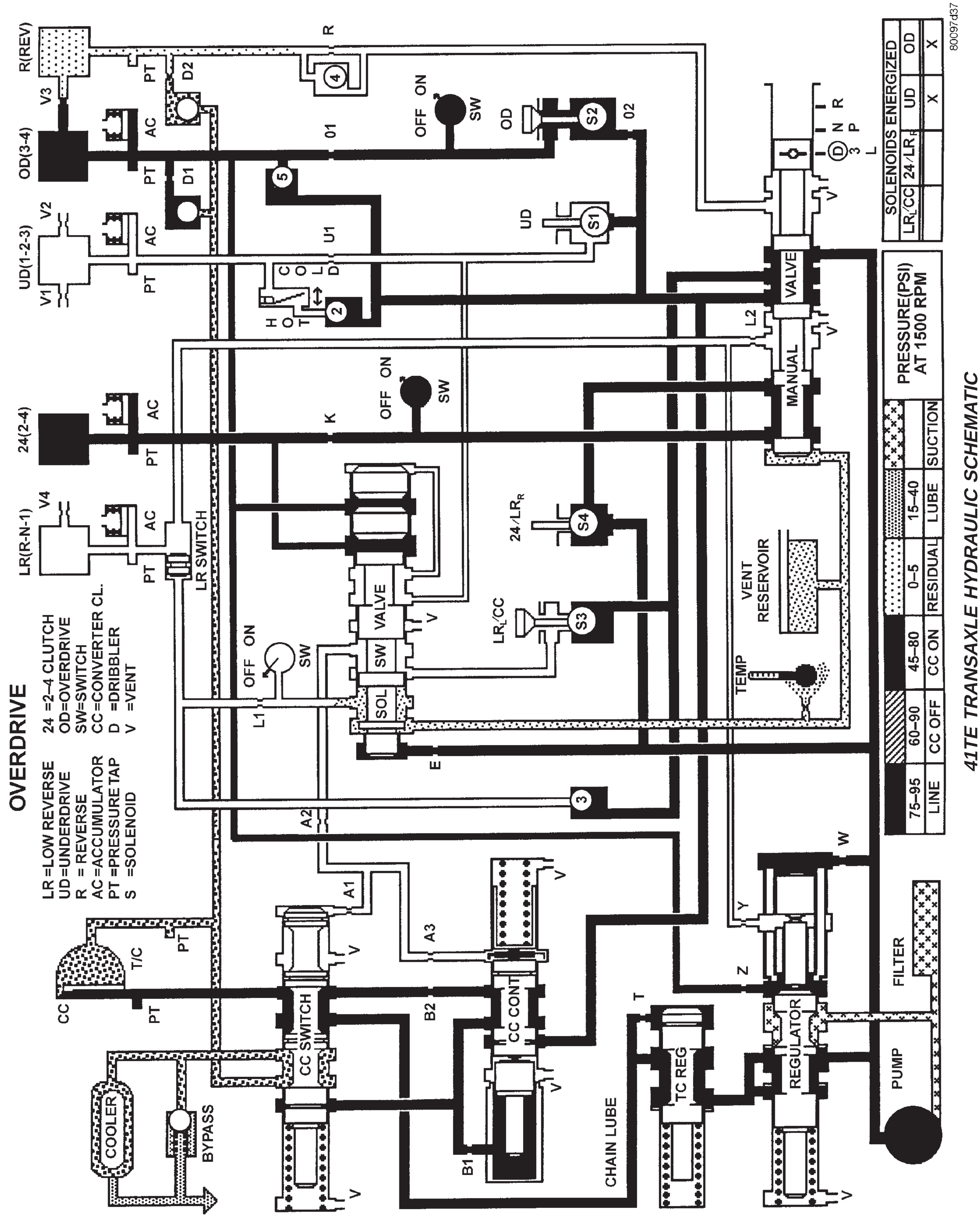
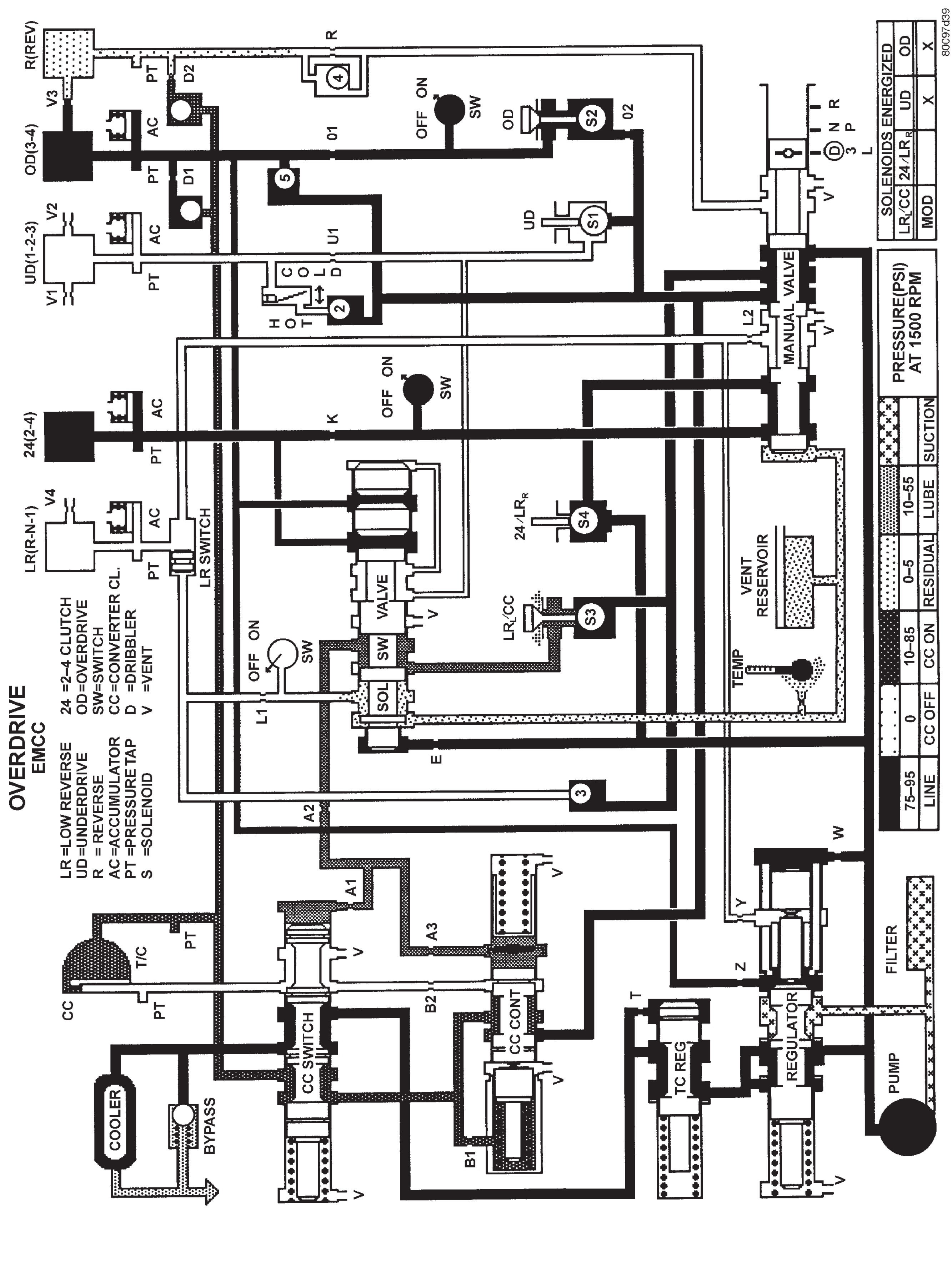


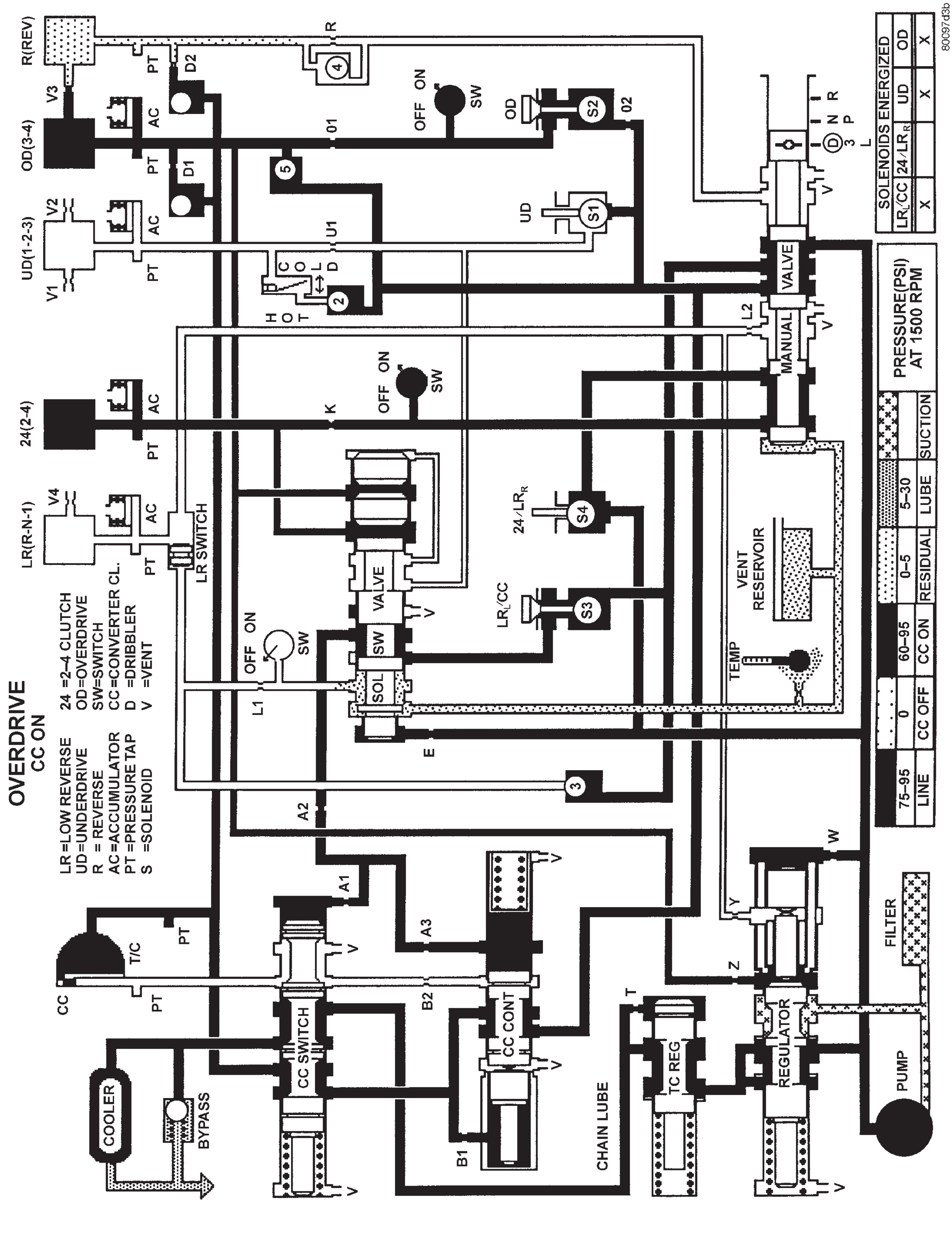
41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



41TE TRANSAXLE HYDRAULIC SCHEMATIC

SPECIFICATIONS

41TE AUTOMATIC TRANSAXLE

Type . . Fully adaptive, electronically controlled, four speed automatic with torque converter and integral differential
Torque Converter Diameter . . 241 millimeters (9.48 in.)
Oil Capacity . . . . 8.6 Liters (18.25 pints)
Oil Type . . . . Mopar® ATF+3 Type 7176
Cooling Method . . Water Heat Exchanger and/or air to oil heat exchanger
Lubrication . . . . . Pump (internal-external gear-type

Gear Ratios

Transmission
First Gear 2.84
Second Gear 1.57
Direct Gear 1.00
Overdrive Gear 0.69
Reverse Gear 2.21

Overall Top Gear Ratio
2.0 Liter 2.81
2.4 Liter 2.69
2.5 Liter 2.69

Bearing Preload
Differential Assembly . . 5 to 18 in. lbs. Drag Torque
Output Hub . . . . 3 to 8 in. lbs. Drag Torque
Transfer Shaft . . . . 0.002 to 0.004 in. End Play
Overall Drag At
Output Hub . . . . . . 3 to 16 in. lbs. Drag Torque

Clutch Pack Clearances
Low/Rev Clutch
(Select Reaction Plate) . . . . 0.89-1.04 mm (0.035-0.042 in.)
Two/Four Clutch (No Selection) . . . . . 0.76-2.64 mm (0.030-0.104 in.)
Reverse Clutch (Select Snap Ring) . . . 0.76-1.24 mm (0.030-0.049 in.)
Overdrive Clutch (No Selection) . . . 1.355–3.188 mm (0.053-0.125 in.)
Underdrive Clutch
(Select Pressure Plate) . . . . 0.91-1.47 mm (0.036-0.058 in.)
Input Shaft End
Play . . . . 0.12-0.63 mm (0.005-0.025 in.)

Input Shaft
End Play . . . . 0.127–0.635mm (0.005–0.025 in.)

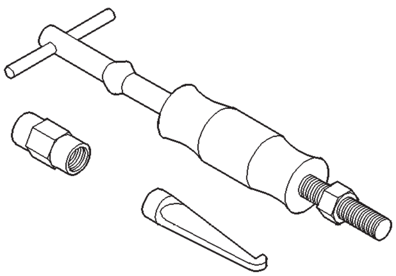
Pump Clearances
Outer Gear To Pocket . . . . 0.045-0.141 mm (0.0018-0.0056 in.)
Outer Gear Side Clearance . . . . 0.020-0.046 mm (0.0008-0.0018 in.)
Inner Gear Side Clearance . . . . 0.020-0.046 mm (0.0008-0.0018 in.)

41TE TORQUE SPECIFICATIONS

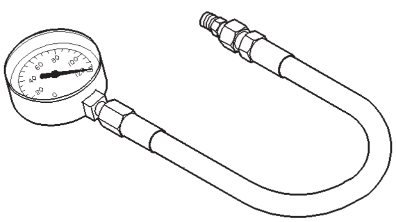
DESCRIPTION	TORQUE
Cooler Line Fittings	12 N·m (105 in. lbs.)
Differential Cover	19 N·m (165 in. lbs.)
Differential Ring Gear	95 N·m (70 ft. lbs.)
Differential Bearing Ret.	28 N·m (21 ft. lbs.)
Driveplate To Crank. Bolts	95 N·m (70 ft. lbs.)
Driveplate To Torque Conv.	75 N·m (55 ft. lbs.)
Eight Way Solenoid Conn.	4 N·m (35 in. lbs.)
Extension Housing	28 N·m (21 ft. lbs.)
Input Speed Sensor	27 N·m (20 ft. lbs.)
L/R Clutch Retainer	5 N·m (45 in. lbs.)
Oil Pan To Trans. Case	19 N·m (165 in. lbs.)
Output Gear Bolt	271 N·m (200 ft. lbs.)
Output Gear Stirrup Ret.	23 N·m (17 ft. lbs.)
Output Speed Sensor	27 N·m (20 ft. lbs.)
Pressure Taps	5 N·m (45 in. lbs.)
Pump To Case Bolts	27 N·m (20 ft. lbs.)
Reaction Shaft Bolts	27 N·m (20 ft. lbs.)
Rear End Cover	20 N·m (175 in. lbs.)
Sixty-Way Connector	4 N·m (35 in. lbs.)
Solenoid Assembly To Case	12 N·m (105 in. lbs.)
Transmission Range Sensor	5 N·m (45 in. lbs.)
Transfer Gear Nut	271 N·m (200 ft. lbs.)
Transfer Plate To Case	12 N·m (105 in. lbs.)
Valve Body To Case Bolts	12 N·m (105 in. lbs.)
Valve Body Bolts	5 N·m (45 in. lbs.)
Vent Assembly	12 N·m (105 in. lbs.)

SPECIAL TOOLS

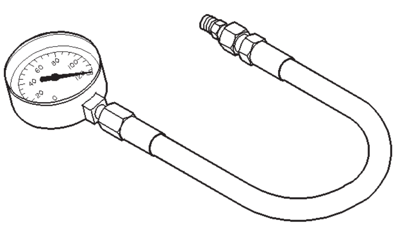
41TE AUTOMATIC TRANSAXLE



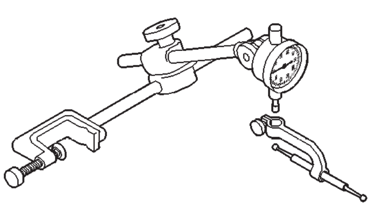
Puller C-637



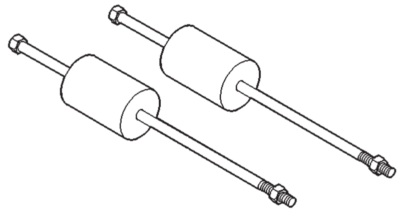
Pressure Gauge (Low) C-3292



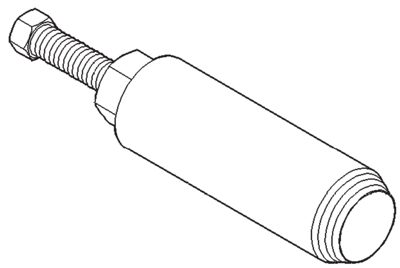
Pressure Gauge (High) C-3293SP



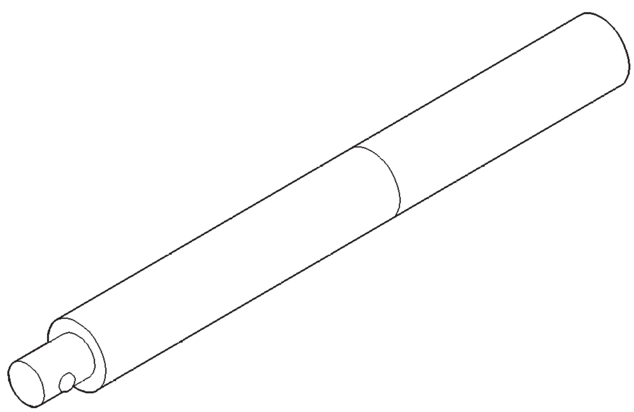
Dial Indicator C-3339



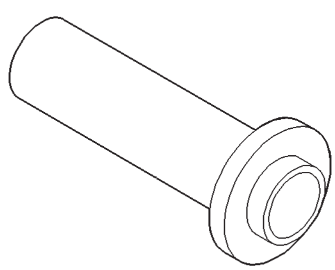
Oil Pump Puller C-3752



Seal Puller C-3981B

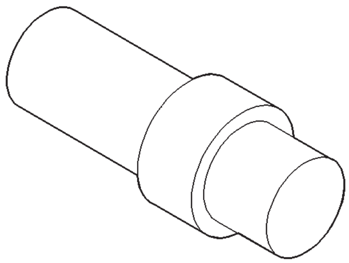


Universal Handle C-4171

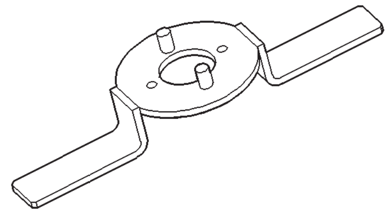


Seal Installer C-4193A

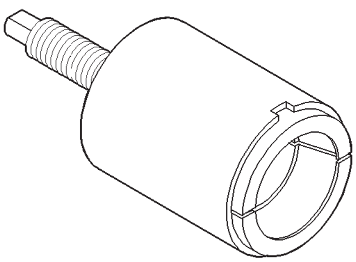
SPECIAL TOOLS (Continued)



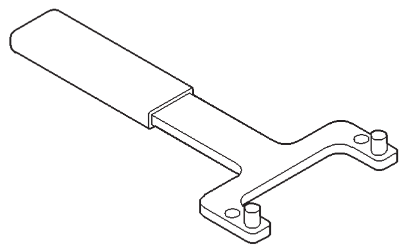
Adapter C-4996



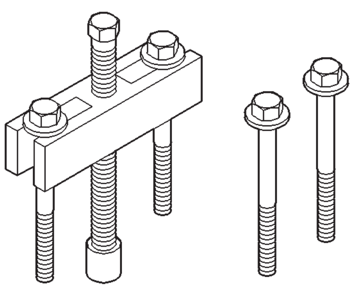
Gear Checking Plate L-4432



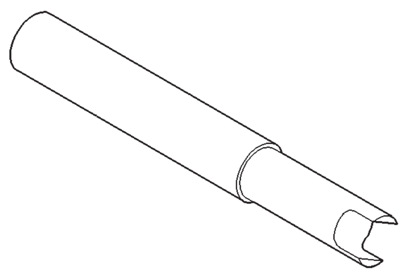
Remover Kit L-4406



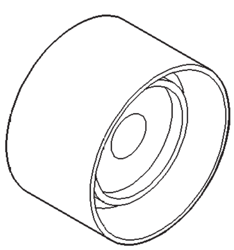
Bearing Puller L-4435



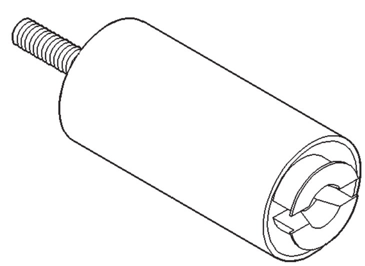
Gear Puller L-4407A



Differential Tool L-4436A

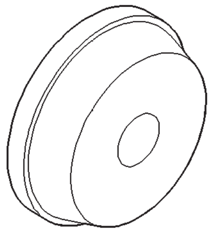


Bearing Installer L-4410

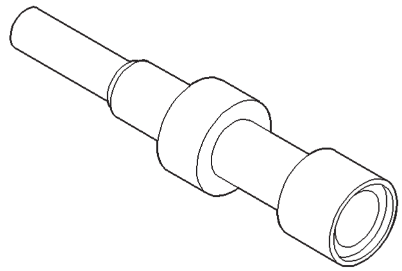


Special Jaw Set L-4518

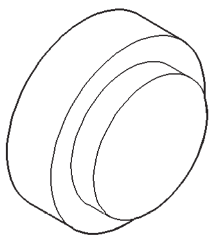
SPECIAL TOOLS (Continued)



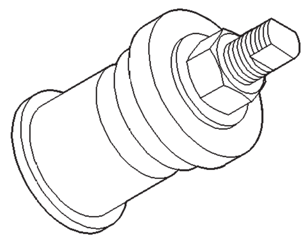
Installer L-4520



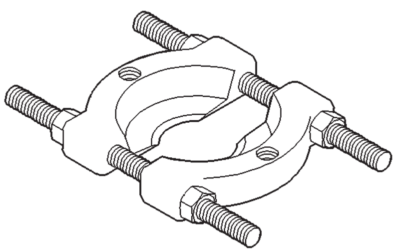
Remover/Installer 5049-A



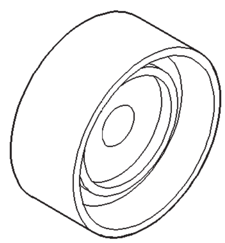
Thrust Button L-4539-2



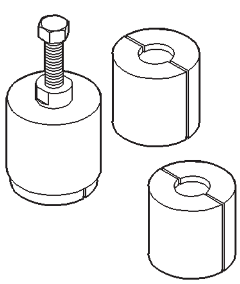
Installer 5050A



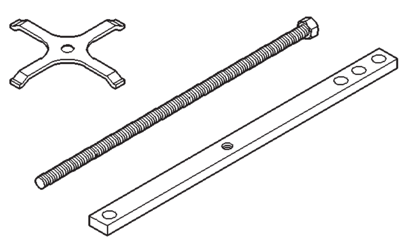
Bearing Splitter P-334



Installer 5052

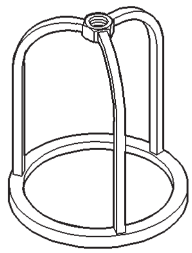


Puller Set 5048

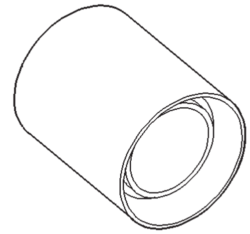


Compressor 5058A

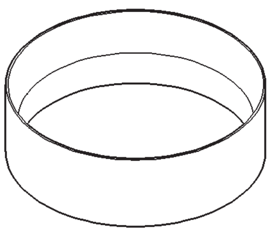
SPECIAL TOOLS (Continued)



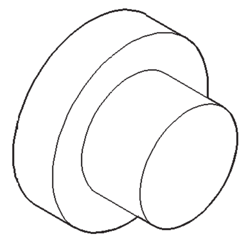
Compressor 5059-A



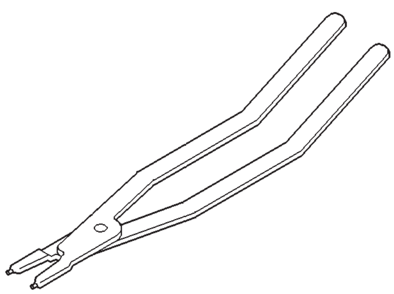
Installer 6053



Installer 5067



Button 6055



Pliers 6051

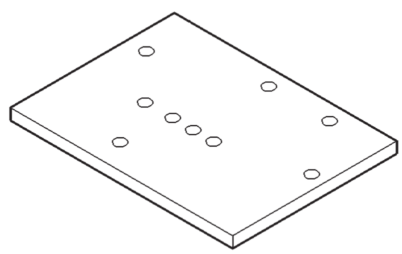
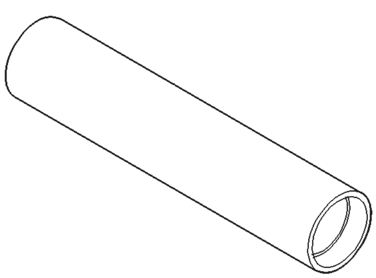
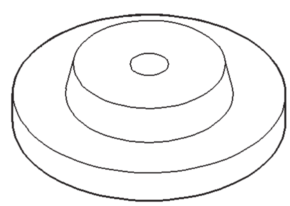


Plate 6056



Installer 6052



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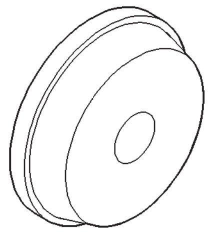
SPECIAL TOOLS (Continued)



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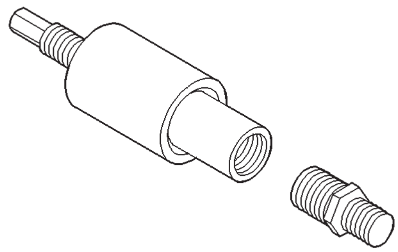

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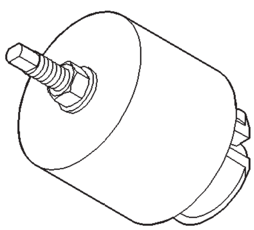

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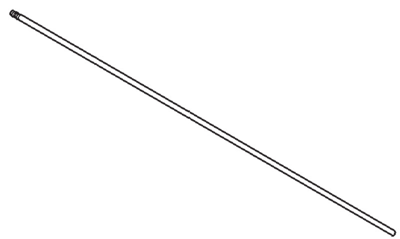

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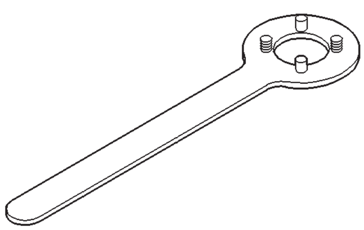

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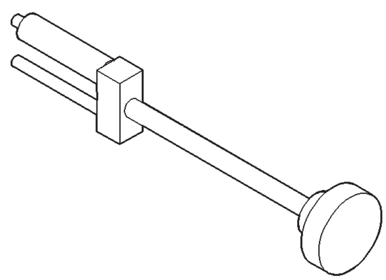

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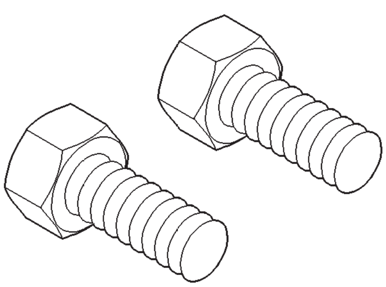

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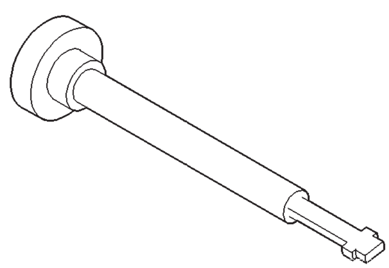
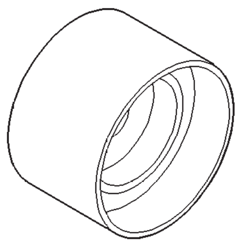
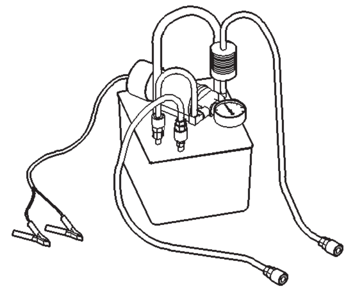


Remover/Installer 6302

SPECIAL TOOLS (Continued)



Installer 6536-A



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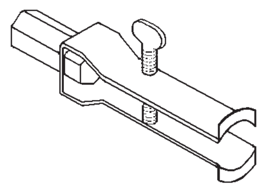


Puller 7794-A

TRANSAXLE

CONTENTS

DESCRIPTION AND OPERATION

BRAKE TRANSMISSION SHIFT INTERLOCK (BTSI) SYSTEM

The Brake Transmission Shift Interlock (BTSI) System, is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch. The BTSI system locks the shifter into the PARK position. The BTSI system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position.

An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half an inch. A solenoid integrated with the BTSI cable assembly (Fig. 1) is energized when the ignition switch is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The BTSI system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING

BRAKE TRANSMISSION SHIFT INTERLOCK (BTSI) SYSTEM

If the ignition switch cannot be turned to the LOCK position, with the shifter in PARK and the brake pedal depressed, an adjustment of the Brake Transmission Shift Interlock (BTSI) System may be required. To adjust the Brake Transmission Shift Interlock (BTSI) System, follow the procedure in the Adjustment section of this group.

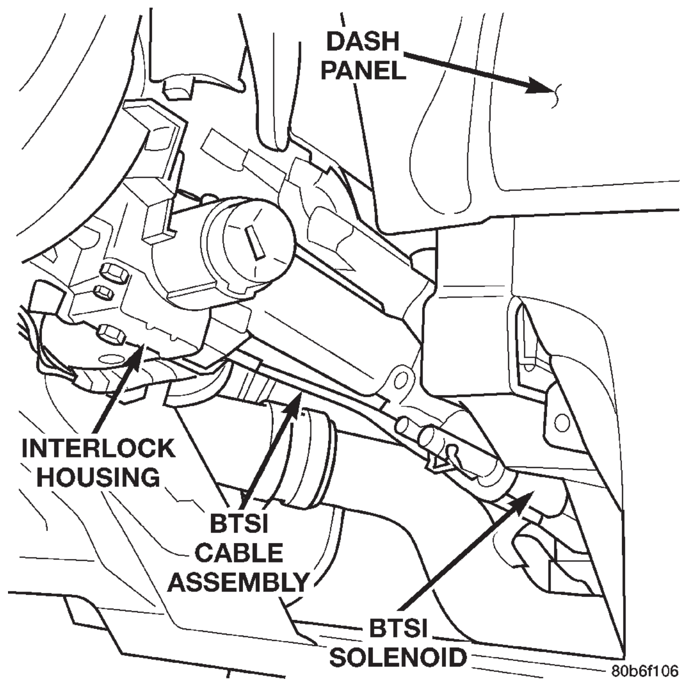


Fig. 1 BTSI Cable Assembly

REMOVAL AND INSTALLATION

BRAKE TRANSMISSION SHIFT INTERLOCK (BTSI) CABLE ASSEMBLY

REMOVAL

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove the gearshift knob set screw and knob.

(3) Remove console assembly. Refer to Group 23, Body for procedure.

(4) Pry up the adjuster lock on the BTSI cable assembly. Unsnap the BTSI cable assembly end fitting from the groove in the gearshift mechanism.

(5) Remove the cable core end from the plastic cam of the shifter mechanism and pull the BTSI cable out of the gear shift mechanism.

REMOVAL AND INSTALLATION (Continued)

(6) Remove the steering column cover. Refer to Group 8E, Instrument Panels and Systems for Removal and Installation procedures.

(7) Remove the steering column cover liner. Refer to Group 8E, Instrument Panel and Systems for Removal and Installation Procedures.

(8) Remove the three lower–to–upper shroud attaching screws through the bottom of the lower shroud and remove the lower shroud (Fig. 2).

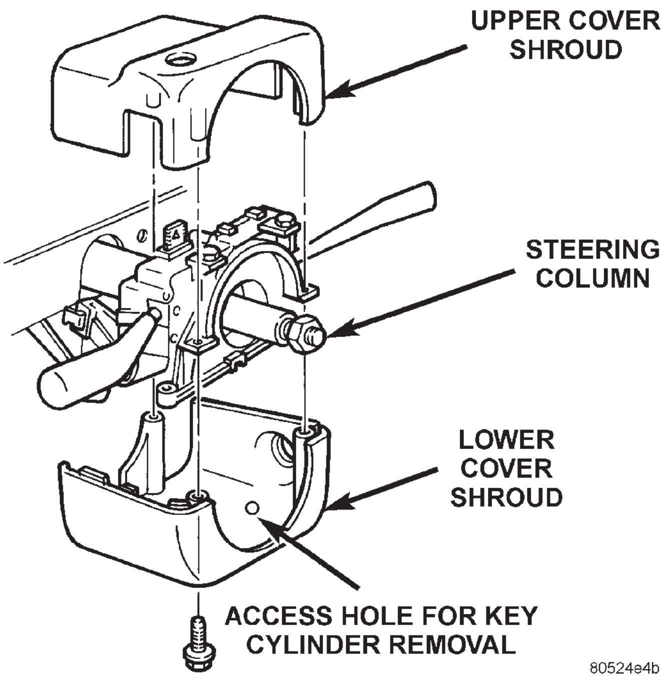


Fig. 2 Upper/Lower Shroud

(9) Turn the ignition to the RUN position.

(10) Grasp the BTSI cable assembly clip and connector. Remove the connector from the interlock housing (Fig. 3).

(11) Disconnect the BTSI solenoid electrical connector (Fig. 4).

(12) Disengage BTSI cable assembly routing clip from the steering column mounting stud.

(13) Unclip the BTSI cable assembly from the retaining clip located within the wiring harness.

(14) Remove BTSI cable assembly from the dash panel.

INSTALLATION

CAUTION: When installing BTSI cable assembly, care must be taken not to bend exposed cable wire and slug at shifter end of cable.

(1) Route BTSI cable assembly into lower dash panel.

(2) Install the BTSI cable assembly connector into the interlock housing at the steering column (Fig. 5). Verify the cable snaps into the housing.

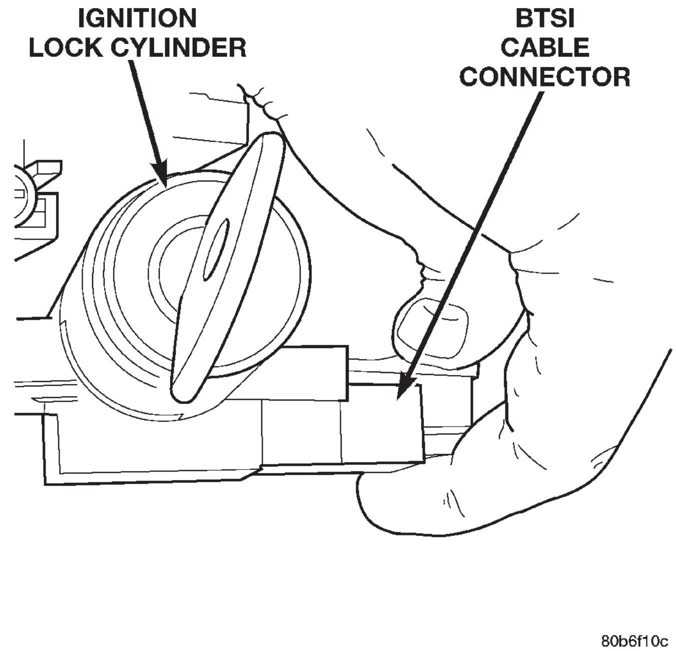


Fig. 3 BTSI Cable Assembly Connector

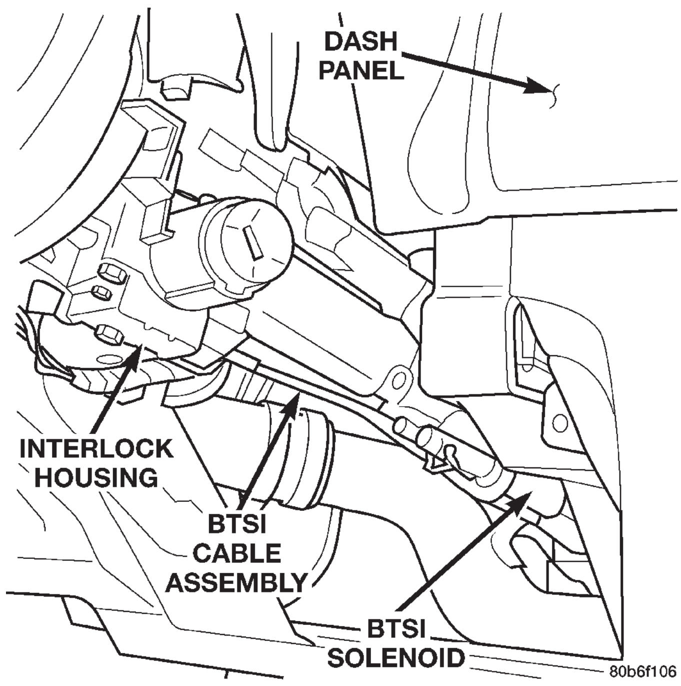


Fig. 4 BTSI Solenoid

(3) Install BTSI cable assembly into routing clip located within the wiring harness.

(4) Route BTSI cable assembly to the console.

(5) Secure the BTSI cable assembly routing clip to the steering column mounting stud.

(6) Install the cable core end to the plastic cam of the shifter mechanism. Snap the BTSI cable assembly end fitting into the groove in the gearshift mechanism.

REMOVAL AND INSTALLATION (Continued)

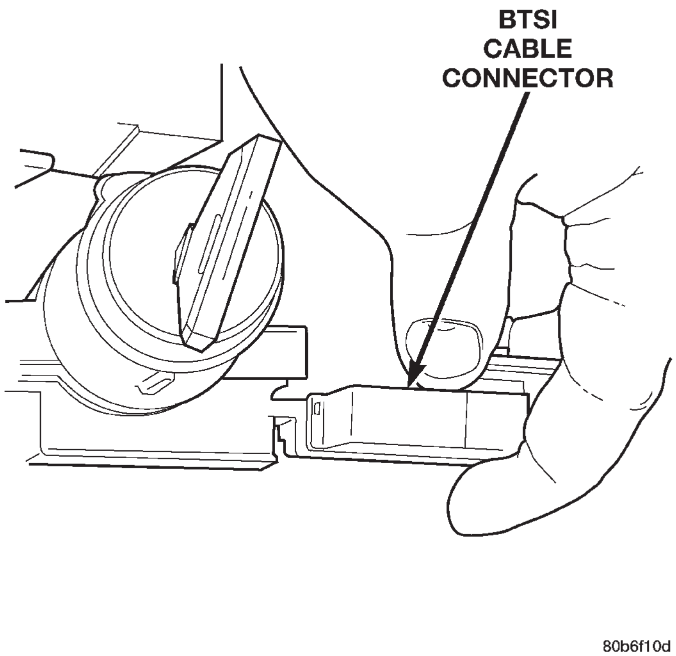


Fig. 5 BTSI Cable at Interlock Housing

(7) Adjust the Brake Transmission Shift Interlock (BTSI) System. See Brake Transmission Shift Interlock (BTSI) System Adjustment, in this section.

(8) Check operation of the Brake Transmission Shift Interlock (BTSI) System, as described in the beginning of this section.

(9) Install console assembly. Refer to Group 23, Body.

(10) Install screws retaining the gearshift indicator bezel and install bezel and indicator lamp.

(11) Install the gearshift knob set screw and knob.

(12) Install two screws at the upper area of the column liner and lower left corner.

(13) Position the lower shroud in place. Install the three lower–to–upper shroud attaching screws through the bottom of the lower shroud (Fig. 6).

(14) Reconnect the battery negative (-) cable to the vehicle battery.

ADJUSTMENTS

BRAKE TRANSMISSION SHIFT INTERLOCK (BTSI) SYSTEM ADJUSTMENT

If ignition switch cannot be turned to the LOCK position, an adjustment of the Interlock System may be required. To adjust the Brake Transmission Shift Interlock (BTSI) System, follow procedure listed below.

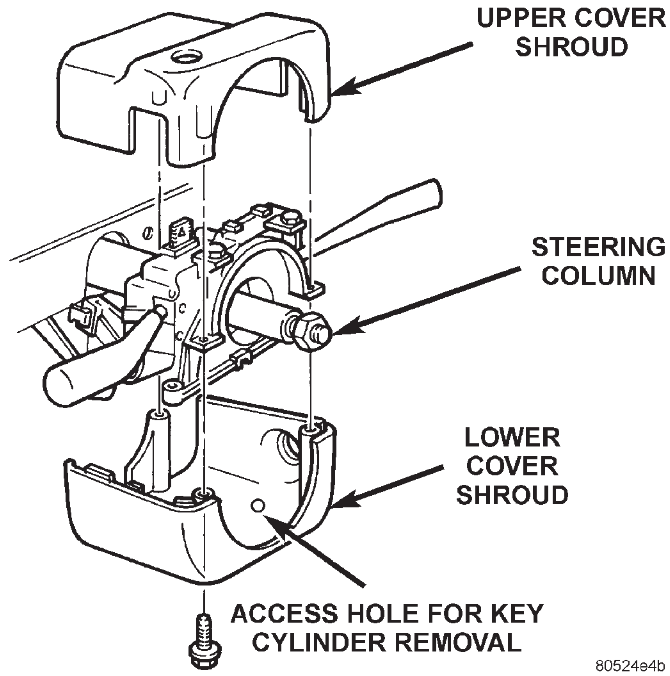


Fig. 6 Upper/Lower Shroud

(1) Disconnect and isolate, the battery negative (-) cable from the vehicle battery.

(2) Remove console assembly. Refer to Group 23, Body.

(3) Remove the gearshift knob set screw and knob.

(4) Reinstall the gearshift knob.

(5) Place shifter in PARK.

(6) Turn ignition switch to the LOCK or ACCESSORY position. If cable has lost its adjustment, manually position cable to get key into LOCK or ACCESSORY position. Grasp slug on interlock cable with needle nose pliers and pull back on cable. This will allow the ignition switch to be turned to the LOCK or ACCESSORY position.

(7) Check that the interlock cable slug is completely seated into the shifter interlock lever.

(8) Check that the ignition switch is still in the LOCK or ACCESSORY position.

(9) Pry up the adjuster lock on the BTSI cable.

(10) The spring on the BTSI cable should automatically compensate for the slack in the adjuster.

(11) Snap down the interlock adjuster lock onto the cable.

(12) After adjusting the BTSI system, check operation of the Brake Transmission Shift Interlock (BTSI) System, as described in the beginning of this section.

TIRES AND WHEELS

CONTENTS

TIRES

INDEX

DESCRIPTION AND OPERATION

TIRE

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles
- Operating vehicle with over or under inflated tire pressures

Radial ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation. This will help to achieve a greater tread-life potential.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 1).

Performance tires will have a speed rating letter after the aspect ratio number. For example, the letter "S" indicates that the tire is speed rated up to 112 mph. The speed rating is not always printed on the tire sidewall.

- Q -up to 100 mph
- T -up to 118 mph
- U -up to 124 mph
- H -up to 130 mph
- V -up to 149 mph
- Z -more than 149 mph (consult the tire manufacturer for the specific speed rating)

An All Season type tire will have either M + S, M & S or M-S (indicating mud and snow traction) imprinted on the side wall.

DESCRIPTION AND OPERATION (Continued)

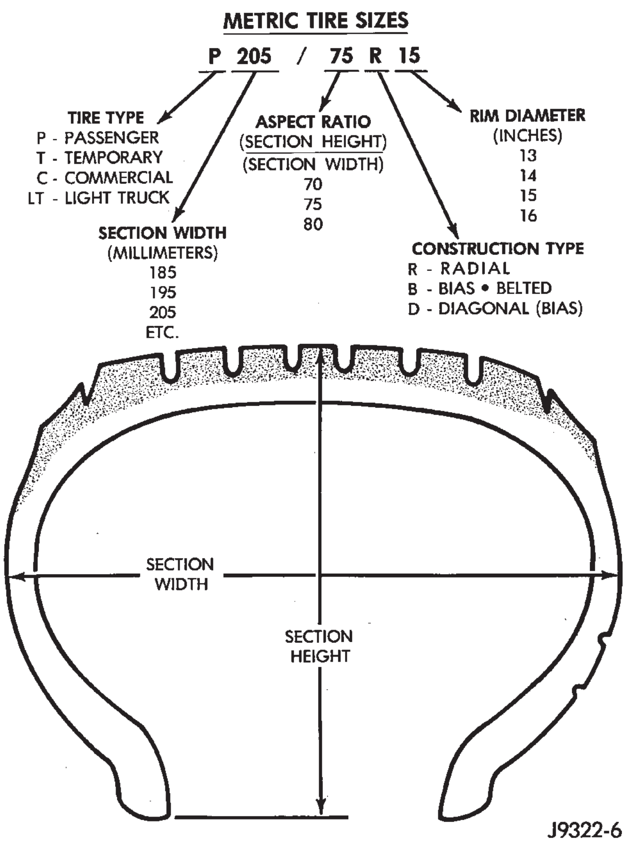


Fig. 1 Tire Identification

TIRE CHAINS

Refer to the owners manual supplied with the vehicle to determine whether the use of tire chains is permitted on this vehicle.

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

SPARE TIRE–TEMPORARY

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity and reinstall. Do not exceed speeds of 50 MPH. Refer to Owner's Manual for complete details.

REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommend that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires not listed in the specification charts may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band (Fig. 2).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

DIAGNOSIS AND TESTING (Continued)

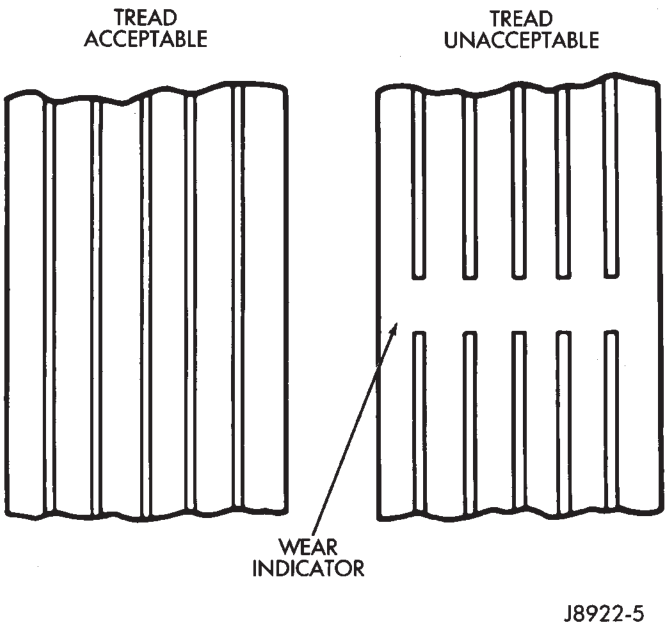


Fig. 2 Tread Wear Indicators

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other (Fig. 3).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 3).

TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

VEHICLE LEAD CORRECTION CHART

Use the following chart to diagnose a vehicle that has a complaint of a drift or lead condition. The use of the chart will help to determine if the lead condition is the result of a bad tire or is caused by the wheel alignment.

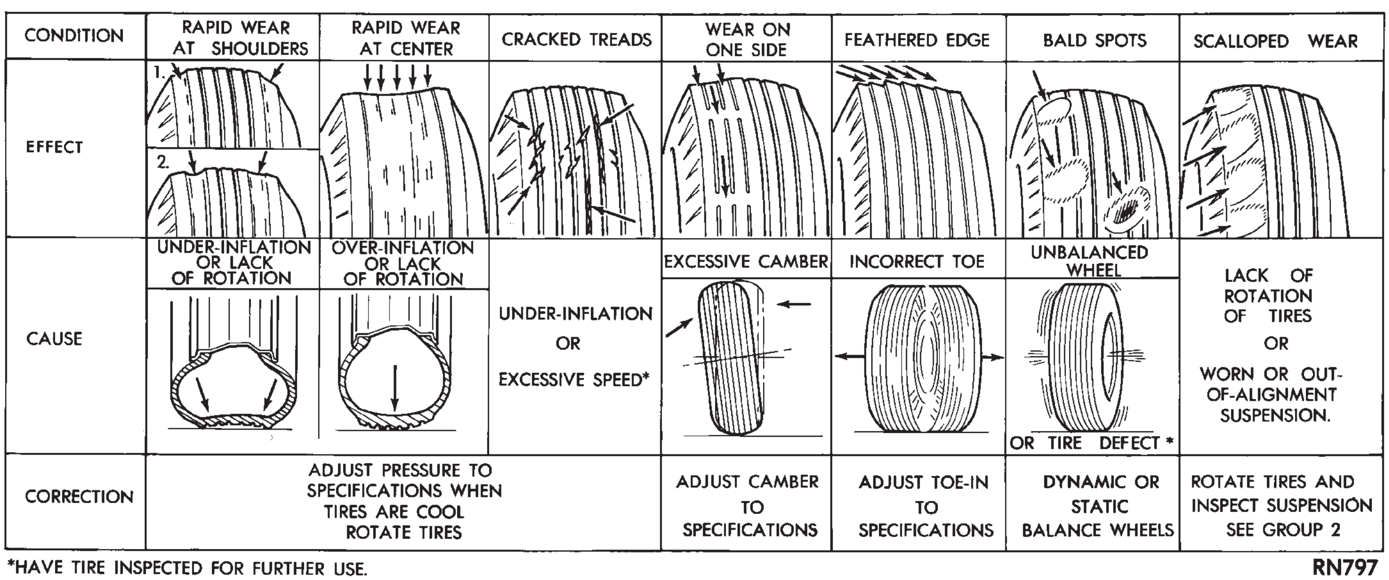
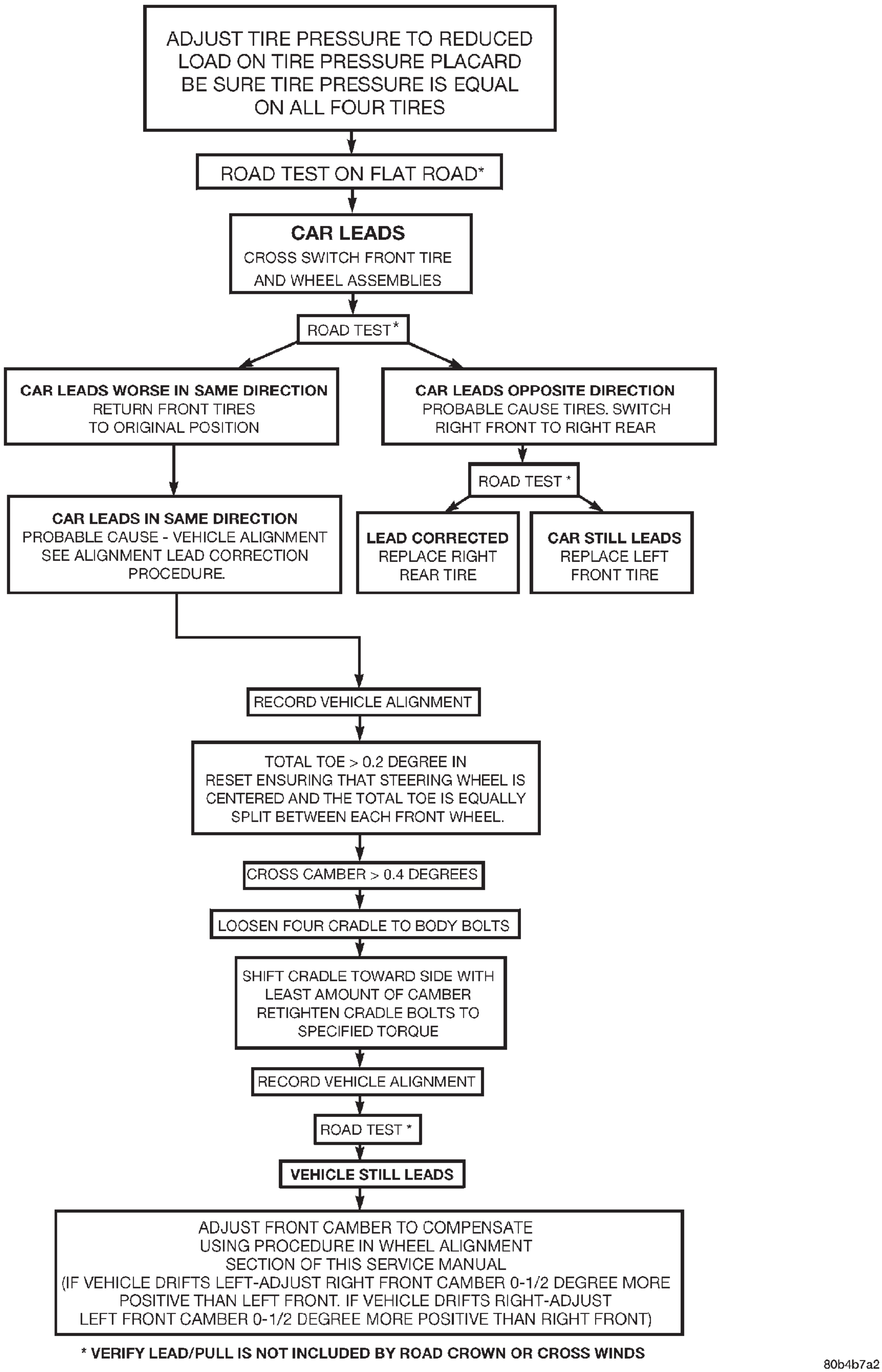


Fig. 3 Tire Wear Patterns

DIAGNOSIS AND TESTING (Continued)

VEHICLE LEAD DIAGNOSIS

LEAD DIAGNOSIS AND CORRECTION PROCEDURE



SERVICE PROCEDURES

TIRE INFLATION PRESSURES

Under inflation causes rapid shoulder wear, tire flexing, and can result in tire failure (Fig. 4).

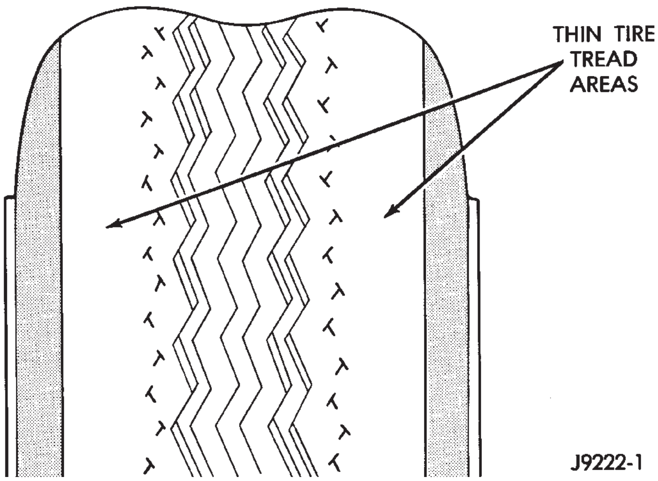


Fig. 4 Under Inflation Wear

Over inflation causes rapid center wear and loss of the tire's ability to cushion shocks (Fig. 5).

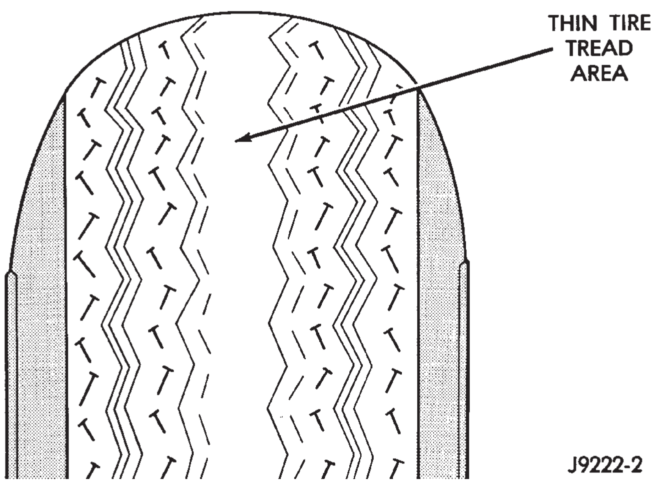


Fig. 5 Over Inflation Wear

Improper inflation can cause:
- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- The vehicle to drift.

For proper tire pressure specification refer to the Tire Inflation Pressure Chart Placard provided with the vehicle.

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once per month. Check tire pressure more frequently when the weather temperature varies widely. Tire pressure will decrease when the outdoor temperature drops.

Inflation pressures specified on the placard are always the cold inflation pressure of the tire. Cold inflation pressure is obtained after the vehicle has not been operated for at least 3 hours, or the vehicle is driven less than one mile after being inoperative for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING. THE TIRE CAN FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

TIRE PRESSURE FOR HIGH SPEED OPERATION

Chrysler Corporation advocates driving at safe speeds within posted speed limits. Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

TIRE AND WHEEL ROTATION

NON-DIRECTIONAL TREAD PATTERN TIRES

Tires on the front and rear axles operate at different loads and perform different functions. For these reasons, they wear at unequal rates, and tend to develop irregular wear patterns. These effects can be reduced by timely rotation of tires. The benefits of rotation are especially worthwhile. Rotation will increase tread life, help to maintain mud, snow, and wet traction levels, and contribute to a smooth, quiet ride.

The suggested rotation method is the forward-cross tire rotation method (Fig. 6). This method takes advantage of current tire industry practice which allows rotation of radial-ply tires. Other rotation methods may be used, but may not have all the benefits of the recommended method.

SERVICE PROCEDURES (Continued)

NOTE: Only the 4 tire rotation method may be used if the vehicle is equipped with a low mileage or temporary spare tire.

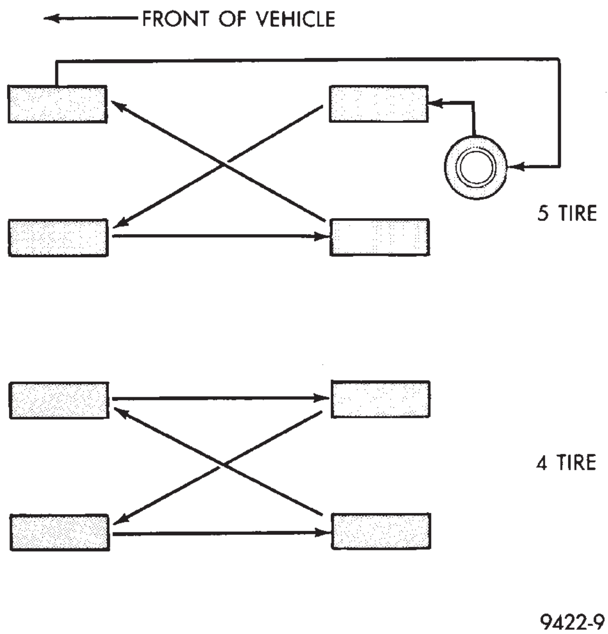


Fig. 6 Forward-Cross Tire Rotation Method

DIRECTIONAL TREAD PATTERN TIRES

Some vehicles are fitted with special high-performance tires having a directional tread pattern. These tires are designed to improve traction on wet pavement. To obtain the full benefits of this design, the tires must be installed so that they rotate in the correct direction. This is indicated by arrows on the tire sidewalls.

When wheels and tires are being installed, extra care is needed to ensure that this direction of rotation is maintained.

Refer to Owner's Manual for rotation schedule.

REPAIRING TIRE LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 7). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before attempting to dismount the tire from the wheel. **Use a lubricant such as a mild soap solution when dismounting or mounting tire.** Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and progressively tighten the 5 wheel nuts to a torque of 135 N·m (100 ft. lbs.).

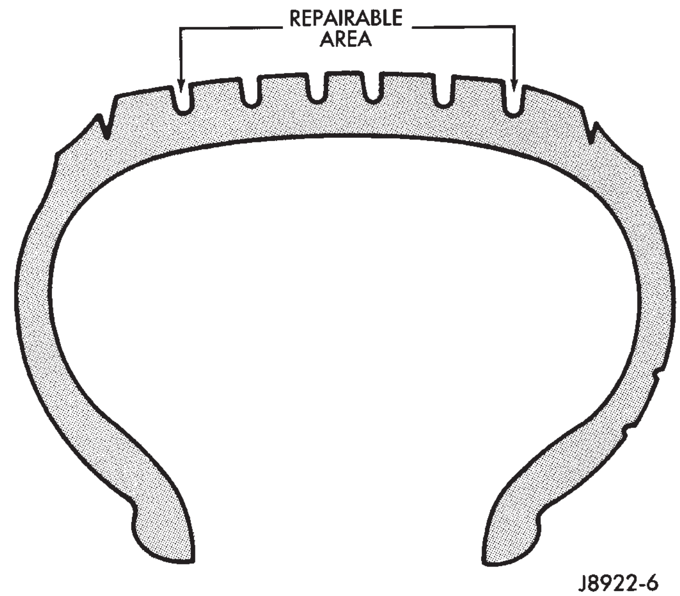


Fig. 7 Tire Repair Area

TIRE AND WHEEL MATCH MOUNTING

Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. This technique is used to reduce run-out in the wheel/tire assembly. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot or line in the drop well on the tire side of the rim. If the outside label has been removed the tire will have to be removed to locate the dot or line on the inside of the rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Measure the total indicator runout on the center of the tire tread rib. Record the indicator reading. Mark the tire to indicate the high spot. Place a mark on the tire at the valve stem location (Fig. 8).

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 9).

(3) Measure the total indicator runout again. Mark the tire to indicate the high spot.

(4) If runout is still excessive (in excess of 1.524 mm or 0.060 in.), the following procedures must be done.

- If the high spot is within 102 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 102 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.

SERVICE PROCEDURES (Continued)

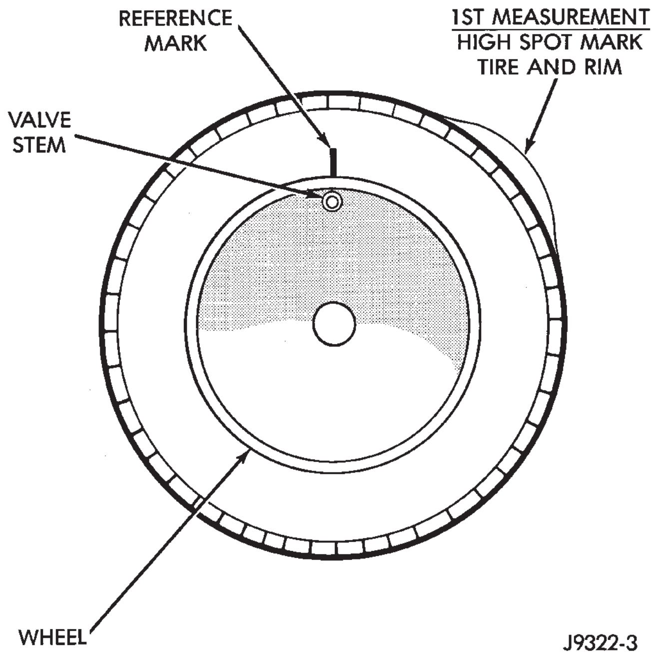


Fig. 8 First Measurement On Tire

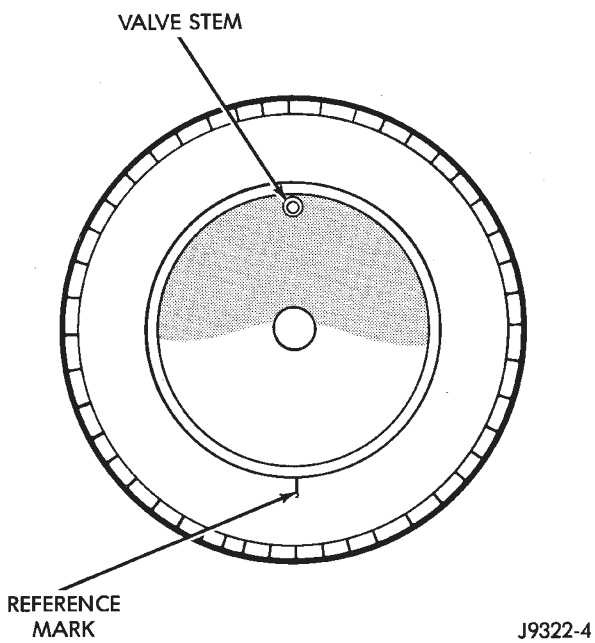


Fig. 9 Remount Tire 180 Degrees

- If the high spot is NOT within 102 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 10). This procedure will normally reduce the runout to an acceptable amount.

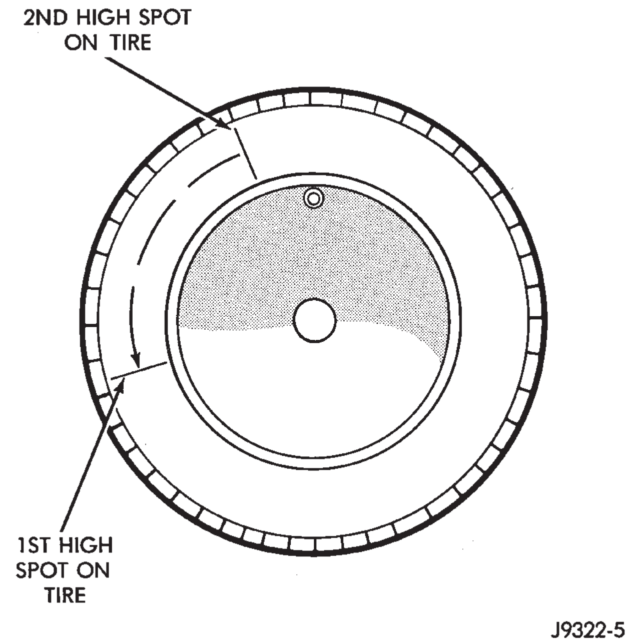


Fig. 10 Remount Tire 90 Degrees In Direction of Arrow

CLEANING AND INSPECTION

CLEANING TIRES

Remove protective coating on tires before delivery of vehicle. This coating may cause deterioration of tires.

To remove the protective coating applying warm water and let it soak for a few minutes. Then scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or wire brush for cleaning.

SPECIFICATIONS

TIRE SPECIFICATIONS

The following guide should help you understand the tire designations:

P	Passenger car tire (or ''T'' for temporary-use tire).
185	Nominal width of tire in millimeters.
70	Tire height-to-width ratio.
R	Radial-ply tire (or ''D'' for bias-ply tire).
14	Nominal rim diameter in inches.

Do not install smaller than minimum size tires shown on the tire inflation placard on the vehicle.

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WHEELS

INDEX

DESCRIPTION AND OPERATION

WHEEL

Original equipment wheels are designed for proper operation at all loads up to the specified maximum vehicle capacity.

All models use steel or cast aluminum drop center wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 1).

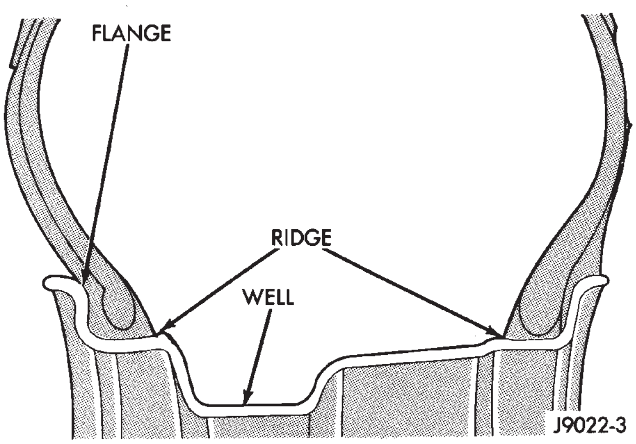

Fig. 1 Safety Rim

Initial inflation of the tires forces the bead over these raised sections. In case of air loss the raised sections help hold the tire in position on the wheel until the vehicle can be brought to a safe stop.

Cast aluminum wheels require special balance weights to fit on the rim flange of the wheel and special wheel clamps for the alignment equipment.

The wheel studs and nuts are designed for specific wheel applications and must be replaced with equivalent parts. Do not use replacement parts of lesser quality or of a substitute design. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels.

Before installing a wheel, remove any buildup of corrosion on the wheel mounting surface.

WARNING: INSTALLING WHEELS WITHOUT GOOD METAL-TO-METAL CONTACT COULD CAUSE LOOSENING OF WHEEL LUG NUTS. THIS COULD ADVERSELY AFFECT THE SAFETY AND HANDLING OF YOUR VEHICLE.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

DIAGNOSIS AND TESTING (Continued)

TIRE AND WHEEL RUNOUT

Radial run out is the vertical distance between the high and low points on the tire or wheel edge.

Lateral run out is the horizontal movement of the tire or wheel.

Radial run out of more than 1.524 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral run out of more than 2.032 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Runout should always be measured off the vehicle and on a suitable balance machine.

Usually radial run out can be reduced by relocating the wheel and tire on the wheel studs (See Method 1). If this does not reduce run out to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

METHOD 1 (RELOCATE WHEEL ON HUB)

Check accuracy of the wheel mounting surface; adjust wheel bearings.

Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

Verify all wheel nuts are properly torqued (Fig. 2).

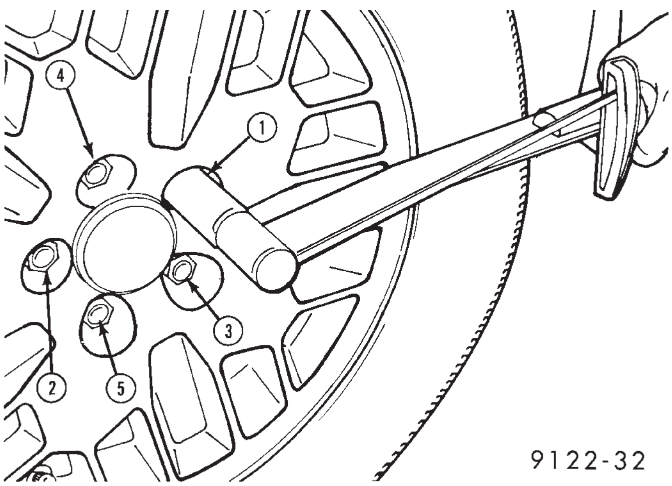

Fig. 2 Tightening Wheel Nuts

Use run out gauge D-128-TR to determine run out (Fig. 3).

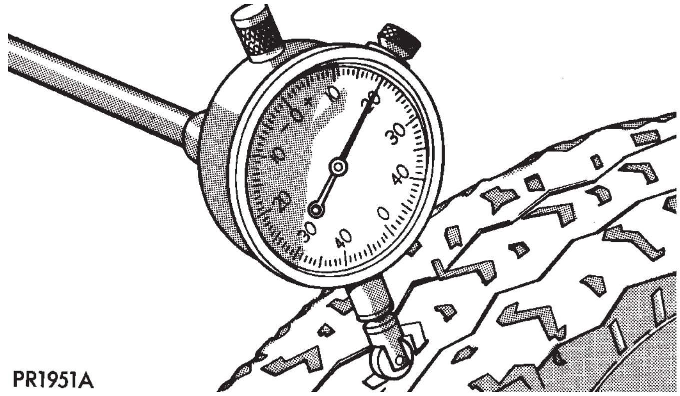

Fig. 3 Run Out Gauge

Relocate wheel on the mounting, two studs over from the original position.

Retighten wheel nuts until all are properly torqued. This will prevent brake distortion.

Check the radial run out of the wheel. If still excessive, mark tire sidewall, wheel, and stud at point of maximum run out (Fig. 4) and proceed to Method 2.

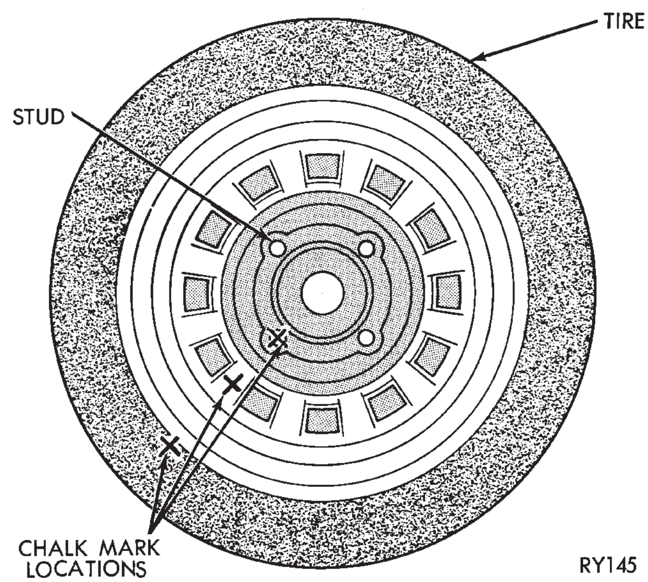

Fig. 4 Chalk Marking On Wheel, Tire And Stud

DIAGNOSIS AND TESTING (Continued)

METHOD 2 (RELOCATE TIRE ON WHEEL)

Rotating tire on wheel is particularly effective when there is run out in both tire and wheel.

Remove tire from wheel and remount wheel on hub in former position.

Check the radial run out of the wheel (Fig. 5). The radial run out of the wheel should be no more than 1.524 mm (0.060 inch).

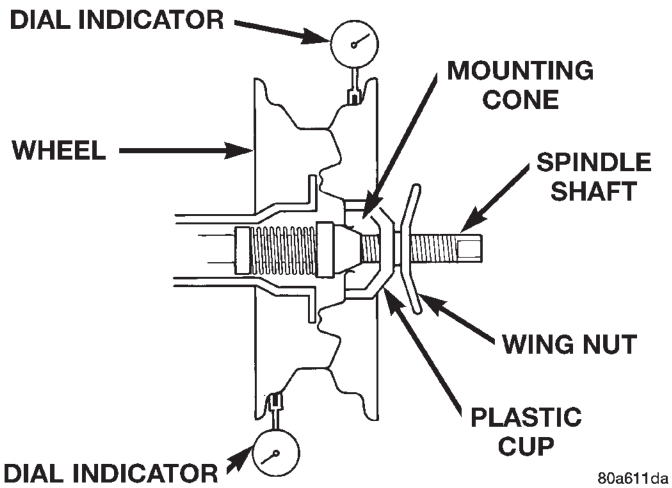

Fig. 5 Checking Radial Run Out Of Wheel

Check the lateral run out of the wheel (Fig. 6). The lateral run out of the wheel should be no more than 0.762 mm (0.030 inch).

If point of the most wheel radial run out is near original chalk mark, remount tire 45 degrees from its original spot. Recheck run out.

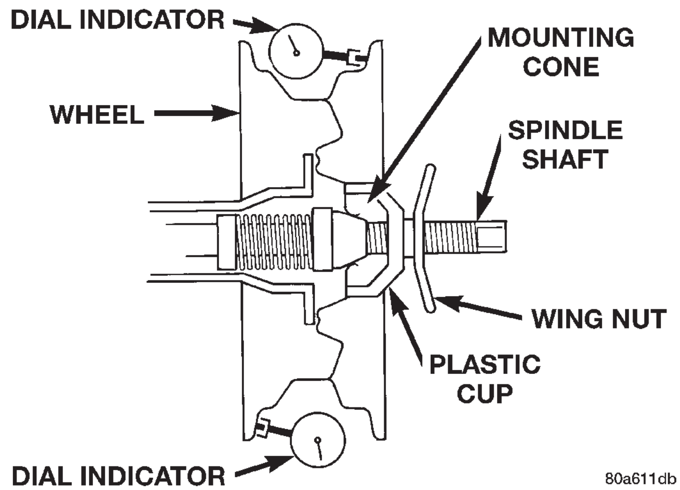

Fig. 6 Checking Lateral Run Out Of Wheel

SERVICE PROCEDURES

TIRE AND WHEEL BALANCE

Balancing need is indicated by vibration of seats, floor pan, or steering wheel. The vibration will be noticed mostly when driving over 95 km/h (60 mph) on a smooth road.

It is recommended that a two plane dynamic balancer be used when a wheel and tire assembly require balancing. Static should be used only when a two plane balancer is not available.

For static imbalance, find location of heavy spot causing imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counterbalance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 7) (Fig. 8). Off-vehicle balancing is necessary.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire.

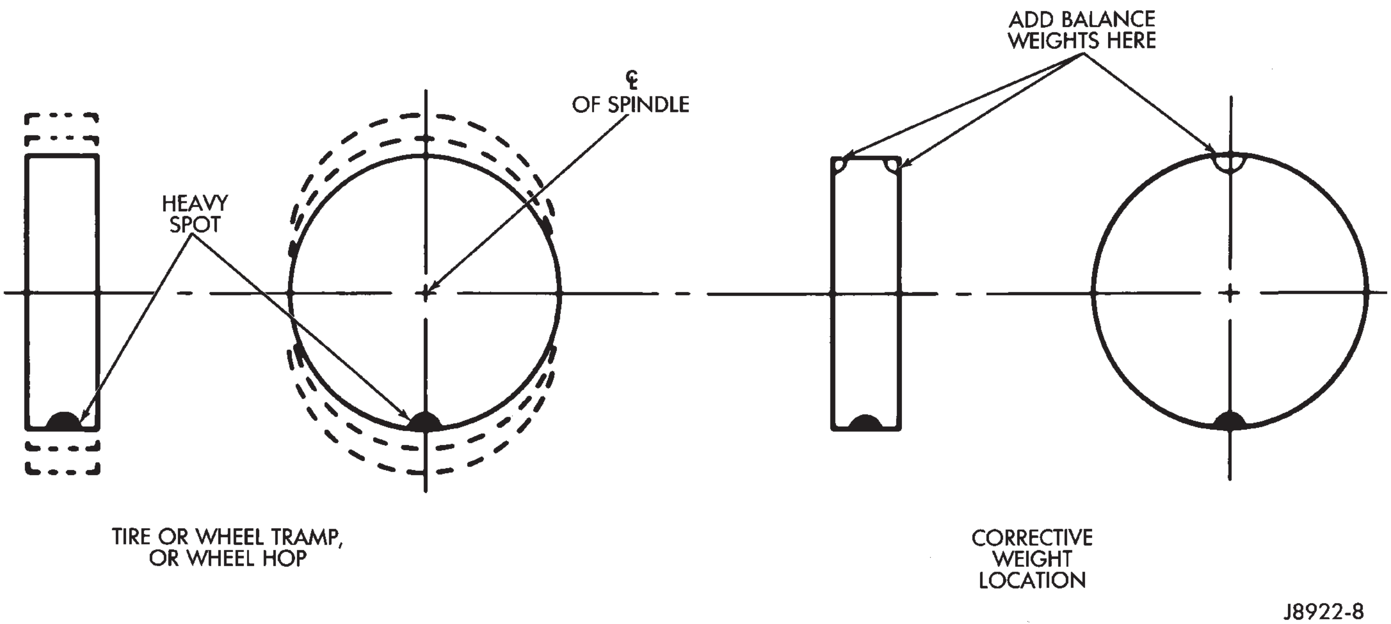

Fig. 7 Static Unbalance & Balance

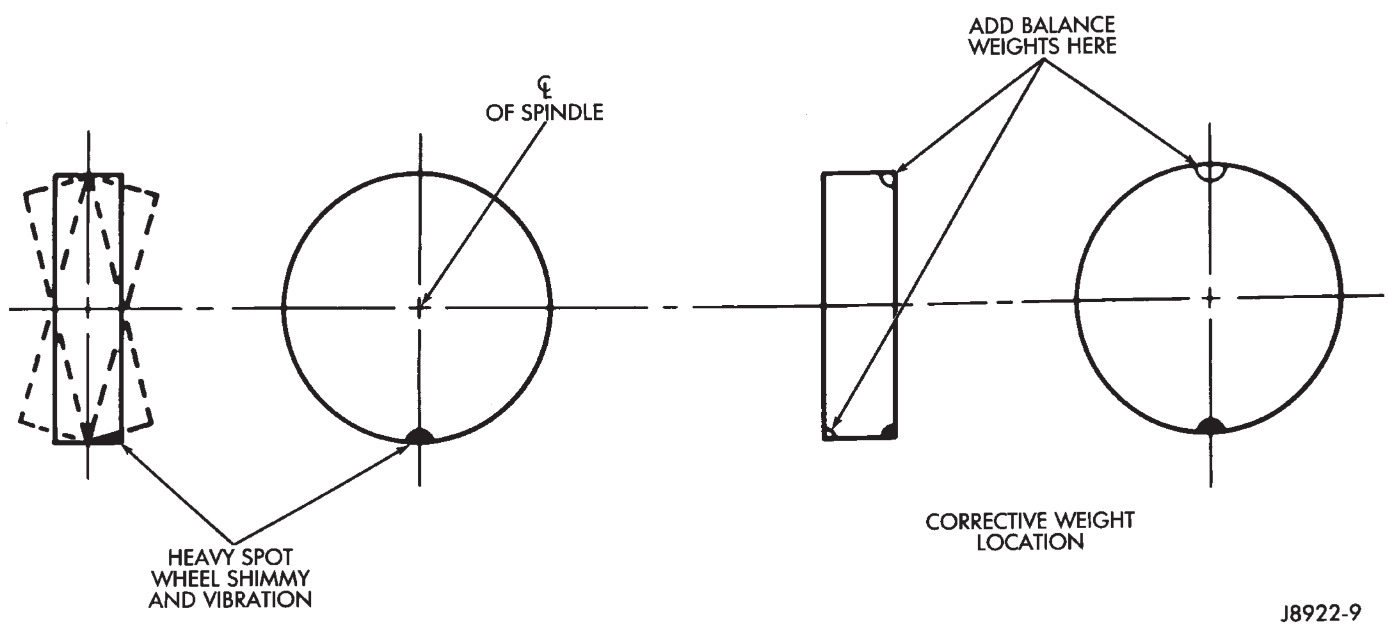

Fig. 8 Dynamic Unbalance & Balance

REMOVAL AND INSTALLATION

WHEEL AND TIRE

REMOVAL

(1) Raise the vehicle so the tires clear ground level. Refer to LUBRICATION AND MAINTENANCE for the required procedure.

(2) If the vehicle is equipped with wheel covers, remove the cover from the wheel by prying it off with an appropriate wheel cover removal tool.

(3) Remove the wheel nuts from the studs.

(4) Remove the tire and wheel from the hub.

INSTALLATION

(1) To install the wheel, first position it properly on the studs and hub mounting surface using the hub pilot as a guide. Install and lightly tighten the wheel nuts in the proper sequence (Fig. 9).

CAUTION: Never apply oil or grease to the wheel mounting studs or nuts.

(2) Progressively tighten the 5 wheel nuts in the proper sequence (Fig. 9) until tightened to half of the specified torque. Then tighten the wheel nuts in the proper sequence to a torque of 135 N·m (100 ft. lbs.).

(3) If equipped with wheel covers, align the valve stem notch in the wheel cover with the valve stem on the wheel. By hand, tap the wheel cover onto the wheel until it is fully seated against the wheel.

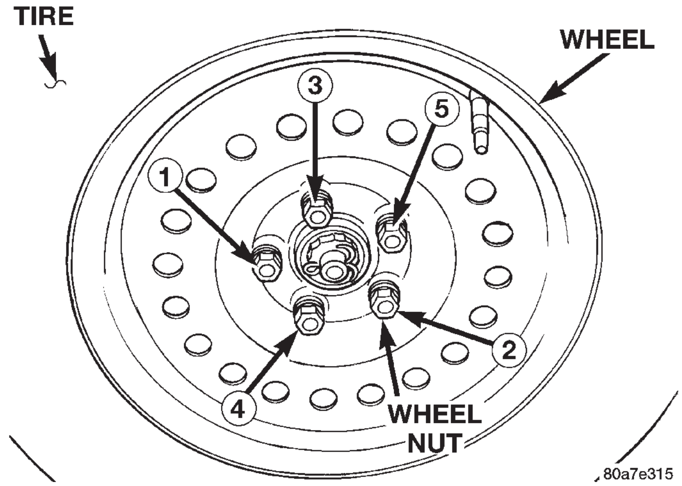

Fig. 9 Wheel Nut Tightening Sequence

(4) Lower the vehicle.

SPECIFICATIONS

WHEEL SPECIFICATIONS

Wheel:

Mounting Stud Size . . . . M12 x 1.5mm
Mounting Stud Lug Nut Hex Size 19mm
Mounting Lug Nut Tightening Torque
(4 and 5 Stud Wheels) . . . . 135 N·m (100 ft. lbs.)

BODY

CONTENTS

GENERAL INFORMATION

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GENERAL INFORMATION

VEHICLE IDENTIFICATION

Throughout this group, references to the Chrysler Corporation vehicle family identification code are used when describing a procedure that is unique to that vehicle. Refer to Introduction Group of this manual for detailed information on vehicle identification. If a procedure is common to all vehicles covered in this manual, no reference will be made to a vehicle family code.

SAFETY PRECAUTIONS AND WARNINGS

WARNING: USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

DO NOT STAND UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.

CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.

Always have a fire extinguisher ready for use when welding.

Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.

Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.

Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.

Chrysler Corporation uses many different types of push-in fasteners to secure the interior and exterior trim to the body. Most of these fasteners can be reused to assemble the trim during various repair procedures. At times, a push-in fastener cannot be removed without damaging the fastener or the component it is holding. If it is not possible to remove a fastener without damaging a component or body, cut or break the fastener and use a new one when installing the component. Never pry or pound on a plastic or pressed-board trim component. Using a suitable fork-type prying device, pry the fastener

GENERAL INFORMATION (Continued)

from the retaining hole behind the component being removed. When installing, verify fastener alignment with the retaining hole by hand. Push directly on or over the fastener until it seats. Apply a low-force pull to the panel to verify that it is secure.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges holding the component in place.

PAINT

INDEX

GENERAL INFORMATION

PAINT CODE

Exterior vehicle body colors are identified on the Body Code plate. The plate is located on the in the engine compartment and attached to the top of the right frame rail. Refer to the Introduction section at the front of this manual for body code plate description. The paint code is also identified on the Vehicle Safety Certification Label which is located on the drivers door shut face. The first digit of the paint code listed on the vehicle indicates the sequence of application, ie: P= primary coat, Q= secondary coat. The codes listed in the Aftermarket Paint Repair Products chart are used for manufacturing purposes. The first digit may vary from the Body Code Plate. The color names provided in the Aftermarket Paint Repair Products chart are the color names used on most repair product containers.

BASE COAT/CLEAR COAT FINISH

On most vehicles a two-part paint application (base coat/clear coat) is used. Color paint that is applied to primer is called base coat. The clear coat protects the base coat from ultraviolet light and provides a durable high-gloss finish.

CAUTION: Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted surfaces. Damage to finish or color can result.

WET SANDING, BUFFING, AND POLISHING

Minor acid etching, orange peel, or smudging in clear coat or single-stage finishes can be reduced with light wet sanding, hand buffing, and polishing. **If the finish has been wet sanded in the past, it cannot be repeated. Wet sanding operation should be performed by a trained automotive paint technician.**

CAUTION: Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat for durability.

PAINTED SURFACE TOUCH-UP

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Top Coat. Refer to Introduction group of this manual for Body Code Plate information.

CAUTION: USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

TOUCH-UP PROCEDURE

(1) Scrape loose paint and corrosion from inside scratch or chip.

(2) Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.

(3) Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the defect without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.

(4) Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.

(5) On vehicles without clear coat, the touch-up color can be lightly wet sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

GENERAL INFORMATION (Continued)

CAUTION: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

AFTERMARKET PAINT REPAIR PRODUCTS

EXTERIOR COLORS

EXTERIOR COLOR	CHRY CODE	PPG	DuPONT	S-W M-S **	AKZ0/NOBEL SIKKENS	ICI **
Bright Platinum Met. Clear Coat	MS4	4820	B9462	48823	CHA94:MS4	6GG7B
Champagne Pearl Pearl Coat	VTE	5360	B9825	54835 557700	CHA98:VTE	JAF2B
Deep Amethyst Pearl Coat	TCN	5426	B9736	52566	CHA97:TCN	FNE4B
Deep Cranberry Pearl Coat	VMT	5359	B9842	54119	CHA98:VMT	6JX2B
Deep Slate Pearl Coat	VAW	5292	B9774	54118	CHA97:VAW	HMR8B
Forest Green Pearl-Coat	SG8	47439	B9609	5106	CHA95:SG8	7MR8B
Intense Blue Pearl Coat	VB3	5357	B9822	54468	CHA98:VB3	HMR9B
Inferno Red Pearl Coat	WEL	5471	B9843	56090	CHA99:WEL	KDH3B
Light Cypress Green Pearl Coat	WG2	5471	B9843	56090	CHA99:WG2	KDH3B
Stone White Clear Coat	SW1	83542	B9622	51539	CHA96:SW1	8KY5B

*BASF, Glasurit, Herberts Standox and Spies Hecker use the Chrysler paint code. **S-W = Sherwin-Williams, M-S = Martin Senour, ICI = Autocolor

MOLDING COLORS

EXTERIOR COLOR	CHRY CODE	PPG	DuPONT	S-W M-S **	AKZ0/NOBEL SIKKENS	ICI **
Bright Platinum Met. Clear Coat	MS4	4820	B9462	48823	CHA94:MS4	6GG7B
Champagne Pearl Pearl Coat	VTE	5360	B9825	54835 557700	CHA98:VTE	JAF2B
Deep Amethyst Pearl Coat	TCN	5426	B9736	52566	CHA97:TCN	FNE4B
Deep Cranberry Pearl Coat	VMT	5359	B9842	54119	CHA98:VMT	6JX2B

GENERAL INFORMATION (Continued)

EXTERIOR COLOR	CHRY CODE	PPG	DuPONT	S-W M-S **	AKZ0/NOBEL SIKKENS	ICI **
Deep Slate Pearl Coat	VAW	5292	B9774	54118	CHA97:VAW	HMR8B
Forest Green Pearl-Coat	SG8	47439	B9609	5106	CHA95:SG8	7MR8B
Intense Blue Pearl Coat	VB3	5357	B9822	54468	CHA98:VB3	HMR9B
Inferno Red Pearl Coat	WEL	5471	B9843	56090	CHA99:WEL	KDH3B
Light Cypress Green Pearl Coat	WG2	5471	B9843	56090	CHA99:WG2	KDH3B
Stone White Clear Coat	SW1	83542	B9622	51539	CHA96:SW1	8KY5B

INTERIOR COLORS

CHRY CODE	PPG	BASF	DuPONT	S-W M-S **	AKZO/NOBEL SIKKENS	ICI **
AZ	9856/2-1461	22135	C9208	45994	CHALAZI	7WC8
K5	27731 2-1584	26120	C9603	51541	CHARJ5I	7VX6
JK	35798 2-1577	25066	C9516	50510	CHARJKI	7WB4

STATIONARY GLASS

INDEX

DESCRIPTION AND OPERATION

SAFETY PRECAUTIONS

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT.

URETHANE ADHESIVES ARE APPLIED AS A SYSTEM. USE GLASS CLEANER, GLASS PREP SOLVENT, GLASS PRIMER, PVC (VINYL) PRIMER AND PINCH WELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.

CHRYSLER DOES NOT RECOMMEND GLASS ADHESIVE BY BRAND. TECHNICIANS SHOULD REVIEW PRODUCT LABELS AND TECHNICAL DATA SHEETS, AND USE ONLY ADHESIVES THAT THEIR MANUFACTURES WARRANT WILL RESTORE A VEHICLE TO THE REQUIREMENTS OF FMVSS 212. TECHNICIANS SHOULD ALSO INSURE THAT PRIMERS AND CLEANERS ARE COMPATIBLE WITH THE PARTICULAR ADHESIVE USED.

BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

VAPORS THAT ARE EMITTED FROM THE URETHANE ADHESIVE OR PRIMER COULD CAUSE PERSONAL INJURY. USE THEM IN A WELL-VENTILATED AREA.

SKIN CONTACT WITH URETHANE ADHESIVE SHOULD BE AVOIDED. PERSONAL INJURY MAY RESULT.

ALWAYS WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS.

CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers.

Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

It is difficult to salvage a windshield during the removal operation. The windshield is part of the structural support for the roof. The urethane bonding used to secure the windshield to the fence is difficult to cut or clean from any surface. If the moldings are set in urethane, it would also be unlikely they could be salvaged. Before removing the windshield, check the availability of the windshield and moldings from the parts supplier.

REMOVAL AND INSTALLATION

WINDSHIELD

The urethane adhesive holding the windshield to the opening pinch weld (fence) can be cut using a sharp cold knife from the exterior of the vehicle. Using the cold knife method is effective if the windshield is already broken. If the glass must be salvaged, cutting the urethane adhesive from the interior of the vehicle using a reciprocating or oscillating power knife is recommended.

REMOVAL

(1) Remove inside rear view mirror.

(2) Remove cowl cover. Refer to Cowl Cover Removal paragraph in this group.

(3) Remove drip rail weatherstrips as necessary to gain access to screws holding windshield side moldings to A-pillars.

(4) Remove screws holding windshield side moldings to A-pillars

(5) Remove windshield moldings. (Fig. 1) Pull outward on molding at the bottom of A-pillars using pliers.

(6) Cut urethane bonding from around windshield using a suitable sharp cold knife. A pneumatic cutting device can be used if available. (Fig. 2)

(7) Separate windshield from vehicle.

REMOVAL AND INSTALLATION (Continued)

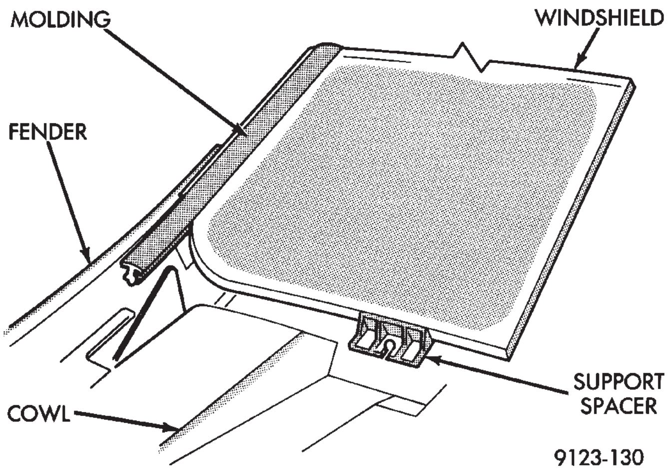

Fig. 1 Windshield Moldings

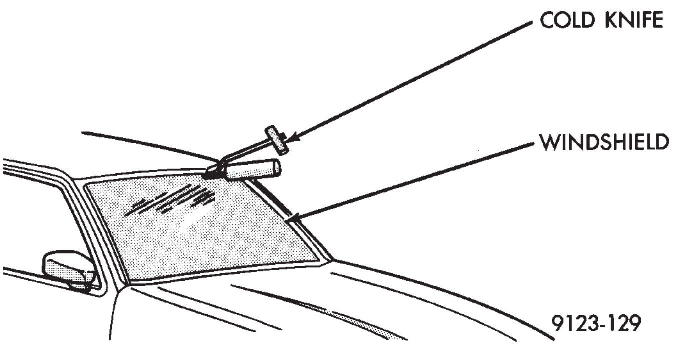

Fig. 2 Cut Urethane Around Windshield

INSTALLATION

CAUTION: Open the left front door glass before installing windshield to avoid pressurizing the passenger compartment. If a door is slammed before urethane bonding is cured, water leaks can result.

Allow the urethane at least 24 hours to cure before returning the vehicle to use.

To avoid stressing the replacement windshield, the urethane bonding material on the windshield fence should be smooth and consistent to the shape of the replacement windshield . The support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

(1) Place replacement windshield into position and center in the opening against the support spacers.

(2) Verify the glass lays evenly against the pinch weld fence at the sides, top and bottom of the replacement windshield. If not, the pinch weld fence must be formed to the shape of the new glass.

(3) Mark the glass at the support spacers with a grease pencil or pieces of masking tape and ink pen to use as a reference for installation (Fig. 3).

(4) Remove replacement windshield from windshield opening.

(5) Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart (Fig. 4).

WARNING: DO NOT USE SOLVENT BASED GLASS CLEANER TO CLEAN WINDSHIELD BEFORE APPLYING GLASS PREP AND PRIMER. POOR ADHESION CAN RESULT.

(6) Clean inside of windshield with ammonia based glass cleaner and lint-free cloth.

(7) Apply molding to perimeter of windshield.

(8) Apply Glass Prep adhesion promoter 25 mm (1 in.) wide around perimeter of windshield and wipe with clean/dry lint-free cloth until no streaks are visible.

(9) Apply Glass Primer 25 mm (1 in.) wide around perimeter of windshield. Allow at least three minutes drying time.

(10) Using a razor knife, remove as much original urethane as possible. Do not damage paint on windshield fence.

(11) Apply pinch weld primer 15 mm (.75 in.) wide around the windshield fence. Allow at least three minutes drying time.

(12) If a low viscosity urethane adhesive is used, install compression spacers on the fence around the windshield opening (Fig. 5).

(13) Apply a 10 mm (0.4 in.) bead of urethane on center line of windshield fence.

(14) With the aid of a helper, position the windshield over the windshield opening. Align the reference marks at the bottom of the windshield to the support spacers.

(15) Slowly lower windshield glass to windshield opening fence. Guide the molding into proper position as necessary. Push windshield inward molding is flush to roof line and A-pillars (Fig. 6).

(16) Clean access urethane from exterior with Mopar® Super Kleen or equivalent.

(17) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold molding in place until urethane cures.

(18) Install windshield side moldings and drip rail weatherstrips.

(19) Install cowl cover and wipers.

(20) Install inside rear view mirror.

(21) After urethane has cured, remove tape strips and water test windshield to verify repair.

REAR WINDOW GLASS

Refer to the windshield paragraph of this section for a description of tools and adhesive systems that are recommended for use in this procedure.

REMOVAL AND INSTALLATION (Continued)

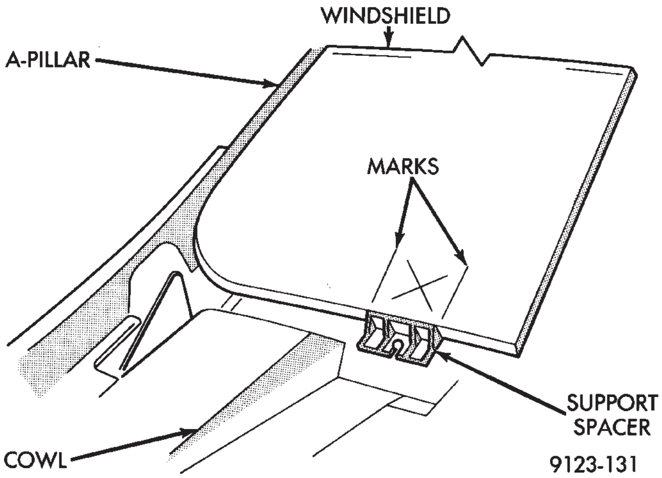

Fig. 3 Center Windshield and Mark at Support Spacers

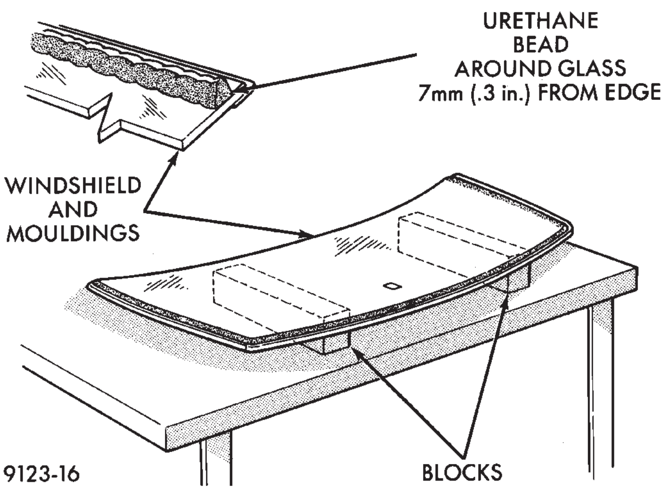

Fig. 4 Work Surface Set up and Molding Installation

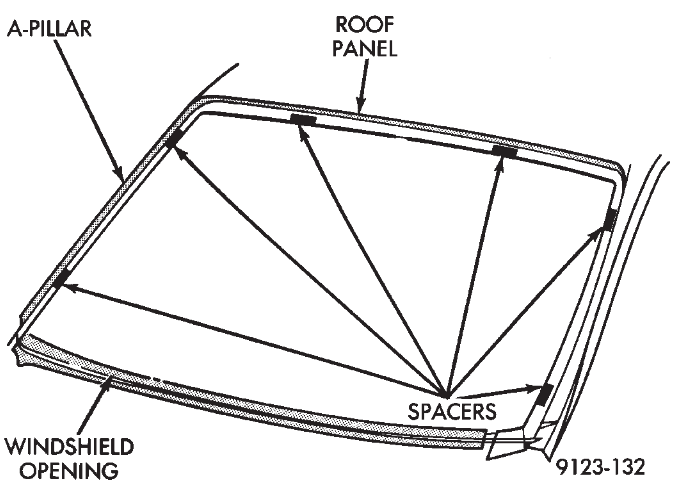

Fig. 5 Position Urethane Compression Spacers

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT. BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

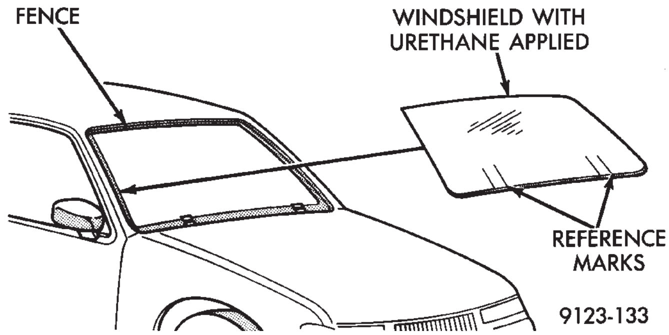

Fig. 6 Lower Windshield Into Position

CAUTION: Open the left front door glass before installing the rear window to avoid pressurizing the passenger compartment if a door is slammed before the urethane bonding is fully cured. Water leaks can result

REAR WINDOW REMOVAL

(1) Remove rear window moldings.

(2) Remove upper quarter trim panel.

(3) Disengage wire connectors from rear window defogger, and rear window mounted radio antenna, if so equipped.

(4) Remove C-pillar applique, if so equipped.

WARNING: WEAR EYE AND HAND PROTECTION WHEN HANDLING SAFETY GLASS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not damage body or trim finish when cutting out glass or applying fence primer.

(5) Cut the urethane around the perimeter of the rear window glass. Refer to Windshield section of this group for proper procedures.

(6) Separate the rear window from the vehicle.

REAR WINDOW INSTALLATION

REAR WINDOW INSTALLATION

(1) Prepare the work area, window fence, and glass the same way as described in the Windshield section of this group.

(2) Place fence spacers at the locations shown (Fig. 7).

(3) Install the rear window molding on glass.

(4) Apply a 10 mm (0.4 in.) bead of urethane along center line of window fence.

REMOVAL AND INSTALLATION (Continued)

(5) Install the glass in the same manner described in the Windshield section of this group (Fig. 7).

(6) Connect rear window defogger wiring, and rear window mounted radio antenna, if so equipped.

(7) Install C-pillar applique, and interior trim.

(8) After urethane has cured, water test rear window to verify repair. Verify rear window defogger operation, see Group 8N, Rear Window Defogger.

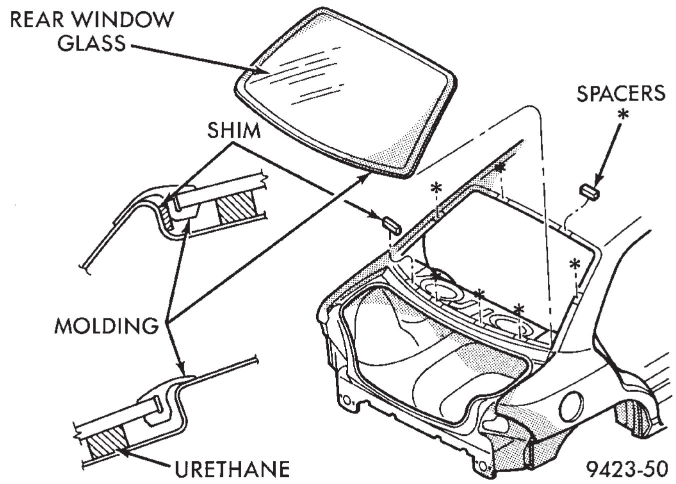

Fig. 7 Rear Window Glass – Typical

SEATS

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REMOVAL AND INSTALLATION

FRONT SEAT

REMOVAL

(1) Position seat far enough forward to gain access to rear mount bolts on floor.
(2) Remove bolts holding rear of seat track to floor (Fig. 1).
(3) Slide seat rearward.
(4) Remove bolts attaching front of the seat track to floor kick up.
(5) Disconnect front seat wire harness connector from body harness connector.
(6) Remove front seat from vehicle.

INSTALLATION

NOTE: Ensure that the seat tracks are rearward

(1) Place front seat in position in vehicle.
(2) Connect front seat wire harness connector to body harness connector.
(3) Install bolts to attach front of seat track to the floor kick up. Tighten bolts to 61 N·m (45 ft. lbs.) torque.
(4) Slide seat forward and install bolts attaching rear of seat track to the floor. Tighten bolts to 61 N·m (45 ft. lbs.) torque.
(5) Verify front seat operation.

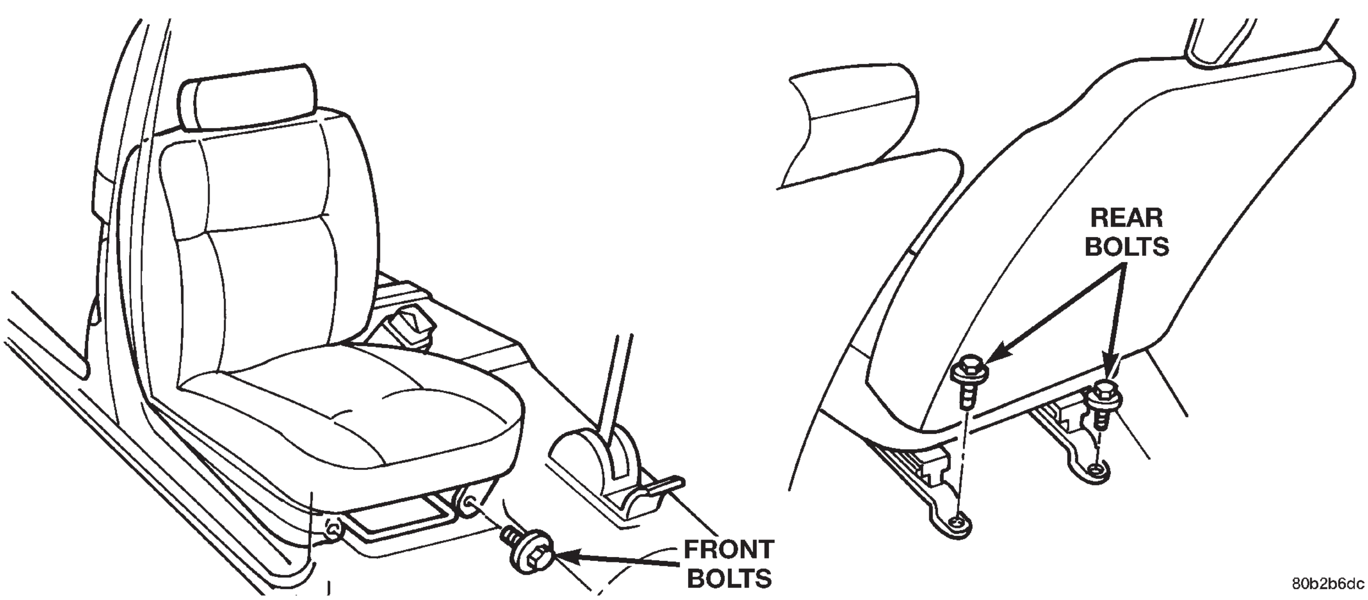


Fig. 1 Front Seat Removal

REMOVAL AND INSTALLATION (Continued)

FRONT SEAT HEAD RESTRAINT

REMOVAL

(1) Lower head restraint slightly.

(2) Insert a stiff wire into the hole on the right hand side head restraint sleeve/guide and push to release latch (Fig. 2).

(3) At the same time, press the button on the head restraint sleeve/guide left hand side and pull upward to release the head restraint.

(4) Remove head restraint from seat back.

INSTALLATION

(1) Place head restraint in position.

(2) Push head restraint down into the lock position.

(3) Raise head restraint to ensure it locks at the last stop.

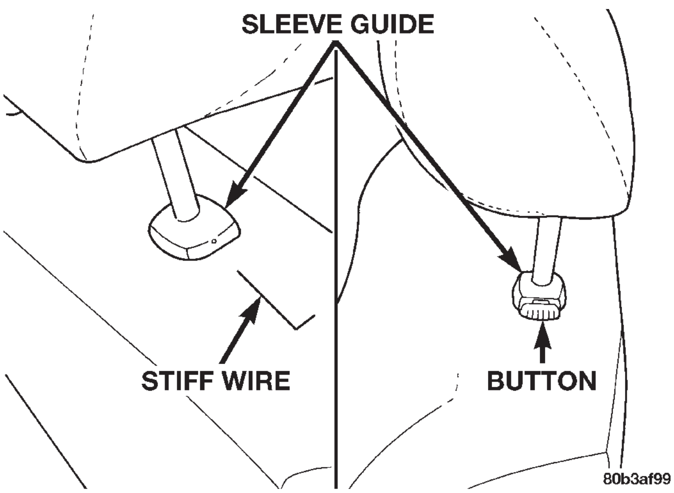


Fig. 2 Head Restraint Removal

FRONT SEAT CUSHION SIDE SHIELD

REMOVAL

(1) Remove seat from vehicle.

(2) Remove screws attaching seat cushion side shield to the bottom and side of seat cushion (Fig. 3) and (Fig. 4).

(3) Remove shield from seat

(4) Disconnect switch wire connectors, if equipped.

(5) Remove seat switches, if equipped.

INSTALLATION

(1) Transfer seat switches, if equipped.

(2) Connect switch wire connectors to cushion side shield, if equipped.

(3) Place shield in position on seat cushion.

(4) Install screws attaching seat cushion side shield.

(5) Install seat. Tighten front screws to 61 N·m (45 ft. lbs.) and the rear screws to 61 N·m (45 ft. lbs.).

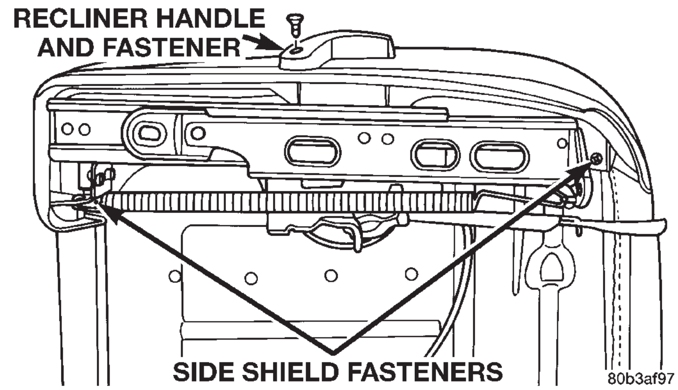


Fig. 3 Bottom View of Side Shield

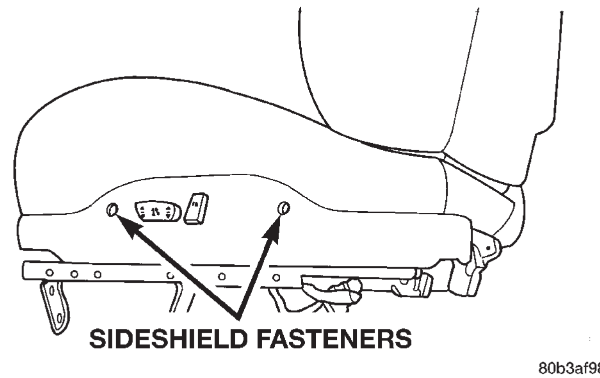


Fig. 4 Side View of Side Shield

FRONT SEAT BACK

REMOVAL

(1) Remove seat from vehicle.

(2) Remove seat cushion side shields.

(3) Remove bolts attaching recliner to seat back cushion frame (Fig. 5).

(4) Remove inboard pivot bolt (Fig. 6).

(5) Disconnect any electrical connectors to the seat back, if equipped.

(6) Remove seat back from seat cushion.

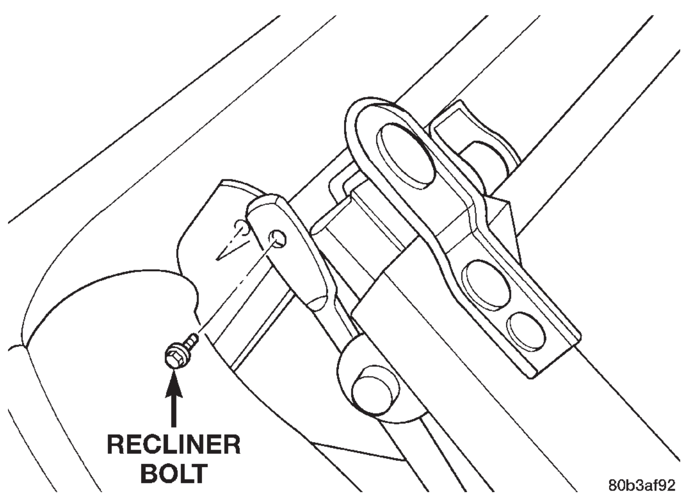


Fig. 5 Recliner Attaching Bolt

REMOVAL AND INSTALLATION (Continued)

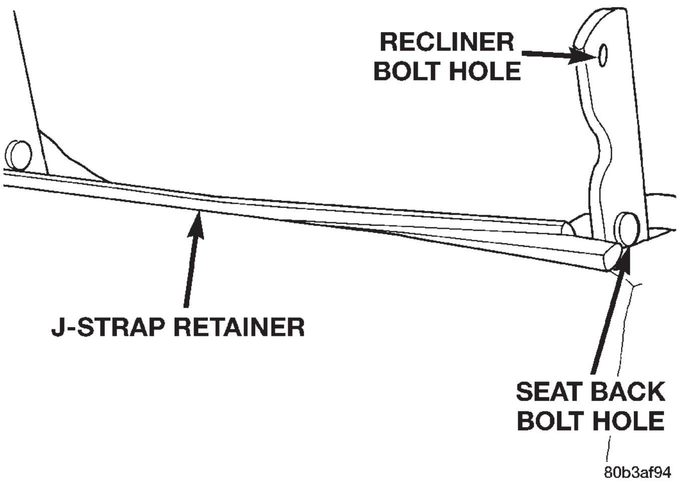


Fig. 6 Remove Seat Back

INSTALLATION

(1) Position seat back on cushion.
(2) Connect electrical connectors to the seat back, if equipped.
(3) Install inboard pivot bolt. Tighten bolt to 40 N·m (30 ft. lbs.) torque.
(4) Install bolts attaching recliner to seat cushion frame. Tighten bolts to 12 N·m (9 ft. lbs.) torque.
(5) Install seat cushion side shields.
(6) Install seat in vehicle.

FRONT SEAT BACK COVER

REMOVAL

(1) Remove seat from vehicle.
(2) Remove head restraint.
(3) Remove front seat back.
(4) Remove lumbar support handle, if equipped.
(5) Disengage the J-strap retainer (Fig. 6).
(6) Roll cover upward to hog rings. Cut hog rings to free cover (Fig. 7).
(7) Roll cover to top of cushion and remove head rest sleeve guides.
(8) Remove cover from seat back.

INSTALLATION

NOTE: Do not reuse the recliner assembly attaching bolts.

(1) Position cover at the top of seat back.
(2) Carefully roll cover down to the area that hog rings are to be installed.
(3) Install hog rings.
(4) Roll cover downward.
(5) Engage the J-strap retainer
(6) Install lumbar support handle, if equipped.
(7) Install new head rest sleeve guides.
(8) Install seat back to seat cushion. Tighten bolts to 12 N·m (9 ft. lbs.) torque.
(9) Install seat in vehicle.
(10) Install head restraint.
(11) Check seat back and headrest operation.

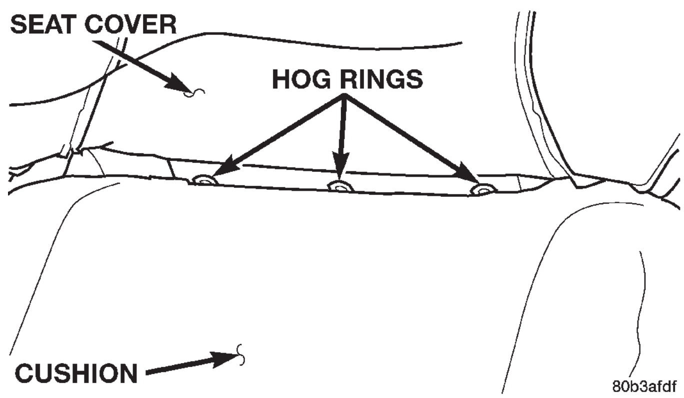


Fig. 7 Front Seat Back Hog Rings

FRONT SEAT CUSHION

REMOVAL

(1) Remove seat from vehicle.
(2) Remove front seat cushion side shields and disconnect wire connectors, if equipped.
(3) Remove seat back.
(4) Remove track and recliner assembly.
(5) Disconnect seat cushion heater element connector, if equipped.
(6) Disconnect wire harness fasteners from cushion frame (Fig. 8).
(7) Remove seat cushion (Fig. 9).

INSTALLATION

(1) Install wire harness fasteners to cushion frame.
(2) Connect seat cushion heater element connector, if equipped.
(3) Install track and recliner assembly.
(4) Install seat back. Tighten bolts to 40 N·m (30 ft. lbs.) torque.
(5) Connect switch wire connectors to the cushion side shield, if equipped.
(6) Install cushion side shields.
(7) Install seat in vehicle.

FRONT SEAT CUSHION COVER

REMOVAL

(1) Remove seat from vehicle.
(2) Remove front seat cushion side shields.
(3) Remove seat back.
(4) Remove track and recliner assembly.
(5) Disengage J-strap attaching seat cover from the seat cushion frame (Fig. 10).

REMOVAL AND INSTALLATION (Continued)

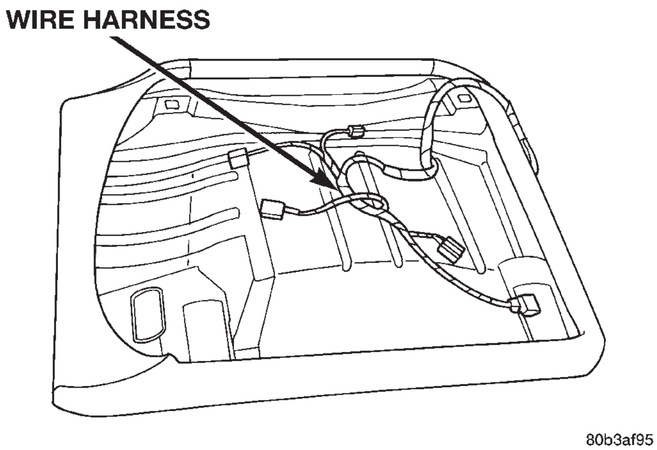


Fig. 8 Front Seat Cushion Wire Harness

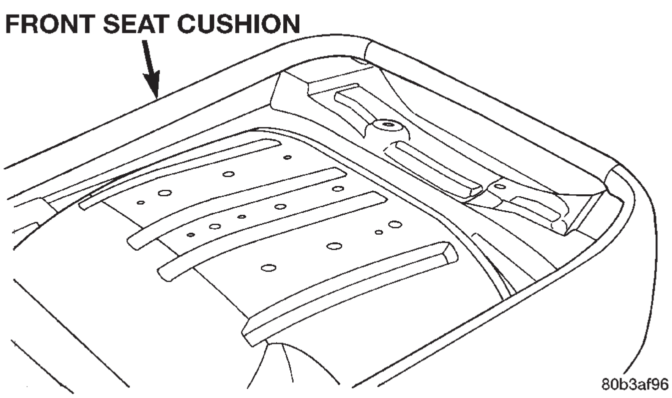


Fig. 9 Front Seat Cushion

(6) Pull cover off to the hog rings (Fig. 11).

(7) Cut hog rings attaching seat cover seat cushion.

(8) Route seat function switches through access hole on outboard side of seat cushion, if equipped.

(9) Disconnect seat cushion heater element connector, if equipped.

(10) Remove seat cushion cover from seat cushion.

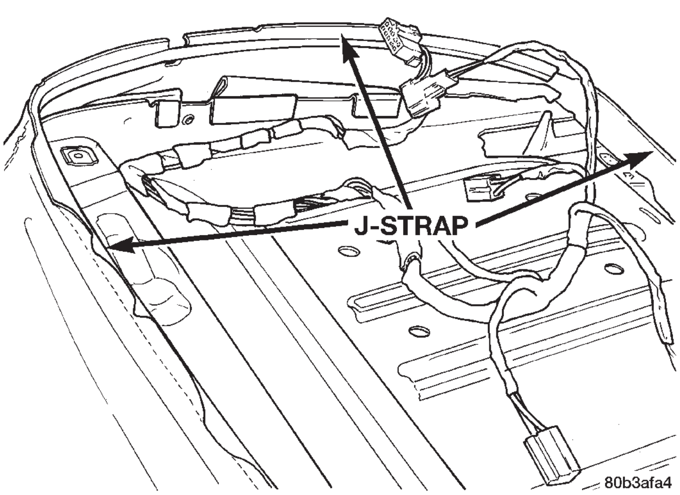


Fig. 10 Front Seat Cushion J- Strap

INSTALLATION

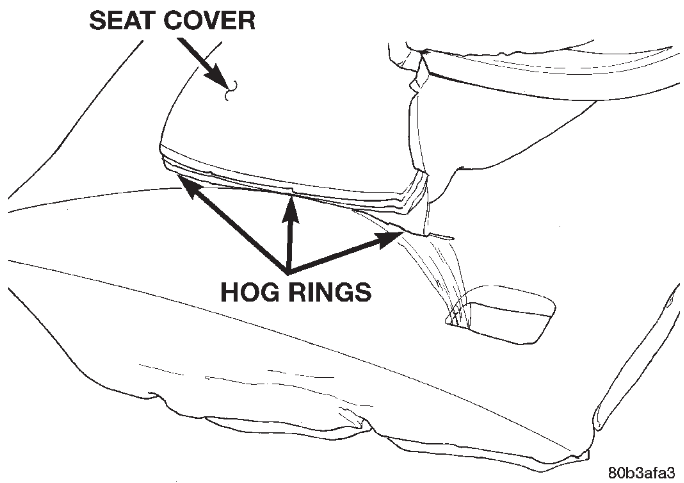


Fig. 11 Seat Cushion Cover

(1) Position seat cover on cushion.

(2) Align seat cover with cushion alignment indentations.

(3) Engage seat cushion heater element connector, if equipped.

(4) Install hog rings.

(5) Engage J-strap attaching seat cover to front of seat cushion frame.

(6) Install track and recliner assembly.

(7) Install seat back.

(8) Install front seat cushion side shields.

(9) Install seat in vehicle.

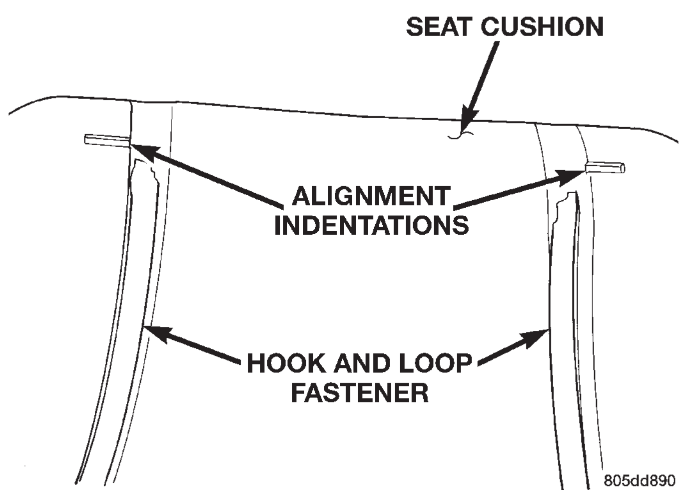


Fig. 12 Seat Cushion Alignment Indentations

FRONT SEAT TRACK AND RECLINER

REMOVAL

(1) Remove front seat from vehicle.

(2) Remove seat cushion side shield and disconnect switch connector, if equipped.

REMOVAL AND INSTALLATION (Continued)

(3) Remove bolt attaching seat back recliner to seat back frame on each side of seat (Fig. 13).

(4) Remove bolts attaching seat track and recliner to cushion frame (Fig. 14).

(5) Remove seat track and recliner from seat cushion.

INSTALLATION

(1) Place seat track in position on seat cushion.

(2) Install bolts to attach seat track and recliner to cushion frame.

(3) Install bolt to attach seat back recliner to seat back on each side of seat. Tighten bolt to 12 N·m (9 ft. lbs.) torque.

(4) Connect wire connectors and install the cushion side shields.

(5) Install front seat in vehicle.

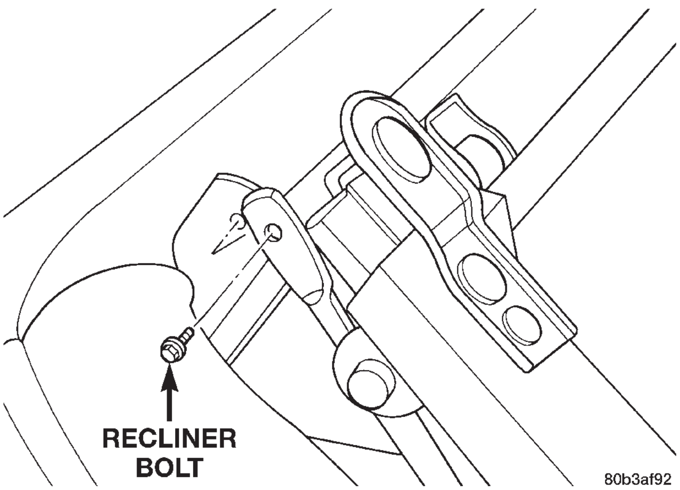


Fig. 13 Recliner Pivot Bolt

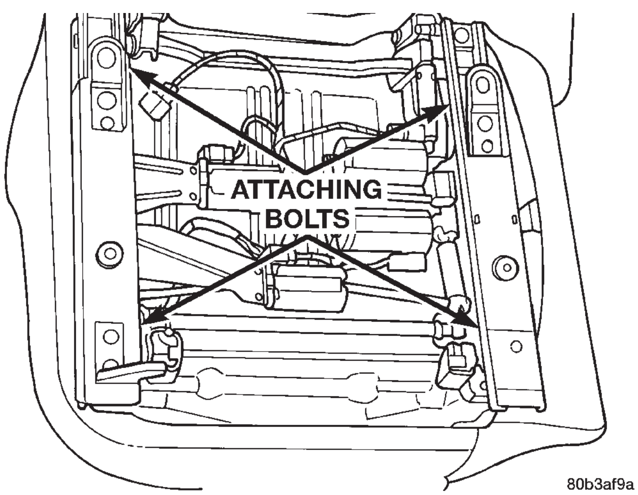


Fig. 14 Front Seat Track – Typical

REAR SEAT CUSHION

REMOVAL

(1) Pull upward at each retainer loop of the rear seat cushion to disengage retainer loops from cups in floor (Fig. 15).

(2) Remove rear seat cushion from vehicle.

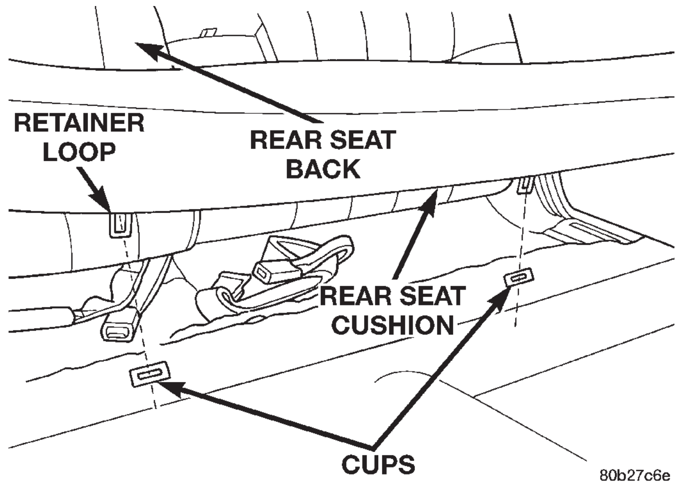


Fig. 15 Rear Seat Cushion

INSTALLATION

(1) Place rear seat cushion in position in vehicle.

(2) Engage retainer loops into cup on floor kick-up.

(3) Push downward at each retainer loop of the rear seat cushion to engage retainers.

REAR SEAT BACK

REMOVAL

(1) Remove rear seat cushion.

(2) Release seat back striker from latch lock located at upper center of seat back (Fig. 16).

(3) Remove pivot bolts from lower corners of seat back.

(4) Remove rear seat back from vehicle.

INSTALLATION

(1) Place seat back into vehicle and align the pivot brackets at the lower corners of seat back.

(2) Install pivot bolts through pivot bracket into seat back and tighten to 12 N·m (9 ft. lbs.).

(3) Rotate seat back upward to latch into position.

(4) Install rear seat cushion.

REMOVAL AND INSTALLATION (Continued)

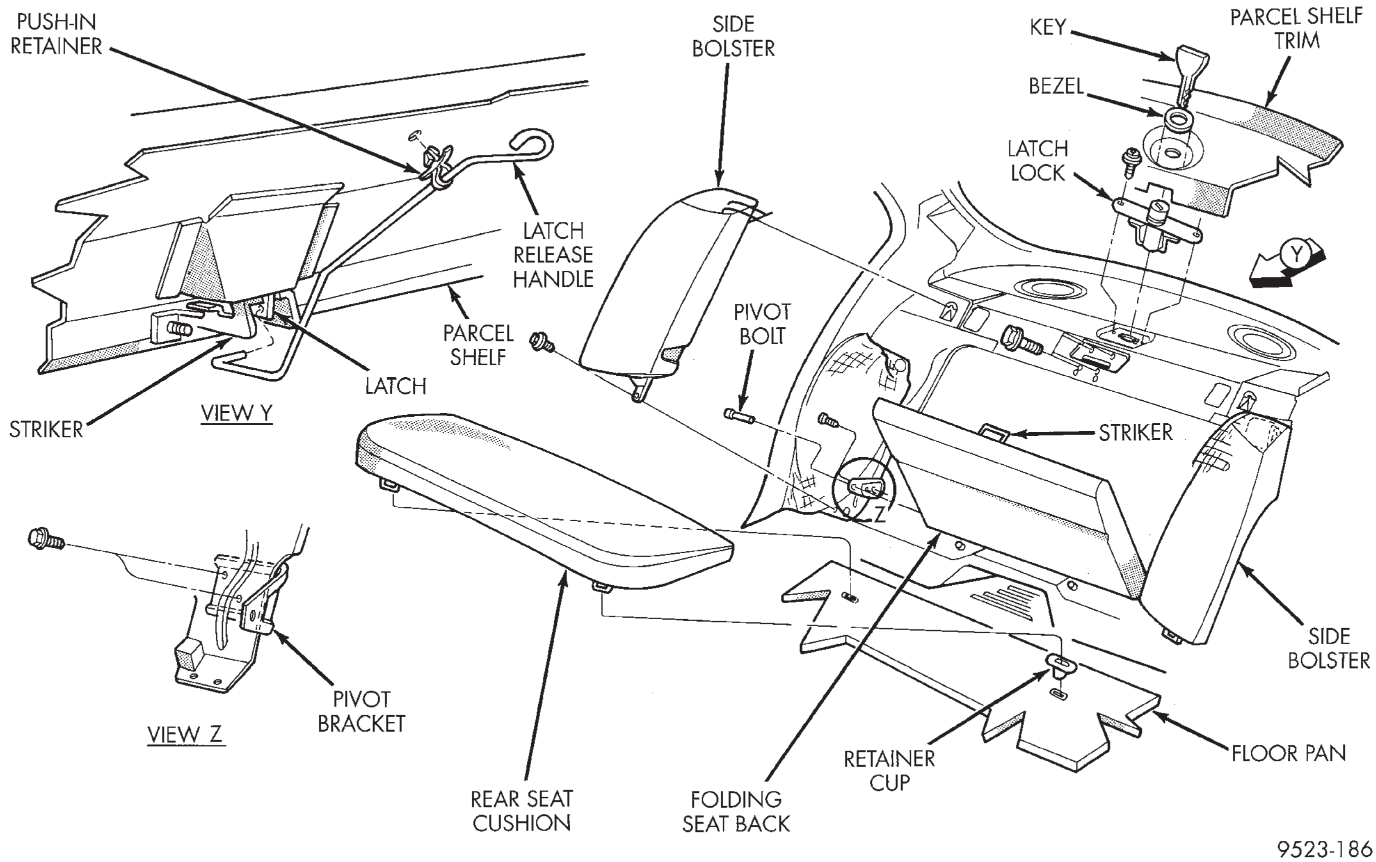


Fig. 16 Rear Seat

REAR SEAT CUSHION COVER

REMOVAL

(1) Remove rear seat cushion.
(2) Disengage the J-strap retainers (Fig. 17).
(3) Cut hog rings to free cover (Fig. 18).
(4) Remove seat cushion cover from seat cushion.

INSTALLATION

(1) Position seat cushion cover on cushion.
(2) Install hog rings to seat cover.
(3) Engage the J-strap retainers.
(4) Steam wrinkles from seat cushion, if necessary.
(5) Install seat cushion.

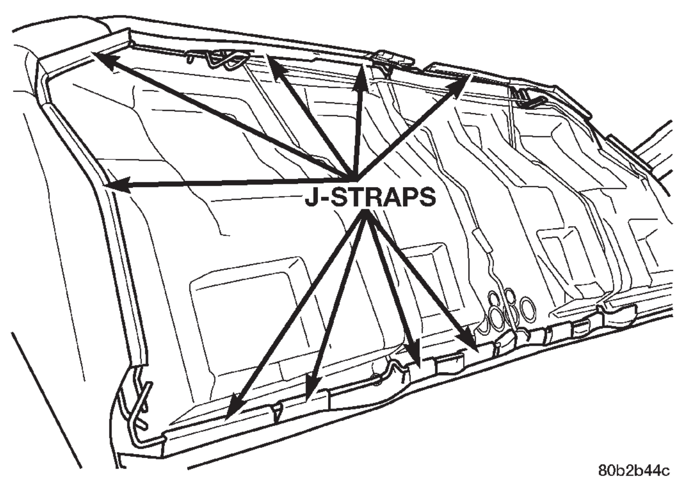


Fig. 17 Rear Seat Cushion Cover J-Straps

REMOVAL AND INSTALLATION (Continued)

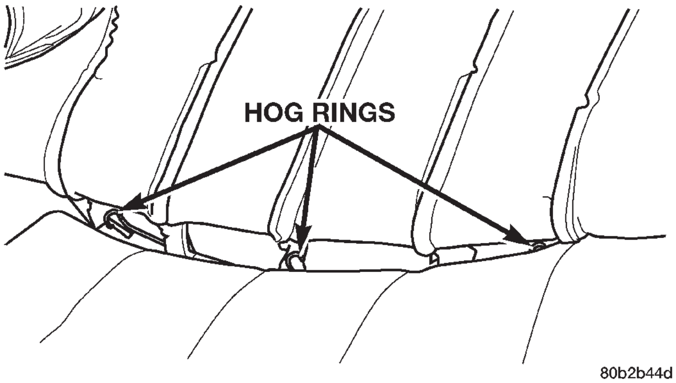


Fig. 18 Rear Seat Cushion Cover Hog Rings

REAR SEAT BACK BOLSTER

REMOVAL

(1) Remove seat cushion.
(2) Remove the lower attaching screw at the bottom of bolster (Fig. 16).
(3) Lift bolster up wards to unhook the bolster from body hook at top of bolster.
(4) Remove bolster from vehicle.

INSTALLATION

(1) Hook wire on top of bolster to hook on vehicle body.
(2) Push down on bolster to engage lock in place.
(3) Install screw at bottom of bolster.
(4) Install seat cushion.

REAR SEAT BACK LATCH

REMOVAL

(1) Release seat back from latch and rotate downward.
(2) Remove two screws from latch lock release button and lift button up and out (Fig. 16).
(3) Remove four screws from latch lock and remove latch from vehicle.

INSTALLATION

(1) Place latch lock in position and install four screws.
(2) Place latch lock button down into latch lock and install screws.
(3) Rotate seat back upward and latch into position.

REAR SEAT BACK PIVOT BRACKET

REMOVAL

(1) Remove rear seat cushion.
(2) Remove rear seat back
(3) Locate and remove the bolts attaching pivot bracket (Fig. 16).
(4) Remove pivot bracket from vehicle.

INSTALLATION

(1) Place pivot bracket into body by sliding tab into the slot at each end of the pivot bracket base.
(2) Install pivot bracket attaching bolts.
(3) Install rear seat back.
(4) Install rear seat cushion.

FOLDING REAR SEAT BACK

REMOVAL

(1) Remove rear seat cushion.
(2) Remove side bolsters.
(3) Remove pivot-bolts attaching folding rear seat back to lower pivot brackets (Fig. 16).
(4) Release folding rear seat back latch.
(5) Remove seat back from vehicle.

INSTALLATION

(1) Position seat back in vehicle.
(2) Engage folding rear seat back latch.
(3) Install pivot-bolts attaching folding rear seat back to lower pivot brackets.
(4) Install side bolsters.
(5) Install rear seat cushion.

FOLDING REAR SEAT BACK LATCH HANDLE

REMOVAL

(1) From inside luggage compartment, disengage push-in retainer holding latch release handle to bottom of parcel shelf.
(2) Disengage handle from folding rear seat back latch (Fig. 16).

INSTALLATION

Reverse the preceding operation.

FOLDING REAR SEAT BACK LATCH/LOCK

REMOVAL

(1) Remove parcel trim cover.
(2) Remove bolts attaching folding rear seat back latch/lock to parcel shelf (Fig. 16).
(3) Remove folding rear seat back latch/lock from vehicle.

INSTALLATION

Reverse the preceding operation.

FOLDING REAR SEAT BACK SIDE BOLSTERS

REMOVAL

(1) Remove rear seat cushion.

REMOVAL AND INSTALLATION (Continued)

(2) Remove bolts holding side bolster to floor pan at the rear wheelhouse kick-up (Fig. 16).

(3) Lift side bolster upward to disengage hook retaining top of bolster.

(4) Remove side bolster from vehicle.

INSTALLATION

(1) Position side bolster in vehicle.

(2) Lower side bolster to engage hook retaining top of bolster.

(3) Install bolts holding side bolster to floor pan at the rear wheelhouse kick-up.

(4) Install rear seat cushion.

SUNROOF

INDEX

DESCRIPTION AND OPERATION

GENERAL INFORMATION

SUNROOF OPERATION

WARNING: Keep fingers and other body parts out of sunroof opening at all times.

The sunroof features a power sliding glass panel and a sunshade which can be manually positioned anywhere along its travel, rearward of glass panel front edge.

The sunroof is electrically operated from a two switches located on the windshield header, rearward of the map lamp. To operate the sunroof the ignition switch must be in either the Accessory or On/Run position. One switch (vent) is a push button type and opens the sunroof to the vent position only. The other switch (open/close) is a rocker type for opening and closing the sunroof. Pressing and releasing the open button once the sunroof will express open and the wind deflector will raise. If the button is pressed a second time the sunroof will stop in that position. Pressing and holding the close button will close the sunroof. If the close button is released the sunroof will stop in that position.

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

Before beginning sunroof diagnostics verify that all other power accessories are in proper operating condition. Refer to Sunroof Diagnostic Chart for possible causes. If not, a common electrical problem may exist. Refer to Group 8W, Wiring Diagrams, of this publication for circuit, splice and component descriptions. Check the condition of the circuit protection (20 amp circuit breaker in cavity 19 of the Junction Block). Inspect all wiring connector pins for proper engagement and continuity. Check for battery voltage at the power sunroof controller, refer to Group 8W, Wiring Diagrams, for circuit information. If battery voltage of more than 10 volts is detected at the controller, proceed with the following tests (the controller will not operate at less than 10 volts).

Before beginning diagnosis for wind noise or water leaks, verify that the problem was not caused by releasing the control switch before the sunroof was fully closed. The sunroof module has a water-management system. If however, the sunroof glass is in a partial closed position, high pressure water may be forced beyond the water management system boundaries and onto the headlining.

DIAGNOSIS AND TESTING (Continued)

SUNROOF DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE
Sunroof motor inoperative.	Faulty control switch. Faulty circuit ground between sunroof express module, drive motor, control switch, and body harness. Faulty power circuit between sunroof express module, drive motor, switch, and body harness. Faulty sunroof drive motor. Faulty sunroof express module. Faulty sunroof drive motor connector.
Audible whine when switch is depressed, sunroof does not operate.	Faulty sunroof drive motor. Binding cable.
Audible clicking or ratcheting when switch is pressed, sunroof does not operate.	Broken or worn drive cable. Worn drive motor gear. Mechanisms not synchronized.
Sunroof vents and opens, but does not close.	Binding cable. Faulty circuit. Faulty control switch. Faulty sunroof express module. Faulty drive motor.
Sunroof vents, but does not open.	Binding linkage. Faulty circuit. Faulty switch. Faulty sunroof controller. Faulty drive motor.
Sunroof does not vent	Binding cable. Faulty circuit. Faulty control switch. Faulty sunroof express module.
Sunroof water leak.	Drain tubes clogged or kinked. Glass panel improperly adjusted. Faulty glass panel seal.
Wind noise from sunroof.	Front of glass panel too high or rear too low. Glass panel not centered in opening. Faulty glass panel seal.
Rattles from open sunroof while driving	Loose or broken attaching hardware. Worn or broken mechanism.
Rattles from closed sunroof while driving	Loose or broken attaching hardware. Worn or broken mechanism

WATER DRAINAGE AND WIND NOISE DIAGNOSIS

The sliding glass panel is designed to seal water entry with a snug fit between the roof and the seal. The fit can be checked by inserting a piece of paper between the roof and the seal. The piece of paper should have some resistance when pulled out when the glass panel is in the closed position. The sunroof housing will drain off a minimum amount of water. Excessive wind noise could result if the gap clearances are exceeded. The sunroof glass panel may need to be adjusted. Refer to Sunroof Glass Panel Adjustment for proper procedures.

Adequate drainage is provided by a drain trough in the sunroof housing which encircles the sliding glass panel and leads to drain hoses. If a wet headliner or other water leak complaints are encountered, before performing any adjustments, first ensure that the drainage system is not plugged or disconnected. Use a pint container to pour water into the sunroof housing drain trough. If water flow is restricted, use compressed air to blow out any material plugging the drain system. Retest system again.

DIAGNOSIS AND TESTING (Continued)

To further check for a disconnected drain hose:

(1) Remove A-pillar trim, sun visors, and map lamps/mini console.

(2) Remove sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(3) Lower headliner as necessary to gain access to sunroof housing drain tubes. Refer to Headlining Removal and Installation for proper procedures.

(4) Repair as necessary.

REMOVAL AND INSTALLATION

SUNROOF MODULE ASSEMBLY

REMOVAL

(1) Move glass panel to the fully closed position.

(2) Disconnect battery negative cable.

(3) Recline both front seats.

(4) Remove sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(5) Remove control switch. Refer to Sunroof Control Switch.

(6) Remove headliner

(7) Disconnect the drain tubes from sunroof housing.

(8) Loosen fasteners attaching sunroof module assembly (Fig. 1).

(9) With the aid of a helper, remove fasteners attaching sunroof module assembly to roof panel.

INSTALLATION

NOTE: There are locating pins on the roof panel near the front corners of the sunroof opening that will help position the sunroof module correctly.

(1) With the Glass panel in the fully closed position.

(2) Raise rear end of sunroof module assembly and guide into position and start fasteners.

(3) Tighten the fasteners holding the sunroof module to roof panel. Tighten the fasteners to 11 N·m (97 in. lbs.) torque.

(4) Connect the drain tubes to the sunroof housing.

(5) Set headliner into position.

(6) Connect express module, drive motor, and control switch wire connectors.

(7) Test sunroof operation, adjust as necessary.

(8) Finish installing the headliner.

(9) Install sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(10) Connect battery negative cable.

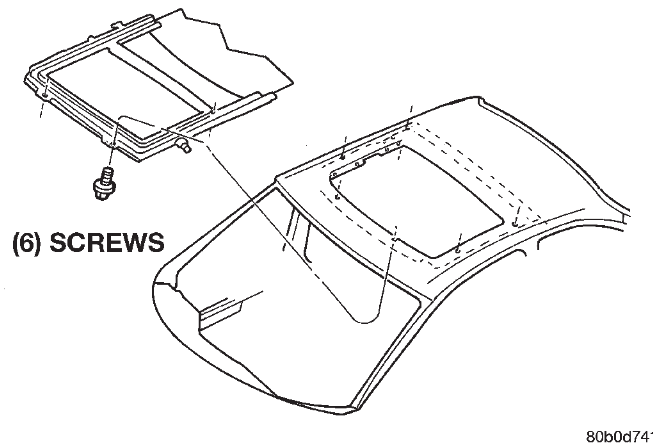


Fig. 1 Sunroof Module Assembly

SUNROOF EXPRESS MODULE

REMOVAL

(1) Remove A-pillar trim, sun visors, and map lamps/mini console.

(2) Remove sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(3) Remove headliner as necessary to gain access to sunroof express module.

(4) Disconnect the express module wire harness connectors (Fig. 2).

(5) Remove express module from the keyway by sliding module towards the center of the vehicle.

INSTALLATION

(1) Place express module in the keyway located in sunroof module and slide module outward to lock it into position.

(2) Set headliner into position.

(3) Connect drive motor, express module, and control switch wire connectors.

(4) Test sunroof operation, adjust as necessary.

(5) Finish installing headliner.

(6) Install sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(7) Install A-pillar trim, sun visors, and map lamps/mini console.

REMOVAL AND INSTALLATION (Continued)

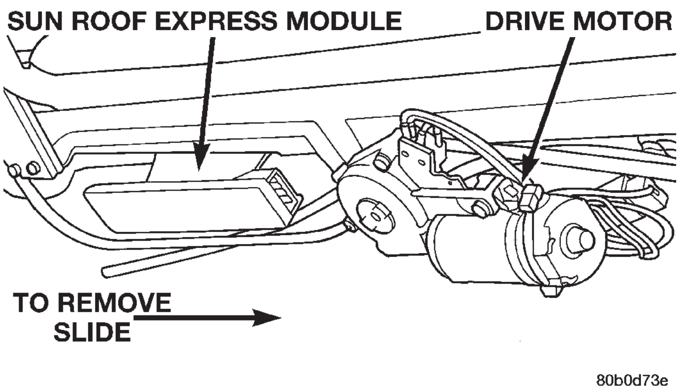


Fig. 2

SUNROOF DRIVE MOTOR

REMOVAL

NOTE: The sunroof system is timed from the factory so that the motor shuts off automatically when the sunroof window reaches a certain position. Extreme care must be taken when removing the motor from the sunroof module assembly or this timing may be thrown off causing damage to the sunroof system. Anytime the motor needs to be removed from the module assembly the sunroof window must be in the FULLY CLOSED POSITION.

(1) Move glass panel to the fully closed position.

(2) Remove A-pillar trim, sun visors, and map lamps/mini console.

(3) Disconnect the control switch wire connector.

(4) Remove sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(5) Remove headliner as necessary to gain access to sunroof drive motor. Refer to headlining Removal and Installation for proper procedures.

(6) Disconnect the drive motor wire harness connectors.

(7) Remove drive motor attaching screws and remove motor from the sunroof housing.

INSTALLATION

(1) Before installing a new motor or the original motor ensure that the motor and module are timed to the closed position.

(2) Ensure that sunroof is in the FULLY closed position before mounting the motor. If necessary, move the sunroof glass to the fully closed position by hand with the motor disconnected from the sunroof housing.

(3) To time the drive motor connect all wire connectors to the express module. Run motor in the close position till the hole in the gear aligns with the Timing Marks shown in (Fig. 3).

(4) Place drive motor into position on the sunroof housing and install attaching screws.

(5) Set headliner into position.

(6) Connect express module, drive motor, and control switch wire connectors.

(7) Test sunroof operation, adjust as necessary.

(8) Finish installing the headliner.

(9) Install sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(10) Connect the control switch wire connector.

(11) Install A-pillar trim, sun visors, and map lamps/mini console.

(12) Install glass panel. Verify glass position in opening.

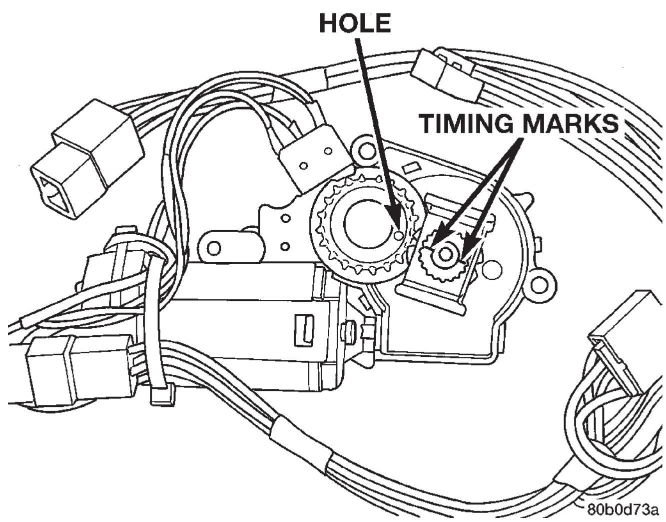


Fig. 3 Sunroof Drive Motor Timing

SUNROOF GLASS PANEL

REMOVAL

(1) Slide sunshade rearward to the open position.

(2) Move the glass panel to the vent position.

(3) Remove the glass panel screws on each side (Fig. 4).

(4) Lift off glass panel and remove from vehicle.

INSTALLATION

(1) Position glass panel on to mechanism.

(2) Start the six attaching screws.

(3) Tighten screws.

(4) Verify sunroof operation and alignment. Check fit and adjust as necessary, refer to Sunroof Glass Panel Adjustment for proper procedures.

REMOVAL AND INSTALLATION (Continued)

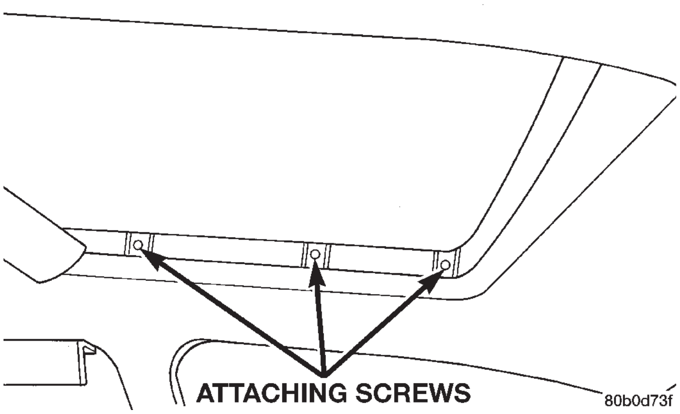


Fig. 4 Sunroof Glass Panel Screws

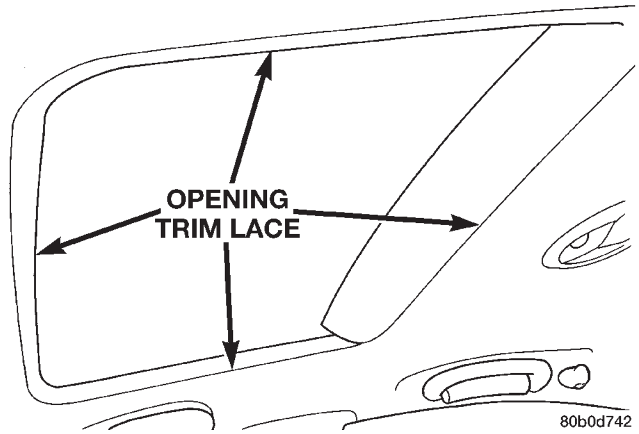


Fig. 5

SUNROOF SUNSHADE

REMOVAL

(1) Place the sunroof glass panel in the vent position.

(2) Move the sunshade to the closed position

(3) From the outside of the vehicle, using a flat blade tool, disengage the rear sunshade guides. Pushing the guide toward the center of the vehicle (Fig. 5). Raise up on sunshade and slide it rearward out through the opening. Release the front two guides and remove sunshade from the vehicle.

CAUTION: Use care not to crease the sunshade when removing or installing.

(4) Remove the sunshade handle from sunshade by compressing the back side of the handle together and pull the handle out.

INSTALLATION

(1) Install sunshade handle into the sunshade, by pressing the handle into place until the tabs lock behind the sunshade.

(2) Install the sunshade into the vehicle between the roof and the glass panel in the vent position.

(3) Move the sunshade to the closed position. Through the opening using a flat tool, engage the rear guides into the guide rails.

(4) Slide sunshade rearward to access the front two guides. Engage the front guides into the guide rails.

(5) Ensure the sunshade operation and operate the sunroof.

SUNROOF GLASS PANEL SEAL

REMOVAL

(1) Remove sunroof glass panel. Refer to Sunroof Glass Panel Removal and Installation procedures.

(2) Grasp the seal and pull seal away from the glass panel. The seal is a one piece seal.

INSTALLATION

NOTE: Always position seal seam on center of the passenger side of glass panel.

(1) Install seal on glass. Using care working the seal around the glass, being careful not to over stretch the seal while installing.

(2) Install sunroof glass panel.

(3) Test sunroof operation, adjust as necessary.

SUNROOF OPENING TRIM LACE

REMOVAL

Remove lace by starting at the joint and pull one end of the lace away from the headliner until the entire lace is removed (Fig. 6).

INSTALLATION

Install lace by starting at the spot of the previous joint, fully seat the lace in place around the sunroof opening. cut to fit if necessary.

REMOVAL AND INSTALLATION (Continued)

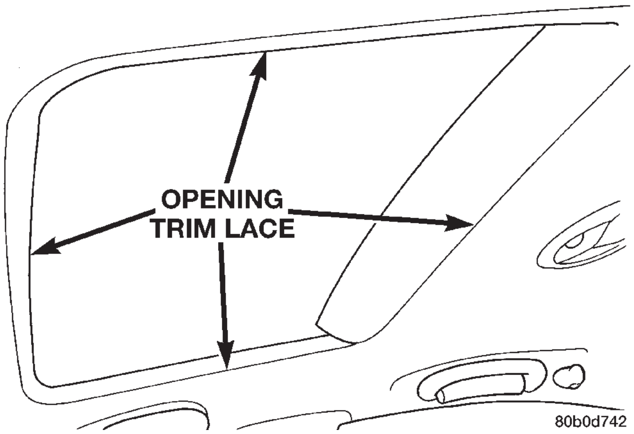


Fig. 6 Sunroof Opening Trim Lace

SUNROOF HOUSING DRAIN HOSE

FRONT HOSES

REMOVAL

(1) Move glass panel to the fully closed position.

(2) Remove sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(3) Disconnect the control switch and wire connector.

(4) Remove headliner. Refer to Headlining Removal and Installation for proper procedures.

(5) Disconnect the drain hose from the sunroof housing (Fig. 7).

(6) Drain any liquid from hose connection, if necessary.

(7) Attach new drain hose to old hose with tape that is to be replaced.

(8) Work the old hose back and forth to loosen the sealer.

(9) Pull the old hose out through the bottom and the new hose through.

INSTALLATION

(1) Connect the drain hose to the sunroof housing and test drainage.

(2) Set headliner into position.

(3) Connect express module, drive motor, and control switch wire connectors.

(4) Test sunroof operation, adjust as necessary.

(5) Finish installing headliner. Refer to Headlining Removal and Installation for proper procedures.

(6) Install sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(7) Connect the control switch wire connector. Install control switch.

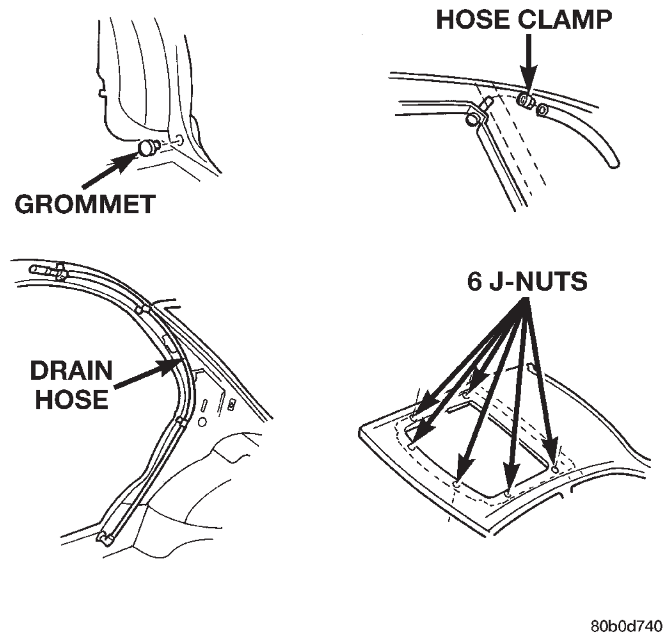


Fig. 7 Sunroof Housing Drain Hoses

REAR HOUSING HOSE

REMOVAL

(1) Move glass panel to the fully closed position.

(2) Remove sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

(3) Disconnect the control switch and wire connector.

(4) Remove headliner. Refer to Headlining Removal and Installation for proper procedures.

(5) Disconnect the drain hose from the sunroof housing (Fig. 7).

(6) Drain any liquid from hose connection, if necessary.

(7) Attach new drain hose to old hose with tape that is to be replaced.

(8) Work the old hose back and forth to loosen the sealer.

(9) Pull the old hose out through the bottom and the new hose through.

INSTALLATION

(1) Connect the drain hose to the sunroof housing and test drainage.

(2) Set headliner into position.

(3) Connect express module, drive motor, and control switch wire connectors.

(4) Test sunroof operation, adjust as necessary.

(5) Finish installing headliner. Refer to Headlining Removal and Installation for proper procedures.

(6) Install sunroof opening trim lace. Refer to Sunroof Opening Trim Lace.

REMOVAL AND INSTALLATION (Continued)

(7) Connect the control switch wire connector. Install control switch.

SUNROOF CONTROL SWITCH

REMOVAL

(1) Using a flat blade tool, release switch from the headliner (Fig. 8).

(2) Disconnect the wire connector from the switch.

INSTALLATION

(1) Connect the wire connector to the control switch.

(2) Install control switch into headliner.

(3) Test sunroof operation.

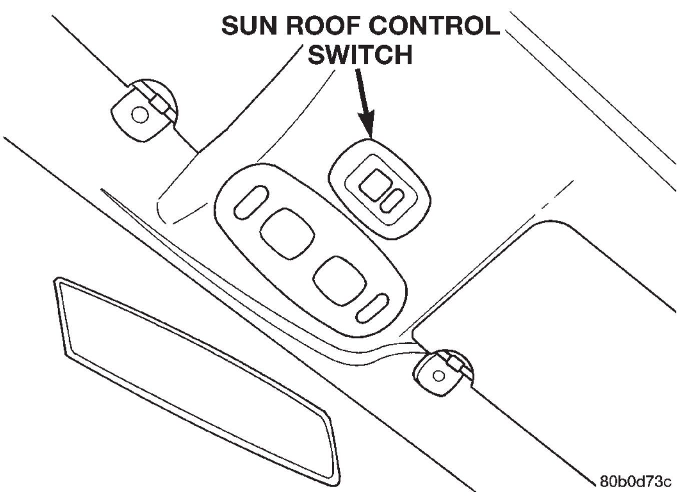


Fig. 8 Sunroof Control Switch

SUNROOF WIND DEFLECTOR

REMOVAL

(1) Open sunroof glass panel.

(2) Remove hinge pins by pushing them outboard to release the wind deflector from sunroof housing (Fig. 9).

(3) Remove wind deflector (Fig. 10).

INSTALLATION

(1) Place wind deflector on wind deflector brackets.

(2) Install wind deflector hinge pins.

(3) Test sunroof operation.

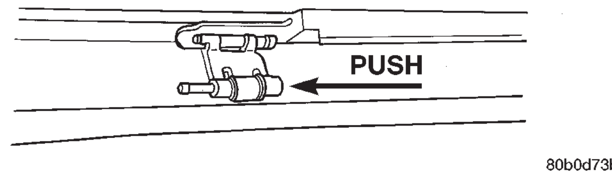


Fig. 9 Wind Deflector Hinge Pin

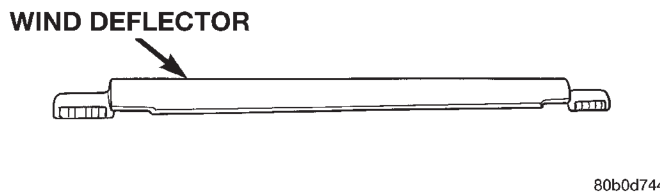


Fig. 10 Wind Deflector

ADJUSTMENTS

SUNROOF GLASS PANEL ADJUSTMENT

(1) Move the sunshade rearward to the open position.

(2) Move the sunroof glass panel to the fully closed position.

(3) Loosen the forward and center screws on each side enough to make the front adjustment.

(4) Adjust the front of the sunroof glass panel 1 mm (1/32 inch) below the top surface of the roof panel.

(5) Tighten the front two screws.

(6) Loosen the rear screws on each side enough to make the rear adjustment.

(7) Adjust the rear of the sunroof glass panel 1 mm (1/32 inch) above the top surface of the roof panel.

(8) Tighten the rear two screws.

(9) Check for proper fit. If not OK, repeat glass panel adjustment. If OK, tighten the center two screws.

BODY COMPONENTS

INDEX

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water-test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

DIAGNOSIS AND TESTING (Continued)

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

SERVICE PROCEDURES

HEAT STAKING

(1) Remove trim panel.

(2) Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.

(3) Heat stake the components.

(a) If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

(b) If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

(4) Allow the repaired area to cool and verify the repair.

(5) Install trim panel.

BODY PANEL REPAIR

DESCRIPTION OPERATION

Resin Transfer Molded (RTM) body panels are reinforced with a continuous fiberglass mesh. Epoxy resin is injected into a gel-coated and fiberglass-lined mold to form a body panel. Sheet molded compound (SMC) body panels are constructed with fiberglass strands usually 1 inch or shorter, epoxy resin formed into sheet stock and pressed in mold flowing material to form a sheet molded compound (SMC) body panel. RTM and SMC body panels can be repaired with epoxy adhesive after market products. Refer to instructions provided by the manufacturer of products being used to repair RTM or SMC. Chrysler Corporation recommends that a trained automotive body technician perform body panel repair procedures (Fig. 1).

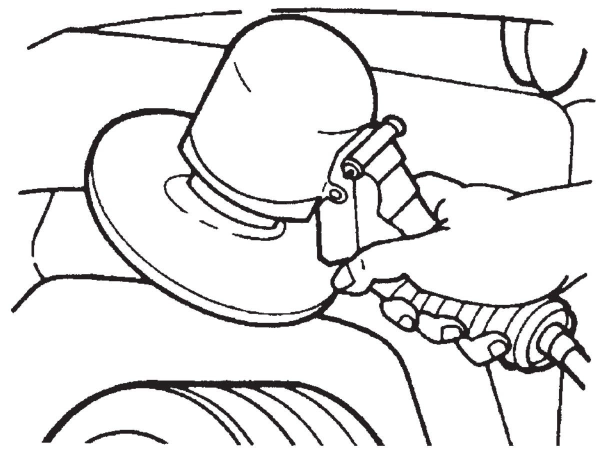


Fig. 1 Panel Repair

SERVICE PROCEDURES (Continued)

SAFETY PRECAUTION AND WARNINGS

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING RTM AND SMC COMPONENTS. PERSONAL INJURE CAN RESULT.

USE AN OSHA APPROVED BREATHING DEVICE WHEN MIXING EPOXY, GRINDING RTM AND SMC, AND SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

AVOID PROLONGED SKIN CONTACT WITH EPOXY RESIN, PETROLEUM, OR ALCOHOL BASED SOLVENTS. PERSONAL INJURY CAN RESULT.

DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.

- When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.
- Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.

PANEL SECTIONING

If it is required to section a large panel for an SMC or RTM repair, it will be necessary to reinforce the panel with epoxy structural adhesive (rigid repair adhesive) (Fig. 2). To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be "V'd" at a 20 degree angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.

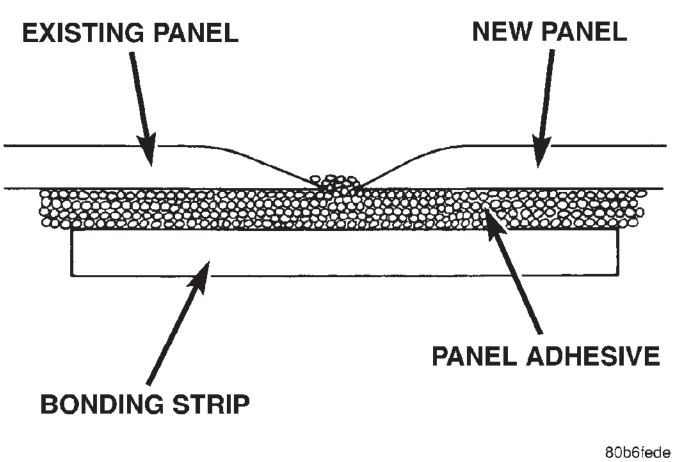


Fig. 2 Panel Sectioning

When bonding SMC or RTM panels, use a two-part epoxy adhesive. Properly mix parts A and B, and apply it to the panels being repaired. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun.

After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spatula, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done withy soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

PANEL REINFORCEMENT

Structural repair procedures for rigid panels such as Sheet Molded compound (SMC) or Resin Transfer Molded (RTM) with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with epoxy structural adhesive, semirigid or flexible repair materials should be used for semirigid or flexible part repairs (Fig. 3) and (Fig. 4). Open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the epoxy adhesive. Structurally, the more dry wall tape used, the stronger the repair.

Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and should have a generous amount of overlap on either side of the cracked or broken area.

When repairing plastic, the damaged area is first "V'd" out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20 degree angle will increase the bonding surface for a repair (Fig. 5). It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.

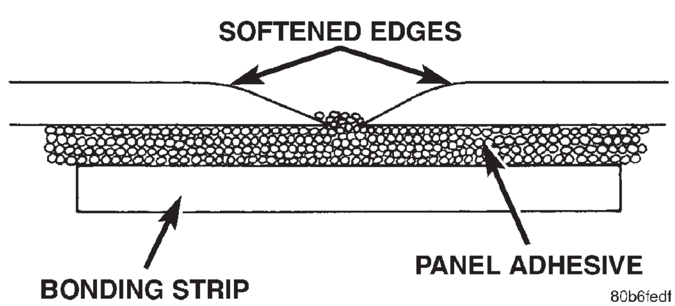


Fig. 3 Softened Edges

SERVICE PROCEDURES (Continued)

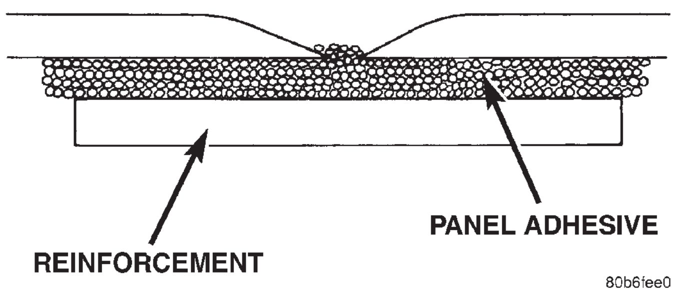


Fig. 4 Panel Reinforcement

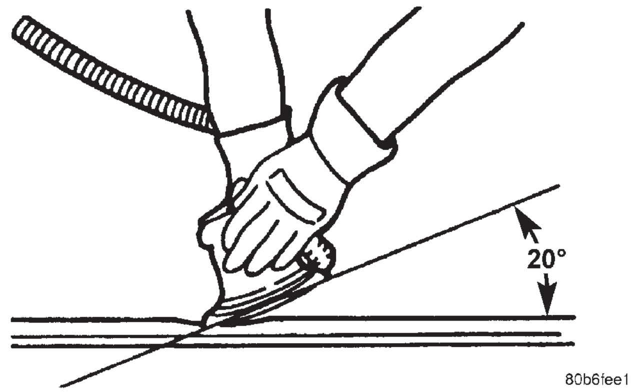


Fig. 5 20 Degree Beveling Angle

- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used (Fig. 6).
- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.
- When plastic repairs are required, it is recommended that the part be left on the vehicle when every possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.

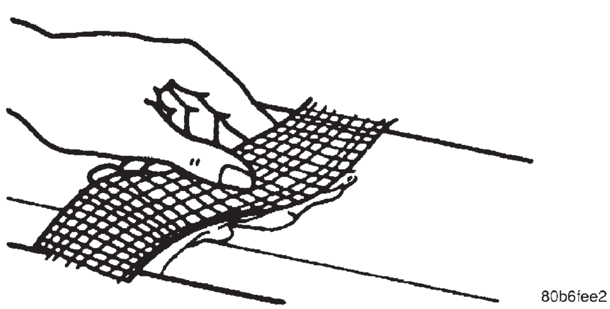


Fig. 6 Fiberglass Tape

VISUAL INSPECTION

Sheet Molded Compound (SMC) and Resin Transfer Molded (RTM), because they are composites, react differently to impact that sheet metal does. Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structure need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair:

Puncture or Crack – Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind (Fig. 7).

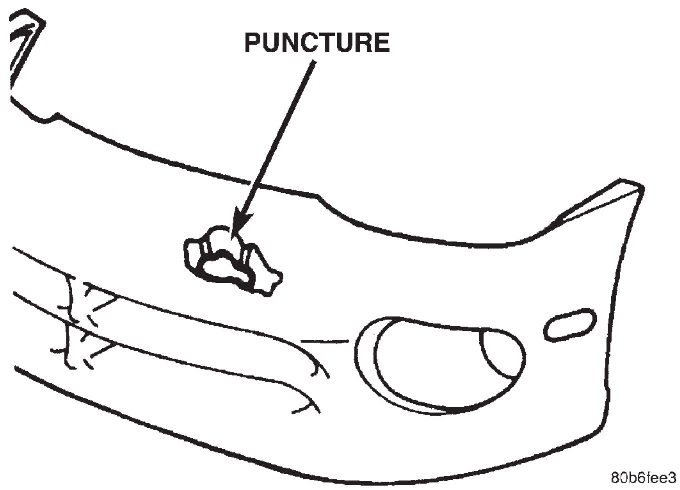


Fig. 7 Damage Component

PANEL SURFACE PREPARATION

If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a SMC or RTM panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from was and oil. Scuff surfaces around repair area with 360 grit wet/dry sand paper, or equivalent, to assure adhesion of epoxy repair materials.

PATCHING PANELS

An RTM or SMC panel that has extensive puncture type damage can be repaired by cutting out the damaged material (Fig. 8). Use a suitable reciprocating saw or cut off wheel to remove the section of the SMC or RTM panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout

SERVICE PROCEDURES (Continued)

at 20 degrees to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.

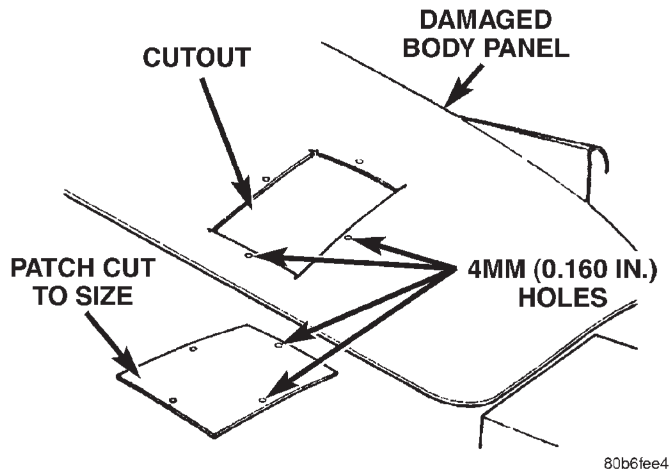


Fig. 8 Damaged Panel Cutout and Patch

PANEL PATCH FABRICATIONS

A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. discard SMC or RTM panels. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with epoxy and reinforcement mesh (dry wall tape). Perform the following operation if required:

(1) Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required (Fig. 9).

(2) Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.

(3) Apply a liberal coat of epoxy adhesive over the reinforcement mesh (Fig. 9). If necessary apply a second or third coat of epoxy and mesh after firs coat has cured. The thickness of the patch should be the same as the repair area.

(4) After patch has cured, peel waxed paper or plastic from the back of the patch.

(5) If desired, a thin film coat of poesy can be applied to the back of the patch to cover mesh for added strength.

PANEL PATCH INSTALLATION

(1) Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.

(2) Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.

(3) Using the pattern as a guide, cut the patch to size.

(4) Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.

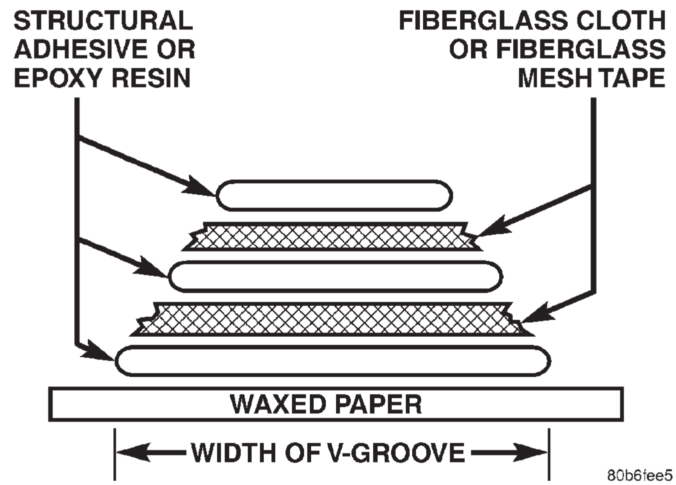


Fig. 9 Fabricated Panel

(5) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole (Fig. 8).

(6) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole (Fig. 8).

(7) Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.

(8) Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.

(9) Mix enough epoxy to cover one side of all support squares.

(10) Apply epoxy to the support squares on the half with the hole pre-drilled in it.

(11) Using number 8 sheet metal screws, secure support squares to back side of body panel with epoxy sandwiched between the panel and squares (Fig. 10).

(12) Position patch in cutout against support squares and adjust patch until the gap is equal along all sides (Fig. 11).

(13) Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.

(14) Apply a coat of epoxy to the exposed ends of the support squares (Fig. 12).

(15) Install screws to hold the patch to support squares (Fig. 13). Tighten screws until patch surface is flush with panel surface.

(16) Allow epoxy to cure, and remove all screws.

(17) Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch (Fig. 14). With compressed air, blow dust from around patch.

(18) Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch (Fig. 15).

(19) Mix enough epoxy to cover the entire patch area.

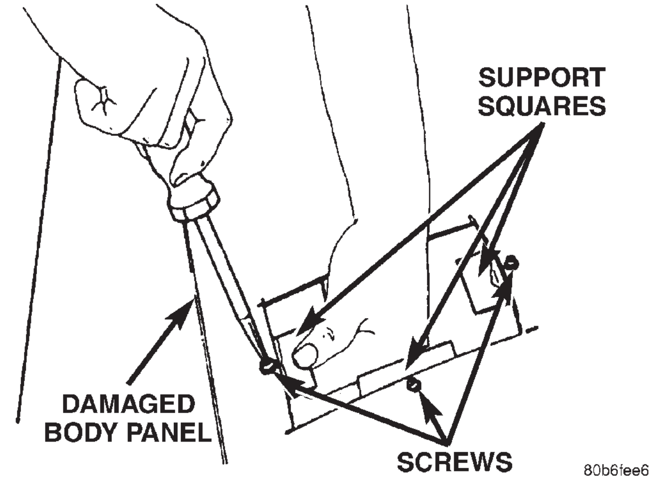


Fig. 10 Secure Support Squares To Body Panel

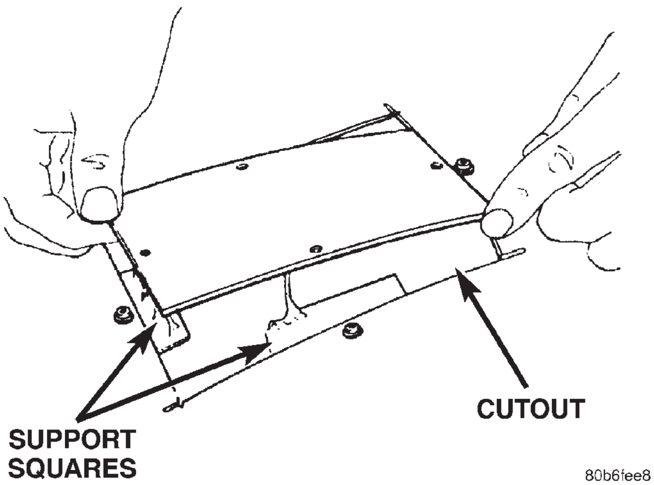


Fig. 11 Position Patch In Cutout And Align

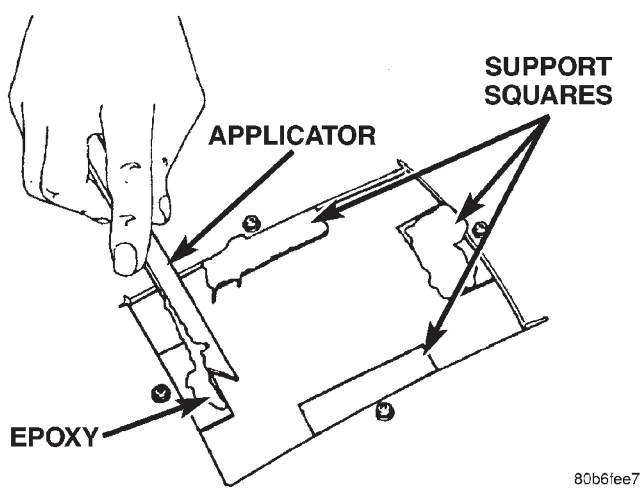


Fig. 12 Apply Epoxy To Support Squares

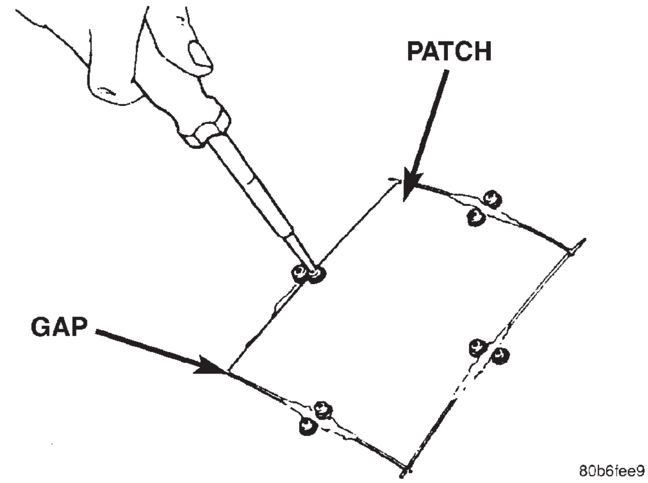


Fig. 13 Install Screws

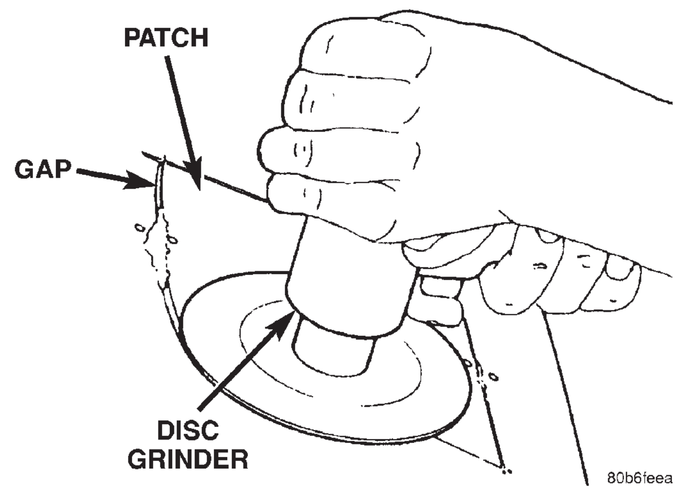


Fig. 14 Grind Surface

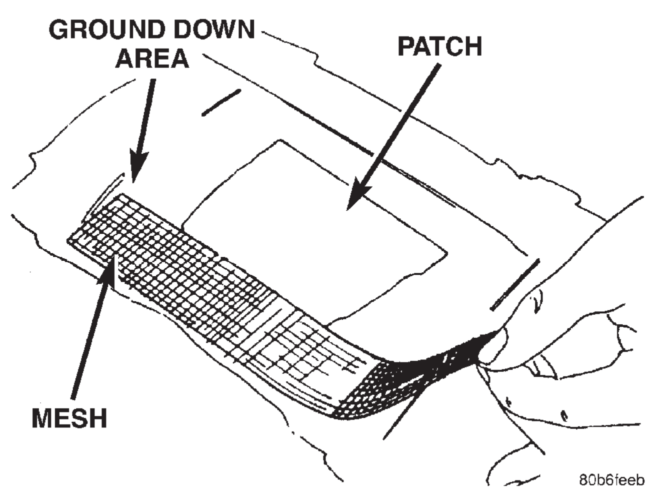


Fig. 15 Cover Gaps With Mesh

(20) Apply epoxy over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and epoxy to create a stronger repair (Fig. 16).

SERVICE PROCEDURES (Continued)

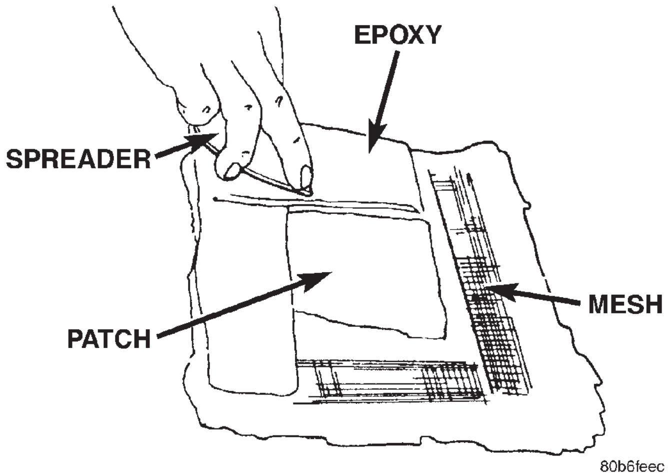


Fig. 16 Cover Mesh With Epoxy

PATCHED PANEL SURFACING

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

REMOVAL AND INSTALLATION

RADIATOR SUPPORT CROSSMEMBER

REMOVAL

(1) Release hood latch and open hood.
(2) Remove push-in fasteners holding fascia/grille to radiator support crossmember.
(3) Remove bolts holding support braces to bottom of radiator support crossmember.
(4) Remove bolts holding crossmember to radiator closure panel.
(5) Remove nuts holding hood latch to radiator support crossmember.
(6) Separate radiator support crossmember from vehicle.

INSTALLATION

Reverse the preceding operation.

GRILLE – CIRRUS

REMOVAL

(1) Remove front bumper fascia, refer to Group 13, Bumpers and Frame for proper procedures.
(2) Using a suitable drill, remove rivets holding grille to front fascia.
(3) Remove grille from fascia (Fig. 17).

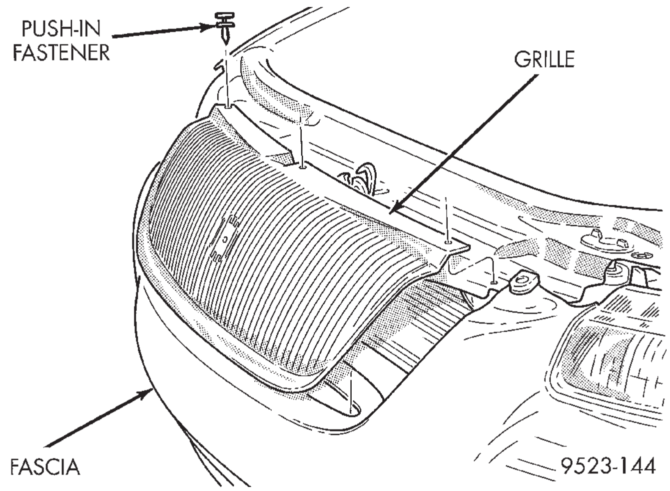


Fig. 17 Grille

INSTALLATION

For installation, reverse the above procedures.

HOOD LATCH

REMOVAL

(1) Release hood latch and open hood.
(2) Mark outline of hood latch on radiator support crossmember to aid installation.
(3) Remove nuts holding hood latch to radiator support crossmember (Fig. 18).
(4) Separate hood latch from crossmember.
(5) Disengage hood release cable casing from groove in latch housing.
(6) Disengage cable end from hood latch release lever.
(7) Separate hood latch from vehicle.

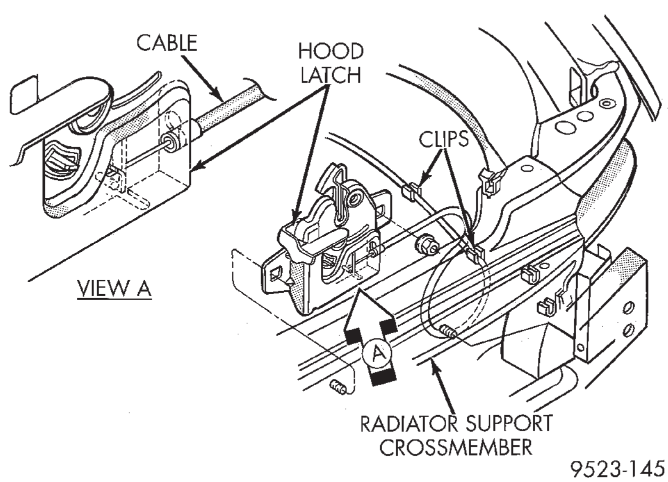


Fig. 18 Hood Latch

INSTALLATION

(1) Position hood latch on vehicle.
(2) Engage release cable end from hood latch release lever.

REMOVAL AND INSTALLATION (Continued)

(3) Engage hood release cable casing to groove in latch housing.

(4) Install nuts holding hood latch to radiator support crossmember.

(5) Verify operation. Adjust as necessary.

HOOD RELEASE CABLE

REMOVAL

(1) Remove hood latch.

(2) Disconnect release cable from hood latch.

(3) Disengage cable from clips holding cable to radiator closure panel.

(4) Route cable rearward through engine compartment toward dash panel.

(5) Remove left front cowl trim panel.

(6) Remove screws holding hood release handle to cowl panel (Fig. 19).

(7) Disengage rubber grommet from dash panel behind instrument panel.

(8) Disengage push-in retainer holding cable to dash panel behind clutch/brake pedal.

(9) Pull release cable through hole in dash panel.

(10) Separate cable and handle from vehicle.

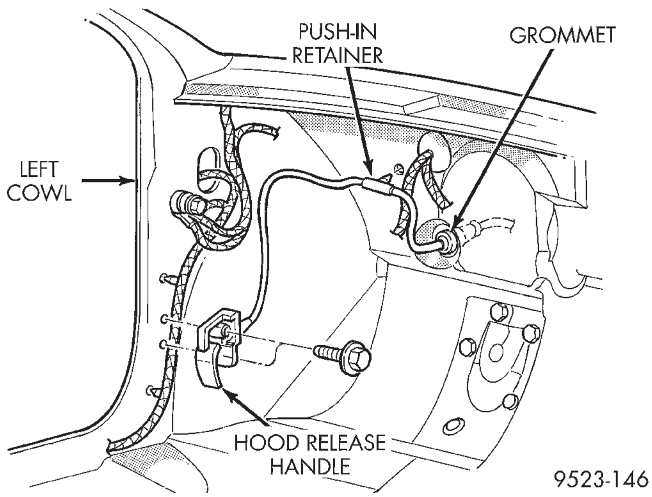


Fig. 19 Hood Release Cable

INSTALLATION

Reverse the preceding operation.

HOOD PROP-ROD

REMOVAL

(1) Release hood latch and open hood.

CAUTION: Do not place prop-rod or substitute against outer hood panel, damage to exterior finish will result.

(2) Using a length of wooden dowel rod, prop hood open.

(3) Disengage prop-rod from retainer holding prop-rod to radiator closure panel (Fig. 20).

(4) Separate prop-rod from vehicle.

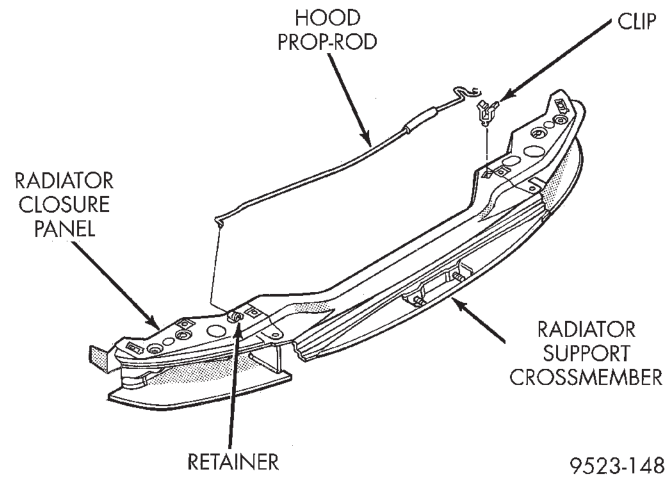


Fig. 20 Hood Prop Rod

INSTALLATION

(1) Position prop-rod to vehicle.

(2) Engage prop-rod to retainer holding prop-rod to radiator closure panel.

HOOD

REMOVAL

(1) Open hood.

(2) Disengage under hood lamp wire connector from engine compartment wire harness.

(3) Mark outline of hinges on inside of hood to aid installation.

(4) Remove the top bolts holding hood to hinge and loosen the bottom bolts until they can be removed by hand.

(5) With assistance from a helper at the opposite side of the vehicle to support the hood, remove bottom bolts holding hood to hinge.

(6) Separate the hood from the vehicle.

INSTALLATION

(1) With assistance from a helper, place hood in position on vehicle.

(2) Install bottom bolts to hold hood to hinge finger tight.

(3) Install top bolts to hold hood to hinge finger tight.

(4) Position bolts at outline marks and tighten bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders.

(5) Engage under hood lamp wire connector to engine compartment wire harness.

REMOVAL AND INSTALLATION (Continued)

(6) Verify hood latch operation and alignment. Adjust as necessary.

HOOD HINGE

REMOVAL

(1) Support hood on the side that requires hinge replacement.
(2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to aid installation.
(3) Remove cowl cover.
(4) Remove bolts holding hood to hinge.
(5) Remove bolts holding hood hinge to front fender flange and separate hinge from vehicle. If necessary, paint new hinge before installation.

INSTALLATION

(1) If necessary, paint new hinge before installation.
(2) Place hinge in position on vehicle.
(3) Install bolts to hold hood hinge to front fender flange.
(4) Install bolts to hold hood to hinge.
(5) Align all marks and secure bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders. Shims can be added or removed under hood hinge to achieve proper hood height.
(6) Install cowl cover.
(7) Verify hood latch operation. Adjust as necessary.

HOOD ADJUSTER BUMPER

REMOVAL

(1) Release hood latch and open hood.
(2) Rotate hood slam bumper counterclockwise.
(3) Separate hood slam bumper from radiator closure panel (Fig. 21).

INSTALLATION

Reverse the preceding operation. Adjust hood slam bumper to achieve a hood height that is flush across the gaps to the fenders.

COWL COVER

REMOVAL

(1) Release hood latch and open hood.
(2) Remove windshield wiper arms, refer to Group 8K, Windshield Wipers and Washers.
(3) Remove screws holding cowl cover to cowl (Fig. 22).
(4) Separate cowl cover from vehicle.

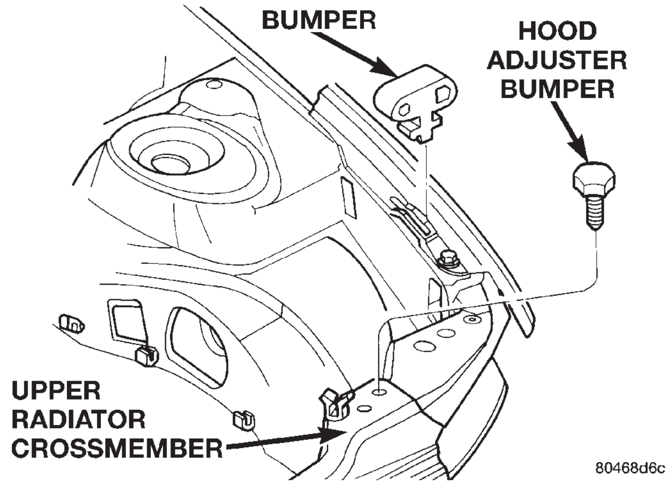


Fig. 21 Hood Adjuster Bumper

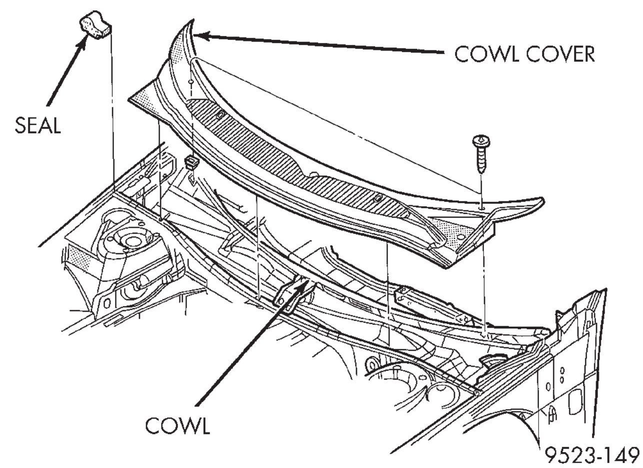


Fig. 22 Cowl Cover

INSTALLATION

Reverse the preceding operation.

BATTERY SPLASH SHIELD

REMOVAL

(1) Remove screws holding battery splash shield to front bumper fascia (Fig. 23).
(2) Rotate half turn retainers holding battery splash shield to wheelhouse splash shield counterclockwise.
(3) Separate battery splash shield from wheelhouse splash shield.
(4) Rotate half turn retainer holding battery splash shield to frame rail counterclockwise.
(5) Separate battery splash shield from vehicle.

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

LEFT FRONT WHEELHOUSE SPLASH SHIELD

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove left front wheel, refer to Group 22, Wheels and Tires for proper lug nut tightening procedures.

(3) Remove battery splash shield.

(4) Remove screws holding wheelhouse splash shield to front fender lip (Fig. 23).

(5) Remove push-in fastener holding wheelhouse splash shield to fender at the rocker panel.

(6) Remove push-in fasteners holding wheelhouse splash shield to fender support.

(7) Separate wheelhouse splash shield from vehicle.

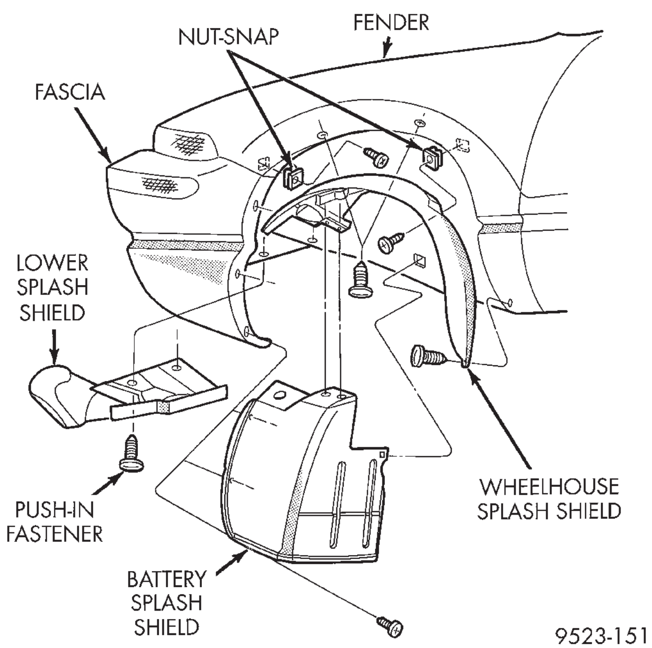


Fig. 23 Left Front Wheelhouse Splash Shield

INSTALLATION

Reverse the preceding operation.

ACCESSORY DRIVE BELT SPLASH SHIELD

REMOVAL

(1) Remove screw holding accessory drive belt splash shield to front fender (Fig. 24).

(2) Remove push-in fasteners holding accessory drive belt splash shield to frame rail.

(3) Separate accessory drive belt splash shield from vehicle.

INSTALLATION

Reverse the preceding operation.

RIGHT FRONT WHEELHOUSE SPLASH SHIELD

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove right front wheel.

(3) Remove screws holding wheelhouse splash shield to front fender lip (Fig. 24).

(4) Remove screws holding wheelhouse splash shield to front bumper fascia.

(5) Remove push-in fastener holding wheelhouse splash shield to fender at rocker panel.

(6) Remove push-in fasteners holding wheelhouse splash shield to fender support.

(7) Separate wheelhouse splash shield from vehicle.

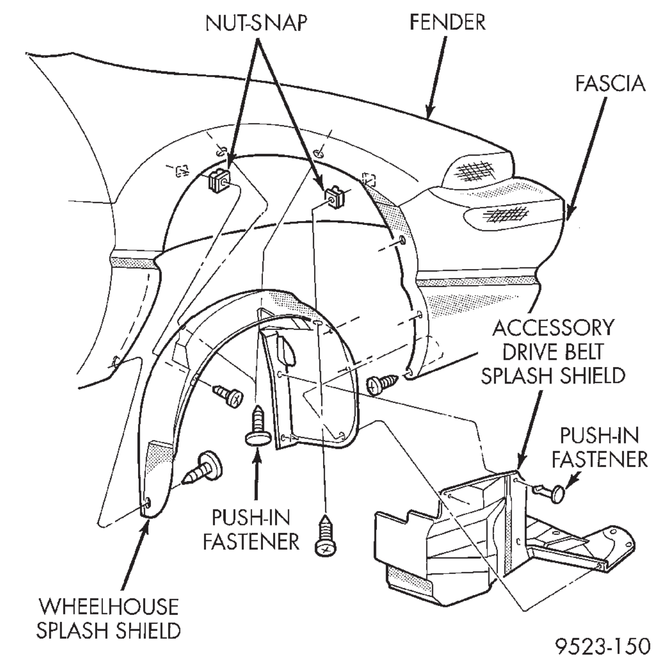


Fig. 24 Right Front Wheelhouse Splash Shield

INSTALLATION

Reverse the preceding operation.

FENDER

REMOVAL

(1) Remove headlamp housing.

(2) Remove mud guard.

(3) Remove inner splash shield.

(4) Remove fender to fascia nuts.

(5) Remove fender bolt to lower rocker panel.

(6) Remove fender bolt to lower cowl.

(7) Pull fascia away from fender.

(8) Remove bolts attaching fender to upper rail.

(9) Remove fender from vehicle (Fig. 25).

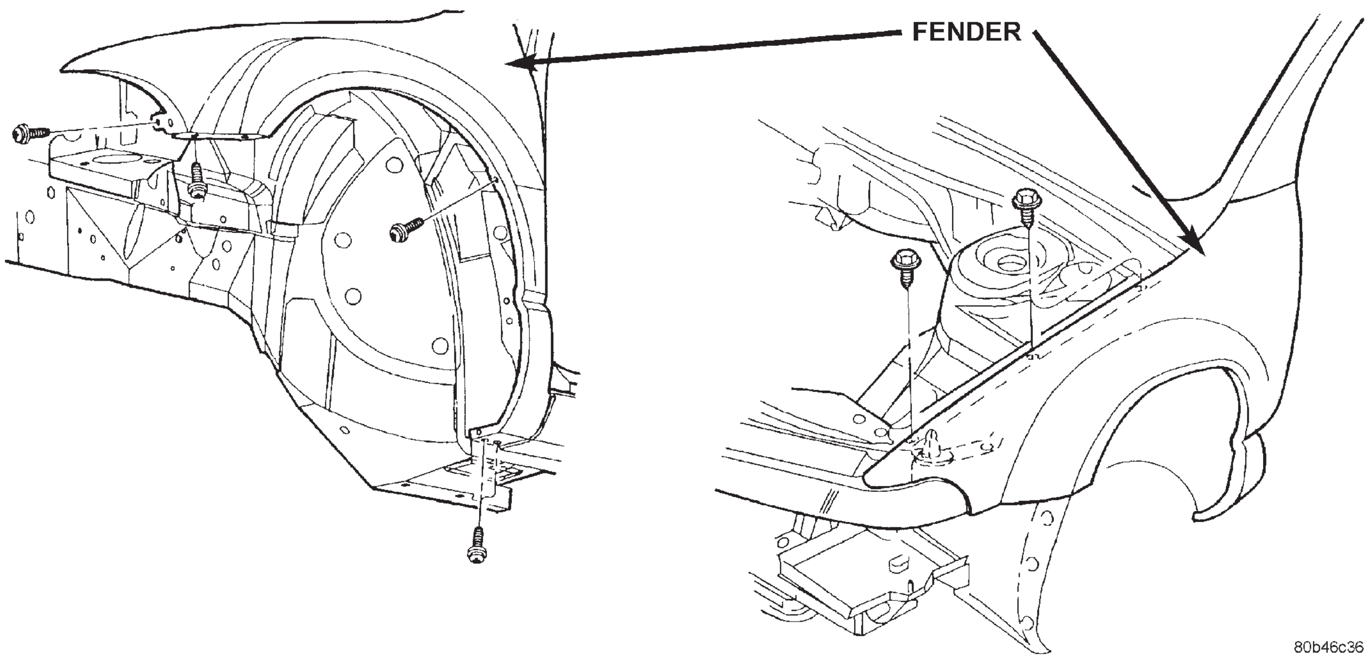


Fig. 25 Fender

INSTALLATION

(1) Place fender in position on vehicle.
(2) Start the center upper rail bolt.
(3) From inside engine compartment, start the center upper rail bolt. install all the bolts attaching fender to upper rail and tighten.
(4) Install fender to lower cowl panel bolt.
(5) Install fender to rocker panel bolt.
(6) Place fascia into position.
(7) Install fender to fascia nuts.
(8) Install inner splash shield.
(9) Install mud guard.
(10) Install headlamp assembly.
(11) Check fender for flush and gap.

EXTERIOR BADGEING ATTACHED WITH DOUBLE SIDED FOAM TAPE

REMOVAL

(1) Mark reference points before removing.
(2) Using a heat gun gently apply heat in a circular motion to loosen the adhesive bond.
(3) Using a non-metallic prying device, such as a plactic or wood trim stick gently pry up at corners and remove.
(4) Clean off all traces of adhesive or double sided tape from the panel with a general purpose adhesive remover.

INSTALLATION

(1) Clean panel surface with isopropy alcohol.
(2) Align badgeing to reference points.
(3) Install and press securely to full adhesive contact.
(4) Clean away any reference points.

EXTERIOR BADGEING/TAPE STRIPES ATTACHED WITH ADHESIVES

REMOVAL

(1) Mark reference points before removing.
(2) Using a heat gun gently apply heat in a circular motion to loosen the adhesive bond.
(3) With your fingernail lift up and peel away badgeing /tape from panel, using a heat gun as you go.
(4) Clean off all traces of adhesive from the panel(s) with a general purpose adhesive remover.

INSTALLATION

(1) Clean panel surface with isopropy alcohol.
(2) Remove paper carrier and align badgeing/tape to reference points or adjacent panel.
(3) Install and press securely, using a plastic spreader to eliminate all air bubbles.
(4) Remove top protective carrier.
(5) Clean away any reference points.

REMOVAL AND INSTALLATION (Continued)

BODY SIDE MOLDING

STICK-ON BODY SIDE MOLDING

REMOVAL

(1) Warm the effected stick-on molding and body metal to approximately 38° C (100° F) using a suitable heat lamp or heat gun.

(2) Pull stick-on molding from painted surface (Fig. 26).

(3) Remove adhesive tape residue from painted surface of vehicle.

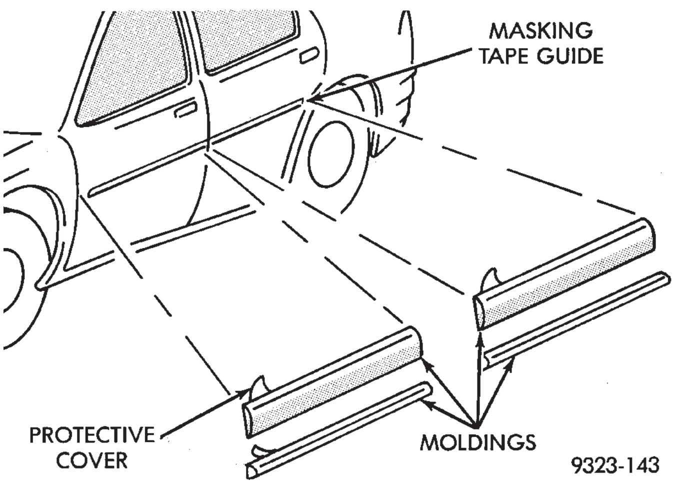


Fig. 26 Body Side Molding

INSTALLATION

(1) If molding is to be reused, remove tape residue from molding. Clean back of molding with Mopar® Super Kleen solvent or equivalent. Wipe molding dry with lint free cloth. Apply new body side molding (two sided adhesive) tape to back of molding.

(2) Clean body surface with Mopar® Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(3) Apply a length of masking tape on the body, parallel to the top edge of the molding to use as a guide, if necessary.

(4) Remove protective cover from tape on back of molding. Apply molding to body below the masking tape guide.

(5) Remove masking tape guide and heat body and molding, see Step 1 of Removal. Firmly press molding to body surface to assure adhesion.

A-PILLAR SEAL

REMOVAL

(1) Open front door.

(2) Using a fork-type tool (C-4828), disengage push-in fasteners holding A-pillar seal to A-pillar.

(3) Separate A-pillar seal from vehicle.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR TRIM PANEL

REMOVAL

(1) Disconnect battery

(2) Open door.

(3) Disconnect main wiring harness at door opening.

(4) If equipped, remove window crank (Fig. 27).

(5) Disengage clips attaching speaker grille to trim panel (Fig. 28).

(6) Remove screws attaching door trim panel to door from around speaker opening.

(7) Remove screw cap from bottom of arm rest pull cup.

(8) Remove screw attaching arm rest pull cup to support bracket behind trim panel.

(9) Remove screw cap from behind inside door latch handle.

(10) Remove screw attaching door latch handle to door panel.

(11) Disengage clips holding trim panel to perimeter of door.

(12) Lift trim panel upward to disengage upper retainer channel.

(13) Tilt top of trim panel away from door.

(14) Disengage clip holding latch linkage to back of release handle (Fig. 29).

(15) Remove door trim panel from vehicle.

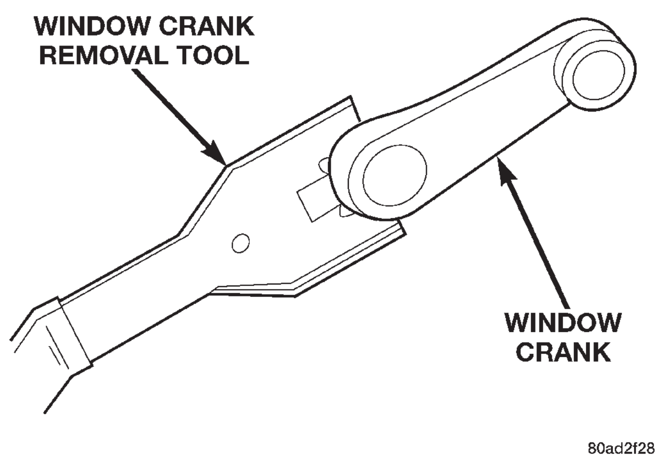


Fig. 27 Window Crank

REMOVAL AND INSTALLATION (Continued)

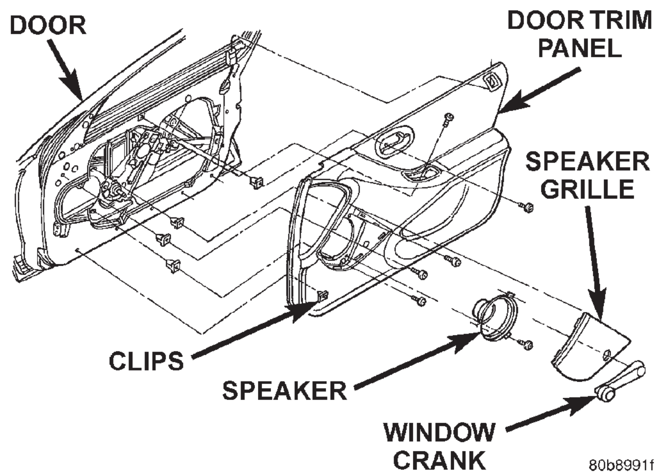


Fig. 28 Front Door Trim Panel

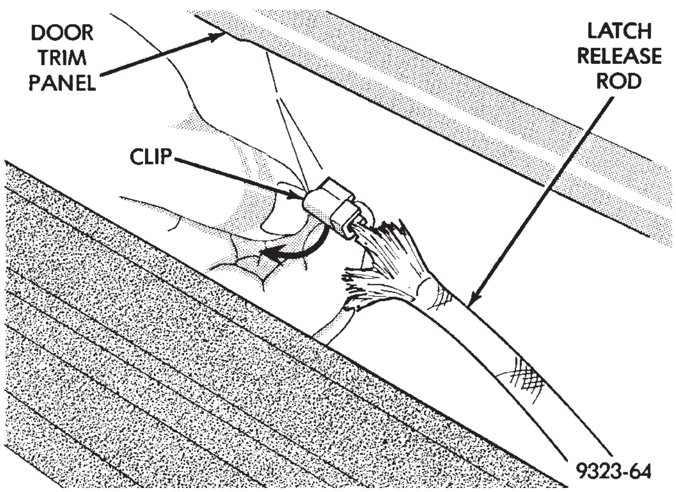


Fig. 29 Linkage Clip

INSTALLATION

(1) Replace the clips attaching trim panel to perimeter of door.
(2) Connect main harness at door opening.
(3) Position door trim panel next to door.
(4) Engage clip holding latch linkage to back of release handle.
(5) Position door trim panel on vehicle.
(6) Engage trim panel to upper retainer channel.
(7) Engage clips holding trim panel to perimeter of door.
(8) Install screw attaching door latch handle to door panel.
(9) Install screw cap from behind inside door handle.
(10) Install screw attaching arm rest pull cup to support bracket behind trim panel.
(11) Install screw cap from bottom of arm rest pull cup.
(12) Install screws attaching door trim panel to door from around speaker opening.
(13) Engage clips attaching speaker grille to trim panel.
(14) Install window crank handle, if so equipped.
(15) Connect battery.

FRONT DOOR WATER DAM

REMOVAL

(1) Remove door trim panel.
(2) Remove door speaker, if equipped.
(3) Disconnect clip attaching lock linkage to lock button bell crank.
(4) Peel water dam away from adhesive around perimeter of inner door panel (Fig. 30).

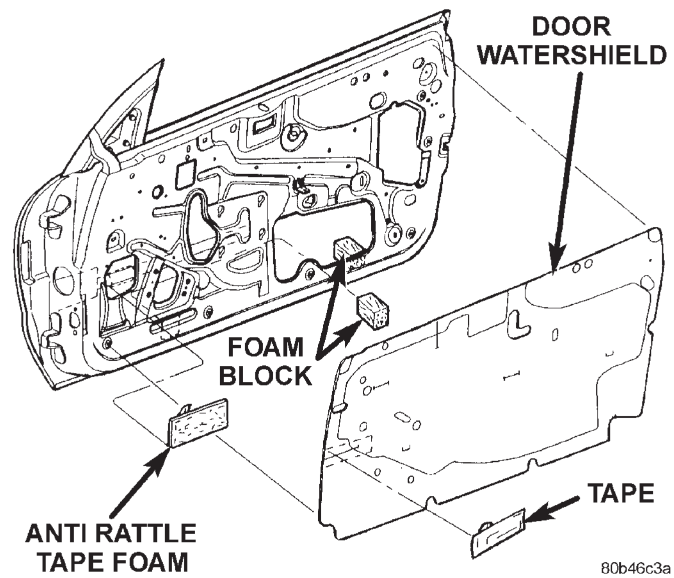


Fig. 30 Front Door Water Dam

INSTALLATION

(1) Insure that enough adhesive remains to securely retain the water dam. Replace as necessary.
(2) Place the water dam into position and press securely to adhesive making sure to properly route wiring and linkages.
(3) Connect clip attaching lock linkage to lock button bell crank.
(4) Install door speaker, if equipped.
(5) Install door trim panel.

FRONT DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove door trim panel.
(2) Close door glass.
(3) Disconnect latch linkage from door latch.
(4) Remove nuts holding door handle to outer door panel (Fig. 31).
(5) Separate door handle from vehicle.

REMOVAL AND INSTALLATION (Continued)

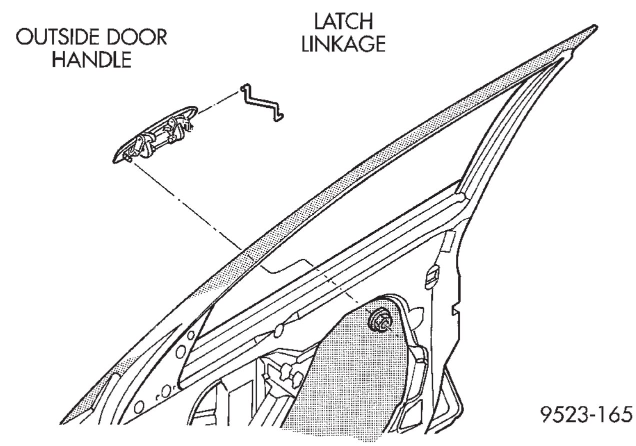


Fig. 31 Front Door Outside Handle

INSTALLATION

Reverse the preceding operation.

FRONT DOOR LOCK CYLINDER

REMOVAL

(1) Remove front door outside handle.
(2) Disengage clip holding lock linkage to back of lock cylinder.
(3) Separate linkage from lock cylinder.
(4) Remove retainer holding lock cylinder to outer door panel (Fig. 32).
(5) Separate lock cylinder from vehicle.

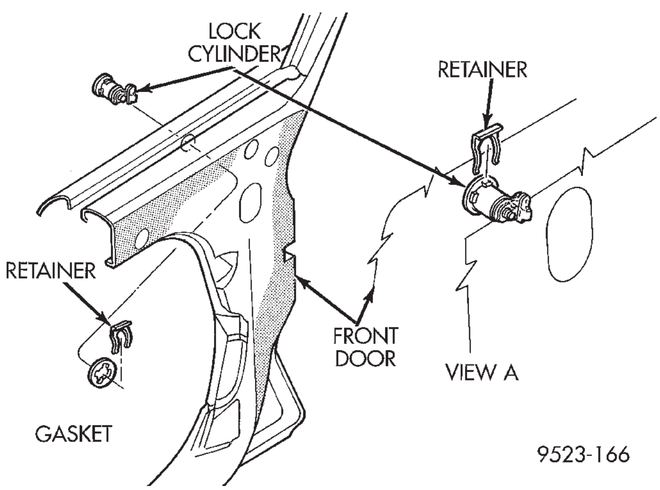


Fig. 32 Front Door Lock Cylinder

INSTALLATION

Reverse the preceding operation.

FRONT DOOR LATCH

REMOVAL

(1) Remove door trim panel.
(2) Close door up.
(3) Disconnect lock cylinder, lock button and latch release rods from door latch.
(4) Disconnect wire connector from power door lock motor, if equipped.
(5) Remove screws holding latch to door end frame.
(6) Remove door latch from vehicle.

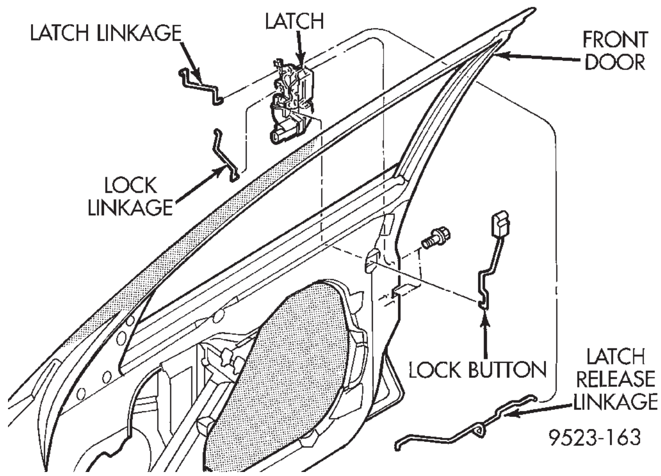


Fig. 33 Front Door Latch

INSTALLATION

CAUTION: Do not close door before adjusting the door latch, door may fail to open.

Reverse the preceding operation.

FRONT DOOR LATCH STRIKER

REMOVAL

(1) Mark outline of door latch striker on B-pillar to aid installation.
(2) Remove screws holding door latch striker to B-pillar (Fig. 34).
(3) Separate door latch striker from vehicle.

NOTE: Be sure to check for any shims between door latch striker and B–pillar. If any shims are found, they must be reinstalled with the new door latch striker to maintain proper door operation.

INSTALLATION

Reverse the preceding operation.

FRONT DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove front door trim panel.
(2) Pull upward at rear end of inner belt weather-strip.

REMOVAL AND INSTALLATION (Continued)

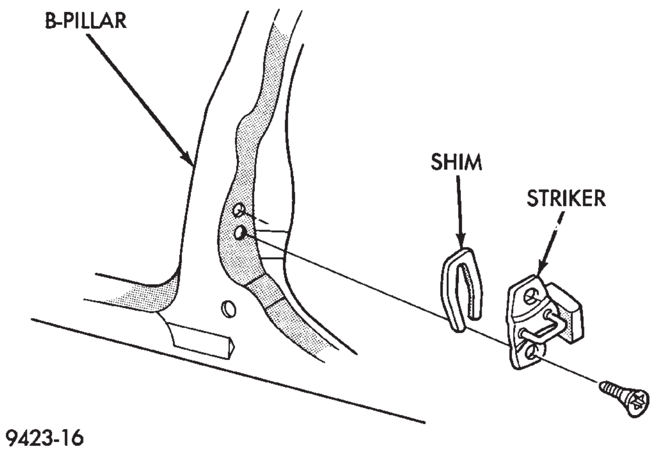


Fig. 34 Front Door Latch Striker

(3) Separate inner belt weatherstrip from vehicle (Fig. 35).

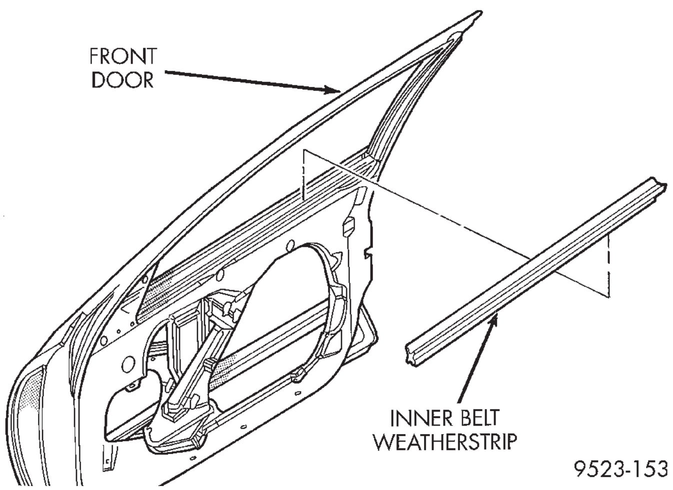


Fig. 35 Front Door Inner Belt Weatherstrip

INSTALLATION

Reverse the preceding operation.

FRONT DOOR OUTER BELT MOLDING

REMOVAL

(1) Remove screw attaching rearward end of molding to front door (Fig. 36).

(2) Using a rubber mallet and block of wood, tap upward at each clip attaching belt molding to door (Fig. 37).

(3) Lift up on the rear of the belt molding and pull rearward to remove.

INSTALLATION

(1) Place belt molding in position.

(2) Using your hand press downward at each clip attaching belt molding to door till in position.

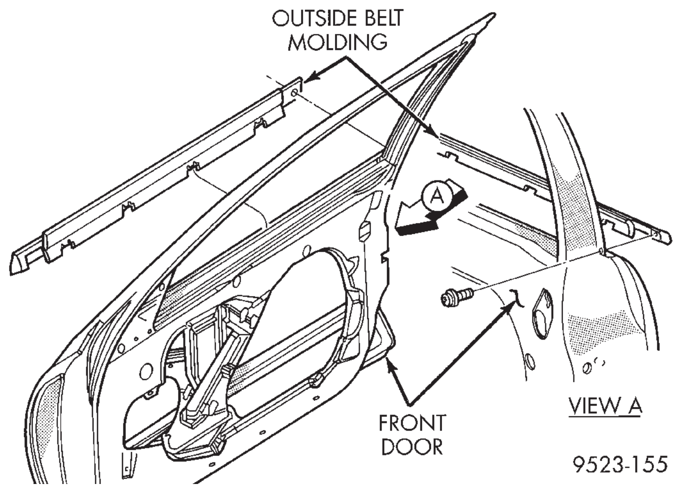


Fig. 36 Front Door Outer Belt Molding

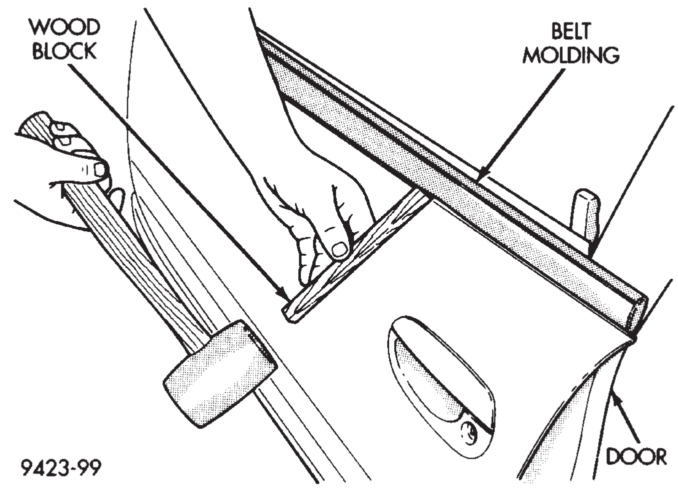


Fig. 37 Front Door Outer Belt Molding Removal

(3) Install screw attaching rearward end of molding to front door.

FRONT DOOR GLASS

REMOVAL

(1) Remove door trim panel and inner belt weatherstrip.

(2) Connect power window switch or install crank and lower window to 50 mm (2 in.) from bottom of travel.

(3) Loosen screws holding regulator roller channel to glass.

(4) Slide roller channel rearward to allow screw heads to pass through key hole slots in channel.

(5) Separate glass from roller channel.

(6) Raise glass upward and out of the opening at top of door (Fig. 38).

REMOVAL AND INSTALLATION (Continued)

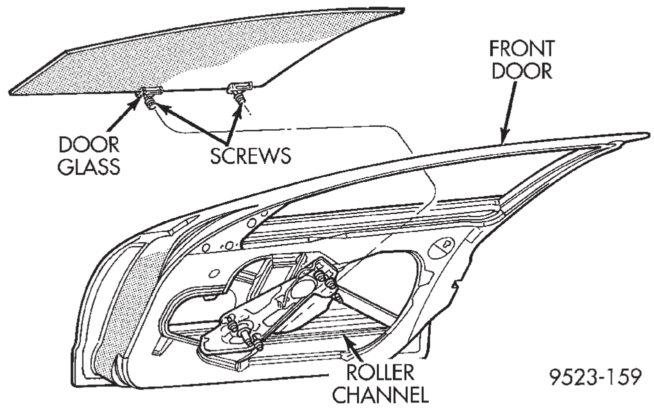


Fig. 38 Front Door Glass

INSTALLATION

(1) Lower glass down and in the opening at top of door.

(2) Position glass on roller channel.

(3) Slide roller channel forward to allow screw heads to engage key hole slots in channel.

(4) Tighten screws holding regulator roller channel to glass.

(5) Install door trim panel and inner belt weatherstrip.

DOOR GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.

(2) Remove door glass.

(3) Remove bolt holding bottom of front lower run channel to inner door panel.

(4) Pull glass run weatherstrip from door glass opening frame.

(5) Remove lower run channel through opening at top of door (Fig. 39).

INSTALLATION

Reverse the preceding operation.

FRONT DOOR WINDOW REGULATOR

Power and manual door glass regulators are serviced using the same procedures. For power window motor service procedures refer to Group 8S, Power Windows.

REMOVAL

(1) Remove door trim panel.

(2) Separate glass from regulator roller channel.

(3) Disengage power window motor wire connector, if equipped.

(4) Loosen screw holding regulator scissor channel to door panel.

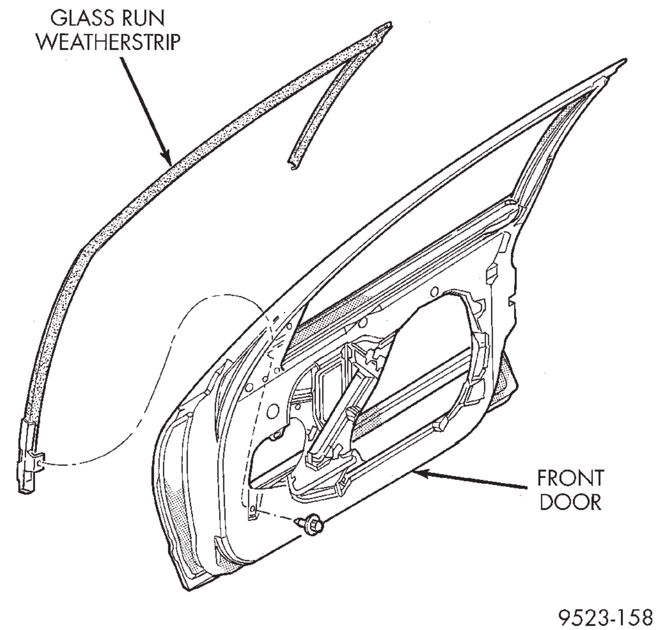


Fig. 39 Door Glass Run Weatherstrip

(5) Separate screw and bolt heads from keyhole slots in door panel.

(6) Loosen bolts holding regulator to door panel.

(7) Separate regulator from door panel (Fig. 40).

(8) Slide regulator rearward and rotate forward end of roller channel through access hole in door panel.

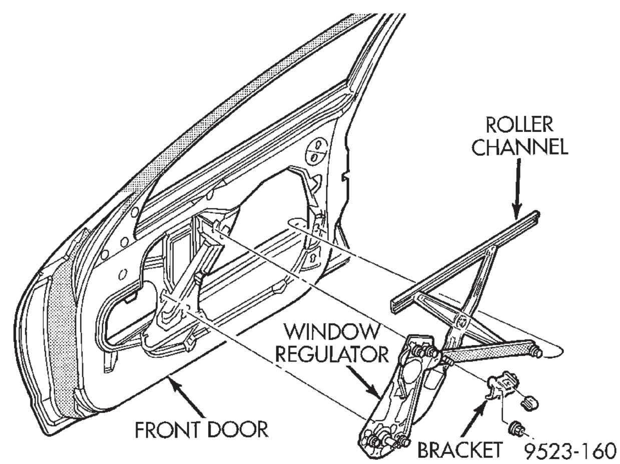


Fig. 40 Front Door Glass Regulator

INSTALLATION

(1) Position regulator in door through access hole in door panel.

(2) Position regulator on door panel.

(3) Tighten bolts holding regulator to door panel.

(4) Position screw and bolt heads in keyhole slots in door panel.

REMOVAL AND INSTALLATION (Continued)

(5) Tighten screw holding regulator scissor channel to door panel.
(6) Engage power window motor wire connector, if equipped.
(7) Position glass in regulator roller channel.
(8) Tighten fasteners holding door glass to roller channel.
(9) Install door trim panel.

FRONT DOOR CHECK STRAP

REMOVAL

(1) Remove front door trim panel.
(2) Remove bolt holding check strap to hinge pillar.
(3) Remove bolts holding check strap to inner door panel (Fig. 41).
(4) Remove bolt holding check strap to door end frame.
(5) Separate check strap from vehicle.

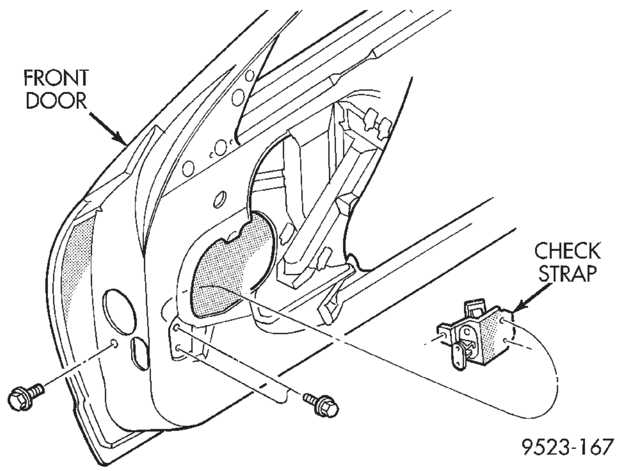


Fig. 41 Front Door Check Strap

INSTALLATION

Reverse the preceding operation.

FRONT DOOR

REMOVAL

(1) Open and support door on a suitable lifting device.
(2) Disengage wire connector at hinge pillar.
(3) Remove bolts holding door check strap to hinge pillar.
(4) Remove clip holding hinge pin in lower door hinge (Fig. 42).
(5) Remove pin from lower hinge.
(6) Remove clip holding hinge pin in upper hinge.
(7) Remove pin from upper hinge.
(8) Separate door from vehicle.

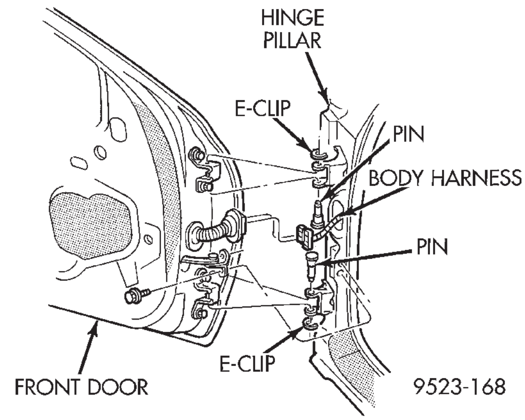


Fig. 42 Front Door

INSTALLATION

(1) Position door on vehicle.
(2) Install pin in upper hinge.
(3) Install clip holding hinge pin in upper hinge.
(4) Install pin in lower hinge.
(5) Install clip holding hinge pin in lower door hinge.
(6) Install bolts holding door check strap to hinge pillar.
(7) Engage wire connector at hinge pillar.
(8) Verify door fit and operation. Adjust as necessary.

DOOR HINGE

NOTE: If both hinges on one door are to be replaced, remove and install one hinge completely prior to beginning the second hinge.

REMOVAL

(1) Open and support door on a suitable lifting device.
(2) Remove bolts attaching door check strap to lower A–pillar for greater access, if necessary.
(3) Mark position of hinge on both the door end frame and lower A–pillar to ease installation.
(4) Remove bolts attaching hinge to door end frame (Fig. 43).
(5) Remove bolts attaching hinge to lower A–pillar.
(6) Remove door hinge from vehicle.

INSTALLATION

CAUTION: When installing a new hinge, make sure that the head of each hinge pin is fully seated into the door hinge. Also, remove the plastic shipping clip and replace it with the correct metal retaining clip once the hinge pin is seated.

REMOVAL AND INSTALLATION (Continued)

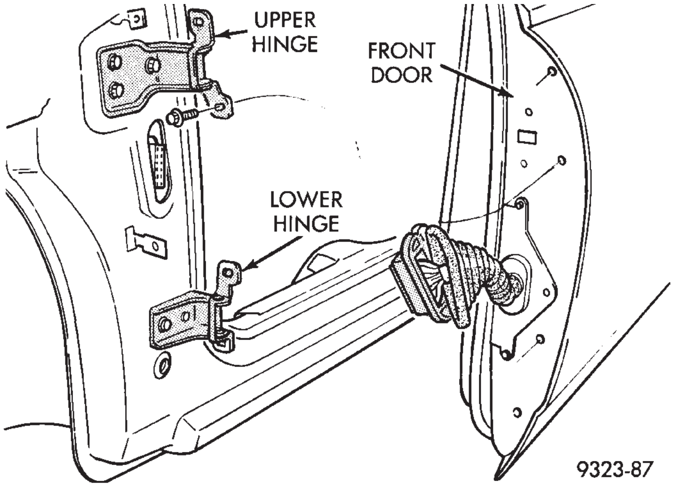


Fig. 43 Door and Hinge – Typical

(1) If necessary, paint new door hinge prior to installation.
(2) Position door hinge on vehicle.
(3) Loosely install bolts attaching hinge to lower A–pillar.
(4) Loosely install bolts attaching hinge to door end frame.
(5) Align hinge to marks made previously and tighten all bolts.
(6) Install bolts attaching door check strap to lower A–pillar, if removed previously.
(7) Verify door fit and operation. Adjust door hinge for proper door alignment, if necessary.

REAR DOOR TRIM PANEL

REMOVAL

(1) Open rear door and open glass.
(2) Remove window crank (Fig. 44).
(3) Remove screw cap from bottom of arm rest pull cup.
(4) Remove screw from bottom of arm rest pull cup (Fig. 45).
(5) Remove screw cap from behind door latch handle.
(6) Remove screw holding door latch handle to door.
(7) Disengage clips holding perimeter of trim panel to rear door.
(8) Remove trim panel from inner belt weatherstrip at top of door.
(9) Remove top of trim panel from door.
(10) Disengage clip holding linkage to latch handle (Fig. 46).
(11) Remove linkage from latch handle.
(12) Lift trim up and off lock button.
(13) Remove rear door trim panel from vehicle.

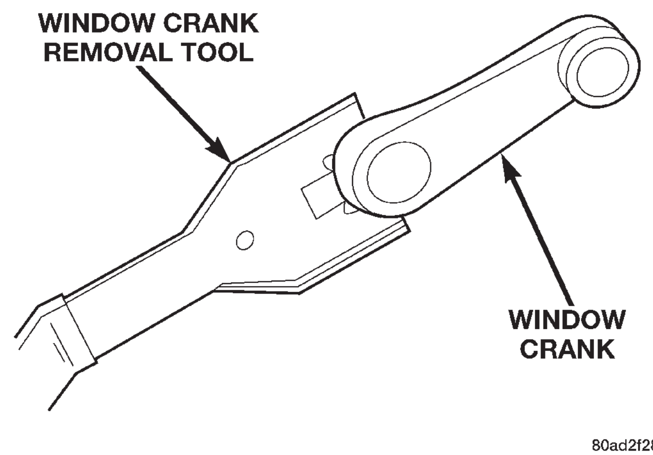


Fig. 44 Window Crank

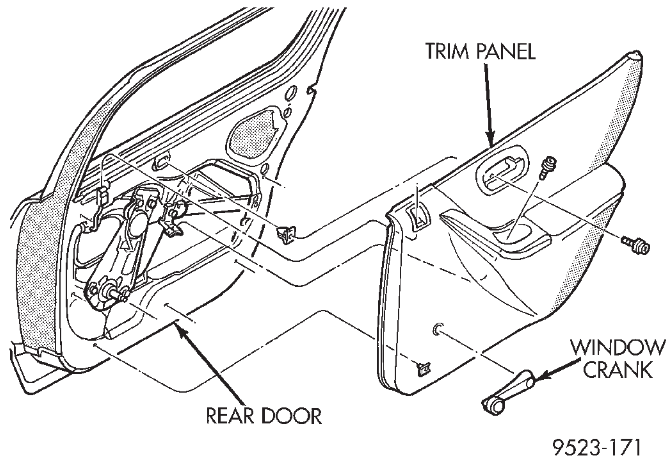


Fig. 45 Rear Door Trim Panel

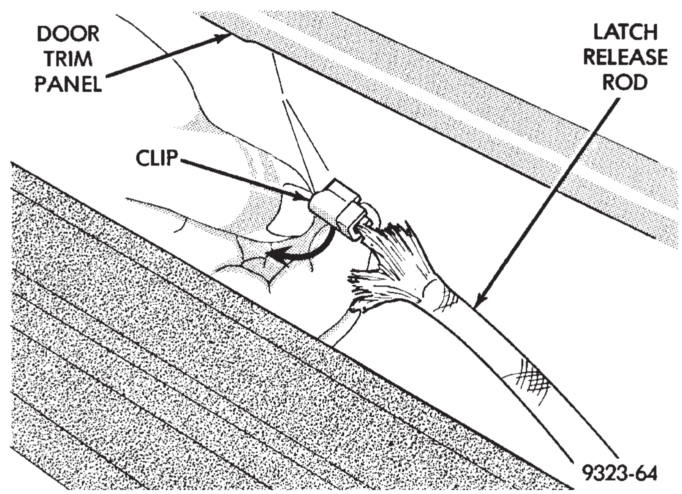


Fig. 46 Linkage Clip

INSTALLATION

(1) Position rear door trim panel on vehicle.
(2) Connect linkage to latch handle.
(3) Engage clip holding linkage to latch handle.

(4) Engage trim panel from inner belt weatherstrip at top of door.

(5) Engage clips attaching perimeter of trim panel to rear door.

(6) Install screw holding door latch handle to door.

(7) Install screw cap from behind door latch handle.

(8) Install screw from bottom of arm rest pull cup.

(9) Install screw cap from bottom of arm rest pull cup.

(10) Install window crank.

REAR DOOR WATER DAM

REMOVAL

(1) Remove door trim panel.

(2) Remove door speaker, if equipped.

(3) Disconnect clip attaching lock linkage to lock button bell crank.

(4) Peel water dam away from adhesive around perimeter of inner door panel.

INSTALLATION

(1) Insure that enough adhesive remains to securely retain the water dam. Replace as necessary.

(2) Place the water dam into position and press securely to adhesive making sure to properly route wiring and linkages.

(3) Connect clip attaching lock linkage to lock button bell crank.

(4) Install door speaker, if equipped.

(5) Install door trim panel.

REAR DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove rear door trim panel.

(2) Close door glass.

(3) Disengage clip holding linkage to outside handle.

(4) Remove linkage from outside handle (Fig. 47).

(5) Remove nuts holding outside handle to outer door panel.

(6) Remove outside door handle from vehicle.

INSTALLATION

(1) Position outside door handle from vehicle.

(2) Install nuts attaching outside handle to outer door panel.

(3) Connect linkage to outside handle (Fig. 47).

(4) Connect clip holding linkage to outside handle.

(5) Replace the clips attaching trim panel to perimeter of door.

(6) Install rear door trim panel.

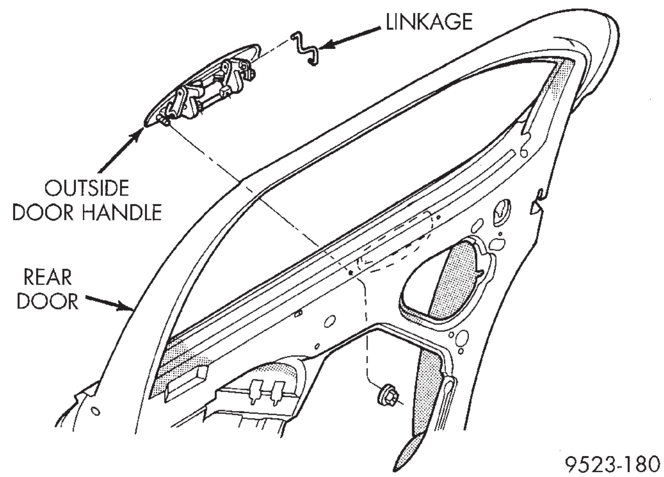


Fig. 47 Rear Door Outside Handle

REAR DOOR LATCH

REMOVAL

(1) Remove rear door trim panel.

(2) Close door glass.

(3) Remove lower rear run channel.

(4) Disengage clips holding linkage rods to door latch.

(5) Separate linkage rods from latch (Fig. 48).

(6) Remove screws holding latch to door end frame.

(7) Separate latch from door.

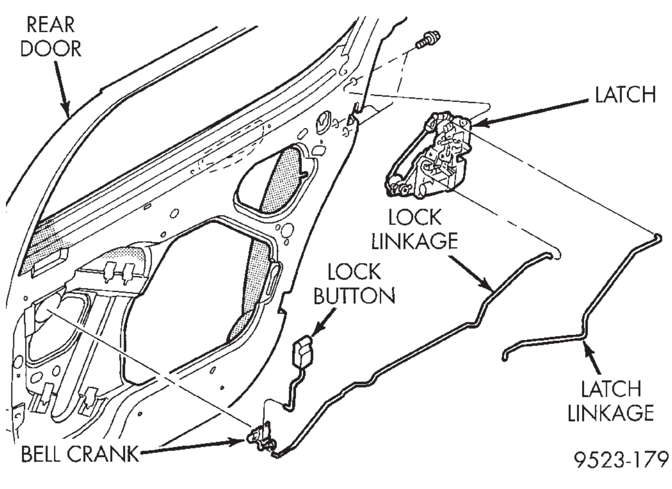


Fig. 48 Rear Door Latch

INSTALLATION

CAUTION: Do not close door before adjusting the door latch, door may fail to open.

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

REAR DOOR LATCH STRIKER

REMOVAL

(1) Mark outline of door latch striker on C-pillar to aid installation.

(2) Remove screws holding door latch striker to C-pillar.

(3) Remove door latch striker from vehicle.

NOTE: Be sure to check for any shims between door latch striker and C-pillar. If any shims are found, they must be reinstalled with the new door latch striker to maintain proper door operation.

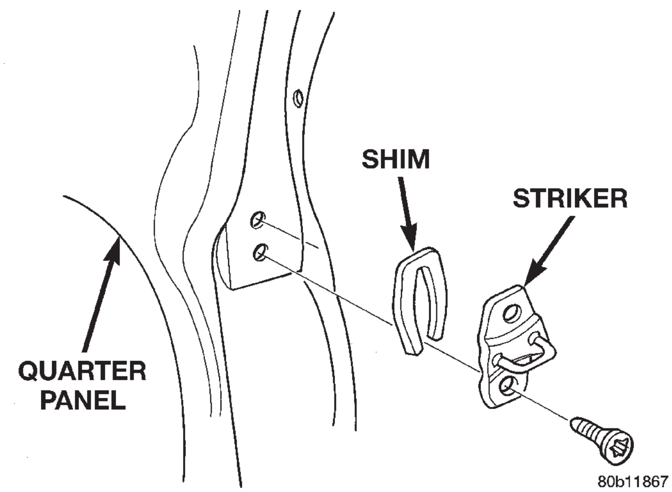


Fig. 49 Rear Door Latch Striker

INSTALLATION

(1) Position door latch striker and any shims on vehicle.

(2) Loosely install screws holding latch striker to C-pillar.

(3) Align latch striker to marks on C-pillar made previously.

(4) Tighten all fasteners.

(5) Verify door fit and operation. Adjust door latch striker as necessary.

REAR DOOR INTERLOCK LATCH STRIKER

REMOVAL

(1) Release door latch and open rear door.

(2) Mark outline of interlock striker on C-pillar to aid installation.

(3) Remove interlock striker from vehicle (Fig. 50).

INSTALLATION

For installation, reverse the above procedures.

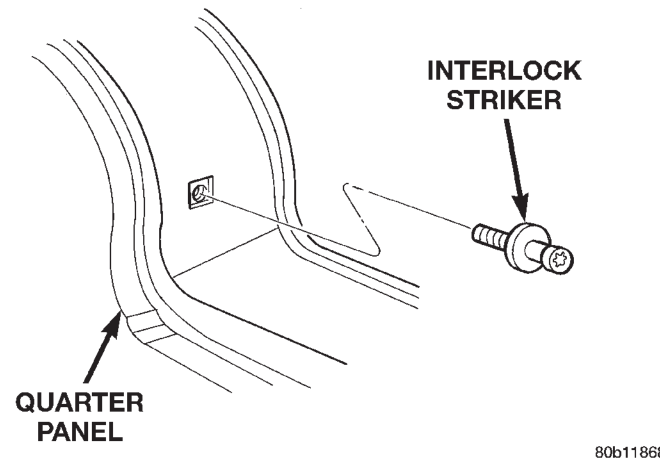


Fig. 50 Rear Door Interlock Striker

REAR DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove rear door trim panel.

(2) Pull upward at front end of inner belt weatherstrip.

(3) Remove inner belt weatherstrip from vehicle (Fig. 51).

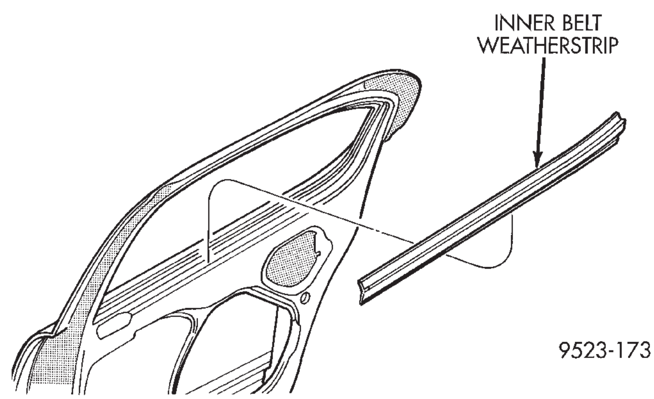


Fig. 51 Rear Door Inner Belt Weatherstrip

INSTALLATION

Reverse the preceding operation.

REAR DOOR OUTER BELT MOLDING

REMOVAL

(1) Remove screw holding forward end of molding to rear door (Fig. 52).

(2) Disengage clips holding rearward end of belt molding to rear door.

(3) Using a rubber mallet and block of wood, tap upward at each clip holding belt molding to door (Fig. 53).

(4) Separate belt molding from door.

REMOVAL AND INSTALLATION (Continued)

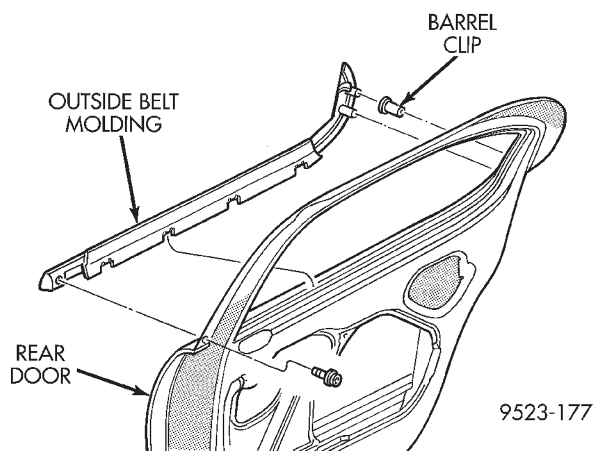


Fig. 52 Rear Door Outer Belt Molding

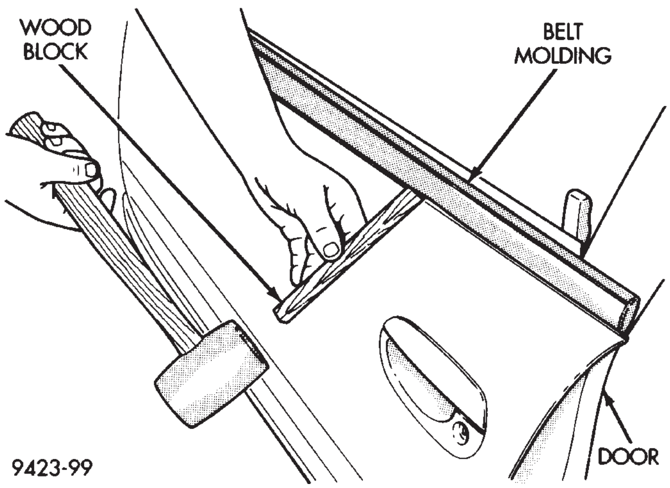


Fig. 53 Outer Belt Molding Removal

INSTALLATION

Reverse the preceding operation.

REAR DOOR WINDOW REGULATOR

Power and manual door glass regulators are serviced using the same procedures. For power window motor service procedures refer to Group 8S, Power Windows.

REMOVAL

(1) Remove door trim panel.
(2) Separate glass from regulator roller channel.
(3) Disengage power window motor wire connector, if equipped.
(4) Loosen screw holding regulator scissor channel to door panel (Fig. 54).
(5) Separate screw and bolt heads from keyhole slots in door panel.
(6) Loosen bolts holding regulator to door panel.
(7) Separate regulator from door panel.
(8) Slide regulator rearward and rotate forward end of roller channel through access hole in door panel.

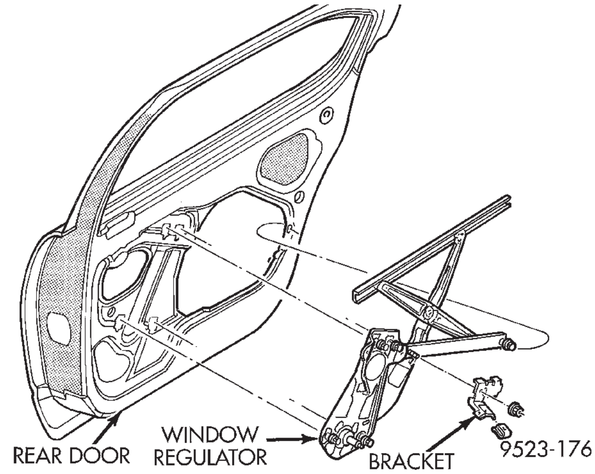


Fig. 54 Rear Window Door Glass Regulator

INSTALLATION

(1) Position regulator on door panel through access hole in door panel.
(2) Tighten bolts holding regulator to door panel.
(3) Engage screw and bolt heads on scissor channel to keyhole slots in door panel.
(4) Tighten screw holding regulator scissor channel to door panel.
(5) Connect power window motor wire connector, if equipped.
(6) Position glass to regulator roller channel.
(7) Tighten fasteners holding door glass to roller channel.
(8) Install door trim panel.

REAR DOOR GLASS

REMOVAL

(1) Remove door trim panel and inner belt weatherstrip.
(2) Connect power window switch or install crank and lower window to 50 mm (2 in.) from bottom of travel.
(3) Loosen bolts holding rear lower run channel to inner door panel (Fig. 55).
(4) Separate rear run channel from door.
(5) Loosen screws holding regulator roller channel to glass.
(6) Slide roller channel rearward to allow screw heads to pass through key hole slots in channel.
(7) Separate glass from roller channel.
(8) Lift glass upward and out of the opening at top of door.

REMOVAL AND INSTALLATION (Continued)

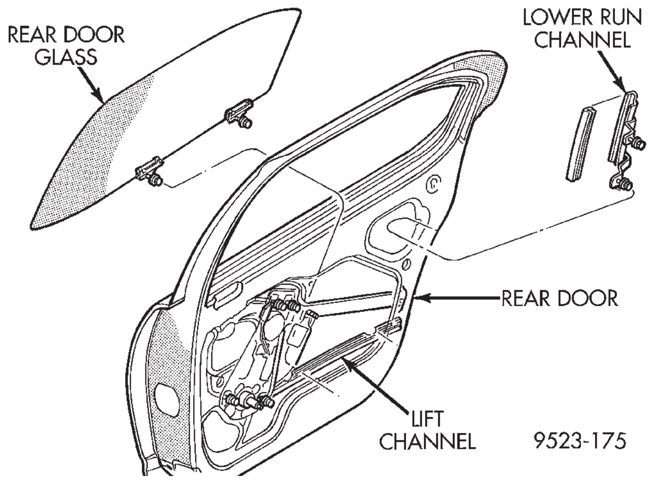


Fig. 55 Rear Door Glass

INSTALLATION

(1) Lower door glass through opening at top of door.

(2) Position door glass onto roller channel.

(3) Slide roller channel forward to allow screw heads to engage key hole slots in channel.

(4) Tighten screws holding regulator roller channel to glass.

(5) Position rear run channel on door.

(6) Tighten bolts holding rear lower run channel to inner door panel.

(7) Install door trim panel and inner belt weather-strip.

REAR DOOR GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.

(2) Remove door glass.

(3) Pull glass run weatherstrip from door glass opening frame (Fig. 56).

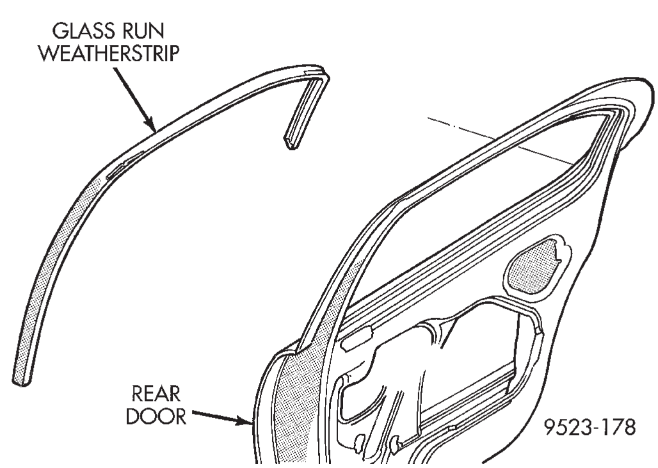


Fig. 56 Door Glass Run Weatherstrip

INSTALLATION

For installation, reverse the above procedures.

REAR DOOR CHECK STRAP

REMOVAL

(1) Remove rear door trim panel.

(2) Remove bolt holding check strap to hinge pillar.

(3) Remove bolt holding check strap to inner door panel (Fig. 57).

(4) Remove bolts holding check strap to door end frame.

(5) Separate check strap from vehicle.

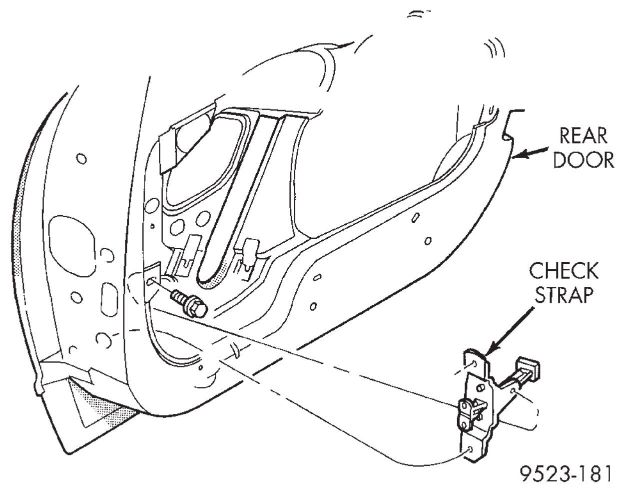


Fig. 57 Rear Door Check Strap

INSTALLATION

Reverse the preceding operation.

REAR DOOR

REMOVAL

(1) Open and support door on a suitable lifting device.

(2) Disengage wire connector at hinge pillar.

(3) Remove bolts holding door check strap to B-pillar.

(4) Remove clip holding hinge pin in lower door hinge (Fig. 58).

(5) Remove pin from lower hinge.

(6) Remove clip holding hinge pin in upper hinge.

(7) Remove pin from upper hinge.

(8) Separate door from vehicle.

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

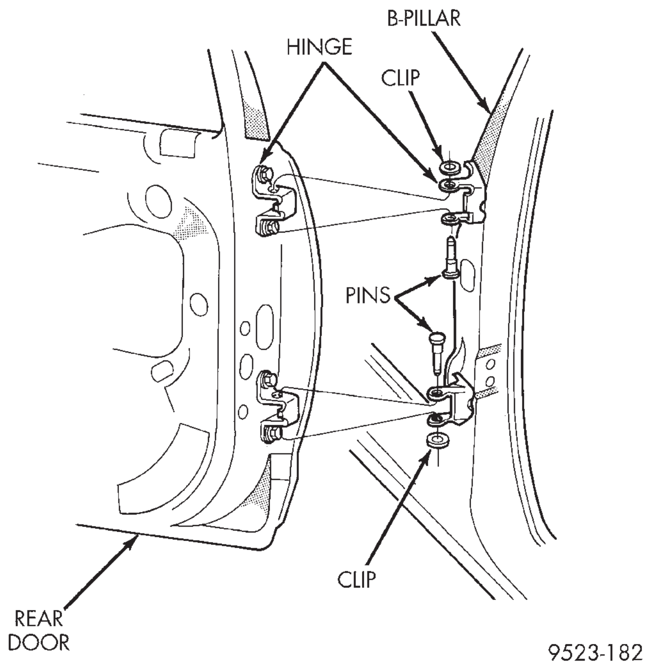


Fig. 58 Rear Door

DECKLID HINGE GAS PROP-ROD

REMOVAL

(1) Open decklid.

(2) Remove the gas prop-rod lock caps (Fig. 59).

(3) Remove prop-rod from mounting studs.

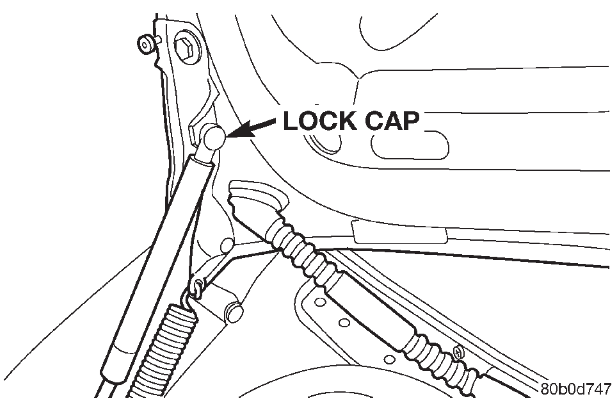


Fig. 59 Gas Prop-Rod Lock Cap

INSTALLATION

For installation, reverse the above procedures.

DECKLID

REMOVAL

(1) Release decklid latch and open decklid.

(2) Mark outline of hinge on decklid to aid in installation (Fig. 60).

(3) Disconnect all wire connectors from decklid latch and disconnect wire harness from decklid.

(4) Place suitable padding between decklid and deck panel to protect paint finish.

(5) With aid of a helper, remove bolts attaching decklid to decklid hinge.

(6) Remove decklid from vehicle.

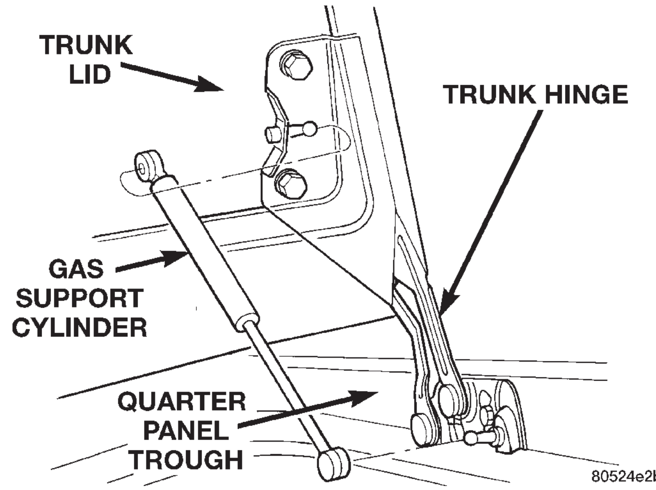


Fig. 60 Decklid Hinge And Gas Support Cylinder

INSTALLATION

(1) Position decklid on vehicle.

(2) With aid of a helper, loosely install bolts attaching decklid to decklid hinge.

(3) Align marks made on decklid previously to decklid hinge and tighten bolts attaching decklid to decklid hinge.

(4) Connect all wire connectors to decklid latch and install wire harness to decklid.

(5) Verify fit of decklid to deck panel. Adjust as necessary.

DECKLID HINGE

REMOVAL

(1) Open decklid.

(2) Mark outline of hinge on quarter panel trough and inside of decklid to aid installation.

(3) Place a padded block between the deck panel and the decklid.

(4) Remove the gas prop-rod lock caps (Fig. 61).

(5) Remove prop-rod from mounting studs.

(6) Disconnect spring (Fig. 62).

(7) Remove bolts attaching hinge to decklid.

(8) Place decklid against padded block and hold it steady.

(9) Remove bolts attaching hinge to quarter panel trough.

(10) Remove hinge from vehicle.

REMOVAL AND INSTALLATION (Continued)

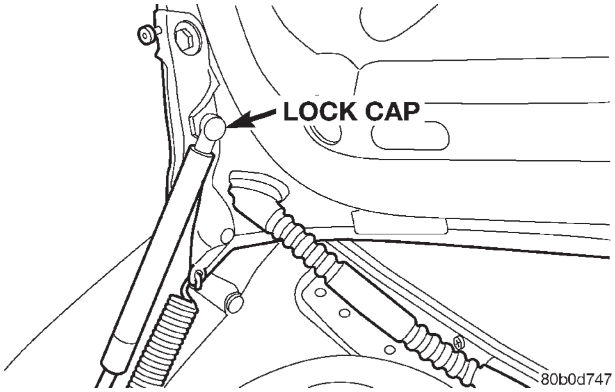


Fig. 61 Gas Prop-Rod Lock Cap

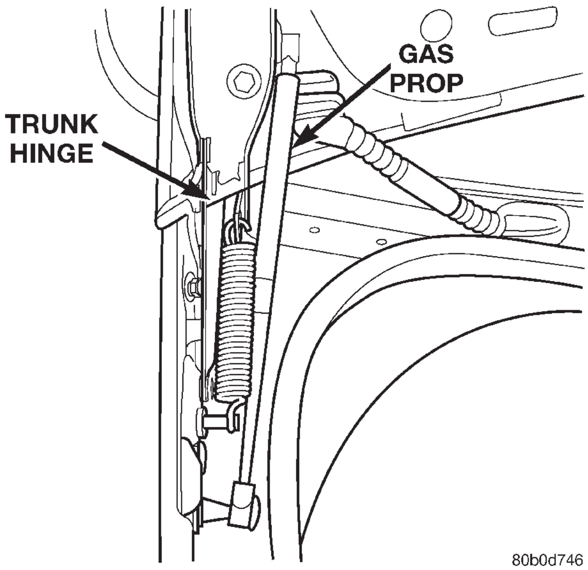


Fig. 62 Decklid Hinge

INSTALLATION

For installation, reverse the above procedures.

DECKLID LOCK

REMOVAL

(1) Remove decklid latch.

(2) Remove clip attaching decklid lock cylinder to decklid latch (Fig. 63).

(3) Remove lock cylinder from decklid latch.

INSTALLATION

For installation, reverse the above procedures.

DECKLID LATCH

REMOVAL

(1) Open decklid.

(2) Disconnect clips attaching latch cover to decklid (Fig. 64).

(3) Disconnect wire connectors from decklid latch.

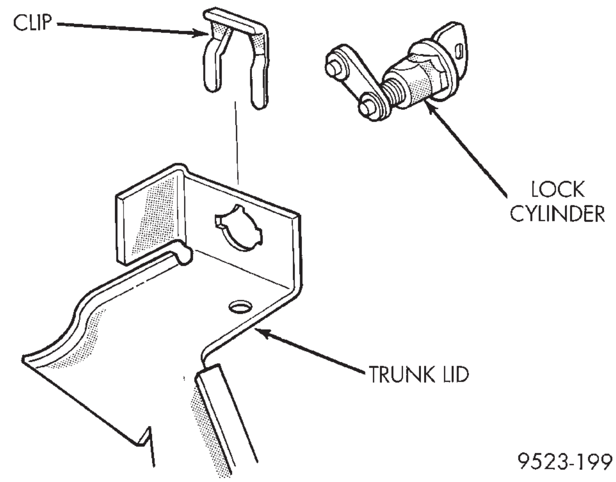


Fig. 63 Decklid Lock

(4) Remove bolts attaching decklid latch to decklid.

(5) Remove decklid latch from decklid.

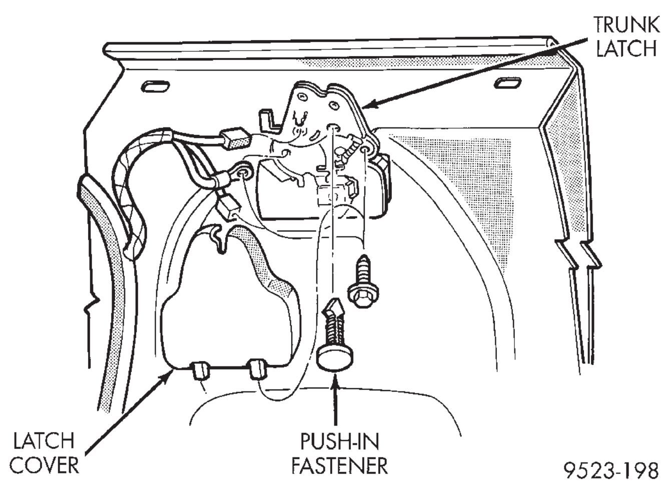


Fig. 64 Decklid Latch

INSTALLATION

For installation, reverse the above procedures

DECKLID LATCH RELEASE CABLE AND LATCH STRIKER

REMOVAL

(1) Remove left front sill plate.

(2) Remove left rear sill plate.

(3) Remove left lower B-pillar trim as necessary to gain access to release cable.

(4) Disconnect retainers attaching carpet to door opening sills.

(5) Remove screws attaching decklid release handle to floor pan (Fig. 65).

(6) Route handle and cable into rear seat area.

(7) Remove rear seat cushion and back.

(8) Remove lower quartet trim panel.

REMOVAL AND INSTALLATION (Continued)

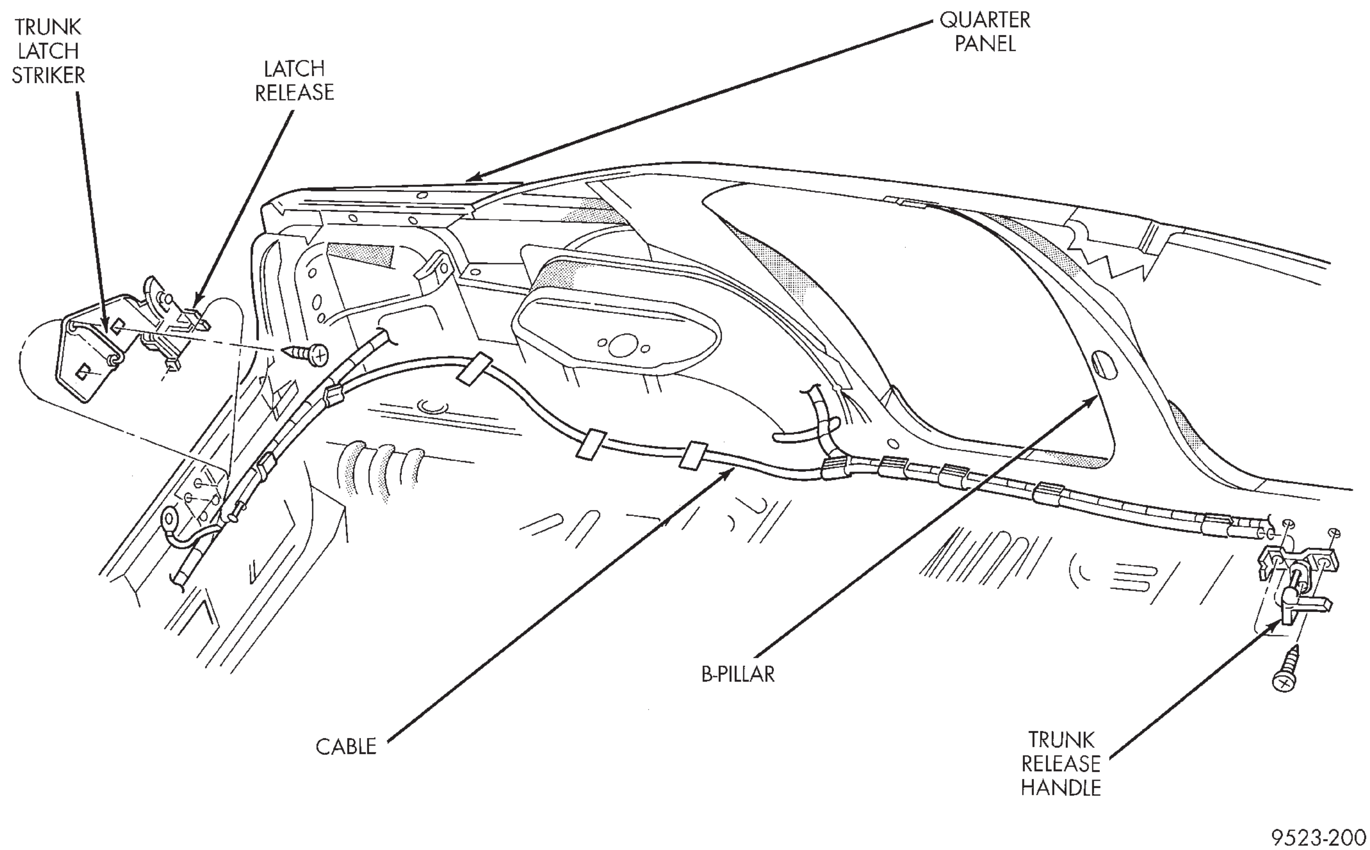


Fig. 65 Decklid Release Cable and Latch Striker

(9) Route handle and cable into trunk.

(10) Remove trunk lining away from left quarter panel.

(11) Remove trunk opening sill plate.

(12) Remove bolts attaching decklid latch striker to rear closure panel.

(13) Remove decklid latch release cable from vehicle.

INSTALLATION

For installation, reverse the above procedures.

A-PILLAR TRIM

REMOVAL

(1) Disengage clips holding A-pillar trim to A-pillar (Fig. 66).

(2) Separate A-pillar trim from vehicle.

INSTALLATION

Reverse the preceding operation.

REMOVAL AND INSTALLATION (Continued)

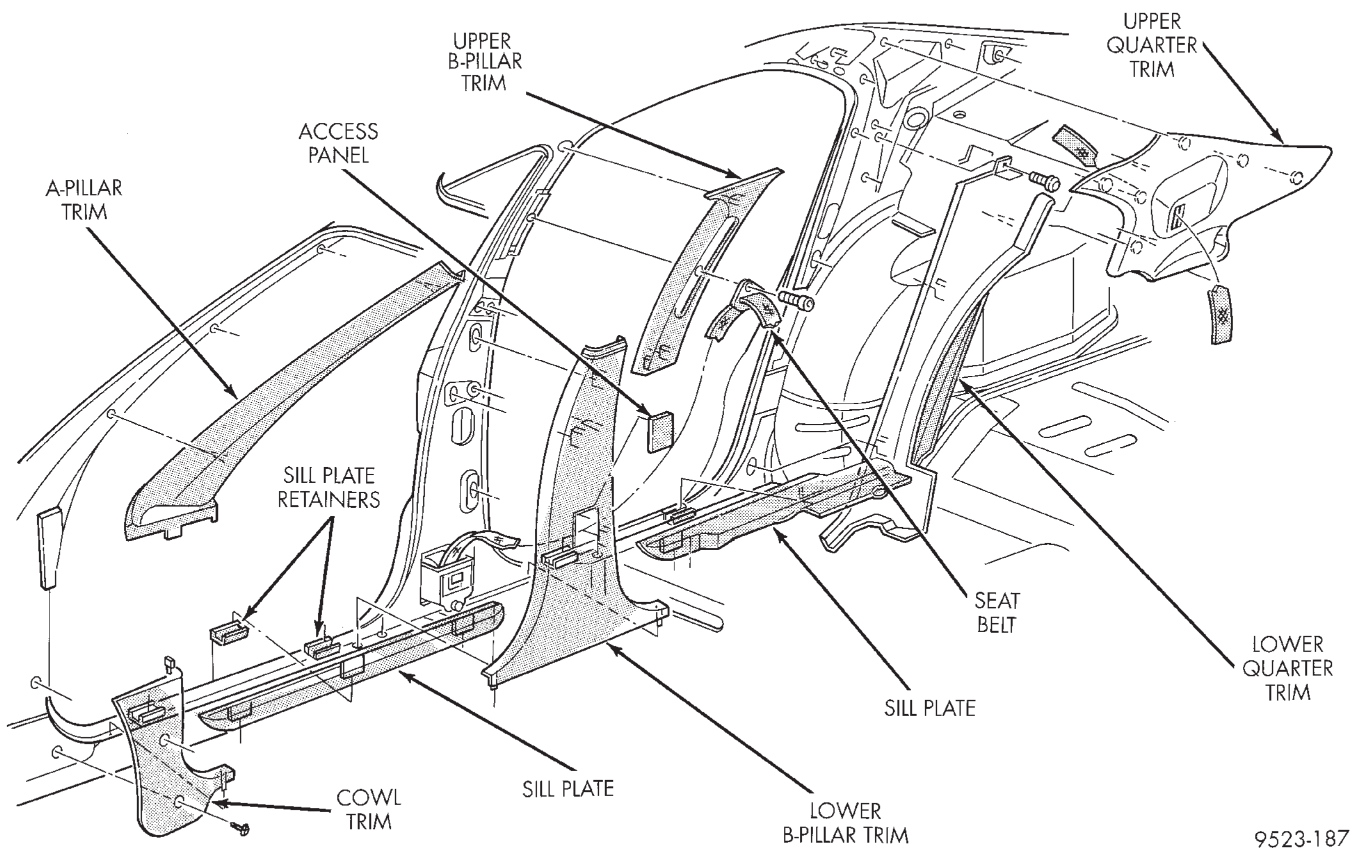


Fig. 66 Interior Trim Panels

COWL TRIM

REMOVAL

(1) Remove front door sill plate.

(2) Remove screws holding cowl trim to lower cowl panel (Fig. 69).

(3) Separate cowl trim from vehicle.

INSTALLATION

Reverse the preceding operation.

DRIP RAIL WEATHERSTRIP

REMOVAL

(1) Open front and rear doors.

(2) Starting at the bottom of the A-pillar, pull the drip rail weatherstrip from the windshield side molding.

(3) Pull the drip rail weatherstrip from the roof rail pinch flange above door openings.

(4) Remove drip rail weatherstrip from vehicle (Fig. 67).

INSTALLATION

Reverse the preceding operation.

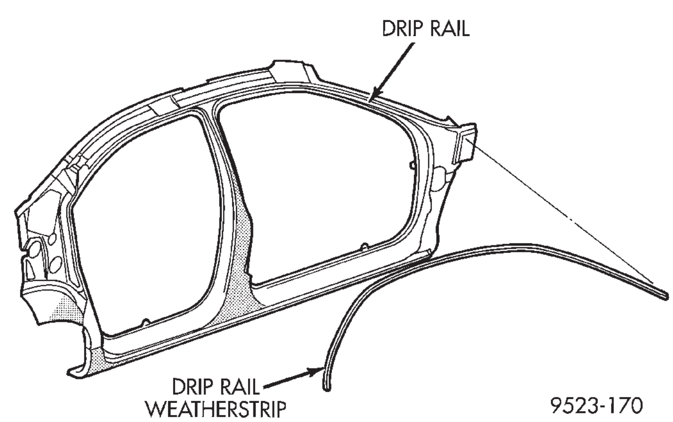


Fig. 67 Drip Rail Weatherstrip

SECONDARY SILL WEATHERSTRIP

REMOVAL

(1) Open front door.

(2) Using fork tool C-4828, disengage push in fasteners attaching secondary sill weatherstrip to bottom of door.

REMOVAL AND INSTALLATION (Continued)

(3) Remove secondary sill weatherstrip from vehicle (Fig. 68).

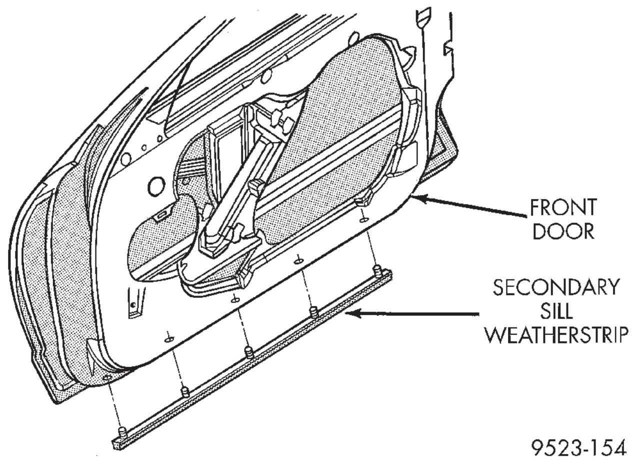


Fig. 68 Secondary Sill Weatherstrip

INSTALLATION

Reverse the preceding operation.

DOOR OPENING SILL PLATES

REMOVAL – FRONT OR REAR

(1) Pry upward at ends of sill plate to disengage retainers holding sill plate to door opening flange (Fig. 69).

(2) Separate sill plate from vehicle.

INSTALLATION

Reverse the preceding operation.

DOOR OPENING WEATHERSTRIPS

REMOVAL

(1) Open door.

(2) Remove door sill scuff plate.

(3) Pull weatherstrip from pinch flange around door opening (Fig. 70).

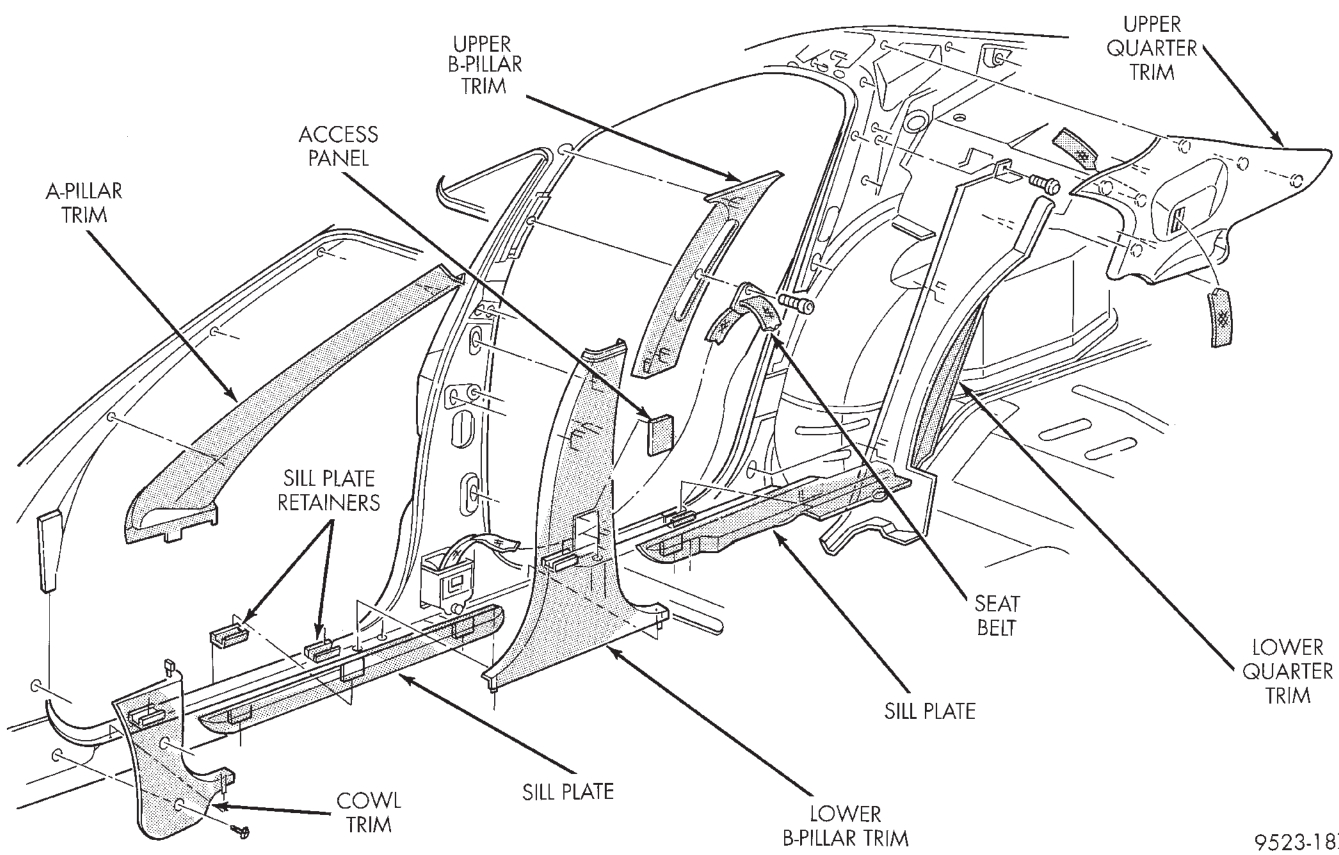


Fig. 69 Interior trim

REMOVAL AND INSTALLATION (Continued)

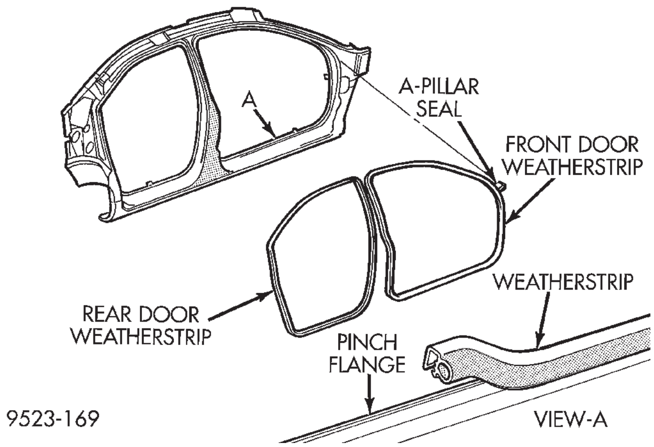


Fig. 70 Door Opening Weatherstrips

INSTALLATION

Position the splice in the door opening weatherstrip in the center of the bottom of the opening and reverse the preceding operation.

UPPER B-PILLAR TRIM

REMOVAL

(1) Pry shoulder belt knob straight off height adjuster using a trim stick (C-4755).

(2) Remove seat belt turning loop cover.

(3) Remove bolt holding turning loop to height adjuster.

(4) Remove bolt holding seat belt lower anchor to floor.

(5) Disengage clips holding upper B-pillar trim to B-pillar.

(6) Separate upper B-pillar trim from vehicle (Fig. 66).

INSTALLATION

Reverse the preceding operation.

LOWER B-PILLAR TRIM

REMOVAL

(1) Remove upper B-pillar trim.

(2) Disengage clips holding seat belt access panel to lower B-pillar trim (Fig. 66).

(3) Remove sill plates.

(4) Disengage clips holding lower B-pillar trim to B-pillar.

(5) Route seat belt webbing through access hole in lower B-pillar trim.

(6) Separate lower B-pillar trim from vehicle.

INSTALLATION

Reverse the preceding operation.

SECONDARY REAR SILL WEATHERSTRIP

REMOVAL

(1) Open rear door.

(2) Using fork tool (C-4828), disengage push in fasteners holding secondary sill weatherstrip to bottom of door.

(3) Remove secondary rear sill weatherstrip from vehicle (Fig. 71).

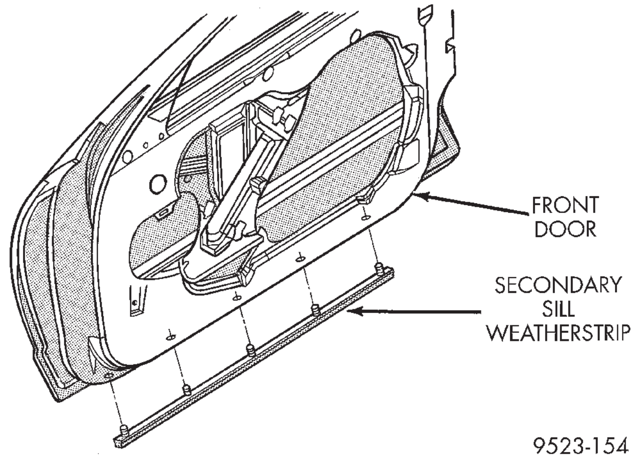


Fig. 71 Secondary Rear Sill Weatherstrip

INSTALLATION

Reverse the preceding operation.

REAR DOOR B-PILLAR SEAL

REMOVAL

(1) Using a suitable heat gun, warm seal to approximately 100° F to ease adhesive separation.

(2) Peel B-pillar seal from upper door frame, top to bottom (Fig. 72).

(3) Clean adhesive residue from door frame.

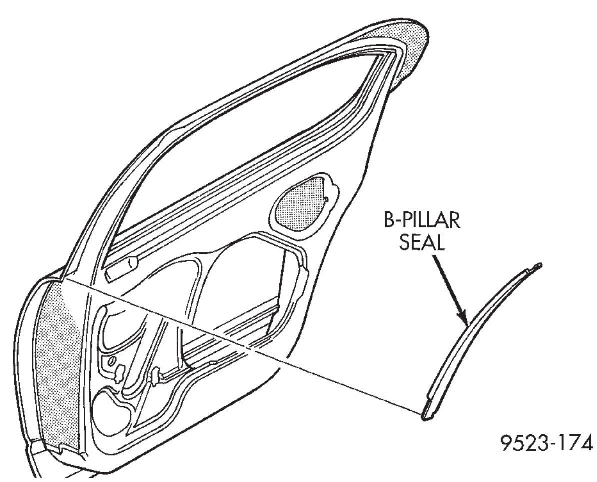


Fig. 72 Rear Door B-Pillar Seal

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) If original seal is reused, clean adhesive residue from back of seal.
(2) Apply body side molding tape to back of seal.
(3) Peel protective paper from back of tape.
(4) Place cutout in seal around screw head at bottom of seal location.
(5) Align seal to edge of door frame.
(6) Press adhesive onto door frame.

UPPER QUARTER TRIM

REMOVAL

(1) Remove bolt holding rear seat belt anchor to floor.
(2) Disengage clips holding upper quarter trim to inner quarter panel (Fig. 66).
(3) Route seat belt webbing through access hole in upper quarter trim.
(4) Separate upper quarter trim panel from vehicle.

INSTALLATION

Reverse the preceding operation.

LOWER QUARTER TRIM

REMOVAL

(1) Remove upper quarter trim panels and position them out of the way.
(2) Remove rear seat side bolster or seat back.
(3) Remove rear door sill plate.
(4) Remove screw holding lower quarter trim to inner quarter panel.
(5) Separate lower quarter trim from vehicle (Fig. 66).

INSTALLATION

Reverse the preceding operation.

QUARTER TRIM EXTENSIONS

REMOVAL

(1) Remove rear seat back side bolsters.
(2) Disengage clips holding quarter trim extensions to trunk closure panel (Fig. 73).
(3) Separate quarter trim extensions from vehicle.

INSTALLATION

Reverse the preceding operation.

PARCEL SHELF TRIM

REMOVAL

(1) Remove upper quarter trim panels.

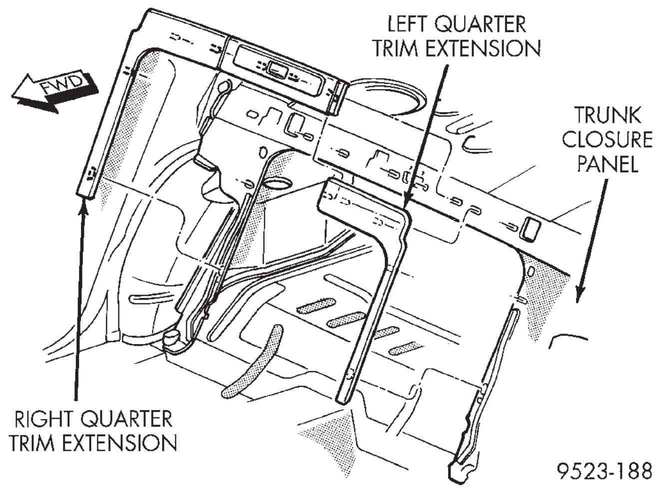


Fig. 73 Quarter Trim Extensions

(2) Remove rear seat cushion and back or quarter extension panels.
(3) Remove push-in fastener holding parcel shelf trim to shelf panel (Fig. 74).
(4) Pull trim forward to disengage clip holding trim to shelf panel.
(5) Separate parcel shelf trim from vehicle.

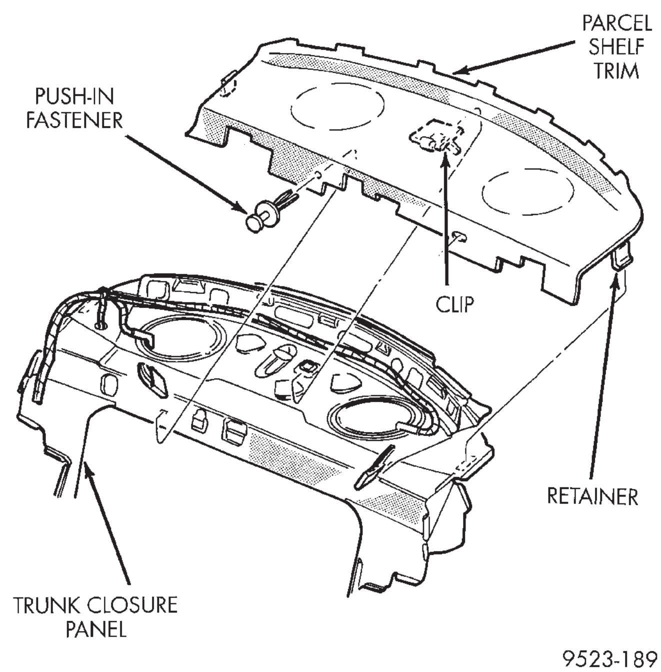


Fig. 74 Parcel Shelf Trim Panel

INSTALLATION

Reverse the preceding operation.

SEAT BELT – FRONT OUTBOARD

Inspect the condition of the shoulder belt and lap belt. Replace any belt that is cut, frayed, torn, or damaged in any way. Also, replace the shoulder belt if the retractor is either damaged or inoperative.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove upper B-pillar trim panel.

(2) Remove lower B-pillar trim panel.

(3) Remove bolt attaching seat belt retractor to B-pillar (Fig. 75).

(4) Remove retractor and belt from vehicle.

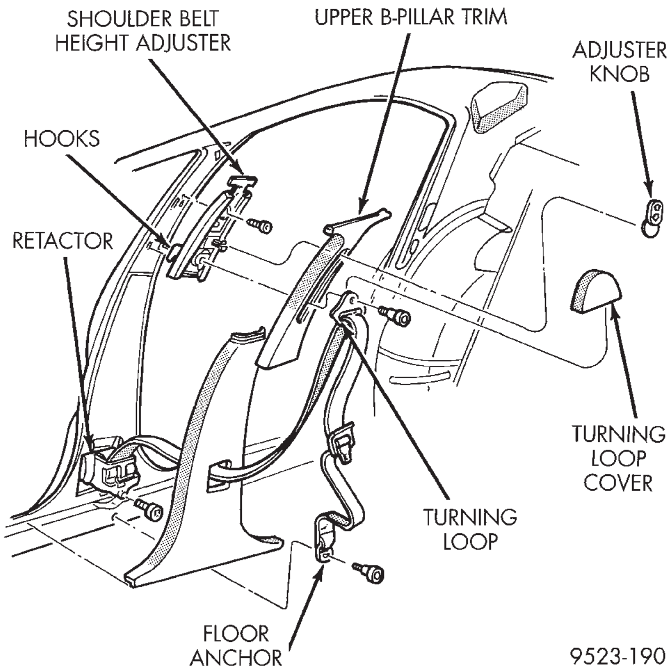


Fig. 75 Seat Belt – Front Outboard

INSTALLATION

For installation, reverse the above procedures.

SEAT BELT HEIGHT ADJUSTER

REMOVAL

(1) Remove upper B-pillar trim panel.

(2) Remove bolt holding seat belt height adjuster to B-pillar.

(3) Separate seat belt height adjuster from vehicle.

INSTALLATION

Reverse the preceding operation.

SEAT BELT– REAR INBOARD

REMOVAL

(1) Remove rear seat cushion.

(2) Remove nut attaching seat belt to floor (Fig. 76).

(3) Remove seat belt from vehicle.

INSTALLATION

Reverse the preceding operation.

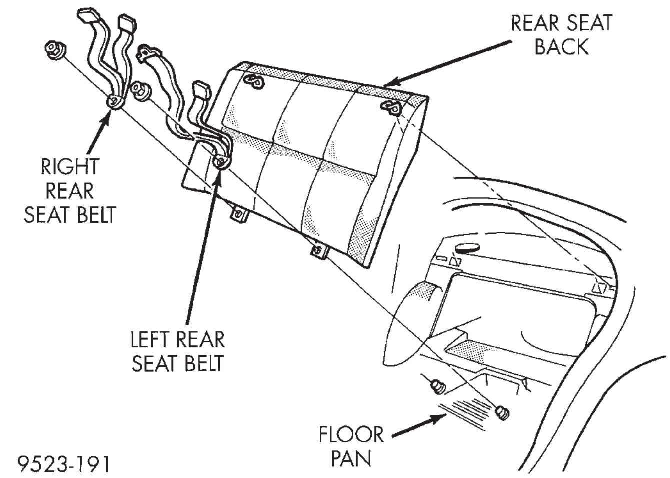


Fig. 76 Seat Belt – Rear Inboard

SEAT BELT – REAR OUTBOARD

REMOVAL

(1) Remove rear seat cushion.

(2) Remove bolt holding seat belt anchor to floor pan (Fig. 77).

(3) Remove upper quarter trim panel.

(4) Remove nut holding rear seat belt retractor to inner quarter panel.

(5) Remove retractor and belt from vehicle.

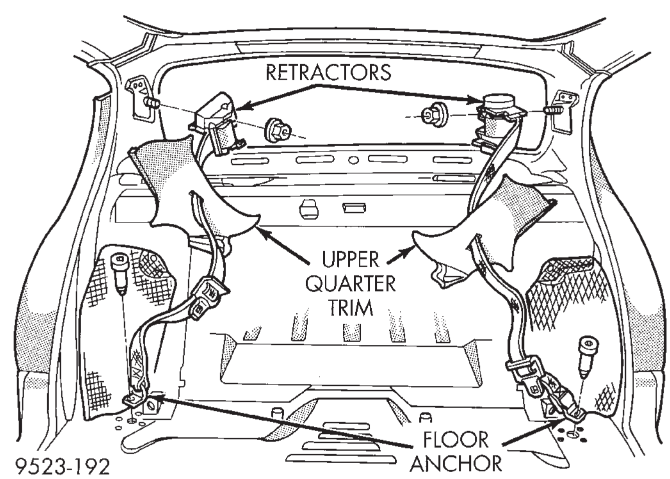


Fig. 77 Seat Belt – Rear Outboard

INSTALLATION

For installation, reverse the above procedures.

FLOOR CONSOLE

REMOVAL

(1) Remove gear shift knob, refer to Group 21, Transaxle for proper procedure.

(2) Remove transmission range indicator bezel from floor console (Fig. 78).

REMOVAL AND INSTALLATION (Continued)

(3) Disconnect the transmission range indicator bezel electrical connector from the wire harness.

(4) Remove screws attaching the forward end of the console to shifter bracket.

(5) Remove screws attaching rearward end of console to clips in floor bracket.

(6) Fully engage parking brake.

(7) Pull floor console up off of the floor bracket.

(8) Remove floor console from vehicle.

INSTALLATION

(1) Fully engage parking brake.

(2) Engage forward tabs on console into forward instrument panel console.

(3) Locate the 4-way locator on the forward portion of console to shifter bracket.

(4) Locate the 2-way locator on the rearward portion of console base into floor bracket hole.

(5) Align rearward portion of the console to clips in the floor bracket.

(6) Install screws, next to floor shifter and in console to shifter bracket.

(7) Install electrical connector between the transmission range indicator bezel and wire harness.

(8) Install the transmission range indicator bezel into console.

(9) Install gear shift knob, refer to Group 21, Transaxle for the proper procedures.

FORWARD IP CONSOLE

REMOVAL

(1) Remove floor console.

(2) Remove instrument cluster bezel, refer to Group 8E, Instrument Panel and Gauges for proper procedure.

(3) Remove screws holding storage bin forward IP console (Fig. 78).

(4) Separate storage bin from console.

(5) Remove screws holding forward IP console to gear selector mount bracket.

(6) Remove screws holding IP console to instrument panel at each side of HVAC control.

(7) Remove screws holding IP console to instrument panel at each side of storage bin area.

(8) Remove screws holding IP console to instrument panel support braces.

(9) Remove forward IP console from vehicle.

INSTALLATION

Reverse the preceding operation.

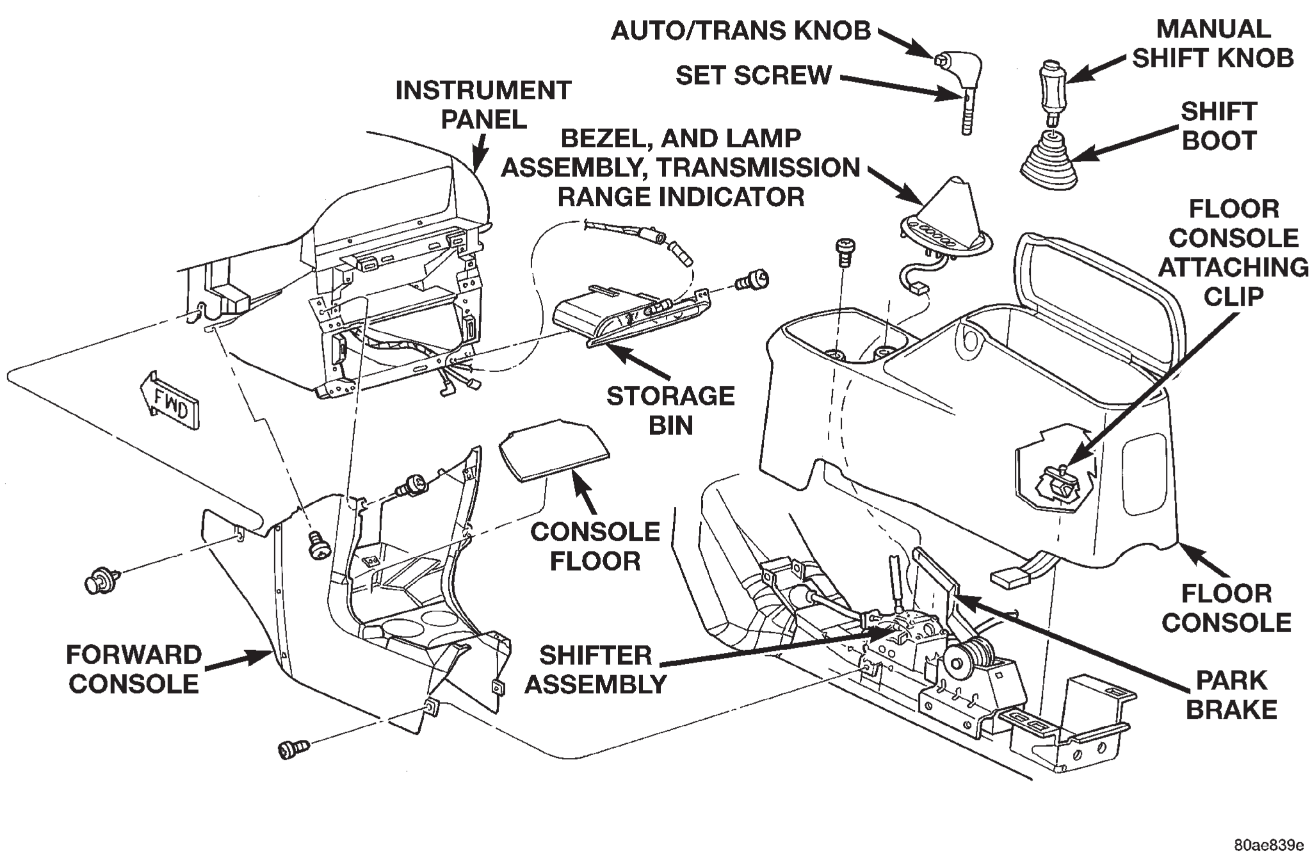


Fig. 78 Floor Console

REMOVAL AND INSTALLATION (Continued)

FLOOR CARPET

REMOVAL

(1) Remove door opening sill plates.
(2) Remove rear seat cushion.
(3) Remove front seats.
(4) Remove amplifier on passenger side of floor pan, if equipped.
(5) Remove bolts holding front seat belts to floor.
(6) Remove lower B-pillar trim panels as necessary to clear carpet.
(7) Remove cowl trim panels.
(8) Remove floor console.
(9) Remove forward IP console.
(10) Disengage retainer channels holding carpet to door sills (Fig. 79).
(11) Pull carpet from behind brake pedal, accelerator pedal, and HVAC.
(12) Fold carpet to center of vehicle.
(13) Remove carpet from vehicle through passenger door opening.

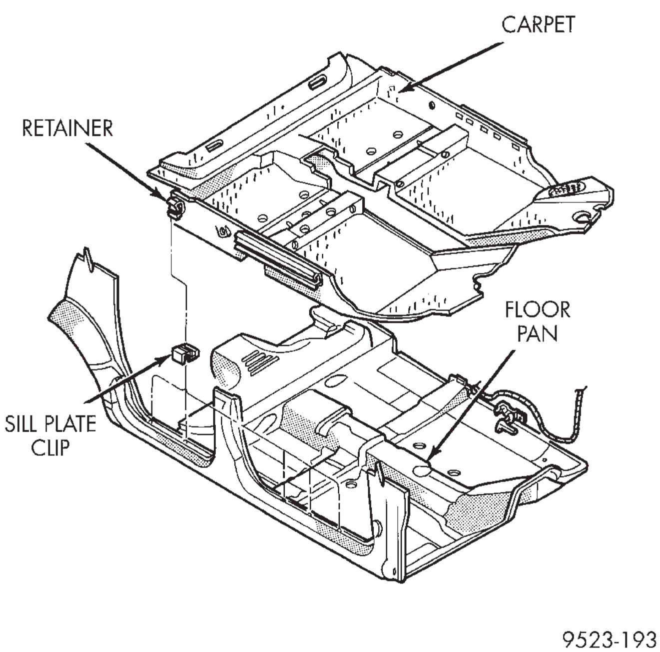


Fig. 79 Floor Carpet

INSTALLATION

Reverse the preceding operation.

SUN VISOR

REMOVAL

(1) Disengage sun visor from center support (Fig. 80).
(2) Remove screws holding sun visor to roof header.
(3) Separate sun visor from header.
(4) If equipped, disengage wire connector from body harness.
(5) Separate sun visor from vehicle.

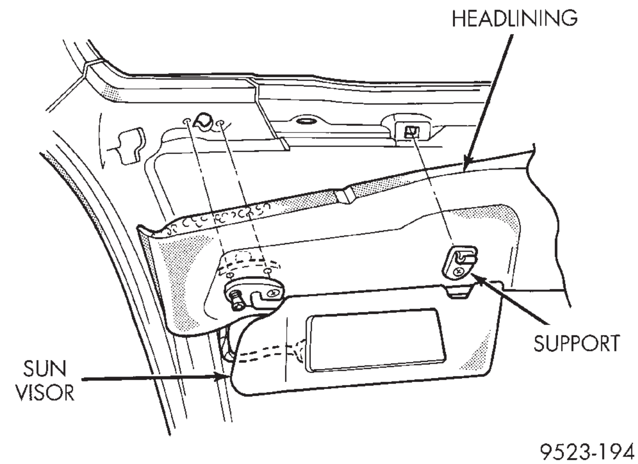


Fig. 80 Sun Visor

INSTALLATION

Reverse the preceding operation.

SUN VISOR SUPPORT

REMOVAL

(1) Disengage sun visor from center support.
(2) Remove screw holding support to roof header,
(3) Separate support from vehicle.

INSTALLATION

Reverse the preceding operation.

HEADLINING

REMOVAL

CAUTION: It is not possible to remove the rear locating clip attached to the headlining just forward of the rear window without damaging the headlining substrate or locating clip. Verify availability of replacement headlining prior to beginning procedure.

(1) Remove sun visors.
(2) Remove sun visor supports.
(3) Remove assist handles.
(4) Remove coat hooks.
(5) Pull dome lamp straight down to disengage retaining clips.
(6) Disengage wire connector from dome lamp.
(7) Pull map lamp, if so equipped, straight down to disengage retaining clips.
(8) Disengage wire connector from map lamp, if so equipped.

REMOVAL AND INSTALLATION (Continued)

(9) Pull sunroof switch, if so equipped, straight down to disengage switch from retainer.

(10) Disengage wire connector from sunroof switch, if so equipped.

(11) Remove left A-pillar trim panel.

(12) Disengage push in fasteners holding headliner wiring harness to A–pillar and instrument panel brackets.

(13) Disengage headliner wire connector from fuse panel (Fig. 81).

(14) Disengage upper fasteners on right A–pillar trim panel and allow trim panel to lay toward center of vehicle.

(15) Remove upper B-pillar trim panels.

(16) Remove upper quarter trim panels as necessary to clear headlining removal path.

(17) Recline passenger side front seat.

(18) On sun roof equipped vehicles, disengage hook and loop fasteners holding headlining to sunroof module.

(19) Disengage clip holding headlining to roof above rear window (Fig. 82).

(20) Separate headlining from roof.

(21) Remove headlining through passenger side from door opening.

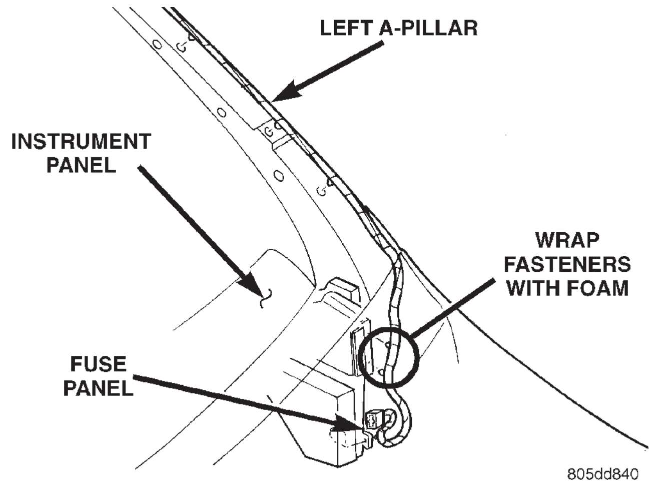


Fig. 81 Headlining Wiring

INSTALLATION

(1) Fully recline both front seats.

(2) Tilt steering wheel fully up.

(3) Move shifter fully rearward.

(4) Move headliner into vehicle through front passenger door.

(5) Lay headlining wiring harness out along A–pillar to prevent capturing between headlining and roof.

(6) Install left inboard sun visor support.

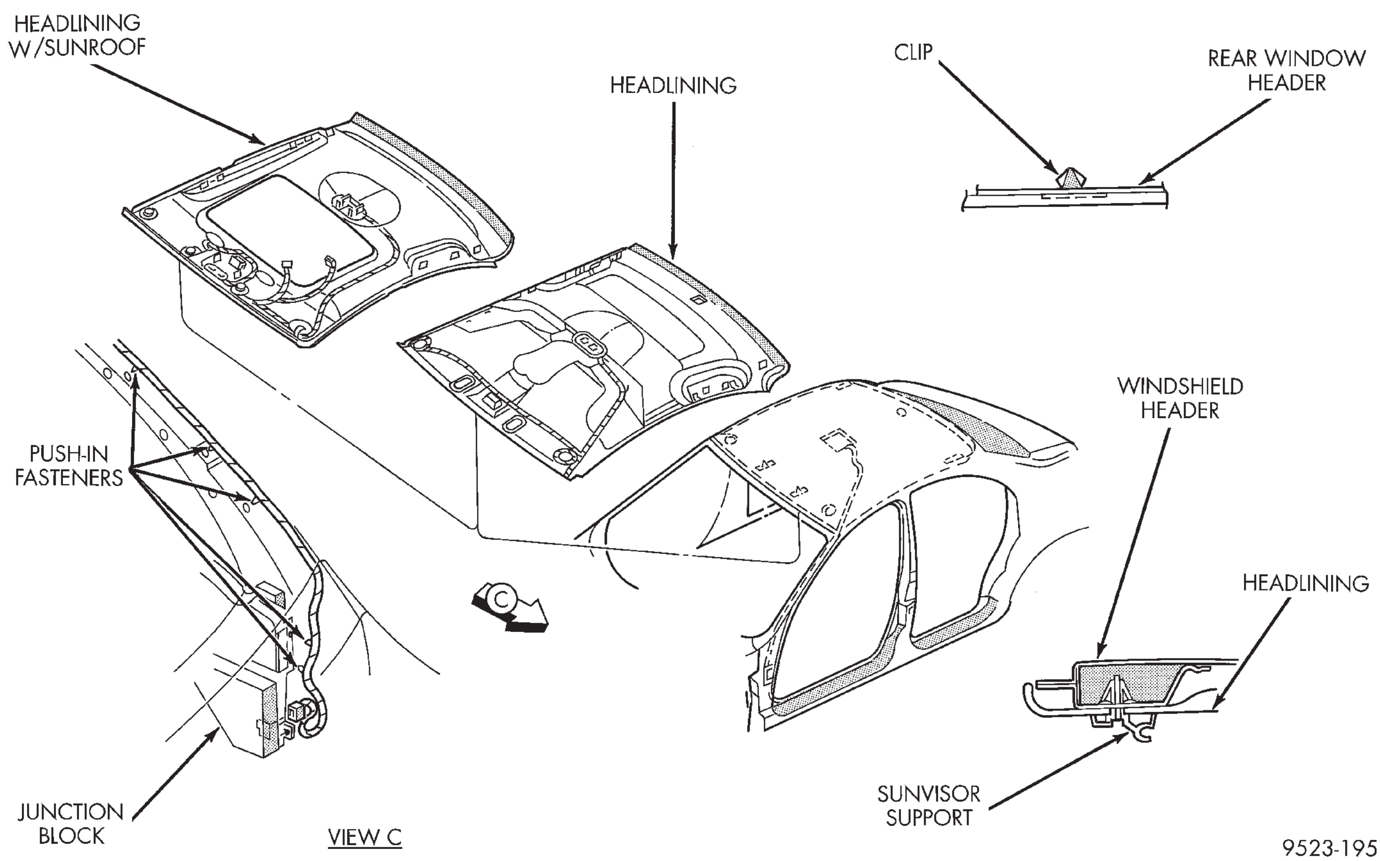


Fig. 82 Headlining

REMOVAL AND INSTALLATION (Continued)

(7) Align rear locator with mating hole in roof bow and press upward on headlining until rear locator engages.

(8) Install coat hooks.

(9) Install assist handles.

(10) Install sun visors.

(11) Engage wire connector to sunroof switch, if so equipped.

(12) Push upward on sunroof switch, if so equipped, to engage into switch retainer.

(13) Push upward on headlining around sunroof opening to engage hook and loop fasteners, if equipped with a sunroof.

(14) Engage map lamp, if so equipped, wire connector to map lamp.

(15) Push upward on map lamp, if so equipped, to engage lamp to headlining.

(16) Engage dome lamp wire connector to dome lamp.

(17) Push upward on dome lamp to engage dome lamp to headlining and roof.

(18) Install headlining wiring harness to A–pillar and fuse panel.

NOTE: It is not possible to reinstall the push in fasteners holding the wiring harness to the instrument panel bracket and to the fuse panel area. Wrap these two fasteners with foam tape to prevent buzz, squeak, and rattle complaints (Fig. 81).

(19) Install A–pillar trim panels.

(20) Install B–pillar trim panels.

(21) Install upper quarter trim panels.

(22) Verify that the door opening weatherstrip lip overlaps the edge of the headlining and trim panels.

(23) Perform sunroof relearn procedure, if so equipped. Refer to Group 23, Body, for procedure.

ADJUSTMENTS

DOOR LATCH ADJUSTMENT

(1) Insert a hex-wrench through the elongated hole in the door end frame near the latch striker opening (Fig. 83).

(2) Loosen socket head screw on the side of the latch linkage.

(3) Lift upward on outside door handle and release it.

(4) Tighten socket head screw on latch.

(5) Verify latch operation.

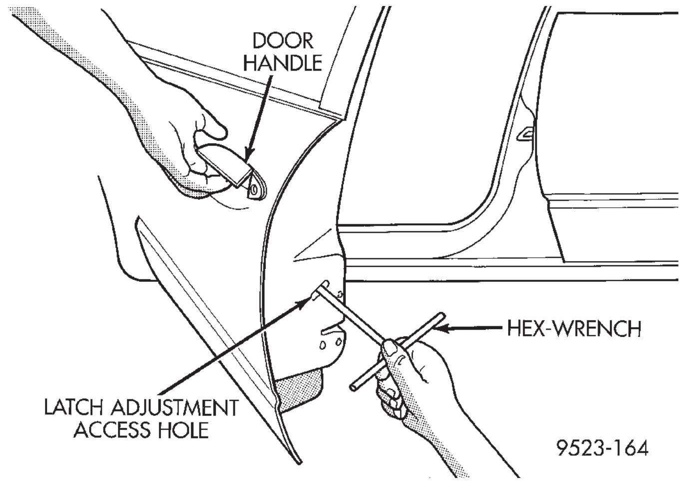
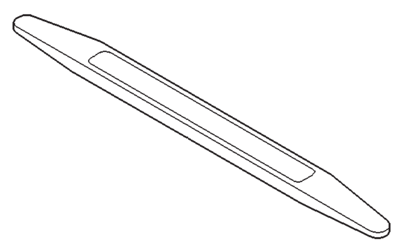


Fig. 83 Door Latch Adjustment

SPECIAL TOOLS

BODY



STICK, TRIM C 4755

SPECIFICATIONS

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SPECIFICATIONS

BODY LUBRICATION SPECIFICATIONS

LUBRICATION REQUIREMENTS

Body mechanisms and linkages should be inspected, cleaned, and lubricated, as required, to maintain ease of operation and to provide protection against rust and wear. When performing other under hood services, the hood latch release mechanism and safety catch should be inspected, cleaned, and lubricated. During the winter season, external door lock cylinders should be lubricated to assure proper operation when exposed to water and ice.

Prior to the application of any lubricant, the parts concerned should be wiped clean to remove dust and grit. If necessary, a suitable solvent can be used to clean the item to be lubricated. After lubricating a component, any excess oil or grease should be removed.

LUBRICANT APPLICATION

DOOR LOCK CYLINDERS

(1) Apply a small amount of lubricant directly into the lock cylinder.

(2) Apply a small amount of lubricant to the key.

(3) Insert key into lock cylinder and cycle the mechanism from the locked to the unlocked position.

NOTE: Do not add more lubricant.

(4) Cycle the lock cylinder mechanism several times to allow the lubricant to flow throughout the cylinder.

(5) Wipe all lubricant from exterior of lock cylinder and key.

ALL OTHER BODY MECHANISMS

(1) Clean component as described above.

(2) Apply specified lubricant to all pivoting and sliding contact areas of component.

LUBRICANT USAGE

ENGINE OIL

- Door Hinges – Hinge Pin and Pivot Contact Areas
- Hood Hinges – Pivot Points
- Liftgate Hinges
- Decklid Hinges

MOPAR® SPRAY WHITE CUBE OR EQUIVALENT

- Door Check Straps
- Liftgate Latches
- Liftgate Prop Pivots
- Ash Receiver
- Fuel Filler Door Remote Control Latch Mechanism
- Parking Brake Mechanism
- Sliding Seat Tracks
- Decklid Latch

MOPAR® Multipurpose GREASE OR EQUIVALENT

- All Other Hood Mechanisms

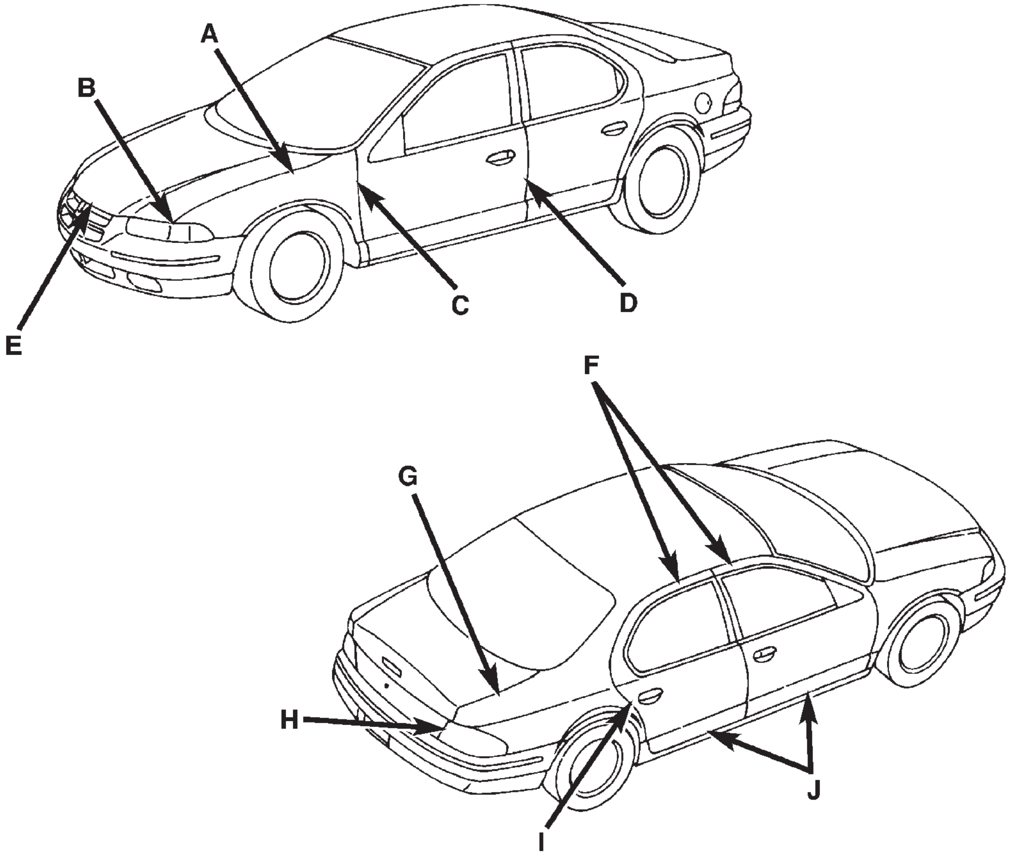
MOPAR® LOCK CYLINDER LUBRICANT OR EQUIVALENT

- Door Lock Cylinders
- Decklid Lock Cylinder

SPECIFICATIONS (Continued)

BODY GAP AND FLUSH MEASUREMENTS

BODY GAP AND FLUSH



	LOCATION	GAP	FLUSH
A	Hood to Fender	4.2 ± 1.5 (30)	0.7 ± 2.4 (30)
B	Hood to Fender Fore and Aft	5.0 ± 3.2 (30)	
C	Front Door to Fender	4.8 ± 1.6 (30)	-0.4 ± 1.9 (30)
D	Rear Door to Front Door	4.2 ± 1.5 (30)	0.1 ± 1.9 (30)
E	LT Fascia to Hood	5.0 ± 3.2 (30)	
E	RT Fascia to Hood	5.3 ± 4.9 (30)	
F	Front Door to Roof	5.4 ± 3.9 (30)	1.9 ± 2.6 (30)
F	Rear Door to Roof	4.5 ± 3.3 (30)	2.6 ± 2.8 (30)
G	Decklid to Quarter Panel	4.0 ± 1.7 (30)	-0.7 ± 2.1
H	Taillamp to Applique and Decklid	8.1 ± 2.4 (30)	-0.2 ± 3.1 (30)
I	Rear Door to Quarter Panel	3.8 ±0.9 (30)	0.0 ± 2.4 (30)
J	Front Door to Sill	9.4 ± 2.6 (30)	
J	Rear Door to Sill	8.4 ± 2.6 (30)	

NOTE: ALL MEASUREMENTS ARE IN MM.

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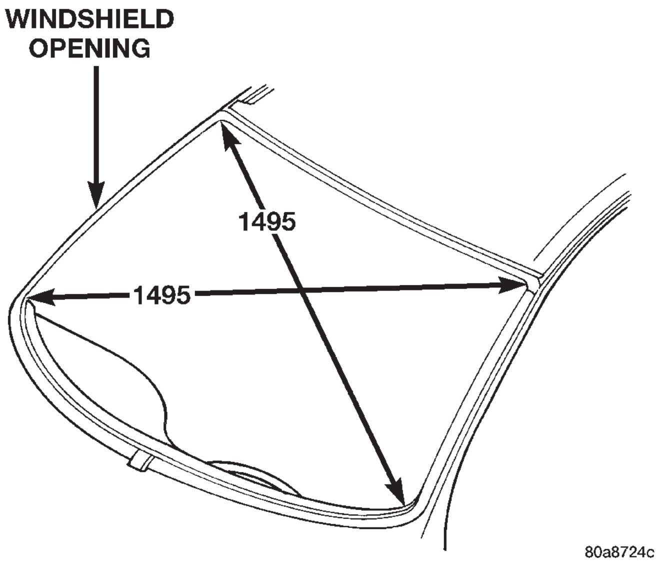
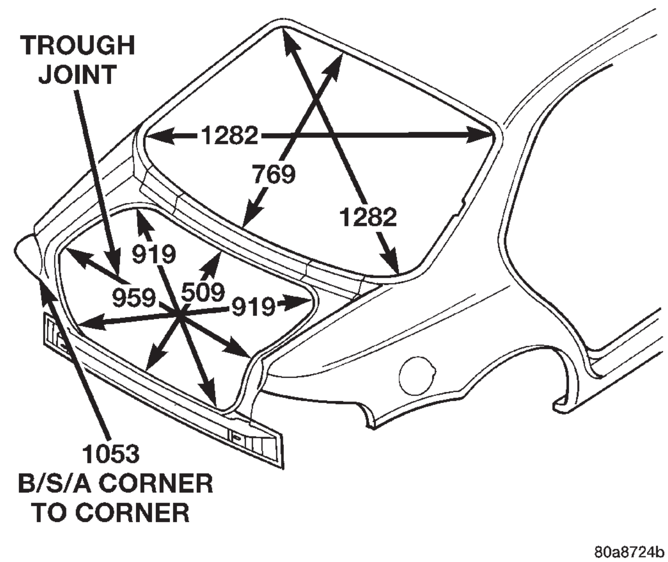
SPECIFICATIONS (Continued)

BODYOPENING DIMENSION

WINDSHIELD OPENING

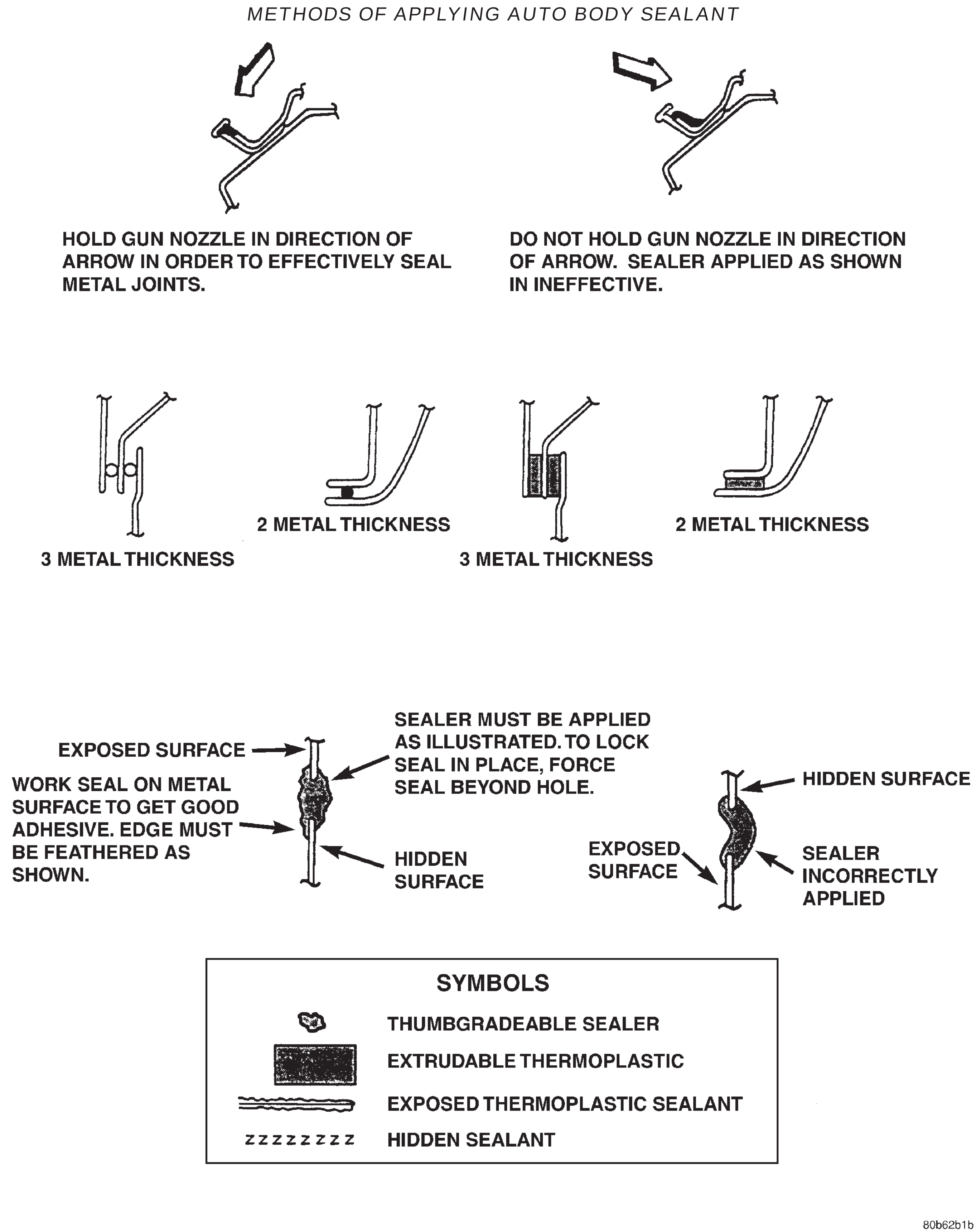


REAR WINDOW AND TRUNK OPENING



SPECIFICATIONS (Continued)

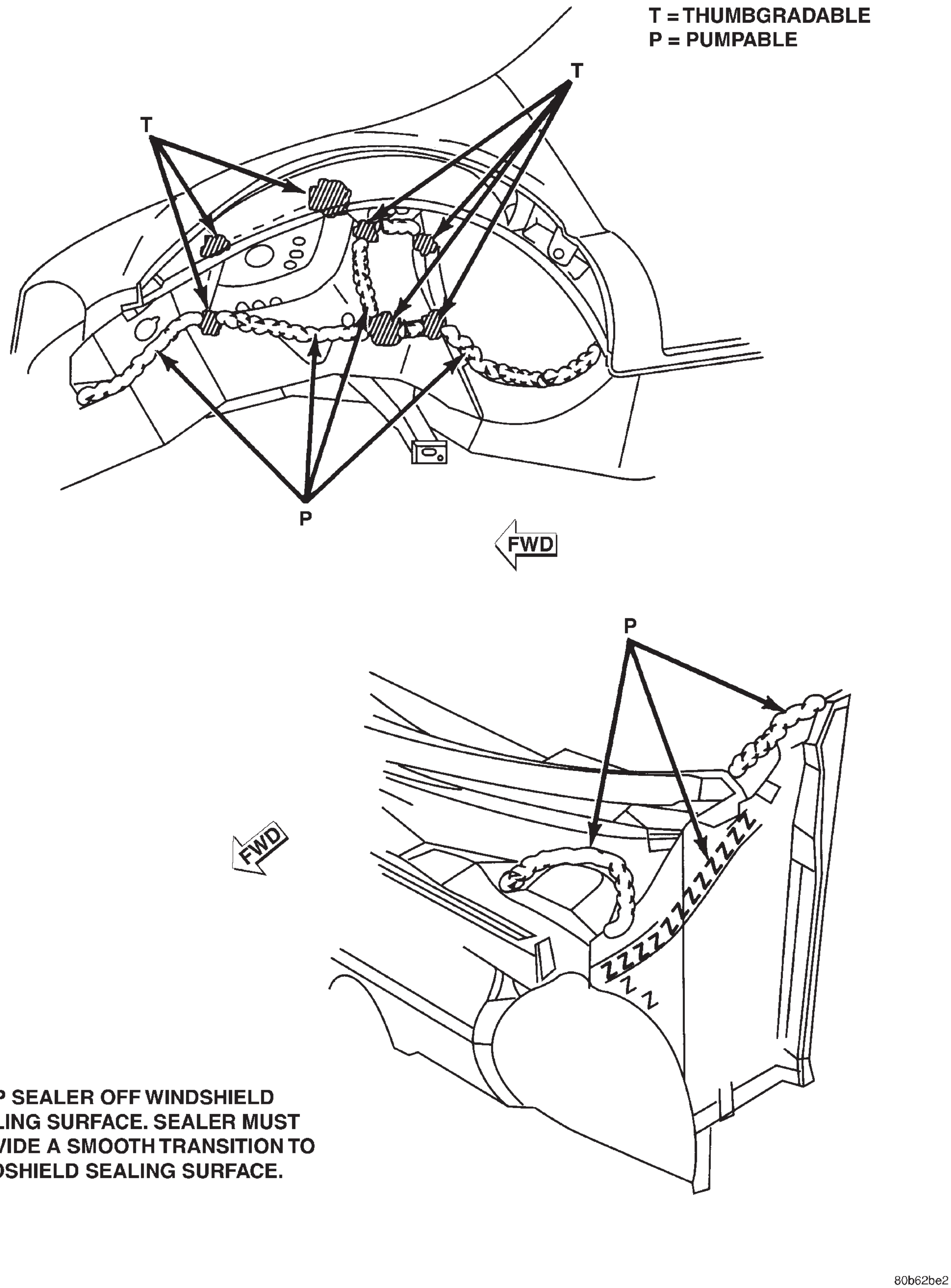
BODY SEALING LOCATIONS



SPECIFICATIONS (Continued)

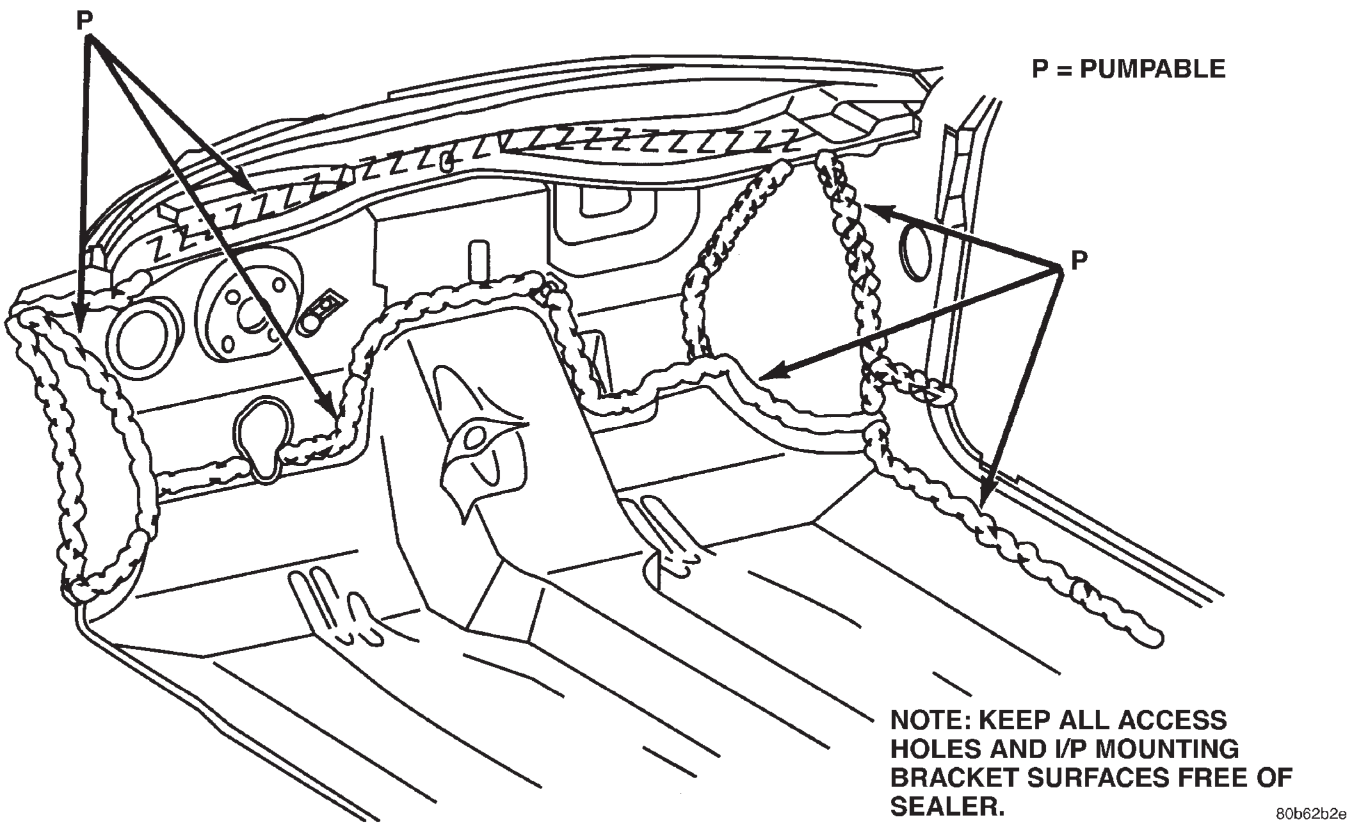
STRUCTURAL ADHESIVE LOCATIONS

STRUT TOWER AND COWL AREA

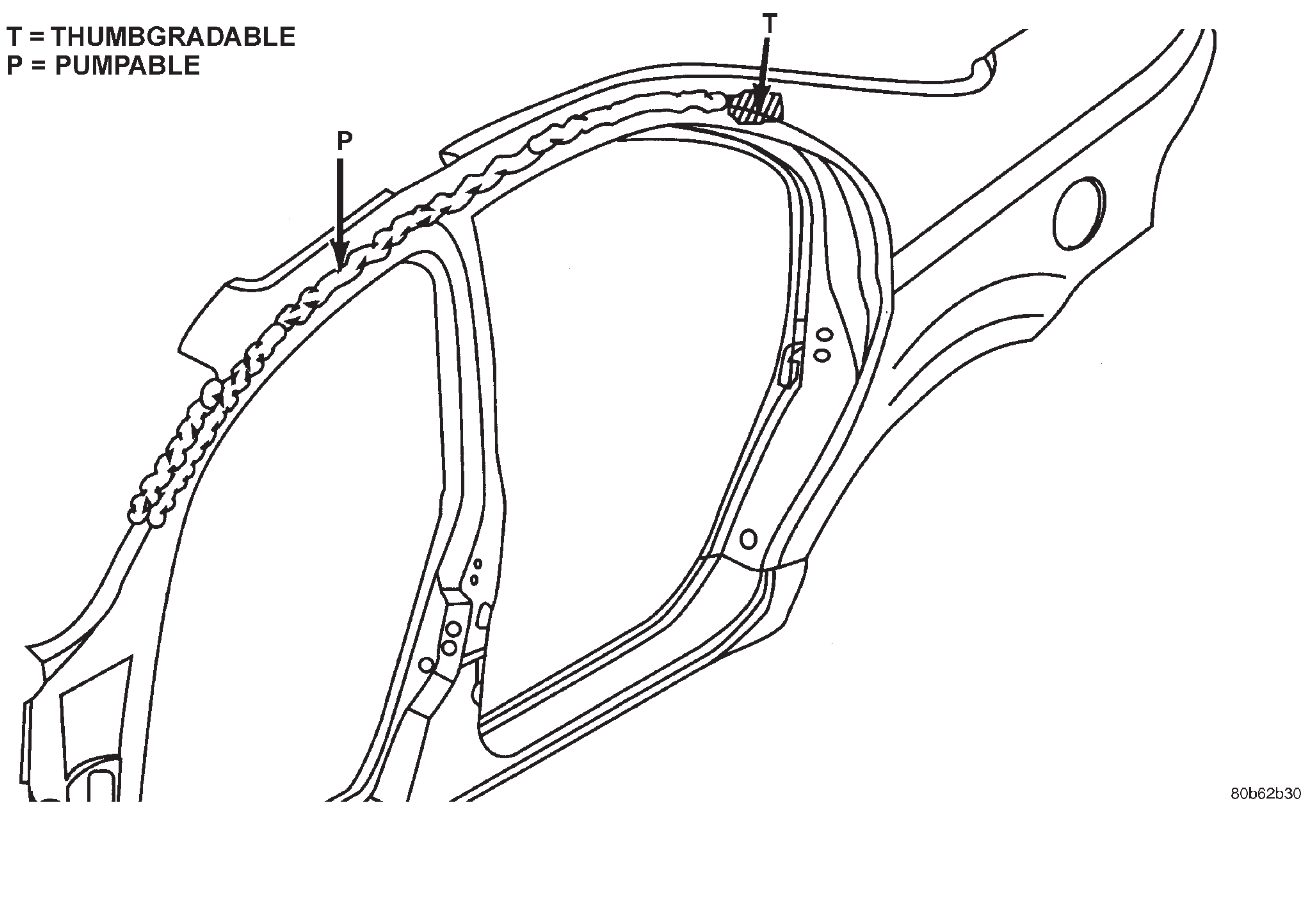


SPECIFICATIONS (Continued)

COWL AND PLENUM AREA

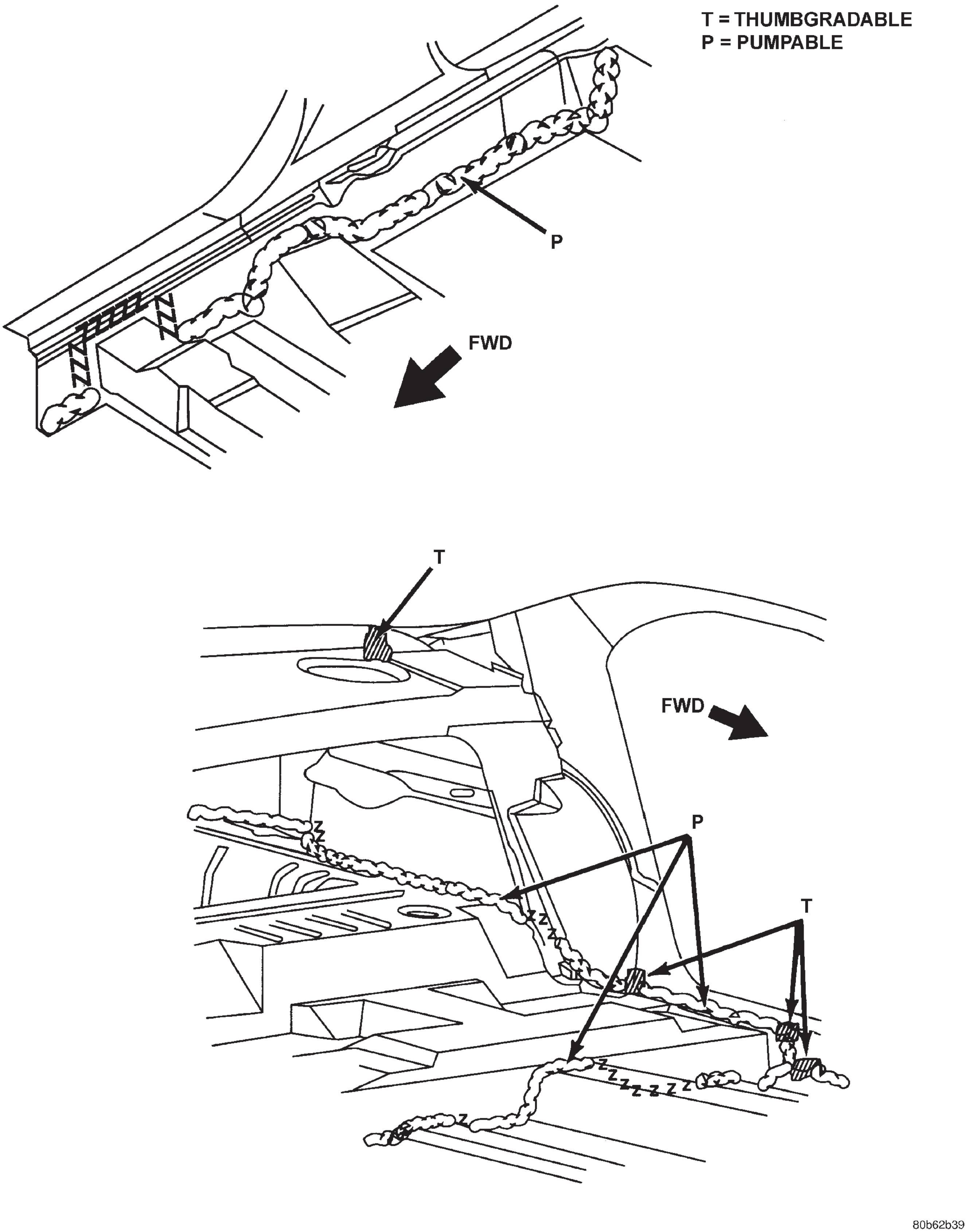


BODY SIDE APERTURE



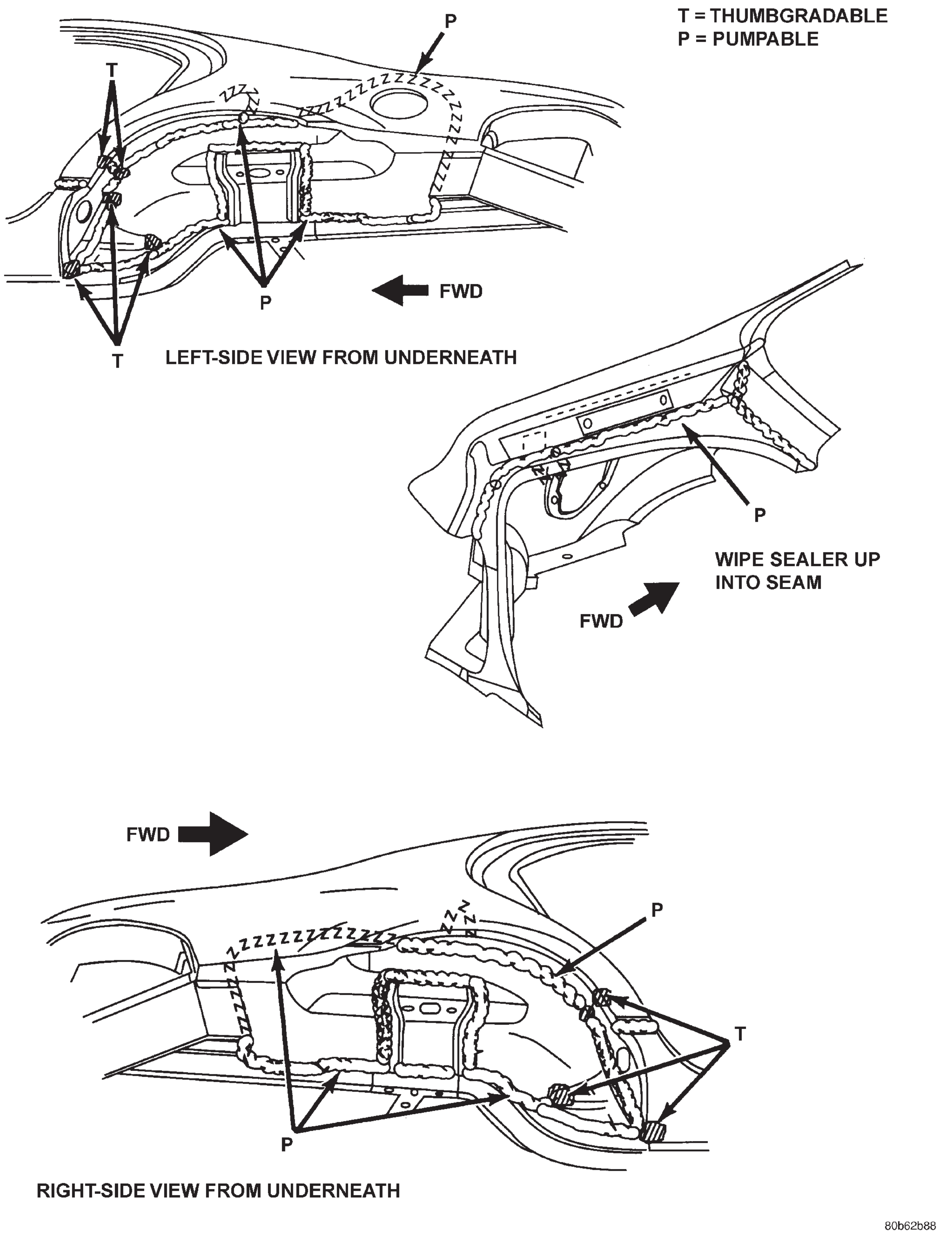
SPECIFICATIONS (Continued)

FLOOR PAN



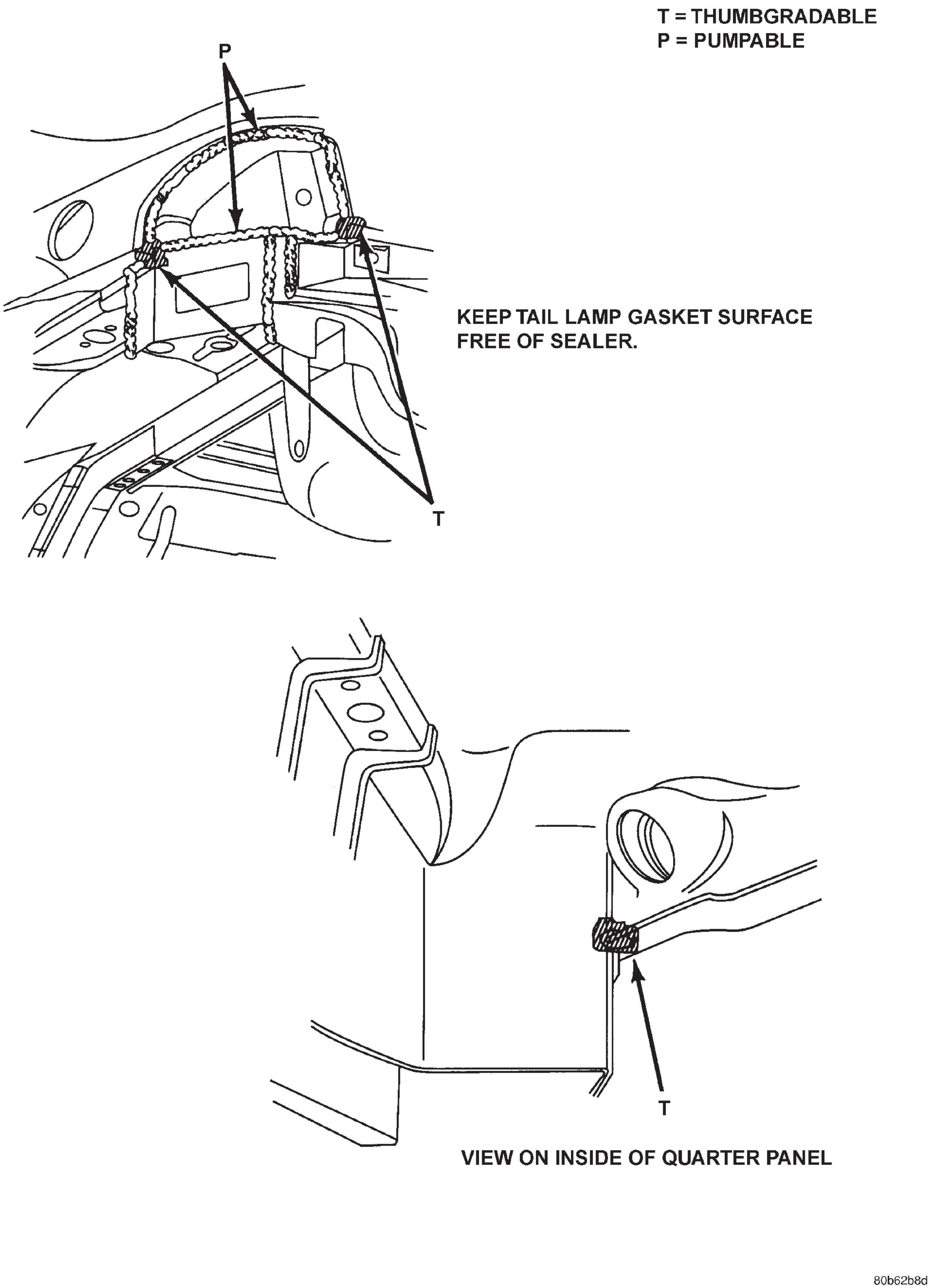
SPECIFICATIONS (Continued)

INNER WHEELHOUSE AND REAR QUARTER PANEL



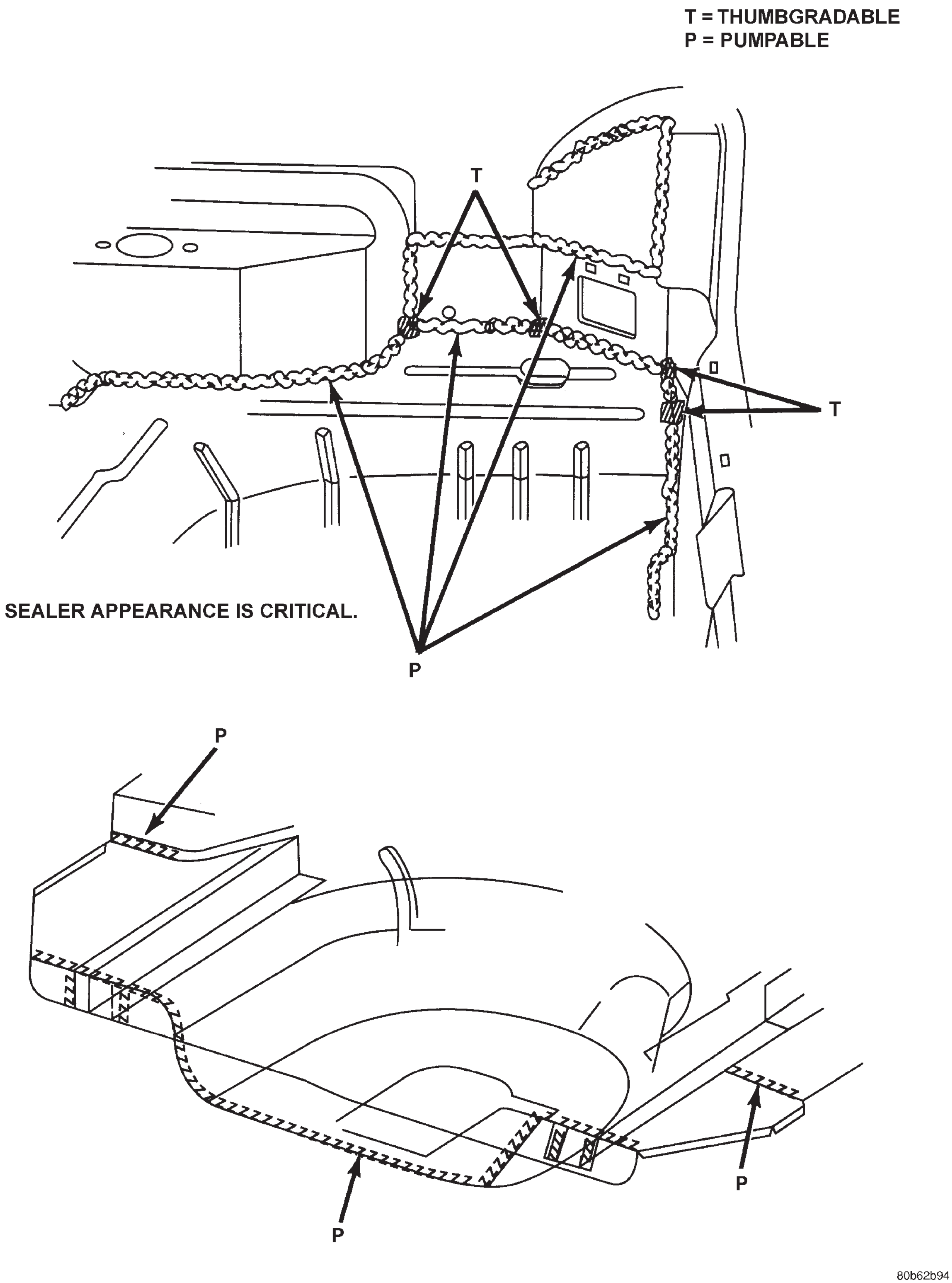
SPECIFICATIONS (Continued)

REAR QUARTER PANEL AND TAIL LIGHT AREA



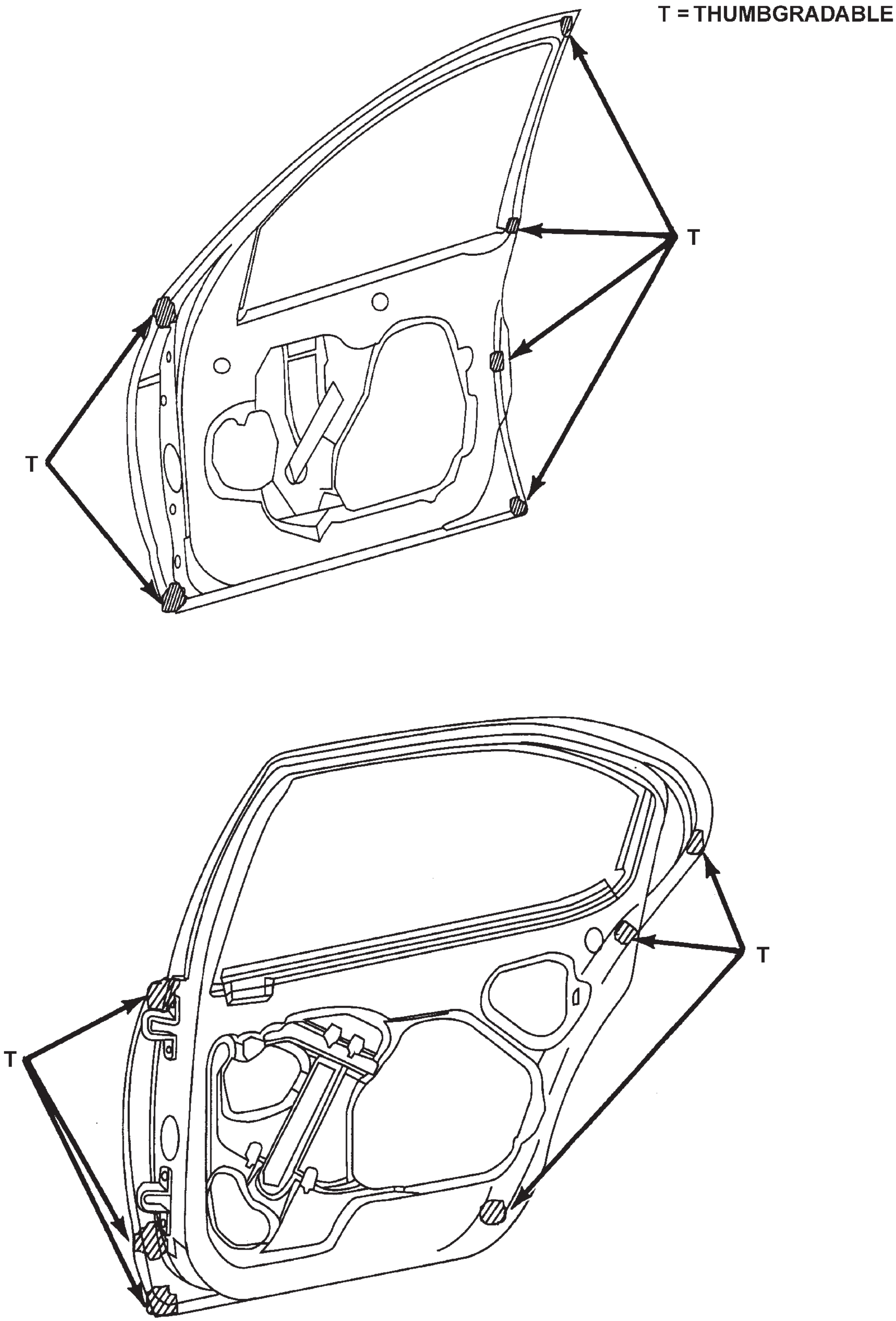
SPECIFICATIONS (Continued)

TRUNK FLOOR AREA



SPECIFICATIONS (Continued)

FRONT AND REAR DOORS



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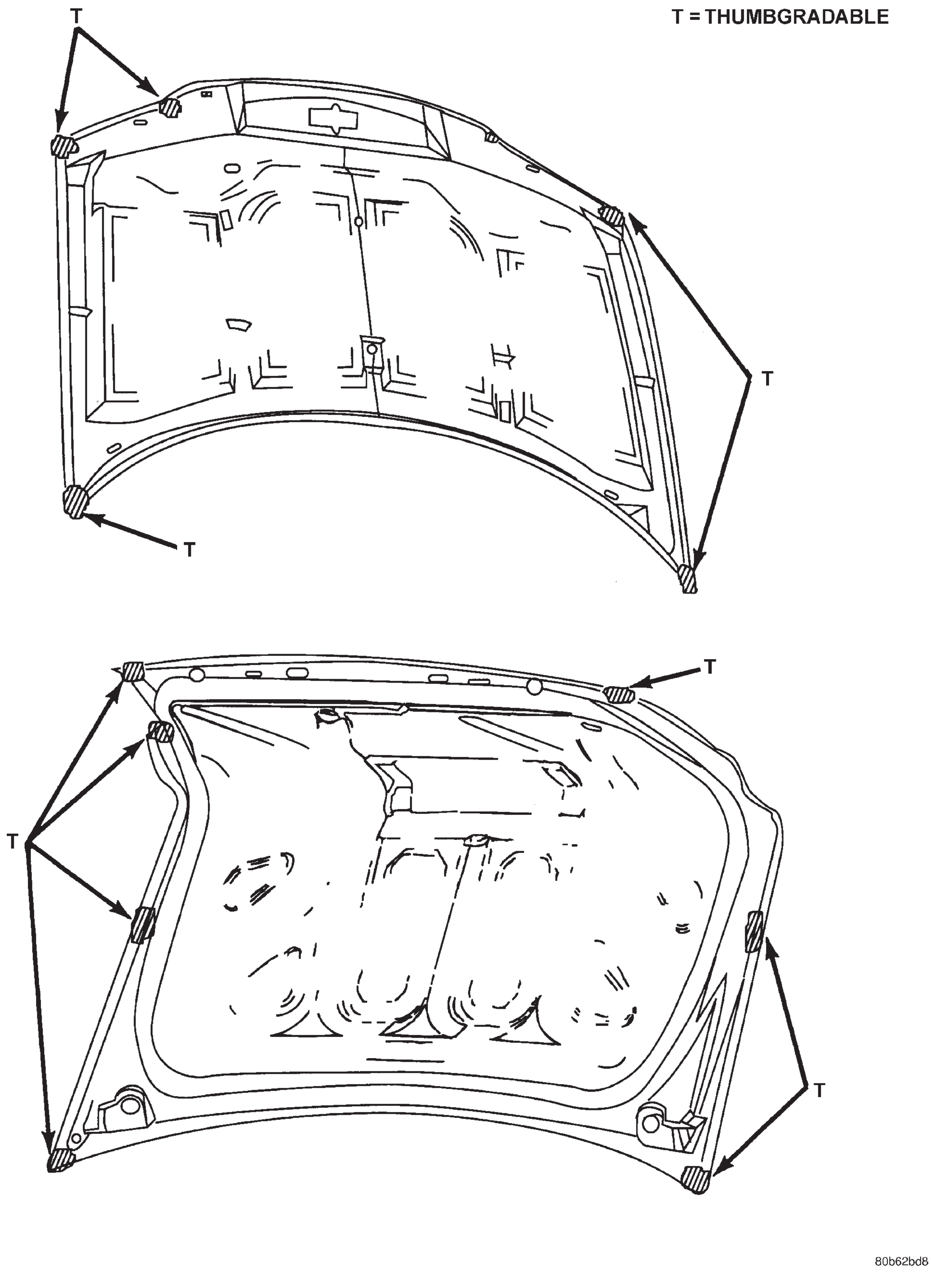
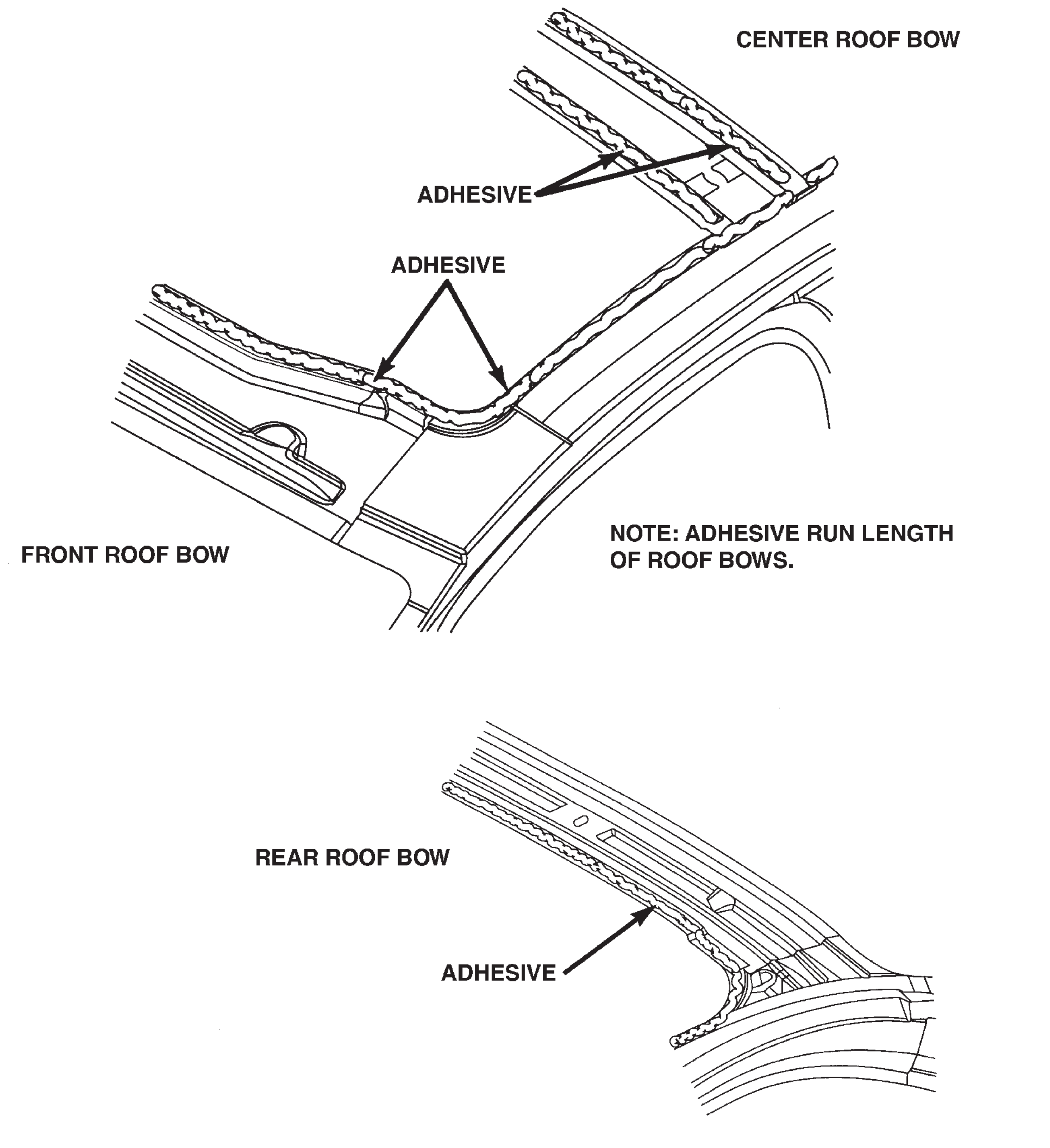
SPECIFICATIONS (Continued)

HOOD AND DECKLID



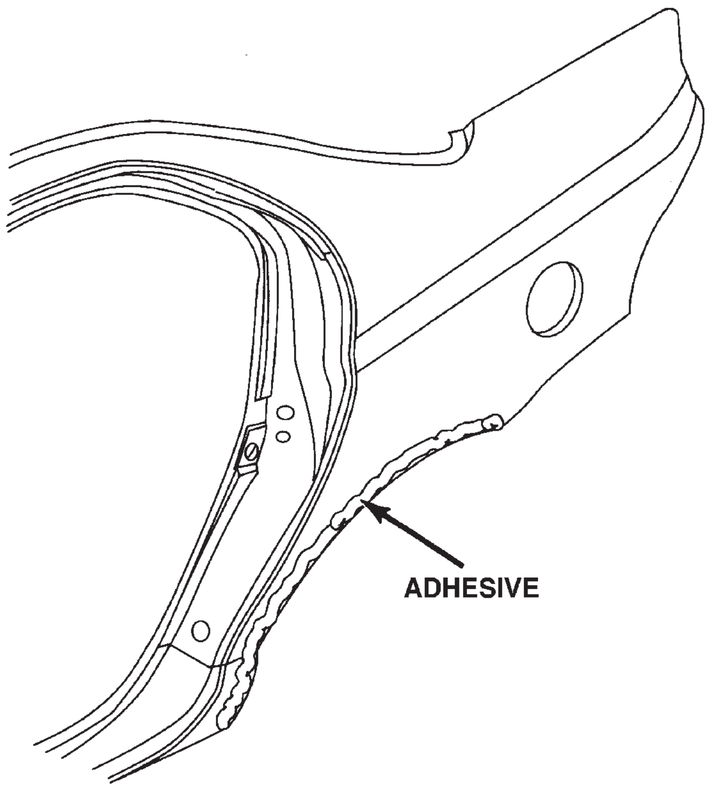
SPECIFICATIONS (Continued)

ROOF BOWS



SPECIFICATIONS (Continued)

QUARTER PANEL



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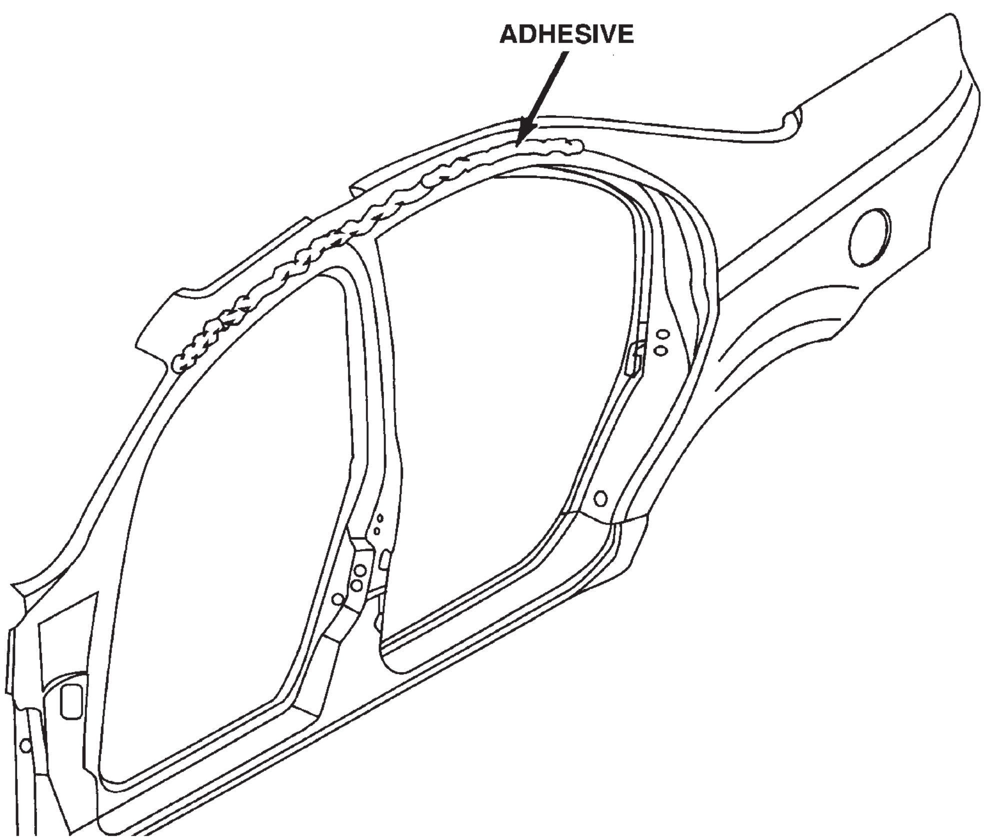
DRIP RAIL



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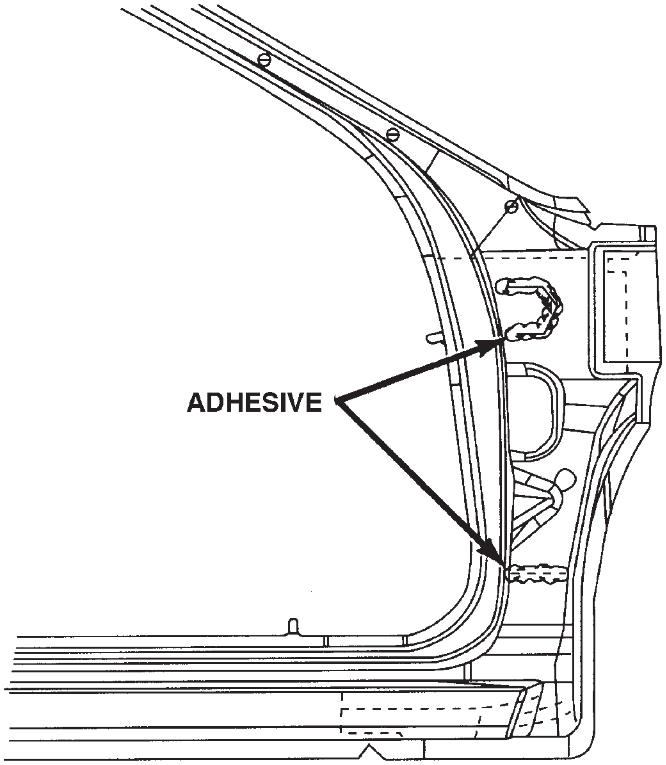
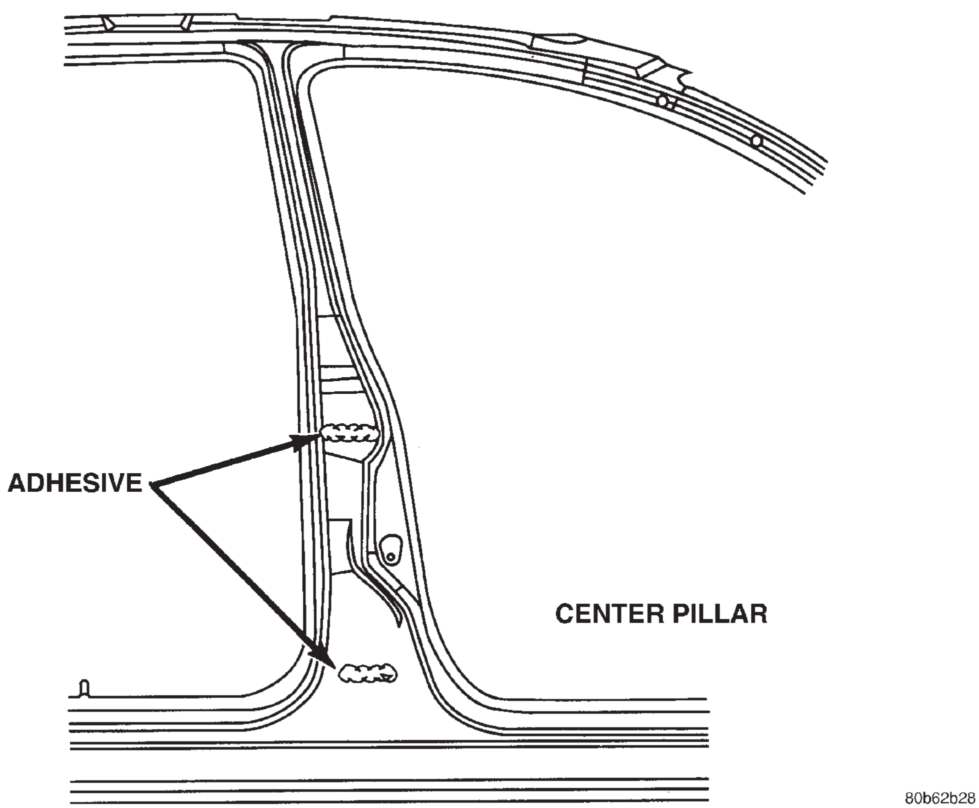
SPECIFICATIONS (Continued)

PILLARS

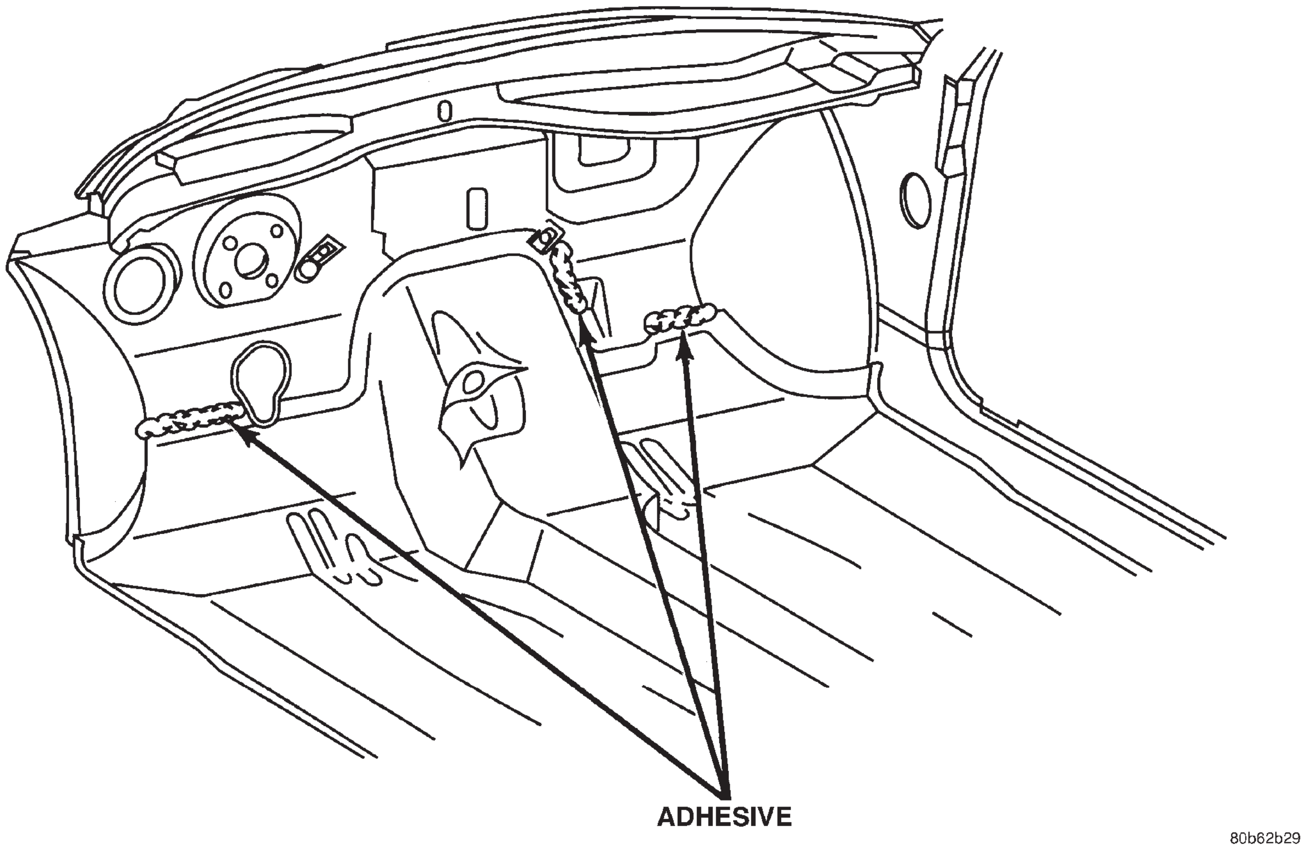


FRONT HINGE PILLAR

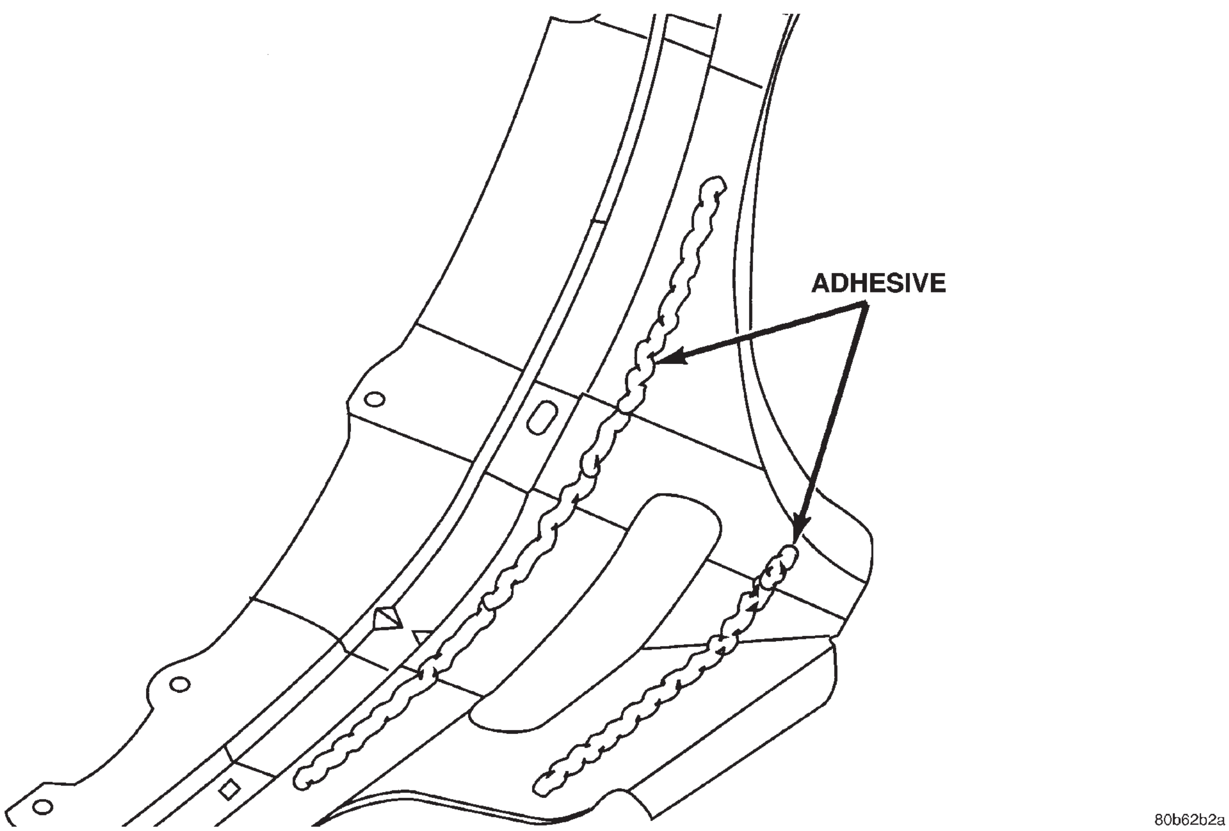


SPECIFICATIONS (Continued)

INSTRUMENT PANEL

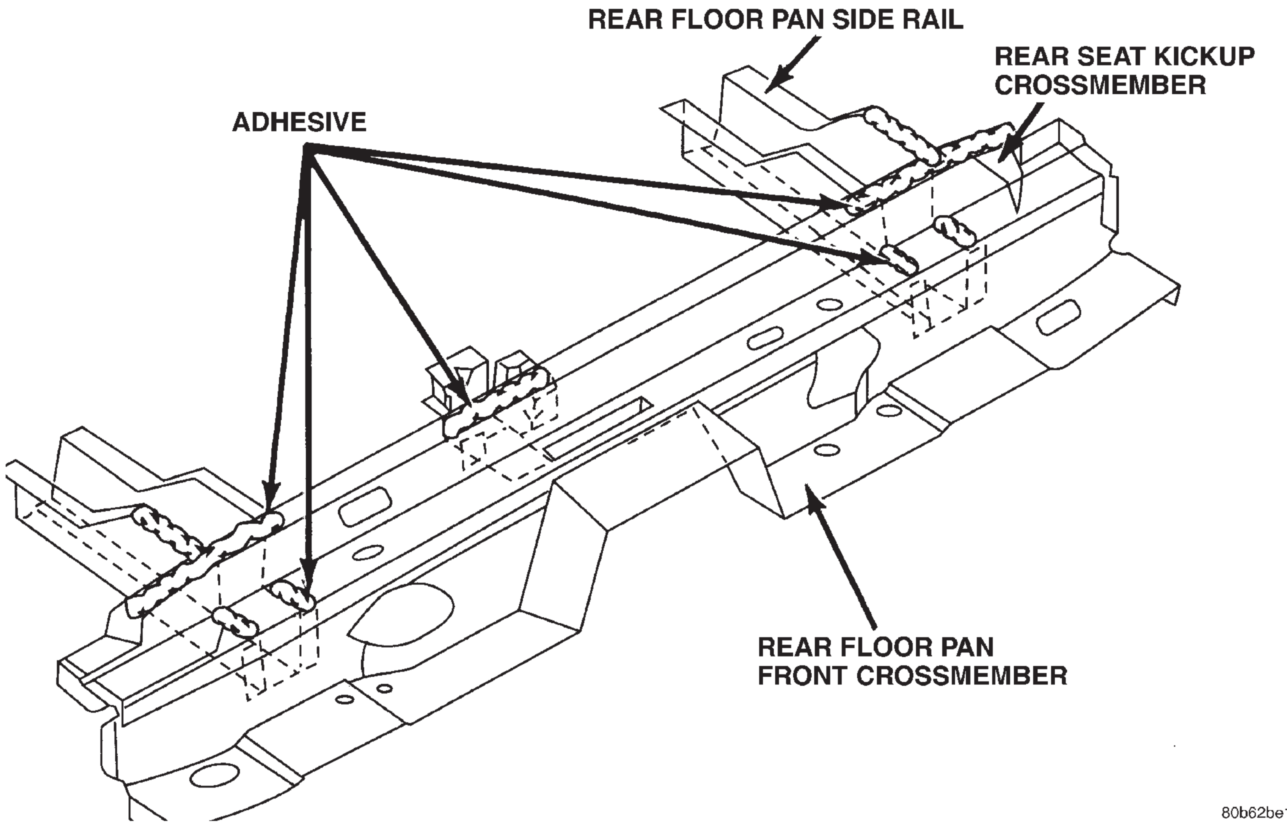


FRONT SIDE RAIL REAR CAP



SPECIFICATIONS (Continued)

REAR RAIL TO REAR SEAT KICK UP CROSSMEMBER



TORQUE SPECIFICATIONS

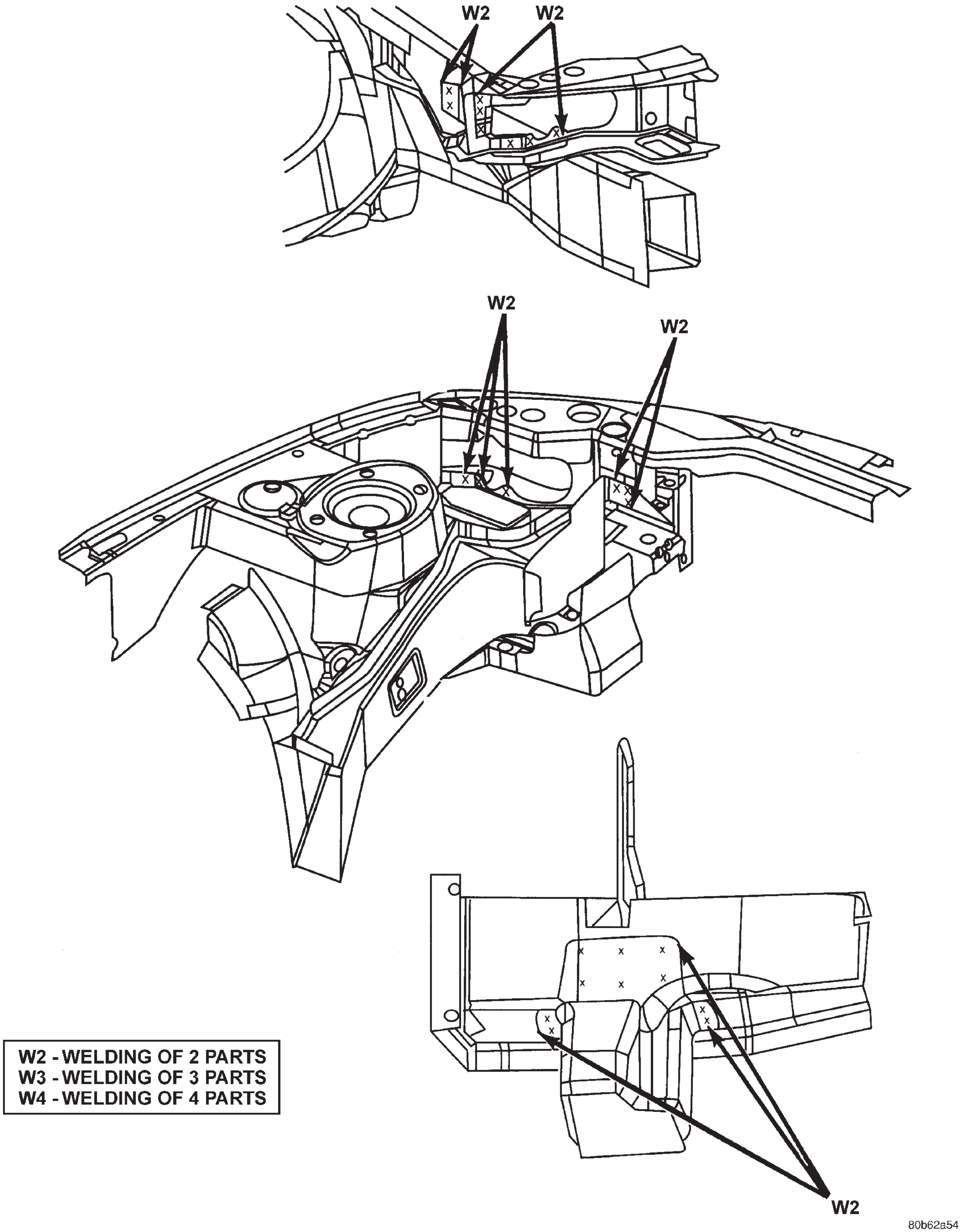
BODY COMPONENTS

DESCRIPTION	TORQUE
Front seat track to floor pan bolts	61 N·m (45 ft. lbs.)
Front seat inboard pivot bolt	40 N·m (30 ft. lbs.)
Front seat recliner to seat cushion frame	12 N·m (9 ft. lbs.)
Front seat track to cushion frame bolt	12 N·m (9 ft. lbs.)
Front seat back	40 N·m (30 ft. lbs.)
Front seat back recliner to seat back	12 N·m (9 ft. lbs.)
Front seat belt buckle anchor nut	40 N·m (29 ft. lbs.)
Front seat belt retractor bolt	38 N·m (28 ft. lbs.)
Front seat belt buckle anchor bolt	40 N·m (29 ft. lbs.)
Front door hinge to hinge pillar bolt	28 N·m (21 ft. lbs.)
Front door hinge to door nuts and bolt	28 N·m (21 ft. lbs.)
Front door latch striker	28 N·m (20 ft. lbs.)
Front seat rear outboard seat track to floor pan bolts	28 N·m (20 ft. lbs.)
Decklid latch striker	22 N·m (16 ft. lbs.)
Rear door glass to regulator bolt	11 N·m (105 in. lbs.)
Rear door hinge to B-pillar bolt	28 N·m (20 ft. lbs.)
Rear door hinge to door bolt	28 N·m (20 ft. lbs.)
Rear door latch striker	28 N·m (20 ft. lbs.)
Sunroof module to roof panel	11 N·m (97 in. lbs.)

WELD LOCATIONS

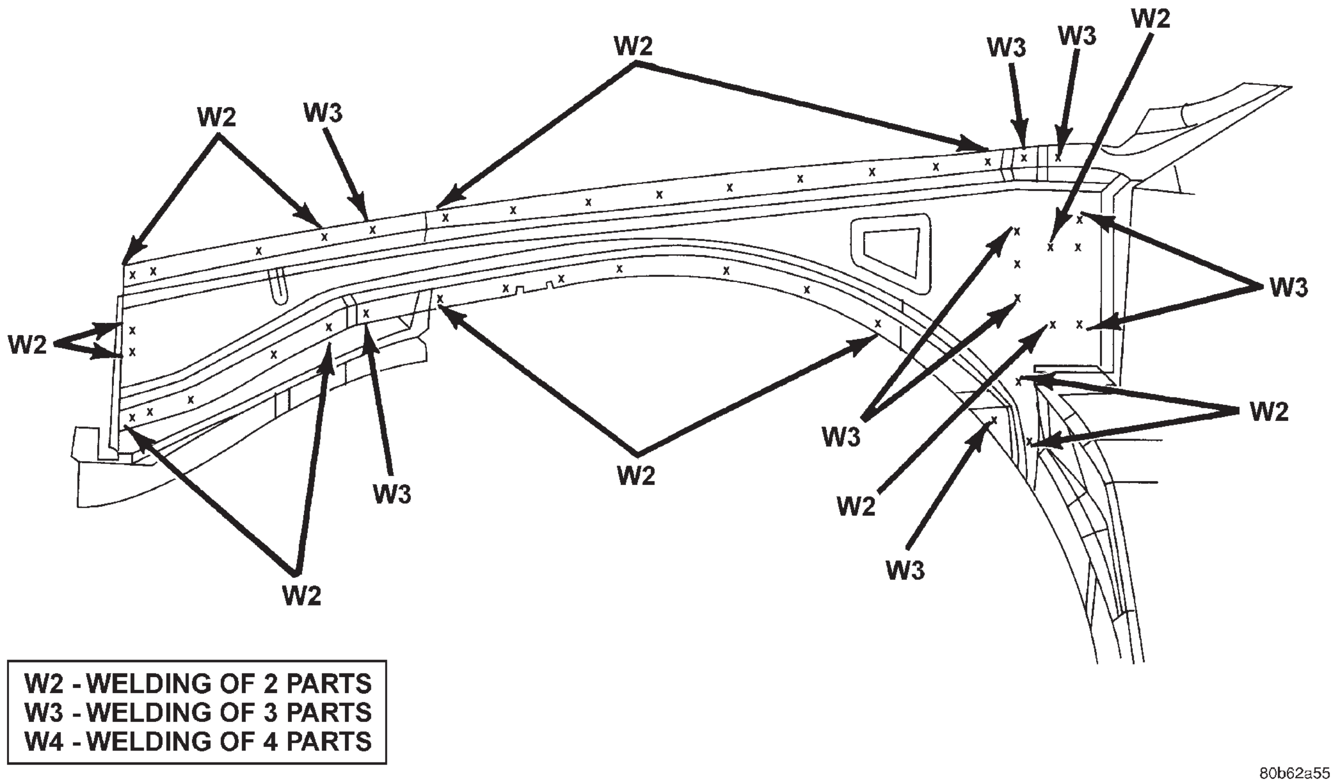
SPECIFICATIONS (Continued)

HEADLAMP AND RADIATOR SUPPORTS



SPECIFICATIONS (Continued)

UPPER LOAD PATH BEAM – OUTER



SPECIFICATIONS (Continued)

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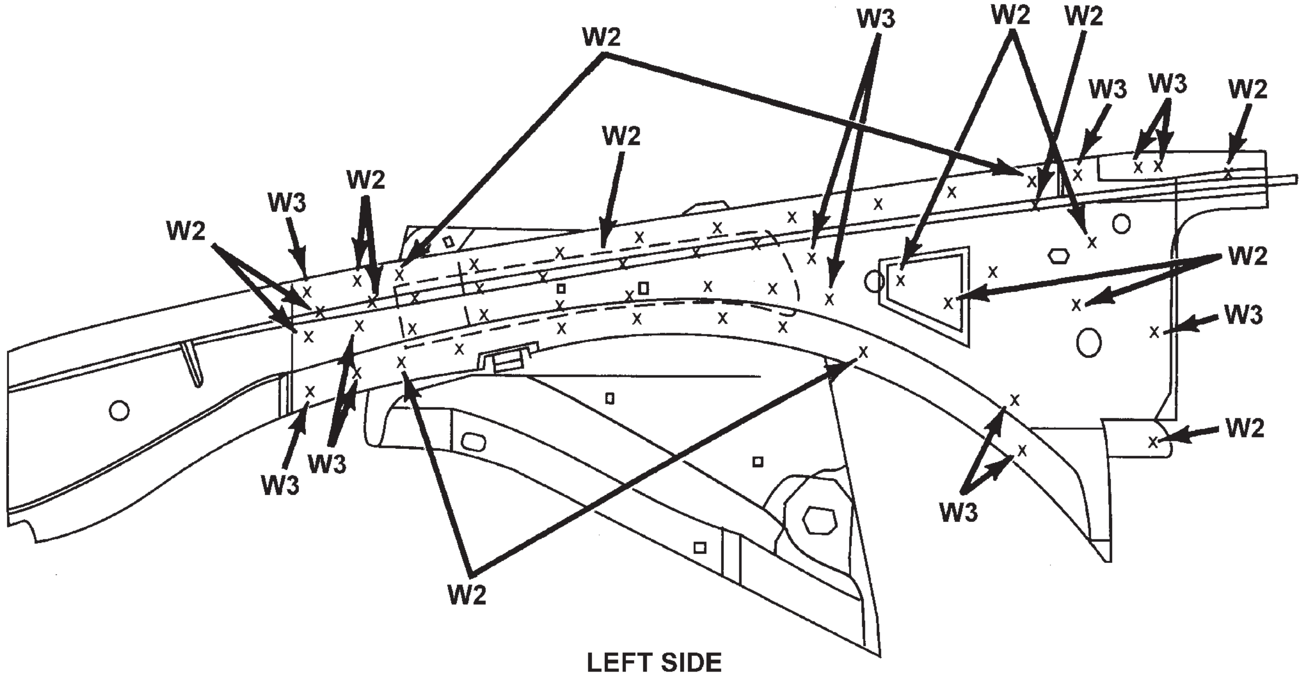
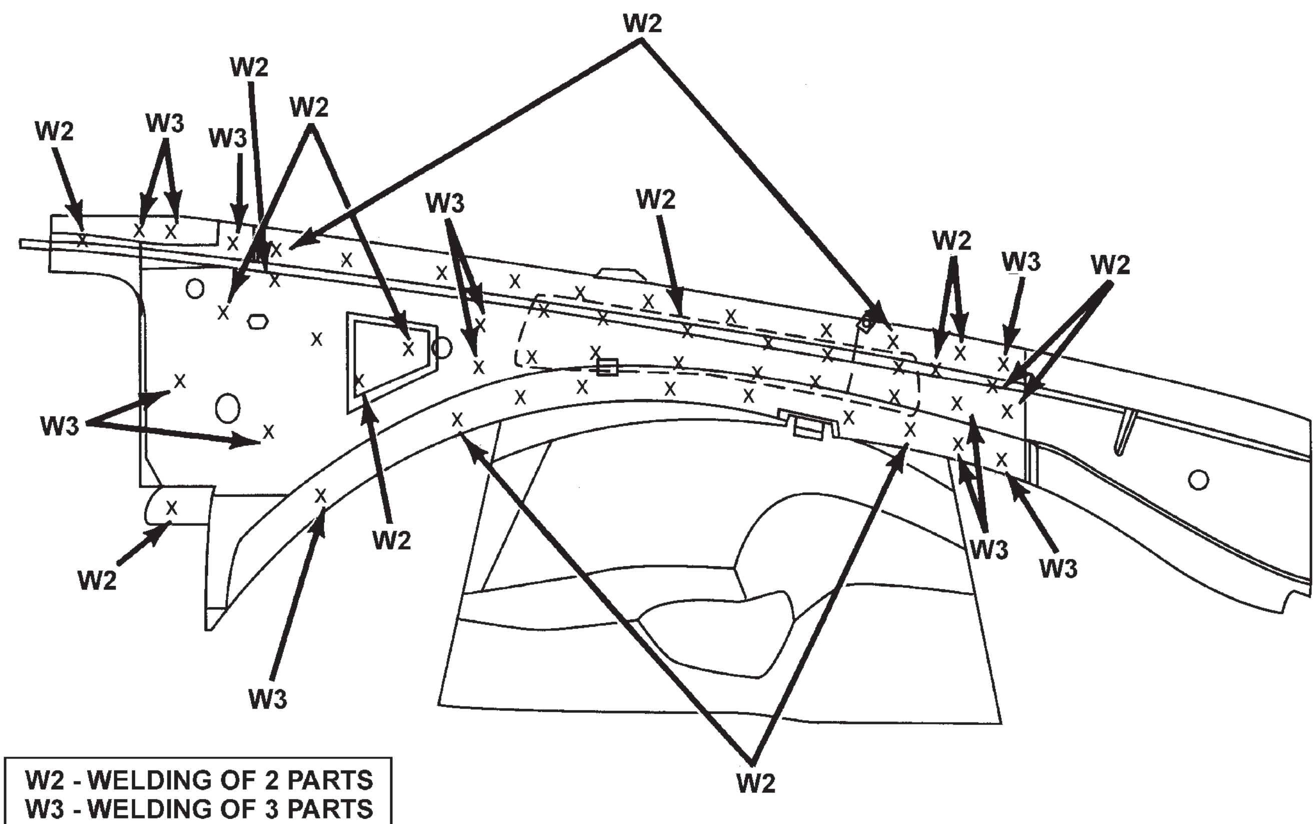


LEFT SIDE



RIGHT SIDE

W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

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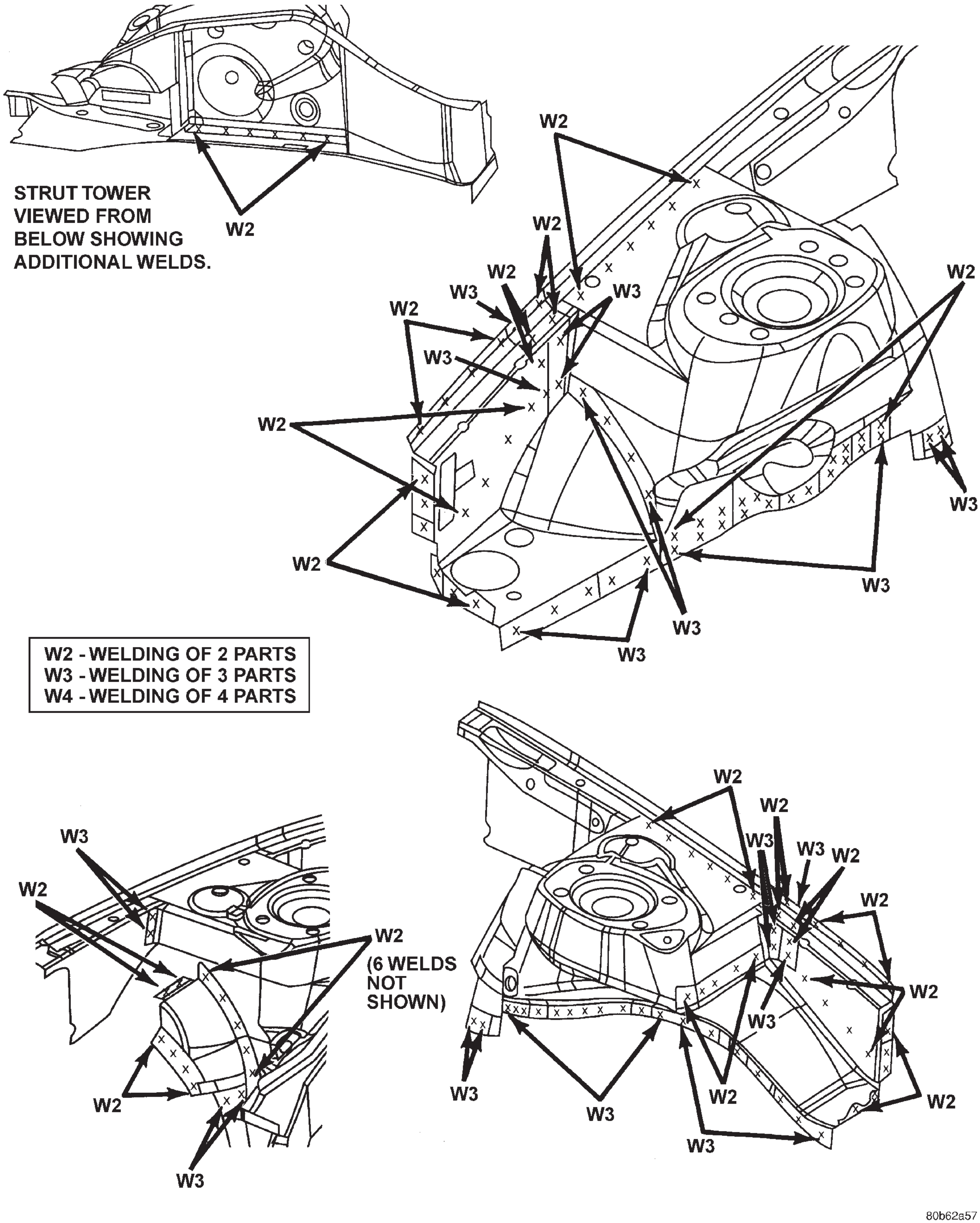
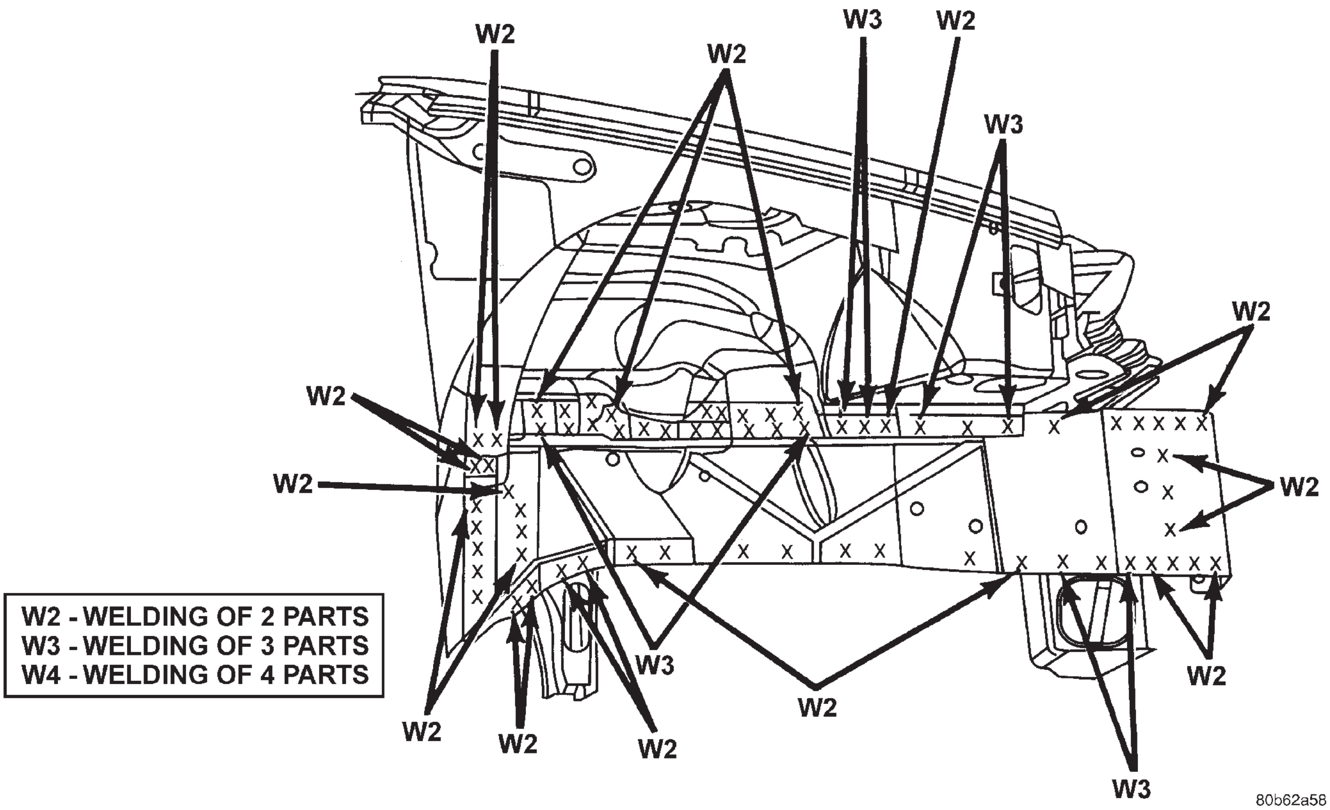
SPECIFICATIONS (Continued)

FRONT SIDE SHIELD AND STRUT TOWER



SPECIFICATIONS (Continued)

FRONT LOWER SIDE RAIL AND EXTENSION



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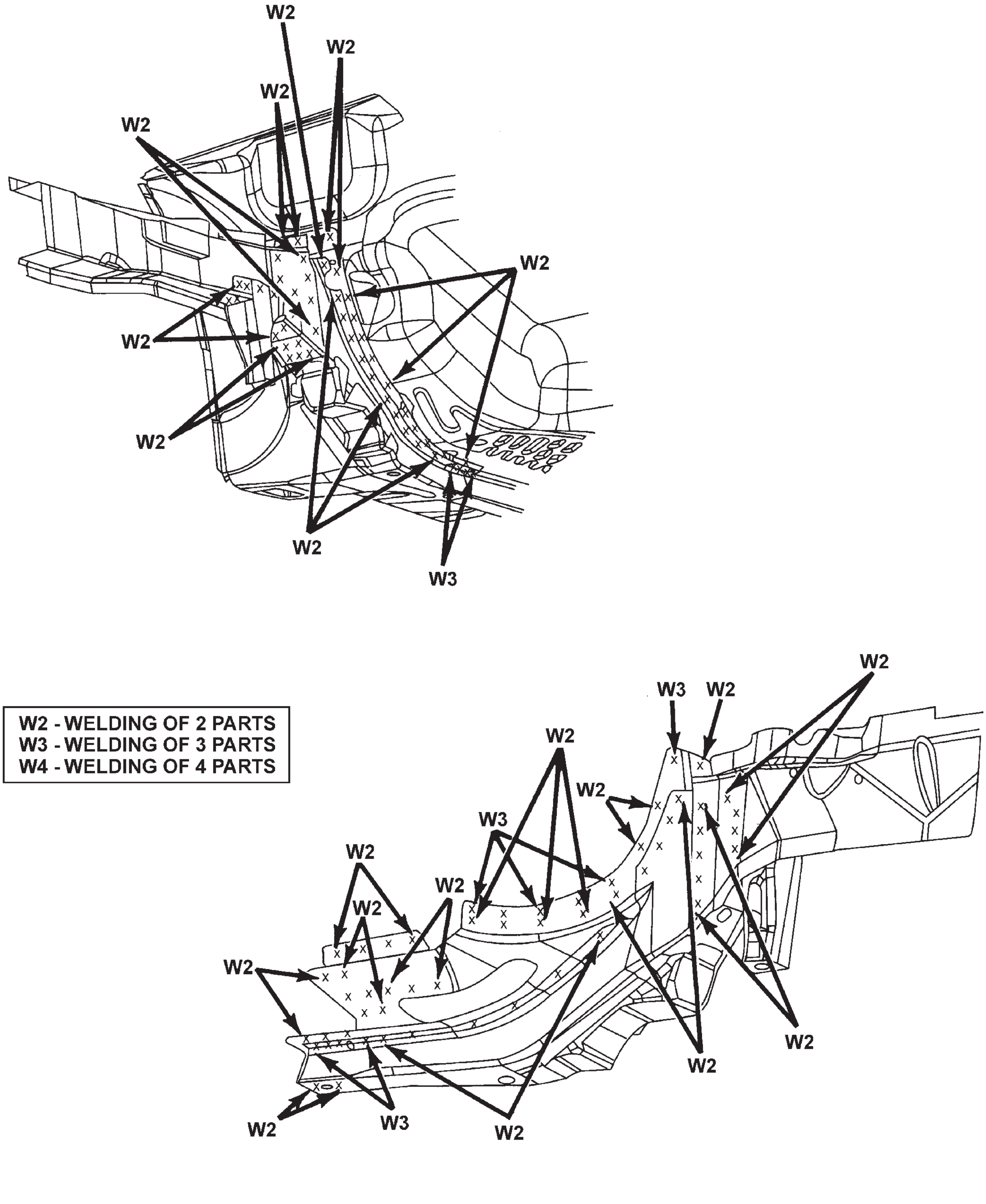

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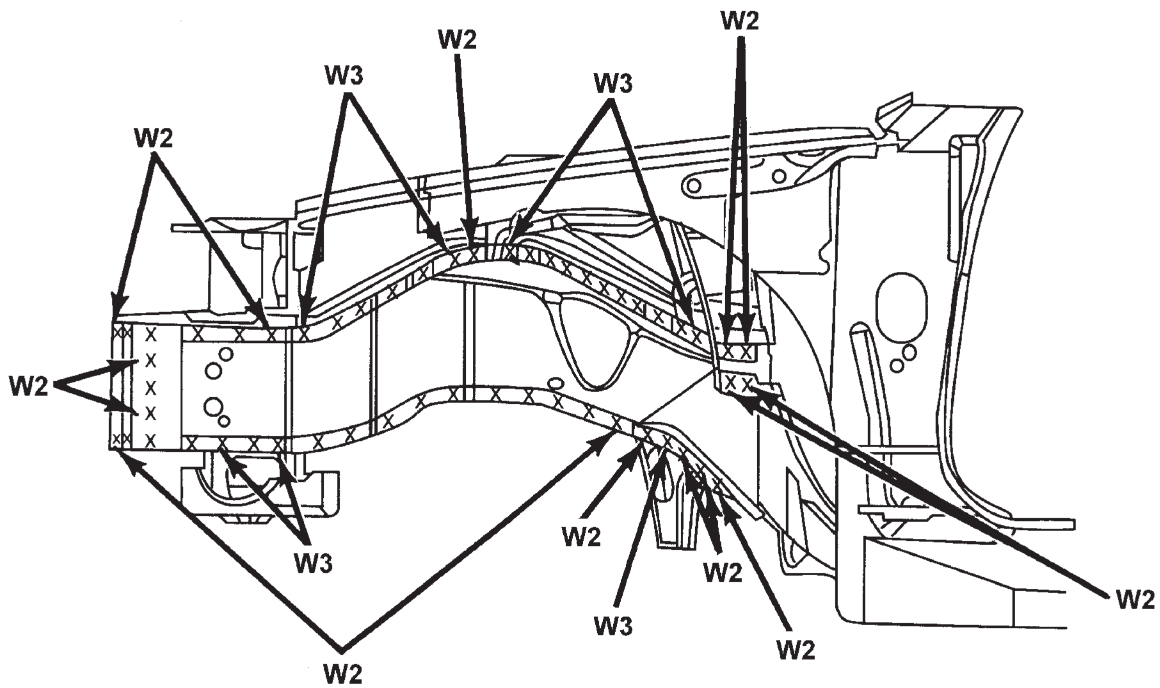

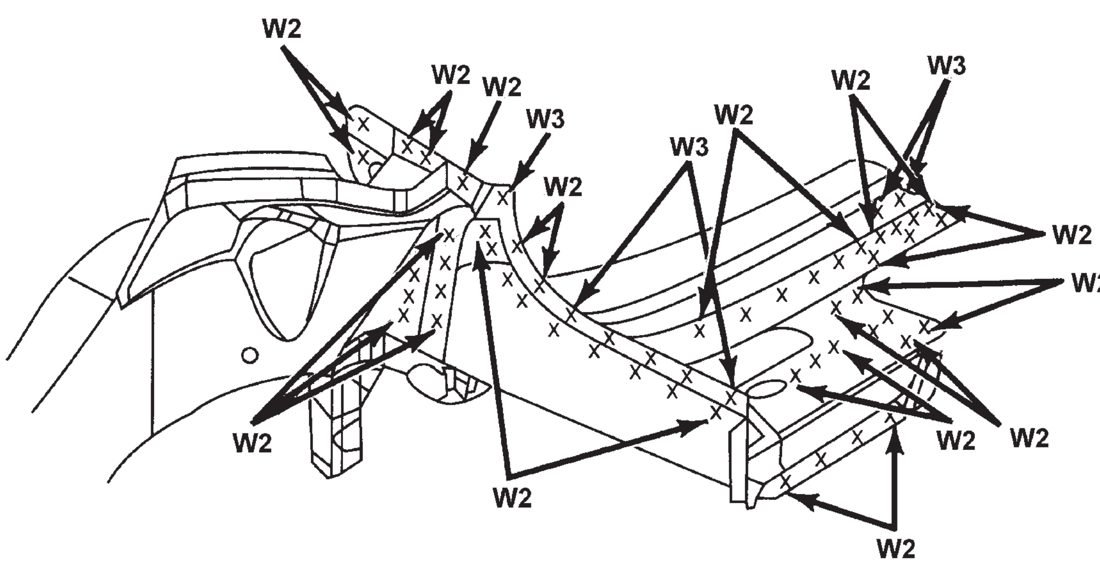

W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

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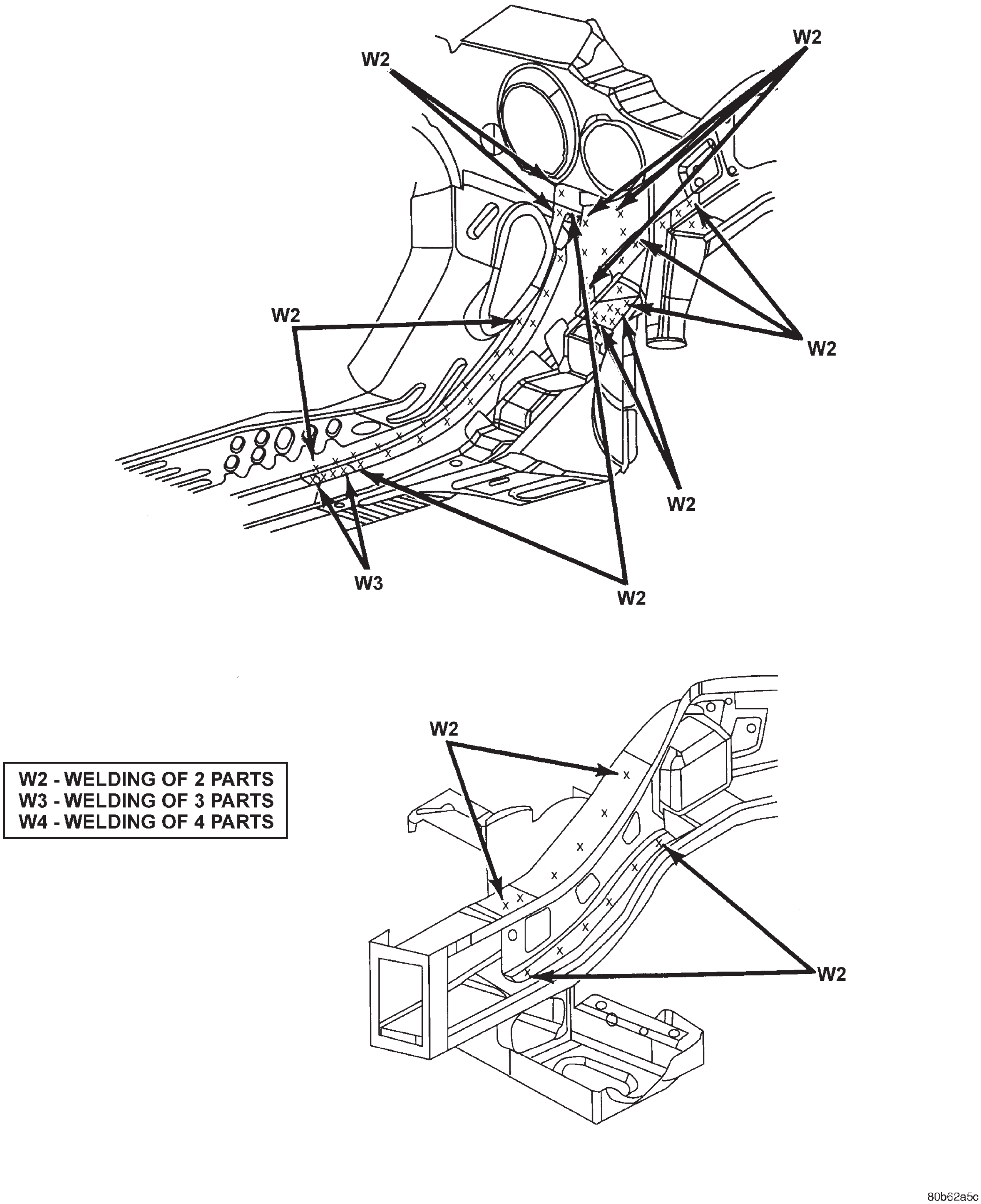
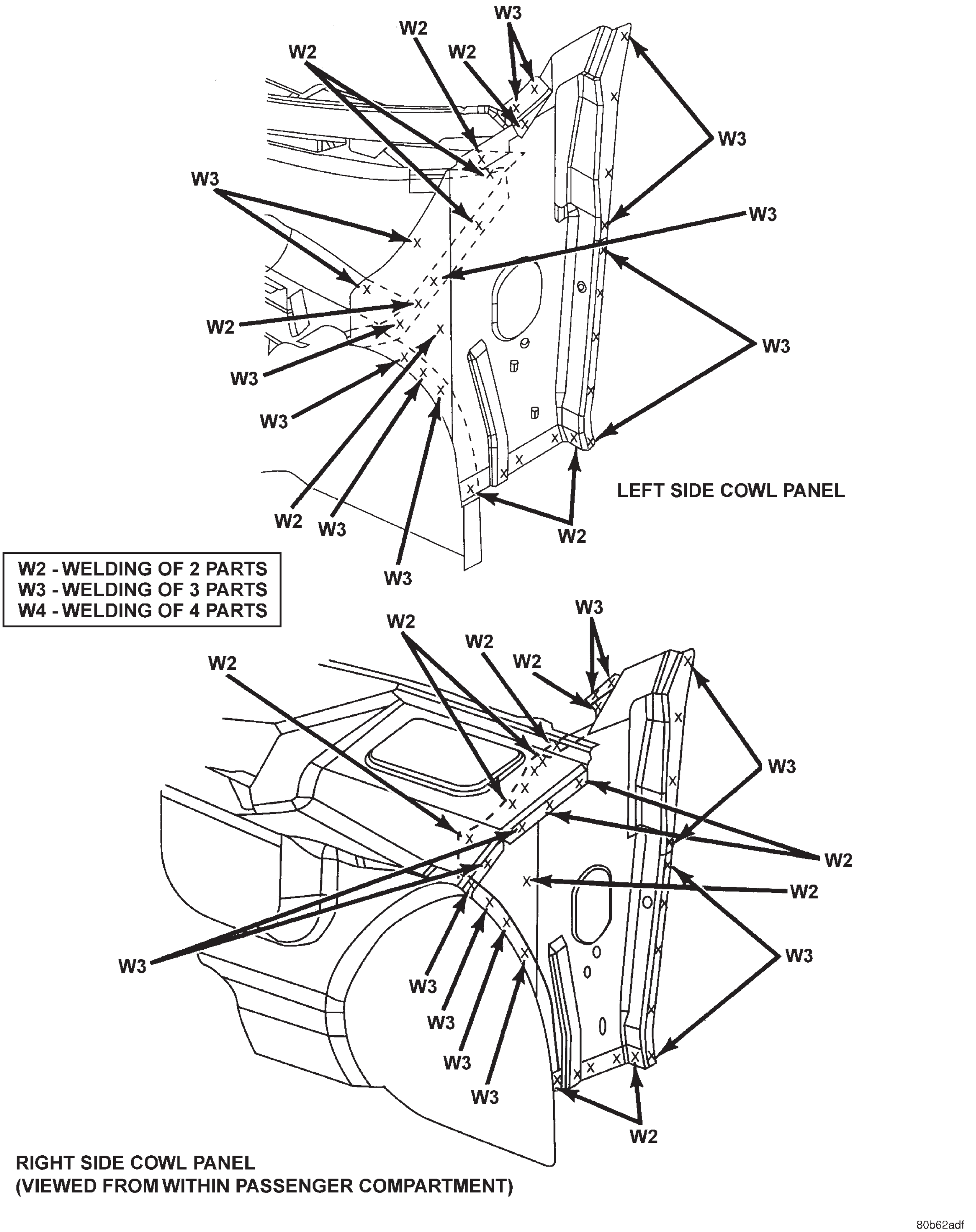
SPECIFICATIONS (Continued)

FRONT LOWER SIDE RAIL AND EXTENSION



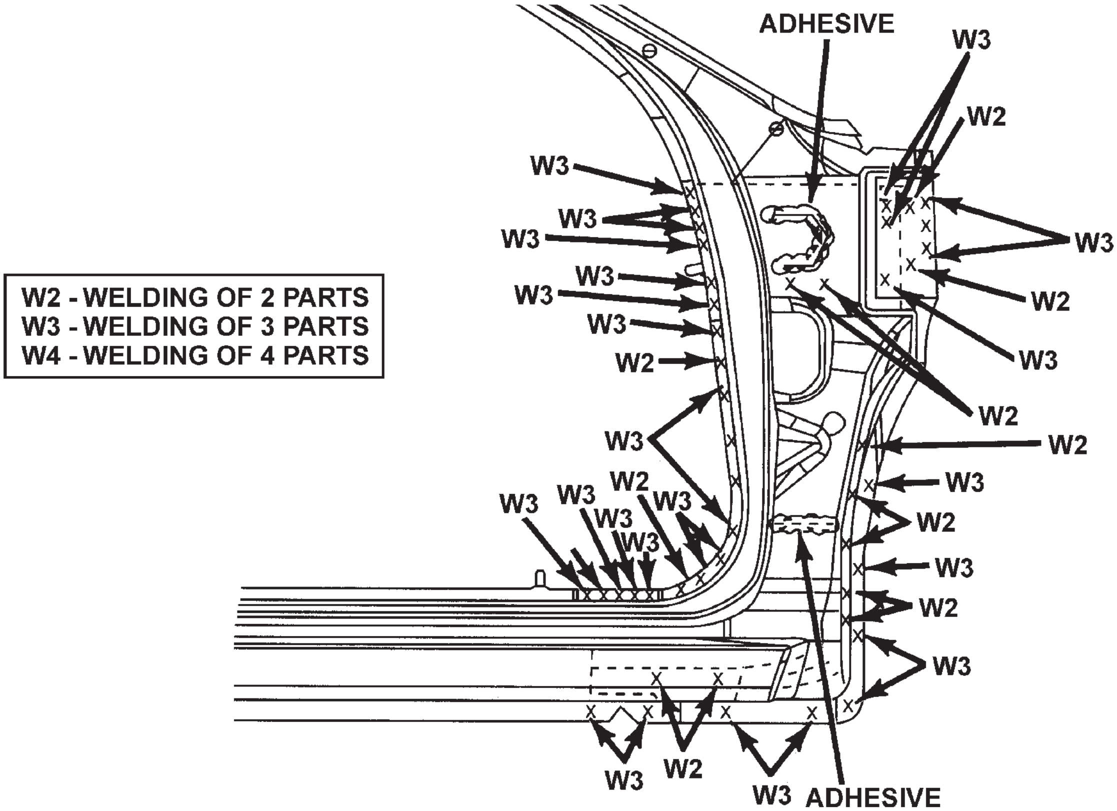
SPECIFICATIONS (Continued)

COWL SIDE PANEL



SPECIFICATIONS (Continued)

FRONT HINGE PILLAR



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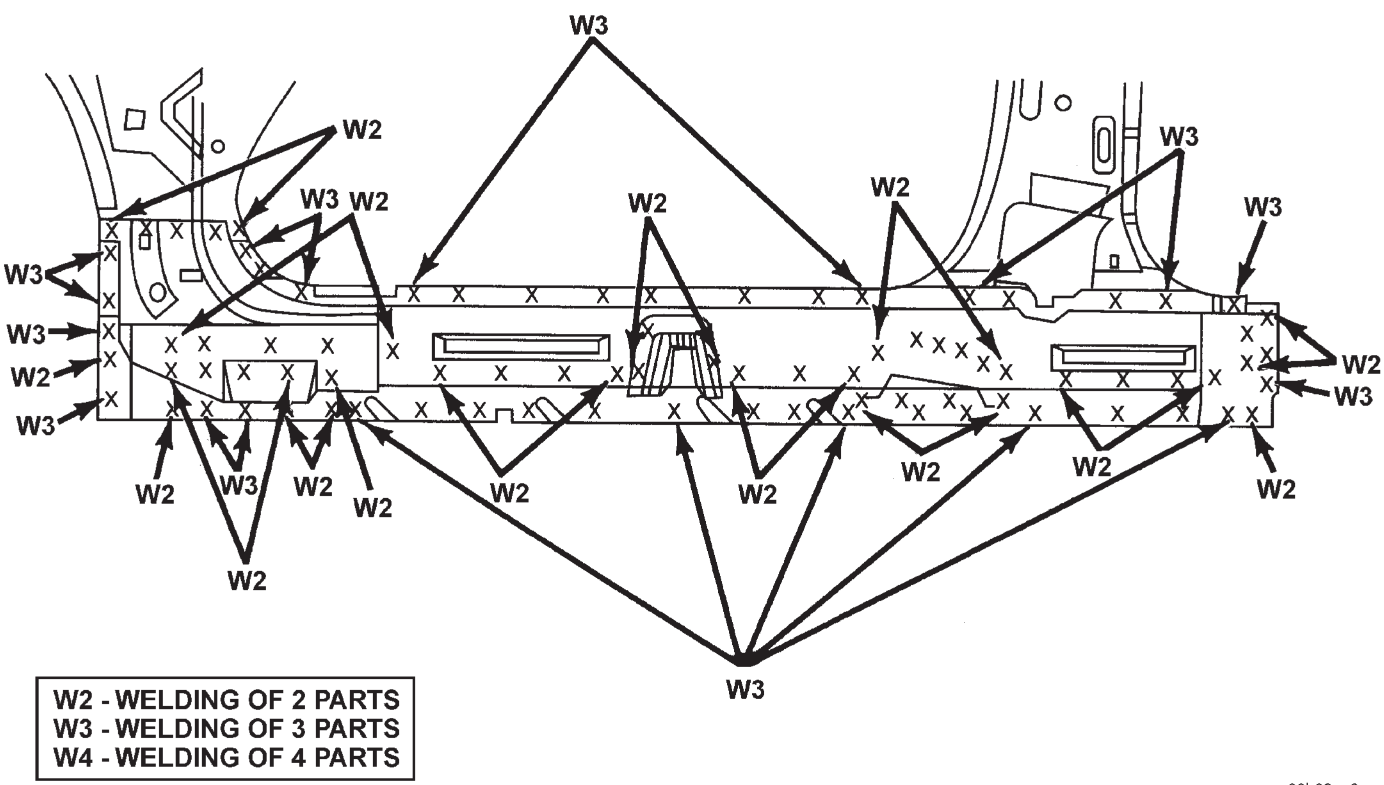
SIDE SILL – INNER



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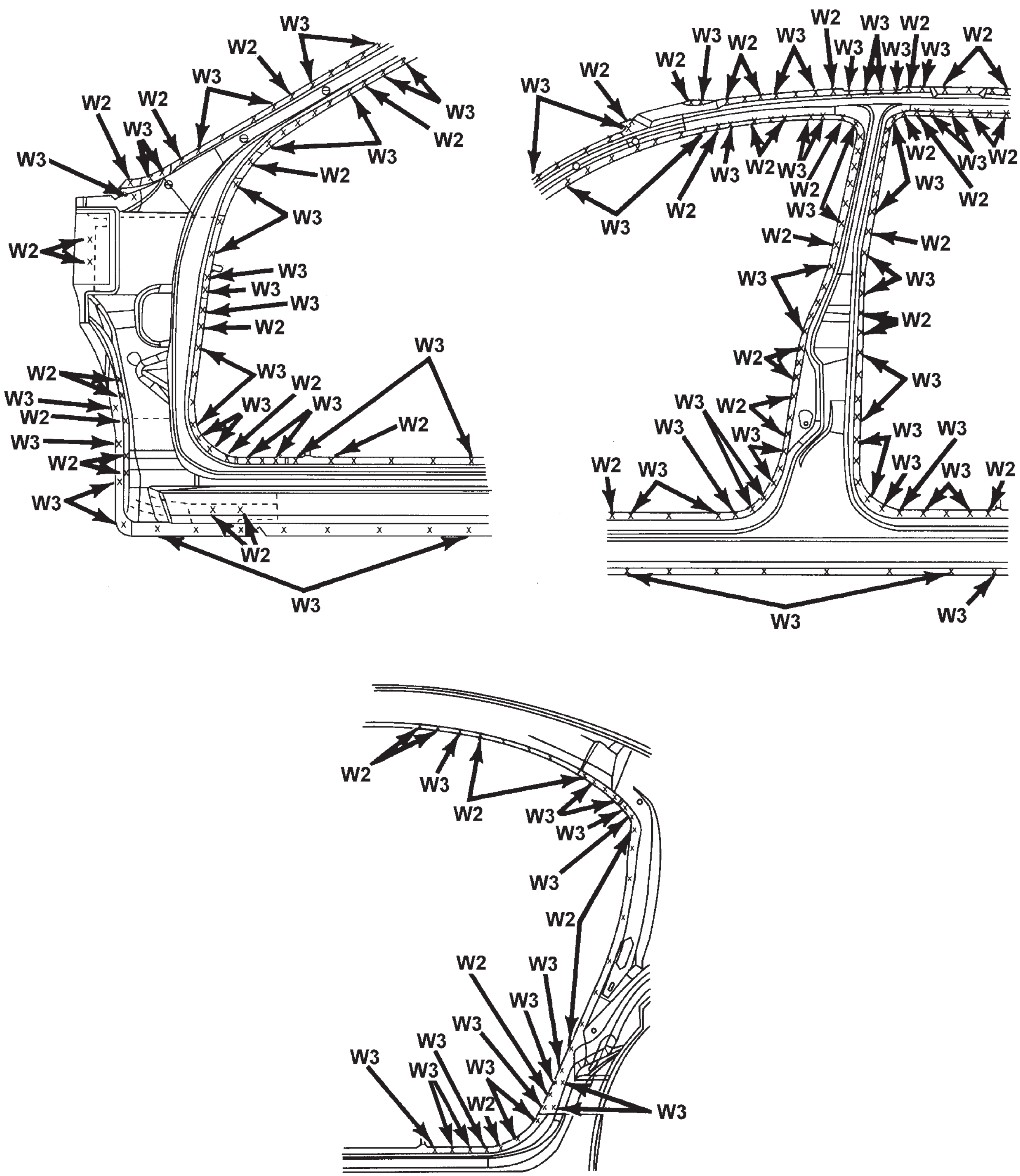
SPECIFICATIONS (Continued)

SIDE APERTURE



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

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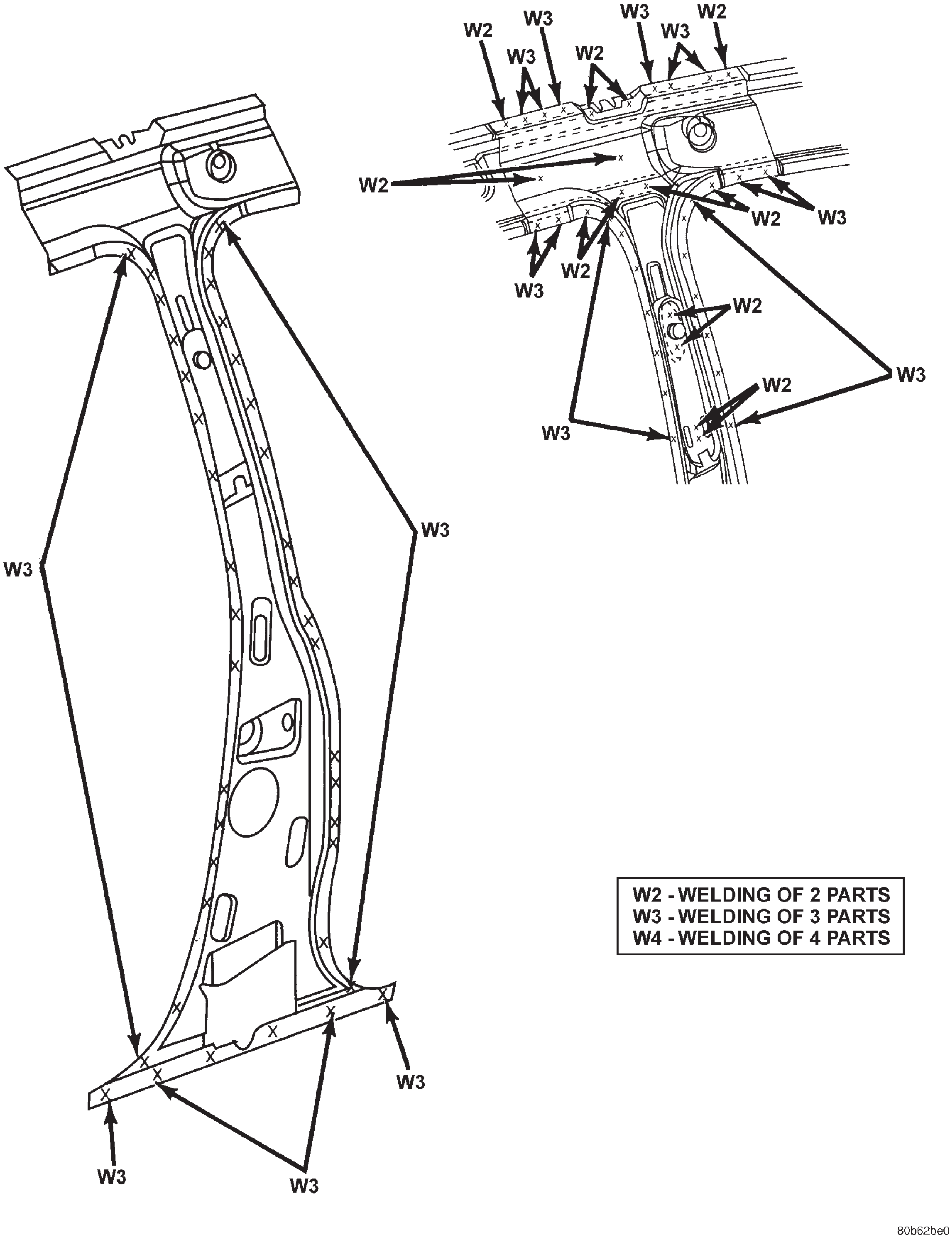
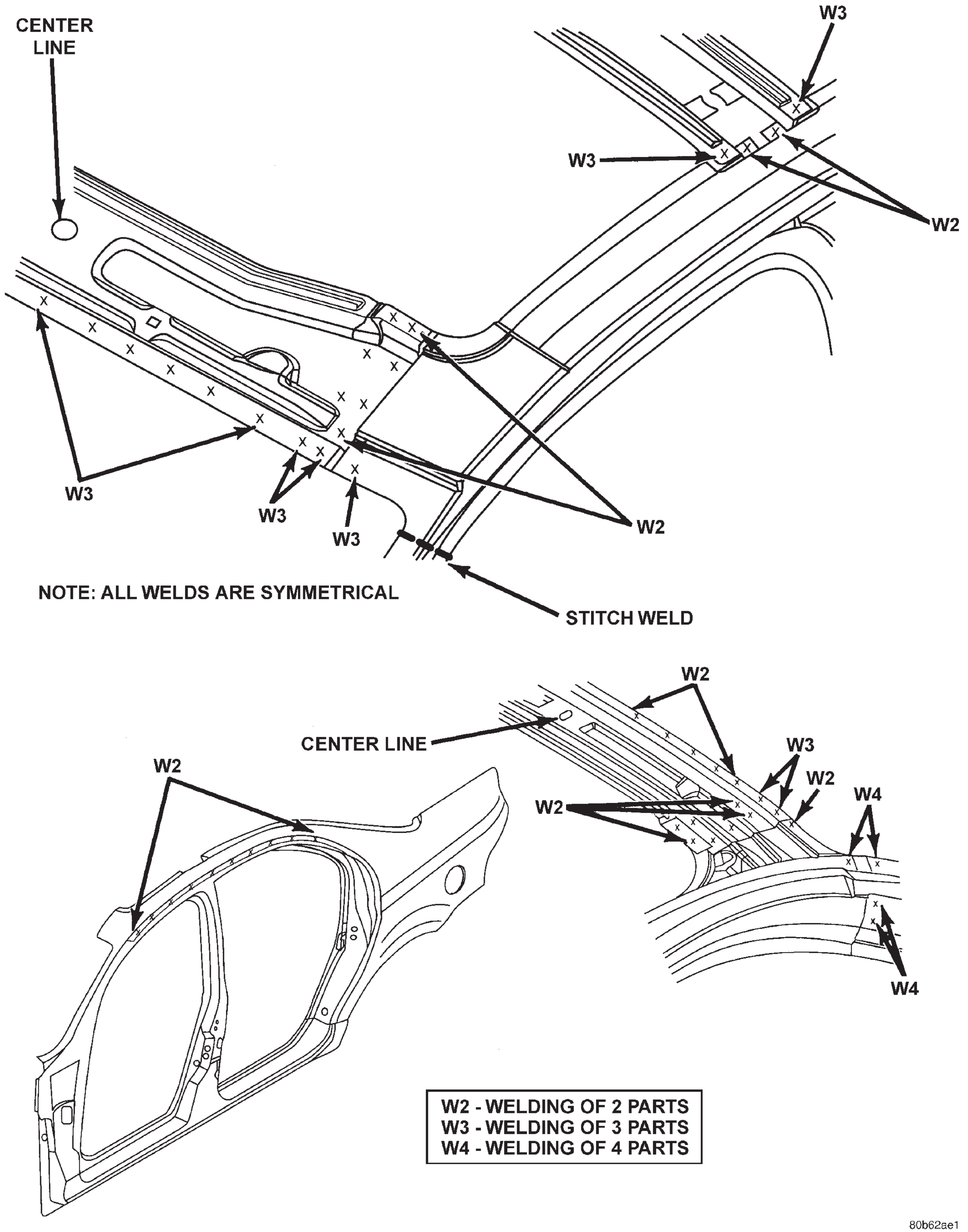
SPECIFICATIONS (Continued)

CENTER PILLAR



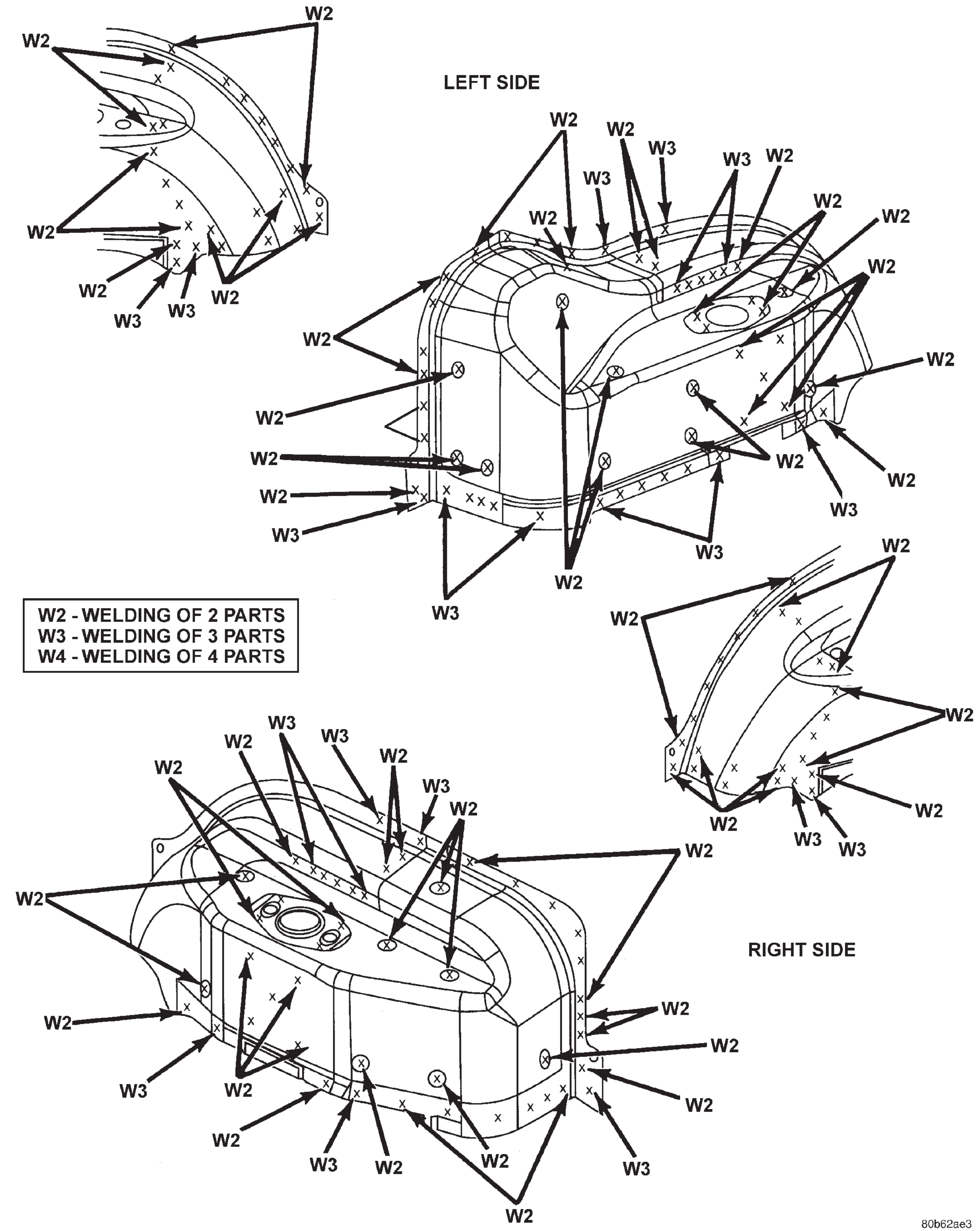
SPECIFICATIONS (Continued)

ROOF PANEL AND INNER ROOF RAILS



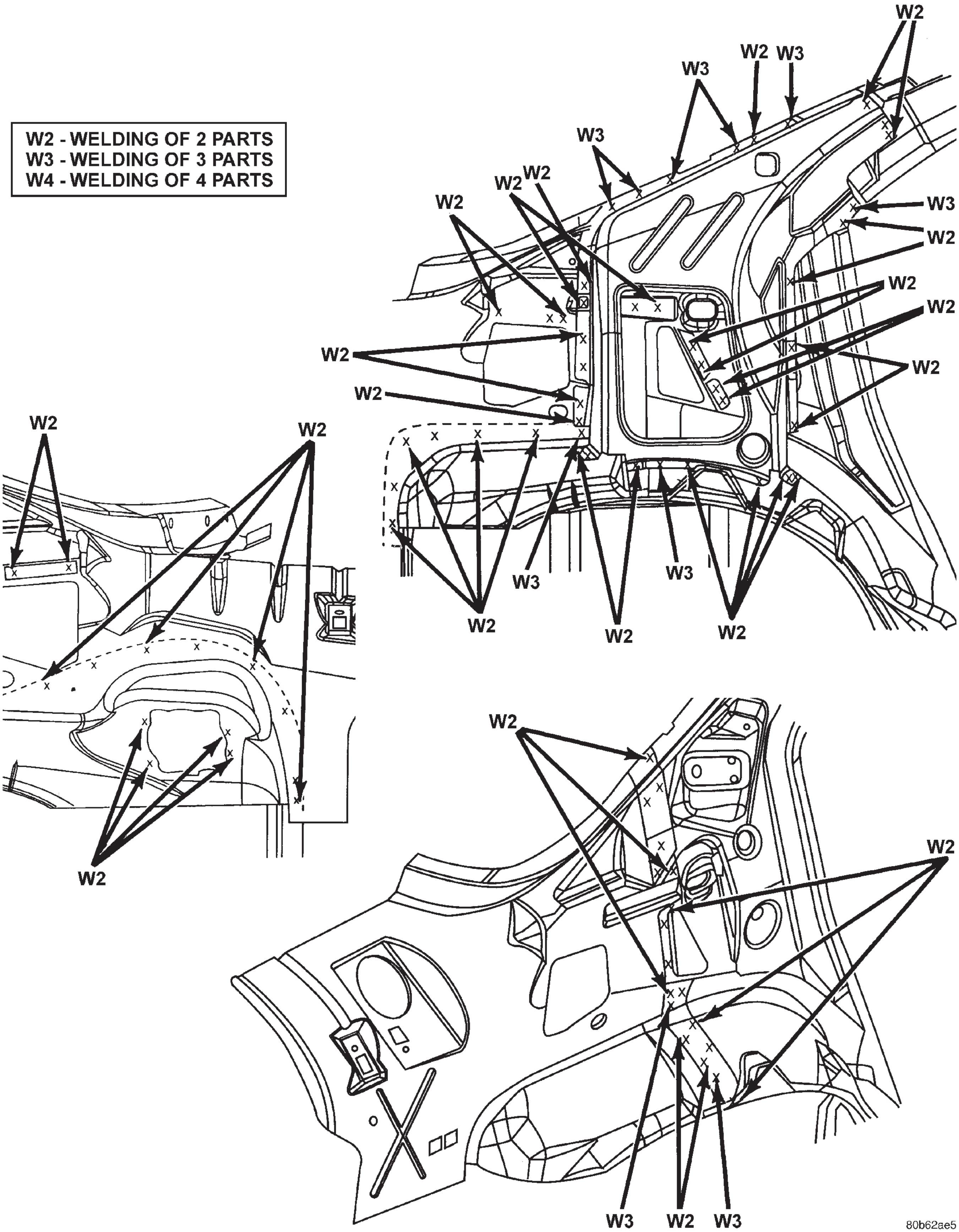
SPECIFICATIONS (Continued)

INNER WHEELHOUSE – REAR



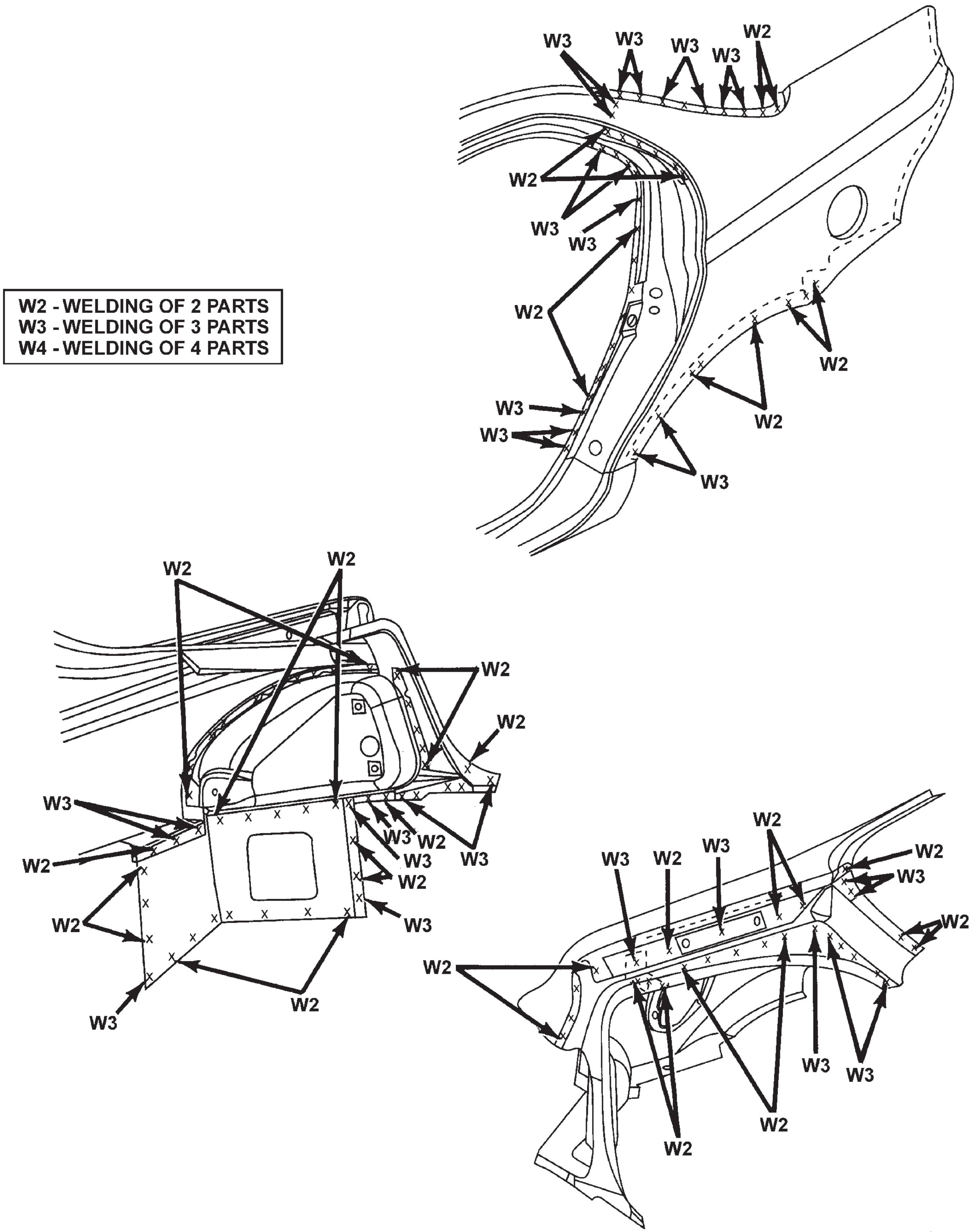
SPECIFICATIONS (Continued)

OUTER WHEELHOUSING – REAR



SPECIFICATIONS (Continued)

QUARTER PANEL



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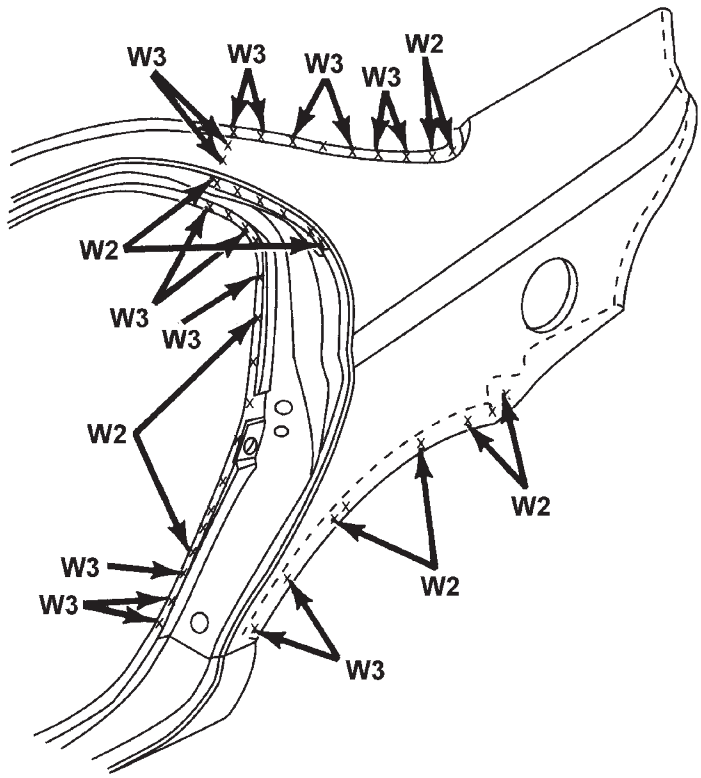
SPECIFICATIONS (Continued)

REAR FRAME RAIL



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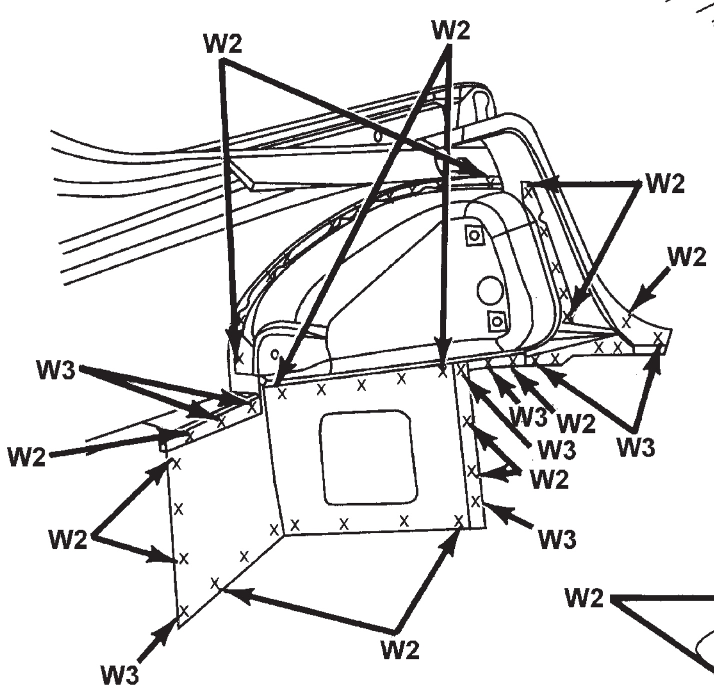
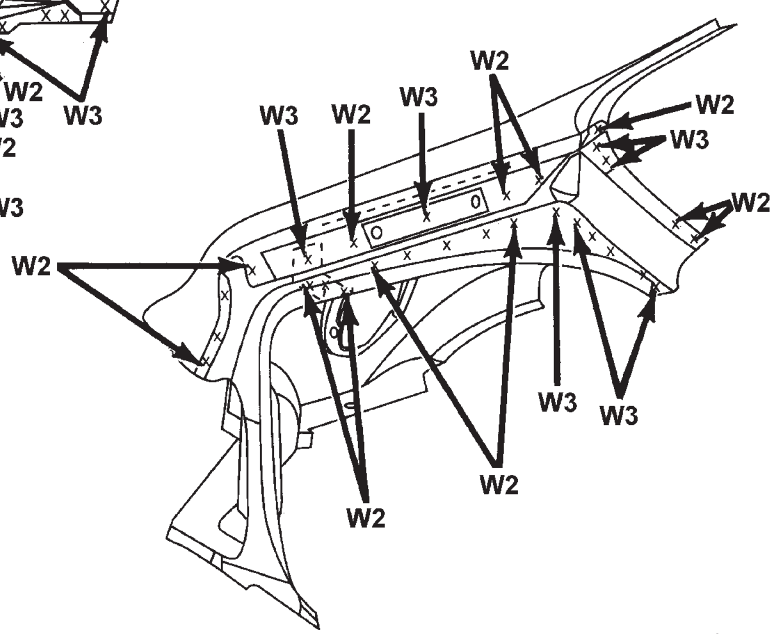
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS





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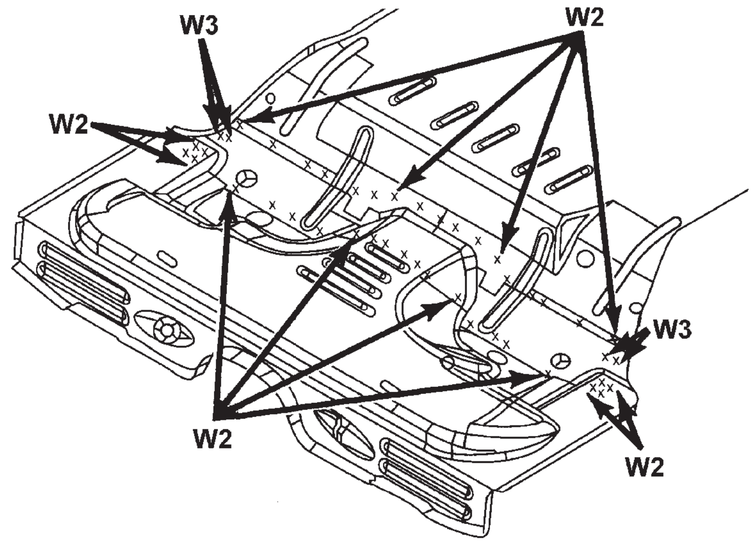
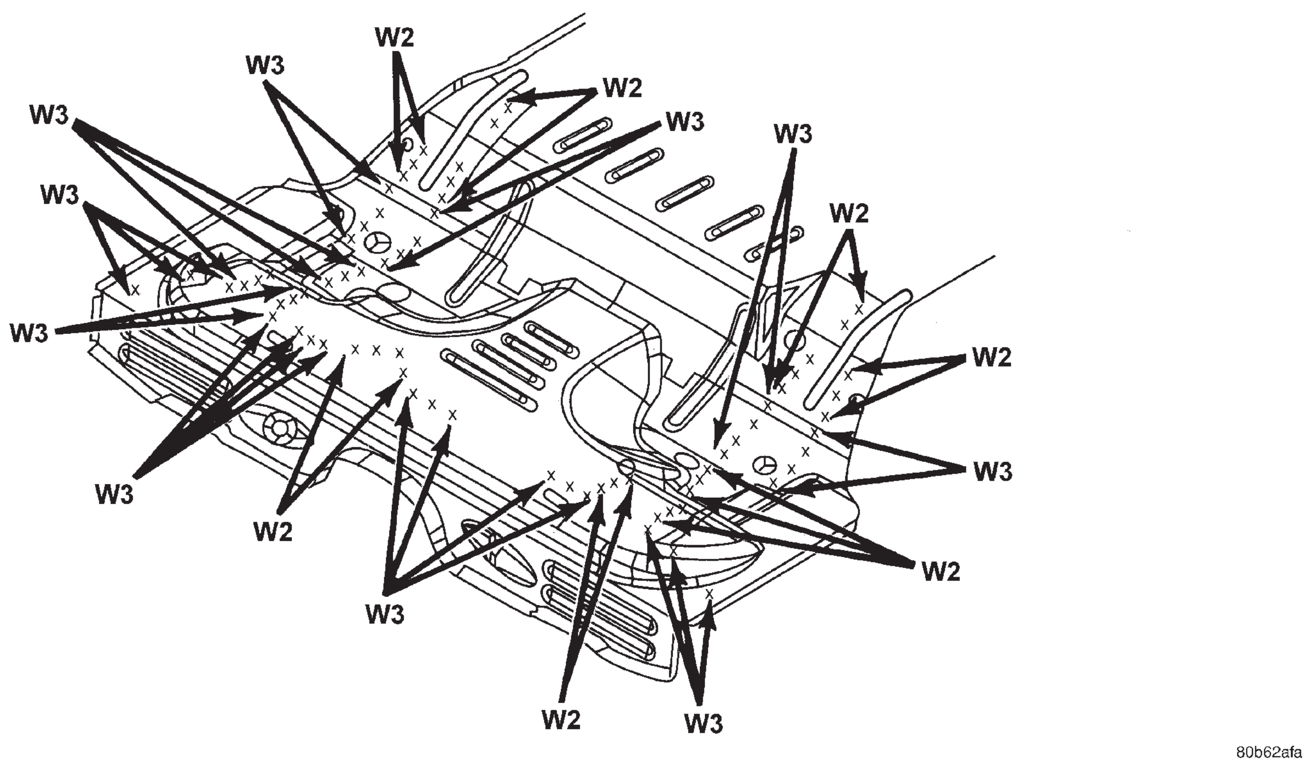
SPECIFICATIONS (Continued)

REAR FLOOR PAN



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS



SPECIFICATIONS (Continued)

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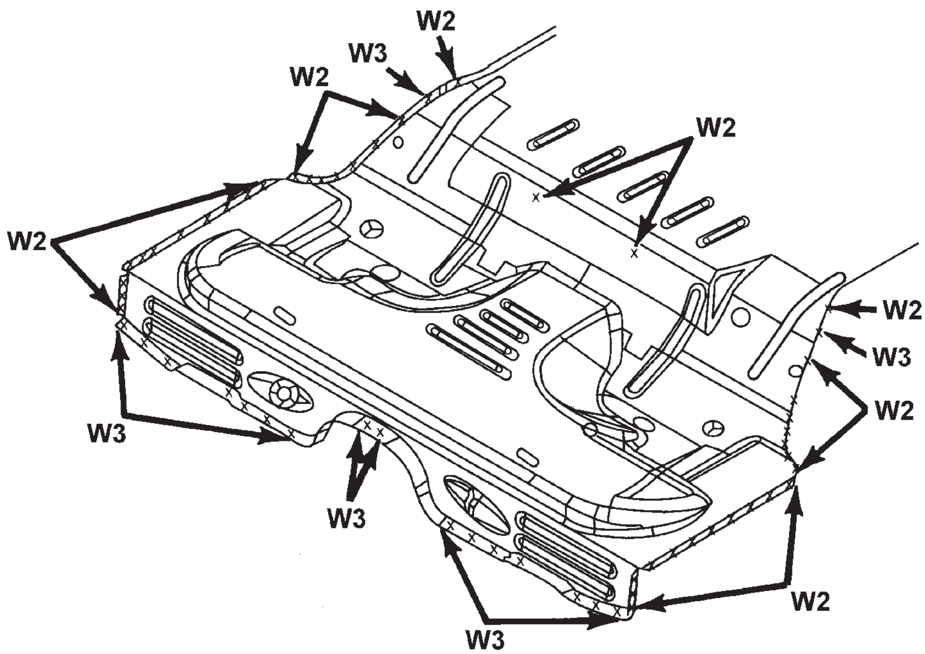

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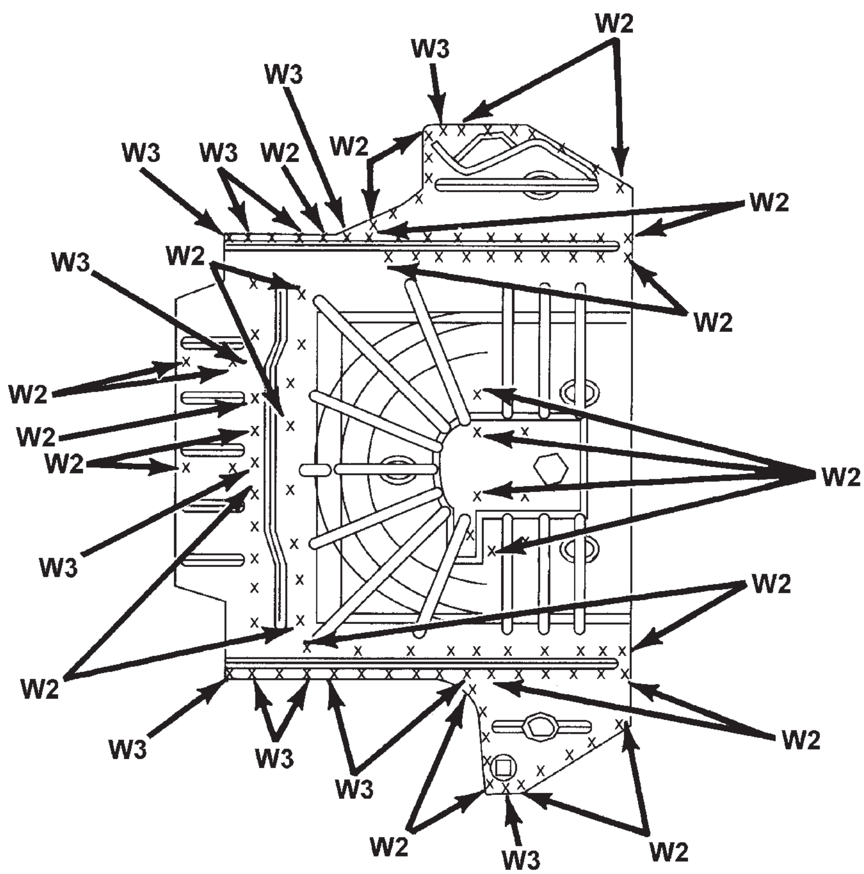
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS



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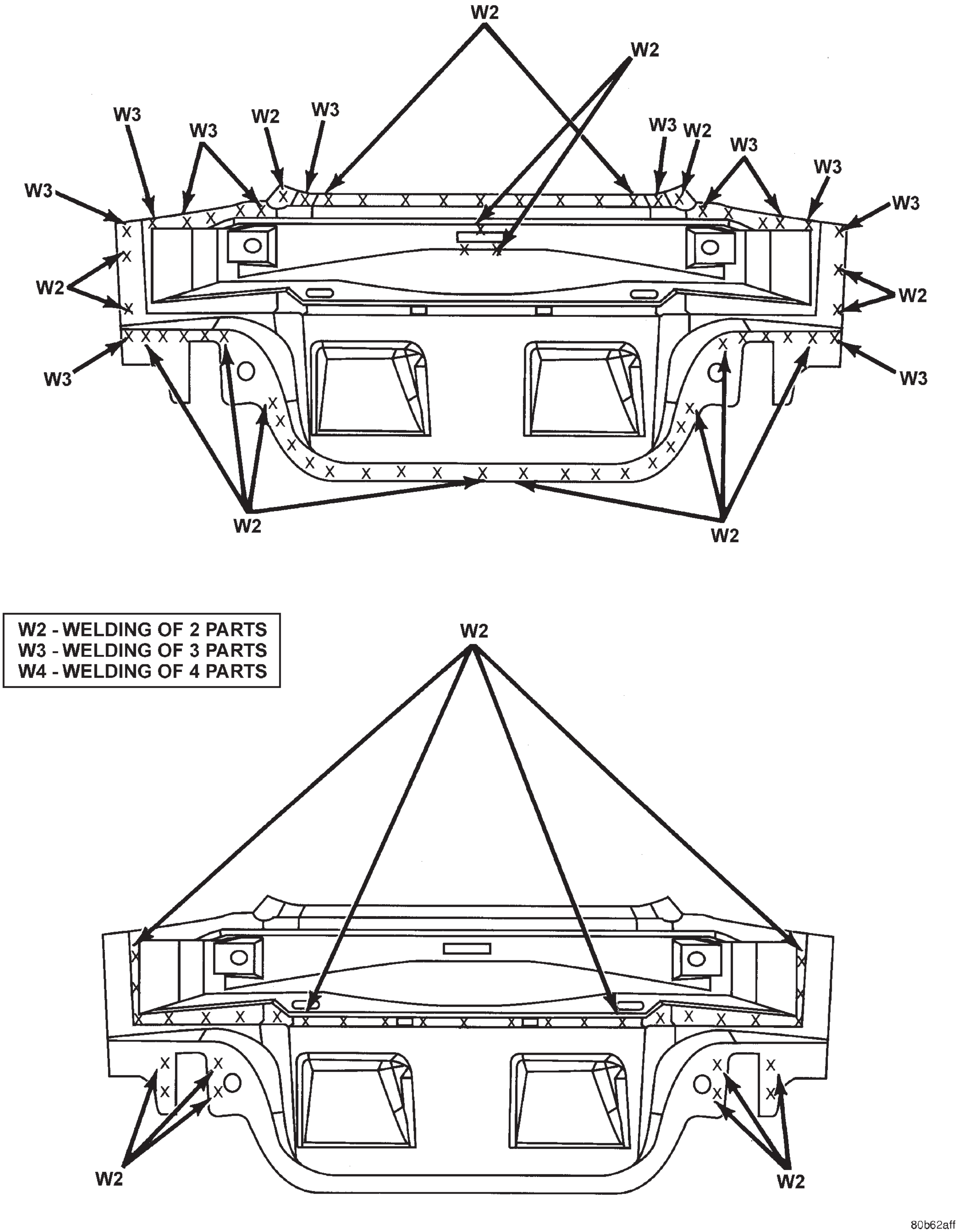
SPECIFICATIONS (Continued)

REAR DECK OPENING



HEATING AND AIR CONDITIONING

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The heater/air conditioning systems share many of the same components. This group will deal with both systems together when component function is common, and separately when they are not.

For proper operation of the instrument panel controls, refer to the Owner's Manual provided with the vehicle.

All vehicles are equipped with a common Heater-A/C unit housing assembly.

GENERAL INFORMATION (Continued)

SAFETY PRECAUTIONS AND WARNINGS

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM EYE CONTACT WITH REFRIGERANT. IF EYE CONTACT IS MADE, SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC TYPE LEAK DETECTOR IS RECOMMENDED.

LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

THE EVAPORATION RATE OF REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH REFRIGERANT. R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR.

SOME MIXTURES OF AIR and R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. SEEK MEDICAL ATTENTION IMMEDIATELY IF SWALLOWED OR INHALED. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN AND PETS.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY CAN RESULT.

CAUTION: The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi). Allow the vehicle to cool a minimum of 15 minutes before opening the cooling system. Refer to Group 7, Cooling System.

A/C APPLICATION TABLE

Item	Description	Notes
VEHICLE	JA Cirrus, Stratus, Breeze, JX Sebring Convertible	4-door sedan, 2-door convertible
SYSTEM	R134a w/expansion valve	
COMPRESSOR	Sanden TRS-090 (Scroll)	SP-15 PAG Oil
Freeze–up Control	evaporator temp probe (2-wire)	BCM input, signals OFF < 33.7° F, ON > 35.7° F
Low psi Control	pressure transducer to PCM	opens < 29.4 psi
High psi Control		opens > 431 psi
Thermal Limiter Switch	cut Out > 252-262° F, cut In < 225-235° F	scroll compressors only serviced with clutch
CONTROL HEAD	manual type	resistive multiplex signal for A/C request to BCM
Mode Door	electric actuator w/feedback	BCM controlled
Blend Air Door	cable	
Fresh/Recirc door	cable	
Blower Motor	hardwired to control head	resistor block
COOLING FANS	PCM controlled module, two fan motors - low/high	low & high relays
CLUTCH		
Control	relay	PCM
Draw	2-4.15 amps @ 12V	± 0.5V
Gap	0.013″-0.025″	
DRB III®		
Reads	Mode door, TPS, RPM, A/C switch test	
Actuators	clutch and fan relays	

DESCRIPTION AND OPERATION

AIR CONDITIONING COMPONENTS

A/C PRESSURE TRANSDUCER

The switch is located on the discharge line near the compressor. The pressure transducer functions as the refrigerant system pressure sensor. It supports the condenser/radiator fans and compressor functions.

CLUTCH, PULLEY AND COIL

They are mounted on the compressor providing a way to drive the compressor. The compressor clutch and coil are the only serviced parts on the compressor. When the compressor is not in operation, the pulley free wheels on the clutch hub bearing. When the coil is energized the clutch plate is magnetically engaged with the pulley and turns the compressor shaft.

COMPRESSOR

The compressor compresses the low pressure refrigerant vapor from the evaporator into a high pressure, high temperature vapor. The Scroll TRS-90 Compressor is used on all models. The system uses polyalkylene glycol synthetic wax-free refrigerant oil SP-15 PAG.

CONDENSER

It is located in front of the engine cooling radiator. Its function is to cool the hot high pressure refrigerant gas. This causes it to condense into a high pressure liquid refrigerant.

EVAPORATOR COIL

The coil removes heat and dehumidifies the air before it enters the vehicle. The coil is located in the A/C housing.

EVAPORATOR PROBE

The evaporator temperature probe prevents condensate water on the evaporator coil from freezing and obstructing A/C system air flow. It does this by cycling the compressor clutch on and off. The switch is attached to the evaporator coil with the sensing probe inserted into the coil fins.

EXPANSION VALVE

The valve is used to meter refrigerant into the evaporator in accordance with cooling requirements. The valve is located in front of the evaporator coil.

HIGH PRESSURE RELIEF VALVE

The valve is located at the rear of the compressor. The valve is used to prevent excessive high system pressure. The valve vents the system when a pressure of 3445-4135 kPa (500-600 psi) and above is reached. This prevents damage to the compressor and other system components. The valve closes with a minimum pressure of 2756 kPa (400 psi).

FILTER/DRIER

The drier is used to remove any traces of moisture from the refrigerant system. The filter is used to separate any foreign particles.

REFRIGERANT LINES

The lines are used to carry the refrigerant between the various system components.

SERVICE GAUGE PORT

The high pressure gauge port is located on the compressor discharge line. The low pressure gauge port is located on the suction line.

THERMAL LIMITER SWITCH

The switch is used to measure compressor surface temperature. If compressor surface temperature is excessive the switch will cut battery feed voltage to the compressor clutch. The switch will then reset once compressor surface temperature returns to normal.

A/C PRESSURE TRANSDUCER

The A/C Pressure Transducer functions as the refrigerant system pressure sensor. It supports the condenser/radiator fans and compressor functions. The pressure transducer is screwed attached to a valve on the discharge line near the compressor.

A/C REFRIGERANT LINES

The air conditioning lines used on this vehicle are made from reinforced rubber with a nylon liner on the inner walls. The ends of the A/C lines are made with light weight aluminum fittings or quick connects.

The A/C lines use special connectors called quick connects. There are four quick connects in the system. Two are located at the condenser and the other two are located at the expansion valve. Each quick connector has a clip installed on it.

CAUTION: Never attempt to remove a clip or disconnect a quick connect without reclaiming all refrigerant from the air conditioning system. The system must be empty.

All quick connects use two O-rings to seal the connection. The O-rings are made from a special type of rubber that is not affected by R-134a refrigerant. O-ring replacement is required whenever lines are removed and installed. Use only O-rings specified for

DESCRIPTION AND OPERATION (Continued)

this vehicle. Failure to use the correct type of O-ring will cause the connection to leak within a short period of time.

When it is necessary to open the refrigeration system, have everything needed to service the system ready. The system should not be left open any longer than necessary. Cap or plug all lines and fittings as soon as they are opened. This will prevent the entrance of dirt and moisture into the system. All new lines and components should be capped or sealed until they are ready to be used.

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

COMPRESSOR

The TRS90 is a fixed displacement type compressor (Fig. 1).

CAUTION: Cleanliness is extremely important. Clean the surfaces around the suction and discharge ports of the compressor before opening the system. If compressor is removed from vehicle, apply tape to the opened ports to prevent any contamination.

COMPRESSOR CLUTCH/COIL ASSEMBLY

The clutch assembly consists of a stationary electromagnetic coil, hub bearing pulley assembly, and clutch plate.

The electromagnetic coil and pulley are retained on the compressor with snap rings. The clutch plate is mounted on the compressor shaft and secured with a nut.

When the compressor is not operating, the pulley free wheels on the hub bearing which is part of the pulley. When the coil is energized the plate is magnetically engaged with the pulley and turns the compressor shaft.

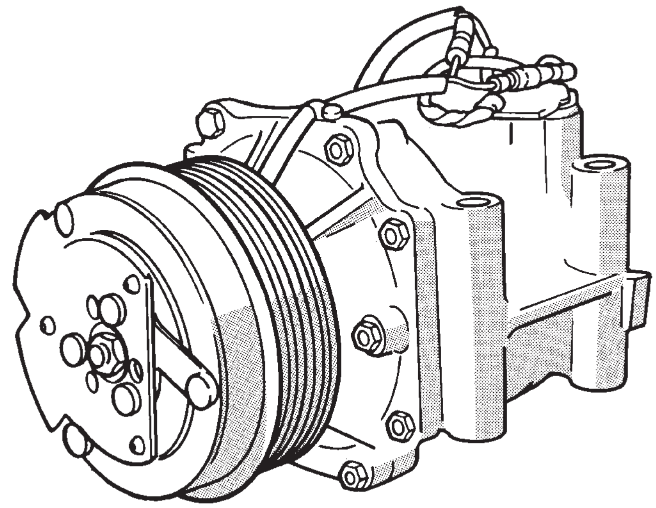


Fig. 1 TRS90 Compressor

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain ample temperature levels from the heating-A/C system, the cooling system must be in proper working order. Refer to Group 0, Lubrication and Maintenance or Group 7, Cooling System of this manual.

The use of a bug screen is not recommended. Any obstructions forward of the condenser can reduce the effectiveness of the air conditioning system.

EVAPORATOR PROBE

The evaporator probe is a temperature sensing element located at the coldest point on the face of the evaporator. Output from the probe is sampled by the Body Control Module (BCM). It is used to switch the A/C compressor clutch OFF before evaporator freeze up occurs. The clutch is switched OFF when the probe temperature reaches 0.94°C. (33.7°F.). It is allowed to switch ON when the probe temperature reaches 2.05°C. (35.7°F.).

The evaporator probe is located on the lower right side of the evaporator housing.

EXPANSION VALVE

The expansion valve is located on the engine side of the dash panel, near the right shock tower.

The expansion valve can fail in three different positions (open, closed or restricted).

In an Open Position: this will result in a noisy compressor or no cooling. The cause can be a broken spring, broken ball or excessive moisture in the A/C system. If the spring or ball are found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system, recycle the refrigerant.

In a Closed Position: There will be low suction pressure and no cooling. This may be caused by a

DESCRIPTION AND OPERATION (Continued)

failed power dome or excessive moisture in the A/C system. If the power dome on the expansion valve is found to be defective replace the expansion valve. If excessive moisture is found recycle the refrigerant.

A Restricted Orifice: There will be low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be the cause, recycle the refrigerant and replace the expansion valve and receiver/drier.

HANDLING TUBING AND FITTINGS

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The refrigerant oil will absorb moisture readily out of the air. This moisture will convert into acids within a closed system.

CAUTION: The system must be completely empty before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been emptied. If any pressure is noticed as a fitting is loosened, retighten fitting and evacuate the system again.

A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 3 inches (80 mm) from the exhaust manifold. Inspect all flexible hose lines to make sure they are in good condition and properly routed.

The use of correct wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings.

The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities.

When opening a refrigeration system, have everything you will need to repair the system ready. This will minimize the amount of time the system must be opened. Cap or plug all lines and fittings as soon as they are opened. This will help prevent the entrance of dirt and moisture. All new lines and components should be capped or sealed until they are ready to be used.

All tools, including the refrigerant dispensing manifold, the manifold gauge set, and test hoses should be kept clean and dry.

THERMAL LIMITER SWITCH

The switch is used to measure compressor surface temperature. If compressor surface temperature is excessive the switch will cut battery feed voltage to the compressor clutch. The switch will then reset once compressor surface temperature returns to normal.

SYSTEM AIRFLOW

The system draws outside air through the cowl opening at the base of the windshield. Then it goes into the plenum chamber above the Heater A/C unit housing and passes through the evaporator. At this point airflow can be directed either through or around the heater core. This is done by adjusting the blend-air door with the TEMP control on the control head. After the air passes the blend air door, the air flow is then directed from the PANEL, BI-LEVEL (panel and floor), and FLOOR - DEFROST outlets. Air flow velocity can be adjusted with the blower speed selector switch on the control head.

Ambient air intake can be shut off by closing the recirculating air door. This will recirculate the air that is already inside the vehicle. This is done by rotating the RECIRC. knob on the control head. Rotating the MODE control knob to the Defrost/Floor or Defrost setting on the control head will engage the compressor. This will send refrigerant through the evaporator, and remove heat and humidity from the air before it goes through the heater core. The compressor can also be engaged by depressing the A/C button on the control head.

DIAGNOSIS AND TESTING

A/C PERFORMANCE TEST

The air conditioning system is designed to remove heat and humidity from the air entering the passenger compartment. The evaporator, located in the heater A/C unit, is cooled to temperatures near the freezing point. As warm damp air passes over the fins in the evaporator, moisture in the air condenses to water, dehumidifying the air. Condensation on the evaporator fins reduces the evaporators ability to absorb heat. During periods of high heat and humidity, an air conditioning system will be less effective. With the control module set to RECIRC, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels rise.

DIAGNOSIS AND TESTING (Continued)

PERFORMANCE TEST PROCEDURE

Review Safety Precautions and Warnings in this group before proceeding with this procedure. Air temperature in test room and on vehicle must be 21° C (70°F) minimum for this test.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

(1) Connect a tachometer and manifold gauge set. Attach a thermocouple to the evaporator inlet line.

(2) Set control to A/C, RECIRC, and PANEL, temperature lever on full cool and blower on high.

(3) Start engine and hold at 1000 rpm with A/C clutch engaged.

(4) Engine should be warmed up with doors and windows closed.

(5) Insert a thermometer or place a thermocouple in the left center A/C outlet and operate the engine for five minutes. The A/C clutch may cycle depending on ambient conditions.

(6) With the A/C clutch engaged, compare the discharge air temperature to the evaporator inlet line temperature. The evaporator inlet line temperature should be no more than 12°C (10°F) cooler than the discharge air temperature.

(7) If the discharge air temperature fails to meet the specifications. Refer to the System Charge Level.

COMPRESSOR CLUTCH COIL

(1) Verify battery state of charge.

(2) Connect an ammeter (0-10 ampere scale) in series with the clutch coil terminal. Use a volt meter (0-20 volt scale) with clip leads measuring voltage across the battery and A/C clutch.

(3) With A/C control in A/C mode and blower at low speed, start the engine and run at normal idle.

(4) The A/C clutch should engage immediately and the clutch voltage should be within 2 volts of the battery voltage. If the A/C clutch does not engage, test the fusible link.

(5) The A/C clutch coil is acceptable if the current draw is 2.0 to 4.15 amperes at 11.5 to 12.5 volts at clutch coil. This is with the work area temperature at 21°C (70°F). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.

(6) If coil current reads zero, the coil is open and should be replaced. If the ammeter reading is 5 amperes or more, the coil is shorted and should be replaced. If the coil voltage is not within two volts of the battery voltage, test clutch coil feed circuit for excessive voltage drop.

COMPRESSOR NOISE TEST

When investigating an air conditioning related noise, you must first know the conditions when the noise occurs. These conditions are: weather, vehicle speed, in gear or neutral, engine temperature, or any other special condition.

Noises that develop during air conditioning operation can often be misleading. For example: what sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose clutch assembly. Improper drive belt tension can cause a misleading noise when compressor is engaged. The noise may not occur when compressor is disengaged.

Drive belt(s) are speed sensitive. At different engine speeds and depending upon belt tension, belt(s) can develop noises that are mistaken for a compressor noise.

(1) Select a quiet area for testing. Duplicate conditions as much as possible. Switch compressor on and off several times to clearly identify compressor noise. Listen to compressor clutch while engaged and disengaged.

(2) To duplicate high-ambient condition (high-head pressure), restrict air flow through condenser. Install manifold gauge set to make sure discharge pressure doesn't exceed 2070 kPa (300 psi).

(3) Tighten ALL compressor mounting bolts, clutch mounting bolt, clutch coil mounting screws

(4) Check refrigerant hoses for rubbing or interference which can cause unusual noises.

(5) Check refrigerant charge (refer to Charging the System).

(6) Check compressor noise as in Step 1.

(7) If noise still exists, loosen compressor mounting bolts and torque. Repeat Step 1.

(8) If noise continues, replace compressor and repeat Step 1.

CONTROL MODULE

The control switch and timer circuit may be tested in the vehicle with or without scan tool (DRB).

TESTING WITH SCAN TOOL

If using the scan tool, refer to the proper Body Diagnostic Procedures Manual.

TESTING WITHOUT SCAN TOOL

(1) Remove the control switch from console and disconnect control switch (Fig. 2).

(2) Using a ohmmeter, check leads between Pins 5 and 8 of the 8-Way connector. Turn the control module to each position shown on Control Module Test table. The resistance reading should be within the specifications shown. If not OK, replace the control module. If OK, check:

- Blown fuse
- Cut wire

DIAGNOSIS AND TESTING (Continued)

- Poor ground
- Poor connection
- Defective BCM
- Bulkhead connector inoperative

Refer to Group 8W, Wiring Diagrams.

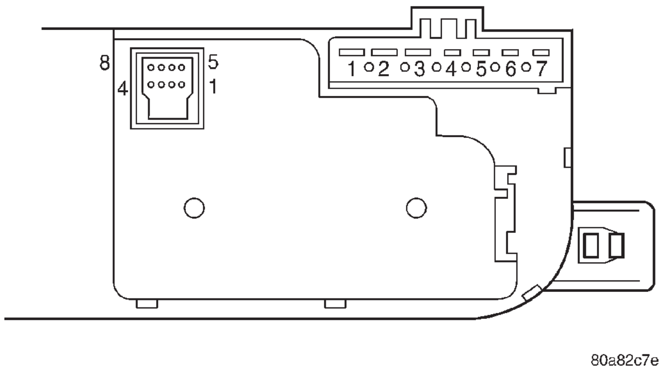


Fig. 2 HVAC Control Module Connectors

CONTROL MODULE TEST

SWITCH POSITION	OHM RANGE
Panel	828 to 856 ohms
Bi-Level	1.279 to 1.315 K ohns
Floor	2.302 to 2.358 K ohms
Mix	5.202 to 5.318 K ohms
Defrost	99.5 to 101.5 K ohms

HEATER PERFORMANCE TEST

PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings in this group before performing the following procedures.

Check the coolant level, drive belt tension, vacuum line connections, radiator air flow and fan operation. Start engine and allow to warm up to normal temperature.

WARNING: DO NOT REMOVE RADIATOR CAP WHEN ENGINE IS HOT, PERSONAL INJURY CAN RESULT.

If vehicle has been run recently, wait 15 minutes before removing cap. Place a rag over the cap and turn it to the first safety stop. Allow pressure to escape through the overflow tube. When the system stabilizes, remove the cap completely.

MAXIMUM HEATER OUTPUT: TEST AND ACTION

Engine coolant is provided to the heater system by two 16 mm (5/8 inch inside diameter) heater hoses. With engine idling at normal running temperature, set the control to maximum heat, floor, and high blower setting. Using a test thermometer, check the air temperature coming from the floor outlets, refer to Temperature Reference Table.

TEMPERATURE REFERENCE TABLE

Ambient Temp.		Minimum Outlet Floor Temp.	
Celsius	Fahrenheit	Celsius	Fahrenheit
15.5°	60°	62.2°	144°
21.1°	70°	63.8°	147°
26.6°	80°	65.5°	150°
32.2°	90°	67.2°	153°

If the floor outlet air temperature is insufficient, refer to Group 7, Engine Cooling for specifications. Both heater hoses should be HOT to the touch (coolant return hose should be slightly cooler than the supply hose). If coolant return hose is much cooler than the supply hose, locate and repair engine coolant flow obstruction in heater system.

POSSIBLE LOCATIONS OR CAUSE OF OBSTRUCTED COOLANT FLOW

(1) Pinched or kinked heater hoses.
(2) Improper heater hose routing.
(3) Plugged heater hoses or supply and return ports at cooling system connections, refer to Group 7, Cooling System.
(4) Plugged heater core.
(5) Air locked heater core.
(6) If coolant flow is verified and outlet temperature is insufficient, a mechanical problem may exist.

POSSIBLE LOCATION OR CAUSE OF INSUFFICIENT HEAT

(1) Obstructed cowl air intake.
(2) Obstructed heater system outlets.
(3) Blend-air door not functioning properly.

TEMPERATURE CONTROL

If temperature cannot be adjusted with the TEMP lever on the control panel, the following could require service:
(1) Blend-air door binding.
(2) Improper engine coolant temperature.
(3) Faulty Instrument Panel Control.

SYSTEM OIL LEVEL

It is important to have the correct amount of lubricant in the A/C system to ensure proper lubrication of the compressor. Too little lubricant will result in

DIAGNOSIS AND TESTING (Continued)

damage to the compressor. Too much lubricant will reduce the cooling capacity of the system and consequently result in higher discharge air temperatures.

The lubricant used in the compressor is polyalkalene glycol PAG lubricant. Only refrigerant lubricant approved for use with R-134a should be used to service the system. Do not use any other lubricant. The lubricant container should be kept tightly capped until it is ready for use. Refrigerant lubricant will quickly absorb any moisture it comes in contact with.

It is not necessary to check or add lubricant unless it has been lost. Lubricant loss at the leak point will be evident by the presence of a wet, shiny surface around the leak.

REFRIGERANT OIL LEVEL CHECK

When an air conditioning system is first assembled, all components (except the compressor) are refrigerant oil free. After the system has been charged with (R-134a) refrigerant and operated, the oil in the compressor is dispersed through the lines and components. The evaporator, condenser, and receiver/drier will retain a significant amount of oil. Refer to the A/C Component Refrigerant Oil Capacities table. When a component is replaced, the specified amount of refrigerant oil must be added. When the compressor is replaced, the amount of oil that is retained in the rest of the system must be drained from the replacement compressor. When a line or component has ruptured and oil has escaped, the compressor should be removed and drained. The receiver/drier must be replaced along with the ruptured part. The oil capacity of the system, minus the amount of oil still in the remaining components, can be measured and poured into the suction port of the compressor.

Example: On an A/C system the evaporator retains 60 ml. (2 oz.). The condenser retains 30 ml. (1 oz.) of oil, and system capacity may be 150 ml. (5.00 oz.) of oil.

150 ml. minus 90 ml. equals 60 ml. (2.00 oz.).

A/C COMPONENT REFRIGERANT OIL CAPACITIES

COMPONENT NAME	ml.	oz.
Total Air Conditioning System	150 ml.	5.00 oz.
Condenser	30 ml.	1.00 oz.
Evaporator	59 ml.	2.00 oz.
Filter/Drier	30 ml.	1.00 oz.
Line Blown	44 ml.	1.50 oz.

CAUTION: The refrigerant oil used in a R-134a A/C system is unique. Use only oils which were designed to work with R-134a refrigerant. The oil designated for this vehicle is ND 8 PAG (polyalkalene glycol).

VERIFY REFRIGERANT LUBRICANT LEVEL

(1) Discharge refrigerant system using a recycling/reclaiming equipment if a charge is present.

(2) Disconnect refrigerant lines from A/C compressor. Cap the open lines to prevent moisture from entering system.

(3) Remove compressor from vehicle.

(4) From suction and discharge ports on top of compressor, drain lubricant from compressor.

(5) Add system capacity minus the capacity of components that have not been replaced. Refer to the A/C Component Refrigerant Oil Capacities chart above. Add lubricant through the suction and discharge ports on compressor. This is not to exceed 150 ml. (5.00 oz.) in total.

(6) Install compressor and connect refrigerant lines. Then evacuate and charge refrigerant system.

(7) Most reclaim/recycling equipment will measure the lubricant being removed. This is the amount of lubricant to be added back to the system. If a new compressor is being installed, drain lubricant from old compressor, measure the amount drained and discard old lubricant. Drain the lubricant from the new compressor into a clean container. Return the amount of lubricant measured from the old compressor, plus the amount reclaimed from the system back into the new compressor.

THERMAL LIMITER SWITCH

(1) Unplug Thermal Limiter wiring connector.

(2) With an ohmmeter check for continuity between the two terminals. If no continuity is present replace switch.

(3) The Thermal Limiter is calibrated to open and close at:

- Open circuit (no continuity) at 122 to 128°C (252 to 262°F)
- Close circuit (continuity) at 106 to 116°C (225 to 235°F)

There is no serviceability of the thermal limiter switch. If the thermal limiter switch fails, the compressor must be replaced. To replace the compressor, refer to Compressor Removal and Installation in this section.

SERVICE PROCEDURES

EVACUATING REFRIGERANT SYSTEM

NOTE: Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

If a compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection. If connection is still difficult to make refer to TSB #24-02-93.

(1) Connect a suitable charging station, refrigerant recovery machine, and a manifold gauge set with vacuum pump (Fig. 3).

(2) Open suction and discharge valves and start vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge, to eliminate all moisture in system. When suction gauge reads -88 kPa (-26 in. Hg) vacuum or greater for 45 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.

(3) Close all valves. Turn off and disconnect the vacuum pump.

(4) The refrigerant system is prepared to be charged with refrigerant.

R-134a REFRIGERANT

This vehicle uses a new type of refrigerant called R-134a. It is a non-toxic, non-flammable, clear colorless liquefied gas.

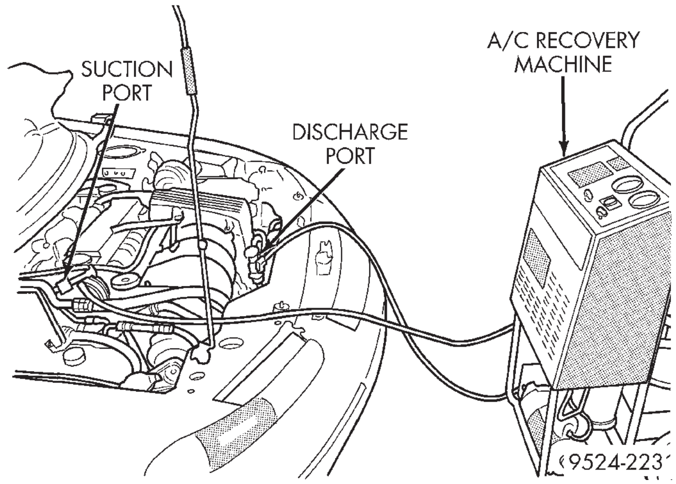


Fig. 3 Refrigerant Recovery Machine Hookup

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 in a R-134a system could cause compressor failure, refrigerant oil sludging or poor performance. **Never add R-12 to a system designed to use R-134a. System failure will occur.**

Both of the service ports to charge the air conditioning system are located on the hoses (Fig. 4). New design of service ports have been used to ensure that the system is not accidentally filled with the wrong refrigerant (R-12).

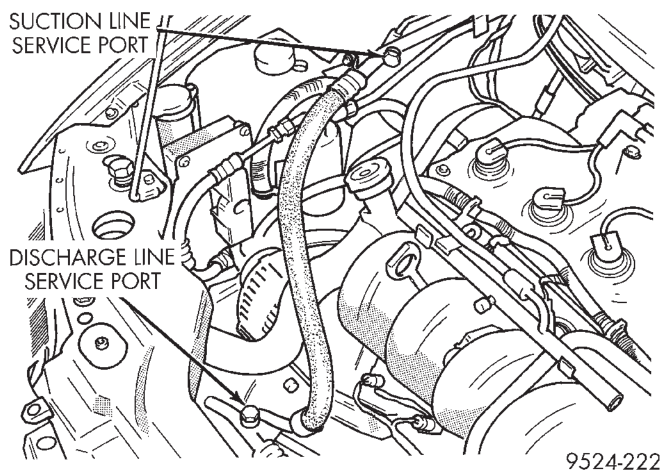


Fig. 4 A/C Service Ports

When servicing a system, it is required that an air conditioning charging recovery/recycling machine be used (Fig. 5). Contact an automotive service equipment supplier for proper equipment. Refer to the operating instructions provided with the equipment for proper operation.

A manifold gauge set (Fig. 6) must also be used in conjunction with the charging and/or recovery/recycling device. Only use gauges that have not been

SERVICE PROCEDURES (Continued)

used for R-12. The service hoses on the gauge set should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant R-134a from being released into the atmosphere.

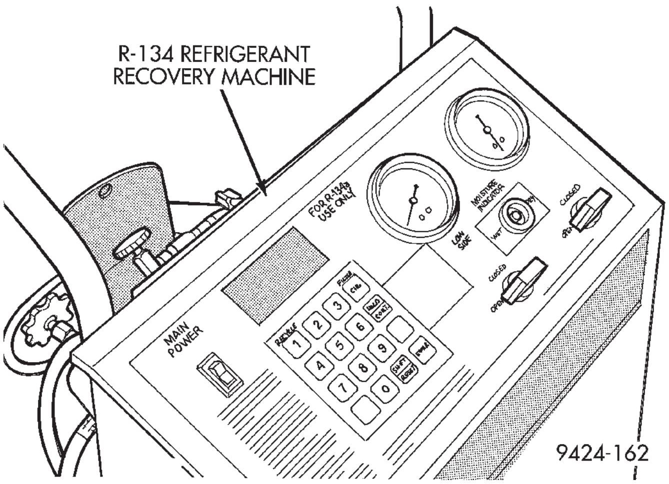


Fig. 5 Refrigerant Recovery/Recycling Station - Typical

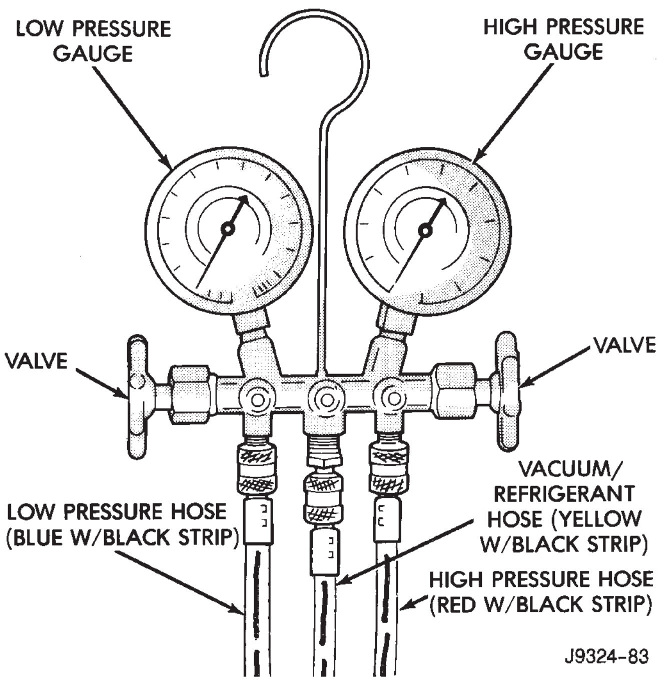


Fig. 6 Manifold Gauge Set - Typical

R-134a refrigerant requires a special type of compressor oil. When adding oil, make sure that it is designed to be used in a R-134a system. Refer to the label under the hood for proper oil and refrigerant charge levels (Fig. 7).

Due to the different characteristics of R-134a it requires all new service procedures.

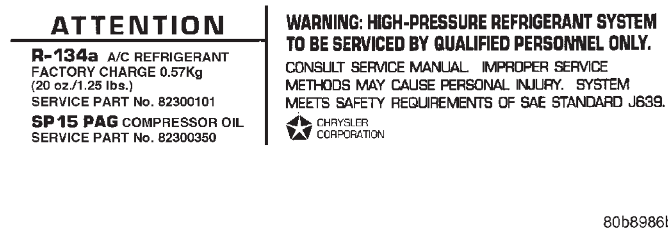


Fig. 7 Underhood Label

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO RECLAIM R-134a SYSTEMS. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR and R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

The use of R-134a will have a positive environmental impact due to it’s zero ozone depletion and low global warming impact.

SYSTEM CHARGE LEVEL

TO CHECK OR FILL SYSTEM

The procedure below should be used to check and/or fill the refrigerant charge in the air conditioning system.

NOTE: The air conditioning system in this vehicle holds 0.57 Kg. (20 oz. or 1.25 lbs.) of R-134a refrigerant.

NOTE: The condenser has been changed on 1999 models. The System Charge Level Specifications and Charge Determination Graph were not available at the time of printing. A Technical Service Bulletin will be issued for insertion into the manual when data becomes finalized.

SERVICE PROCEDURES (Continued)

SYSTEM LEAK CHECKING

WARNING: R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

If the A/C system is not cooling properly, determine if the refrigerant system is fully charged with R-134a. This is accomplished by performing a system Charge Level-Check or Fill. If while performing this test A/C liquid line pressure is less than 345 kPa (50 psi) proceed to Empty Refrigerant System Leak Test. If liquid line pressure is greater than 345 kPa (50 psi) proceed to low refrigerant level leak test. If the refrigerant system is empty or low in refrigerant charge, a leak at any line fitting or component seal is likely. A review of the fittings, lines and components for oily residue is an indication of the leak location. To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

EMPTY REFRIGERANT SYSTEM LEAK TEST

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible (approx. 28 in Hg.). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed with this procedure.

(2) Prepare a .284 Kg. (10 oz.) refrigerant charge to be injected into the system.

(3) Connect and dispense .284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.

(4) Proceed to Step 2 of Low Refrigerant Level Leak Test.

LOW REFRIGERANT LEVEL LEAK TEST

(1) Determine if there is any (R-134a) refrigerant in the system.

(2) Position the vehicle in a wind free work area. This will aid in detecting small leaks.

(3) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run for five minutes with the system set to the following:

- Transaxle in Park
- Engine Idling at 700 rpm
- A/C Controls Set in 100 percent outside air
- Blower switch in the high A/C position
- A/C in the ON position
- Open all windows

CAUTION: A leak detector designed for R-12 refrigerant (only) will not detect leaks in a R-134a refrigerant system.

(4) Shut off the vehicle and wait 2 to 7 minutes. Then use an Electronic Leak Detector that is designed to detect R-134a type refrigerant and search for leaks. Fittings, lines, or components that appear to be oily usually indicates a refrigerant leak. To inspect the evaporator core for leaks, insert the leak detector probe into the drain tube opening or a heat duct.

NOTE: A R-134a dye is available to aid in leak detection. Use only Chrysler approved refrigerant dye.

If a thorough leak check has been completed without indication of a leak, proceed to System Charge Level.

THERMOCOUPLE PROBE

To diagnose the A/C system, a temperature probe is required to measure liquid line temperature. The clamp-on type K probe shown in this manual is available through the Chrysler Professional Service Equipment (PSE) program. This probe is compatible with temperature-measuring instruments that accept Type K Thermocouples and have a miniature connector input. Other temperature probes are available through aftermarket sources. All references in this manual will reflect the use of the probe made available through the Professional Service Equipment program.

In order to use the temperature probe, a digital thermometer will be required. If a digital thermometer is not available, an adapter is available through the Professional Service Equipment program. It can convert any standard digital multimeter into a thermometer. This adapter is designed to accept any standard K-type thermocouple.

If a digital multimeter is not available, it too can be ordered through Professional Service Equipment program.

REMOVAL AND INSTALLATION

MODE DOOR ACTUATOR MOTOR

NOTE: If battery voltage is low or not sensed at the actuator/motor for less than a (60) second interval, the actuator/motor will be out of calibration. Remove the M1 (I.O.D.) fuse for a minimum of (60) seconds. The actuator/motor will then self calibrate itself upon reinstallation of fuse.

The mode door actuator is an electric motor. It mechanically positions the A/C unit panel/bi-level door and the floor/defrost door. Prior to part replacement, re-calibration of the HVAC actuator is recommended. Calibration is performed by disconnecting the battery negative cable or the removal of the instrument panel M-1 fuse. Electrical power should be re-established after (60) seconds which will automatically initiate the software calibration procedure. If this procedure fails, it will be necessary to replace the mode door actuator/motor. The mode door actuator/motor is not serviceable and must be replaced if found to be defective.

The mode door actuator is located on the upper left side of the A/C- Heater housing (Fig. 8).

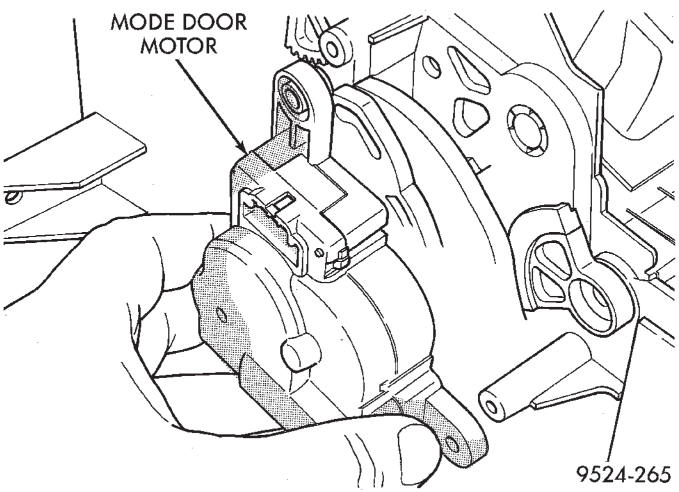


Fig. 8 Mode Door Motor Location

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove left underpanel silencer/duct.

(3) Remove electrical connection on actuator (Fig. 9).

(4) Remove actuator retaining screws. Then pull actuator straight down. Upon removal, note the shaft position of the actuator, because the shaft on this motor is keyed. When installing new actuator, its shaft must be positioned in the same location.

INSTALLATION

For installation, reverse the above procedures.

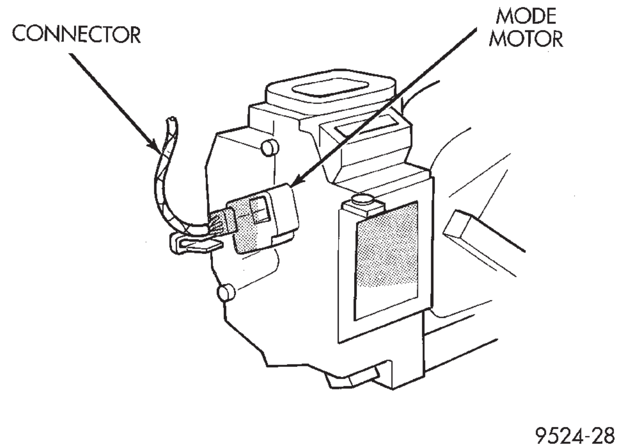


Fig. 9 Mode Motor Connector

A/C PRESSURE TRANSDUCER

CAUTION: A/C pressure transducer switch connector terminal contacts can be damaged by probing tools during system diagnosis and repair. Failure to use their respective mating terminals or pin gauge to check for tightness will cause contact beam spreads. This will result in loss of continuity.

NOTE: O-ring replacement is required whenever the pressure transducer is serviced. Be sure to use the O-ring specified for this vehicle.

REMOVAL

(1) If equipped with a 2.4L engine, hoist vehicle.

(2) Disconnect the wire harness connector from the A/C pressure transducer.

NOTE: A slight release of pressure trapped in the fitting may be experienced. It is not necessary to discharge the refrigerant system.

(3) Remove the transducer with a counterclockwise rotation using a 14 mm open-end wrench (Fig. 10) and (Fig. 11).

INSTALLATION

For installation, reverse above procedures. Tighten pressure transducer to 6 N·m (50 in. lbs.).

BLOWER MOTOR AND WHEEL ASSEMBLY

The blower motor is located on the right side of the heater housing.

REMOVAL AND INSTALLATION (Continued)

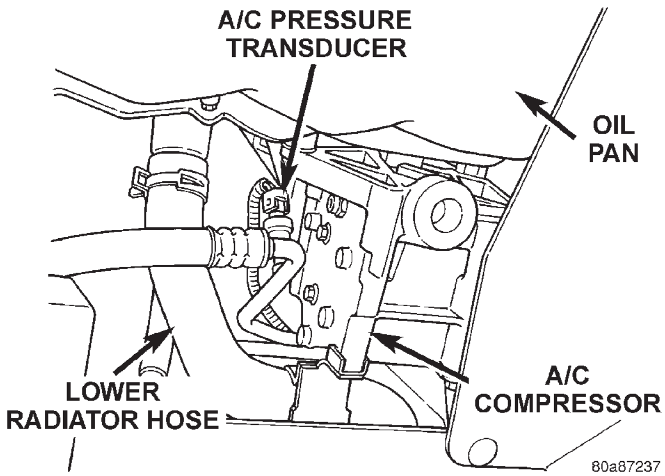


Fig. 10 Pressure Transducer (2.4L engine, viewed from beneath vehicle)

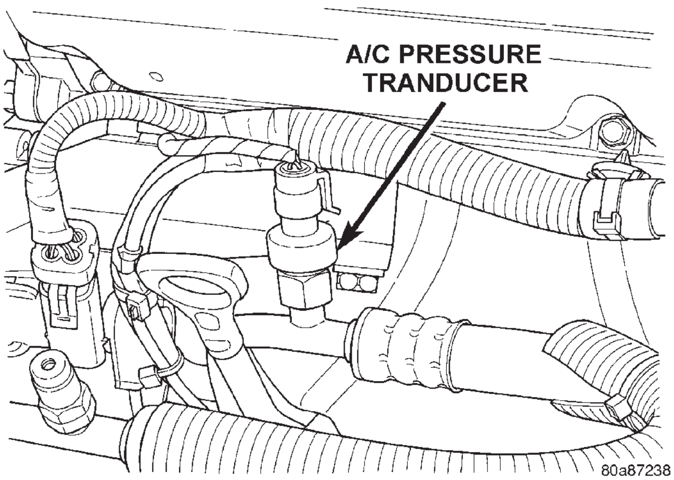


Fig. 11 Pressure Transducer (2.5L engine)

REMOVAL

(1) Disconnect battery.

(2) Remove lower right under panel silencer duct.

(3) Remove blower motor connector from resistor block (Fig. 12).

(4) Remove blower motor case retaining screws.

(5) Lower blower motor case from housing (Fig. 13).

(6) Remove fan scroll from motor shaft.

(7) Remove motor from motor case.

INSTALLATION

For installation, reverse the above procedures.

BLOWER MOTOR RESISTOR

The blower motor resistor is located on the lower right side of the heater housing.

REMOVAL

(1) Remove lower right underpanel silencer/duct.

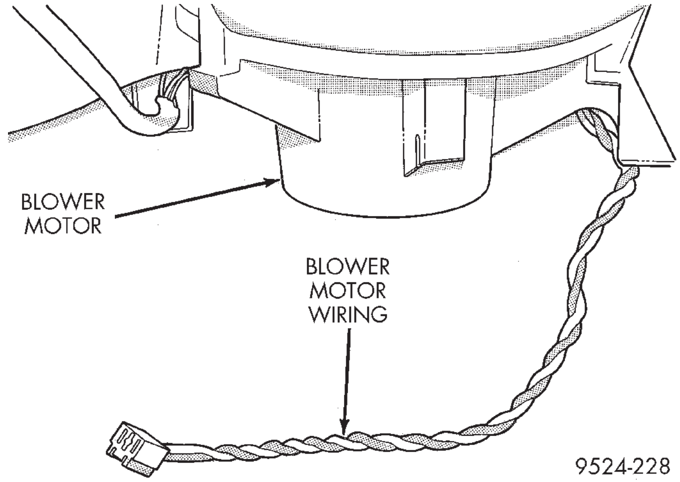


Fig. 12 Blower Motor Wiring

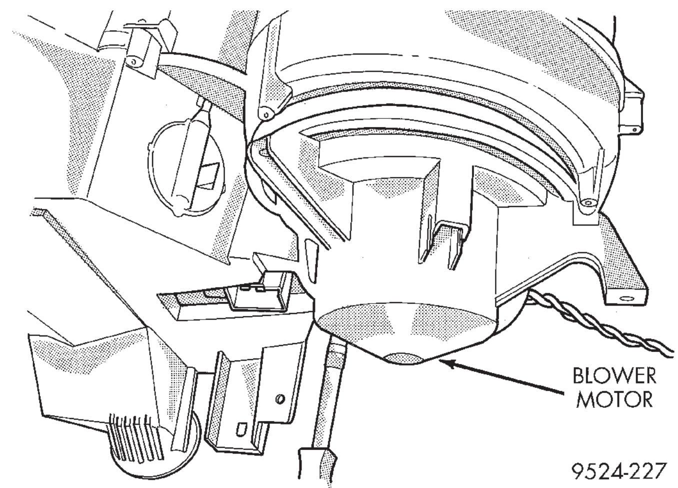


Fig. 13 Blower Motor

(2) Disconnect wiring connectors on blower motor resistor.

(3) Remove blower motor resistor retaining screws.

(4) Pull blower motor resistor out of heater housing (Fig. 14).

INSTALLATION

For installation, reverse the above procedures.

BLOWER MOTOR WHEEL

The blower motor wheel is only serviced with the blower motor. The wheel and the motor are balanced as an assembly. If the blower motor wheel requires replacement, the blower motor must also be replaced. Refer to blower motor for replacement procedure.

COMPRESSOR

REMOVAL

(1) Disconnect the battery negative remote cable.

REMOVAL AND INSTALLATION (Continued)

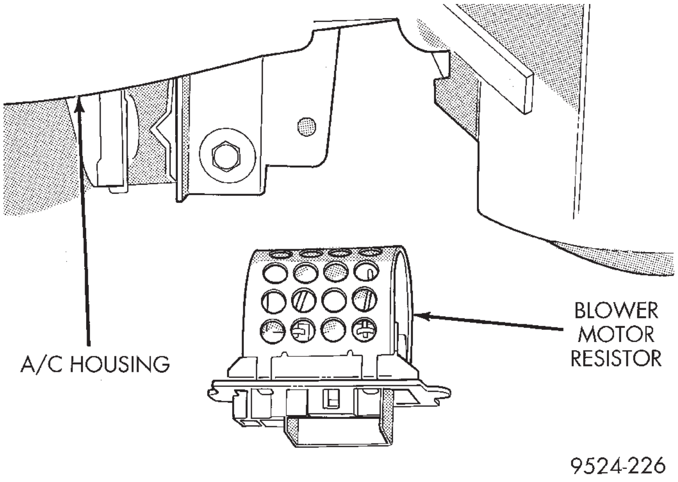


Fig. 14 Blower Motor Resistor

(2) Loosen and remove drive belt (Fig. 15). Refer to Group 7, Engine Cooling.
(3) Disconnect compressor clutch wire lead.
(4) Recover refrigerant system with R-134a recovery unit.
(5) Remove refrigerant lines from compressor (Fig. 16).
(6) Remove compressor attaching bolts (Fig. 17) and (Fig. 18).
(7) Remove compressor (Fig. 19).

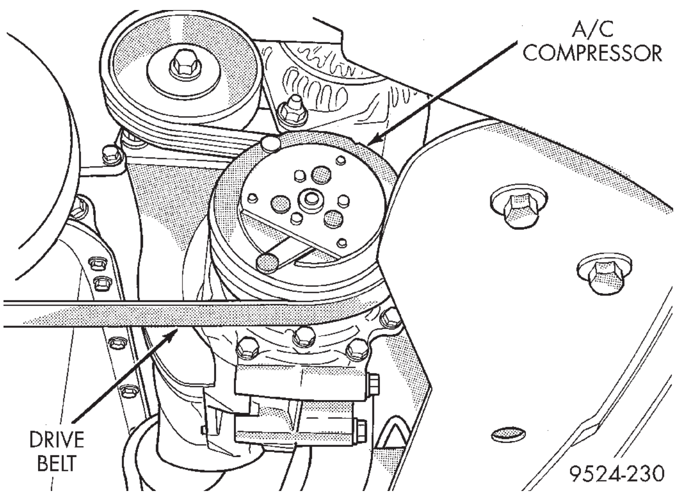


Fig. 15 Drive Belt

INSTALLATION

(1) Position the compressor on the mount.
(2) Install the compressor attaching bolts. Tighten bolts to 41 N·m (30 ft. lbs.) torque.
(3) Install drive belt (refer to Group 7, Cooling System).
(4) Install refrigerant hoses and new seals.
(5) Connect the clutch wire.
(6) Charge the system.
(7) Connect the negative cable to the battery.

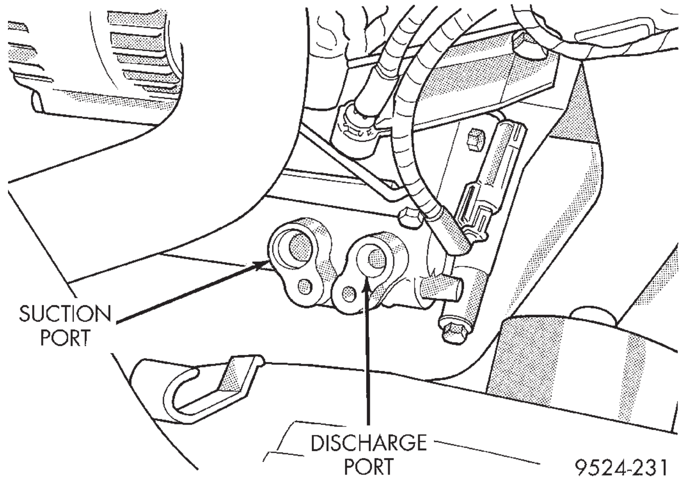


Fig. 16 A/C Lines

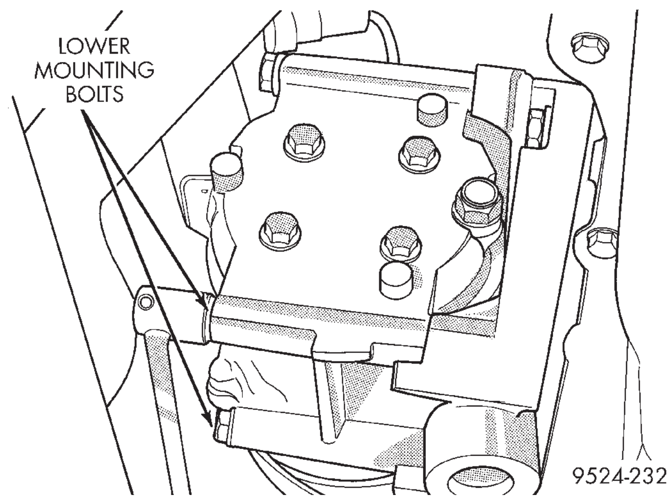


Fig. 17 Lower Attaching Bolts

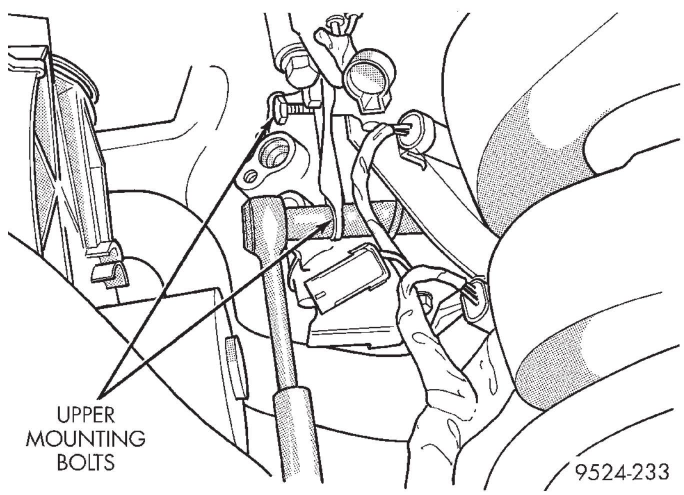


Fig. 18 Upper Attaching Bolts

COMPRESSOR CLUTCH/COIL ASSEMBLY

REMOVAL

(1) Remove the compressor from the mount.

REMOVAL AND INSTALLATION (Continued)

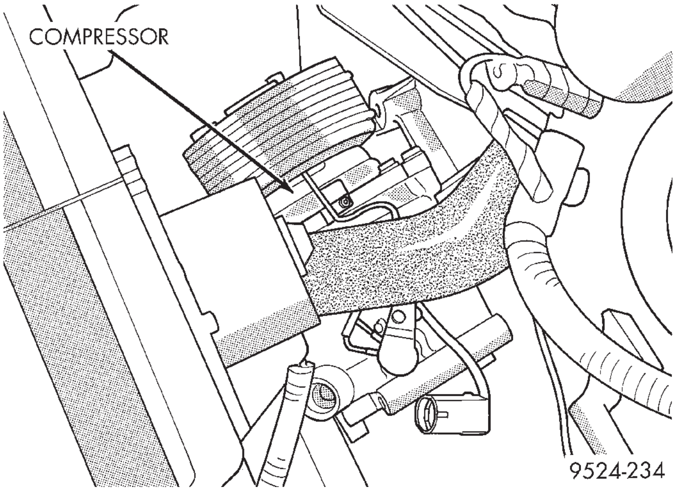


Fig. 19 Compressor Removal

(2) Install two (6 mm) bolts into the threaded holes in the armature plate. Hold bolts with two wrenches to prevent shaft from turning (Fig. 20). Remove compressor shaft nut.

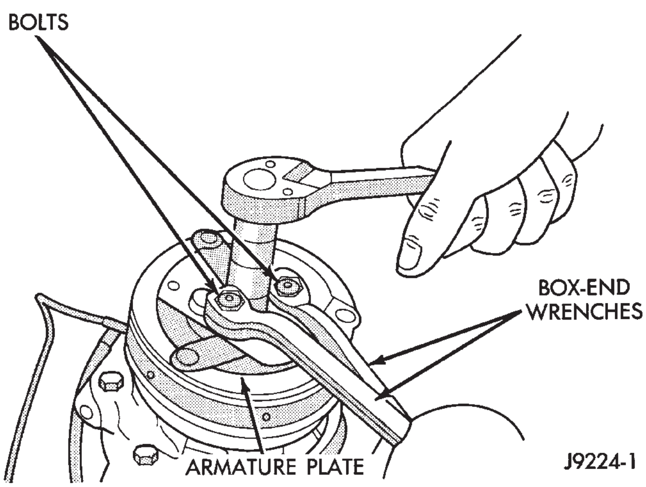


Fig. 20 Compressor Shaft Nut Removal/Installation

(3) Lightly tap clutch plate with a plastic hammer and remove plate and shim(s) (Fig. 21).

CAUTION: Do not use screwdrivers between the armature plate assembly and rotor-pulley to remove the armature plate. This may damage the armature plate assembly.

(4) Remove pulley retaining snap ring with snap ring pliers. Remove pulley assembly from compressor. Use a plastic hammer, if necessary.

(5) Loosen the lead wire retaining clamps and remove lead wire from the compressor front end cover. Disconnect the lead wire from the thermal limiter switch.

(6) Remove snap ring which secures field coil-core assembly to the front cover (Fig. 21). Note the alignment of field coil-core assembly when removing.

WARNING: TAKE CARE THAT THE SNAP RING DOES NOT FLY OUT FROM THE GROOVE.

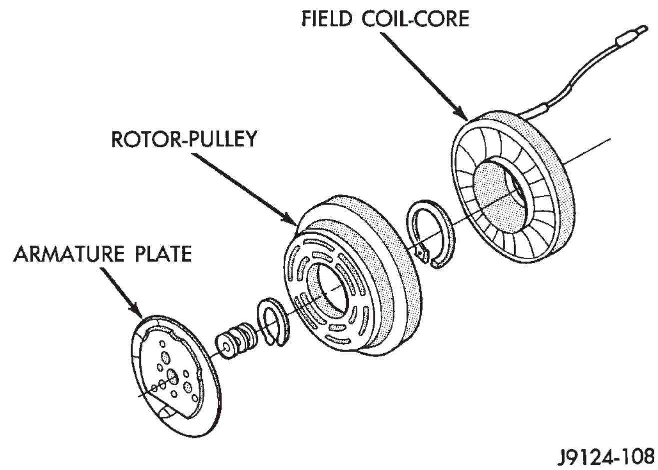


Fig. 21 Clutch Plate/Pulley/Field Coil

INSPECTION

Examine frictional faces of the rotor-pulley and armature plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring. If the friction surfaces are oily, inspect the shaft nose area of the compressor for excess oil. If excess oil is present, the shaft seal is leaking and the compressor must be replaced.

Check pulley hub bearing for roughness or excessive grease leakage. Check for bearing grease contamination on armature plate faces.

CAUTION: The pulley and clutch plate were mated at the factory by a burnishing operation. No attempt should be made to separately replace either part. This will result in clutch slippage due to insufficient contact area.

INSTALLATION

(1) Position the back of the field coil on the compressor front cover. Be sure the locating nipple on the back of the coil lines up with the locating indentation on the front cover. This ensures correct position of the coil and lead wire.

(2) Fasten lead wire to the compressor front cover with the retaining clip. Connect the lead wire to the thermal limiter switch.

(3) Install field coil retaining snap ring (bevel side outward) with snap ring pliers. Insure snap ring is properly seated into groove.

REMOVAL AND INSTALLATION (Continued)

CAUTION: If snap rings on field coil or pulley assembly are not fully seated, they will vibrate out. A clutch failure and possible severe damage to the compressor could result.

(4) Position pulley assembly onto compressor.

CAUTION: Do not mar the pulley frictional surface.

(5) Install pulley assembly retaining snap ring (bevel side outward) with snap ring pliers. Insure snap ring is properly seated into groove.

(6) Place a trial stack of shims, 2.54 mm (0.10 in.) thick, on the compressor shaft.

(7) Install clutch plate on compressor shaft. Note the machined mating splines (Fig. 22).

(8) With the front clutch plate assembly tight against the shims, measure the air gap between clutch plate and pulley face with feeler gauges (Fig. 23). The air gap should be between 0.35 and 0.65 mm (0.013 and 0.025 inch). If proper air gap is not obtained, add or subtract shims until desired air gap is obtained.

(9) Install compressor shaft nut. Tighten nut to 17.6 N·m (13 ft. lbs.) torque.

(10) Shims may compress after tightening shaft bolt. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

(11) Install the compressor onto the mount.

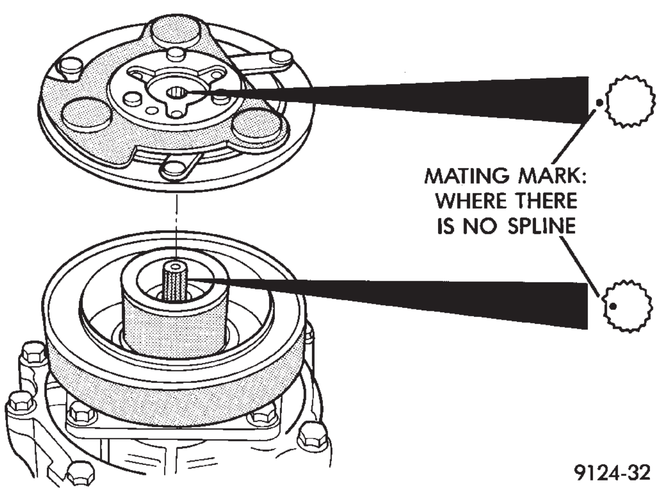


Fig. 22 Aligning Clutch Plate Splines

CLUTCH BREAK-IN

After installing a new field coil-core, check for correct voltage/amperage. Cycle the A/C clutch approximately 20 times (5 seconds on and 5 seconds off). For this procedure run engine at 1,500 to 2,000 rpm and set the system to MAX A/C mode. This procedure will seat the opposing friction surfaces and provide a higher clutch torque capability.

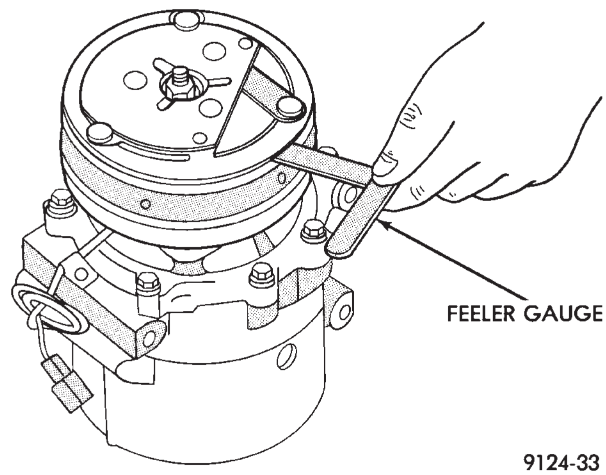


Fig. 23 Measuring Air Gap

CONDENSER

The condenser is located between the radiator and the front bumper. The condenser can be serviced without having to drain the cooling system or remove the radiator.

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO RECOVER R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Disconnect and cap A/C lines at the condenser.

(3) Remove grille retainers (Fig. 24). Refer to Group 23, Body for removal procedures.

(4) Remove upper radiator support crossmember (Fig. 25).

(5) Remove condenser lines. Use Special Tool kit 7193 for quick disconnect couplers.

(6) Remove radiator fan module mounts.

(7) Remove condenser line support bracket.

(8) Remove condenser mounting bolts (Fig. 26).

REMOVAL AND INSTALLATION (Continued)

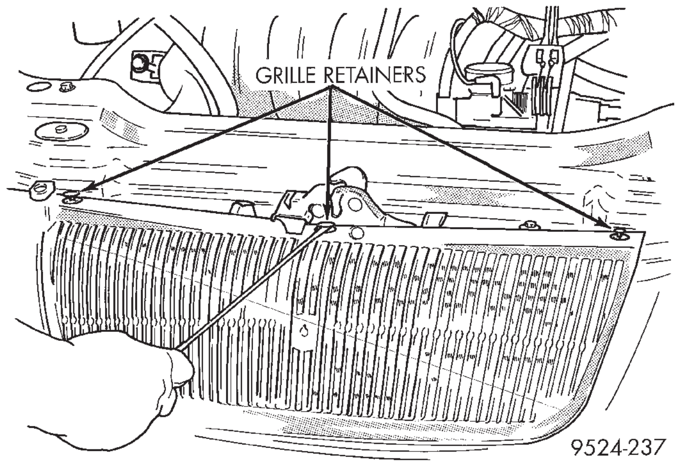


Fig. 24 Grille Retainers

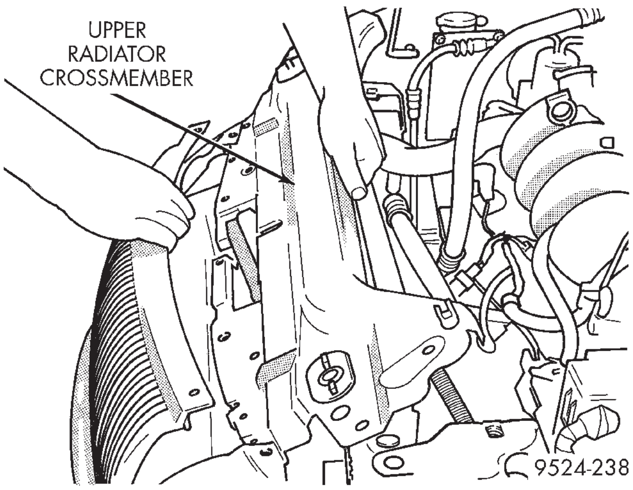


Fig. 25 Radiator Support Crossmember

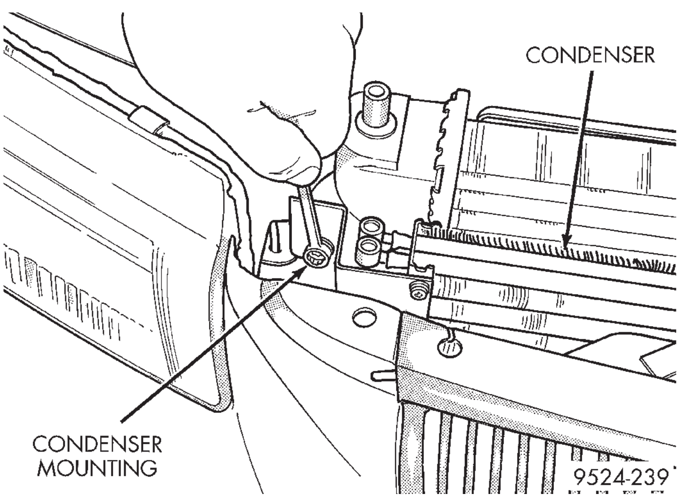


Fig. 26 Condenser Mounting

CAUTION: Avoid bending or breaking condenser inlet tube when lifting condenser from the vehicle.

(9) Lift condenser from vehicle (Fig. 27).

INSTALLATION

For installation, reverse above procedures.

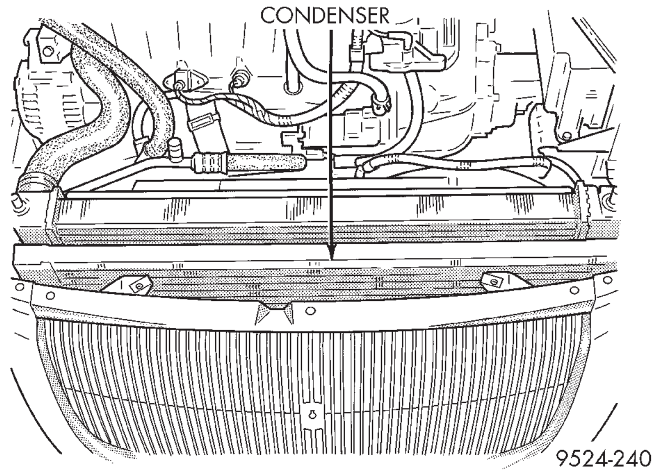


Fig. 27 Condenser Removal

CONTROL MODULE

The control module is located below the radio.

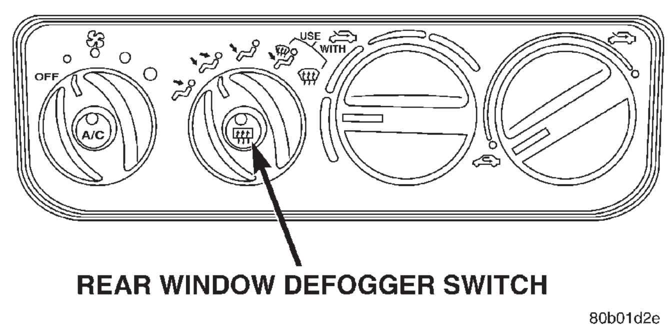


Fig. 28 HVAC Control Module

REMOVAL

(1) Place the ignition key in the OFF position before removing control module.

(2) Remove trim bezel (Fig. 29).

(3) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 30).

(4) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

(5) Remove the cubby bin/cigar lighter bezel and wiring.

(6) Remove the control module retaining screws.

(7) Drop the A/C control module into the cigar lighter/cubby bin bezel opening (Fig. 31). Then disconnect the wiring on the rear of the control module.

(8) Release the cable clips from the top of the control module. Retain the clips for future use. Then disconnect the temperature control and recirculation control cables.

(9) Remove the control module.

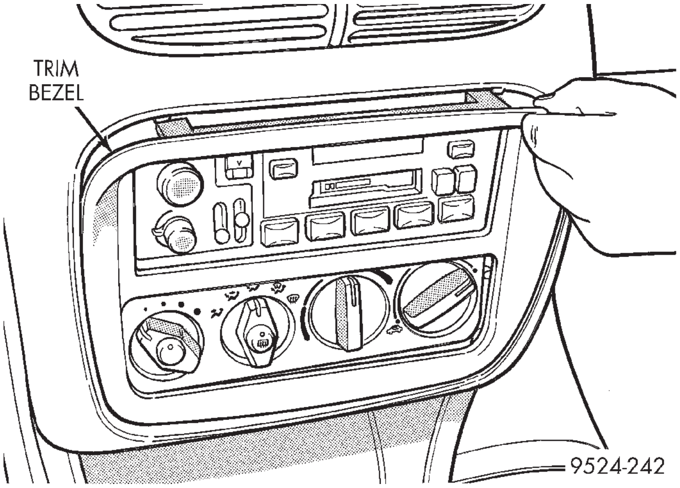


Fig. 29 Control Module

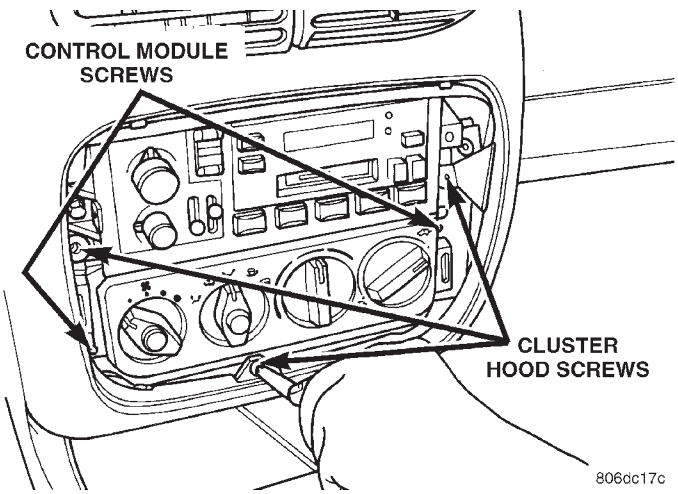


Fig. 30 Control Module Screws

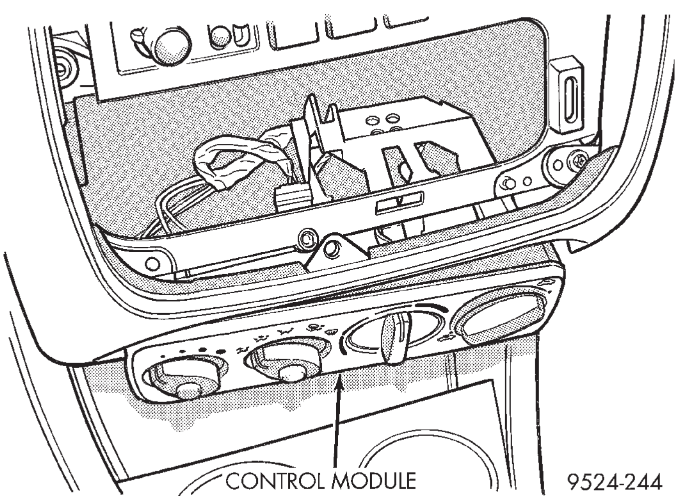


Fig. 31 Control Module At Bezel Opening

INSTALLATION

For installation, reverse the above procedures. Verify that the cables are properly adjusted and the module is seated properly.

CABLE ADJUSTMENT

The cables must be adjusted for proper function of the control module. To adjust the cable, attach the cable to the lever arm of the control module. Turn the knob fully counterclockwise. Pull the cable jacket away from the cable end until taut. Clip the cable jacket to the control module. The knob should travel a full 180° if the cable is properly adjusted.

DISCHARGE LINE

REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Disconnect A/C pressure transducer wire harness.

(3) Remove quick connect clip and disconnect quick connect at condenser using Special Tool kit 7193 (Fig. 32) and (Fig. 33).

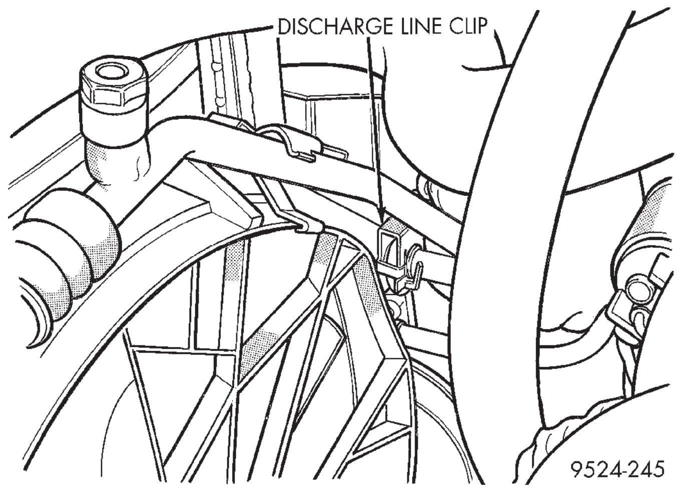


Fig. 32 Quick Connect Clip

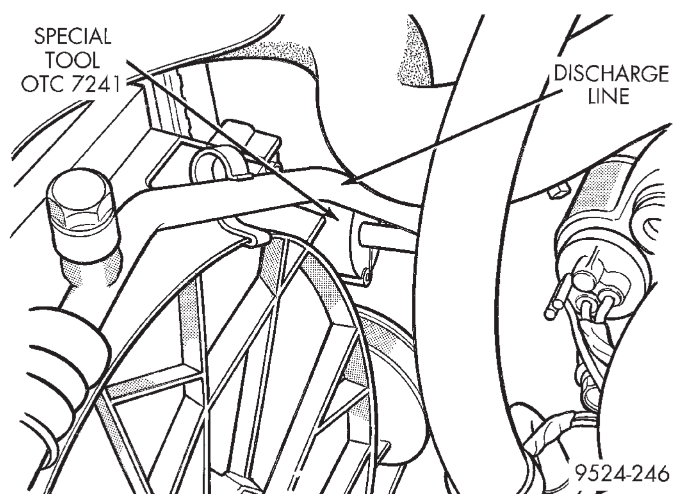


Fig. 33 Special Tool For Line At Condenser

CAUTION: Cap all lines that are not being replaced and cap the expansion valve tubes.

REMOVAL AND INSTALLATION (Continued)

(4) Disconnect line at A/C compressor (Fig. 34). Remove discharge line.

INSTALLATION

For installation, reverse the above procedures. Tighten bolts to 22 N·m (200 in. lbs.).

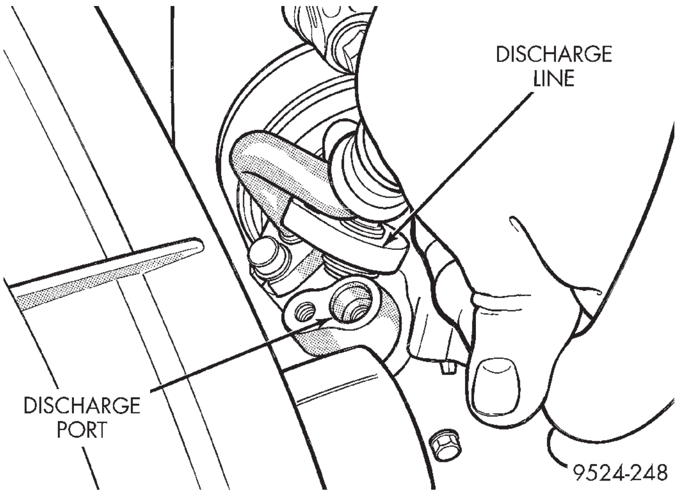


Fig. 34 Line at Compressor

EVAPORATOR

The Heater A/C housing must be removed from the vehicle when replacing the evaporator.

REMOVAL

(1) Disconnect battery negative remote cable.

CAUTION: The refrigerant must be removed from the system before removing Heater-A/C housing. Use a refrigerant recovery machine.

(2) Remove A/C housing from vehicle (Fig. 35). Refer to Heater-A/C Housing Removal and Installation in this section for procedure.

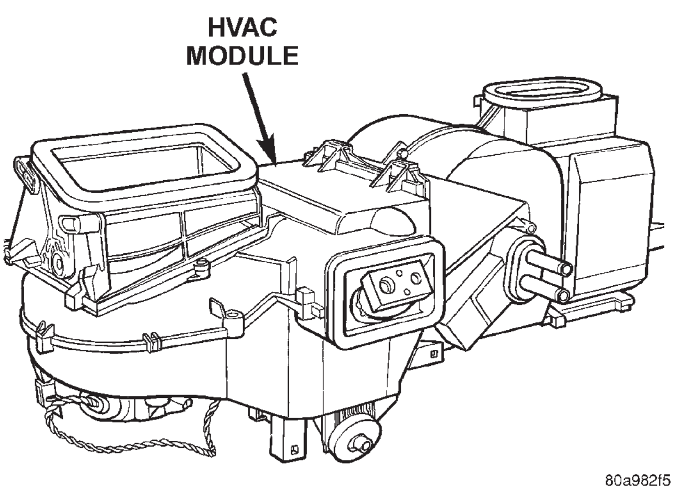


Fig. 35 A/C Housing

(3) Remove recirculation door inlet cover.

(4) Remove evaporator temperature probe.

(5) Remove clips retaining evaporator housing to heater/distribution housing (Fig. 36).

(6) Separate evaporator housing from heater/distribution housing (Fig. 37) and (Fig. 38).

(7) Remove seal around evaporator tube inlet.

(8) Remove evaporator housing upper cover (Fig. 39).

(9) Lift evaporator out of lower housing (Fig. 40).

(10) Remove styrofoam seal around evaporator.

(11) Transfer evaporator sensor. Place the evaporator sensor in the same location as on the previous evaporator.

INSTALLATION

For installation, reverse the above procedure.

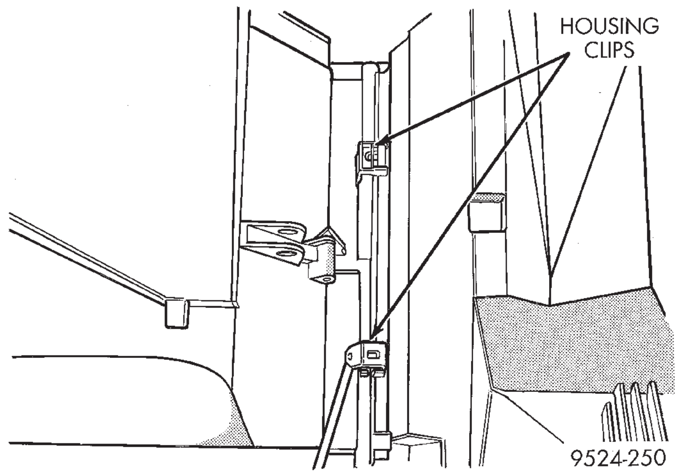


Fig. 36 Housing Clips

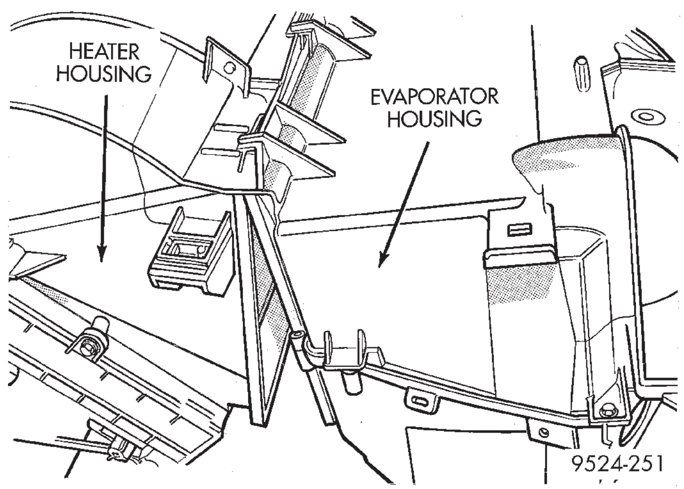


Fig. 37 Separate Housings

REMOVAL AND INSTALLATION (Continued)

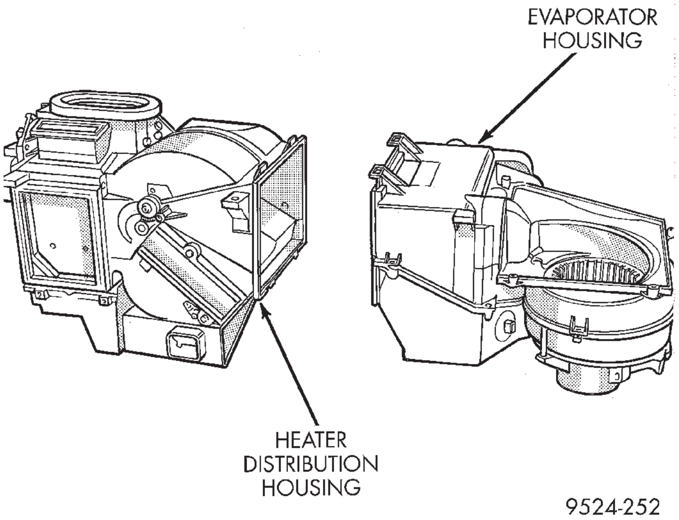


Fig. 38 Housings

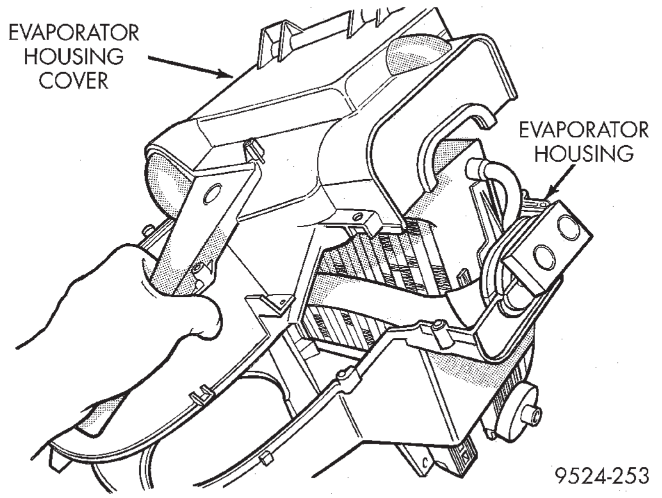


Fig. 39 Evaporator Housing Upper Cover

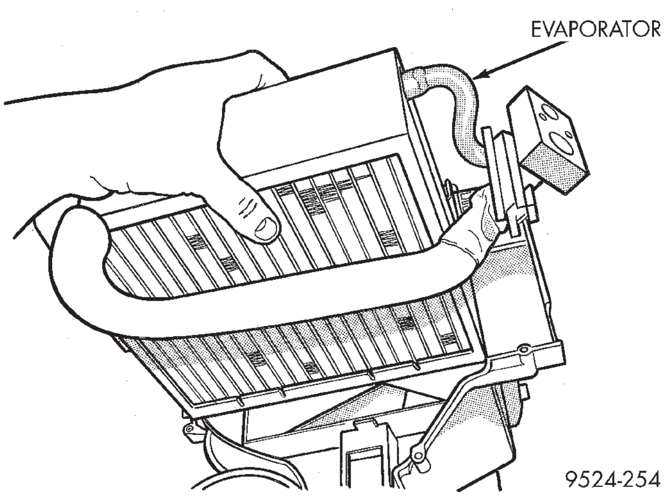


Fig. 40 Remove Evaporator From Housing

EVAPORATOR PROBE

REMOVAL

(1) Disconnect battery.

(2) Remove right under panel silencer/duct.

(3) Disconnect wiring connector for evaporator probe (Fig. 41).

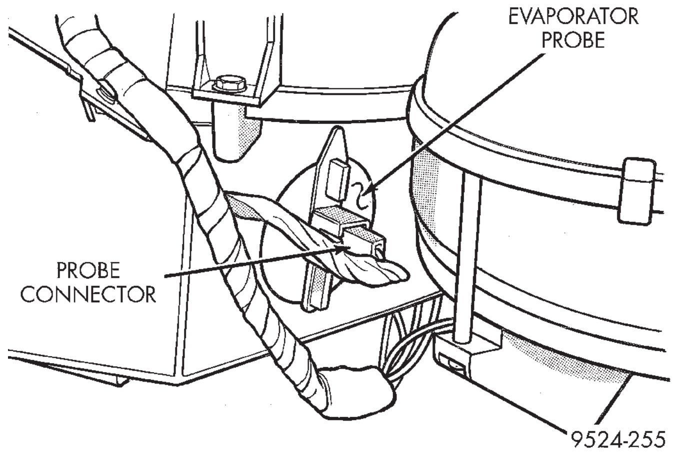


Fig. 41 Evaporator Probe Wiring

(4) Using a flat blade pry tool, pull back on the locking tab. Twist the access plate clockwise one-quarter turn and remove plate (Fig. 42).

(5) Pull probe out of evaporator core (Fig. 43). This plate must be pushed inside the A/C unit and orientated in such a way that the plate can be removed.

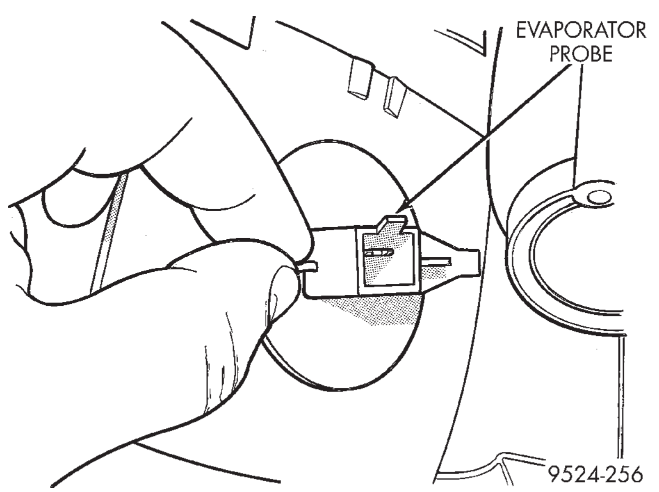


Fig. 42 Evaporator Probe

REMOVAL AND INSTALLATION (Continued)

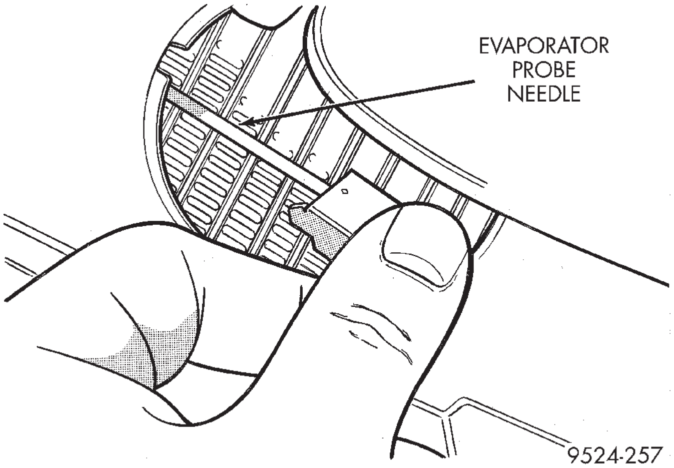


Fig. 43 Remove Probe

INSTALLATION

(1) Install new probe into the evaporator. **The new probe must not go into the same hole (in the evaporator core) that the old probe was removed.** The evaporator is manufactured with three holes for probe insertion. Insert the probe in the uppermost hole.

(2) Install evaporator probe access panel.

(3) Connect probe wiring harness.

(4) Reconnect battery.

EXPANSION VALVE

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Disconnect clips from expansion valve lines (Fig. 44) and (Fig. 45).

(3) Use special tool kit 7193 to disconnect quick connectors on expansion valve (Fig. 46) and (Fig. 47).

(4) Remove lines at expansion valve (Fig. 48).

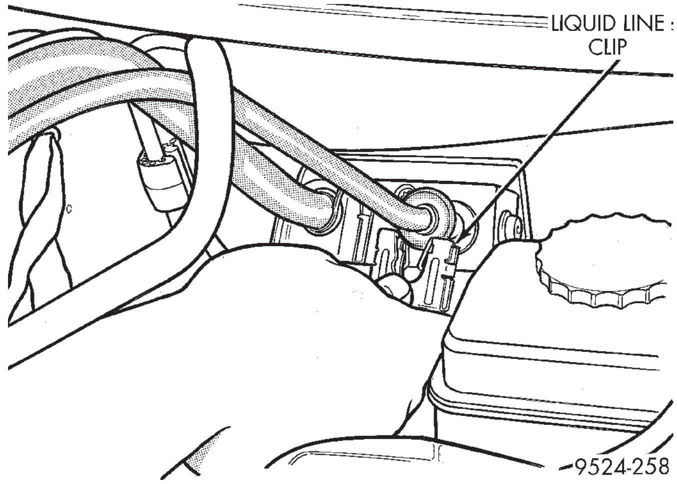


Fig. 44 Liquid Line Clip

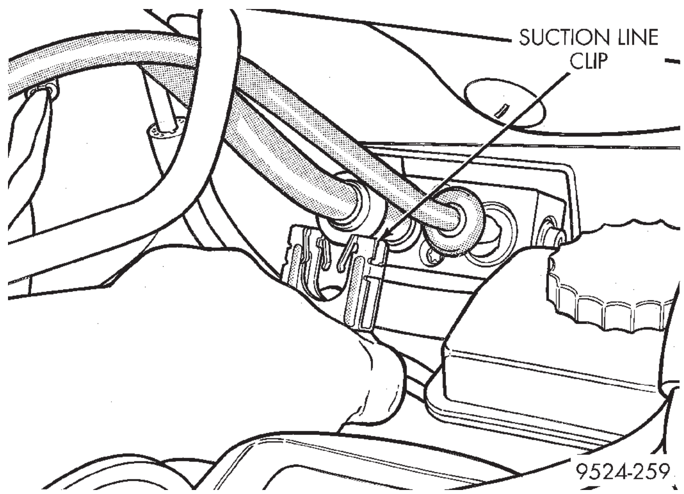


Fig. 45 Suction Line Clip

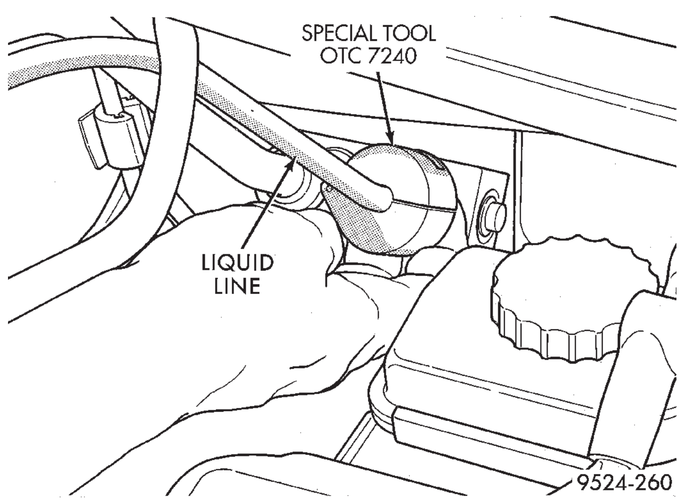


Fig. 46 Special Tool 7240 For Liquid Line

(5) Remove two retaining bolts from expansion valve (Fig. 49).

(6) Remove expansion valve (Fig. 50).

(7) Remove expansion valve gasket.

REMOVAL AND INSTALLATION (Continued)

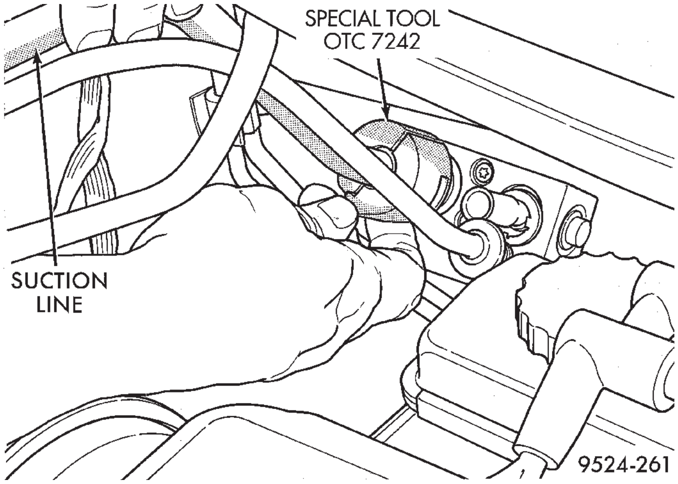


Fig. 47 Special Tool 7242 For Suction Line

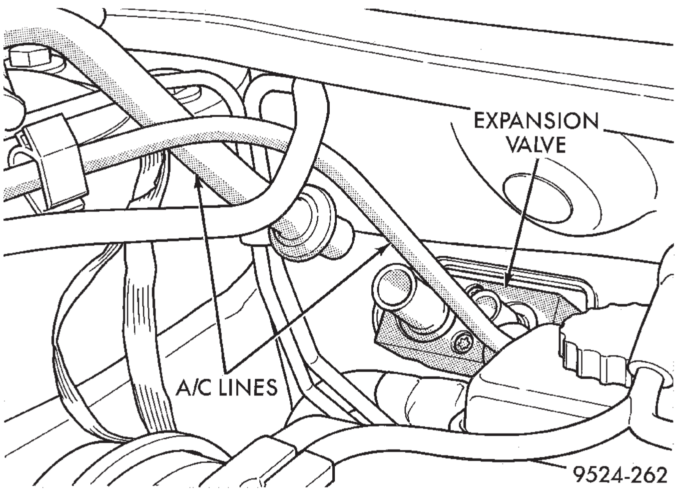


Fig. 48 Lines At Expansion Valve

INSTALLATION

CAUTION: Always install a new gasket when replacing expansion valve.

For installation, reverse the above procedures. Tighten new expansion valve to 11 N·m (100 in. lbs.).

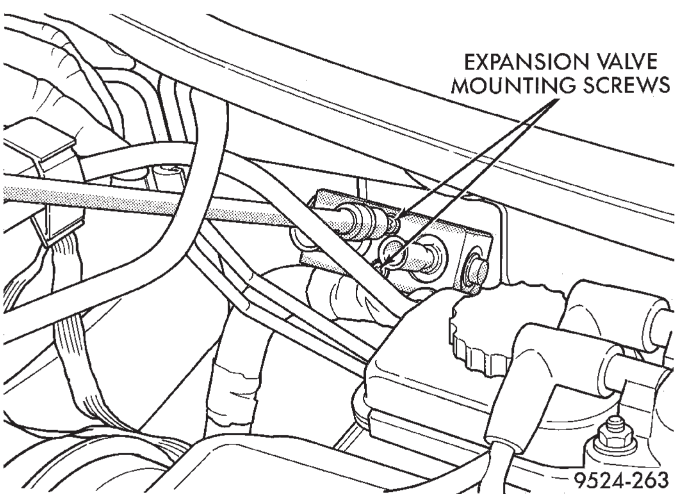


Fig. 49 Expansion Valve Bolts

FILTER/DRIER

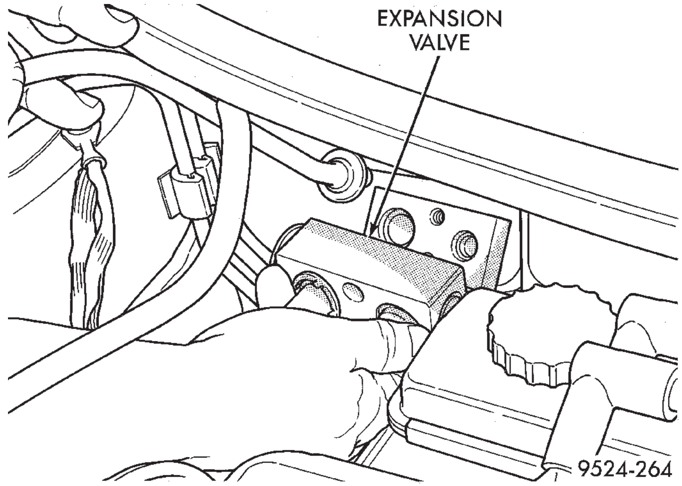


Fig. 50 Expansion Valve

The filter/drier is a receiver for reserve refrigerant. It also has a desiccant bag and a filter. This is used to absorb moisture and filter the refrigerant as it passes through the filter/drier.

The filter/drier is located left of the coolant bottle (Fig. 51). The A/C refrigerant must be removed from the system before removing the filter/drier. Always use a refrigerant recovery machine.

Replace the filter/drier if an A/C system is left open for an extended period of time.

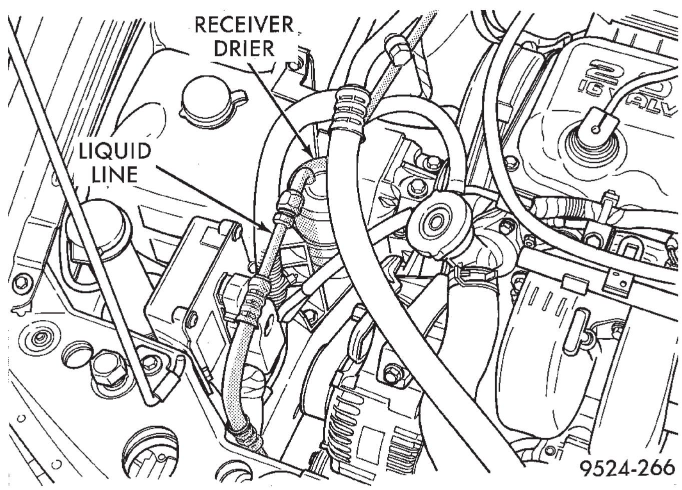


Fig. 51 Filter/Drier Location

REMOVAL

(1) Remove refrigerant from A/C system using a refrigerant recovery machine.

(2) Remove liquid line at filter/drier from condenser (Fig. 52).

(3) Remove liquid line at filter/drier from expansion valve (Fig. 53).

(4) Remove filter/drier bracket bolt at base of filter/drier (Fig. 54).

REMOVAL AND INSTALLATION (Continued)

(5) Cap liquid line and condenser threaded fitting while system is open to prevent moisture from entering system.

INSTALLATION

CAUTION: When installing new filter/drier do not leave open to atmosphere for a long period of time. The filter/drier contains moisture absorbing materials which will absorb moisture in the atmosphere.

For installation, reverse the above procedures.

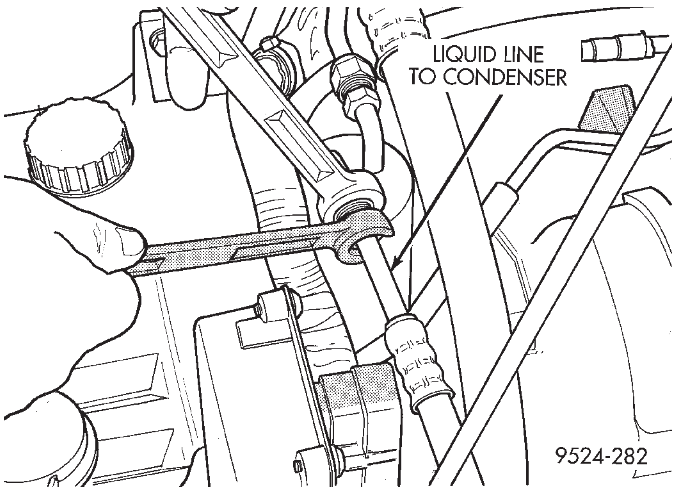


Fig. 52 Liquid Line From Condenser

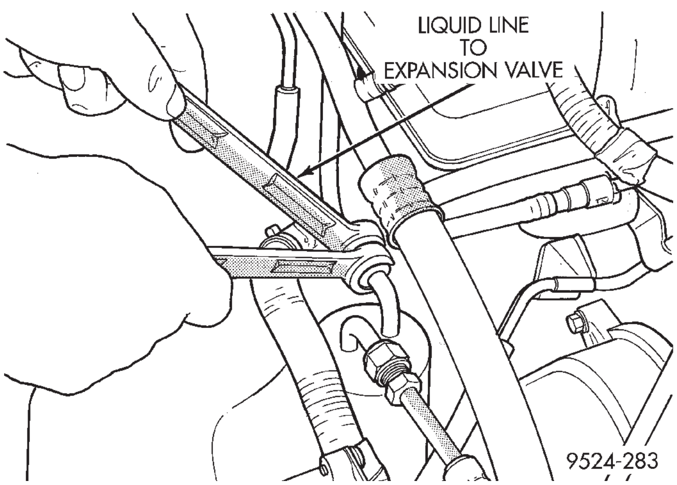


Fig. 53 Liquid Line From Expansion Valve

HEATER CORE

The heater core is serviceable inside the vehicle. However, if the core has leaked a significant amount of coolant, the A/C housing must be removed. The housing should be disassembled and cleaned thoroughly before heater core replacement. If housing removal is necessary, refer to Heater-A/C Housing, Removal and Installation in this section.

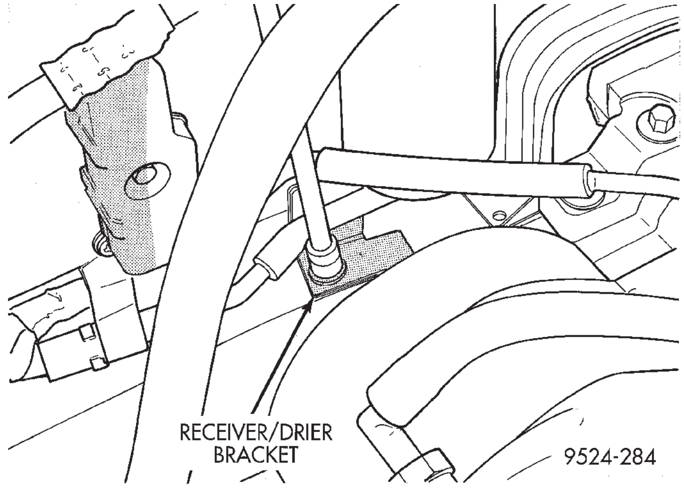


Fig. 54 Receiver/Drier Bracket

REMOVAL

(1) Disconnect battery negative remote cable.
(2) Remove radio/control module bezel (Fig. 29).
(3) Remove right instrument panel side trim.
(4) Remove two screws at lower right side support beam.
(5) Remove bolt for instrument panel support at A-pillar.
(6) Remove left instrument panel side trim.
(7) Remove upper instrument panel bezel.
(8) Remove lower knee bolster.
(9) Remove console screws at instrument panel.
(10) Remove gearshift knob.
(11) Remove shifter bezel.
(12) Remove console screws at rear. Remove rear half of console.
(13) Remove front console screws. Remove front half of console.
(14) Remove right side instrument panel support strut.
(15) Drain coolant.
(16) Remove heater hoses at cowl.
(17) Remove heater core cover screws and cover.
(18) Remove heater core.

INSTALLATION

(1) Carefully install new heater core into the heater housing.
(2) Fasten heater core cover to housing with screws provided.
(3) Reinstall all necessary trim.
(4) Fill coolant to level.
(5) Reconnect battery.

HEATER HOSES

The heater hoses attach at the engine compartment cowl onto the heater core inlet/outlet and on the left side of the engine.

REMOVAL AND INSTALLATION (Continued)

HEATER HOSES (2.0L-2.4L)

The heater hoses are serviced separately of each other. The hoses can not be serviced with bulk roll heater hose. If it is necessary to replace a hose, use hose of the exact diameter and size and shape. The hoses are attached using spring tension clamps.

REMOVAL

NOTE: Review Safety Precautions and Warnings before proceeding with this operation.

(1) Drain engine cooling system. Refer to Group 7, Cooling System.

(2) Using spring tension clamp pliers, remove clamps at each end of hose to be removed (Fig. 55) and (Fig. 56).

(3) Carefully rotate hose back and forth while tugging slightly away from connector nipple.

CAUTION: When removing hoses from heater core inlet or outlet nipples, do not use excessive force. Heater core may become damaged and leak engine coolant into heater unit.

INSTALLATION

For installation, reverse the above procedures.

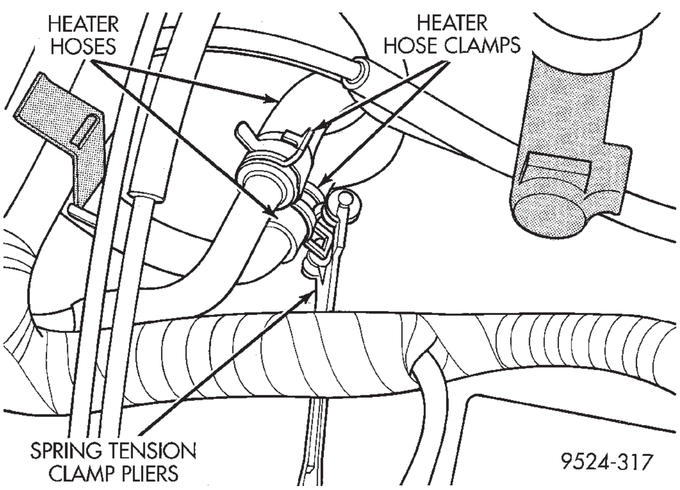


Fig. 55 Heater Hose Connection At Engine

HEATER HOSES (2.5L)

REMOVAL

The heater hoses for the 2.5L engine are preformed hoses with quick connect fittings at the engine. These hoses are not serviceable and must be replaced using OEM parts. The hoses are attached at the heater core using spring tension clamps.

NOTE: Review Safety Precautions and Warnings before proceeding with this operation.

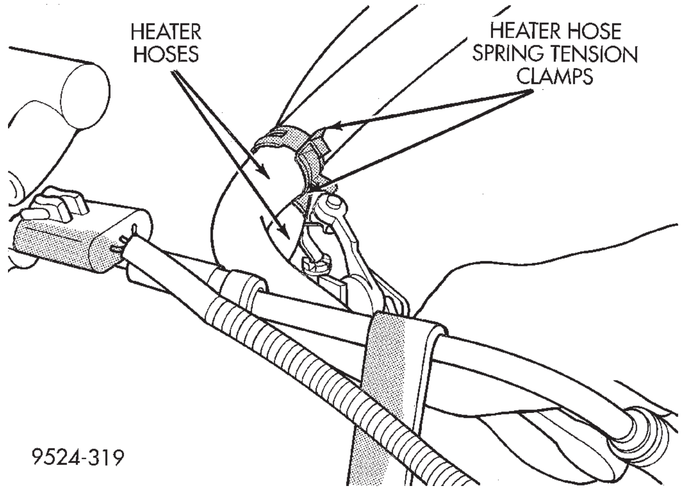


Fig. 56 Heater Hose Connection At Heater Core

(1) Drain engine cooling system. Refer to Group 7, Engine Cooling.

(2) Using thin slide-jaw pliers, pinch quick connect fitting in, of hose to be removed (Fig. 57).

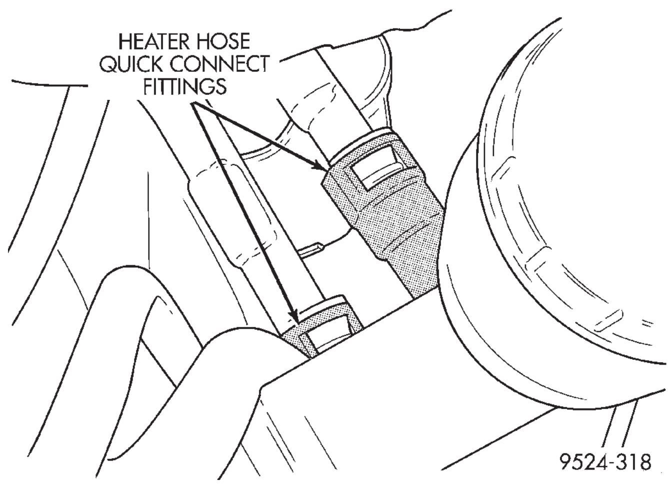


Fig. 57 Heater Hose Connection At Engine

(3) Remove intake manifold plenum. Refer to Group 11, Exhaust System And Intake Manifold for service information.

(4) Using spring tension clamp pliers, remove clamp at heater core end of hose to be removed (Fig. 56).

(5) Carefully rotate hose back and forth while tugging slightly away from connector nipple.

CAUTION: When removing hoses from heater core inlet or outlet nipples, do not use excessive force. Heater core may become damaged and leak engine coolant into heater unit.

INSTALLATION

For installation, reverse the above procedures.

REMOVAL AND INSTALLATION (Continued)

LIQUID LINE

TO EXPANSION VALVE

REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Remove A/C quick connect clip at expansion valve (Fig. 58).

(3) Disconnect quick connector on expansion valve. Remove liquid line from expansion valve. Use Special Tool kit 7193 to disconnect quick connector (Fig. 59).

CAUTION: Cap all lines that are not being replaced and cap the expansion valve tubes.

(4) Disconnect liquid line from the receiver/drier (Fig. 60).

(5) Remove the liquid line from the vehicle.

INSTALLATION

For installation, reverse the above procedures.

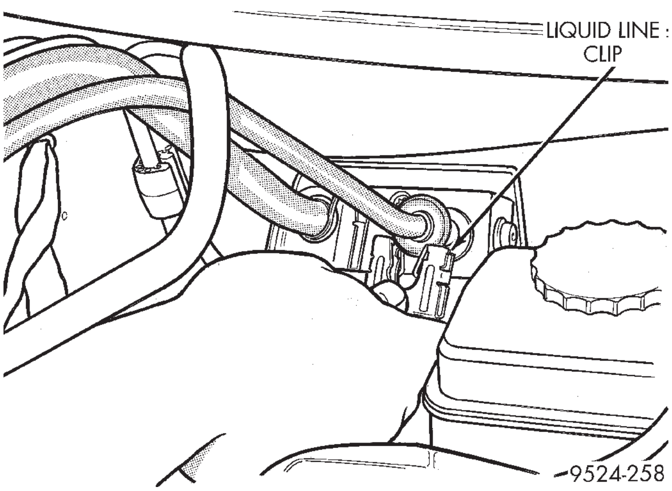


Fig. 58 Liquid Line Clip At Expansion Valve

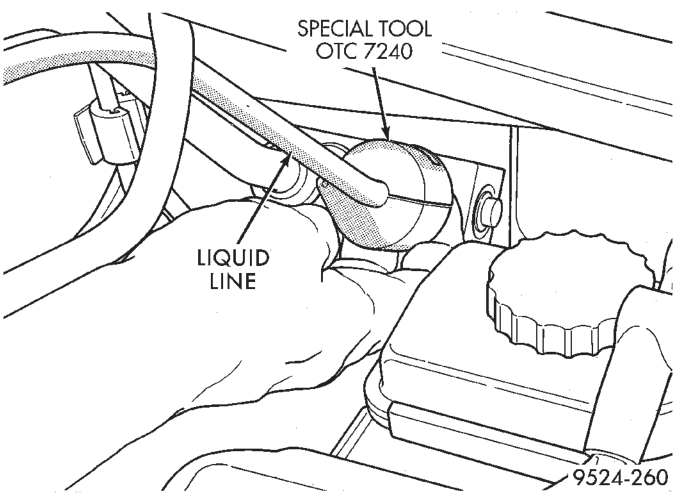


Fig. 59 Use Special Tool 7240 For Quick Connect

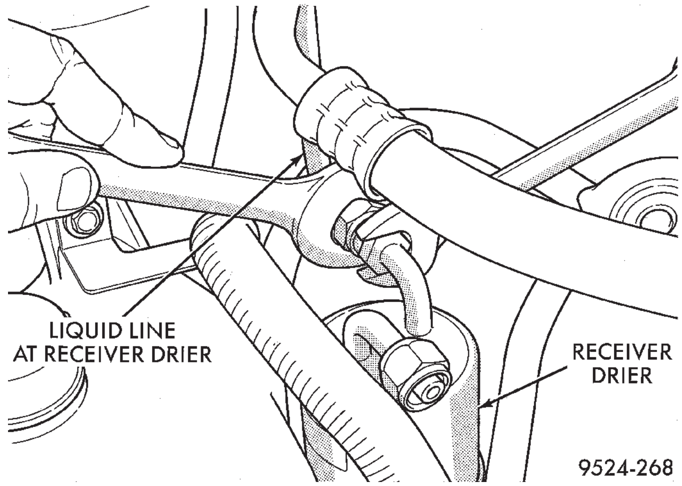


Fig. 60 Liquid Line At Receiver/Drier

TO CONDENSER

REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Remove A/C quick connect clip at condenser (Fig. 61).

(3) Disconnect quick connector at condenser. Remove liquid line from condenser. Use special tool kit 7193 to disconnect quick connector (Fig. 62). Remove line at condenser (Fig. 63).

CAUTION: Cap all lines that are not being replaced and cap the condenser inlet.

(4) Disconnect liquid line from the receiver/drier (Fig. 64).

(5) Remove the liquid line from the vehicle.

INSTALLATION

For installation, reverse the above procedures.

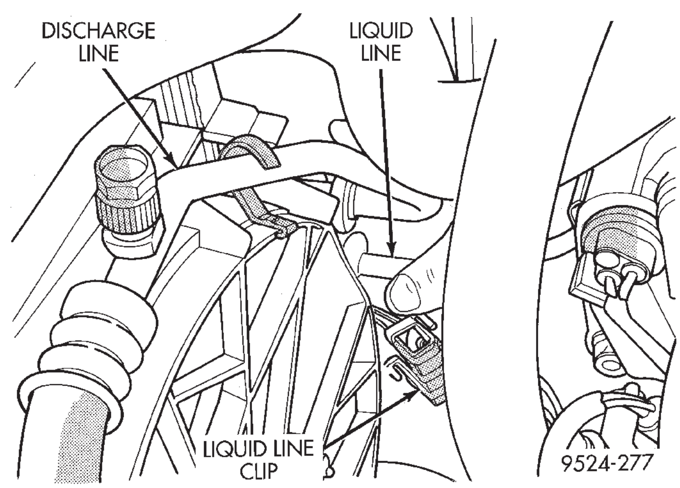


Fig. 61 Clip Removal

REMOVAL AND INSTALLATION (Continued)

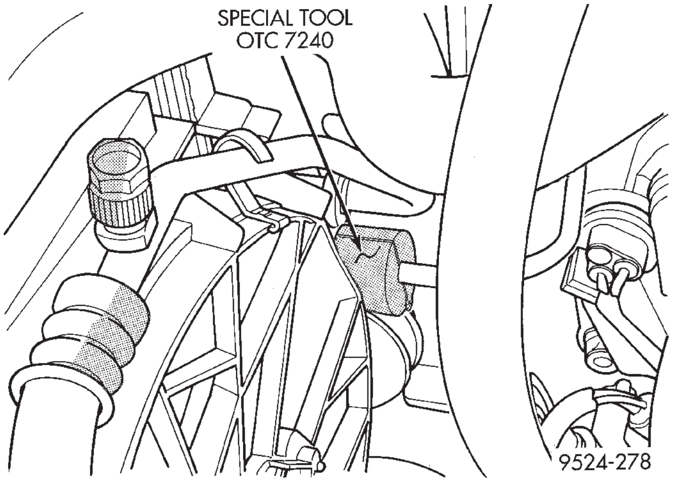


Fig. 62 Quick Coupler Using Special Tool 7240

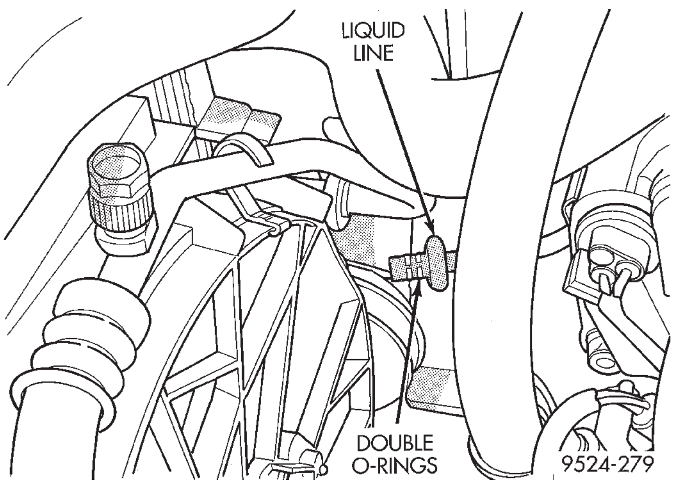


Fig. 63 Line At Condenser

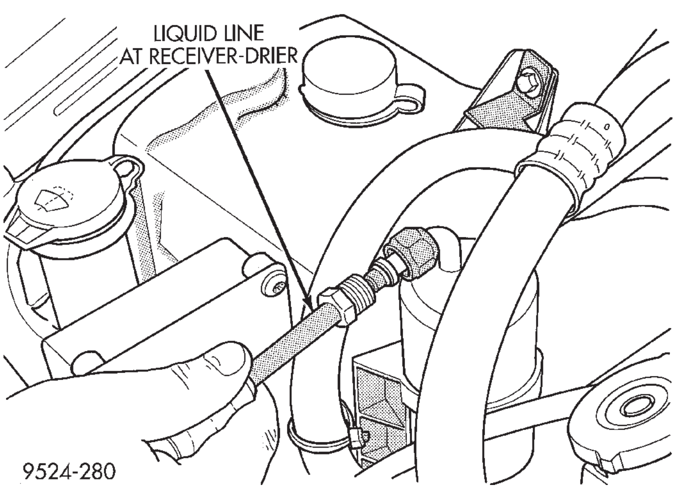


Fig. 64 Liquid Line at Receiver/Drier

RECIRCULATION DOOR CABLE

The RECIRC door is actuated by a cable which mechanically positions the door.

The RECIRC door actuator is located at the far right of the A/C Heater housing near the right A-pillar (Fig. 65).

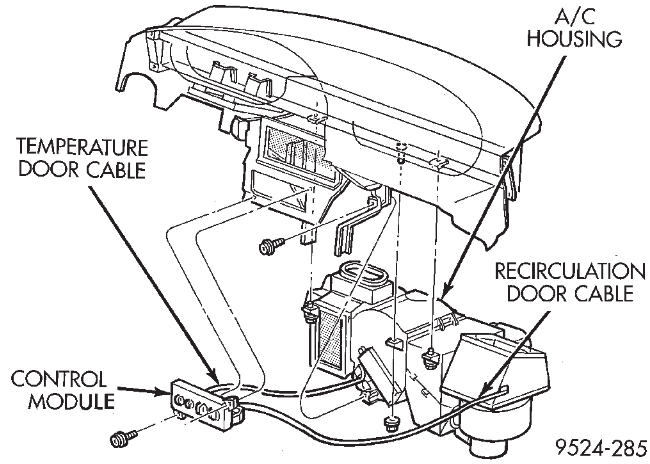


Fig. 65 Recirculation Cable Location

REMOVAL

(1) Place the ignition key in the OFF position before removing control module.

(2) Remove trim bezel (Fig. 66).

(3) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 67).

(4) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

(5) Remove the cubby bin/cigar lighter bezel and wiring.

(6) Remove the control module retaining screws.

(7) Drop the A/C control module into the cigar lighter/cubby bin bezel opening (Fig. 68). Then disconnect the wiring on the rear of the control module.

(8) Release the recirculation cable retaining clip from the top of the control module. Retain the clip for future use. Then disconnect the recirculation control cable.

(9) Remove right under panel silencer/duct.

(10) Disconnect cable flag at right of recirculation housing (Fig. 69).

(11) Remove cable core end from recirculation actuator lever.

INSTALLATION

For installation, reverse the above procedures. Verify that the cables are properly adjusted, free of interference, and the module is seated properly.

CABLE ADJUSTMENT

The cables must be adjusted for proper function of the control module. To adjust the cable, attach the cable to the lever arm of the control module. Turn the knob fully counterclockwise. Pull the cable jacket away from the cable end until taut. Clip the cable jacket to the control module. The knob should travel a full 180° if the cable is properly adjusted.

REMOVAL AND INSTALLATION (Continued)

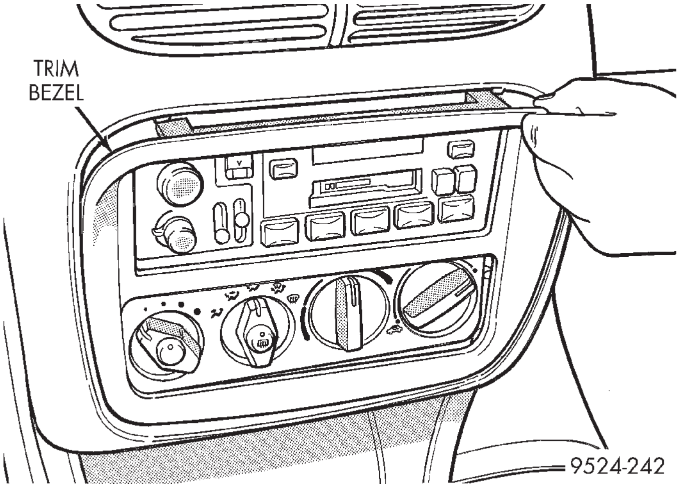


Fig. 66 Trim Bezel

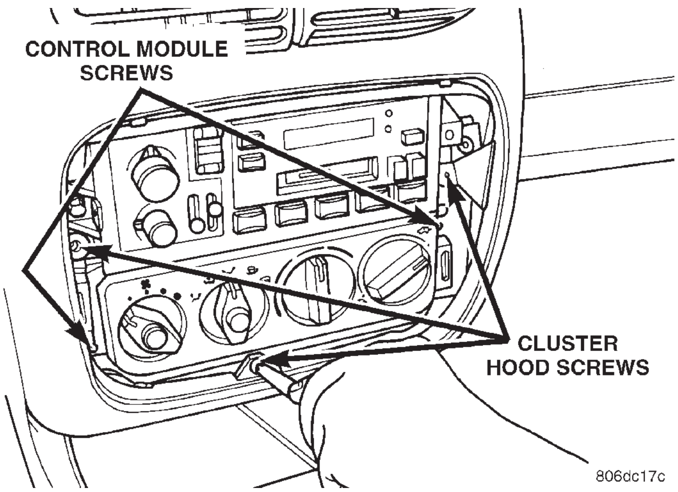


Fig. 67 Control Module Screws

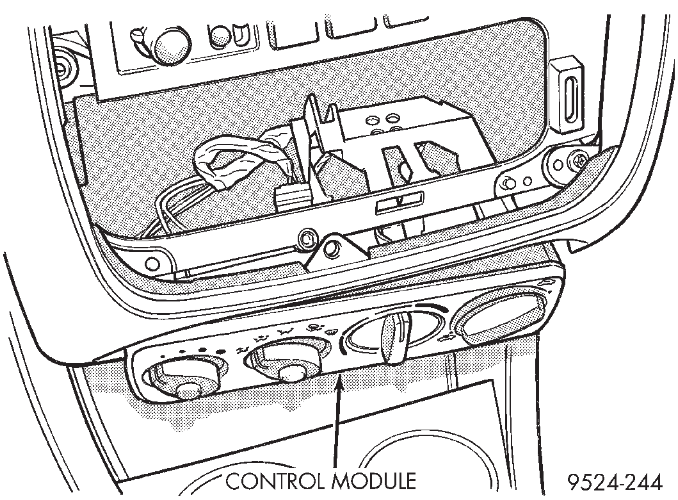


Fig. 68 Control Module At Bezel Opening

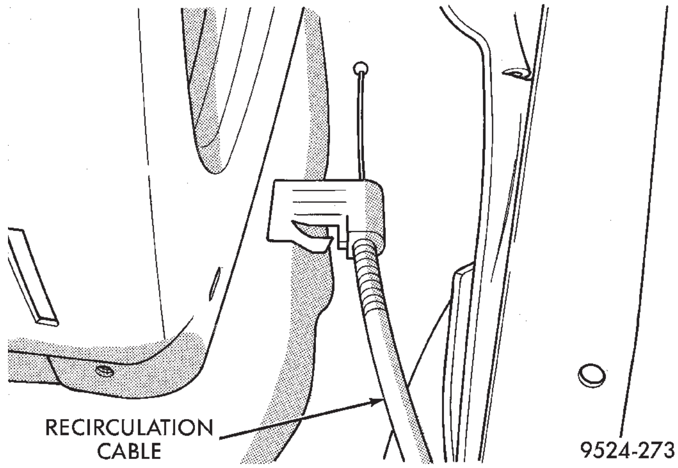


Fig. 69 Disconnect Recirculation Cable

SUCTION LINE

REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Remove suction line clip at right strut tower (Fig. 70).

(3) Remove quick connect clip (Fig. 71). Disconnect quick connect at expansion valve end using Special Tool Kit 7193.

CAUTION: Cap all lines that are not being replaced and cap the expansion valve tubes.

(4) Disconnect line at compressor end (Fig. 72).

(5) Remove suction line from vehicle.

INSTALLATION

For installation, reverse the above procedures. Tighten bolts to 22 N·m (200 in. lbs.).

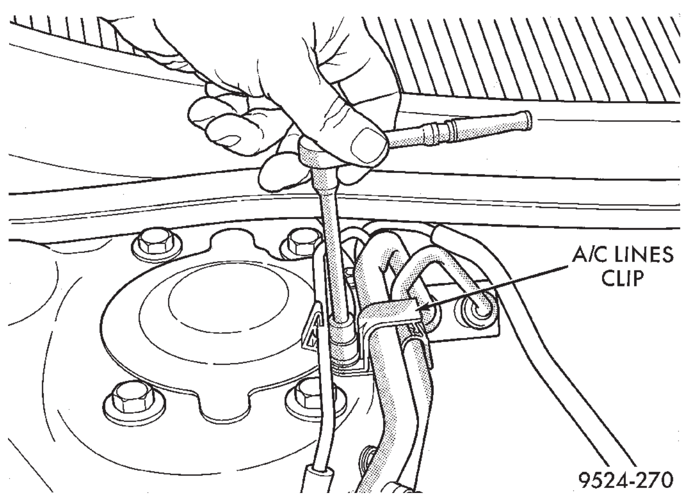


Fig. 70 Suction Line Routing Clip

REMOVAL AND INSTALLATION (Continued)

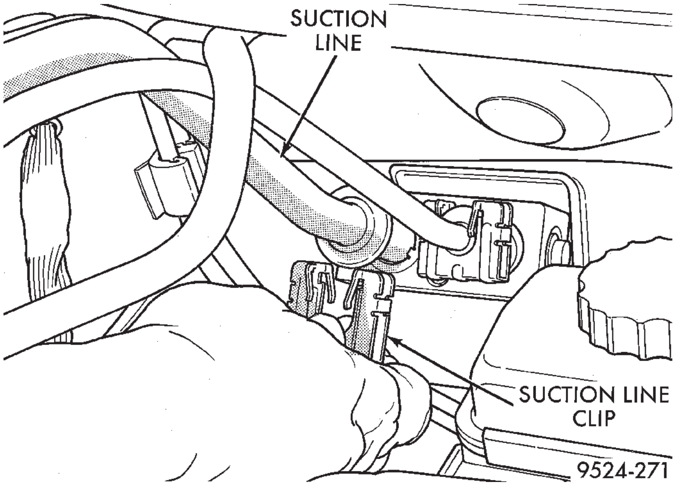


Fig. 71 Quick Connect Clip

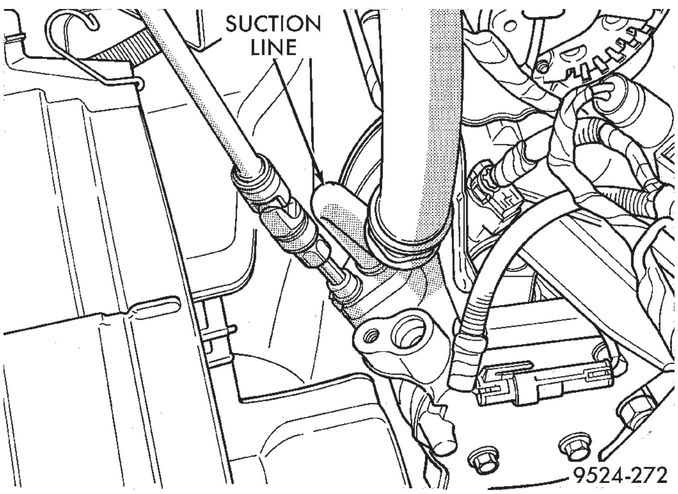


Fig. 72 Suction Line At Compressor

TEMPERATURE DOOR CABLE

The blend-air (temperature) door is actuated by a cable which mechanically positions the temperature door.

The temperature door actuator is located at the center of the A/C Heater housing at the center tunnel.

REMOVAL

(1) Place the ignition key in the OFF position before removing control module.

(2) Remove trim bezel (Fig. 66).

(3) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 67).

(4) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

(5) Remove the cubby bin/cigar lighter bezel and wiring.

(6) Remove the control module retaining screws.

(7) Remove control module and disconnect the wire connectors.

(8) Release the temperature control cable retaining clip from the top of the control module. Retain the clip for future use. Then disconnect the temperature control cable.

(9) Disconnect cable at A/C housing (Fig. 73).

(10) Remove cable core end from temperature actuator lever.

INSTALLATION

For installation, reverse the above procedures.

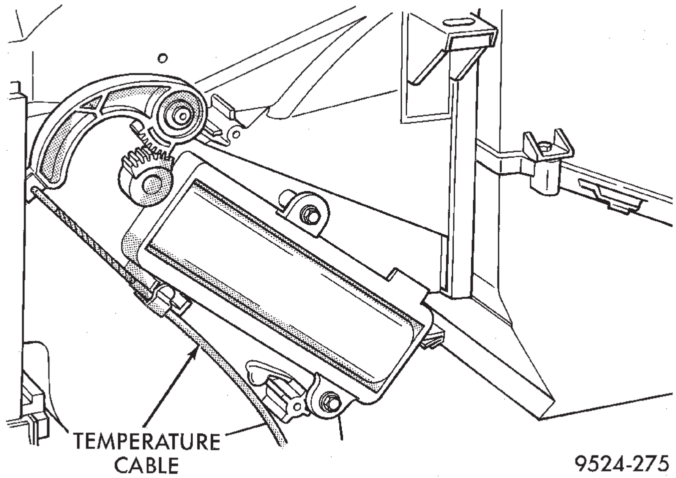


Fig. 73 Temperature Cable At A/C Housing

THERMAL LIMITER SWITCH

There is no serviceability of the thermal limiter switch. If the thermal limiter switch fails, the compressor must be replaced. To replace the compressor, refer to Compressor Replacement in this section.

UNIT HOUSING

REMOVAL

The heater core may be removed without removing the unit housing. Refer to heater core replacement in this section.

(1) Disconnect battery negative remote cable. This must be done to prevent accidental air bag deployment.

REMOVAL AND INSTALLATION (Continued)

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

(2) Using an A/C recovery unit, remove all R-134a refrigerant from the A/C system.

(3) Remove air cleaner hose and air distribution duct from the engine.

(4) Drain the engine cooling system.

NOTE: If equipped with 2.5L engine, the upper intake manifold has to be removed at this time to access the heater hose connections at the bulkhead. Refer to group 11, Exhaust System And Intake Manifold for service information.

(5) Disconnect heater hoses at the dash panel. Plug the heater core inlet and outlet tubes to prevent antifreeze from spilling on the vehicle interior during removal. If an appropriate plug cannot be found pull back carpet and use caution when removing unit. Keep the heater tubes elevated to prevent spillage of coolant.

(6) Remove both A/C lines from expansion valve. Use Special Tool Kit 7193 to disconnect quick connectors on A/C lines. Refer to A/C line removal in this section for complete procedure. After removing lines cap the expansion valve openings and the A/C hose openings. This will prevent any dirt or moisture from entering the refrigerant system during servicing.

CAUTION: The lubricant used in this air conditioning system absorbs moisture readily (similar to brake fluid). Do not leave any portion of the system open for extended periods of time.

(7) Remove trim bezel (Fig. 66).

(8) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 67).

(9) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

(10) Remove the cubby bin/cigar lighter bezel and wiring.

(11) Remove the control module retaining screws.

(12) Drop the A/C control module into the cigar lighter/cubby bin bezel opening (Fig. 68). Then disconnect the wiring on the rear of the control module.

(13) Release the cable clips from the top of the control module. Retain the clips for future use. Then disconnect the temperature control and recirculation control cables.

(14) Remove the control module.

(15) Remove upper instrument panel bezel.

(16) Remove right and left instrument panel end caps.

(17) Remove left lower knee bolster. Disconnect mode door motor wiring.

(18) Remove right and left interior door post kick panel.

(19) Remove front and rear halves of floor console.

(20) Remove the radio.

(21) Remove right side lower silencer/duct.

(22) Remove glove box assembly.

(23) Remove right side vertical support strut brace.

(24) Remove left side vertical support strut brace.

(25) Remove center lower distribution housing.

(26) Remove bolts securing Heater-A/C housing to metal I/P frame.

(27) Remove upper instrument panel cowl trim cover.

(28) Disconnect steering column from instrument panel. Lower steering column.

(29) Remove instrument panel bolts at cowl fence.

(30) Remove bolts at lower A-posts.

(31) Remove instrument panel frame and wiring.

(32) Remove bolts securing Heater-A/C housing to cowl.

INSTALLATION

For installation, reverse the above procedure. Verify that the cables are properly adjusted, free of interference, and the control module is seated properly.

CABLE ADJUSTMENT

The cables must be adjusted for proper function of the control module. To adjust the cable, attach the cable to the lever arm of the control module. Turn the knob fully counterclockwise. Pull the cable jacket away from the cable end until taut. Clip the cable jacket to the control module. The knob should travel a full 180° if the cable is properly adjusted.

DISASSEMBLY AND ASSEMBLY

UNIT HOUSING RECONDITION

Heater-A/C housing must be removed from vehicle before performing this operation. Refer to Heater-A/C Unit Housing—Removal and Installation.

DISASSEMBLY AND ASSEMBLY (Continued)

The heater a/c unit need not be disassembled to replace the heater core. Refer to Heater Core replacement in this section.

DISASSEMBLE

(1) Place Heater-A/C unit assembly on workbench (Fig. 74) and (Fig. 75).

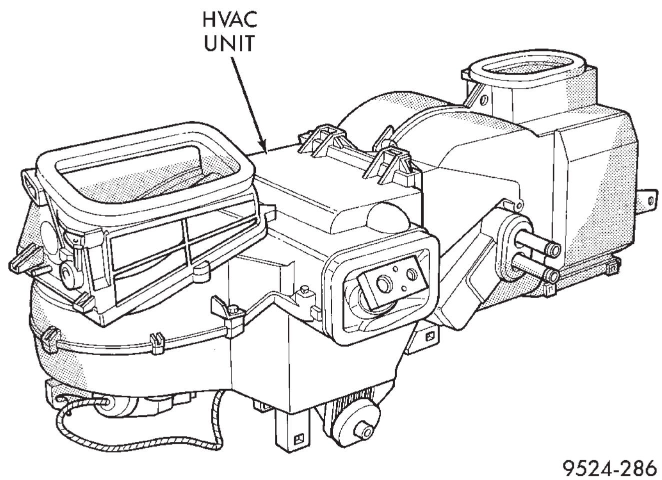


Fig. 74 Heater-A/C Unit

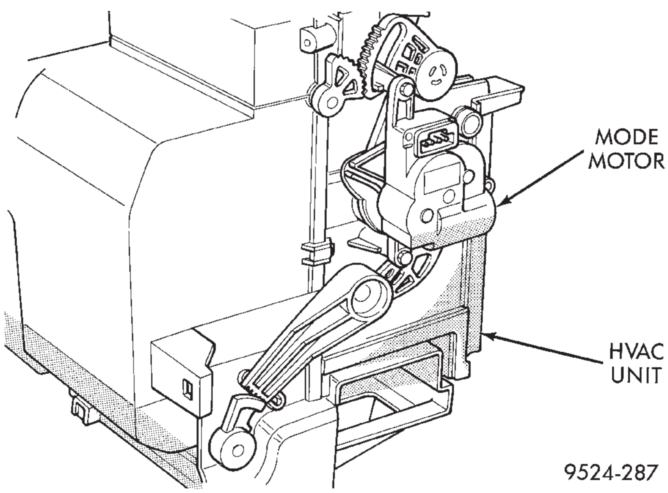


Fig. 75 Mode Motor Linkage

(2) Remove A/C mode motor (Fig. 76).

(3) Remove upper recirculation air inlet housing (Fig. 77) and (Fig. 78).

(4) From inside of air inlet, depress release tang on rear inlet door (Fig. 79).

(5) Remove rear Y-cam actuator lever (Fig. 80).

(6) Turn front toggle lever until it lines up with slots on housing.

(7) Pull straight up on toggle lever and slide toggle lever from underneath front actuator lever (Fig. 80).

(8) Remove front toggle lever (Fig. 80).

(9) Remove Y-cam rear lever (Fig. 80).

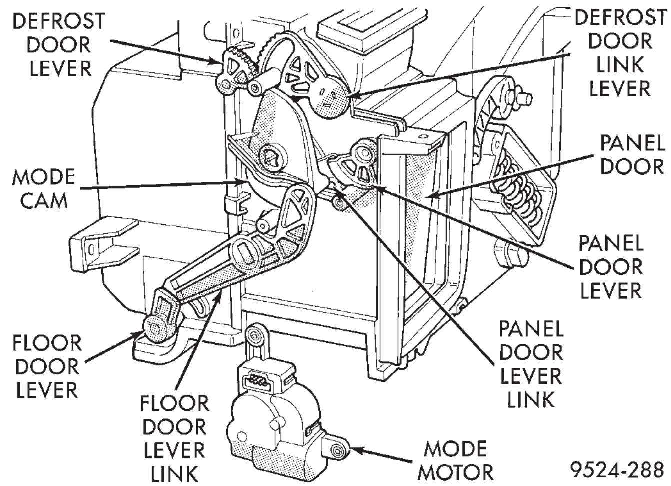


Fig. 76 Mode Motor

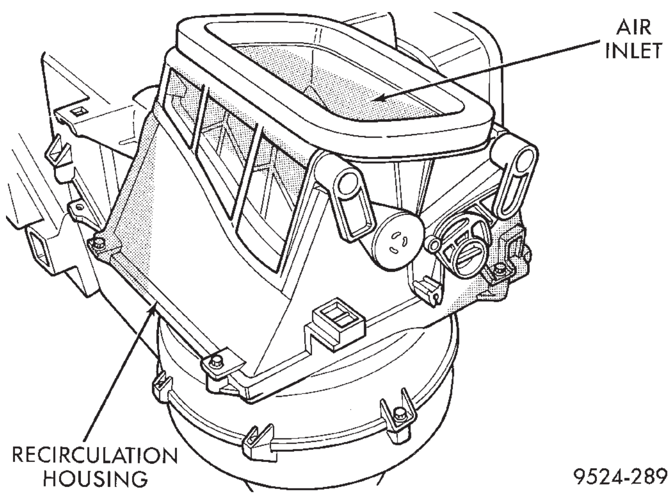


Fig. 77 Recirculation Air Inlet

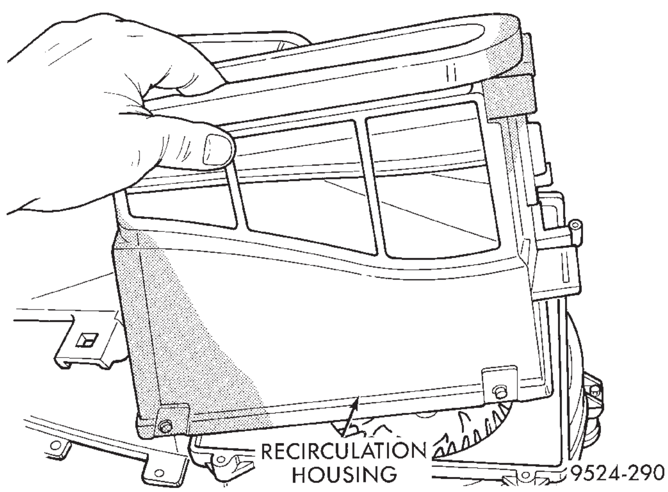


Fig. 78 Recirculation Housing Removal

(10) Unsnap and remove rear air inlet door (Fig. 81).

(11) Front air inlet door and lever is serviced with recirculation housing.

DISASSEMBLY AND ASSEMBLY (Continued)

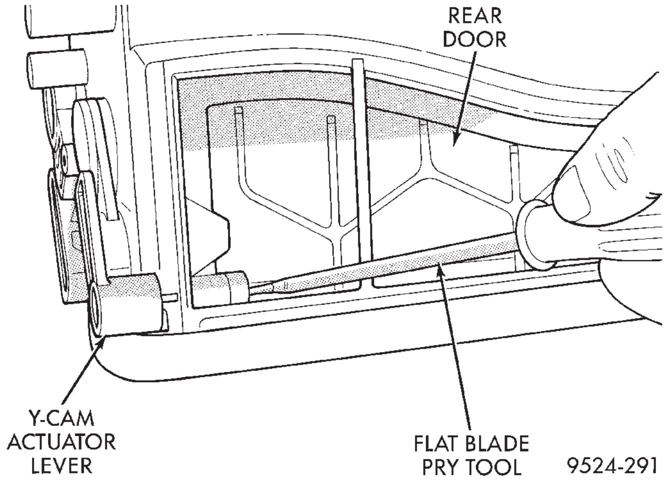


Fig. 79 Rear Y-Cam Release

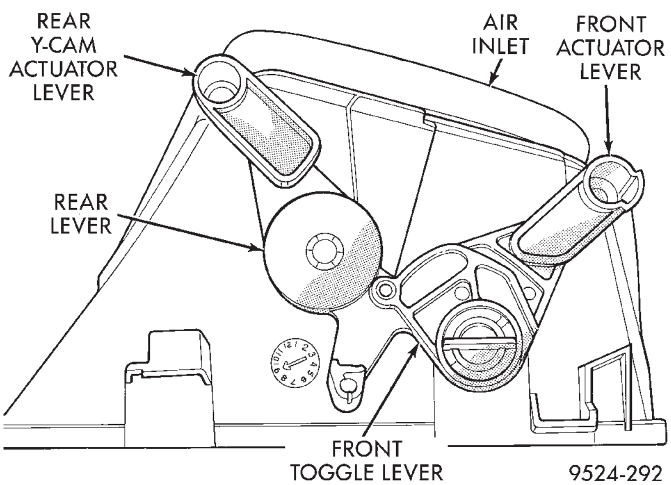


Fig. 80 Rear Y-Cam Actuator

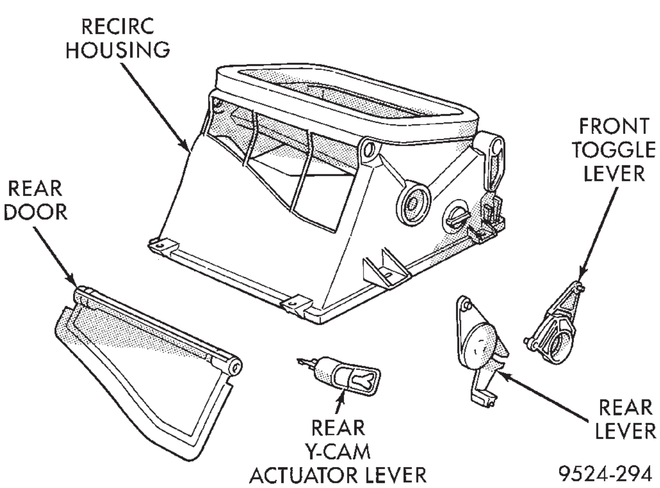


Fig. 81 Rear Air Inlet Door

(12) Remove blower motor wiring at resistor (Fig. 82).

(13) Remove blower motor (Fig. 83).

(14) Using a flat blade pry tool, Pull up on tab at evaporator probe cover (Fig. 84). Turn evaporator probe cover clockwise 90°.

(15) Remove evaporator probe cover. Pull evaporator needle from evaporator (Fig. 85).

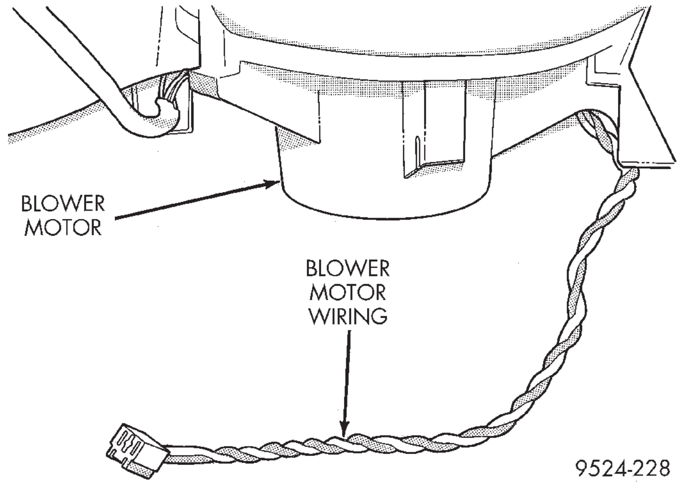


Fig. 82 Blower Motor Wiring

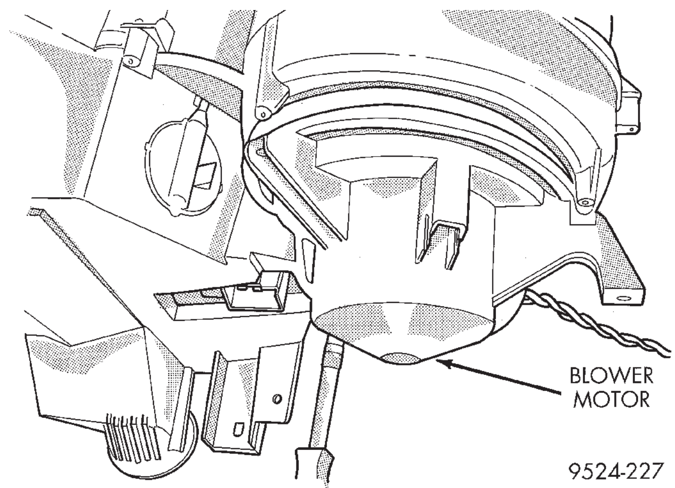


Fig. 83 Blower Motor

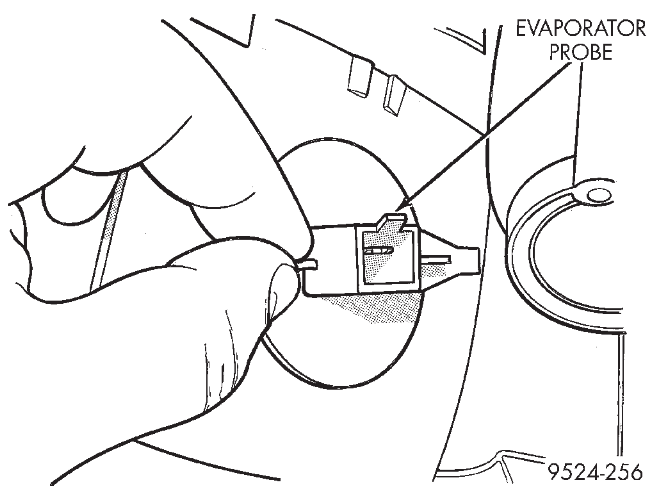


Fig. 84 Evaporator Probe

DISASSEMBLY AND ASSEMBLY (Continued)

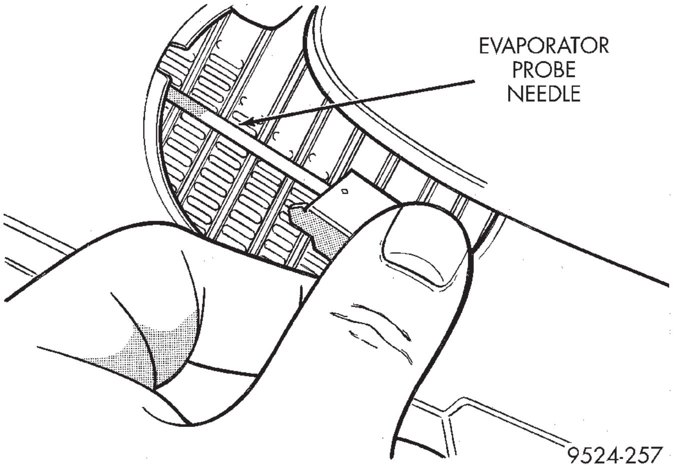


Fig. 85 Evaporator Probe Needle

(16) Remove blower motor resistor (Fig. 86).

(17) Remove clips retaining evaporator housing to heater/distribution housing (Fig. 87).

(18) Separate evaporator housing from heater/distribution housing (Fig. 88).

(19) Remove seal around evaporator tube inlet (Fig. 89).

(20) Remove evaporator housing upper cover (Fig. 90).

(21) Lift evaporator out of lower housing (Fig. 91).

(22) Remove styrofoam seal around evaporator.

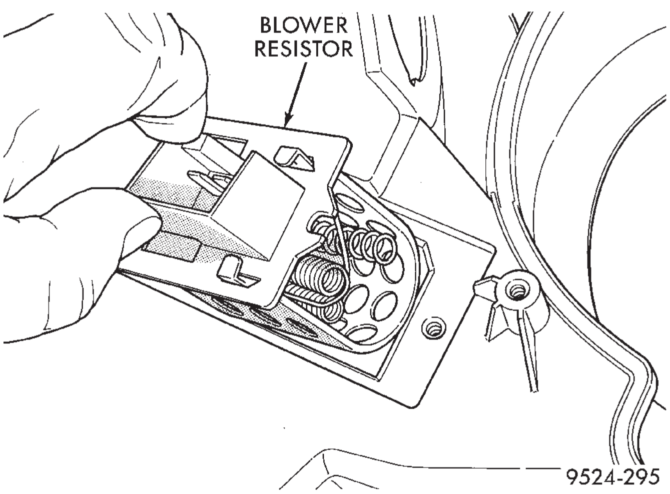


Fig. 86 Blower Motor Resistor

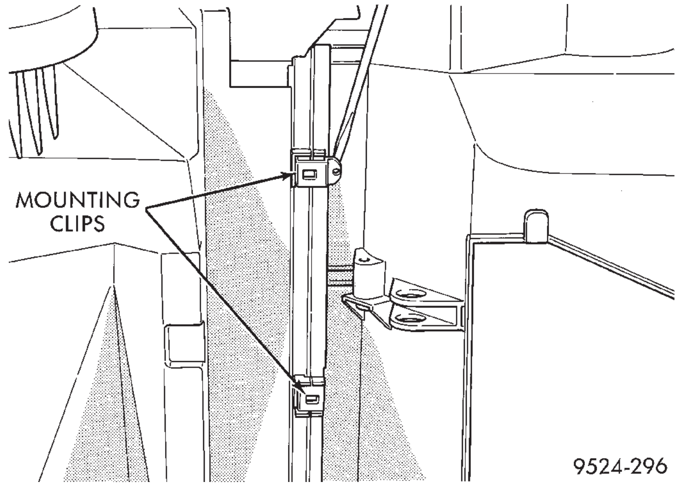


Fig. 87 Housing Clips

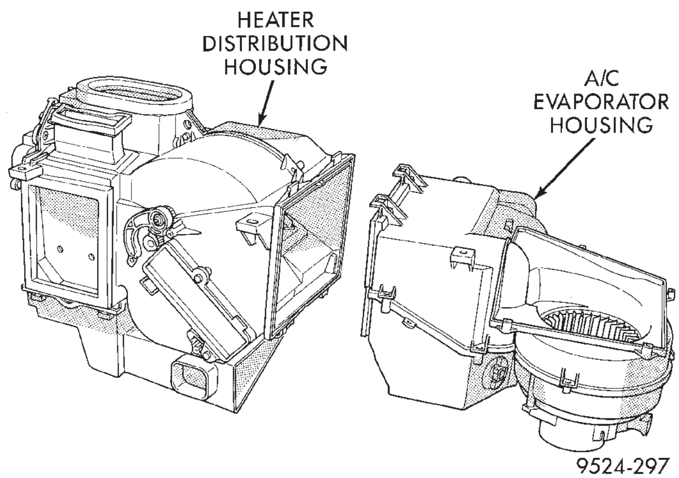


Fig. 88 Separate Housings

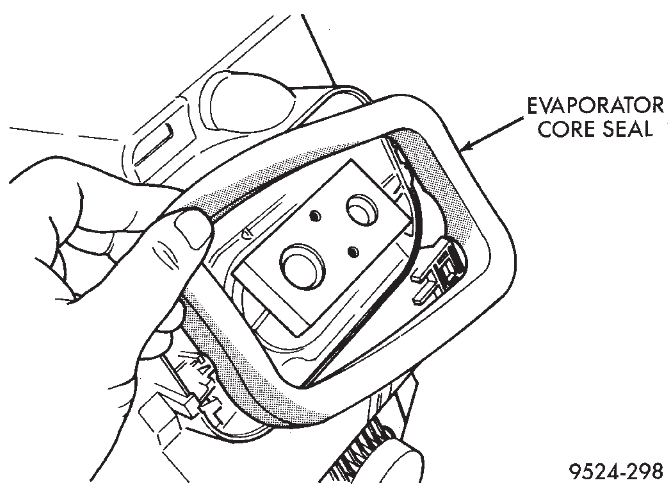


Fig. 89 Evaporator Tube Inlet Seal

DISASSEMBLY AND ASSEMBLY (Continued)

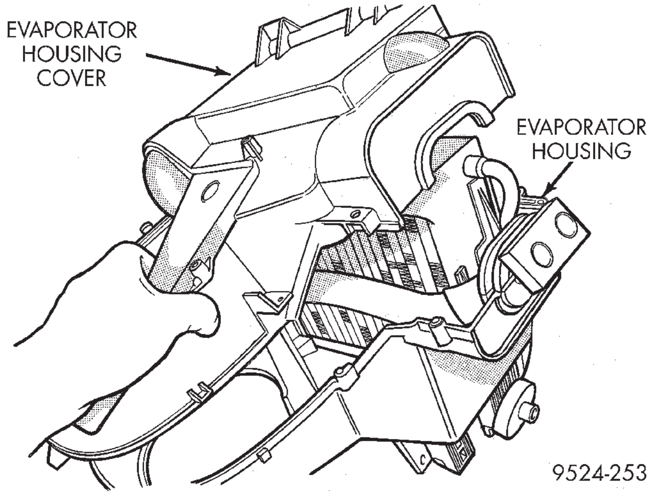


Fig. 90 Evaporator Housing Upper Cover

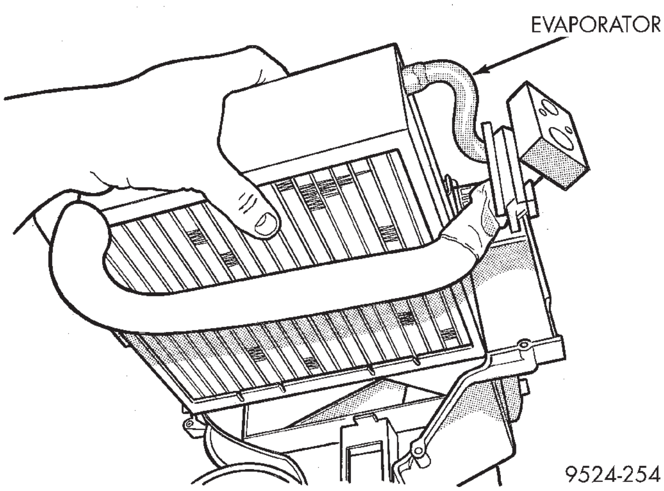


Fig. 91 Remove Evaporator From Housing

(23) Remove lower heat/distribution housing clips. Remove housing (Fig. 92).

(24) Remove heater core cover (Fig. 93) and (Fig. 94).

(25) Slide heater core out of heater housing (Fig. 95).

(26) Remove temperature door lever link retaining screw (Fig. 96).

(27) Remove temperature door lever link (Fig. 97).

(28) From the panel door air opening, using a long thin screwdriver, push in clip for floor door gear. Remove floor door gear (Fig. 98).

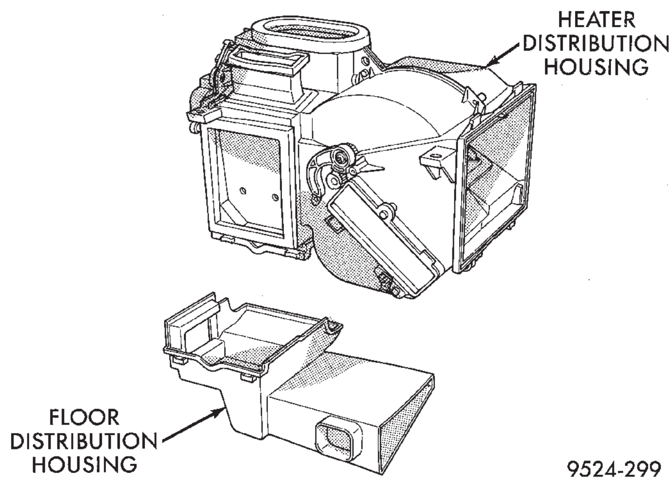


Fig. 92 Lower Floor Distribution Housing

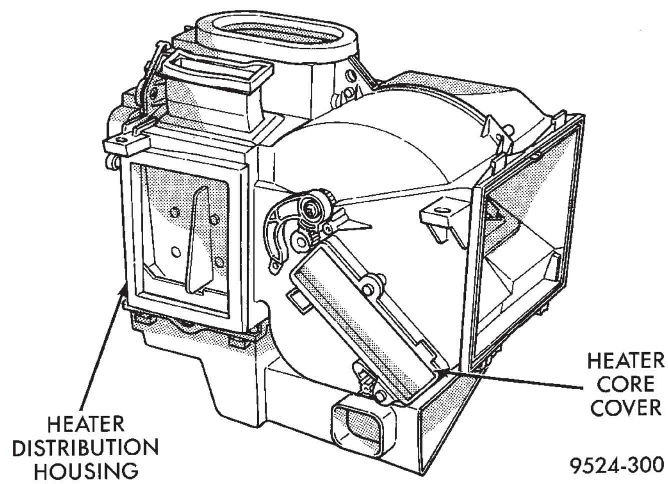


Fig. 93 Heater Core Cover

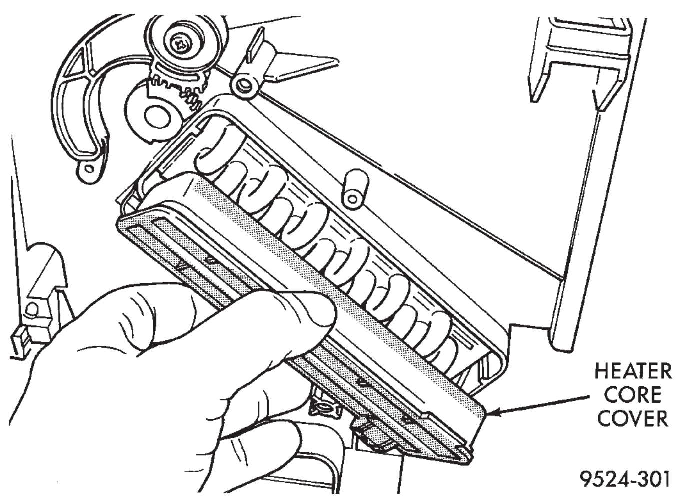


Fig. 94 Heater Core Cover Removal

DISASSEMBLY AND ASSEMBLY (Continued)

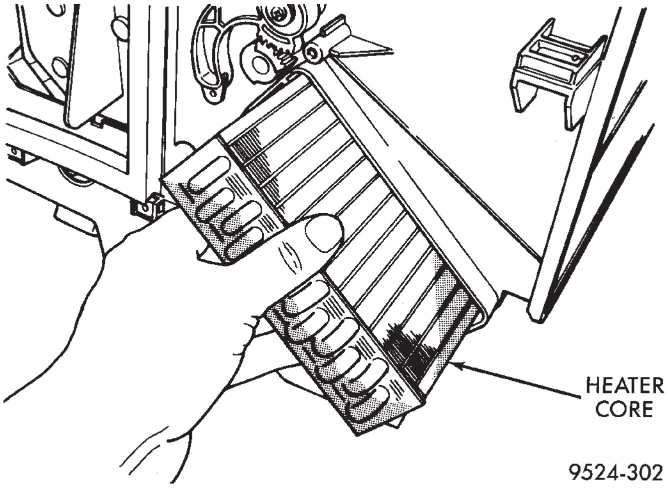


Fig. 95 Slide Out Core

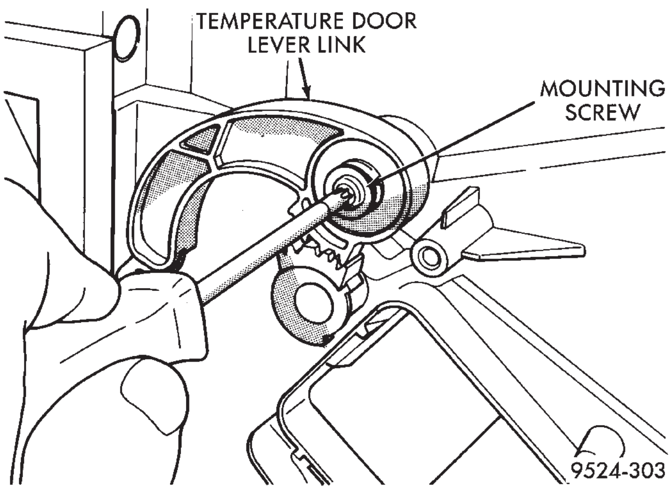


Fig. 96 Temperature Door Lever Link

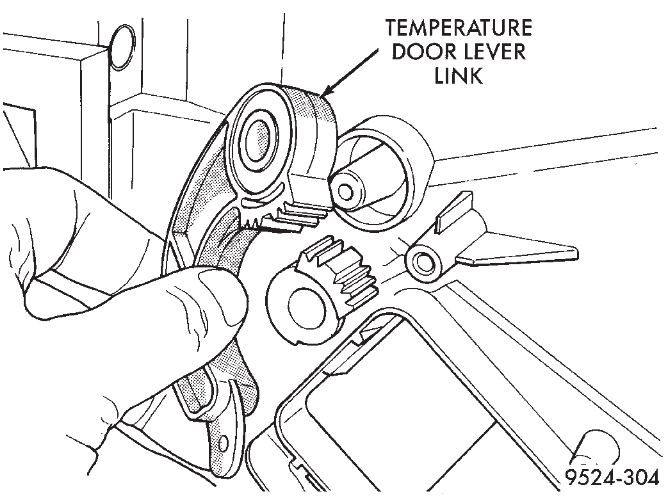


Fig. 97 Temperature Door Lever Link Removal

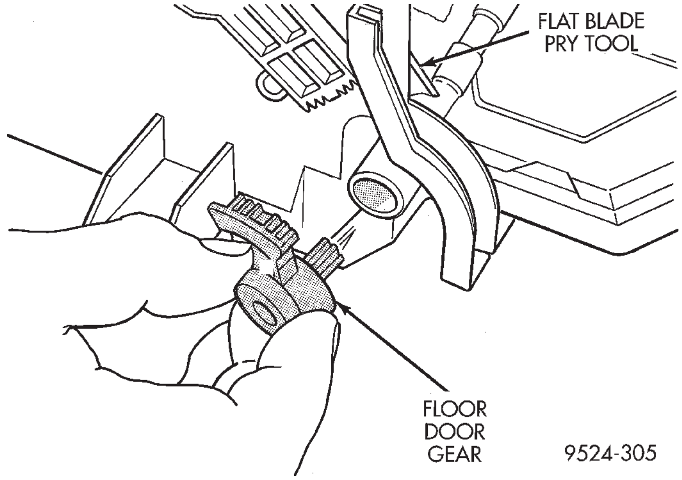


Fig. 98 Floor Door Gear

(29) Turn floor door lever link until it aligns with slots cut into it (Fig. 99). Remove floor door lever link (Fig. 100).

(30) Remove mode motor cam from housing (Fig. 101) and (Fig. 102).

(31) From panel door access, using a long thin screwdriver, push in release tang on panel door gear (Fig. 103).

(32) Remove panel door gear from housing.

(33) Line up slots on panel door lever link. Remove panel door lever link from housing (Fig. 104).

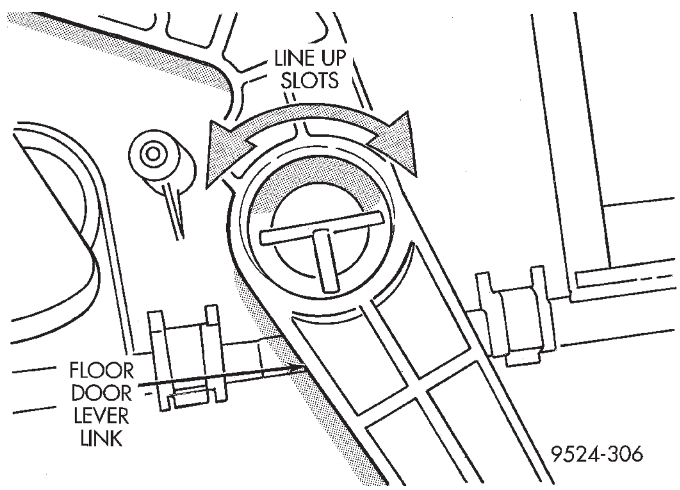


Fig. 99 Align Slots

DISASSEMBLY AND ASSEMBLY (Continued)

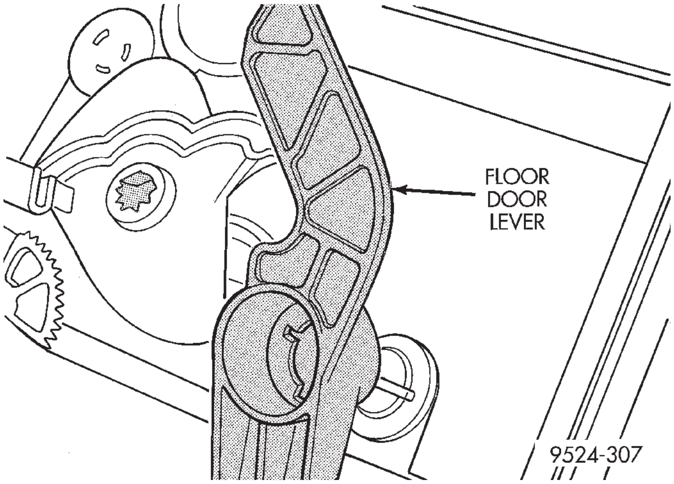


Fig. 100 Remove Lever Link

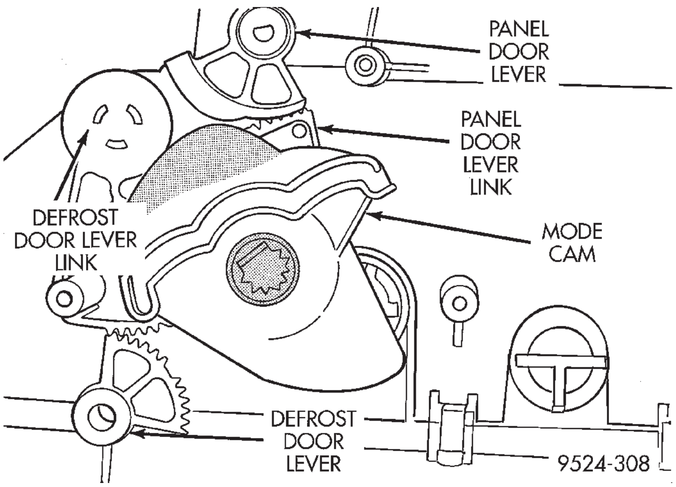


Fig. 101 Mode Motor Cam

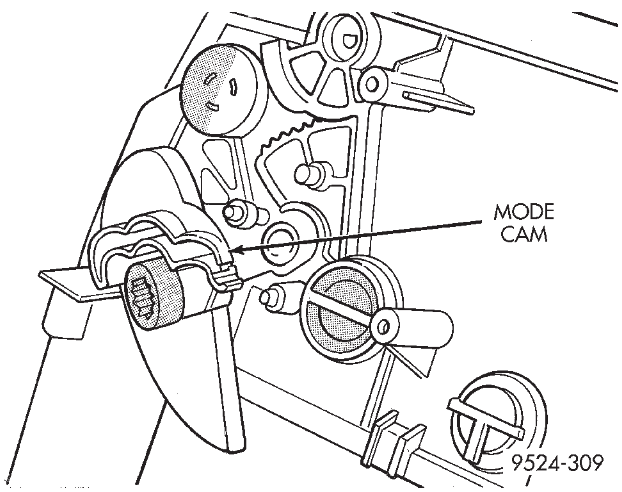


Fig. 102 Mode Motor Cam Removal

(34) Unsnap defrost door lever link from housing (Fig. 105).

(35) Remove defrost door seal from housing.

(36) Remove A/C housing rear cover half from front half (Fig. 106).

(37) Remove defrost door from housing (Fig. 107).

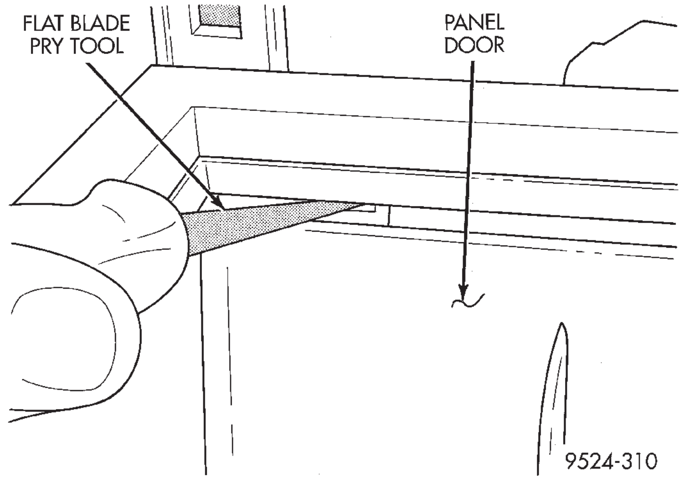


Fig. 103 Panel Door Gear Release

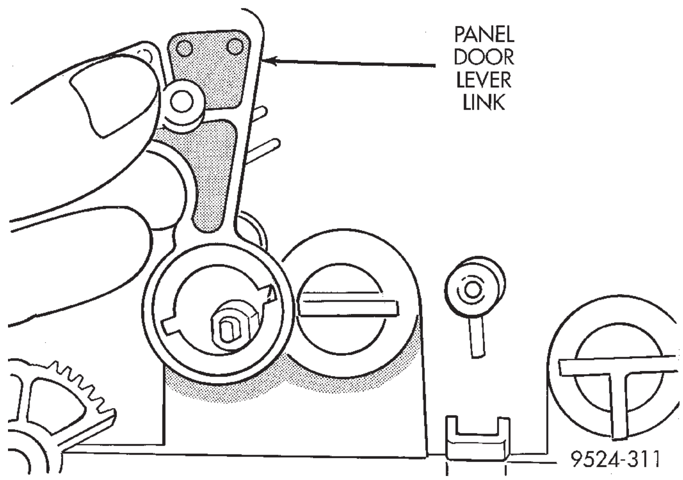


Fig. 104 Panel Door Lever Link

(38) Depress retaining clip at temperature control door, remove temperature control door (Fig. 108).

(39) Unsnap panel door from rear half of housing. Remove door from housing.

(40) Unsnap floor door from front half of housing. Remove door from housing (Fig. 109).

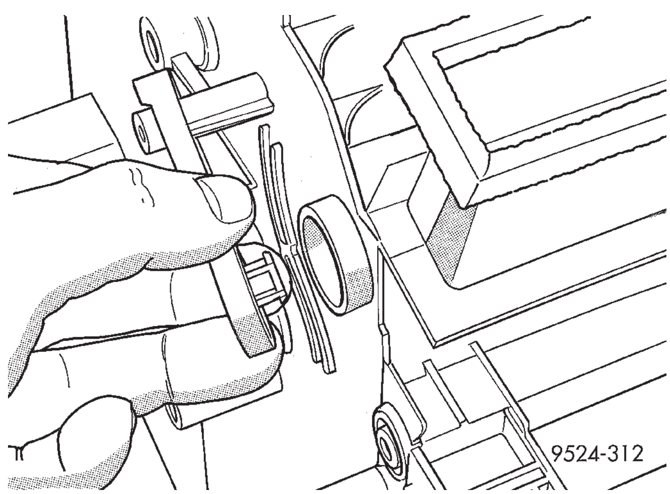


Fig. 105 Defrost Door Lever Link

DISASSEMBLY AND ASSEMBLY (Continued)

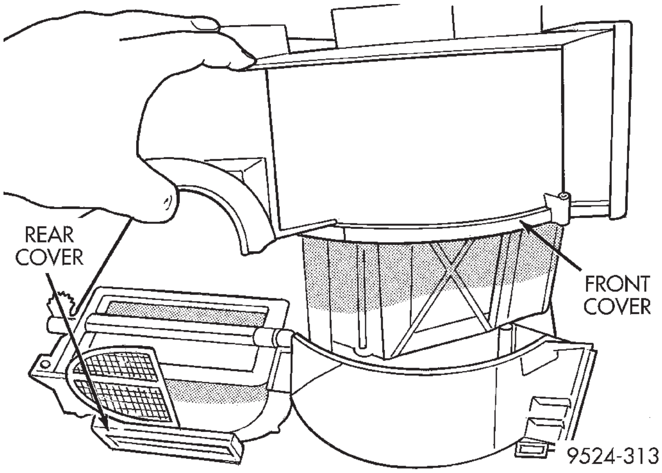


Fig. 106 Front And Rear Housing Halves

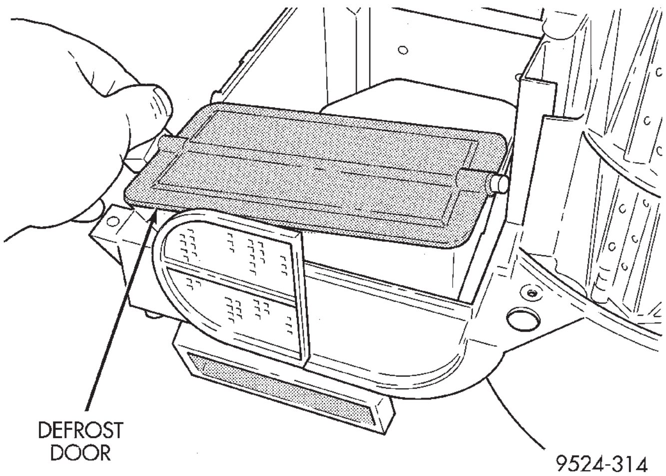


Fig. 107 Defrost Door Removal

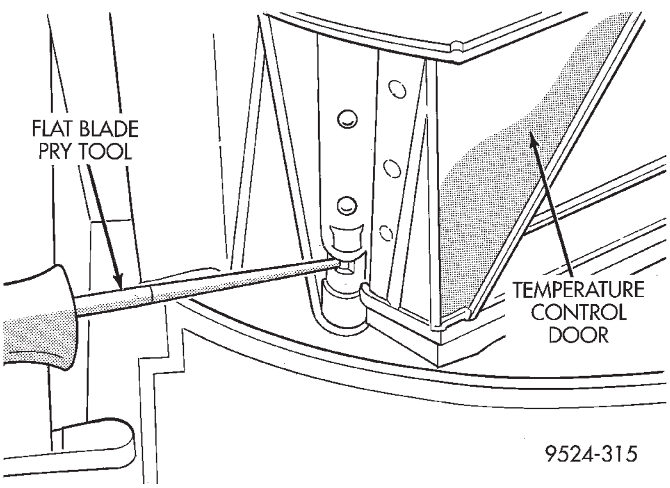


Fig. 108 Temperature Control Door Removal

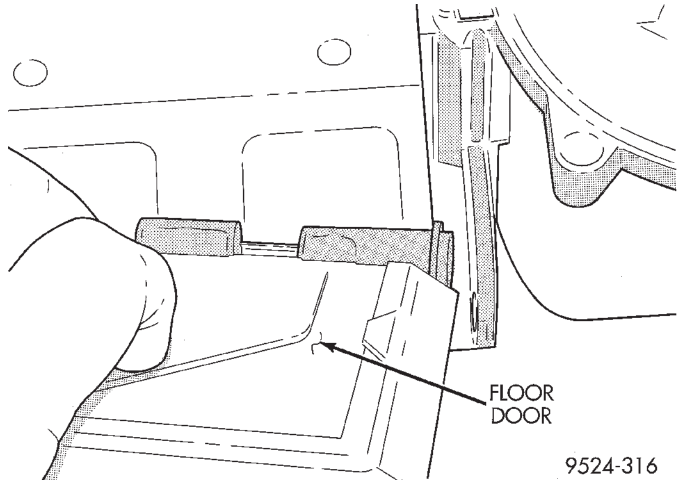


Fig. 109 Floor Door Removal

ASSEMBLE

(1) Install floor, panel, temperature, and defrost doors in housings.

(2) Position front A/C housing half to rear half. Install retaining screws.

(3) Install defrost door seal.

(4) Snap defrost door lever link to door.

(5) Install panel door lever link. Install panel door lever gear.

(6) Install mode motor cam.

(7) Install floor door lever link.

(8) Install floor door lever gear.

(9) Install temperature door lever gear.

(10) Install temperature door lever link.

(11) Slide heater core into housing. Install cover.

(12) Install lower distribution housing and clips.

(13) Install styrofoam to evaporator. Install evaporator into the evaporator housing.

(14) Install upper cover to evaporator housing.

(15) Install seal around evaporator tube inlet.

(16) Install evaporator probe into evaporator and housing.

(17) Install blower motor and resistor.

(18) Install air inlet housing to evaporator housing.

(19) Install evaporator housing to heat/distribution housing.

(20) Install mode motor.

SPECIFICATIONS

COMPRESSOR

DESCRIPTION

Displacement per Revolution . . . . 85.7 cc/rev (5.2 cu. in./rev.)
Maximum Allowable rpm . . . . 12000 rpm
Maximum Allowable Continuous rpm . . . 10000 rpm
Refrigerant R-134A
Oil . . . . SP15PAG 150cc (5.08 fl. oz.)
Weight . . . . 39.2 N·m (8.82 lbs., 4.0 kgf.)

CLUTCH

DESCRIPTION

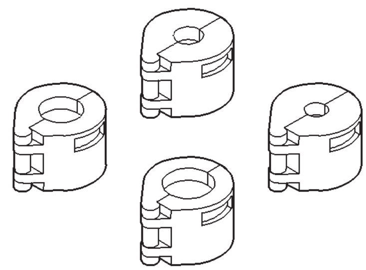
Rated Voltage . . . . 12 VDC
Minimum Breakaway Torque . . . . 31.4 N·m (23 ft. lbs., 3.2 Kgf.m) at 12VDC
Minimum Engagement Voltage . . . 7.5 AT AIR GAP 0.5 mm REF
Power Consumption . . . . 50 WATTS MAX.
Pulley Diameter . . . . 110 mm DIA. (4.3 in.)
Weight . . . . 18.9 N·m (4.23 lbs., 1.92 Kgf.)
Clutch Type . . . . Standard

THERMAL LIMITER SWITCH

DESCRIPTION	TEMPERATURE
Cut OFF Temperature	122 to 128°C (252 to 262°F)
Cut IN Temperature	104 to 116°C (225 to 235°F)

SPECIAL TOOLS

AIR CONDITIONING



A/C Line Disconnect Tool 7193

EMISSION CONTROL SYSTEMS

CONTENTS

ON-BOARD DIAGNOSTICS

INDEX

GENERAL INFORMATION

SYSTEM DESCRIPTION

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warmup cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). Refer to Malfunction Indicator Lamp in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example** , assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, use the DRB scan tool to erase all DTC's and extinguish the MIL.

Technicians can display stored DTC's by using the DRB scan tool. Refer to Diagnostic Trouble Codes in this section. For DTC information, refer to charts in this section.

DESCRIPTION AND OPERATION

MALFUNCTION INDICATOR LAMP (MIL)

OPERATION

As a functional test, the Malfunction Indicator Lamp (MIL) illuminates at key-on before engine

DESCRIPTION AND OPERATION (Continued)

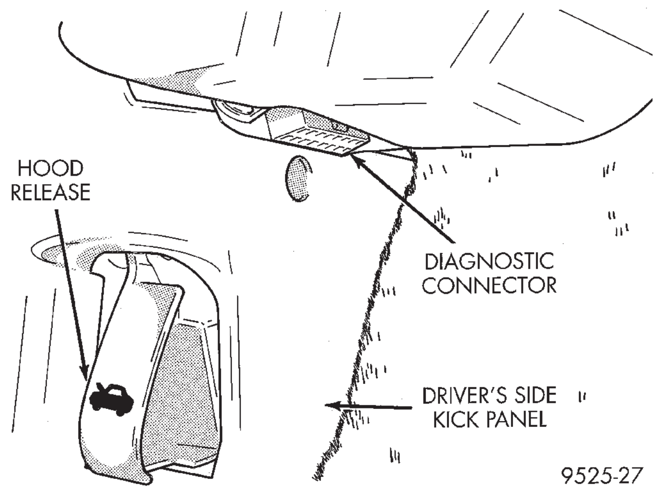


Fig. 1 Data Link (Diagnostic) Connector

cranking. Whenever the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) that affects vehicle emissions, it illuminates the MIL. If a problem is detected, the PCM sends a message over the CCD Bus to the instrument cluster to illuminate the lamp. The PCM illuminates the MIL only for DTC's that affect vehicle emissions. The MIL stays on continuously when the PCM has entered a Limp-In mode or identified a failed emission component or system. The MIL remains on until the DTC is erased. Refer to the Diagnostic Trouble Code charts in this group for emission related codes.

Also, the MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring in this section.

Additionally, the PCM may reset (turn off) the MIL when one of the following occur:

• PCM does not detect the malfunction for 3 consecutive trips (except misfire and fuel system monitors).

• PCM does not detect a malfunction while performing three successive engine misfire or fuel system tests. The PCM performs these tests while the engine is operating within ± 375 RPM of and within 10 % of the load of the operating condition at which the malfunction was first detected.

STATE DISPLAY TEST MODE

OPERATION

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. From the state display screen, access either State Display Inputs and Outputs or State Display Sensors.

CIRCUIT ACTUATION TEST MODE

OPERATION

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly.

DIAGNOSTIC TROUBLE CODES

OPERATION

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

NOTE: For a list of DTC's, refer to the charts in this section.

BULB CHECK

Each time the ignition key is turned to the ON position, the malfunction indicator (check engine) lamp on the instrument panel should illuminate for approximately 2 seconds then go out. This is done for a bulb check.

OBTAINING DTC'S USING DRB SCAN TOOL

(1) Connect the DRB scan tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel; near the steering column.

(2) Turn the ignition switch on and access the "Read Fault" screen.

(3) Record all the DTC's and "freeze frame" information shown on the DRB scan tool.

(4) To erase DTC's, use the "Erase Trouble Code" data screen on the DRB scan tool. **Do not erase any DTC's until problems have been investigated and repairs have been performed.**

DESCRIPTION AND OPERATION (Continued)

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0030	1/1 O2 Sensor Heater Relay Circuit	
P0036	1/2 O2 Sensor Heater Relay Circuit	
P0106 (M)	Barometric Pressure Out of Range	MAP sensor input voltage out of an acceptable range detected during reading of barometric pressure at key-on.
P0107 (M)	Map Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
P0108 (M)	Map Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
P0112 (M)	Intake Air Temp Sensor Voltage Low	Intake air (charge) temperature sensor input below the minimum acceptable voltage.
P0113 (M)	Intake Air Temp Sensor Voltage High	Intake air (charge) temperature sensor input above the maximum acceptable voltage.
P0116		A rationatilty error has been detected in the coolant temp sensor.
P0117 (M)	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below the minimum acceptable voltage.
P0118 (M)	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above the maximum acceptable voltage.
P0121 (M)	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor signal.
P0122 (M)	Throttle Position Sensor Voltage Low	Throttle position sensor input below the acceptable voltage range.
P0123 (M)	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
P0125 (M)	Closed Loop Temp Not Reached	Time to enter Closed Loop Operation (Fuel Control) is excessive.
P0131 (M)	1/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0132 (M)	1/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0133 (M)	1/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0134 (M)	1/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor input.
P0135 (M)	1/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0137 (M)	1/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0138 (M)	1/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0139 (M)	1/2 O2 Sensor Slow Response	Oxygen sensor response not as expected.
P0140 (M)	1/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P0141 (M)	1/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0143	1/3 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0144	1/3 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0145	1/3 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0146	1/3 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0147	1/3 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0151 (M)	2/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0152 (M)	2/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage sustained above normal operating range.
P0153 (M)	2/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0154 (M)	2/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0155 (M)	2/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0157 (M)	2/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0158 (M)	2/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0159	2/2 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0160 (M)	2/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0161 (M)	2/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0165	Starter Relay Control Circuit	An open or shorted condition detected in the starter relay control circuit.
P0171 (M)	1/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0172 (M)	1/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0174 (M)	2/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0175 (M)	2/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0178	Water in Fuel Sensor Voltage Too Low	Flex fuel sensor input below minimum acceptable voltage.
P0179	Flex Fuel Sensor Volts Too High	Flex fuel sensor input above maximum acceptable voltage.
P0182	CNG Temp Sensor Voltage Too Low	Compressed natural gas temperature sensor voltage below acceptable voltage.
P0183	CNG Temp Sensor Voltage Too High	Compressed natural gas temperature sensor voltage above acceptable voltage.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P0201 (M)	Injector #1 Control Circuit	An open or shorted condition detected in control circuit for injector #1 or the INJ 1 injector bank.
P0202 (M)	Injector #2 Control Circuit	An open or shorted condition detected in control circuit for injector #2 or the INJ 2 injector bank.
P0203 (M)	Injector #3 Control Circuit	An open or shorted condition detected in control circuit for injector #3 or the INJ 3 injector bank.
P0204 (M)	Injector #4 Control Circuit	Injector #4 or INJ 4 injector bank output driver stage does not respond properly to the control signal.
P0205 (M)	Injector #5 Control Circuit	Injector #5 output driver stage does not respond properly to the control signal.
P0206 (M)	Injector #6 Control Circuit	Injector #6 output driver stage does not respond properly to the control signal.
P0207	Injector #7 Control Circuit	Injector #7 output driver stage does not respond properly to the control signal.
P0208	Injector #8 Control Circuit	Injector #8 output driver stage does not respond properly to the control signal.
P0209	Injector #9 Control Circuit	Injector #9 output driver stage does not respond properly to the control signal.
P0210	Injector #10 Control Circuit	Injector #10 output driver stage does not respond properly to the control signal.
P0300 (M)	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
P0301 (M)	CYLINDER #1 MISFIRE	Misfire detected in cylinder #1.
P0302 (M)	CYLINDER #2 MISFIRE	Misfire detected in cylinder #2.
P0303 (M)	CYLINDER #3 MISFIRE	Misfire detected in cylinder #3.
P0304 (M)	CYLINDER #4 MISFIRE	Misfire detected in cylinder #4.
P0305 (M)	CYLINDER #5 MISFIRE	Misfire detected in cylinder #5.
P0306 (M)	CYLINDER #6 MISFIRE	Misfire detected in cylinder #6.
P0307 (M)	CYLINDER #7 MISFIRE	Misfire detected in cylinder #7
P0308 (M)	CYLINDER #8 MISFIRE	Misfire detected in cylinder #8.
P0309 (M)	CYLINDER #9 MISFIRE	Misfire detected in cylinder #9.
P0310 (M)	CYLINDER #10 MISFIRE	Misfire detected in cylinder #10.
P0320	No Crank Referance Signal at PCM	No reference signal (crankshaft position sensor) detected during engine cranking.
P0325	Knock Sensor #1 Circuit	Knock sensor (#1) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0330	Knock Sensor #2 Circuit	Knock sensor (#2) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0340 (M)	No Cam Signal At PCM	No fuel sync
P0350	Ignition Coil Draws Too Much Current	A coil (1-5) is drawing too much current.
P0351 (M)	Ignition Coil # 1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0352 (M)	Ignition Coil # 2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P0353 (M)	Ignition Coil # 3 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0354 (M)	Ignition Coil # 4 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0355 (M)	Ignition Coil # 5 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0356 (M)	Ignition Coil # 6 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0357	Ignition Coil # 7 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0358	Ignition Coil # 8 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0401 (M)	EGR System Failure	Required change in air/fuel ration not detected during diagnostic test.
P0403 (M)	EGR Solenoid Circuit	An open or shorted condition detected in the EGR solenoid control circuit.
P0404 (M)	EGR Position Sensor Rationality	EGR position sensor signal does not correlate to EGR duty cycle.
P0405 (M)	EGR Position Sensor Volts Too Low	EGR position sensor input below the acceptable voltage range.
P0406 (M)	EGR Position Sensor Volts Too High	EGR position sensor input above the acceptable voltage range.
P0412	Secondary Air Solenoid Circuit	An open or shorted condition detected in the secondary air (air switching/aspirator) solenoid control circuit.
P0420 (M)	1/1 Catalytic Converter Efficiency	Catalyst 1/1 efficiency below required level.
P0432 (M)	1/2 Catalytic Converter Efficiency	Catalyst 2/1 efficiency below required level.
P0441 (M)	Evap Purge Flow Monitor	Insufficient or excessive vapor flow detected during evaporative emission system operation.
P0442 (M)	Evap Leak Monitor Medium Leak Detected	A small leak has been detected in the evaporative system.
P0443 (M)	Evap Purge Solenoid Circuit	An open or shorted condition detected in the EVAP purge solenoid control circuit.
P0455 (M)	Evap Leak Monitor Large Leak Detected	A large leak has been detected in the evaporative system.
P0456	Evap Leak Monitor Small Leak Detected	
P0460	Fuel Level Unit No Change Over Miles	No movement of fuel level sender detected.
P0461	Fuel Level Unit No Changeover Time	No level of fuel level sender detected.
P0462	Fuel Level Sending Unit Volts Too Low	Fuel level sensor input below acceptable voltage.
P0463	Fuel Level Sending Unit Volts Too High	Fuel level sensor input above acceptable voltage.
P0500 (M)	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
P0505 (M)	Idle Air Control Motor Circuits	Replace

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P0522	Oil Pressure Sens Low	Oil pressure sensor input below acceptable voltage.
P0523	Oil Pressure Sens High	Oil pressure sensor input above acceptable voltage.
P0551 (M)	Power Steering Switch Failure	Incorrect input state detected for the power steering switch circuit. PL: High pressure seen at high speed.
P0600 (M)	PCM Failure SPI Communications	No communication detected between co-processors in the control module.
P0601 (M)	Internal Controller Failure	Internal control module fault condition (check sum) detected.
P0604		Transmission control module RAM self test fault detected. -Aisin transmission.
P0605		Transmission control module ROM self test fault detected -Aisin transmission.
P0622 (G)	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
P0645	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay control circuit.
P0700 (M)	EATX Controller DTC Present	This SBEC III or JTEC DTC indicates that the EATX or Aisin controller has an active fault and has illuminated the MIL via a CCD (EATX) or SCI (Aisin) message. The specific fault must be acquired from the EATX via CCD or from the Aisin via ISO-9141.
P0703 (M)	Brake Switch Stuck Pressed or Released	Incorrect input state detected in the brake switch circuit. (Changed from P1595).
P0711	Trans Temp Sensor, No Temp Rise After Start	Relationship between the transmission temperature and overdrive operation and/or TCC operation indicates a failure of the Transmission Temperature Sensor. OBD II Rationality.
P0712	Trans Temp Sensor Voltage Too Low	Transmission fluid temperature sensor input below acceptable voltage.
P0713	Trans Temp Sensor Voltage Too High	Transmission fluid temperature sensor input above acceptable voltage.
P0720	Low Output SPD Sensor RPM, Above 15 MPH	The relationship between the Output Shaft Speed Sensor and vehicle speed is not within acceptable limits.
P0740 (M)	Torq Con Clu, No RPM Drop at Lockup	Relationship between engine and vehicle speeds indicated failure of torque convertor clutch lock-up system (TCC/PTU sol).
P0743	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter clutch (part throttle unlock) solenoid control circuit. Shift solenoid C electrical fault - Aisin transmission
P0748	Governor Pressur Sol Control/Trans Relay Circuits	An open or shorted condition detected in the Governor Pressure Solenoid circuit or Trans Relay Circuit in JTEC RE transmissions.
P0751	O/D Switch Pressed (Lo) More Than 5 Minutes	Overdrive override switch input is in a prolonged depressed state.
P0753	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the overdrive solenoid control circuit or Trans Relay Circuit in JTEC RE transmissions.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P0756	AW4 Shift Sol B (2-3) Functional Failure	Shift solenoid B (2-3) functional fault - Aisin transmission
P0783	3-4 Shift Sol, No RPM Drop at Lockup	The overdrive solenoid is unable to engage the gear change from 3rd gear to the overdrive gear.
P0801	Reverse Gear Lockout Circuit Open or Short	An open or shorted condition detected in the transmission reverse gear lock-out solenoid control circuit.
P1195 (M)	1/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/1 during catalyst monitor test. (was P0133)
P1196 (M)	2/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 2/1 during catalyst monitor test. (was P0153)
P1197	1/2 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/2 during catalyst monitor test. (was P0139)
P1198	Radiator Temperature Sensor Volts Too High	Radiator coolant temperature sensor input above the maximum acceptable voltage.
P1199	Radiator Temperature Sensor Volts Too Low	Radiator coolant temperature sensor input below the minimum acceptable voltage.
P1281	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (Thermostat).
P1282	Fuel Pump Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
P1288	Intake Manifold Short Runner Solenoid Circuit	An open or shorted condition detected in the short runner tuning valve circuit.
P1289	Manifold Tune Valve Solenoid Circuit	An open or shorted condition detected in the manifold tuning valve solenoid control circuit.
P1290	CNG Fuel System Pressure Too High	Compressed natural gas system pressure above normal operating range.
P1291	No Temp Rise Seen From Intake Heaters	Energizing Heated Air Intake does not change intake air temperature sensor an acceptable amount.
P1292	CNG Pressure Sensor Voltage Too High	Compressed natural gas pressure sensor reading above acceptable voltage.
P1293	CNG Pressure Sensor Voltage Too Low	Compressed natural gas pressure sensor reading below acceptable voltage.
P1294 (M)	Target Idle Not Reached	Target RPM not achieved during drive idle condition. Possible vacuum leak or IAC (AIS) lost steps.
P1295	No 5 Volts to TP Sensor	Loss of a 5 volt feed to the Throttle Position Sensor has been detected.
P1296	No 5 Volts to MAP Sensor	Loss of a 5 volt feed to the MAP Sensor has been detected.
P1297 (M)	No Change in MAP From Start To Run	No difference is recognized between the MAP reading at engine idle and the stored barometric pressure reading.
P1298	Lean Operation at Wide Open Throttle	A prolonged lean condition is detected during Wide Open Throttle.
P1299 (M)	Vacuum Leak Found (IAC Fully Seated)	MAP Sensor signal does not correlate to Throttle Position Sensor signal. Possible vacuum leak.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P1389	No ASD Relay Output Voltage At PCM	No Z1 or Z2 voltage sensed when the auto shutdown relay is energized.
P1390 (M)	Timing Belt Skipped 1 Tooth or More	Relationship between Cam and Crank signals not correct.
P1391 (M)	Intermittent Loss of CMP or CKP	Loss of the Cam Position Sensor or Crank Position sensor has occurred. For PL 2.0L
P1398 (M)	Mis-Fire Adaptive Numerator at Limit	PCM is unable to learn the Crank Sensor's signal in preparation for Misfire Diagnostics. Probable defective Crank Sensor.
P1399	Wait To Start Lamp Cicuit	An open or shorted condition detected in the Wait to Start Lamp circuit.
P1403		Loss of 5v feed to the EGR position sensor.
P1476	Too Little Secondary Air	Insufficient flow of secondary air injection detected during aspirator test.(was P0411)
P1477	Too Much Secondary Air	Excessive flow of secondary air injection detected during aspirator test (was P0411).
P1478 (M)	Battery Temp Sensor Volts Out of Limit	Internal temperature sensor input voltage out of an acceptable range.
P1479	Transmission Fan Relay Circuit	An open or shorted condition detected in the transmission fan relay circuit.
P1480	PCV Solenoid Circuit	An open or shorted condition detected in the PCV solenoid circuit.
P1481		EATX RPM pulse generator signal for misfire detection does not correlate with expected value.
P1482	Catalyst Temperature Sensor Circuit Shorted Low	Catalyst temperature sensor circuit shorted low.
P1483	Catalyst Temperature Sensor Circuit Shorted High.	Catalyst temperature sensor circuit shorted high.
P1484	Catalytic Converter Overheat Detected	A catalyst overheat condition has been detected by the catalyst temperature sensor.
P1485	Air Injection Solenoid Circuit	An open or shorted condition detected in the air assist solenoid circuit.
P1486 (M)	Evap Leak Monitor Pinched Hose Found	LDP has detected a pinched hose in the evaporative hose system.
P1487	Hi Speed Rad Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the #2 high speed radiator fan control relay.
P1488	Auxiliary 5 Volt Supply Output Too Low	Auxiliary 5 volt sensor feed is sensed to be below an acceptable limit.
P1489 (M)	High Speed Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the high speed radiator fan control relay.
P1490 (M)	Low Speed Fan CTRL Relay Circuit	An open or shorted condition detected in control circuit of the low speed radiator fan control relay.
P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the radiator fan control relay control circuit. This includes PWM solid state relays.
P1492 (M,G)	Ambient/Batt Temp Sen Volts Too High	External temperature sensor input above acceptable voltage.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P1493 (M,G)	Ambient/Batt Temp Sen Volts Too Low	External temperature sensor input below acceptable voltage.
P1494 (M)	Leak Detection Pump Sw or Mechanical Fault	Incorrect input state detected for the Leak Detection Pump (LDP) pressure switch.
P1495 (M)	Leak Detection Pump Solenoid Circuit	An open or shorted condition detected in the Leak Detection Pump (LDP) solenoid circuit.
P1496 (M)	5 Volt Supply, Output Too Low	5 volt sensor feed is sensed to be below an acceptable limit. (< 4v for 4 sec).
P1498	High Speed Rad Fan Ground CTRL Rly Circuit	An open or shorted condition detected in the control circuit of the #3 high speed radiator fan control relay.
P1594 (G)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in either of the speed control vacuum or vent solenoid control circuits.
P1596	Speed Control Switch Always High	Speed control switch input above maximum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below minimum acceptable voltage.
P1598	A/C Pressure Sensor Volts Too High	A/C pressure sensor input above maximum acceptable voltage.
P1599	A/C Pressure Sensor Volts Too Low	A/C pressure sensor input below minimum acceptable voltage.
P1680	Clutch Released Switch Circuit	
P1681	No I/P Cluster CCD/J1850 Messages Received	No CCD/J1850 messages received from the cluster control module.
P1682 (G)	Charging System Voltage Too Low	Battery voltage sense input below target charging voltage during engine operation and no significant change in voltage detected during active test of generator output circuit.
P1683	SPD CTRL PWR Relay; or S/C 12v Driver CKT	An open or shorted condition detected in the speed control servo power control circuit. (SBECII: ext relay).
P1684		The battery has been disconnected within the last 50 starts.
P1685	Skim Invalid Key	The engine controler has received an invalid key from the SKIM.
P1686	No SKIM BUS Messages Received	No CCD/J1850 messages received from the Smart Key Immobilizer Module (SKIM).
P1687	No MIC BUS Message	No CCD/J1850 messages received from the Mechanical Instrument Cluster (MIC) module.
P1693	DTC Detected in Companion Module	A fault has been generated in the companion engine control module.
P1694	Fault In Companion Module	No CCD/J1850 messages received from the powertrain control module-Aisin transmission.
P1695	No CCD/J1850 Message From Body Control Module	No CCD/J1850 messages received from the body control module.
P1696 (M)	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the control module.

DESCRIPTION AND OPERATION (Continued)

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
P1697 (M)	PCM Failure SRI Mile Not Stored	Unsuccessful attempt to update Service Reminder Indicator (SRI or EMR) mileage in the control module EEPROM.
P1698 (M)	No CCD/J1850 Message From TCM	No CCD/J1850 messages received from the electronic transmission control module (EATX) or the Aisin transmission controller.
P1719	Skip Shift Solenoid Circuit	An open or shorted condition detected in the transmission 2-3 gear lock-out solenoid control circuit.
P1740		A rationality error has been detected in either the tcc solenoid or overdrive solenoid systems.
P1756	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear. (Mid Pressure Malfunction)
P1757	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear (Zero Pressure Malfunction)
P1762	Gov Press Sen Offset Volts Too Lo or High	The Governor Pressure Sensor input is greater than a calibration limit or is less than a calibration limit for 3 consecutive park/neutral calibrations.
P1763	Governor Pressure Sensor Volts Too Hi	The Governor Pressure Sensor input is above an acceptable voltage level.
P1764	Governor Pressure Sensor Volts Too Low	The Governor Pressure Sensor input is below an acceptable voltage level.
P1765	Trans 12 Volt Supply Relay CTRL Circuit	An open or shorted condition is detected in the Transmission Relay control circuit. This relay supplies power to the TCC
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch.

MONITORED SYSTEMS

OPERATION

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator (Check Engine) Lamp will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the check engine lamp or a scan tool.

The following is a list of the system monitors:

- EGR Monitor
- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Evaporative System Leak Detection Monitor

Following is a description of each system monitor, and its DTC.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

DESCRIPTION AND OPERATION (Continued)

OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 air fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrous oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the EGR, Catalyst and Fuel Monitors.

The O2S may fail in any or all of the following manners:

- Slow response rate
- Reduced output voltage
- Dynamic shift
- Shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) DTC as well as a O2S heater DTC, the O2S fault MUST be repaired first. After the O2S fault is repaired, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 °to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S must be tested to ensure that it is heating the sensor properly.

The O2S circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S output voltage from the other effects.

EGR MONITOR

The Powertrain Control Module (PCM) performs an on-board diagnostic check of the EGR system.

The EGR system consists of two main components: a vacuum solenoid back pressure transducer and a vacuum operated valve. The EGR monitor is used to test whether the EGR system is operating within specifications. The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the EGR is turned off (solenoid energized) and the O2S compensation control is monitored. Turning off the EGR shifts the air fuel (A/F) ratio in the lean direction. The O2S data should indicate an increase in the O2 concentration in the combustion chamber when the exhaust gases are no longer recirculated. While this test does not directly measure the operation of the EGR system, it can be inferred from the shift in the O2S data whether the EGR system is operating correctly. Because the O2S is being used, the O2S test must pass its test before the EGR test.

MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the air fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S output. The programmed memory

DESCRIPTION AND OPERATION (Continued)

acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual air-fuel ratio with the O2S (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL (check engine lamp) will be illuminated.

LEAK DETECTION PUMP MONITOR

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5" H20. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the

DESCRIPTION AND OPERATION (Continued)

leak is larger than the required detection limit (currently set at .040” orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP’s solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

TRIP DEFINITION

OPERATION

A “Trip” means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system. The monitors must successfully pass before the PCM can verify that a previously malfunctioning component is meeting the normal operating conditions of that component. For misfire or fuel system malfunction, the MIL may be extinguished if the fault does not recur when monitored during three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first determined.

Anytime the MIL is illuminated, a DTC is stored. The DTC can self erase only when the MIL has been extinguished. Once the MIL is extinguished, the PCM must pass the diagnostic test for the most recent DTC for 40 warm-up cycles (80 warm-up cycles for the Fuel System Monitor and the Misfire Monitor) . A warm-up cycle can best be described by the following:

- The engine must be running
- A rise of 40°F in engine temperature must occur from the time when the engine was started
- Engine coolant temperature must reach at least 160°F
- A “driving cycle” that consists of engine start up and engine shut off.

Once the above conditions occur, the PCM is considered to have passed a warm-up cycle. Due to the conditions required to extinguish the MIL and erase the DTC, it is most important that after a repair has been made, all DTC’s be erased and the repair verified.

COMPONENT MONITORS

OPERATION

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (Check Engine) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum and 1600 rpm.

Any component that has an associated limp in will set a fault after 1 trip with the malfunction present.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

NON-MONITORED CIRCUITS

OPERATION

The PCM does not monitor all circuits, systems and conditions that could have malfunctions causing driveability problems. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code.

The major non-monitored circuits are listed below along with examples of failures modes that do not directly cause the PCM to set a DTC, but for a system that is monitored.

DESCRIPTION AND OPERATION (Continued)

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system. It may set a EGR or Fuel system fault or O2S.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

THROTTLE BODY AIR FLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

HIGH AND LOW LIMITS

OPERATION

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

SPECIFICATIONS

LOAD VALUE

ENGINE	IDLE/NEUTRAL	2500 RPM/NEUTRAL
2.0L SOHC	2% to 8% of Maximum Load	8% to 15% of Maximum Load
2.4L DOHC	2% to 8% of Maximum Load	7% to 15% of Maximum Load
2.5L SOHC	2% to 8% of Maximum Load	7% to 15% of Maximum Load

EVAPORATIVE EMISSION CONTROLS

INDEX

DESCRIPTION AND OPERATION

EVAPORATION CONTROL SYSTEM

OPERATION

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to an activated carbon filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

All engines use a proportional purge solenoid system. The PCM controls vapor flow by operating the purge solenoid. Refer to Proportional Purge Solenoid in this section.

NOTE: The evaporative system uses specially manufactured hoses. they need replacement, only use fuel resistant hose. Also the hoses must be able to pass an Ozone compliance test.

NOTE: For more information on Onboard Refueling Vapor Recovery (ORVR), refer to the Fuel Delivery section.

EVAP CANISTER

DESCRIPTION

The canister mounts to a bracket on top of the fuel tank in the rear of the vehicle (Fig. 1). The vacuum and vapor tube connect to the top of the canister.

OPERATION

All vehicles use a sealed, maintenance free, evaporative (EVAP) canister. Fuel tank pressure vents into the canister. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the combustion chamber. The Powertrain Control Module (PCM) purges the canister through the proportional purge solenoid. The PCM purges the canister at predetermined intervals and engine conditions.

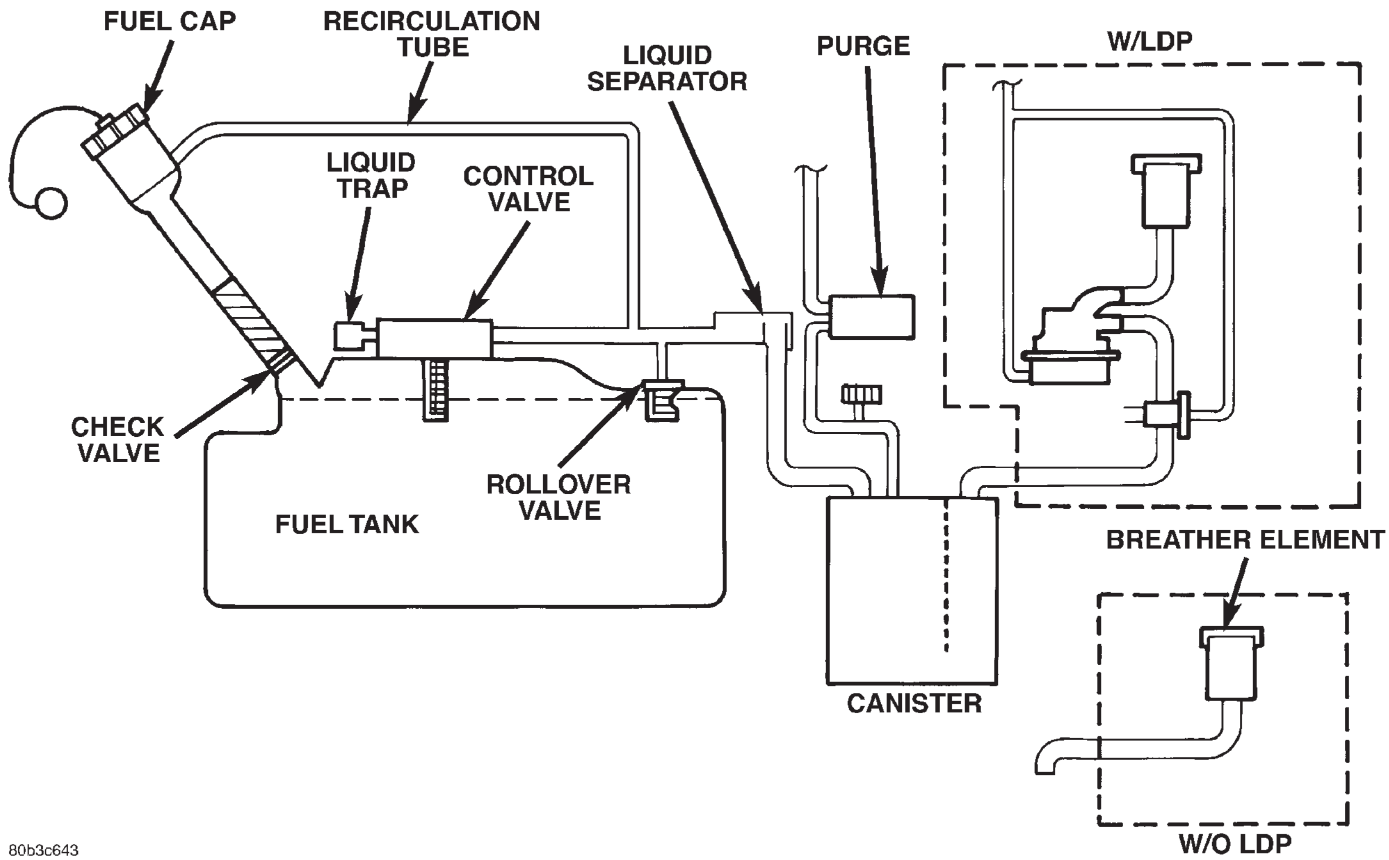
PROPORTIONAL PURGE SOLENOID

DESCRIPTION

OPERATION

All vehicles use a proportional purge solenoid. The solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

DESCRIPTION AND OPERATION (Continued)



ORVR System Schematic

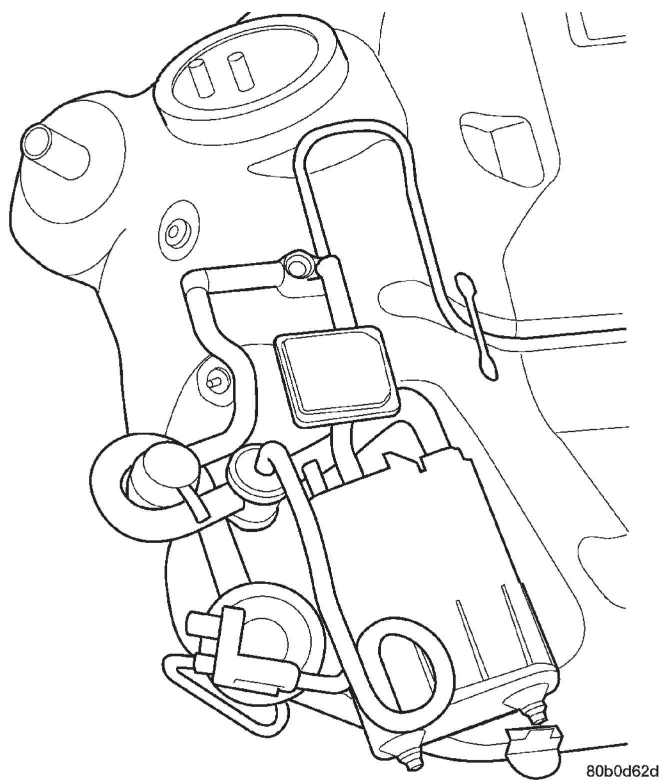


Fig. 1 EVAP Canister

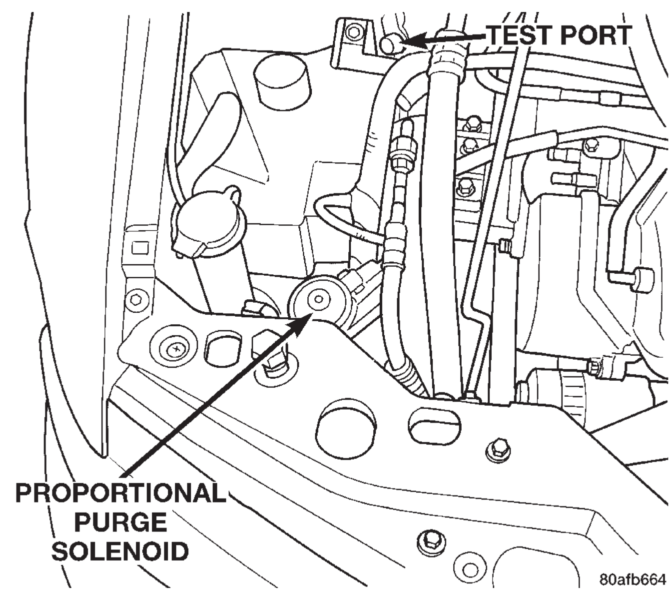


Fig. 2 Proportional Purge Solenoid

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged.

The proportional purge solenoid operates at a frequency of 200 hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts

DESCRIPTION AND OPERATION (Continued)

that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

LEAK DETECTION PUMP

DESCRIPTION

The leak detection pump is a device used to detect a leak in the evaporative system.

The pump contains a 3 port solenoid, a pump that contains a switch, a spring loaded canister vent valve seal, 2 check valves and a spring/diaphragm.

OPERATION

Immediately after a cold start, when the engine temperature is between 40°F and 86°F, the 3 port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non-test test conditions, the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling. This is due to the operation of the 3 port solenoid which prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized, allowing atmospheric pressure to enter the pump cavity. This permits the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de-energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

PUMP MODE: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test time.

TEST MODE: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5 inches of water.

When the pump starts, the cycle rate is quite high. As the system becomes pressurized, pump rate drops. If there is no leak, the pump will quit. If there is a leak, the test is terminated at the end of the test mode.

If there is no leak, the purge monitor is run. If the cycle rate increases due to the flow through the purge system, the test is passed and the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEMS

DESCRIPTION

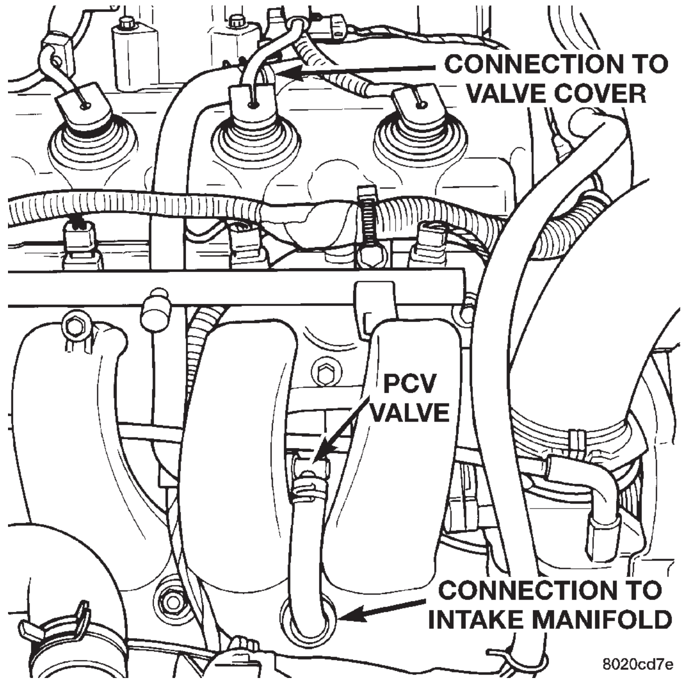


Fig. 3 PCV System—2.0L

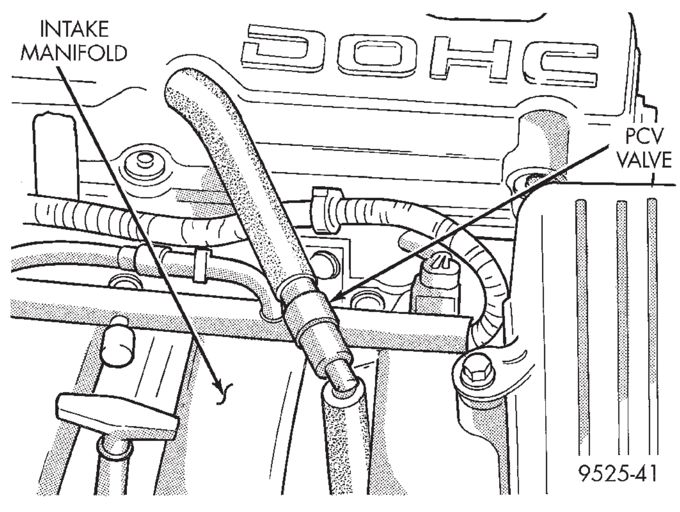


Fig. 4 PCV System—2.4L

DESCRIPTION AND OPERATION (Continued)

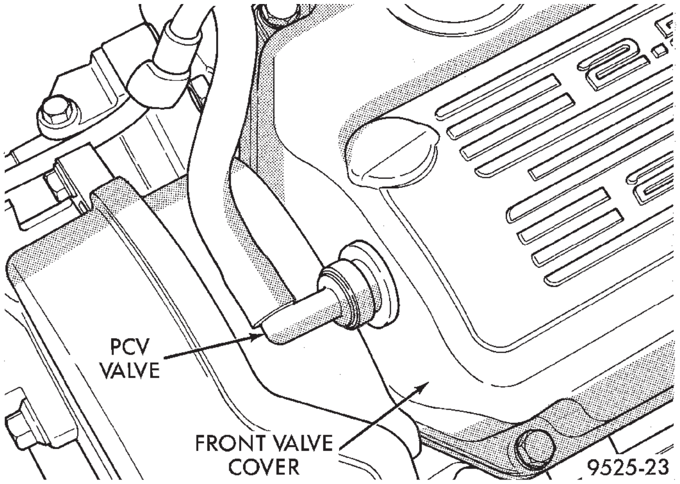


Fig. 5 PCV System—2.5L

OPERATION

Intake manifold vacuum removes crankcase vapors and piston blow-by from the engine. The emissions pass through the PCV valve into the intake manifold where they become part of the calibrated air-fuel mixture. They are burned and expelled with the exhaust gases. The air cleaner supplies make up air when the engine does not have enough vapor or blow-by gases. In this system, fresh air does not enter the crankcase.

CRANKCASE VENT FILTER

OPERATION

All engines use filtered air to vent the crankcase. The filtered air is drawn through the resonator assembly located between the air cleaner and throttle body.

VEHICLE EMISSION CONTROL INFORMATION LABEL

DESCRIPTION

All models have a Vehicle Emission Control Information (VECI) Label. Chrysler permanently attaches the label in the engine compartment. It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

DIAGNOSIS AND TESTING

LEAK DETECTION PUMP

Refer to the appropriate Powertrain Diagnostic Procedures Manual for testing procedures.

PCV VALVE TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST OR ADJUSTMENT WITH THE ENGINE OPERATING.

With the engine idling, remove the PCV valve from its attaching point. If the valve is operating properly, a hissing noise will be heard and a strong vacuum felt when placing a finger over the valve inlet (Fig. 6). With the engine off, shake the valve. The valve should rattle when shaken. Replace the valve if it does not operate properly. **Do not attempt to clean the PCV valve.**

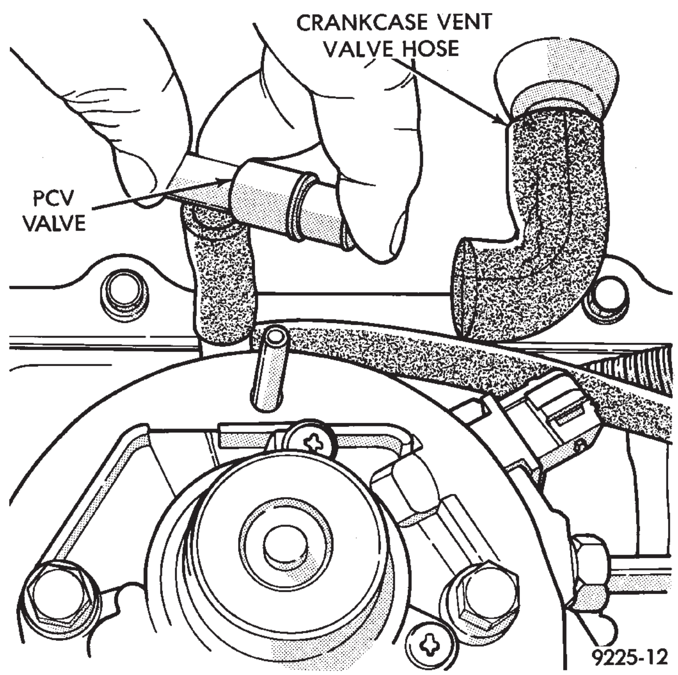


Fig. 6 PCV Test —Typical

REMOVAL AND INSTALLATION

LEAK DETECTION PUMP

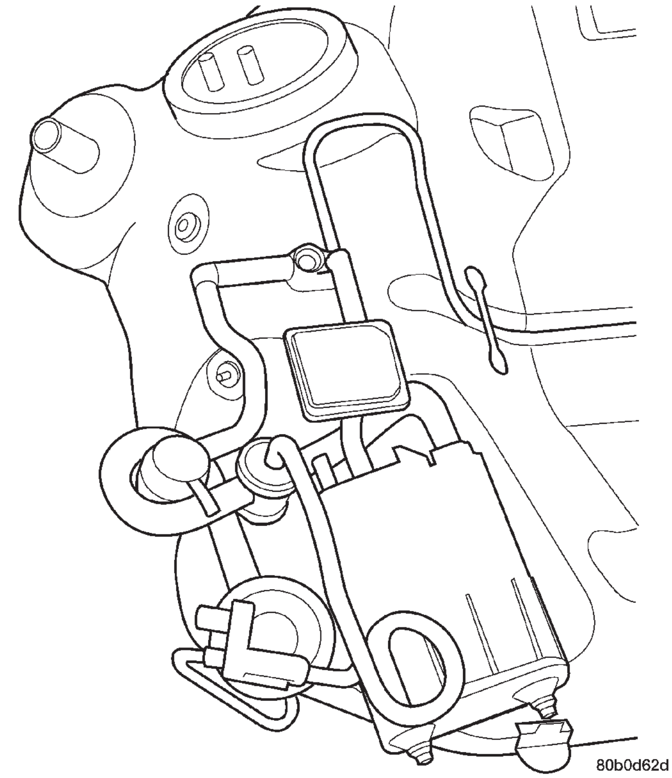


Fig. 7 Fuel Tank Assembly

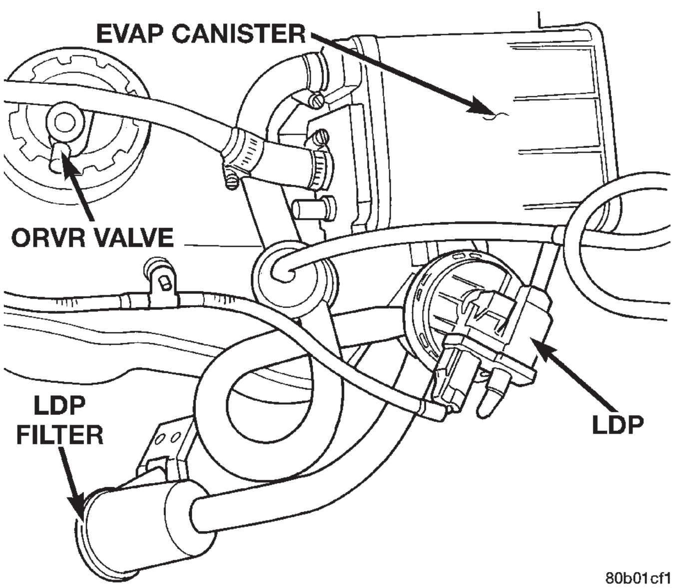


Fig. 8 EVAP System

REMOVAL

(1) Release fuel pressure, Refer to Fuel System Pressure Release Procedure in the Fuel Delivery section.

(2) Disconnect battery cable (Fig. 9).

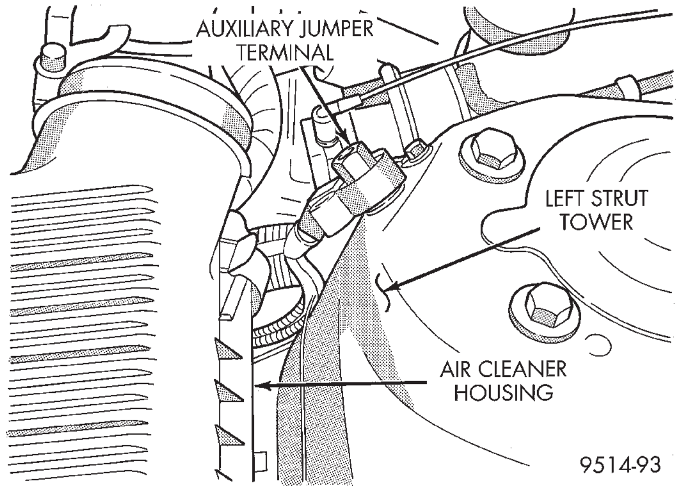


Fig. 9 Battery Cable

(3) Raise vehicle and support.

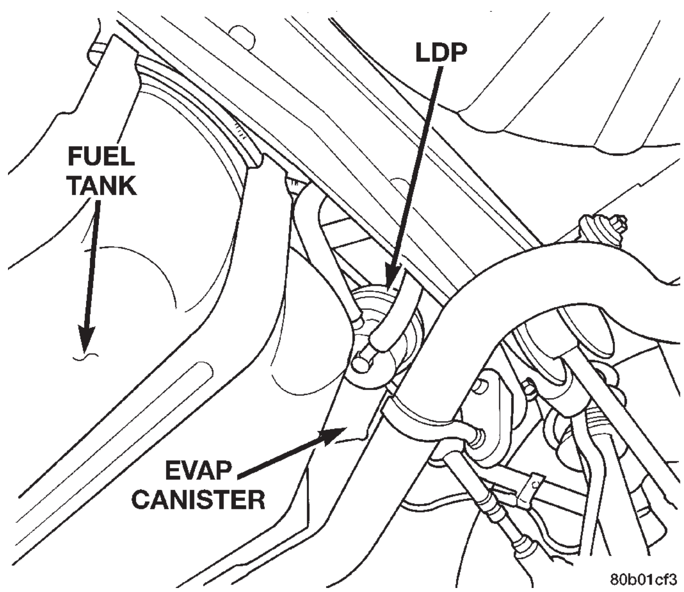


Fig. 10 EVAP System

REMOVAL AND INSTALLATION (Continued)

(4) Drain fuel tank, refer to Draining Fuel Tank in the Fuel Delivery section (Fig. 11).

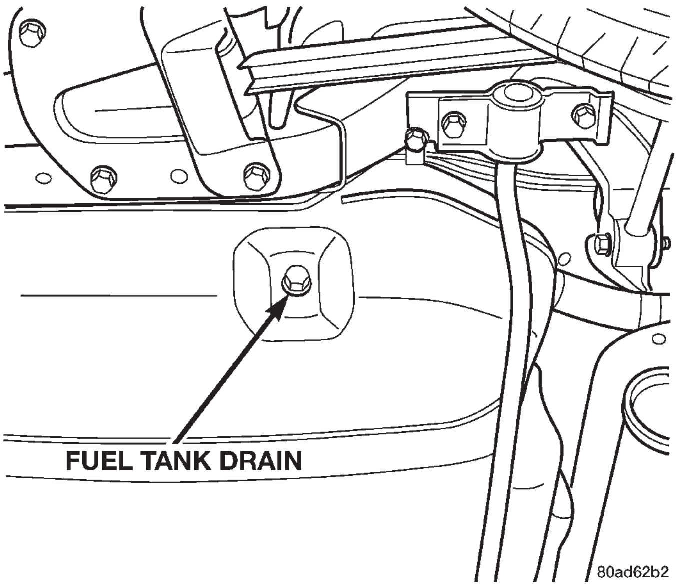


Fig. 11 Fuel Tank Drain

(5) Loosen and remove fuel filler tube from fuel tank (Fig. 12).

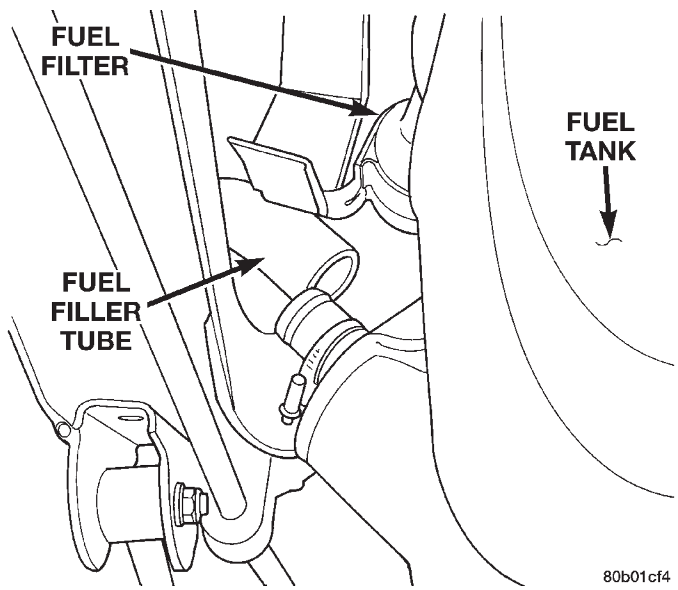


Fig. 12 Fuel Filler Tube

(6) Disconnect fuel line (Fig. 13).

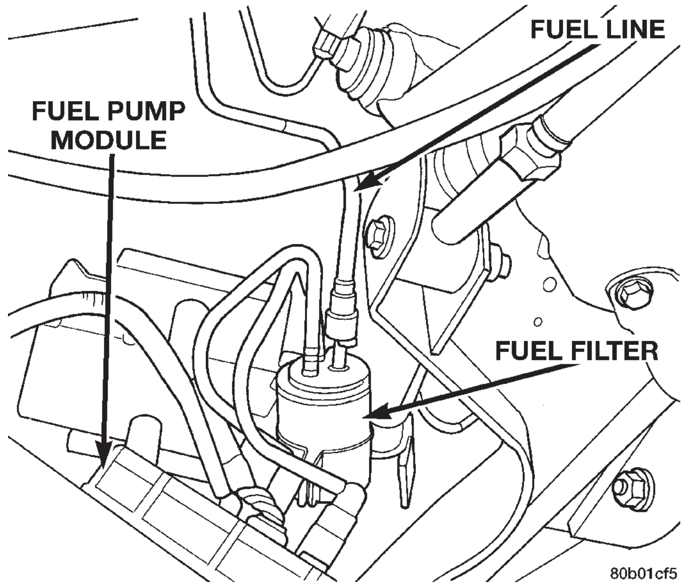


Fig. 13 Fuel Line

(7) Position transmission jack under fuel tank assembly.

(8) Remove fuel tank straps bolts. Passenger side first.

(9) Lower fuel tank and remove the purge line and vent line (Fig. 14).

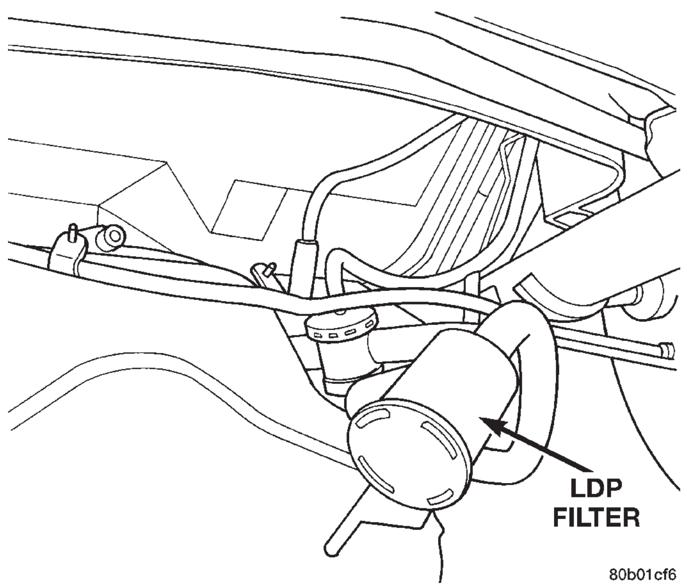


Fig. 14 Evap Components

REMOVAL AND INSTALLATION (Continued)

(10) Remove hoses from EVAP canister.

(11) Disconnect electrical connector for Leak Detection Pump (LDP).

(12) Remove push pin from bracket for EVAP canister (Fig. 15).

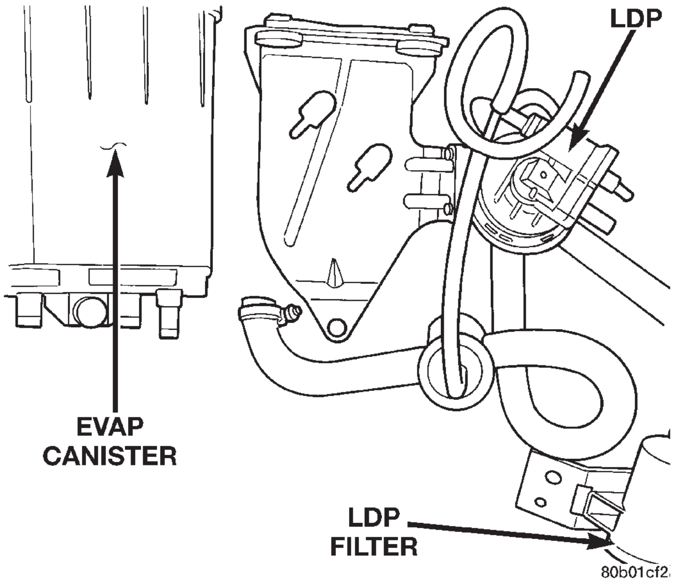


Fig. 15 LDP and EVAP Canister

(13) Remove bracket and Leak Dectection Pump.

(14) Remove LDP from bracket.

INSTALLATION

(1) Install LDP onto bracket.

(2) Install bracket and LDP onto fuel tank assebly.

(3) Install EVAP canister to bracket install push pin.

(4) Install hoses and lines.

(5) Raise the fuel tank on the transmission stand.

(6) Connect the purge and vent lines.

(7) Connect LDP and fuel pump electrical connector.

(8) Raise tank into position and install tank straps.

(9) Install the fuel filler tube and tighten the clamp.

(10) Lower vehicle.

(11) Connect the battery cable.

(12) Fill fuel tank. Use the DRB scan tool to pressurize the fuel system. Check for leaks.

EVAP CANISTER

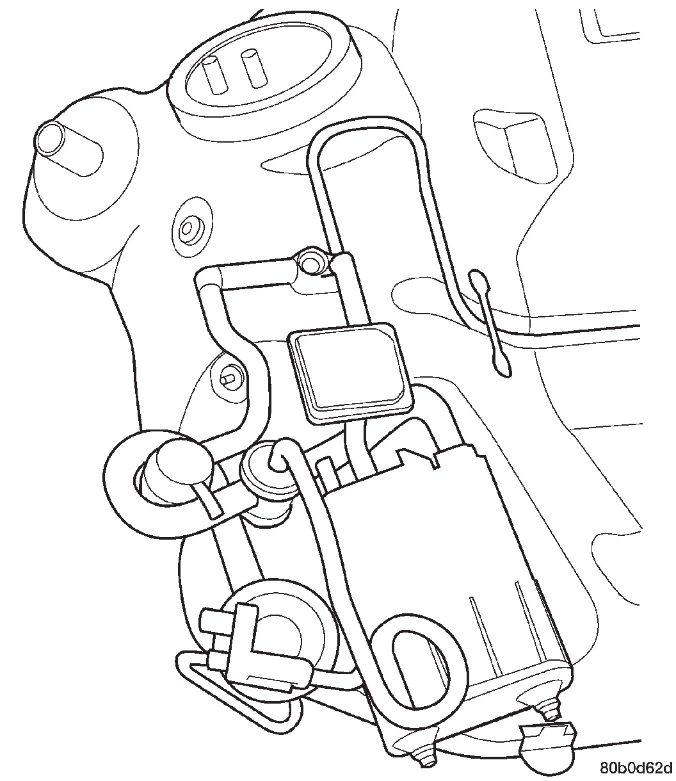


Fig. 16 Fuel Tank Assembly

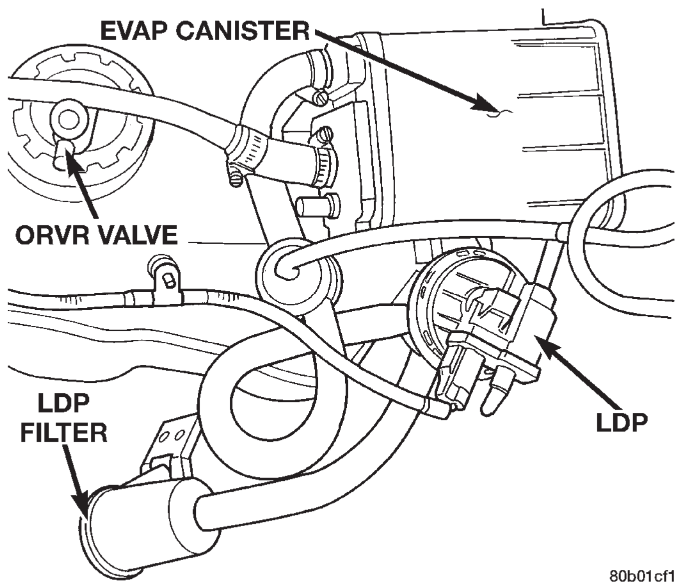


Fig. 17 EVAP System

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Release fuel pressure, Refer to Fuel System Pressure Release Procedure in the Fuel Delivery section.

(2) Disconnect battery cable (Fig. 18).

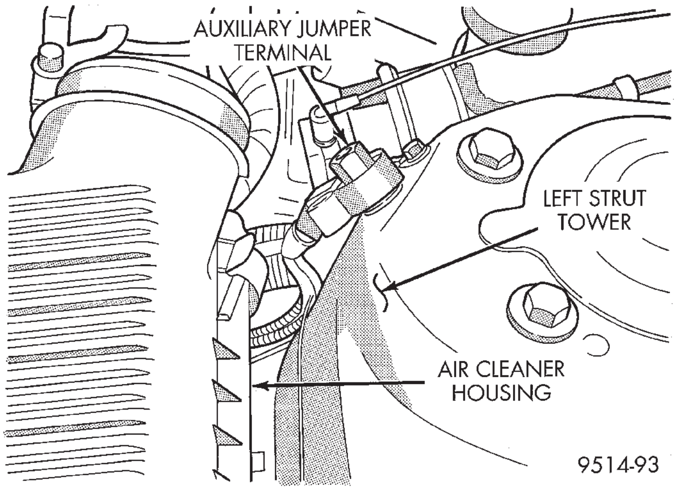


Fig. 18 Battery Cable

(3) Raise vehicle and support.

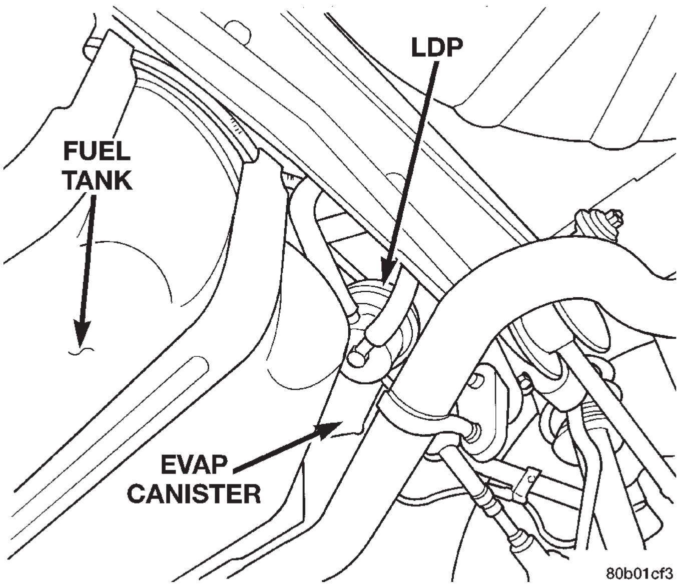


Fig. 19 EVAP System

(4) Drain fuel tank, refer to Draining Fuel Tank in the Fuel Delivery section (Fig. 20).

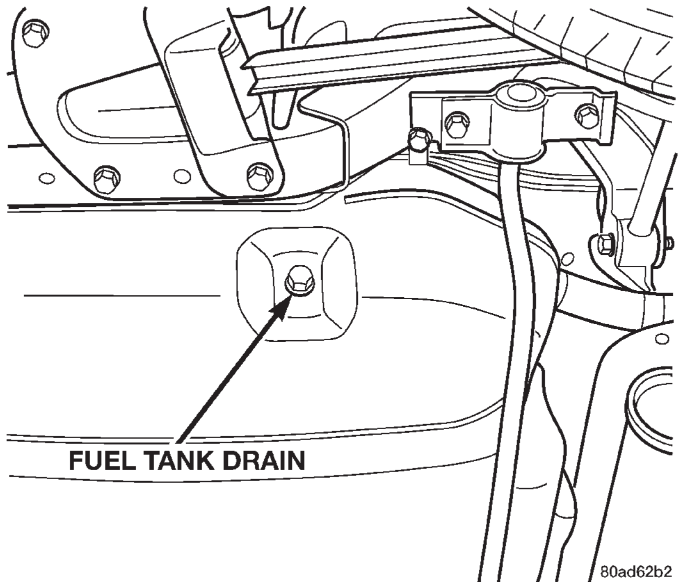


Fig. 20 Fuel Tank Drain

(5) Loosen and remove fuel filler tube from fuel tank (Fig. 21).

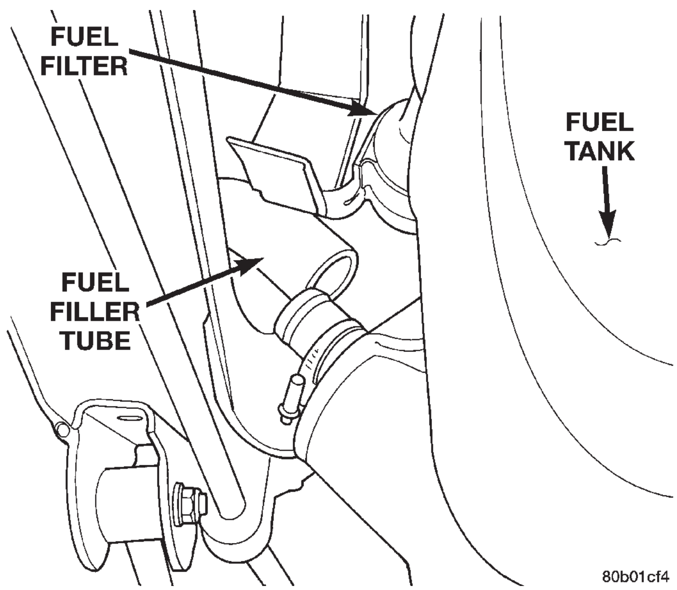


Fig. 21 Fuel Filler Tube

REMOVAL AND INSTALLATION (Continued)

(6) Disconnect fuel line (Fig. 22).

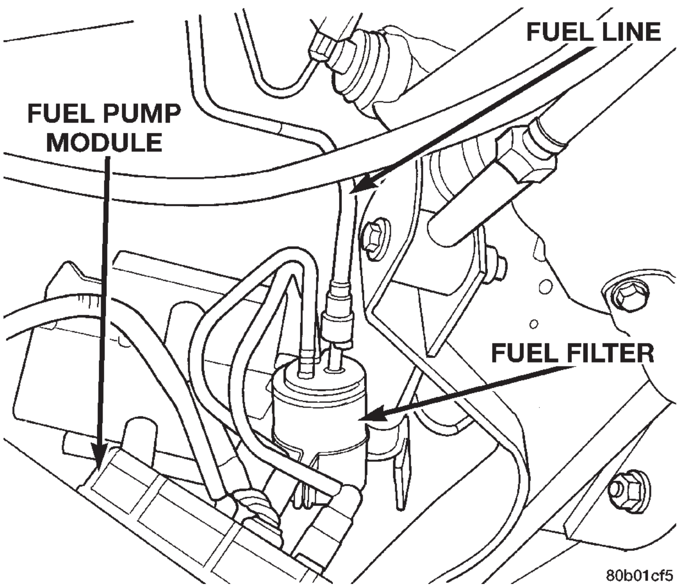


Fig. 22 Fuel Line

(7) Position transmission jack under fuel tank assembly.

(8) Remove fuel tank straps bolts. Passenger side first.

(9) Lower fuel tank and remove the purge line and vent line (Fig. 23).

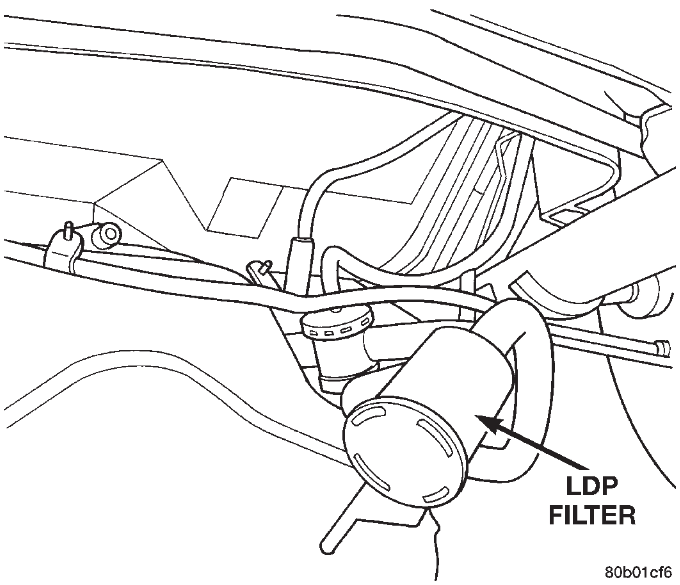


Fig. 23 Evap Components

(10) Remove hoses from EVAP canister.

(11) Disconnect electrical connector for Leak Detection Pump (LDP).

(12) Remove push pin from bracket for EVAP canister (Fig. 24). Remove canister.

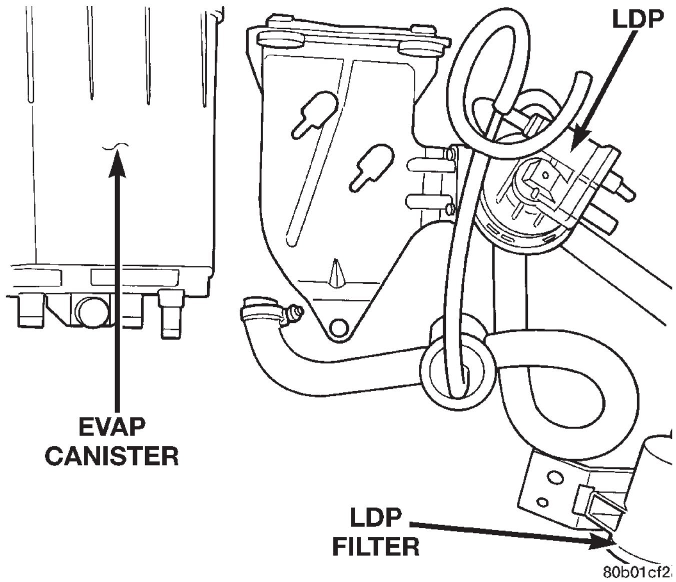


Fig. 24 LDP and EVAP Canister

INSTALLATION

(1) Install EVAP canister to bracket install push pin.

(2) Install hoses and lines.

(3) Raise the fuel tank on the transmission stand.

(4) Connect the purge and vent lines.

(5) Connect LDP and fuel pump electrical connector.

(6) Raise tank into position and install tank straps.

(7) Install the fuel filler tube and tighten the clamp.

(8) Lower vehicle.

(9) Connect the battery cable.

(10) Fill fuel tank. Use the DRB scan tool to pressurize the fuel system. Check for leaks.

PROPORTIONAL PURGE SOLENOID

REMOVAL

(1) Remove solenoid from bracket by pulling up on solenoid.

(2) Disconnect electrical connector from solenoid.

(3) Disconnect vacuum tubes from solenoid.

INSTALLATION

The top of the solenoid has TOP printed on it. The solenoid will not operate unless it is installed correctly.

(1) Connect vacuum tube to solenoid.

(2) Connect electrical connector to solenoid.

(3) Install solenoid on bracket.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

INDEX

DESCRIPTION AND OPERATION

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

DESCRIPTION

The EGR system consists of (Fig. 1), (Fig. 2), and (Fig. 3) :
- EGR tube
- EGR valve
- Electric EGR Transducer
- Connecting hoses

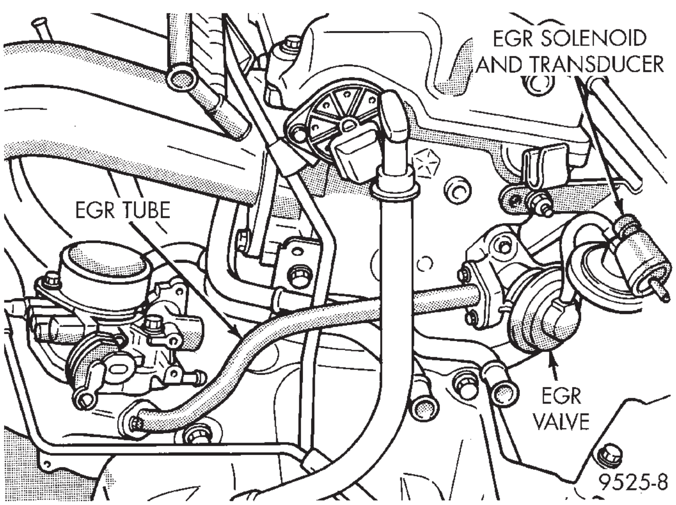


Fig. 1 EGR System—2.4L

OPERATION

Refer to Monitored Systems - EGR Monitor in this group for more information.

The EGR system reduces oxides of nitrogen (NOx) in engine exhaust and helps prevent detonation (engine knock). Under normal operating conditions, engine cylinder temperature can reach more than 3000°F. Formation of NOx increases proportionally with combustion temperature. To reduce the emission

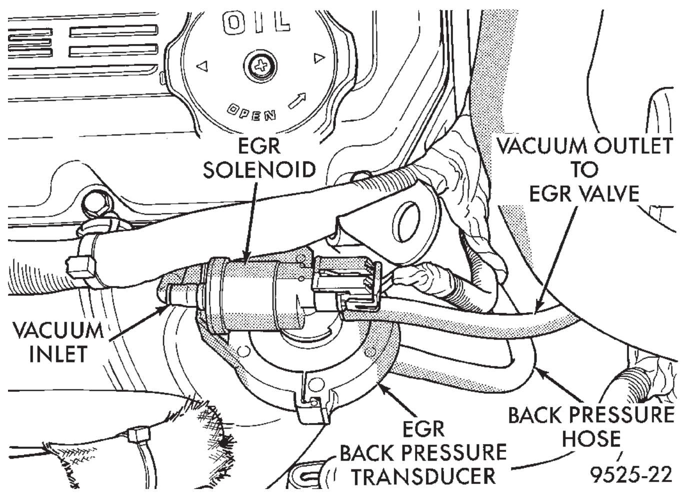


Fig. 2 EGR Control Valve—2.5L

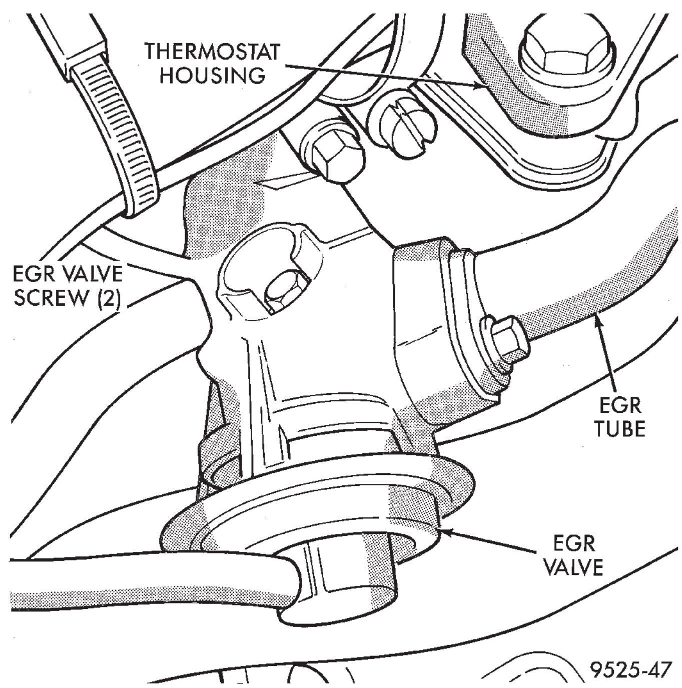


Fig. 3 EGR Valve—2.5L

DESCRIPTION AND OPERATION (Continued)

of these oxides, the cylinder temperature must be lowered. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming air/fuel mixture. The diluted air/fuel mixture reduces peak flame temperature during combustion.

The electric EGR transducer contains an electrically operated solenoid and a back-pressure transducer (Fig. 4). The Powertrain Control Module (PCM) operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back-pressure controls the transducer.

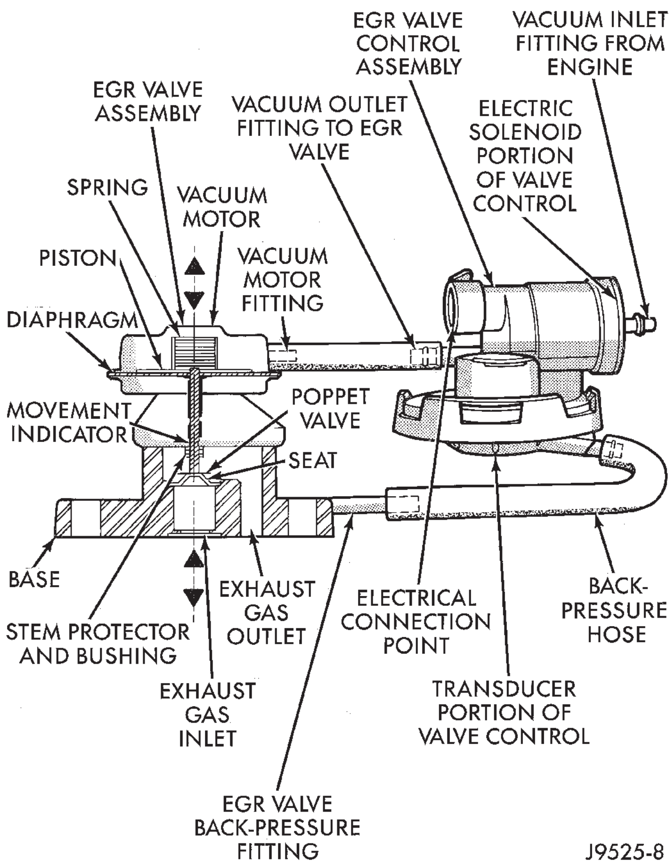


Fig. 4 Electric EGR Transducer

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vacuum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of vacuum applied to the EGR valve. Varying the strength of the vacuum changes the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

This system does not allow EGR at idle.

A failed or malfunctioning EGR system can cause engine spark knock, sags or hesitation, rough idle, engine stalling and increased emissions.

DIAGNOSIS AND TESTING

EGR SYSTEM ON-BOARD DIAGNOSTICS

The PCM performs an on-board diagnostic check of the EGR system. The diagnostic system uses the electronic EGR transducer for the system tests.

The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the PCM energizes the transducer solenoid to disable the EGR. The PCM checks for a change in the heated oxygen sensor signal. If the air-fuel mixture goes lean, the PCM will attempt to enrichen the mixture. The PCM registers a Diagnostic Trouble Code (DTC) if the EGR system is not operating correctly. After registering a DTC, the PCM turns on the malfunction indicator (Check Engine) lamp after 2 consecutive trips. There are 2 types of failures sensed by the PCM. The first is a short or open in the electrical solenoid circuit. the second is a mechanical failure or loss of vacuum. The Malfunction Indicator Lamp (MIL) indicates the need for service.

If a problem is indicated by the MIL and a DTC for the EGR system is set, check for proper operation of the EGR system. Use the System Test, EGR Gas Flow Test. If the EGR system tests properly, check the system using the DRB scan tool. Refer to On-Board Diagnosis sections in this Group. Also, refer to the DRB scan tool and the appropriate Powertrain Diagnostics Procedure manual.

EGR SYSTEM TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE TESTING THE EGR SYSTEM.

(1) Check the condition of all EGR system hoses and tubes for leaks, blockages, cracks, kinks and hardening of rubber hoses. Repair and correct these conditions before performing any tests.

(2) Be sure the hoses at both the EGR valve and EGR valve control are connected to the proper fittings (Fig. 5).

(3) Be sure the electrical connector is firmly connected at the valve control.

(4) To check EGR system operation, connect the DRB scan tool to the 16–way data link connector. The data link connector is located on the lower edge of the instrument panel near the steering column.

DIAGNOSIS AND TESTING (Continued)

Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool when diagnosing the EGR system.

(5) After checking the system with the DRB scan tool, proceed to the following EGR Valve Leakage and EGR Valve Control Tests and repair as necessary.

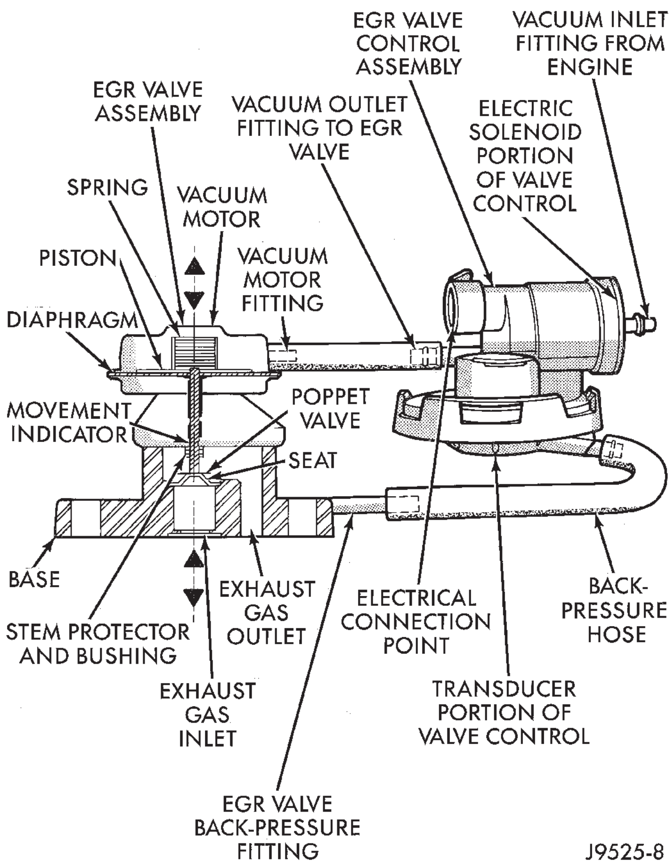


Fig. 5 EGR Value and EGR Value —Typical

EGR GAS FLOW TEST

Use the following test procedure to determine if exhaust gas is flowing through the EGR valve. It can also be used to determine if the EGR tube is plugged, or the system passages in the intake or exhaust manifolds are plugged.

This is not to be used as a complete test of the EGR system.

The engine must be started, running and warmed to operating temperature for this test.

(1) All engines are equipped with two fittings located on the EGR valve (Fig. 6). The upper fitting (located on the vacuum motor) supplies engine vacuum to a diaphragm within the EGR valve for valve operation. The lower fitting (located on the base of the EGR valve) is used to supply exhaust back-pressure to the EGR valve control.

(2) Disconnect the rubber hose at the vacuum motor fitting (Fig. 6) on the top of the EGR valve vacuum motor.

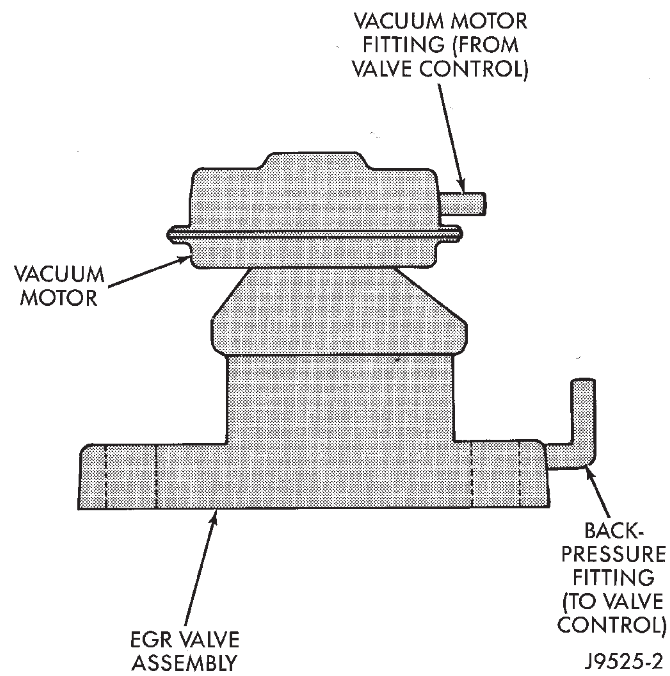


Fig. 6 Typical EGR Valve

(3) Connect a hand-held vacuum pump to this fitting.

(4) Start the engine.

(5) Slowly apply 5 inches of vacuum to the fitting on the EGR valve motor.

(6) While applying vacuum, a minimum of 3 inches of vacuum, and with the engine running at idle speed, the idle speed should drop or the engine may even stall, if the vacuum is applied quickly. This is indicating that exhaust gas is flowing through the EGR tube between the intake and exhaust manifolds.

(7) If the engine speed did not change, the EGR valve may be defective, or EGR tube may be plugged with carbon, or the passages in the intake and exhaust manifolds may be plugged with carbon.

(a) Remove EGR valve from engine. Refer to EGR Valve Removal in this group.

(b) Apply vacuum to the vacuum motor fitting and observe the stem on the EGR valve. If the stem is moving, it can be assumed that the EGR valve is functioning correctly. The problem is in either a plugged EGR tube or plugged passages at the intake or exhaust manifolds, refer to step (c). If the stem will not move, replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one unit. Refer to EGR Valve Removal/Installation in this group.

(c) Remove the EGR tube between the intake and exhaust manifolds. Check and clean the EGR tube and its related openings on the manifolds. Refer to EGR Tube in this group for procedures.

DIAGNOSIS AND TESTING (Continued)

(8) Do not attempt to clean the EGR valve. If the valve shows evidence of heavy carbon build-up near the base, replace it.

EGR VALVE LEAKAGE TEST

This is not to be used as a complete test of the EGR system.

If the engine will not idle, dies out on idle, or idle is rough or slow, the poppet valve (Fig. 5) at the base of the EGR valve may be leaking in the closed position.

(1) The engine should be off for the following test.

(2) Disconnect the rubber hose from the fitting (Fig. 5) at the top (vacuum motor) side of the EGR valve.

(a) Connect a hand-held vacuum pump to this fitting.

(b) Apply 15 inches of vacuum to the pump.

(c) Observe the gauge reading on the pump.

(d) If vacuum falls off, the diaphragm in the EGR valve has ruptured.

(e) Replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group.

(f) Proceed to the next step.

(3) A small metal fitting (back-pressure fitting) is located at the base of the EGR valve (Fig. 5). A rubber back-pressure hose connects it to the back-pressure fitting on the EGR valve control. Disconnect this rubber hose at the EGR valve fitting.

(4) Remove the air cleaner housing from the throttle body.

(5) Using compressed air, and using an air nozzle with a rubber tip, apply approximately 50 psi of regulated shop air to the metal back- pressure fitting on the EGR valve.

(6) By hand, open the throttle to the wide open position. Air **SHOULD NOT BE HEARD** emitting from the intake manifold while applying air pressure at the back-pressure fitting.

(7) If air **CAN BE HEARD** emitting from the intake manifold, the poppet valve (Fig. 5) is leaking at the bottom of the EGR valve. Replace the EGR valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group. Do not attempt clean the old EGR valve.

EGR VALVE CONTROL (TRANSDUCER) TEST

TESTING ELECTRICAL SOLENOID PORTION OF VALVE

This is not to be used as a complete test of the EGR system.

Electrical operation of the valve should be checked with the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool. Replace solenoid if necessary, unit serviced only as an assembly.

TESTING VACUUM TRANSDUCER PORTION OF VALVE

The first part of this test will determine if the transducer diaphragm at the back-pressure side of the valve has ruptured or is leaking. The second part of the test will determine if engine vacuum (full-manifold) is flowing from the inlet to the outlet side of the valve. This is not to be used as a complete test of the EGR system.

(1) Disconnect the rubber back-pressure hose from the fitting at the bottom of EGR valve (Fig. 5).

(2) Connect a hand-held vacuum pump to this fitting.

(3) Apply 10 inches of vacuum to this fitting.

(4) If vacuum falls off, the valve diaphragm is leaking.

(5) Replace the Complete EGR valve assembly. Proceed to next step for further testing.

(6) Reconnect hose to EGR valve.

(7) Remove the vacuum supply hose at the vacuum **inlet** fitting (Fig. 5) on the EGR solenoid.

(8) Connect a vacuum gauge to this disconnected vacuum line.

(9) Start the engine and bring to operating temperature. Hold engine speed at approximately 1500 rpm.

(10) Check for steady engine vacuum (full-manifold) at this hose.

(11) If engine vacuum (full-manifold) is not present, check vacuum line to engine and repair as necessary before proceeding to next step.

(12) Reconnect the rubber hose to the vacuum **inlet** fitting (Fig. 5) on the EGR valve.

(13) Disconnect the rubber hose at the vacuum **outlet** fitting (Fig. 5) on the EGR valve.

(14) Connect a vacuum gauge to this fitting.

(15) Disconnect the electrical connector (Fig. 5) at the valve control. This will simulate an open circuit (no ground from the PCM) at the valve, activating the valve. A DTC will be set in the PCM that must be erased after testing is complete.

(16) Start the engine and bring to operating temperature.

(17) Hold the engine speed to approximately 2000 rpm while checking for engine vacuum (full-manifold) at this fitting. **To allow full manifold vacuum to flow through the valve, exhaust back-pressure must be present at valve. It must be high enough to hold the bleed valve in the transducer portion of the valve closed.** Have a helper

DIAGNOSIS AND TESTING (Continued)

momentarily (a second or two) hold a rag over the tailpipe opening to build some exhaust back-pressure while observing the vacuum gauge. Heavy gloves should be worn. **Do not cover the tailpipe opening for an extended period of time as damage to components or overheating may result.**

(18) As temporary back-pressure is built, full manifold vacuum should be observed at the vacuum outlet fitting. Without back-pressure, and engine at approximately 2000 rpm, the gauge reading will be low. This low reading is normal. At idle speed, the gauge reading may be erratic. This is also normal.

(19) If full manifold vacuum is not present at the outlet fitting, but was present at the inlet fitting, replace the valve. Note: The EGR valve, valve control and attaching hoses are serviced as one assembly. Refer to EGR Valve Removal/Installation in this group.

REMOVAL AND INSTALLATION

EGR VALVE AND TRANSDUCER—2.0L

If the EGR system operates incorrectly, replace the entire EGR valve and transducer together. The EGR valve and electrical transducer are calibrated together.

REMOVAL

The EGR valve and EGR transducer attach to the rear of the cylinder head (Fig. 7).

(1) Disconnect vacuum supply tube from EGR transducer solenoid.

(2) Disconnect electrical connector from solenoid.

(3) Remove EGR tube to EGR valve screws.

(4) Remove EGR valve mounting screws. Remove EGR valve and transducer.

(5) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

INSTALLATION

(1) Loosely install EGR valve with new gaskets.

(2) Finger tighten EGR tube fasteners.

(3) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.

(4) Tightening EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.

(5) Connect vacuum supply tube to solenoid.

(6) Attach electrical connector to solenoid.

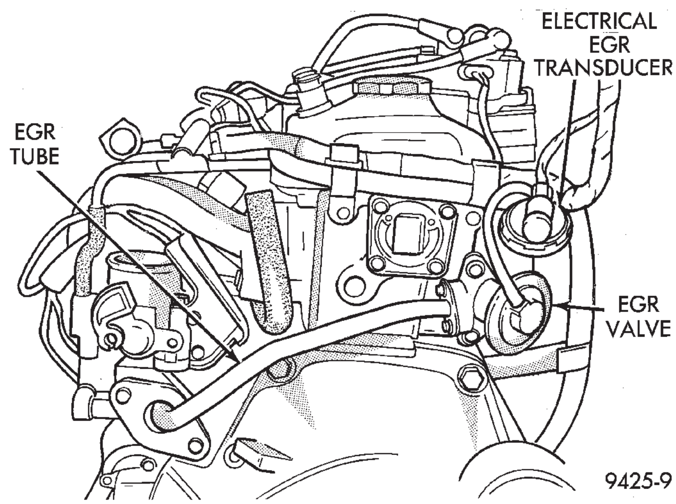


Fig. 7 EGR System

EGR VALVE AND TRANSDUCER—2.4L

If the EGR system operates incorrectly, replace the entire EGR valve and transducer together. The EGR valve and electrical transducer are calibrated together.

REMOVAL

(1) Disconnect vacuum supply tube from solenoid.

(2) Disconnect electrical connector from solenoid.

(3) Remove EGR tube to EGR valve screws.

(4) Remove EGR valve mounting screws. Remove EGR valve and transducer.

(5) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

INSTALLATION

(1) Loosely install EGR valve with new gaskets.

(2) Finger tighten EGR tube fasteners.

(3) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.

(4) Tightening EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.

(5) Connect vacuum supply tube to solenoid.

(6) Attach electrical connector to solenoid.

EGR VALVE AND TRANSDUCER—2.5L

The EGR valve attaches to the front exhaust manifold. The transducer/solenoid attach to the front cylinder head.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect vacuum supply from solenoid.

(2) Disconnect electrical connector from solenoid.

(3) Remove screws holding transducer to bracket.

(4) Remove screws holding Transmission Control Module (TCM) to bracket (Fig. 8). Swing TCM up to allow access to EGR screws (Fig. 9).

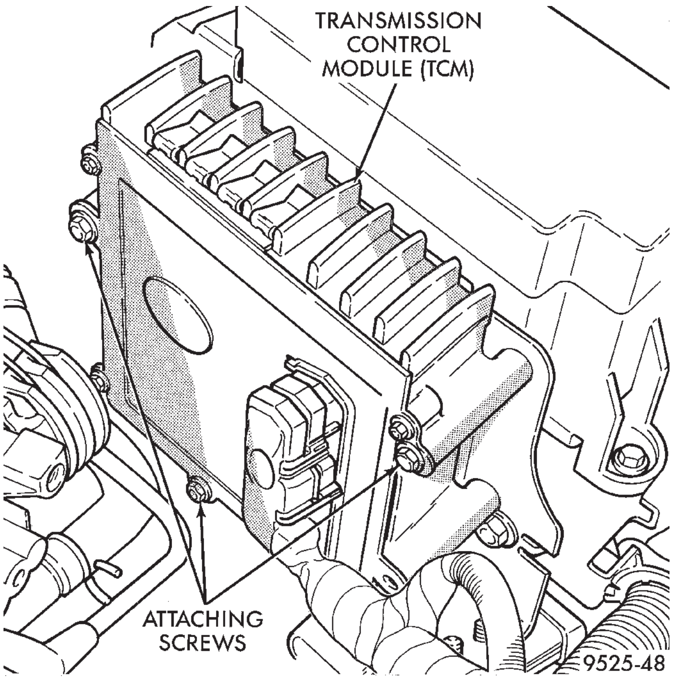


Fig. 8 TCM Removal

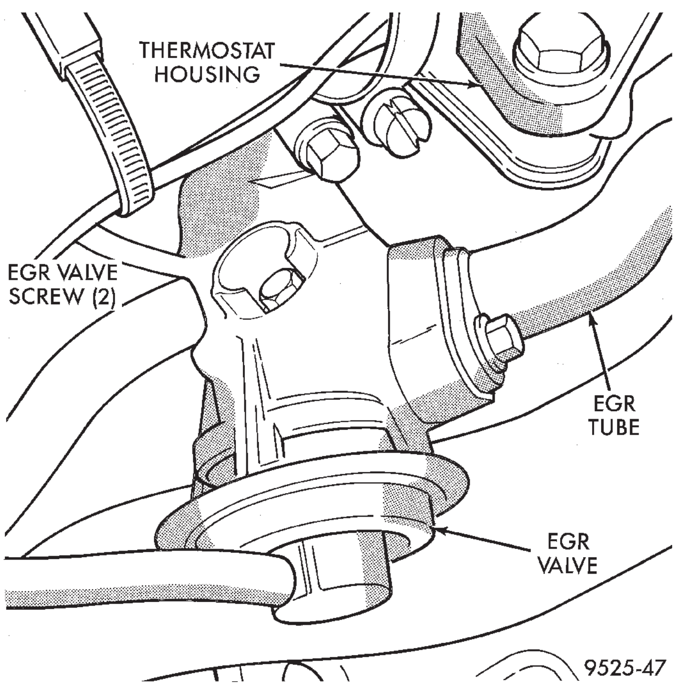


Fig. 9 EGR Removal

(5) Remove screws holding EGR tube.

(6) Remove EGR valve mounting screws. Remove EGR valve and transducer.

(7) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

INSTALLATION

(1) Loosely install EGR valve with new gaskets.

(2) Finger tighten EGR tube fasteners.

(3) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.

(4) Tightening EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.

(5) Install transducer to bracket.

(6) Connect vacuum supply to solenoid.

(7) Attach electrical connector to solenoid.

EGR TUBE—2.0L

The EGR tube attaches to the intake manifold plenum below the throttle body and EGR valve.

REMOVAL

(1) Remove screws attaching EGR tube to intake manifold (Fig. 10).

(2) Remove EGR tube to EGR valve screws.

(3) Remove EGR tube. Clean gasket surface on the EGR valve. Wipe clean the grommet on the intake manifold.

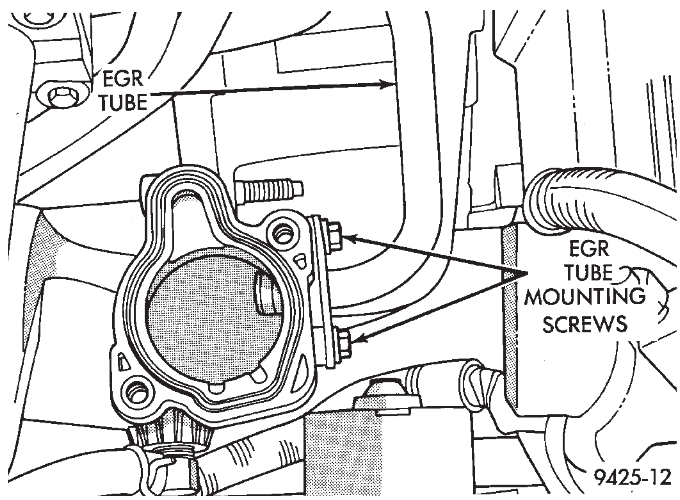


Fig. 10 EGR Tube Stud Bolts

INSTALLATION

The rubber grommet that seals the EGR tube to intake manifold connection is reusable. Use a new gasket on the EGR tube to EGR valve connection.

(1) Loosely install the EGR tube and fasteners.

(2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.

(3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

EGR TUBE—2.4L

The EGR tube attaches to the intake manifold plenum below the throttle body and to the EGR valve (Fig. 1).

REMOVAL

(1) Remove screws attaching EGR tube to intake manifold (Fig. 11).

(2) Remove EGR tube to EGR valve screws.

(3) Remove EGR tube. Clean gasket surface on the EGR valve. Wipe the grommet clean on the intake manifold.

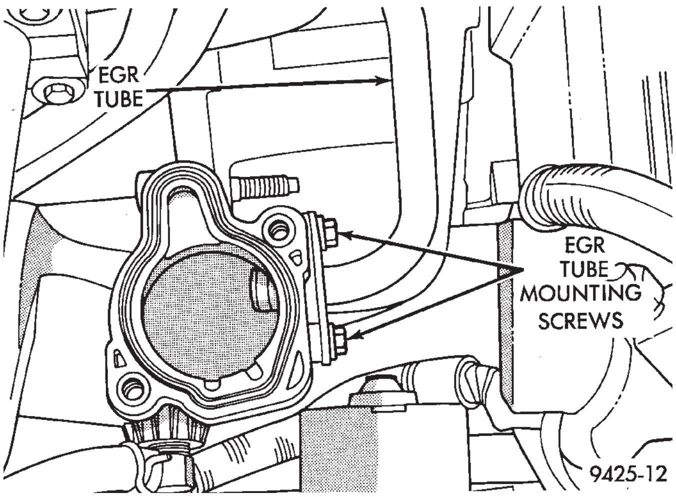


Fig. 11 EGR Tube Stud Bolts

INSTALLATION

The rubber grommet that seals the EGR tube to intake manifold connection is reusable. Use a new gasket on the EGR tube to EGR valve connection.

(1) Loosely install the EGR tube and fasteners.

(2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.

(3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.

EGR TUBE—2.5L

The EGR tube attaches to the intake manifold plenum behind the throttle body and to the EGR valve.

REMOVAL

(1) Remove screws attaching EGR tube to intake manifold (Fig. 12).

(2) Remove EGR tube to EGR valve screws (Fig. 13).

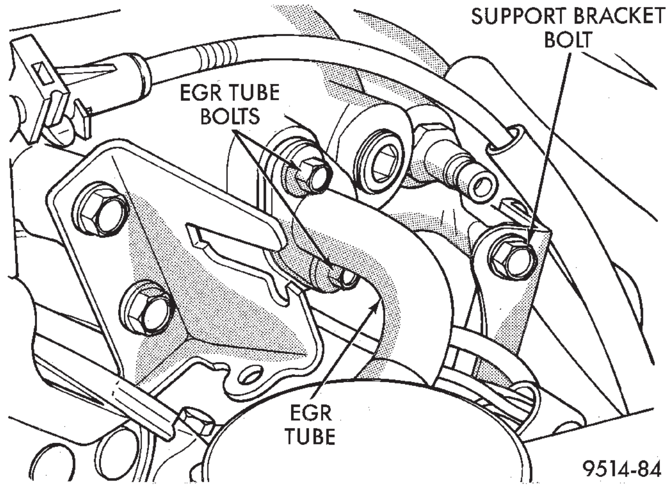


Fig. 12 EGR Tube at Intake Manifold

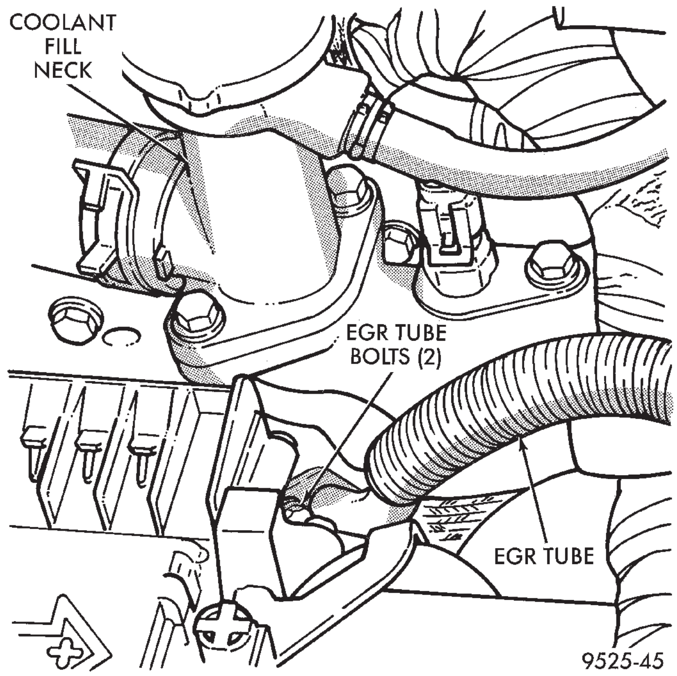


Fig. 13 EGR Tube at EGR Valve

(3) Remove EGR tube. Clean gasket surface on the EGR valve. Wipe clean the grommet on the intake manifold.

INSTALLATION

Use new gaskets on both ends of the EGR tube.

(1) Loosely install the EGR tube and fasteners.

(2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.

(3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.

SPECIFICATIONS

TORQUE

Description	Torque
EGR valve to cyl. head	22 N·m (200 in. lbs.)
EGR tube to EGR valve	11 N·m (95 in. lbs.)
EGR tube to intake manifold	9 N·m (80 in. lbs.)
EGR tube to exhaust manifold	11 N·m (95 in. lbs.)

EMISSION CONTROL SYSTEM

CONTENTS

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GENERAL INFORMATION

DIAGNOSTIC TROUBLE CODES—FUEL SYSTEMS CALIBRATED FOR LEADED FUEL

Since vehicles with fuel systems calibrated for leaded fuel do not have oxygen sensors, and the Exhaust Gas Recirculation (EGR) system is turned off, the codes that are related to those systems are not displayed by the PCM.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS—LEADED FUEL SYSTEMS

MIL CODE	SAE SCAN TOOL J2012 CODE	HEX CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
11		28	No Crank Reference Signal at PCM	No crank reference signal detected during engine cranking.
12*			Battery Disconnect	Direct battery input to PCM was disconnected within the last 50 key-on cycles.
13**		26	MAP Pneumatic Signal	
	1297	27	No Change in MAP From Start to Run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading from start-up.
14**	P0107	24	MAP Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
	or			
	P0108	25	MAP Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
15**	P0500	23	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
17		21	Engine too Cold too Long	Engine did not reach operating temperature within acceptable limits.
22**	P0117	1E	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below minimum acceptable voltage.
	or			
	P0118	1F	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above maximum acceptable voltage.

GENERAL INFORMATION (Continued)

MIL CODE	SAE SCAN TOOL J2012 CODE	HEX CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
23**	P0112	39	Intake Air Temp Sensor Voltage Low	Intake air temperature sensor input below the maximum acceptable voltage.
24	P0122 or P0123	1A 1B	Throttle Position Sensor Voltage Low Throttle Position Sensor Voltage High	Throttle position sensor input below the minimum acceptable voltage. Throttle position sensor input above the maximum acceptable voltage.
25**	P0505	19	Idle Air Control Motor Circuits	A shorted or open condition detected in one or more of the idle air control motor circuits.
27**	P0201 or P0202 or P0203	15 14 13	Injector #1 Control Circuit Injector #2 Control Circuit Injector #3 Control Circuit	Injector #1 output driver does not respond properly to the control signal. Injector #2 output driver does not respond properly to the control signal. Injector #3 output driver does not respond properly to the control signal.
31*	P0443	12	EVAP Purge Solenoid Circuit	An open or shorted condition detected in the duty cycle purge solenoid circuit.
33*		10	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay circuit.
34*		0F	Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
35**	P1489 or P1490	5D 5C	High Spd Fan Relay Circuit Check Low Spd Fan Relay Circuit Check	An open or shorted condition detected in the high speed radiator fan relay control circuit. An open or shorted condition detected in the low speed radiator fan relay control circuit.
41***		0B	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
42*		0A	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
43**	P0351	2B	Ignition Coil #1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
44**	P1492 or P1493	9A 99	Battery Temp Sensor Voltage Too High Battery Temp Sensor Voltage Too Low	Battery temperature sensor input voltage above an acceptable range. Battery temperature sensor input voltage below an acceptable range.
46***		06	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.

GENERAL INFORMATION (Continued)

MIL CODE	SAE SCAN TOOL J2012 CODE	HEX CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
47***		05	Charging System Voltage Too Low	Battery voltage sense input below target charging during engine operation. Also, no significant change detected in battery voltage during active test of generator output circuit.
53**	P0601	02	Internal Controller Failure	PCM Internal fault condition detected.
54**	P0340	01	No Cam Signal at PCM	No camshaft signal detected during engine cranking.
62	P1697	30	PCM Failure SRI Mile Not Stored	Unsuccessful attempt to update EMR mileage in the PCM EEPROM.
63**	P1696	31	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the PCM.
66		61	No Body CCD Message	No communication from body control module.
71**	P1496	92	5 Volts Output Low	Intrenal PCM check for 5 volts.
77		52	S/C Power Relay Circuit	Malfunction detected with power feed to speed control servo soleniods.

* Check Engine Lamp (MIL) will not illuminate if this Diagnostic Trouble Code was recorded. Cycle Ignition key as described in manual and observe code flashed by Check Engine lamp.

** Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

*** Generator Lamp illuminated.