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1995 ZJ Jeep Grand Cherokee
Electronic Service Manual

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FOR INSTRUCTIONS

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UNITED STATES

The special service tools referred to herein are required for certain service operations. These special service tools or their equivalent, if not obtainable through a local source, are available through the following outlet.

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MILLER SPECIAL TOOLS

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CAUTION

ALL SERVICE AND REBUILDING INSTRUCTIONS CONTAINED HEREIN ARE APPLICABLE TO, AND FOR THE CONVENIENCE OF, THE AUTOMOTIVE TRADE ONLY. All test and repair procedures on components or assemblies in non-automotive applications should be repaired in accordance with instructions supplied by the manufacturer of the total product.

Proper service and repair is important to the safe, reliable, operation of all motor vehicles. The service procedures recommended and described in this publication were developed for professional service personnel and are effective methods for performing vehicle repair. Following these procedures will help assure efficient economical vehicle performance and service reliability. Some of these service procedures require the use of special tools designed for specific procedures. These special tools should be used when recommended throughout this publication.

Special attention should be exercised when working with spring or tension loaded fasteners and devices such as E-Clips, Circlips, Snap rings, etc., as careless removal may cause personal injury. Always wear safety goggles whenever working on vehicles or vehicle components.

It is important to note that this publication contains various **Cautions** and **Warnings.** These should be carefully read in order to minimize the risk of personal injury, or the possibility that improper service methods may damage the vehicle or render it unsafe. It is important to note that these **Cautions** and **Warnings** cover only the situations and procedures DaimlerChrysler Corporation has encountered and recommended. DaimlerChrysler Corporation could not possibly know, evaluate, and advise the service trade of all conceivable ways that service may be performed, or of the possible hazards of each. Consequently, DaimlerChrysler Corporation has not undertaken any such broad service review. Accordingly, anyone who uses a service procedure, or tool, that is not recommended in this publication must assure oneself thoroughly that neither personal safety, nor vehicle safety, be jeopardized by the service methods they select.

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CHRYSLER CORPORATION

SERVICE MANUAL

1995 JEEP®
GRAND CHEROKEE

To order the special service tools used and illustrated, please refer to the instructions on inside back cover.

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FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. This manual does not cover theory of operation, which is addressed in service training material. Information describing the operation and use of standard and optional equipment is included in the Owner's Manual provided with the vehicle.

Information in this manual is divided into groups. These groups contain general information, diagnosis, testing, adjustments, removal, installation, disassembly, and assembly procedures for the components. To assist in locating a group title page, use the Group Tab Locator on the following page. The solid bar after the group title is aligned to a solid tab on the first page of each group. The first page of the group has a contents section that lists major topics within the group. If you are not sure which Group contains the information you need, look up the Component/System in the alphabetical index located in the rear of this manual.

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

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

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

NOTE: The acronyms, terminology and nomenclature used to identify emissions related components in this manual may have changed from prior publications. These new terms are in compliance with S.A.E. recommended practice J1930.

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GROUP TAB LOCATOR

INTRODUCTION

CONTENTS

DESIGNATIONS, LABELS/PLATES/DECALS, CODES AND DIMENSIONS/WEIGHTS

INDEX

VEHICLE DESIGNATION

The Vehicle Code Designation for Grand Cherokee vehicles is ZJ. The code is used to identify the vehicle in charts, captions and in service procedures. The vehicle code is different than the Vehicle Identification Number (VIN) or the wheelbase/model code.

The following illustration shows the labels, decals and plates as well as locations on the vehicle (Fig. 1).

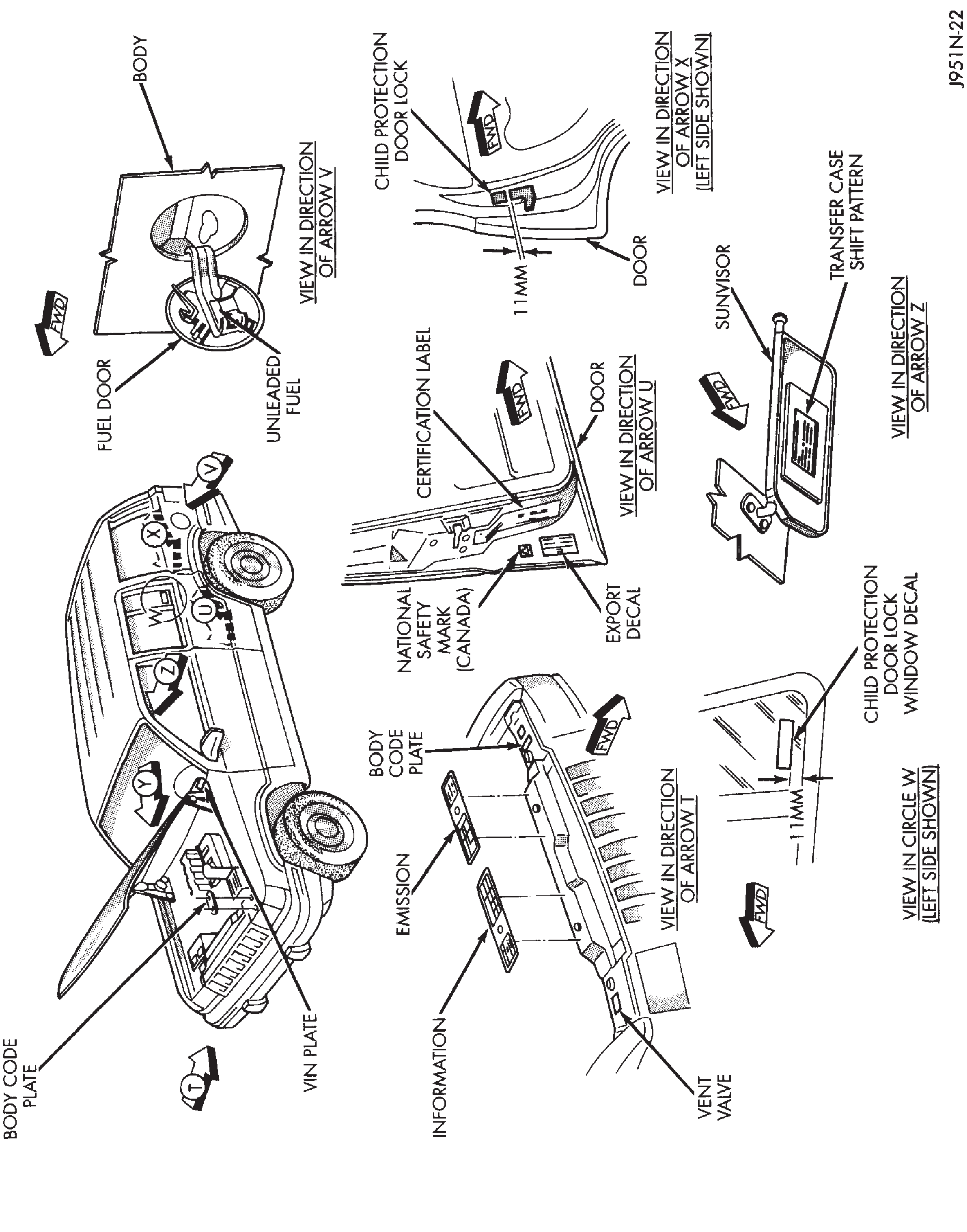


Fig. 1 Vehicle, Labels and PLates

VEHICLE SAFETY CERTIFICATION LABEL

A certification label is attached to the left side B-pillar (Fig. 2). The label certifies that the vehicle conforms to Federal Motor Vehicle Safety Standards (FMVSS).The label also lists the:

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

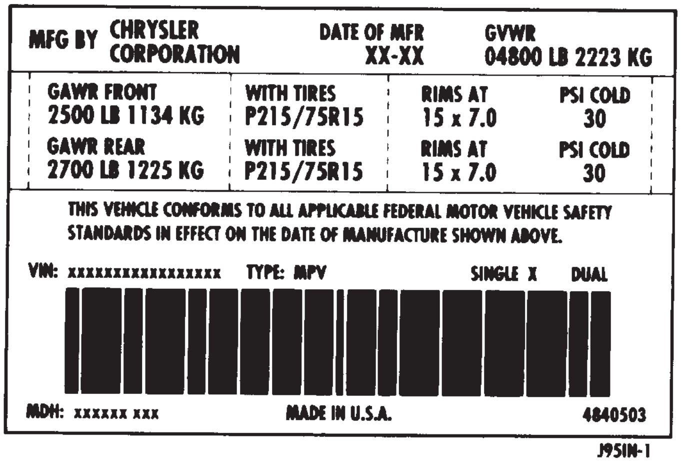


Fig. 2 Vehicle Safety Certification Label—Typical

VEHICLE IDENTIFICATION NUMBER (VIN) PLATE

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

The Vehicle Identification Number is also imprinted on the:

- Body Code Plate.
- Equipment Identification Plate.
- Vehicle Safety Certification Label.
- Frame rail.

BODY CODE PLATE

A metal Body Code plate is attached (riveted) to the top, left side of the radiator reinforcement. There can be a maximum of seven rows of vehicle information imprinted on the plate. The information should be read from left to right, starting with line 1 at the bottom of the plate up to line 7 (as applicable) at the top of the code plate (Fig. 3).

Refer to the decoding chart to decode lines 1 through 3.

Lines 4 through 7 on the plate are imprinted in sequence according to the following descriptions:

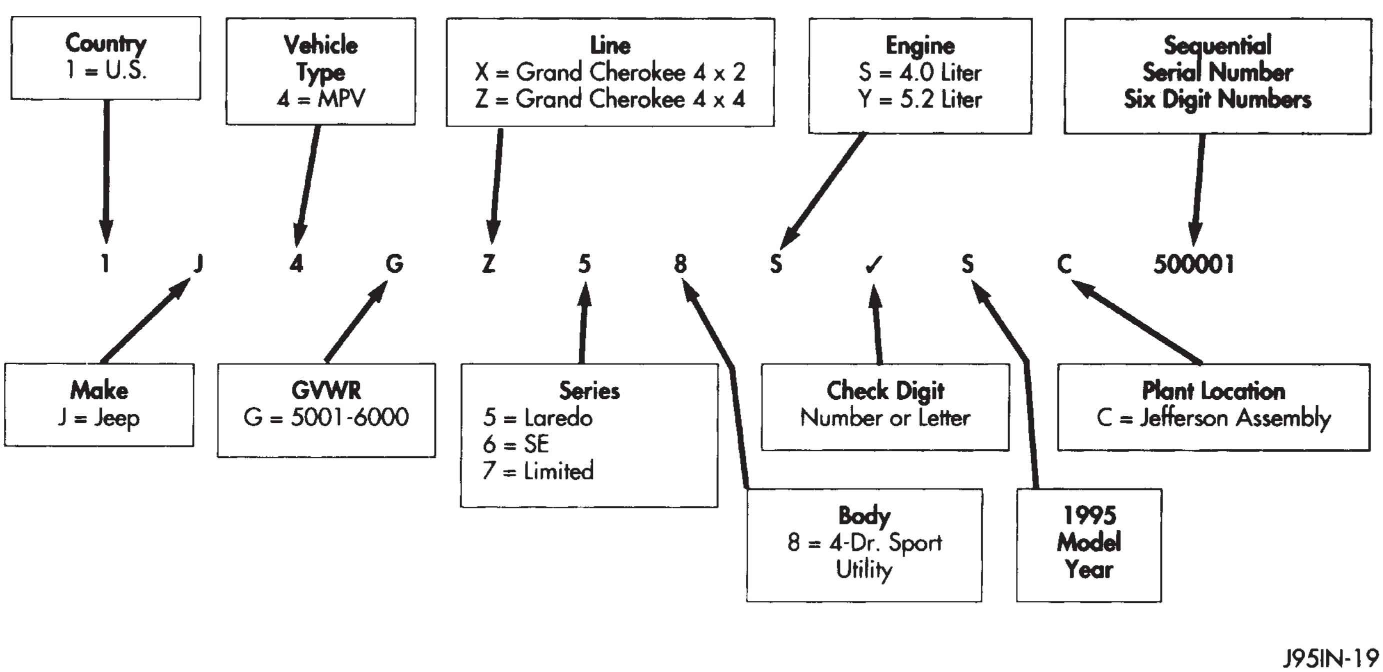
- 3-character sales code.
- 3-digit numerical code.
- 6-digit SEC code.

If there is not enough space left in the row for all of the 6-digit SEC code:

- The unused space will remain blank.
- The code will be listed in the next row..

The last nine positions of row 7 will contain a 2-digit code and a 6-digit serial number.

VEHICLE IDENTIFICATION NUMBER (VIN) DECODING



The last code on a body code plate will be followed by the imprinted word END. When two plates are required, the last available spaces on the first plate will be imprinted with the letters CTD (for continued).

When a second body code plate is necessary, the first four spaces on each row will not be used because of the plate overlap.

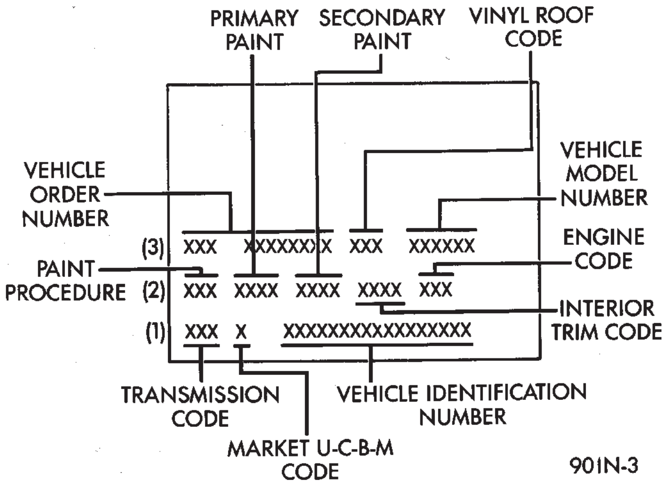


Fig. 3 Body Code Plate

ENGINE AND TRANSMISSION/TRANSFER CASE IDENTIFICATION

Refer to Group 9, Engines for all engine identification data.

Refer to Group 21, Transmissions for all transmission/transfer case identification data.

MAJOR COMPONENT IDENTIFICATION

Refer to the applicable group for identification data.

VEHICLE DIMENSION

The Vehicle Dimension chart provides the dimensions for each type of Grand Cherokee vehicle.

BODY CODE DECODING

Line #1	Digit 1-3	Transmission Sales Code
	Digit 4	Open Space
	Digit 5	Market Code - U-C-B-M
	Digit 6	Open Space
	Digit 7-23	Vehicle Identification No.
Line #2	Digit 1-3	Paint Procedure
	Digit 4	Open Space
	Digit 5-8	Primary Paint
	Digit 9	Open Space
	Digit 10-13	Secondary Paint
	Digit 14	Open Space
	Digit 15-18	Trim Code
	Digit 19	Open Space
	Digit 20-22	Engine Sales Code
	Digit 23	Open Space
Line #3	Digit 1-12	Vehicle Order Number
	Digit 13	Open Space
	Digit 14-16	Vinyl Roof Code (Door Combo Code - Pillette)
	Digit 17	Open Space
	Digit 18-23	Model

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VEHICLE WEIGHTS

The Vehicle Weights chart provides:

- The Gross Vehicle Weight Rating (GVWR).
- The payload.
- The curb weight for each vehicle type/wheelbase.

TRAILER TOWING SPECIFICATIONS

The Trailer Towing Specifications chart provides:

- The maximum trailer tongue weight.
- The maximum trailer weight.
- The maximum combined weight of the trailer/load/towing vehicle with a specific engine/transmission/axle combination.

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

The graphic symbols illustrated in the following chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

VEHICLE DIMENSIONS

EXTERIOR DIMENSIONS					
WHEEL BASE cm/in	TRACK FRONT	TRACK REAR cm/in	LENGTH	OVERALL WIDTH cm/in	HEIGHT
269.1	147.3	147.3	448.8	175.8	163.5
105.9	58.0	58.0	176.7	69.2	64.4

INTERIOR DIMENSIONS							
HEAD FRONT cm/in	HEAD REAR cm/in	LEG FRONT cm/in	LEG REAR cm/in	SHOULDER FRONT cm/in	SHOULDER REAR cm/in	HIP FRONT cm/in	HIP REAR cm/in
99.1	99.4	104.4	94.5	148.0	146.3	144.5	125.2
39.0	39.1	41.1	37.2	58.3	57.6	56.9	49.3

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VEHICLE WEIGHTS

VEHICLE	ENGINE	WHEEL/ TIRE[1]	GVWR[2]	PASSENGER WEIGHT (MAX)	CARGO WEIGHT (MAX)	GAWR[3] FRONT	GAWR[3] REAR
ZJ 4WD	5.2L	P225/75R15 15 x 7	5500	750	400	2750	2950
ZJ 4WD	4.0L	P215/75R15 15 x 7	5300	750	400	2750	2950
ZJ 2WD	4.0L	P215/75R15 15 x 7	4950	750	400	2500	2950

All Weights Listed In Pounds.

[1]Minimum Tire Requirement
[2]Gross Vehicle Weight Rating
[3]Gross Axle Weight Rating

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TRAILER TOWING SPECIFICATIONS

Trailer Type	Gross Trailer Weight	Tongue Weight (See Note 1)	Towing Pkg.	GCWR (Max.) (See Note 2)	Engine	Trans-mission	Steering System	Cooling	Axle	Minimum Tire Size
Class I ● 25 ft2 (2.3m2) or Less Frontal Area ● Up to 2,000 lbs. (907 kg) GTW ● 20 ft. Maximum Trailer Length	2,000 lbs. (907 kg) (Max.)	300 lbs. (91 kg) (Max.)	Class I Hitch (Light Duty)	4x2 5,781 lbs. (2,627 kg) 4x4 6,060 lbs. (2,754 kg)	4.0L 6 cyl.	All	All	All	All	P215/75R15
Class III ● 64 ft2 (5.8m2) or Less Frontal Area ● Up to 5,000 lbs. (2 268 kg) GTW ● 25 ft. Maximum Trailer Length	5,000 lbs. (2,268 kg) (Max.)	750 lbs. (340 kg) (Max.)	Class III Hitch (Heavy Duty)	4x2 8,781 lbs. (3,393 kg) 4x4 9,550 lbs. (4,332 kg)	4.0L 6 cyl.	Auto. Trans. with Cooler	Hi-Temp.*	Heavy Duty	All with synthetic lube	P215/75R15
Class IV ● 64 ft2 (5.8m2) or Less Frontal Area ● Up to 6,500 lbs. (2 948 kg) GTW ● 30 ft. Maximum Trailer Length	6,500 lbs. (2,948 kg) (Max.)	750 lbs. (340 kg) (Max.)	Class IV Hitch (Heavy Duty)	4x4 10,500 lbs. (4,649 kg)	5.2L 8 cyl.	Auto. Trans. with Cooler	Hi-Temp*	Heavy Duty	3.73:1 Ratio with synthetic lube	P225/70R15 or P225/75R15

1 The towing vehicle payload should be reduced by the tongue load (for a dead weight hitch) to keep the rear axle loading below GAWR (Gross Axle Weight Rating) of 2,950 lbs. (1,338 kg).

2 GCWR = Total combined weight of trailer and tow vehicle.

* Class III and Class IV towing requires special power steering pumps and gears with high temperature seals.

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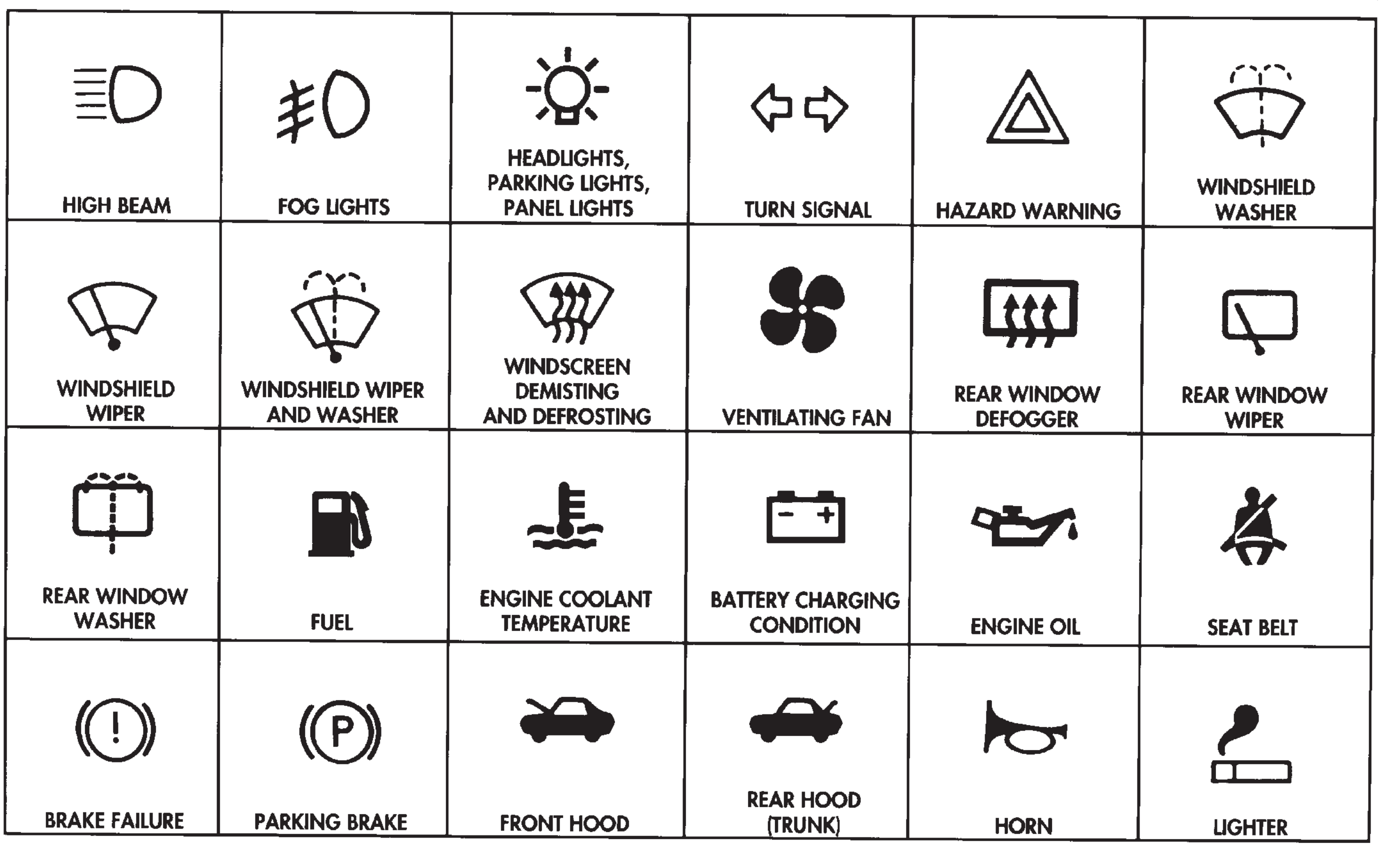
INTERNATIONAL CONTROL AND DISPLAY SYMBOLS



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MEASUREMENT AND TORQUE SPECIFICATIONS

INDEX

SPECIFICATION NOTATIONS

WARNING: THE USE OF INCORRECT ATTACHING HARDWARE CAN RESULT IN COMPONENT DAMAGE AND/OR PERSONAL INJURY.

It is important to retain the original attaching hardware for assembly of the components. If the attaching hardware is not reusable, hardware with equivalent specifications must be used.

METRIC AND ENGLISH/SAE CONVERSION

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

TORQUE SPECIFICATIONS

TORQUE CHARTS

A torque chart for fasteners is provided at the end of each group (of service information). Refer to the Torque Specifications chart to determine torque values not listed in the group.

It is important to be aware that the torque values listed in the chart are based on clean and dry bolt threads. Reduce the torque value by 10 percent when the bolt threads are lubricated and by 20 percent if new.

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

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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

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BOLT THREAD AND GRADE/CLASS IDENTIFICATION

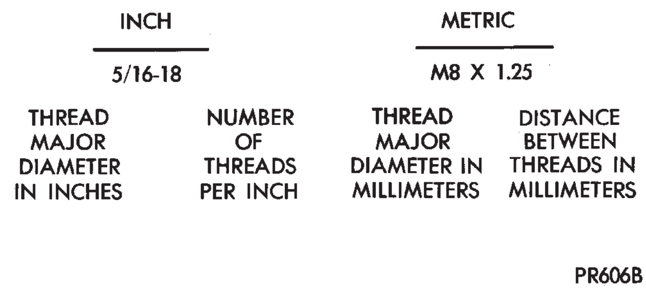
THREAD IDENTIFICATION

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

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 bolt identification and bolt strength chart.

THREAD NOTATION—SAE AND METRIC



METRIC CONVERSION

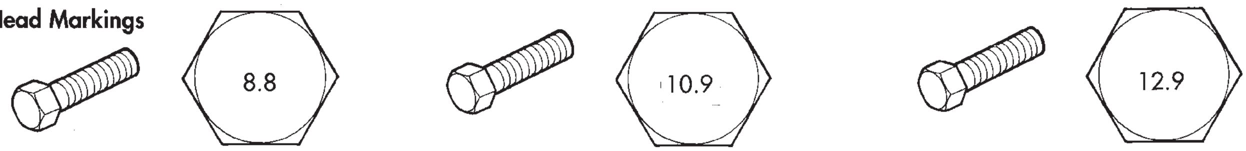
Refer to the chart to convert torque values listed in metric Newton-meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.)

BOLT IDENTIFICATION

Bolt Markings and Torque - Metric

Commercial Steel Class — 8.8 / 10.9 / 12.9

Bolt Head Markings

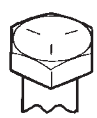


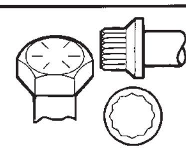
Body Size	Torque 8.8				Torque 10.9				Torque 12.9			
Diam.	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	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	Bolt Torque - Grade 5 Bolt: Cast Iron N•m	Cast Iron ft-lb	Aluminum N•m	Aluminum ft-lb	Bolt Torque - Grade 8 Bolt: Cast Iron N•m	Cast Iron ft-lb	Aluminum N•m	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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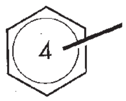
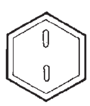
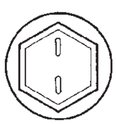
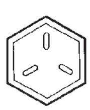
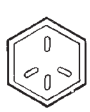
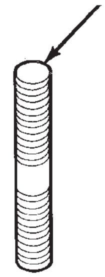
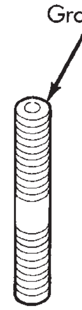
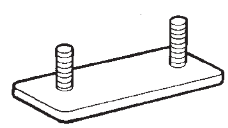
BOLT STRENGTH

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

95IN-4

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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EXHAUST SYSTEM AND INTAKE MANIFOLD

CONTENTS

EXHAUST SYSTEM

GENERAL INFORMATION

The basic exhaust system consists of exhaust manifold(s), exhaust pipe with oxygen sensor, catalytic converter, heat shield(s), muffler and tailpipe (Fig. 1 or 2).

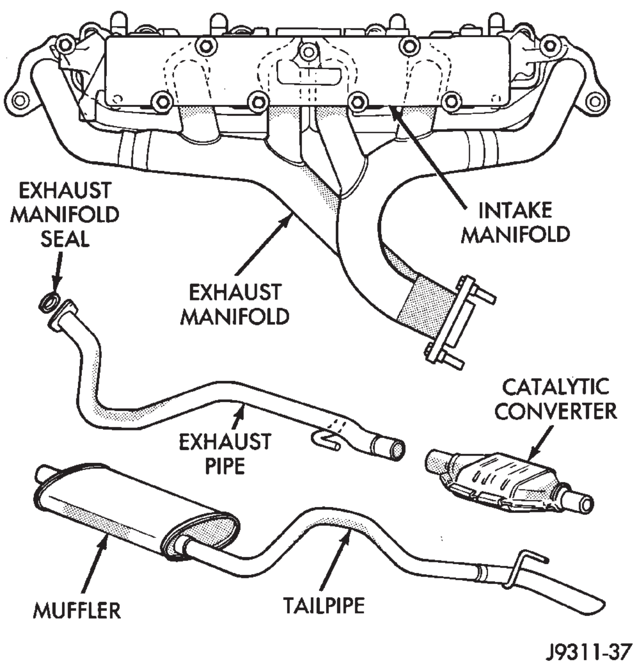

Fig. 1 Exhaust System—4.0L Engine

The exhaust system uses a single muffler with a single monolithic-type catalytic converter.

The 4.0L engines use a seal between the exhaust manifold and exhaust pipe to assure a tight seal and strain free connections.

The 5.2L exhaust manifolds are equipped with ball flange outlets to assure a tight seal and strain free connections.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it may amplify objectionable noises originating from the engine or body.

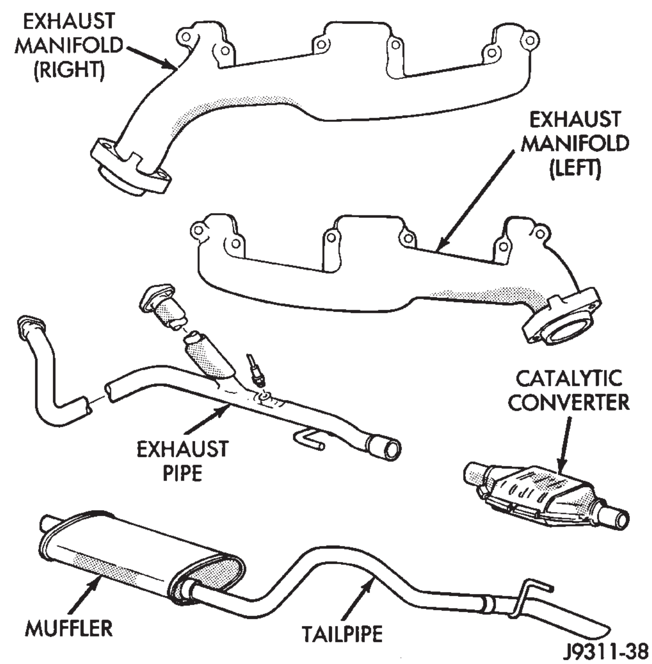

Fig. 2 Exhaust System—5.2L Engine

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or their equivalent). This will assure proper alignment and provide acceptable exhaust noise levels.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

CATALYTIC CONVERTER

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

Unleaded gasoline must be used to avoid contaminating the catalyst core.

HEAT SHIELDS

Heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter (Fig. 3 or 4). The catalytic converter releases additional heat into the exhaust system. Under severe operating conditions, the temperature increases in the area of the converter. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency.

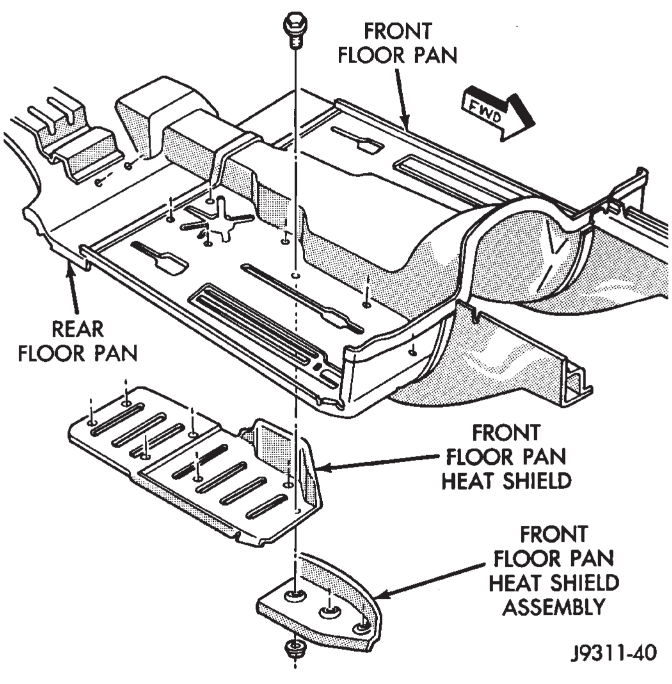

Fig. 3 Front Floor Pan Heat Shield

DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

DO NOT allow the engine to operate at fast idle for extended periods (over 5 minutes). This condition may result in excessive temperatures in the exhaust system and on the floor pan.

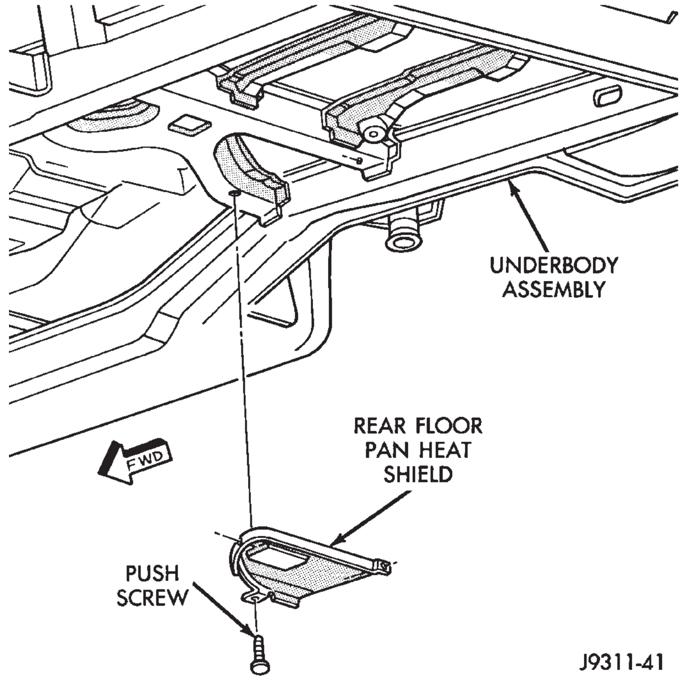

Fig. 4 Rear Floor Pan Heat Shield

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 piped from the exhaust manifold to the intake manifold through an EGR tube. Refer to Group 25, Emission Control Systems for complete description, diagnosis and service procedures of the exhaust gas recirculation system and components.

EXHAUST SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE	1. Leaks at pipe joints.	1. Tighten clamps at leaking joints.
	2. Burned or blown-out muffler.	2. Replace muffler assembly. Check exhaust system.
	3. Burned or rusted-out exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten connection attaching nuts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head stud nuts or bolts.
	7. Restriction in muffler or tail pipe.	7. Remove restriction, if possible. Replace muffler or tail pipe, as necessary.
LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten clamps at leaking joints.
	2. Damaged or improperly installed gaskets.	2. Replace gaskets, as necessary.

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SERVICE PROCEDURES

INDEX

EXHAUST PIPE

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the oxygen sensor from the exhaust pipe (Fig. 1 or 2).

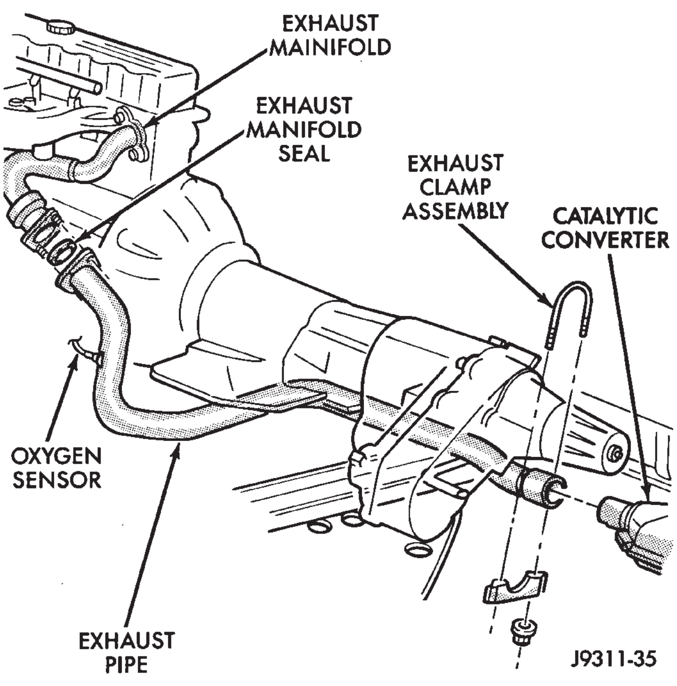

Fig. 1 Exhaust Pipe—4.0L Engine

(4) Disconnect the exhaust pipe from the engine exhaust manifold. On 4.0L engines, discard the exhaust manifold seal (Fig. 1).

(5) Remove the exhaust clamp and nuts from the exhaust pipe and catalytic converter connection (Fig. 1 or 2). Disconnect the exhaust pipe from the catalytic converter. If needed:

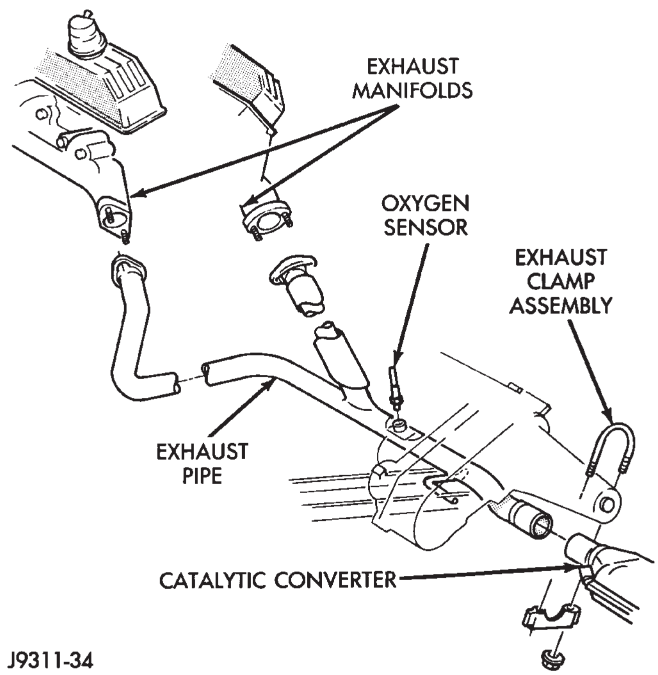

Fig. 2 Exhaust Pipe—5.2L Engine

(a) Heat the exhaust pipe and catalytic converter connection with an torch until the metal becomes cherry red.

(b) While the metal is still cherry red, twist the exhaust pipe back and forth to separate it from the catalytic converter.

(6) Disconnect the exhaust pipe hanger from the rear mount bracket insulator (Fig. 3).

(7) Remove the exhaust pipe.

INSTALLATION

(1) Position the exhaust pipe onto the catalytic converter.

(2) Connect the exhaust pipe hanger to the rear mount bracket insulator.

(3) On 4.0L engines, install a new seal between the exhaust pipe and the engine exhaust manifold (Fig. 1). Connect the exhaust pipe to the engine exhaust manifold. Tighten the nuts to 31 N·m (23 ft. lbs.) torque.

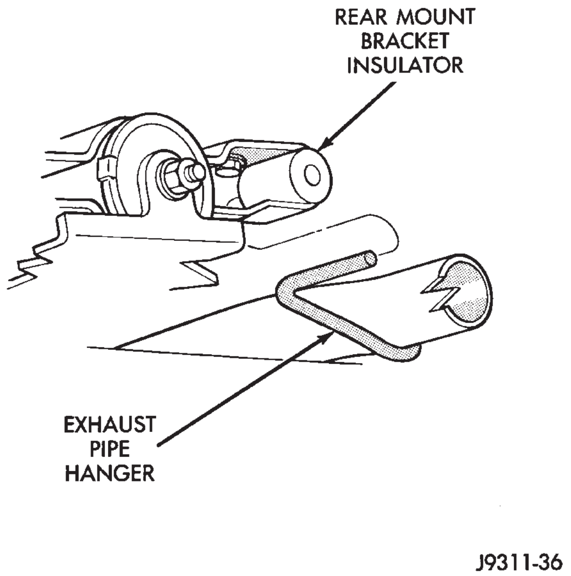

Fig. 3 Rear Mount Bracket Insulator

(4) Position the exhaust clamp assembly over the exhaust pipe/catalytic converter connection (Fig. 1 or 2). Tighten the nuts to 68 N·m (50 ft. lbs.) torque.

(5) Coat the oxygen sensor with anti-seize compound. Install the sensor and tighten the nut to 48 N·m (35 ft. lbs.) torque.

(6) Lower the vehicle.

(7) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

(8) After initial start-up, check the engine exhaust manifold to exhaust pipe nuts for proper torque.

CATALYTIC CONVERTER

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the clamp and nuts from the catalytic converter and exhaust pipe connection (Fig. 4).

(4) Remove the clamp and nuts from the catalytic converter and muffler connection (Fig. 4).

(5) Heat the exhaust pipe, catalytic converter and muffler connections with an torch until the metal becomes cherry red.

(6) While the metal is still cherry red, twist the catalytic converter back and forth to separate it from the exhaust pipe and the muffler.

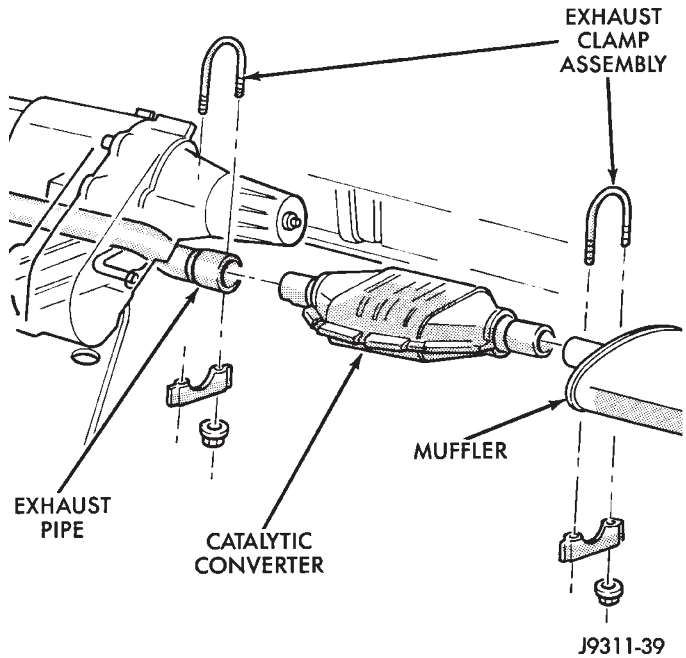

Fig. 4 Exhaust Pipe-to-Catalytic Converter-to-Muffler Connection

INSTALLATION

(1) Position the exhaust clamp assembly over the exhaust pipe/catalytic converter connection (Fig. 4). Tighten the nuts to 68 N·m (50 ft. lbs.) torque.

(2) Install the muffler onto the catalytic converter until the alignment tab is inserted into the alignment slot.

(3) Install the exhaust clamp assembly at the muffler and catalytic converter connection (Fig. 4). Tighten the clamp nuts to 68 N·m (50 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

MUFFLER AND TAILPIPE

All original equipment exhaust systems are manufactured with the tailpipe welded to the muffler. Service replacement mufflers and tailpipes are either clamped together or welded together.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the exhaust clamp and nuts from the catalytic converter and muffler connection (Fig. 4).

(4) Heat the catalytic converter-to-muffler connection with an torch until the metal becomes cherry red.

(5) While the metal is still cherry red, remove the tailpipe/muffler assembly from the catalytic converter.

(6) Remove the tailpipe from the tailpipe hanger (Fig. 5).

(7) Remove the tailpipe/muffler assembly.

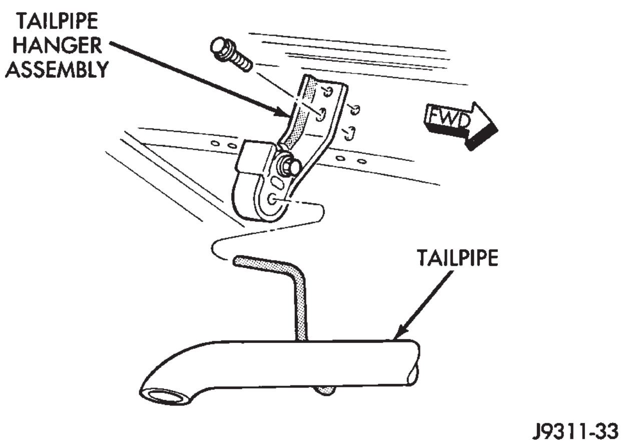

Fig. 5 Tailpipe Hanger

INSTALLATION

(1) If the tailpipe hanger assembly was removed, install the hanger to the frame. Tighten the bolts to 22 N·m (192 in. lbs.) torque.

(2) Position the tailpipe and muffler onto the tailpipe hanger (Fig. 5).

(3) Install the muffler onto the catalytic converter. Make sure that the tailpipe has sufficient clearance from the floor pan. Install the exhaust clamp assembly and tighten the nuts to 68 N·m (50 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

EXHAUST MANIFOLD—4.0L ENGINE

The intake and engine exhaust manifold must be removed and installed together. The manifolds use a common gasket at the cylinder head.

Refer to Intake Manifold in this section for the proper removal and installation procedures.

INTAKE MANIFOLD—4.0L ENGINE

The intake and engine exhaust manifold must be removed and installed together. The manifolds use a common gasket at the cylinder head.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove air cleaner inlet hose from throttle plate assembly.

(3) Remove the air cleaner assembly.

(4) Remove the throttle cable, vehicle speed control cable (if equipped) and the transmission line pressure cable.

(5) Disconnect all electrical connectors on the intake manifold.

(6) Disconnect and remove the fuel system supply and return lines from the fuel rail assembly (refer to Group 14, Fuel System).

(7) Loosen the accessory drive belt (refer to Group 7, Cooling System). Loosen the tensioner.

(8) Remove the power steering pump and bracket from the intake manifold and set aside.

(9) Remove the fuel rail and injectors (refer to Group 14, Fuel System).

(10) Raise the vehicle.

(11) Disconnect the exhaust pipe from the engine exhaust manifold. Discard the seal.

(12) Lower the vehicle.

(13) Remove the intake manifold and engine exhaust manifold.

CLEANING

Clean the mating surfaces of the cylinder head and the manifold if the original manifold is to be installed.

INSTALLATION

If the manifold is being replaced, ensure all the fitting, etc. are transferred to the replacement manifold.

(1) Install a new engine exhaust/intake manifold gasket over the alignment dowels on the cylinder head.

(2) Position the engine exhaust manifold to the cylinder head. Install fastener No.3 and finger tighten at this time (Fig. 6).

(3) Install intake manifold on the cylinder head dowels.

(4) Install washers and fasteners Nos.1, 2, 4, 5, 8, 9, 10 and 11 (Fig. 6).

(5) Install washers and fasteners Nos.6 and 7 (Fig. 6).

(6) Tighten the fasteners in sequence and to the specified torque (Fig. 6).

- Fasteners Nos.1 through 5—Tighten to 33 N·m (24 ft. lbs.) torque.
- Fasteners Nos.6 and 7—Tighten to 31 N·m (23 ft. lbs.) torque.
- Fasteners Nos.8 through 11—Tighten to 33 N·m (24 ft. lbs.) torque.

(7) Install the fuel rail and injectors (refer to Group 14, Fuel System).

(8) Install the power steering pump and bracket to the intake manifold. Tighten the belt to specification (refer to Group 7, Cooling System for the proper procedures).

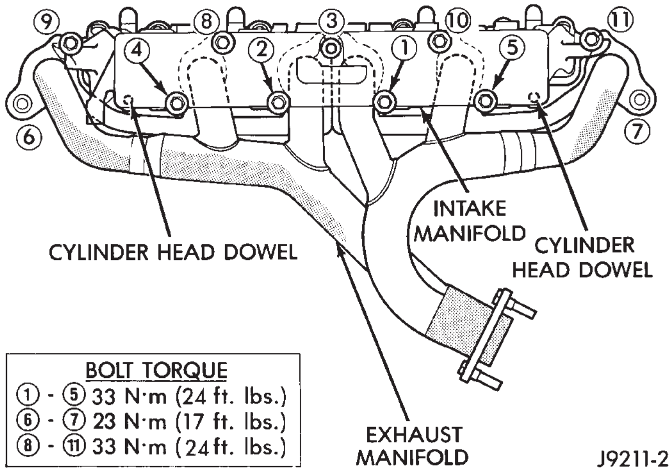

Fig. 6 Engine Exhaust/Intake Manifold

(9) Install the fuel system supply and return lines to the fuel rail assembly. **Before connecting the fuel system lines to the fuel rail replace the O-rings in the quick-connect fuel line couplings. Refer to Group 14, Fuel System for the proper procedure.**

(10) Connect all electrical connections on the intake manifold.

(11) Connect the vacuum connector on the intake manifold and install it in the bracket.

(12) Install throttle cable, vehicle speed control cable (if equipped).

(13) Install the transmission line pressure cable (if equipped). Refer to Group 21, Transmission for the adjustment procedures.

(14) Install air cleaner assembly.

(15) Connect air inlet hose to the throttle plate assembly.

(16) Raise the vehicle on a side mounted hoist.

(17) Use a new engine exhaust manifold seal. Connect the exhaust pipe to the engine exhaust manifold.

(18) Lower the vehicle.

(19) Connect the negative cable to the battery.

(20) Start the engine and check for leaks.

INTAKE MANIFOLD—5.2L ENGINE

The aluminum intake manifold is a single plane design with equal length runners. The manifold is sealed by flange side gaskets with front and rear cross-over gaskets. The intake manifold has internal EGR.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Drain the cooling system (refer to Group 7, Cooling System for the proper procedures).

(3) Remove the generator (refer to Group 8B Battery/Starting/Charging Systems).

(4) Remove the air cleaner.

(5) Remove the fuel lines and fuel rail (refer to Group 14, Fuel System).

(6) Disconnect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(7) Remove the return spring.

(8) Remove the distributor cap and wires.

(9) Disconnect the coil wires.

(10) Disconnect the heat indicator sending unit wire.

(11) Disconnect the heater hoses and bypass hose.

(12) Remove the closed crankcase ventilation and evaporation control systems.

(13) Remove the A/C compressor bolts and set the compressor on the fan shroud.

(14) Remove the support bracket from the intake manifold and the mounting bracket.

(15) Remove intake manifold bolts.

(16) Lift the intake manifold and throttle body out of the engine compartment as an assembly.

(17) Remove and discard the flange side gaskets and the front and rear cross-over gaskets.

(18) Remove the throttle body bolts and lift the throttle body off the intake manifold (Fig. 7). Discard the throttle body gasket.

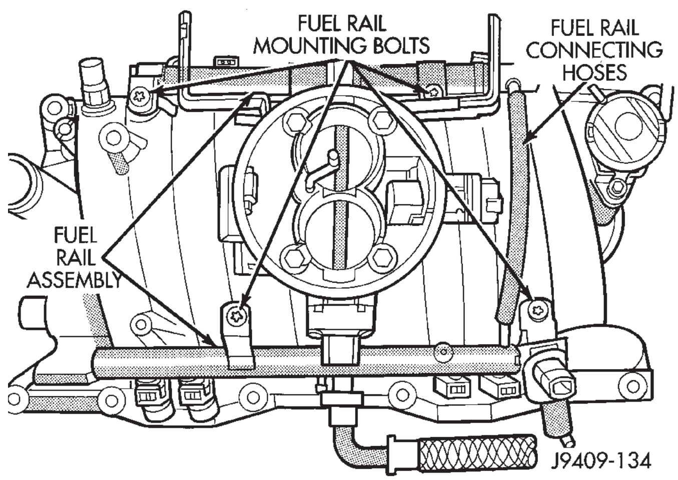

Fig. 7 Throttle Body Assembly

(19) Remove the plenum pan as follows:

(a) Turn the intake manifold upside down. Support the manifold.

(b) Remove the bolts and lift the pan off the manifold. Discard the gasket.

CLEANING

Clean manifold in solvent and blow dry with compressed air.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

The plenum pan rail must be clean and dry (free of all foreign material).

INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straightedge.

INSTALLATION

(1) Install the plenum pan, if removed, as follows:

(a) Turn the intake manifold upside down. Support the manifold.

(b) Place a new plenum pan gasket onto the seal rail of the intake manifold. Position the pan over the gasket. Align all the gasket and pan holes with the intake manifold.

(c) Hand start all bolts.

(d) Tighten the bolts, in sequence (Fig. 8), as follows:

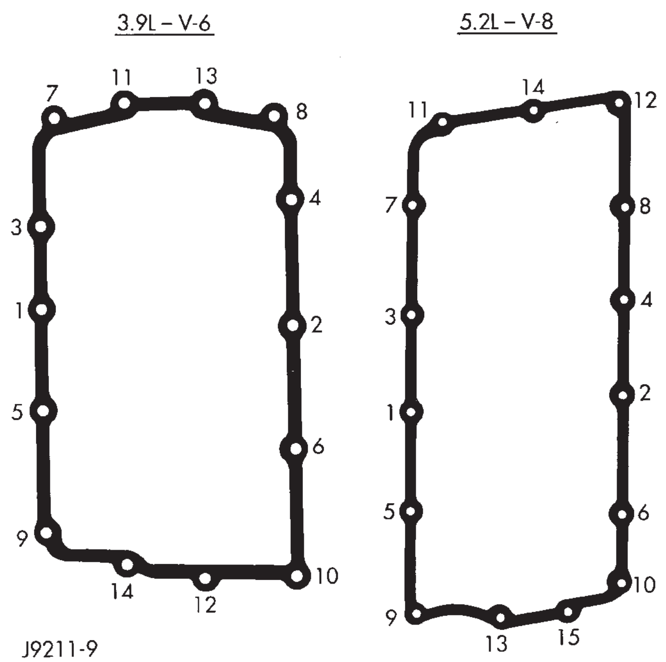

Fig. 8 Plenum Pan Bolt Tightening Sequence

• Step 1—Tighten bolts to 2.7 N·m (24 in. lbs.) torque.
• Step 2—Tighten bolts to 5.4 N·m (48 in. lbs.) torque.
• Step 3—Tighten bolts to 9.5 N·m (84 in. lbs.) torque.
• Step 4—Check that all bolts are tighten to 9.5 N·m (84 in. lbs.) torque.

(2) Using a new gasket, install the throttle body onto the intake manifold. Tighten the bolts to 23 N·m (200 in. lbs.) torque.

(3) Place the 4 plastic locator dowels into the holes in the block Fig. 9).

(4) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, to the four corner joints. An excessive amount of sealant is not required to ensure a leak proof seal. However, an excessive amount of sealant may reduce the effectiveness of the flange gasket. The sealant should be slightly higher than the cross-over gaskets, approx. 5 mm (0.2 in).

(5) Install the front and rear cross-over gaskets onto the dowels (Fig. 9).

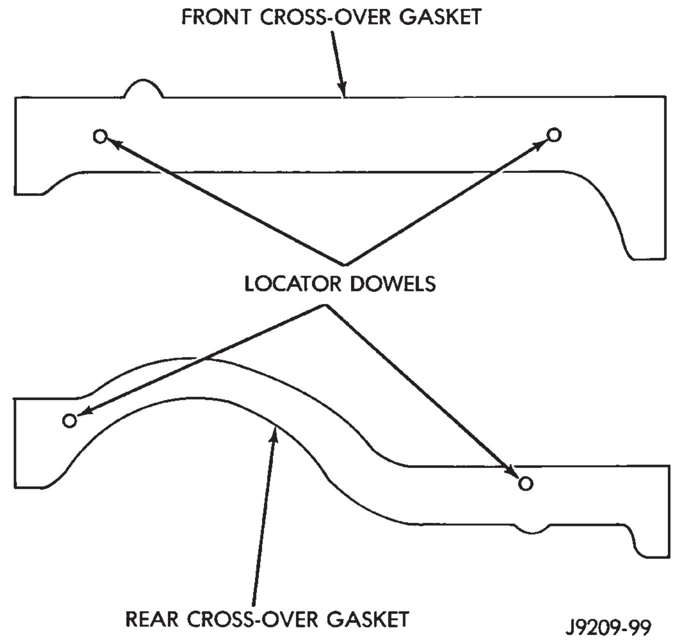

Fig. 9 Cross-Over Gaskets and Locator Dowels

(6) Install the flange gaskets. Ensure that the vertical port alignment tab is resting on the deck face of the block. Also the horizontal alignment tabs must be in position with the mating cylinder head gasket tabs (Fig. 10). The words MANIFOLD SIDE should be visible on the center of each flange gasket.

(7) Carefully lower intake manifold into position on the cylinder block and cylinder heads. Use the alignment dowels in the cross-over gaskets to position the intake manifold. After intake manifold is in place, inspect to make sure seals are in place.

(8) The following torque sequence duplicates the expected results of the automated assembly system (Fig. 11).

• Step 1—Tighten bolts 1 through 4, in sequence, to 8 N·m (72 in. lbs.) torque. Tighten in alternating steps 1.4 N·m (12 in. lbs.) torque at a time.
• Step 2—Tighten bolts 5 through 12, in sequence, to 8 N·m (72 in. lbs.) torque.
• Step 3—Check that all bolts are tighten to 8 N·m (72 in. lbs.) torque.
• Step 4—Tighten all bolts, in sequence, to 16 N·m (12 ft. lbs.) torque.
• Step 5—Check that all bolts are tighten to 16 N·m (12 ft. lbs.) torque.

(9) Install closed crankcase ventilation and evaporation control systems.

(10) Install the coil wires.

(11) Connect the heat indicator sending unit wire.

(12) Connect the heater hoses and bypass hose.

(13) Install distributor cap and wires.

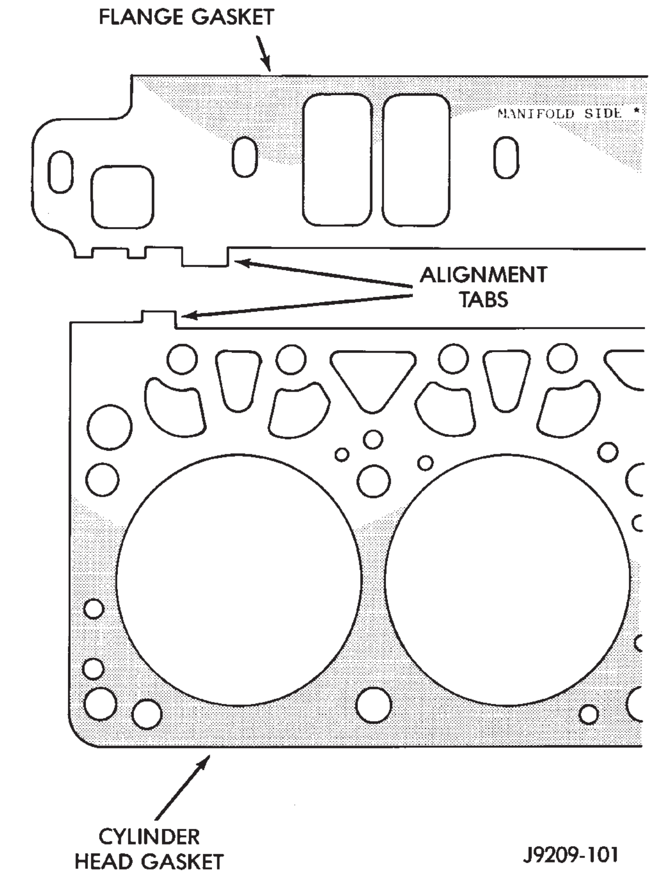

Fig. 10 Intake Manifold Flange Gasket Alignment

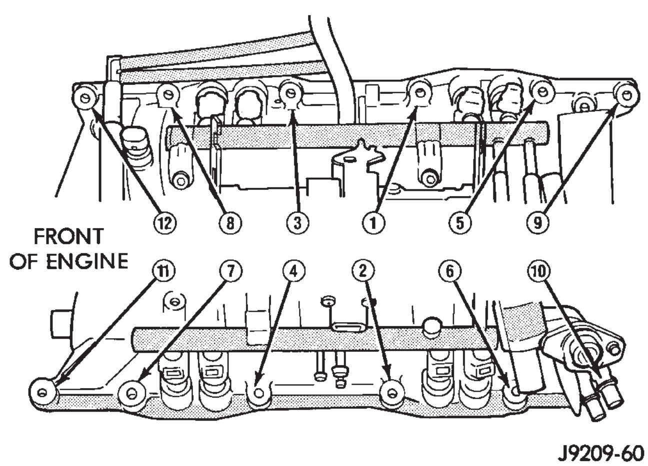

Fig. 11 Intake Manifold Bolt Tightening Sequence

(14) Hook up the return spring.

(15) Connect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(16) Install the fuel lines and fuel rail (refer to Group 14, Fuel System).

(17) Install the support bracket to the intake manifold and the mounting bracket.

(18) Install the generator and drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque. Tighten the adjusting strap bolt to 23 N·m (200 in. lbs.) torque. Refer to Group 7, Cooling System for the proper adjusting of belt tension.

(19) Install the A/C compressor on the mounting bracket (refer to Group 24, Heating and Air Conditioning).

(20) Install the air cleaner.

(21) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).

(22) Connect the negative cable to the battery.

EXHAUST MANIFOLD—5.2L ENGINE

Exhaust manifolds are LOG type with balanced flow.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove the exhaust manifold heat shields (Fig. 12).

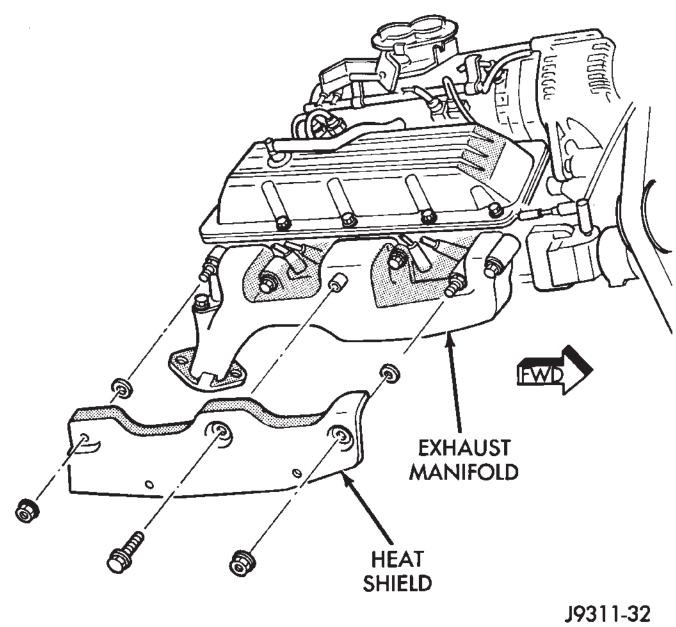

Fig. 12 Exhaust Manifold Heat Shields (Left Shield Shown)

(3) Remove the ERG tube (refer to Group 25, Emission Control Systems).

(4) Raise the vehicle.

(5) Remove the bolts and nuts attaching the exhaust pipe to the exhaust manifold.

(6) Lower the vehicle.

(7) Remove bolts, nuts and washers attaching manifold to cylinder head.

(8) Remove manifold from the cylinder head.

CLEANING

Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air. Inspect manifold for cracks.

INSPECTION

Inspect mating surfaces of manifold for flatness with a straight edge. Seal surfaces must be flat within 0.1 mm (0.004 inch) overall.

INSTALLATION

CAUTION: If the studs came out with the nuts when removing the exhaust manifold, install new studs.

(1) Position the exhaust manifolds on the two studs located on the cylinder head. Install conical washers and nuts on these studs (Fig. 13).

(2) Install new bolt and washer assemblies in the remaining holes (Fig. 13). Start at the center arm and work outward. Tighten the bolts and nuts to 27 N·m (20 ft. lbs.) torque.

(3) Raise the vehicle.

(4) Assemble the exhaust pipe to the exhaust manifold and secure with bolts, nuts and washers. Tighten these nuts to 31 N·m (23 ft. lbs.) torque.

(5) Lower the vehicle.

(6) Install the EGR tube (refer to Group 25, Emission Control Systems).

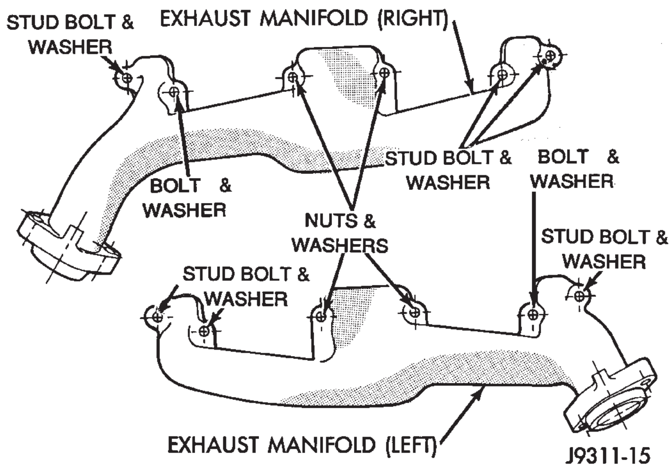

Fig. 13 Exhaust Manifold

CAUTION: The exhaust manifold heat shields MUST be installed to protect the underhood components.

(7) Install the exhaust manifold heat shields. Tighten the nuts to 27 N·m (20 ft. lbs.) torque.

(8) Connect the negative cable to the battery.

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Adjusting Strap Bolt	23 N·m (200 in. lbs.)
Catalytic Converter-to-Exhaust Pipe Clamp Nuts	68 N·m (50 ft. lbs.)
Exhaust Pipe-to-Manifold Nuts	31 N·m (23 ft. lbs.)
Exhaust/Intake Manifold Nut/ Bolts #1-5 & #8-11 (4.0L)	33 N·m (24 ft. lbs.)
Exhaust Manifold Heat Shield Nuts (5.2L)	27 N·m (20 ft. lbs.)
Exhaust Manifold Nuts #6 & 7 (4.0L Engine)	31 N·m (23 ft. lbs.)
Exhaust Manifold Nuts/Bolts (5.2L Engine)	27 N·m (20 ft. lbs.)
Floor Pan Heat Shield Bolts/Nuts	5 N·m (45 in. lbs.)
Generator Mounting Bolts	41 N·m (30 ft. lbs.)

DESCRIPTION	TORQUE
Intake Manifold Bolts (5.2L)	Refer to Procedure in Service Manual
Muffler-to-Catalytic Converter Clamp Nuts	68 N·m (50 ft. lbs.)
Oxygen Sensor	48 N·m (35 ft. lbs.)
Plenum Pan Bolts (5.2L)	Refer to Procedure in Service Manual
Rear Tailpipe Hanger Assembly	22 N·m (192 in. lbs.)
Throttle Body (5.2L)	23 N·m (200 in. lbs.)

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FRONT SUSPENSION AND AXLE

CONTENTS

GENERAL INFORMATION

FRONT SUSPENSION

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

- Drive axle (4WD), tube axle (2WD)
- Track bar
- Stabilizer bar
- Upper and lower suspension arms
- Coil springs
- Dual-action shock absorbers
- Jounce bumpers

The link/coil suspension allows each wheel to adapt to different road surfaces without greatly affecting the opposite wheel. Wheels are attached to a hub/bearings which bolts to the knuckles. The hub/bearing is not serviceable and is replaced as a unit. Steering knuckles pivot on replaceable ball studs attached to the axle tube yokes.

The upper and lower suspension arms use bushings to isolate road noise. The suspension arms are bolted to the frame and axle through the rubber bushings.

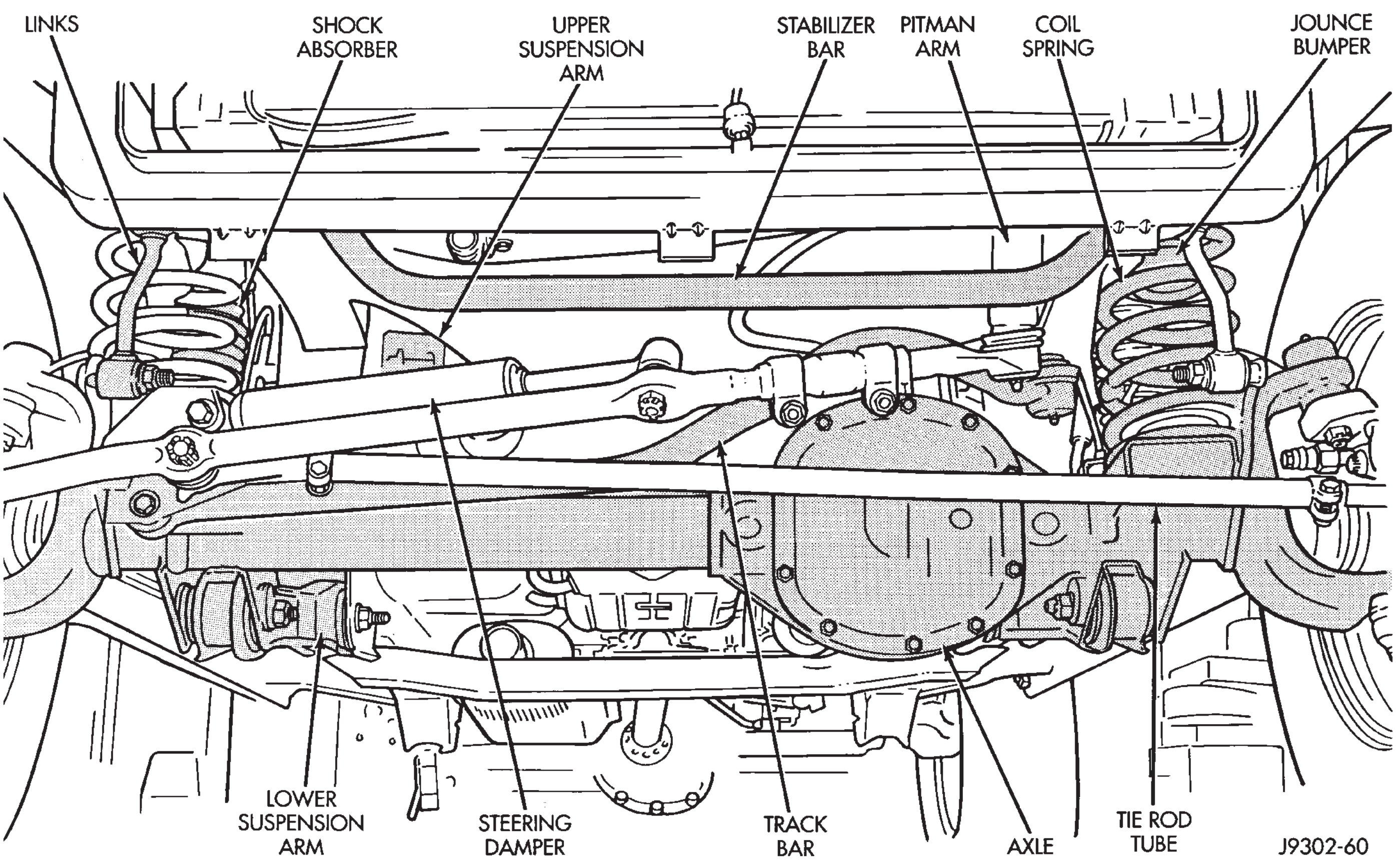


Fig. 1 Front Suspension

The lower suspension arm uses cam bolts at the axle to allow for caster and pinion angle adjustment. The suspension arm travel is limited through the use of jounce bumpers in compression and shocks absorbers in rebound.

The coil springs control ride quality and maintain proper ride height. The coil springs mount up in the wheelhouse which is part of the unitized body bracket. A rubber doughnut isolator is located between the top of the spring and the body. The bottom of the spring seats on a axle pad and is retained with a clip.

The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions. The top of the shock absorbers are bolted to the body. The bottom of the shocks are bolted to the axle brackets.

The stabilizer bar is used to control vehicle body roll during turns. The spring steel bar helps to control the vehicle body in relationship to the suspension. The bar extends across the front underside of the chassis and connects to the frame rails. Links are connected from the bar to the axle brackets. Stabilizer bar mounts are isolated by rubber bushings.

The track bar is used to control front axle lateral movement. The bar is attached to a frame rail bracket with a ball stud and isolated with a bushing at the axle bracket.

Suspension components which use rubber bushings should be tightened at vehicle ride height. This will prevent premature failure of the bushing and maintain ride comfort. Bushings must never be lubricated.

FRONT DRIVE AXLE

The integral type housing, has the centerline of the pinion set below the centerline of the ring gear.

The axles are equipped with A.B.S. brake systems. The A.B.S. tone rings are pressed onto the axle shaft near the hub and knuckle. For additional information on the A.B.S. system refer to Group 5, Brakes.

The Model 30 axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the housing cover (Fig. 2). Build date identification codes are stamped on the axle shaft tube cover side.

STANDARD DIFFERENTIAL OPERATION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

In operation, power flow occurs as follows:

- Pinion gear rotates the ring gear

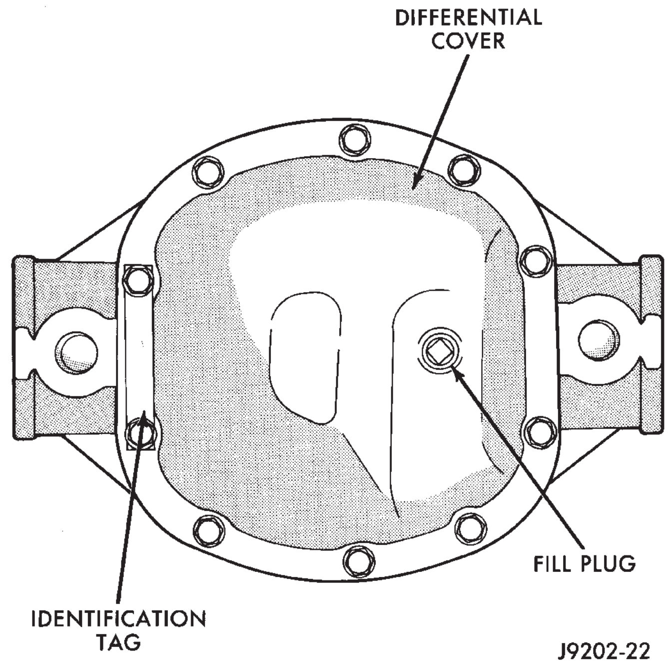


Fig. 2 Model 30 Differential Cover

- Ring gear (bolted to the differential case) rotates the case
- Differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- Side gears (splined to the axle shafts) rotate the shafts

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 3).

When turning corners, the outside wheel must travel a greater distance than the inside wheel in order to complete a turn. This difference must be compensated for in order to prevent the wheels from scuffing and skidding through the turn. To accom-

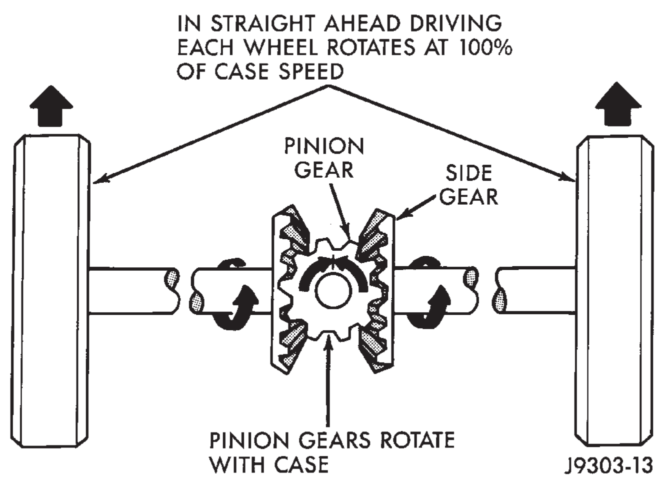


Fig. 3 Differential Operation—Straight-Ahead Driving

plish this the differential allows the axle shafts to turn at unequal speeds (Fig. 4). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

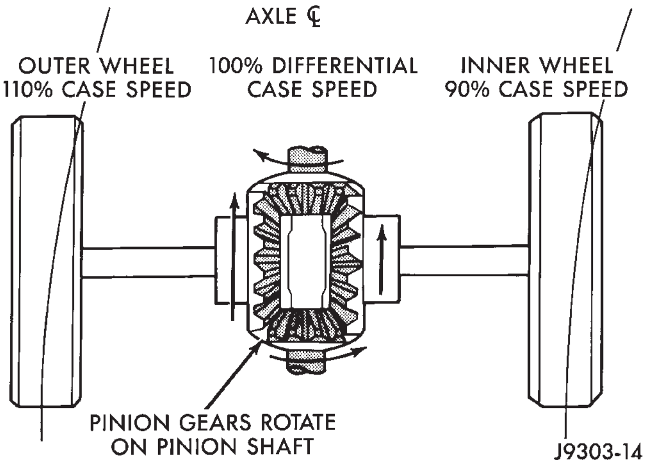


Fig. 4 Differential Operation—On Turns

TUBE AXLE (2WD VEHICLES)

The front axle used on two wheel drive vehicles is a one-piece, tubular axle (Fig. 5). The tubular axle mounts in the same bracketry as does the four wheel drive front axle. The steering knuckles and hub bearing assemblies are the same as used on the Model 30 drive axle.

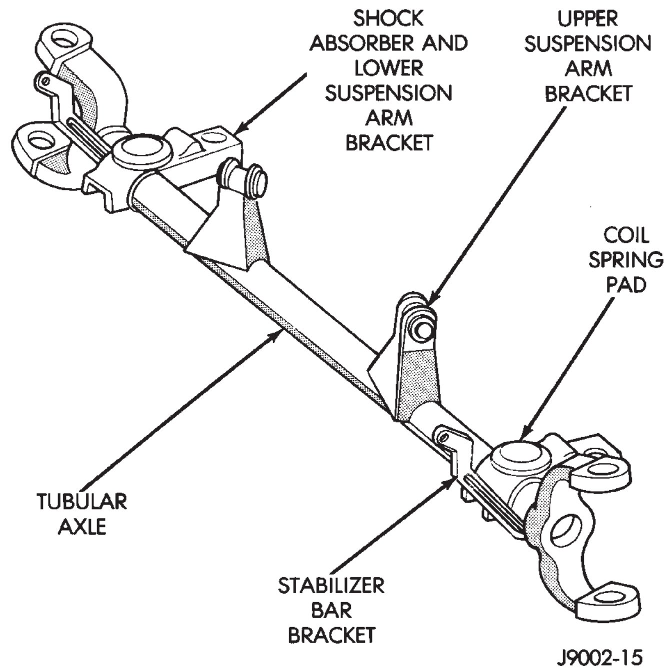


Fig. 5 Front Axle—2WD Vehicles

WHEEL ALIGNMENT

GENERAL INFORMATION

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

Routine inspection of the front suspension and steering components is a good preventative maintenance practice. Inspection also helps to ensure safe operation of the vehicle.

• CASTER is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle forward provides negative caster. Tilting the top of the knuckle rearward provides positive caster. Positive caster promotes directional stability. This angle enables the front wheels to return to a straight ahead position after turns (Fig. 1).

• CAMBER is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire (Fig. 1).

• TOE is the difference between the leading inside edges and trailing inside edges of the front tires (Fig. 1). Uneven wheel toe position cause's unstable steering, uneven tire wear and steering wheel off-center. The wheel toe position is the **final** front wheel alignment adjustment.

• THRUST ANGLE is the angle of the rear axle relative to the vehicle center line. If this angle is off the vehicle may drift or wander.

• STEERING AXIS INCLINATION ANGLE is measured in degrees. It is the angle that the steering knuckles are tilted (Fig. 1). The inclination angle has a fixed relationship with the camber angle. It will not change except when a spindle or ball stud is damaged or bent. The angle is not adjustable and the damaged component(s) must be replaced to correct mis-alignment.

CAUTION: Do not attempt to modify any suspension or steering component by heating and bending.

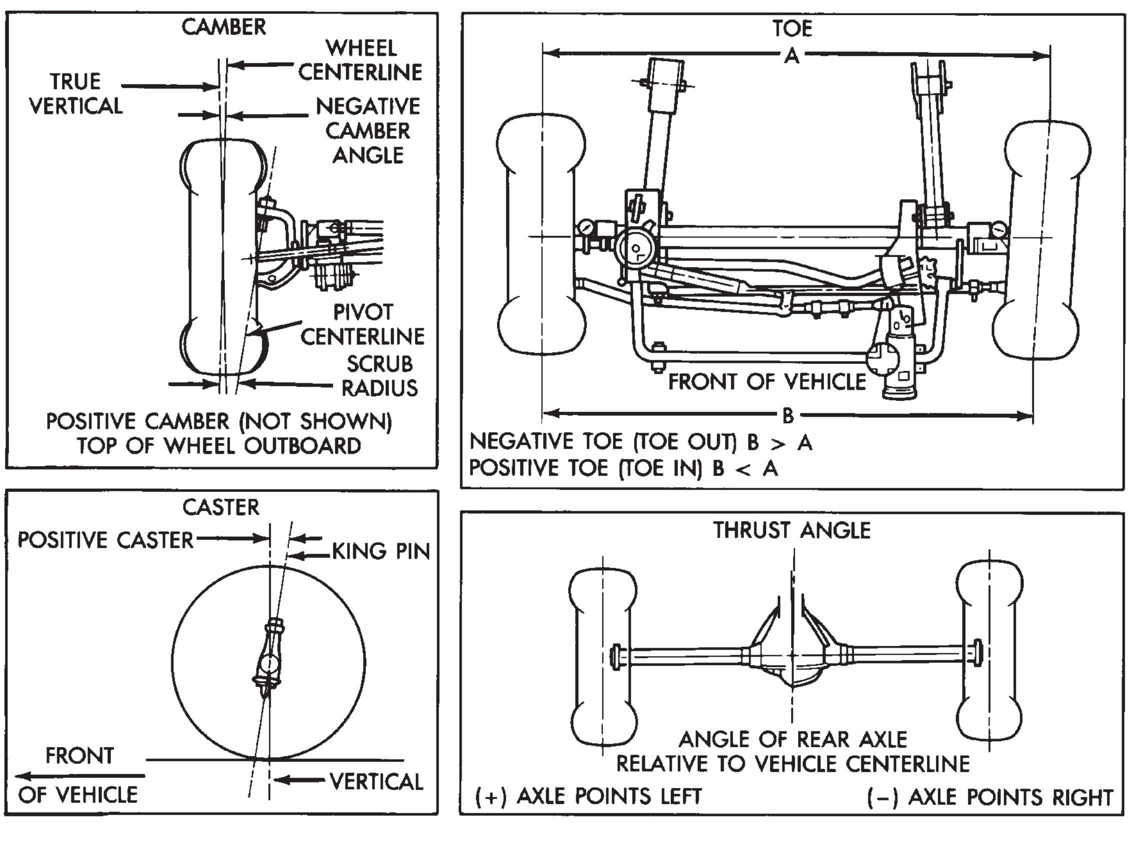


Fig. 1 Wheel Alignment Angles

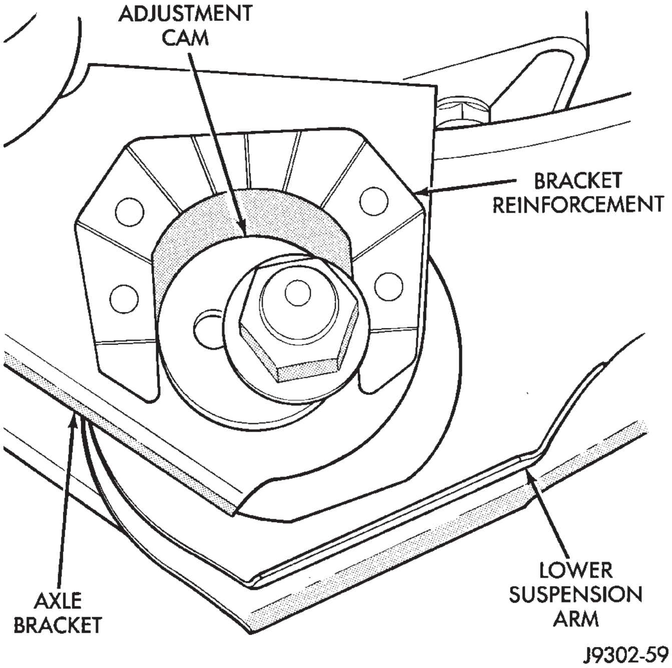


Fig. 2 Cam Adjuster

PRE-ALIGNMENT INSPECTION

Before starting a front wheel alignment, the following inspection and necessary corrections must be completed.

(1) Tires with the same recommended air pressure, size, and tread wear. Refer to Group 22, Wheels and Tires for diagnosis information.

(2) Front wheel bearings for wear.

(3) Ball studs, steering linkage pivot points and steering gear for looseness, roughness, binding or wear. Refer to Group 19, Steering for additional information.

(4) Wheels for excessive radial, lateral runout and unbalance. Refer to Group 22, Wheels and Tires for diagnosis information.

(5) Suspension components for wear and noise. Check components for correct torque. Refer to Groups 2 and 3, Suspension and Axle for additional information.

ALIGNMENT MEASUREMENTS AND ADJUSTMENTS

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

CAMBER

The wheel camber angle (Fig. 1) is preset. This angle is not adjustable and cannot be altered.

CASTER

Check the caster of the front axle for correct angle (fig. 1). Be sure the axle is not bent or twisted. Road test the vehicle and observe the steering wheel return-to-center position. Low caster will cause poor steering wheel returnability.

During the road test, turn the vehicle to both the left and right. If the steering wheel returns to the center position unassisted, the caster angle is correct. However, if steering wheel does not return toward the center position unassisted, a low caster angle is probable.

Front aster can be adjusted by loosening and rotating the cams on the lower suspension arm (Fig. 2). **Changing caster angle will also change the front propeller shaft angle. The propeller shaft angle has priority over caster. Refer to Group 16, Propeller Shafts for additional information.**

TOE POSITION

The wheel toe position adjustment should be the final adjustment.

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

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

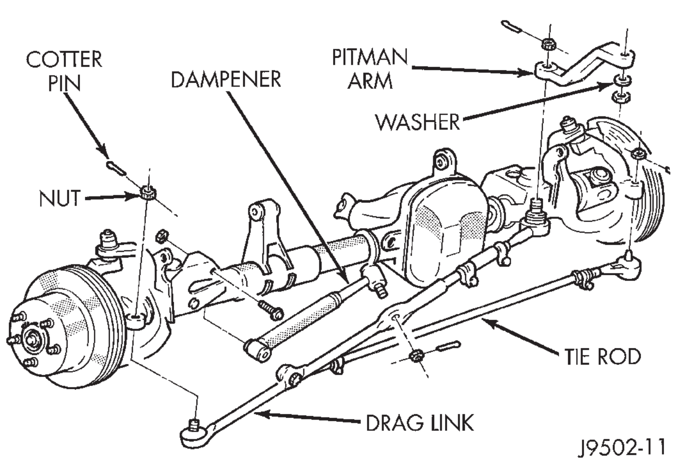
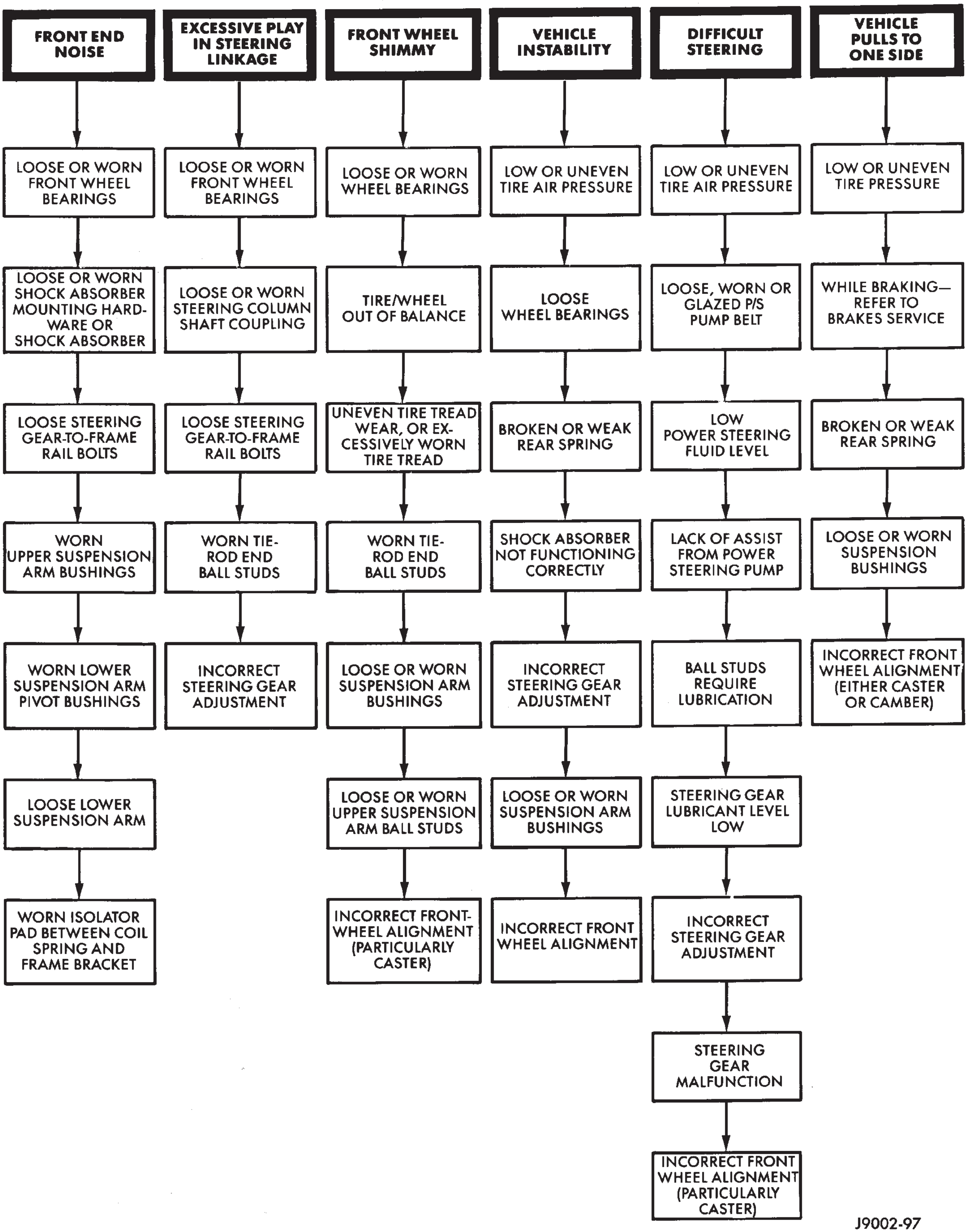


Fig. 3 Steering Linkage

SUSPENSION AND STEERING SYSTEM DIAGNOSIS



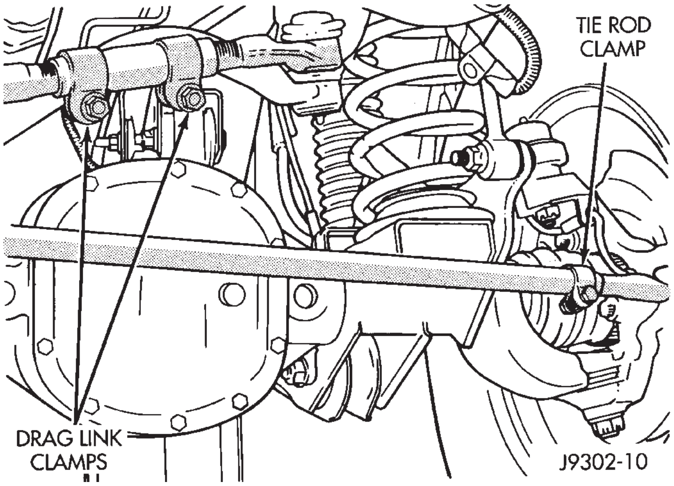


Fig. 4 Drag Link and Tie Rod Clamp Location

(3) Adjust the right wheel toe position with the drag link. Turn the sleeve until the right wheel is at the correct positive TOE-IN position. Position the clamp bolts as shown (Fig. 4) and tighten to 49 N·m (36 ft. lbs.) torque. **Make sure the toe setting does not change during clamp tightening.**

(4) Adjust the left wheel toe position with the tie rod. Turn the sleeve until the left wheel is at the same TOE-IN position as the right wheel. Position the clamp bolts as shown (Fig. 4) and tighten to 27 N·m (20 ft. lbs.) torque. **Make sure the toe setting does not change during clamp tightening.**

(5) Verify the right toe setting.

ALIGNMENT SPECIFICATIONS

ADJUSTMENT	SET TO	OK RANGE
CASTER	7°	6.5° to 7.5°
CAMBER (not adjustable)	- 0.25°	- 0.75° to + .50°
WHEEL TOE-IN (each side)	0.12°	0 to + 0.22°

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FRONT SUSPENSION

INDEX

SERVICE INFORMATION

Periodic lubrication of the front suspension (steering) system components is required. Refer to Group 0, Lubrication And Maintenance for the recommended maintenance schedule.

CAUTION: Suspension components with rubber bushings should be tightened with the vehicle at normal height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur. Rubber bushings must never be lubricated.

TRACK BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the cotter pin and nut from the ball stud end at the frame rail bracket (Fig. 1).

A puller tool may be necessary to separate the ball stud from the frame rail bracket.

(3) Remove the bolt and flag nut from the axle shaft tube bracket (Fig. 1). Remove the track bar.

INSTALLATION

(1) Install the track bar at axle tube bracket. Loosely install the retaining bolt and flag nut (Fig. 1).

(2) It may be necessary to pry the axle assembly over to install the track bar at the frame rail. Install track bar at the frame rail bracket (Fig. 1). Install the retaining nut on the stud.

(3) Remove the supports and lower the vehicle.

(4) Tighten the bolt at the axle shaft tube bracket to 75 N·m (55 ft. lbs.) torque.

(5) Tighten the ball stud nut to 81 N·m (60 ft. lbs.) torque. Install a new cotter pin.

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

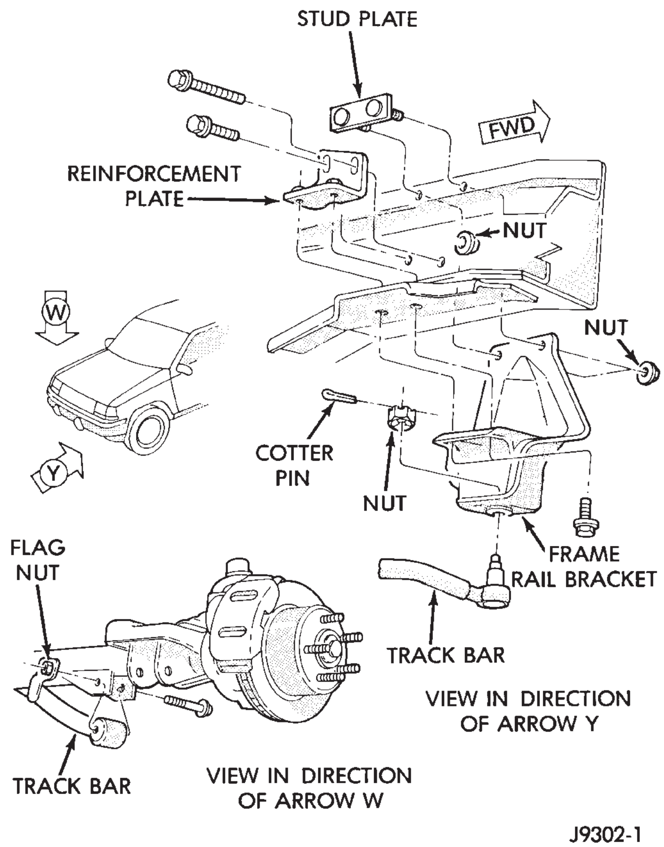

Fig. 1 Track Bar

STABILIZER BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Disconnect the stabilizer bar links from the axle brackets (Fig. 2).

(3) Disconnect the stabilizer bar from the links.

(4) Disconnect the stabilizer bar clamps from the frame rails. Remove the stabilizer bar.

INSTALLATION

(1) Position the stabilizer bar on the frame rail and install the clamps and bolts. Ensure the bar is centered with equal spacing on both sides. Tighten the bolts to 54 N·m (40 ft. lbs.).

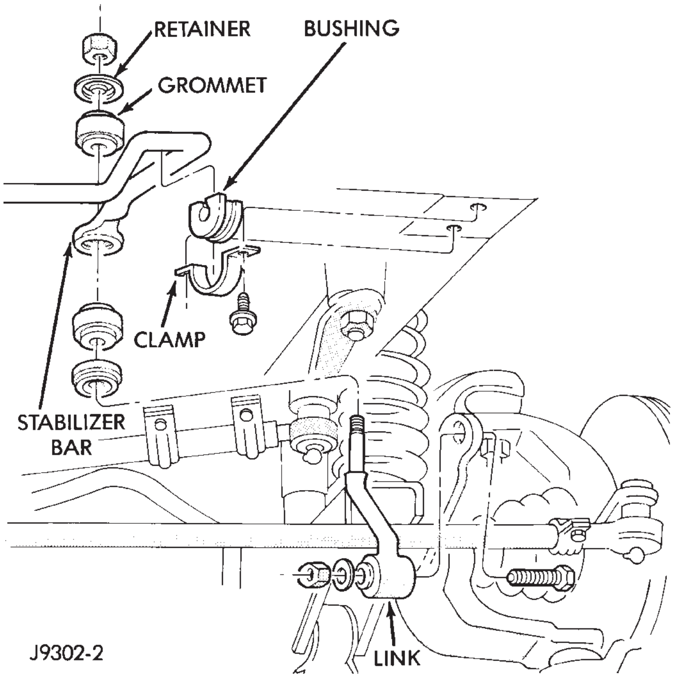

Fig. 2 Stabilizer Bar

(2) Install the links and grommets onto the stabilizer bar and axle brackets (Fig. 2). Tighten the nut at the connecting links at the axle bracket to 95 N·m (70 ft. lbs.) torque.

(3) Tighten the stabilizer bar to connecting link nut to 36 N·m (27 ft. lbs.) torque.

(4) Remove the supports and lower the vehicle.

UPPER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the upper suspension arm nut and bolt at the axle bracket (Fig. 3).

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

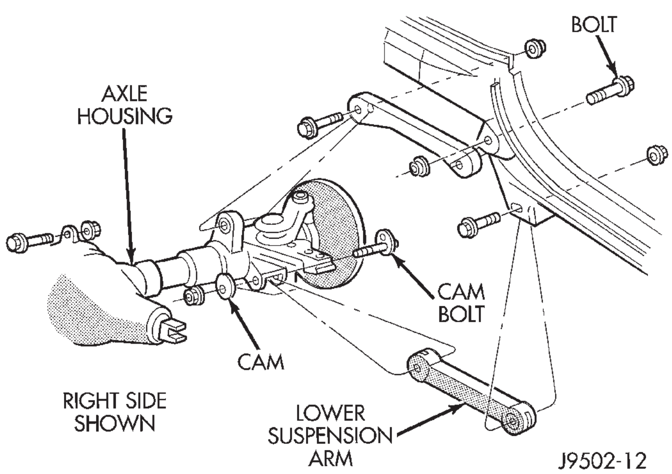

Fig. 3 Upper and Lower Suspension Arms

INSTALLATION

(1) Position the upper suspension arm at the axle and frame rail (Fig. 3).

(2) Install the bolts and finger tighten the nuts (Fig. 3).

(3) Remove the supports and lower the vehicle.

(4) Tighten the nut at the axle and frame bracket to 75 N·m (55 ft. lbs.) torque.

AXLE BUSHING REPLACEMENT

(1) Remove the upper suspension arm from axle. Refer to Upper Suspension Arm Removal in this Group.

(2) Insert Spacer 7932-3 (J-35581-3) around the bushing in the axle bracket ears (Fig. 4).

(3) Assemble and install Bushing Removal/Installer (Fig. 4).

(4) Remove the bushing by tightening the hex-head on Long Nut.

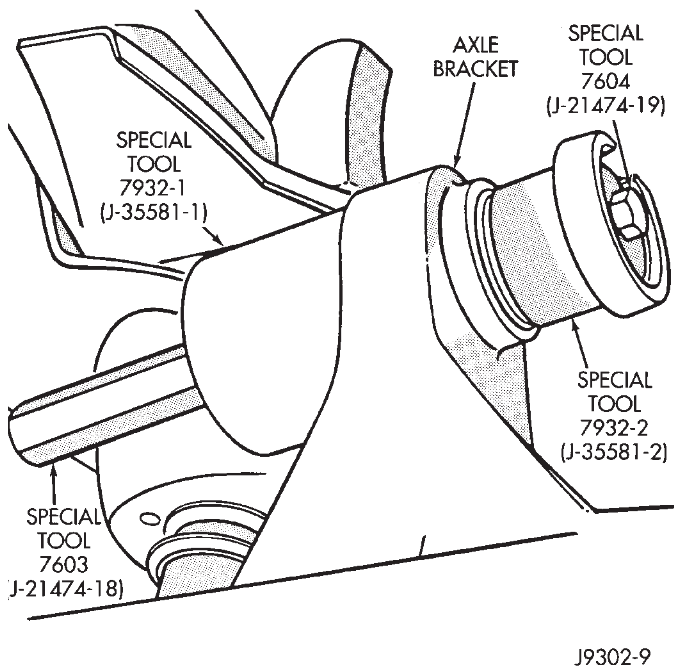

Fig. 4 Axle Bracket Bushing Removal

For two-wheel drive axles and right side on Model 30 axle, do not remove Spacer 7932-3 (J-35581-3) at this time.

(5) Position the new bushing on Installer.

(6) Install the bushing by tightening the hex-head on Long Nut (Fig. 5). Remove Spacer 7932-3 (J-35581-3).

(7) Install the upper suspension arm to axle. Refer to Upper Suspension Arm Installation in this Group.

LOWER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.

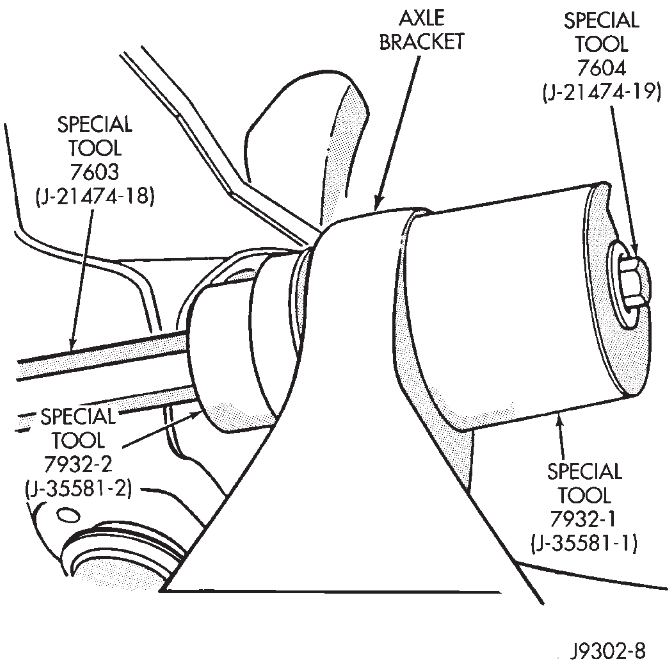

Fig. 5 Axle Bracket Bushing Installation

(2) Paint or scribe alignment marks on the cam adjusters and suspension arm for installation reference (Fig. 6).

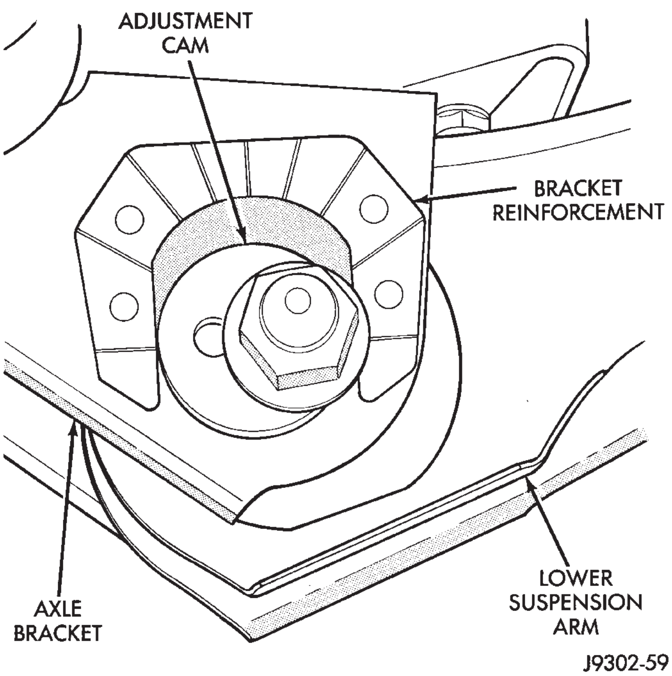

Fig. 6 Cam Adjuster

(3) Remove the lower suspension arm nut, cam and cam bolt from the axle (Fig. 3).

(4) Remove the nut and bolt from the frame rail bracket and remove the lower suspension arm (Fig. 6).

INSTALLATION

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

(2) Install the rear bolts and finger tighten the new nuts (Fig. 6).

(3) Install a new cam bolt, cam and new nut in the axle. Re-align the reference marks.

(4) Install the bolts and finger tighten the new nuts (Fig. 6).

(5) Lower the vehicle.

(6) Tighten the front and rear nuts to 115 N·m (85 ft. lbs.) torque.

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

SPRING AND SHOCK DIAGNOSIS

A squeak noise from the shock absorber can be produced if movement between the rubber bushings and the metal occurs. This noise can usually be stopped by tightening the attaching nuts. If the squeak noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston into and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

SHOCK ABSORBER

REMOVAL

(1) Remove the nut, retainer and grommet from the upper stud in the engine compartment (Fig. 7).

(2) Remove the lower nuts and bolts from the axle bracket (Fig. 7). Remove the shock absorber.

INSTALLATION

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

(2) Install the lower bolts and nuts. Tighten nuts to 28 N·m (250 in. lbs.) torque.

(3) Install the upper grommet and retainer on the stud in the engine compartment. Install the nut and tighten to 23 N·m (17 ft. lbs.) torque.

COIL SPRING

REMOVAL

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

(2) Paint or scribe alignment marks on the cam adjusters and axle bracket for installation reference (Fig. 6).

(3) Mark and disconnect the front propeller shaft from the axle.

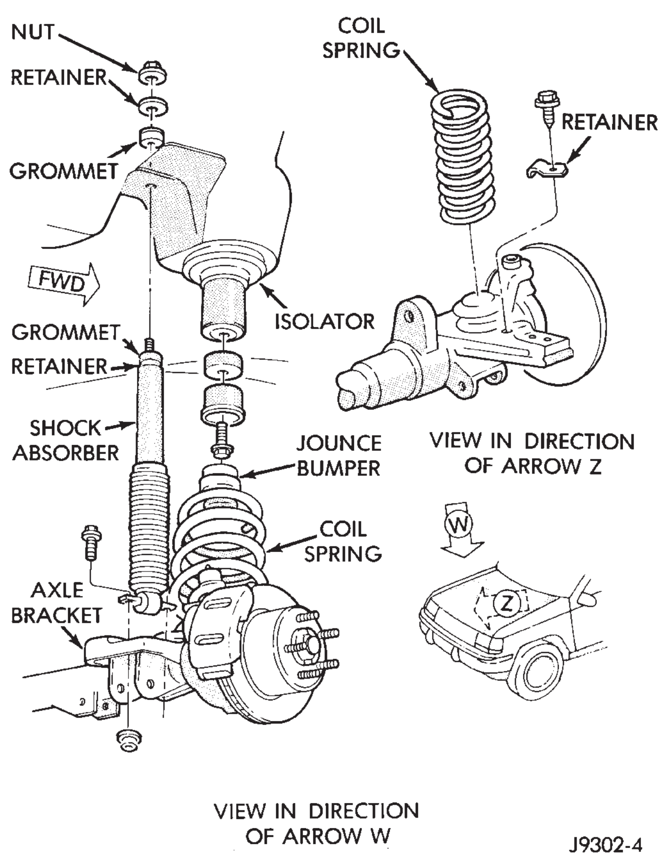

Fig. 7 Coil Spring & Shock Absorber

(4) Remove the lower suspension arm nut, cam and cam bolt from the axle (Fig. 3).

(5) Disconnect the stabilizer bar link and shock absorber from the axle.

(6) Disconnect the track bar from the frame rail bracket.

(7) Disconnect the drag link from the pitman arm.

(8) Lower the axle until the spring is free from the upper mount. Remove the coil spring retainer bolt and remove the spring.

(9) Remove the jounce bumper if necessary from the upper spring mount (Fig. 7).

INSTALLATION

(1) Install the jounce bumper on the upper spring mount. Tighten the bolts to 42 N·m (31 ft. lbs.) torque (Fig. 7).

(2) Position the coil spring on the axle pad. Install the spring retainer and bolt.

(3) Raise the axle into position until the spring seats in the upper mount.

(4) Connect the stabilizer bar links and shock absorbers to the axle bracket. Connect the track bar to the frame rail bracket.

(5) Install the lower suspension arm to the axle.

(6) Install the front propeller shaft to the axle.

(7) Install drag link to pit man arm.

(8) Remove the supports and lower the vehicle.

(9) Tighten all suspension components to proper torque.

AXLE NOISE/VIBRATION DIAGNOSIS

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GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:

- Insufficient or incorrect lubricant
- Foreign matter/water contamination
- Incorrect bearing preload torque adjustment
- Incorrect backlash (to tight)

When serviced, the bearings must be cleaned thoroughly. They should be dried with lint free shop towels. **Never dry bearings with compressed air. This will overheat them and brinell the bearing surfaces. This will result in noisy operation after repair.**

Axle gear problem conditions are usually the result of:

- Insufficient lubrication
- Incorrect or contaminated lubricant
- Overloading (excessive engine torque)
- Exceeding vehicle weight capacity
- Incorrect clearance or backlash adjustment

Insufficient lubrication is usually the result of a housing cover leak. It can also be from worn axle shaft or pinion gear seals. Check for cracks or porous areas in the housing or tubes.

Using the wrong lubricant will cause overheating and gear failure. Gear tooth cracking and bearing spalling are indicators of this.

Axle component breakage is most often the result of:

- Severe overloading
- Insufficient lubricant
- Incorrect lubricant
- Improperly tightened components

Common causes of overloading is from full throttle acceleration. Overloading happens when towing heavier than recommended loads. Component breakage can occur when the wheels are spun excessively. Insufficient or incorrect lubricants contribute to breakage through overheating. Loose differential components can also cause breakage.

Incorrect bearing preload or gear backlash will not result in component breakage. This will cause accelerated wear and contribute to early failure. Mis-adjustment will produce noise. If a mis-adjustment condition is not corrected, component failure can result.

Excessive bearing preload may not be noisy. This condition will cause high temperature which can result in bearing failure.

GEAR AND BEARING NOISE

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant. Incorrect backlash, tooth contact, or worn/damaged gears can cause noise.

Gear noise usually happens at a specific speed range. The range is 30 to 40 mph, or above 50 mph. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, accelerate the vehicle to the speed range where the noise is the greatest. Shift out of gear and coast through the peak noise range. If the noise stops or changes greatly, check for insufficient lubricant. Incorrect ring gear backlash, or gear damage can cause noise changes.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise in straight ahead driving. These gears are loaded during vehicle turns. If noise does occur during vehicle turns, the side or pinion gears could be worn or damaged. A worn pinion gear mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

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

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

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

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

LOW SPEED KNOCK

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

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:
- Damaged drive shaft
- Missing drive shaft balance weight
- Worn, out-of-balance wheels
- Loose wheel lug nuts
- Worn U-joint
- Loose spring U-bolts
- Loose/broken springs
- Damaged axle shaft bearings
- Loose pinion gear nut
- Excessive pinion yoke run out
- Bent axle shaft

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

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels And Tires for additional information.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:
- High engine idle speed
- Loose engine/transmission/transfer case mounts
- Worn U-joints
- Loose spring mounts
- Loose pinion gear nut and yoke
- Excessive ring gear backlash
- Excessive differential side gear-to-case clearance

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

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
WHEEL NOISE	(a) Wheel loose. (b) Faulty, brinelled wheel bearing.	(a) Tighten loose nuts. (b) Faulty or brinelled bearings must be replaced.
AXLE SHAFT NOISE	(a) Misaligned axle shaft tube. (b) Bent or sprung axle shaft. (c) End play in drive pinion bearings. (d) Excessive gear backlash between ring gear and pinion gear. (e) Improper adjustment of drive pinion gear shaft bearings. (f) Loose drive pinion gearshaft yoke nut. (g) Improper wheel bearing adjustment. (h) Scuffed gear tooth contact surfaces.	(a) Inspect axle shaft tube alignment. Correct as necessary. (b) Replace bent or sprung axle shaft. (c) Refer to Drive Pinion Bearing Pre-Load Adjustment. (d) Check adjustment of ring gear backlash and pinion gear. Correct as necessary. (e) Adjust drive pinion shaft bearings. (f) Tighten drive pinion gearshaft yoke nut with specified torque. (g) Readjust as necessary. (h) If necessary, replace scuffed gears.
AXLE SHAFT BROKE	(a) Misaligned axle shaft tube. (b) Vehicle overloaded. (c) Erratic clutch operation (d) Grabbing clutch.	(a) Replace broken axle shaft after correcting axle shaft tube alignment. (b) Replace broken axle shaft. Avoid excessive weight on vehicle. (c) Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. (d) Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.
DIFFERENTIAL CASE CRACKED	(a) Improper adjustment of differential bearings. (b) Excessive ring gear backlash. (c) Vehicle overloaded. (d) Erratic clutch operation.	(a) Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. (b) Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. (c) Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. (d) Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.
DIFFERENTIAL GEARS SCORED	(a) Insufficient lubrication. (b) Improper grade of lubricant. (c) Excessive spinning of one wheel/tire.	(a) Replace scored gears. Scoring marks on the drive face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear differential housing to required capacity with proper lubricant. Refer to Specifications. (b) Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. (c) Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.
LOSS OF LUBRICANT	(a) Lubricant level too high.	(a) Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.

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SERVICE DIAGNOSIS (CONT'D)

Condition	Possible Cause	Correction
	(b) Worn axle shaft seals.	(b) Replace worn seals.
	(c) Cracked differential housing.	(c) Repair or replace housing as necessary.
	(d) Worn drive pinion gear shaft seal.	(d) Replace worn drive pinion gear shaft seal.
	(e) Scored and worn yoke.	(e) Replace worn or scored yoke and seal.
	(f) Axle cover not properly sealed.	(f) Remove cover and clean flange and reseal.
AXLE OVERHEATING	(a) Lubricant level too low.	(a) Refill differential housing.
	(b) Incorrect grade of lubricant.	(b) Drain, flush and refill with correct amount of the correct lubricant.
	(c) Bearings adjusted too tight.	(c) Readjust bearings.
	(d) Excessive gear wear.	(d) Inspect gears for excessive wear or scoring. Replace as necessary.
	(e) Insufficient ring gear backlash.	(e) Readjust ring gear backlash and inspect gears for possible scoring.
GEAR TEETH BROKE (RING GEAR AND PINION)	(a) Overloading.	(a) Replace gears. Examine other gears and bearings for possible damage. Replace parts as needed. Avoid overloading of vehicle.
	(b) Erratic clutch operation.	(b) Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation.
	(c) Ice-spotted pavements.	(c) Replace gears. Examine the remaining parts for possible damage. Replace parts as required.
	(d) Improper adjustments.	(d) Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.
AXLE NOISE	(a) Insufficient lubricant.	(a) Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary.
	(b) Improper ring gear and drive pinion gear adjustment.	(b) Check ring gear and pinion gear teeth contact pattern.
	(c) Unmatched ring gear and drive pinion gear.	(c) Remove unmatched ring gear and drive pinion gear. Replace with matched gear and drive pinion gear set.
	(d) Worn teeth on ring gear or drive pinion gear.	(d) Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set.
	(e) Loose drive pinion gear shaft bearings.	(e) Adjust drive pinion gearshaft bearing preload torque.
	(f) Loose differential bearings.	(f) Adjust differential bearing preload torque.
	(g) Misaligned or sprung ring gear.	(g) Measure ring gear runout.
	(h) Loose differential bearing cap bolts.	(h) Tighten with specified torque.

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MODEL 30 AXLE AND TUBE AXLE (2WD)

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GENERAL INFORMATION

The housing for Model 30 front axles consists of an iron center casting with tubes on each side. The tubes are pressed into and welded to the differential housing.

The integral type housing, hypoid gear design has the centerline of the pinion set below the centerline of the ring gear.

The axle has a vent used to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning that loads are supported by the hub bearings. The axle shafts are retained by nuts at the hub bearings. The hub bearings are bolted to the steering knuckle at the outboard end of the axle tube yoke. The hub bearings are serviced as an assembly.

The axles are equipped with ABS brake sensors. The sensors are attached to the knuckle assemblies and tone rings are pressed on the axle shaft. **Use care when removing axle shafts as NOT to damage the tone wheel or the sensor.**

The stamped steel cover provides a means for inspection and servicing the differential.

The Model 30 axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the housing cover. Build date identification codes are stamped on the axle shaft tube cover side.

The differential case is a one piece design. The differential pinion mate shaft is retained with a roll pin. Differential bearing preload and ring gear backlash is adjusted by the use of shims. The shims are located between the differential bearing cones and case. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

LUBRICANT SPECIFICATIONS

Multi-purpose, hypoid gear lubricant should be used for Model 30 axles. The lubricant should have MIL-L-2105C and API GL 5 quality specifications. MOPAR® Hypoid Gear Lubricant conforms to both of these specifications.

- The factory fill for the Model 30 axle is SAE Thermally Stable 80W-90 gear lubricant
- The factory installed lubricant quantity for the NON-DISCONNECT TYPE AXLE is 40±1 fluid oz.

Refer to Group 0, Lubrication and Maintenance for additional information.

CAUTION: If axle is submerged in water, lubricant must be replaced immediately to avoid contamination.

DRIVE AXLE ASSEMBLY REPLACEMENT

REMOVAL

(1) Raise vehicle and position support stands under the frame rails behind the lower suspension arm brackets.

(2) Remove the front wheels.

(3) Remove the brake components and ABS brake sensor (if equipped). Refer to Group 5—Brakes.

(4) On 4WD vehicles, disconnect the axle vent hose.

(5) On 4WD vehicles, mark the drive shaft yoke and axle pinion yoke for alignment reference. Disconnect the drive shaft from the axle.

(6) Disconnect the stabilizer bar link at the axle bracket.

(7) Disconnect the shock absorbers from axle bracket.

(8) Disconnect the track bar from the axle bracket.

(9) Disconnect the tie rod and drag link from the steering knuckle. Disconnect the steering dampener from the axle bracket.

(10) Support the axle with a hydraulic jack under the differential.

(11) Disconnect the upper and lower suspension arms from the axle bracket.

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

(13) Remove the coil springs from the axle bracket.

INSTALLATION

CAUTION: Suspension components with rubber bushings should be tightened with the vehicle at normal height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur. Rubber bushings must never be lubricated.

(1) Install the springs, retainer clip and bolts.

(2) Support the axle on a hydraulic jack under the differential. Position the axle under the vehicle.

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

(4) Position the upper and lower suspension arm at the axle bracket. Install bolts and nuts finger tighten.

(5) Connect the track bar to the axle bracket and install the bolt. **Do not tighten at this time.**

It is important that the springs support the weight of the vehicle when the track bar is connected. If the springs are not at their usual position, the vehicle ride comfort could be affected.

(6) Install the shock absorber and tighten nuts to 27 N·m (20 ft. lbs.) torque.

(7) Install the stabilizer bar link to the axle bracket. Tighten the nut to 95 N·m (70 ft. lbs.) torque.

(8) Install the drag link and tie rod to the steering knuckles and tighten the nuts to 47 N·m (35 ft. lbs.) torque. Install the steering dampener to the axle bracket and tighten the nut to 75 N·m (55 ft. lbs.) torque.

(9) Install the brake components and ABS brake sensor (if equipped). Refer to Group 5—Brakes.

(10) On 4WD vehicles, connect the vent hose to the tube fitting.

(11) On 4WD vehicles, align the reference marks and connect the drive shaft to the axle yoke. Tighten the U-joint clamp bolts to 19 N·m (14 ft. lbs.) torque.

(12) Check differential lubricant and add if necessary.

(13) Install the wheel and tire.

(14) Remove the supports and lower the vehicle.

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

(16) Tighten the track bar bolt at the axle bracket to 75 N·m (55 ft. lbs.) torque.

(17) Check the front wheel alignment.

LUBRICANT CHANGE

The gear lubricant will drain quicker if the vehicle has been recently driven.

(1) Raise and support the vehicle.

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

(3) Remove the differential housing cover and drain the lubricant from the housing.

(4) Clean the housing cavity and oil channels with a flushing oil, light engine oil or lint free cloth. **Do not use water, steam, kerosene or gasoline for cleaning.**

(5) Remove the sealant from the housing and cover surfaces. Use solvent to clean the mating surfaces.

(6) Apply a bead of MOPAR® Silicone Rubber Sealant to the housing cover (Fig. 1). **Allow the sealant to cure for a few minutes.**

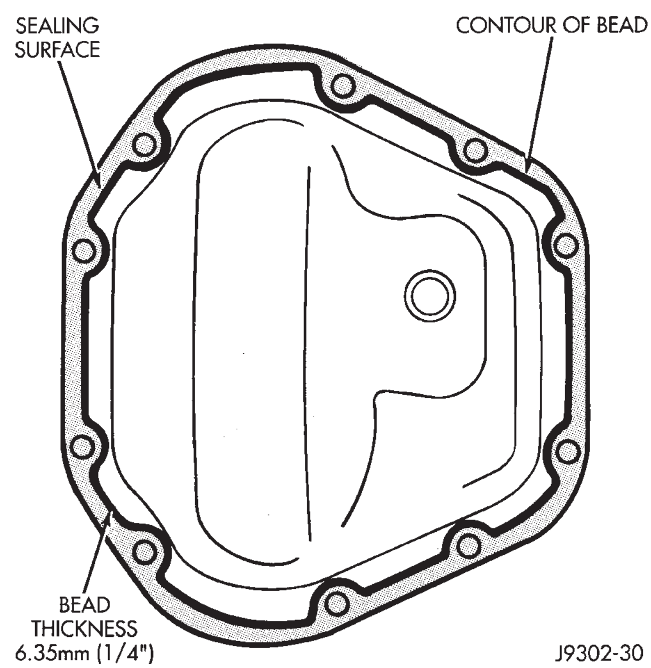

Fig. 1 Typical Housing Cover With Sealant

Install the housing cover within 5 minutes after applying the sealant. If not installed the sealant must be removed and another bead applied.

(7) Install the cover and any identification tag. Tighten the cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.) torque.

(8) Refill the differential with MOPAR® Hypoid Gear Lubricant to the bottom of fill plug hole.

(9) Install the fill hole plug and lower the vehicle.

PINION SHAFT SEAL REPLACEMENT

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies

(3) Mark the propeller shaft yoke and pinion yoke for installation alignment reference.

(4) Remove the propeller shaft from the yoke.

(5) Rotate the pinion gear three or four times. **Make sure brakes are not dragging during this procedure.**

(6) Measure the amount of torque (in Newton-meters or inch-pounds) necessary to rotate the pinion gear with a torque wrench. Note the torque for installation reference. **It must be known to properly adjust the pinion gear bearing preload torque after seal installation.**

(7) Remove the pinion yoke nut and washer. Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 2).

(8) Mark the positions of the yoke and pinion gear for installation alignment reference.

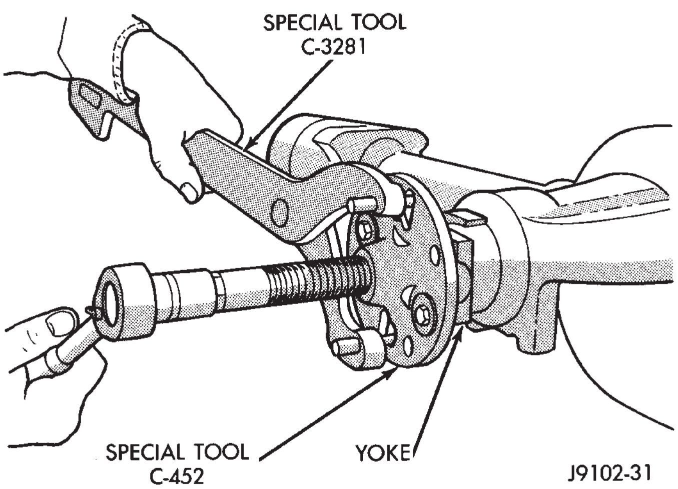

Fig. 2 Pinion Yoke Removal

(9) Use Remover 7794A and slide hammer to remove the pinion gear seal (Fig. 3).

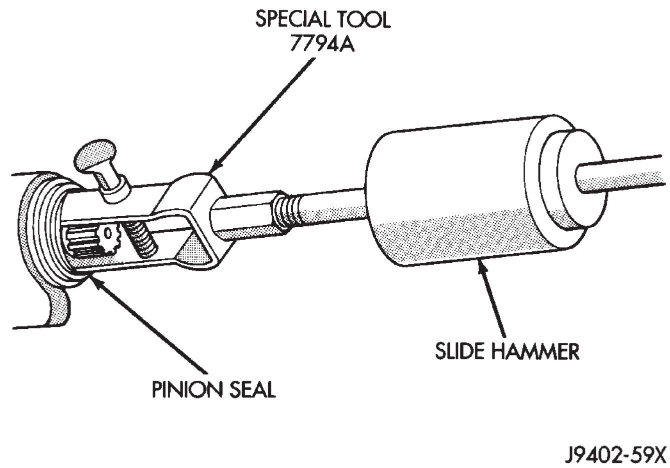

Fig. 3 Seal Removal

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer D-163 and Handle C-4171 (Fig. 4).

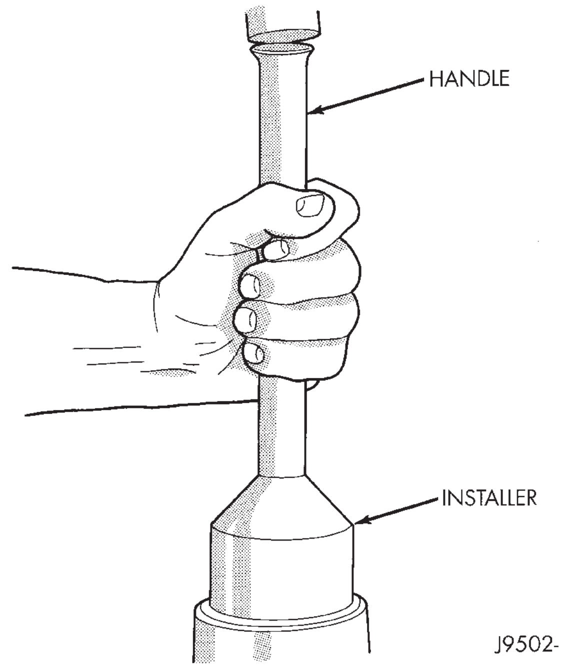

Fig. 4 Pinion Seal Installation

(2) Align the installation reference marks and install yoke on the pinion gear with Installer W-162D.

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

CAUTION: Exercise care during the bearing preload torque adjustment. Do not over-tighten, or loosen and then re-tighten the nut. Do not exceed the bearing preload torque. The collapsible preload spacer on the pinion shaft will have to be replaced. The bearing preload torque will be re-adjusted afterward.

(4) Install a socket and inch-pound torque wrench on the pinion nut.

(5) Rotate the shaft with the torque wrench and note the torque.

The required preload is equal to amount recorded during removal plus 0.56 N·m (5 in. lbs.). The used bearing preload torque must never exceed 2.25 N·m (20 in. lbs.)

(6) Use Flange Wrench C-3281 to retain the yoke and shaft (Fig. 5). Tighten the shaft nut in very small increments. Vehicles with Type 3 propeller shaft use Flange Wrench C-3281 with 2 bolts installed into the flange (Fig. 6).

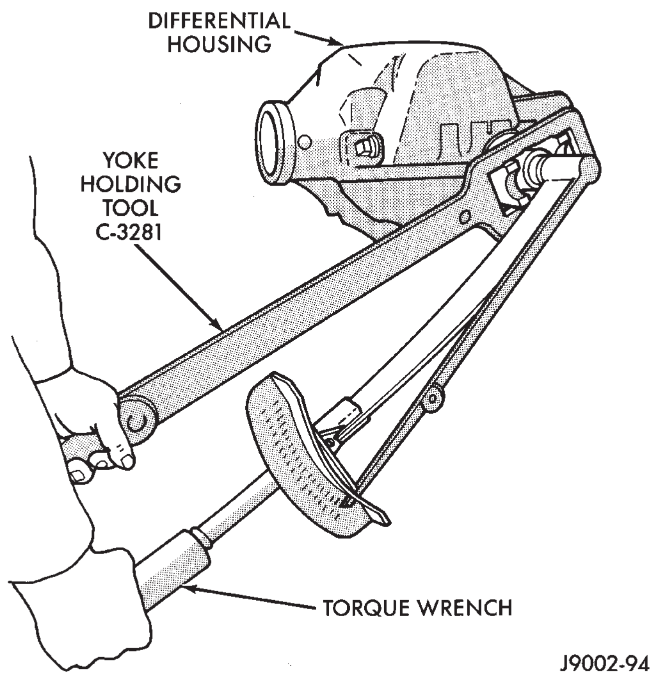

Fig. 5 Tightening Pinion Nut

(7) Continue tightening the shaft nut in small increments until the correct bearing preload torque is attained. Tighten the pinion shaft nut:

- **No less than 217 N·m (160 ft. lbs.) torque**
- **No greater than 352 N·m (260 ft. lbs.) torque**

(8) Align the installation reference marks and attach the propeller shaft to the yoke.

(9) Add API grade GL 5 hypoid gear lubricant to the differential housing, if necessary.

(10) Install wheel and tire assemblies

(11) Lower the vehicle.

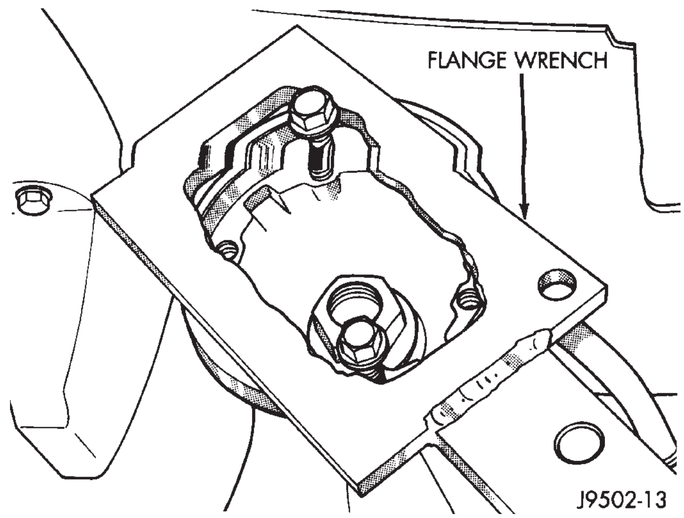

Fig. 6 Tightening Pinion Nut with Type 3 Shaft

HUB BEARING AND AXLE SHAFT

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove the brake components from the axle, refer to Group 5, Brakes.

(4) Remove the cotter pin, nut retainer and axle hub nut (Fig. 7).

(5) Remove the hub to knuckle bolts (Fig. 7). Remove the hub from the steering knuckle and axle shaft.

(6) Remove the disc brake rotor shield from the bearing carrier (Fig. 7).

(7) **On 4WD vehicles, remove the axle shaft from the housing. Avoid damaging the axle shaft oil seals in the differential.**

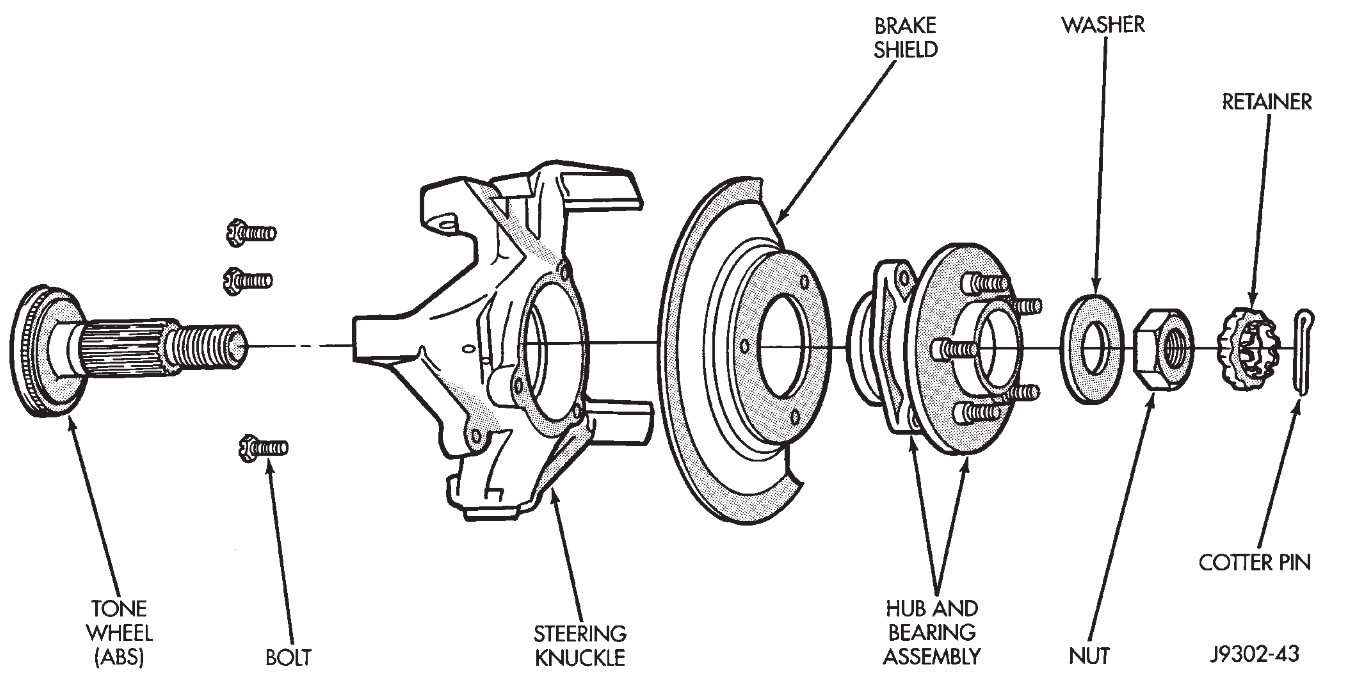

Fig. 7 Hub, Knuckle and Axle Shaft

INSTALLATION

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

(2) On 4WD vehicles, install the axle shaft into the housing and differential side gears. Avoid damaging the axle shaft oil seals in the differential.

(3) Install the hub bearing and brake dust shield to the knuckle.

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

(5) Install the hub washer and nut. Tighten the hub nut to 237 N·m (175 ft. lbs.) torque. Install the nut retainer and a new cotter pin (Fig. 7).

(6) Install the brake components, refer to Group 5, Brakes.

(7) Install the wheel and tire assembly.

(8) Lower the vehicle.

AXLE SHAFT— CARDAN U-JOINT

DISASSEMBLY

Single cardan U-joints are not serviceable. If defective, they must be replaced as a unit. If the bearings, seals, spider or bearing caps are damaged or worn, replace the complete U-joint.

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

(1) Remove the bearing cap retaining snap rings (Fig. 8).

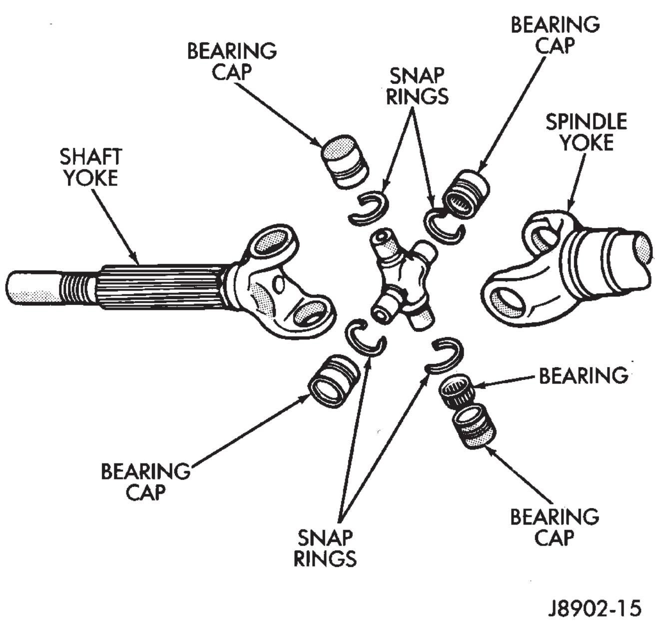

Fig. 8 Axle Shaft Outer U-Joint

It can be helpful to saturate the bearing caps with penetrating oil prior to removal.

(2) Locate a socket that is larger in diameter than the bearing cap. Place the socket (receiver) against the yoke and around the perimeter of the bearing cap to be removed. Locate a socket that is smaller in diameter than the bearing cap. Place the socket (driver) against the opposite bearing cap. Position the yoke with the sockets in a vise (Fig. 9).

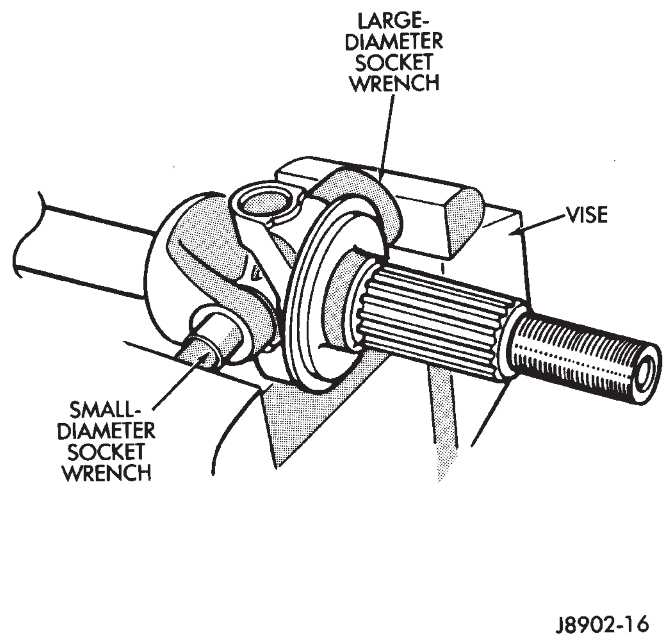

Fig. 9 Yoke Bearing Cap Removal

(3) Compress the vise jaws to force the bearing cap into the larger socket (receiver).

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

(5) Repeat the above procedure for the remaining bearing cap.

(6) Remove the remaining bearing cap, bearings, seals and spider from the propeller shaft yoke.

CLEANING AND INSPECTION

(1) Clean all the U-joint yoke bores with cleaning solvent and a wire brush. Ensure that all the rust and foreign matter are removed from the bores.

(2) Inspect the yokes for distortion, cracks and worn bearing cap bores.

(3) Replace the complete U-joint if any of the components are defective.

ASSEMBLY

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

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

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

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

(5) Install the bearing cap retaining clips.

(6) Install the axle shaft, refer to Hub Bearing and Axle Shaft installation.

AXLE SHAFT— CV-JOINT

HANDLING AND CLEANING PRECAUTIONS

Extreme care must be exercised to avoid puncturing or tearing the boots. Also avoid damage to the ABS tone ring pressed onto the CV-joint.

The rubber material in shaft boots is not compatible with oil, gasoline, or petroleum based cleaning solvents. Do not expose the rubber boots to any of these fluids. Use only soap and water to clean the rubber boots. After cleaning, the rubber boot must be thoroughly rinsed and dried.

INSPECTION

The most common failure of CV-joints is torn or ripped boots and subsequent lubricant loss or contamination. Look for lubricant around the exterior of boot. Check for a punctured or torn boot or retaining clamp loose. If joint was operating satisfactorily and grease does not appear contaminated, replace boot. When a CV drive shaft is removed from the vehicle for service, the boot should be properly cleaned. Inspect the boot for cracks, tears and scuffed areas on the surfaces. If any of these conditions exist boot replacement is recommended.

If joint is noisy or worn, bypass following disassembly and replace entire unit and boot.

DISASSEMBLY

(1) Remove retaining clamps from the outer CV joint and discard. Slide the boot off the outer joint and down the shaft.

(2) Remove the lubricant to expose the joint components (Fig. 10).

(3) Clamp the shaft in a vise (with soft jaws). Give a sharp tap to the top of the housing to dislodge joint from internal circlip. Slide the joint from the shaft. (Fig. 11).

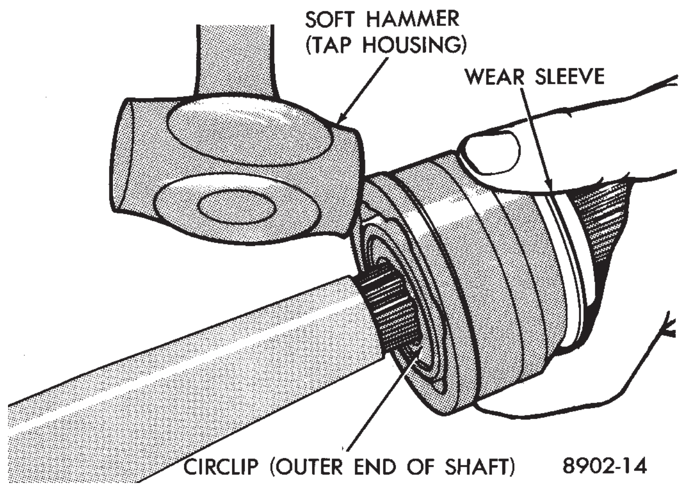

Fig. 11 Joint Removal

(4) Remove the surplus lubricant. Apply installation alignment marks on the bearing hub, bearing cage and housing with dabs of paint (Fig. 12).

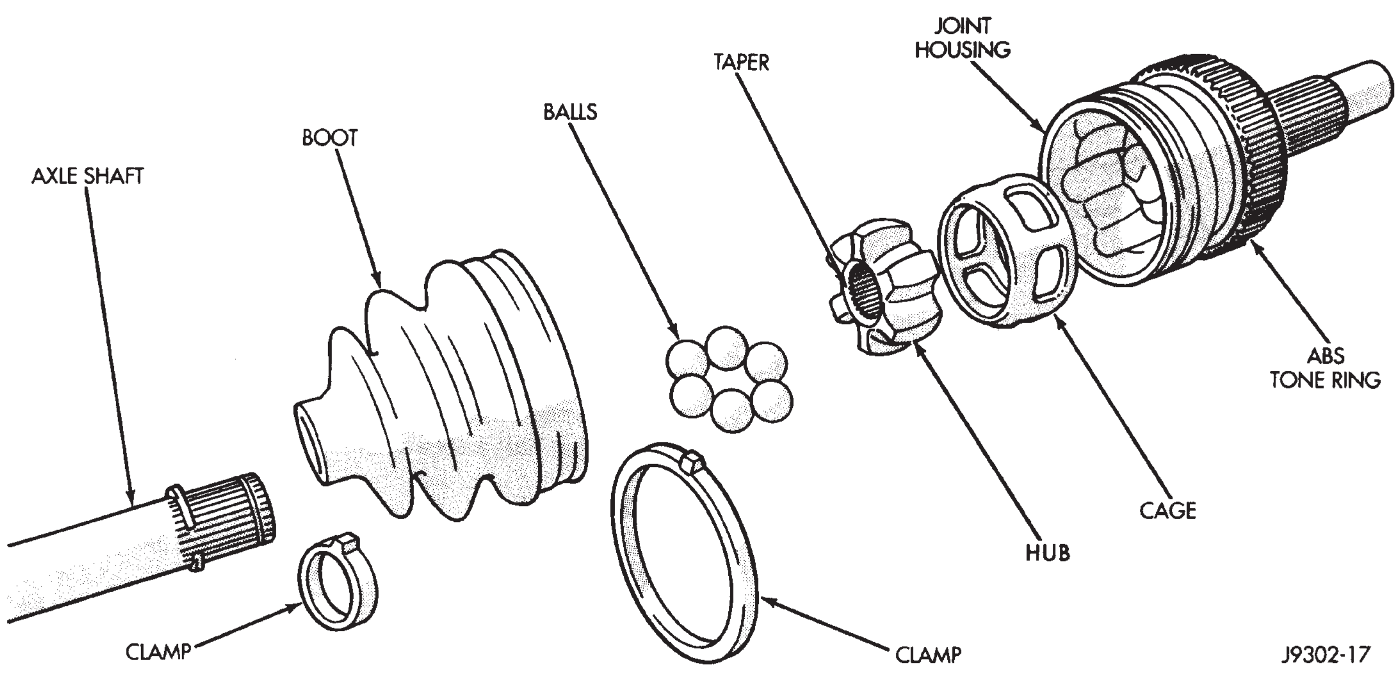

Fig. 10 CV Joint Components

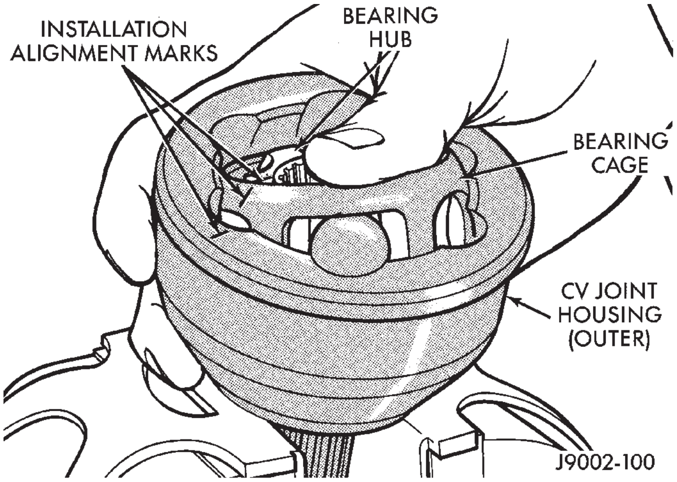

Fig. 12 Ball Access

(5) Place the stub shaft in a soft-jawed vise to avoid damage to the shaft splines.

(6) Press down on one side of the bearing cage/hub to tilt the cage. This will provide access to a ball at the opposite side of the cage. If the CV joint is tight, use a hammer and brass drift to loosen the bearing hub. **Do not hit the bearing cage with the drift.**

(7) Remove the ball from the bearing cage (Fig. 13). If necessary, a small pry bar can be used to pry the ball loose from the cage.

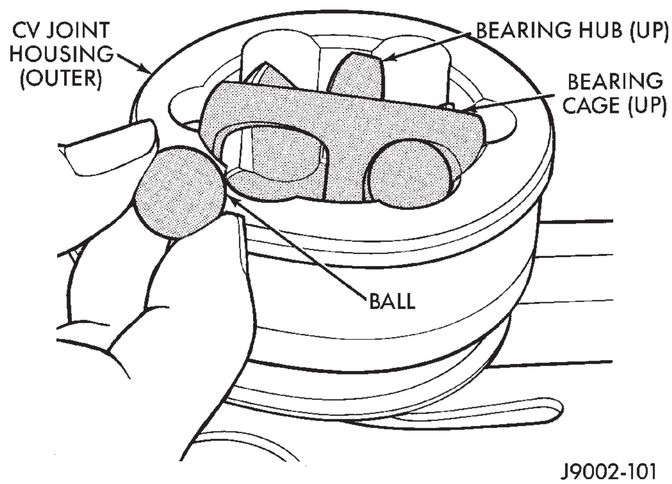

Fig. 13 Ball Removal

(8) Repeat the step above until all **six** balls are removed from the bearing cage.

(9) Tilt the bearing cage and hub to a vertical position to remove (Fig. 14).

(10) Insert one of the bearing hub lands into the adjacent cage window and roll it out of the cage (Fig. 15).

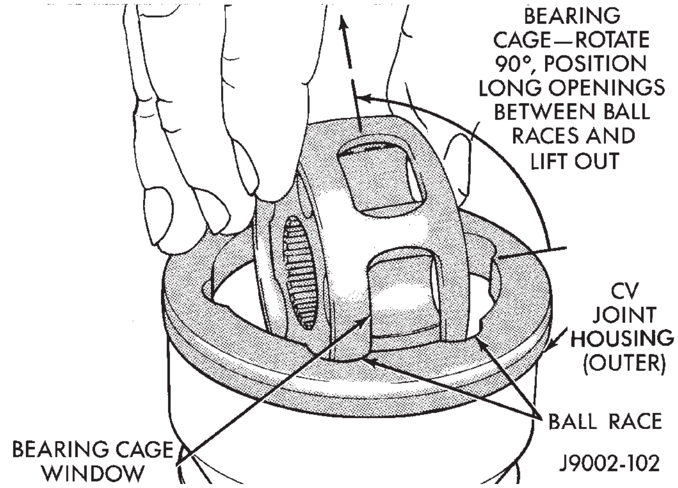

Fig. 14 Bearing Cage & Hub Removal

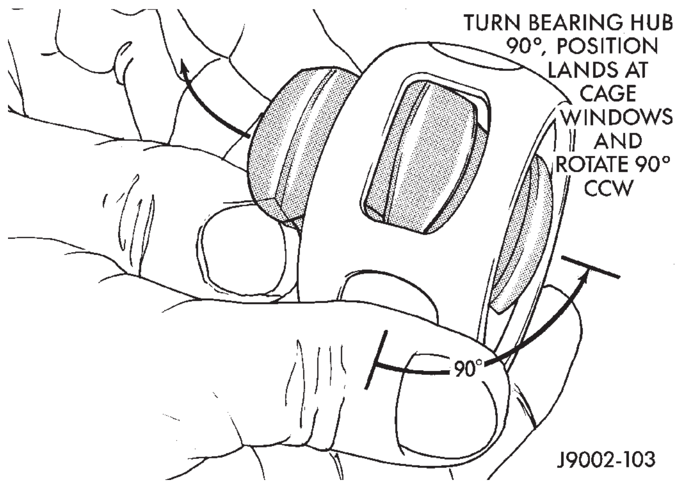

Fig. 15 Bearing Hub Removal

INSPECTION

Polished contact surface areas on raceways and bearing cage spheres are normal. If joint was noisy or vibrated it should be replaced.

(1) Inspect the lubricant for grit, dirt, water damage and metallic particles.

(2) Clean all the components with an appropriate solvent and dry them with compressed air.

(3) Inspect the ball raceways in the housing for excessive wear or scoring.

(4) Examine the stub shaft splines and threads for damage.

(5) Inspect the balls for pitting, cracks, scoring and excessive wear. A dull exterior surface is normal.

(6) Inspect the bearing cage for wear, grooves, ripples, cracks and chipping.

(7) Inspect the bearing hub for excessive wear and scoring on ball raceways.

ASSEMBLY

(1) Lightly apply lubricating oil to all joint components before assembling them.

(2) Align the bearing hub, cage and housing according to the alignment reference marks.

(3) Insert one of the bearing hub lands into a bearing cage window and roll it into the cage (Fig. 16). Rotate the bearing hub 90° to complete the installation (Fig. 17).

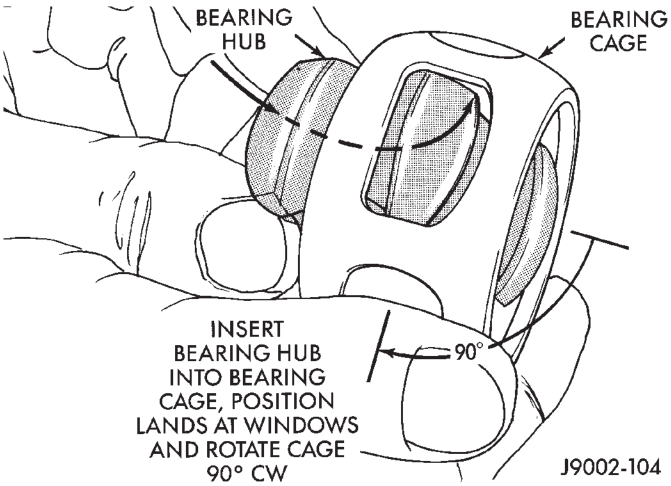

Fig. 16 Bearing Hub Installation

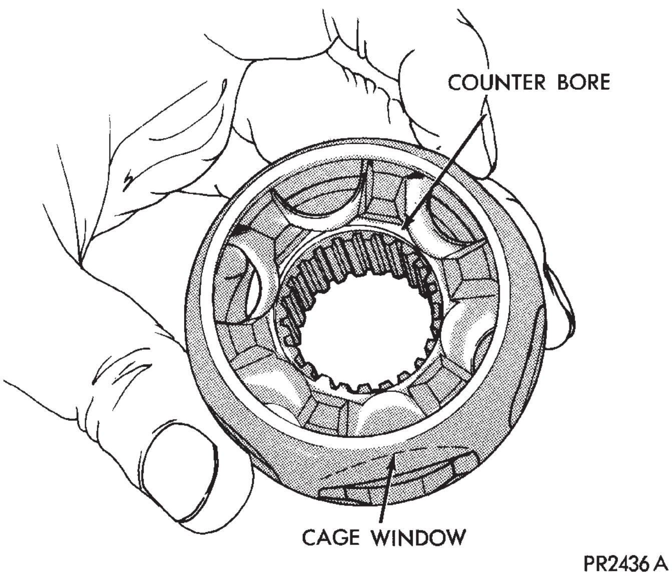

Fig. 17 Assembled Bearing Cage & Hub

(4) Insert bearing cage/hub into the housing (Fig. 18). Rotate the cage/hub 90° to complete the installation. **Ensure the tapered edge is facing outward (Fig. 19).**

(5) Apply the lubricant included with the replacement rubber boot to the ball raceways. Spread the lubricant equally between all the raceways. One packet of lubricant is sufficient to lubricate the joint.

(6) Tilt the bearing hub and cage and install the balls in the raceways (Fig. 20).

(7) Install the rubber boot on the axle shaft. Ensure the clamp sealing area is in the grooved section of the axle shaft. Install a new clamp.

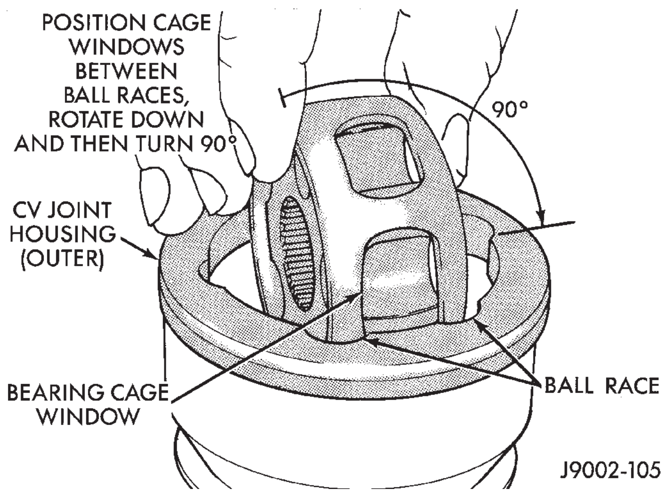

Fig. 18 Bearing Cage & Hub Installation

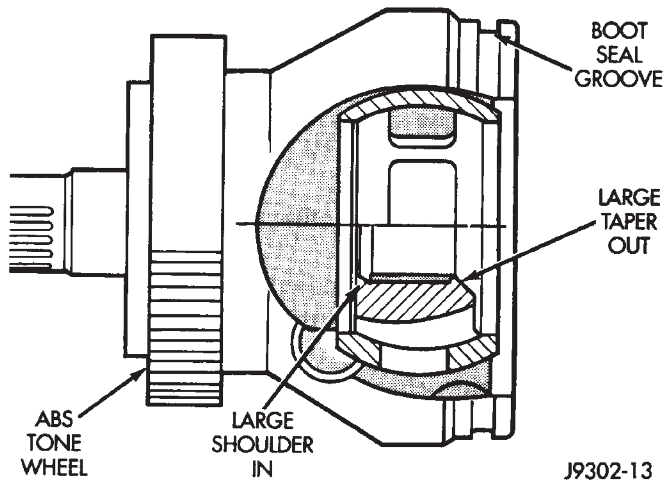

Fig. 19 Assembly Installed

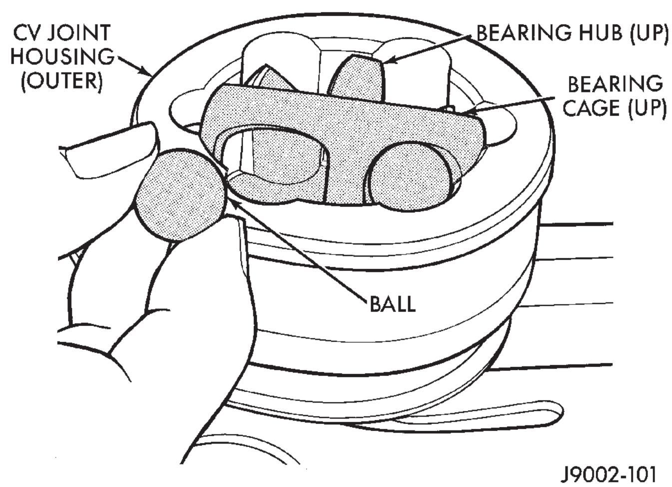

Fig. 20 Ball Installation In Raceway

(8) Engage the splines and install the joint onto the shaft. Tap sharply with mallet until seated (Fig. 21).

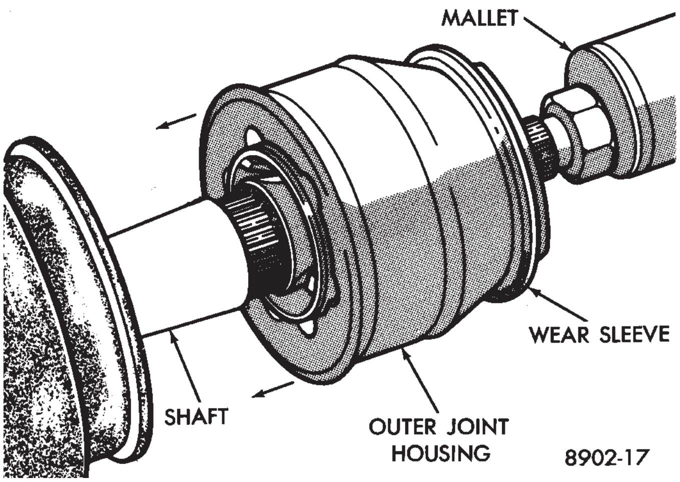

Fig. 21 Joint Installation

(9) Ensure that the snap ring is properly seated in the housing. Pull the outer CV joint from the shaft to test, it should not come off.

(10) Install remaining amount of lubricant to cage and balls.

(11) Place the large diameter end of the rubber boot over the edge of the housing. **Ensure that the boot is not twisted.**

(12) Ensure the clamp sealing area is in the grooved section of the housing. Install a new clamp.

(13) Install the axle shaft, refer to Hub Bearing and Axle Shaft installation.

STEERING KNUCKLE AND BALL STUDS

Ball Stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball stud requires use of Tool Kit 6289 (J34503-A).

KNUCKLE REMOVAL

(1) Remove hub bearing and axle shaft. Refer to the Removal procedures in this Group.

(2) Remove tie-rod or drag link end from the steering knuckle arm. Remove the ABS sensor wire and bracket from knuckle.

(3) Remove the cotter pin from the upper ball stud nut. Remove the upper and lower ball stud nuts.

(4) Strike the steering knuckle with a brass hammer to loosen. Remove knuckle from axle tube yokes (Fig. 22).

UPPER BALL STUD REPLACEMENT

(1) Position tools as shown to remove and install ball stud (Fig. 23).

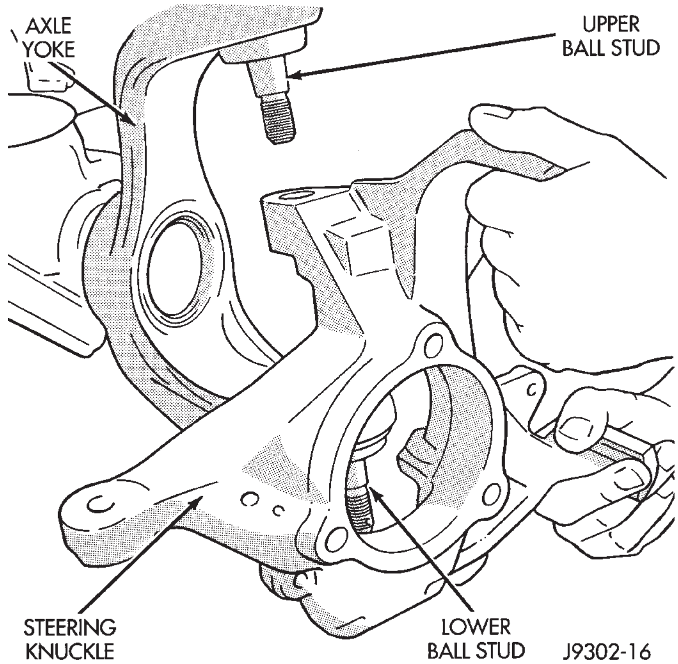

Fig. 22 Steering Knuckle Removal/Installation

LOWER BALL STUD REPLACEMENT

(1) Position tools as shown to remove and install ball stud (Fig. 24).

KNUCKLE INSTALLATION

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

(2) Install and tighten the bottom retaining nut to 108 N·m (80 ft. lbs.) torque. Install new cotter pins.

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

(4) Install the Hub Bearing and Axle Shaft. Refer to the installation procedure.

(5) Install tie-rod or drag link end onto the steering knuckle arm. Install the ABS sensor wire and bracket to the knuckle, refer to Group 5, Brakes for proper set-up.

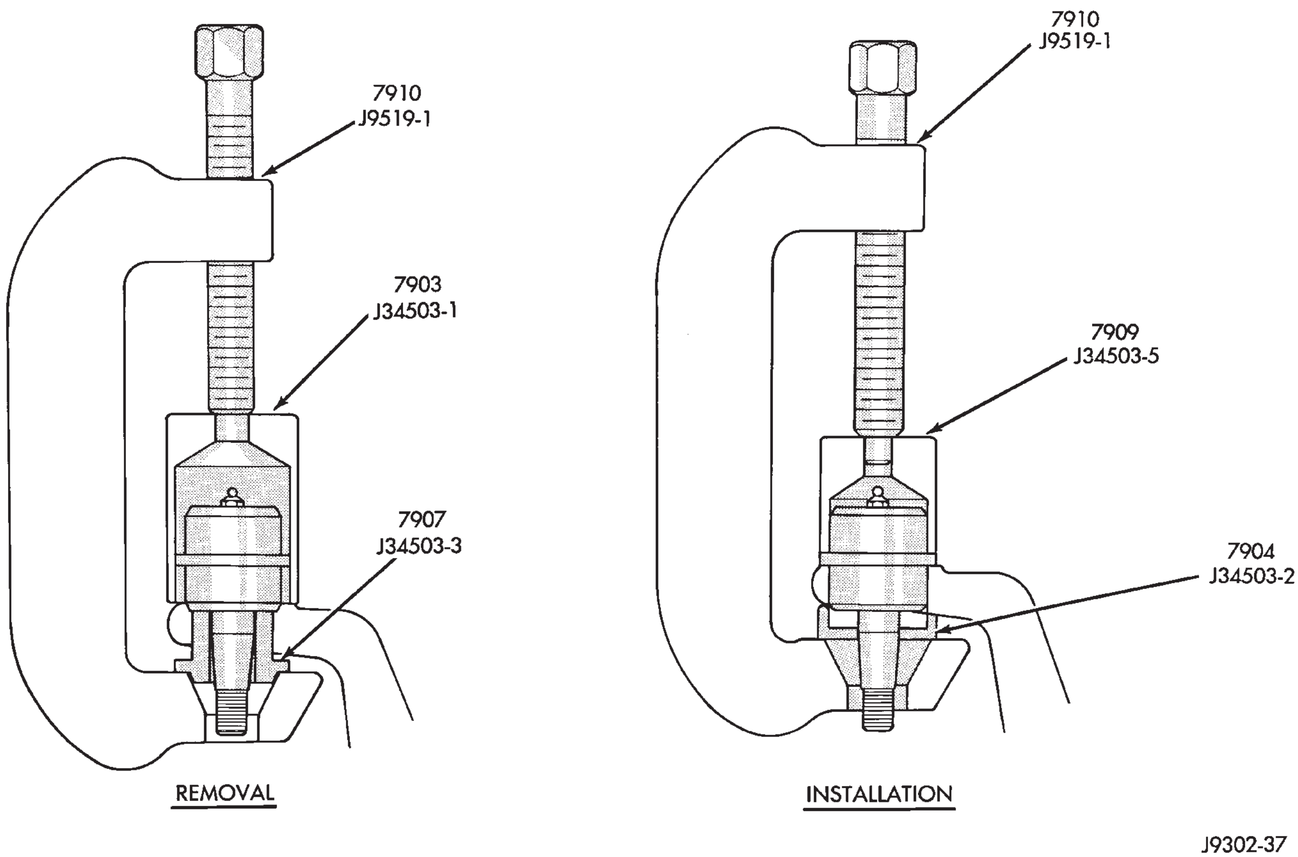

Fig. 23 Upper Ball Stud Remove/Install

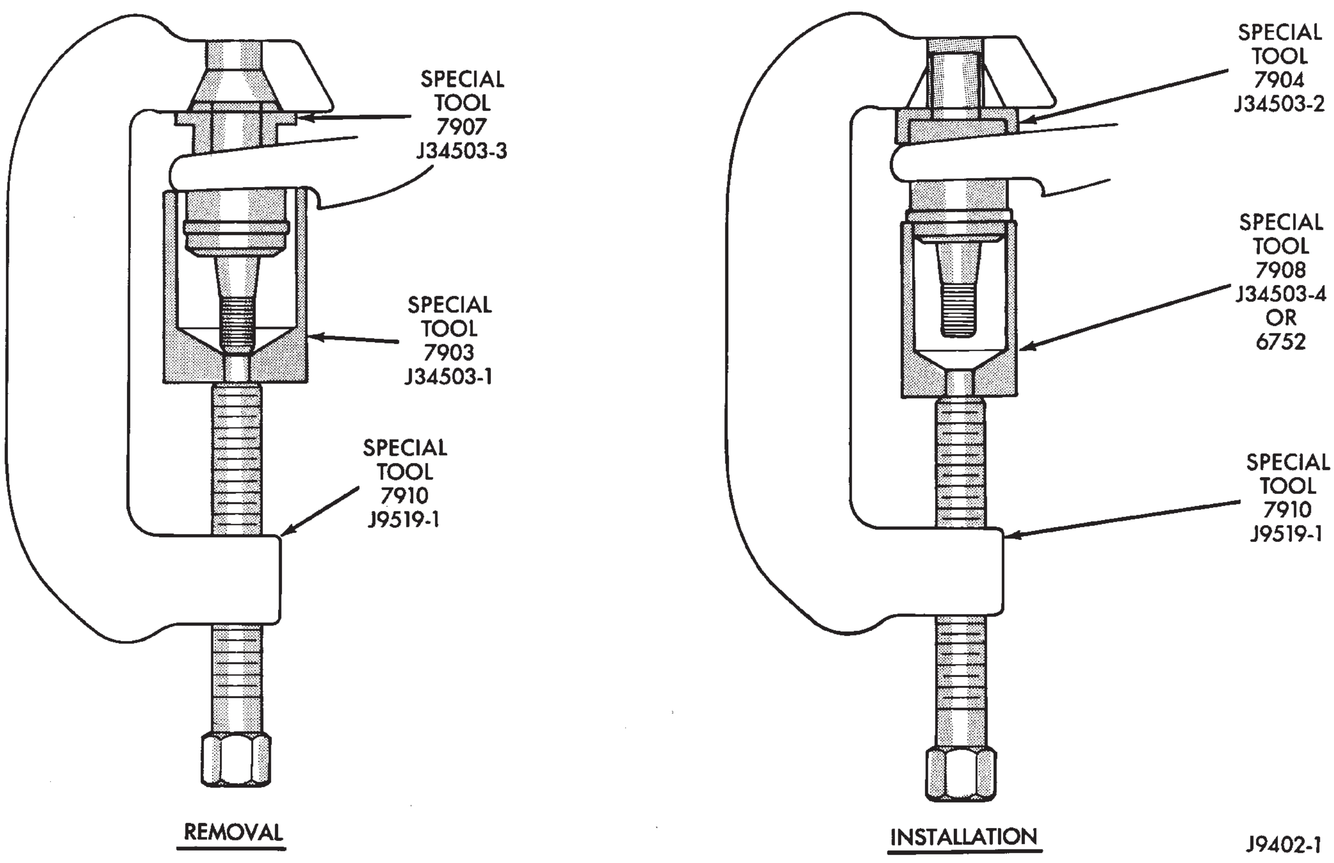

Fig. 24 Lower Ball Stud Remove/Install

AXLE BUSHING REPLACEMENT

Refer to Axle Bushing Replacement in the Front Suspension section.

DIFFERENTIAL REMOVAL

To service the differential the axle shafts must be removed. Refer to the removal procedures in this Group.

(1) **Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 25).**

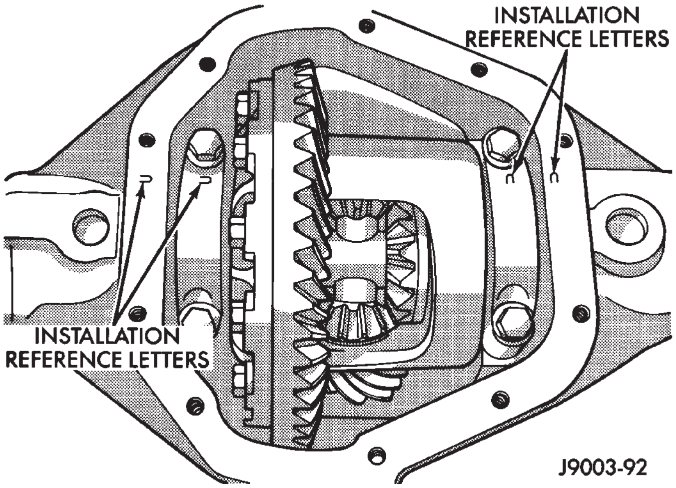

Fig. 25 Bearing Cap Identification

(2) Remove the differential bearing caps.

(3) Position Spreader W-129B with the tool dowel pins seated in the locating holes (Fig. 26). Install the holddown clamps and tighten the tool turnbuckle finger-tight.

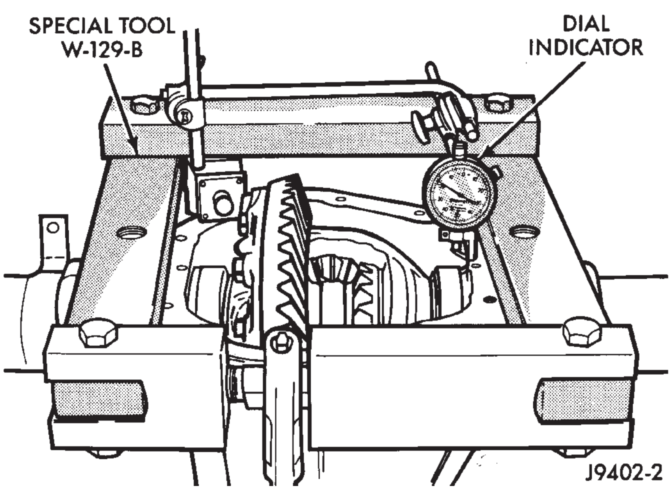

Fig. 26 Spread Differential Housing

(4) Install a pilot stud at the left side of the differential housing. Attach Dial Indicator to housing pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 26) and zero the indicator.

CAUTION: Do not spread over 0.38 mm (0.015 in.). If the housing is spread too much, it could be distorted or damaged.

(5) Separate the housing a maximum of 0.38 mm (0.015 in.). Measure the distance with the dial indicator (Fig. 26).

(6) Remove the dial indicator.

(7) Pry the differential case loose from the housing. To prevent damage, pivot on housing with the end of the pry bar against spreader (Fig. 27).

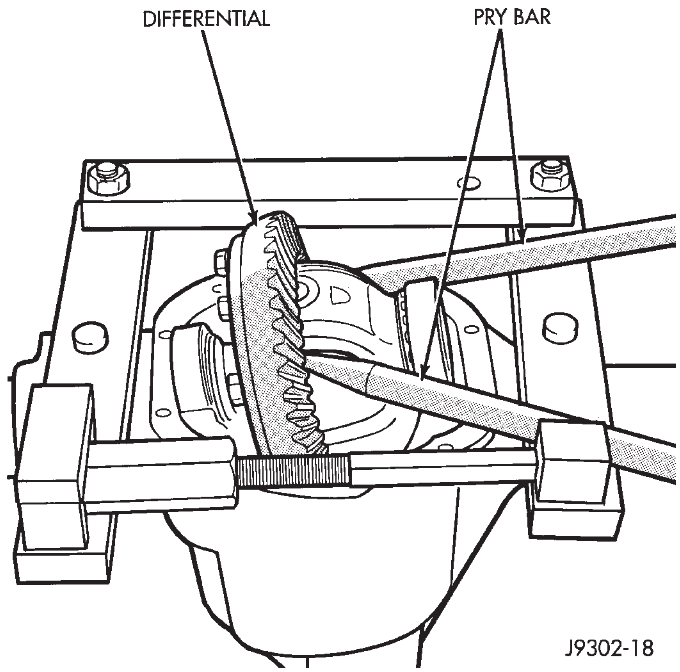

Fig. 27 Differential Removal

(8) Remove the case from housing. Mark or tag bearing cups indicating which side they were removed. Remove spreader from housing.

AXLE SHAFT OIL SEALS

(1) Remove the inner axle shaft seals with a pry bay.

(2) Install oil seals with Discs 6798 and Turnbuckle 6797 (Fig. 28). Tighten tool until disc bottoms in housing.

DIFFERENTIAL DISASSEMBLY

(1) Remove the bearings from the differential case with Press C-293PA, Plug C-293-3, Adapter C-293-39 (Fig. 29).

Place adapter rings so they do not damage the bearing cage.

(2) Remove bearing shims from case hubs and mark them (with hub identity) for assembly reference. Record the thickness of the shims.

(3) Clamp the differential case in a vise equipped with soft jaws. Remove **and discard** the ring gear

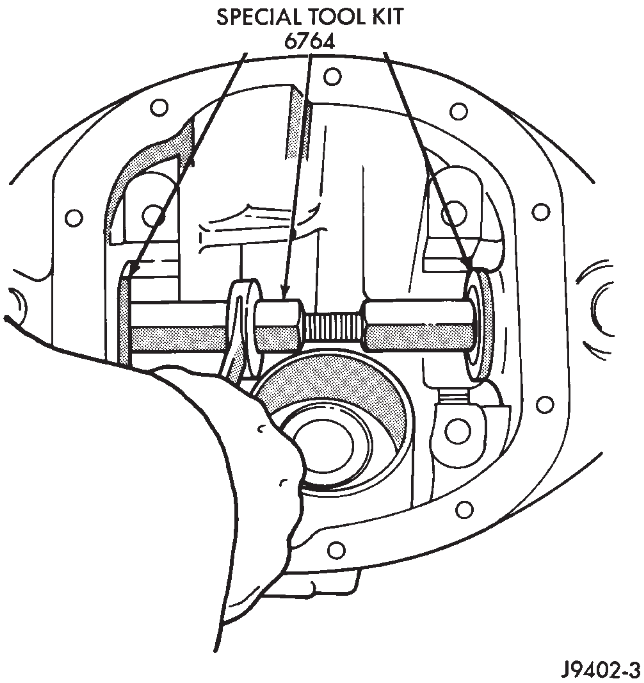

Fig. 28 Axle Shaft Oil Seal Installation

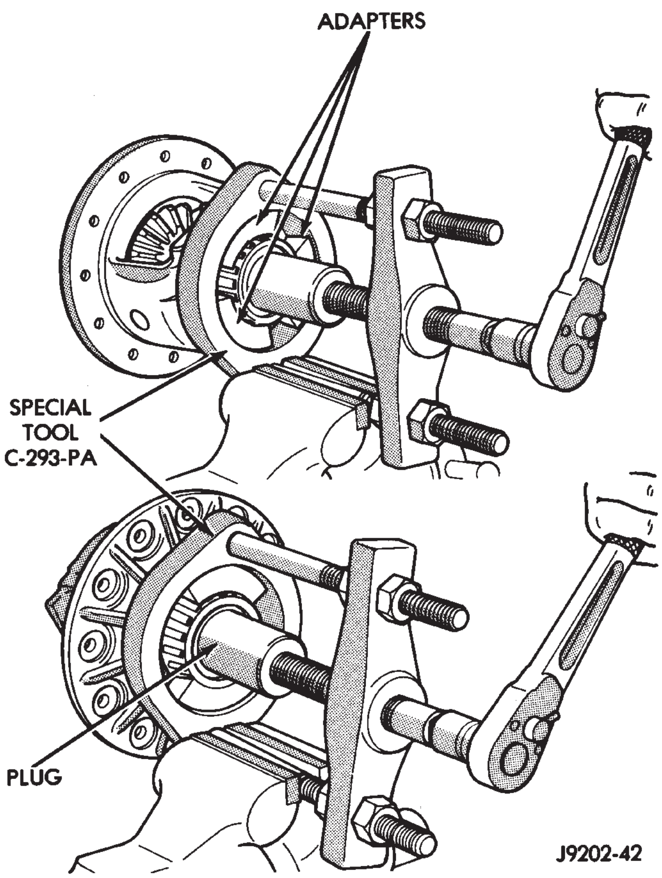

Fig. 29 Differential Bearing Removal

bolts. Tap the ring gear with a rawhide or plastic mallet and remove (Fig. 30).

(4) Use a drift to remove the pinion gear mate shaft lock pin (Fig. 31).

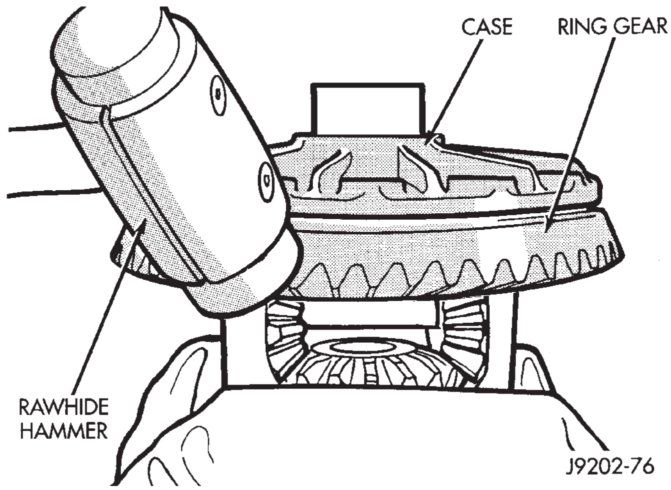

Fig. 30 Ring Gear Removal

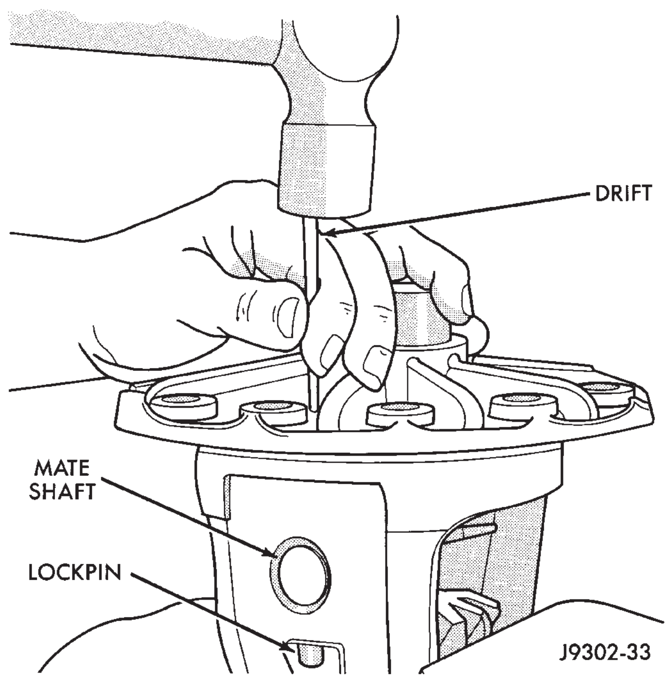

Fig. 31 Mate Shaft Lock Pin Removal

(5) Remove the mate shaft with a drift and hammer (Fig. 32).

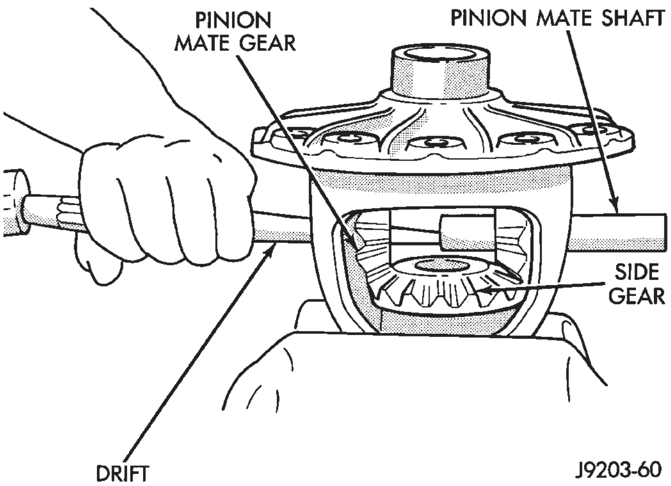

Fig. 32 Mate Shaft Removal

(6) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 33).

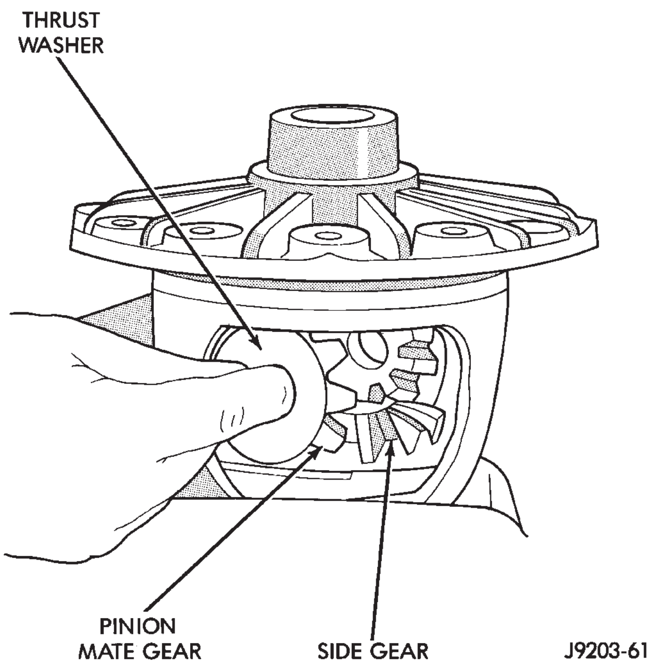

Fig. 33 Pinion Mate Gear Removal

(7) Remove the differential side gears and thrust washers.

(8) Remove the case from the vise.

PINION REMOVAL/DISASSEMBLY

(1) Remove the pinion yoke nut and washer. Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 34).

(2) Drive out pinion gear from housing with rawhide or plastic hammer (Fig. 35). Catch the pinion with your hand to prevent it from falling and being

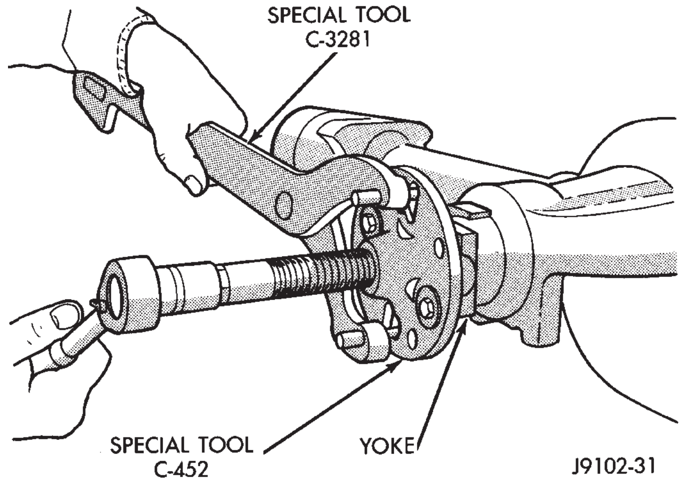

Fig. 34 Pinion Yoke Removal

damaged. **This will damage the front bearing rollers and bearing cup. The front bearing and cup must be replaced.**

(3) Remove the pinion gear seal with a slide hammer or pry out with bar.

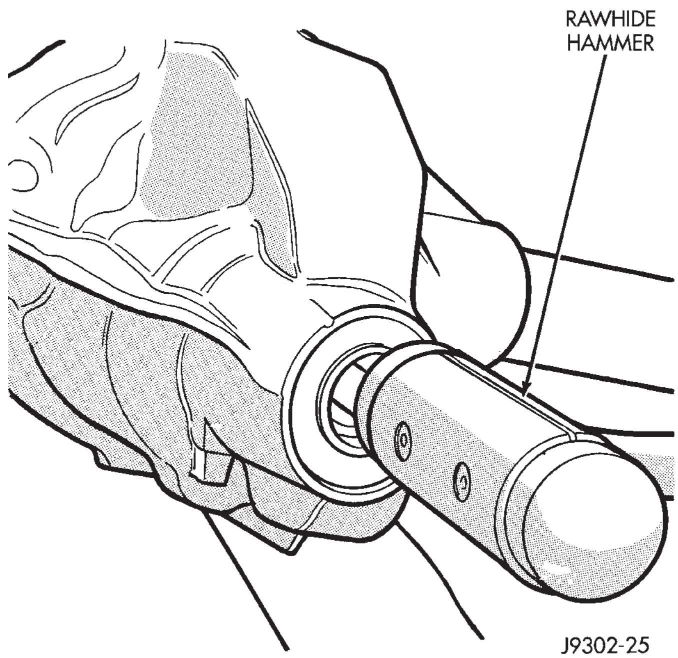

Fig. 35 Remove Pinion Gear

(4) Remove oil slinger, front bearing.

(5) Remove the front pinion bearing cup and seal with Remover D-147 and Handle C-4171 (Fig. 36).

(6) Remove the rear bearing cup from housing with Remover D-149 and Handle C-4171 (Fig. 37).

(7) Remove the collapsible preload spacer (Fig. 38).

(8) Remove the inner bearing from the pinion with Puller C-293PA and Adapter C-293-39 (Fig. 39).

Place adapter rings so they do not damage the bearing cage.

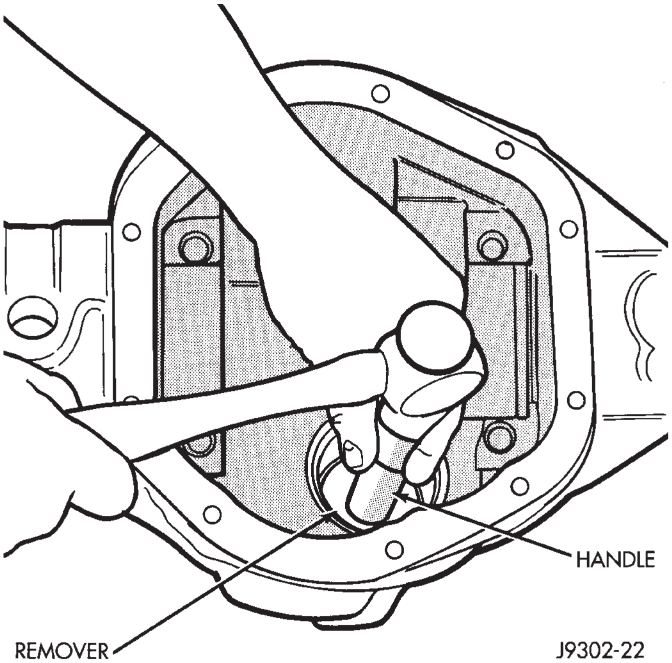

Fig. 36 Front Bearing Cup Removal

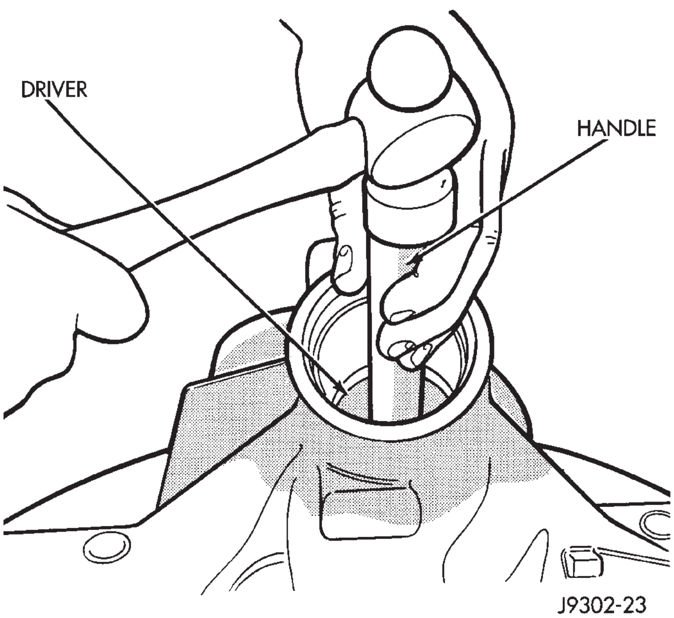

Fig. 37 Rear Bearing Cup Removal

(9) Remove the oil slinger (select thickness-production) from the pinion gear shaft. **Record the thickness of slinger.**

CLEANING/INSPECTION

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry, do spin dry bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

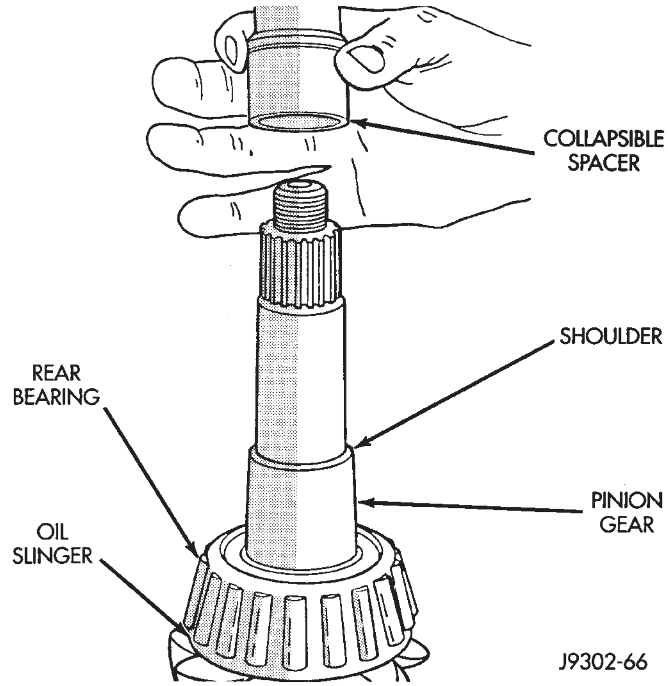

Fig. 38 Collapsible Spacer

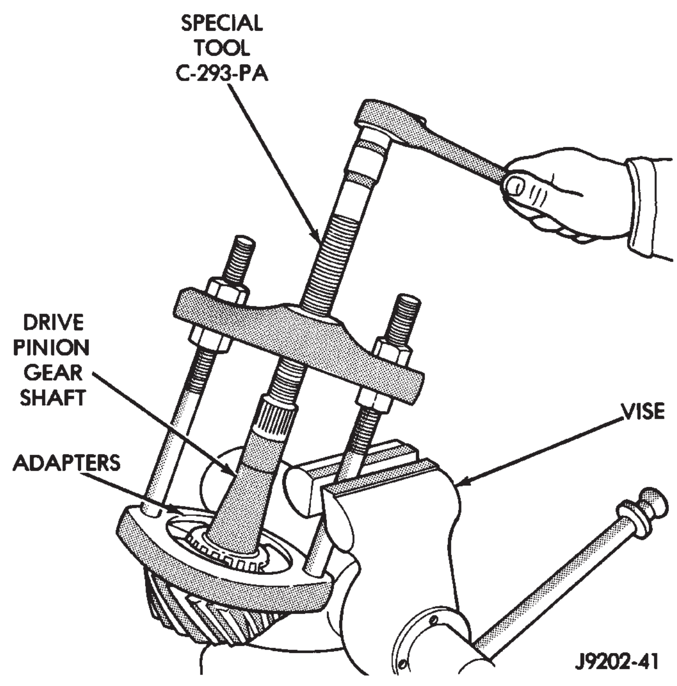

Fig. 39 Inner Bearing Removal

Clean the axle shaft tubes with a stiff wire brush or clean cloth.

Inspect the components for;

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces
- Bearing cups must not be distorted or cracked
- Machined surfaces should be smooth and without any raised edges

• Raised metal on shoulders of cup bores should be removed with a hand stone
• Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
• Ring and pinion gear for worn and chipped teeth
• Ring gear for damaged bolt threads. Replaced as a matched set only.
• Pinion yoke for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
• Preload shims for damage and distortion. Install new shims if necessary.

DIFFERENTIAL ASSEMBLY

(1) Install the following components in the differential case.
• Differential side gears and thrust washers
• Pinion gears and thrust washers
• Pinion gear mate shaft (align holes in shaft and case)

(2) Install and seat the locking roll pin in the differential case and mate shaft with a punch and hammer (Fig. 40). Peen metal part of case over pin in two places a 180 degrees apart.

If replacement gears and thrust washers were installed, it is not necessary to measure the gear backlash. Correct fit is due to close machining tolerances during manufacture.

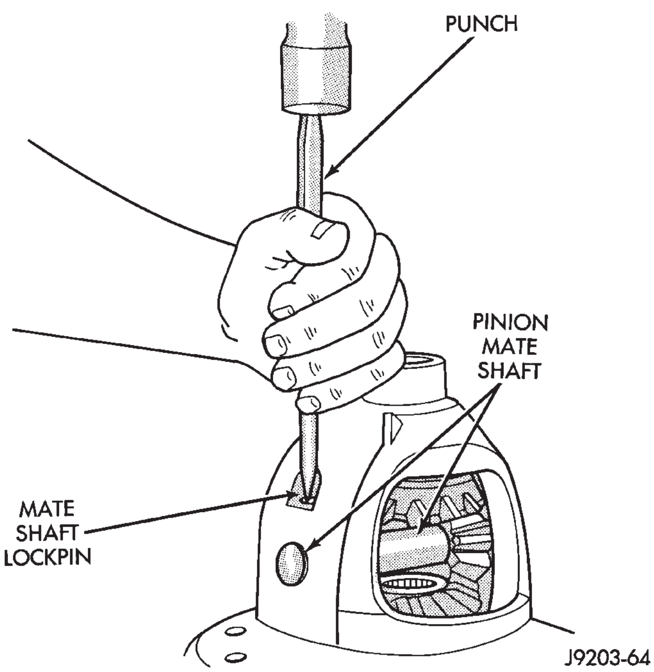

Fig. 40 Mate Shaft Pin Installation

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

(4) Install new ring gear bolts and alternately tighten to 95-122 N·m (70-90 ft. lbs.) torque (Fig. 41).

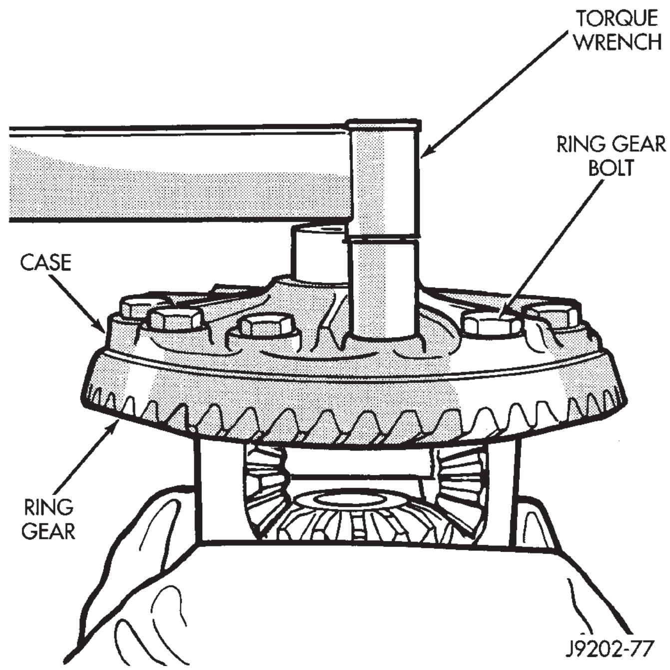

Fig. 41 Ring Gear Bolt Installation

(5) Lubricate all differential components with a light coat of grease or hypoid gear lubricant.

PINION GEAR DEPTH INFORMATION

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 42). A plus (+) number, minus (-) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the centerline of the ring gear to the back face of the pinion is 92.1 mm (3.625 inches) for Model 30 axles (Fig. 43). The standard depth provides the best teeth contact pattern.

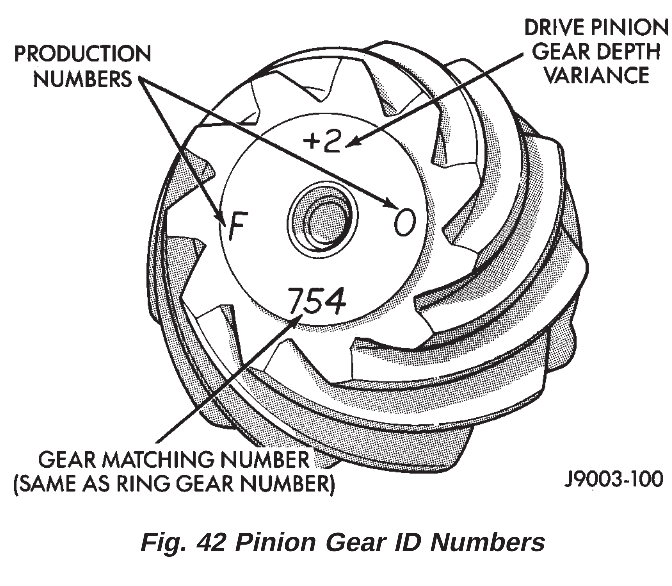

Fig. 42 Pinion Gear ID Numbers

THE BUTTON END ON THE PINION GEAR HEAD IS NO LONGER A MACHINED-TO-SPECIFICATIONS SURFACE. DO NOT USE THIS SURFACE FOR PINION DEPTH SET-UP OR CHECKING (Fig. 43).

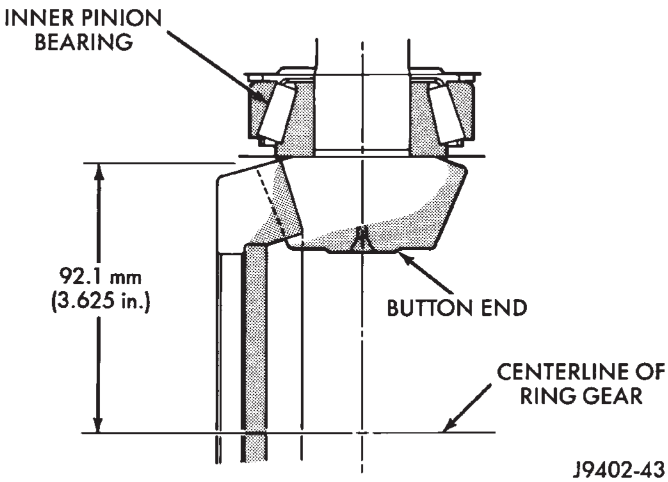

Fig. 43 Pinion Gear Head

Compensation for depth variance is achieved by a selected thickness oil slinger (production) or shims (service). The slinger is placed between the inner pinion bearing cone and gear head (Fig. 44). The shim pack is placed under the inner (rear) bearing cup. To change the pinion adjustment, shims are available in thicknesses of 0.003, 0.005, and 0.010 inch. **If equipped, the oil slinger or baffle must be measured and the thickness included with the total shim pack.**

If a new gear set is being installed, note the number etched into both pinion gears. Add or subtract the thickness of original depth shims to compensate for the difference in depth variances. Refer to the Depth Variance charts.

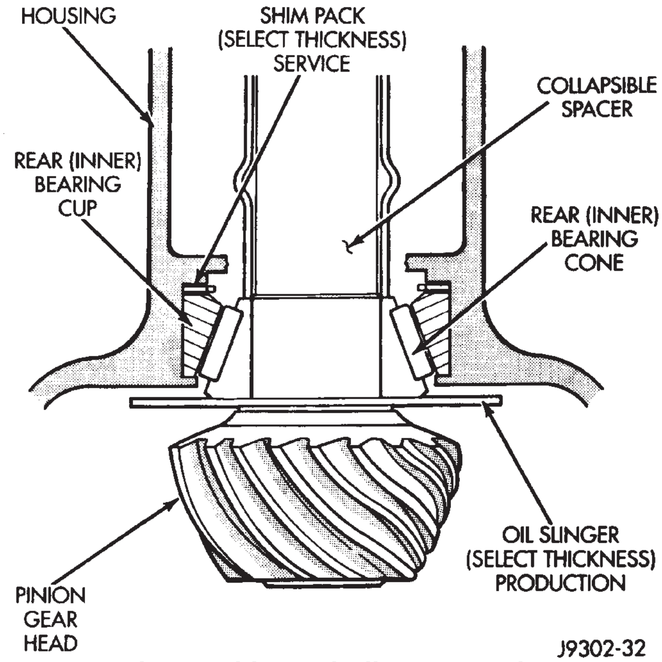

Fig. 44 Shim and Slinger Location

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

For example, if old pinion is plus (+) 1 and the new pinion is minus (-) 3, intersecting figure is (+) 0.004 inch (0.10 mm). Add this amount to the original shim. Or if the old pinion is (-) 3 and the new pinion is (-) 2, intersecting figure is (-) 0.001 inch (0.025

PINION GEAR DEPTH VARIANCE

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

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mm). Subtract this amount from original shim. Refer to the Pinion Gear Depth Variance Chart.

DIFFERENTIAL AND PINION MEASUREMENT

DIFFERENTIAL ZERO END PLAY MEASUREMENT

(1) Place Master Differential Bearing D-134 (D-348) on the case hubs (Fig. 45).

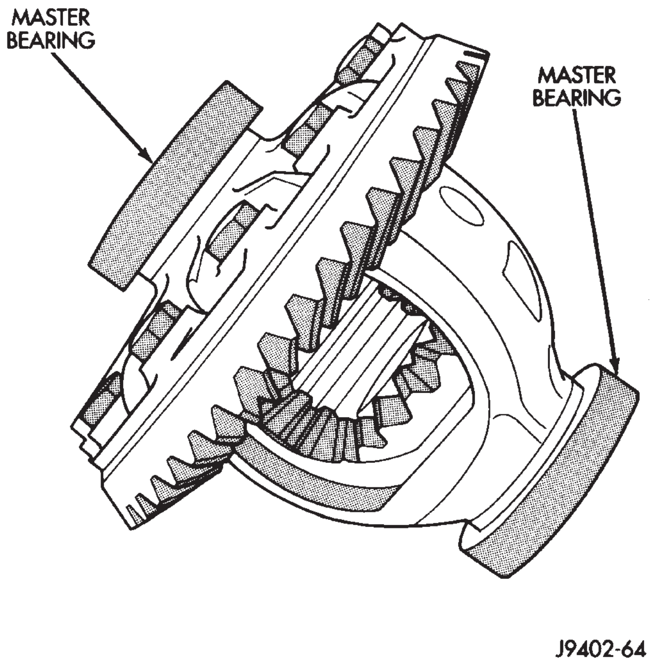

Fig. 45 Master Bearing Tools On Hubs

(2) Install a pilot stud at the right side of housing. Attach Dial Indicator to the pilot stud. Load indicator plunger against the back of the ring gear (Fig. 46).

(3) Insert a small pry bar between the bearing cap and left side of differential case. Pry the case as far as possible to right side (Fig. 46). Zero the dial indicator pointer.

(4) Pry the case to left side and **record** the travel distance.

The measurement above is the shim thickness necessary for case zero end-play. The total thickness will be determined during the ring gear backlash adjustment.

(5) Remove indicator and pilot stud.

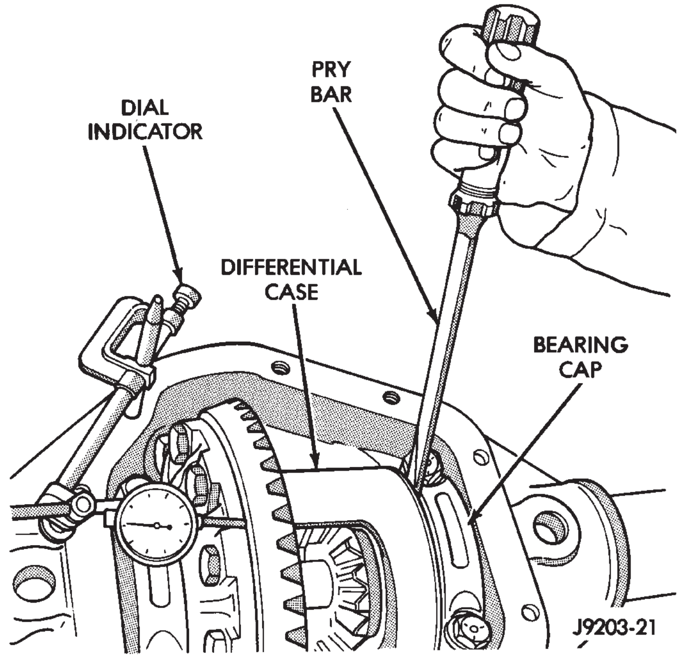

Fig. 46 Differential Case End Play Measurement

PINION GEAR DEPTH MEASUREMENT

Pinion gear depth measurement is necessary when;

- Axle housing or differential case is replaced
- Pinion select shim pack is unknown
- Ring and pinion gears are replaced

Measurements are done with pinion cups and pinion bearings installed in housing. Take measurements with Pinion Gauge Set 6774, Pinion Block 6733 and Dial Indicator C-3339 (Fig. 47).

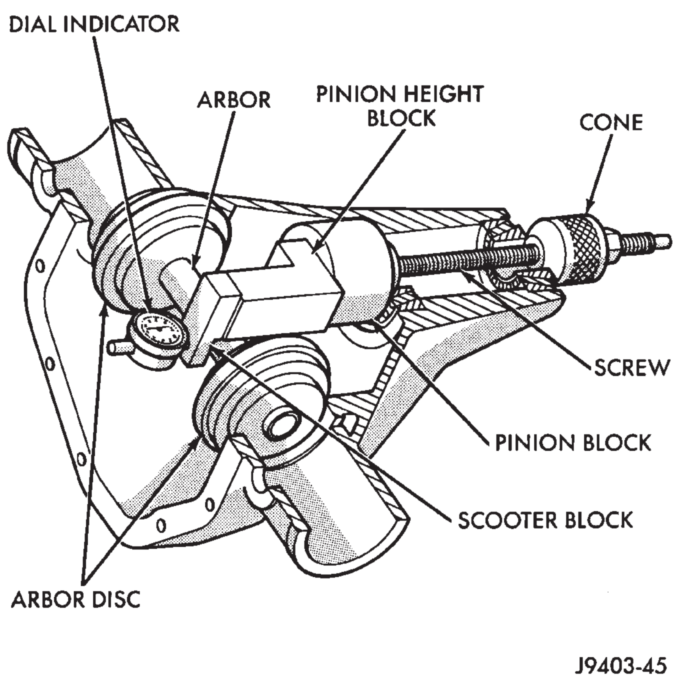

Fig. 47 Pinion Gear Depth Gauge Tools

(1) Assemble Pinion Gauge Set, Pinion Block and pinion bearings. Install assembly into differential pinion gear bore and hand tighten cone (Fig. 48).

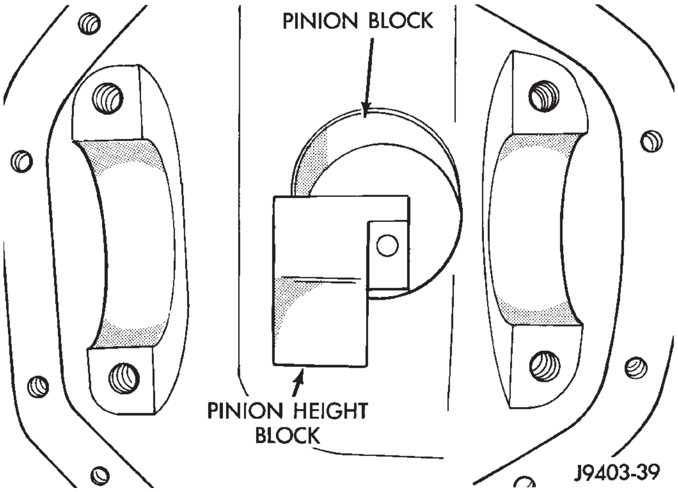

Fig. 48 Pinion Height Block

(2) Place Arbor Disc 6732 on Arbor D-115-3 and position in the bearing cradles (Fig. 49). Install differential bearing caps on Arbor Discs and tighten caps snug only.

Arbor Discs have different steps to fit other axle sizes. Pick correct size step for axle being serviced.

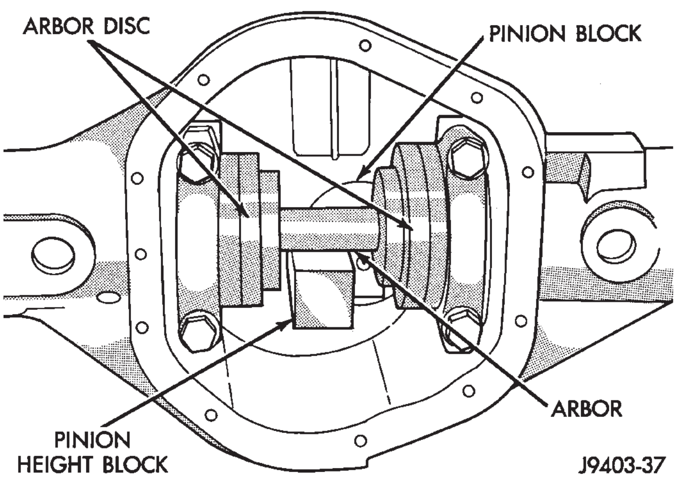

Fig. 49 Gauge Tools In Housing

(3) Firmly place Scooter Block and Dial Indicator on pinion height block tool and zero the dial indicator pointer.

(4) Slide the Scooter Block across the arbor while observing indicator (Fig. 50). Record the longest travel distance, whether inward (-) or outward (+), indicated by the pointer.

The plunger travel indicated, plus or minus the variance etched in the gear is the required thickness for the depth shims.

(5) Measure the thickness of each depth shim with a micrometer. Then combine the shims needed for to-

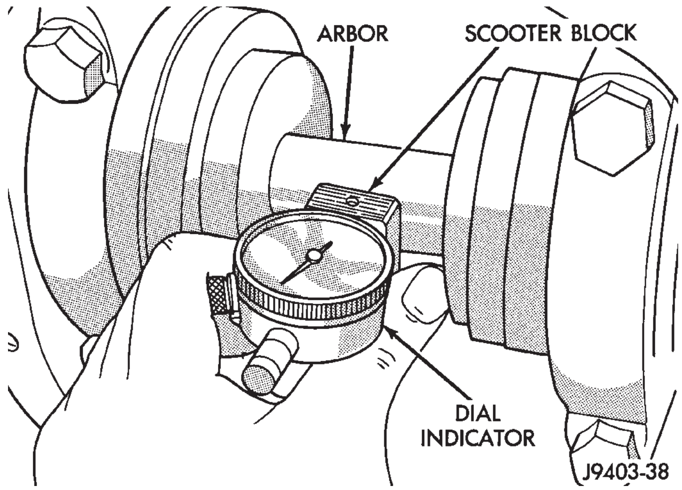

Fig. 50 Pinion Gear Depth Measurement

tal shim pack thickness. **Include oil slinger or baffle thickness with the total shim pack thickness.**

(6) Remove the measurement tools from the differential housing.

PINION GEAR ASSEMBLY/INSTALLATION

(1) Place the needed shim pack thickness in the pinion gear rear bearing bore (service only). Install the bearing cup with Installer D-146 and Driver Handle C-4171 (Fig. 51). Ensure cup is correctly seated.

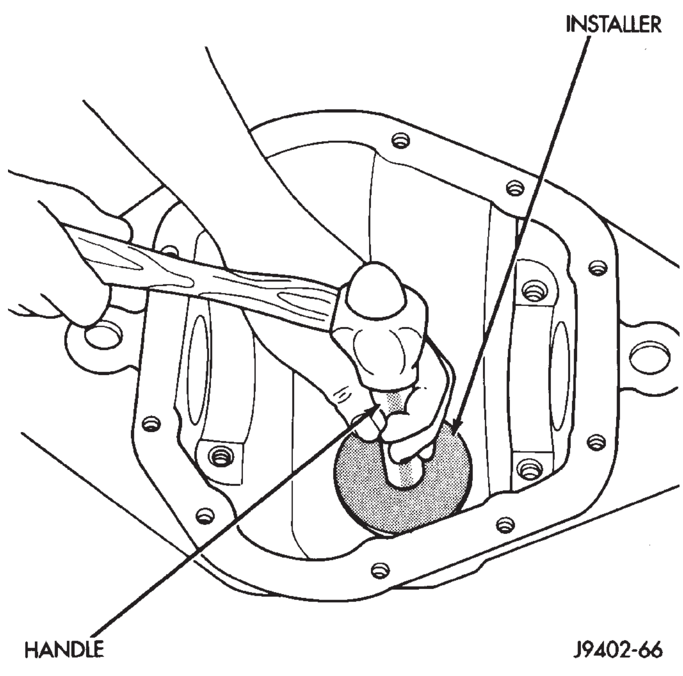

Fig. 51 Pinion Rear Bearing Cup Installation

(2) Install the pinion front bearing cup with Installer D-144 and Handle C-4171 (Fig. 52).

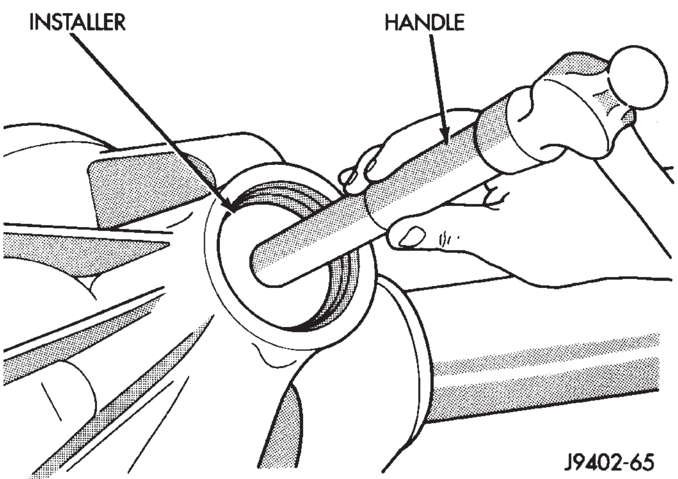

Fig. 52 Pinion Front Bearing Cup Installation

(3) If used, place the oil slinger on the pinion gear. Install the rear (inner) bearing on the pinion gear with Installer W-262 (Fig. 53).

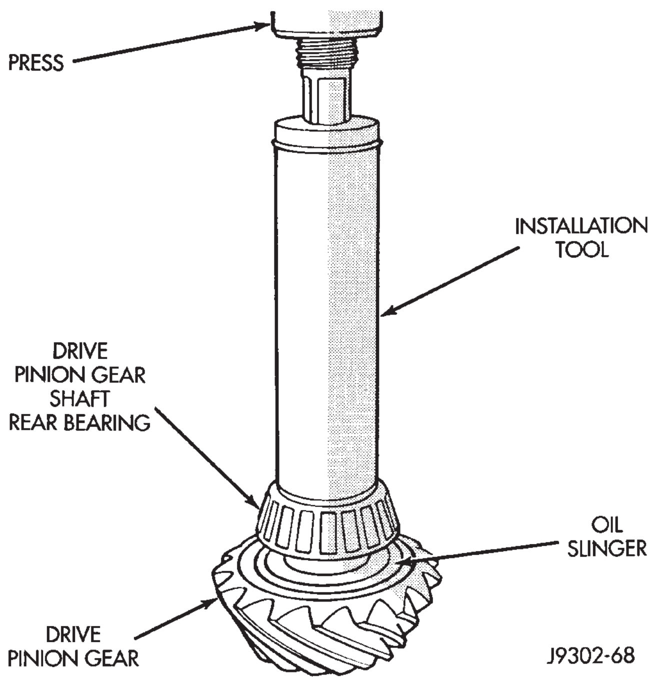

Fig. 53 Rear Bearing Installation

(4) Install a new collapsible preload spacer on pinion shaft. (Fig. 54).

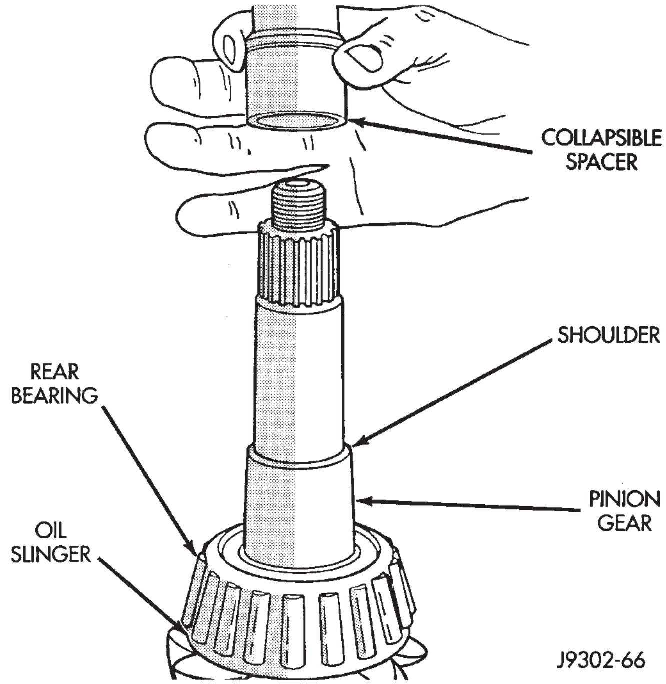

Fig. 54 Collapsible Preload Spacer

(5) Install pinion front bearing and oil slinger. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer D-163 and Handle C-4171 (Fig. 55).

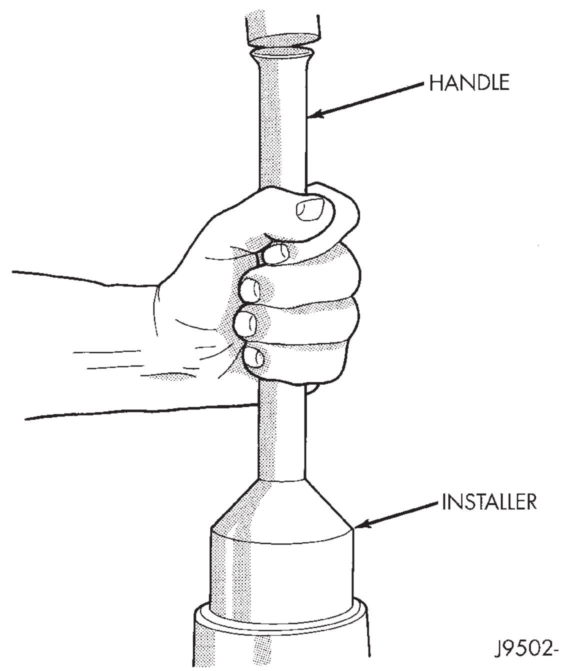

Fig. 55 Pinion Seal Installation

(6) Install pinion gear into differential housing.

(7) Install yoke with Installer W-162D and Wrench C-3281 (Fig. 56).

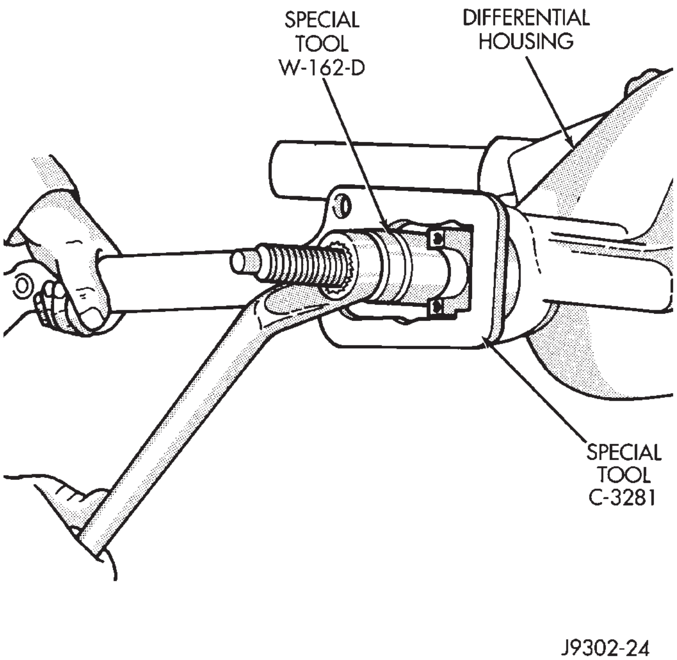

Fig. 56 Pinion Yoke Installation

(8) Install the yoke washer AND A NEW NUT on the pinion gear. **Tighten the nut to 216 N·m (160 ft. lbs.).**

CAUTION: Never loosen the pinion gear nut to decrease the pinion gear bearing preload torque. If the specified preload torque exceeds 352 N·m (260 ft. lbs.) a new collapsible spacer must be installed. The torque sequence will have to be repeated.

(9) Use Flange Wrench C-3281 to retain the yoke (Fig. 57). Slowly tighten the nut in small increments until the rotating torque is achieved. **Measure the preload torque frequently to avoid over-tightening the nut.**

(10) Check bearing preload torque with an inch pound torque wrench (Fig. 58). The torque necessary to rotate the pinion gear should be;

- Original Bearings: 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings: 1.5 to 4 N·m (15 to 35 in. lbs.).

DIFFERENTIAL SHIM PACK MEASUREMENT AND ADJUSTMENT

(1) Place Master Differential Bearing D-134 (D-348) on the case hubs.

(2) Place Differential assembly in the housing. Assemble Differential bearing caps.

(3) Install a pilot stud at the left side of housing. Attach Dial Indicator to housing. Load the indicator plunger against the back of the ring gear (Fig. 59).

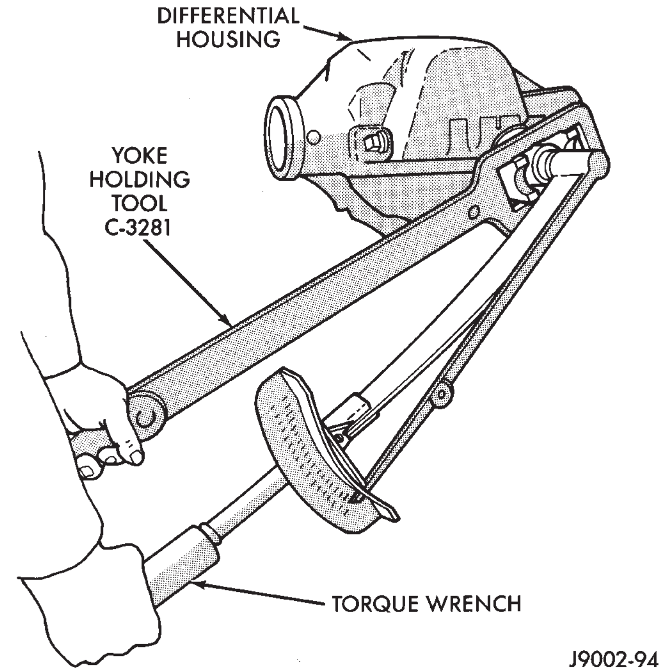

Fig. 57 Tightening Pinion Nut

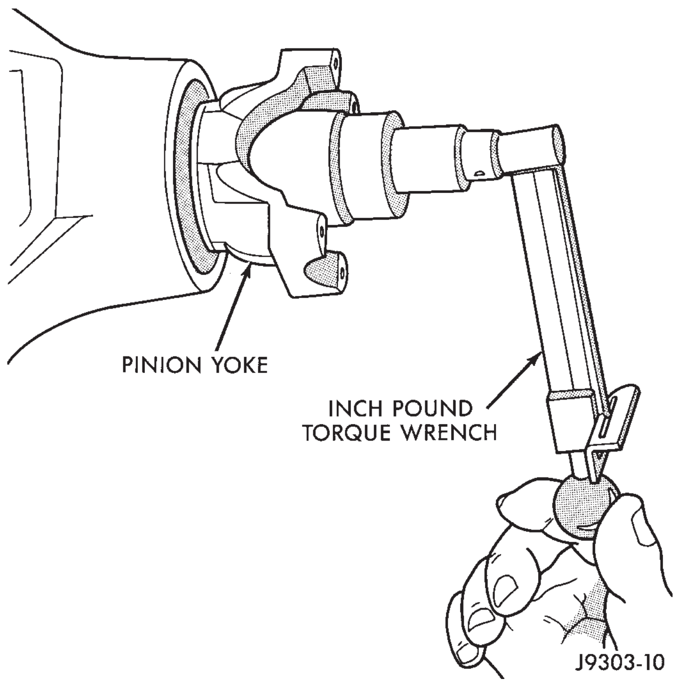

Fig. 58 Check Pinion Gear Torque

Ensure ring and pinion gear teeth are tightly meshed. Zero the indicator.

(4) Insert a small pry bar between the bearing cap and left side of differential case. Pry the case as far as possible to right side (Fig. 60). Zero the dial indicator pointer.

(5) Repeat the measurement several times to check consistency. Record the travel distance.

The measurement above shows shim thickness necessary to eliminate ring gear backlash. Subtract this thickness from case zero end-play

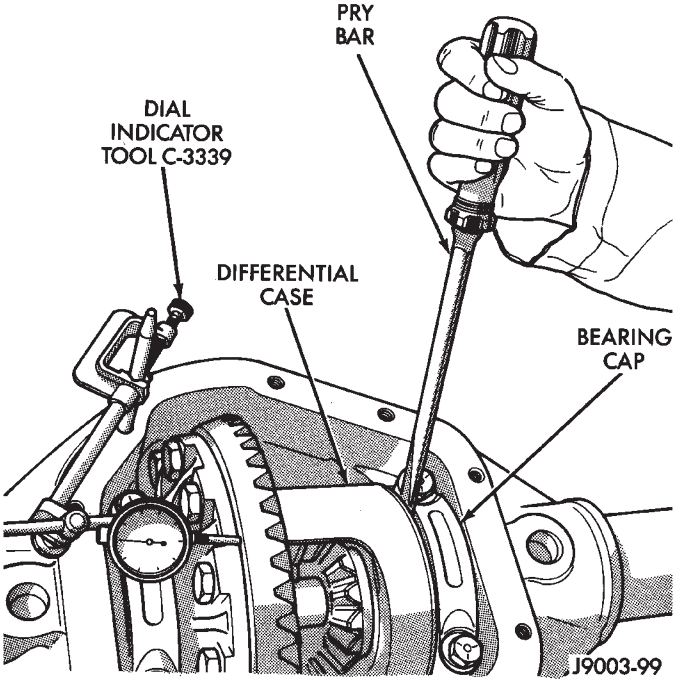

Fig. 59 Shim Pack Measurement

shim thickness (Fig. 60). The shims must be placed at the ring gear side between the case and bearing.

For Example:

Indicator Reading	LESS PINION	0.085 in.	total
Indicator Reading	WITH PINION	0.055 in.	total
BALANCE OF SHIM PACK		0.030 in.	total

Place BALANCE of shims at opposite side of ring gear

ADD an additional 0.015 in. shim to opposite side of ring gear for bearing preload

Ring Gear Side (Flange Side)	0.055 in.
Opposite Side	0.030 in.
Opposite Side Preload	0.015 in.
Total Opposite Side	0.045 in.

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Fig. 60 Shim Pack Calculations

(6) Remove indicator and pilot stud.

(7) Remove the differential case from housing.

(8) Remove the master bearing tools from the differential case hubs.

(9) Position the backlash shims (with determined thickness) on case hub (ring gear side). Install bearing on the hub with Bearing Installer C-3716A and Driver Handle C-4171 (Fig. 61).

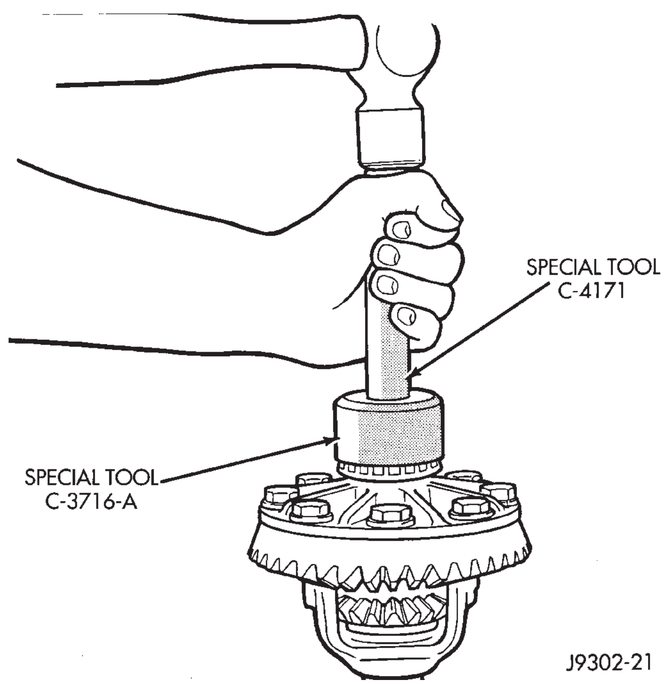


Fig. 61 Differential Bearing Installation

(10) Position the remaining zero end-play shims on hub at opposite side of case. Include an additional 0.015 in. (0.38 mm) thick shim on this hub. This will provide the required differential bearing preload.

(11) Install bearings on hubs with Installer C-3716A and Handle C-4171 (Fig. 61).

(12) Match each bearing cup with bearing (original). Install the cups on the bearings.

DIFFERENTIAL INSTALLATION

(1) Position Spreader W-129B with the tool dowel pins seated in the locating holes (Fig. 62). Install the holddown clamps and tighten the tool turnbuckle finger-tight.

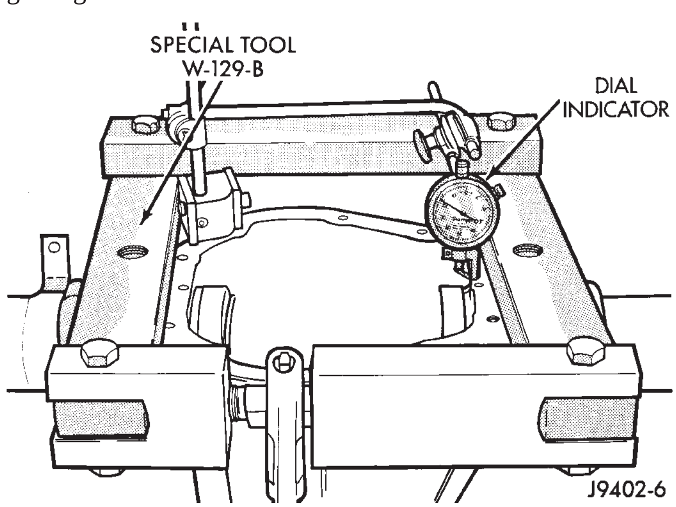


Fig. 62 Spread Differential Housing

(2) Install a pilot stud at the left side of the differential housing. Attach Dial Indicator to housing pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 63) and zero the indicator.

CAUTION: Do not spread over 0.38 mm (0.015 in). If the housing is over-separated, it could be distorted or damaged.

(3) Separate the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 62).

(4) Remove the dial indicator.

(5) Install case in the housing. Tap the differential case to ensure the bearings are fully seated. Remove the spreader.

(6) Install the bearing caps at their original locations. Tighten the bearing cap bolts to 61 N·m (45 ft. lbs.) torque.

BACKLASH AND CONTACT PATTERN ANALYSIS

(1) Rotate assembly several revolutions to seat bearings. Measure backlash at three equally spaced locations around the perimeter of the ring gear with a dial indicator (Fig. 63).

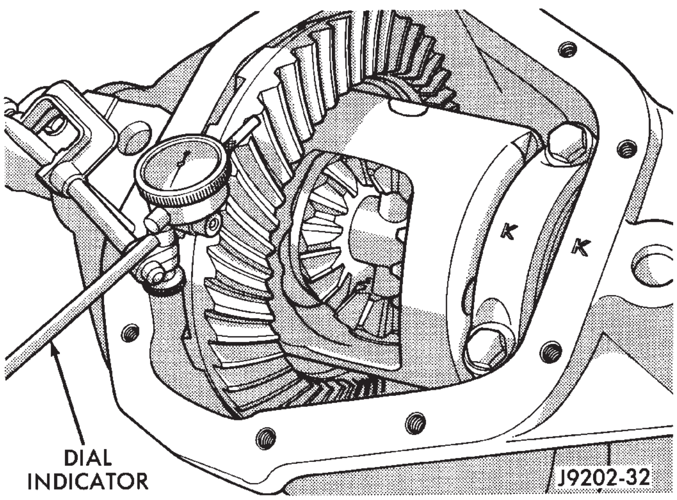


Fig. 63 Ring Gear Backlash Measurement

The ring gear backlash must be within 0.005 - 0.008 inch (0.12 - 0.20 mm). It cannot vary more than 0.002 inch (0.05 mm) between the points checked.

If backlash must be adjusted, transfer shims from one side of carrier to the other side. Adjust the backlash accordingly (Fig. 64). **DO NOT INCREASE THE TOTAL SHIM PACK THICKNESS, EXCESSIVE BEARING PRELOAD AND DAMAGE MAY OCCUR.**

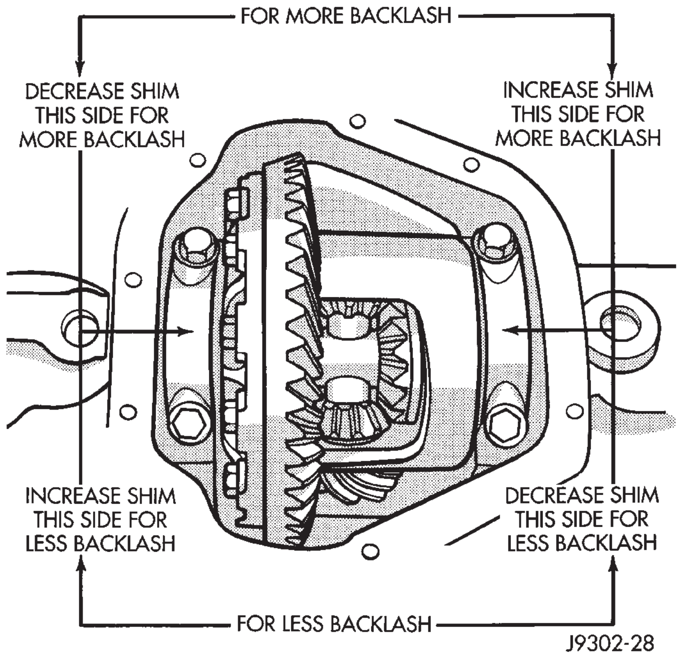


Fig. 64 Backlash Shim Adjustment

If the mesh and backlash steps have been followed in the procedures above, good gear teeth contact patterns should exist.

The ring gear teeth contact patterns will show if the pinion gear depth shim(s) have the correct thickness. It will also show if the ring gear backlash has been adjusted correctly. The backlash must be maintained within the specified limits until the correct tooth contact patterns are obtained.

(2) Apply a thin coat of **hydrated ferric oxide** to the drive and coast side of the ring gear.

(3) Rotate the ring gear several revolutions in both directions while a load is being applied. Insert a pry bar between the differential housing and the case flange. This action will produce distinct contact patterns on both the drive side and coast side of the ring gear teeth.

(4) Note patterns in compound. Refer to (Fig. 65) for interpretation of contact patterns and adjust accordingly.

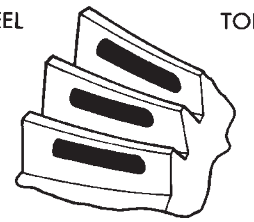
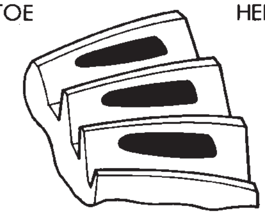
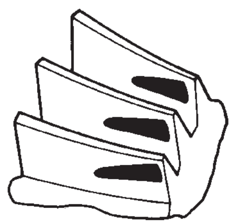
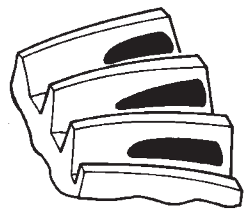
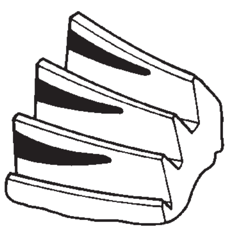
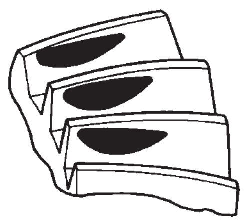
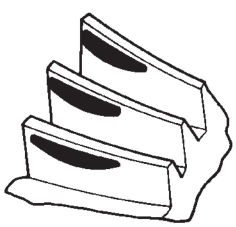
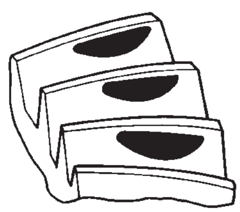
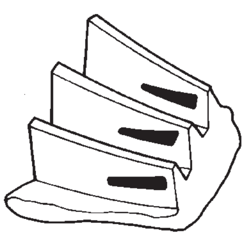
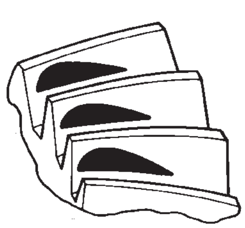
DRIVE SIDE OF RING GEAR TEETH	COAST SIDE OF RING GEAR TEETH	
HEEL TOE 	TOE HEEL 	DESIRABLE CONTACT PATTERN. PATTERN SHOULD BE CENTERED ON THE DRIVE SIDE OF TOOTH. PATTERN SHOULD BE CENTERED ON THE COAST SIDE OF TOOTH, BUT MAY BE SLIGHTLY TOWARD THE TOE. THERE SHOULD ALWAYS BE SOME CLEARANCE BETWEEN CONTACT PATTERN AND TOP OF THE TOOTH.
		RING GEAR BACKLASH CORRECT. **THINNER** PINION GEAR DEPTH SHIM REQUIRED.
		RING GEAR BACKLASH CORRECT. **THICKER** PINION GEAR DEPTH SHIM REQUIRED.
		PINION GEAR DEPTH SHIM CORRECT. **DECREASE** RING GEAR BACKLASH.
		PINION GEAR DEPTH SHIM CORRECT. **INCREASE** RING GEAR BACKLASH.

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Fig. 65 Gear Tooth Contact Patterns

FINAL ASSEMBLY

(1) Install the axle shafts. Refer to Axle Shaft Installation in this Group.

(2) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of MOPAR® Silicone Rubber Sealant on the housing cover (Fig. 66). **Allow the sealant to cure for a few minutes.**

Install the housing cover within 5 minutes after applying the sealant. If not installed the sealant must be removed and another bead applied.

(3) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts with 41 N·m (30 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(4) Refill the differential housing with the specified quantity of MOPAR® Hypoid Gear Lubricant.

(5) Install the fill hole plug and tighten to 34 N·m (25 ft. lbs.) torque.

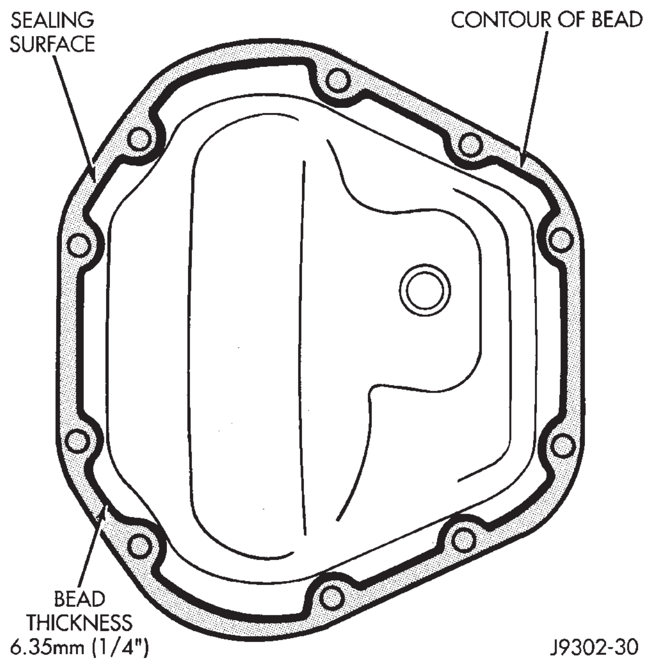

Fig. 66 Typical Housing Cover With Sealant

AXLE SPECIFICATIONS

MODEL 30 AXLE

Axle Type .... Hypoid
Lubricant .... SAE Thermally Stable 80W-90
Lube Capacity .... 1.18 L (2.5 pts.)
Axle Ratio 3.55 3.73
Differential
Bearing Preload .... 0.38 mm (0.015 in.)
Ring Gear
Diameter .... 18.09 cm (7.125 in.)
Backlash .... 0.12-0.20 mm (0.005-0.008 in.)
Pinion Std. Depth .... 92.1 mm (3.625 in.)
Pinion Bearing Preload Torque
Original Bearing .... 1-2 N·m (10-20 in. lbs.)
New Bearing .... 1.5-4 N·m (15-35 in. lbs.)

TORQUE SPECIFICATIONS

FRONT SUSPENSION COMPONENTS

DESCRIPTION	TORQUE
Shock Absorber	
Upper Nut	23 N·m (17 ft. lbs.)
Lower Nut	28 N·m (250 in. lbs.)
Suspension Arm Upper	
Nuts	75 N·m (55 ft. lbs.)
Suspension Arm Lower	
Nuts	115 N·m (85 ft. lbs.)
Stabilizer Bar	
Clamp Bolt	54 N·m (40 ft. lbs.)
Link Upper Nut	36 N·m (27 ft. lbs.)
Link Lower Bolt	95 N·m (70 ft. lbs.)
Track Bar	
Ball Stud Nut	81 N·m (60 ft. lbs.)
Axle Bracket Bolt	75 N·m (55 ft. lbs.)
Track Bar Bracket	
Bolts	121 N·m (90 ft. lbs.)
Nut	121 N·m (90 ft. lbs.)
Support Bolts	95 N·m (70 ft. lbs.)

MODEL 30 AXLE

DESCRIPTION	TORQUE
Fill Hole Plug	34 N·m (25 ft. lbs.)
Diff. Cover Bolt	41 N·m (30 ft. lbs.)
Bearing Cap Bolt	61 N·m (45 ft. lbs.)
Ring Gear Bolt	95-122 N·m (70-90 ft. lbs.)
Axle Nut	237 N·m (175 ft. lbs.)
Wheel Brg. Bolt	102 N·m (75 ft. lbs.)
Lower Ball Stud	108 N·m (80 ft. lbs.)
Upper Ball Stud	101 N·m (75 ft. lbs.)
ABS Sensor Bolt	11 N·m (96 in. lbs.)

REAR SUSPENSION AND AXLES

CONTENTS

GENERAL INFORMATION

REAR SUSPENSION

The Grand Cherokee rear suspension is link/coil design comprised of (Fig. 1);

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

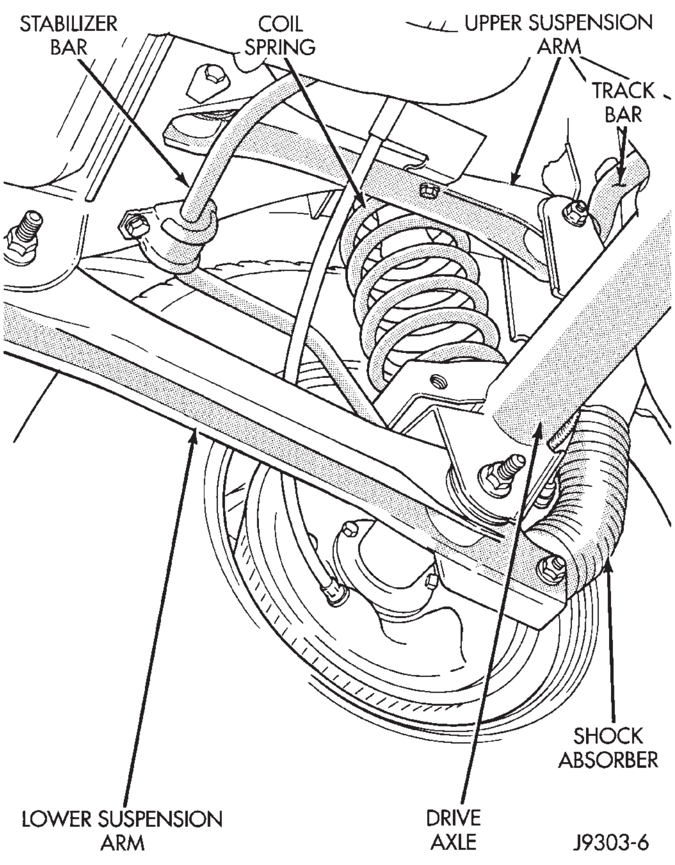

Fig. 1 Rear Suspension

The upper and lower suspension arms use bushings to isolate road noise. The suspension arms are bolted to the body and axle through the rubber bushings. The upper suspension arm has provision for the use of cam bolts at the axle to allow for pinion angle or thrust angle adjustment. The cams are available as a service kit and are not installed at the factory. The suspension arm travel is limited through the of use jounce bumpers in compression and shock absorbers in rebound.

Suspension components which use rubber bushings should be tightened at vehicle ride height. This will prevent premature failure of the bushing and maintain ride comfort. Bushings must never be lubricated.

The coil springs mount up in the fender shield that is part of the unitized body bracket. There is a rubber isolator between the top of the spring and bracket to isolate road noise. The bottom of the spring seats on the axle pad and is retained with a clip.

The shock absorbers dampen jounce and rebound of the vehicle over various road conditions. The top of the shock absorbers are bolted to the body. The bottom of the shocks are bolted to the axle shock absorber bracket.

The stabilizer bar is used to control vehicle body roll during turns. The spring steel bar helps to equalize the vehicle body in relationship to the suspension. The bar extends across the underside of the chassis and connects to the frame rails. Links are connected from the bar to the axle brackets. Stabilizer bar are isolated by rubber bushings.

The track bar is used to control rear axle lateral movement. The track bar is attached to a frame rail bracket and an axle bracket. It is isolated with bushings at both ends.

REAR AXLE

The integral housing, hypoid design has the pinion set below the ring gear.

The axles are equipped with A.B.S. brake systems. The A.B.S. tone rings are pressed onto the axle shaft near the hub flange. For additional information on the A.B.S. system refer to Group 5, Brakes.

The Model 35 axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the housing cover (Fig. 2). Build date identification codes are stamped on the axle shaft tube cover side.

The Model 35 axle is available with Trac-Lok™ (limited slip) differential as an option.

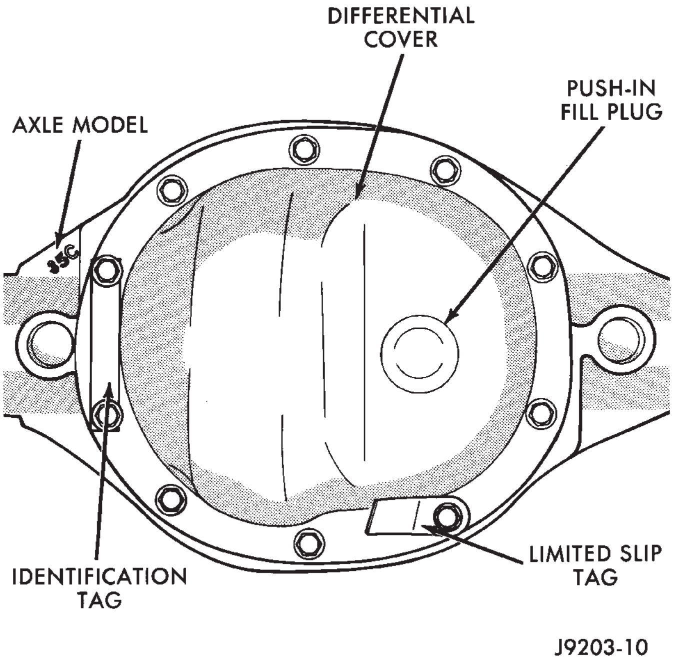

Fig. 2 Model 35 Differential Cover

STANDARD DIFFERENTIAL OPERATION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

In operation, power flow occurs as follows:

- Pinion gear rotates the ring gear
- Ring gear (bolted to the differential case) rotates the case
- Differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- Side gears (splined to the axle shafts) rotate the shafts

During straight ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 3).

When turning corners, the outside wheel must travel a greater distance than the inside wheel in order to complete a turn. This difference must be compensated for in order to prevent the wheels from scuffing and skidding through the turn. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 4). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

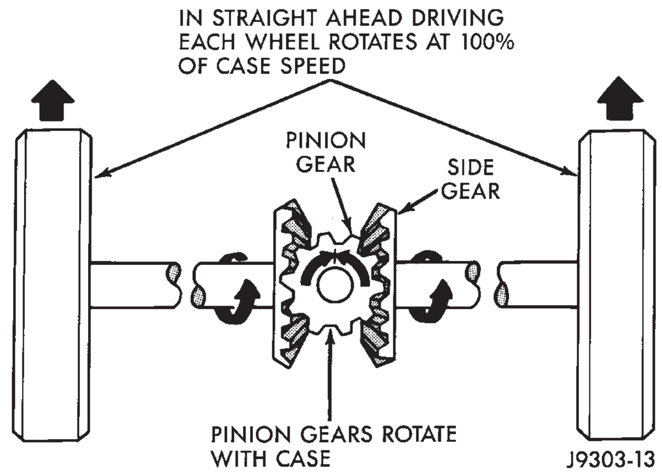

Fig. 3 Differential Operation—Straight-Ahead Driving

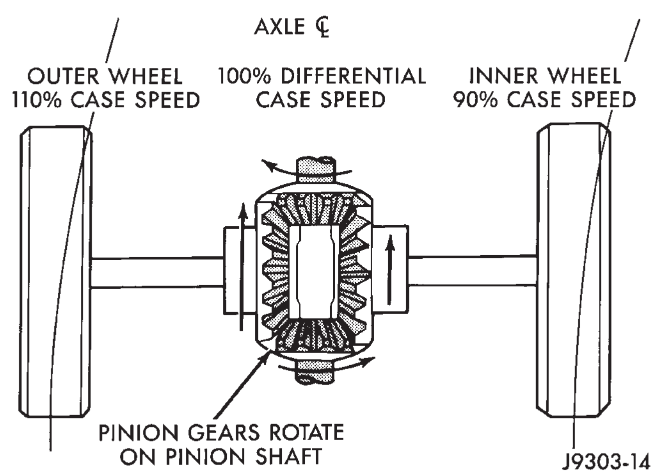

Fig. 4 Differential Operation—On Turns

REAR SUSPENSION

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SERVICE INFORMATION

CAUTION: Suspension components that use rubber bushings should be tightened with the vehicle at normal ride height. If the springs are not at their normal ride position, vehicle ride comfort and handling could be affected. Rubber bushings must never be lubricated.

TRACK BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the bolt and nut from the frame rail bracket (Fig. 1).

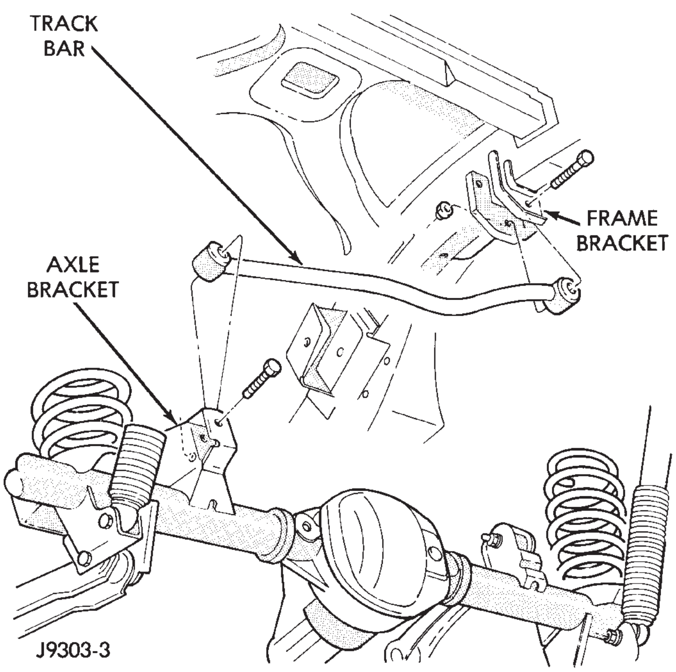

Fig. 1 Rear Track Bar

(3) Remove the bolt from the axle tube bracket (Fig. 1). Remove the track bar.

INSTALLATION

(1) Install the track bar to the axle bracket and install a new bolt (Fig. 1).

(2) It may be necessary to pry the axle assembly over to install the track bar. Install the track bar to the frame rail bracket. Loosely install the bolt and flag nut (Fig. 1).

(3) Remove the supports and lower the vehicle.

(4) Tighten the track bar bolts 100 N·m (74 ft. lbs.) torque.

STABILIZER BAR

REMOVAL

(1) Raise and support the vehicle. Remove one wheel and tire.

(2) Disconnect the stabilizer bar links from the axle brackets (Fig. 2).

(3) Lower the exhaust by disconnecting the muffler and tail pipe hangers.

(4) Disconnect the stabilizer bar from the links.

(5) Disconnect the stabilizer bar clamps from the frame rails. Remove the stabilizer bar.

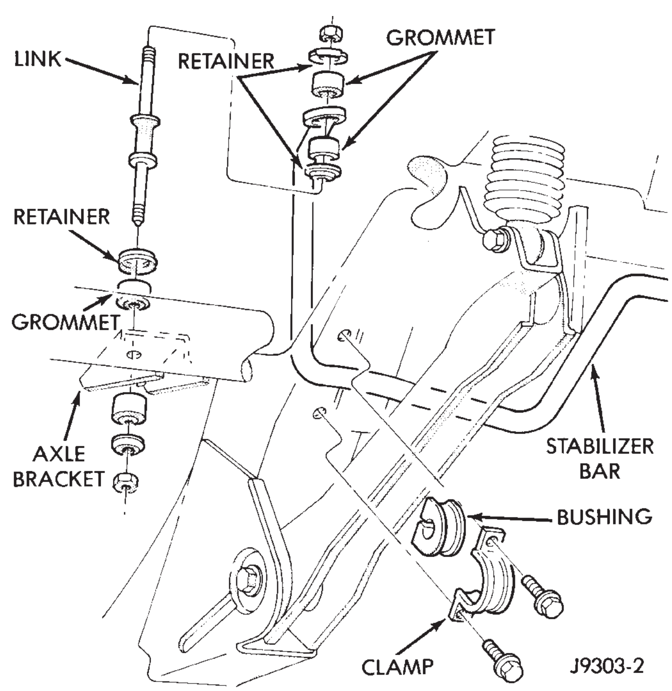

Fig. 2 Rear Stabilizer Bar

INSTALLATION

(1) Position the stabilizer bar on the frame rail and install the clamps and bolts. Ensure the bar is centered with equal spacing on both sides. Tighten the bolts to 54 N·m (40 ft. lbs.).

(2) Install the links and grommets onto the stabilizer bar and axle brackets (Fig. 2). Install the nuts and tighten to 36 N·m (27 ft. lbs.) torque.

(3) Connect the muffler and tail pipe to their hangers.

(4) Install the wheel and tire.

UPPER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the upper suspension arm nut and bolt at the axle bracket (Fig. 3). Remove the ABS wire bracket from the arm.

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

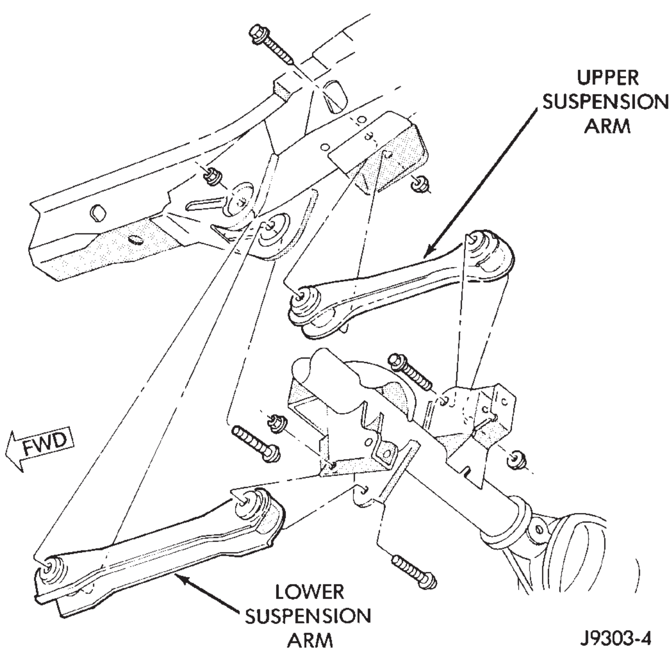

Fig. 3 Upper and Lower Suspension Arms

INSTALLATION

(1) Position the upper suspension arm at the axle and frame rail (Fig. 3).

(2) Install the bolts and finger tighten the nuts (Fig. 3). Install the ABS wire bracket onto the arm.

(3) Remove the supports and lower the vehicle.

(4) Tighten the upper suspension arm nuts to 75 N·m (55 ft. lbs.) torque.

LOWER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the lower suspension arm nut and bolt at the axle bracket (Fig. 3).

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

INSTALLATION

(1) Position the lower suspension arm at the axle bracket and frame rail bracket (Fig. 3).

(2) Install the bolts and finger tighten the nuts (Fig. 3).

(3) Remove the supports and lower the vehicle.

(4) Tighten the lower suspension arm nuts to 177 N·m (130 ft. lbs.) torque.

SPRING AND SHOCK DIAGNOSIS

A squeak noise from the shock absorber can be produced if movement between the rubber bushings and the metal occurs. This noise can usually be corrected by tightening the attachment nuts. If the squeak noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston into and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

SHOCK ABSORBER

REMOVAL

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

(2) Remove the upper nut and retainer from the frame rail stud (Fig. 4).

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

INSTALLATION

(1) Install the shock absorber on the upper frame rail stud. Install the shock absorber on the axle bracket (Fig. 4).

(2) Install the retainer and nut on the stud. Tighten the upper nut to 70 N·m (52 ft. lbs.) torque.

(3) Tighten the lower nut to 92 N·m (68 ft. lbs.) torque.

(4) Remove the supports and lower the vehicle.

COIL SPRING

REMOVAL

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

(2) Disconnect the stabilizer bar link and shock absorber from the axle bracket.

(3) Disconnect the track bar from the frame rail bracket.

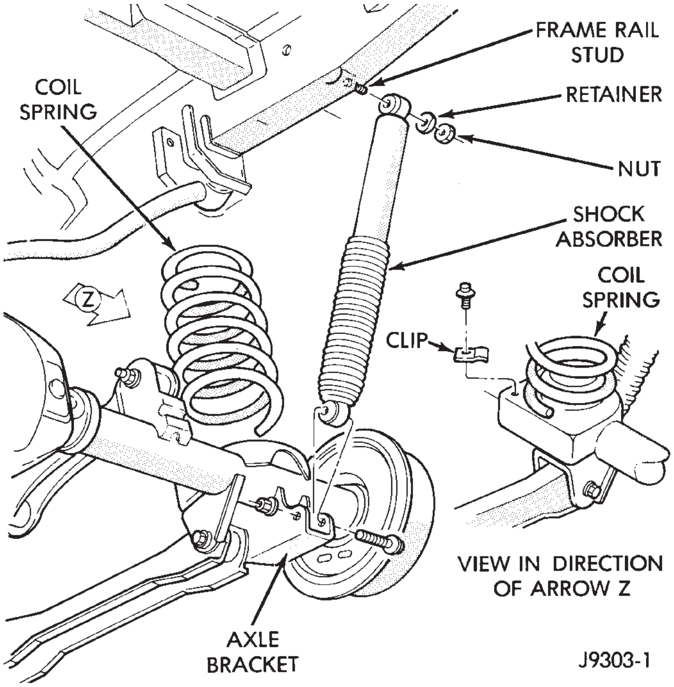

Fig. 4 Rear Coil Spring & Shock Absorber

(4) Lower the axle until the spring is free from the upper mount seat. Remove the coil spring retainer bolt (Fig. 4) and remove the spring.

INSTALLATION

Inspect isolator the for damage or wear. Replace the isolator if necessary before installing spring.

(1) Position the coil spring on the axle pad. Install the spring retainer and bolt (Fig. 4). Tighten the bolt to 22 N·m (16 ft. lbs.) torque.

(2) Raise the axle into position until the spring seats in the upper mount.

(3) Connect the stabilizer bar links and shock absorbers to the axle bracket. Connect the track bar to the frame rail bracket.

(4) Remove the supports and lower the vehicle.

AXLE NOISE/VIBRATION DIAGNOSIS

INDEX

GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:

- Insufficient or incorrect lubricant
- Foreign matter/water contamination
- Incorrect bearing preload torque adjustment

When serviced, the bearings must be cleaned thoroughly. They should be dried with lint free shop towels. **Never spin bearings with compressed air. This will overheat them and brinell the bearing surfaces. This will result in noisy operation after repair.**

Axle gear problem conditions are usually the result of:

- Insufficient lubrication
- Incorrect or contaminated lubricant (water)
- Overloading (excessive engine torque)
- Incorrect clearance or backlash adjustment

Insufficient lubrication is usually the result of a housing cover leak. It can also be from worn axle shaft or pinion gear seals. Check for cracks or porous areas in the housing or tubes.

Using the wrong lubricant will cause overheating and gear failure. Gear tooth cracking and bearing spalling are indicators of this.

Axle component breakage is most often the result of:

- Severe overloading
- Insufficient lubricant
- Incorrect lubricant
- Improperly tightened components

Common causes of overloading is from full throttle acceleration. Overloading happens when towing heavier than recommended loads. Component breakage can occur when the wheels are spun excessively. Insufficient or incorrect lubricants contribute to breakage through overheating. Loose differential components can also cause breakage.

Incorrect bearing preload or gear backlash will not result in component breakage. Mis-adjustment will produce enough noise to cause service repair before a failure occurs. If a mis-adjustment condition is not corrected, component failure can result.

GEAR AND BEARING NOISE

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant. Incorrect backlash, tooth contact, or worn/damaged gears can cause noise.

Gear noise usually happens at a specific speed range. The range is 30 to 40 mph, or above 50 mph. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, accelerate the vehicle to the speed range where the noise is the greatest. Shift out of gear and coast through the peak noise range. If the noise stops or changes greatly, check for insufficient lubricant. Incorrect ring gear backlash, or gear damage can cause noise changes.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise in straight ahead driving. These gears are loaded during vehicle turns. If noise does occur during vehicle turns, the side or pinion gears could be worn or damaged. A worn pinion gear mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

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

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

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

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right.

This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

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

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:
- Damaged drive shaft
- Missing drive shaft balance weight
- Worn, out-of-balance wheels
- Loose wheel lug nuts
- Worn U-joint
- Loose spring U-bolts
- Loose/broken springs
- Damaged axle shaft bearings
- Loose pinion gear nut
- Excessive pinion yoke run out
- Bent axle shaft

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

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires for additional information.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:
- High engine idle speed
- Loose engine/transmission/transfer case mounts
- Worn U-joints
- Loose spring mounts
- Loose pinion gear nut and yoke
- Excessive ring gear backlash
- Excessive differential side gear to case clearance

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

REAR AXLE ALIGNMENT

MEASUREMENT

The following procedure can be used to determine if abnormal rear tire tread wear is the result of a bent or deformed rear axle shaft.

(1) Raise both rear wheels off the surface with a frame contact hoist.

(2) Attach a one inch long piece of masking tape at the center of each tire tread for use as reference marks.

(3) Rotate the rear wheels until both reference marks face the front of the vehicle. Measure the distance between the outside edges of the two pieces of tape. Record this measurement as the front of tire (FTR) measurement.

(4) Rotate the rear wheels until both reference marks face the rear of the vehicle. Measure the distance between the outside edges of the two pieces of tape. Record this measurement as the rear of tire (RTR) measurement.

(5) Subtract the (RTR) measurement from the (FTR) measurement to obtain the amount of wheel toe. The acceptable rear wheel toe-in position is 1/16 inch (1.6 mm) to 3/16 inch (4.8 mm) toe-out.

(6) Rotate the rear wheels until the reference marks are facing downward. Measure the distance between the outside edges of the two pieces of tape. Record this measurement as the bottom of tire (BTR) measurement.

(7) Average the (FTR) and the (RTR) distance measurements. Subtract the (BTR) measurement from this average distance to obtain the camber. The acceptable amount of camber is 1/16 inch to 3/32 inch (1.6 to 2.4 mm).

(FTR + RTR) DIVIDED BY 2 (TWO) MINUS BTR EQUALS CAMBER

If the (BTR) distance measurement is less than the average FTR and RTR distance measurement, the camber will be positive (+). If the (BTR) distance measurement is greater than the average FTR and RTR distance, the camber will be negative (-).

If the toe position or camber is not acceptable, a bent or deformed rear axle shaft is most likely the cause.

LIMITED SLIP DIFFERENTIAL

Under normal traction conditions, engine torque is divided evenly. With low traction surfaces, engine torque is transferred to the wheel with the most tire traction. When diagnosing a limited-slip differential problem condition, the wheel with the least traction can continue spinning.

The most common problem is a chatter noise when turning corners. Check for incorrect or contaminated lubricant. Replace the gear lubricant if necessary.
- With **Trac-Lok** differentials add a container of MOPAR® Trac-Lok Lubricant.

This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure eight turns. This maneuver will pump lubricant through the clutches.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
WHEEL NOISE	(a) Wheel loose. (b) Faulty, brinelled wheel bearing.	(a) Tighten loose nuts. (b) Faulty or brinelled bearings must be replaced.
AXLE SHAFT NOISE	(a) Misaligned axle shaft tube. (b) Bent or sprung axle shaft. (c) End play in drive pinion bearings. (d) Excessive gear backlash between ring gear and pinion gear. (e) Improper adjustment of drive pinion gear shaft bearings. (f) Loose drive pinion gearshaft yoke nut. (g) Improper wheel bearing adjustment. (h) Scuffed gear tooth contact surfaces.	(a) Inspect axle shaft tube alignment. Correct as necessary. (b) Replace bent or sprung axle shaft. (c) Refer to Drive Pinion Bearing Pre-Load Adjustment. (d) Check adjustment of ring gear backlash and pinion gear. Correct as necessary. (e) Adjust drive pinion shaft bearings. (f) Tighten drive pinion gearshaft yoke nut with specified torque. (g) Readjust as necessary. (h) If necessary, replace scuffed gears.
AXLE SHAFT BROKE	(a) Misaligned axle shaft tube. (b) Vehicle overloaded. (c) Erratic clutch operation (d) Grabbing clutch.	(a) Replace broken axle shaft after correcting axle shaft tube alignment. (b) Replace broken axle shaft. Avoid excessive weight on vehicle. (c) Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. (d) Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.
DIFFERENTIAL CASE CRACKED	(a) Improper adjustment of differential bearings. (b) Excessive ring gear backlash. (c) Vehicle overloaded. (d) Erratic clutch operation.	(a) Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. (b) Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. (c) Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. (d) Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.
DIFFERENTIAL GEARS SCORED	(a) Insufficient lubrication. (b) Improper grade of lubricant. (c) Excessive spinning of one wheel/tire.	(a) Replace scored gears. Scoring marks on the drive face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear differential housing to required capacity with proper lubricant. Refer to Specifications. (b) Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. (c) Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.
LOSS OF LUBRICANT	(a) Lubricant level too high.	(a) Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.

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SERVICE DIAGNOSIS (CONT'D)

Condition	Possible Cause	Correction
	(b) Worn axle shaft seals.	(b) Replace worn seals.
	(c) Cracked differential housing.	(c) Repair or replace housing as necessary.
	(d) Worn drive pinion gear shaft seal.	(d) Replace worn drive pinion gear shaft seal.
	(e) Scored and worn yoke.	(e) Replace worn or scored yoke and seal.
	(f) Axle cover not properly sealed.	(f) Remove cover and clean flange and reseal.
AXLE OVERHEATING	(a) Lubricant level too low.	(a) Refill differential housing.
	(b) Incorrect grade of lubricant.	(b) Drain, flush and refill with correct amount of the correct lubricant.
	(c) Bearings adjusted too tight.	(c) Readjust bearings.
	(d) Excessive gear wear.	(d) Inspect gears for excessive wear or scoring. Replace as necessary.
	(e) Insufficient ring gear backlash.	(e) Readjust ring gear backlash and inspect gears for possible scoring.
GEAR TEETH BROKE (RING GEAR AND PINION)	(a) Overloading.	(a) Replace gears. Examine other gears and bearings for possible damage. Replace parts as needed. Avoid overloading of vehicle.
	(b) Erratic clutch operation.	(b) Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation.
	(c) Ice-spotted pavements.	(c) Replace gears. Examine the remaining parts for possible damage. Replace parts as required.
	(d) Improper adjustments.	(d) Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.
AXLE NOISE	(a) Insufficient lubricant.	(a) Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary.
	(b) Improper ring gear and drive pinion gear adjustment.	(b) Check ring gear and pinion gear teeth contact pattern.
	(c) Unmatched ring gear and drive pinion gear.	(c) Remove unmatched ring gear and drive pinion gear. Replace with matched gear and drive pinion gear set.
	(d) Worn teeth on ring gear or drive pinion gear.	(d) Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set.
	(e) Loose drive pinion gear shaft bearings.	(e) Adjust drive pinion gearshaft bearing preload torque.
	(f) Loose differential bearings.	(f) Adjust differential bearing preload torque.
	(g) Misaligned or sprung ring gear.	(g) Measure ring gear runout.
	(h) Loose differential bearing cap bolts.	(h) Tighten with specified torque.

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MODEL 35 AXLE

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GENERAL INFORMATION

The housing for Model 35 rear axles consists of an iron center casting with tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one piece axle housing.

The integral type housing, hypoid gear design has the centerline of the pinion set below the centerline of the ring gear.

The axle has a fitting for a vent hose used to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning that loads are supported by the axle shaft and bearings. The axle shafts are retained by C-clips in the differential side gears.

The axles are equipped with ABS brake sensors. The sensors are attached to the brake backing plate assemblies and tone rings are pressed on the axle shaft. Use care when removing axle shafts as NOT to damage the tone wheel or the sensor.

The removable cover provides a means for servicing the differential without removing the axle assembly.

The Model 35 axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the housing cover. Build date identification codes are stamped on the axle shaft tube cover side.

The differential case is a one piece design. The differential pinion mate shaft is retained with a threaded roll pin. Differential bearing preload and ring gear backlash is adjusted by the use of spacer shims. The shims are located between the differential bearing cups and housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

For complete drive axle assembly removal and installation refer to Drive Axle Assembly Replacement in this Group.

LUBRICANT SPECIFICATIONS

Multi-purpose, hypoid gear lubricant should be used for Model 35 axle. The lubricant should have MIL-L-2105C and API GL 5 quality specifications. MOPAR® Hypoid Gear Lubricant conforms to both of these specifications.

• Lubricant for standard Model 35 axle use thermally stable SAE 80W-90 gear lubricant.
• Lubricant for Model 35 axle with Trailer Tow use SAE 75W-140 SYNTHETIC gear lubricant.
• Trac-Lok (limited slip) differentials add 4 fluid oz. of friction modifier.
• The lubricant quantity is 56±1 fluid oz..

Refer to Group 0, Lubrication and Maintenance for additional information.

CAUTION: If axle is submerged in water, lubricant must be replaced immediately to avoid possible premature axle failure.

AXLE ASSEMBLY REPLACEMENT

REMOVAL

(1) Raise and support the vehicle.
(2) Position a floor jack under the axle.
(3) Remove the wheels and tires. Remove the brake components from the axle, refer to Group 5, Brakes.
(4) Disconnect the vent hose from the axle shaft tube.
(5) Mark the propeller shaft and yokes for installation alignment reference. Remove the propeller shaft.
(6) Disconnect stabilizer bar links.
(7) Disconnect shock absorbers from axle.
(8) Disconnect track bar.
(9) Disconnect upper and lower suspension arms from the axle brackets.
(10) Lower the axle with the jack.

INSTALLATION

Have the springs supporting the weight of the vehicle when the arms and track bar fasteners are being torqued. If the springs are not at

their normal ride position, vehicle ride comfort and handling could be affected.

(1) Raise the axle with a floor jack and align coil springs.

(2) Position the upper and lower suspension arms on the axle brackets. Install nuts and bolts, DO NOT TORQUE BOLTS AT THIS TIME.

(3) Install track bar and attachment bolts, DO NOT TORQUE BOLTS AT THIS TIME.

(4) Install shock absorber and tighten nuts to 60 N·m (44 ft. lbs.) torque

(5) Install stabilizer bar link and tighten nuts to 36 N·m (27 ft. lbs.) torque

(6) Install brake components refer to Group 5 Brakes.

(7) Install axle vent hose

(8) Align propeller shaft and pinion yoke reference marks. Install U-joint straps and bolts tighten to 19 N·m (14 ft. lbs.) torque

(9) Install the wheels and tires.

(8) Check and add gear lubricant if needed.

(9) Remove support and lower the vehicle.

(10) Tighten lower suspension arms bolts to 177 N·m (130 ft. lbs.) torque.

(11) Tighten upper suspension arms bolts to 75 N·m (55 ft. lbs.) torque.

(12) Tighten track bar bolts to 100 N·m (74 ft. lbs.) torque.

LUBRICANT CHANGE

The gear lubricant will drain quicker if the vehicle has been recently driven.

(1) Raise and support the vehicle.

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

(3) Remove the differential housing cover and drain the lubricant from the housing.

(4) Clean the housing cavity with a flushing oil, light engine oil or lint free cloth. **Do not use water, steam, kerosene or gasoline for cleaning.**

(5) Remove the sealant from the housing and cover surfaces. Use solvent to clean the mating surfaces.

(6) Apply a bead of MOPAR® Silicone Rubber Sealant to the housing cover (Fig. 1). **Allow the sealant to cure for a few minutes.**

Install the housing cover within 5 minutes after applying the sealant. If not installed the sealant must be removed and another bead applied.

(7) Install the cover and any identification tag. Tighten the cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.) torque.

(8) Refill the differential with MOPAR® Hypoid Gear Lubricant to bottom of fill plug hole.

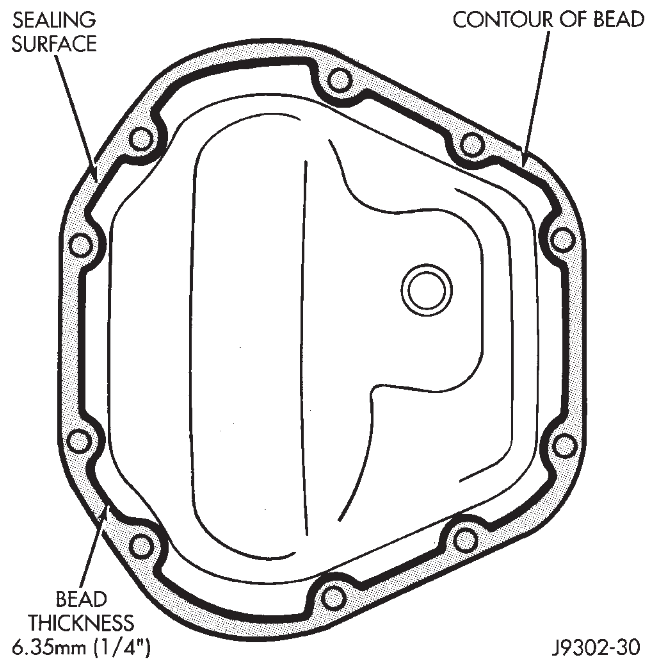

Fig. 1 Typical Housing Cover With Sealant

Trac-Lok (limited slip) Differentials; A container of Trac-Lok Lubricant (friction modifier) should be added after repair service or a lubricant change.

(9) Install the fill hole plug and lower the vehicle.

LIMITED SLIP DIFFERENTIAL vehicles should be road tested by making 10 to 12 slow figure eight turns. This maneuver will pump the lubricant through the clutch discs to eliminate a possible **chatter** noise complaint.

PINION SHAFT SEAL REPLACEMENT

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies

(3) Mark the drive shaft yoke and pinion yoke for installation alignment reference.

(4) Remove the drive shaft from the yoke.

(5) Rotate the pinion gear three or four times. **Make sure brakes are not dragging during this procedure.**

(6) Measure the amount of torque (in Newton meters or inch pounds) necessary to rotate the pinion gear with a torque wrench. Note the torque for installation reference. **It must be known to properly adjust the pinion gear bearing preload torque after seal installation.**

(7) Remove the pinion yoke nut and washer. Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 2).

(8) Mark the positions of the yoke and pinion gear for installation alignment reference.

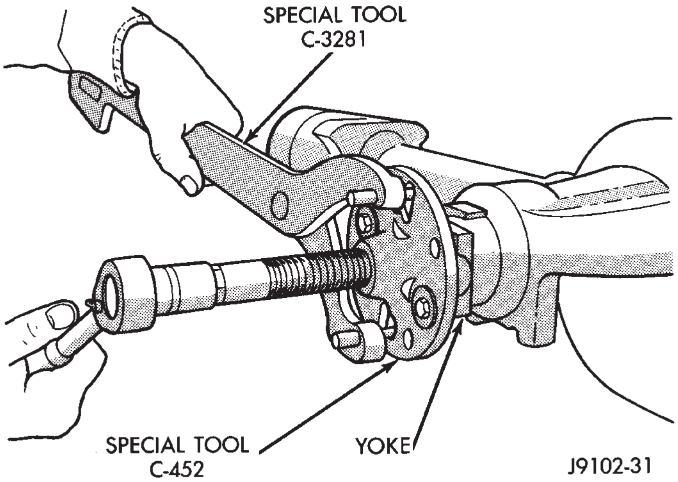

Fig. 2 Pinion Yoke Removal

(9) Use Remover 7794A and slide hammer to remove the pinion gear seal (Fig. 3).

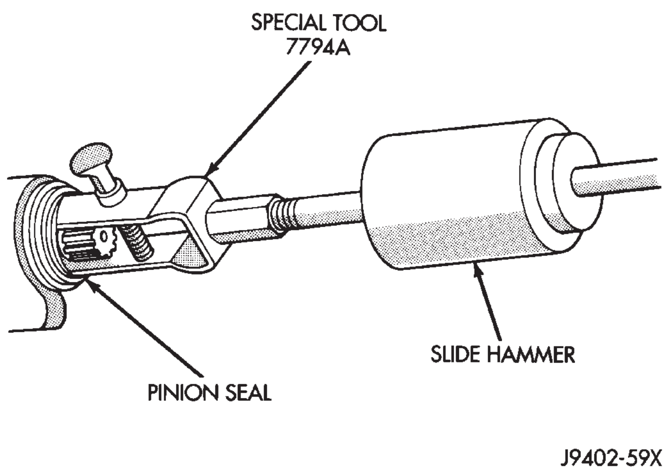

Fig. 3 Seal Removal

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer D-163 and Handle C-4171 (Fig. 4).

(2) Align the installation reference marks and install yoke on the pinion gear with Installer W-162D.

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

CAUTION: Exercise care during bearing preload torque adjustment. Do not overtighten, or loosen and then re-tighten the nut. Do not exceed the bearing preload torque. The collapsible preload spacer on the pinion shaft will have to be replaced. The bearing preload torque will be re-adjusted afterward.

(4) Install a socket and inch pound torque wrench on the pinion nut.

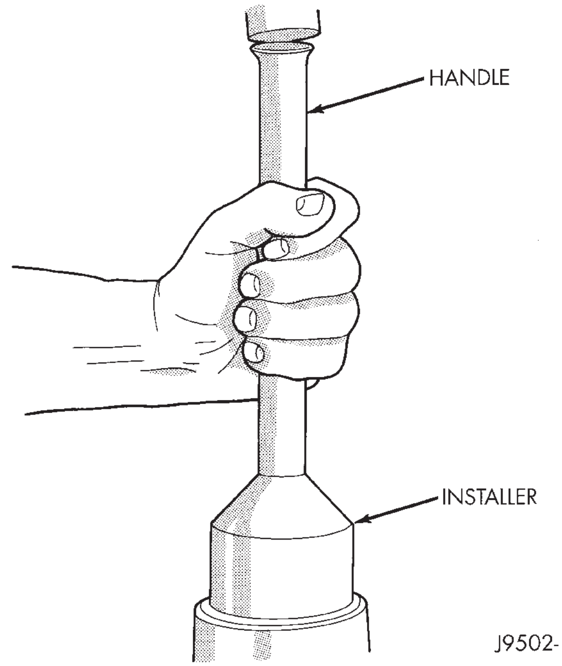

Fig. 4 Pinion Seal Installation

(5) Rotate the shaft with the torque wrench and note the torque.

The required preload is equal to the amount at removal plus 0.56 N·m (5 in. lbs.).

(6) Use Flange Wrench C-3281 to retain the yoke and shaft (Fig. 5). Tighten the shaft nut in very small increments.

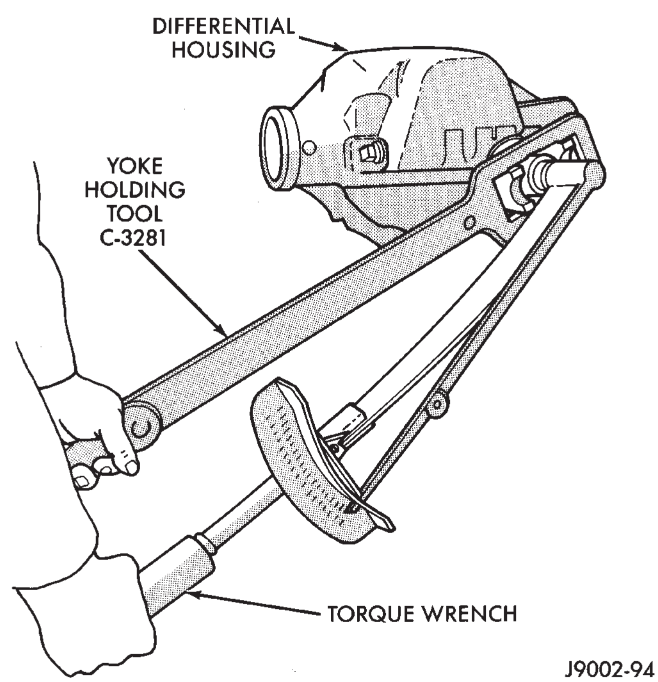

Fig. 5 Tightening Pinion Shaft Nut

(7) Continue tightening the shaft nut in small increments until the correct bearing preload torque is attained.

(8) Align the installation reference marks and attach the drive shaft to the yoke.
(9) Add API grade GL 5 hypoid gear lubricant to the differential housing, if necessary.
(10) Install wheel and tire assemblies
(11) Lower the vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the wheel and tire.
(3) Remove the brake drum. If equipped with rear disc brakes refer to Group 5 Brakes for procedure.
(4) Clean all the foreign material from housing cover area.
(5) Loosen the housing cover bolts. Drain the lubricant from the housing and the axle shaft tubes. Remove the housing cover.
(6) Rotate the differential case so that the pinion mate gear shaft lock screw is accessible. Remove the lock screw and the pinion mate gear shaft from the case (Fig. 6).

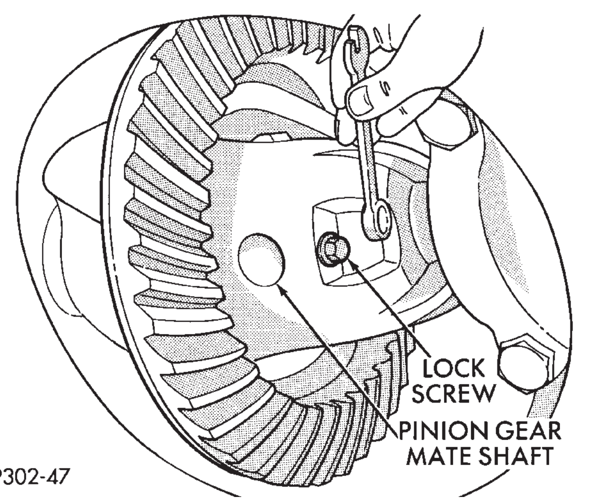

Fig. 6 Mate Shaft Lock Screw

(7) Force the axle shaft in toward the center of the vehicle. Remove the axle shaft C-clip lock from the axle shaft (Fig. 7).
(8) Remove the axle shaft. Use care to prevent damage to the axle shaft bearing and seal, which will remain in the axle shaft tube.
(9) Inspect the roller bearing contact surface on the axle shaft for signs of brinelling, spalling and pitting.
(10) If any of these conditions exist, the axle shaft and bearing must be replaced.

INSTALLATION

(1) Lubricate the bearing bore and seal lip with gear lubricant. Insert the axle shaft through the seal, bearing, and engage it with the side gear splines.

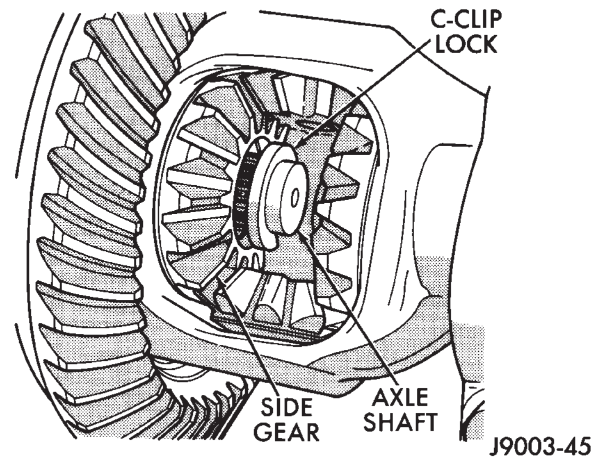

Fig. 7 Axle Shaft C-Clip Lock

Use care to prevent the shaft splines from damaging the axle shaft seal lip.
(2) Insert the C-clip lock in the end of the axle shaft. Push the axle shaft outward to seat the C-clip lock in the side gear.
(3) Insert the mate shaft into the case and through the thrust washers and pinion gears. Align the hole in shaft with the hole in the differential case and install the lock screw with Loctite® on the threads. Tighten the screw to 19 N·m (14 ft. lbs.) torque.
(4) Install the cover and add fluid. Refer to the Drain and Refill in this section.

AXLE SHAFT SEAL AND BEARING

REMOVAL

(1) Remove the axle shaft. Refer to the Removal procedures in this Section.
(2) Remove the axle shaft seal from the end of the axle shaft tube with a small pry bar.
(3) Remove the bearing if it appears damaged.
The seal and bearing can be removed at the same time with the bearing removal tool.
(4) Remove the axle shaft bearing from the tube (Fig. 8) with Bearing Removal Tool Set 6310 (T.Ar 960-02).
(5) Inspect the axle shaft tube bore for roughness and burrs. Remove as necessary.

CAUTION: Inspect the housing bore for burrs and remove if they exist.

INSTALLATION

Do not install the original axle shaft seal. Always install a new seal.
(1) Wipe the bore in the axle shaft tube clean.
(2) Install axle shaft bearing with Installer 6436 and Handle C-4171. Ensure part number on the bearing must go against the Installer.

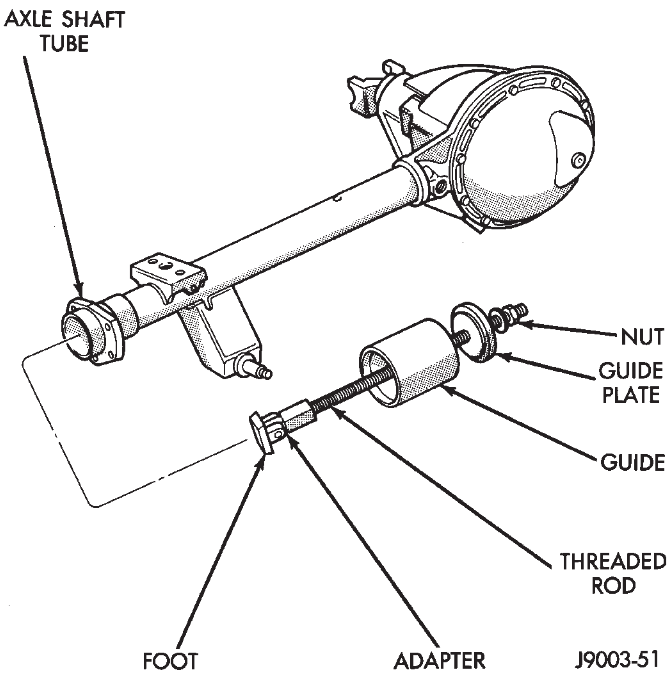

Fig. 8 Axle Shaft Bearing Removal Tool

(3) Install the new axle shaft seal (Fig. 9) with Installer 6437 and Handle C-4171.

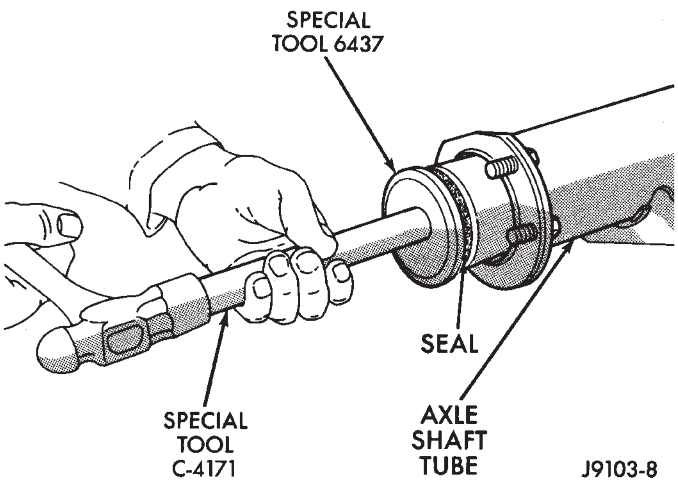

Fig. 9 Axle Shaft Seal Installation

(4) Install the Axle Shaft. Refer to the installation procedure.

DIFFERENTIAL REMOVAL

To service the differential the axle shafts must be removed. Refer to the removal procedures in this Group.

(1) **Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 10).**

(2) Remove the differential bearing caps.

(3) Position Spreader W-129B with the tool dowel pins seated in the locating holes (Fig. 11). Install the holddown clamps and tighten the tool turnbuckle finger-tight.

(4) Install a pilot stud at the left side of the differential housing. Attach Dial Indicator to housing pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 11) and zero the indicator.

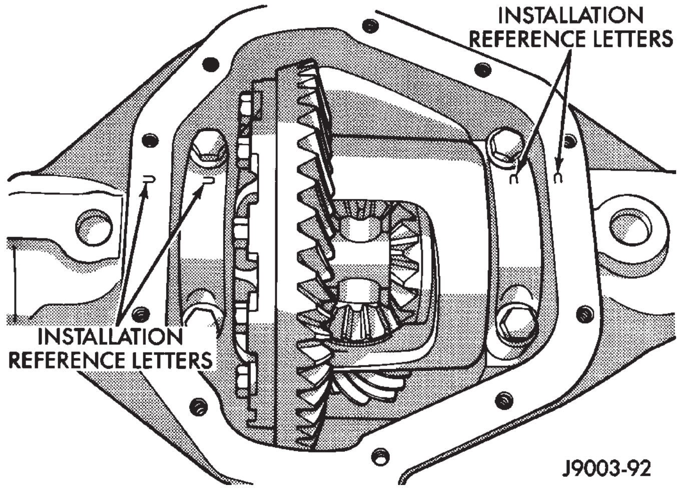

Fig. 10 Bearing Cap Identification

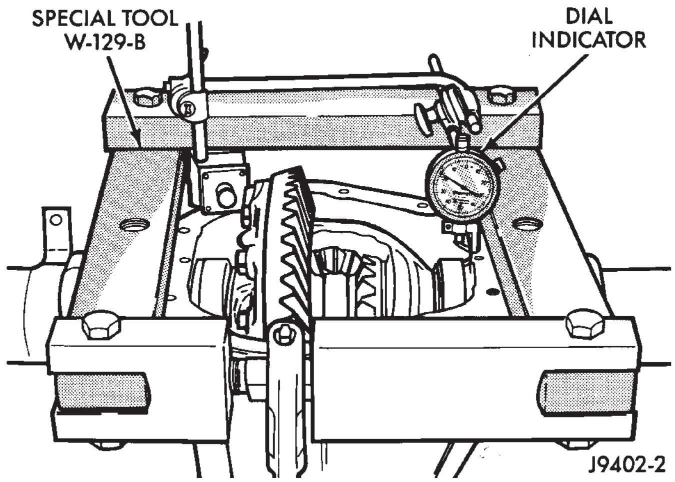

Fig. 11 Spread Differential Housing

CAUTION: Do not spread over 0.38 mm (0.015 in). If the housing is over-separated, it could be distorted or damaged.

(5) Separate the housing enough to remove the case from the housing. Measure the distance with the dial indicator (Fig. 11).

(6) Remove the dial indicator.

(7) Pry the differential case loose from the housing. To prevent damage, pivot on housing with the end of the pry bar against spreader (Fig. 12).

(8) Remove the case from housing. Mark or tag bearing cups and outboard shim/spacer (selected thickness) indicating which side they were removed. Remove spreader from housing.

DIFFERENTIAL DISASSEMBLY

(1) Remove the bearings from the differential case with Press C-293PA, Plug SP3289, Adapter C-293-18 (Fig. 13).

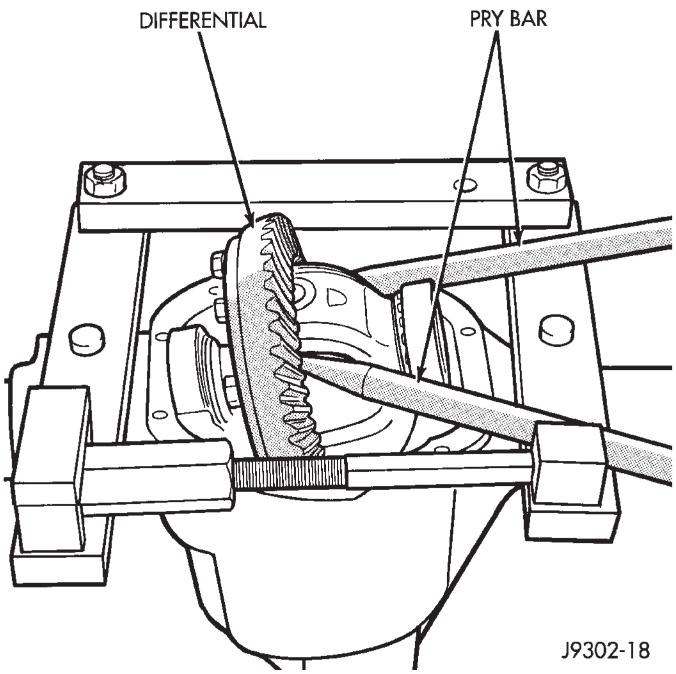

Fig. 12 Differential Removal

Place adapter rings so they do not damage the bearing cage.

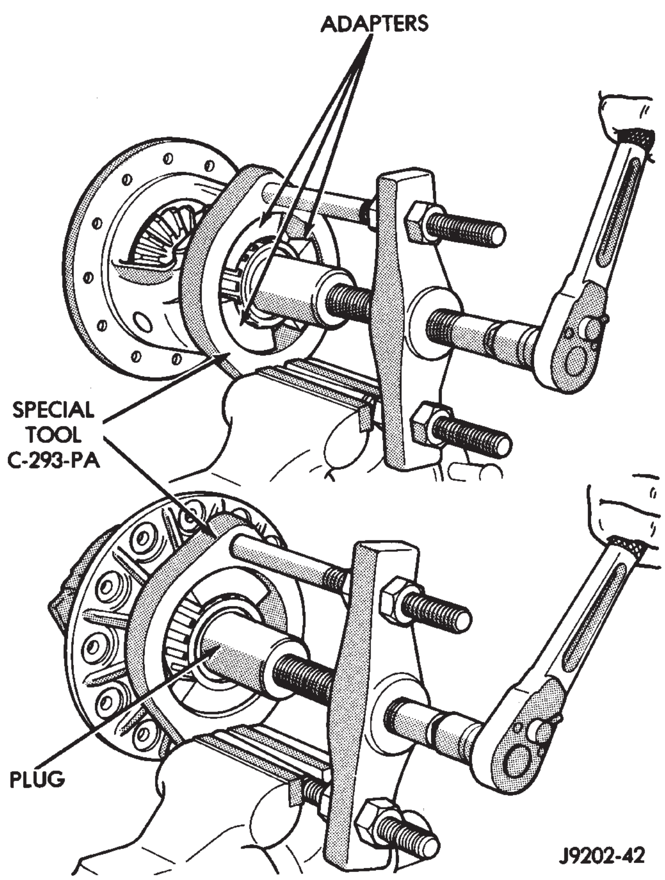

Fig. 13 Differential Bearing Removal

(2) Clamp the differential case in a vise equipped with soft jaws. Remove **and discard** the ring gear bolts. Tap the ring gear with a rawhide or plastic mallet and remove (Fig. 14).

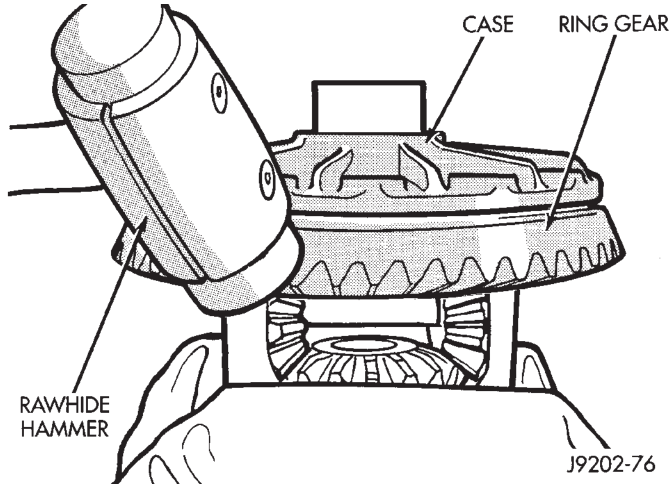

Fig. 14 Ring Gear Removal

(3) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 15).

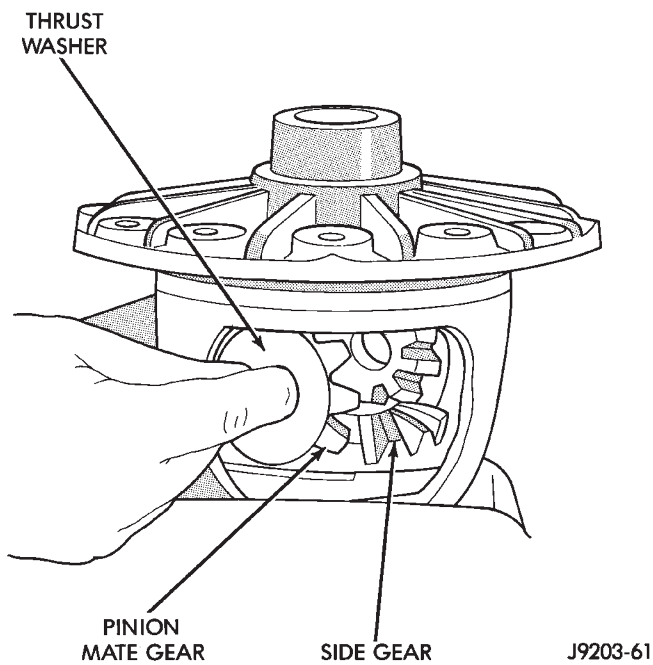

Fig. 15 Pinion Mate Gear Removal

(4) Remove the differential side gears and thrust washers.

(5) Remove the case from the vise.

PINION REMOVAL/DISASSEMBLY

(1) Remove the pinion yoke nut and washer. Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 16).

(2) Remove the pinion gear from housing (Fig. 17). Catch the pinion with your hand to prevent it from falling and being damaged.

(3) Remove the pinion gear seal with a slide hammer or pry out with bar.

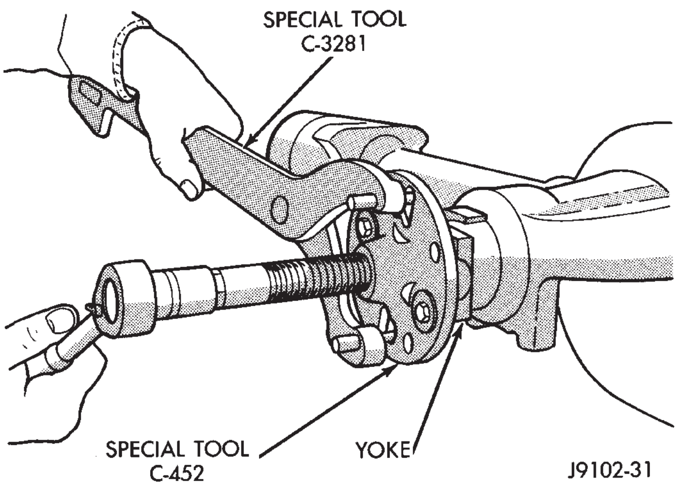

Fig. 16 Pinion Yoke Removal

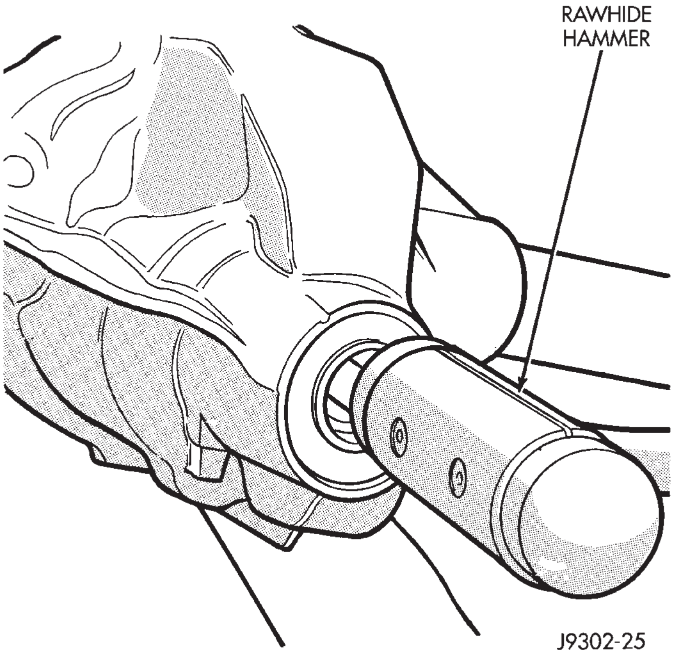

Fig. 17 Remove Pinion Gear

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

(5) Remove the front pinion bearing cup with Remover D-147 and Handle C-4171 (Fig. 18).

(6) Remove the rear bearing cup from housing (Fig. 19). Use Remover D-148 and Handle C-4171.

(7) Remove the collapsible preload spacer (Fig. 20).

(8) Remove the inner bearing from the pinion with Puller C-293PA and Adapter C-293-39 (Fig. 21).

Place adapter rings so they do not damage the bearing cage.

(9) Remove the depth shims from the pinion gear shaft. Record the thickness of the depth shims.

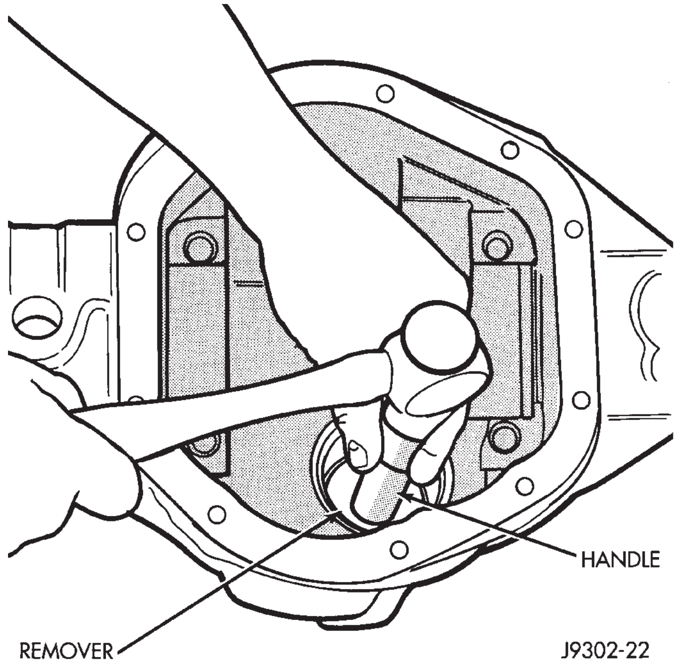

Fig. 18 Front Bearing Cup Removal

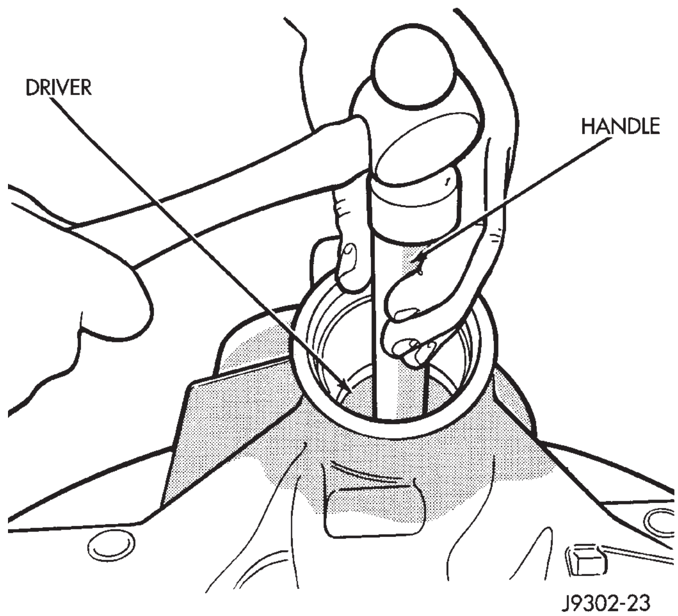

Fig. 19 Rear Bearing Cup Removal

CLEANING/INSPECTION

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as a matched sets only.**

Clean the axle shaft tubes and oil channel in housing with a stiff wire and clean cloth.

Inspect for;

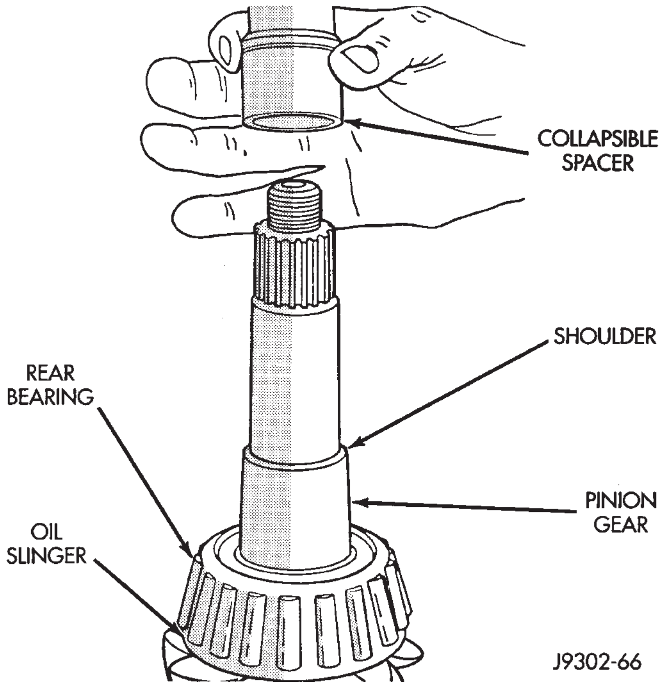

Fig. 20 Collapsible Preload Spacer

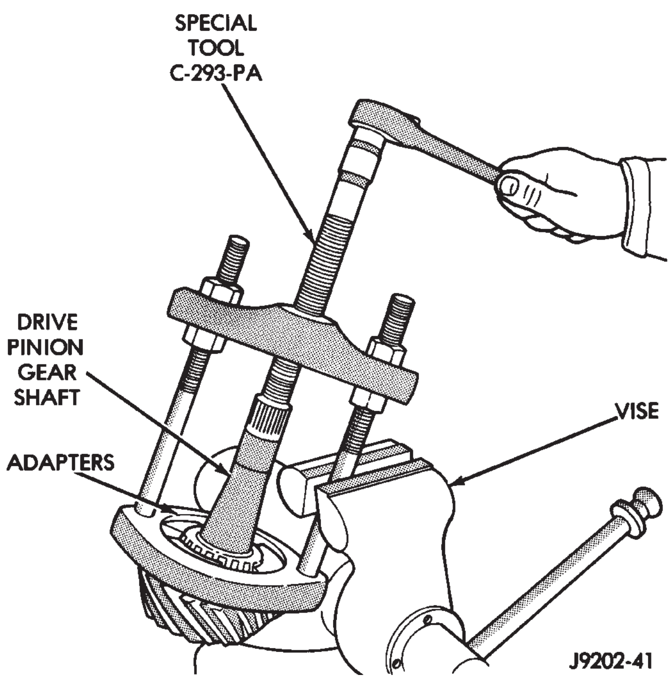

Fig. 21 Inner Bearing Removal

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
- Ring and pinion gear for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Pinion yoke for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Preload shims for damage and distortion. Install new shims if necessary.

DIFFERENTIAL ASSEMBLY

(1) Install the following components in the differential case.

- Differential side gears and thrust washers
- Pinion gears and thrust washers
- Pinion gear mate shaft (align holes in shaft and case)

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

PINION GEAR DEPTH INFORMATION

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 22). A plus (+) number, minus (-) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the centerline of the ring gear to the back face of the pinion is 96.8 mm (3.813 inches) for Model 35 axles (Fig. 23). The standard depth provides the best teeth contact pattern.

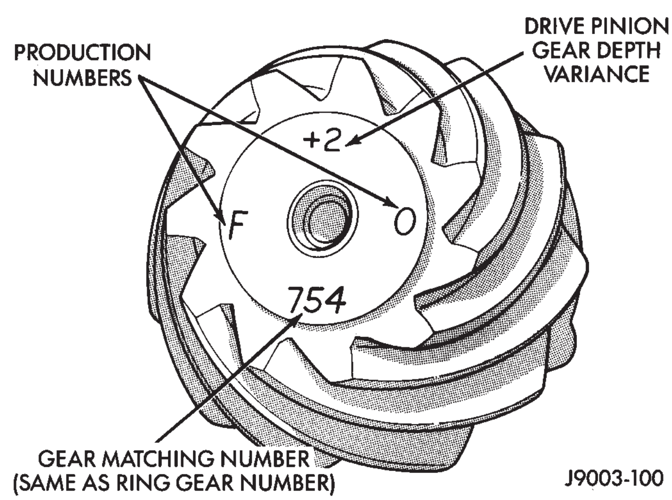

Fig. 22 Pinion Gear ID Numbers

THE BUTTON END ON THE PINION GEAR HEAD IS NO LONGER A MACHINED-TO-SPECIFICATIONS SURFACE. DO NOT USE THIS SURFACE FOR PINION DEPTH SET-UP OR CHECKING (Fig. 23).

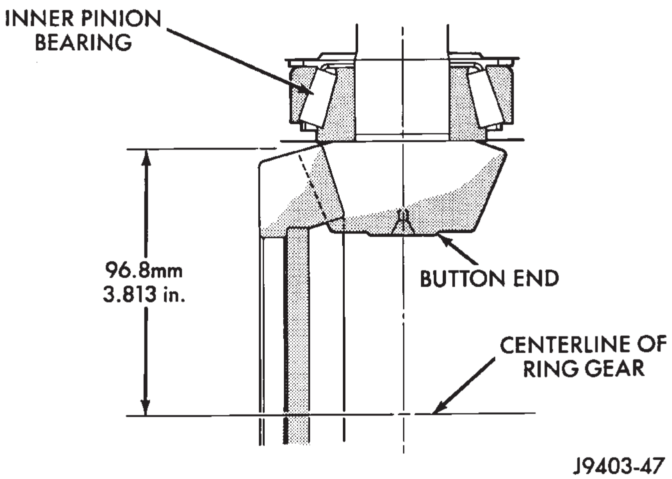

Fig. 23 Pinion Gear Head

Compensation for pinion depth variance is achieved with select shims. In production the shims are placed between the pinion gear and the inner pinion bearing cone. For service the shims are placed under the inner pinion bearing cup (Fig. 24).

If a new gear set is being installed, note the depth variance etched into both pinion gears. Add or subtract the thickness of the original depth shims to compensate for the difference in depth variances. Refer to the Depth Variance charts.

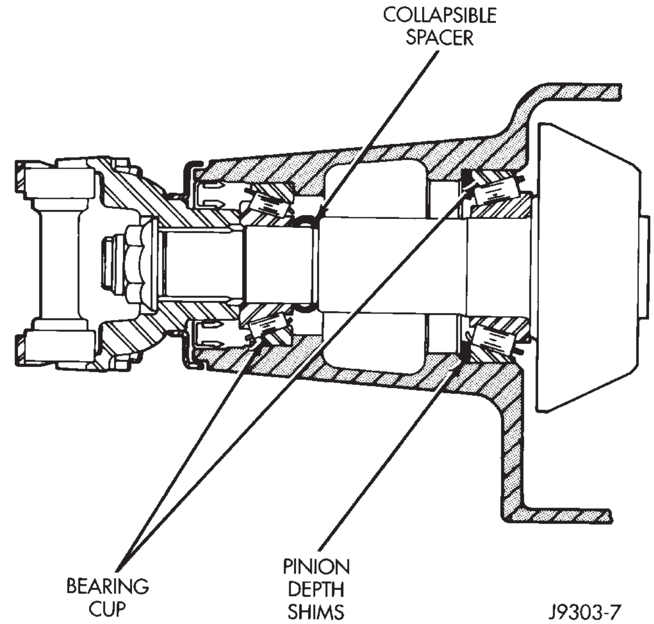

Fig. 24 Shim Locations

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

For example, if old pinion is plus (+) 1 and the new pinion is minus (-) 3, intersecting figure is (+) 0.004 inch (0.10mm). Add this amount to the original shim. Or if the old pinion is (-) 3 and the new pinion is (-) 2, intersecting figure is (-) 0.001 inch (0.025mm). Subtract this amount from original shim. Refer to the Pinion Gear Depth Variance Chart.

PINION GEAR DEPTH VARIANCE

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

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PINION MEASUREMENT AND ASSEMBLY

PINION GEAR DEPTH MEASUREMENT

Pinion gear depth measurement is necessary when;

- Axle housing or differential case is replaced
- Pinion select shim pack is unknown
- Ring and pinion gears are replaced

Compensation for pinion depth variance is achieved with select shims. In production the shims are placed between the pinion gear and the inner pinion bearing cone. For service the shims are placed under the inner pinion bearing cup.

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with Pinion Gauge Set 6774, Pinion Block 6735 and Dial Indicator C-3339 (Fig. 25).

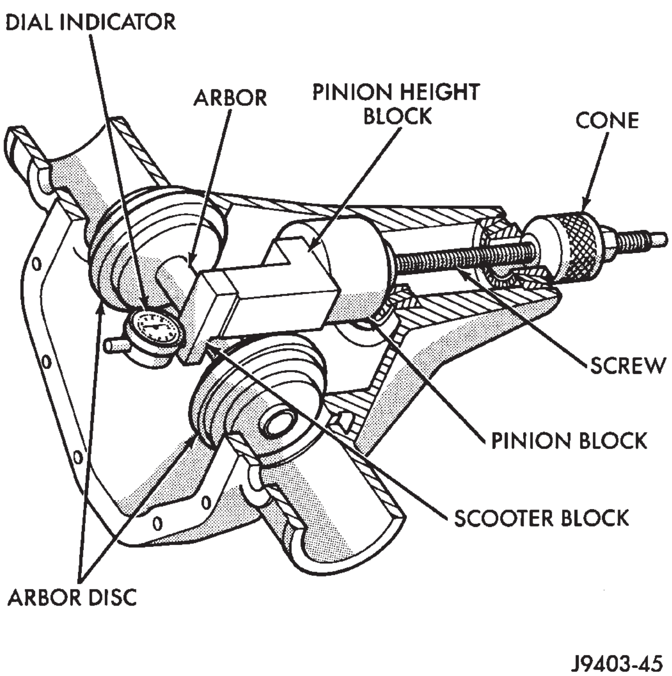

Fig. 25 Pinion Gear Depth Gauge Tools

(1) Assemble Pinion Gauge Set, Pinion Block and pinion bearings. Install assembly into differential pinion gear bore and hand tighten cone (Fig. 26).

(2) Place Arbor Disc 6732 on Arbor D-115-3 and position in the bearing cradles (Fig. 27). Install differential bearing caps on Arbor Discs and tighten caps snug only.

Arbor Discs have different steps to fit other axle sizes. Pick correct size step for axle being serviced.

(3) Firmly place Scooter Block and Dial Indicator on pinion height block tool and zero the dial indicator pointer.

(4) Slide the Scooter Block across the arbor while observing indicator (Fig. 28). Record the longest travel distance, whether inward (-) or outward (+), indicated by the pointer.

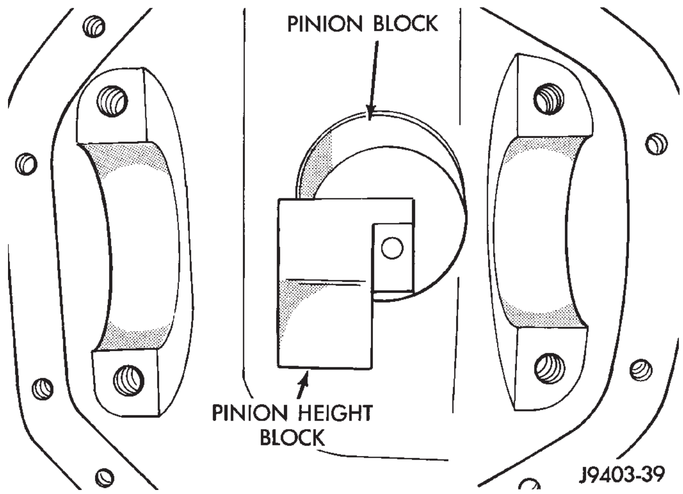

Fig. 26 Pinion Height Block

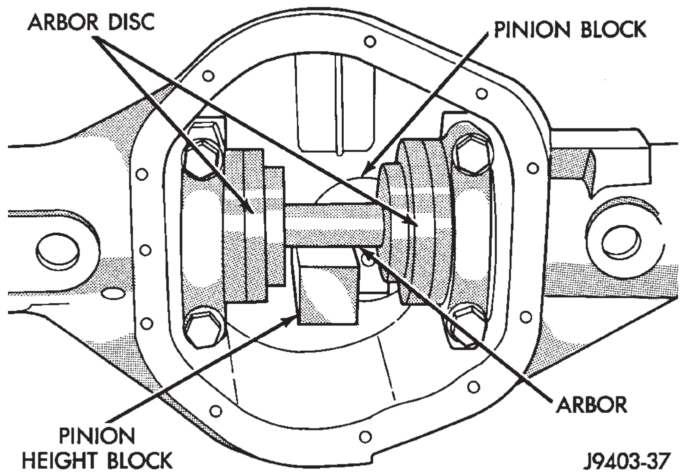

Fig. 27 Gauge Tools In Housing

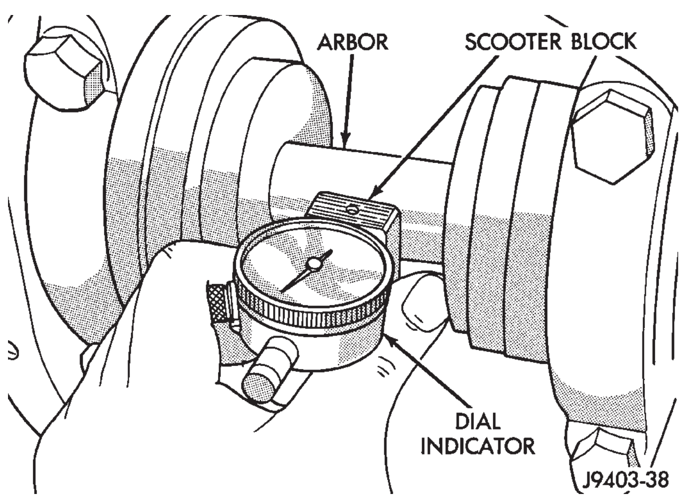

Fig. 28 Pinion Gear Depth Measurement

The plunger travel distance indicated, plus or minus the variance etched in the gear is the required thickness for the depth shims.

(5) Measure the thickness of each depth shim with a micrometer and combine the shims necessary for

total required shim pack thickness. **Include oil slinger or baffle thickness with the total shim pack thickness.**

(6) Remove the measurement tools from the differential housing.

PINION GEAR ASSEMBLY/INSTALLATION

(1) Place the depth shims (and baffle if equipped) in the pinion gear rear bearing bore. Install the bearing cup with Installer D-146 and Driver Handle C-4171 (Fig. 29). Ensure cup is correctly seated.

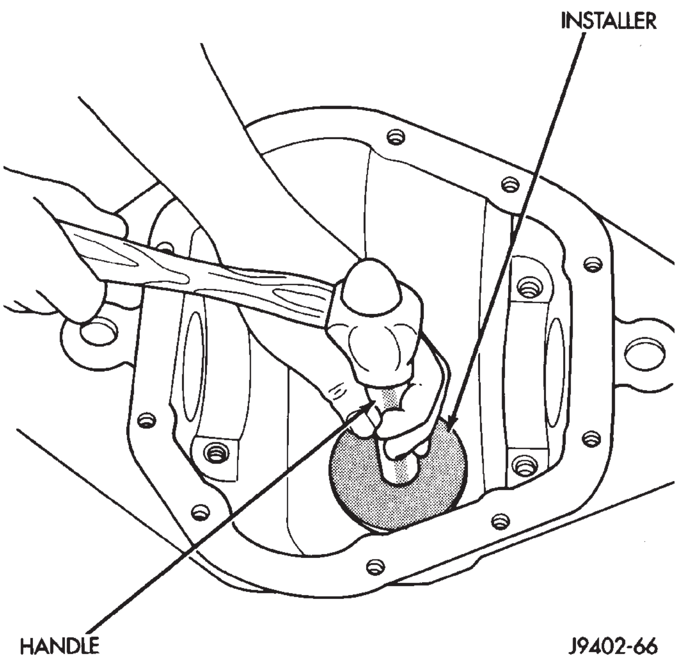

Fig. 29 Pinion Rear Bearing Cup Installation

(2) Install the pinion front bearing cup with Installer D-130 and Handle C-4171 (Fig. 30).

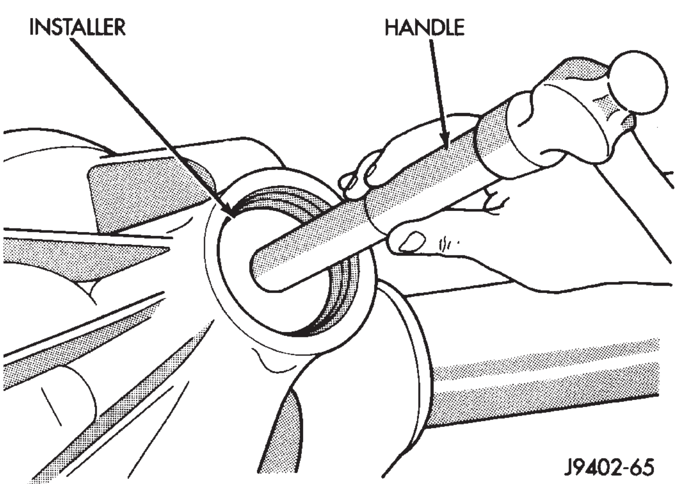

Fig. 30 Pinion Front Bearing Cup Installation

(3) Install pinion front bearing, oil slinger. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer D-163 and Handle C-4171 (Fig. 31).

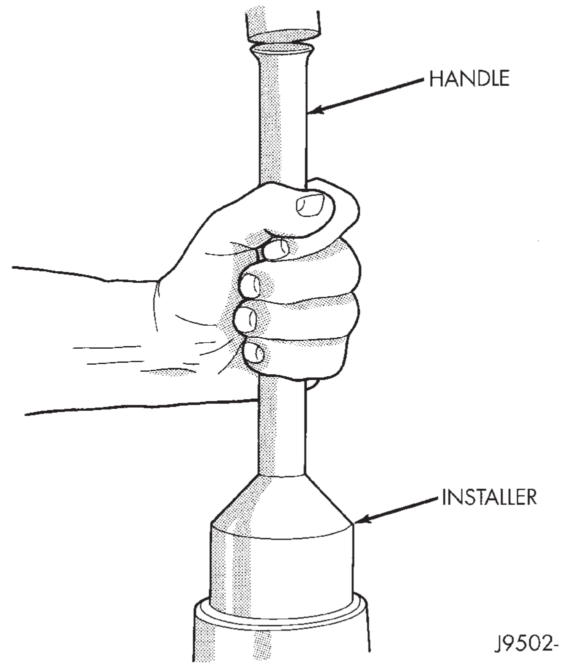

Fig. 31 Pinion Seal Installation

(4) Install the rear bearing (and slinger if used) on the pinion gear with Installer W-262 (Fig. 32).

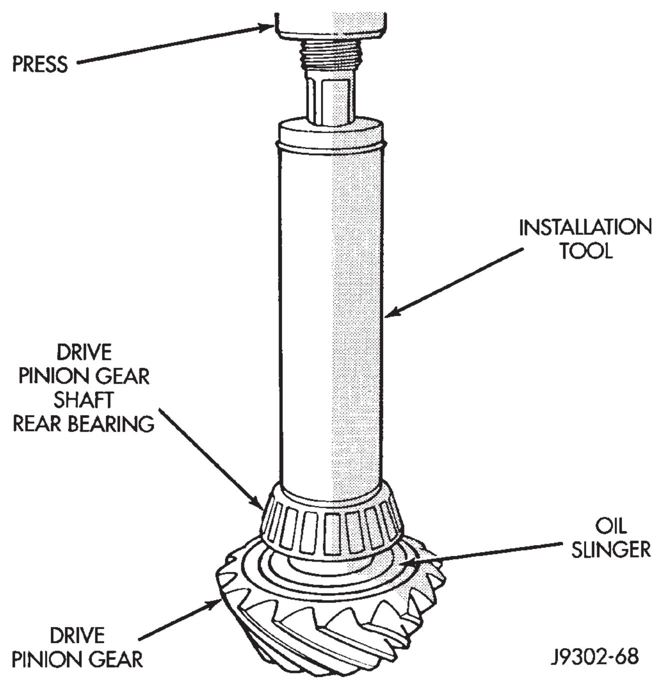

Fig. 32 Rear Pinion Bearing Installation

(5) Install a new collapsible preload spacer on pinion shaft (Fig. 33).

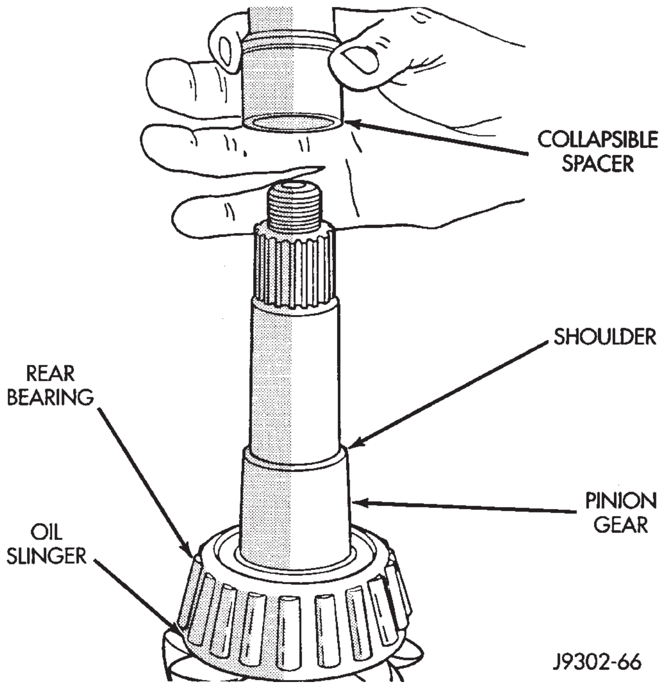

Fig. 33 Collapsible Preload Spacer

(6) Install pinion gear into differential housing.

(7) Install yoke with Installer W-162D and Wrench C-3281 (Fig. 34).

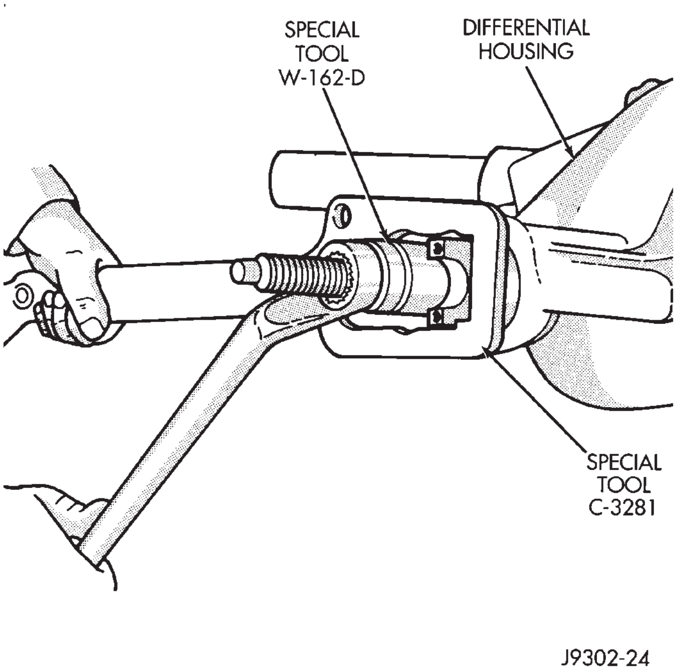

Fig. 34 Pinion Yoke Installation

(8) Install the yoke washer and a new nut on the pinion gear. **Tighten nut to 271 N·m (200 ft lbs.) min. Do not over-tighten.**

CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing preload torque and never exceed specified preload torque. If preload torque is exceeded a new collapsible spacer must be installed. The torque sequence will have to be repeated.

(9) Use Flange Wrench C-3281 to retain the yoke (Fig. 35). Slowly tighten the nut in small increments until the rotating torque is achieved. **Measure the preload torque frequently to avoid over-tightening the nut. The maximum pinion nut torque is 475 N·m (350 ft. lbs.).**

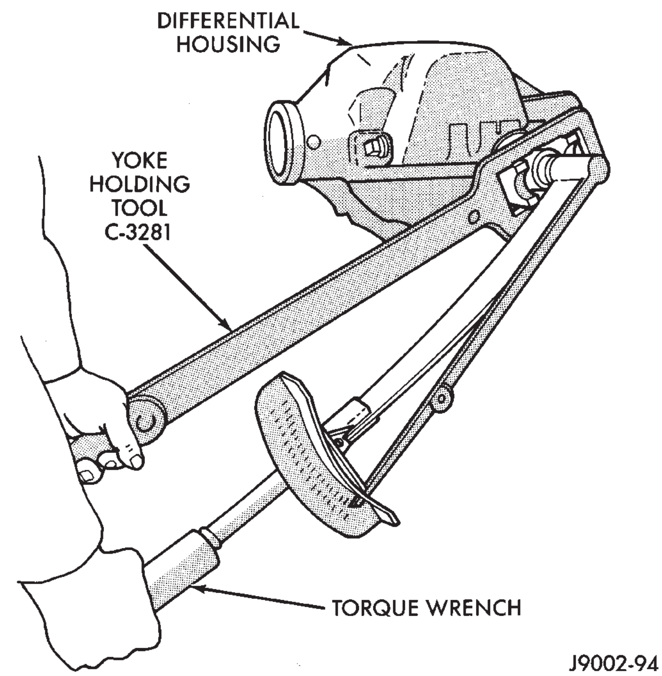

Fig. 35 Tightening Pinion Nut

(10) Check bearing preload torque with an inch pound torque wrench (Fig. 36). The torque necessary to rotate the pinion gear should be;

- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.)
- New Bearings — 1.7 to 3.9 N·m (15 to 35 in. lbs.)

DIFFERENTIAL MEASUREMENT AND INSTALLATION

DIFFERENTIAL SHIM PACK MEASUREMENT

(1) Install the bearings on the hub with Installer C-3716A and Driver Handle C-4171.

(2) Match each bearing cup with bearing (original). Install the cups on the bearings.

(3) Install the differential case in the housing.

(4) Install the outboard shim/spacer (selected thickness) on each side between bearing cup and housing (Fig. 37). Use 0.142 in. (3.6 mm) as a starting point, shim/spacers are available in various thicknesses.

(5) Install the marked bearing caps in their correct positions. Install and snug the bolts.

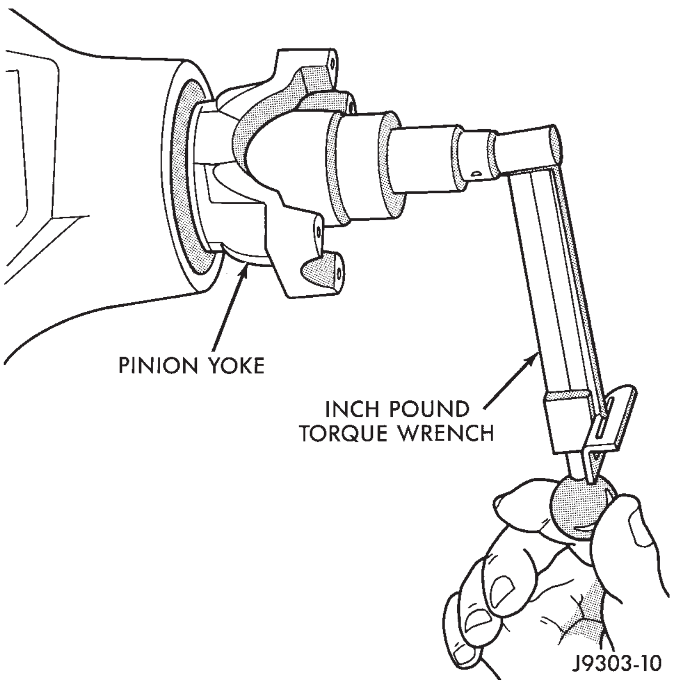

Fig. 36 Check Pinion Gear Torque

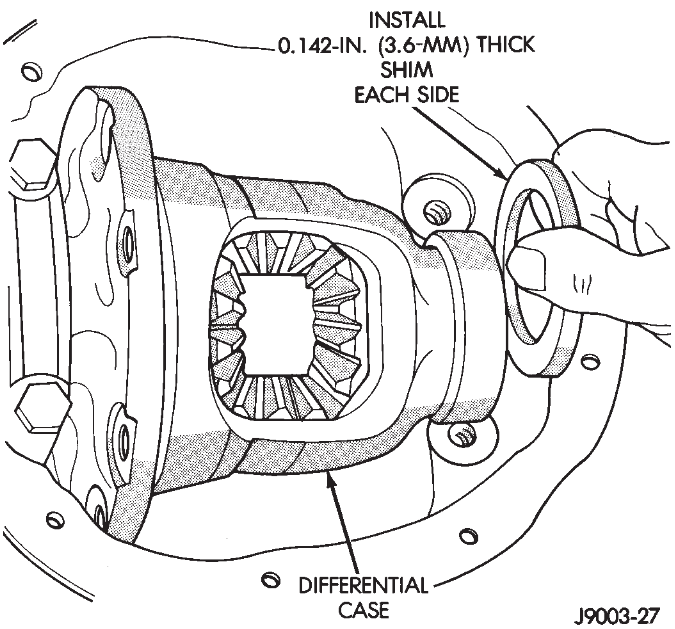

Fig. 37 Differential Bearing Shim Installation

(6) Attach a dial indicator to the housing. Position the indicator plunger so that it contacts the ring gear mating surface (Fig. 38).

(7) Pry the differential case to one side and zero the dial indicator pointer.

(8) Pry the differential case to the opposite side and record indicator reading. Reading is additional shim thickness needed for zero end play. For example, if reading was 0.008 inch (0.20 mm), an additional 0.004 inch (0.10 - mm) thick shim will be needed at each side zero end play.

(9) Install zero end-play shims on each side of case.

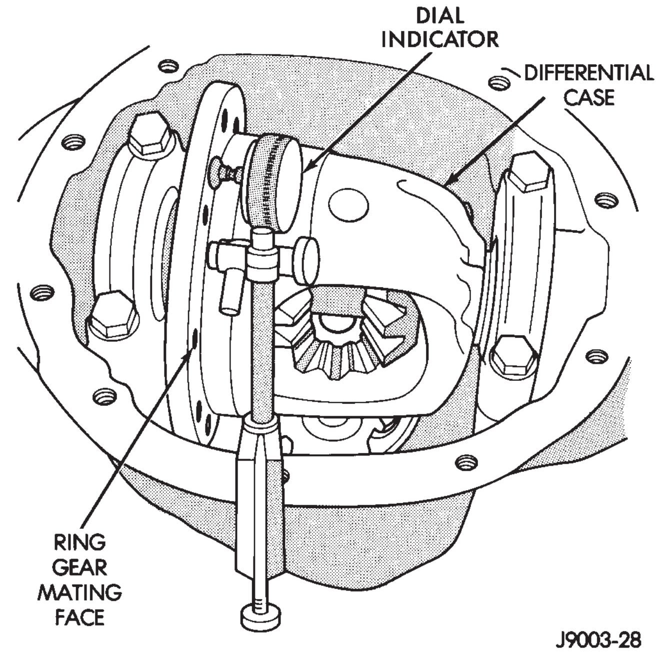

Fig. 38 Shim Measurement

The differential bearings must be preloaded to compensate for heat and load during operation.

(10) Add an additional 0.004 - inch (0.1 - mm) to **each** outboard shim/spacer for bearing preload.

RING GEAR INSTALLATION

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

(2) Install new ring gear bolts and alternately tighten to 95-122 N·m (70-90 ft. lbs.) torque (Fig. 39).

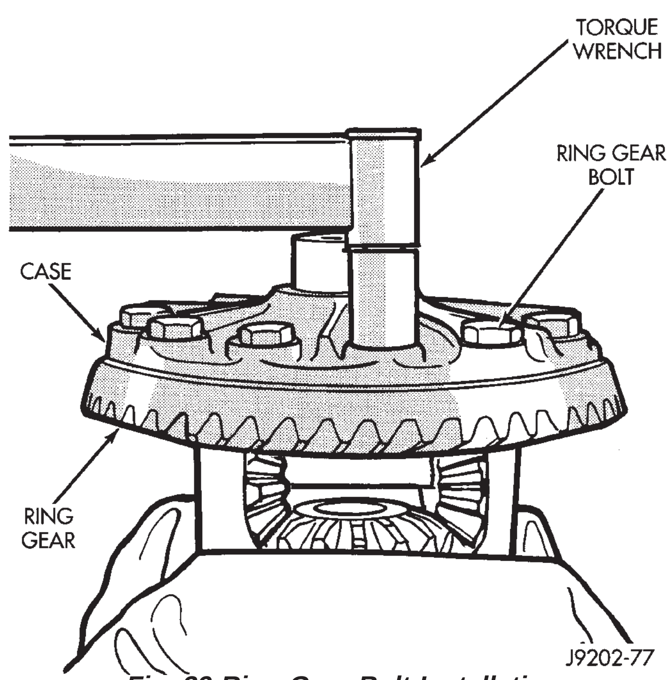

Fig. 39 Ring Gear Bolt Installation

DIFFERENTIAL INSTALLATION

(1) Position Spreader W-129B with the tool dowel pins seated in the locating holes (Fig. 40). Install the holddown clamps and tighten the tool turnbuckle finger-tight.

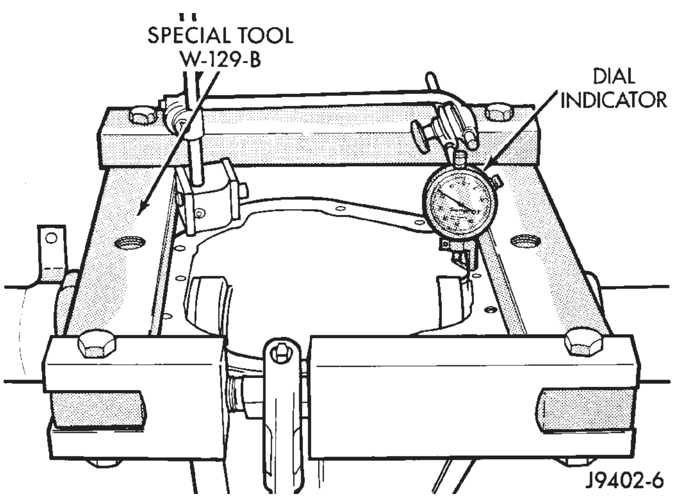

Fig. 40 Spread Differential Housing

(2) Install a pilot stud at the left side of the differential housing. Attach Dial Indicator to housing pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 40) and zero the indicator.

CAUTION: Do not spread over 0.38 mm (0.015 in). If the housing is over-separated, it could be distorted or damaged.

(3) Separate the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 40).

(4) Remove the dial indicator.

(5) Install differential and outboard shim/spacer (selected thickness) in housing.

(6) Install case in the housing. Tap the differential case to ensure the bearings are fully seated (Fig. 41). Remove the spreader.

(7) Install the bearing caps at their original locations (Fig. 42). Tighten the bearing cap bolts to 77 N·m (57 ft. lbs.) torque.

BACKLASH AND CONTACT PATTERN ANALYSIS

(1) Rotate assembly several revolutions to seat bearings. Measure backlash at three equally spaced locations around the perimeter of the ring gear with a dial indicator (Fig. 43).

The ring gear backlash must be within 0.12 - 0.20 mm (0.005 - 0.008 inch). It cannot vary more than 0.05 mm (0.002 inch) between the points checked.

If backlash must be adjusted, spacers are available in various thicknesses. Adjust the backlash accordingly (Fig. 44). **DO NOT INCREASE THE TOTAL SHIM PACK THICKNESS, EXCESSIVE BEARING PRELOAD AND DAMAGE WILL OCCUR.**

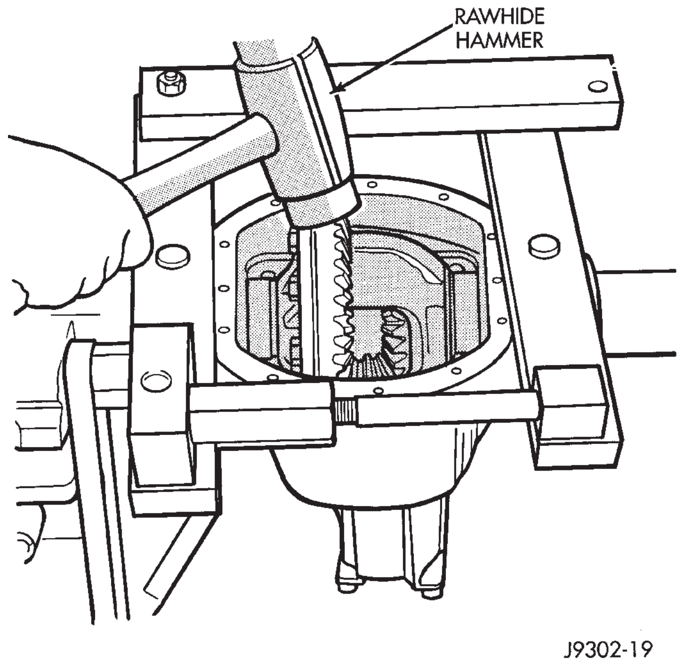

Fig. 41 Differential Installation

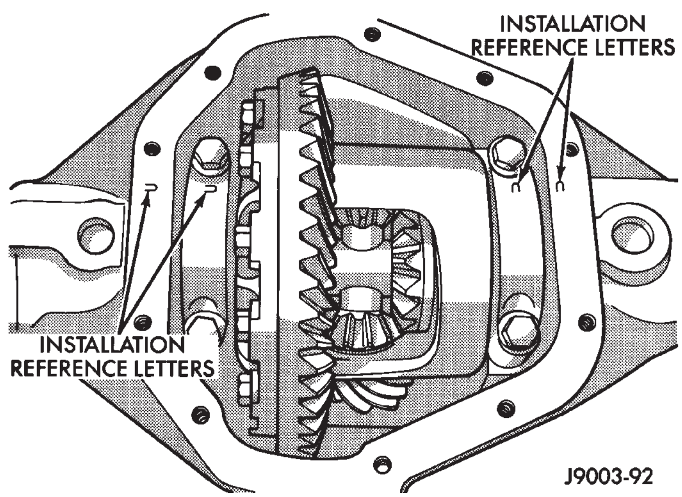

Fig. 42 Differential Bearing Cap Reference Letters

The ring gear teeth contact patterns will show if the pinion gear depth shim(s) have the correct thickness. It will also show if the ring gear backlash has been adjusted correctly. The backlash must be maintained within the specified limits until the correct tooth contact patterns are obtained.

(2) Apply a thin coat of **hydrated ferric oxide**, to the ring gear teeth.

(3) Rotate the ring gear one complete revolution in both directions while a load is being applied. Insert a pry bar between the differential housing and the case flange. This action will produce distinct contact patterns on both the drive side and coast side of the ring gear teeth.

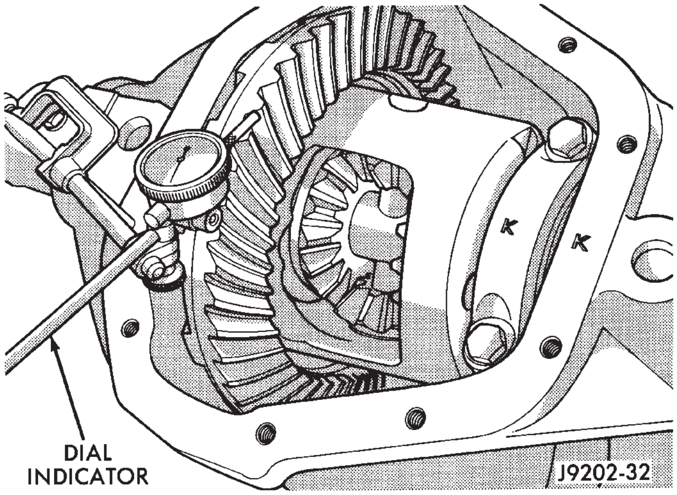

Fig. 43 Ring Gear Backlash Measurement

(4) Note patterns in compound. Refer to (Fig. 45) for interpretation of contact patterns and adjust accordingly.

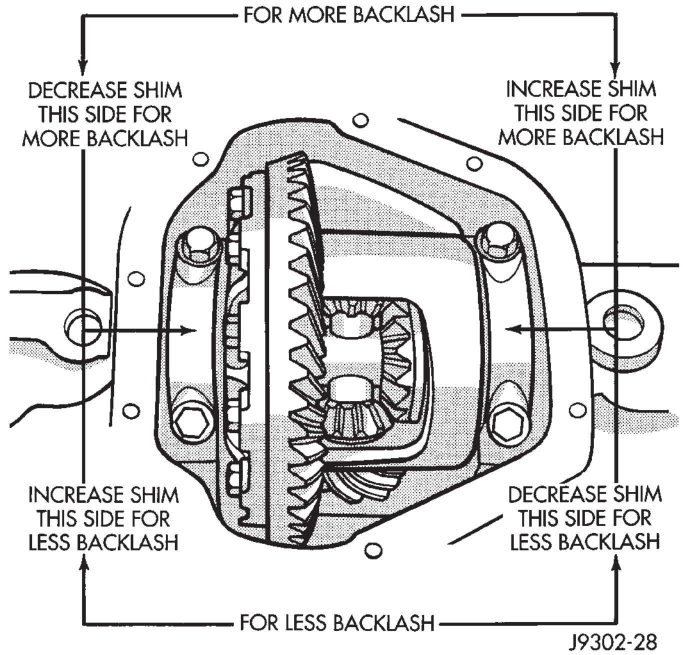

Fig. 44 Backlash Shim Adjustment

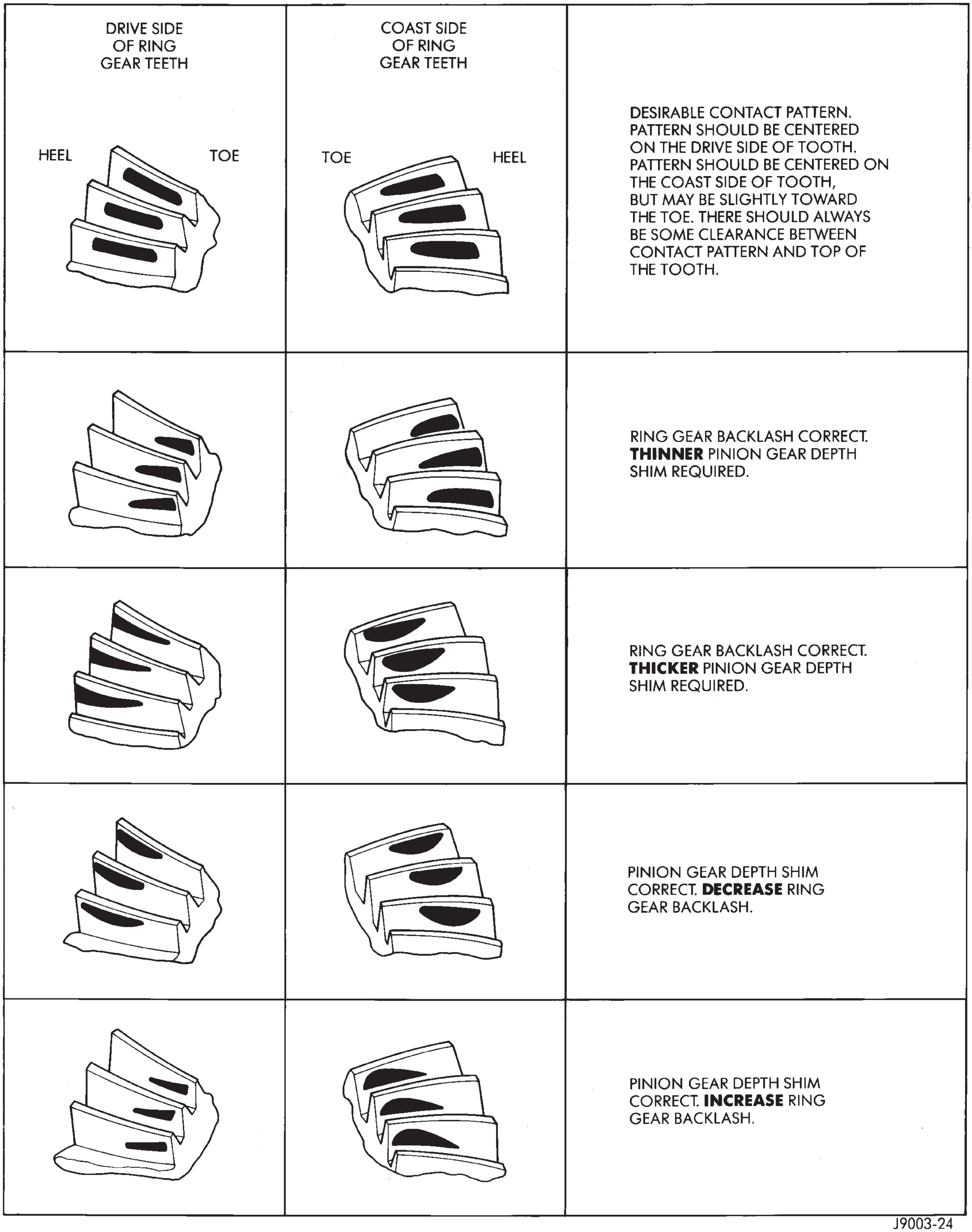

Fig. 45 Gear Tooth Contact Patterns

FINAL ASSEMBLY

(1) Install the axle shafts. Refer to Axle Shaft Installation within this group.

(2) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of MOPAR® Silicone Rubber Sealant on the housing cover (Fig. 46). **Allow the sealant to cure for a few minutes.**

Install the housing cover within 5 minutes after applying the sealant. If not installed the sealant must be removed and another bead applied.

(3) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in the lubricant foaming and overheating.

(4) Refill the differential housing with the specified quantity of MOPAR® Hypoid Gear Lubricant.

(5) Install the fill hole plug if used and tighten to 34 N·m (25 ft. lbs.) torque. Axles with rubber plug will snap into place.

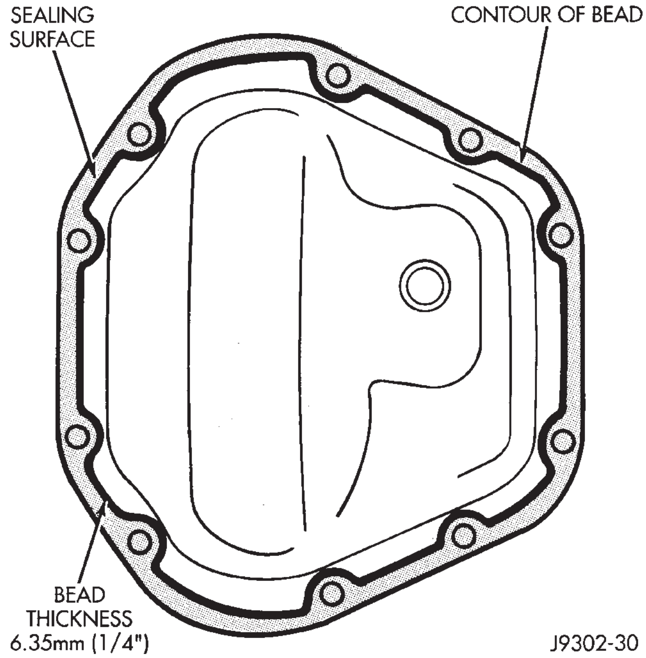

Fig. 46 Typical Housing Cover With Sealant

TRAC-LOK DIFFERENTIAL

OPERATION

In a conventional differential, the torque applied to the ring gear is transmitted to the axle shafts through the differential gears. During normal operation, the torque transmitted to each wheel is equal at all times. However, if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

In the Trac-Lok differential, part of the ring gear torque is transmitted through clutch packs. The clutch packs contain multiple disc. The clutch will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth appearance.

In operation, the Trac-Lok clutches are engaged by two concurrent forces. The first being preload force exerted through Belleville spring washers contained in the clutch packs. The second from separating forces generated by the side gears as torque is applied through the ring gear (Fig. 1).

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

NOISE DIAGNOSIS

If a noise occurs when turning corners, the most probable cause is incorrect or contaminated lubricant. Before removing the Trac-Lok unit for repair, drain, flush and refill the axle with the specified lubricant. Refer to Lubricant change in this Group.

A container of Trac-Lok Lubricant (friction modifier) should be added after repair service or a lubricant change.

Vehicles with a limited slip differential should be road tested by making 10 to 12 slow figure eight turns. This maneuver will pump the lubricant through the clutch discs to eliminate a possible **chatter or pop** noise complaint.

Refer to Group 0, Lubrication and Maintenance for additional information.

DIFFERENTIAL TEST

WARNING: WHEN SERVICING VEHICLES WITH A LIMITED SLIP DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A LIMITED SLIP AXLE CAN EXERT ENOUGH FORCE (IF ONE WHEEL IS IN CONTACT WITH THE SURFACE) TO CAUSE THE VEHICLE TO MOVE.

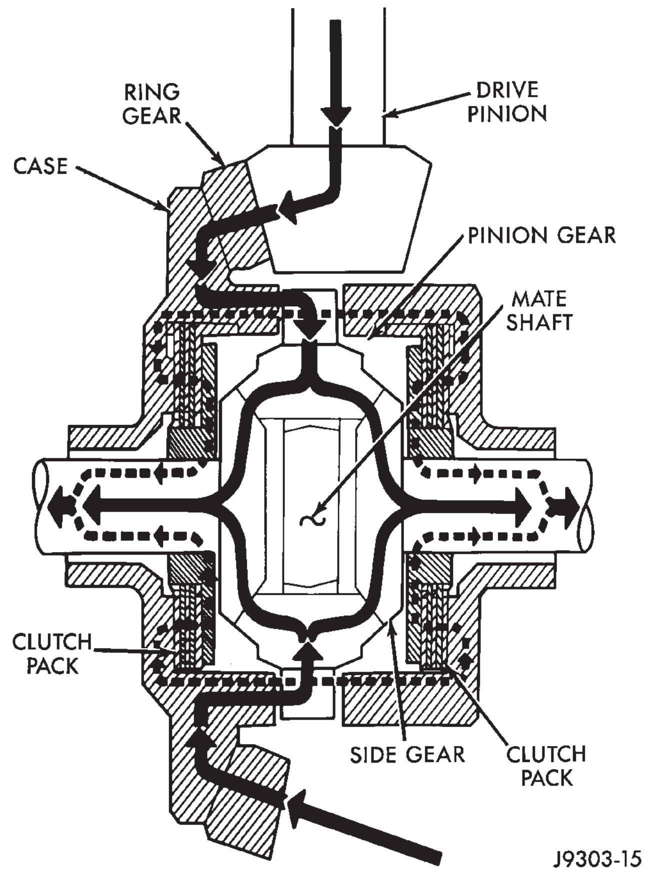

Fig. 1 Limited Slip Differential Operation—Both Wheels Driving

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Engine of, transmission in neutral, and parking brake off.

(2) Place blocks in front and rear of both front wheels.

(3) Jack up one rear wheel until it is completely off the ground.

(4) Remove wheel and bolt Special Tool 6790 to studs.

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 2).

(6) If rotating torque is less than 22 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be service.

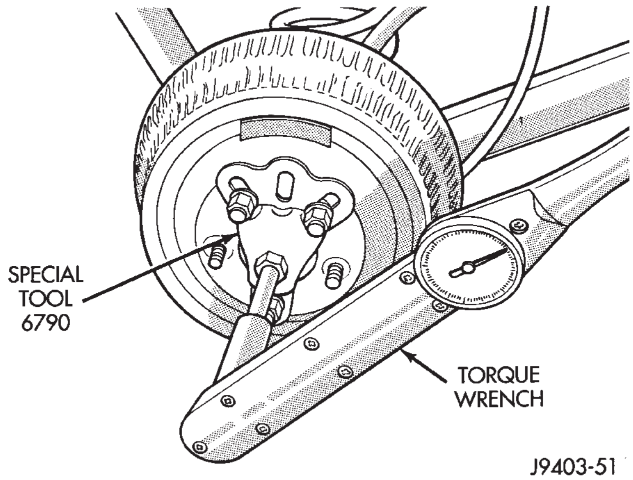

Fig. 2 Trac-Loc Test

DIFFERENTIAL OVERHAUL

The **Trac-Lok** (limited-slip) differential components are illustrated in (Fig. 3). Refer to this illustration during repair service.

DISASSEMBLY

Service to the Trac-Lok differential requires the use of Tool Set C-4487 (J-23781). Refer to Model 35 Axle section in this Group for Differential Removal and Installation.

(1) Clamp one axle shaft in a vise equipped with soft jaws (Fig. 4).

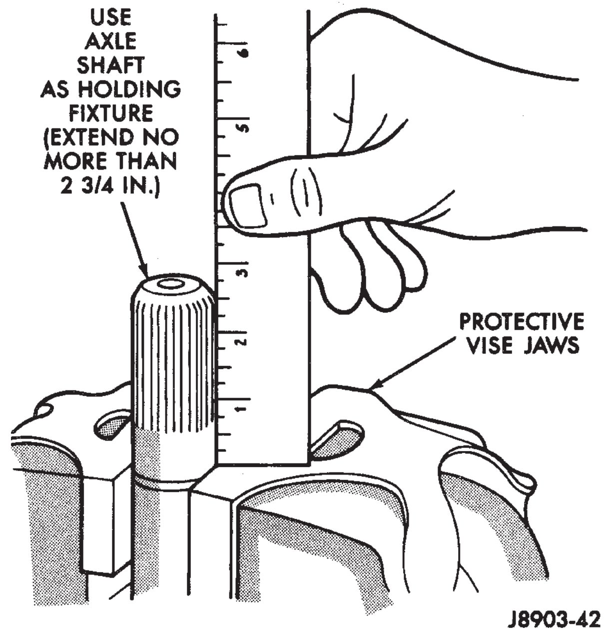

Fig. 4 Axle Shaft As Holding Fixture

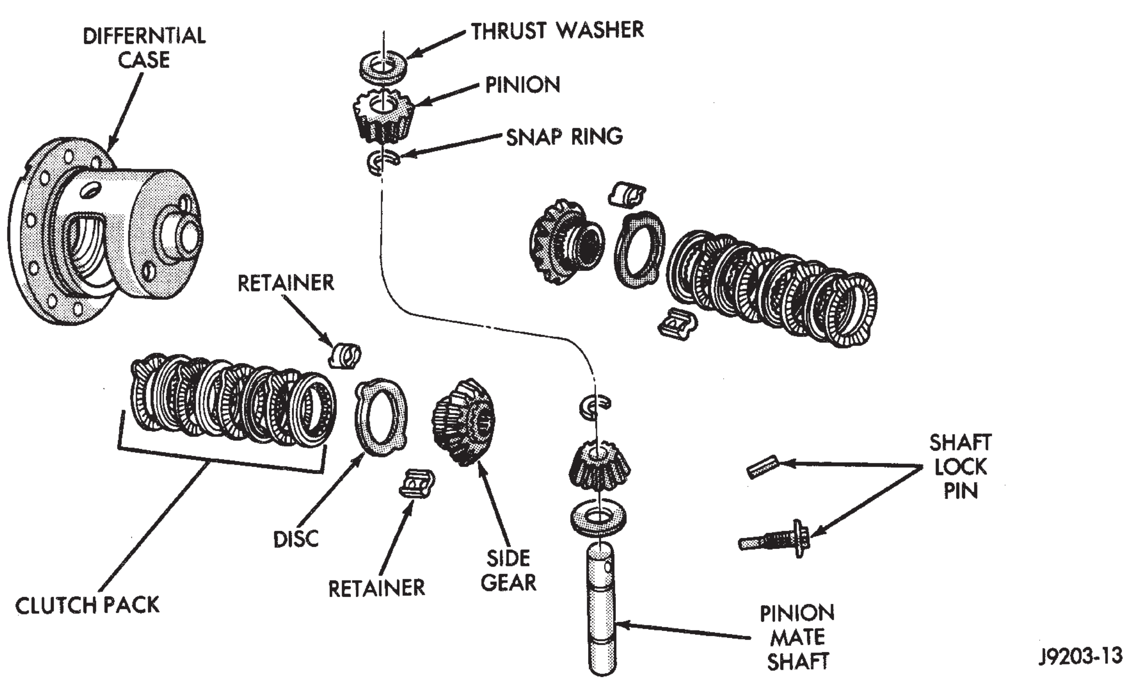

Fig. 3 Trac-Lok Differential Components

(2) Position the differential case on the axle shaft (Fig. 5). Place shop towels under the differential to avoid damage during removal of the ring gear (Fig. 5).

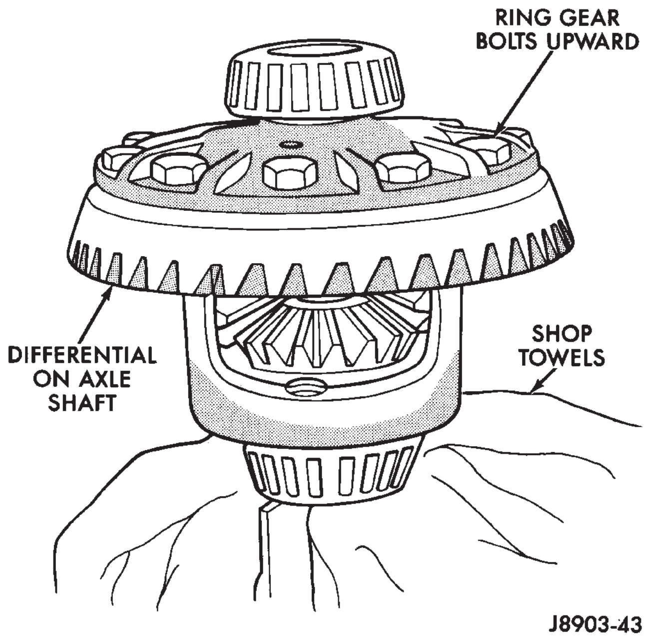

Fig. 5 Differential Case On Shaft

(3) Remove **and discard** the ring gear bolts. Tap the ring gear with a rawhide or plastic mallet and remove (Fig. 6).

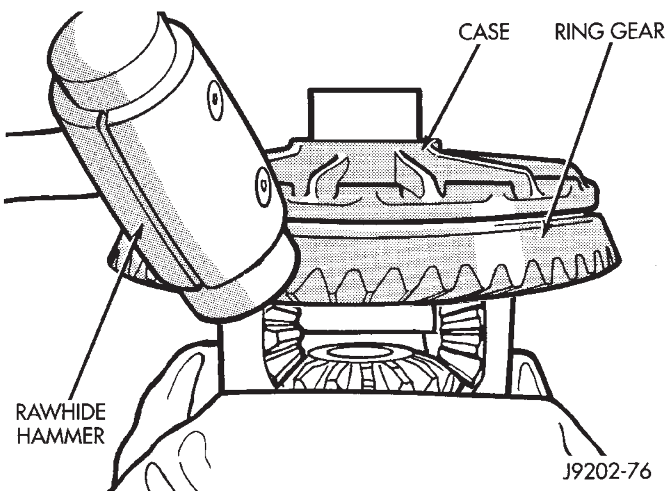

Fig. 6 Ring Gear Removal

(3) Remove the pinion gear mate shaft lock screw (Fig. 7).

(5) Remove the pinion gear mate shaft with a drift and hammer (Fig. 8).

(6) Install and lubricate Step Plate C-4487-1 (Fig. 9).

(7) Assemble Threaded Adapter C-4487-3 into top side gear. Thread forcing Screw C-4487-2 into adapter until it becomes centered in adapter plate.

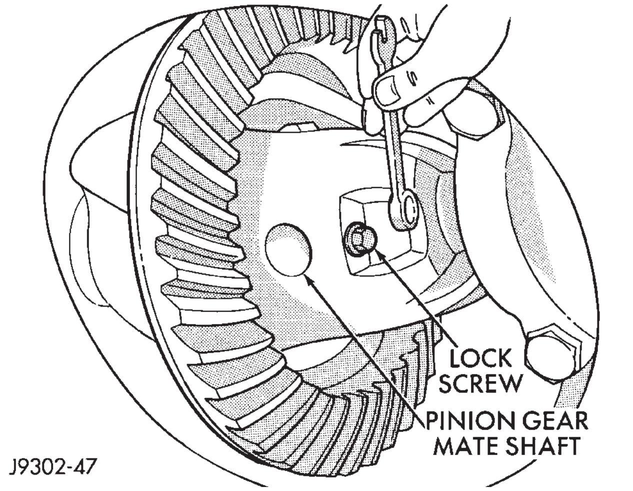

Fig. 7 Mate Shaft Lock Screw

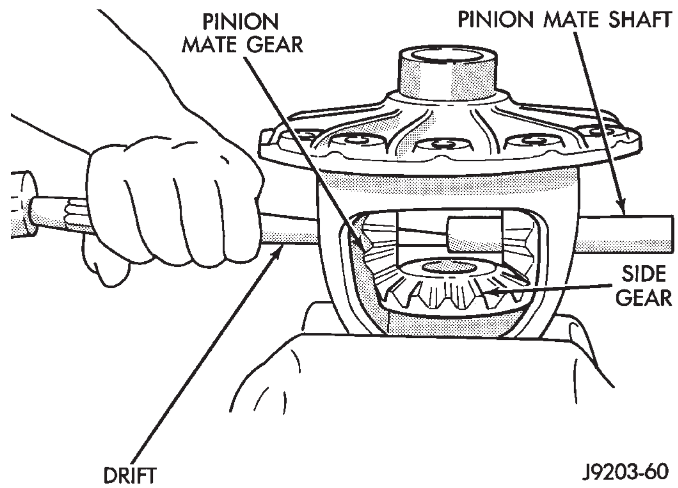

Fig. 8 Mate Shaft Removal

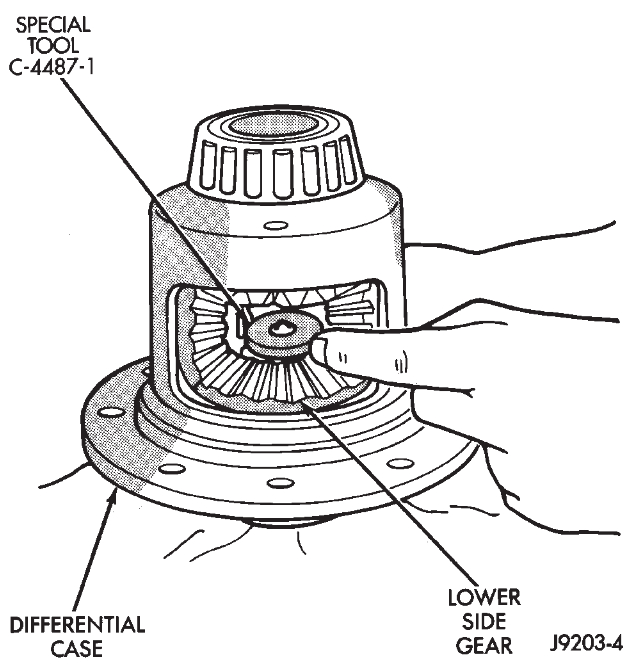

Fig. 9 Step Plate Tool Installation

(8) Position a small screw driver in slot of Threaded Adapter C-4487-3 (Fig. 10) to prevent adapter from turning.

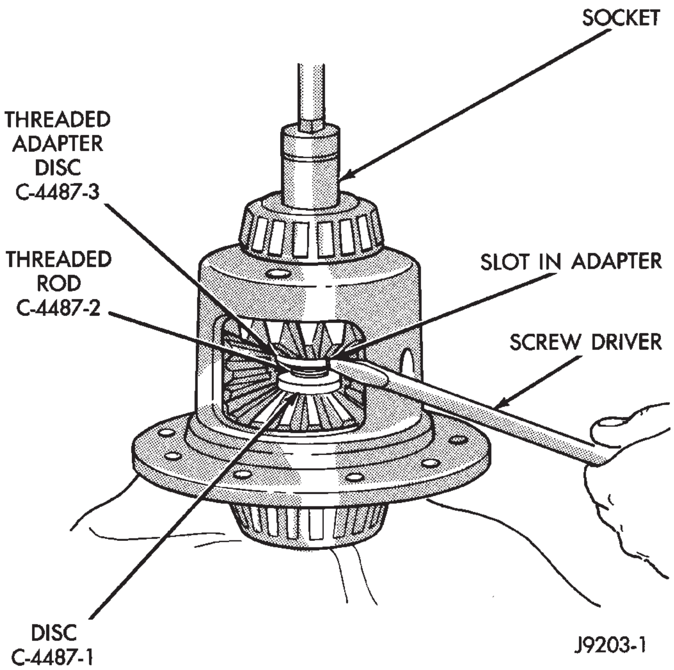

Fig. 10 Threaded Adapter Installation

(9) Tighten forcing screw tool enough to relieve clutch pack tension. Remove both pinion thrust washers (Fig. 11).

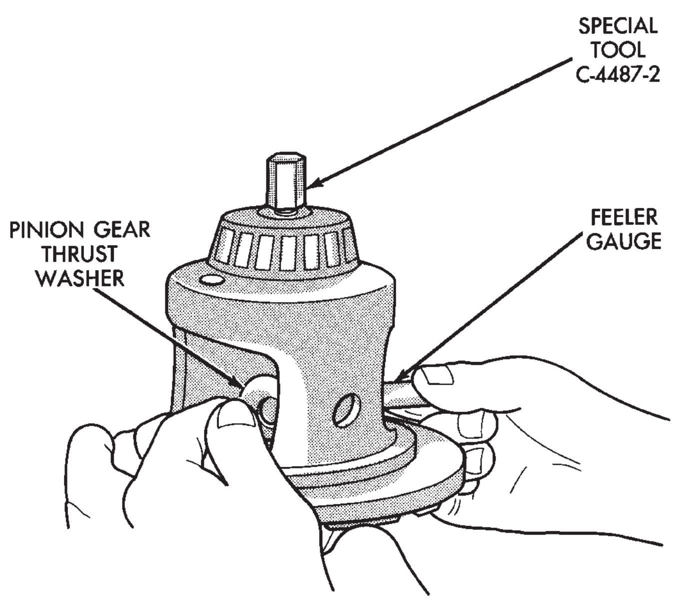

Fig. 11 Remove Pinion Thrust Washer

(10) Loosen the forcing screw tool until the clutch pack tension is relieved.

(11) Insert Turning Bar C-4487-4 in case. Rotate case with tool until pinion gears can be removed (Fig. 12).

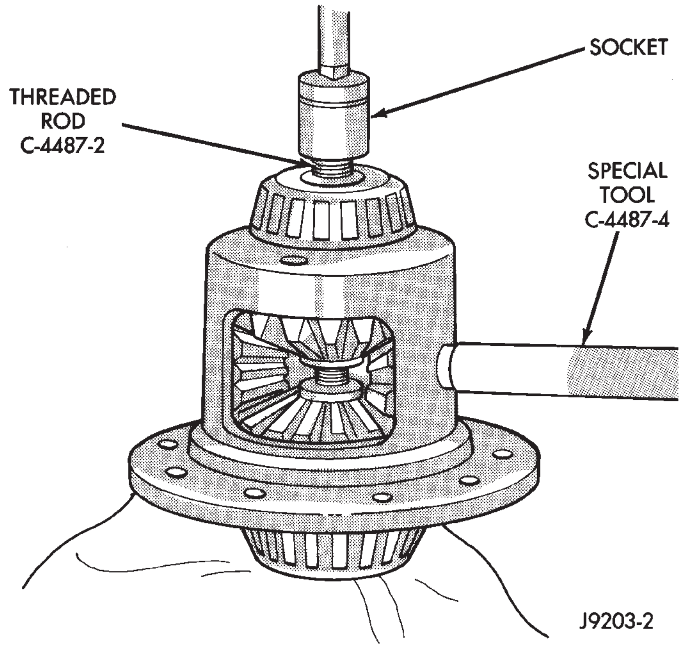

Fig. 12 Pinion Gear Removal

(12) Remove top side gear and clutch pack. Keep plates in correct order during removal (Fig. 13).

(13) Remove case from fixture. Remove remaining clutch pack.

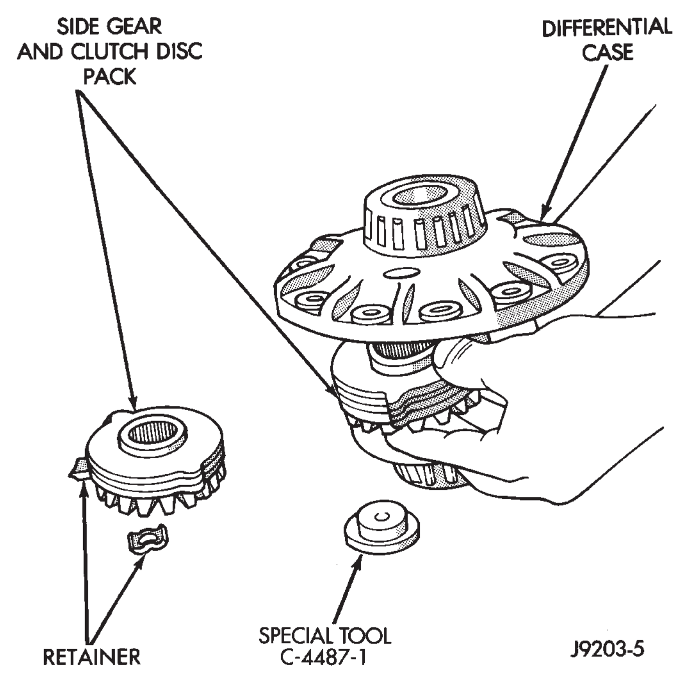

Fig. 13 Side Gear & Clutch Disc Removal

(14) Remove clutch pack retaining clips. Mark each clutch pack for installation reference.

CLEANING AND INSPECTION

(1) Clean all components in cleaning solvent. Dry components with compressed air.

(2) Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged.

(3) Inspect side and pinion gears. Replace any gear that is worn, cracked, chipped or damaged.

(4) Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and dics with fiber coating (no groves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes. Add remaining Friction Modifier to differential after assembly.

ASSEMBLY

The clutch discs are replaceable as complete sets only. **If one clutch disc pack is damaged, both packs must be replaced.**

Lubricate each component with gear lubricant before assembly.

(1) Assemble the clutch discs into packs secure disc packs with retaining clips (Fig. 14).

(2) Position assembled clutch disc packs on the side gear hubs.

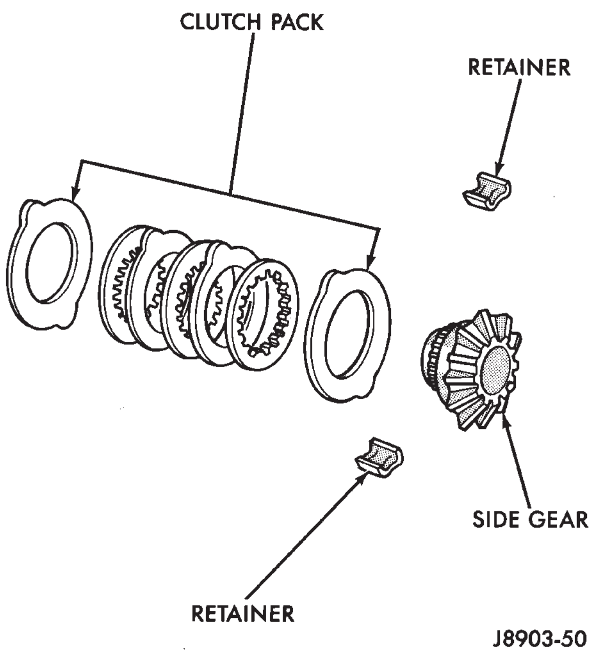

Fig. 14 Clutch Disc Pack

(3) Position case on axle fixture.

(4) Install clutch pack and side gear in lower bore (Fig. 15). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(5) Install lubricated Step Plate C-4487-1 on first clutch pack (Fig. 16).

(6) Install the upper side gear and clutch disc pack (Fig. 16).

(7) Hold assembly in position. Insert Threaded Adapter C-4487-3 into top side gear, insert forcing Screw C-4487-2.

(8) Tighten forcing screw tool to compress clutch discs.

(9) Install pinion gears. Rotate case with Turning Bar C-4487-4. Make sure holes of pinion mate gears are aligned with case.

(10) Tighten forcing screw to compress the Belleville plates. Lubricate and install pinion gear thrust washers with a small screw driver.

(11) Remove forcing screw, threaded adapter and step plate. Install pinion gear mate shaft, align holes in shaft and case.

(12) Install the pinion mate shaft lock screw finger tight to hold shaft durning installation.

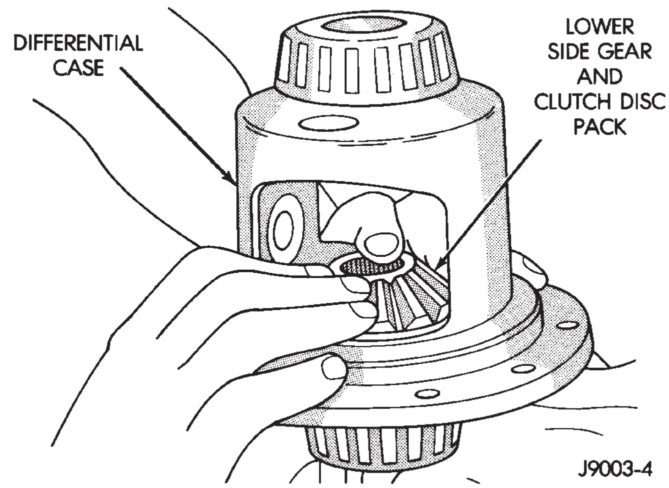

Fig. 15 Clutch Discs & Lower Side Gear Installation

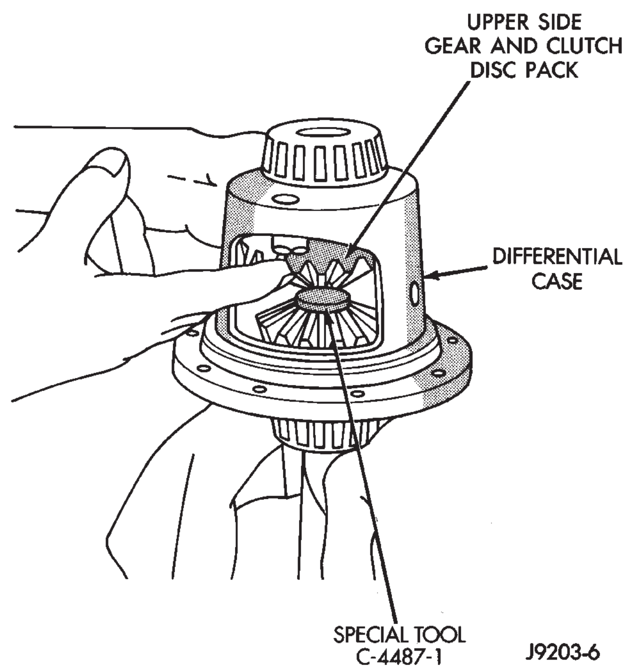

Fig. 16 Upper Side Gear & Clutch Disc Pack Installation

If replacement gears and thrust washers were installed, it is not necessary to measure the gear backlash. Correct fit is due to close machining tolerances during manufacture.

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

(14) Install new ring gear bolts and alternately tighten to 95-122 N·m (70-90 ft. lbs.) torque (Fig. 17).

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

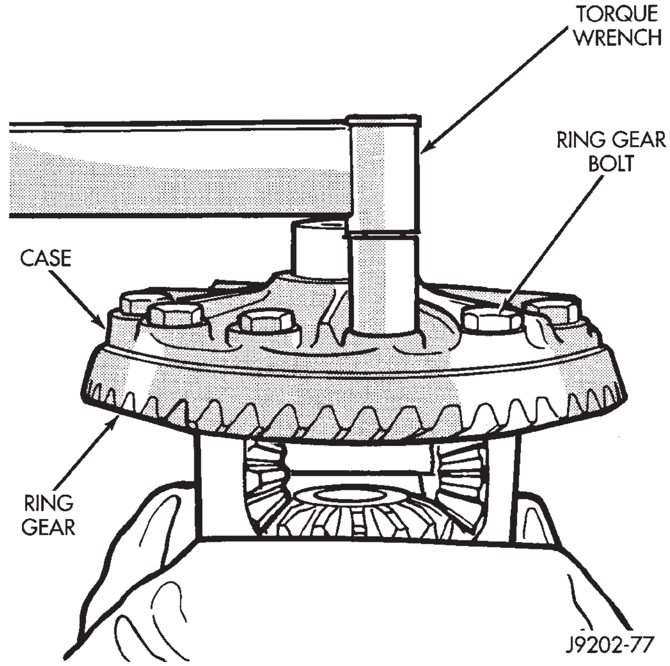

Fig. 17 Ring Gear Bolt Installation

AXLE SPECIFICATIONS

MODEL 35 AXLE

Axle Type .... Semi-Floating Hypoid
Lubricant .... Thermally Stable SAE 80W-90
Lubricant Trailer Tow .... Synthetic 75W-140
Lube Capacity .... 1.66 L (3.5 pts.)
Axle Ratio 3.55 3.73
Diff. Brg. Preload .... 0.1 mm (0.004 in.)
Side Gear Clearance .... 0-0.15 mm (0-0.006)

Ring Gear
Diameter .... 19.2 cm (7.562 in.)
Backlash .... 0.12-0.20 mm (0.005-0.008 in.)
Pinion Std. Depth .... 96.8 mm (3.813 in.)
Pinion Bearing Preload
Original Bearing .... 1-2 N·m (10-20 in. lbs.)
New Bearing .... 1.5-4 N·m (15-35 in. lbs.)

TORQUE SPECIFICATIONS

REAR SUSPENSION COMPONENTS

DESCRIPTION .... TORQUE
Shock Upper Nut .... 70 N·m (52 ft. lbs.)
Shock Lower Nut .... 92 N·m (68 ft. lbs.)
Suspension Arm Upper
Nuts .... 75 N·m (55 ft. lbs.)
Suspension Arm Lower
Nuts .... 177 N·m (130 ft. lbs.)
Stabilizer Bar
Clamp Bolt .... 54 N·m (40 ft. lbs.)
Link Nut .... 36 N·m (27 ft. lbs.)
Track Bar
Frame Bracket Nut .... 100 N·m (74 ft. lbs.)
Axle Bracket Bolt .... 100 N·m (74 ft. lbs.)

MODEL 35 AXLE

DESCRIPTION .... TORQUE
Fill Hole Plug .... 34 N·m (25 ft. lbs.)
Diff. Cover Bolt .... 41 N·m (30 ft. lbs.)
Bearing Cap Bolt .... 77 N·m (57 ft. lbs.)
Ring Gear Bolt .... 95-122 N·m (70-90 ft. lbs.)

BRAKES

CONTENTS

GENERAL INFORMATION

INDEX

WHEEL BRAKE COMPONENTS

All Grand Cherokee models are equipped with power assist four-wheel disc brakes. Antilock (ABS) brakes are also standard equipment on all models.

Single piston, disc brake calipers are used front and rear. Ventilated disc brake rotors are used at the front and solid rotors are used at the rear.

Power brake assist is supplied by a vacuum operated, dual diaphragm power brake booster.

The master cylinder used for all applications has an aluminum body and nylon reservoir with single filler cap.

A combination valve is used for all applications. The valve contains a pressure differential switch and rear brake proportioning valve.

ABS BRAKES

The antilock system is an electronically operated all wheel brake control system. The system is designed to prevent wheel lockup during periods of high wheel slip when braking.

The antilock electronic control system is separate from other electrical circuits in the vehicle. A separate electronic control unit (ECU) is used for the ABS system.

BRAKE CHANGES FOR 1995

A different master cylinder, power brake booster, and HCU are used in the 1995 Grand Cherokee ABS system.

The master cylinder reservoir has a single filler cap and is no longer interconnected with the HCU. The new HCU has built-in accumulators. The pedal travel sensor has been eliminated which means the power brake booster is different as a result.

The rear disc brakeshoes and caliper bracket are new for 1995. The bracket ledges are machined to accommodate the changed brakeshoes. The outboard brakeshoes now have anti-rattle springs and the inboard shoe has a wear warning strip attached.

The rear disc splash shield is now secured to the caliper bracket with two factory installed rivets. Although the rivets have to be drilled out to separate the shield from the bracket, the rivets do not have to be replaced afterward. Refer to the service procedures in the parking brake section.

PARKING BRAKE MECHANISM

The parking brake mechanism consists of a cable operated, dual shoe, drum brake mechanism. The brake shoes operate within a drum cast into the rear disc brake rotor. The shoes are mounted on a splash shield attached to the caliper bracket and rear axle tube flange. Parking brake adjustment is controlled by a cable tensioner mechanism.

BRAKE WARNING LIGHTS

All Grand Cherokee models have two brake warning lights. A red light is used for the service and parking brake system. An amber light is used for the ABS system. Both lights are in the instrument cluster.

The red light alerts the driver if a pressure differential exists between the front and rear hydraulic systems. The red light also alerts the driver when the parking brakes are applied.

The amber antilock light only illuminates when an antilock system fault occurs.

Both lights illuminate for about 1-2 seconds at engine start; this occurs as part of a normal bulb check.

BRAKELINING MATERIAL

Factory installed front and rear brakelining on Grand Cherokee models, is made from organic materials combined with metallic particles. The brakelining material does not contain asbestos.

BRAKE FLUID/LUBRICANTS/CLEANING SOLVENTS

Recommended brake fluid is Mopar brake fluid, or equivalent meeting SAE J1703 and DOT 3 standards.

Use Mopar multi-mileage grease to lubricate drum brake pivot pins and rear brakeshoe contact points on the support plates. Use GE 661 or Dow 111 silicone grease, or multi-mileage grease on caliper bushings and slide pins.

Use Mopar Brake Cleaner, or fresh brake fluid to clean or flush brake system components. These are the only cleaning materials recommended.

CAUTION: Never use gasoline, kerosene, methyl or isopropyl alcohol, paint thinner, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Drain and flush the system with new brake fluid if contamination is suspected.

BRAKE SAFETY PRECAUTIONS

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELINING ON GRAND CHEROKEE MODELS IS MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE WITH PRIOR BRAKE SERVICE. WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS FIBERS CAN BE A HEALTH HAZARD. NEVER CLEAN BRAKE COMPONENTS WITH COMPRESSED AIR. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR REMOVING BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN THE PARTS WITH WATER DAMPENED SHOP RAGS. DO NOT CREATE DUST BY SANDING BRAKELINING. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS IN SEALED 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 DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

ABS BRAKE DIAGNOSIS

INDEX

GENERAL INFORMATION

The DRB scan tool is required for all ABS diagnosis. The scan tool is used to identify ABS circuit faults.

Once a circuit fault has been identified, refer to the appropriate chassis/body diagnostic manual for individual component testing.

ABS WARNING LIGHT DISPLAY

The amber antilock light illuminates at startup as part of the system self check feature. The light illuminates for 1-3 seconds then goes off as part of the normal bulb check routine.

An ABS circuit fault is indicated when the amber light remains on after startup, or illuminates at any time during vehicle operation.

Verify that a fault is actually related to the ABS system before making repairs. For example, if the red light illuminates but the ABS light does not, the problem is related to a service brake component and not the ABS system. Or, if neither light illuminates but a brake problem is noted, again, the problem is with a service brake component and not with the ABS system.

ABS DIAGNOSTIC CONNECTOR

The ABS diagnostic connector is located inside the vehicle. The connecter is the access point for the DRB scan tool.

The connector is blue or black in color and is a 6-way type. The connector is under the carpet at the forward end of the console just under the IP center.

DRB SCAN TOOL

ABS diagnosis is performed with the DRB scan tool. Refer to the DRB scan tool manual for test hookup and procedures. Diagnosis information is provided in the Chassis Diagnostic Procedures Manual for Jeep Grand Cherokee Models.

WHEEL/TIRE SIZE AND INPUT SIGNALS

Antilock system operation is dependant on accurate signals from the wheel speed sensors. Ideally, the vehicle wheels and tires should all be the same size and type. However, the Jeep ABS system is designed to function with a compact spare tire installed.

NORMAL OPERATING CONDITIONS

Sound Levels

The hydraulic control unit pump and solenoid valves may produce some sound as they cycle on and off. This is a normal condition and should not be mistaken for faulty operation. Under most conditions, pump and solenoid valve operating sounds will not be audible.

Vehicle Response In Antilock Mode

During antilock braking, the hydraulic control unit solenoid valves cycle rapidly in response to antilock electronic control unit signals.

The driver will experience a pulsing sensation within the vehicle as the solenoids decrease, hold, or increase pressure as needed. Brake pedal pulsing will also be noted and is a **normal** condition.

Steering Response

A modest amount of steering input is required during extremely high deceleration braking, or when braking on differing traction surfaces. An example of differing traction surfaces would be when the left side wheels are on ice and the right side wheels are on dry pavement.

Owner Induced Faults

Driving away with the parking brakes still applied will cause warning light illumination. Pumping the brake pedal will also generate a system fault and interfere with ABS system operation.

ANTILOCK ECU AND HCU DIAGNOSIS

An ECU or HCU fault can only be determined through testing with the DRB scan tool. Do not replace either component unless a fault is actually indicated.

SERVICE BRAKE DIAGNOSIS

INDEX

GENERAL INFORMATION

The diagnosis information in this section covers the vehicle service brake components which include:
- disc brake calipers
- disc brakeshoes
- disc brake rotors
- parking brake mechanism
- master cylinder
- combination valve
- power brake booster
- brake pedal and brakelight switch
- red brake warning light

DIAGNOSIS PROCEDURES

Service brake diagnosis involves determining if the problem is related to a mechanical, hydraulic or vacuum operated part. A preliminary check, road testing and component inspection are needed to determine a problem cause.

Road testing will either verify proper brake operation or confirm the existence of a problem. Component inspection will, in most cases, identify the actual part causing a problem.

The first diagnosis step is the preliminary check. This involves inspecting fluid level, parking brake action, wheel and tire condition, checking for obvious leaks or component damage and testing brake pedal response. A road test will confirm or deny the existence of a problem. The final diagnosis procedure involves road test analysis and a visual inspection of brake components.

PRELIMINARY BRAKE CHECK

(1) If amber antilock light is illuminated, refer to Antilock Brake System Diagnosis. However, if the red warning light is illuminated, or if no warning light is illuminated, continue with diagnosis.

(2) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, tramp and a condition similar to grab.

(3) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn, or damaged suspension or steering components.

(4) Inspect brake fluid level and condition. Correct fluid level is to FULL mark on reservoir. Remember that fluid level will decrease slightly as normal brakelining wear occurs. If fluid level is abnormally low, look for leaks at calipers, wheel cylinders, brakelines and master cylinder.

(5) Check fluid condition.

(a) Fluid should be reasonably clear and free of foreign material. **Note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination. If fluid is reasonably clear and free of foreign material, it is OK.**

(b) If fluid is highly discolored, or appears to contain foreign material, drain out a sample with a clean suction gun. Pour sample in a glass container and note condition described in step (c).

(c) If fluid separates into layers, or obviously contains oil or substance other than brake fluid, system seals and cups will have to be replaced and hydraulic system flushed.

(6) Check parking brake operation. Verify free movement and full release of cables and foot pedal or hand lever. Also note if vehicle was being operated with parking brake partially applied.

(7) If components checked appear OK, proceed to Road Test.

ROAD TEST

(1) If red light is not on, proceed to step (3).

(2) If red light is on, proceed as follows:

(a) See if parking brakes are applied. Release them if necessary and proceed to step (b).

(b) Note if brake pedal is abnormally low. If pedal is definitely low and red light is on, check front and rear brake hydraulic circuits for leak. **Do not continue with road test. Inspect and repair hydraulic components as needed.**

(3) Check brake pedal response with transmission in Neutral and engine running.

(a) If pedal remains firm under steady foot pressure, proceed to step (4).

(b) If pedal falls away, problem is in master cylinder, or HCU on ABS models. **Do not road test vehicle; repair as necessary instead.**

(4) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as hard pedal, pull, grab, drag, noise, fade, pedal pulsation, etc.

(5) Inspect brake components after road test and refer to problem diagnosis information for causes of various brake conditions.

BRAKE COMPONENT INSPECTION

Fluid leak points and dragging brake units can usually be located without removing any components. The area around a leak point will be wet with fluid. The components at a dragging brake unit (wheel, tire, rotor) will be quite warm or hot to the touch.

Other brake problem conditions will require component removal for proper inspection. Raise the vehicle and remove the necessary wheels for better visual access.

During inspection, pay particular attention to heavily rusted/corroded brake components (e.g. rotors, caliper pistons, cables, brakelines, etc.).

Heavy accumulations of rust may be an indicator of rust and corrosion damage to a brake component. It is wise to remove surface rust in order to accurately determine the depth of rust penetration and damage.

Light surface rust is normal and not a major concern (as long as it is removed, or neutralized). However, heavy rust buildup, especially on high mileage vehicles, may actually cover structural damage to such important components as: brakelines, rotors, or brake booster.

SERVICE BRAKE WARNING LIGHT OPERATION

The red warning light illuminates when the parking brakes are applied and when there is a leak in the front or rear wheel brake hydraulic circuit. It will also illuminate at startup as part of a bulb check.

If the light comes on, first verify that the parking brakes are fully released. Then check pedal action and fluid level. If a problem is confirmed, inspect the wheel brake hydraulic system.

The amber antilock warning light illuminates only when an ABS circuit fault has occurred. Refer to the Antilock Brake Diagnosis section.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brakeline, fitting, hose, or caliper. Internal leakage in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

If leakage is severe, fluid will be evident at or around the leaking component. However internal leakage in the master cylinder may not be physically evident. Refer to the cylinder test procedure in this section.

LOW PEDAL

If a low pedal is experienced and the red light is not on, worn lining and rotors are the most likely cause.

If the red warning light is on, a system leak has occurred. A leak at a front or rear caliper, brakeline, or brake hose will activate the differential pressure switch in the combination valve. The switch will shuttle forward or rearward depending on where the leak is. Switch movement in either direction will complete the electrical circuit to the red warning light causing the light to illuminate.

SPONGY PEDAL

A spongy pedal is caused by air in the brake hydraulic system. Brake bleeding will be necessary to purge the air.

Air enters the system through leak points and when the master cylinder reservoir runs dry as a result of a leak. Allowing the cylinder to run dry during brake bleeding, will also allow air into the system.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or severely worn.

The power brake booster, or booster check valve could also be faulty. Loss of brake boost will cause a hard pedal and high effort. Test the booster and valve as described in this section.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor. Drag can occur at one wheel, all wheels, fronts only, or rears only. It is a product of incomplete brakeshoe release. Drag can be minor or severe enough to overheat the linings and rotors.

Brake drag also has a direct effect on fuel economy. If undetected, minor brake drag can be misdiagnosed as an engine or transmission/torque converter problem.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors from the overheat-cool down process. In most cases, the rotors, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char brakelining all the way through. It can also distort and score rotors to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Common causes of brake drag are:

- seized or sticking caliper piston
- caliper binding (on bushings, bolts, bracket)
- incorrect length caliper mounting bolts (too long)
- loose or damaged wheel bearing
- loose caliper mounting bracket
- misassembled components
- mispositioned brakelight switch
- binding brake pedal
- master cylinder internal fault

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder compensator port or faulty power booster (binds-does not release). The condition will worsen as system component temperature increases.

An improperly mounted or adjusted brakelight switch can prevent full brake pedal return. The result will be the same as if the cylinder compensator ports are blocked. In this case, the brakes would be partially applied all the time causing drag (which will become more severe as component temperature increases).

BRAKE FADE

Brake fade is a product of overheating caused by brake drag. However, brake overheating and subsequent fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep roads. Refer to the Brake Drag information in this section for causes.

PEDAL PULSATION (NON-ABS BRAKES ONLY)

Pedal pulsation is caused by brake parts that are loose, or out of tolerance limits. This type of pulsation is experienced every time the brakes are applied.

Disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums are the primary causes of pulsation.

On vehicles with ABS brakes, remember that pedal pulsation is **normal** during antilock mode brake stops. If pulsation occurs during light to moderate brake stops, a standard brake part is either loose, or worn beyond tolerance.

BRAKE PULL

A front pull condition that only occurs when the brakes are applied, could result from contaminated lining in one caliper, seized caliper piston, binding caliper, loose caliper, loose or corroded slide pins, improper brakeshoes, or a damaged rotor.

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause constant pull that is magnified when the brakes are applied.

A common and confusing pull condition is where direction of pull changes after a few brake stops. The cause is a combination of brake drag followed by fade at the dragging brake unit.

As the dragging brake overheats, efficiency is so reduced that fade occurs. If the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the brake unit that is functioning normally.

When diagnosing a change in pull condition, remember that pull will return to the original direction if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE GRAB

Rear grab is usually caused by contaminated lining, bent or binding shoes, or improperly assembled components.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes lightly applied for a mile or two. However, if the lining is also dirty, shoe removal and cleaning with brake cleaner will be necessary.

CONTAMINATED BRAKELINING

Brakelining contaminated by water is salvageable. The lining can either be air dried or dried using heat.

In cases where brakelining is contaminated by oil, grease, or brake fluid, the lining should be replaced. Replacement is especially necessary when fluids/lubricants have actually soaked into the lining material. However, grease or dirt that gets onto the lining surface (from handling) during brake repairs, can be cleaned off. Simply spray the lining surface clean with Mopar brake cleaner.

BRAKE FLUID CONTAMINATION

There are two basic causes of brake fluid contamination. The first involves allowing dirt, debris, or other liquid materials to enter the cylinder reservoir when the cap or cover is off. The second involves topping off, or filling the reservoir with non-recommended fluid.

Brake fluid contaminated with only dirt, or debris usually retains a normal appearance. Generally, the foreign material will remain suspended in the fluid and be visible. The fluid and foreign material can be removed from the reservoir with a suction gun but only if the brakes have not been applied. If the brakes are applied after contamination, system flushing will be required. The master cylinder will also have to be flushed or replaced if the contaminants cannot be removed. Foreign material lodged in the reservoir compensator/return ports can cause brake drag by restricting fluid return after brake application.

Brake fluid contaminated by a non-recommended fluid, may appear highly discolored, milky, oily looking, or foamy. In some cases, the fluid may even appear to contain sludge. **However, be advised that brake fluid will darken in time and occasionally be cloudy in appearance. These are normal conditions and should not be mistaken for contamination.**

If some type of oil has been added to the system, the fluid will separate into distinct layers. To verify this, drain off a sample with a clean suction gun. Then pour the sample into a glass container and observe fluid action. If the fluid separates into distinct layers, it is definitely contaminated.

The only real correction for contamination, is to disassemble and flush the entire hydraulic system and replace all seals.

BRAKE NOISE

Squeak/Squeal

Factory installed brakelining is made from asbestos free materials. These materials have different operating characteristics than previous brakelining material. Under certain conditions, asbestos free lining may generate some squeak, groan or chirp noise. This noise is considered normal and does not indicate a problem. The only time inspection is necessary, is when noise becomes constant or when grinding, scraping noises occur.

The rear brakeshoes are equipped with wear warning tabs. The tabs contact the rotors when the lining wears to replacement thickness. A constant scraping, squeak type noise will occur at contact.

Constant brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots will produce squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

Loud brake squeak, squeal, scraping, or grinding sounds are a sign of severely worn brake lining. If the lining has worn completely through in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors can become scored severely enough to require replacement.

Thump/Clunk

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brakeshoes can also produce a thump noise.

Chatter/Shudder

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

BRAKELINING CONTAMINATION

Brakelining contamination is a product of leaking calipers or wheel cylinders, driving through deep water puddles, or lining that has become covered with grease and grit during repair.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with little or no tread left can produce a grab-like condition as the tire loses and recovers traction.

Flat-spotted tires can cause vibration and wheel tramp and generate shudder during brake operation.

A tire with internal damage such as a severe bruise or ply separation can cause pull and vibration.

PARKING BRAKE DIAGNOSIS

Adjustment Mechanism

Parking brake adjustment is controlled by a cable tensioner. Once the tensioner is adjusted at the factory, it should not require further attention. However, there are two instances when adjustment will be required. The first is when a new tensioner, or cables have been installed. And the second, is when the tensioner and cables are disconnected for access to other brake components.

Parking Brake Switch And Warning Light Illumination

The parking brake switch is in circuit with the red warning light in the dash. The switch will cause the light to illuminate only when the parking brakes are applied. If the light remains on after parking brake release, the switch or wires are faulty, or cable tensioner adjustment is incorrect.

If the red light comes on while the vehicle is in motion and brake pedal height decreases, a fault has occurred in the front or rear brake hydraulic system.

Parking Brake problem Causes

In most cases, the actual cause of an improperly functioning parking brake (too loose/too tight/wont hold), can be traced to a parking brake component.

The leading cause of improper parking brake operation, is excessive clearance between the parking brakeshoes and the shoe braking surface. Excessive clearance is a result of lining and/or drum wear, drum surface machined oversize, or inoperative adjuster components.

Excessive parking brake lever travel (sometimes described as a loose lever or too loose condition), is the result of worn brakeshoes, improper brakeshoe adjustment, or improperly assembled brake parts.

A "too loose" condition can also be caused by inoperative or improperly assembled parking brakeshoe parts.

A condition where the parking brakes do not hold, will most probably be due to a wheel brake component.

Items to look for when diagnosing a parking brake problem, are:

- rear brakeshoe wear
- drum surface (in rear rotor) machined oversize
- front cable not secured to lever
- rear cable not attached to lever
- rear cable seized
- parking shoes reversed
- parking brake strut not seated in shoes
- parking brake lever not seated
- parking brake lever bind
- cam and lever worn or misassembled
- adjuster screws seized
- adjuster screws reversed

Parking brake adjustment and parts replacement procedures are described in the Parking Brake section.

POWER BRAKE BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

(2) Remove check valve and valve seal from booster (Fig. 1). Inspect seal for cuts, cracks, tears, and replace if necessary.

(3) Hand operated vacuum pump can be used for test (Fig. 2).

(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 1).

(5) Vacuum should hold steady. If gauge on pump indicates any vacuum loss, valve is faulty and must be replaced.

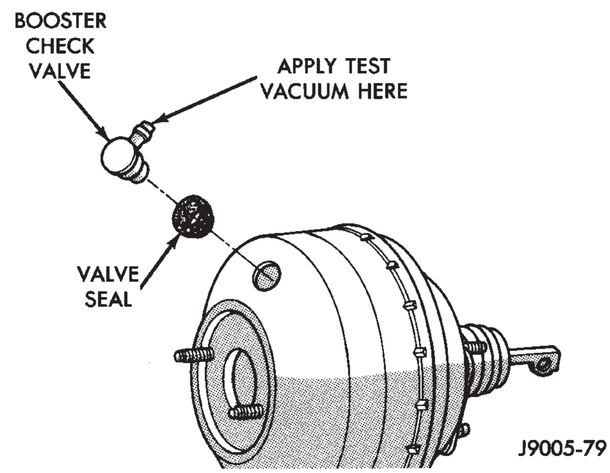

Fig. 1 Vacuum Check Valve And Seal Location

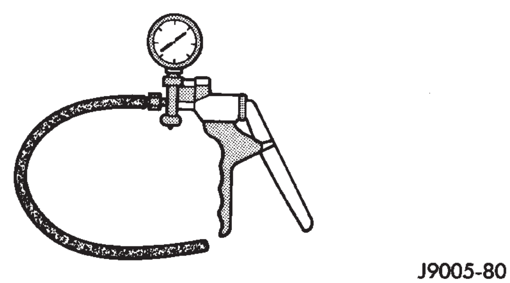

Fig. 2 Typical Hand Operated Vacuum Pump

POWER BRAKE BOOSTER VACUUM TEST

(1) Connect a vacuum gauge to the booster check valve with a short length of hose and a T-fitting (Fig. 3).

(2) Start and run engine at idle speed for one minute.

(3) Clamp hose shut between vacuum source and check valve (Fig. 3).

(4) Stop engine and observe vacuum gauge.

(5) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.

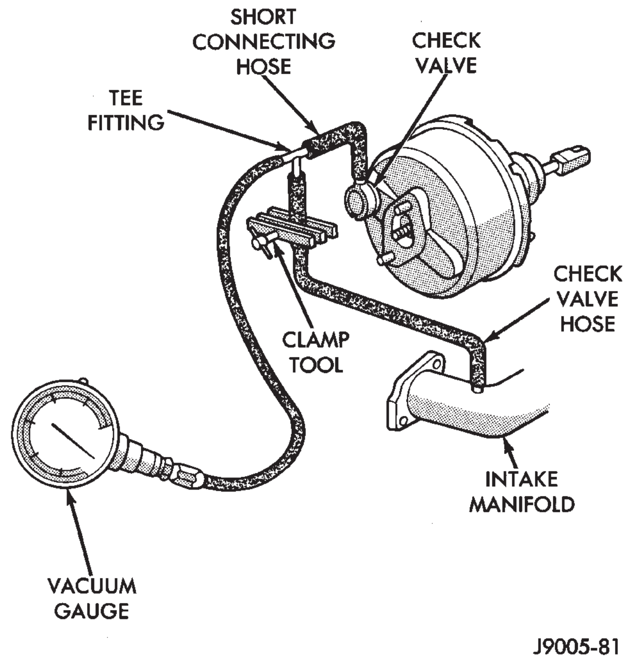

Fig. 3 Booster Vacuum Test Connections

ABS SYSTEM OPERATION

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SYSTEM DESCRIPTION

The Jeep antilock brake system (ABS) is an electronically operated, all wheel brake control system. The system is designed to prevent wheel lockup and maintain steering control during periods of high wheel slip when braking. Preventing wheel lockup and is accomplished by modulating fluid pressure to the wheel brake units.

The hydraulic system is a three channel design. The front wheel brakes are controlled individually and the rear wheel brakes in tandem (Fig. 1). The ABS electrical system is separate from other electrical circuits in the vehicle. A specially programmed electronic control unit (ECU) operates the system components.

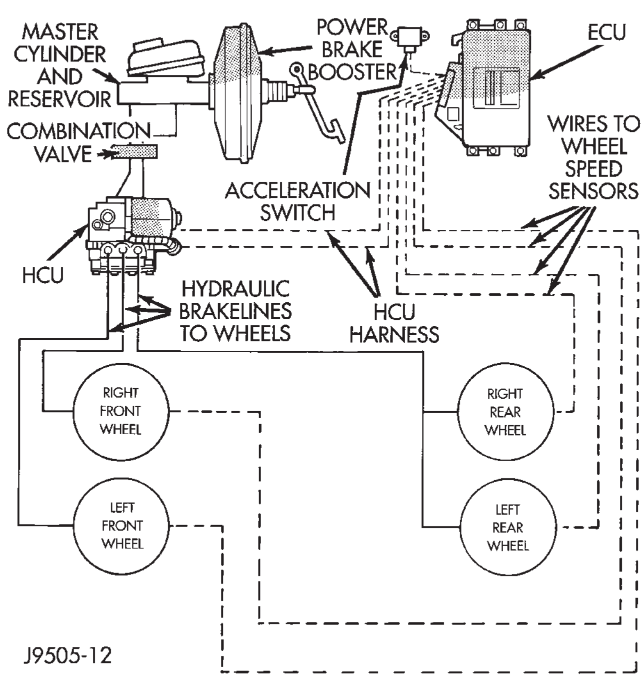

Fig. 1 Jeep AntiLock System

ABS system components include:

- hydraulic control unit (HCU)
- electronic control unit (ECU)
- wheel speed sensors and axle shaft tone rings
- acceleration switch
- main relay, pump motor relay,
- pump motor speed sensor
- ABS warning light

HYDRAULIC CONTROL UNIT (HCU)

The hydraulic control unit (HCU) consists of a valve body, pump body, accumulators, pump motor, and wire harnesses (Fig. 2).

The pump body, motor, and accumulators are combined into an assembly attached to the valve body. The accumulators store the fluid released for ABS mode operation. The pump provides the fluid volume needed for antilock braking and a DC-type motor runs the pump. The pump/motor is controlled by the ECU.

The valve body contains solenoid valves. The solenoid valves modulate brake pressure during antilock braking. The valves are controlled by the ECU.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two other channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

At the start of antilock braking, pedal height will decrease as the initial volume of fluid is released to the accumulators. The accumulators then provide the fluid needed for initial operation. The pump motor runs continuously until the ABS mode brake stop is completed.

The 1995 master cylinder and HCU are different from previous models. The new HCU has built-in accumulators that store the fluid released for antilock braking. The new master cylinder has a single filler cap and the reservoir and HCU are no longer interconnected by hoses. The 1995 ABS components are **not** interchangeable with prior year ABS components.

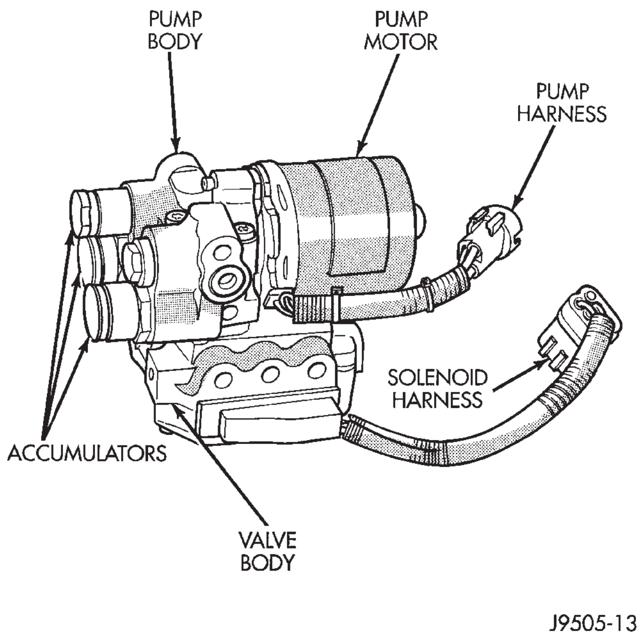

Fig. 2 Antilock Hydraulic Control Unit (HCU)

ELECTRONIC CONTROL UNIT (ECU)

An electronic control unit (ECU) operates the ABS system (Fig. 3). The ECU is separate from other vehicle electrical circuits. ECU voltage source is through the ignition switch in the Run position.

The ECU is located in the engine compartment. It is mounted on the driver side inner fender panel.

The ECU contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals which are processed and compared simultaneously.

The ECU contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the DRB scan tool.

ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

WHEEL SPEED SENSORS

A speed sensor is used at each wheel. The sensors convert wheel speed into an electrical signal. This signal is transmitted to the antilock ECU.

A gear type tone ring serves as the trigger mechanism for each sensor. The tone rings are mounted at the outboard ends of the front and rear axle shafts.

Different sensors are used at the front and rear wheels (Fig. 4). The front/rear sensors have the same electrical values but are not interchangeable.

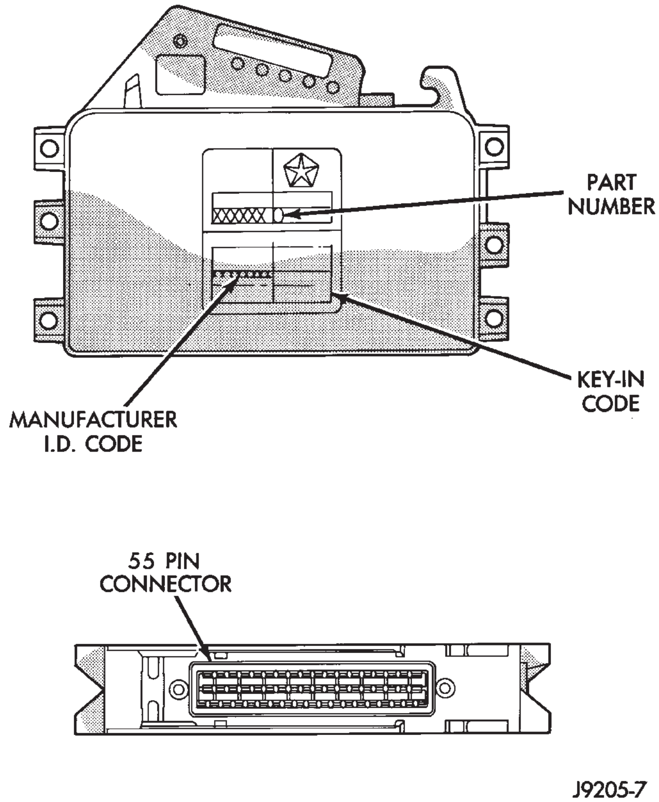

Fig. 3 Anti-Lock ECU

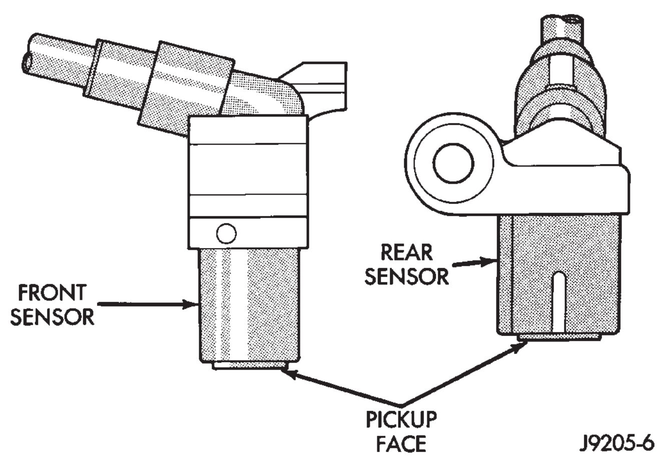

Fig. 4 Wheel Speed Sensors

ABS DIAGNOSTIC CONNECTOR

ABS circuit diagnosis is performed with the DRB scan tool. The access point for the scan tool is the diagnostic connector.

The connector is under the carpet at the forward end of the console just under the IP center. The connector is black or blue in color and is a 6-way type.

ACCELERATION SWITCH

An acceleration switch (Fig. 5), provides an additional vehicle deceleration reference during 4-wheel drive operation. The switch is monitored by the antilock ECU at all times. The switch reference signal is utilized by the ECU when all wheels are decelerating at the same rate.

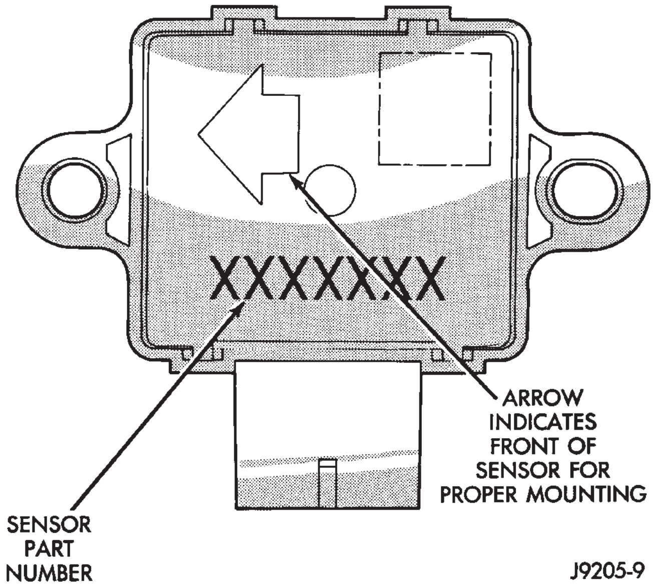

Fig. 5 Acceleration Switch

SYSTEM RELAYS

The ABS system has two relays, which are the main and motor pump relays. The motor pump relay is used for the motor pump only. The main relay is used for the solenoid valves. The main relay is connected to the ECU at the power control relay terminal. The pump motor relay starts/stops the pump motor when signaled by the ECU.

IGNITION SWITCH

The antilock ECU and warning light are in standby mode with the ignition switch in Off or Accessory position. No operating voltage is supplied to the system components.

A 12 volt power feed is supplied to the ECU and warning light when the ignition switch is in the Run position.

SYSTEM WARNING LIGHT

The amber ABS warning light is in circuit with the ECU and operates independently of the red brake warning light.

The ABS light indicates antilock system condition. The light illuminates for 1-2 seconds at start-up as part of a bulb check routine. The light goes out when the self test program determines system operation is normal.

COMBINATION VALVE

A combination valve is used with the ABS system. The valve contains a front/rear brake pressure differential valve and switch and a rear brake proportioning valve.

ABS SYSTEM POWER-UP AND INITIALIZATION

battery voltage is supplied to the ECU ignition terminal when the ignition switch is turned to Run position. The ECU performs a system initialization procedure at this point. Initialization consists of a static and dynamic self check of system electrical components.

The static check occurs immediately after the ignition switch is turned in Run position. The dynamic check occurs when vehicle road speed reaches approximately 10 kph (6 mph). During the dynamic check, the ECU briefly cycles the pump to verify operation and the HCU solenoids are checked.

If an ABS component exhibits a fault during initialization, the ECU illuminates the amber warning light and registers a fault code in the microprocessor memory.

ABS OPERATION IN NORMAL BRAKING MODE

The ECU monitors wheel speed sensor inputs continuously while the vehicle is in motion. However, the ECU will not activate any ABS components as long as sensor inputs and the acceleration switch indicate normal braking.

During normal braking, the master cylinder, power booster and wheel brake units all function as they would in a vehicle without ABS. The HCU pump and solenoids are not activated.

ABS OPERATION IN ANTILOCK BRAKING MODE

The purpose of the antilock system is to prevent wheel lockup during periods of high wheel slip. Preventing lockup helps maintain vehicle braking action and steering control.

The antilock ECU activates the system whenever sensor signals indicate periods of high wheel slip. High wheel slip can be described as the point where wheel rotation begins approaching zero (or lockup) during braking. Periods of high wheel slip may occur when brake stops involve high rates of vehicle deceleration.

The antilock system prevents lockup during high slip conditions by modulating fluid apply pressure to the wheel brake units.

Brake fluid apply pressure is modulated according to wheel speed, degree of slip and rate of deceleration. A sensor at each wheel converts wheel speed into electrical signals. These signals are transmitted to the ECU for processing and determination of wheel slip and deceleration rate.

The ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem (Fig. 1). A speed sensor input signal indicating high slip conditions activates the ECU antilock program.

Two solenoid valves are used in each antilock control channel. The valves are all located within the

HCU valve body and work in pairs to either increase, hold, or decrease apply pressure as needed in the individual control channels.

The solenoid valves are not static during antilock braking. They are cycled continuously to modulate pressure. Solenoid cycle time in antilock mode can be measured in milliseconds.

HCU OPERATION

Normal Braking

During normal braking, the HCU solenoid valves, pump, accumulators, and motor are not activated. The master cylinder and power booster operate the same as a vehicle without ABS brakes.

Antilock Pressure Modulation

Solenoid valve pressure modulation occurs in three stages which are: pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

Pressure Decrease

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle (Fig. 6).

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the ECU opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the ECU closes the outlet valve and begins a pressure increase or hold cycle as needed.

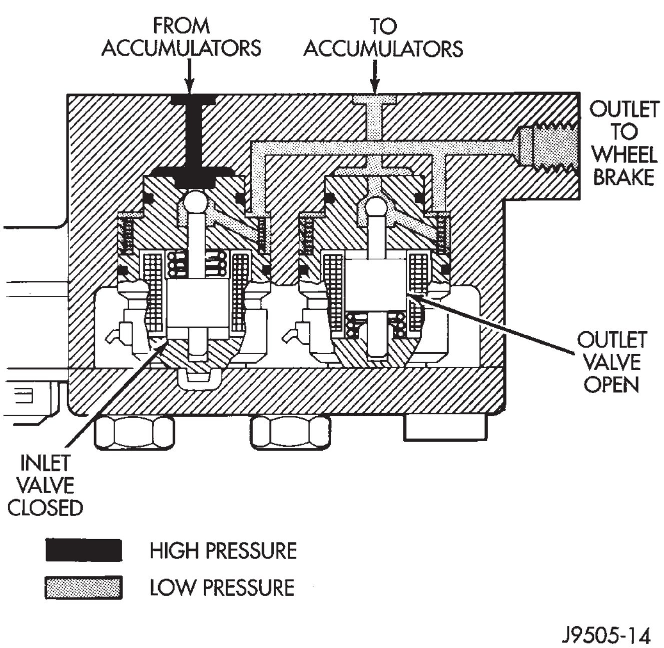

Fig. 6 Pressure Decrease Cycle

Pressure Hold

Both solenoid valves are closed in the pressure hold cycle (Fig. 7). Fluid apply pressure in the control channel is maintained at a constant rate. The ECU maintains the hold cycle until sensor inputs indicate a pressure change is necessary. The pump does not run during the pressure hold cycle.

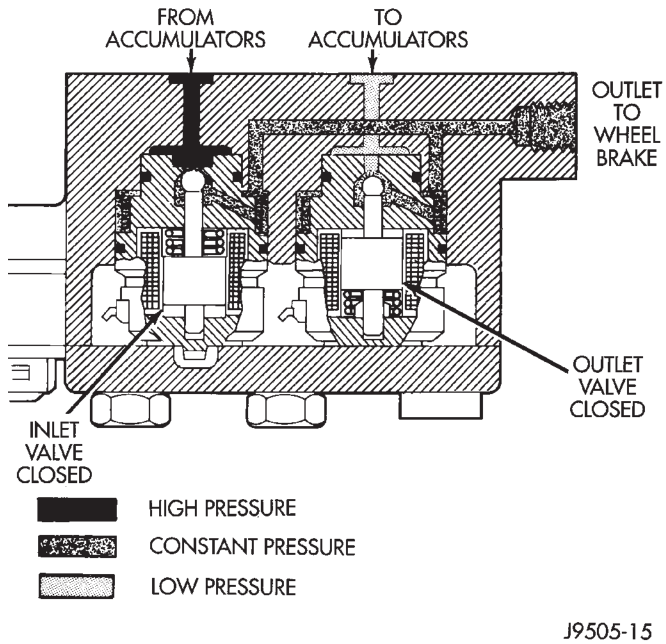

Fig. 7 Pressure Hold Cycle

Pressure Increase

The inlet valve is open and the outlet valve is closed during the pressure increase cycle (Fig. 8). The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

WHEEL SPEED SENSOR OPERATION

Wheel speed input signals are generated by a sensor and tone ring at each wheel. The sensors, which are connected directly to the ECU, are mounted on brackets attached to the front steering knuckles and rear brake support plates.

The sensor triggering devices are the tone rings which are similar in appearance to gears. The tone rings are located on the outboard end of each front/rear axle shaft. The speed sensors generate a signal whenever a tone ring tooth rotates past the sensor pickup face.

The wheel speed sensors provide the input signal to the ECU. If input signals indicate ABS mode braking, the ECU causes the HCU solenoids to decrease, hold, or increase fluid apply pressure as needed.

The HCU solenoid valves are activated only when wheel speed input signals indicate that a wheel is approaching a high slip, or lockup condition. At this

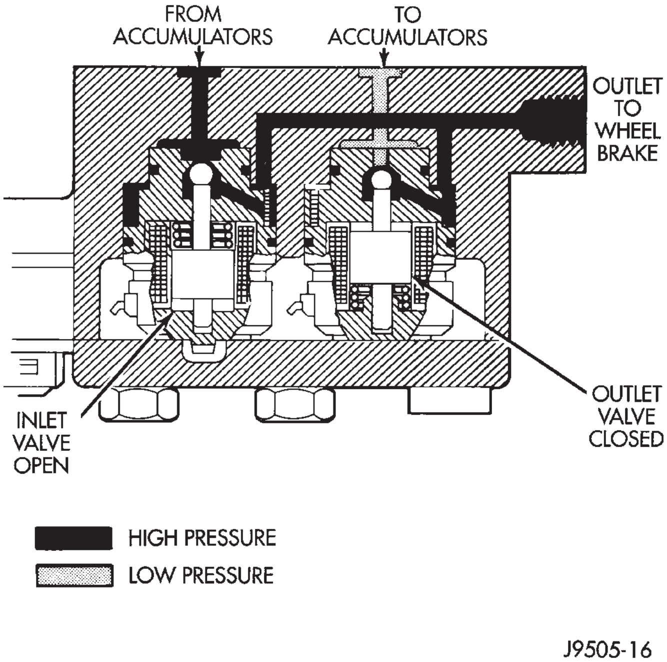

Fig. 8 Pressure Increase Cycle

point, the ECU will cycle the appropriate wheel control channel solenoid valves to prevent slip or lockup.

The wheel sensors provide speed signals whenever the vehicle wheels are rotating. The ECU examines these signals for degree of deceleration and wheel slip. If signals indicate normal braking, the solenoid valves are not activated. However, when incoming signals indicate the approach of wheel slip, or lockup, the ECU cycles the solenoid valves as needed.

ACCELERATION SWITCH OPERATION

The ECU monitors the acceleration switch at all times. The switch assembly contains three mercury switches that monitor vehicle ride height and deceleration rates (G-force). Sudden, rapid changes in vehicle and wheel deceleration rate, triggers the switch sending a signal to the ECU. The switch assembly provides three deceleration rates; two for forward braking and one for rearward braking.

ECU OPERATION

The antilock ECU controls all phases of antilock operation. It monitors and processes input signals from the system sensors.

It is the ECU that activates the solenoid valves to modulate apply pressure during antilock braking. The ECU program is able to determine which wheel control channel requires modulation and which fluid pressure modulation cycle to use. The ECU cycles the solenoid valves through the pressure decrease, hold and increase phases.

BRAKE FLUID—BRAKE BLEEDING—BRAKELINES/HOSES

INDEX

RECOMMENDED BRAKE FLUID

Recommended brake fluid is Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703 and DOT 3 standards.

Brake fluid used in the ABS system must not only meet SAE/DOT standards, it must be exceptionally clean as well. **Never use substandard fluid, fluid not meeting SAE/DOT standards, reclaimed fluid, or fluid from containers that have been left open for lengthy periods.**

CORRECT BRAKE FLUID LEVEL

Correct fluid level is marked on each the side of the master cylinder reservoir (Fig. 1).

Preferred fluid level is to the FULL mark. Acceptable fluid level is between the ADD and FULL marks.

If fluid level is below the ADD mark, the brake hydraulic system should be checked for leaks.

CAUTION: Clean the reservoir cap and exterior thoroughly before checking fluid level. Do not allow any dirt or foreign material to enter the reservoir while checking fluid level. Such materials can interfere with solenoid valve operation causing an ABS malfunction.

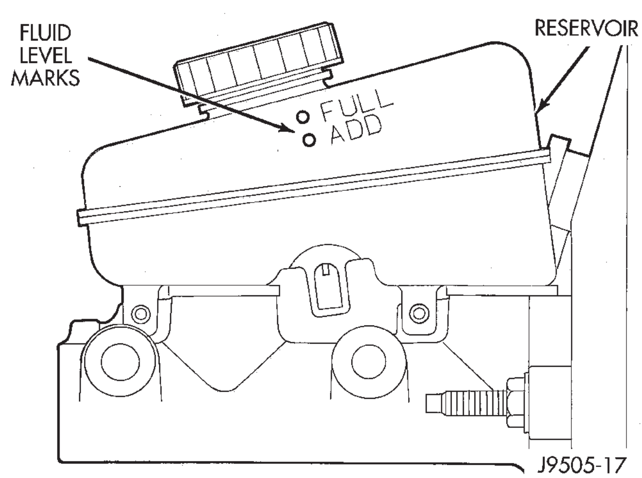

Fig. 1 Reservoir Fluid Level Indicator Marks

IMPORTANCE OF CLEAN BRAKE FLUID

The ABS system brake fluid must be kept clean and free of any type of contamination. Foreign material in the fluid, or non-recommended fluids will cause system malfunctions.

Clean the reservoir and cap thoroughly before checking level or adding fluid. Cap open lines and hoses during service to prevent dirt entry.

Dirt or foreign material entering the ABS hydraulic system through the reservoir opening will circulate within the system. Dirt or foreign material in the system can lead to component malfunction. Always clean the reservoir exterior before checking fluid level or adding fluid. Use clean, fresh fluid only to top off, or refill the system.

CHECKING BRAKE FLUID FOR CONTAMINATION

Oil in the fluid will cause brake system rubber seals to soften and swell. The seals may also become porous and begin to deteriorate.

If fluid contamination is suspected, drain off a sample from the master cylinder. A suction gun or similar device can be used for this purpose.

Empty the drained fluid into a glass container. Contaminants in the fluid will cause the fluid to separate into distinct layers. If contamination has occurred, the system rubber seals, hoses and cups must be replaced and the system thoroughly flushed with clean brake fluid.

ABS BRAKE BLEEDING

ABS brake bleeding requires use of the DRB scan tool. The procedure involves performing a conventional bleed, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second conventional bleed procedure is then required to ensure that all air is purged from the system.

BRAKE BLEED PROCEDURE

(1) If new master cylinder is to be installed, bleed cylinder on bench before installation in vehicle. Refer to procedure in section covering master cylinder service.

(2) Wipe master cylinder reservoir and cap clean. This avoids having dirt or foreign material fall into reservoir.

(3) Fill reservoir with Mopar, or equivalent quality brake fluid meeting SAE J1703 and DOT 3 standards.

(4) Perform conventional brake bleed as described in steps (5) and (6).

(5) Bleed master cylinder and combination valve at brakeline fittings. Have helper operate brake pedal while bleeding cylinder and valve.

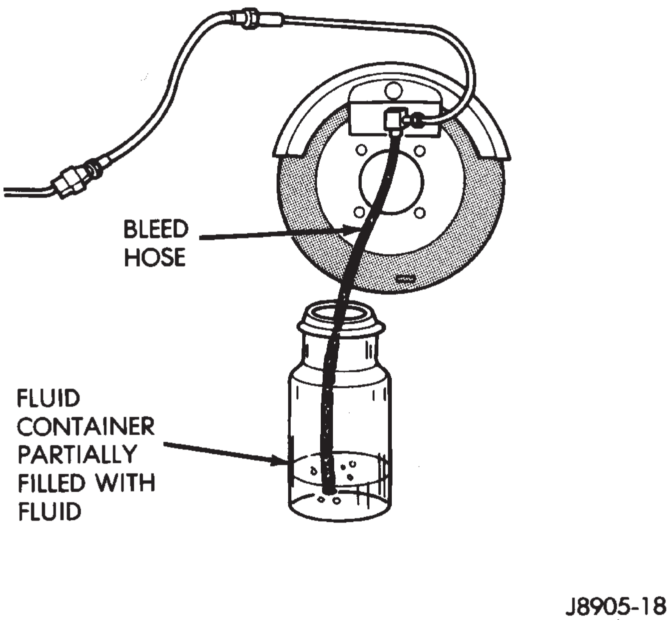

Fig. 2 Bleed Hose Immersed In Fluid

(6) Bleed wheel brakes in recommended sequence which is: right rear wheel; left rear wheel; right front wheel; left front wheel. Procedure is as follows:

(a) Attach bleed hose to caliper bleed screw. Immerse end of hose in glass container partially filled with brake fluid. Be sure hose end is submerged in fluid (Fig. 2).

(b) Open bleed screw 1/2 turn. Then have helper depress and hold brake pedal.

(c) Close bleed screw when brake pedal contacts floorpan. **Do not pump brake pedal at any time while bleeding. This compresses air into small bubbles which are distributed throughout system. Additional bleeding will be necessary to remove trapped air.**

(d) Repeat bleeding operation at each wheel brake unit until fluid entering glass container is free of air bubbles. Check reservoir fluid level frequently and add fluid if necessary.

(7) Perform HCU bleed procedure with DRB scan tool as follows:

(a) Connect scan tool to ABS diagnostic connector. Connector is under carpet at front of console, just under instrument panel center bezel.

(b) Select CHASSIS SYSTEM, followed by TEVES ABS BRAKES, then BLEED BRAKES. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed to next step.

(8) **Repeat** conventional bleed procedure described in steps (5) and (6).

(9) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

BRAKELINES AND HOSES

Metal brakelines and rubber front brake hoses (Figs. 3 and 4), should be inspected periodically and replaced if damaged.

The HCU lines with the braided, flexible sections should be replaced if damaged. Do not use substitute brakelines here. Use the flexible braided lines only.

Rubber brake hoses should be replaced if cut, cracked, swollen, or leaking. Rubber hoses must only be replaced. They are not repairable parts.

The steel brakelines should be checked every time the vehicle is in for normal maintenance. This is important on high mileage vehicles. It is especially important when the vehicle is operated in areas where salt is used on road surfaces during winter.

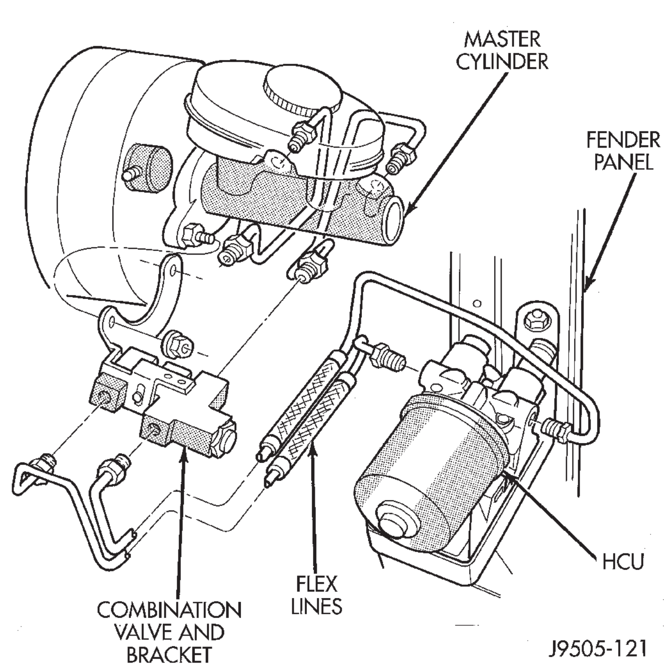

Fig. 3 Master Cylinder/Combination Valve/HCU Brakeline Connections

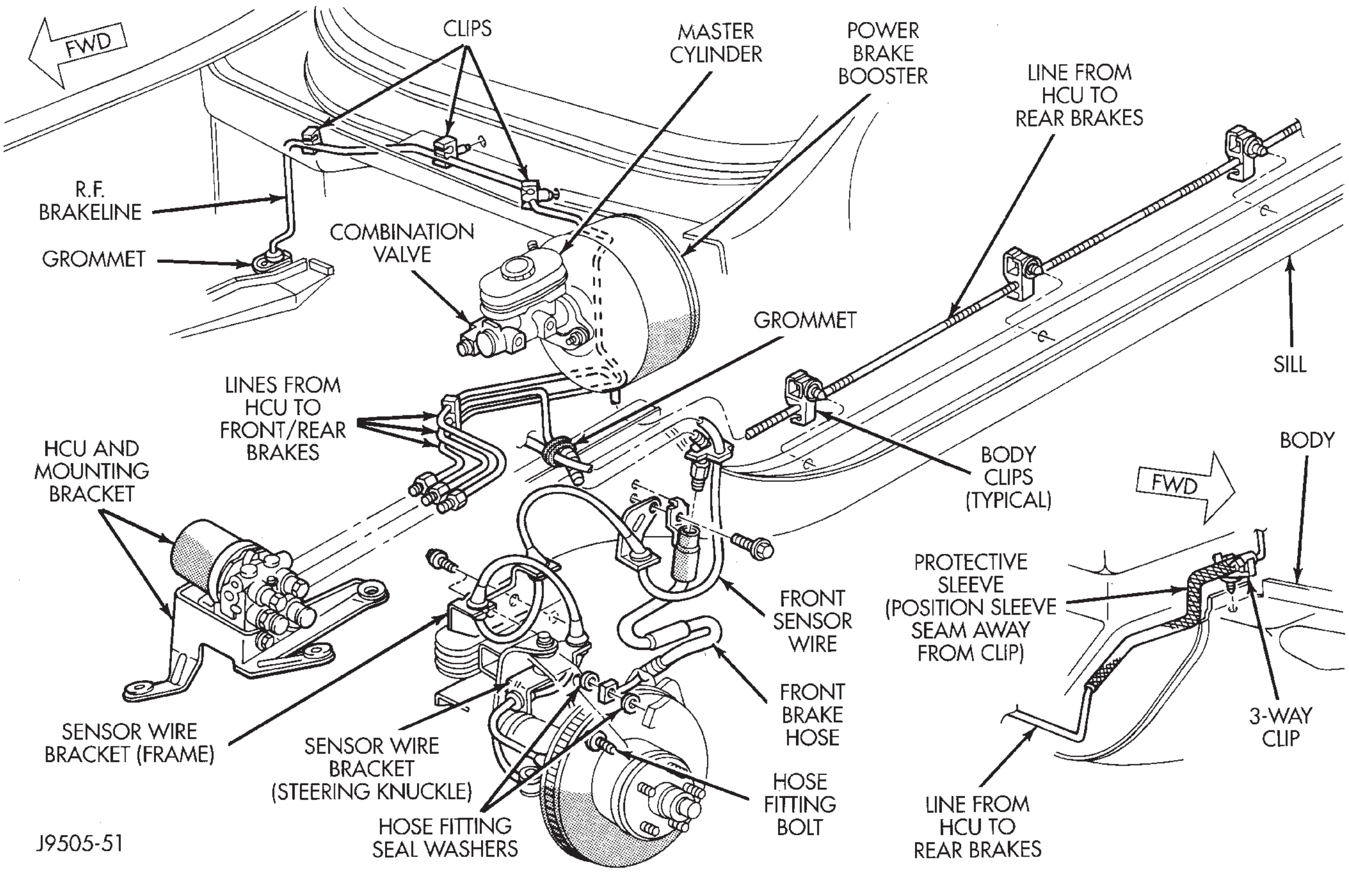

Fig. 4 Front Brakeline Routing And Connections

Heavily rusted/corroded brakelines should be carefully inspected. Heavy rust buildup can hide severe component damage. Severely rusted parts should be replaced if doubt exists about their condition.

MASTER CYLINDER—BRAKE BOOSTER—COMBINATION VALVE—HCU

INDEX

GENERAL SERVICE INFORMATION

A two-piece master cylinder with a 25.4 mm bore and a 205 mm (8.07 in.) dual diaphragm power brake booster are used for all applications.

A combination valve is used on all models. The valve consists of a pressure differential switch and valve, and a rear proportioning valve.

Changes For 1995

A different master cylinder, brake booster, and HCU are used in 1995 Grand Cherokee models.

The master cylinder reservoir has a single filler cap and is no longer interconnected with the HCU. The new HCU has built-in accumulators to store fluid released for antilock braking. The pedal travel sensor has been eliminated which means the power brake booster is different as well. The new parts on 1995 models are not interchangeable with prior models.

Component Service

The power brake booster, HCU, and combination valve are not repairable. These components must be replaced as an assembly whenever diagnosis indicates this is necessary.

The nylon reservoir and grommets are the only serviceable parts on the master cylinder (Fig. 1). The combination valve bracket is an integral part of the valve; it is not removable.

The only serviceable parts on the power brake booster (Fig. 1) are the check valve, and vacuum hose. The booster itself is not serviceable. Replace the booster as an assembly whenever diagnosis indicates a malfunction has occurred.

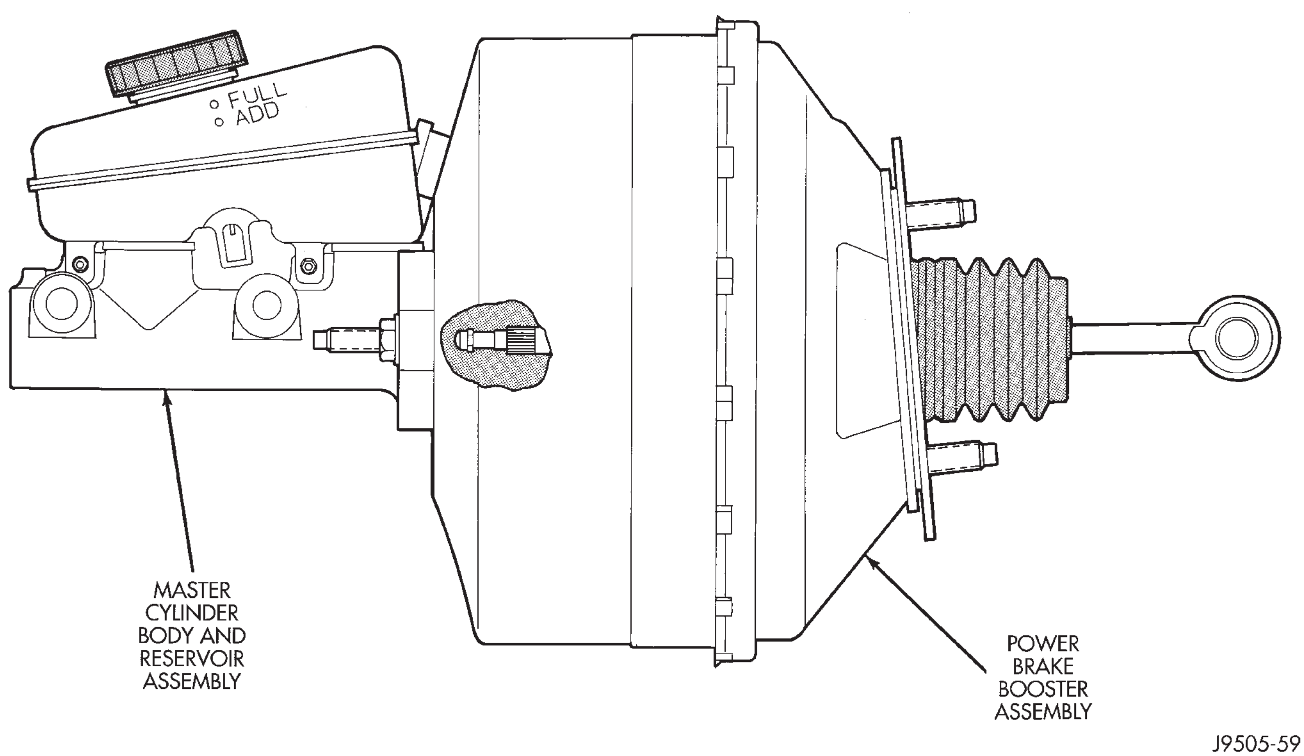

Fig. 1 Master Cylinder/Brake Booster Assembly

POWER BRAKE BOOSTER OPERATION

Booster Components

The booster assembly consists of a housing divided into separate chambers by two internal diaphragms (Fig. 2). The outer edge of each diaphragm is attached to the booster housing. The diaphragms are connected to the booster primary push rod.

Two push rods are used to operate the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod, which connects the booster to the master cylinder, strokes the master cylinder pistons.

The atmospheric inlet valve is opened and closed by the primary push rod. The booster vacuum supply is through a hose attached to a fitting on the intake manifold. The hose is connected to a vacuum check valve in the booster housing. The check valve is a one-way device that prevents vacuum leak back.

How Brake Boost Is Generated

Power assist is generated by utilizing the pressure differential between normal atmospheric pressure and a vacuum. The vacuum needed for booster operation is taken directly from the engine intake manifold. The entry point for atmospheric pressure is through a filter and inlet valve at the rear of the housing (Fig. 2).

The chamber areas forward of the booster diaphragms are exposed to manifold vacuum. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Depressing the brake pedal causes the primary push rod to open the atmospheric inlet valve. This action exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential is what provides the extra apply pressure for power assist.

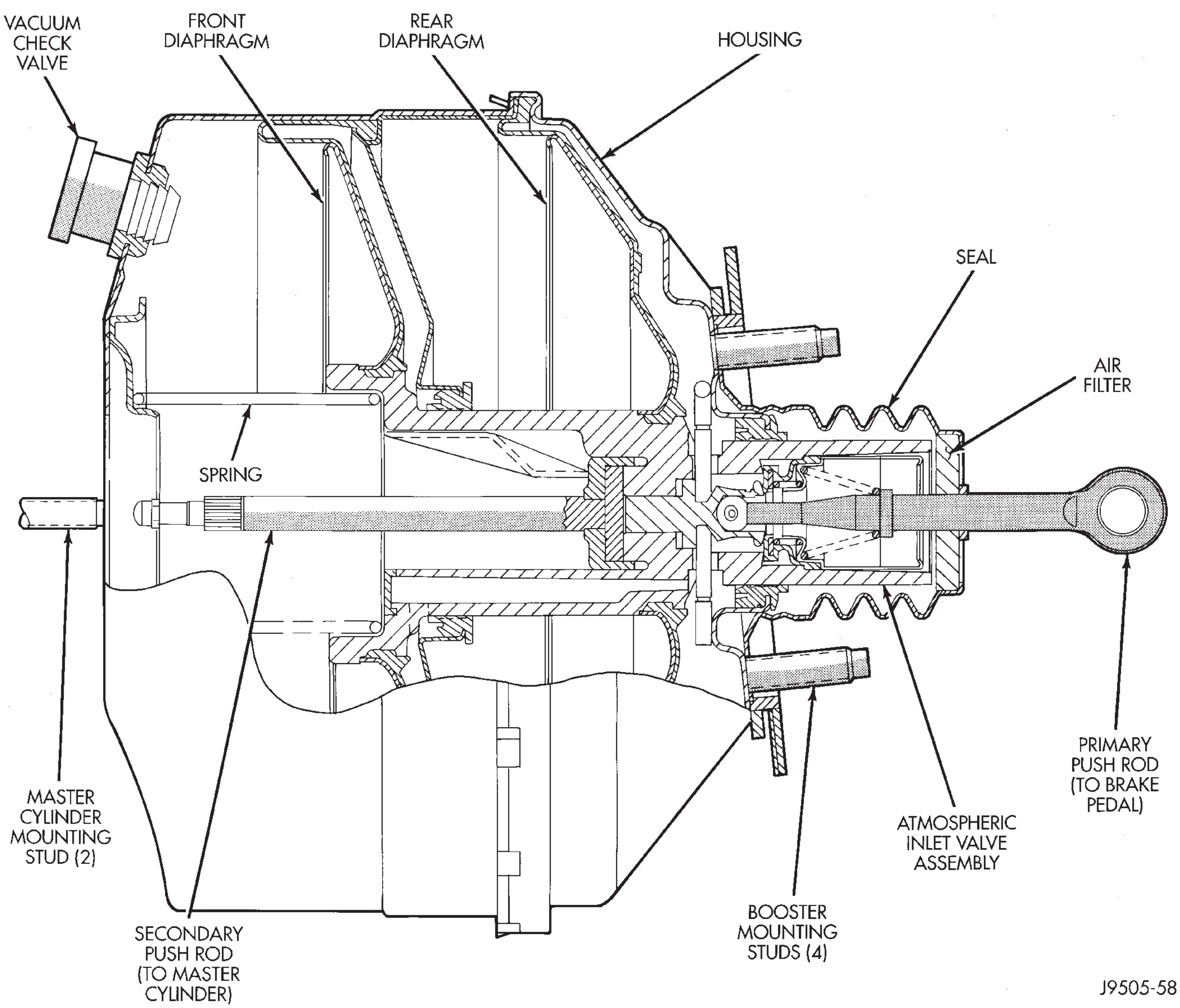

Fig. 2 Power Brake Booster Internal Components

COMBINATION VALVE REMOVAL

(1) Disconnect clean air and PCV hoses. Then unsnap and remove engine air cleaner top cover (Fig. 3). Cover intake manifold inlet with shop towel.

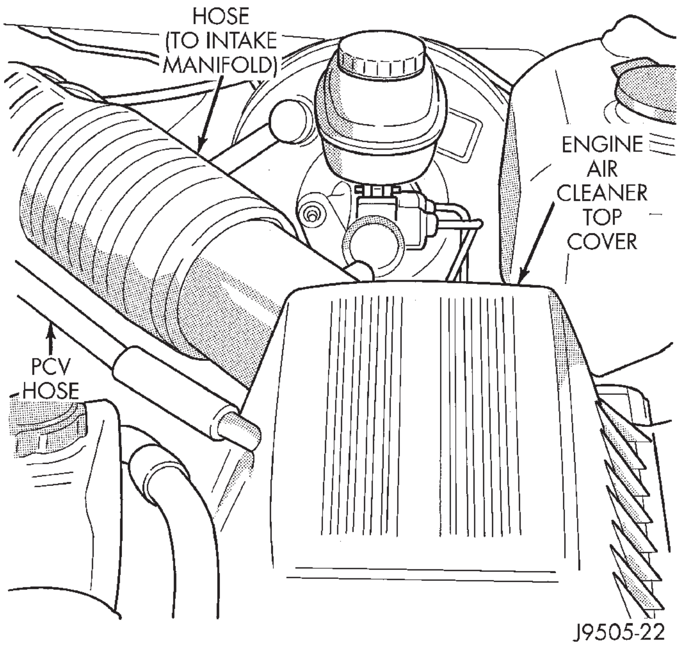

Fig. 3 Air Cleaner Top Cover And Hoses

(2) Remove brakelines that connect master cylinder to combination valve (Fig. 4).

(3) Disconnect wire from combination valve switch terminal (Fig. 4). Be careful when separating wire connector as lock tabs are easily damaged if not fully disengaged.

(4) Disconnect brakelines that connect combination valve to HCU (Fig. 4).

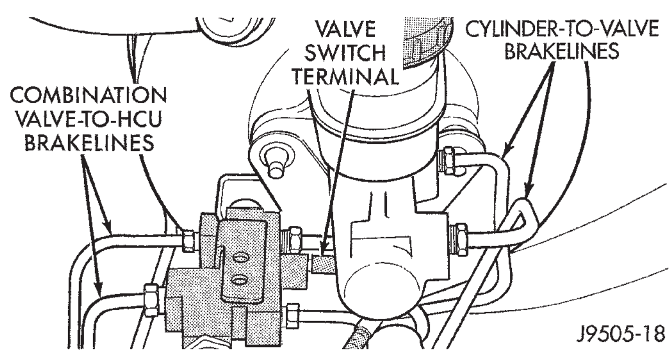

Fig. 4 Combination Valve Connections

(5) Slide HCU solenoid harness connectors off combination valve bracket. Then move harness aside for working clearance.

(6) Remove nuts attaching combination valve bracket to booster studs (Fig. 5).

(7) Slide combination valve bracket off booster studs (Fig. 5).

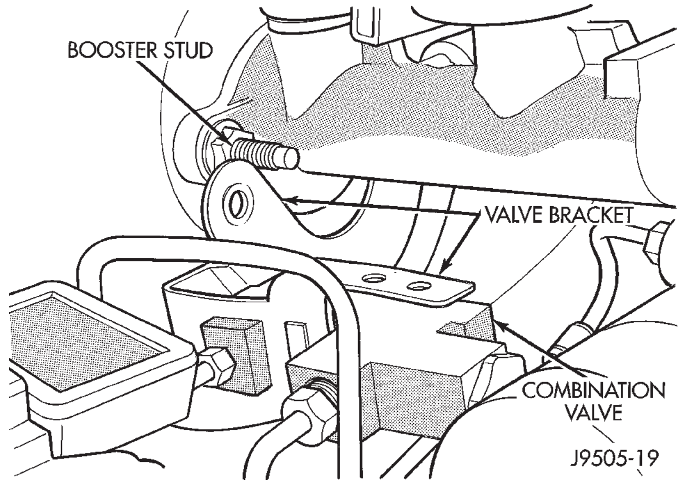

Fig. 5 Combination Valve Bracket Attachment

(8) Remove combination valve and bracket assembly (Fig. 6).

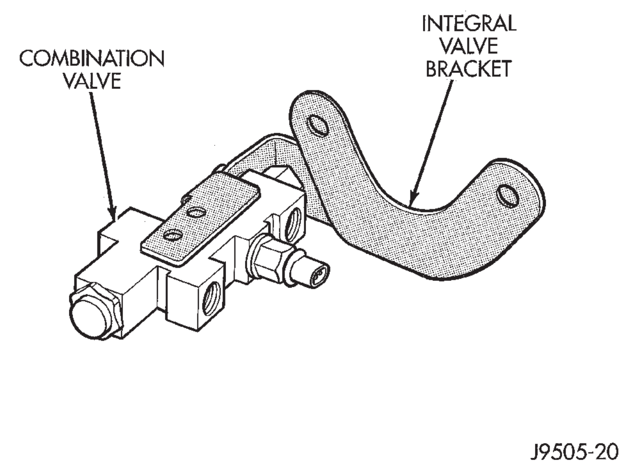

Fig. 6 Combination Valve And Bracket Assembly

COMBINATION VALVE INSTALLATION

(1) Position valve bracket on booster studs (Fig. 7).

(2) Install but do not tighten nuts that secure valve bracket to booster studs.

(3) Align and start all four brakeline fittings in combination valve by hand to avoid cross threading. Then tighten fittings just enough to prevent leakage.

(4) Tighten combination valve bracket attaching nuts to 25 N·m (220 in. lbs.) torque.

(5) Connect wire to differential pressure switch in combination valve (Fig. 4).

(6) Tighten brakeline fittings at master cylinder just enough to prevent leakage.

(7) Bleed brakes. Refer to procedure in Brake Bleeding-Fluid Level-Brakelines section.

(8) Attach HCU solenoid harness connectors to combination valve bracket.

(9) Install air cleaner top cover and hoses.

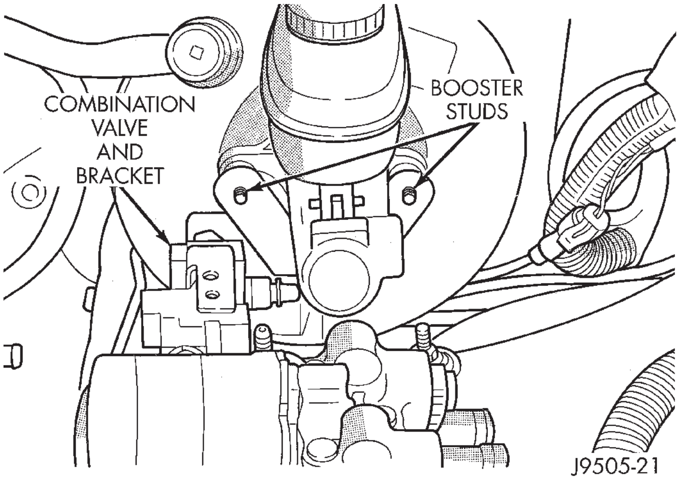

Fig. 7 Positioning Valve Bracket On Booster Studs

MASTER CYLINDER REMOVAL

(1) Disconnect Loosen clamp that secures clean air hose to intake manifold. Then disconnect PCV hose at valve.

(2) Unsnap air cleaner top cover and remove cover and hoses (Fig. 3). Air filter can either be removed or covered with shop towel at this time.

(3) Cover intake manifold air inlet with shop towel.

(4) Remove windshield washer reservoir attaching screws. Then lift reservoir upward and position it on top of fender (Fig. 8). **It is not necessary to disconnect reservoir hoses or wires to position reservoir on fender.**

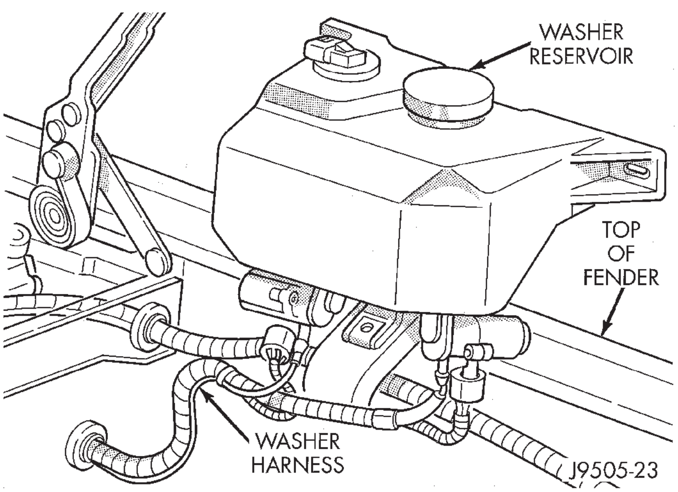

Fig. 8 Windshield Washer Reservoir Positioned On Fender

(5) Remove brakelines that connect master cylinder to combination valve (Fig. 4).

(6) Remove nuts that secure combination valve bracket to booster mounting studs.

(7) Slide combination valve bracket off booster studs (Fig. 5).

(8) Remove nuts that attach master cylinder to booster studs. a 6-point deep socket is needed to reach nuts (Fig. 9). **Retain nuts as they are special locking types.**

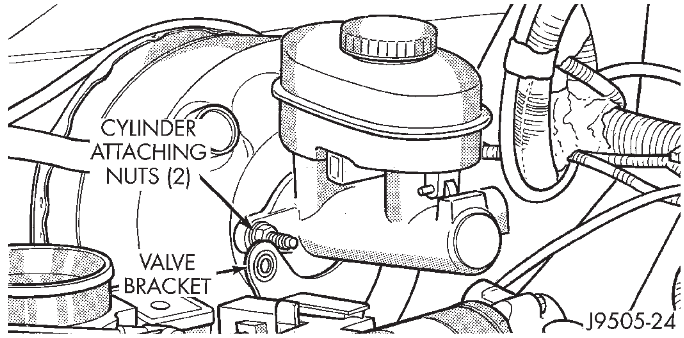

Fig. 9 Master Cylinder Attaching Nut Location

(9) Remove master cylinder from booster (Fig. 10).

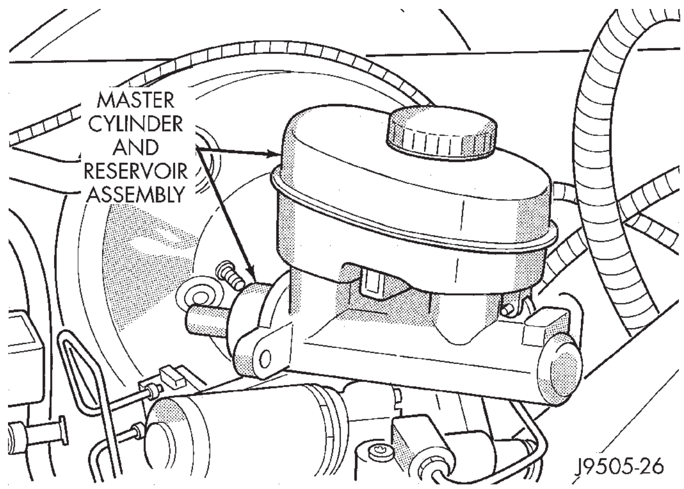

Fig. 10 Master Cylinder Removal

MASTER CYLINDER RESERVOIR REPLACEMENT

The only serviceable master cylinder parts are the reservoir, grommets, and seal (Fig. 11). The cylinder body is not a repairable item. The body and pistons are only serviced as an assembly.

RESERVOIR AND GROMMET REPLACEMENT

(1) Remove reservoir cap and empty fluid into drain container.

(2) Remove pins that retain reservoir to master cylinder. Use hammer and pin punch to remove pins (Fig. 12).

(3) Clamp cylinder body in vise with brass protective jaws.

(4) Loosen reservoir from grommets with pry tool (Fig. 13).

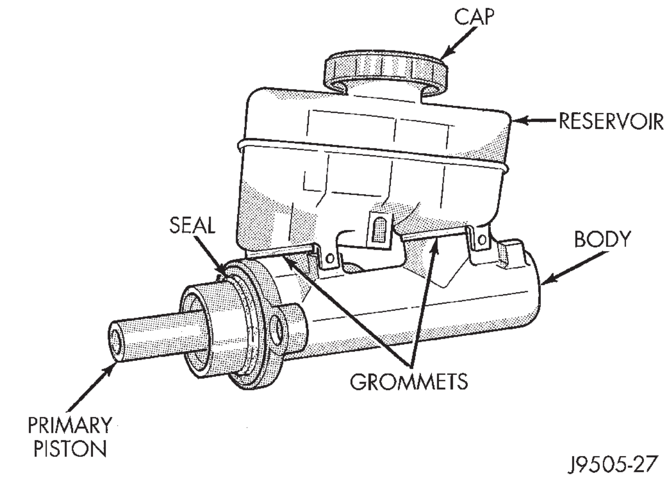

Fig. 11 Master Cylinder And Reservoir Assembly

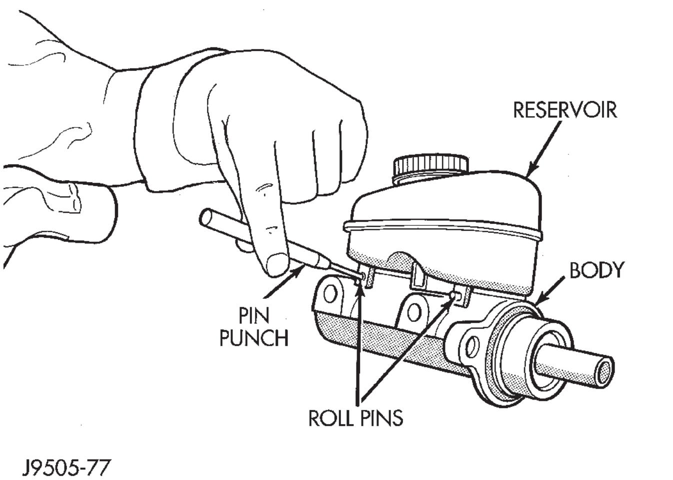

Fig. 12 Removing/Installing Reservoir Retaining Pins

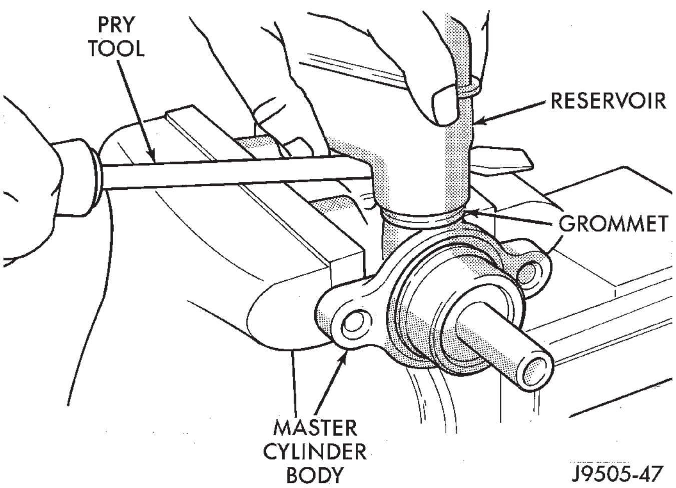

Fig. 13 Loosening Reservoir From Grommets

(5) Remove reservoir by rocking it to one side and pulling free of grommets (Fig. 14).

(6) Remove old grommets from cylinder body (Fig. 15).

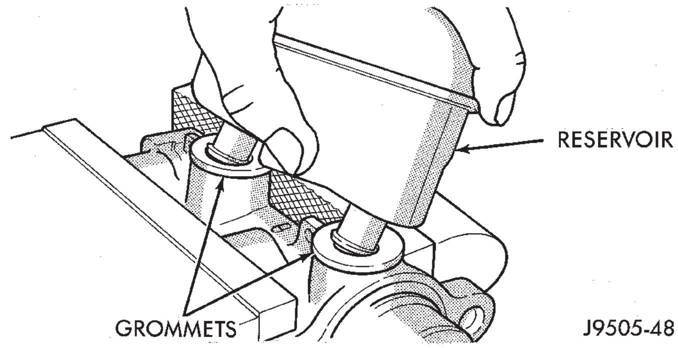

Fig. 14 Reservoir Removal

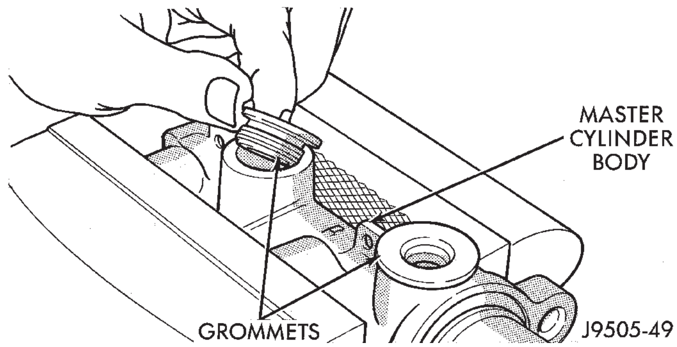

Fig. 15 Grommet Removal

(7) Lubricate new grommets with clean brake fluid.

(8) Install new grommets in cylinder body (Fig. 16). Use finger pressure only to install and seat grommets.

CAUTION: Do not use any type of tool to install the grommets. Tools will cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only.

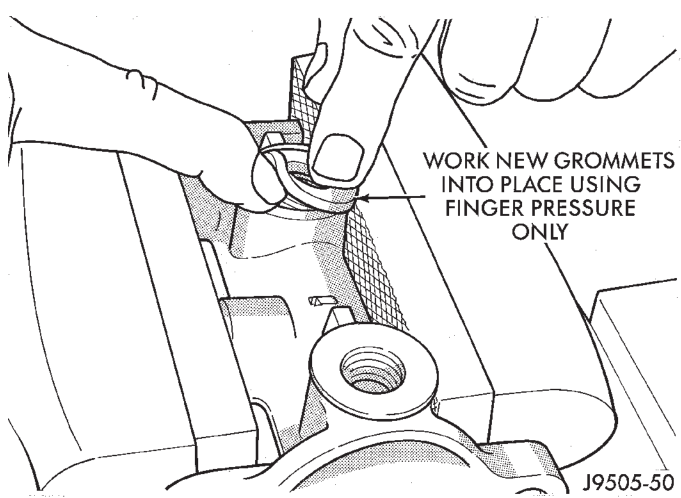

Fig. 16 Grommet Installation

(9) Start reservoir in grommets. Then rock reservoir back and forth while pressing downward to seat it in grommets.

(10) Install pins that retain reservoir to cylinder body (Fig. 12).

(11) Fill and bleed master cylinder on bench before installation in vehicle.

MASTER CYLINDER BENCH BLEEDING

A new master cylinder should always be bled before installation in the vehicle. This practice saves time during brake bleeding because air in the cylinder will not be pumped into the lines.

The only tools needed for bench bleeding are a vise, a pair of bleed tubes and a wood dowel the same diameter as the cylinder push rod. Bleed tubes can either be purchased, or fabricated from spare brakelines and fittings.

The bench bleeding procedure is as follows:

(1) Mount master cylinder in vise. Clamp vise jaws on one of the cylinder mounting ears.

(2) Install bleed tubes in cylinder outlet ports and direct tube ends into appropriate reservoir chambers (Fig. 17).

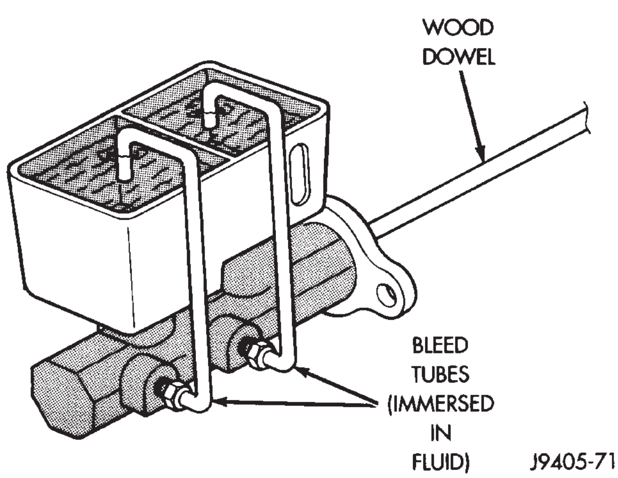

Fig. 17 Typical Method Of Bench Bleeding Master Cylinder

(3) Fill reservoir chambers about 3/4 full with fresh, clean brake fluid.

(4) Bleed cylinder by stroking cylinder pistons inward then allowing them to return under spring pressure. Use a wood dowel, or similar tool to stroke pistons (Fig. 17).

(5) Continue stroking pistons until bubbles no longer appear in fluid entering reservoir.

(6) Remove bleed tubes and install plastic plugs in cylinder outlet ports. Plugs will prevent fluid loss and keep dirt out until cylinder assembly is ready for installation.

(7) Top off reservoir fluid level and install cap.

MASTER CYLINDER INSTALLATION

(1) If new master cylinder is being installed, remove protective cover from end of primary piston. Then bleed cylinder on bench as described in this section.

(2) Slide master cylinder onto booster studs. Align booster push rod in cylinder primary piston and seat cylinder against booster.

(3) Install master cylinder attaching nuts (Fig. 18). Tighten nuts to 25 N·m (220 in. lbs.) torque. **Cylinder attaching nuts are special locking type. Do not use substitute fasteners.**

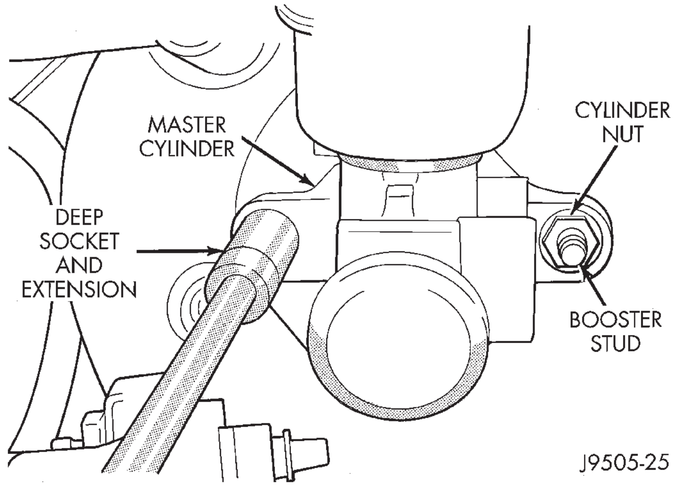

Fig. 18 Master Cylinder Attaching Nut Removal/ Installation

(4) Mount combination valve bracket on booster mounting studs.

(5) Install brakelines that connect master cylinder to combination valve. Start brakeline fittings by hand to avoid cross threading.

(6) Install nuts that attach combination valve bracket to booster mounting studs. Tighten nuts to 25 N·m (220 in. lbs.) torque.

(7) Fill and bleed brake system.

(8) Install windshield washer reservoir.

(9) Install engine air cleaner top cover and hoses.

HCU REMOVAL

(1) Loosen clamp that secures clean air hose to intake manifold. Then disconnect PCV hose at valve.

(2) Unsnap engine air cleaner top cover and remove cover and hoses (Fig. 19).

(3) Remove filter from air cleaner housing (Fig. 19).

(4) Remove bolts/nuts attaching air cleaner housing to body panel. Then work housing off ambient air duct and remove housing from engine compartment.

(5) Remove windshield washer reservoir attaching screws. Then position on top of fender (Fig. 8). It is not necessary to disconnect reservoir hoses or wires.

(6) Slide HCU solenoid harness connector off retaining tab on combination valve. Then unplug con-

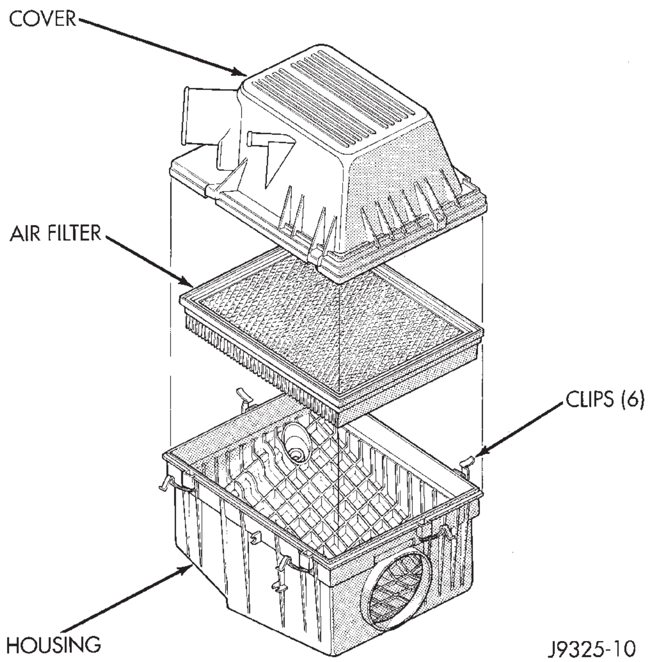

Fig. 19 Air Cleaner Components

nector from engine compartment harness and move it aside (Fig. 20).

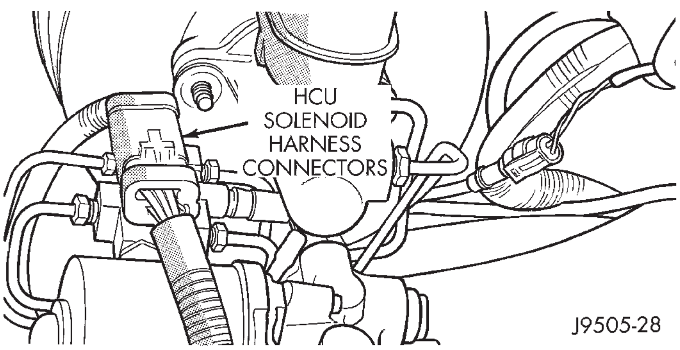

Fig. 20 HCU Solenoid Harness Connector

(7) Disconnect wire from combination valve switch (Fig. 4). Be careful when separating wire connector as lock tabs are easily damaged if not fully disengaged.

(8) Remove brakelines that connect master cylinder to combination valve (Fig. 4).

(9) Disconnect remaining two brakelines (from HCU) at combination valve.

(10) Remove nuts attaching combination valve bracket to booster mounting studs.

(11) Slide combination valve bracket off booster mounting studs and remove valve (Fig. 21). If bracket is tight fit, use pry tool to work bracket off studs.

(12) Remove nuts attaching master cylinder to booster mounting studs (Fig. 22). **Retain cylinder attaching nuts as they have a special interference fit thread.**

(13) Remove master cylinder (Fig. 10).

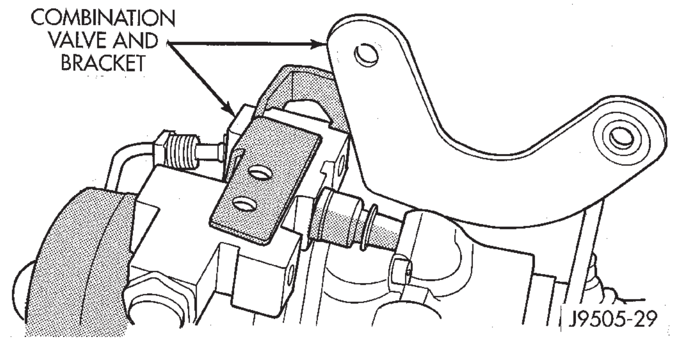

Fig. 21 Combination Valve Assembly Removal

(14) Remove three nuts that attach HCU bracket to suspension support panel (Fig. 22). Retain bracket nuts.

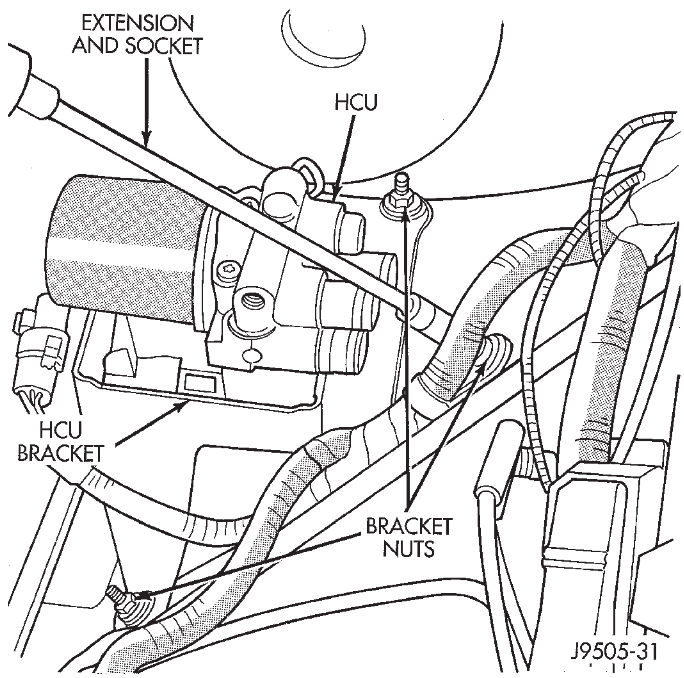

Fig. 22 Removing HCU Bracket Attaching Nuts

(15) Disconnect HCU pump motor harness (Fig. 23).

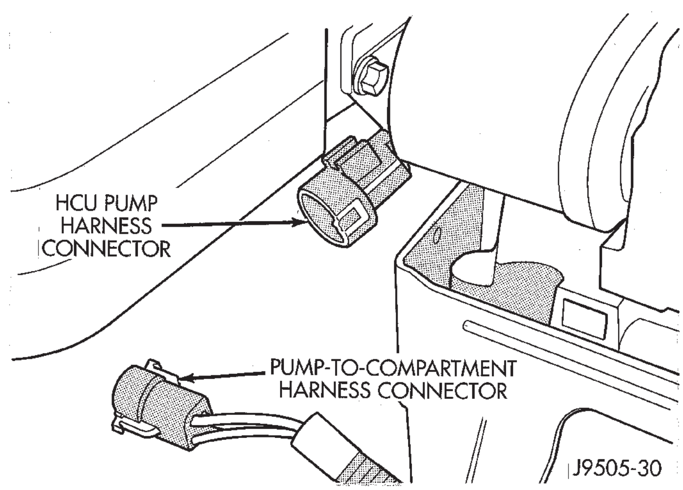

Fig. 23 HCU Pump Motor Harness Connector

(16) Disconnect three brakelines at rear of HCU (Fig. 24). These are lines that connect HCU to front/rear brakes.

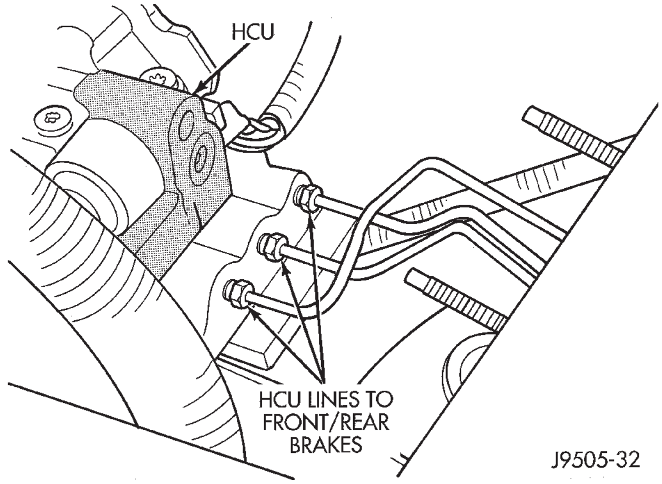

Fig. 24 Brakeline Connections

(17) If HCU is to be replaced, remove flex lines from HCU. These are lines that connect HCU to combination valve.

(18) Lift HCU and bracket off mounting studs and remove assembly from engine compartment (Fig. 25).

(19) If HCU is to be replaced, remove three bolts attaching mounting bracket to HCU (Fig. 26).

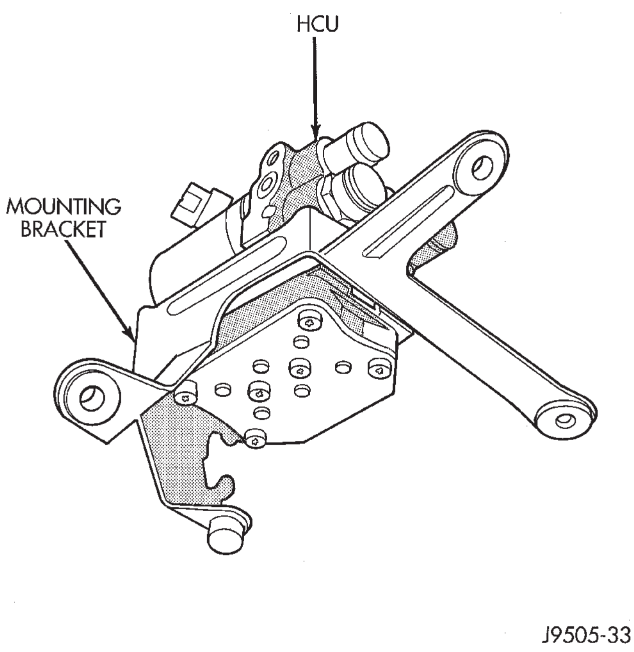

Fig. 25 HCU And Bracket Removal

(20) Separate bracket from HCU (Fig. 27). **Note that special shoulder bolts are used to attach bracket to HCU. If bolts are damaged, do not use substitute bolts. Use factory replacement bolts only.**

(21) Inspect rubber isolators and sleeves in HCU bracket (Figs. 26 and 27). Replace any washers or isolators if missing, or damaged with factory replacement parts only. Do not use substitute fasteners.

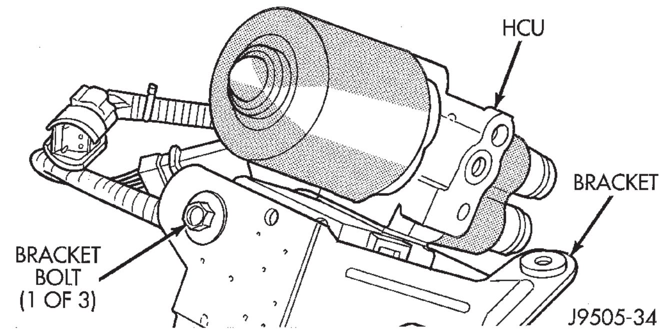

Fig. 26 HCU Bracket Bolt Location

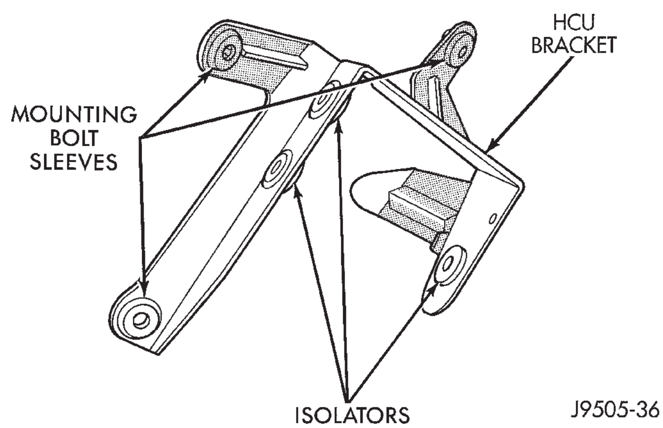

Fig. 27 HCU Bracket Isolators and Sleeves

HCU INSTALLATION

(1) If new HCU is being installed, transfer mounting bracket to new HCU. Be sure to use original shoulder style bolts to attach bracket to HCU; do not use substitute fasteners.

(2) If stud plate that attaches HCU bracket to suspension support panel, was removed, position stud plate on underside of panel and secure it with new retaining nuts (Fig. 29).

(3) Position HCU bracket on mounting studs (Fig. 30). Then install and tighten bracket attaching nuts to 10-13 N·m (92-112 in. lbs.) torque.

(4) Align and start brakeline fittings into ports at rear of HCU (Fig. 31). **Start fittings by hand to avoid cross threading.** Then tighten fittings to 14-16 N·m (125-140 in. lbs.) torque.

(5) Slide master cylinder onto booster studs (Fig. 32). Align booster push rod in cylinder primary piston and seat cylinder against booster.

(6) Install and tighten master cylinder attaching nuts to 25 N·m (220 in. lbs.) torque. **Cylinder at-**

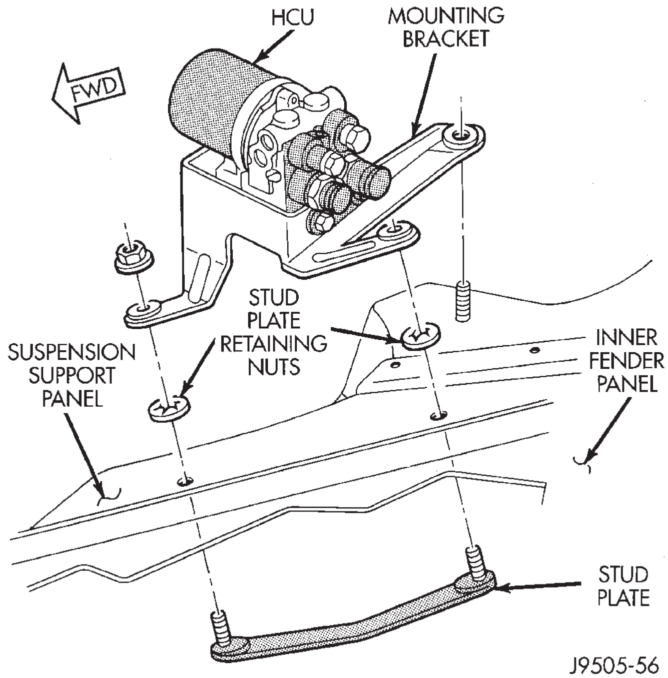

Fig. 29 Stud Plate And HCU Bracket Attachment

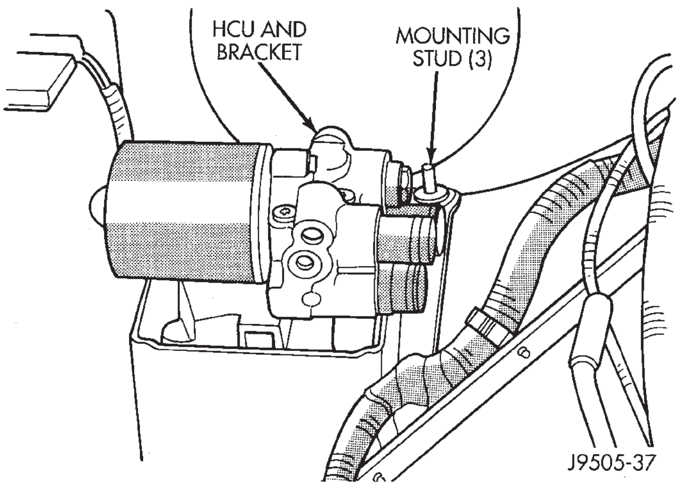

Fig. 30 HCU Installation

taching nuts are special and have an interference fit thread. Do not use substitute fasteners at any time.

(7) Install combination valve (Fig. 32). Be sure valve bracket is seated on booster mounting studs.

(8) Connect brakelines from HCU to combination valve. Start brakeline fittings by hand to avoid cross threading.

(9) Install master cylinder-to-combination valve brakelines. **Start brakeline fittings by hand to avoid cross threading.**

(10) Install nuts that attach combination valve bracket to booster mounting studs. Tighten nuts to 25 N·m (220 in. lbs.) torque.

(11) Connect HCU solenoid and pump motor wire harnesses.

(12) Connect wire to combination valve switch.

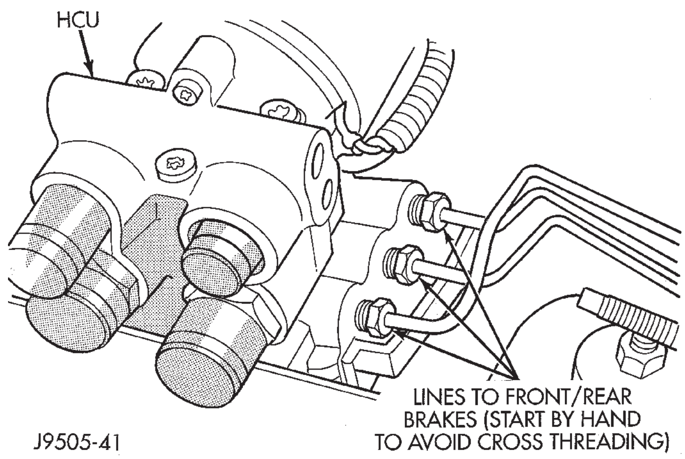

Fig. 31 HCU Brakeline Installation (To Front/Rear Brakes)

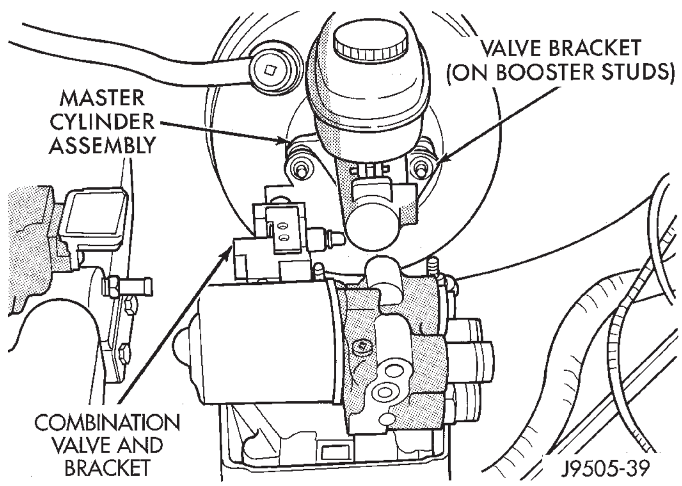

Fig. 32 Master Cylinder/Combination Valve Installation

(13) Fill and bleed brake system. Bleed procedure is described in section covering Brake Bleeding-Fluid Level-Brakelines. Tighten brakelines at HCU, master cylinder and combination to specified torque (Fig. 33).

(14) Install windshield washer reservoir.

(15) Install air cleaner housing, filter, top cover, and hoses.

POWER BRAKE BOOSTER REMOVAL

(1) Disconnect battery negative cable.

(2) Remove air cleaner top cover, filter, housing, and hoses.

(3) Remove screws attaching windshield washer reservoir to fender panel. Then position reservoir on top of fender.

(4) Remove master cylinder, combination valve, and HCU. Refer to procedures in this section.

(5) Disconnect vacuum hose at booster check valve (Fig. 34).

(6) Inside passenger compartment:

ITEM	TORQUE
A	15-18 N•m (130-160 in. lbs.)
B	18-24 N•m (160-210 in. lbs.)

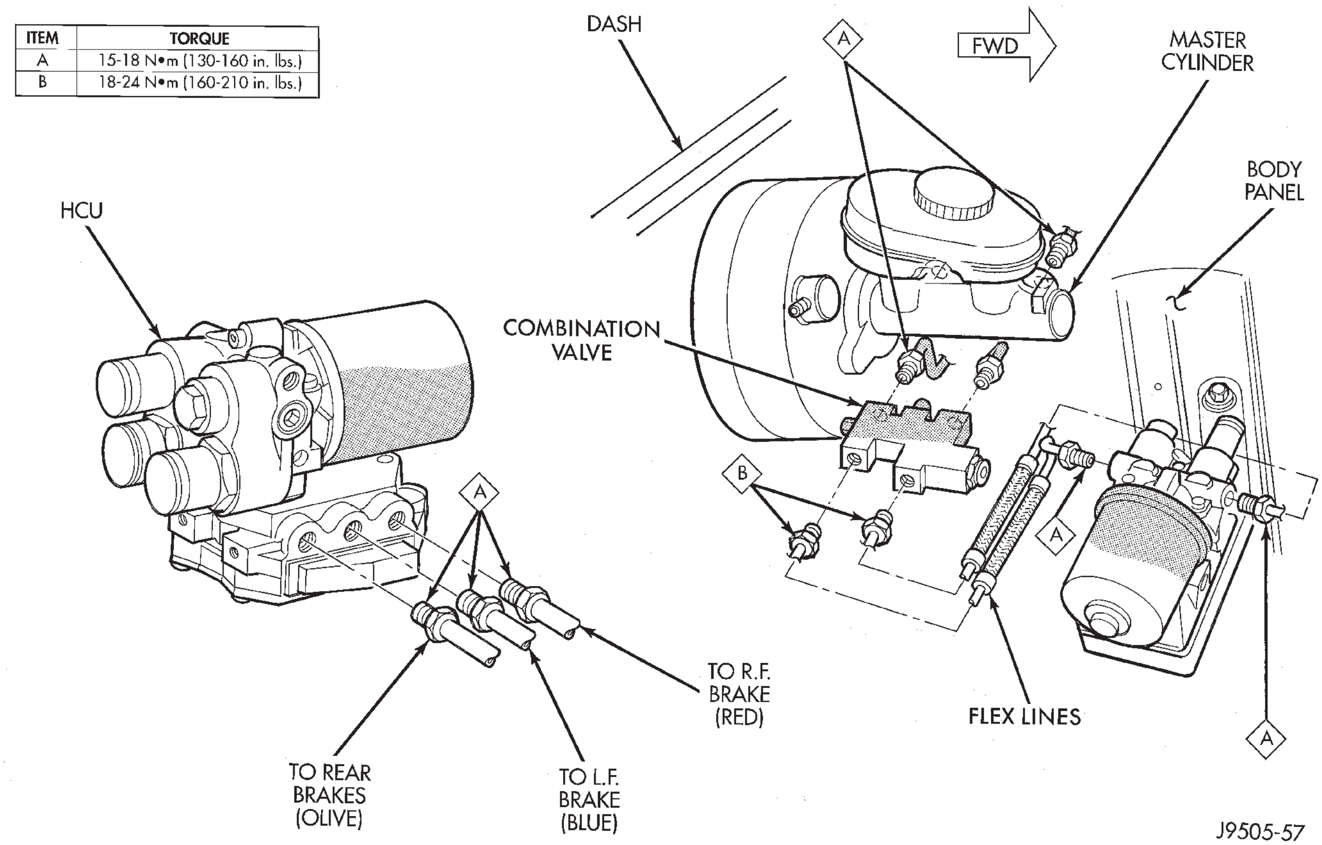

Fig. 33 Brakeline Connections (At Master Cylinder/Combination Valve/HCU)

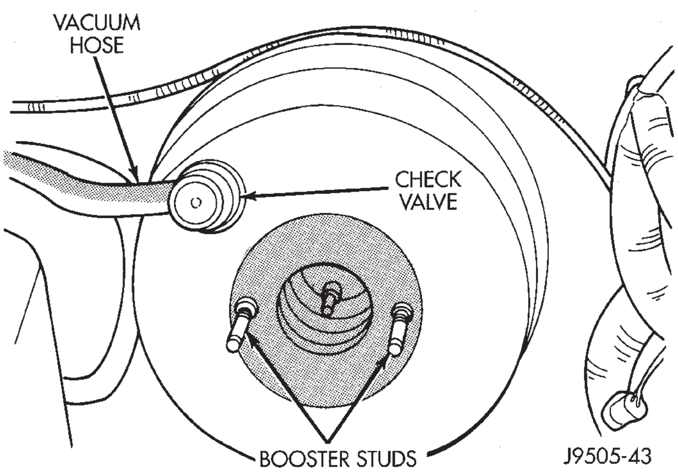

Fig. 34 Booster Check Valve And Hose

(a) Remove retainer clip that booster push rod to pedal pin (Fig. 35). Then slide push rod off pin.

(b) Remove four locknuts that attach booster to dash panel (Fig. 35).

(7) In engine compartment, slide booster forward, tilt it upward slightly, and remove it from engine compartment.

(8) If booster will be stored on bench for any length of time, cover booster with shop towels to prevent dust entry and place short lengths of rubber hose over booster studs to protect threads.

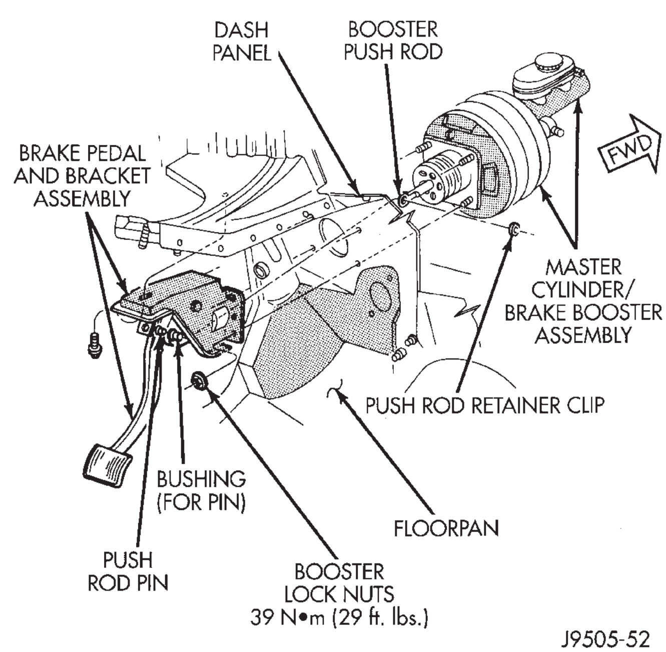

Fig. 35 Power Brake Booster Mounting

POWER BRAKE BOOSTER INSTALLATION

(1) Check condition of grommet that secures check valve in booster. Replace grommet if cut, torn, or loose (no longer secures valve tightly).

(2) Wipe booster mounting surface of dash panel clean with shop towel.

(3) Align and position booster on engine compartment side of dash panel.

(4) Inside passenger compartment:

(a) Lubricate pedal pin and bushing with Mopar multi-mileage grease.

(b) Install booster attaching nuts on studs. Tighten attaching nuts to 41 N·m (30 ft. lbs.) torque.

(c) Slide booster push rod on pedal pin. Then secure rod to pin with retainer clip.

(5) In engine compartment, attach vacuum hose to booster check valve (Figs. 36 and 37).

(6) Install master cylinder, combination valve, and HCU. Refer to procedures in this section.

(7) Bleed brakes. Refer to section covering brake bleeding.

(8) Install engine air cleaner and hoses.

(9) Install windshield washer reservoir.

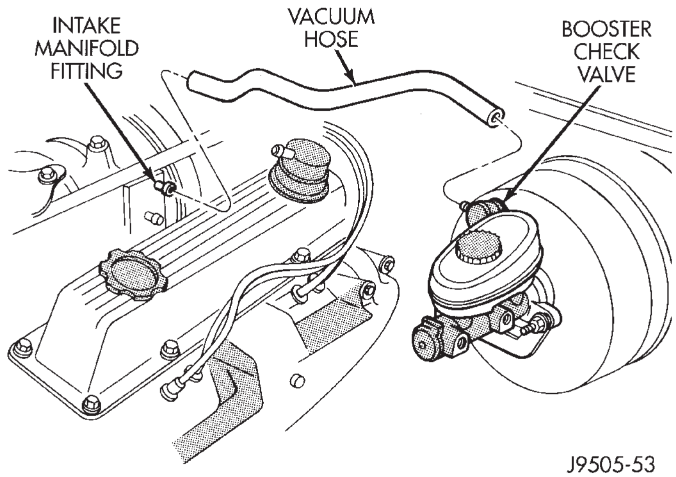

Fig. 36 Vacuum Hose Connection (5.2L)

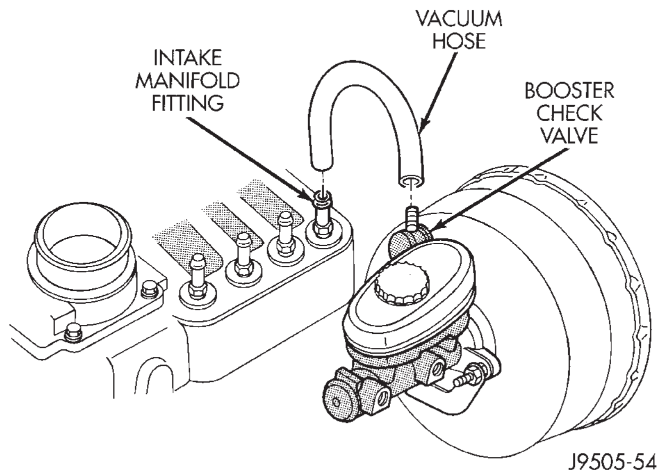

Fig. 37 Vacuum Hose Connection (4.0L)

SPEED SENSORS—TONE WHEELS—ACCELERATION SWITCH—ECU

INDEX

SERVICE INFORMATION

The ECU, speed sensors, and acceleration switch used in the antilock brake system are not repairable parts. They are serviced as assemblies only.

TONE WHEEL SERVICE

The axle shaft tone wheels are not serviceable. If a tone wheel becomes damaged, it will be necessary to replace the axle shaft.

SPEED SENSOR AIR GAP

Front sensor air gap is fixed and not adjustable. Only rear sensor air gap is adjustable.

Although front sensor air gap is not adjustable, it can be checked if diagnosis indicates this is necessary. Front air gap should be 0.40 to 1.3 mm (0.0157 to 0.051 in.). If gap is incorrect, the sensor is either loose, or damaged.

Rear sensor air gap adjustment is only needed when reinstalling an original sensor. Replacement sensors have an air gap spacer attached to the sensor pickup face. The spacer establishes correct air gap when pressed against the tone ring during installation. As the tone ring rotates, it peels the spacer off the sensor to create the required air gap. Rear sensor air gap is 0.92-1.45 mm (0.036-0.057 in.).

Sensor air gap measurement, or adjustment procedures are provided in this section. Refer to the front, or rear sensor removal and installation procedures as required.

FRONT WHEEL SENSOR REMOVAL

(1) Turn ignition switch to OFF position.

(2) Raise vehicle.

(3) Remove wheel and tire.

(4) Remove bolt attaching front sensor to steering knuckle (Fig. 1).

(5) Disengage sensor wire from brackets on steering knuckle and frame member (Figs. 2 and 3).

(6) Unseat grommet that secures sensor wire in fender panel (Fig. 3)

(7) In engine compartment, disconnect sensor wire connector at harness plug (Fig. 4).

(8) Remove sensor and wire assembly.

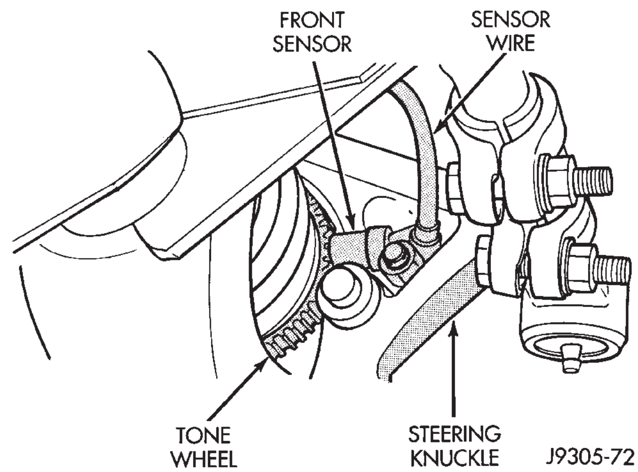

Fig. 1 Front Wheel Sensor Location

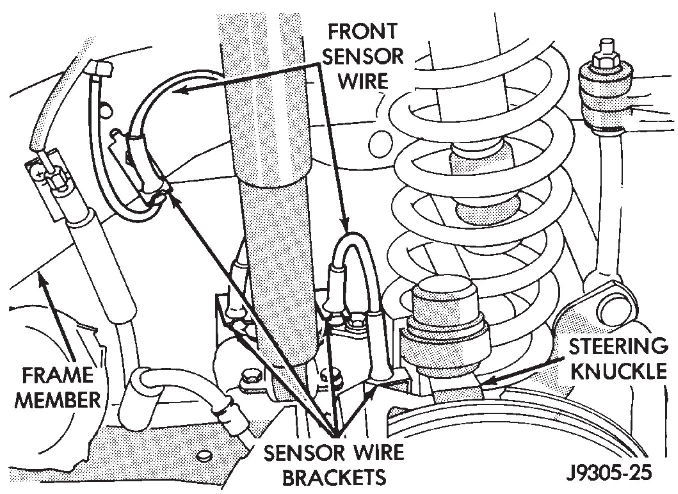

Fig. 2 Front Wheel Sensor Wire Routing

FRONT WHEEL SENSOR INSTALLATION

(1) Apply Mopar Lock N' Seal or Loctite 242 to sensor attaching bolt. Use new sensor bolt if original bolt is worn or damaged.

(2) Position sensor on steering knuckle. Seat sensor locating tab in hole in knuckle and install sensor attaching bolt finger tight.

(3) Tighten sensor bolt to 14 N·m (11 ft. lbs.) torque.

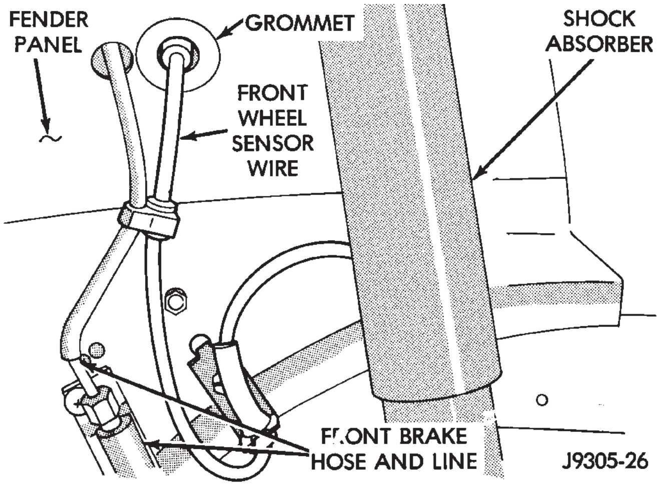

Fig. 3 Front Wheel Sensor Wire Grommet Location

(4) Route sensor wire from steering knuckle to fender panel.

(5) Engage grommets on sensor wire in brackets on body, chassis, frame, and steering knuckle.

(6) Check sensor wire routing. Be sure wire is clear of all chassis components and is not twisted or kinked at any spot.

(7) Seat sensor wire in body grommet and seat grommet in fender panel (Fig. 4).

(8) Connect sensor wire to harness in engine compartment.

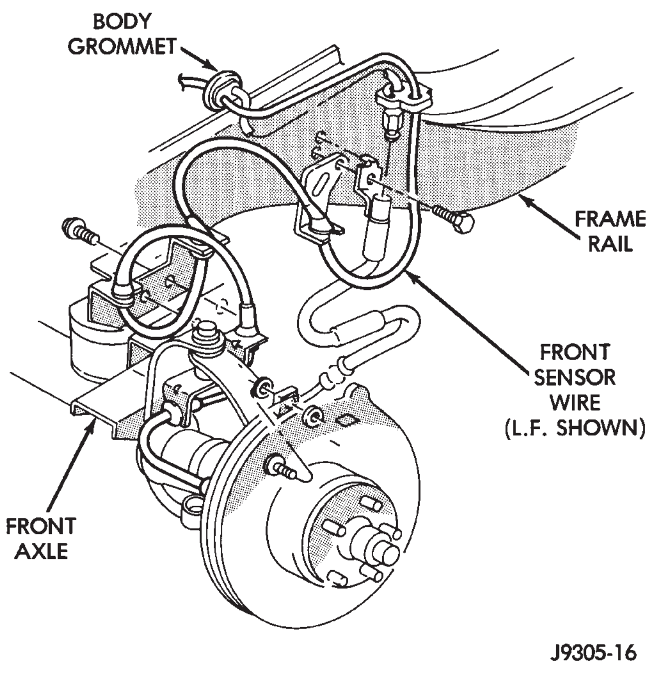

Fig. 4 Front Sensor Wire Routing (Left Front Shown)

REAR WHEEL SENSOR REMOVAL

(1) Raise and fold rear seat forward. Then move carpeting aside for access to rear sensor connectors.

(2) Disconnect rear sensor wires at harness connectors.

(3) Push sensor wires and grommets through floorpan holes.

(4) Raise vehicle.

(5) Remove wheel and brake drum.

(6) Disengage sensor wire from axle and chassis brackets and from brakeline retainers (Fig. 5).

(7) Unseat sensor grommet from brake support plate.

(8) Remove bolt attaching sensor to support plate bracket (Fig. 6).

(9) Remove sensor and wire through opening in support plate.

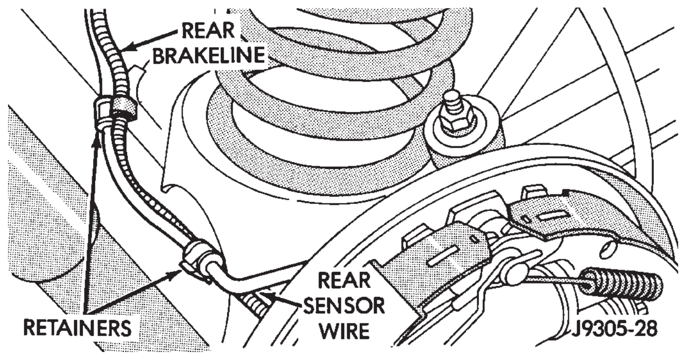

Fig. 5 Rear Wheel Sensor Wire Attachment

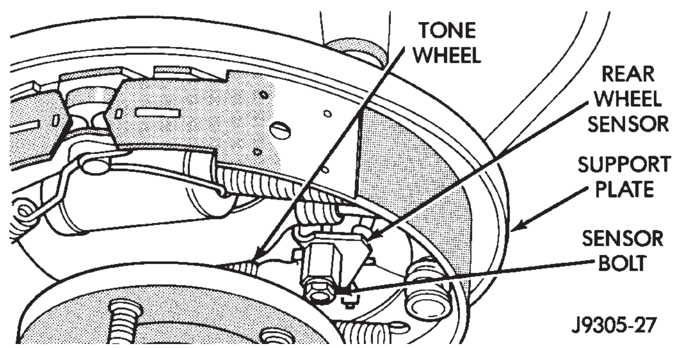

Fig. 6 Rear Wheel Sensor Mounting

REAR WHEEL SENSOR INSTALLATION AND ADJUSTMENT

(1) Insert sensor wire through support plate hole. Then seat sensor wire grommet in hole to secure wire.

(2) Apply Mopar Lock N' Seal or Loctite 242 to original sensor bolt. Use new bolt if original is worn or damaged.

(3) Install sensor bolt finger tight only at this time.

(4) Set sensor air gap as follows:

(a) If **original sensor** is being installed or adjusted, remove any remaining pieces of cardboard spacer from sensor pickup face. Set air gap to 0.92-1.45 mm (0.036-0.057 in.) with feeler gauge (Fig. 7). Tighten sensor bolt to 14 N·m (11 ft. lbs.) torque.

(b) If **new sensor** is being installed, push cardboard spacer on sensor face (Fig. 8) against tone ring. Then tighten sensor bolt to 14 N·m (11 ft. lbs.) torque. Correct air gap will be established as tone ring rotates and peels spacer off sensor face.

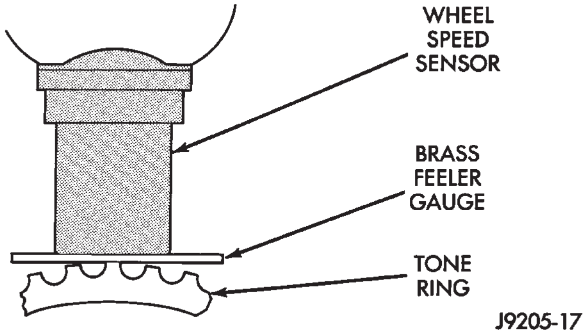

Fig. 7 Setting Air Gap On Original Rear Sensor

(5) Route sensor wires to rear seat area.

(6) Feed sensor wires through floorpan access hole and seat sensor grommets in floorpan.

(7) Secure sensor wire in brackets and in retainers on rear brakelines. Verify that sensor wire is secure and clear of rotating components.

(8) Install brake drum and wheel and lower vehicle.

(9) Fold rear seat and carpet forward for access to sensor wires and connectors.

(10) Connect sensor wires to harness connectors.

(11) Reposition carpet and fold rear seat down.

ACCELERATION SWITCH REMOVAL

(1) Turn ignition switch to OFF position.

(2) Disconnect battery negative cable.

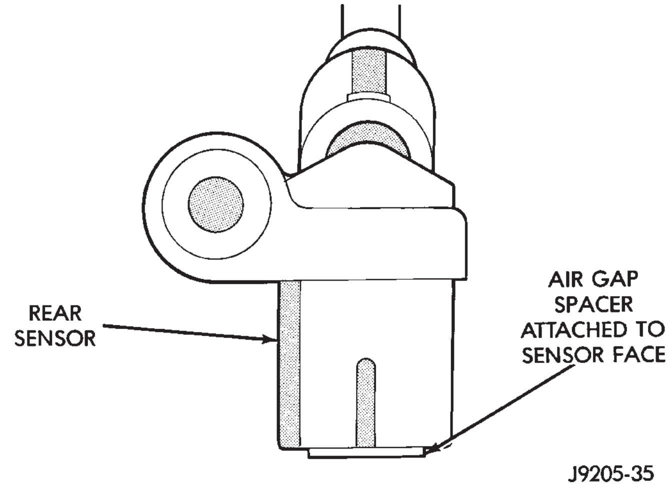

Fig. 8 New Rear Sensor With Air Gap Spacer

(3) Tilt rear seat assembly forward for access to sensor.

(4) Disconnect sensor harness (Fig. 9).

(5) Remove screws attaching sensor to bracket.

(6) Remove sensor.

ACCELERATION SWITCH INSTALLATION

(1) Note position of locating arrow on switch. Position switch so arrow faces forward.

CAUTION: The mercury switch (inside the acceleration switch), will not function properly if the switch is mispositioned. Verify that the locating arrow is pointing to the front of the vehicle.

(2) Position switch in mounting bracket (Fig. 9).

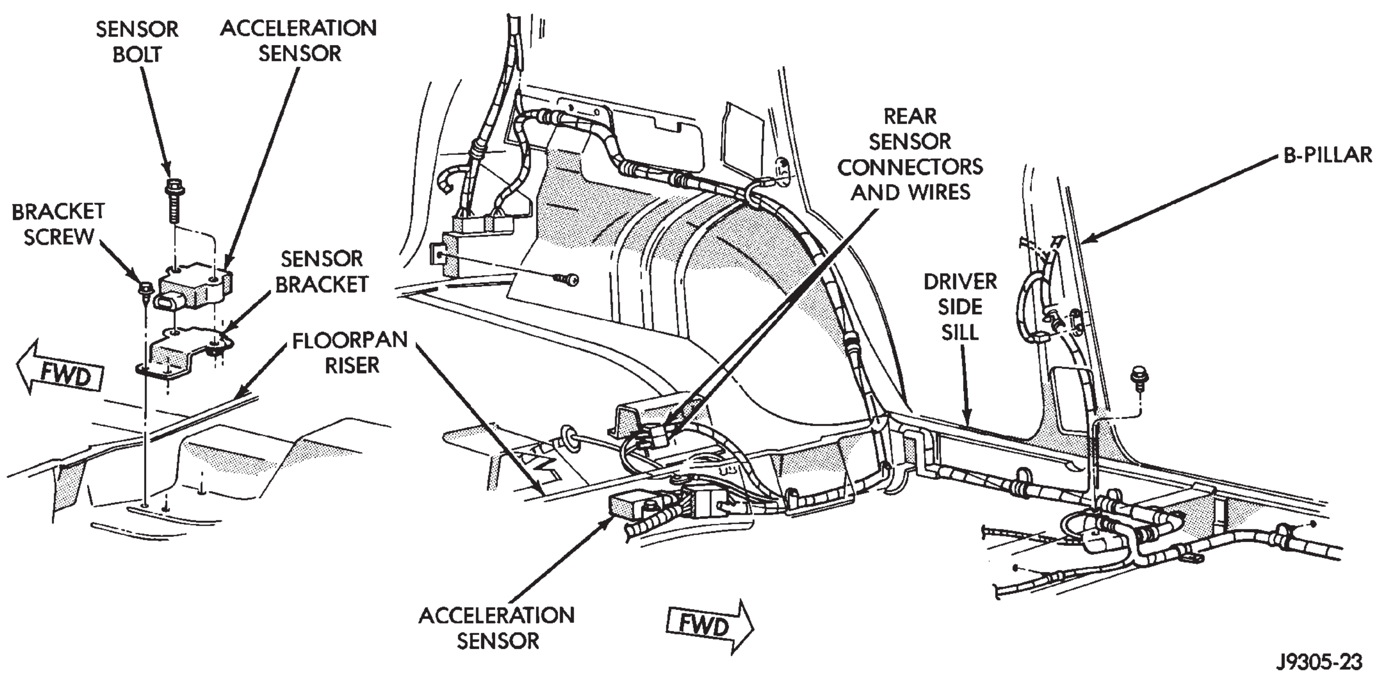

Fig. 9 Acceleration Sensor Mounting

(3) Install and tighten switch attaching screws to 2-4 N·m (17-32 in. lbs.) torque.

(4) Connect harness to switch. Be sure harness connector is firmly seated.

(5) Move rear seat back to normal position.

(6) Connect battery negative cable.

ECU REMOVAL

(1) Turn ignition switch to OFF position.

(2) Remove engine air cleaner and hoses.

(3) On California 4.0L models, disconnect and remove duty purge solenoid and bracket (Fig. 10). Solenoid and bracket must be removed for access to ECU bracket.

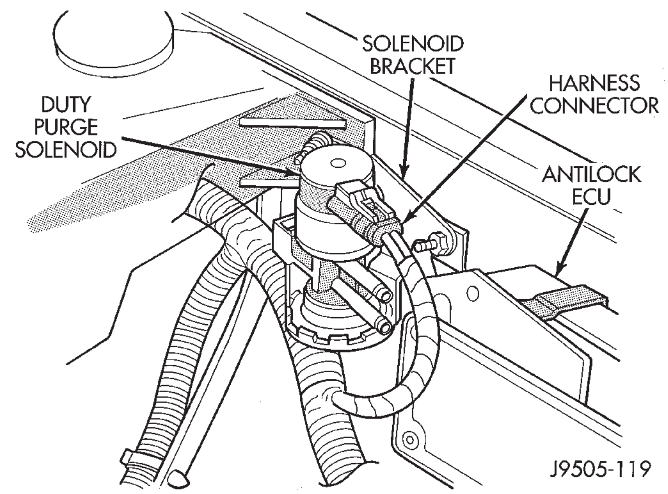

Fig. 10 Duty Purge Solenoid And Bracket Mounting

(4) Release strap securing harness connector to ECU pin terminals (Fig. 11). Use tool such as small flat blade screwdriver to lift metal strap upward to release it.

(5) Disconnect harness connector from ECU. Tilt connector upward to disengage it from ECU pin terminals. Then slide it out of retaining tangs in ECU.

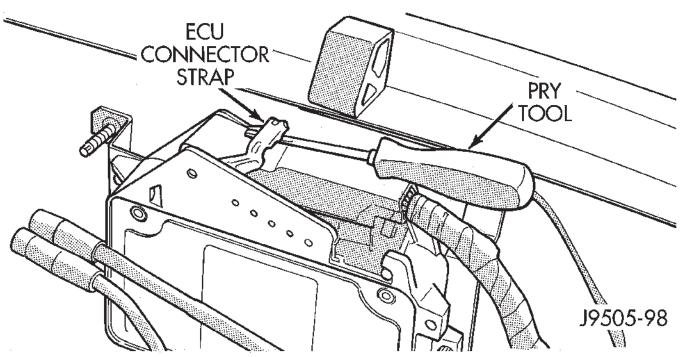

Fig. 11 Releasing ECU Harness Connector Strap

(6) Remove screws/nuts attaching ECU bracket to fender panel.

(7) Lift ECU off driver side inner fender panel and out of engine compartment (Fig. 12).

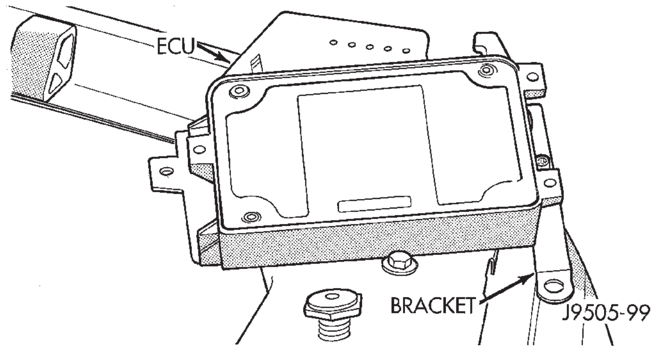

Fig. 12 ECU And Bracket Removal

(8) If ECU will be replaced, remove mounting bracket from ECU.

ECU INSTALLATION

(1) If new ECU is being installed, transfer mounting bracket to new ECU (Fig. 13).

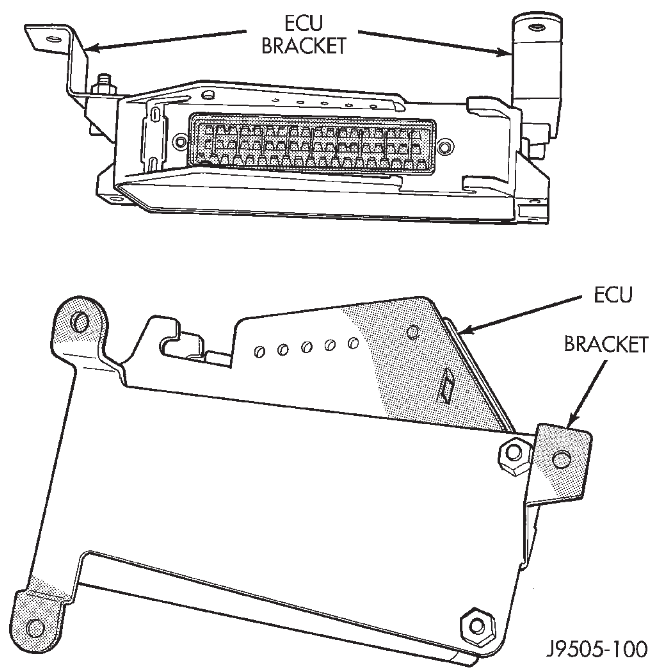

Fig. 13 Mounting Bracket Position On ECU

(2) Position ECU on fender panel and install attaching screws/nuts.

(3) On California 4.0L models, install duty purge solenoid and bracket on fender panel (Fig. 10). Then connect harness to solenoid.

(4) Align and attach harness connector to ECU. Slide connector into engagement with tangs on ECU. Then tilt connector downward and into engagement with ECU pin terminals. Exercise care as pin terminals can be damaged if connector is forced into place.

(5) Install engine air cleaner and hoses.

FRONT DISC BRAKES

INDEX

GENERAL INFORMATION

Grand Cherokee models are equipped with single piston, floating-type front disc brake calipers. Ventilated rotors are used at the front and solid rotors are used at the rear.

The front calipers are supported in mounting arms that are an integral part of the steering knuckle. The calipers slide on mounting bolts that also attach the calipers to the steering knuckle.

CALIPER OPERATION AND WEAR COMPENSATION

Caliper Operation

The significant feature of single piston caliper operation is that the calipers are free to slide laterally on the mounting bolts. It is the freedom of lateral movement that allows continuous compensation for lining wear.

A simplified cross section of a single piston caliper is shown in Figure 1. The illustration portrays the forces at work when the brakes are applied.

At brake application, fluid pressure exerted against the caliper piston increases greatly. Of equal importance, is the fact that fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal.

Fluid pressure applied to the piston is transmitted directly to the inboard brakeshoe. This forces the shoe lining against the inner surface of the disc brake rotor (Fig. 1). At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brakeshoe lining into contact with the outer surface of the disc brake rotor (Fig. 1).

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will stop the rotors from turning and bring the vehicle to a stop.

Brakeshoe Wear Compensation

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brakeshoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

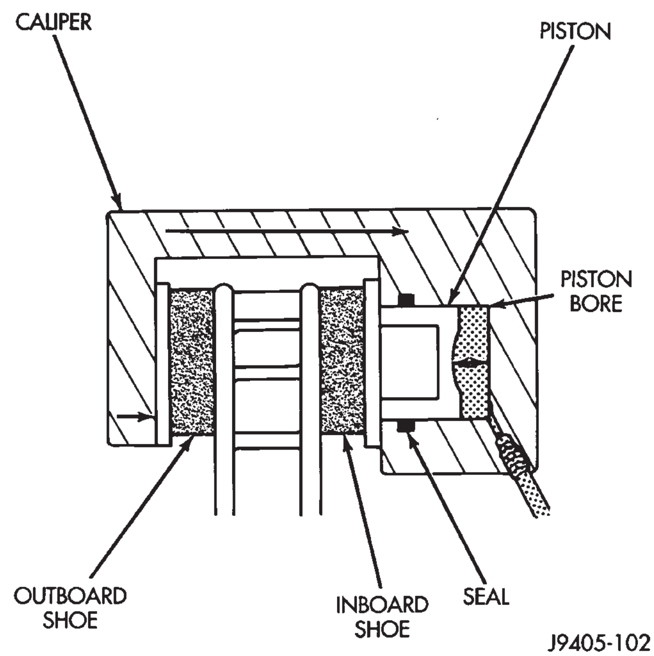

Fig. 1 Disc Brake Caliper Operation

The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement (Fig. 2). When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

The amount of piston retraction is determined by brakelining wear. Generally, the amount is just enough to maintain contact between the piston and inboard brakeshoe. Brakelining running clearance at the rotor, will be held between zero and a maximum of 0.12 mm (0.005 in.).

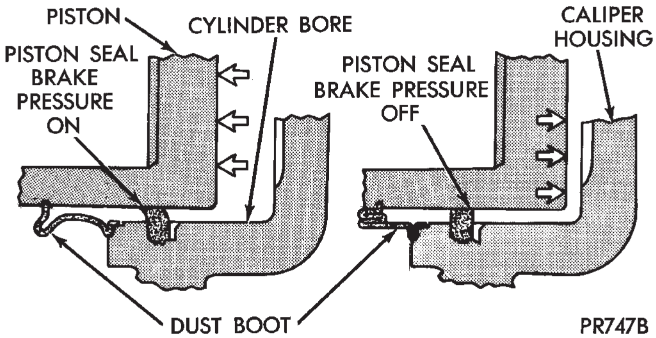

Fig. 2 Lining Wear Compensation By Piston Seal

FRONT BRAKESHOE REMOVAL

(1) Raise vehicle and remove front wheels.

(2) If brakeshoes are severely worn, drain small amount of fluid from master cylinder front brake reservoir with suction gun.

(3) Bottom caliper piston in caliper bore with C-clamp. Position clamp screw on outboard brakeshoe and frame of clamp on rear of caliper. **Do not allow clamp screw to bear directly on outboard shoe retainer spring. Use wood or metal spacer between shoe and clamp screw if necessary.** A typical method of bottoming piston with C-clamp is shown in Figure 3.

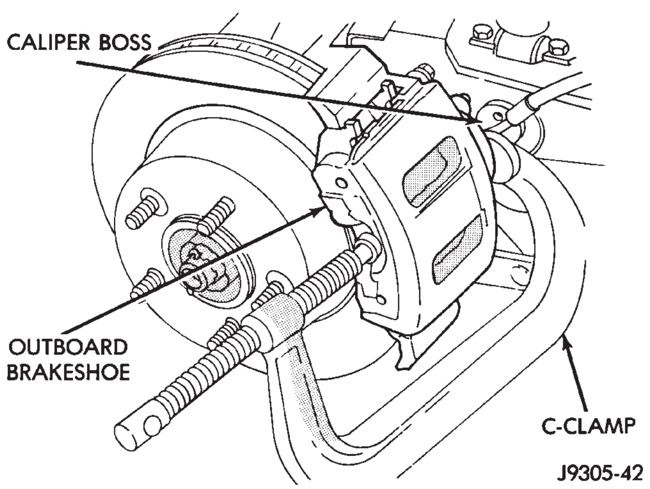

Fig. 3 Bottoming Caliper Piston With C-Clamp

(4) Remove caliper mounting bolts (Fig. 4). **If brakeshoes are being removed to correct a pull or drag condition, verify length of caliper bolts as they may be incorrect length. Refer to bolt information in brakeshoe installation procedure.**

(5) Tilt top of caliper outward. Use pry tool if necessary (Fig. 5).

(6) Lift caliper off steering knuckle (Fig. 6).

(7) **If original brakeshoes will be used, keep them in sets (left and right as they are not interchangeable.**

(8) Remove outboard shoe. Press one end of shoe inward to disengage shoe lug and rotate shoe upward until retainer spring clears caliper. Then press opposite end of shoe inward to disengage opposite shoe lug and rotate shoe up and out of caliper (Fig. 7).

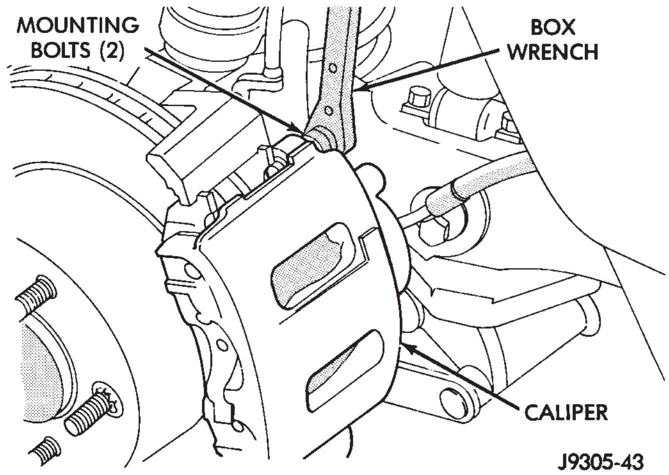

Fig. 4 Caliper Mounting Bolt Removal/Installation

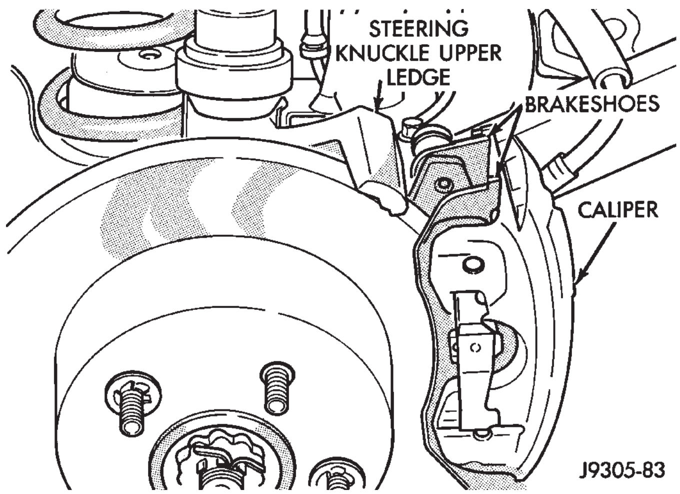

Fig. 5 Tilting Caliper Outward

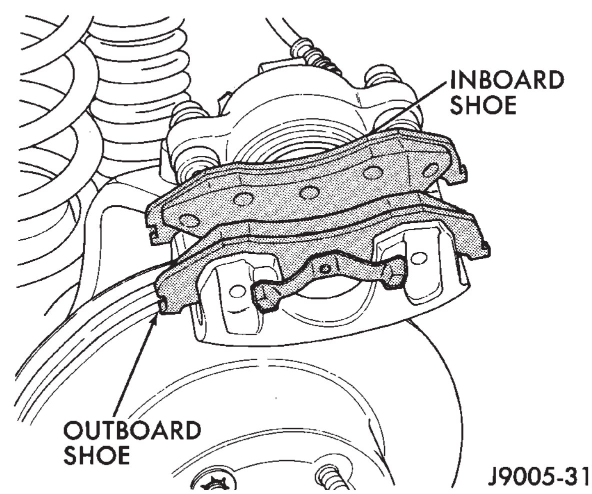

Fig. 6 Front Caliper Removal

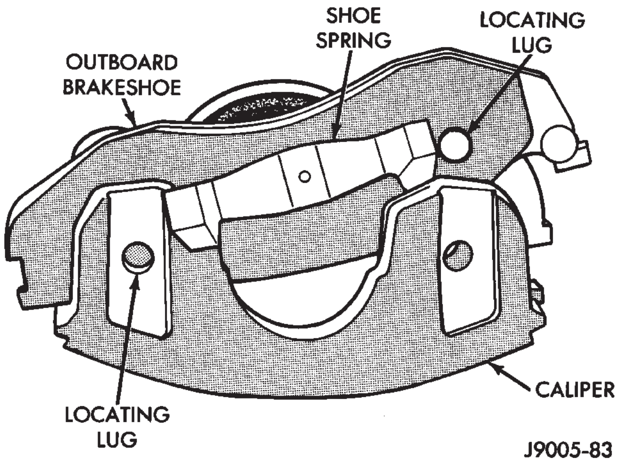

Fig. 7 Outboard Brakeshoe Removal

(9) Remove inboard shoe. Grasp ends of shoe and tilt shoe outward to release springs from caliper piston (Fig. 8). Then remove shoe from caliper.

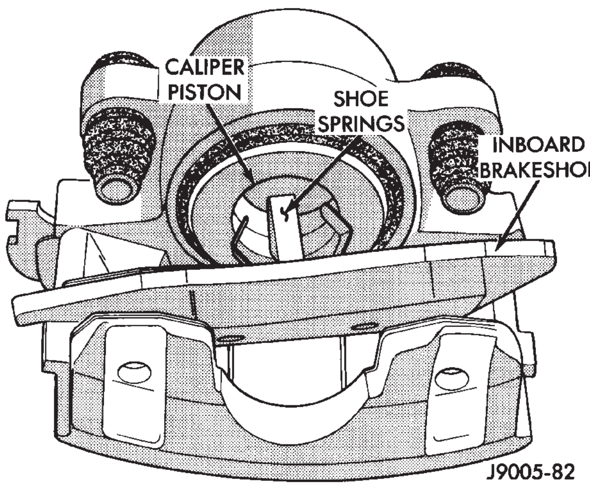

Fig. 8 Front Inboard Brakeshoe Removal

(10) Support caliper on box, mechanics stool, or similar device. **Do not allow brake hose to support caliper weight.**

(11) Wipe caliper off with shop rags or towels. **Do not use compressed air. Compressed air can unseat dust boot and force dirt into piston bore.**

(12) Inspect condition of caliper piston dust boot (Fig. 9). Overhaul caliper if there is evidence of leakage past piston and dust boot. Then inspect caliper bushings and boots (Fig. 9). Replace boots if torn or cut. If bushings or boots are damaged, replace them.

FRONT BRAKESHOE INSTALLATION

(1) Lubricate caliper mounting bolts and bushings (Fig. 9) with GE 661 or Dow 111 silicone grease.

(2) **Keep new or original brakeshoes in sets. They should never be interchanged from side to side.**

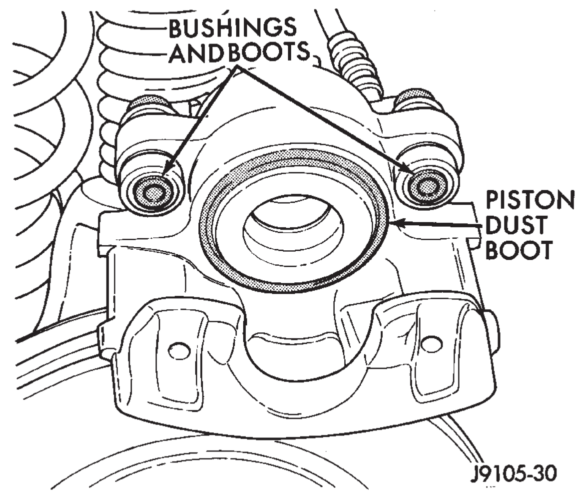

Fig. 9 Front Caliper Dust Boot And Bushing Locations

(3) Install inboard shoe in caliper (Fig. 10). Be sure shoe retaining springs are fully seated in caliper piston.

(4) Install outboard shoe in caliper (Fig. 11). Start one end of shoe in caliper and rotate shoe downward and into place until shoe locating lugs and shoe spring are seated in caliper.

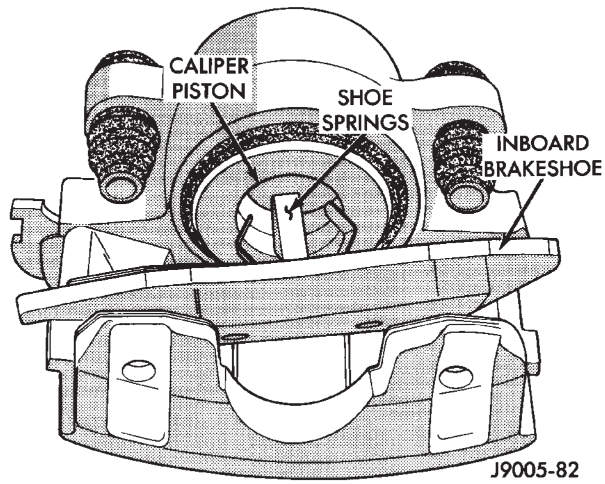

Fig. 10 Front Inboard Disc Brakeshoe Installation

(5) Verify that locating lugs on outboard shoe are seated in caliper (Fig. 6).

(6) Install caliper. Position notches at lower end of brakeshoes on bottom mounting ledge of steering knuckle. Then rotate caliper onto rotor and seat tabs at upper ends of brakeshoes on top mounting ledge (Fig. 12).

(7) Check brakeshoe position on steering knuckle mounting ledges. Be sure notches at lower end of brakeshoes are securely seated on bottom mounting ledges. Then verify that tabs at upper ends of shoes are seated on top mounting ledge (Fig. 12).

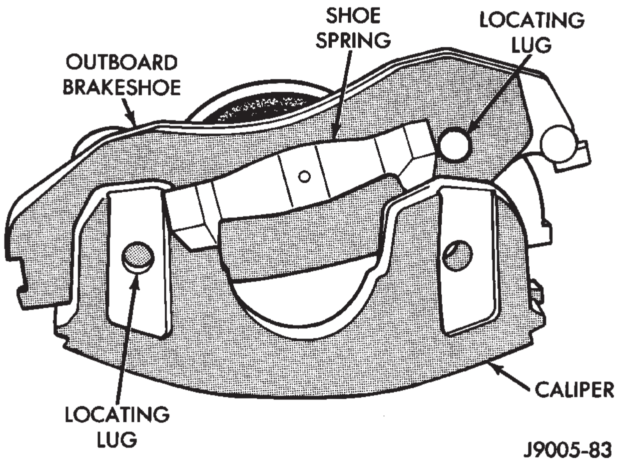

Fig. 11 Front Outboard Disc Brakeshoe Installation

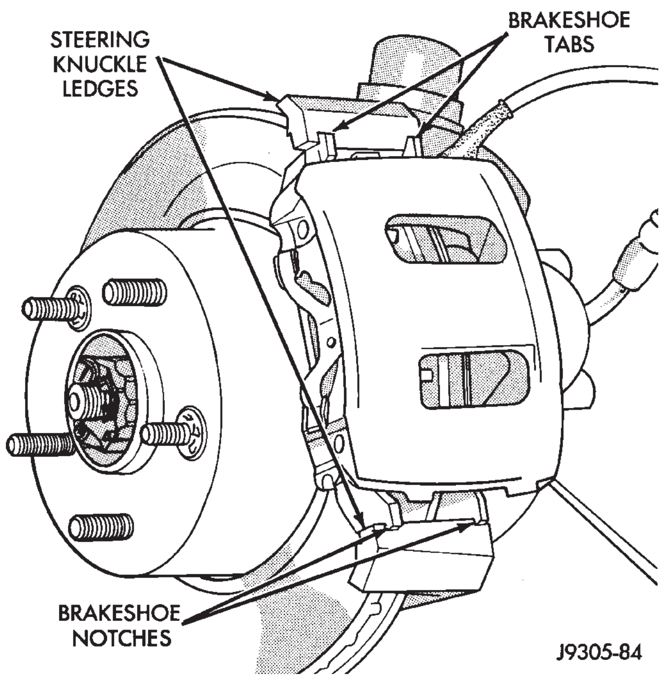

Fig. 12 Front Caliper And Brakeshoe Installation

CAUTION: Before securing the caliper, be sure the front brake hose is not twisted, kinked or touching any chassis components (Fig. 13).

(8) Lubricate and install caliper mounting bolts. Start bolts by hand then tighten bolts to 10-20 N·m (7-15 ft. lbs.) torque.

CAUTION: If new caliper bolts are being installed, or if the original reason for repair was a drag/pull condition, check caliper bolt length before proceeding. If the bolts have a shank length greater than 67.6 mm (2.66 in.), they will contact the inboard brakeshoe causing a partial apply condition. Refer to Figure 14 for required caliper bolt length.

(9) Install wheels. Tighten wheel nuts to 109-150 N·m (80-110 ft. lbs.) torque.

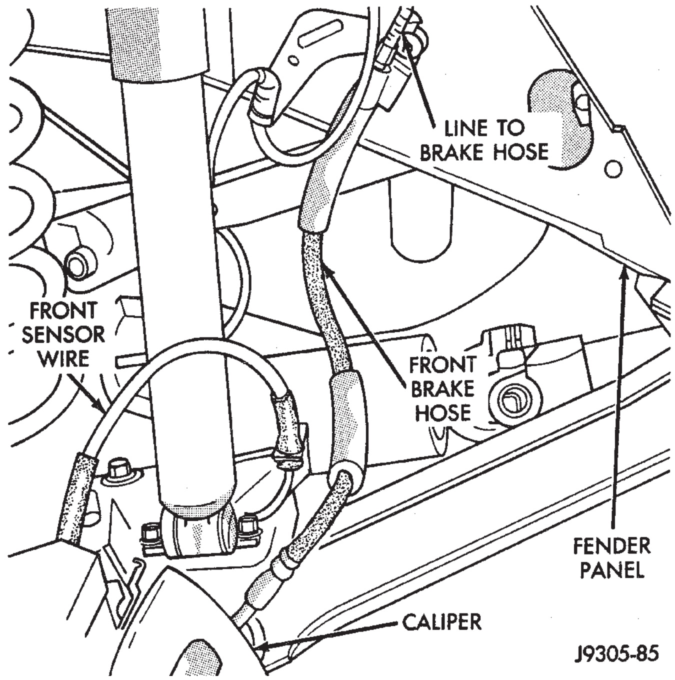

Fig. 13 Correct Front Brake Hose Routing (Driver Side Shown)

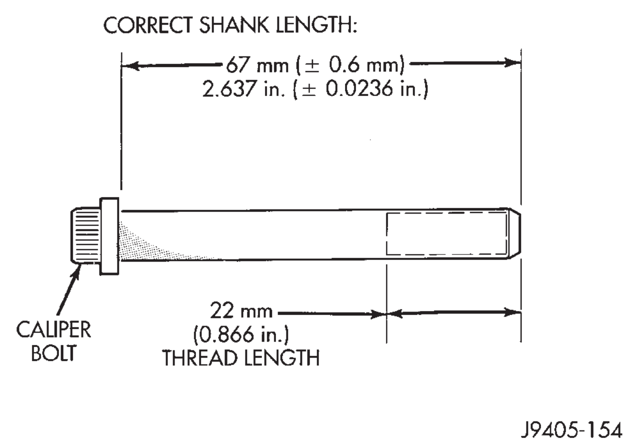

Fig. 14 Caliper Mounting Bolt Dimensions

(10) Turn ignition On and run pump until it shuts off. Then pump brake pedal until shoes are seated.

(11) Top off brake fluid level if necessary. Use Mopar brake fluid or equivalent meeting SAE J1703 and DOT 3 standards only.

FRONT CALIPER REMOVAL

(1) Raise vehicle and remove front wheels.

(2) If brakeshoes are severely worn, drain small amount of fluid from master cylinder front brake reservoir with suction gun.

(3) Bottom caliper piston in caliper bore with C-clamp. Position clamp screw on outboard brakeshoe and frame of clamp on rear of caliper. **Do not allow clamp screw to bear directly on outboard shoe retainer spring. Use wood or metal spacer**

between shoe and clamp screw if necessary. A typical method of bottoming piston with C-clamp is shown in Figure 3.

(4) Remove caliper mounting bolts (Fig. 4).

(5) Tilt top of caliper outward. Use pry tool if necessary (Fig. 5).

(6) Lift caliper off steering knuckle (Fig. 6).

(7) **If original brakeshoes will be used, keep them in sets left and right, as they should not be interchanged.**

(8) Remove front brake hose fitting bolt and washers. Then remove caliper from vehicle.

(9) Cover open end of front brake hose to prevent dirt entry. Use tape or shop towels.

FRONT CALIPER DISASSEMBLY AND OVERHAUL

(1) Remove outboard and inboard brakeshoes from caliper.

(2) Pad interior of caliper with minimum, one-inch thickness of shop towels (Fig. 15). Towels are needed to protect caliper piston during removal.

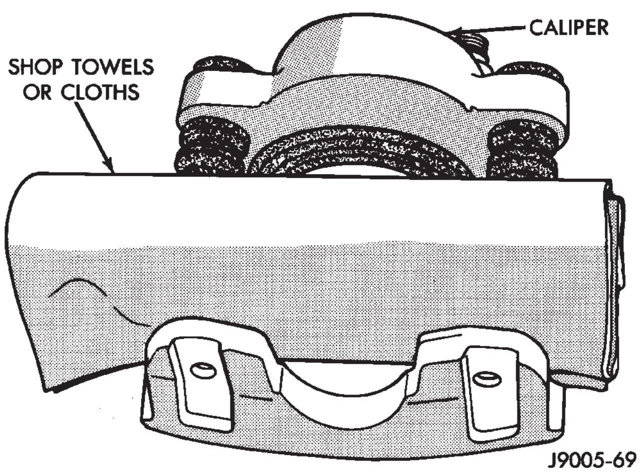

Fig. 15 Padding Caliper Interior To Protect Piston During Removal

(3) Remove caliper piston with **short bursts** of low pressure compressed air. Direct air through fluid inlet port and ease piston out of bore (Fig. 16).

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out. In addition, NEVER attempt to catch the piston as it leaves the bore. This could result in personal injury.

(4) Remove caliper piston dust boot. Either pry boot out of caliper with suitable tool, or collapse boot with punch to remove it (Fig. 17).

(5) Remove and discard caliper piston seal with pencil, or plastic tool (Fig. 18). Do not use metal tools as they will scratch piston bore.

(6) Remove caliper mounting bolt bushings and boots (Fig. 19).

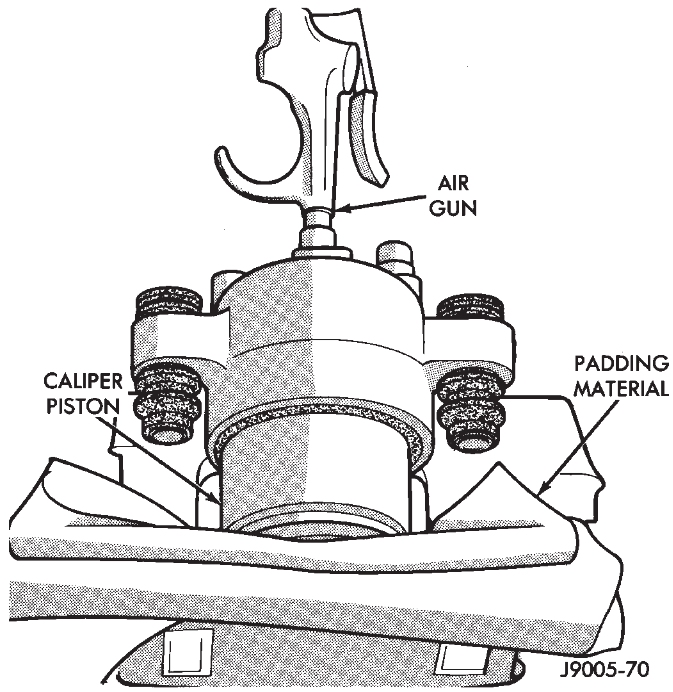

Fig. 16 Caliper Piston Removal

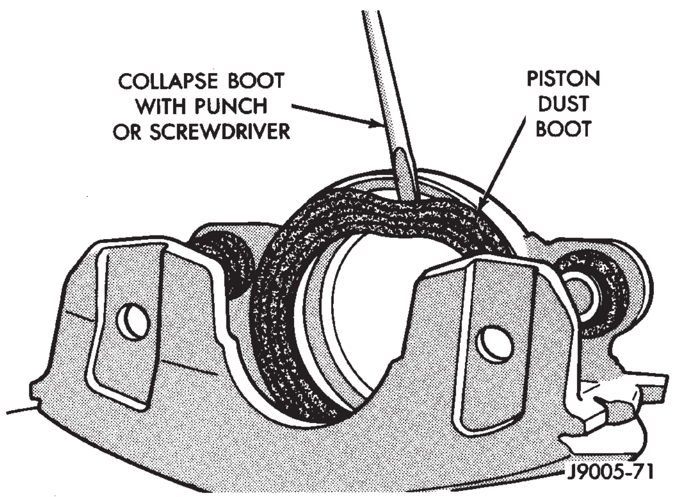

Fig. 17 Removing Caliper Piston Dust Boot

FRONT CALIPER CLEANING AND INSPECTION

Clean the caliper and piston with clean brake fluid or Mopar brake cleaning solvent only. Do not use gasoline, kerosene, paint thinner, or similar types as a solvent. These products may leave a residue that could damage the piston and seal.

Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

Inspect the piston and piston bore. Replace the caliper if the bore is corroded, rusted, or scored. Do not hone the caliper piston bore. Replace the caliper if the bore is damaged.

Inspect the caliper piston. The piston is made from a phenolic resin and should be smooth and clean. Surface discoloration is normal but replace the piston

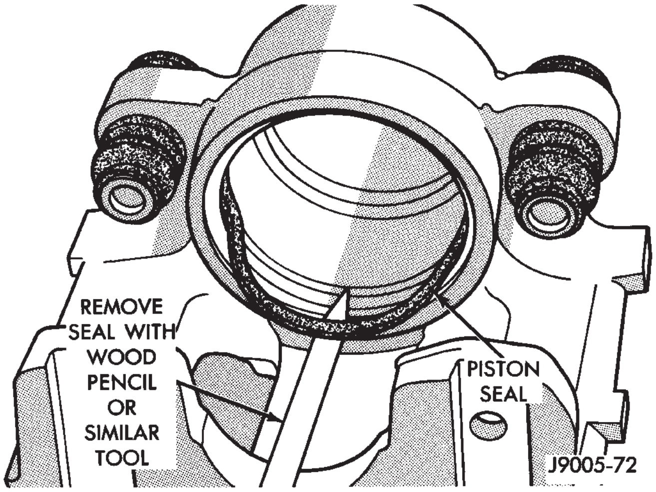

Fig. 18 Removing Caliper Piston Seal

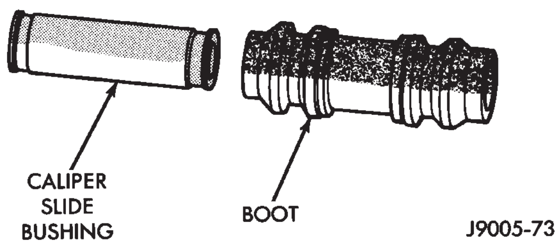

Fig. 19 Caliper Bushing And Boot Removal

if cracked, chipped, or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: Never interchange phenolic resin and steel caliper pistons. The seals, seal grooves, caliper bores and piston tolerances are different for resin and steel pistons. Do not intermix these components.

Inspect the caliper bushings and boots. Replace the boots if cut or torn. Clean and lubricate the bushings with GE 661 or Dow 111 silicone grease if necessary.

Inspect condition of the caliper mounting bolts. Replace the bolts if corroded, rusted, or worn. Do not reuse the bolts if unsure of their condition.

Length of the caliper mounting bolts is also extremely important. **Use the replacement bolts specified in the parts catalog at all times. Do not use substitute bolts. Bolts that are too long will partially apply the inboard brakeshoe causing drag and pull.** Refer to the caliper and brakeshoe installation procedures for service details and bolt dimensions.

FRONT CALIPER ASSEMBLY

(1) Coat caliper piston bore, new piston seal and piston with liberal quantity of clean, fresh brake fluid.

(2) Install new piston seal in caliper bore. Press seal into seal groove with finger (Fig. 20).

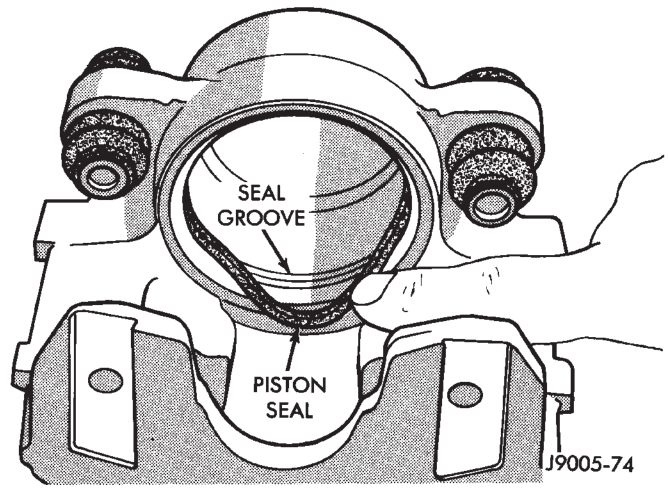

Fig. 20 Installing Caliper Piston Seal

(3) Install dust boot on caliper piston (Fig. 21).

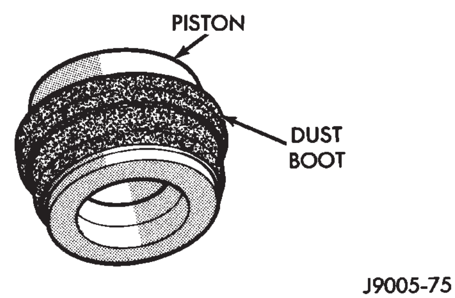

Fig. 21 Installing Dust Boot On Caliper Piston

(4) Start caliper piston in bore and into seal by hand (Fig. 22). Use a twisting, rocking motion to start piston into seal. Keep piston level during installation to avoid cocking seal.

(5) Once piston is started in seal, press piston **about 2/3 of way into bore.** A large C-clamp or bench vise can be used to press piston into bore. **Be sure to place a wood block between piston and vise jaws or C-clamp. Piston is made of phenolic resin and can be cracked if care is not exercised.**

(6) Seat dust boot in caliper with Special Tool C-4842 (Fig. 23).

(7) Install caliper bleed screw if removed.

(8) Lubricate caliper mounting bolt bushings and interior of bushing boots with GE 661 or Dow 111 silicone grease.

(9) Install rubber bushing boots in caliper (Fig. 24). Fold boots in half and work them into caliper. Be sure boots are centered in caliper.

(10) Install bushings in boots. Be sure boot is seated in groove at each end of bushing (Fig. 24).

(11) Install brakeshoes in caliper (Figs. 7, 8).

(12) Install caliper bleed screw if removed.

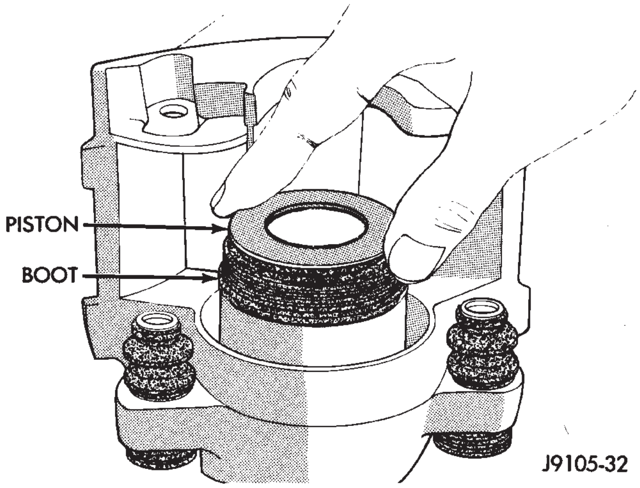

Fig. 22 Caliper Piston Installation

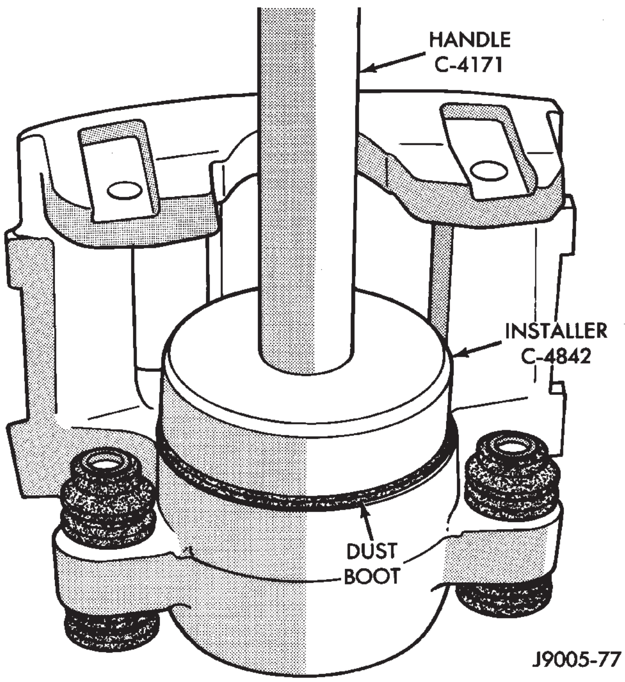

Fig. 23 Seating Dust Boot In Caliper

FRONT CALIPER INSTALLATION

(1) Connect brake hose fitting to caliper but do not tighten fitting bolt completely at this time. **Install new washers on fitting bolt to avoid leaks (Fig. 25).**

(2) Install caliper over rotor and into mounting bracket. Position notches at each end of brakeshoes on mounting bracket ledges.

(3) Coat caliper mounting bolts with GE 661 or Dow 111 silicone grease. Then install and tighten bolts to 10-20 N·m (7-15 ft. lbs.) torque.

CAUTION: If new caliper bolts are being installed, or if the original reason for repair was a drag/pull condition, check caliper bolt length before proceeding. If the bolts have a shank length greater than

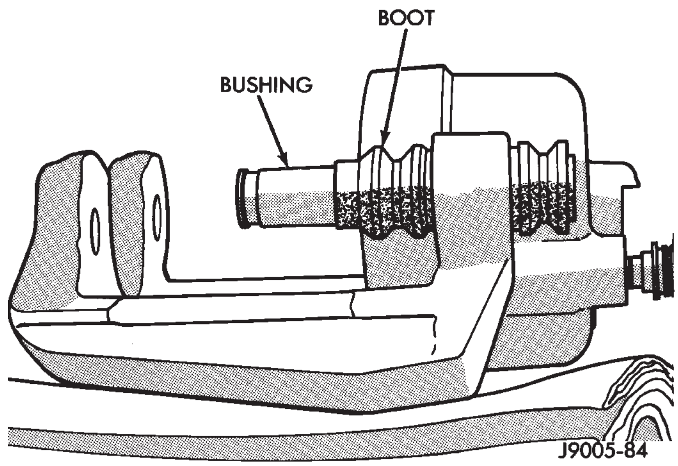

Fig. 24 Installing Bushings And Boots

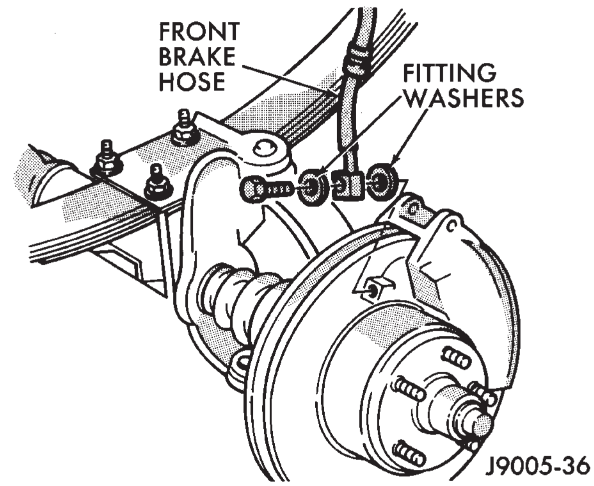

Fig. 25 Front Brake Hose And Fitting Components

67.6 mm (2.66 in.), they may contact the inboard brakeshoe causing a partial apply condition. Refer to Figure 14 for the required caliper bolt length.

(4) Position front brake hose clear of all chassis components and tighten caliper fitting bolt to 24-38 N·m (216-336 in. lbs.) torque.

CAUTION: Be sure the front brake hose is not twisted or kinked at any point. Also be sure the hose is clear of all steering and suspension components. Loosen and reposition the hose if necessary.

(5) Install wheel and tire assemblies. Tighten wheel nuts to 109-150 N·m (80-110 ft. lbs.) torque.

(6) Bleed brake system.

FRONT ROTOR REMOVAL

(1) Raise vehicle and remove wheel.

(2) Remove caliper.

(3) Remove push nuts securing rotor to hub studs (Fig. 26).

(4) Remove rotor from hub (Fig. 27).

(5) If rotor shield requires service, remove front hub and bearing assembly.

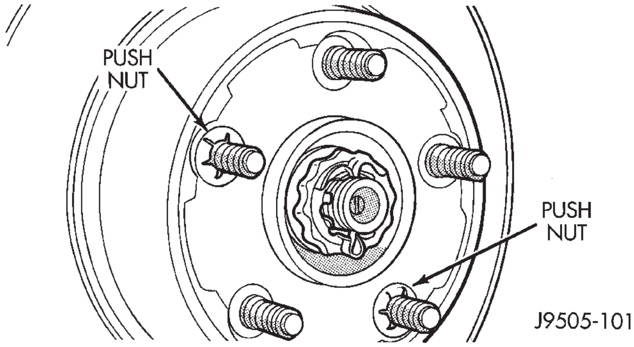

Fig. 26 Front Rotor Push Nut Location

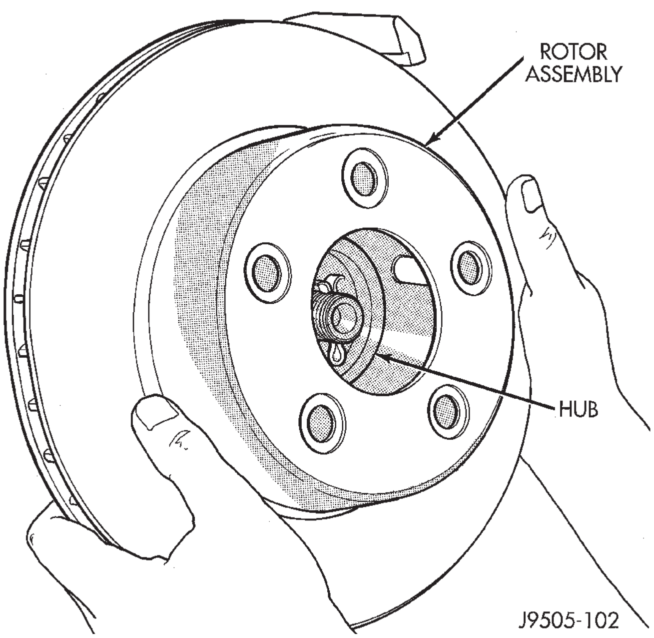

Fig. 27 Front Rotor Removal/Installation

FRONT ROTOR INSTALLATION

(1) Install rotor on hub (Fig. 27).

(2) Install caliper.

(3) Install wheel and lower vehicle.

WHEEL NUT TIGHTENING

The wheel attaching nuts must be tightened properly to ensure efficient brake operation. Overtightening the nuts or tightening them in the wrong sequence can cause distortion of the brake rotors and drums.

Impact wrenches are not really recommended for tightening wheel nuts. A torque wrench is preferred for this purpose. Correct tightening torque is 109-150 N·m (80-110 ft. lbs.).

The correct tightening sequence is important in avoiding rotor and drum distortion. The correct sequence is in a diagonal crossing or star pattern. Seat the wheel and install the wheel nuts finger tight. Tighten the nuts in sequence to half the required torque. Then repeat the tightening sequence to final specified torque.

REAR DISC BRAKES

INDEX

GENERAL INFORMATION

Rear disc brake components consist of single piston, floating-type, rear disc brake calipers and solid rotors.

The rear calipers are mounted in a bracket attached to the rear axle tube flange (Fig. 1). The calipers are secured to the bracket with mounting bolts. The bracket also secures the rear disc brake rotor splash shield to the tube flange.

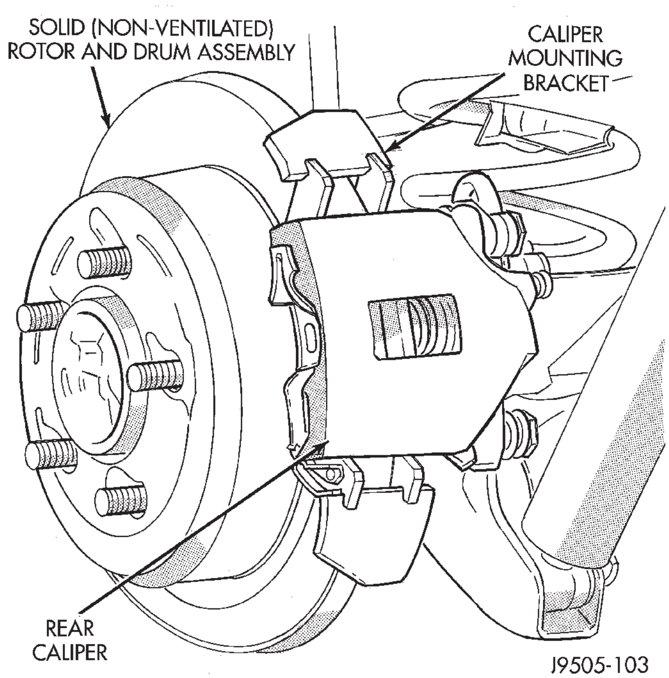

Fig. 1 Rear Disc Brake Caliper Mounting

The rotor and splash shield used for rear disc brake applications are unique. The parking brakeshoes are mounted on the splash shield. The disc brake rotor has a built in brake drum surface for the parking brakeshoes (Fig. 2). Parking brakeshoe service is covered in the parking brake service section.

Changes For 1995

The rear brakeshoes, caliper, and caliper bracket are different for 1995. The outboard shoe now has an anti-rattle spring attached at the shoe rear. A wear strip has been added to the inboard shoe and the caliper bracket shoe contact surfaces are machined for the new shoes. There are dimensional differences between the 1995 and prior built calipers, shoes, and brackets. It is important that these parts not be interchanged at any time.

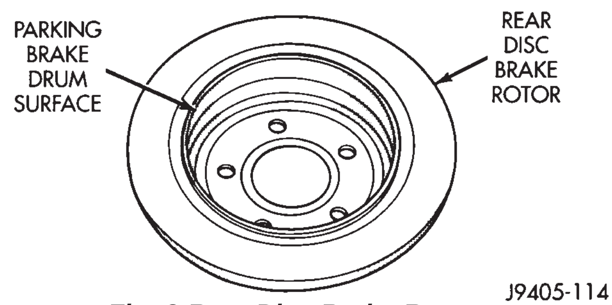

Fig. 2 Rear Disc Brake Rotor

REAR CALIPER OPERATION AND WEAR COMPENSATION

Rear disc caliper operation is the same as for front disc brakes. Refer to the information in the front disc brake section.

REAR BRAKESHOE REMOVAL

(1) Raise and support vehicle.

(2) Remove rear wheels and tires.

(3) Press caliper piston back into caliper bore with large C-clamp (Fig. 3).

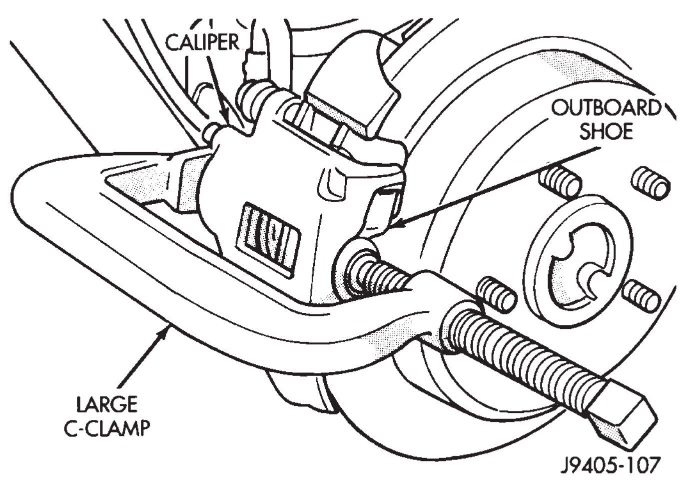

Fig. 3 Bottoming Rear Caliper Piston In Bore

(4) Remove caliper mounting bolts with ratchet handle and 13 mm socket (Fig. 4).

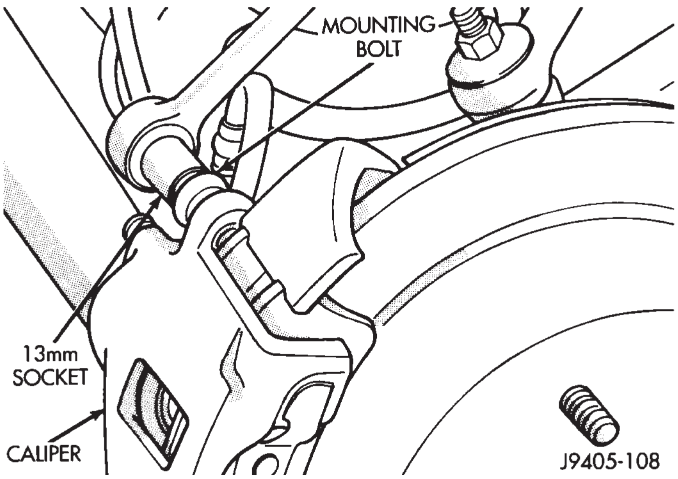

Fig. 4 Rear Caliper Mounting Bolt Removal/ Installation

(5) Rotate caliper rearward and off rotor (Fig. 5).

(6) Remove outboard brakeshoe from caliper (Fig. 5). Press one corner of shoe inward then pry shoe upward with suitable tool and rotate shoe out of caliper.

(7) Remove inboard brakeshoe (Fig. 5). Pry shoe outward until shoe retainers come out of caliper piston. Then remove shoe from caliper.

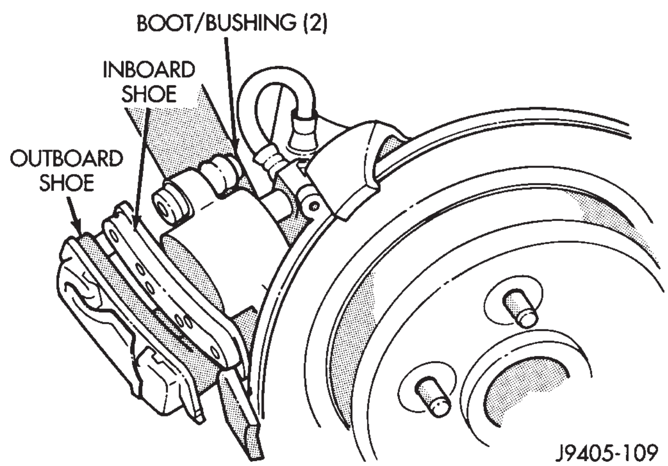

Fig. 5 Rear Caliper Removal (From Rotor)

(8) Support caliper with wire attached to nearby suspension component. **Do not allow brake hose to support caliper weight.**

(9) Wipe caliper off with shop rags or towels. **Do not use compressed air. Compressed air can unseat dust boot and force dirt into piston bore.**

(10) Inspect condition of caliper piston dust boot. Overhaul caliper if evidence of leakage past piston seal and dust boot is evident.

(11) Inspect caliper mounting bolt bushings and boots. Replace boots if torn or cut. Replace bushings, or bolts if either exhibits wear, or heavy corrosion.

REAR BRAKESHOE INSTALLATION

(1) Clean brakeshoe contact surfaces of caliper mounting bracket (Fig. 6). Use wire brush or emery cloth.

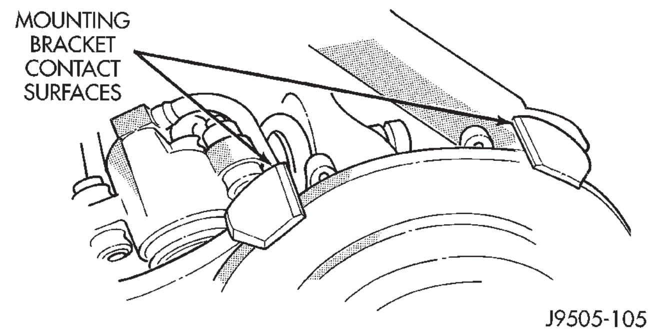

Fig. 6 Brakeshoe Contact Surfaces Of Mounting Bracket

(2) Install brakeshoes in caliper.

(3) Install caliper over rotor and into mounting bracket.

(4) Verify that brakeshoe lugs are properly seated on caliper mounting bracket (Fig. 7). Be sure springs on outboard shoes are also seated against bracket.

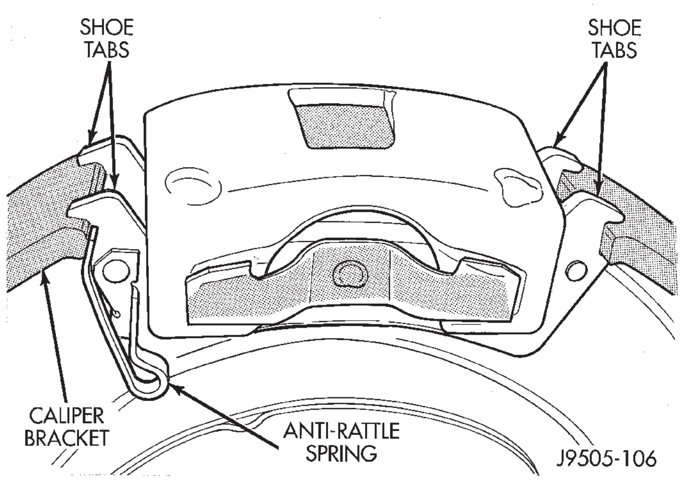

Fig. 7 Correct Brakeshoe Position On Bracket (Right Rear Caliper Shown)

(5) Check rear brake hose position (Fig. 8). Hose must not be twisted or kinked.

(6) Lubricate and install caliper mounting bolts. Start bolts by hand then tighten bolts to 10-20 N·m (7-15 ft. lbs.) torque.

(7) Install wheel and tire assemblies. Tighten lug nuts to 109-150 N·m (80-110 ft. lbs.) torque.

(8) Turn ignition On and run HCU pump until it shuts off. Then pump brake pedal until shoes are seated and indicator lights go out.

(9) Top off brake fluid level if necessary. Use Mopar brake fluid or equivalent meeting SAE J1703 and DOT 3 standards only.

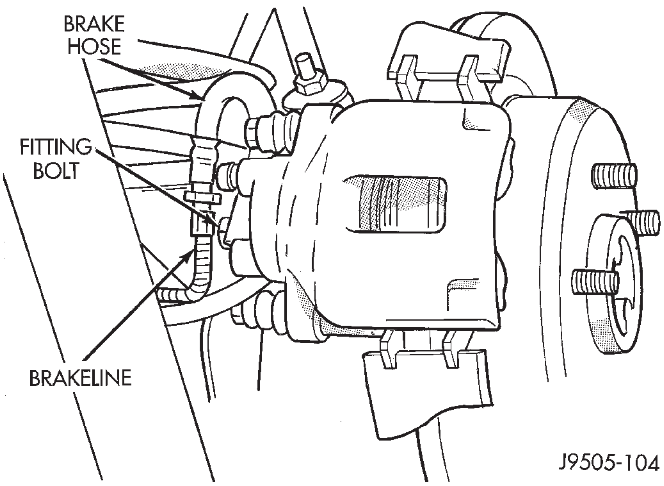

Fig. 8 Rear Brake Hose Position

REAR CALIPER REMOVAL

(1) Raise vehicle and remove wheels.

(2) Remove caliper mounting bolts (Fig. 4).

(3) Rotate caliper rearward by hand or with pry tool. Then rotate caliper and brakeshoes off ledges of mounting bracket.

(4) Remove caliper fitting bolt and disconnect rear brake hose at caliper. Discard metal washers on fitting bolt. Washers should be replaced and not reused.

(5) Remove caliper from vehicle.

REAR CALIPER DISASSEMBLY AND OVERHAUL

(1) Remove outboard brakeshoe from caliper (Fig. 9). Push one end of shoe inboard and pry shoe up with tool to free shoe spring from caliper.

(2) Remove inboard brakeshoe from caliper (Fig. 10). Tilt shoe out until shoe spring is free of caliper piston.

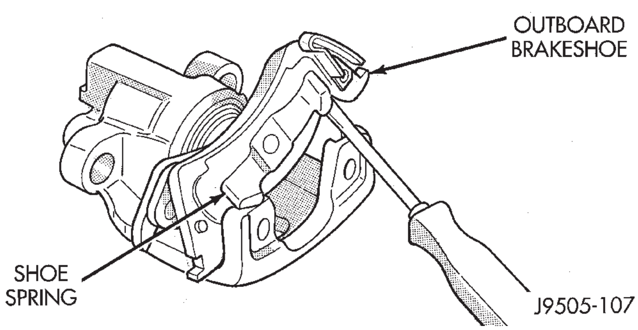

Fig. 9 Outboard Brakeshoe Removal

(3) Remove mounting bolt boots and bushings from caliper (Fig. 11).

(4) Pad interior of caliper with minimum, one-inch thickness of shop towels or rags (Fig. 12). Towels are needed to protect caliper piston during removal.

(5) Remove caliper piston with **short bursts** of low pressure compressed air. Direct air through fluid inlet port and ease piston out of bore (Fig. 13).

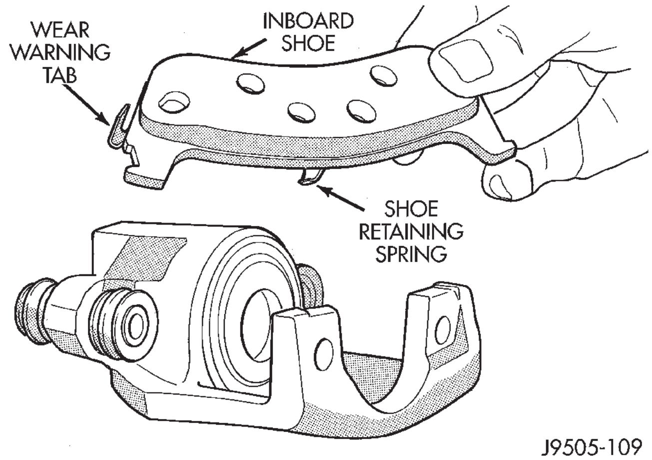

Fig. 10 Inboard Brakeshoe Removal

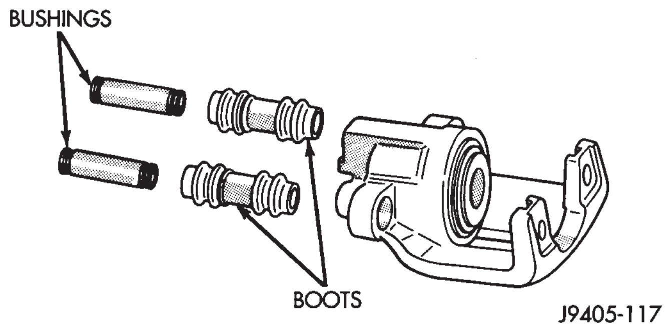

Fig. 11 Mounting Bolt Bushing And Boot Removal

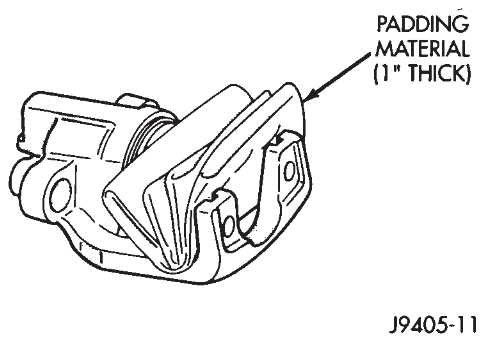

Fig. 12 Padding Caliper Interior (For Piston Removal)

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out. In addition, NEVER attempt to catch the piston as it leaves the bore. This could result in personal injury.

(6) Remove caliper piston dust boot (Fig. 14). Use suitable pry tool to remove boot.

(7) Remove and discard caliper piston seal with pencil, or plastic tool (Fig. 15). Do not use metal tools as they will scratch piston bore.

CALIPER CLEANING AND INSPECTION

Clean the caliper and piston with clean brake fluid or Mopar brake cleaning solvent only. Do not use gas-

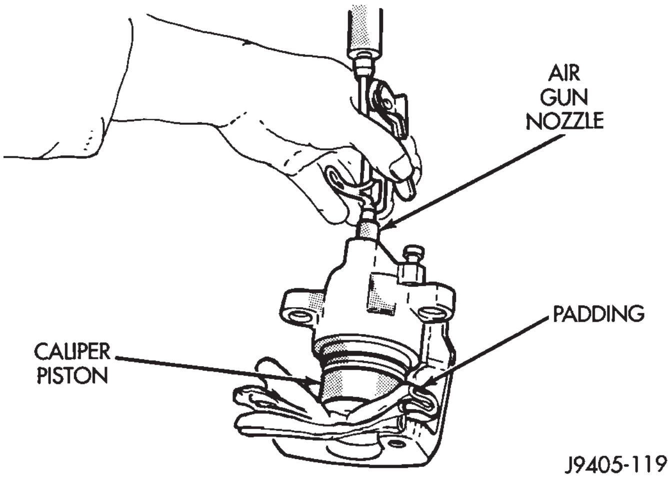

Fig. 13 Caliper Piston Removal

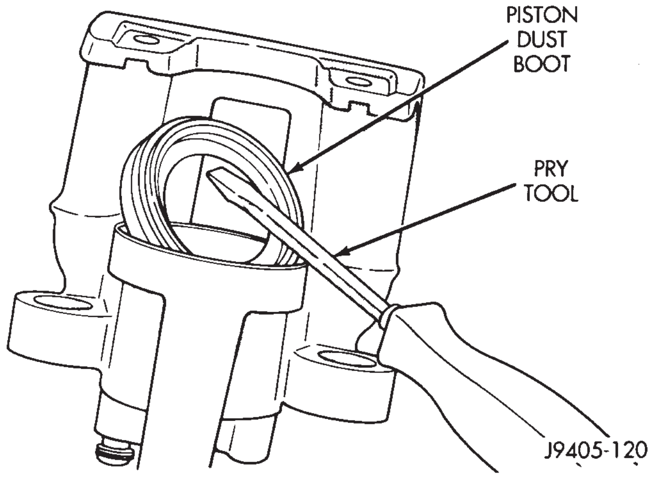

Fig. 14 Removing Caliper Piston Dust Boot

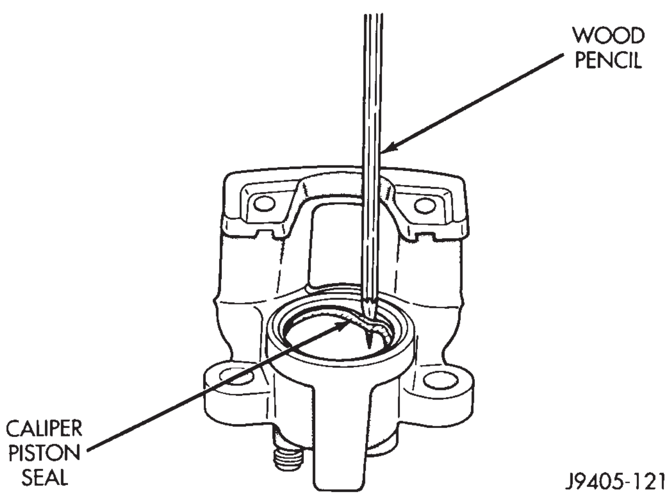

Fig. 15 Removing Caliper Piston Seal

oline, kerosene, thinner, or similar fluids. These products may leave a residue that could damage the piston and seal.

Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

Inspect the piston and piston bore. Replace the caliper if the bore is corroded, rusted, or scored. Do not hone the caliper piston bore. Replace the caliper if the bore is damaged.

Inspect the caliper piston (Fig. 16). The piston is made from a phenolic resin and should be smooth and clean. Although surface discoloration is normal, replace the piston if cracked, chipped, or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: Never interchange phenolic resin and steel caliper pistons. The seals, seal grooves, caliper bores and piston tolerances are different for resin and steel pistons. Do not intermix these components.

Inspect the caliper bushings and boots (Fig. 16). Replace the boots if cut or torn. Clean and lubricate the bushings with GE 661 or Dow 111 silicone grease if necessary. Replace the bolts if worn, or the threads are damaged.

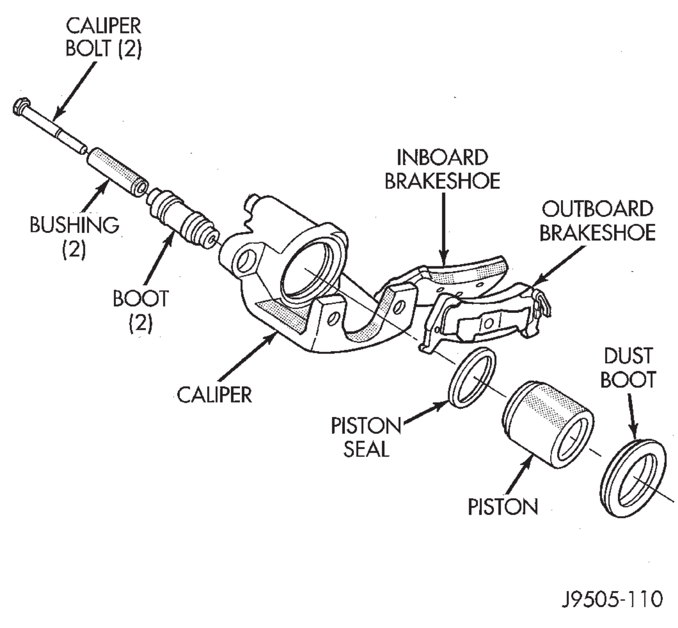

Fig. 16 Rear Caliper Components

REAR CALIPER ASSEMBLY

(1) Lubricate caliper piston bore and new piston seal with clean brake fluid.

(2) Install new piston seal in groove machined in piston bore. Be sure seal is fully seated and is not twisted. Press seal into place with fingertips.

(3) Lubricate caliper piston with clean brake fluid and start piston into bore and seal by hand. Use a twisting, rocking motion to start piston into seal. **Keep piston level while starting it in seal otherwise seal can be folded over.**

(4) Once piston is firmly started in seal, press piston about 2/3 of way into bore with C-clamp or bench vise (Fig. 17).

CAUTION: Position a protective wood block between the piston and C-clamp or vise jaws (Fig. 18). The wood block will avoid chipping or cracking the piston while pressing it into place.

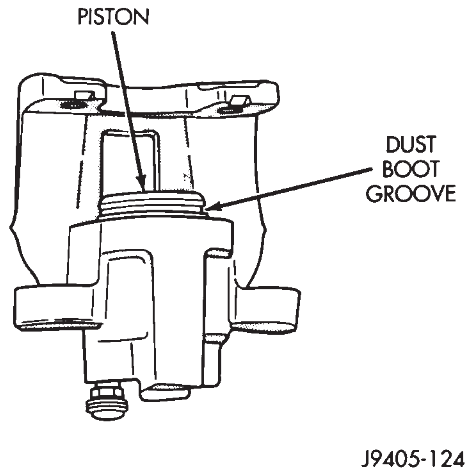

Fig. 17 Piston Installed Part Way In Caliper Bore

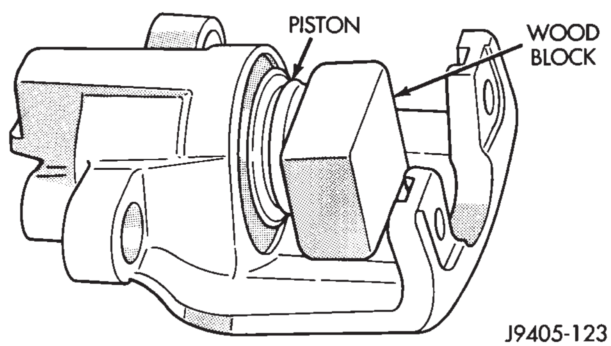

Fig. 18 Using Wood Block To Protect Piston

(5) Install dust boot on piston. Be sure boot lip is fully seated in groove at top of caliper piston.

(6) Seat dust boot in caliper either by hand, or with a suitable size installer tool (Fig. 19).

(7) Press caliper to bottom of bore after seating dust boot. Be sure to use wood block to protect piston and boot.

(8) Install caliper bleed screw, if removed.

(9) Install bushing and boot assemblies in caliper. Be sure boots are centered in caliper as shown (Fig. 20).

(10) Apply GE or Dow silicone grease to interior of bushing boots. Then apply same lubricant to exterior and interior of bushings.

(11) Install mounting bolt bushings in boots (Fig. 21). Be sure boot lips are seated in grooves at ends of bushings.

(12) Center bushing boots in caliper.

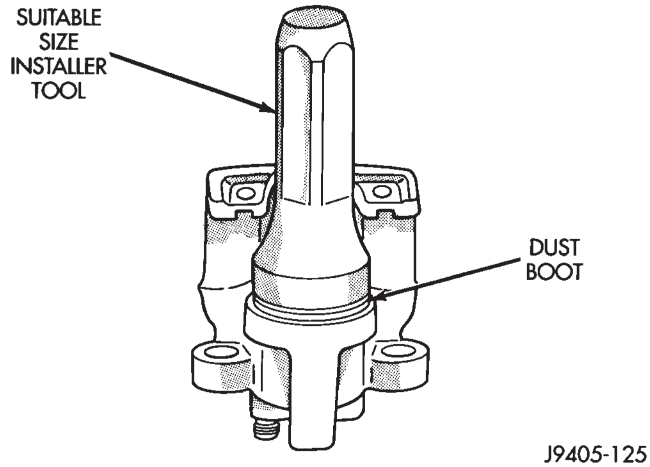

Fig. 19 Seating Caliper Piston Dust Boot

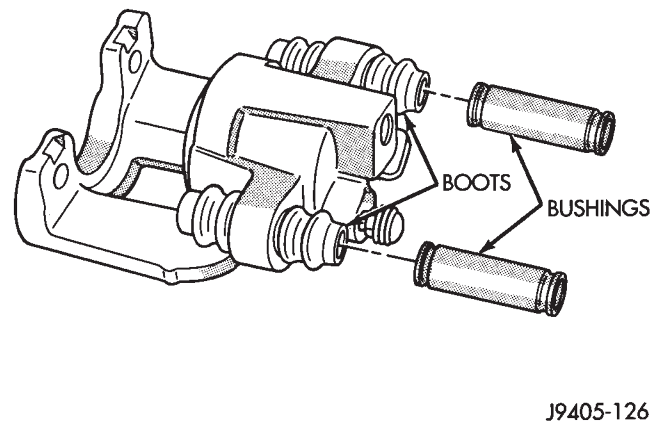

Fig. 20 Mounting Bolt Bushing Boots Centered In Caliper

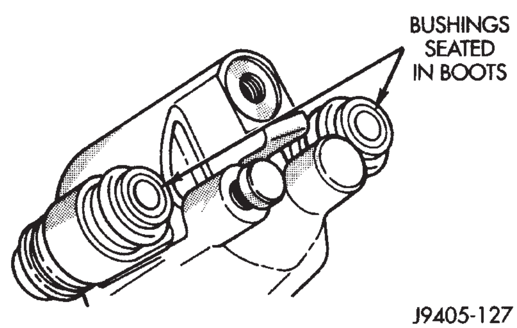

Fig. 21 Mounting Bolt Bushings Installed In Boots

(13) Install inboard brakeshoe in caliper (Fig. 22). Be sure shoe spring is fully seated in caliper piston.

(14) Install outboard brakeshoe in caliper (Fig. 23). Seat one end of shoe spring in caliper and rotate and snap shoe into place. Be sure both ends of shoe spring are firmly seated in caliper.

(15) If caliper will not be installed immediately, cover caliper assembly with clean shop towels.

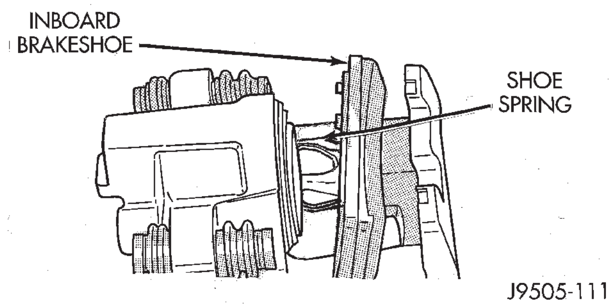

Fig. 22 Inboard Brakeshoe Installation

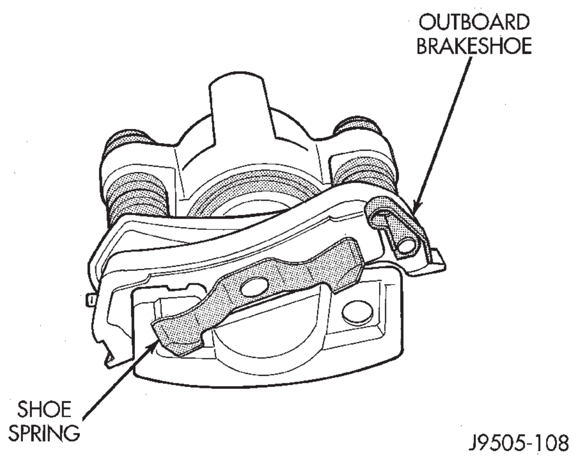

Fig. 23 Outboard Brakeshoe Installation

REAR CALIPER INSTALLATION

(1) Verify that brakeshoes, boots and bushings are correctly positioned in caliper (Fig. 24).

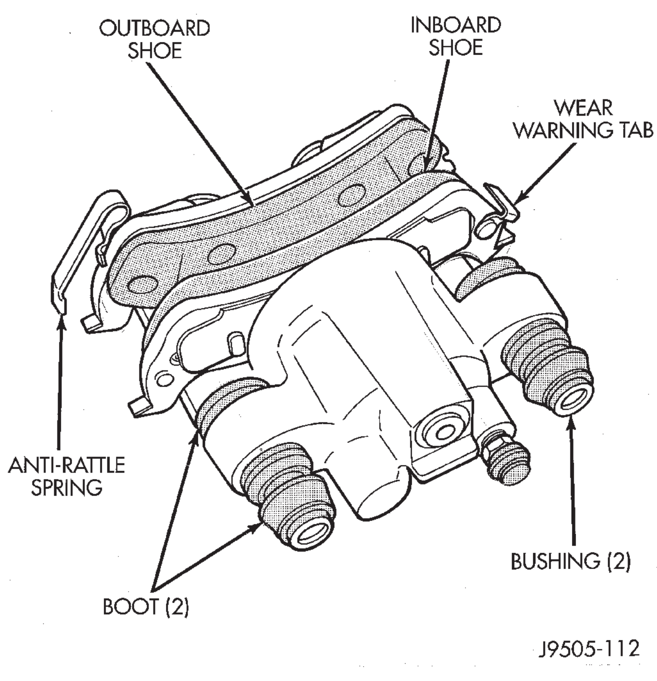

Fig. 24 Shoe/Bushing/Boot Position In Caliper

(2) Position caliper over rotor and into bracket. Be sure brakeshoe tabs are properly seated on mounting bracket ledges.

(3) Connect rear brake hose to caliper. Use new washers on hose fitting. Tighten hose fitting bolt to 24-38 N·m (216-336 in. lbs.) torque.

(4) Check brake hose position before proceeding. Verify that hose is not twisted, kinked, or touching any suspension components.

(5) Lubricate and install caliper mounting bolts. Start bolts by hand then tighten bolts to 10-20 N·m (7-15 ft. lbs.) torque.

CAUTION: If new caliper bolts are being installed, or if the original reason for repair was a drag/pull condition, check caliper bolt length before proceeding. If the bolts have a shank length greater than 67.6 mm (2.66 in.), they will contact the inboard brakeshoe causing a partial apply condition. Refer to Figure 25 for required caliper bolt length.

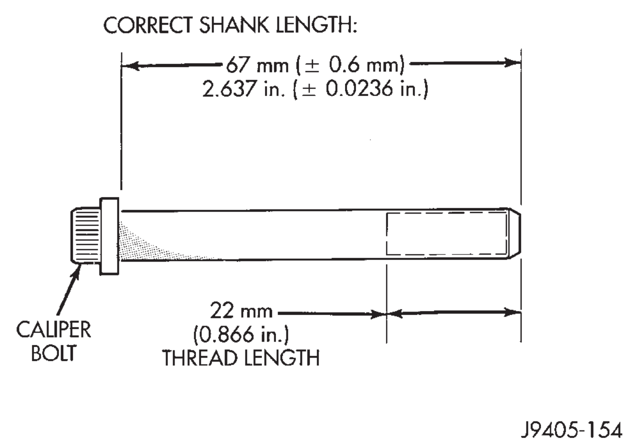

Fig. 25 Caliper Mounting Bolt Dimensions

(6) Fill and bleed brake system. Refer to bleeding procedure in brake adjustments section.

(7) Install wheel and tire assemblies. Tighten lug nuts to 109-150 N·m (80-110 ft. lbs.) torque.

(8) Lower vehicle.

REAR ROTOR REMOVAL

(1) Raise vehicle.

(2) Remove wheel and tire assembly.

(3) Bottom caliper piston in bore with C-clamp, or screwdriver. Then remove caliper mounting bolts and slide caliper off rotor. Secure caliper to spring or suspension arm with wire.

(4) Remove access plug from splash shield and back off parking brakeshoes by rotating adjuster screw star wheel with brake tool (Fig. 26). At driver side rear wheel, rotate adjuster screw star wheel clockwise to back off shoes. At passenger side wheel,

rotate star wheel in counterclockwise direction. Direction of rotation is while looking from rear to front of vehicle.

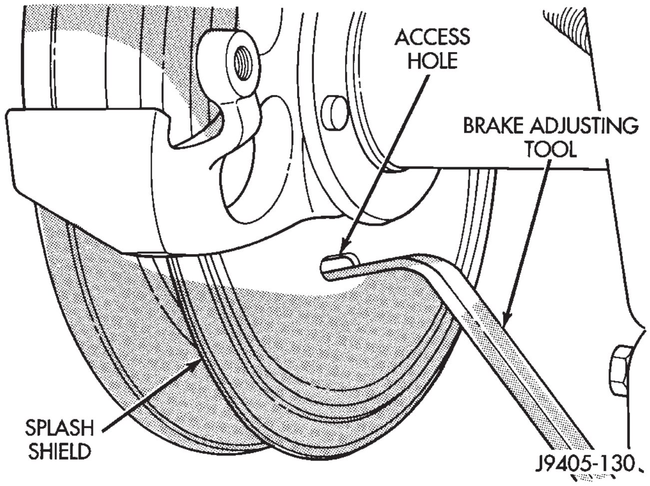

Fig. 26 Backing Off Parking Brake Shoes

(5) If rotor and/or axle hub contact surfaces are heavily rusted, apply Mopar rust penetrant to rotor and axle hub and through spaces around wheel studs.

(6) Remove push nuts securing rotor to axle shaft studs.

(7) Work rotor off axle hub and studs. Use plastic or rawhide mallet to loosen rotor if necessary.

(8) Clean and inspect rotor braking surfaces. Refinish, or replace rotor if necessary.

(9) Inspect condition of parking brakeshoes (Fig. 27). Replace shoes if worn to thickness of 1.6 mm (0.063 in.). Refer to procedures in Parking Brake service section.

REAR ROTOR INSTALLATION

(1) Clean axle hub and hub bore in rotor with wire brush, or emery cloth.

(2) Install rotor on axle hub.

(3) Install disc brake caliper. Refer to procedure in this section.

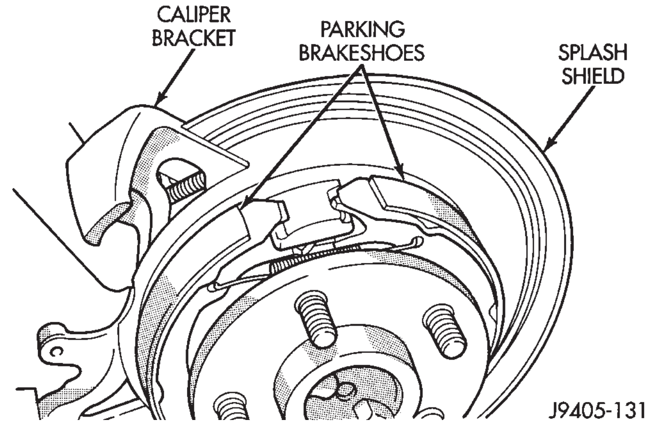

Fig. 27 Parking Brakeshoe Inspection

(4) Install wheel and tire assembly and lower vehicle.

(5) Adjust parking brakeshoes. Use brake tool to rotate adjuster screw star wheel. Tighten shoes until light drag is created. Then back off shoes about 1/2 to one turn of star wheel.

(6) Install plug in splash shield access hole.

(7) Pump brake pedal to seat caliper piston and brakeshoes. Do not move vehicle until firm brake pedal is obtained.

WHEEL NUT TIGHTENING

The wheel attaching nuts must be tightened properly to ensure efficient brake operation. Overtightening the nuts or tightening them in the wrong sequence can cause distortion of the brake rotors and drums.

Impact wrenches are not really recommended for tightening wheel nuts. A torque wrench is preferred for this purpose. Correct tightening torque is 109-150 N·m (80-110 ft. lbs.).

The correct tightening sequence is important in avoiding rotor and drum distortion. The correct sequence is in a diagonal crossing or star pattern. Seat the wheel and install the wheel nuts finger tight. Tighten the nuts in sequence to half the required torque. Then repeat the tightening sequence to final specified torque.

DISC BRAKE ROTOR SERVICE

INDEX

ROTOR REFINISHING

Rotor braking surfaces can be refinished by sanding and/or machining in a disc brake lathe. Machining can be performed on, or off the vehicle. Use a standard lathe, or one of the newer style, portable lathes. The new portable lathes machine the rotor while in place on the vehicle.

The disc brake lathe must be capable of machining both rotor surfaces simultaneously with dual cutter heads (Fig. 1). **Equipment capable of machining only one side at a time will produce a tapered rotor.** The lathe should also be equipped with a grinder attachment or dual sanding discs for final cleanup or light refinishing.

If the rotor surfaces only need minor cleanup of rust, scale, or minor scoring, use abrasive discs to clean up the rotor surfaces. However, when a rotor is scored or worn, machining with cutting tools will be required.

CAUTION: Do not refinish a rotor if machining would cause the rotor to fall below minimum allowable thickness.

The final finish on the rotor should be a non-directional, cross hatch pattern (Fig. 2). Use sanding discs to produce this finish.

The final finish on the rotor should be a non-directional, cross hatch pattern. Use sanding discs to produce this finish.

CHECKING FRONT ROTOR THICKNESS

Rotor minimum usable thickness is 22.7 mm (0.89 in.). Do not resurface a rotor if machining would cause thickness to fall below this limit.

Measure rotor thickness at the center of the brakeshoe contact surface. Replace the rotor if worn below minimum thickness, or if refinishing would reduce thickness below the allowable minimum.

CHECKING FRONT ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at four to six points around the rotor face. Position the micrometer ap-

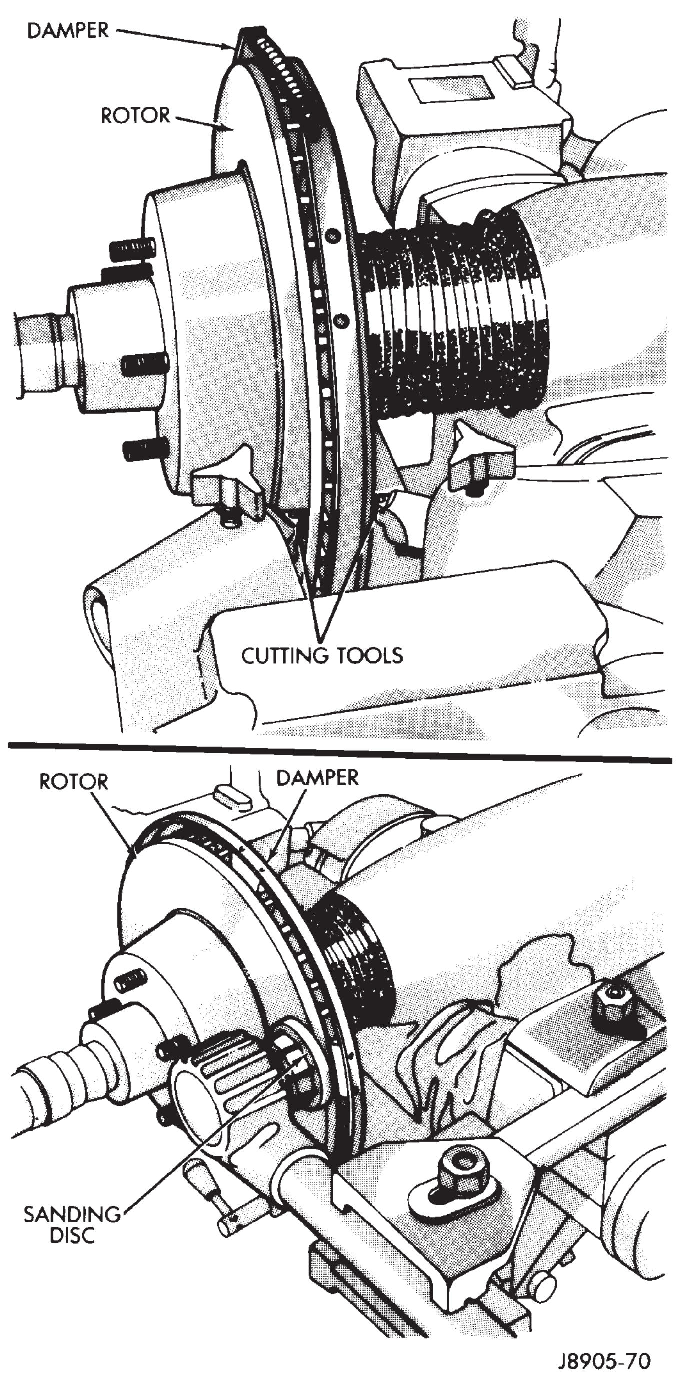

Fig. 1 Typical Rotor Refinishing Equipment

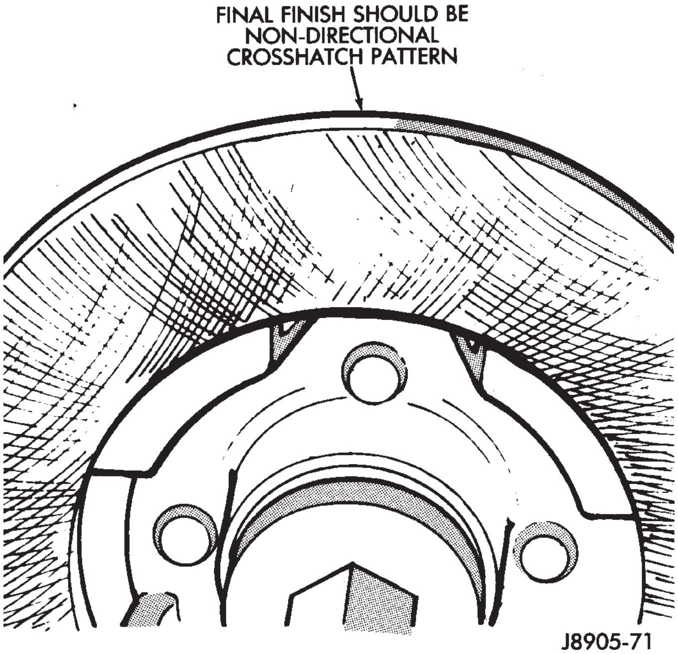

Fig. 2 Preferred Rotor Surface Finish

proximately 3/4 inch from the rotor outer circumference for each measurement (Fig. 3).

Thickness should not **vary** by more than 0.013 mm (0.0005 in.) from point to point on the rotor. Refinish or replace the rotor if necessary.

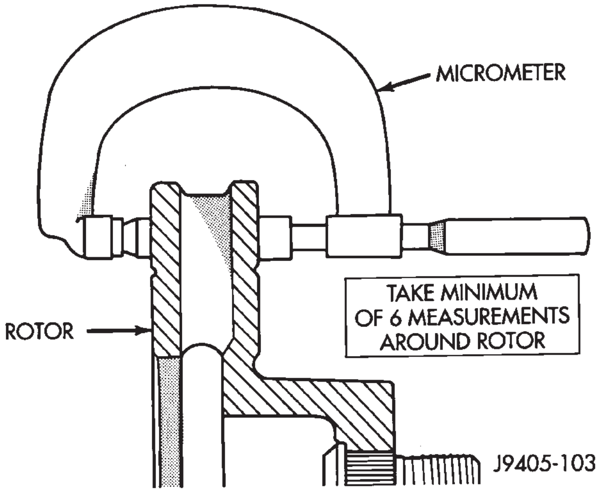

Fig. 3 Measuring Rotor Thickness Variation

CHECKING ROTOR LATERAL RUNOUT

Check rotor lateral runout whenever pedal pulsation, or rapid, uneven brakelining wear has occurred.

The rotor must be securely clamped to the hub to ensure an accurate runout measurement. Secure the rotor with the wheel nuts and 4 or 5 large diameter flat washers on each stud as shown (Fig. 4).

Use a dial indicator to check lateral runout (Fig. 5).

Maximum allowable rotor lateral runout is 0.13 mm (0.005 in.).

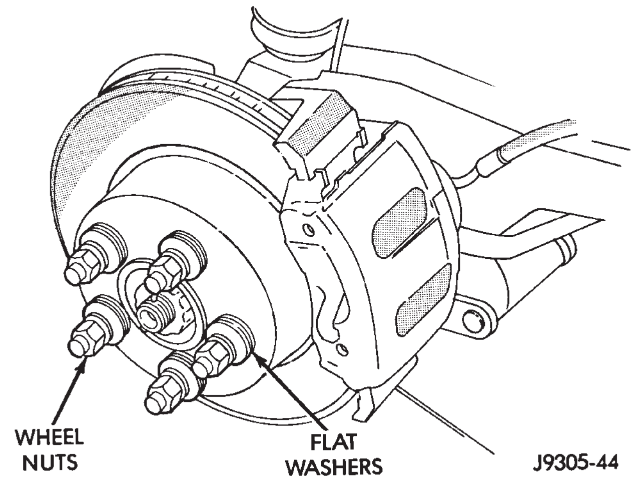

Fig. 4 Securing Rotor For Runout Check

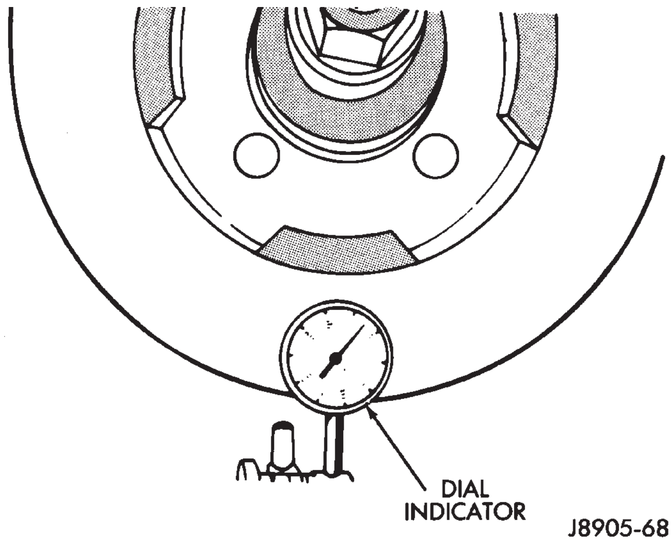

Fig. 5 Checking Rotor Lateral Runout

REAR DISC BRAKE ROTOR USABLE THICKNESS

Minimum usable thickness of the rear disc brake rotor is 9.5 mm (0.374 in.). The thickness specification is located on the edge of the parking brake drum section of the rotor (Fig. 6).

Never resurface a rotor if machining would cause thickness to fall below this limit.

Measure rotor thickness at the center of the brake-shoe contact surface. Replace the rotor if worn below minimum thickness, or if refinishing would reduce thickness below the allowable minimum.

CHECKING REAR ROTOR THICKNESS

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at four to six points around the rotor face. Position the micrometer approximately 3/4 inch from the rotor outer circumference for each measurement.

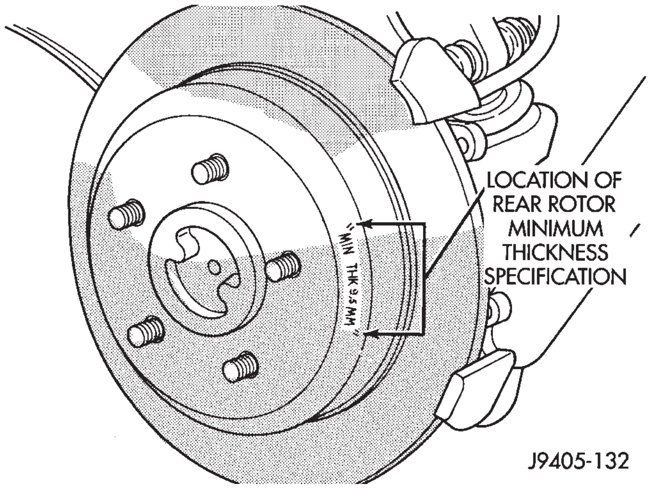

Fig. 6 Location Of Thickness Specification On Rear Rotor

Thickness should not **vary** by more than 0.0254 mm (0.001 in.) from point to point on the rotor. Refinish or replace the rotor if necessary.

CHECKING REAR ROTOR LATERAL RUNOUT

Check rotor lateral runout whenever diagnosis indicates pedal pulsation and rapid, uneven brakelining wear.

On 4-wheel drive models, the rotor must be securely clamped to the hub to ensure an accurate runout measurement. Secure the rotor with the wheel nuts and 4 or 5 large diameter flat washers on each stud as shown (Fig. 5).

Use a dial indicator to check lateral runout (Fig. 5). Maximum allowable lateral runout is 0.13 mm (0.005 in.).

PARKING BRAKES

INDEX

GENERAL SERVICE INFORMATION

The parking brakes on Grand Cherokee models are operated by a cable and hand lever system. Three cables are used, consisting of one front cable and two rear cables. The hand lever is mounted on the floorpan adjacent to the driver (Fig. 1).

All three cables are interconnected at the cable tensioner and equalizer mechanism. The front cable is connected to the hand lever and the rear cables are connected to the brakeshoes. Cable adjustment is performed at the tensioner which is attached to the front cable.

Parking Brake Systems

A separate set of brakeshoes are used for parking brake operation. The shoes are mounted on the disc brake splash shield and are enclosed within the combination disc brake rotor and parking brake drum (Fig. 2). On these models, the rear cables are connected to a cam and lever mechanism. It is the cam and lever that operates the shoes on these models.

Rear Cable Attachment

The cable is connected to the lever by a rectangular eyelet on the cable end (Fig. 3). A retainer on the cable secures it in a bracket attached to the rear of the caliper bracket.

Parking Brake Cable Tensioner Adjustment

Parking brake cable adjustment is controlled by a tensioner mechanism. This applies to ZJ models from 1992 to current. The cable tensioner, once adjusted at the factory, will not need further adjustment under normal circumstances. There are only two instances when adjustment is required. The first is when a new tensioner, or cables have been installed. And the second, is when the tensioner and cables are disconnected for access to other brake components.

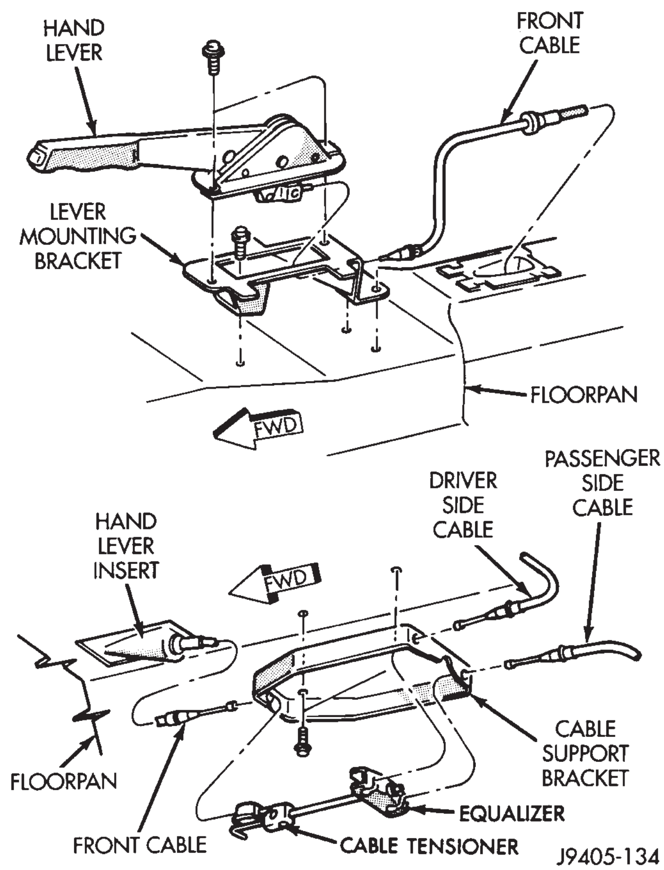

Fig. 1 Parking Brake Hand Lever Mounting (All)

PARKING BRAKE HAND LEVER REMOVAL (WITH FULL CONSOLE)

(1) Release parking brakes.

(2) Disconnect battery negative cable.

(3) Remove screws at bottom of console storage bin (Fig. 4).

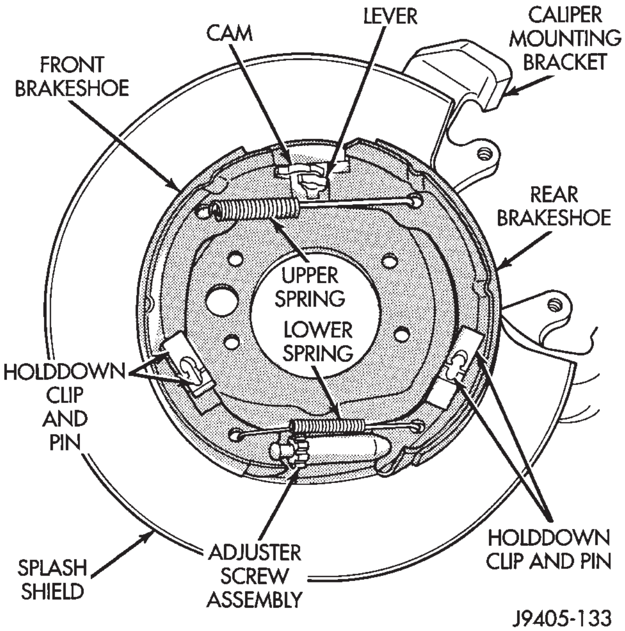

Fig. 2 Parking Brake Components

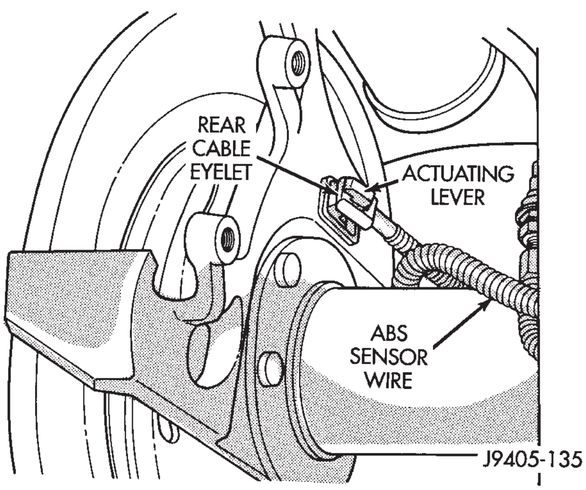

Fig. 3 Rear Cable Attachment At Lever

(4) On models with automatic transmission, remove handle from transmission shift lever. Grasp handle and pull up sharply to remove handle from lever.

(5) Unsnap and remove shift lever bezel (Fig. 5). Bezel has two retainer tabs on each side.

(6) Remove bulb from shift lever bezel.

(7) Remove screws attaching front of console. Screws are under shift lever bezel and are accessible once bezel has been removed.

(8) Remove bezel under parking brake lever.

(9) Move transmission and transfer case shift levers rearward.

(10) Raise front of console and remove bulb at rear of transfer case shift lever bezel.

(11) Remove console by lifting it upward and off shift levers.

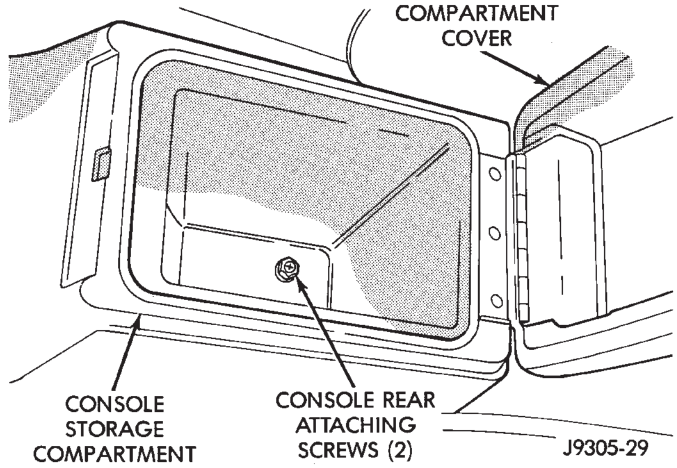

Fig. 4 Full Console Rear Attaching Screw Location

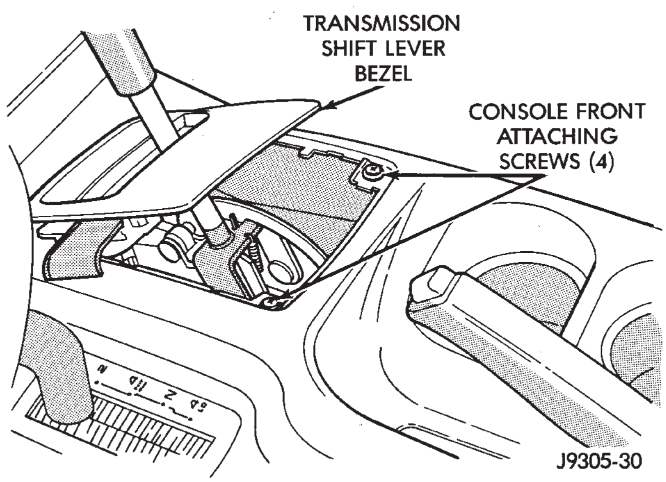

Fig. 5 Full Console Front Attaching Screw Location

(12) Disconnect and remove air bag control module (Fig. 6).

(13) Disconnect parking brake switch wires.

(14) Remove parking brake lever attaching screws.

(15) Disengage front cable from parking brake lever and remove lever assembly.

PARKING BRAKE HAND LEVER INSTALLATION (WITH FULL CONSOLE)

(1) Attach front cable to parking brake lever.

(2) Install parking brake lever on floorpan.

(3) Connect parking brake switch wires to lever.

(4) Install air bag control module and connect all wires to module.

(5) Install console over shift levers and on mounting brackets and floorpan.

(6) Install bulbs in shift lever bezels.

(7) Install console attaching screws.

(8) Install transmission shift lever bezel and install bezel under parking brake lever.

(9) Align and install shift handle on transmission shift lever.

(10) Adjust parking brake cable if a new tensioner has been installed.

(11) Lower vehicle.

(12) Connect battery negative cable.

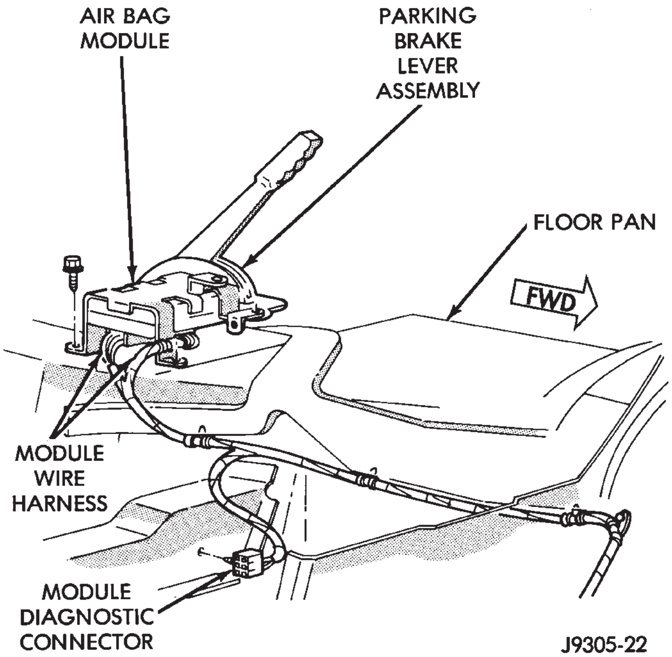

Fig. 6 Air Bag Control Module Mounting

PARKING BRAKE HAND LEVER REMOVAL (WITH MINI CONSOLE)

(1) Release parking brakes if applied.

(2) Disconnect battery negative cable.

(3) Raise vehicle on hoist.

(4) Remove front cable adjusting nut and disengage cable tensioner from equalizer. Then remove front cable from tensioner (Fig. 7).

(5) disengage front cable from insert and insert from floorpan (Fig. 7).

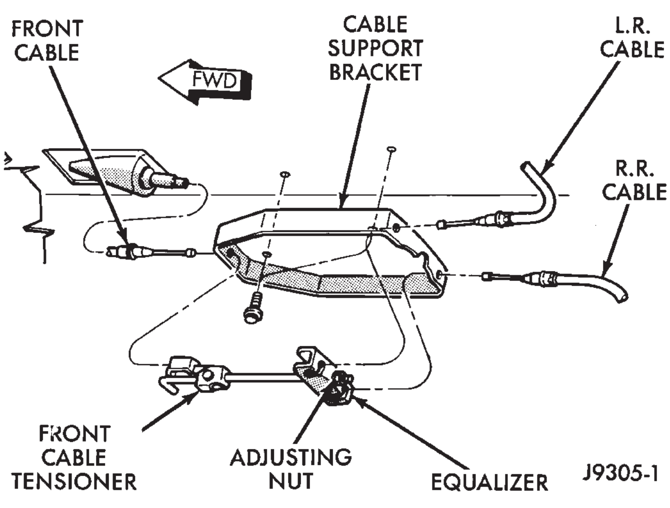

Fig. 7 Parking Brake Front Cable Attachment

(6) Lower vehicle.

(7) Unsnap and remove cup holder from parking brake lever cover (Fig. 8).

(8) Remove screws attaching lever cover to floor pan and remove cover (Fig. 8).

(9) Disconnect wires at parking brake switch and at air bag module (Figs. 5 and 8). Note that air bag module has two sets of wires connected to it.

(10) Remove screws attaching air bag control module to floorpan and parking brake lever (Figs. 8 and 9). Then move module aside for access to lever.

(11) Remove screws attaching parking brake lever to bracket (Fig. 10) and lift lever upward for access to front cable.

(12) Disengage front cable from parking brake lever and remove lever assembly from vehicle.

PARKING BRAKE HAND LEVER INSTALLATION (WITH MINI CONSOLE)

(1) Connect front cable to lever assembly.

(2) Seat front cable in floor pan.

(3) Install lever assembly on mounting bracket (Fig. 8).

(4) Connect parking brake switch wire.

(5) Install air bag control module (Fig. 6). Be sure all module wires harnesses are securely connected.

(6) Install parking lever cover.

(7) Install cup holder in cover.

(8) Raise vehicle.

(9) Assemble front cable, cable tensioner and cable bracket.

(10) Adjust parking brake front cable. Refer to procedure in this section.

(11) Lower vehicle.

(12) Connect battery negative cable.

PARKING BRAKE FRONT CABLE REMOVAL

(1) Release parking brakes, if applied.

(2) Disconnect battery negative cable and raise vehicle on hoist.

(3) Remove front cable adjusting nut and disengage cable tensioner from equalizer. Then remove front cable from tensioner (Fig. 7).

(4) disengage front cable from insert and insert from floorpan (Fig. 7).

(5) Lower vehicle.

(6) On models with full console, remove console. Refer to parking brake lever removal procedure for full console.

(7) On models with mini console, unsnap and remove cup holder from parking brake lever cover (Fig. 8). Then remove screws attaching lever cover to floor pan and remove cover.

(8) Disconnect wires at parking brake switch and at air bag module (Figs. 6 and 10). Note that air bag module has two sets of wires connected to it.

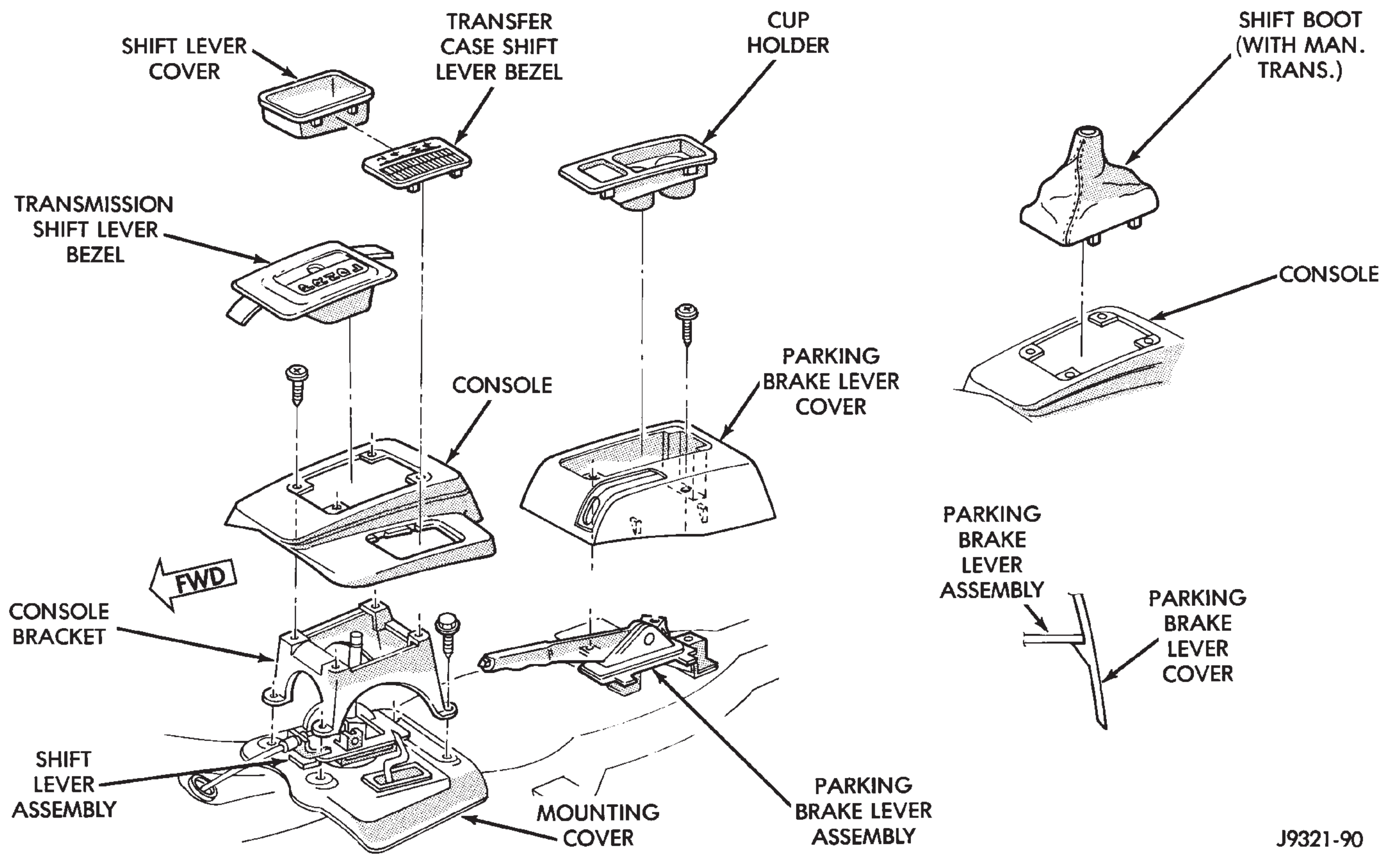

Fig. 8 Mini Console Components

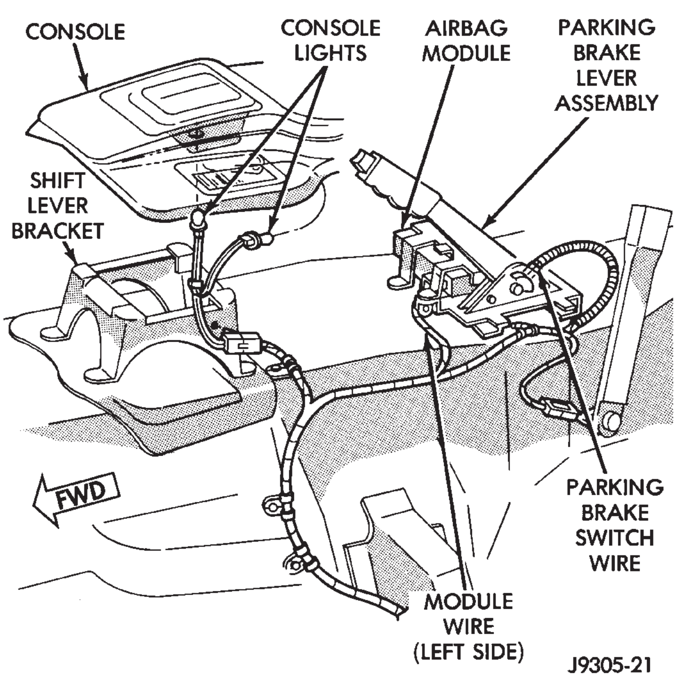

Fig. 9 Parking Brake Lever Mounting

(9) Remove screws attaching air bag control module to floorpan and parking brake lever. Then move module aside for access to lever.

(10) Remove screws attaching parking brake lever to bracket and lift lever upward for access to front cable.

(11) Disconnect front cable from parking brake lever and remove cable.

PARKING BRAKE FRONT CABLE INSTALLATION

(1) Connect front cable to lever assembly.
(2) Seat front cable in floor pan.
(3) Install lever assembly on mounting bracket.
(4) Connect parking brake switch wire.
(5) Install air bag control module. Be sure all module wires harnesses are securely connected.
(6) Install parking lever cover.
(7) Install cup holder in cover.
(8) Raise vehicle.
(9) Assemble front cable, cable tensioner and equalizer.
(10) Adjust parking brake system if new cable, or tensioner has been installed, or if tensioner mechanism has been loosened, or removed for access to other components. Refer to Parking Brake Adjustment procedure in this section.
(11) Lower vehicle.
(12) Disconnect battery negative cable.

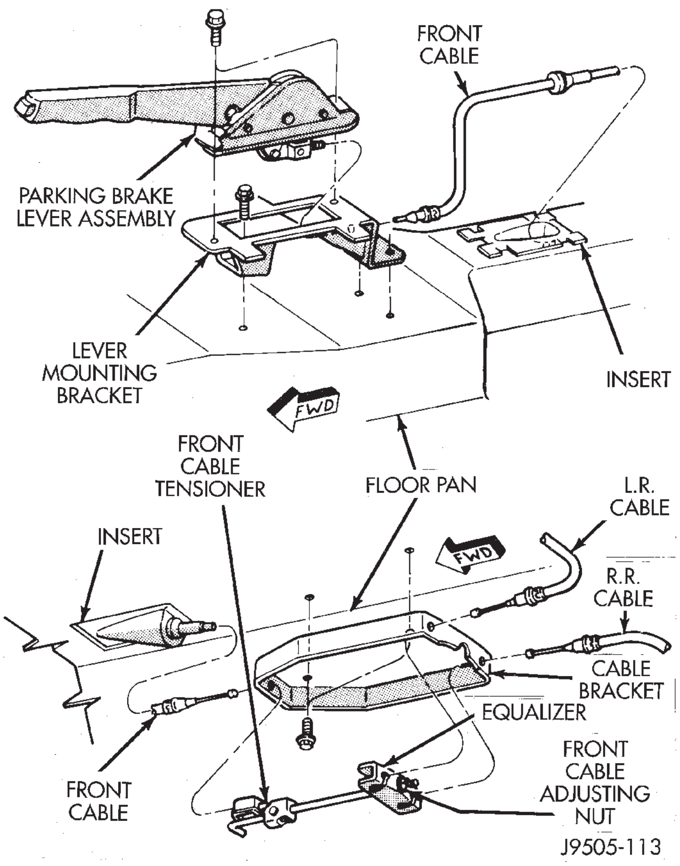

Fig. 10 Parking Brake Lever And Cable Attachment

PARKING BRAKE REAR CABLE REMOVAL

(1) Raise vehicle and loosen adjusting nut at equalizer to provide slack in rear cables.

(2) Disengage cable at equalizer. Then disengage cable from body and chassis clips and retainers.

(3) Slide cable eyelet off actuating lever (Fig. 11).

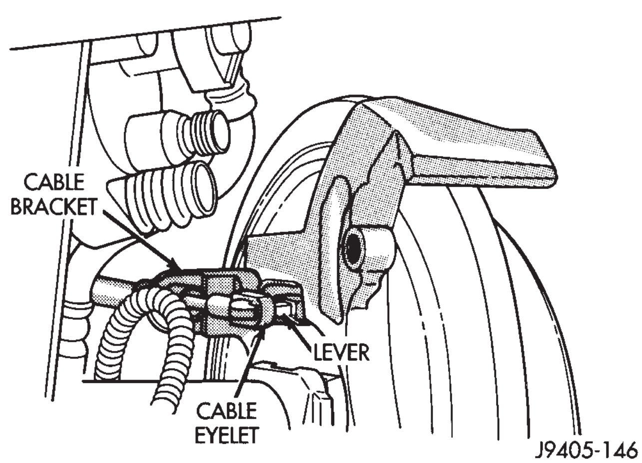

Fig. 11 Parking Brake Cable Attachment (With Disc Brakes)

(4) Compress retainer securing cable in bracket attached to caliper bracket. Then remove cable from bracket.

PARKING BRAKE REAR CABLE INSTALLATION

(1) Install cable eyelet on lever. Be sure eyelet is seated in lever notch.

(2) Seat cable retainer in caliper bracket.

(3) Route cable up to cable tensioner and equalizer. Then connect cable to equalizer.

(4) Check cable routing. Be sure cable is secured in body and chassis clips and retainers. Also be sure cable is not twisted, kinked or touching any rotating components.

(5) Adjust parking brake front cable as described in following procedure.

PARKING BRAKE TENSIONER ADJUSTMENT

Parking brake tensioner adjustment is only necessary when the tensioner, or a cable has been replaced or disconnected for service. When adjustment is necessary, perform adjustment only as described in the following procedure. This is necessary to avoid faulty parking brake operation.

(1) Raise vehicle.

(2) Back off tensioner adjusting nut at equalizer to create slack in cables.

(3) Remove rear wheel/tire assemblies. Then remove calipers and rotors.

(4) Adjust parking brake shoes as follows:

(a) Replace worn parts if necessary. **Excessive shoe-to-drum clearance, or worn cam and lever components will result in faulty parking brake adjustment and operation.**

(b) Verify that parking brake cables operate freely and are not binding, or seized. Replace faulty cables, or cam and lever before proceeding.

(c) Install rotors if removed.

(d) Adjust parking brakeshoes to drum surface in rotor by turning adjuster screw star wheel with brake tool. Verify that rotor assembly rotates freely without drag.

(e) Install calipers.

(5) Reinstall wheel/tire assemblies after brakeshoe adjustment is complete.

(6) Lower vehicle enough for access to parking brake lever or foot pedal. **Then fully apply parking brakes. Leave brakes applied until adjustment is complete.**

(7) Raise vehicle again.

(8) Mark tensioner rod 6.5 mm (1/4 in.) from tensioner bracket (Fig. 12).

(9) **Tighten adjusting nut at equalizer until mark on tensioner rod moves into alignment with tensioner bracket (Fig. 12).**

CAUTION: Do not loosen, or tighten the tensioner adjusting nut for any reason after completing adjustment.

(10) Lower vehicle until rear wheels are 15-20 cm (6-8 in.) off shop floor.

(11) Release parking brake hand lever and verify that rear wheels rotate freely without drag. Then lower vehicle.

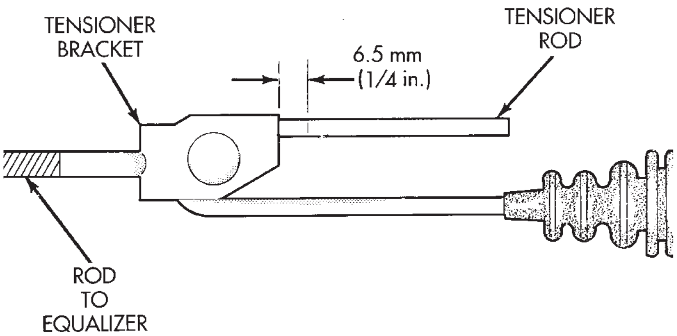

Fig. 12 Placing Adjustment Mark On Tensioner Rod

PARKING BRAKESHOE REPLACEMENT

A drum style, dual-shoe parking brake mechanism is used on all models. The shoes are expanded mechanically by a cable operated cam and lever.

The braking surface for the parking brake shoes is cast into the central hub of the rear disc brake rotor. The shoes are mounted on the splash shield and secured with holddown clips and return springs.

A cam and lever mechanism is used to expand the park brake shoes. The levers are connected to and operated by the parking brake rear cables.

PARKING BRAKESHOE REMOVAL

(1) Raise vehicle.

(2) Remove rear wheel and tire assembly.

(3) Apply Mopar rust penetrant all around joint formed by axle hub and disc brake rotor. Then apply penetrant through stud holes in rotor. This will help loosen any corrosion buildup that may have formed and ease rotor removal.

(4) Press caliper piston back into caliper bore with large C-clamp or screwdriver.

(5) Remove caliper mounting bolts with ratchet and 13 mm socket.

(6) Rotate caliper rearward and off rotor. **Do not allow brake hose to support caliper weight. Support caliper with wire attached to suspension component.**

(7) Remove rubber access plug from back of rear disc brake splash shield.

(8) Retract parking brakeshoes. Use standard brake tool to rotate adjuster screw star wheel (Fig. 13). Position tool at top of star wheel and rotate wheel downward in clockwise direction (while facing front of vehicle).

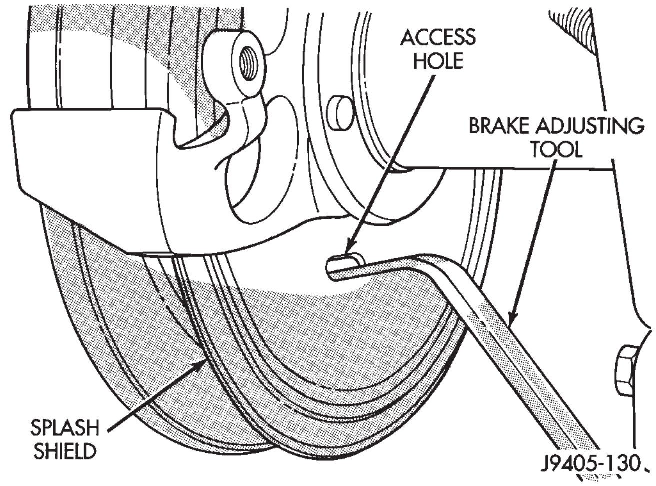

Fig. 13 Retracting Parking Brake Shoes (With Rear Disc Brakes)

(9) Tap rotor a few times with plastic or rubber mallet to loosen it. Then remove rotor from axle hub flange and park brake shoes (Fig. 14).

(10) Remove rear shoe holddown clip and pin (Fig. 14). Clip is held in place by pin which fits in clip notch. To remove clip, first push clip ends together with thumb or forefinger. Next, slide clip upward until head of pin clears narrow part of notch. Then remove pin and clip.

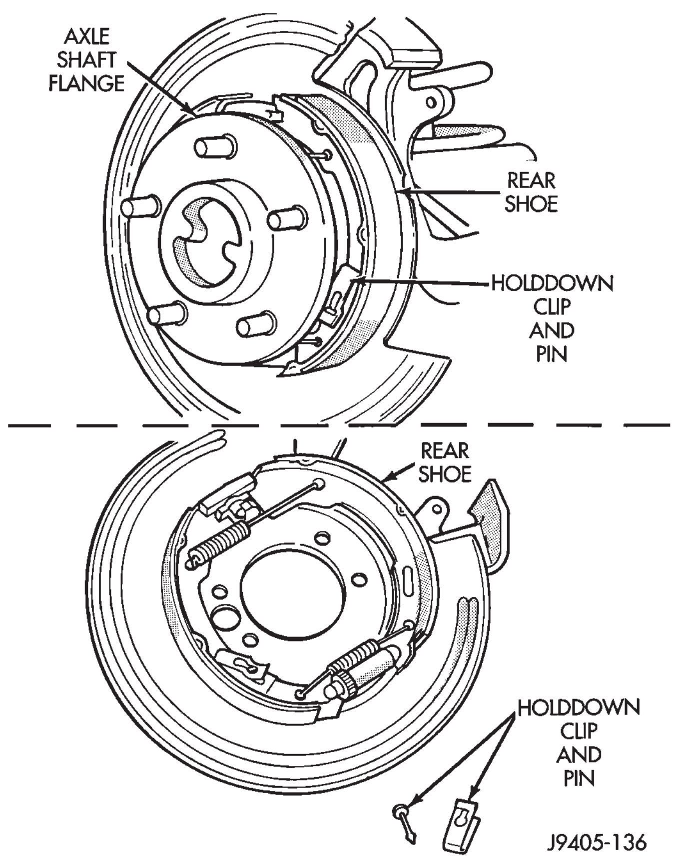

Fig. 14 Rear Shoe Holddown Clip And Pin Removal

(11) Disengage lower spring from rear shoe with needle nose pliers (Fig. 15).

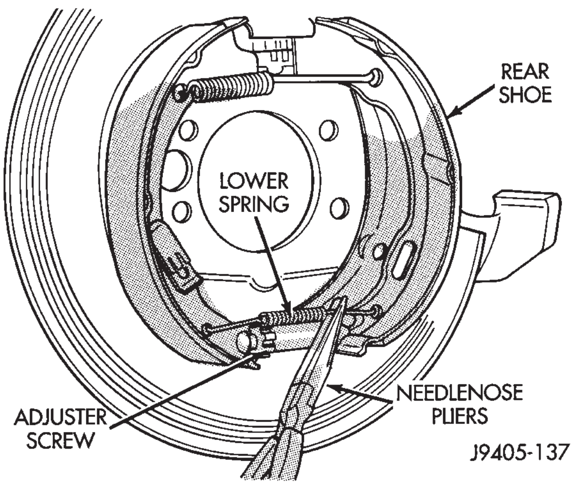

Fig. 15 Disengaging Lower Spring From Rear Shoe

(12) Tilt rear shoe outward and remove spring and adjuster screw (Fig. 16). **Note spring and adjuster screw position for installation reference.**

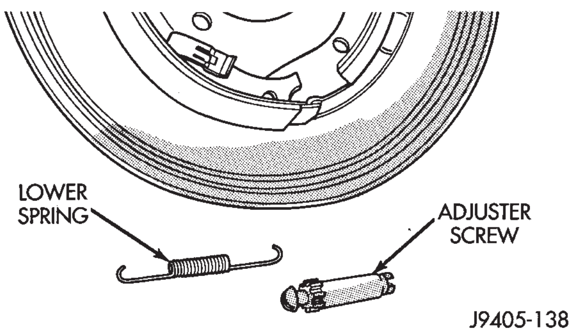

Fig. 16 Lower Shoe Spring And Adjuster Screw Removal

(13) Disengage upper spring from front shoe and remove rear shoe and upper spring (Fig. 17).

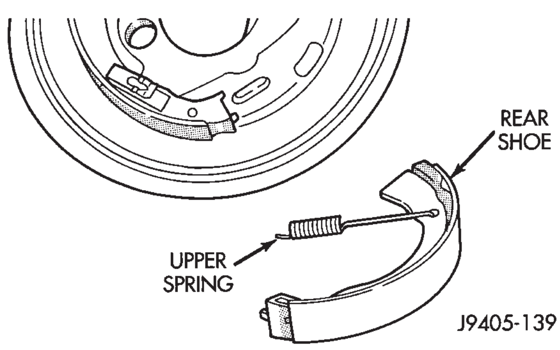

Fig. 17 Rear Brakeshoe And Upper Spring Removal

(14) Remove front shoe holddown clip and pin. Then remove front shoe (Fig. 18).

(15) Inspect condition of shoe springs, holddown clips and pins. Replace these parts if bent, distorted, or heat damaged.

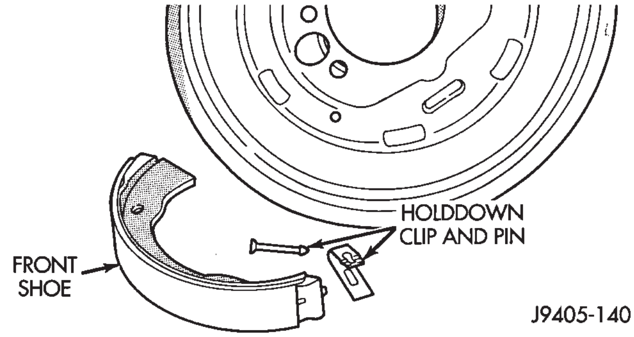

Fig. 18 Front Brakeshoe And Holddown Clip And Pin Removal

(16) Clean and inspect condition of adjuster screw assembly. Replace assembly if worn, or damaged in any way.

(17) Inspect condition of park brake cam and lever. If these parts are worn, replace both parts as an assembly. **Note position of cam and lever for installation reference.**

(18) Clean splash shield with Mopar brake cleaner and note condition of shoe contact pads (Fig. 19). Replace shield if any pad surfaces are worn through. Refer to Splash Shield/Caliper Bracket/Lever Boot replacement procedure in this section.

(19) Note condition of cam and lever dust boot. If boot is cut, torn, folded over, or mispositioned, replace boot. **Refer to Splash Shield/Caliper Bracket/Lever Boot replacement procedure in this section as boot position is important to proper rotor to splash shield clearance.**

(20) Clean and inspect rotor. Minor surface corrosion, nicks, or scratches can be reduced with 180 grit emery cloth. Replace rotor if either braking surface is scored, or worn. **Do not machine the rotor.**

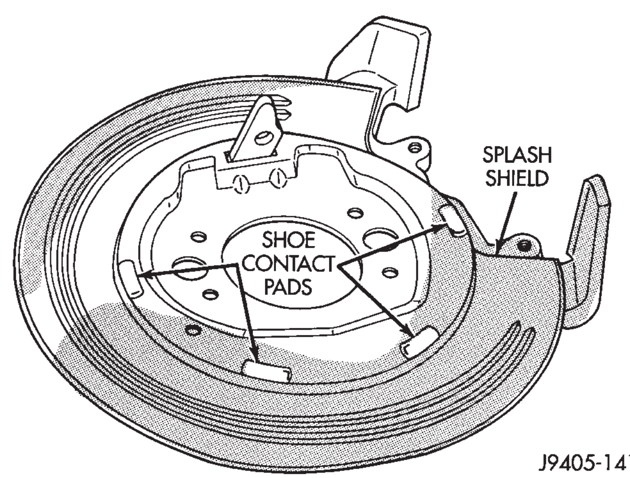

Fig. 19 Shoe Contact Pad Locations On Splash Shield

PARKING BRAKESHOE INSTALLATION

(1) Lubricate shoe contact pads and cam and lever with Mopar multi-mileage grease.

(2) Install shoes on splash shield. Use new hold-down clips and pins to secure shoes if necessary. Be sure shoes are properly engaged in caliper bracket and cam.

(3) Lubricate adjuster screw threads with Mopar spray lube, LPS all purpose lube, or equivalent. Be sure star wheel turns freely.

(4) Install adjuster screw assembly. Be sure notched ends of screw assembly are properly seated on shoes and that star wheel is aligned with access hole in shield.

(5) Install shoe lower return spring. Needle nose pliers can be used to connect spring to each shoe.

(6) Install shoe upper return spring. Engage short end of spring in front shoe. Then use pointed tool with 20-25 cm (8-10 in.) long shank to engage spring in rear shoe.

(7) Check shoe installation. Operate lever to verify that shoes expand and retract properly.

(8) Install rotor.

(9) Install caliper over rotor and into bracket.

(10) Adjust parking brakeshoes. Refer to procedure in this section.

(11) Lubricate caliper mounting bolts with light coat of Dow or GE silicone grease. Then install and tighten bolts to 10-20 N·m (7-15 ft. lbs.) torque.

(12) Install wheel and tire assembly.

(13) Adjust parking brake cable tensioner. Refer to Parking Brake Tensioner Adjustment procedure in this section.

(14) Lower vehicle and verify correct parking brake operation.

PARKING BRAKESHOE ADJUSTMENT

(1) Install rotor, if removed. Temporarily secure rotor with one or two wheel nuts.

(2) Remove rubber access plug from back of splash shield.

(3) Insert brake tool through access hole in splash shield (Fig. 11). Position tool at bottom of star wheel.

(4) Rotate star wheel upward in counterclockwise direction to expand shoes (while facing front of vehicle).

(5) Expand shoes until light drag is experienced. Then back off adjuster screw only enough to eliminate drag.

(6) Install plug in splash shield access hole.

CAM AND LEVER REPLACEMENT

The cam and lever that operates each set of parking brakeshoes are serviceable parts.

The lever boot should also be inspected and serviced when necessary. Replace the boot if cut, torn, or folded over (mispositioned). Refer to the Splash Shield/Caliper Bracket/Lever Boot Replacement procedure in this section.

Lever/Cam Interchangeability And Correct Position

The cams are reversible and can be used at either wheel.

The levers are NOT reversible. They are marked R and L to identify them and must only be used on the correct wheel.

Correct lever position is important. The lever notch (for the cable eyelet), faces rearward on both sides. In addition, be sure the R side is facing up on the passenger side and the L side is facing up on the driver side.

Replacement Procedure

(1) Raise vehicle.

(2) Remove wheel and tire assembly.

(3) Remove disc brake caliper.

(4) Remove parking brakeshoes.

(5) Move lever forward and disconnect parking brake rear cable from lever.

(6) Pull lever forward through boot. Disengage cam from lever and remove cam (Fig. 20). Note cam position for installation reference.

(7) Remove lever.

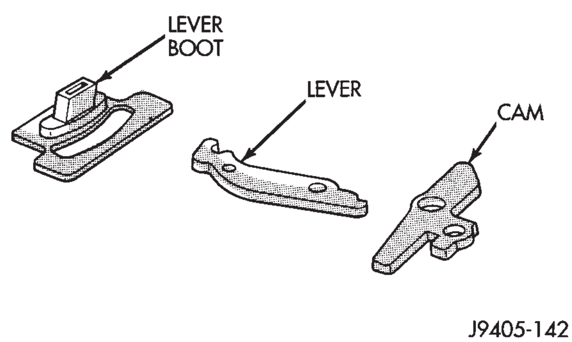

Fig. 20 Parking Brake Cam, Lever And Boot

(8) Lubricate replacement lever with GE or Dow silicone grease. Then insert lever part way through boot. Be sure lever notch is facing rearward.

(9) Engage cam in lever. Then simultaneously slide cam into place on splash shield and work lever through boot.

(10) Install parking brakeshoes.

(11) Verify correct installation of cam and lever by pulling lever toward front of vehicle. Cam should expand both brakeshoes as lever is pulled forward.

(12) Install rotor and adjust parking brakeshoes. Refer to procedure in this section.

(13) Connect rear cable to lever. Be sure cable eyelet is securely attached in lever notch.

(14) Install brake caliper and wheel and tire assembly.

(15) Lower vehicle and verify correct parking brake operation.

SPLASH SHIELD/CALIPER BRACKET/LEVER BOOT REPLACEMENT

The splash shield and caliper bracket are now riveted together at the factory. The rivets only ensure that the parking brake lever boot is not displaced during assembly operations. Although the rivets must be drilled out for shield, bracket, or boot replacement, **it is not necessary to install new rivets afterward.**

(1) Raise vehicle and remove appropriate wheel and tire assembly.

(2) Remove caliper bolts and lift caliper off rotor and bracket. Suspend caliper from chassis or suspension component with wire.

(3) Retract parking brakeshoes and remove rotor.

(4) Remove axle shaft. Refer to Group 3 for procedure.

(5) Remove parking brakeshoes from splash shield.

(6) Remove nuts attaching splash shield and caliper bracket to axle tube flange.

(7) Remove splash shield and caliper bracket from axle studs and work lever out of rear cable eyelet.

(8) Mark position of splash shield and bracket for assembly reference (Fig. 21). Use paint or scriber to mark parts.

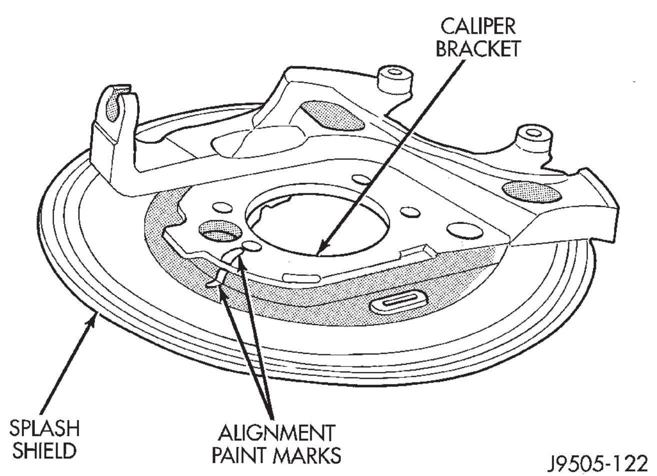

Fig. 21 Marking Position Of Splash Shield And Bracket

(9) Drill out rivets that retain splash shield to caliper bracket (Fig. 22). If rivet heads did not come completely off after drilling, remove remaining pieces with small chisel. **Note that the rivets do not have to be replaced at installation. The rivets are only used during manufacture to keep the boot in place during handling.**

(10) Note position of cam and lever for installation reference. Then remove cam and lever from splash shield and bracket.

(11) Separate splash shield and caliper bracket. Then remove lever boot from bracket (Fig. 23).

(12) If original bracket and shield will be reused, clean them with Mopar carb and brake cleaner. Also clean shoe contact pad surfaces of shield with 400 grit paper. Lubricate pad surfaces with light coat of Mopar multi-mileage grease.

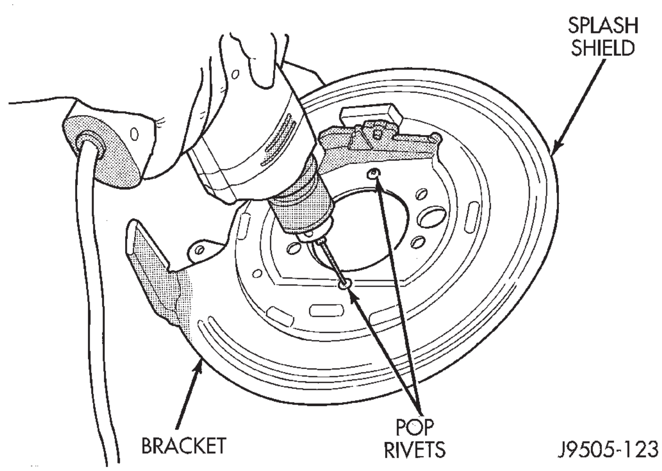

Fig. 22 Drilling Out Splash Shield Rivets

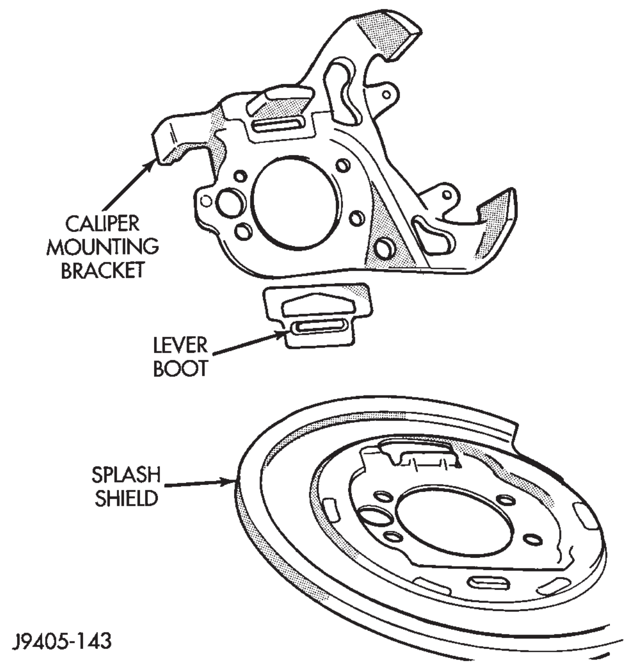

Fig. 23 Caliper Bracket, Splash Shield And Lever Boot

(13) Apply thin coat of contact cement or silicone adhesive to new lever boot and to boot mounting area of caliper bracket (Fig. 24). Apply adhesive to areas where boot and bracket contact one another. Adhesive is needed to hold boot in position when splash shield is attached to bracket.

(14) Install new boot on caliper bracket. Metal retainer part of boot fits over ledge on caliper as shown (Fig. 25). Rubber part of boot extends through rear opening in bracket. Allow adhesive on boot and bracket to set up for a minute or two before proceeding.

(15) Position splash shield on caliper bracket. Then carefully install shield and bracket assembly on axle tube flange studs.

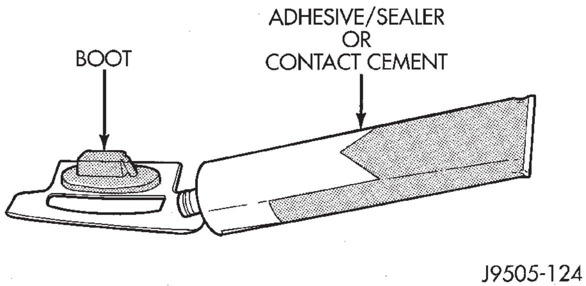

Fig. 24 Applying Adhesive To Parking Brake Lever Boot

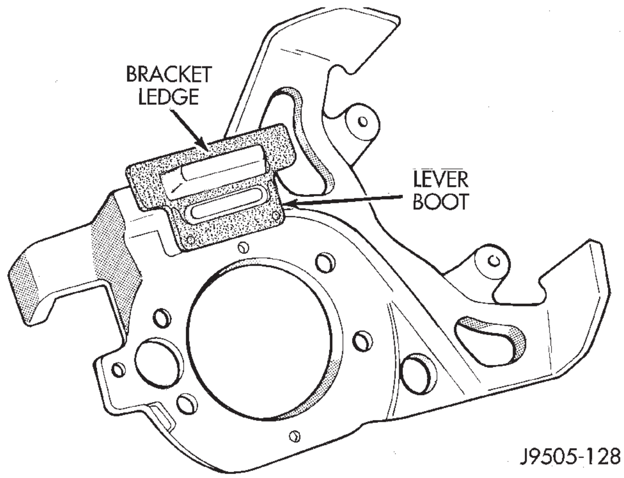

Fig. 25 Lever Boot Installation

CAUTION: Be sure the parking brake lever boot is not displaced when the shield/assembly is installed. If the boot becomes mispositioned, it will prevent the shield from seating squarely on the bracket. This will cock the shield causing it to rub against the rotor after installation. Inspect the boot and reposition it if necessary.

(16) Apply Mopar Lock N' Seal (or Loctite 242), to axle tube stud nuts. Then install and tighten nuts to 43-61 N·m (32-45 ft. lbs.) torque.

(17) Assemble and install cam and lever. Push lever through boot and seat cam between lip on shield and ledge on bracket (Fig. 26). Then engage lever in cable eyelet. Be sure cable notch in lever is facing rearward. Remove and reposition cam and lever if necessary.

(18) Install parking brakeshoes on splash shield. Verify positioning of cam and lever, shoes, springs and holddown clips and pins (Fig. 27).

(19) Verify correct positioning of caliper bracket and shield (Fig. 28). Caliper opening and ledges should be to rear as shown.

(20) Install axle shaft, shaft retainer clips and housing cover. Check lube level and add lubricant if needed.

(21) Install rotor, caliper, and wheel and tire assembly. Then adjust parking brakeshoes.

(22) Lower vehicle and verify correct service and parking brake operation.

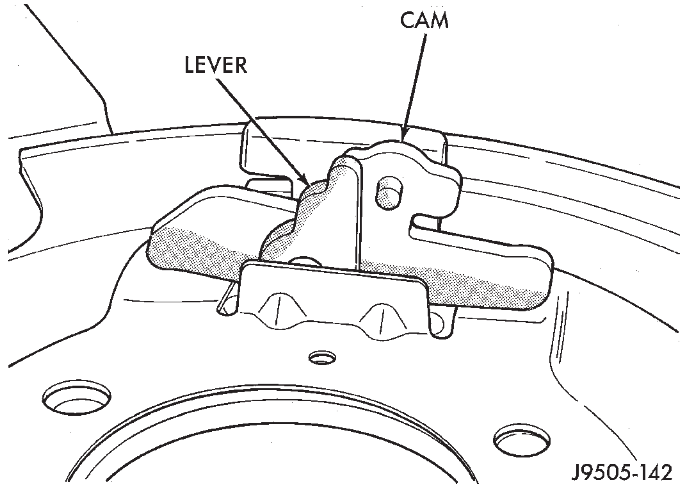

Fig. 26 Cam And Lever Installation

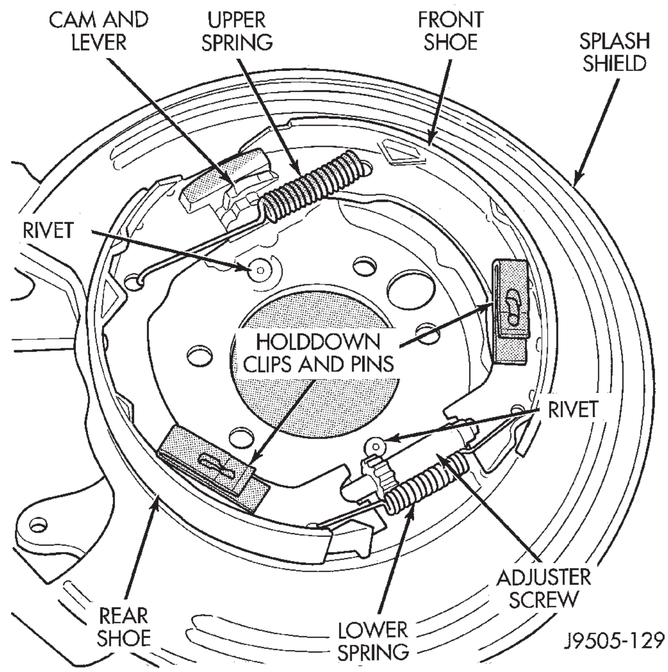

Fig. 27 Parking Brakeshoes Mounted On Shield

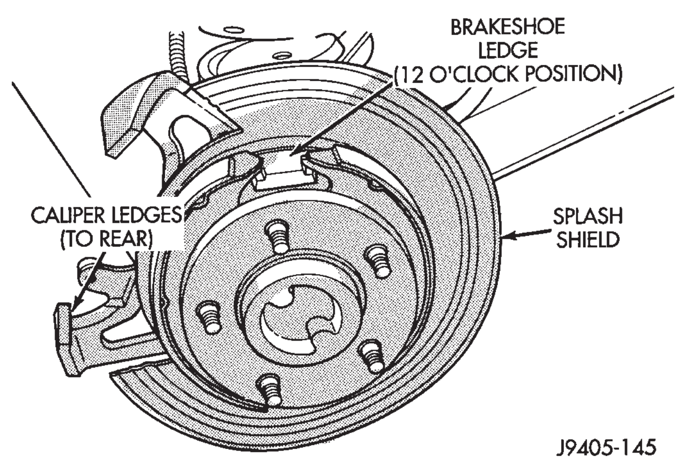

Fig. 28 Checking Caliper Bracket And Shield Position

BRAKE PEDAL AND BRAKELIGHT SWITCH

INDEX

GENERAL INFORMATION

A suspended-type brake pedal is used on all models (Fig. 1). The pedal pivots on a pin mounted in the pedal support bracket. The bracket is attached to the dash and instrument panels on all models.

A plunger-type, self adjusting brakelight switch is used on all models. The switch is attached to a flange on the pedal support bracket.

BRAKE PEDAL SERVICE

The brake pedal is a serviceable component. The pedal, pivot pin, sleeve, pedal bushings and spacers/ washers are all replaceable parts. The pedal bracket can also be replaced when necessary.

BRAKE PEDAL REMOVAL

(1) Remove lower trim panel and air conditioning duct if necessary.

(2) Remove steering column lower trim panel and bezel.

(3) Remove necessary dash panel-to-instrument panel brace rods.

(4) Remove retainer clip and washers attaching booster push rod to pedal pin (Fig. 1).

(5) Remove nut securing pedal shaft in support bracket.

(6) Slide pedal shaft outward for clearance and remove brake pedal.

(7) Remove pedal bushings if they are to be replaced.

BRAKE PEDAL INSTALLATION

(1) Install new bushings in pedal. Lubricate bushings and pivot pin with Mopar multi-mileage grease.

(2) Position pedal, sleeve and spacer(s) in bracket and install pedal shaft in support and through pedal.

(3) Install new nut on pedal shaft. **Shaft nut is specially formed and should not be reused. Be sure to install new nut to secure shaft.**

(4)) Tighten pedal shaft nut to 27 N·m (20 ft. lbs.) on models with manual transmission. Tighten nut to 35 N·m (26 ft. lbs.) on models with automatic transmission.

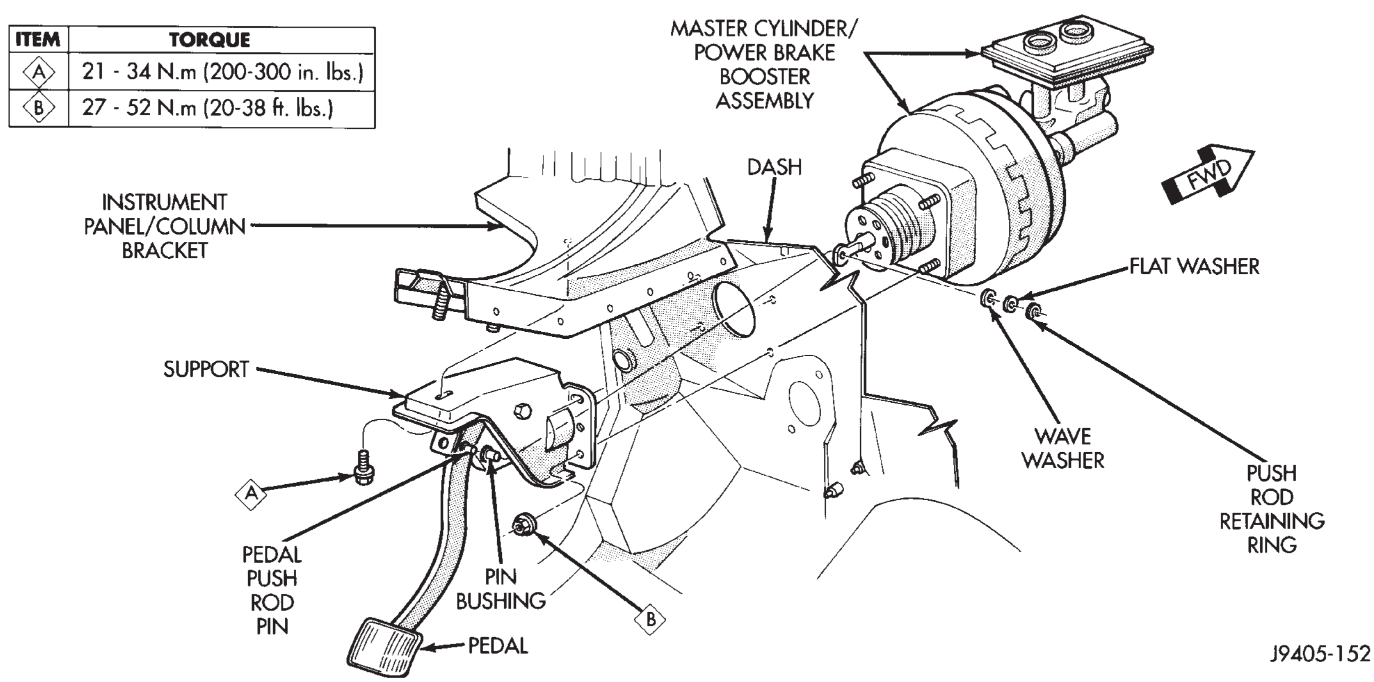

Fig. 1 Brake Pedal Mounting

(5) Install bushing on pedal pin if removed (Fig. 1).

(6) Install booster push rod on pedal pin. Secure push rod to pedal with retainer ring and washers.

(7) Install dash brace rod, if equipped.

(8) Install instrument panel trim and air conditioning duct if removed.

(9) Check and adjust brakelight switch if necessary. Refer to procedure in this section.

BRAKELIGHT SWITCH REMOVAL

The brakelight switch is mounted on the pedal support bracket. The switch plunger is actuated by a striker attached to the pedal. The switch is secured in the bracket means of a built-in retainer on the switch body.

(1) Remove steering column cover and lower trim panel for switch access (if necessary).

(2) Press brake pedal downward to fully applied position.

(3) Rotate switch approximately 30° in counterclockwise direction to unlock switch retainer. Then pull switch rearward and out of bracket.

(4) Disconnect switch wire harness and remove switch from vehicle (Fig. 2).

(5) Test switch as described in following procedure, if necessary.

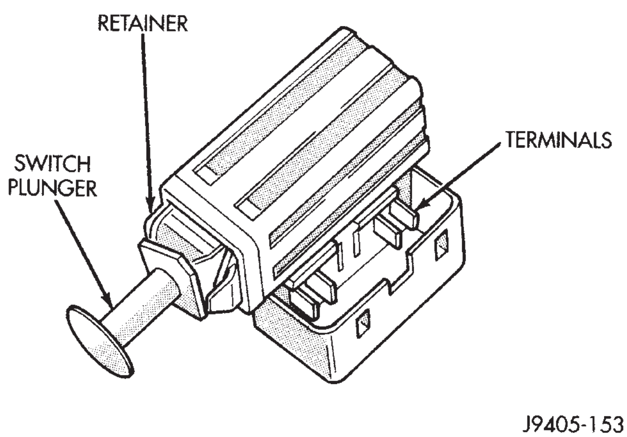

Fig. 2 Brakelight Switch

BRAKELIGHT SWITCH TEST AND DIAGNOSIS

Brakelight switch operation can be tested with an ohmmeter. The ohmmeter is used to check continuity between the pin terminals at different plunger positions (Fig. 3).

The switch wire harness must be disconnected before testing switch continuity.

Switch Circuit Identification

• Switch terminals 1 and 2 are for the brake sensor circuit

• Switch terminals 5 and 6 are for the brakelight circuit

• Switch terminals 3 and 4 are for the speed control circuit

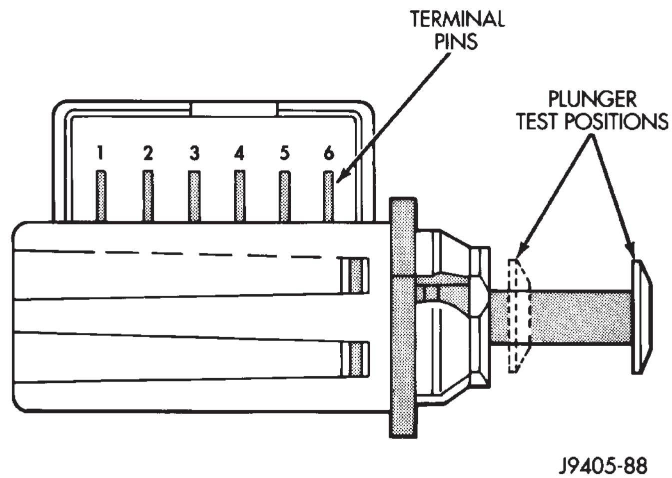

Fig. 3 Brakelight Switch Terminal Identification And Plunger Test Position

Switch Continuity Test Procedure

(1) Check continuity between terminal pins 5 and 6 as follows:

(a) Pull plunger all the way out to fully extended position.

(b) Attach test leads to pins 5 and 6 and note ohmmeter reading.

(c) If continuity exists, proceed to next test. Replace switch if meter indicates lack of continuity (shorted or open).

(2) Check continuity between terminal pins 1 and 2 and pins 3 and 4 as follows:

(a) Push switch plunger inward to fully retracted position.

(b) Attach test leads to pins 1 and 2 and note ohmmeter reading.

(c) If continuity exists, switch is OK. Replace switch if meter indicates lack of continuity (shorted or open).

BRAKELIGHT SWITCH ADJUSTMENT AND INSTALLATION

(1) Pull switch plunger all the way out to fully extended position.

(2) Connect harness wires to switch.

(3) Press and hold brake pedal in applied position.

(4) Install switch as follows: Align tab on switch with notch in switch bracket. Then insert switch in bracket and turn it clockwise about 30° to lock it in place.

(5) Release brake pedal. Then pull pedal fully rearward. Pedal will set plunger to correct position as pedal pushes plunger into switch body. Switch will make racheting sound as it self adjusts.

SPECIFICATIONS

BRAKE TORQUE SPECIFICATIONS

Description	Torque
Acceleration Sensor Screws:	
at sensor	8-9 N•m (71-83 in. lbs.)
at bracket	1-2 N•m (13-18 in. lbs.)
Brake Booster Mounting Nuts	41 N•m (30 ft. lbs.)
Brakeline Fittings At:	
combination valve	18-24 N•m (160-210 in. lbs.)
front brake hose	15-18 N•m (130-160 in. lbs.)
HCU	14-16 N•m (125-140 in. lbs.)
master cylinder primary outlet	14-16 N•m (125-140 in. lbs.)
master cylinder secondary outlet	15-18 N•m (135-160 in. lbs.)
rear brakeline (to hose)	15-18 N•m (130-160 in. lbs.)
wheel cylinder	15-18 N•m (130-160 in. lbs.)
Brake Pedal Support Bolt	23-34 N•m (200-300 in. lbs.)
Brake Pedal Pivot Bolt/Nut	27-35 N•m (20-26 ft. lbs.)
Caliper Mounting Bolts	10-20 N•m (7-15 ft. lbs.)
Combination Valve Adaptor Fittings	23-27 N•m (200-240 in. lbs.)
ECU Mounting Screws	8-13 N•m (75-115 in. lbs.)

Description	Torque
Front Brake Hose Bracket Screw	4-6 N•m (34-50 in. lbs.)
Front Brake Hose Fitting Bolt	24-38 N•m (216-336 in. lbs.)
Front Wheel Sensor Bracket Bolt	4-6 N•m (34-50 in. lbs.)
HCU Bracket Attaching Nuts	10-13 N•m (92-112 in. lbs.)
Master Cylinder Attaching Nuts	13-25 N•m (115-220 in. lbs.)
Parking Brake Cable Retainer Nut	1-2 N•m (12-16 in. lbs.)
Parking Brake Lever Screws	10-14 N•m (85-125 in. lbs.)
Parking Lever Bracket Screws	10-14 N•m (85-125 in. lbs.)
Rear Axle Vent Fitting	11-18 N•m (100-160 in. lbs.)
Rear Brake Hose Bracket Screw	8-9 N•m (74-82 in. lbs.)
Rear Sensor Axle Bracket Bolt	8-9 N•m (74-82 in. lbs.)
Rear Sensor Bolt	12-14 N•m (10-11 ft. lbs.)
Support Plate Bolts/Nuts	43-61 N•m (32-45 ft. lbs.)
Wheel Cylinder Bolts	10 N•m (90 in. lbs.)
Wheel Lug Nuts	120 N•m (88 ft. lbs.)

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CLUTCH

CONTENTS

GENERAL INFORMATION

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CLUTCH COMPONENTS

The clutch mechanism in Grand Cherokee models consists of a single dry disc, and a diaphragm style clutch cover. A hydraulic linkage is used to operate the clutch release lever and bearing.

The transmission input shaft is supported in the crankshaft flange by a pilot bearing. A sleeve type release bearing is used to engage and disengage the clutch cover pressure plate. The bearing rides on the transmission front bearing retainer.

The release bearing is operated by a fork in the clutch housing. The fork pivots on a ball stud and is operated by the hydraulic slave cylinder piston. The slave cylinder is mounted in the clutch housing and is operated by the clutch master cylinder. The clutch master cylinder is mounted on the dash panel and the cylinder piston is connected to the clutch pedal.

The clutch disc has cushion springs in the disc hub and the disc facing is riveted to the hub. The facing is made from a non-asbestos material.

The clutch cover pressure plate is a diaphragm type with a one-piece spring and multiple release fingers. The pressure plate release fingers are preset during manufacture and are not adjustable.

HYDRAULIC LINKAGE COMPONENTS

The hydraulic linkage consists of a remote reservoir, master cylinder, slave cylinder and interconnecting fluid lines.

The clutch master cylinder piston is connected to the clutch pedal. The slave cylinder piston is connected to the clutch release lever. The master cylinder is mounted on the driver side of the dash panel next to the brake master cylinder.

The linkage components are not serviced separately. The linkage is only serviced as a complete assembly.

CLUTCH LINKAGE FLUID

The clutch fluid reservoir, master cylinder, slave cylinder and fluid lines are pre-filled with fluid at the factory during assembly operations.

The hydraulic system should not require additional fluid under normal circumstances. In fact, **the reservoir fluid level will actually increase as normal clutch wear occurs. For this reason, it is important to avoid overfilling, or removing fluid from the reservoir.**

If inspection indicates additional fluid is needed, use Mopar brake fluid, or an equivalent meeting standards SAE J1703 and DOT 3. Do not use any other type of fluid and only use fluid from a sealed container.

CLUTCH PEDAL POSITION SWITCH

A clutch pedal position switch has been added to the starter circuit. The switch is in circuit with the starter solenoid and requires that the clutch pedal be fully depressed in order to start the engine. Switch circuitry and operation is described in section 8W of Group 8.

The switch is located on the clutch master cylinder push rod and is not serviced separately. It is serviced as part of the clutch master cylinder assembly.

CLUTCH COMPONENT LUBRICATION

Proper clutch component lubrication is important to satisfactory operation. Using the correct lubricant and not overlubricating are equally important. Apply recommended lubricant sparingly to avoid disc and pressure plate contamination.

Clutch and transmission components requiring lubrication are:

- pilot bearing
- release lever pivot ball stud
- release lever contact surfaces
- release bearing bore
- clutch disc hub splines
- clutch pedal pivot shaft bore
- clutch pedal bushings
- transmission input shaft splines
- transmission input shaft pilot hub
- transmission front bearing retainer slide surface

Never apply grease to any part of the clutch cover, or disc.

RECOMMENDED LUBRICANTS

Use Mopar multi-purpose grease for the clutch pedal bushings and pivot shaft. Use Mopar high temperature grease (or equivalent) for all other lubrication requirements. Apply recommended amounts and do not overlubricate.

CLUTCH OPERATION

Leverage, clamping force, and friction are the clutch operating principles. The disc serves as the friction element and the cover diaphragm spring acting on the pressure plate provide the clamping force. The pedal, hydraulic linkage, release lever and bearing provide the leverage.

The clutch cover assembly consists of the cover, pressure plate, diaphragm spring and fulcrum components. The pressure plate clamps the clutch disc against the flywheel. Clamping force on the pressure plate, comes from the diaphragm spring.

The clutch disc has a splined hub for installation on the transmission input shaft splines. The splined hub provides the connection to the transmission.

The clutch linkage uses hydraulic pressure to operate the clutch mechanism. The clutch master cylinder is connected to the clutch pedal and the slave cylinder is connected to the release lever.

Pressing the clutch pedal develops fluid pressure in the clutch master cylinder. This pressure is transmitted to the slave cylinder through the connecting line. The slave cylinder piston then operates the clutch release lever.

The clutch release bearing is mounted on the transmission front bearing retainer. The bearing is attached to the release lever which moves the bearing in and out of contact with the diaphragm spring fingers. The release lever is operated by the slave cylinder piston rod.

In operation, slave cylinder force exerted through the cylinder piston, causes the release lever to pivot toward the clutch. This action moves the release bearing into contact with the diaphragm spring fingers. The release bearing pushes the spring fingers inward against the fulcrums to unload spring force on the pressure plate. At this point, clamping force on the disc is released allowing the disc to disengage and freewheel.

The process of clutch re-engagement, is simply the reverse of what occurs during disengagement. Releasing pedal pressure removes linkage pressure. The release bearing moves away from the diaphragm spring which again applies clamping force on the disc through the pressure plate.

CLUTCH DIAGNOSIS

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GENERAL DIAGNOSIS INFORMATION

Unless the cause of a clutch problem is obvious, accurate problem diagnosis will usually require a road test to confirm a problem. Component inspection will then be required to determine the actual problem cause.

During a road test, drive the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If chatter, grab, slip, or improper release is experienced, remove and inspect the clutch components. However, if the problem is noise or hard shifting, further diagnosis may be needed as the transmission or another driveline component may be at fault. Careful observation during the test will help narrow the problem area.

CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunction. Oil, water, or clutch fluid on the clutch contact surfaces will cause chatter, slip, or grab.

During inspection, note if any components are contaminated with oil, hydraulic fluid, or water/road splash.

Oil contamination indicates a leak at either the rear main seal or transmission input shaft. Oil leakage produces a residue of oil on the housing interior and on the clutch cover and flywheel. Heat buildup caused by slippage between the cover, disc and flywheel, can sometimes bake the oil residue onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination means dirt/water is entering the clutch housing due to loose bolts, housing cracks, or through hydraulic line openings. Driving through deep water puddles can force water/road splash into the housing through such openings.

Clutch fluid leaks are from loose or damaged slave cylinder fluid lines and connecting fittings. However, clutch fluid leaks will usually be noted and corrected before severe contamination occurs.

CLUTCH MISALIGNMENT

Clutch components must be in proper alignment with the crankshaft and transmission input shaft. Misalignment caused by excessive runout or warpage of any clutch component will cause grab, chatter and improper clutch release.

FLYWHEEL RUNOUT

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:
- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and further machining will negate this feature.

Minor flywheel scoring can be smoothed by hand with 180 grit emery, or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

CLUTCH COVER AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **new** disc should not exceed 0.50 mm (0.020 in.). Measure runout about 6 mm (1/4 in.) from the outer edge of the disc facing. Obtain another disc if runout is excessive.

Check condition of the clutch before installation. A warped cover or diaphragm spring will cause grab and incomplete release or engagement. Be careful when handling the cover and disc. Impact can distort the cover, diaphragm spring, release fingers and the hub of the clutch disc.

Use an alignment tool when positioning the disc on the flywheel. The tool prevents accidental misalignment which could result in cover distortion and disc damage.

A frequent cause of clutch cover distortion (and consequent misalignment) is improper bolt tightening. To avoid warping the cover, the bolts must tightened alternately (diagonal pattern) and evenly (2-3 threads at a time) to specified torque.

CLUTCH HOUSING MISALIGNMENT

Clutch housing alignment is important to proper clutch operation. The housing maintains alignment between the crankshaft and transmission input shaft. Misalignment can cause clutch noise, hard shifting, incomplete release and chatter. It can also result in premature wear of the pilot bearing, cover release fingers and clutch disc. In severe cases, misalignment can also cause premature wear of the transmission input shaft and front bearing.

Housing misalignment is generally caused by incorrect seating on the engine or transmission, loose housing bolts, missing alignment dowels, or housing damage. Infrequently, misalignment may also be caused by housing mounting surfaces that are not completely parallel. Misalignment can be corrected with shims.

INSTALLATION METHODS AND PARTS USAGE

Distortion of clutch components during installation and the use of non-standard components are additional causes of clutch malfunction.

Improper clutch cover bolt tightening can distort the cover. The usual result is clutch grab, chatter and rapid wear. Tighten the cover bolts as described in Clutch Service section.

An improperly seated flywheel and/or clutch housing are additional causes of clutch failure. Improper seating will produce misalignment and additional clutch problems.

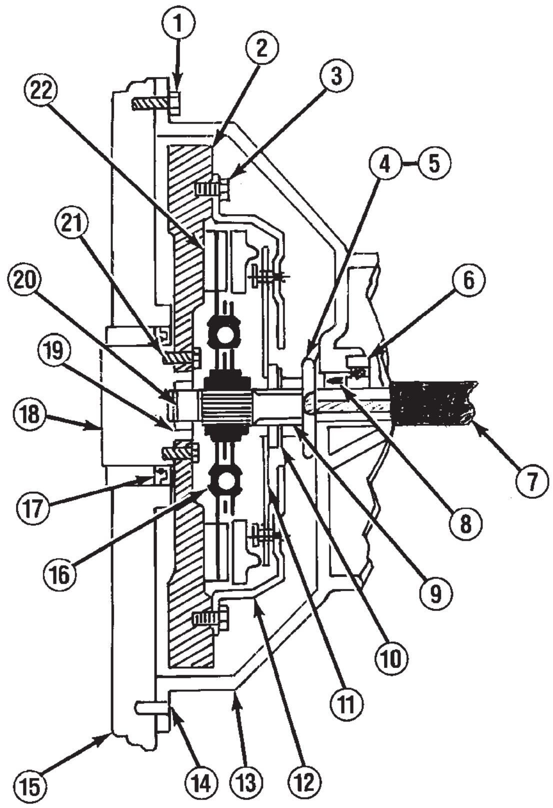
The use of non-standard or low quality parts will also lead to problems and wear. Use recommended factory quality parts to avoid comebacks.

A cocked pilot bearing is another cause of clutch noise, drag, hard shifting, and rapid bearing wear. Always use an alignment tool to install a new bearing. This practice avoids bearing misalignment during installation.

INSPECTION AND DIAGNOSIS CHARTS

The clutch inspection chart (Fig. 1) outlines items to be checked before and during clutch installation. Use the chart as a check list to help avoid overlooking potential problem sources during service operations.

The diagnosis charts describe common clutch problems, causes and correction. Fault conditions are listed at the top of each chart. Conditions, causes and corrective action are outlined in the indicated columns. Use the charts as a guide when diagnosing faulty clutch operation.



1 Check clutch housing bolts. Tighten if loose. Be sure housing is fully seated on engine block.

2 Check flywheel. Scuff sand face to remove glaze. Clean surface with wax and grease remover. Replace flywheel if severely scored, worn or cracked. Secure flywheel with new bolts (if removed). Do not reuse old bolts. Use Mopar Lock N'Seal on bolts.

3 Tighten clutch cover bolts 2-3 threads at a time, alternately and evenly (in a star pattern) to specified torque. Failure to do so could warp the cover.

4 Check release fork. Replace fork if bent or worn. Make sure pivot and bearing contact surfaces are lubricated.

5 Check release fork pivot (in housing). Be sure pivot is secure and ball end is lubricated.

6 Transmission input shaft bearing will cause noise, chatter, or improper release if damaged. Check condition before installing transmission.

7 Check slave cylinder. Replace it if leaking. Be sure cylinder is properly secured in housing and cylinder piston is seated in release fork.

8 Check input shaft seal if clutch cover and disc were oil covered. Replace seal if worn, or cut.

9 Inspect release bearing slide surface of trans. front bearing retainer. Surface should be smooth, free of nicks, scores. Replace retainer if necessary. Lubricate slide surface before installing release bearing.

10 Do not replace release bearing unless actually faulty. Replace bearing only if seized, noisy, or damaged.

11 Check clutch cover diaphragm spring and release fingers. Replace cover if spring or fingers are bent, warped, broken, cracked. Do not tamper with factory spring setting as clutch problems will result.

12 Check condition of clutch cover. Replace clutch cover if plate surface is deeply scored, warped, worn, or cracked. Be sure cover is correct size and properly aligned on disc and flywheel.

13 Inspect clutch housing. Be sure bolts are tight. Replace housing if damaged.

14 Verify that housing alignment dowels are in position before installing housing.

15 Clean engine block surface before installing clutch housing. Dirt, grime can produce misalignment.

16 Make sure side of clutch disc marked "flywheel side" is toward flywheel.

17 Check rear main seal if clutch disc and cover were oil covered. Replace seal if necessary.

18 Check crankshaft flange (if flywheel is removed). Be sure flange is clean and flywheel bolt threads are in good condition.

19 Check pilot bearing. Replace bearing if damaged. Lube with Mopar high temp. bearing grease before installation.

20 Check transmission input shaft. Disc must slide freely on shaft splines. Lightly grease splines before installation. Replace shaft if splines or pilot bearing hub are damaged.

21 Check flywheel bolt torque. If bolts are loose, replace them. Use Mopar Lock N'Seal to secure new bolts.

22 Check clutch disc facing. Replace disc if facing is charred, scored, flaking off, or worn. Also check runout of new disc. Runout should not exceed 0.5 mm (0.02 in.).

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Fig. 1 Clutch Inspection Points

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC FACING WORN OUT	1. Normal wear. Driver frequently rides (slips) clutch. Results in rapid wear overheating. Insufficient clutch cover diaphragm spring tension.	1. Replace clutch disc. Also replace cover if spring is weak or pressure plate surface is damaged.
CLUTCH DISC FACING CONTAMINATED WITH OIL, GREASE, OR CLUTCH FLUID	1. Leak at rear main seal or at transmission input shaft seal. Excessive amount of grease applied to input shaft splines. Road splash, water entering housing. Slave cylinder leaking.	1. Replace leaking seals. Apply less grease to input shaft splines. Replace clutch disc (do not clean and reuse). Clean clutch cover and reuse only if cover is in good condition. Replace slave cylinder if leaking.
CLUTCH IS RUNNING PARTIALLY DISENGAGED	1. Release bearing sticking-binding. Does not return to normal running position.	1. Verify that bearing is actually binding, then replace bearing and transmission front bearing retainer if sleeve surface is damaged.
FLYWHEEL HEIGHT INCORRECT	1. Flywheel surface improperly machined. Too much stock removed or surface is tapered.	1. Replace flywheel.
WRONG DISC OR PRES-SURE PLATE INSTALLED	1. Incorrect parts order or model number.	1. Replace with correct parts. Compare old and new parts before installation.
CLUTCH DISC, COVER AND/OR DIAPHRAGM SPRING, WARPED, DISTORTED	1. Rough handling (impact) bent cover, spring, or disc. Incorrect bolt tightening sequence and method caused warped cover.	1. Install new disc or cover as needed. Follow installation/tightening instructions.
FACING ON FLYWHEEL SIDE OF DISC TORN, GOUGED, WORN	1. Flywheel surface scored and nicked.	1. Reduce scores and nicks by sanding or surface grinding. Replace flywheel if scores-nicks are deeper than .002-.004 inch.
CLUTCH DISC FACING BURNT (CHARRED). FLY-WHEEL AND COVER PRESSURE PLATE SURFACES HEAVILY GLAZED	1. Frequent operation under high loads or hard acceleration conditions. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover.	1. Scuff sand flywheel. Replace clutch cover and disc. Alert driver to problem cause.

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CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC WARPED	1. New disc not checked for axial runout before installation.	1. Replace disc. Be sure runout of new disc is less than .5 mm (.020 in.).
CLUTCH DISC BINDS ON INPUT SHAFT SPLINES	1. Clutch disc hub splines damaged during installation. Input shaft splines rough, damaged. Corrosion, rust formations on splines of disc and input shaft.	1. Clean, smooth and lubricate disc and shaft splines. Replace disc and/or input shaft if splines are severely damaged.
CLUTCH DISC RUSTED TO FLYWHEEL AND/OR PRESSURE PLATE	1. Occurs in vehicles stored, or not driven for extended periods of time. Also occurs after steam cleaning if vehicle is not used for extended period.	1. Remove clutch cover and disc. Sand rusted surfaces clean with 180 grit paper. Replace disc cover, and flywheel if corrosion is severe.
CLUTCH DISC FACING STICKS TO FLYWHEEL	1. Vacuum may form in pockets over rivet heads in clutch disc. Occurs as clutch cools down after use.	1. Drill 1/16 inch diameter hole through rivets and scuff sand disc facing with 180 grit paper.
CLUTCH DISC TOO THICK	1. Wrong disc installed.	1. Replace disc.
PILOT BEARING SEIZED, LOOSE, OR ROLLERS ARE WORN	1. Bearing cocked during installation. Bearing defective. Bearing not lubricated. Clutch misalignment.	1. Lubricate and install new bearing. Check and correct any misalignment.
CLUTCH WILL NOT DISENGAGE PROPERLY	1. Low clutch fluid level.	1. Top off reservoir and check for leaks.
	2. Clutch cover loose.	2. Tighten bolts.
	3. Wrong clutch disc.	3. Install correct disc.
	4. Disc bent, distorted during installation.	4. Replace disc.
	5. Clutch cover diaphragm spring bent or warped during transmission installation.	5. Replace cover.
	6. Clutch disc installed backwards.	6. Remove and reinstall disc correctly. Be sure disc side marked "to flywheel" is actually toward flywheel.
	7. Release fork bent or fork pivot is loose or damaged.	7. Replace fork and pivot if worn or damaged.
	8. Clutch master or slave cylinder fault.	8. Replace master and slave cylinder as assembly.

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CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC FACING COVERED WITH OIL, GREASE, OR CLUTCH FLUID	1. Oil leak at rear main or input shaft seal. 2. Too much grease applied to splines or disc and input shaft.	1. Correct leak and replace disc (do not clean and reuse the disc). 2. Apply lighter grease coating to splines and replace disc (do not clean and reuse the disc).
CLUTCH DISC AND/OR COVER WARPED, OR DISC FACINGS EXHIBIT UNUSUAL WRONG TYPE	1. Incorrect or substandard parts.	1. Replace disc and/or cover with correct parts.
CLUTCH MASTER OR SLAVE CYLINDER PLUNGER DRAGGING-BINDING	1. Master or slave cylinder components worn or corroded.	1. Replace both cylinders as assembly (and reservoir).
NO FAULT FOUND WITH CLUTCH COMPONENTS	1. Problem actually related to suspension or driveline component. 2. Engine related problem.	1. Further diagnosis required. Check engine/transmission mounts, propeller shafts and U-joints, tires, suspension attaching parts and other driveline components as needed. 2. Check EFI and ignition systems.
PARTIAL ENGAGEMENT OF CLUTCH DISC (ONE SIDE WORN-OPPOSITE SIDE GLAZED AND LIGHTLY WORN)	1. Clutch pressure plate position setting incorrect or modified. 2. Clutch cover, spring, or release fingers bent, distorted (rough handling, improper assembly). 3. Clutch disc damaged or distorted. 4. Clutch misalignment.	1. Replace clutch cover and disc. 2. Replace clutch cover and disc. 3. Replace disc. 4. Check alignment and runout of flywheel, disc, or cover and/or clutch housing. Correct as necessary.

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CONDITION	POSSIBLE CAUSE	CORRECTION
Clutch components damaged or worn out prematurely.	1. Incorrect or sub-standard clutch parts.	1. Replace with parts of correct type and quality.
Pilot bearing damaged.	1. Bearing cocked during installation. Bearing not lubricated prior to installation. Bearing defect. 2. Clutch misalignment.	1. Replace bearing. Be sure it is properly seated and lubricated before installing clutch. 2. Check and correct misalignment caused by excessive runout of flywheel, disc, cover or clutch housing. Replace input shaft if bearing hub is damaged.
Loose components.	1. Attaching bolts loose at flywheel, cover, or clutch housing.	1. Tighten bolts to specified torque. Replace any clutch bolts that are damaged.
Components appear overheated. Hub of disc cracked or torsion damper springs are distorted or broken.	1. Frequent high load, full throttle operation.	1. Replace parts as needed. Alert driver to condition causes.
Contact surface of release bearing damaged.	1. Clutch cover incorrect, or release fingers are bent or distorted causing damage. 2. Release bearing defect. 3. Release bearing misaligned.	1. Replace clutch cover and bearing. 2. Replace bearing. 3. Check and correct runout of clutch components. Check front bearing retainer sleeve surface. Replace if damaged.
Release bearing is noisy.	1. Release bearing defect.	1. Replace bearing.
Clutch pedal squeak.	1. Pivot pin loose. Pedal bushings worn out or cracked.	1. Tighten pivot pin. Replace bushings if worn or damaged. Lubricate pin and bushings with silicone base lubricator chassis grease.

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CLUTCH SERVICE

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CLUTCH COVER AND DISC REMOVAL

(1) Raise vehicle.

(2) Remove transmission and clutch housing as assembly (Fig. 2). Refer to Group 21 for procedures.

(3) If clutch cover will be reused, mark position of cover on flywheel with scriber, chalk, or center punch (Fig. 2).

(4) Loosen clutch cover bolts evenly and in rotation to relieve spring tension. Loosen bolts a few threads at a time only to avoid warping cover. This is especially important if cover will be reused.

(5) Remove cover bolts and remove cover and disc.

CLUTCH COVER AND DISC INSTALLATION

(1) Reduce minor scratches or surface glazing on flywheel face with 120/180 grit emery cloth. Clean flywheel surface with Mopar brake cleaner or wax and grease remover afterward.

(2) Check runout and free operation of new clutch disc.

(a) Install disc on transmission input shaft splines. Be sure disc slides freely on splines. Leave disc on splines for runout check.

(b) Measure disc runout with dial indicator. Position indicator plunger about 6 mm (1/4 in.) from outer edge of disc facing.

(c) Rotate input shaft and note indicator reading. Disc runout should not exceed 0.5 mm (0.020 inch). Obtain another disc if runout exceeds this limit.

(3) Lubricate crankshaft pilot bearing with Mopar high temperature grease, or equivalent.

(4) Insert clutch alignment tool in disc and position disc on flywheel.

(5) Verify that disc hub is positioned correctly. Side of hub marked “Flywheel Side” should face flywheel (Fig. 2).

(6) Insert alignment tool or spare input shaft in pilot bushing and position disc on flywheel (Fig. 3).

(7) Position clutch cover over disc and on flywheel. Verify that disc and cover are aligned before proceeding.

(8) Install and tighten clutch cover bolts until snug but not to specified torque.

(9) Tighten clutch cover bolts to 52 N·m (38 ft. lbs.)

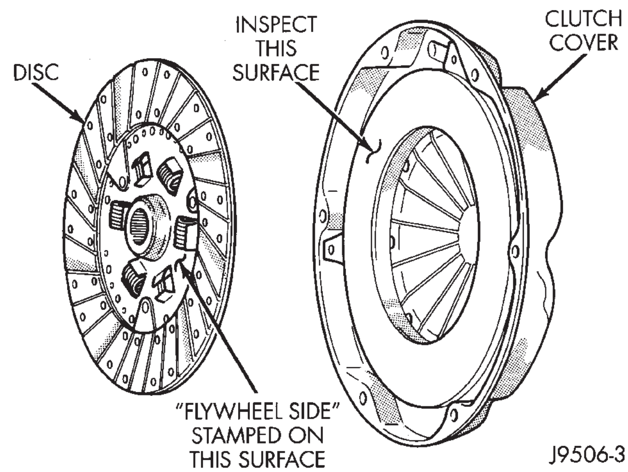

Fig. 2 Clutch Disc Position

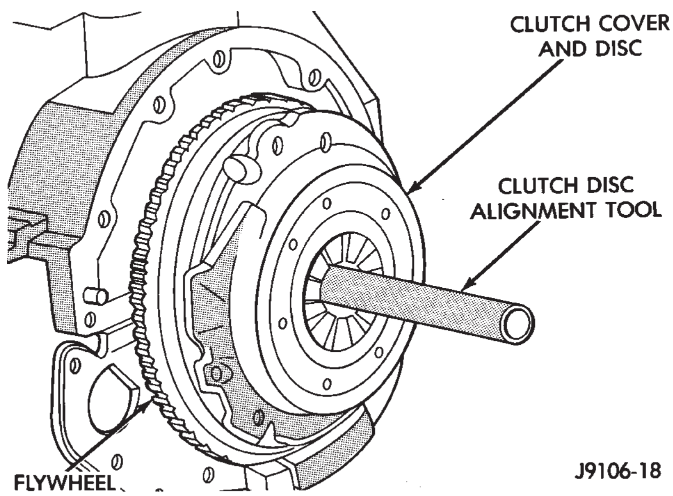

Fig. 3 Clutch Disc Alignment

CAUTION: Tighten the clutch cover bolts evenly in a star pattern to avoid distorting the cover.

(10) Apply light coating of Mopar high temp grease to input shaft splines and to release bearing slide surface of front bearing retainer. **Do not overlubricate shaft splines. This could result in grease contamination of disc.**

(11) Install transmission-clutch housing assembly. Refer to Figure 4 for attaching bolt torques.

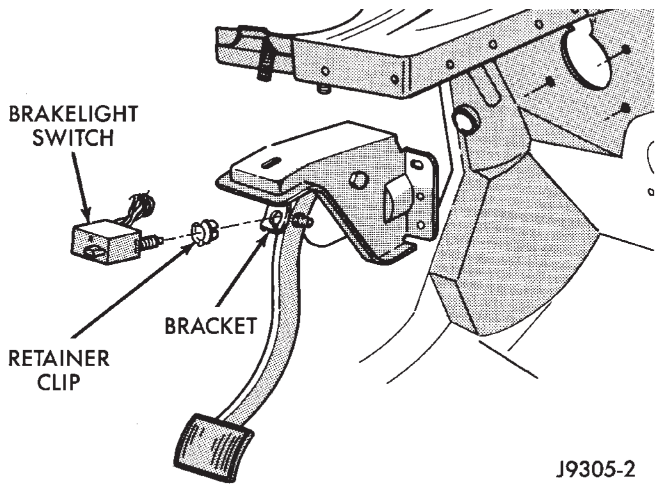

Fig. 4 Transmission/Clutch Housing Installation

CLUTCH HOUSING REMOVAL

(1) Raise vehicle and remove transmission and clutch housing as assembly.

(2) Remove release bearing, release lever, boot, and lever ball stud from clutch housing (Fig. 5).

(3) Remove clutch housing attaching bolts and remove housing from transmission (Fig. 5).

CLUTCH HOUSING INSTALLATION

(1) Clean housing mounting surface of engine block with solvent.

(2) Check alignment dowels in engine block. Be sure dowels are in good condition and properly seated.

(3) Lubricate release bearing bore, release lever and pivot ball contact surfaces with Mopar high temperature grease.

(4) Transfer pivot ball stud, release lever, boot, and release bearing to new housing.

(5) Clean transmission and clutch housing mounting faces with solvent. Be sure all dirt, grease, oil are removed completely. Surfaces must be clean to ensure proper seating and avoid housing misalignment.

(6) Align and install clutch housing on transmission. Tighten housing bolts to 33-43 N·m (24-32 ft. lbs.) torque.

(7) Install transmission as described in Group 21. Install transmission-to-engine struts **after** clutch housing has been installed. Tighten bolts attaching struts to clutch housing first and strut-to-engine bolts last.

RELEASE BEARING REPLACEMENT

(1) Remove transmission and clutch housing as an assembly.

(2) Disconnect release bearing from lever and remove bearing (Fig. 5).

(3) Inspect bearing slide surface of transmission front bearing retainer. Replace retainer if slide surface is scored, worn, or cracked.

(4) Inspect release lever and lever pivot ball stud. Be sure pivot is secure and in good condition. Be sure lever is not distorted or worn. Replace release lever retainer spring if bent or damaged in any way.

(5) Lightly lubricate contact/pivot points of following parts with Mopar high temperature grease:

- crankshaft pilot bearing
- transmission input shaft splines

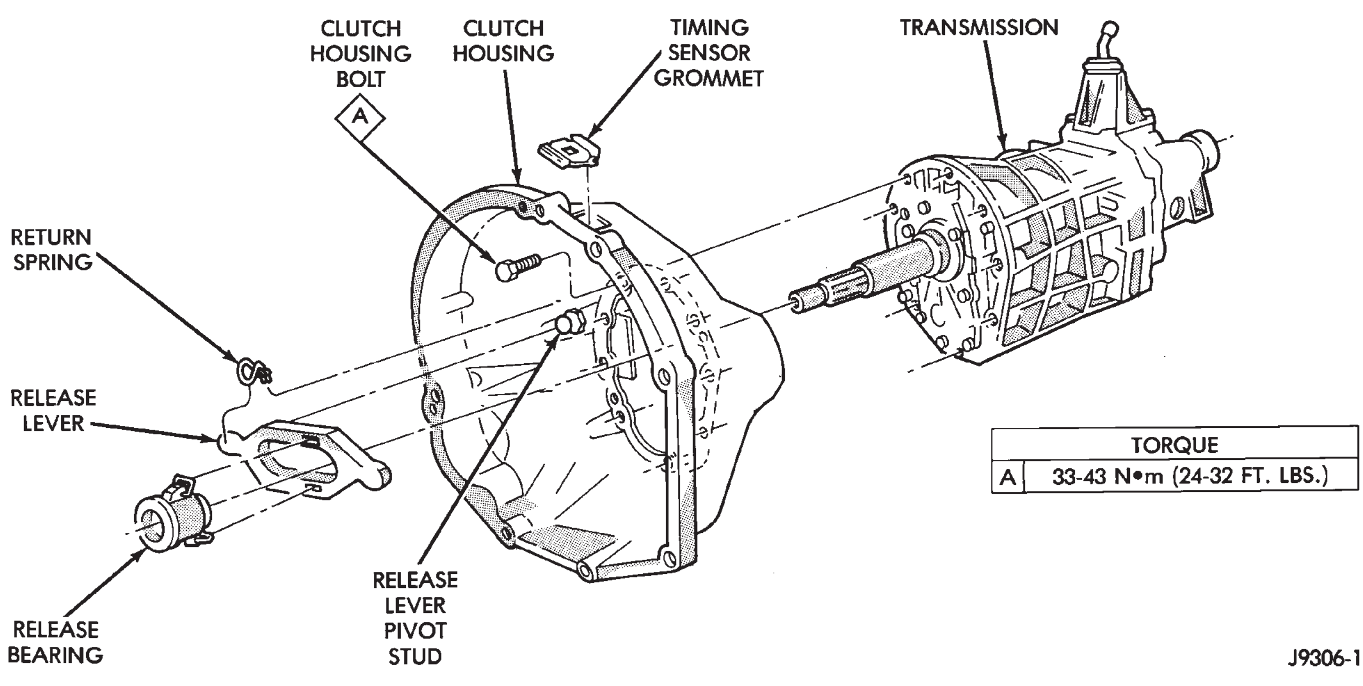

Fig. 5 Clutch Housing And Release Bearing Attachment

- transmission bearing retainer slide surface
- release lever
- release lever pivot stud

(6) Install release lever and new release bearing. Be sure lever and bearing are properly secured.

(7) Install transmission and clutch housing as assembly.

PILOT BEARING REPLACEMENT

(1) Remove transmission and clutch housing.

(2) Remove clutch cover and disc.

(3) Remove pilot bearing. Use blind hole puller tools such as those included in Snap-On set CG40CB to remove bearing.

(4) Clean bearing bore with solvent and wipe dry with shop towel.

(5) Lubricate new pilot bearing with Mopar high temperature grease.

(6) Position and start new bearing in bearing bore by hand. **Note that pilot bearing has seal at one end. Install bearing so seal is facing out and toward transmission.**

(7) Seat pilot bearing with clutch alignment tool (Fig. 6). **Keep bearing straight during installation. Do not allow bearing to become cocked. Tap bearing into place until flush with edge of bearing bore. Do not recess bearing.**

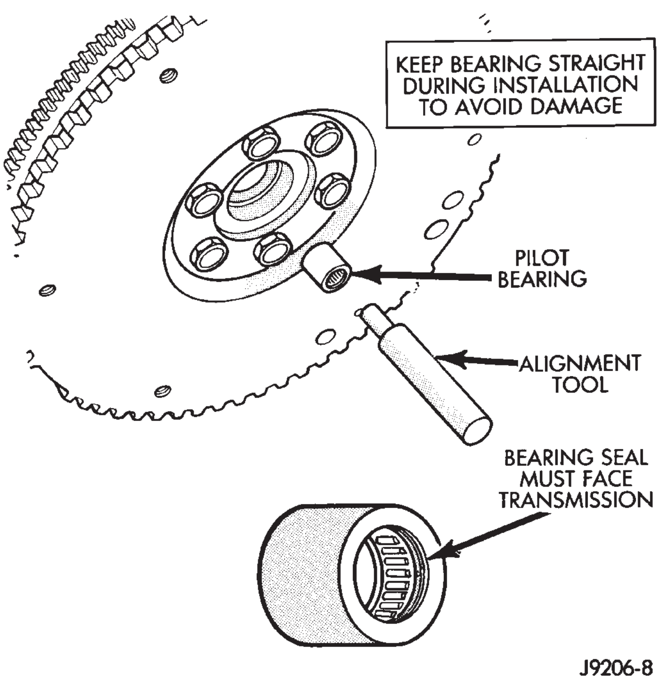

Fig. 6 Pilot Bearing Installation

(8) Install clutch cover and disc.

(9) Install clutch housing and transmission as assembly.

(10) Install transfer case, propeller shafts, wire harnesses, vacuum hoses, crossmembers, shift linkage and remaining components removed during service.

CLUTCH HYDRAULIC LINKAGE REMOVAL

The clutch master cylinder and pedal position switch, remote reservoir, slave cylinder, and connecting lines are only available as a complete assembly. The linkage components cannot be overhauled or serviced separately. The cylinders and connecting lines are sealed units.

(1) Raise vehicle.

(2) Remove nuts attaching slave cylinder to clutch housing.

(3) Remove slave cylinder and clip from housing.

(4) Disengage hydraulic fluid line from body clips.

(5) Lower vehicle.

(6) Remove retaining ring, flat washer and wave washer that attach clutch master cylinder push rod to clutch pedal (Fig. 7).

(7) Disconnect clutch pedal position switch wires. Then slide clutch master cylinder piston rod off clutch pedal pin.

(8) Inspect condition of bushing on clutch pedal pin. Remove and replace bushing if worn or damaged.

(9) Verify that cap on clutch master cylinder reservoir is tight. This is necessary to avoid undue spillage during removal.

(10) Remove screws attaching clutch fluid reservoir to dash panel.

(11) Remove nuts attaching clutch master cylinder to stud nuts (Fig. 7).

(12) Remove both clutch cylinders, reservoir and connecting line from vehicle.

CLUTCH HYDRAULIC LINKAGE INSTALLATION

(1) Tighten cap on clutch fluid reservoir to avoid spillage during installation.

(2) Position cylinders, connecting lines and reservoir in vehicle.

(3) Install clutch master cylinder on mounting studs extending through dash panel (Fig. 7). Tighten attaching nuts to 23-34 N·m (200-300 in. lbs.) torque.

(4) Position reservoir on dash panel and install reservoir screws. Tighten screws to 5 N·m (40 in. lbs.) torque.

(5) Install replacement bushing on clutch pedal pin if necessary.

(6) Install clutch master cylinder push rod on clutch pedal pin. Secure rod with wave washer, flat washer and retainer ring.

(7) Connect clutch pedal position switch wires.

(8) Raise vehicle.

(9) Insert slave cylinder push rod through clutch housing opening and into release lever. Be sure cap on end of rod is securely engaged in lever. Check this before installing cylinder attaching nuts.

(10) Install and tighten slave cylinder attaching nuts to 23-34 N·m (200-300 in. lbs.) torque.

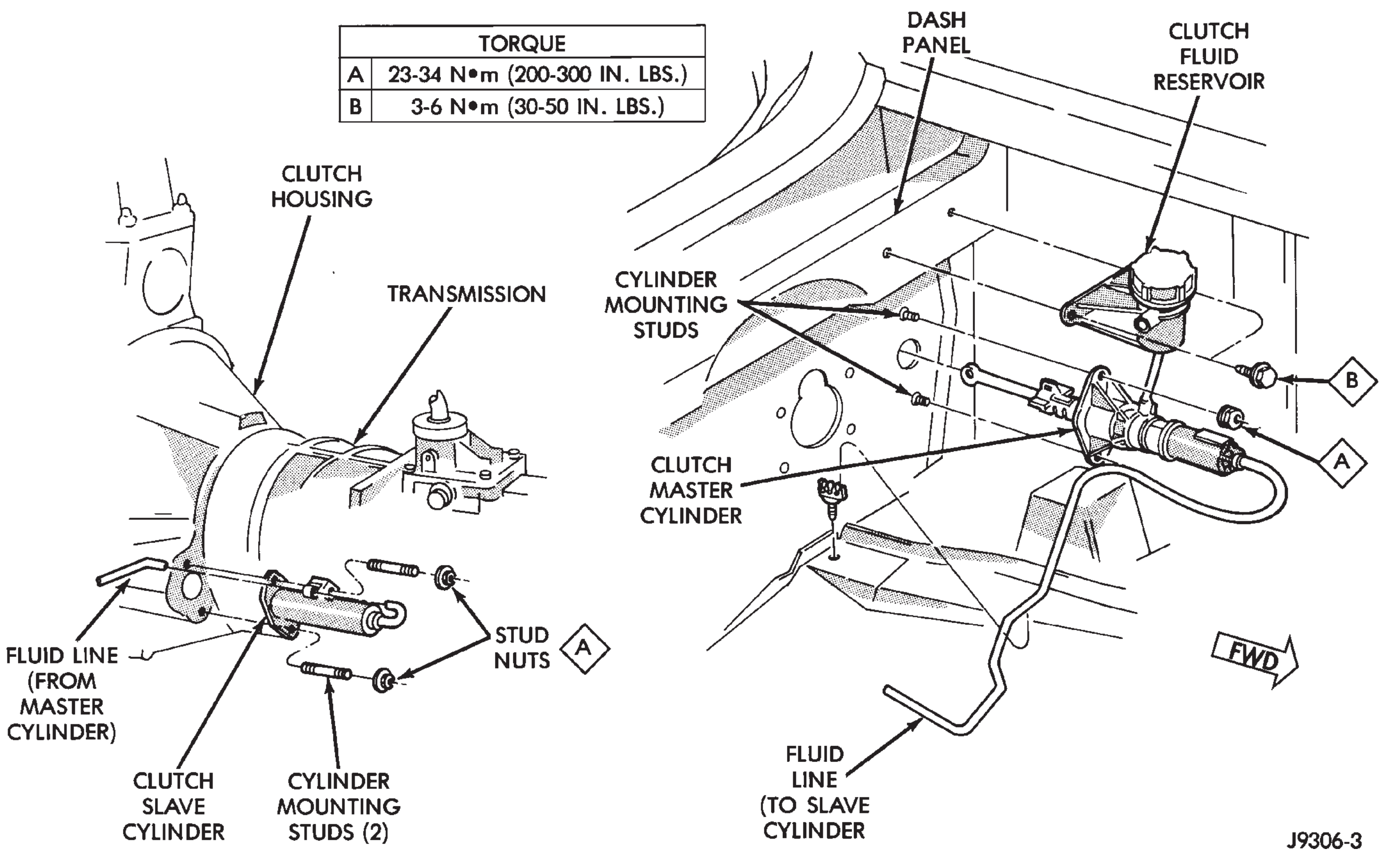

Fig. 7 Clutch Hydraulic Linkage Components

(11) Insert clutch fluid line in body clips and lower vehicle.

CLUTCH PEDAL REMOVAL

(1) Disconnect clutch pedal position switch wires.

(2) Remove retaining ring, flat washer and wave washer that secure clutch master cylinder push rod to clutch pedal pin (Fig. 8).

(3) Remove fastener that secures pedal shaft to pedal support.

(4) Slide pedal shaft out left side of pedal support and out of clutch pedal.

(5) Slide push rod off clutch pedal pin and remove clutch pedal.

(6) Remove and inspect bushings in clutch pedal shaft bore and on bushing on pedal pin. Replace any bushing that is worn or damaged.

CLUTCH PEDAL INSTALLATION

(1) Lubricate pedal shaft, pedal shaft bore and all bushings with generous quantity of Mopar multi-mileage, or high temp grease.

(2) Insert pedal pin into cylinder push rod. Then position clutch pedal in support.

(3) Slide pedal shaft through clutch pedal bore and bushings.

(4) Install bolt that retains pedal shaft in support.

(5) Secure push rod to pedal pin with wave washer, flat washer and retaining ring.

(6) Connect clutch pedal position switch wires.

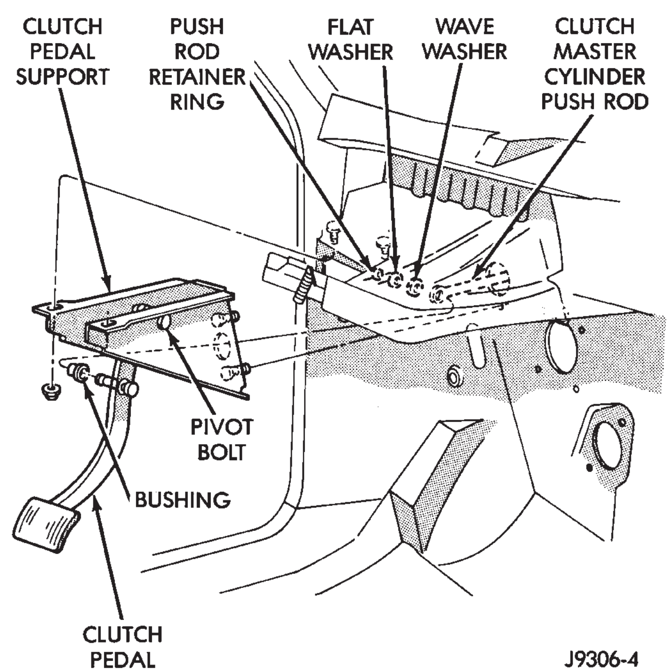

Fig. 8 Clutch Pedal Mounting

FLYWHEEL SERVICE

Inspect the flywheel whenever the clutch disc, cover and housing are removed for service. Check condition of the flywheel face, hub, ring gear teeth, and flywheel bolts.

Minor scratches, burrs, or glazing on the flywheel face can be scuff sanded with 120/180 grit emery cloth. However, the flywheel should be replaced if the disc contact surface is severely scored, heat checked, cracked, or obviously worn.

Cleanup of minor flywheel scoring should be performed with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in. maximum).

Heavy stock removal from the flywheel face is not recommended. Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation. It can also weaken the flywheel and interfere with proper clutch release.

Check flywheel runout if misalignment is suspected. Runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the dial indicator on a stud installed in place of one of the flywheel attaching bolts.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout.

Check condition of the flywheel hub and attaching bolts. Replace the flywheel if the hub exhibits cracks in the area of the attaching bolt holes.

Install new attaching bolts whenever the flywheel is replaced and use Mopar Lock N' Seal, or Loctite 242 on replacement bolt threads.

Recommended flywheel bolt torque is 142 N·m (105 ft. lbs.).

STARTER RING GEAR SERVICE

Inspect the teeth on the starter ring gear. **If the teeth are worn or damaged, the flywheel should be replaced as an assembly. This is the recommended and preferred method of repair.**

In cases where a new flywheel is not readily available, a replacement ring gear can be installed. However, the following precautions must be observed to avoid damaging the flywheel and replacement gear.

Ring Gear Replacement

(1) Mark position of the old gear for alignment reference on the flywheel. Use a scriber for this purpose.

(2) Wear protective goggles or approved safety glasses. Also wear heat resistent gloves when handling a heated ring gear.

(3) Remove the old gear by cutting most of the way through it (at one point) with an abrasive cut-off wheel. Then complete removal with a cold chisel or punch.

(4) The ring gear is a shrink fit on the flywheel. This means the gear must be expanded by heating in order to install it. **The method of heating and expanding the gear is extremely important.** Every surface of the gear must be heated at the same time to produce uniform expansion. An oven or similar enclosed heating device must be used. Temperature required for uniform expansion is 325-350° F. Heating time is approximately 30 minutes.

CAUTION: Never use an oxy/acetylene torch to remove the old gear, or to heat and expand a new gear. The high temperature of the torch flame will cause localized heating and damage the flywheel. In addition, using the torch to heat a replacement gear will cause uneven heating and expansion. The torch flame will also anneal the gear teeth resulting in rapid wear and damage after installation.

(5) The heated gear must be installed evenly to avoid misalignment or distortion. A shop press and suitable press plates should be used to install the gear if at all possible.

(6) Be sure to wear eye and hand protection. Heat resistent gloves and safety goggles are needed for personal safety. Use metal tongs, vise grips, or similar tools to handle the hot gear during installation.

(7) Allow the flywheel and ring gear to cool down before installation. Set the assembly on a workbench and let it cool in normal shop air.

CAUTION: Never use water, or compressed air to cool the new ring gear. The rapid cooling produced by water or compressed air can distort, or crack the ring gear and flywheel.

COOLING SYSTEM

CONTENTS

GENERAL INFORMATION

Throughout this group, references are made to particular vehicle models by alphabetical designation or by the particular vehicle nameplate. A chart showing a breakdown of alphabetical designations is included in the Introduction section at the beginning of this manual.

COOLING SYSTEM

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

An optional factory installed maximum duty cooling package is available on most models. This package will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures.

COOLING SYSTEM COMPONENTS

The cooling system consists of:
- A radiator
- Cooling fan
- Thermal viscous fan drive
- Fan shroud
- Radiator pressure cap

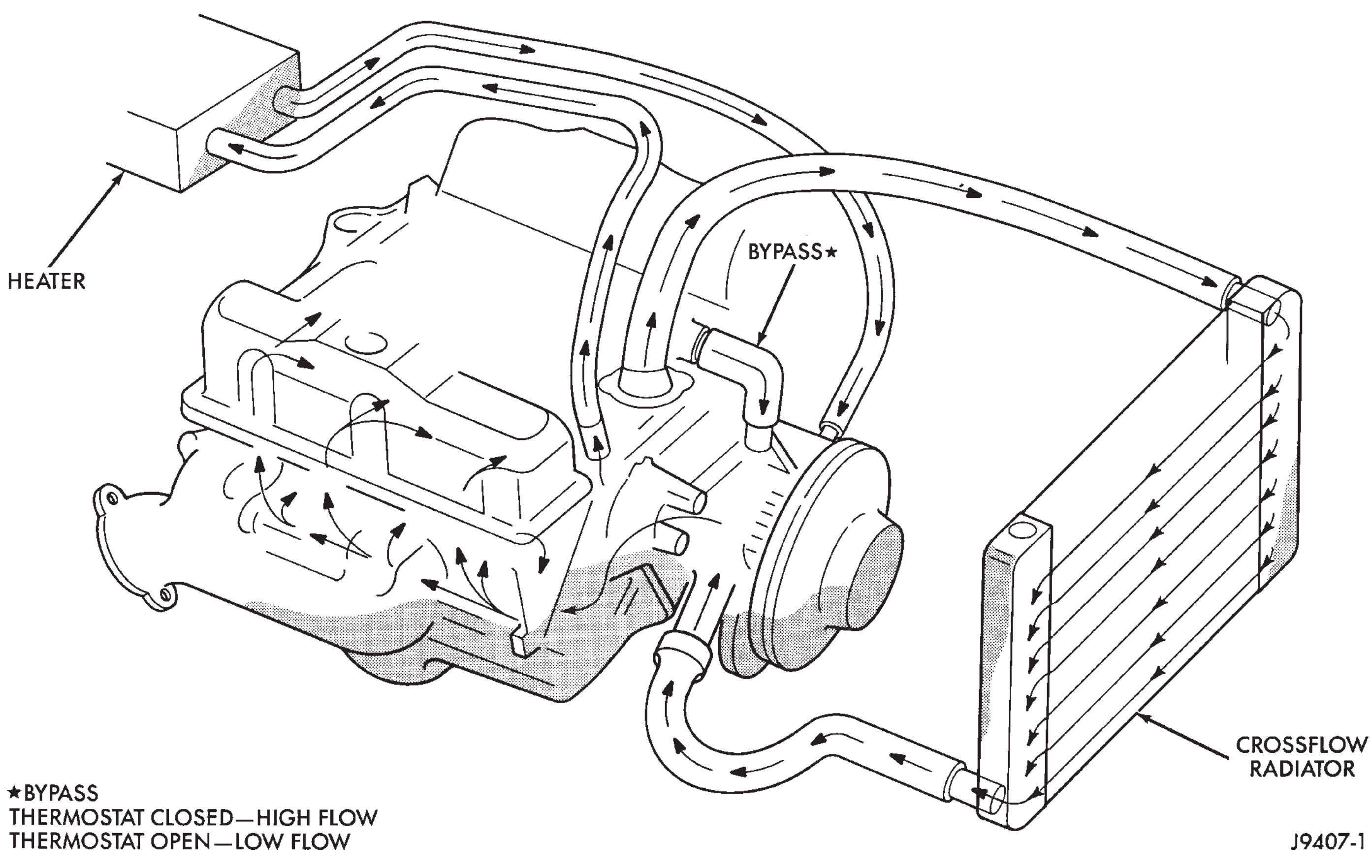

Fig. 2 Engine Cooling System—5.2L Engine—Typical

- Thermostat
- Coolant reserve/overflow system
- Transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps

SYSTEM COOLANT ROUTING

For cooling system routings refer to (Figs. 1 or 2).

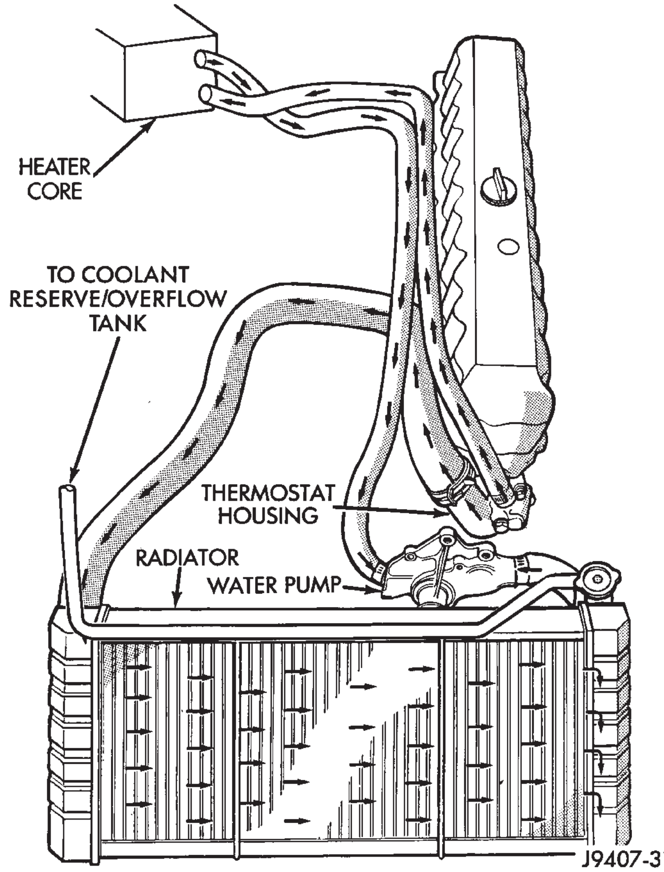

Fig. 1 Engine Cooling System—4.0L Engine—Typical

DIAGNOSIS

INDEX

ON-BOARD DIAGNOSTICS (OBD)

FOR CERTAIN COOLING SYSTEM COMPONENTS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

• If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) number 17 can be observed at the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 3).

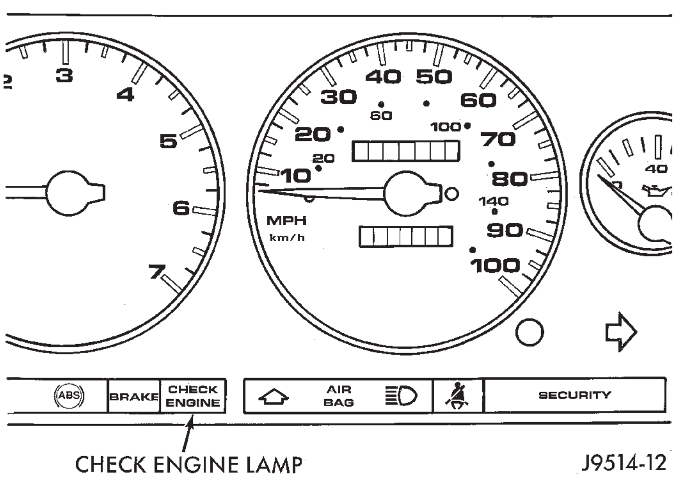

Fig. 3 Check Engine Lamp Location

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. If the problem is repaired or ceases to exist, the PCM cancels the DTC after 51 engine starts.

Certain criteria must be met for a DTC to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine temperature and/or input voltage to the PCM.

A DTC indicates that the PCM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

It is possible that a DTC for a monitored circuit may not be entered into memory even though a malfunction has occurred. Refer to On-Board Diagnostics (OBD) in Group 14, Fuel Systems for additional information.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored Diagnostic Trouble Code (DTC) can be displayed by cycling the ignition key On-Off-On-Off-On within three seconds and observing the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 3).

They can also be displayed through the use of the Diagnostic Readout Box (DRB) scan tool. The DRB connects to the data link connector in the engine compartment (Fig. 4). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.

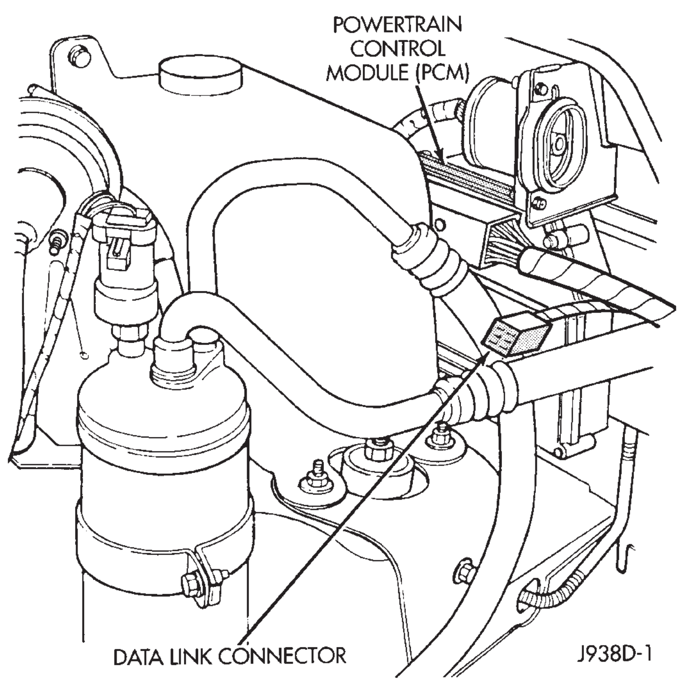

Fig. 4 Data Link Connector Location—Typical

EXAMPLES:

• If the lamp (Fig. 3) flashes 1 time, pauses and flashes 2 more times, a flashing Diagnostic Trouble Code (DTC) number 12 is indicated. If this code is observed, it is indicating that the battery has been disconnected within the last 50 key-on cycles. It could also indicate that battery voltage has been disconnected to the PCM. In either case, other DTC's may have been erased.

• If the lamp flashes 1 time, pauses and flashes 7 more times, a flashing Diagnostic Trouble Code (DTC) number 17 is indicated.

After any stored DTC information has been observed, the display will end with a flashing DTC number 55. This will indicate the end of all stored information.

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause.

1. PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED, OR STEEP GRADES:

Driving techniques that avoid overheating are:

• Idle with A/C off when temperature gauge is at end of normal range.

• Increasing engine speed for more air flow is recommended.

2. TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

3. AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

4. RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

• Engine adjustments (incorrect timing)
• Slipping engine accessory drive belt(s)
• Brakes (possibly dragging)
• Changed parts (incorrect water pump rotating in wrong direction)
• Reconditioned radiator or cooling system refilling (possibly under-filled or air trapped in system).
• Rubber and foam air seals not properly installed to radiator or A/C condenser after a repair.
• Upper and lower portions of radiator fan shroud not tightly connected. All air must flow through the radiator.

If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.

These charts are to be used as a quick-reference only. Refer to the group text for information.

COOLING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) number 17 been set indicating a stuck open engine thermostat?	1. Refer to On-Board Diagnostics in the service manual text. Replace thermostat if necessary. If a Diagnostic Trouble Code (DTC) number 17 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 engine temperature sensor connector in the engine compartment. 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 in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant reserve/overflow tank and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and precautions before removing the radiator cap.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. Refer to Group 24, Heating and Air Conditioning for procedures.
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to 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 normal range, determine the cause for overheating and repair. Refer to POSSIBLE CAUSES (numbers 2 through 20).
	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 coolant reserve/overflow tank and radiator?	4. Check for coolant leaks and repair as necessary. Refer to Testing Cooling System For Leaks in this group.
	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.
	6. Poor seals at radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary. (b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.

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COOLING SYSTEM DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM COOLING SYSTEM - CONT.	7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools. As the engine cools, a vacuum is formed in the cooling system of the engine and radiator. If radiator cap seals are defective, or cooling system has leaks, a vacuum can not be formed.	7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this group. Replace cap if necessary. (b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator. (c) Check the condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary. (d) Check coolant reserve/overflow tank and tank hoses for blockage. Repair as necessary.
	8. Freeze point of antifreeze not correct. Mixture may be too rich.	8. Check antifreeze. Refer to Coolant section of this group. Adjust antifreeze-to-water ratio as required.
	9. Coolant not flowing through system.	9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. 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 insects or debris. Refer to Radiator Cleaning in this group.
	11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
	12. Aftermarket A/C installed without proper radiator.	12. Install proper radiator.
	13. Fuel or ignition system problems.	13. Refer to Fuel and Ignition System groups for diagnosis. Also refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.
	14. Dragging brakes.	14. Check and correct as necessary. Refer to Group 5, Brakes in the manual text.
	15. Bug screen is being used reducing airflow.	15. Remove bug screen.
	16. Thermostat partially or completely shut. This is more prevalent on high mileage vehicles.	16. Check thermostat operation and replace as necessary. Refer to Thermostats in this group.
	17. Thermal viscous fan drive not operating properly.	17. Check fan drive operation and replace if necessary. Refer to Viscous Fan Drive in this group.
	18. Cylinder head gasket leaking.	18. Check for cylinder head gasket leaks. Refer to Testing Cooling System For Leaks in this group. For repair, refer to Group 9, Engines.
	19. Heater core leaking.	19. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.

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COOLING SYSTEM DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly.	1. A normal condition. No correction is necessary.
	2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair if necessary. Refer to Group 8E, Instrument Panel And Gauges.
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).	3. A normal condition. No correction is necessary. Gauge reading should return to normal range after vehicle is driven.
	4. Gauge reading high after re-starting a warmed-up (hot) engine.	4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. Refer to Testing Cooling System For Leaks in this group.
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing thermostat to open late.	6. (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.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. Refer to Water Pumps in this group.
	8. Loose accessory drive belt (water pump slipping).	8. Refer to Engine Accessory Drive Belts in this group. Check and correct as necessary.
	9. Air leak on the suction side of water pump allows air to build up in cooling system causing thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. Refer to Radiator Caps in this group. Replace cap 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 group.

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COOLING SYSTEM DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSES	CORRECTION
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating. 2. Freeze point of antifreeze not correct. Mixture is too rich or too lean.	1. Check reason for overheating and repair as necessary. 2. Check antifreeze. Refer to the Coolant section of this group. Adjust antifreeze-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 reserve/overflow system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this group. Replace if necessary. (b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary. (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
NOISY FAN	1. Fan blades loose. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Thermal viscous fan drive has defective bearing. 5. A certain amount of fan noise (roaring) may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal.	1. Replace fan blade assembly. Refer to Cooling System Fans in this group. 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. 4. Replace fan drive. Bearing is not serviceable. Refer to Viscous Fan Drive in this group. 5. Refer to Viscous Fan Drive in this group for an explanation of normal fan noise.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or A/C condenser is restricted, obstructed or dirty (insects, leaves etc.). 2. Thermal viscous fan drive is free-wheeling. 3. Engine is overheating (heat may be transferred from radiator to A/C condenser. High underhood temperatures due to engine overheating may also transfer heat to A/C components). 4. Some models with certain engines are equipped with air seals at the radiator and/or A/C condenser. If these seals are missing or damaged, not enough air flow will be pulled through the radiator and A/C condenser.	1. Remove restriction and/or clean as necessary. Refer to Radiator Cleaning in this group. 2. Refer to Viscous Fan Drive for diagnosis. Repair as necessary. 3. Correct overheating condition. Refer to text in Group 7, Cooling. 4. Check for missing or damaged air seals and repair as necessary.

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COOLING SYSTEM DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION	1. Has a diagnostic trouble code (DTC) number 17 been set?	1. Refer to On-Board Diagnostics in the manual text and replace thermostat if necessary.
	2. Coolant level low.	2. Refer to Testing Cooling System For Leaks in the manual text. 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. Some models with certain engines are equipped with a water control valve located on one of the heater hoses. This valve may be defective.	5. Refer to Group 24, Heating and Air Conditioning for diagnosis. Repair as necessary.
	6. Water pump is not pumping water to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly. The accessory drive belt may also be slipping causing poor water pump operation.	6. Refer to Water Pumps in this group. Repair as necessary. If a slipping belt is detected, refer to Engine Accessory Drive Belts in this group. Repair as necessary.
HEAT ODOR	1. Various heat shields are used at certain drive line 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 Diagnosis Charts. Repair as necessary.
	3. Is cooling fan operating correctly?	3. Refer to Cooling System Fan in this group 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 convertor to overheat.	5. Refer to the DRB scan tool and the appropriate Powertrain Diagnostic Procedures service manual. 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) number 17 been set?	1. Refer to On-Board Diagnostics in this group. DTC's may also be checked using the DRB scan tool. Refer to the proper Powertrain Diagnostics Procedures service manual for checking the thermostat using the DRB scan tool. Replace thermostat if necessary.

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COOLING SYSTEM DIAGNOSIS (CONT.)

Condition	Possible Causes	Correction
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND 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 contacts 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. Refer to Coolant in this group for antifreeze tests. Adjust antifreeze-to-water ratio as necessary.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/ OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank 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.

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SERVICE PROCEDURES

INDEX

WATER PUMPS—GENERAL INFORMATION

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt on all engines.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

CAUTION: All 4.0L 6-cylinder engines are equipped with a reverse (counterclockwise) rotating water pump and thermal viscous fan drive assembly. REVERSE is stamped or imprinted on the cover of the viscous fan drive and inner side of the fan. The letter R is stamped into the back of the water pump impeller (Fig. 1). Engines from previous model years, depending upon application, may have been equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump or viscous fan drive will cause engine over heating.

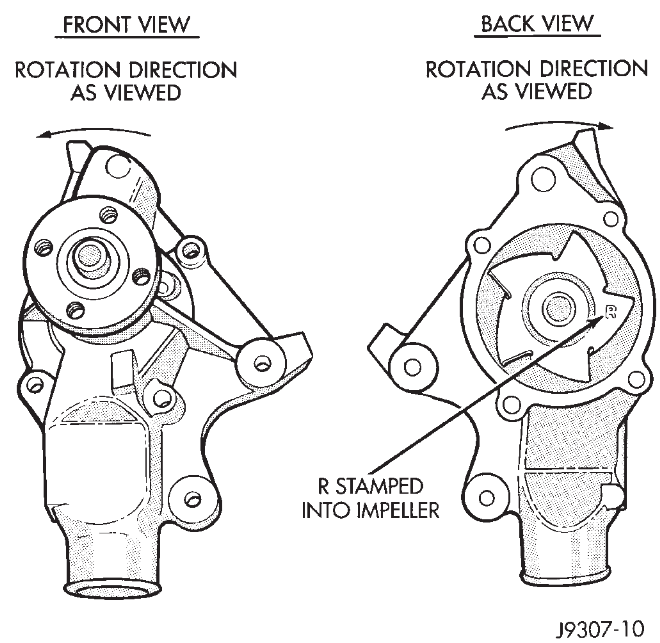

Fig. 1 Reverse Rotating Water Pump—4.0L 6-Cylinder

A quick test to determine if the pump is working is to check if the heater warms properly. A defective water pump will not be able to circulate heated coolant through the long heater hose to the heater core.

5.2L ENGINE: One of the heater hoses is connected to the water pump with a metal coolant return tube (Fig. 2). A rubber o-ring forms a seal at the water pump end of the tube.

WATER PUMP TESTS

LOOSE IMPELLER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) Drain the cooling system. Refer to Draining Cooling System in this group.

(2) Loosen the fan belt. Refer to Belt Service in the Engine Accessory Drive Belt section of this group.

(3) Disconnect the lower radiator hose from the water pump.

(4) Bend a stiff welding rod or similar device as shown in (Fig. 3). To prevent breakage of rod, minimum thickness should be 3/16 inch (.187 inches).

(5) Position the rod in the water pump inlet and attempt to hold the impeller while turning the fan pulley. If equipped with a thermal viscous fan drive, rotate the water pump shaft with a wrench attached to one of the fan pulley mounting nuts. If the impel-

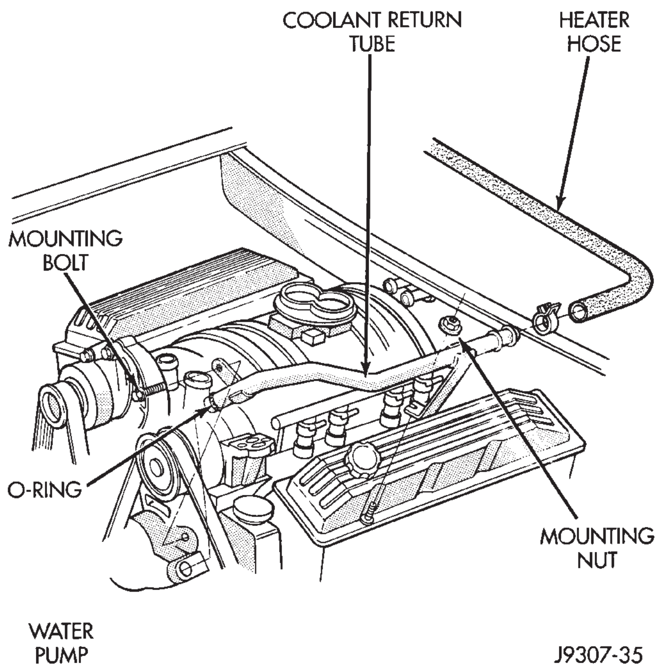

Fig. 2 Coolant Return Tube—5.2L V-8 Engine

ler is loose and can be held with the rod while the fan blades are turning, the pump is defective. Do not use excessive force when rotating pump shaft. If the impeller turns, the pump is OK.

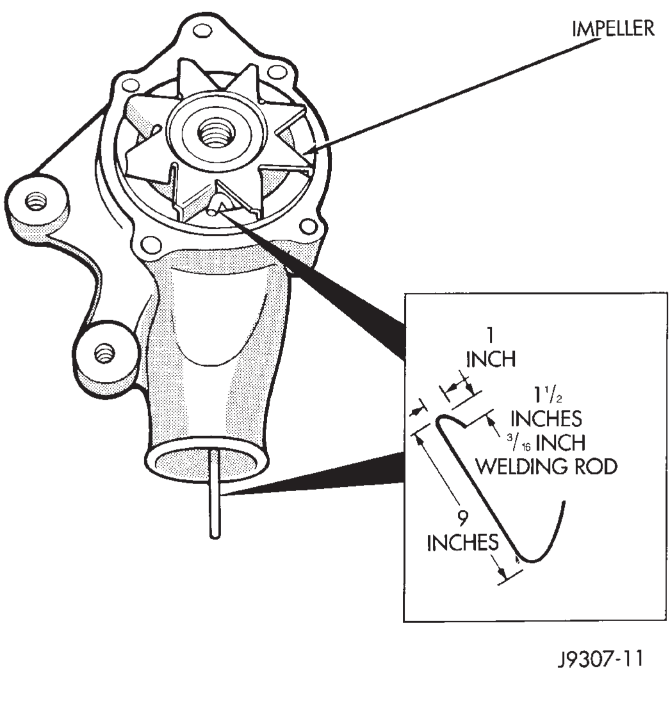

Fig. 3 Impeller Test—Typical

Connect the hose and install the coolant, or proceed with repairs.

INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the water pump heater hose inlet.

DO NOT WASTE reusable coolant. If solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) Drain sufficient coolant from the radiator to decrease the level below the water pump heater hose inlet.

(2) Remove the heater hose.

(3) Inspect the inlet for metal casting flash or other restrictions.

Remove the pump from the engine before removing restriction to prevent contamination of the coolant with debris. Refer to Water Pump Removal in this group.

WATER PUMPS—REMOVAL/INSTALLATION

REMOVAL—4.0L 6-CYL. ENGINE

The water pump on all models can be removed without discharging the air conditioning system (if equipped).

CAUTION: All 4.0L 6-cylinder engines have a reverse (counter-clockwise) rotating water pump. The letter R is stamped into the back of the water pump impeller (Fig. 1) to identify. Engines from previous model years, depending upon application, may be equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump will cause engine over heating.

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

WARNING: DO NOT REMOVE THE BLOCK DRAIN PLUG(S) OR LOOSEN RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

(1) Disconnect negative battery cable at battery.

(2) Drain the cooling system. Refer to Cooling System Draining in this group.

(3) Loosen (but do not remove at this time) the four fan hub-to-water pump pulley mounting nuts.

The engine accessory drive belt must be removed prior to removing the fan.

(4) Remove engine drive belt as follows:

(a) Loosen two rear power steering pump mounting bolts A (Fig. 4).

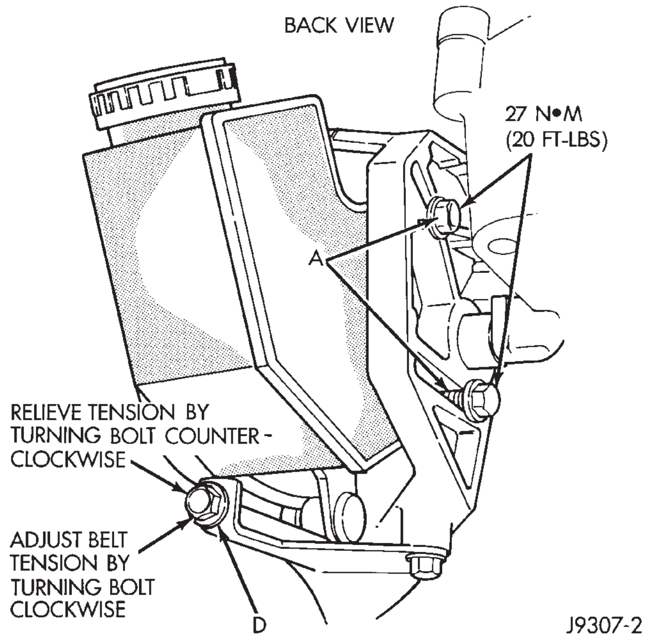

Fig. 4 P.S. Pump Rear Mounting Bolts—4.0L Engine

(b) Loosen upper pump pivot bolt B and lower lock nut C (Figs. 5 or 6).

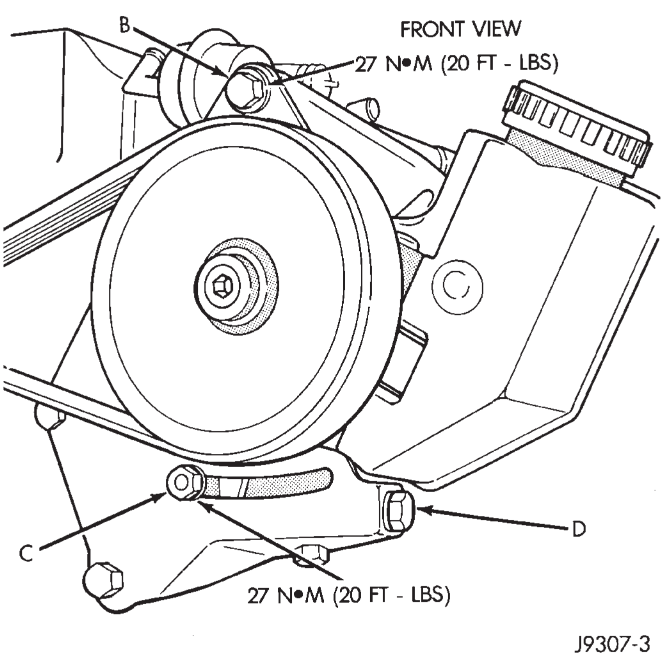

Fig. 5 P.S. Pump Front Mounting Bolt/Locknut—4.0L Engine

(c) Loosen pump adjusting bolt D (Fig. 4) until belt can be removed.

(d) Remove belt.

(5) Check condition of all pulleys.

(6) The power steering pump must be removed from its cast mounting bracket to gain access to bolt E. Bracket mounting bolt E is located behind the power steering pump (Fig. 6).

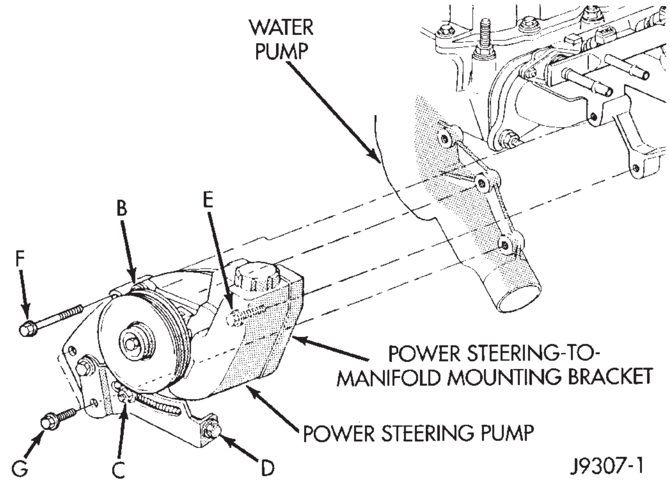

Fig. 6 Bracket Mounting Bolts—4.0L Engine

(7) Remove two bolts A (Fig. 4).

(8) Remove locknut C and belt adjustment bolt D (Figs. 5 or 6).

(9) Remove bolt B (Fig. 5). Position power steering pump to the side. Hold pump in position with wire. Do not disconnect hydraulic lines from pump.

(10) Remove bolts E, F and G (Fig. 6) and remove pump mounting bracket.

(11) Remove idler pulley mounting bolt and remove idler pulley. This must be done to gain clearance for the water pump mounted heater hose fitting when water pump is being removed.

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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (FIG. 7). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 8). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(12) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

(13) Remove the four fan hub-to-water pump pulley mounting nuts.

(14) Remove the two fan shroud-to-upper radiator crossmember attaching nuts (Fig. 9).

(15) Remove the fan assembly and fan shroud (together as one unit) from the vehicle.

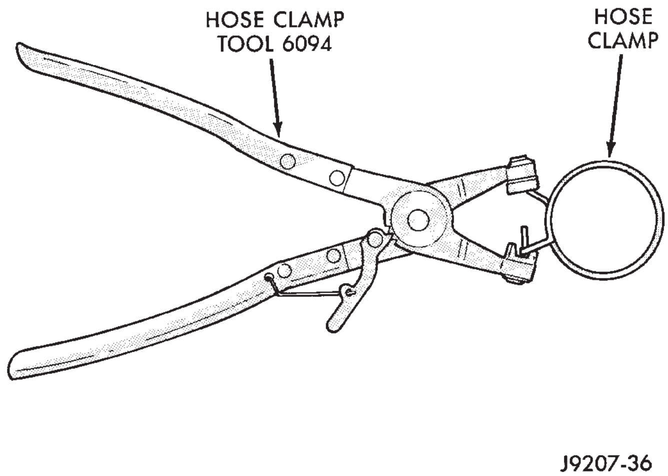

Fig. 7 Hose Clamp Tool—Typical

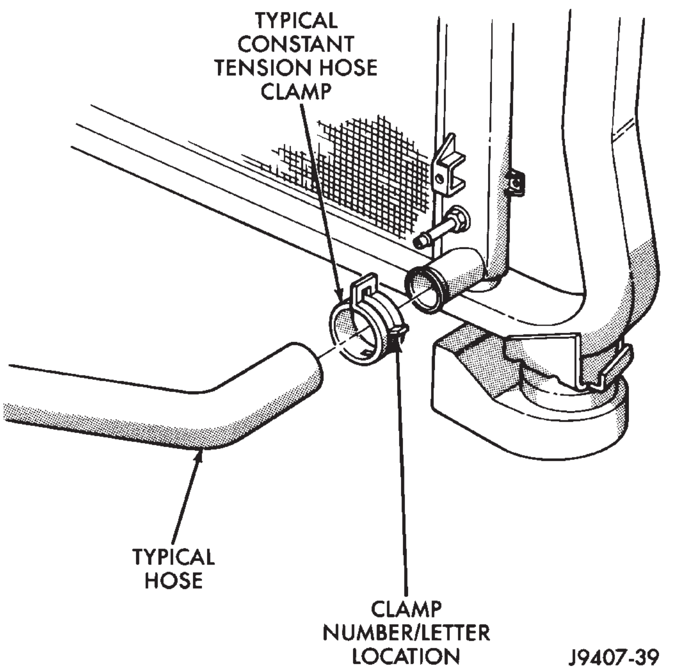

Fig. 8 Clamp Number/Letter Location

(16) Remove the four pump mounting bolts (Fig. 10) and remove pump from vehicle. Discard old gasket. Note that one of the four bolts is longer than the other bolts.

(17) If pump is to be replaced, the heater hose fitting must be removed. Note position of fitting before removal.

INSTALLATION—4.0L 6-CYL. ENGINE

(1) If pump is being replaced, install the heater hose fitting to the pump. Use a sealant on the fitting such as Mopar™ Thread Sealant With Teflon. Refer to the directions on the package.

(2) Clean the gasket mating surfaces. If the original pump is used, remove any deposits or other foreign material. Inspect the cylinder block and water pump mating surfaces for erosion or damage from cavitation.

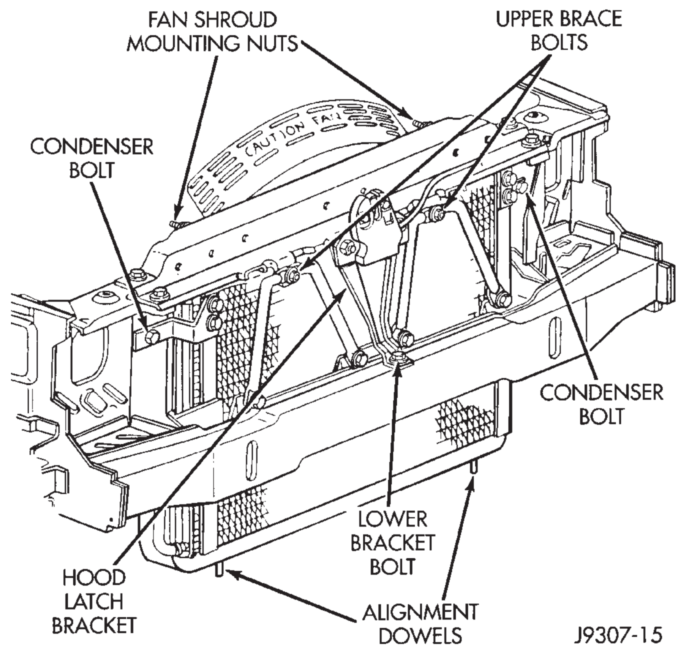

Fig. 9 Fan Shroud Mounting

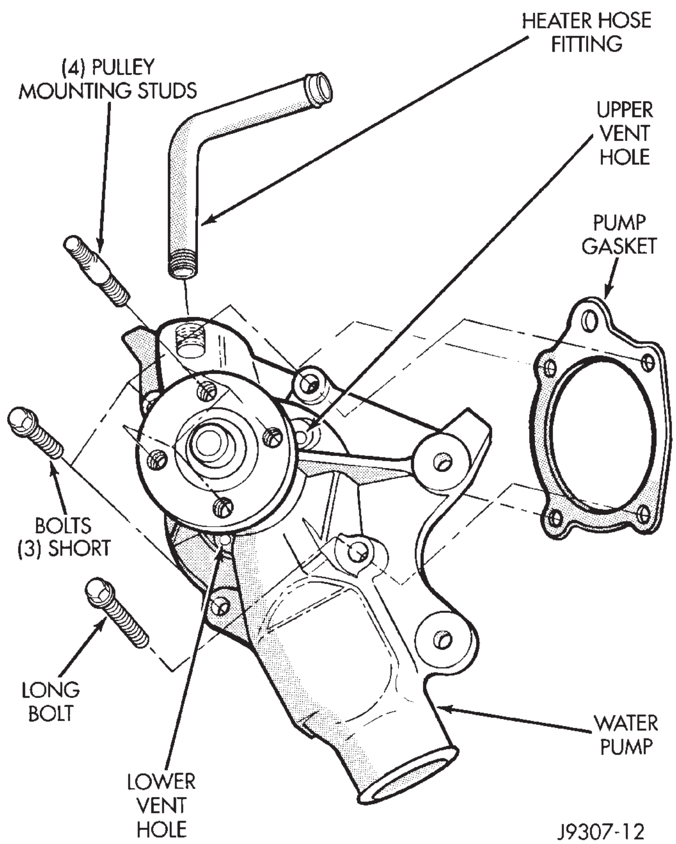

Fig. 10 Water Pump Remove/Install—4.0L 6-Cylinder Engine

(3) Install the gasket and water pump (the gasket is installed dry). Tighten mounting bolts to 30 N·m (22 ft. lbs.) torque. Rotate the shaft by hand to be sure it turns freely.

(4) Connect the radiator and heater hoses to the water pump.

(5) Position the fan assembly and fan shroud (together as one unit) to the engine.

(6) Position fan shroud to radiator. Be sure the alignment tabs at the lower part of shroud are placed into the slots near lower part of radiator. Install and tighten the two fan shroud mounting nuts.

(7) Install fan assembly to water pump hub. Tighten fan drive mounting nuts to 24 N·m (18 ft. lbs.) torque. Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(8) Position power steering pump bracket to engine. Install bolts E, F and G (Fig. 6). Tighten bolts F and G to 38 N·m (28 ft. lbs.) torque. Tighten bolt E to 27 N·m (20 ft. lbs.) torque.

(9) Position power steering pump to mounting bracket. Install pivot bolt B (Fig. 5) finger tight. Install locknut C and adjustment bolt D (Figs. 5 or 6) finger tight.

(10) Install two adjustment bolts A (Fig. 4) finger tight.

(11) Install idler pulley.

CAUTION: When installing the serpentine engine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. Refer to figure 11 for appropriate belt routing. Or, refer to the Belt Routing Label located in the engine compartment.

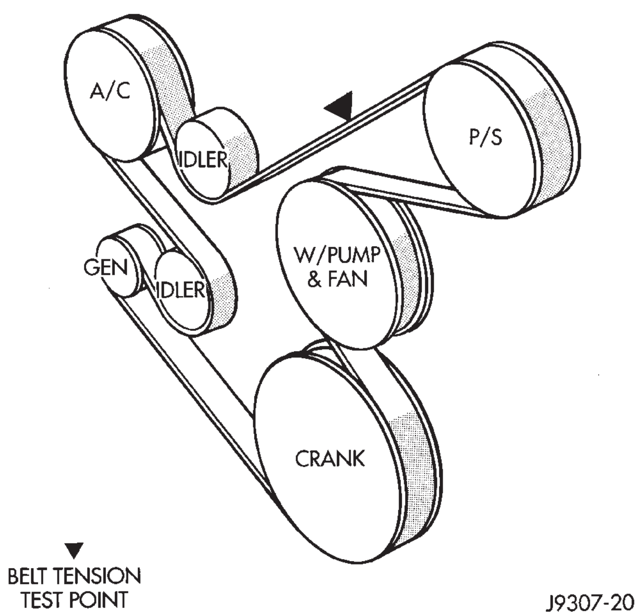

Fig. 11 Belt Routing—4.0L 6-Cylinder Engine

(12) Position drive belt to pulleys.

(13) Tighten belt adjustment bolt D (Fig. 4) to the proper tension. Refer to the Specifications section at the end of this group for belt tension.

(14) Tighten bolts A (Fig. 4) to 27 N·m (20 ft. lbs.) torque.

(15) Tighten pivot bolt B (Fig. 5) to 27 N·m (20 ft. lbs.) torque.

(16) Tighten locknut C (Fig. 5) to 27 N·m (20 ft. lbs.) torque.

(17) After the power steering pump has been tightened, recheck belt tension.

(18) Fill cooling system with coolant and check for leaks. Refer to Refilling Cooling System in this group.

(19) Connect battery cable to battery.

(20) Start and warm the engine. Check for leaks.

REMOVAL—5.2L V-8 ENGINE

The water pump on 5.2L engines is bolted directly to the engine timing chain case/cover.

A gasket is used as a seal between the water pump and timing chain case/cover.

If water pump is replaced because of bearing/shaft damage, or leaking shaft seal, the mechanical cooling fan assembly should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan if any of these conditions are found. Also check condition of the thermal viscous fan drive. Refer to Viscous Fan Drive in this group.

The water pump on all models can be removed without discharging the air conditioning system (if equipped).

(1) Disconnect negative battery cable from battery.

(2) Drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft (Fig. 12). Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) can be used. Place a bar or screwdriver between water pump pulley bolts (Fig. 12) to prevent pulley from rotating. Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

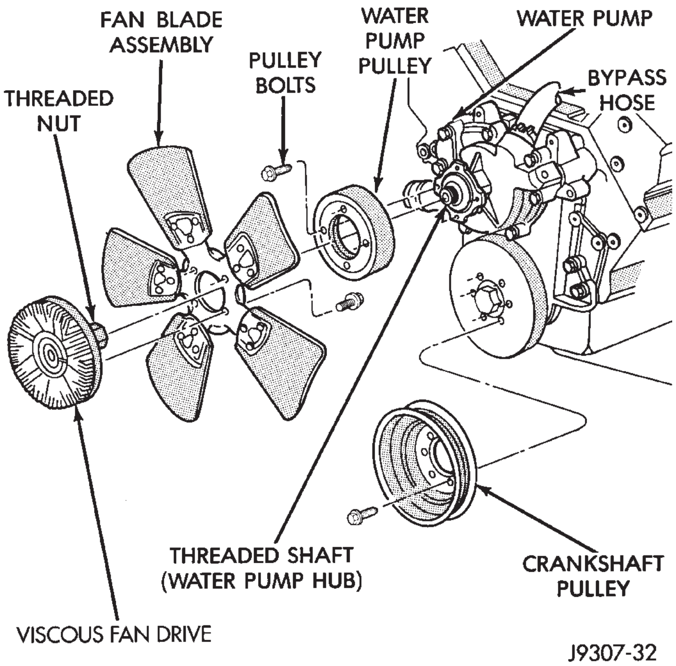

Fig. 12 Fan Blade and Viscous Fan Drive—5.2L Engine

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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (FIG. 7). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 8). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(4) If water pump is being replaced, do not unbolt fan blade assembly (Fig. 12) from thermal viscous fan drive.

(5) Remove two fan shroud-to-radiator nuts (Fig. 13). Do not attempt to remove fan shroud at this time.

(6) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

Do not remove water pump pulley bolts at this time.

(7) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic belt tensioner (Fig. 14). Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 14). When all belt tension has been relaxed, remove accessory drive belt.

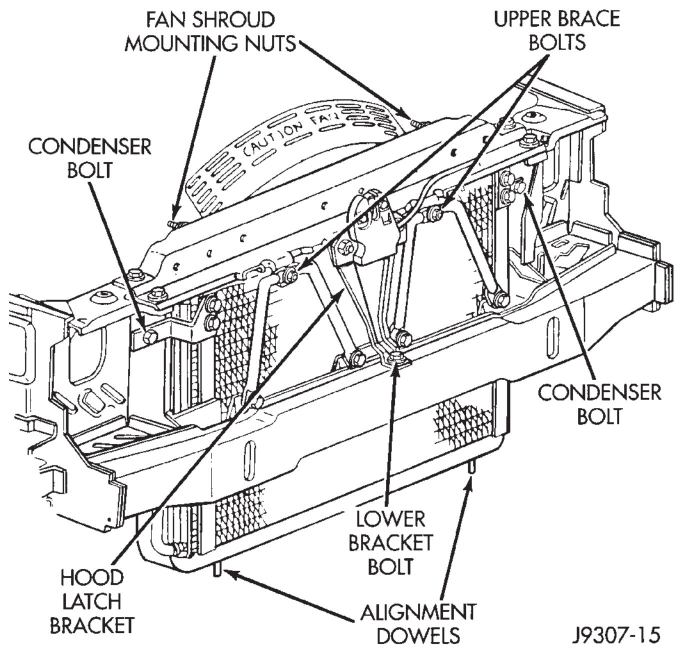

Fig. 13 Fan Shroud Nuts

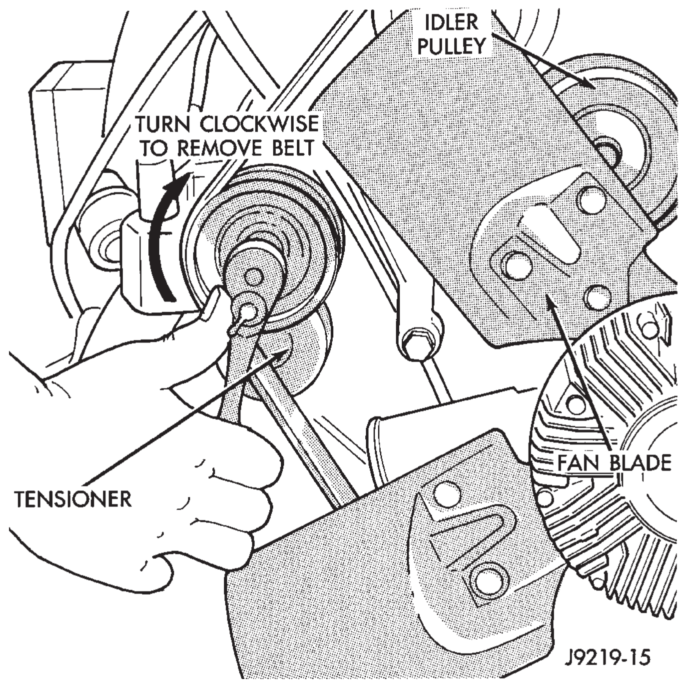

Fig. 14 Belt Tensioner Assembly—5.2L Engine

(8) Remove four water pump pulley-to-water pump hub bolts (Fig. 12) and remove pulley from vehicle.

(9) Remove lower radiator hose clamp and remove lower hose at water pump.

(10) Remove heater hose clamp (Fig. 15) and heater hose from heater hose coolant return tube.

(11) Loosen heater hose coolant return tube mounting bolt and nut (Fig. 15) and remove tube from water pump. Discard the old tube o-ring.

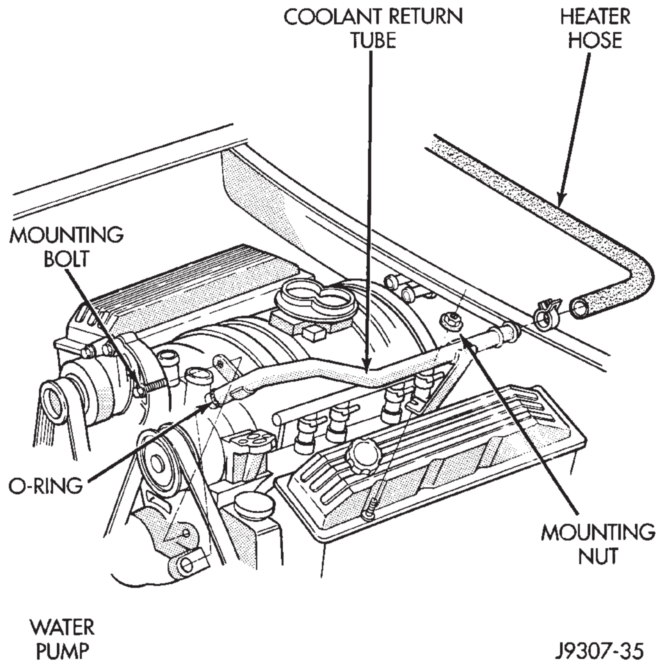

Fig. 15 Coolant Return Tube—5.2L Engine

(12) Remove seven water pump mounting bolts (Fig. 16).

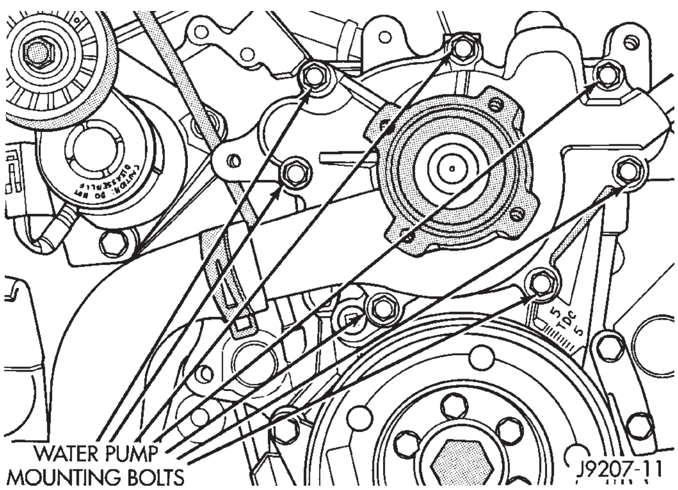

Fig. 16 Water Pump Bolts—5.2L Engine—Typical

(13) Loosen clamp at water pump end of bypass hose (Fig. 12). Slip bypass hose from water pump while removing pump from vehicle. Discard old gasket.

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

INSPECTION

Replace water pump assembly if it has any of the following conditions:

- The body is cracked or damaged
- Water leaks from shaft seal. This is evident by traces of coolant below vent hole
- Loose or rough turning bearing. Also inspect viscous fan drive
- Impeller rubs either the pump body or timing chain case/cover

INSTALLATION—5.2L V-8 ENGINE

(1) Clean gasket mating surfaces.

(2) Using a new gasket, install water pump to engine as follows: Guide water pump nipple into bypass hose as pump is being installed. Install water pump bolts (Fig. 16). Tighten water pump mounting bolts to 40 N·m (30 ft. lbs.) torque.

(3) Position bypass hose clamp to bypass hose.

(4) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(5) Install a new o-ring to the heater hose coolant return tube (Fig. 15). Coat the new o-ring with antifreeze before installation.

(6) Install coolant return tube to engine (Fig. 15). Be sure the slot in tube bracket is bottomed to the mounting bolt. This will properly position return tube.

(7) Connect radiator lower hose to water pump.

(8) Connect heater hose and hose clamp to coolant return tube.

(9) Install water pump pulley. Tighten bolts to 27 N·m (20 ft. lbs.) torque. Place a bar or screwdriver between water pump pulley bolts (Fig. 12) to prevent pulley from rotating.

(10) Relax tension from belt tensioner (Fig. 14). Install drive belt.

CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 17) for correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.

(11) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(12) Install two fan shroud-to-radiator nuts (Fig. 13).

Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(13) Install fan blade/viscous fan drive assembly to water pump shaft.

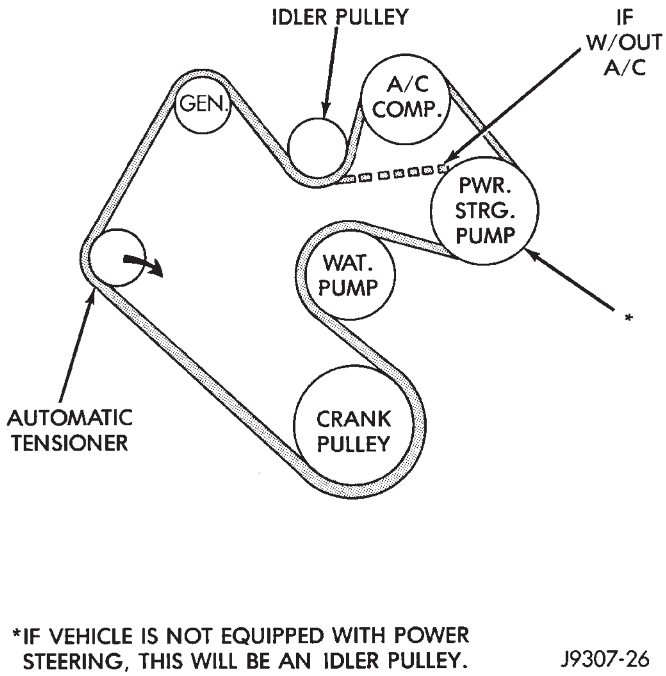

Fig. 17 Belt Routing—5.2L Engine

(14) Fill cooling system. Refer to Refilling the Cooling System in this group.

(15) Connect negative battery cable.

(16) Start and warm the engine. Check for leaks.

WATER PUMP BYPASS HOSE—5.2L V-8 ENGINE

A water pump bypass hose (Fig. 18) is used between the intake manifold and water pump on all 5.2L V-8 engines. To test for leaks, refer to Testing Cooling System for Leaks in this group.

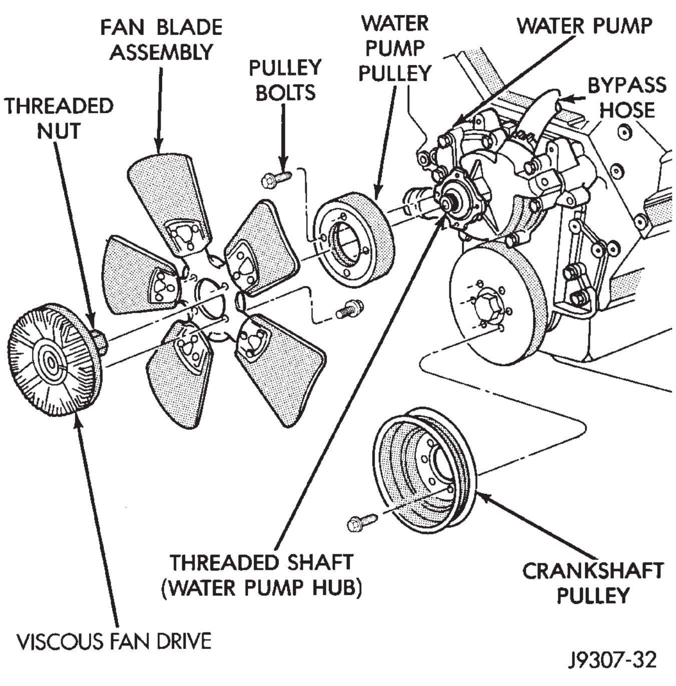

Fig. 18 Water Pump Bypass Hose—5.2L Engine

WITHOUT AIR CONDITIONING (A/C)

REMOVAL

(1) Partially drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (FIG. 19). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 20). If replacement is necessary, use only an original equipment clamp with matching number or letter.

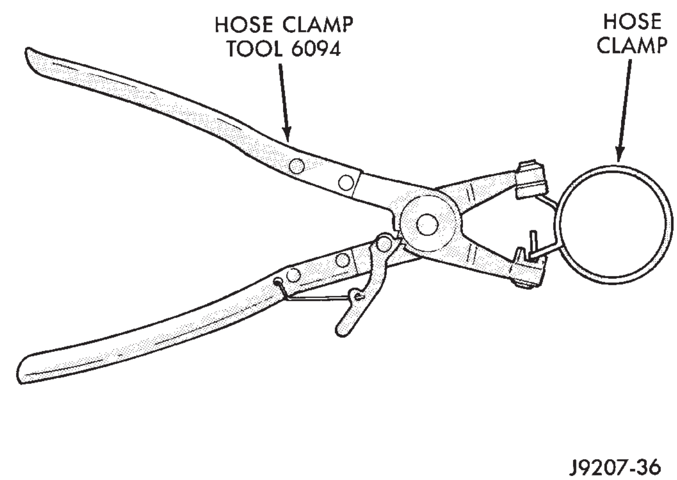

Fig. 19 Hose Clamp Tool—Typical

(2) Loosen both bypass hose clamps (Fig. 19) and position to center of hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps (Fig. 19) to center of hose.

(2) Install bypass hose to engine.

(3) Secure both hose clamps (Fig. 19).

(4) Fill cooling system. Refer to Refilling the Cooling System in this group.

(5) Start and warm the engine. Check for leaks.

WITH AIR CONDITIONING (A/C)

REMOVAL

If equipped with A/C, the generator and A/C compressor along with their common mounting bracket

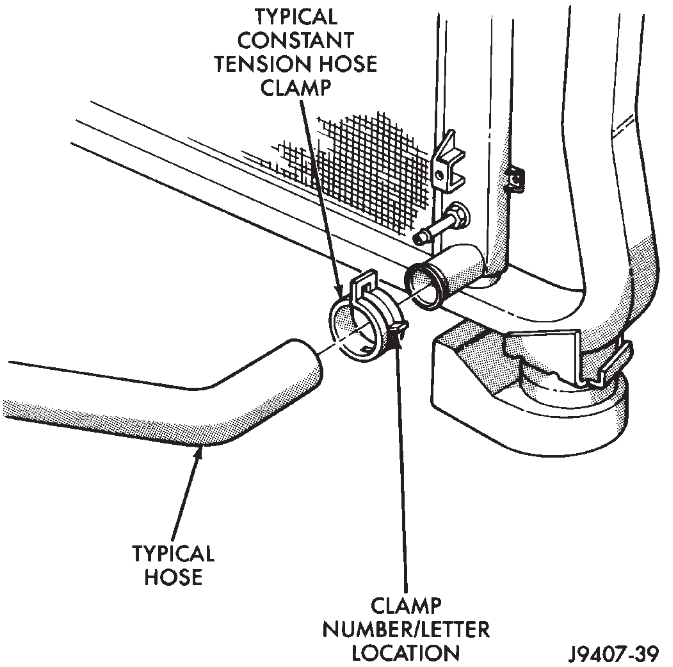

Fig. 20 Clamp Number/Letter Location

(Fig. 21) must be partially removed. Removing generator or A/C compressor from their mounting bracket is not necessary. Also, discharging A/C system is not necessary. **Do not** remove any refrigerant lines from A/C compressor.

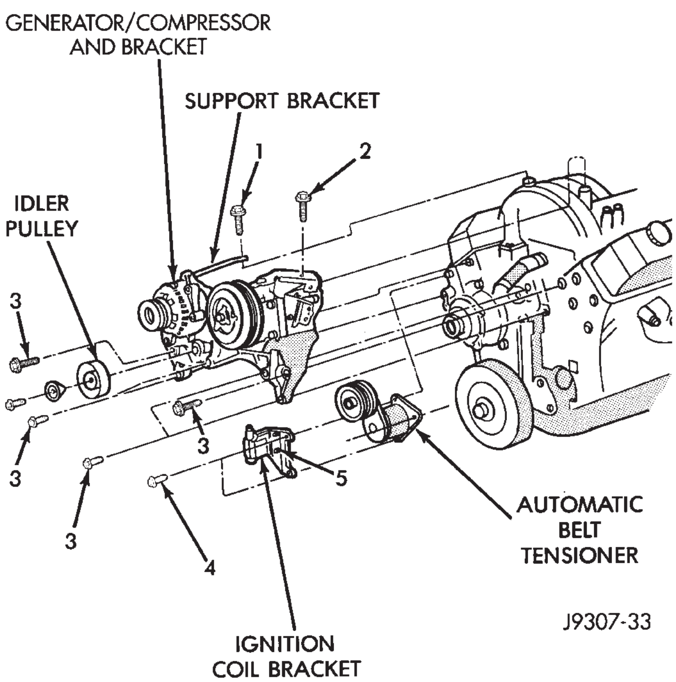

Fig. 21 Generator and A/C Compressor Mounting Bracket—5.2L Engine

WARNING: THE A/C SYSTEM IS UNDER PRESSURE EVEN WITH ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING.

(1) Disconnect negative battery cable from battery.

(2) Partially drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) Remove upper radiator hose clamp (Fig. 19) and hose at radiator.

(4) Unplug wiring harness from A/C compressor.

(5) Remove air duct at throttle body.

(6) Disconnect A/C lines from clip at intake manifold.

(7) Remove heater hose coolant return tube mounting bolt and nut (Fig. 22). Remove tube from engine and discard the old tube o-ring.

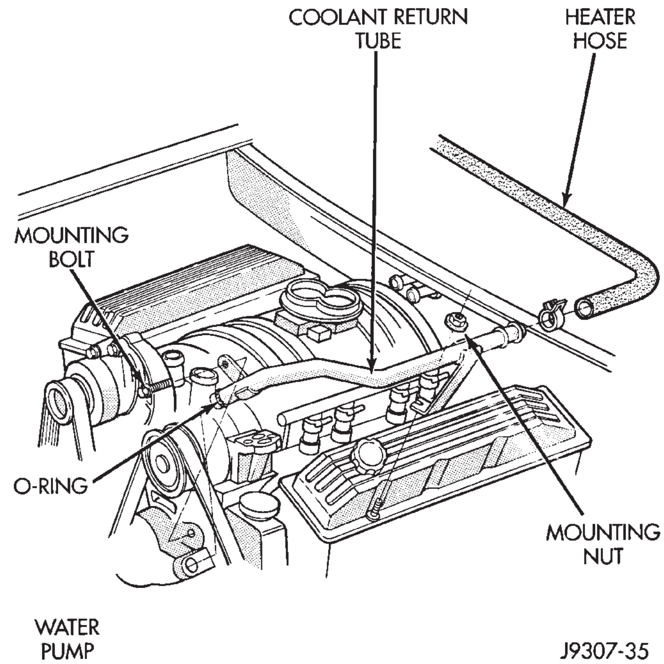

Fig. 22 Coolant Return Tube—5.2L Engine

(8) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic belt tensioner (Fig. 23). Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 23). When all belt tension has been relaxed, remove accessory drive belt.

(9) The drive belt idler pulley must be removed to gain access to one of A/C compressor/generator bracket mounting bolts. Remove idler pulley bolt and remove idler pulley (Fig. 21).

(10) Remove oil dipstick tube mounting bolt at side of A/C-generator mounting bracket.

(11) Disconnect speed control cable and throttle cable at throttle body. Refer to Accelerator Pedal and Throttle Cable in Group 14, Fuel System for throttle cable removal and installation. Refer to Group 8H for removal and installation of speed control cable.

(12) Remove bracket-to-intake manifold bolts (number 1 and 2—figure 21).

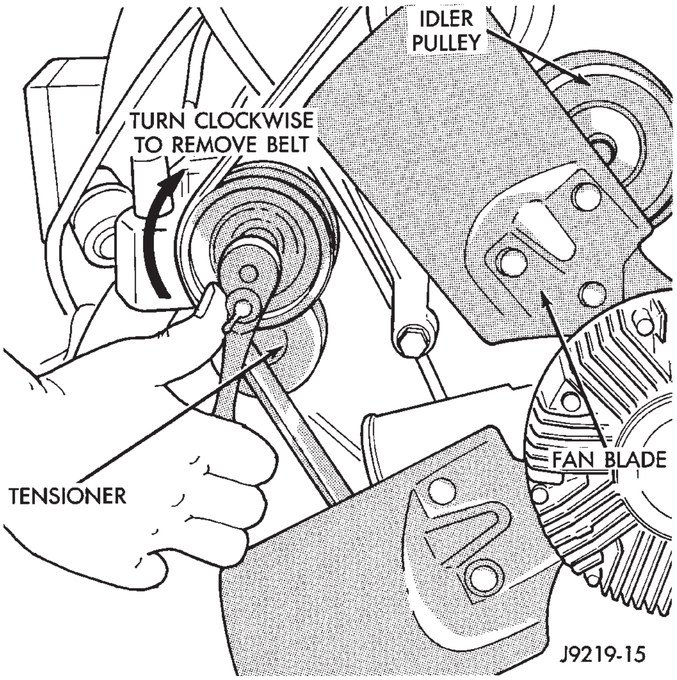

Fig. 23 Belt Tensioner Assembly—5.2L Engine

(13) Remove six bracket bolts (number 3—figure 21).

(14) Lift and position generator and A/C compressor (along with their common mounting bracket) to gain access to bypass hose. A block of wood may be used to hold assembly in position.

(15) Loosen and position both hose clamps to center of bypass hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps to center of hose.

(2) Install bypass hose to engine.

(3) Secure both hose clamps (Fig. 19).

(4) Install generator-A/C mounting bracket assembly to engine. Tighten bolts (number 1 and 2—figure 21) to 54 N·m (40 ft. lbs.) torque. Tighten bolts (number 3—figure 21) to 40 N·m (30 ft. lbs.) torque.

(5) Install a new o-ring to the heater hose coolant return tube (Fig. 22). Coat the new o-ring with antifreeze before installation.

(6) Install coolant return tube to engine (Fig. 22).

Be sure the slot in tube bracket is bottomed to the mounting bolt. This will properly position return tube.

(7) Connect throttle body control cables.

(8) Install oil dipstick mounting bolt.

(9) Install idler pulley. Tighten pulley bolt to 54 N·m (40 ft. lbs.) torque.

(10) Relax tension from belt tensioner (Fig. 23). Install drive belt.

CAUTION: When installing serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to figure 24 for correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.

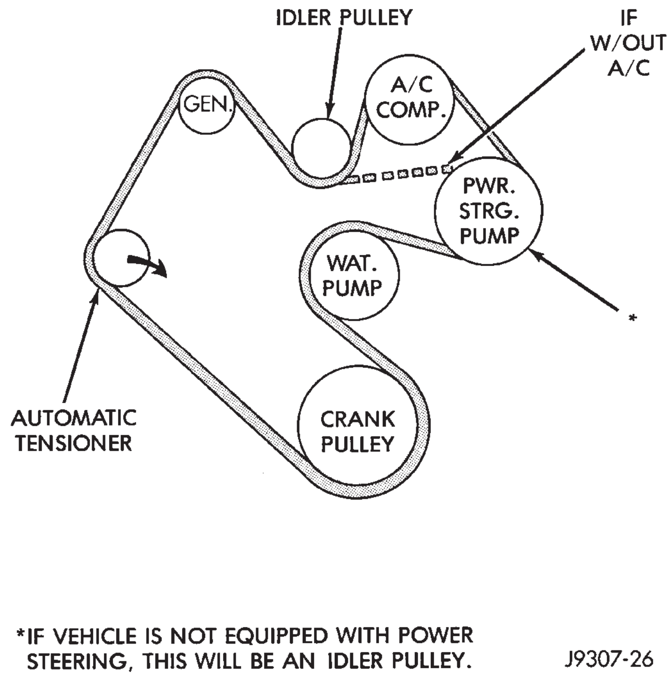

Fig. 24 Belt Routing—5.2L Engine

(11) Install air duct to throttle body.

(12) Install upper radiator hose to radiator.

(13) Connect wiring harness to A/C compressor.

(14) Connect A/C lines to clip at intake manifold.

(15) Fill cooling system. Refer to Refilling the Cooling System in this group.

(16) Start and warm the engine. Check for leaks.

THERMOSTAT

DESCRIPTION AND OPERATION

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control.

An arrow, plus the word **UP** is stamped on the front flange next to the air bleed. The words **TO RAD** are stamped on one arm of the thermostat. They indicate the proper installed position.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The more common type of thermostat failure, usually found on high milage vehicles, is a thermostat failed in the shut position. The temperature gauge (if equipped) will give an indication of this condition. Depending upon length of time that vehicle is operated, pressure cap may vent. This will expel steam and coolant to coolant reserve/overflow tank and to surface below vehicle. Refer to the Diagnosis section of this group.

ON-BOARD DIAGNOSTICS

FOR CERTAIN COOLING SYSTEM COMPONENTS

All models are equipped with On-Board Diagnostics for certain cooling system components. Refer to On-Board Diagnostics (OBD) in the Diagnosis section of this group for additional information. If the powertrain control module (PCM) detects low engine coolant temperature, it will record a Diagnostic Trouble Code (DTC) in the PCM memory. The DTC number for low coolant temperature is 17. Do not change a thermostat for lack of heat as indicated by the instrument panel gauge or heater performance unless a DTC number 17 is present. Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, refer to On-Board Diagnostics in the General Diagnosis section of Group 14, Fuel Systems.

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnostic information and operation of the DRB scan tool.

REMOVAL—4.0L 6-CYLINDER ENGINE

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(1) Drain the coolant from the radiator until the level is below the thermostat housing.

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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (FIG. 19). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 20). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Remove radiator upper hose and heater hose at thermostat housing.

(3) Disconnect wiring connector at engine coolant temperature sensor.

(4) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 25). Discard old gasket.

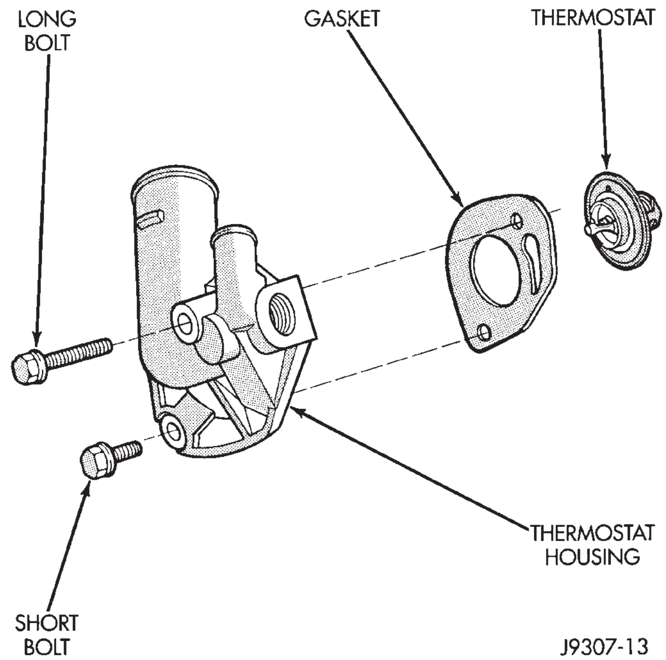

Fig. 25 Thermostat Removal/Installation—4.0L Engine

(5) Clean the gasket mating surfaces.

INSTALLATION—4.0L 6-CYLINDER ENGINE

(1) Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

(a) Observe the recess groove in the engine cylinder head (Fig. 26).

(b) Position thermostat in groove with arrow and air bleed hole on outer flange pointing up.

(2) Install replacement gasket and thermostat housing.

CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess, may result in a cracked housing.

(3) Tighten the housing bolts to 22 N·m (16 ft. lbs.) torque.

(4) Install hoses to thermostat housing.

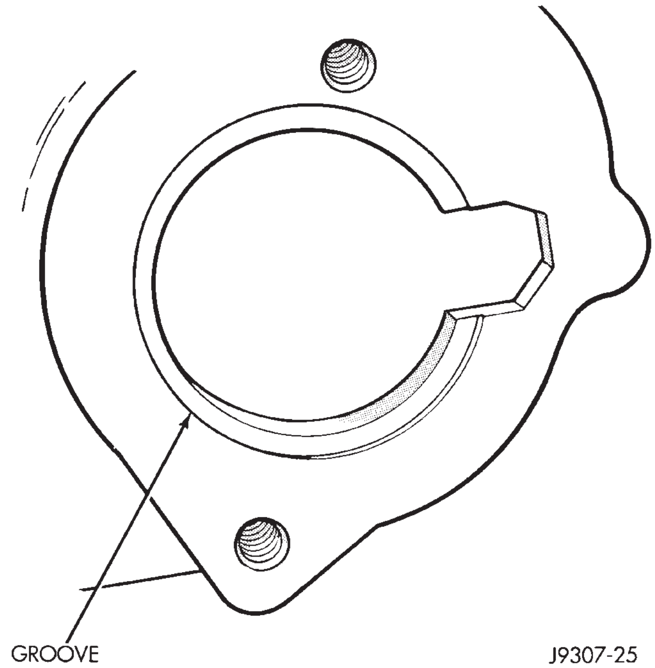

Fig. 26 Thermostat Recess—4.0L Engine

(5) Install electrical connector to coolant temperature sensor.

(6) Be sure that the radiator draincock is tightly closed. Fill the cooling system to the correct level with the required coolant mixture. Refer to Refilling Cooling System in this group.

(7) Start and warm the engine. Check for leaks.

REMOVAL—5.2L V-8 ENGINE

WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

Factory installed thermostat housings on 5.2L engines are installed on a gasket with an anti-stick coating. This will aid in gasket removal and clean-up.

(1) Disconnect negative battery cable at battery.

(2) Drain cooling system until coolant level is below thermostat. Refer to Draining Cooling System in this group.

(3) Air Conditioned vehicles: Remove support bracket (generator mounting bracket-to-intake manifold) located near rear of generator (Fig. 27).

(4) On air conditioning equipped vehicles, the generator must be partially removed.

(a) Remove generator drive belt as follows: Drive belts on the 5.2L engine are equipped with a spring loaded automatic belt tensioner (Fig. 28).

(b) Attach a socket/wrench to pulley mounting

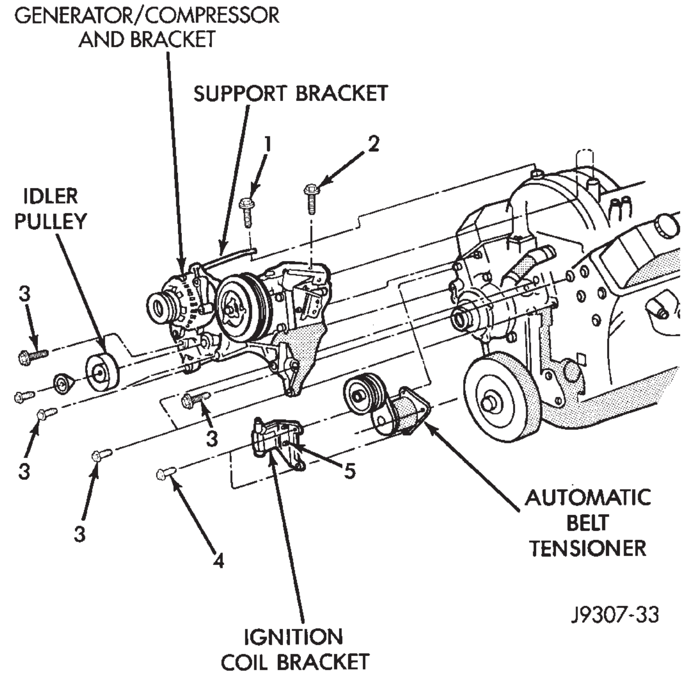

Fig. 27 Generator Support Bracket—5.2L Engine

bolt of automatic belt tensioner (Fig. 28).

(c) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

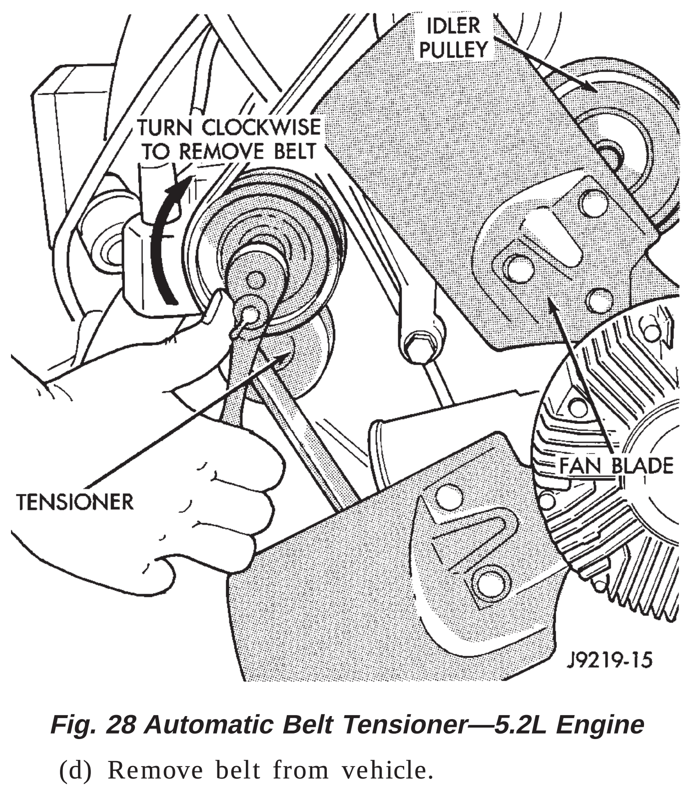

Fig. 28 Automatic Belt Tensioner—5.2L Engine

(d) Remove belt from vehicle.

(e) Remove two generator mounting bolts. Do not remove any wiring at generator. If equipped with 4WD, unplug 4WD indicator lamp wiring harness (located near rear of generator).

(f) Remove generator. Position generator to gain access for thermostat gasket removal.

(5) Remove upper radiator hose clamp (Fig. 19) and upper radiator hose at thermostat housing.

(6) Position wiring harness (behind thermostat housing) to gain access to thermostat housing.

(7) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 29). Discard old gasket.

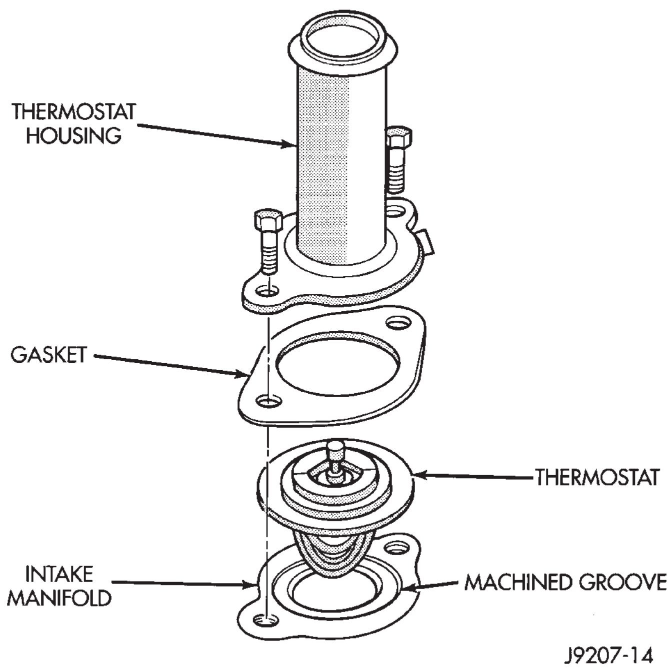

Fig. 29 Thermostat—5.2L Engine

INSTALLATION—5.2L V-8 ENGINE

(1) Clean mating areas of intake manifold and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on intake manifold (Fig. 29).

(3) Install gasket on intake manifold and over thermostat (Fig. 29).

(4) Position thermostat housing to intake manifold. Note the word FRONT stamped on housing (Fig. 30). For adequate clearance, this **must** be placed towards front of vehicle. The housing is slightly angled forward after installation to intake manifold.

(5) Install two housing-to-intake manifold bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.

CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in intake manifold. If not, it may result in a cracked housing, damaged intake manifold threads or coolant leak.

(6) Install upper radiator hose to thermostat housing.

(7) Air Conditioned vehicles:

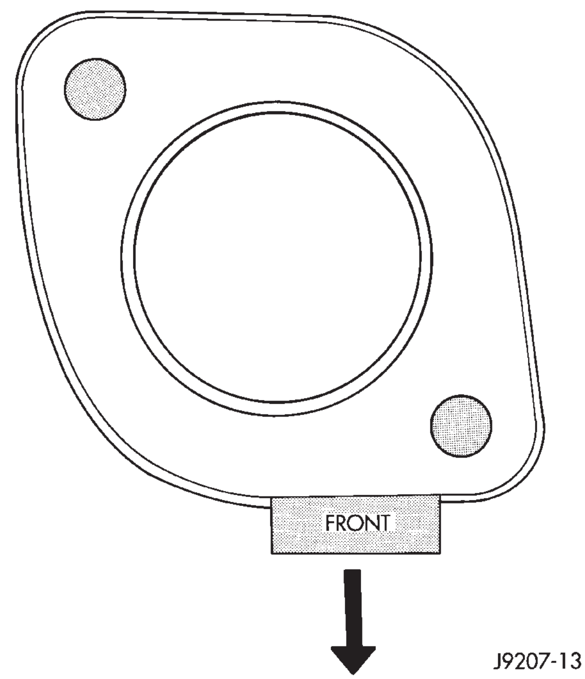

Fig. 30 Thermostat Position—5.2L Engine

(a) Install generator. Tighten bolts to 41 N·m (30 ft. lbs.) torque.

(b) Install support bracket (generator mounting bracket-to-intake manifold) (Fig. 27). Tighten bolts to 54 N·m (40 ft. lbs.) torque.

CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 31) for correct 5.2L engine belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.

(c) Position drive belt over all pulleys **except** idler pulley (located between generator and A/C compressor).

(d) Attach a socket/wrench to pulley mounting bolt of automatic belt tensioner (Fig. 28).

(e) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(8) Fill cooling system. Refer to Refilling Cooling System in this group.

(9) Connect negative battery cable to battery.

(10) Start and warm the engine. Check for leaks.

COOLANT

GENERAL INFORMATION

The cooling system is designed around the coolant. Coolant flows through the engine water jackets absorbing heat produced during engine operation. The

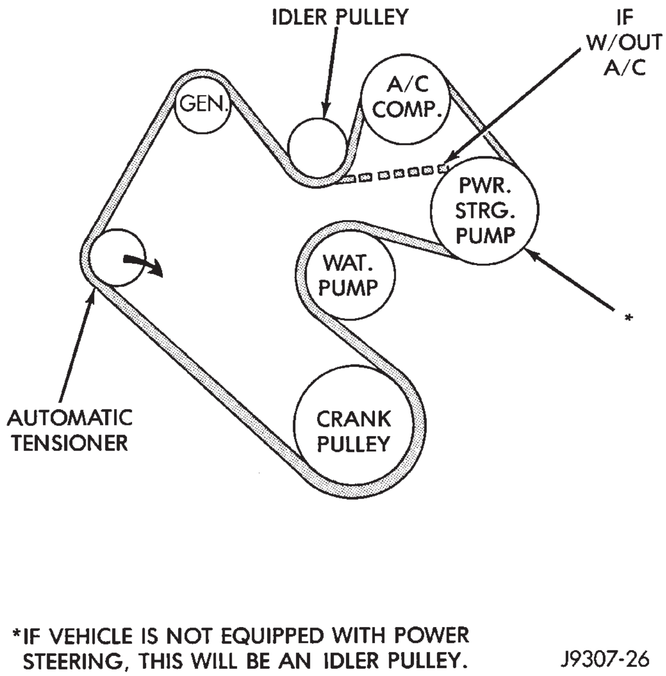

Fig. 31 Belt Routing—5.2L Engine

coolant carries heat to the radiator and heater core. Here it is transferred to ambient air passing through the radiator and heater core fins. The coolant also removes heat from the automatic transmission fluid in vehicles equipped with an automatic transmission.

COOLANT PERFORMANCE

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

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

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

50/50 Ethylene-Glycol and Water-Is the recommended mixture, it provides protection against freezing to -37°C (-35°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

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

COOLANT SELECTION-ADDITIVES

Coolant should be maintained at the specified level with a mixture of ethylene glycol-based antifreeze and low mineral content water. Only use an antifreeze containing ALUGARD 340-2 ™.

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

COOLANT SERVICE

It is recommended that the cooling system be drained and flushed at 84,000 kilometers (52,500 miles), or 3 years, whichever occurs first. Then every two years, or 48,000 kilometers (30,000 miles), whichever occurs first.

COOLANT LEVEL CHECK-ROUTINE

Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant reserve/overflow tank.

The coolant reserve/overflow system provides a quick visual method for determining coolant level without removing radiator pressure cap. With engine idling and at normal operating temperature, observe coolant level in reserve/overflow tank. The coolant level should be between ADD and FULL marks.

ADDING ADDITIONAL COOLANT-ROUTINE

Do not remove radiator cap to add coolant to system. When adding coolant to maintain correct level, do so at coolant reserve/overflow tank. Use a 50/50 mixture of ethylene-glycol antifreeze containing Alugard 340-2 ™ and low mineral content water. Remove radiator cap only for testing or when refilling system after service. Removing cap unnecessarily can cause loss of coolant and allow air to enter system, which produces corrosion.

COOLANT LEVEL CHECK-SERVICE

The cooling system is closed and designed to maintain coolant level to top of radiator.

WARNING: DO NOT OPEN RADIATOR DRAINCOCK WITH ENGINE RUNNING OR WHILE ENGINE IS HOT AND COOLING SYSTEM IS UNDER PRESSURE.

When vehicle servicing requires a coolant level check in radiator, drain several ounces of coolant from radiator drain cock. Do this while observing coolant reserve/overflow system tank. The coolant level in reserve/overflow tank should drop slightly. If not, inspect for a leak between radiator and coolant reserve/overflow system connection. Remove radiator cap. The coolant level should be to top of radiator. If not and if coolant level in reserve/overflow tank is at ADD mark, check for:

- An air leak in coolant reserve/overflow tank or its hose
- An air leak in radiator filler neck
- Leak in pressure cap seal to radiator filler neck

LOW COOLANT LEVEL-AERATION

If the coolant level in radiator drops below top of radiator core tubes, air will enter cooling system.

Low coolant level can cause thermostat pellet to be suspended in air instead of coolant. This will cause thermostat to open later, which in turn causes higher coolant temperature. Air trapped in cooling system also reduces amount of coolant circulating in heater core resulting in low heat output.

DEAERATION

As the engine operates, any air trapped in cooling system gathers under the radiator cap. The next time the engine is operated, thermal expansion of coolant will push any trapped air past radiator cap into the coolant reserve/overflow tank. Here it escapes to the atmosphere into the tank. When the engine cools down the coolant, it will be drawn from the reserve/overflow tank into the radiator to replace any removed air.

DRAINING COOLING SYSTEM

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

DRAINING ENTIRE SYSTEM

Use this procedure if the entire cooling system is to be drained, such as for engine removal.

(1) DO NOT remove radiator cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

- 4.0L 6-cyl. Engine: Radiator draincock is located on the right/lower side of radiator facing to rear of vehicle.
- 5.2L V-8 Engine: Radiator draincock is located on the left/lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant reserve/overflow tank. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture. When tank is empty, remove radiator cap and continue draining cooling system.

To drain the 4.0L 6-cylinder engine of coolant, remove the cylinder block drain plug located on the side of cylinder block (Fig. 32).

To drain the 5.2L V-8 engine of coolant, remove the cylinder block drain plugs located on the sides of cylinder block above the oil pan rail (Fig. 33).

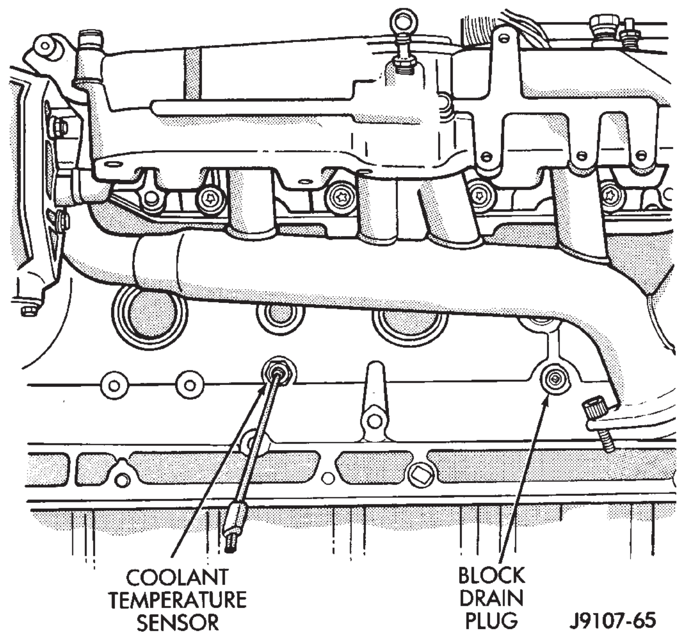

Fig. 32 Drain Plug—4.0L 6-Cylinder Engine

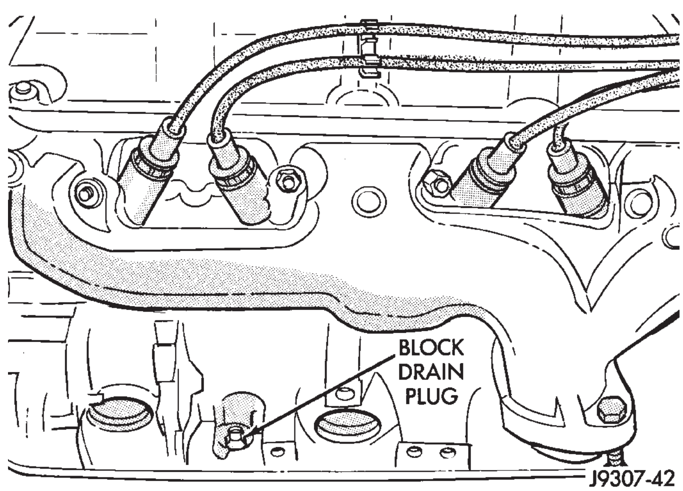

Fig. 33 Drain Plugs—5.2L V-8 Engine

PARTIAL DRAINING

Use this procedure if the coolant is to be partially drained, such as for engine thermostat removal.

(1) With engine cold, slowly remove the radiator cap. Raise vehicle on a hoist and locate radiator draincock.

- 4.0L Engine: Radiator draincock is located on the right/lower side of radiator facing to rear of vehicle.
- 5.2L Engine: Radiator draincock is located on the left/lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container.

(3) Open draincock and drain desired amount of coolant from radiator.

REFILLING COOLING SYSTEM

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

(2) Fill system using a 50/50 mixture of water and antifreeze as described in the Coolant Section of this group. Fill radiator to top and install radiator cap. Add sufficient coolant to the reserve/overflow tank to raise level to FULL mark.

(3) With heater control unit in the HEAT position, operate engine with radiator cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the reserve/overflow tank.

(5) Add coolant to reserve/overflow tank as necessary. **Only add coolant to the reserve/overflow tank when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** To purge the cooling system of all air, this heat up/cool down cycle (adding coolant to cold engine) must be performed three times. Add necessary coolant to raise tank level to the FULL mark after each cool down period.

COOLING SYSTEM CLEANING/REVERSE FLUSHING

CAUTION: The cooling system normally operates at 97-to-124 kPa (14-to-18 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

CLEANING

Drain cooling system and refill with water. Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill system with water, run engine and drain system. Repeat until water drains clean.

REVERSE FLUSHING

Reverse flushing of the cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

CAUTION: The cooling system normally operates at 97-to-124 kPa (14-to-18 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Allow the radiator to fill with water. When radiator is filled, apply air in short blasts allowing radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. For more information, refer to operating instructions supplied with flushing equipment. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain the cooling system. Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump. Attach a lead away hose to the water pump inlet fitting.

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose. For more information, refer to operating instructions supplied with flushing equipment.

Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing and install thermostat. Install the thermostat housing with a replacement gasket. Refer to Thermostat Replacement. Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture.

CHEMICAL CLEANING

In some instances, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid the flushing operation.

CAUTION: Be sure instructions on the container are followed.

TESTING COOLING SYSTEM FOR LEAKS

ULTRAVIOLET LIGHT METHOD

All Jeep models have a leak detection additive added to the cooling system before they leave the factory. The additive is highly visible under ultraviolet light (black light). If the factory original coolant has been drained, pour one ounce of additive into the cooling system. The additive is available through the part's department. Place the heater control unit in HEAT position. Start and operate the engine until the radiator upper hose is warm to the touch. Aim the commercially available black light tool at the components to be checked. If leaks are present, the black light will cause the additive to glow a bright green color.

The black light can be used along with a pressure tester to determine if any external leaks exist (Fig. 34).

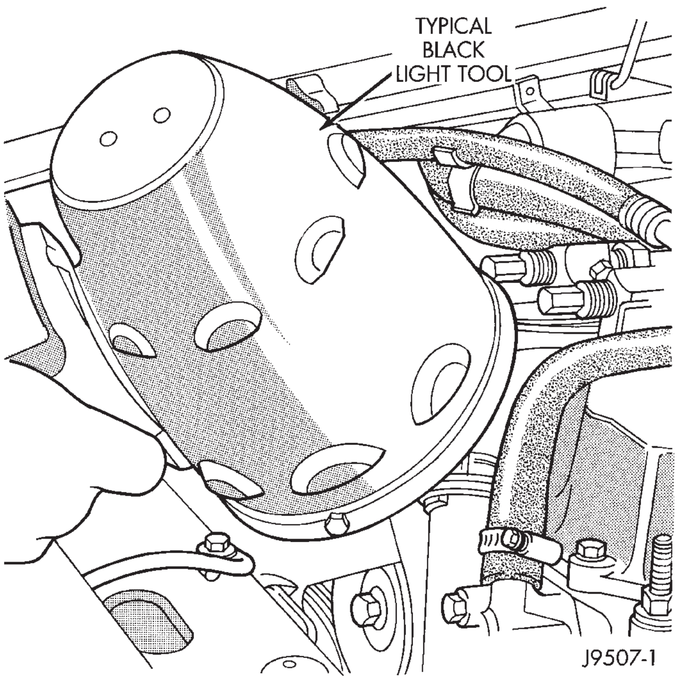

Fig. 34 Leak Detection Using Black Light—Typical

PRESSURE TESTER METHOD

The engine should be at the normal operating temperature. Recheck the system cold if the cause of coolant loss is not located during warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove the radiator pressure cap from the filler neck and check the coolant level. Push down on the cap to disengage it from the stop tabs. Wipe the inner part of the filler neck and examine the lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect the reserve/overflow tank tube for internal obstructions. Insert a wire through the tube to be sure it is not obstructed.

Inspect the cams on the outside part of the filler neck. If the cams are bent, seating of pressure cap valve and tester seal will be affected. Replace cap if cams are bent.

Attach pressure tester 7700 (or an equivalent) to the radiator filler neck (Fig. 35).

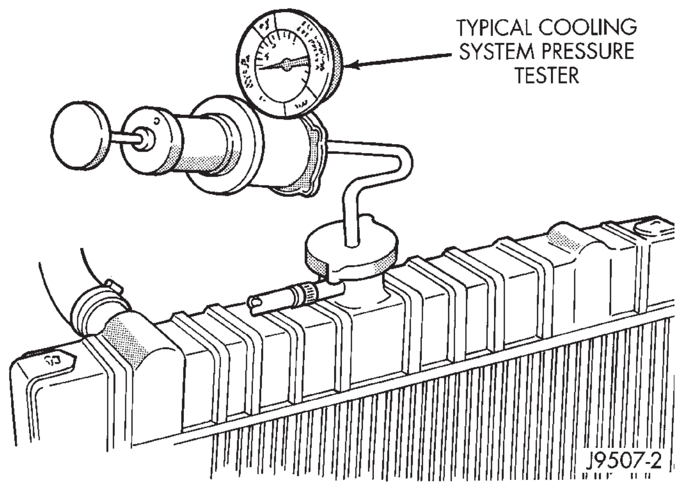

Fig. 35 Pressurizing System—Typical

Operate the tester pump to apply 124 kPa (18 psi) pressure to the system. If the hoses enlarge excessively or bulge while testing, replace as necessary. Observe the gauge pointer and determine the condition of the cooling system according to the following criteria:

- Holds Steady: If the pointer remains steady for two minutes, there are no serious coolant leaks in the system. However, there could be an internal leak that does not appear with normal system test pressure. Inspect for interior leakage or do the Internal Leakage Test. Do this if it is certain that coolant is being lost and no leaks can be detected.
- Drops Slowly: Shows a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect the radiator, hoses, gasket edges and heater. Seal any small leak holes with a Sealer Lubricant or equivalent. Repair leak holes and reinspect the system with pressure applied.
- Drops Quickly: Shows that a serious leakage is occurring. Examine the system for serious external leakage. If no leaks are visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove the oil pan drain plug and drain a small amount of engine oil. Coolant, being heavier, will drain first, or operate engine to churn oil, then examine dipstick for water globules. Inspect the transmission dipstick for water globules. Inspect the transmission fluid cooler for leakage. Operate the engine without the pressure cap on the radiator until thermostat opens.

Attach a Pressure Tester to the filler neck. If pressure builds up quickly, a leak exists as result of a faulty cylinder head gasket or crack in the engine. Repair as necessary.

WARNING: DO NOT ALLOW PRESSURE TO EXCEED 124 KPA (18 PSI). TURN THE ENGINE OFF. TO RELEASE THE PRESSURE, ROCK THE TESTER FROM SIDE TO SIDE. WHEN REMOVING THE TESTER, DO NOT TURN THE TESTER MORE THAN 1/2 TURN IF THE SYSTEM IS UNDER PRESSURE.

If there is no immediate pressure increase, pump the Pressure Tester until the indicated pressure is within the system range. Vibration of the gauge pointer indicates compression or combustion leakage into the cooling system.

WARNING: DO NOT DISCONNECT THE SPARK PLUG WIRES WHILE THE ENGINE IS OPERATING.

CAUTION: Do not operate the engine with a spark plug shorted for more than a minute. The catalytic converter may be damaged.

Isolate the compression leak by shorting each spark plug to the cylinder block. The gauge pointer should stop or decrease vibration when spark plug for leaking cylinder is shorted. This happens because of the absence of combustion pressure.

COMBUSTION LEAKAGE TEST (WITHOUT PRESSURE TESTER)

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow for thermostat removal. Refer to Thermostat Replacement. Disconnect the water pump drive belt.

Disconnect the upper radiator hose from the thermostat housing. Remove the housing and thermostat. Install the thermostat housing.

Add coolant to the radiator to bring the level to within 6.3 mm (1/4 in) of the top of the thermostat housing.

CAUTION: Avoid overheating. Do not operate the engine for an excessive period of time. Open the draincock immediately after the test to eliminate boil over of coolant.

Start the engine and accelerate rapidly three times (to approximately 3000 rpm) while observing the coolant. If internal engine combustion gases are leaking into the cooling system, bubbles will appear in the coolant. If bubbles do not appear, there is no internal combustion gas leakage.

COOLANT RESERVE/OVERFLOW SYSTEM

This system works along with the radiator pressure cap. This is done by using thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides:

- A volume for coolant expansion and contraction.
- A convenient and safe method for checking/adjusting coolant level at atmospheric pressure. This is done without removing the radiator pressure cap.
- Some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

The coolant reserve/overflow system has a radiator mounted pressurized cap, an overflow tube and a plastic coolant reserve/overflow tank (Fig. 36) mounted to the right inner fender.

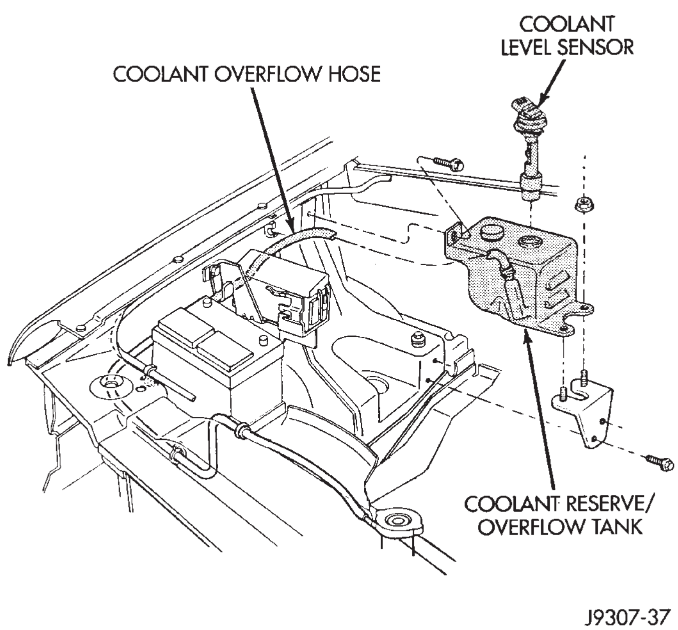

Fig. 36 Coolant Reserve/Overflow Tank—Typical

RADIATOR PRESSURE CAP

All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 97-to-124 kPa (14-to-18 psi). The pressure relief point (in pounds) is engraved on top of the cap (Fig. 37).

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap (Fig. 37) contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 97-to-124 kPa (14-to-18 psi).

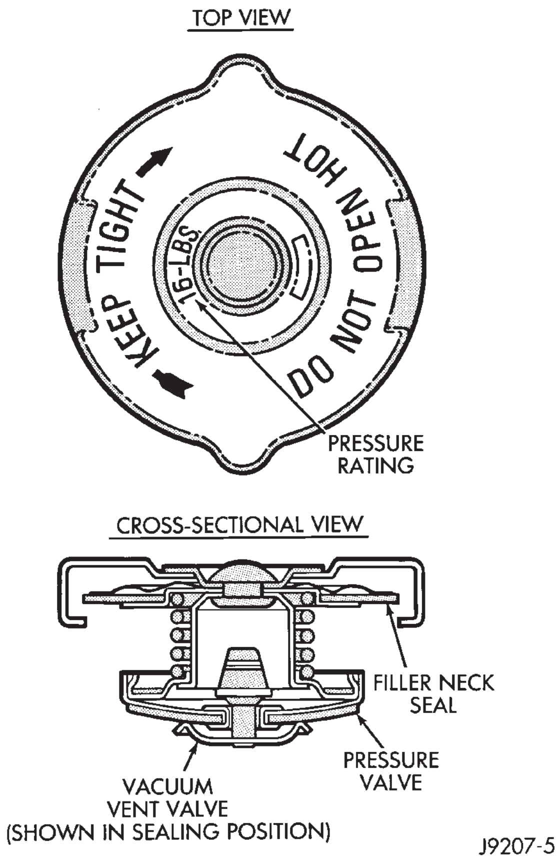

Fig. 37 Radiator Pressure Cap—Typical

A vent valve in the center of the cap allows a small coolant flow through the cap when coolant is below boiling temperature. The valve is completely closed when boiling point is reached. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, radiator hoses will collapse on cool-down.

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK

With radiator cap installed on filler neck, remove coolant reserve/overflow tank hose from nipple on filler neck. Connect a hand operated vacuum pump to nipple. Operate pump until a reading of 47-to-61 kPa (14-to-18 in. Hg) appears on gauge. If the reading stays steady, or drops slightly and then remains steady, the pressure valve seal is good. Replace radiator cap if reading does not hold.

WARNING: THE WARNING WORDS —DO NOT OPEN HOT— ON THE RADIATOR PRESSURE CAP (FIG. 37) ARE A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT AND/OR UNDER PRESSURE.

There is no need to remove the radiator cap **except** for the following purposes:

- To check and adjust antifreeze freeze point.
- To refill system with new antifreeze.
- For conducting service procedures.
- When checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING RADIATOR CAP. WITH A RAG, SQUEEZE RADIATOR UPPER HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER THE CAP AND WITHOUT PUSHING DOWN, ROTATE CAP COUNTER-CLOCKWISE TO THE FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH OVERFLOW HOSE INTO COOLANT RESERVE/OVERFLOW TANK. SQUEEZE RADIATOR UPPER HOSE TO DETERMINE WHEN PRESSURE HAS BEEN RELEASED. WHEN COOLANT AND STEAM STOP BEING PUSHED INTO TANK AND SYSTEM PRESSURE DROPS, REMOVE RADIATOR CAP COMPLETELY.

PRESSURE TESTING RADIATOR CAPS

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install the cap on pressure tester (tool 7700 or an equivalent) (Fig. 38).

Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 97-to-124 kPa (14-to-18 psi). The cap is satisfactory when the pressure holds steady. It is also good if it holds pressure within the 97-to-124 kPa (14-to-18 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which 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 tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

INSPECTION

Visually inspect the pressure valve gasket on the cap. Replace cap if the gasket is swollen, torn or

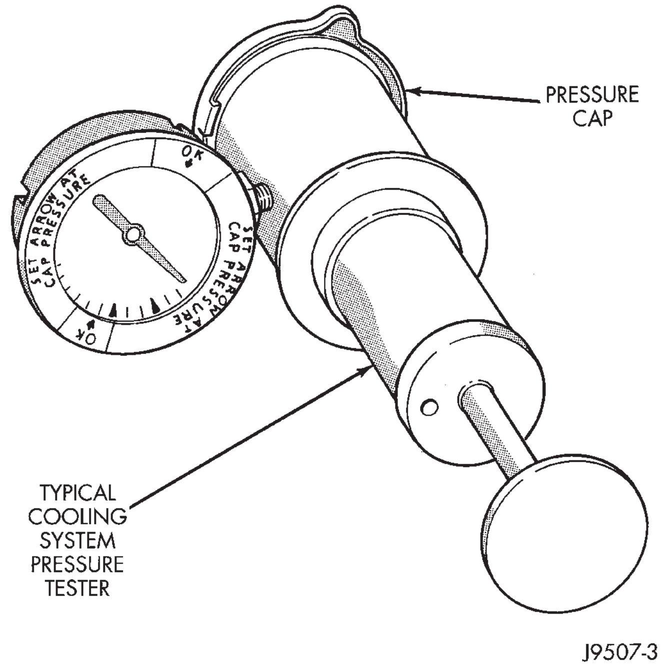

Fig. 38 Pressure Testing Radiator Pressure Cap—Typical

worn. Inspect the area around radiator filler neck for white deposits that indicate a leaking cap.

RADIATOR

GENERAL INFORMATION

All vehicles are equipped with a cross flow type radiator with plastic side tanks.

Plastic tanks, while stronger than brass, are subject to damage by impact, such as from tools or wrenches. Handle radiator with care.

RADIATOR COOLANT FLOW CHECK

The following procedure will determine if coolant is flowing through the cooling system.

If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If hose is hot, the thermostat is open and water is circulating through cooling system.

RADIATOR REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR. REFER TO COOLING SYSTEM DRAINING IN THIS GROUP.

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (FIG. 39). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 40). If replacement is necessary, use only an original equipment clamp with matching number or letter.

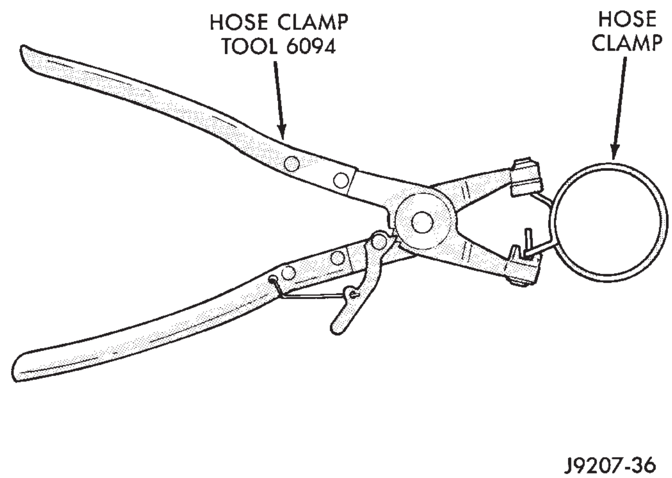

Fig. 39 Hose Clamp Tool—Typical

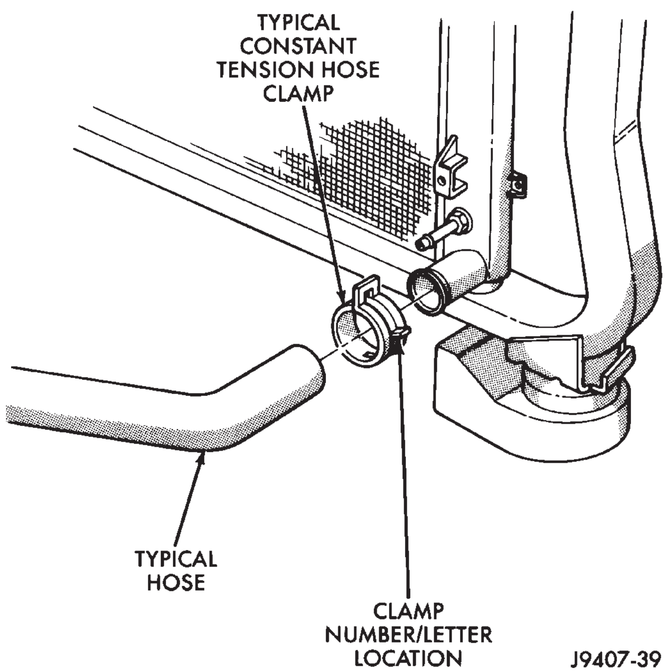

Fig. 40 Clamp Number/Letter Location

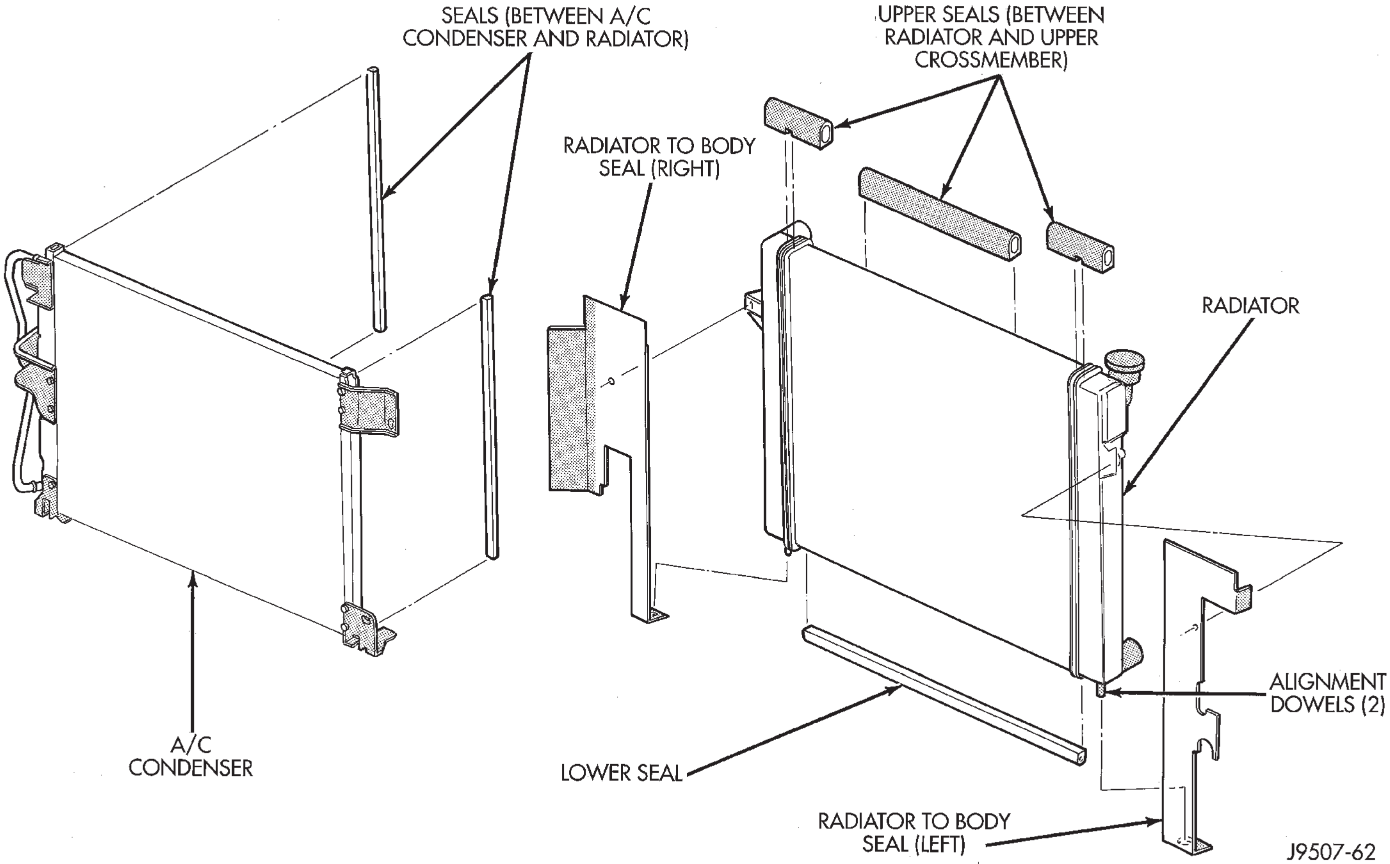

Fig. 41 Air Seals—Typical

CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 41). These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Disconnect the negative battery cable at battery.

(2) Observe the previous WARNINGS and CAUTIONS.

(3) Drain coolant from radiator. Refer to Draining Cooling System in this group.

(4) **4.0L Engine:** Remove the four fan hub-to-water pump pulley mounting nuts (Fig. 42). Carefully remove the fan assembly from the water pump pulley and position to center of fan shroud. Fan belt removal is not necessary as the water pump studs will hold the pump pulley in position.

Do not remove fan/viscous fan drive assembly from vehicle at this time.

5.2L Engine: The thermal viscous fan drive is attached (threaded) to the water pump hub shaft (Fig. 43). Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** A Snap-On 36 MM Fan Wrench

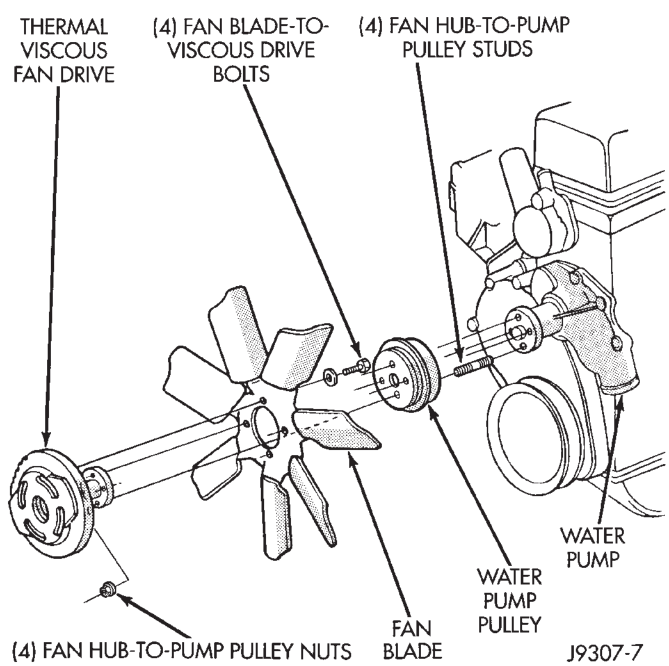

Fig. 42 Fan Mounting Nuts—4.0L 6-Cyl. Engine

(number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) can be used. Place a bar or screwdriver between water pump pulley bolts (Fig.

43) to prevent pulley from rotating. Drive belt removal is not necessary for removal of fan drive.

Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

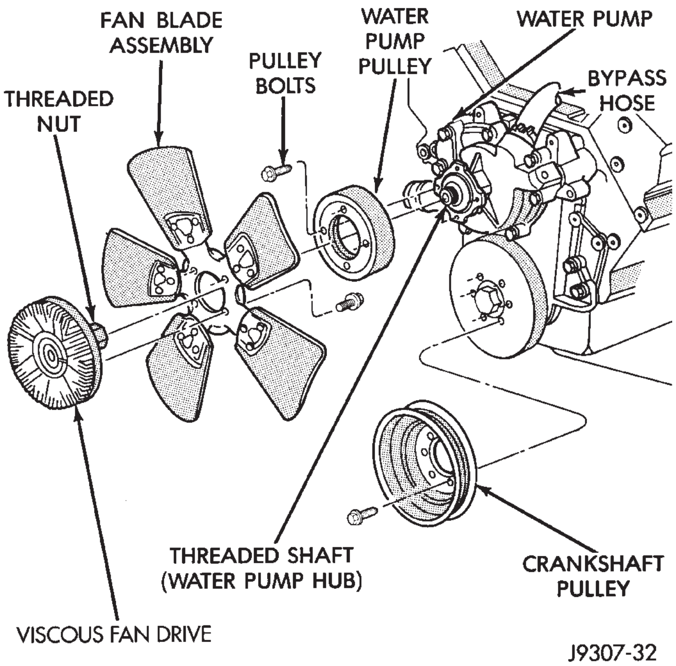

Fig. 43 Fan Blade and Viscous Fan Drive—5.2L V-8 Engine

(5) Remove the two fan shroud-to-upper radiator crossmember mounting nuts (Fig. 44).

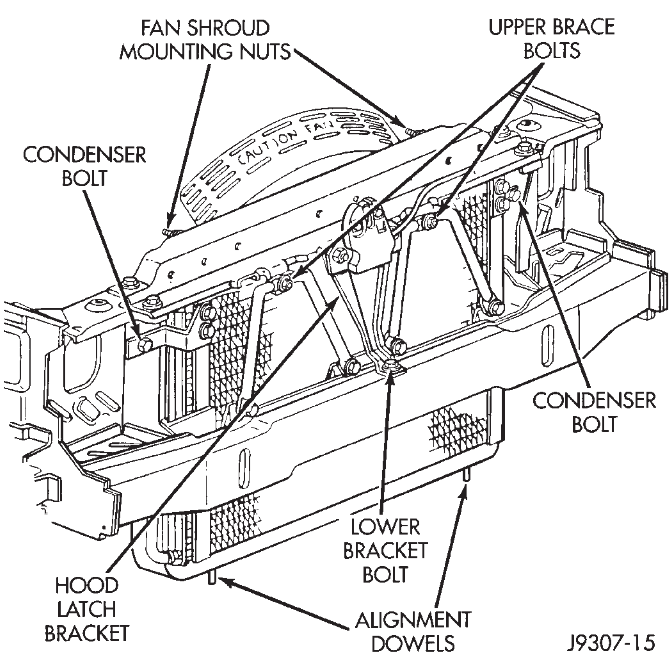

Fig. 44 Radiator and A/C Condenser Mounting

(6) Remove the fan assembly and fan shroud (as one unit) from vehicle.

(7) Special quick-connect fittings are used to join the transmission cooling lines to the radiator. Removal procedures are different between the 4.0L and 5.2L engine. Disconnect the cooling lines from the radiator. Refer to Group 21 for transmission cooling line removal and installation.

(8) The radiator upper crossmember (Fig. 45) can be adjusted left or right through the use of slotted holes. Before removal, mark the original position of the crossmember.

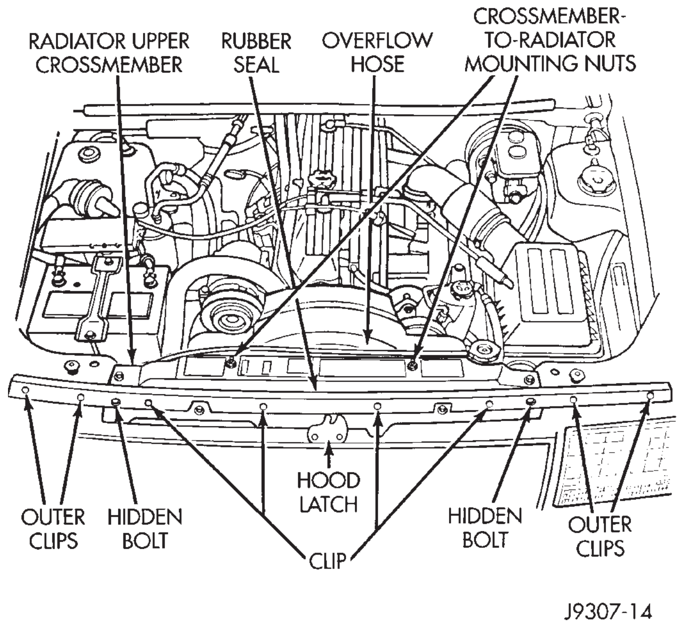

Fig. 45 Radiator Upper Crossmember—Typical

(9) Eight clips are used to retain a rubber seal (Fig. 45) to the body and upper radiator crossmember. Gently pry up the outboard clips (two per side) until rubber seal can be removed. Do not remove the clips entirely. Fold back the seal on both sides for access to (the hidden) grille opening reinforcement mounting bolts (Fig. 45). Remove these two bolts.

(10) Remove the grill. Refer to group 23, Body.

(11) Remove the upper brace bolt from each of the two radiator braces (Fig. 44).

(12) Remove the two crossmember-to-radiator mounting nuts (Fig. 45).

(13) Working through grill opening, remove the lower bracket bolt securing lower part of hood latch support bracket to lower frame crossmember (Fig. 44).

(14) Remove the remaining four bolts securing the radiator upper crossmember to the body. Do not remove the hood latch or hood latch cable from the crossmember. Lift the crossmember straight up and lay to the side.

(15) Equipped with air conditioning: Remove the two A/C condenser-to-radiator mounting bolts (Fig. 44). These two bolts are also used to retain the side

mounted rubber air seals (Fig. 41). These seals are compressed between the A/C condenser and the radiator. The lower part of the air seals are compressed between the radiator and the A/C condenser mounting brackets (Fig. 46).

Not equipped with air conditioning: Remove the two bolts retaining the side mounted rubber air seals (Fig. 41) to the radiator. The lower part of the air seals are compressed between the radiator and the radiator lower crossmember.

CAUTION: Note the location of all rubber air seals (Fig. 41). To prevent overheating, they must be installed back to their original positions.

(16) Disconnect the coolant reserve/overflow tank hose (Fig. 45) at radiator.

(17) Remove upper radiator hose at radiator. A special clamp tool (Fig. 39) must be used to remove the constant tension hose clamps.

(18) 4.0L Engine Only: Remove the lower radiator hose at the water pump end.

(19) To gain access to lower radiator hose clamp at radiator, gently lift the radiator a slight amount. Remove hose clamp and hose.

The lower part of radiator is equipped with two alignment dowel pins (Figs. 44 or 46). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

WARNING: THE AIR CONDITIONING SYSTEM (IF EQUIPPED) IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING BEFORE HANDLING ANY AIR CONDITIONING COMPONENT.

(20) If equipped with an auxiliary automatic transmission oil cooler, use caution when removing radiator. The oil cooler lines are routed through a rubber air seal on the left side of radiator. Do not cut or tear this seal.

(21) Gently lift up and remove radiator from vehicle. Be careful not to scrape the radiator fins against any other component. Also be careful not to disturb the air conditioning condenser (if equipped).

INSTALLATION

CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 41) are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

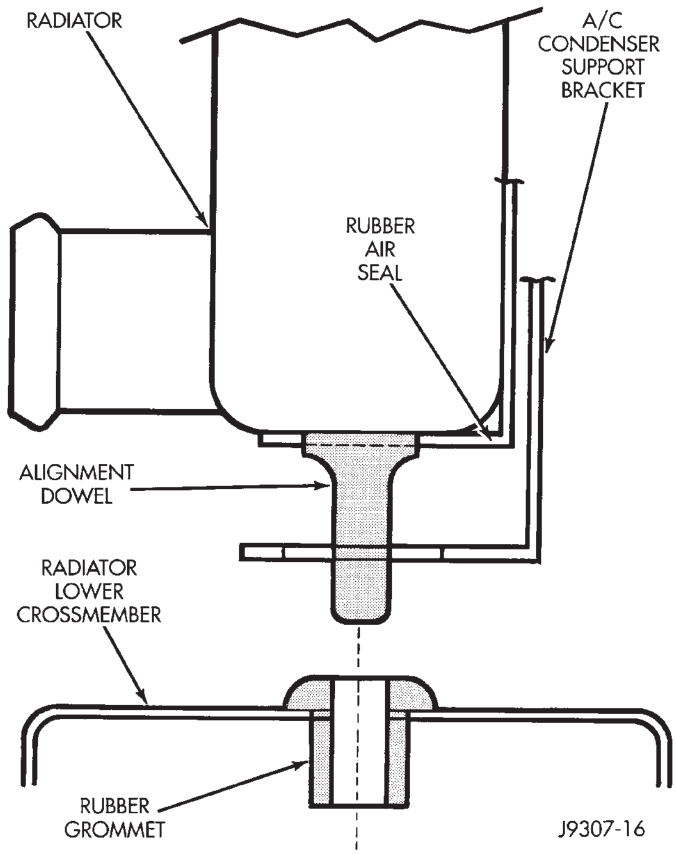

Fig. 46 Radiator Alignment Dowels

(1) Equipped with air conditioning: Gently lower the radiator into the vehicle. Guide the two radiator alignment dowels through the holes in the rubber air seals first and then through the A/C support brackets (Fig. 46). Continue to guide the alignment dowels into the rubber grommets located in lower radiator crossmember (Fig. 46). The holes in the L-shaped brackets (located on bottom of A/C condenser) must be positioned between bottom of rubber air seals and top of rubber grommets.

Not equipped with air conditioning: Gently lower the radiator into the vehicle. Guide the two radiator alignment dowels through the holes in the rubber air seals. Continue to guide the alignment dowels into the rubber grommets located in lower radiator crossmember.

(2) Connect the lower radiator hose and hose clamp to radiator.

CAUTION: The tangs on the hose clamp must be positioned straight down.

(3) 4.0L Engine: Connect the lower radiator hose at the water pump.

(4) Connect the upper radiator hose at the radiator.

(5) Equipped with air conditioning: Install the two A/C condenser-to-radiator mounting bolts (Fig. 44).

These two bolts are also used to retain the rubber air seal (Fig. 41) to the sides of radiator.

Not equipped with A/C: Install the two bolts retaining the rubber air seal (Fig. 41) to sides of radiator.

(6) Install coolant reserve/overflow tank hose at radiator.

(7) If radiator-to-upper crossmember rubber isolators were removed from radiator, install them. Tighten mounting nuts to 3 N·m (24-36 in. lbs.) torque. Position upper radiator crossmember to radiator.

(8) Working through grill opening, install and tighten the hood latch support bracket-to-lower frame crossmember bolt (Fig. 44).

(9) Install the four bolts securing the radiator upper crossmember to the body (Fig. 45).

(10) Install two nuts securing the radiator to the upper radiator crossmember (Fig. 45). Tighten nuts to 2 N·m (18-21 in. lbs.) torque.

(11) Install the upper bolt to each radiator brace (Fig. 44).

(12) Install the grill. Refer to group 23, Body.

(13) Install the rubber seal (Fig. 45) to the four (outer) seal mounting clips on vehicle body. Press down on clips until seated.

(14) Install the transmission cooler lines to radiator. Refer to Group 21 for installation.

(15) Position the fan assembly and fan shroud (as one unit) to the vehicle.

(16) Position fan shroud to radiator. Be sure the alignment tabs at the lower part of shroud are placed into the slots near lower part of radiator.

Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(17) Install the two nuts securing the fan shroud to the upper radiator crossmember (Fig. 44).

(18) 4.0L Engine: Install the four nuts securing the fan assembly to the water pump (Fig. 42). Tighten nuts to 27 N·m (20 ft. lbs.) torque.

5.2L Engine: Install the fan/viscous fan drive assembly to the water pump.

(19) Rotate the fan blades (by hand) and check for interference at fan shroud.

Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(20) Fill cooling system. Refer to Refilling Cooling System in this group.

(21) Connect battery cable at battery.

(22) Start and warm engine. Check for leaks.

RADIATOR CLEANING

The radiator and air conditioning fins should be cleaned when an accumulation of bugs, leaves etc. has occurred. Clean radiator fins are necessary for good heat transfer. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

COOLING SYSTEM HOSES

Rubber hoses route coolant to and from the radiator, intake manifold and heater core.

The lower radiator hose is spring-reinforced to prevent collapse from water pump suction at moderate and high engine speeds.

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, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (FIG. 47). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 48). If replacement is necessary, use only an original equipment clamp with matching number or letter.

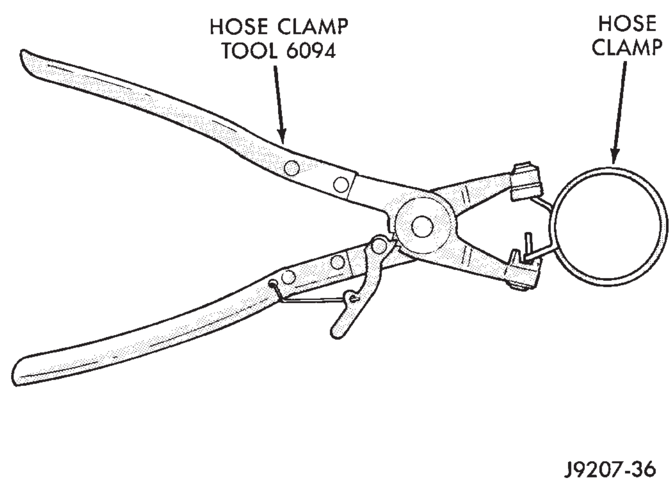

Fig. 47 Hose Clamp Tool—Typical

Inspect the hoses at regular intervals. Replace hoses that are cracked, feel brittle when squeezed, or swell excessively when the system is pressurized.

For all vehicles: In areas where specific routing clamps are not provided, be sure that hoses are positioned with sufficient clearance. Check clearance from exhaust manifolds and pipe, fan blades, drive belts and sway bars. Improperly positioned hoses can be damaged, resulting in coolant loss and engine overheating.

Ordinary worm gear type hose clamps (when equipped) can be removed with a straight screwdriver or a hex socket. **To prevent damage to hoses or clamps, the hose clamps should be**

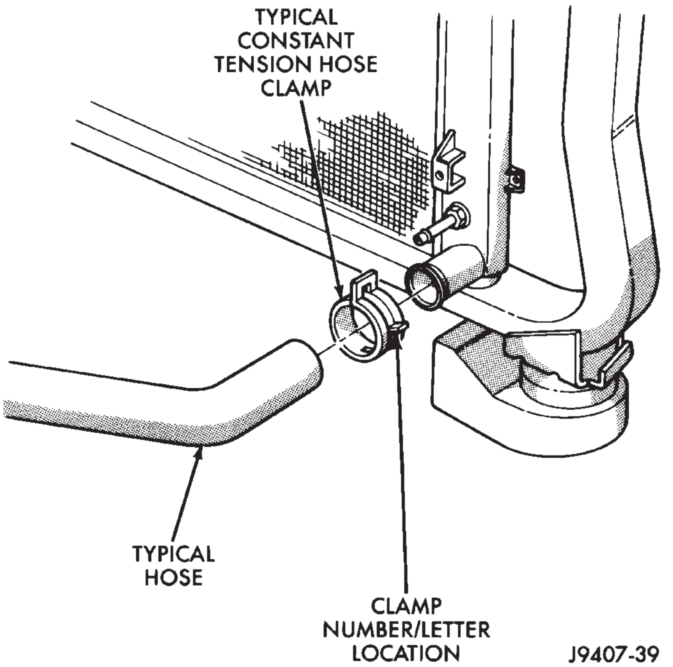

Fig. 48 Clamp Number/Letter Location

tightened to 4 N·m (34 in. lbs.) torque. Do not over tighten hose clamps.

When performing a hose inspection, inspect the radiator lower hose for proper position and condition of the internal spring.

COOLING SYSTEM FAN

For additional information, also refer to Viscous Fan Drive in this group.

REMOVAL—4.0L 6-CYLINDER ENGINE

(1) Remove the four fan hub-to-water pump pulley mounting nuts (Fig. 49). Carefully remove the fan assembly from the water pump pulley and position to center of fan shroud. Fan belt removal is not necessary as the water pump studs will hold the pump pulley in position. Do not remove fan assembly from vehicle at this time.

(2) Remove the two fan shroud-to-upper radiator crossmember mounting nuts (Fig. 50).

(3) Remove fan, viscous fan drive and fan shroud as an assembly from the vehicle.

(4) Remove the four fan blade-to-viscous fan drive mounting bolts. Remove viscous fan drive from fan blades.

After removing fan blade/fan drive assembly **do not** place the thermal viscous fan drive in the horizontal position. If stored horizontally, the silicone fluid in the viscous fan drive could drain into the bearing assembly and contaminate the lubricant.

INSTALLATION—4.0L 6-CYLINDER ENGINE

(1) Assemble fan blades to viscous fan drive. Tighten mounting bolts to 24 N·m (18 ft. lbs.) torque.

(2) Position fan, viscous fan drive and fan shroud

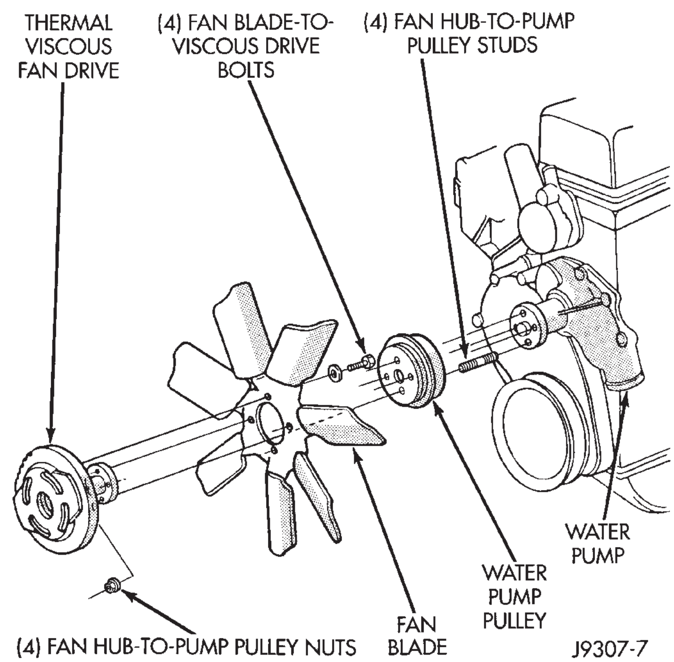

Fig. 49 Fan Mounting Nuts—4.0L 6-Cyl. Engine

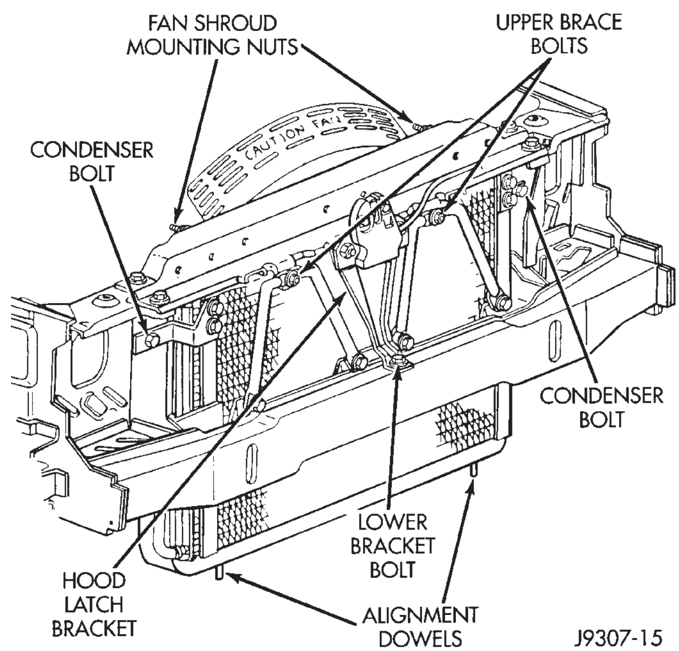

Fig. 50 Fan Shroud Mounting Nuts

to the engine as one assembly.

(3) Position fan shroud to radiator. Be sure the alignment tabs at the lower part of shroud are placed into the slots near lower part of radiator.

Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(4) Position mounting flange of fan/viscous fan drive assembly onto water pump pulley. Install four nuts and tighten to 24 N·m (18 ft. lbs.) torque.

(5) Install two fan shroud mounting nuts.

Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

REMOVAL—5.2L V-8 ENGINE

(1) Disconnect negative battery cable from battery.

(2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft (Fig. 51). Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) can be used. Place a bar or screwdriver between water pump pulley bolts (Fig. 51) to prevent pulley from rotating.

Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

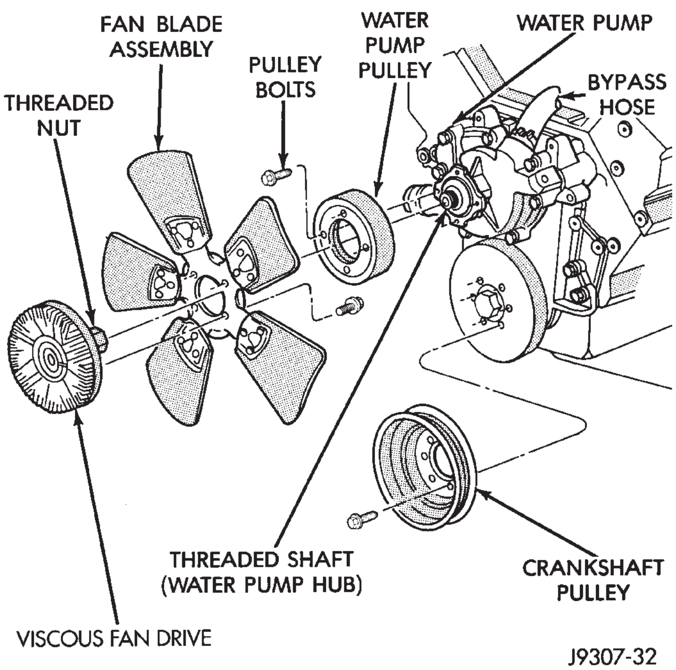

Fig. 51 Fan Blade/Viscous Fan Drive—5.2L V-8 Engine

Do not unbolt fan blade assembly (Fig. 51) from viscous fan drive at this time.

(3) Remove two fan shroud-to-upper crossmember nuts (Fig. 50).

(4) Remove fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.

After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

CAUTION: Do not remove water pump pulley-to-water pump bolts (Fig. 51). This pulley is under spring tension.

(5) Remove four bolts securing fan blade assembly to viscous fan drive (Fig. 51).

INSTALLATION—5.2L V-8 ENGINE

(1) Install fan blade assembly to viscous fan drive. Tighten bolts (Fig. 51) to 23 N·m (17 ft. lbs.) torque.

(2) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

(3) Position fan shroud to radiator. Be sure the alignment tabs at the lower part of shroud are placed into the slots near lower part of radiator. Install and tighten the two fan shroud-to-upper crossmember mounting nuts.

Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(4) Install fan blade/viscous fan drive assembly to water pump shaft.

(5) Connect negative battery cable.

FAN BLADE INSPECTION—ALL ENGINES

The fan blades cannot be repaired. If the fan is damaged, it must be replaced. Inspect the fan blades as follows:

Lay fan blade assembly on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.

WARNING: IF FAN IS NOT WITHIN SPECIFICATIONS, DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN.

Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

CAUTION: If the fan blade assembly is replaced because of mechanical damage, the water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

VISCOUS FAN DRIVE—ALL ENGINES

DESCRIPTION AND OPERATION

Also refer to the previous Cooling System Fan section.

The thermal viscous fan drive (Fig. 52 or 53) is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (a typical viscous unit is shown in figure 52 and 52). This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, the fan will remain at a reduced rpm regardless of engine speed.

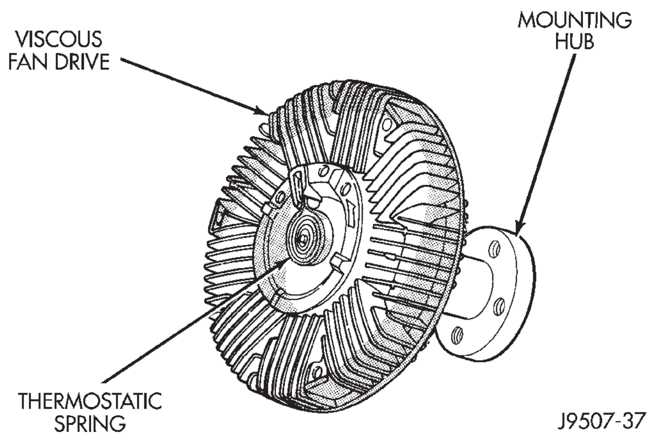

Fig. 52 Viscous Fan Drive—4.0L Engine—Typical

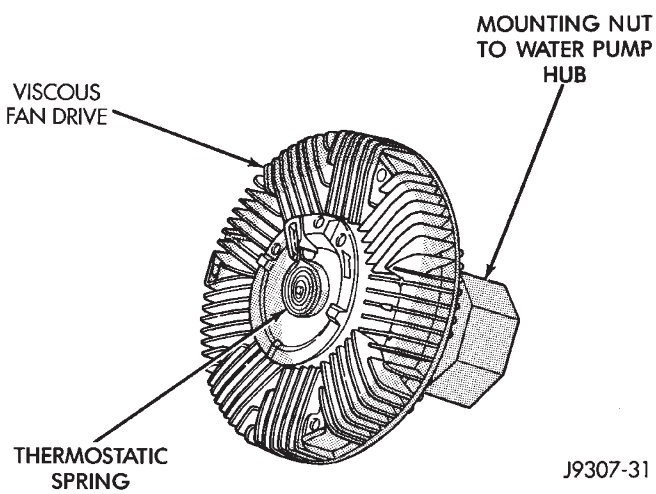

Fig. 53 Viscous Fan Drive—5.2L Engine—Typical

Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.

NOISE

It is normal for fan noise to be louder (roaring) when:

- The underhood temperature is above the engagement point for the viscous drive coupling. This may occur when ambient (outside air temperature) is very high.
- Engine loads and temperatures are high such as when towing a trailer.
- Cool silicone fluid within the fan drive unit is being redistributed back to its normal disengaged (warm) position. This can occur during the first 15 seconds to one minute after engine start-up on a cold engine.

LEAKS

Viscous fan drive operation is not affected by small oil stains near the drive bearing. If leakage appears excessive, replace the fan drive unit.

TESTING

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

(1) Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud.

(2) Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18°-to-105°C (0°-to-220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.

(3) Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).

(4) Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.

(5) Be sure that the air conditioner (if equipped) is turned off.

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 FAN. DO NOT WEAR LOOSE CLOTHING.

(6) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 88° C (190° F). Fan drive **engagement** should have started to occur at between 74° to 82° C (165° to 180° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.

(7) When the air temperature reaches 88° C (190° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 57° to 79° C (135° to 175° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

VISCOUS FAN DRIVE REMOVAL/INSTALLATION

Refer to the previous Cooling System Fan section for removal and installation procedures of the viscous drive unit.

Viscous Fan Drive Fluid Pump Out Requirement: After installing a **new** viscous fan drive, bring the engine speed up to approximately 2000 rpm and hold for approximately two minutes. This will ensure proper fluid distribution within the drive.

AUTOMATIC TRANSMISSION OIL COOLERS

There are two types of automatic transmission oil coolers:

- An oil-to-coolant type. This is supplied as standard equipment on vehicles with an automatic transmission. It is mounted in the radiator outlet tank.
- An external auxiliary oil-to-air cooler. This is supplied as optional equipment. It is mounted in front of the radiator and air conditioning condenser and behind the grille (Fig. 54).

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Remove the grill. Refer to Group 23, Body.

(3) Remove the bumper fascia. Refer to Group 23, Body.

(4) Remove the grill opening reinforcement panel. Refer to Group 23, Body.

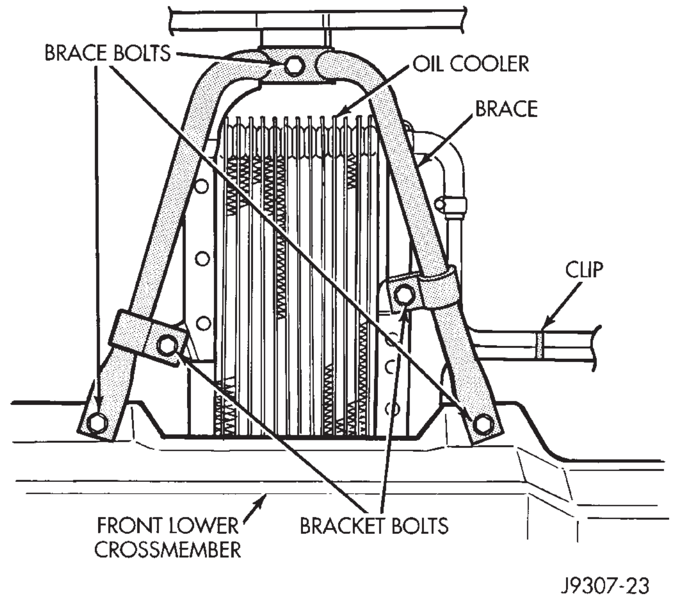

Fig. 54 Oil Cooler Mounting Brackets—Typical

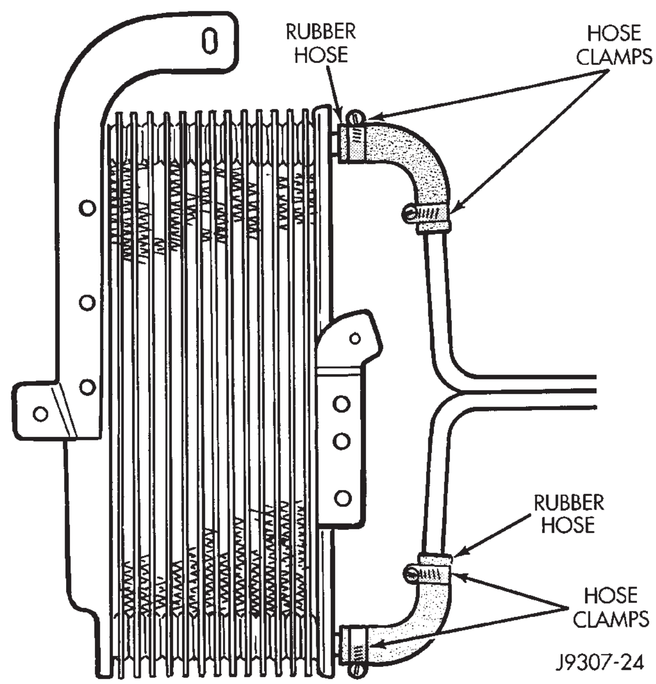

Fig. 55 Oil Cooler Hoses—Typical

(5) Remove two bracket bolts and three brace bolts (Fig. 54).

(6) Remove the retaining clip from the cooler lines (Fig. 54).

(7) Place a drain pan under the cooler.

(8) Disconnect the upper hose clamp at cooler line (Fig. 55). Separate the line from the rubber hose.

(9) Position the cooler to gain access to lower hose. The cooler lines are routed through a rubber seal located on the side of radiator. Be careful not to cut or tear this seal when positioning cooler for lower hose removal.

(10) Remove lower hose clamp and hose from cooler.

(11) Remove cooler from vehicle.

INSTALLATION

(1) Position cooler to vehicle.

(2) Install lower hose and hose clamp to cooler. Hose clamp screws must be facing towards rear of vehicle. Tighten clamp to 2 N·m (18 in. lbs.) torque.

(3) Install upper hose and hose clamp at cooler. Hose clamp screws must be facing towards rear of vehicle. Tighten clamp to 2 N·m (18 in. lbs.) torque.

(4) Install brace and mounting bracket bolts (Fig. 54).

(5) Connect negative battery cable to battery.

(6) Add necessary transmission fluid. Refer to Group 21, Transmissions. Start engine and check for leaks.

(7) Install grill opening reinforcement panel, bumper fascia and grill. Refer to Group 23, Body.

ENGINE ACCESSORY DRIVE BELTS

INDEX

GENERAL INFORMATION

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to water pump rotating in wrong direction. Refer to the appropriate engine Belt Schematic in this Group for the correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment.

BELT DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 1), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 1). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to the Serpentine Accessory Drive Belt Diagnosis charts for further belt diagnosis.

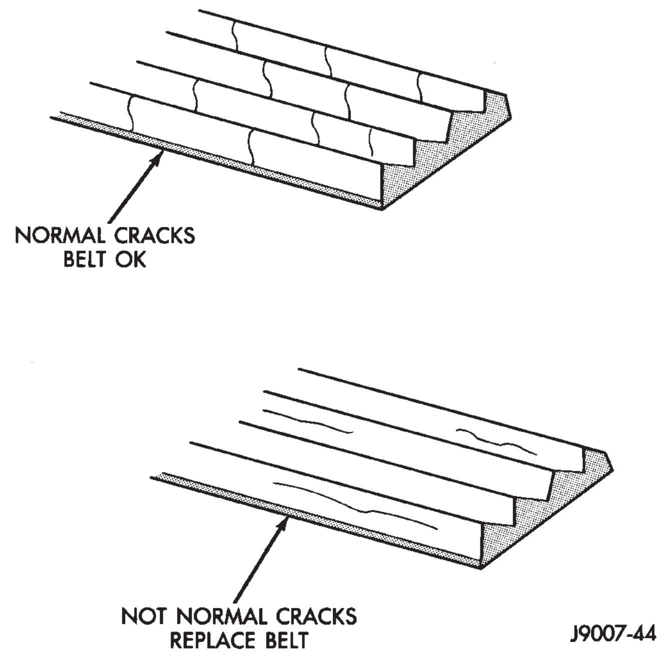

Fig. 1 Serpentine Belt Wear Patterns

SERPENTINE ACCESSORY DRIVE BELT DIAGNOSIS—4.0L 6-CYLINDER ENGINE

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY	1. Foreign objects imbedded in pulley grooves. 2. Installation damage.	1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt.
RIB OR BELT WEAR	1. Pulley(s) misaligned. 2. Abrasive environment. 3. Rusted pulley(s). 4. Sharp or jagged pulley groove tips. 5. Rubber deteriorated.	1. Align pulley(s). 2. Clean pulley(s). Replace belt if necessary. 3. Clean rust from pulley(s). 4. Replace pulley. 5. Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	1. Belt has mistracked from pulley groove. 2. Pulley groove tip has worn away rubber to tensile member.	1. Replace belt. 2. Replace belt.
BELT SLIPS	1. Belt slipping because of insufficient tension. 2. Belt or pulley subjected to substance (belt dressing, oil, ethylene glycol) that has reduced friction. 3. Driven component bearing failure. 4. Belt glazed and hardened from heat and excessive slippage.	1. Adjust tension. 2. Replace belt and clean pulleys. 3. Replace faulty component bearing. 5. Replace belt.
"GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY)	1. Belt tension either too high or too low. 2. Pulley(s) not within design tolerance. 3. Foreign object(s) in grooves. 4. Pulley misalignment. 5. Belt cordline is broken.	1. Adjust belt tension. 2. Replace pulley(s). 3. Remove foreign objects from grooves. 4. Align component. 5. Replace belt.
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED)	1. Excessive tension. 2. Tensile member damaged during belt installation. 3. Severe misalignment. 4. Bracket, pulley, or bearing failure.	1. Replace belt and adjust tension to specification. 2. Replace belt. 3. Align pulley(s). 4. Replace defective component and belt.
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	1. Belt slippage. 2. Bearing noise. 3. Belt misalignment. 4. Belt-to-pulley mismatch.	1. Adjust belt. 2. Locate and repair. 3. Align belt/pulley(s). 4. Install correct belt.

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SERPENTINE ACCESSORY DRIVE BELT DIAGNOSIS—4.0L ENGINE—CONTINUED

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION (Continued)	5. Driven component induced vibration. 6. System resonant frequency induced vibration.	5. Locate defective driven component and repair. 6. Vary belt tension within specifications. Replace belt.
TENSION SHEETING FABRIC FAILURE (WOVEN FABRIC ON OUTSIDE, CIRCUMFERENCE OF BELT HAS CRACKED OR SEPARATED FROM BODY OF BELT)	1. Tension sheeting contacting stationary object. 2. Excessive heat causing woven fabric to age. 3. Tension sheeting splice has fractured.	1. Correct rubbing condition. 2. Replace belt. 3. Replace belt.
CORD EDGE FAILURE (TENSILE MEMBER EXPOSED AT EDGES OF BELT OR SEPARATED FROM BELT BODY)	1. Excessive tension. 2. Belt contacting stationary object. 3. Pulley(s) out of tolerance. 4. Insufficient adhesion between tensile member and rubber matrix.	1. Adjust belt tension. 2. Correct as necessary. 3. Replace pulley. 4. Replace belt and adjust tension to specifications.

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SERPENTINE ACCESSORY DRIVE BELT DIAGNOSIS—5.2L 8-CYLINDER ENGINE

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY	1. Foreign objects imbedded in pulley grooves. 2. Installation damage.	1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt.
RIB OR BELT WEAR	1. Pulley(s) misaligned. 2. Abrasive environment. 3. Rusted pulley(s). 4. Sharp or jagged pulley groove tips. 5. Rubber deteriorated.	1. Align pulley(s). 2. Clean pulley(s). Replace belt if necessary. 3. Clean rust from pulley(s). 4. Replace pulley. 5. Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	1. Belt has mistracked from pulley groove. 2. Pulley groove tip has worn away rubber to tensile member.	1. Replace belt. 2. Replace belt.
BELT SLIPS	1. Belt slipping because of insufficient tension. 2. Incorrect belt. 3. Belt or pulley subjected to substance (belt dressing, oil, ethylene glycol) that has reduced friction. 4. Driven component bearing failure. 5. Belt glazed and hardened from heat and excessive slippage.	1. Replace automatic belt tensioner. 2. Replace belt. 3. Replace belt and clean pulleys. 4. Replace faulty component bearing. 5. Replace belt.
"GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY)	1. Belt tension either too high or too low. 2. Incorrect belt. 3. Pulley(s) not within design tolerance. 4. Foreign object(s) in grooves. 4. Pulley misalignment. 5. Belt cordline is broken.	1. Replace automatic belt tensioner. 2. Replace belt. 3. Replace pulley(s). 4. Remove foreign objects from grooves. 4. Check and replace. 5. Replace belt.
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED)	1. Excessive tension. 2. Incorrect belt. 3. Tensile member damaged during belt installation. 4. Severe misalignment. 5. Bracket, pulley, or bearing failure.	1. Replace belt and automatic belt tensioner. 2. Replace belt. 3. Replace belt. 4. Check and replace. 5. Replace defective component and belt.
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	1. Belt slippage. 2. Bearing noise. 3. Belt misalignment. 4. Belt-to-pulley mismatch.	1. Replace belt or automatic belt tensioner. 2. Locate and repair. 3. Replace belt. 4. Install correct belt.

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BELT TENSION—4.0L 6-CYLINDER ENGINE

Correct drive belt tension is required to ensure optimum performance of the belt driven engine accessories. There are different types of adjustment gauges for checking either a serpentine or a V-type belt. Refer to the instructions supplied with the gauge. Use the correct gauge when checking belt tension. Place gauge in the middle of the section of belt being tested (between two pulleys) to check tension (Fig. 2). Do not allow the gauge (or gauge adapter) to contact anything but the belt.

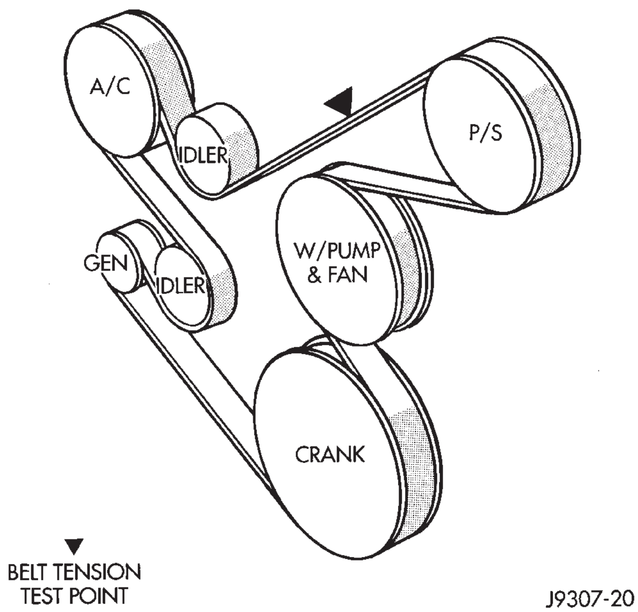

Fig. 2 Belt Routing—4.0L 6-Cylinder Engine

BELT TENSION—5.2L 8-CYLINDER ENGINE

It is not necessary to adjust belt tension on the 5.2L (V-8) engine. The engine is equipped with an automatic belt tensioner (Fig. 3). The tensioner maintains correct belt tension at all times. For other tensioner information and removal/installation procedures, refer to Automatic Belt Tensioner—5.2L Engine proceeding in this group. Due to use of this belt tensioner, do not attempt to use a belt tension gauge on 5.2L (V-8) engines.

BELT TENSION SPECIFICATIONS

4.0L ENGINE

Proper belt tension for a new serpentine accessory drive belt is 800-900 N (180-200 lbs. force). For a used belt, the belt tension is 623-712 N (140-160 lbs. force). Belt tension is not adjustable on the 5.2L engine.

BELT SCHEMATICS

Refer to figures 2 or 4 for proper belt routing. Or, refer to the Belt Routing Label located in the vehicle engine compartment.

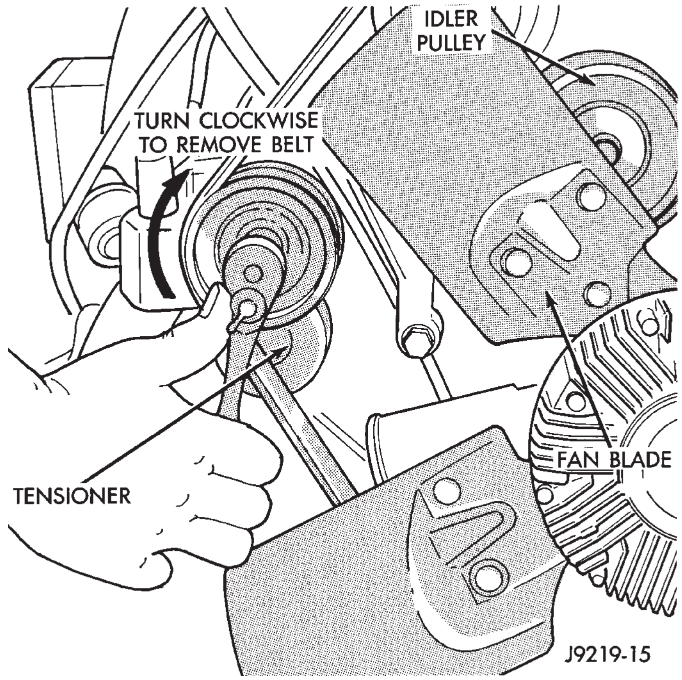

Fig. 3 Automatic Belt Tensioner—5.2L V-8 Engine

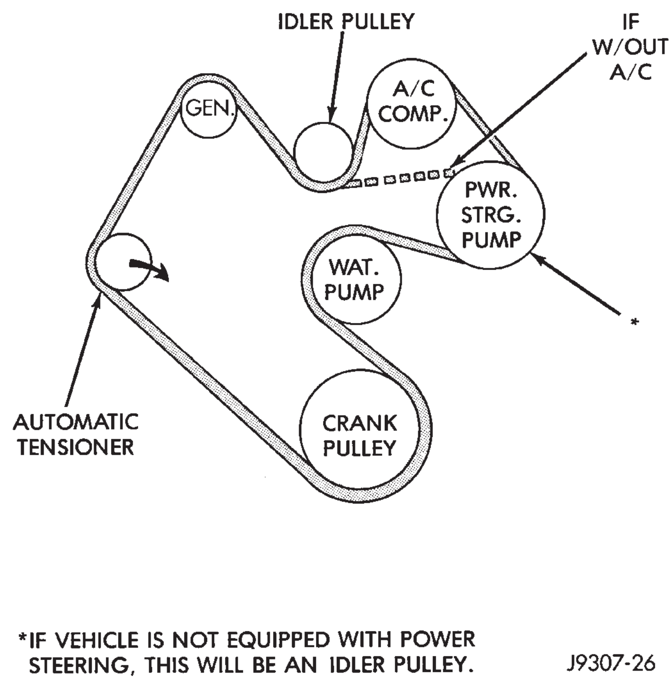

Fig. 4 Belt Routing—5.2 V-8 Engine

BELT SERVICE

REPLACEMENT/ADJUSTMENT—4.0L ENGINE

Belt tension is adjusted at the power steering pump (or idler pulley if not equipped with power steering). To adjust belt tension or to replace belt:

(1) Loosen two rear power steering pump mounting bolts A (Fig. 5).

(2) Loosen upper pump pivot bolt B and lower lock nut C (Fig. 6).

(3) Loosen pump adjusting bolt D (Fig. 5).

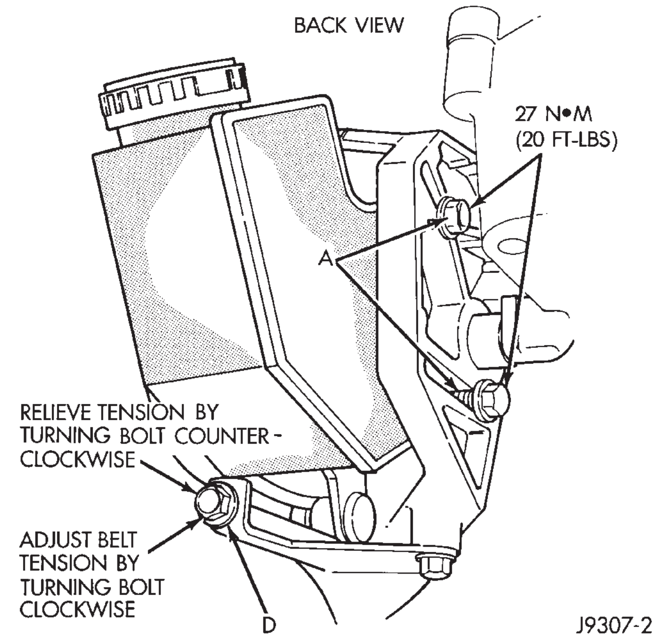

Fig. 5 P.S. Pump Rear Mounting Bolts—4.0L Engine

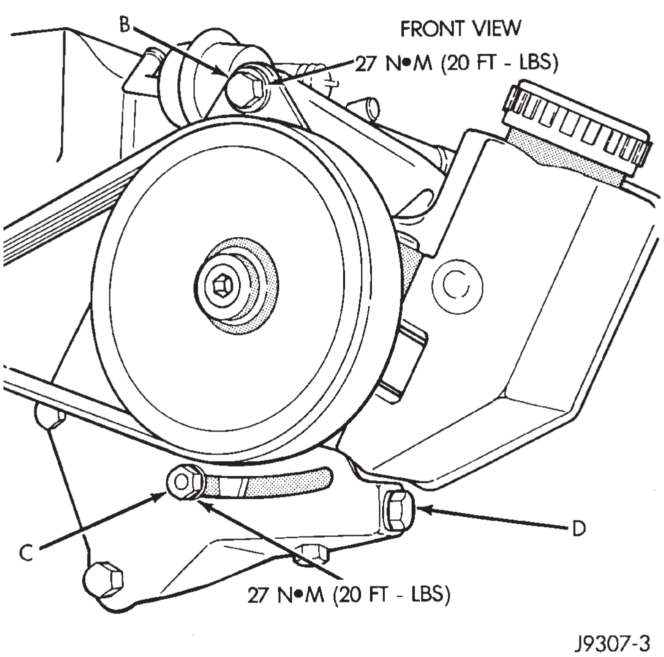

Fig. 6 P.S. Pump Front Mounting Bolt/Locknut—4.0L Engine

(4) If belt is to be adjusted, refer to Drive Belt Tension specifications at the end of this group for correct tension and proceed to step 7.

If belt is to be replaced, remove belt.

(5) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. Refer to (Fig. 4) for correct belt routing. Or, refer to the Belt Routing Label located in the vehicle engine compartment.

(6) Install new belt. Refer to the end of this group for Drive Belt Tension specifications.

(7) Tighten pump adjusting bolt D (Fig. 5) to attain proper belt tension.

(8) Tighten rear pump mounting bolts, pivot bolt and lock nut to 27 N·m (20 ft. lbs.) torque.

(9) After power steering pump has been tightened into position, recheck belt tension. Adjust if necessary.

REPLACEMENT—5.2L V-8 ENGINE

REMOVAL

Drive belts on the 5.2L V-8 engine are equipped with a spring loaded automatic belt tensioner (Fig. 7). This belt tensioner will be used on all belt configurations, such as with or without power steering or air conditioning. For more information, refer to Automatic Belt Tensioner—5.2L Engines, proceeding in this group.

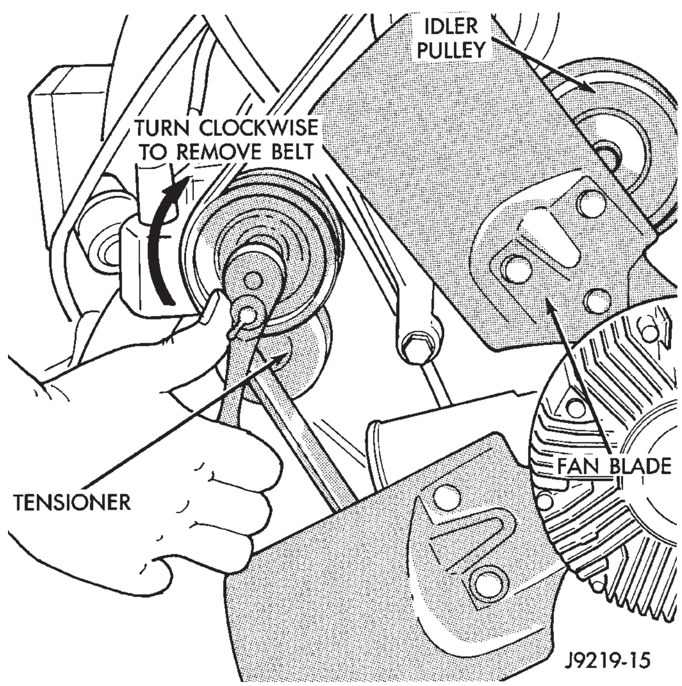

Fig. 7 Belt Tensioner—Belt Removal/Installation—5.2L V-8 Engine

(1) Attach a socket/wrench to pulley mounting bolt of automatic belt tensioner (Fig. 7).

(2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(3) Remove belt from idler pulley first.

(4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 4) for correct 5.2L V-8 engine belt routing. Or, refer to the Belt Routing Label located in the vehicle engine compartment. The correct belt with correct length must be used.

(1) Position drive belt over all pulleys **except** idler pulley. This pulley is located between generator and A/C compressor.

(2) Attach a socket/wrench to pulley mounting bolt of automatic belt tensioner (Fig. 7).

(3) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(4) Check belt indexing marks. Refer to the proceeding Automatic Belt Tensioner—5.2L Engine for more belt information.

AUTOMATIC BELT TENSIONER—5.2L ENGINE

Drive belts on the 5.2L engine are equipped with a spring loaded automatic belt tensioner (Figs. 7 and 8). This belt tensioner will be used with all belt configurations. Such as with or without power steering or air conditioning.

The tensioner is equipped with an indexing arrow (Fig. 8) on back of tensioner and an indexing mark on tensioner housing. If a new belt is being installed, arrow must be within approximately 3 mm (1/8 in.) of indexing mark (Point B—figure 8). Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed. Refer to (Fig. 4)

A used belt should be replaced if tensioner indexing arrow has moved beyond point A—figure 8.

REMOVAL

(1) Attach a socket/wrench to mounting bolt of automatic belt tensioner pulley bolt (Fig. 7).

(2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(3) Remove belt from idler pulley first.

(4) Remove belt from other pulleys.

(5) Disconnect wiring and secondary cable from ignition coil.

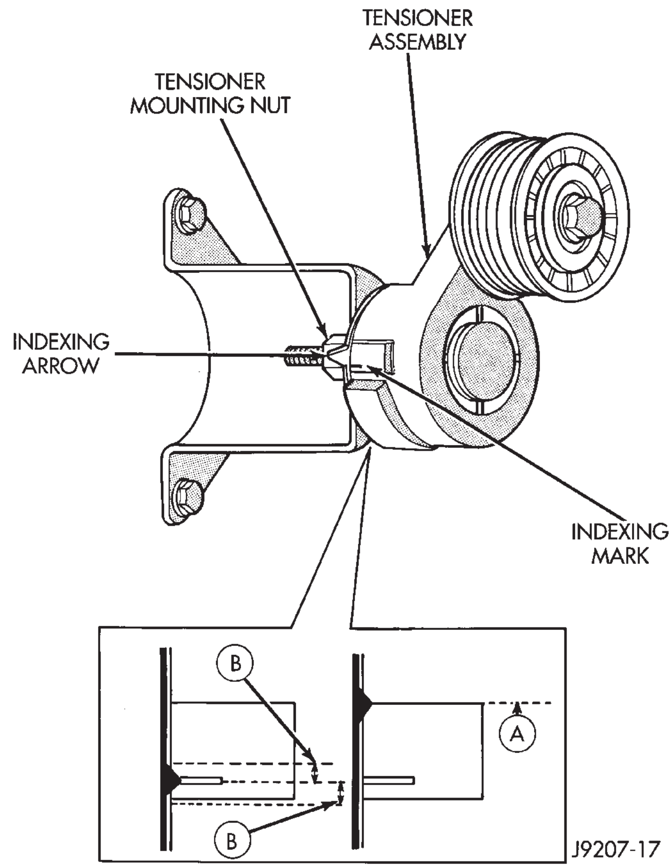

Fig. 8 Belt Tensioner/Pulley Assembly—5.2L V-8 Engine

(6) Remove ignition coil from coil mounting bracket (two bolts). Do not remove coil mounting bracket from cylinder head.

(7) Remove tensioner assembly from mounting bracket (one nut) (Fig. 8).

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC BELT TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY).

(8) Remove pulley bolt. Remove pulley from tensioner.

INSTALLATION

(1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque.

(2) Install tensioner assembly to mounting bracket. An indexing tab is located on back of tensioner. Align this tab to slot in mounting bracket. Tighten nut to 67 N·m (50 ft. lbs.) torque.

(3) Connect all wiring to ignition coil.

(4) Install coil to coil bracket. If nuts and bolts are used to secure coil to coil bracket, tighten to 11 N·m (100 in. lbs.) torque. If coil mounting bracket has been tapped for coil mounting bolts, tighten bolts to 5 N·m (50 in. lbs.) torque.

CAUTION: To prevent damage to coil case, coil mounting bolts must be torqued.

(5) Position drive belt over all pulleys **except** idler pulley (located between generator and A/C compressor).

CAUTION: When installing serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 4) for correct 5.2L engine belt routing. Or, refer to the Belt Routing Label located in the vehicle engine compartment. The correct belt with correct length must be used.

(6) Attach a socket/wrench to pulley mounting bolt of automatic belt tensioner (Fig. 7).

(7) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(8) Check belt indexing marks.

ENGINE BLOCK HEATER

DESCRIPTION AND OPERATION

An optional engine block heater (Figs. 1 or 2) is available with for all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The heater is mounted in a core hole of the engine cylinder block in place of a freeze plug with the heating element immersed in engine coolant. Connect power cord to a grounded 110-120 volt AC electrical outlet with a grounded, three wire extension cord.

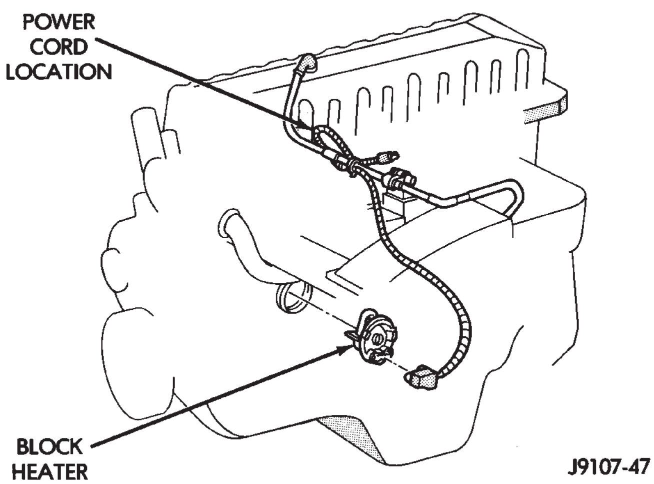

Fig. 1 Block Heater—4.0L 6-Cyl. Engine

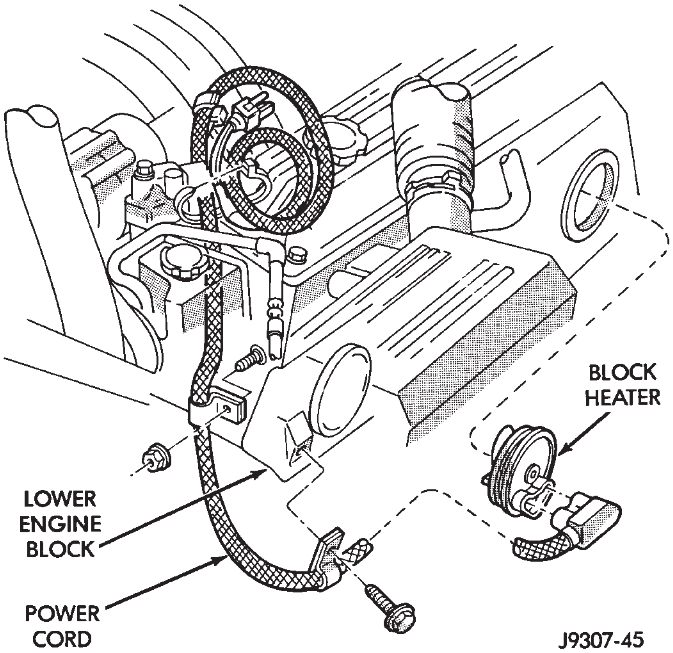

Fig. 2 Block Heater—5.2L V-8 Engine

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) Drain coolant from radiator. Refer to Draining Cooling System in this group.

(3) Raise vehicle.

(4) Remove engine cylinder block drain plug(s) located on the sides of cylinder block above the oil pan rail (Figs. 3 or 4).

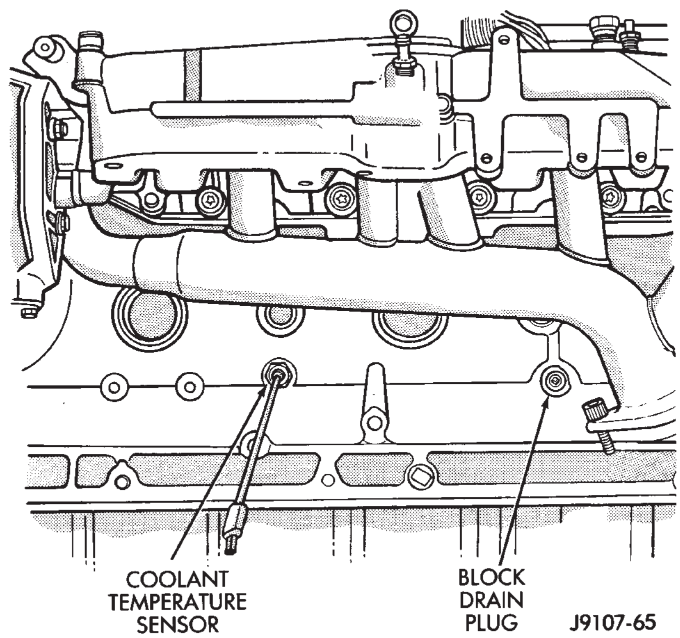

Fig. 3 Drain Plug—4.0L 6-Cylinder Engine

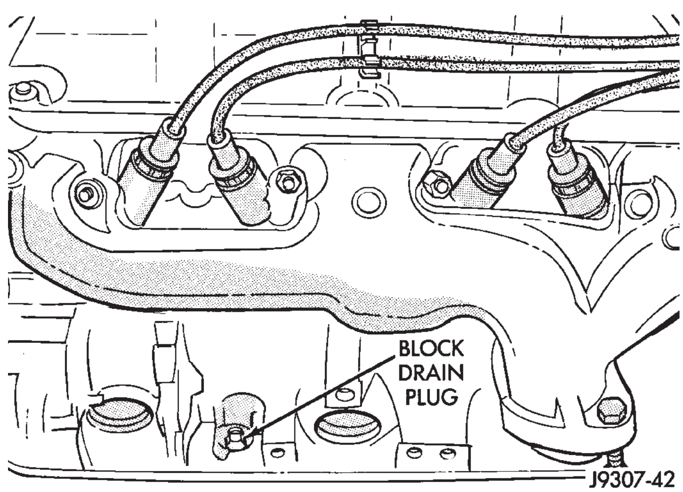

Fig. 4 Drain Plugs—5.2L V-8 Engine

(5) Remove power cord from block heater (Figs. 1 or 2).

(6) Loosen screw at center of block heater. Remove heater assembly.

INSTALLATION

(1) Thoroughly clean cylinder block core hole and block heater seat.

(2) Insert block heater assembly with element loop pointing down.

(3) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.

(4) Fill cooling system with recommended coolant. Refer to Refilling Cooling System section in this group.

(5) Start and warm the engine. Check for leaks.

SPECIFICATIONS

GENERAL INFORMATION

The following specifications are published from the latest information available at the time of publication. **If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label.** The VECI label is located in the engine compartment. Refer to Group 25, Emission System for more information on the VECI label.

COOLING SYSTEM CAPACITIES

4.0L (6 cylinder engine)—
(a) with standard cooling system
8.8L (9.3 qts.)

4.0L (6 cylinder engine)—
(a) (b) with heavy duty cooling system
9.5L (10.0 qts.)

5.2L (V-8) engine
(a) All systems
14.1L (14.9 qts.)

(a) Nominal refill capacities are shown. A variation may be observed due to manufacturing tolerances and refill procedures.

(b) The heavy duty cooling system can be identified by the use of an auxiliary transmission oil cooler located in front of the radiator.

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DRIVE BELT TENSION

4.0L (6 cylinder) engine—
* (With new serpentine belt)
800-900 N (180-200 lbs. force)

4.0L (6 cylinder) engine—
* (With used serpentine belt)
623-712 N (140-160 lbs. force)

5.2L (V-8) engine—
Do not attempt to check belt tension with a tension gauge. Belt is equipped with an automatic tensioner. Refer to Automatic Belt Tensioner in Group 7, Cooling System.

* Specifications for use with a belt tension gauge. Refer to operating instructions supplied with gauge.

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TORQUE

DESCRIPTION	TORQUE
Generator Pivot Bolt (4.0L)	27 N•m (20 ft. lbs.)
Generator Rear Adj. Bolt (4.0L Engine)	27 N•m (20 ft. lbs.)
Automatic Belt Tensioner-To Mounting Bracket (5.2L)	67 N•m (50 ft. lbs.)
Automatic Belt Tensioner Pulley Bolt (5.2L)	61 N•m (45 ft. lbs.)
Auto. Trans. Auxiliary Oil Cooler Mtg. Screws	10 N•m (90 in. lbs.)
Block Htr. Mounting Screw	4 N•m (32 in. lbs.)
Fan Blade Assy.-to- Viscous Drive	24 N•m (18 ft. lbs.)
Fan/Drive Assy.-to- Water Pump (4.0L Engine)	27 N•m (20 ft. lbs.)
Fan Shroud Mtg. Bolts	3 N•m (20 in. lbs.)
Radiator Upper Isolator-to- Crossmember Mounting Nuts	3 N•m (20 in. lbs.)
Radiator Upper Isolator-to- Radiator Mounting Nuts	4 N•m (36 in. lbs.)
Radiator Brace Bolts	10 N•m (90 in. lbs.)
Thermostat Housing	22 N•m (16 ft. lbs.)
Upper Radiator Crossmember-to- Body Mounting Bolts	10 N•m (90 in. lbs.)
Water Pump Bolts (4.0L)	30 N•m (22 ft. lbs.)
Water Pump Bolts (5.2L)	40 N•m (30 ft. lbs.)
Water Pump Pulley (5.2L)	27 N•m (20 ft. lbs.)

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CLUTCHELECTRICAL

GROUP INDEX

BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS

CONTENTS

GENERAL INFORMATION

The battery, starting, and charging systems operate with one another; therefore, they must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components involved in these systems must perform within specifications.

Group 8A covers battery, starting (Fig. 1) and charging (Fig. 2) system diagnostic procedures. These procedures include the most basic conventional diagnostic methods, to On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction milliamp ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp will be required.

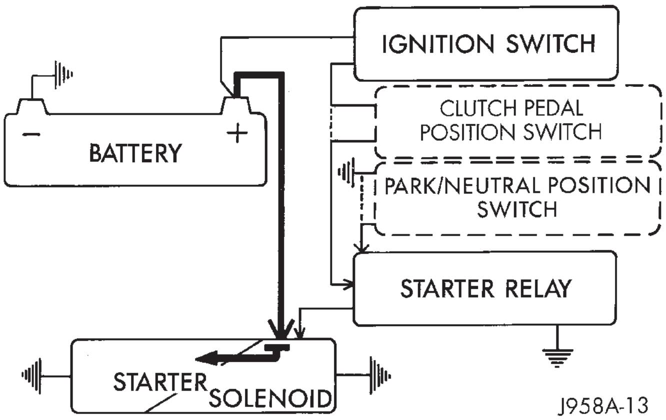


Fig. 1 Starting System Components (Typical)

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. See Using On-Board Diagnostic System in this group for more information.

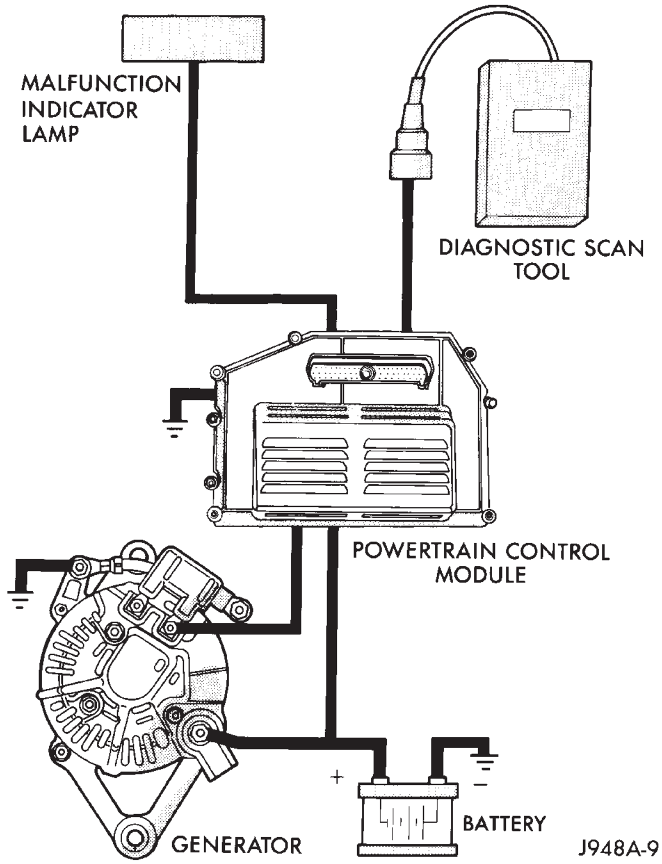


Fig. 2 Charging System Components (Typical)

BATTERY

GENERAL INFORMATION

The storage battery is a device used to store electrical energy potential in a chemical form. When an electrical load is applied to the battery terminals, an electrochemical reaction occurs within the battery. This reaction causes the battery to discharge electrical current.

The battery is made up of 6 individual cells that are connected in series. Each cell contains positively charged plate groups made of lead oxide, and negatively charged plate groups made of sponge lead. These dissimilar metal plates are submerged in a sulfuric acid and water solution called electrolyte.

As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water.

The chemical changes within the battery are caused by movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery, the process is reversed.

Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead oxide, and the water back into sulfuric acid. This action restores the difference in electron charges deposited on the plates, and the voltage potential of the battery cells.

For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

In addition to producing and storing electrical energy, the battery serves as a capacitor or voltage stabilizer for the vehicle electrical system. It absorbs abnormal or transient voltages caused by switching of any of the vehicle's electrical components.

The battery is vented to release excess gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it can ignite.

If the electrolyte level is low, the battery could arc internally and explode. If the battery is equipped with removable cell caps, add distilled water whenever the electrolyte level is below the top of the plates. If the battery cell caps cannot be removed, the battery must be replaced when the electrolyte level is low.

WARNING: DO NOT ATTEMPT TO ASSIST BOOST, CHARGE, OR TEST BATTERY WHEN ELECTROLYTE LEVEL IS BELOW THE TOP OF THE PLATES. PERSONAL INJURY MAY OCCUR.

BATTERY RATINGS

Currently, there are 2 commonly accepted methods for rating and comparing battery performance. These ratings are called Cold Cranking Amperage (CCA), and Reserve Capacity (RC). Be certain that a replacement battery has CCA and RC ratings that equal or exceed the original equipment specification for the vehicle being serviced. See Battery Classifications and Ratings charts in Specifications at the back of this group.

COLD CRANKING AMPERAGE

The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for 30 seconds at -17.7°C (0°F). Terminal voltage must not fall below 7.2 volts during or after the 30 second discharge. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.

RESERVE CAPACITY

The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.2 volts at a discharge rate of 25 amps. RC is determined with the battery fully-charged at 26.7°C (80°F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.

DIAGNOSIS

The battery must be completely charged and the top, posts, and terminal clamps should be properly cleaned before diagnostic procedures are performed. Refer to Group 8B - Battery/Starter/Generator Service for more information.

The condition of a battery is determined by two criteria:

(1) **State-Of-Charge** This can be determined by viewing the built-in test indicator, by checking specific gravity of the electrolyte (hydrometer test), or by checking battery voltage (open circuit voltage test).

(2) **Cranking Capacity** This can be determined by performing a battery load test, which measures the ability of the battery to supply high-amperage current.

If the battery has a built-in test indicator, use this test first. If it has no test indicator, but has removable cell caps, perform the hydrometer test first. If cell caps are not removable, or a hydrometer is not available, perform the open circuit voltage test first.

The battery must be charged before proceeding with a load test if:

• the built-in test indicator has a black or dark color visible
• the temperature corrected specific gravity is less than 1.235
• the open circuit voltage is less than 12.4 volts.

A battery that will not accept a charge is faulty and further testing is not required. A battery that is fully-charged, but does not pass the load test is faulty and must be replaced.

Completely discharged batteries may take several hours to accept a charge. See Charging Completely Discharged Battery.

A battery is fully-charged when:

• all cells are gassing freely during charging
• a green color is visible in the sight glass of the built-in test indicator
• three corrected specific gravity tests, taken at 1-hour intervals, indicate no increase in specific gravity
• open circuit voltage is 12.4 volts or greater.

ABNORMAL BATTERY DISCHARGING

Any of the following conditions can result in abnormal battery discharging:

(1) Corroded battery posts and terminals.
(2) Loose or worn generator drive belt.
(3) Electrical loads that exceed the output of the charging system, possibly due to equipment installed after manufacture or repeated short trip use.
(4) Slow driving speeds (heavy traffic conditions) or prolonged idling with high-amperage draw systems in use.
(5) Faulty circuit or component causing excessive ignition-off draw. See Ignition-Off Draw in this group for diagnosis.
(6) Faulty charging system.
(7) Faulty or incorrect battery.

BUILT-IN TEST INDICATOR

A test indicator (hydrometer) built into the top of the battery case, provides visual information for battery testing (Fig. 3). It is important when using the test indicator that the battery be level and have a clean sight glass to see correct indications. Additional light may be required to view indicator.

WARNING: DO NOT USE OPEN FLAME AS A SOURCE OF ADDITIONAL LIGHT FOR VIEWING TEST INDICATOR. EXPLOSIVE HYDROGEN GAS MAY BE PRESENT IN THE AREA SURROUNDING BATTERY.

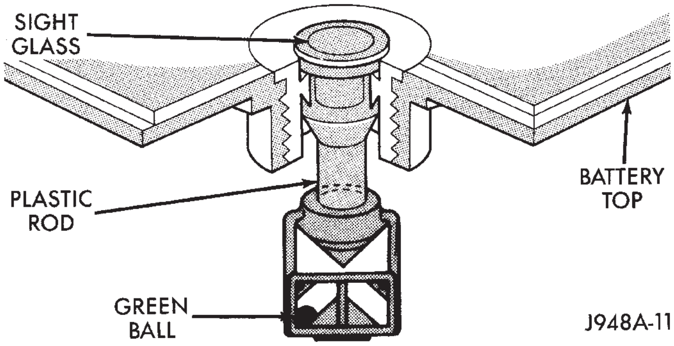


Fig. 3 Built-In Test Indicator

Like a hydrometer, the built-in test indicator measures the specific gravity of the electrolyte. Specific gravity will indicate battery state-of-charge. However, the test indicator will not indicate cranking capacity of the battery. See Load Test in this group for more information.

Look into the sight glass and note the color of the indicator (Fig. 4). Refer to the following description, as the color indicates:

GREEN—indicates 75% to 100% state-of-charge.

The battery is adequately charged for further testing or return to use. If the vehicle will not crank for a minimum of 15 seconds with a fully-charged battery, perform Load Test.

BLACK OR DARK—indicates 0% to 75% state-of-charge.

The battery is inadequately charged and must be charged until green indicator (Fig. 4) is visible in sight glass (12.4 volts or more) before the battery is tested further or returned to use. See Abnormal Battery Discharging in this group to diagnose cause of discharged condition.

YELLOW OR BRIGHT—indicates low electrolyte level.

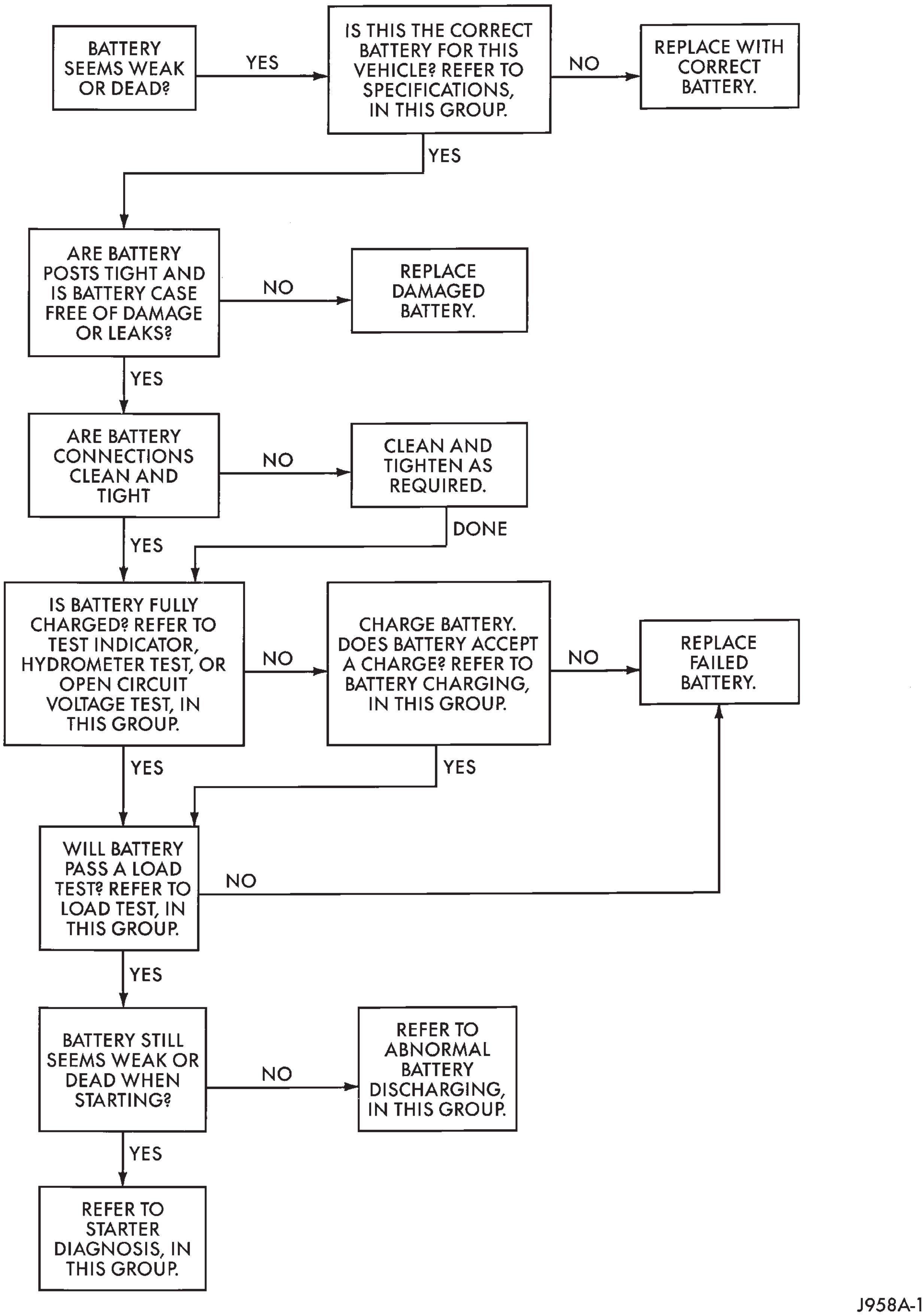
The electrolyte level in the battery is below test indicator. A maintenance-free battery with non-removable cell caps must be replaced if electrolyte level is low. Water can be added to a low-maintenance battery with removable cell caps. A low electrolyte level may be caused by an over-charging condition. See Charging System in this group to diagnose an over-charging condition.

WARNING: DO NOT ATTEMPT TO CHARGE, TEST, OR ASSIST BOOST BATTERY WHEN YELLOW OR BRIGHT COLOR IS VISIBLE IN SIGHT GLASS OF TEST INDICATOR. LOW ELECTROLYTE LEVEL CAN ALLOW BATTERY TO ARC INTERNALLY AND EXPLODE. PERSONAL INJURY MAY OCCUR.

HYDROMETER TEST

The hydrometer test reveals the battery state-of-charge by measuring the specific gravity of the electrolyte. This test cannot be performed on batteries

BATTERY DIAGNOSIS



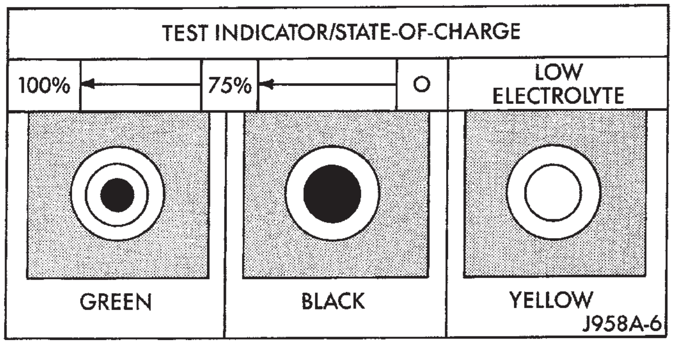


Fig. 4 Built-In Test Indicator Sight Glass

with non-removable cell caps. If battery has non-removable cell caps, see Built-In Test Indicator or Open Circuit Voltage Test.

Specific gravity is a comparison of the density of the electrolyte to the density of pure water. Pure water has a specific gravity of 1.000, and sulfuric acid has a specific gravity of 1.835. Sulfuric acid makes up approximately 35% of the electrolyte by weight, or 24% by volume.

In a fully-charged battery the electrolyte will have a temperature corrected specific gravity of 1.260 to 1.290. However, a specific gravity of 1.235 or above is satisfactory for battery load testing and/or return to service.

Before testing, visually inspect battery for any damage (cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. Then remove cell caps and check electrolyte level. Add distilled water if electrolyte level is below the top of the battery plates.

To use the hydrometer correctly, hold it with the top surface of the electrolyte at eye level. Refer to the hydrometer manufacturer's instructions for correct use of hydrometer. Remove only enough electrolyte from the battery so the float is off the bottom of the hydrometer barrel with pressure on the bulb released.

Exercise care when inserting the tip of the hydrometer into a cell to avoid damaging the plate separators. Damaged plate separators can cause premature battery failure.

Hydrometer floats are generally calibrated to indicate the specific gravity correctly only at 26.7°C (80°F). When testing the specific gravity at any other temperature, a correction factor is required.

The correction factor is approximately a specific gravity value of 0.004, referred to as 4 points of specific gravity. For each 5.5°C above 26.7°C (10°F above 80°F), add 4 points. For each 5.5°C below 26.7°C (10°F below 80°F), subtract 4 points. Always correct the specific gravity for temperature variation. Test the specific gravity of the electrolyte in each battery cell.

Example: A battery is tested at -12.2°C (10°F) and has a specific gravity of 1.240. Determine the actual specific gravity as follows:

(1) Determine the number of degrees above or below 26.7°C (80°F):

26.6°C - -12.2°C = 38.8°C (80°F - 10°F = 70°F)

(2) Divide the result from step 1 by 5.5 (10):

38.8°C/5.5 = 7 (70°F/10 = 7)

(3) Multiply the result from step 2 by the temperature correction factor (0.004):

7 x 0.004 = 0.028

(4) The temperature at testing was below 26.7°C (80°F); therefore, the temperature correction is subtracted:

1.240 - 0.028 = 1.212

The corrected specific gravity of the battery in this example is 1.212.

If the specific gravity of all cells is above 1.235, but variation between cells is more than 50 points (0.050), the battery should be replaced.

If the specific gravity of one or more cells is less than 1.235, charge the battery at a rate of approximately 5 amperes. Continue charging until 3 consecutive specific gravity tests, taken at 1-hour intervals, are constant. If the cell specific gravity variation is more than 50 points (0.050) at the end of the charge period, replace the battery.

When the specific gravity of all cells is above 1.235, and cell variation is less than 50 points (0.050), the battery may be load tested.

OPEN CIRCUIT VOLTAGE TEST

A battery open circuit voltage (no load) test will show state-of-charge of a battery. This test can be used in place of the hydrometer test if a hydrometer is not available, or for maintenance-free batteries with non-removable cell caps.

Before proceeding with this test or load test, completely charge battery as described in Battery Charging in this group.

Test battery open circuit voltage as follows:

(1) Before measuring open circuit voltage the surface charge must be removed from the battery. Turn headlamps on for 15 seconds, then allow up to 5 minutes for voltage to stabilize.

(2) Remove both battery cables, negative first.

(3) Using a voltmeter connected to the battery posts (refer to instructions provided with voltmeter) measure open circuit voltage (Fig. 5).

See Open Circuit Voltage chart. This voltage reading will indicate state-of-charge, but will not reveal cranking capacity. If a battery has an open circuit voltage reading of 12.4 volts or greater, it may be load tested. A battery that will not endure a load test is faulty and must be replaced.

OPEN CIRCUIT VOLTAGE

Open Circuit Volts	Percent Charge
11.7 volts or less	0%
12.0	25%
12.2	50%
12.4	75%
12.6 or more	100%

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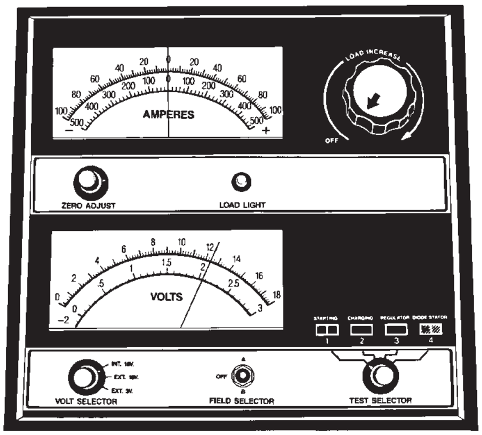

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Fig. 5 Testing Open Circuit Voltage

LOAD TEST

A battery load test will verify battery cranking capacity. The test is based on the Cold Cranking Amperage (CCA) rating of the battery. See Battery Classifications and Ratings chart in Specifications, at the back of this group.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT LOAD TEST. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

Before performing load test, the battery must be FULLY-CHARGED.

(1) Remove both battery cables, negative first. Battery top and posts should be clean.

(2) Connect a suitable volt-ammeter-load tester (Fig. 6) to the battery posts (Fig. 7). Refer to operating instructions provided with the tester being used. Check the open circuit voltage (no load) of the battery. Open circuit voltage must be 12.4 volts or greater.

(3) Rotate the load control knob (carbon pile rheostat) to apply a 300 amp load for 15 seconds, then return the control knob to OFF (Fig. 8). This will remove the surface charge from the battery.

(4) Allow the battery to stabilize to open circuit voltage. It may take up to 5 minutes for voltage to stabilize.

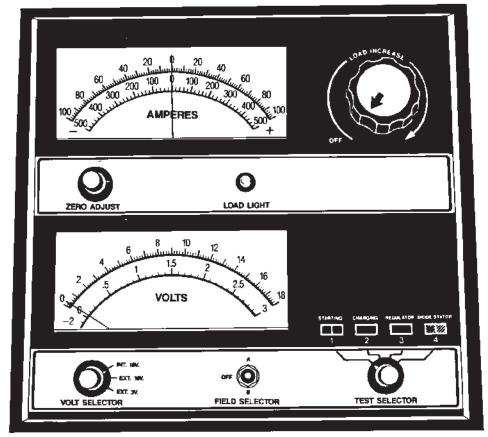

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Fig. 6 Volt-Amps-Load Tester (Typical)

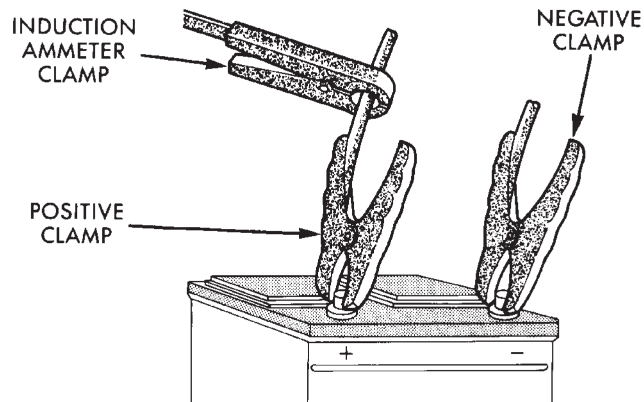

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Fig. 7 Volt-Ammeter-Load Tester Connections

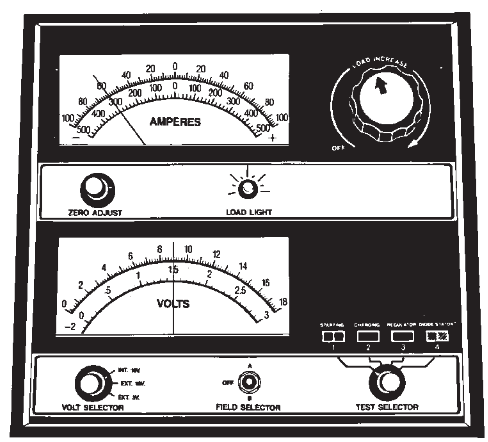

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Fig. 8 Remove Surface Charge from Battery

(5) Rotate the load control knob to maintain a load equal to 50% of CCA rating (Fig. 9). After 15 seconds, record the loaded voltage reading, then return the load control knob to OFF.

(6) Voltage drop will vary with battery temperature at the time of the load test. Battery temperature can be estimated by the ambient temperature over the past several hours. If the battery has been charged, boosted, or loaded a few minutes prior to

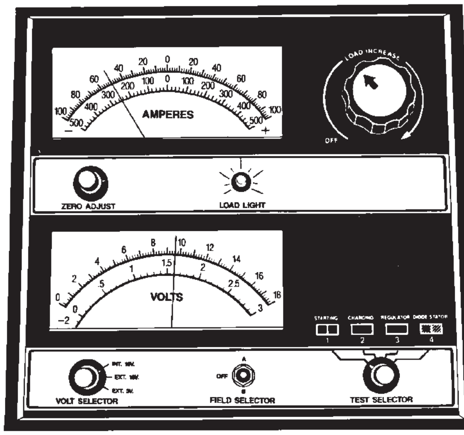

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Fig. 9 Load 50% CCA Rating - Note Voltage

test, the battery will be somewhat warmer. See Load Test Temperature chart for proper loaded voltage reading.

(7) If the voltmeter reading falls below 9.6 volts, at a minimum battery temperature of 21°C (70°F), replace the battery.

LOAD TEST TEMPERATURE		
Minimum Voltage	Temperature	
	F°	C°
9.6	70 and above	21 and above
9.5	60	16
9.4	50	10
9.3	40	4
9.1	30	-1
8.9	20	-7
8.7	10	-12
8.5	0	-18

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BATTERY CHARGING

A battery is fully-charged when:

- all cells are gassing freely during charging
- a green color is visible in sight glass of built-in test indicator
- three corrected specific gravity tests, taken at 1-hour intervals, indicate no increase in specific gravity
- open circuit voltage is 12.4 volts or above.

WARNING: DO NOT ASSIST BOOST OR CHARGE A BATTERY THAT HAS LOW ELECTROLYTE LEVEL OR IS FROZEN. BATTERY MAY ARC INTERNALLY AND EXPLODE.

WARNING: EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY.

WARNING: POISONOUS AND CAUSTIC. BATTERY CONTAINS SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. IN EVENT OF CONTACT, FLUSH WITH WATER AND CALL PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN.

CAUTION: Always disconnect the battery negative cable before charging battery to avoid damage to electrical system components. Do not exceed 16.0 volts while charging battery.

Battery electrolyte will bubble inside battery case during normal battery charging. If the electrolyte boils, or is discharged from the vent holes while charging, immediately reduce charging rate or turn OFF charger and evaluate battery condition.

Battery should not be hot to the touch. If the battery feels hot to the touch, turn OFF charger and let battery cool before continuing charging operation.

Some battery chargers are equipped with polarity sensing circuitry. This circuitry protects the charger and/or battery from being damaged if improperly connected.

If the battery state-of-charge is too low for the polarity sensing circuitry to detect, the charger will not operate. This makes it appear that the battery will not accept charging current. Refer to instructions provided with the battery charger being used to bypass the polarity sensing circuitry.

BATTERY CHARGING TIME TABLE

Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging at 21°C		
12.25 to 12.39	6 Hrs.	3 Hrs.	1.5 Hr.
12.00 to 12.24	8 Hrs.	4 Hrs.	2 Hrs.
11.95 to 12.09	12 Hrs.	6 Hrs.	3 Hrs.
10.00 to 11.95	14 Hrs.	7 Hrs.	3.5 Hrs.
10.00 to 0	See Charging Completely Discharged Battery		

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After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. If the battery will endure a load test, return the battery to use. If the battery will not endure a load test, it must be replaced.

Clean and inspect battery holddowns, tray, terminals, posts, and top before completing service. Refer to Group 8B - Battery/Starter/Generator Service for more information.

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

(1) **Battery Capacity**—A completely discharged heavy-duty battery requires twice the recharging time of a small capacity battery.

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD (-1°C/30°F) BATTERY. PERSONAL INJURY MAY RESULT.

(2) **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 the battery will be very low at first. As the battery warms, it will accept a higher charging current rate.

(3) **Charger Capacity**—A charger that supplies only 5 amperes will require a longer charging time. A charger that supplies 20 amperes or more requires a shorter charging time.

(4) **State-Of-Charge**—A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure voltage at battery posts with a voltmeter, accurate to 1/10 (0.10) volt (Fig. 10). If the reading is below 10 volts, the charge current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on ammeters built into many chargers.

(2) Disconnect battery negative cable. Connect charger leads. Some battery chargers are equipped with polarity sensing circuitry. This circuitry protects the charger and/or battery from being damaged if improperly connected. If the battery state-of-charge is too low for the polarity sensing circuitry to detect, the charger will not operate. This makes it appear that the battery will not accept charging current. Refer to the instructions provided with the battery charger to bypass the polarity sensing circuitry.

(3) Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charger current at various voltages is shown in Charge Rate chart. If charge current is still not measurable at end of charging times, the battery should be replaced. If charge current is measurable during charging time, the battery may be good and charging should be completed in the normal manner.

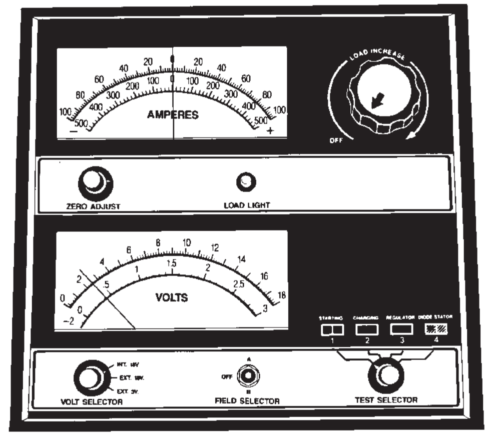

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Fig. 10 Voltmeter Accurate to 1/10 Volt Connected

CHARGE RATE

Voltage	Hours
16.0 volts maximum	up to 4 hrs.
14.0 to 15.9 volts	up to 8 hrs.
13.9 volts or less	up to 16 hrs.

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IGNITION-OFF DRAW

GENERAL INFORMATION

Ignition-Off Draw (IOD) refers to power being drained from the battery with the ignition switch turned OFF. A normal vehicle electrical system will draw from 5 to 20 milliamps (0.005 - 0.020 amps). This is with the ignition switch in the OFF position, and all non-ignition controlled circuits in proper working order. The 20 milliamps are needed to supply PCM memory, digital clock memory, and electronically-tuned radio memory.

A vehicle that has not been operated for approximately 20 days, may discharge the battery to an inadequate level. When a vehicle will not be used for 20 days or more (stored), remove the IOD fuse in the Power Distribution Center (PDC). This will reduce battery discharging.

Excessive battery drain can be caused by:

- electrical items left on
- faulty or improperly adjusted switches
- internally shorted generator
- intermittent shorts in the wiring.

If the IOD is over 20 milliamps, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service.

DIAGNOSIS

Testing for high-amperage IOD must be performed first to prevent damage to most milliamp meters.

(1) Verify that all electrical accessories are off. Turn off all lamps, remove ignition key, and close all doors. If the vehicle is equipped with illuminated entry or electronically-tuned radio, allow the systems to automatically shut off (time out). This may take up to 3 minutes.

(2) Determine that the underhood lamp is operating properly, then disconnect or remove bulb.

(3) Disconnect negative cable from battery.

(4) Connect a typical 12-volt test lamp (low-wattage bulb) between the negative cable clamp and the battery negative terminal. Make sure that the doors remain closed so that illuminated entry is not activated.

The test lamp may light brightly for up to 3 minutes, or may not light at all, depending upon the vehicle's electrical equipment. The term brightly, as used throughout the following tests, implies the brightness of the test lamp will be the same as if it were connected across the battery.

The test lamp must be securely clamped to the negative cable clamp and battery negative terminal. If the test lamp becomes disconnected during any part of the IOD test, the electronic timer function will be activated and all tests must be repeated.

(5) After 3 minutes the test lamp should turn off or be dimly lit, depending upon the vehicle's electrical equipment. If the test lamp remains brightly lit, do not disconnect it. Remove each fuse or circuit breaker (refer to Group 8W - Wiring Diagrams) until test lamp is either off or dimly lit. This will isolate each circuit and identify the source of the high-amperage draw.

If the test lamp is still brightly lit after disconnecting each fuse and circuit breaker, disconnect the wiring harness from the generator. If test lamp now turns off or is dimly lit, see Charging System in this group to diagnose faulty generator. Do not disconnect the test lamp.

After high-amperage IOD has been corrected, low-amperage IOD may be checked. It is now safe to install a milliamp meter to check for low- amperage IOD.

(6) With test lamp still connected securely, clamp a milliamp meter between battery negative terminal and negative cable clamp.

Do not open any doors or turn on any electrical accessories with the test lamp disconnected or the milliamp meter may be damaged.

(7) Disconnect test lamp. Observe milliamp meter. The current draw should not exceed 0.020 amp. If draw exceeds 20 milliamps, isolate each circuit by removing circuit breakers and fuses. The milliamp meter reading will drop when the source of the draw is disconnected. Repair this circuit as necessary, whether a wiring short, incorrect switch adjustment or a component failure is found.

STARTING SYSTEM

GENERAL INFORMATION

The starting system (Fig. 11) consists of:
- ignition switch
- starter relay
- park/neutral position switch (automatic transmission)
- clutch pedal position switch (manual transmission)
- wiring harness and connections
- battery
- starter with an integral solenoid.

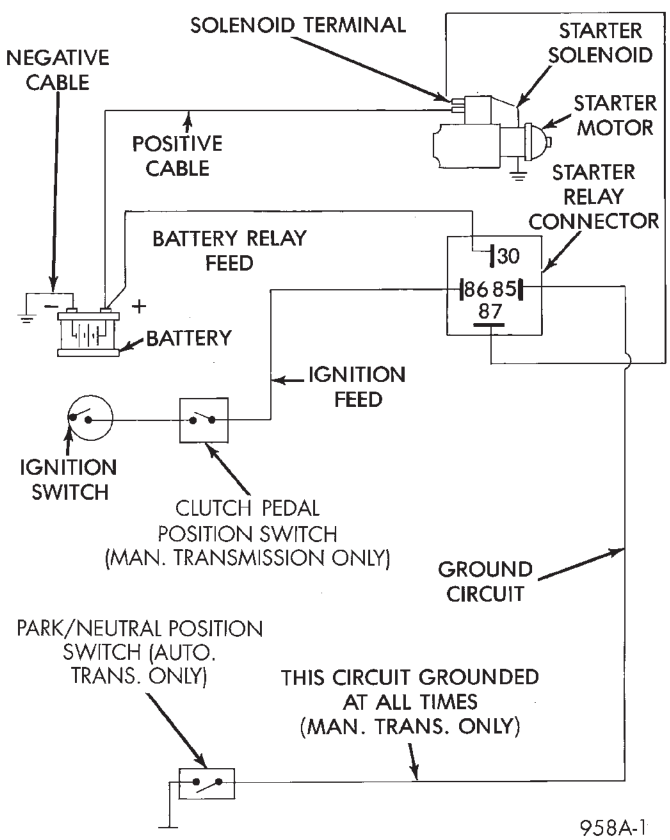

Fig. 11 Starting System Components (Typical)

Following is a general description of the major starting system components. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

These components form 2 separate circuits. A high-amperage feed circuit that feeds the starter up to 300+ amps, and a low-amperage control circuit that operates on less than 20 amps.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the START position. If the vehicle is equipped with a manual transmission, it also has a clutch pedal position switch. The clutch pedal position switch supplies battery voltage to the coil battery terminal of the starter relay only if the clutch pedal is depressed while the ignition switch is turned to the START position.

If the vehicle is equipped with an automatic transmission, the park/neutral position switch provides a ground path to the starter relay coil ground terminal. This switch provides ground only with the transmission in NEUTRAL or PARK. If the vehicle is equipped with a manual transmission, the starter relay coil ground terminal is always grounded.

With the starter relay coil now energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid coils pull-in and hold-in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter. This engages the starter overrunning clutch and pinion gear with the flywheel/drive plate ring gear.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter from damage by allowing the starter pinion gear to spin faster than the pinion shaft. When the driver releases the ignition switch to the ON position the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid coil is de-energized.

When the solenoid coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the ring gear.

The starter motor and solenoid are serviced only as a complete assembly. If either component fails, the entire assembly must be replaced.

DIAGNOSIS

Before removing any unit from the starting system for repair, perform the following inspections:

INSPECTION

BATTERY INSPECTION

To determine condition of the battery, see Battery in this group.

WIRING INSPECTION

Inspect wiring for damage. Inspect all connections at:
- starter solenoid
- park/neutral position switch (automatic transmission)
- clutch pedal position switch (manual transmission)
- ignition switch
- starter relay
- battery (including all ground connections).

Clean, tighten and repair all connections as required.

SOLENOID, RELAY AND SWITCH INSPECTIONS

Inspect the solenoid, relay and ignition switch to determine their condition. Also, if equipped with automatic transmission, inspect condition of the park/neutral position switch. If equipped with manual transmission, inspect condition of the clutch pedal position switch. Testing information can be found in the following pages.

STARTING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
STARTER FAILS TO ENGAGE.	1. Battery discharged or faulty.	1. See Battery, in this group. Charge or replace battery, if required.
	2. Starting circuit wiring faulty.	2. See Cold Cranking Test, in this group. Test and repair feed and/or control circuits, if required.
	3. Starter relay faulty.	3. See Relay Test, in this group. Replace relay, if required.
	4. Ignition switch faulty.	4. Refer to Group 8D – Ignition Systems, for testing and service information. Replace or adjust switch, if required.
	5. Park/Neutral position switch (auto trans) faulty or misadjusted.	5. Refer to Group 21 – Transmission and Transfer Case, for testing and service information. Replace switch, if required.
	6. Clutch pedal position switch (man trans) faulty.	6. Refer to Group 6 – Clutch, for testing and service information. Replace switch, if required.
	7. Starter solenoid faulty.	7. See Solenoid Test, in this group. Replace starter assembly, if required.
	8. Starter assembly faulty.	8 Refer to Group 8B – Battery/Starter/Generator Service, for starter service procedures. Replace starter assembly, if required.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty.	1. See Battery, in this group. Charge or replace battery, if required.
	2. Starting circuit wiring faulty.	2. See Cold Cranking Test, in this group. Test and repair feed and/or control circuits, if required.
	3. Starter assembly faulty.	3. Refer to Group 8B – Battery/Starter/Generator Service, for starter service procedures. Replace starter assembly, if required.
	4. Engine seized.	4. Refer to Group 9 – Engine, for diagnostic and service procedures.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Broken teeth on flywheel or drive plate ring gear.	1. Refer to Group 8B – Battery/Starter/Generator Service, for starter removal procedures. Inspect ring gear and replace, if required.
	2. Starter assembly faulty.	2. Refer to Group 8B – Battery/Starter/Generator Service, for starter service procedures. Replace starter assembly, if required.
STARTER DOES NOT DISENGAGE.	1. Starter improperly installed.	1. Refer to Group 8B – Battery/Starter/Generator Service, for starter installation procedures.
	2. Starter relay faulty.	2. See Relay Test, in this group. Replace relay, if required.
	3. Ignition switch faulty.	3. Refer to Group 8D – Ignition Systems, for testing and service information. Replace or adjust switch, if required.
	4. Starter assembly faulty.	4. Refer to Group 8B – Battery/Starter/Generator Service, for starter service procedures. Replace starter assembly, if required.

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COLD CRANKING TEST

(1) Battery must be fully-charged and load tested before proceeding. See Battery, in this group.

(2) Connect a suitable volt-ampere tester to the battery terminals (Fig. 12). Refer to the operating instructions provided with the tester being used.

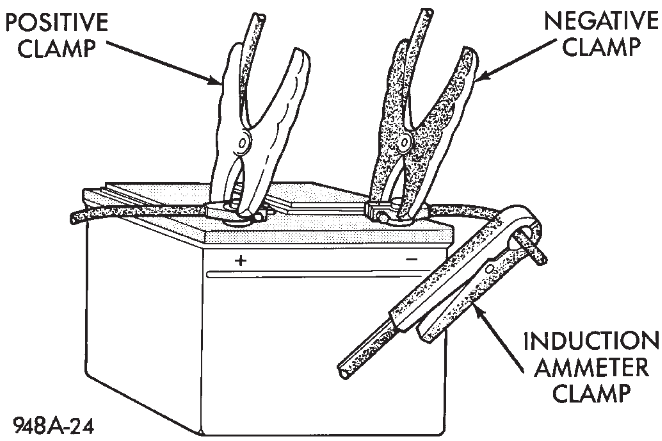


Fig. 12 Volt-Amps Tester Connections (Typical)

(3) Fully engage parking brake. Place manual transmission in NEUTRAL and fully depress clutch pedal. Place automatic transmission in PARK.

(4) Verify that all lamps and accessories are OFF.

(5) Unplug Auto Shut-Down (ASD) relay from Power Distribution Center (PDC) to prevent engine from starting. Relay location is shown on underside of PDC cover.

(6) Rotate and hold the ignition switch in the START position. Note cranking voltage and amperage.

(a) If voltage reads above 9.6 volts and amperage draw reads above specifications, see Feed Circuit Tests.

(b) If voltage reads 12.5 volts or greater and amperage reads below specifications, see Control Circuit Tests.

A cold engine will increase starter current and reduce battery voltage.

FEED CIRCUIT TESTS

The starter feed circuit tests (voltage drop method) will determine if there is excessive resistance in the high-amperage circuit. When performing these tests, it is important that the voltmeter be connected properly. Connect voltmeter leads to the terminals that the cable connectors or clamps are attached to, not to the cable connectors or clamps. For example: When testing between the battery and solenoid, touch the voltmeter leads to the battery post and the solenoid threaded stud.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing the tests, be certain the following procedures are accomplished:

- unplug Auto Shut-Down (ASD) relay from Power Distribution Center (PDC) to prevent engine from starting
- place transmission in NEUTRAL (manual transmission) or PARK (automatic transmission)
- install a jumper wire between two clutch pedal position switch connectors (manual transmission)
- parking brake is applied
- battery is fully-charged (see Battery, in this group).

(1) Connect positive lead of voltmeter to battery negative post. Connect negative lead of voltmeter to battery negative cable clamp (Fig. 13). Rotate and hold ignition switch in the START position. Observe voltmeter. If voltage is detected, correct poor contact between cable clamp and post.

(2) Connect positive lead of voltmeter to battery positive post. Connect negative lead of voltmeter to battery positive cable clamp (Fig. 13). Rotate and hold ignition switch in the START position. Observe voltmeter. If voltage is detected, correct poor contact between cable clamp and post.

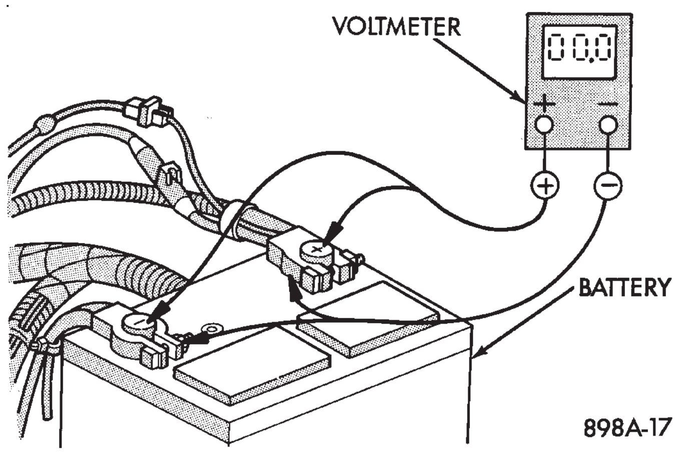


Fig. 13 Test Battery Connection Resistance

(3) Connect voltmeter to measure between the battery positive post and the starter solenoid battery stud (Fig. 14). Rotate and hold ignition switch in the START position. Observe voltmeter. If voltage reads above 0.2 volt, correct poor contact at battery cable to solenoid connection. Repeat test. If reading is still above 0.2 volt, replace battery positive cable.

(4) Connect voltmeter to measure between the battery negative post and a good clean ground on the engine block (Fig. 15). Rotate and hold ignition switch in the START position. Observe voltmeter. If voltage reads above 0.2 volt, correct poor contact at battery negative cable attaching point. Repeat test. If reading is still above 0.2 volt, replace battery negative cable.

(5) Connect positive lead of voltmeter to starter housing. Connect negative lead of voltmeter to battery negative terminal (Fig. 16). Rotate and hold ig-

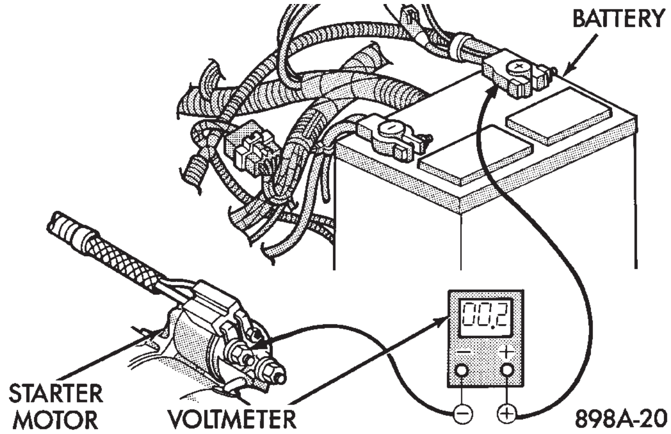


Fig. 14 Test Battery Positive Cable Resistance (Typical)

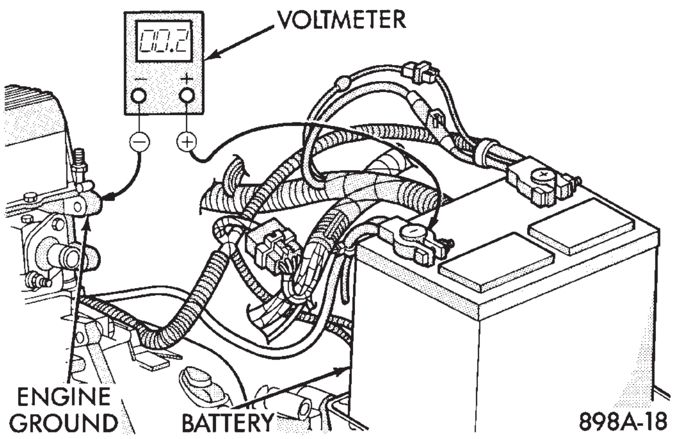


Fig. 15 Test Ground Circuit Resistance

nition switch in the START position. Observe voltmeter. If voltage reads above 0.2 volt, correct poor starter to engine ground.

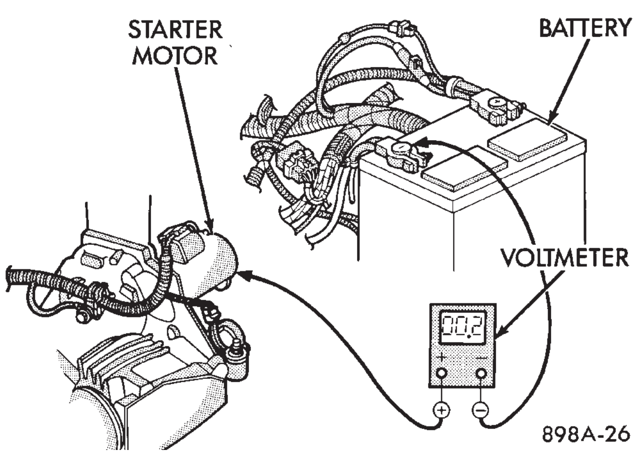


Fig. 16 Test Starter Ground (Typical)

If resistance tests detect no feed circuit problems, remove the starter and see Solenoid Test in this group.

CONTROL CIRCUIT TESTS

The starter control circuit consists of:

- starter solenoid
- starter relay
- ignition switch
- park/neutral position switch (automatic transmission)
- clutch pedal position switch (manual transmission)
- wiring harness and connections.

Test procedures for these components are as follows, and should be followed in the order described.

CAUTION: Before performing any test, unplug Auto Shut-Down (ASD) relay from Power Distribution Center (PDC) to prevent engine from starting.

SOLENOID TEST

Refer to Group 8B - Battery/Starter/Generator Service for starter removal procedures.

(1) Disconnect solenoid field coil wire from field coil terminal.

(2) Check for continuity between solenoid terminal and field coil terminal with a continuity tester. There should be continuity (Fig. 17).

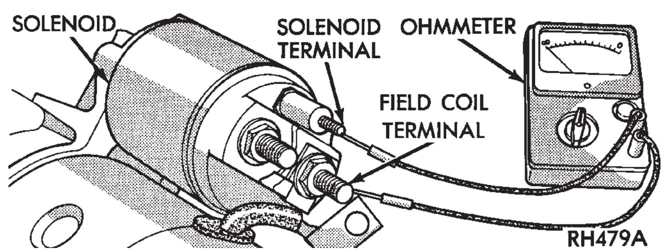


Fig. 17 Continuity Test Between Solenoid Terminal and Field Coil Terminal

(3) Check for continuity between solenoid terminal and solenoid case. There should be continuity (Fig. 18).

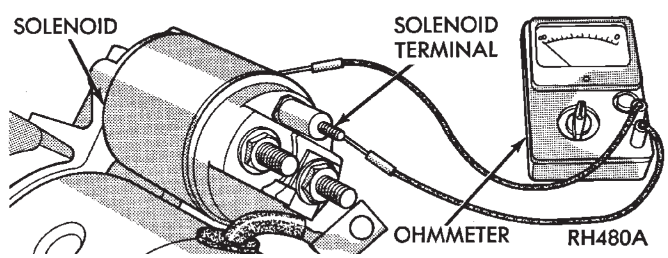


Fig. 18 Continuity Test Between Solenoid Terminal and Solenoid Case

(4) If there is continuity, solenoid is good. If there is no continuity in either test, solenoid has an open circuit and is faulty. Replace starter assembly.

(5) Connect solenoid field coil wire to field coil terminal.

(6) Install starter as described in Group 8B - Battery/Starter/Generator Service.

RELAY TEST

The starter relay is in the Power Distribution Center (PDC)(Fig. 19). Refer to the underside of the PDC cover for relay location.

Remove starter relay from PDC 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 next step. If not OK, replace faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75±5 ohms. If OK, go to next step. If not OK, replace faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, go to Relay Circuit Test. If not OK, replace faulty relay.

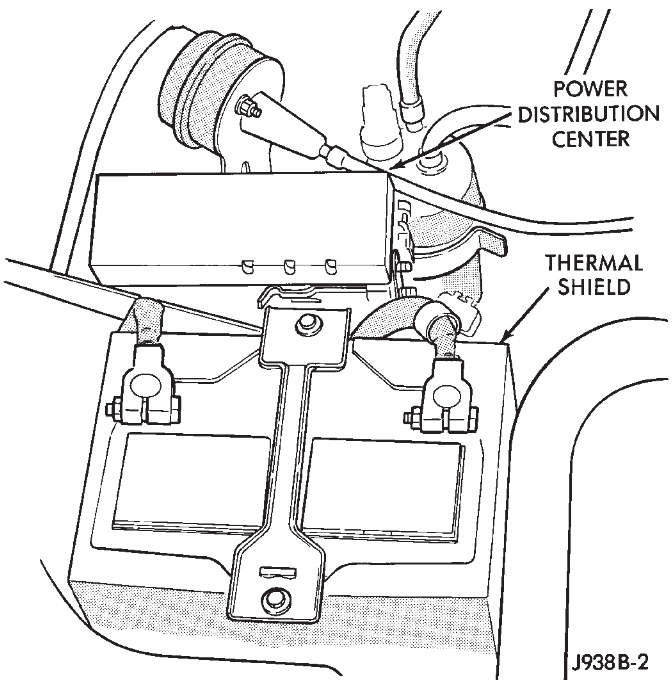


Fig. 19 Power Distribution Center

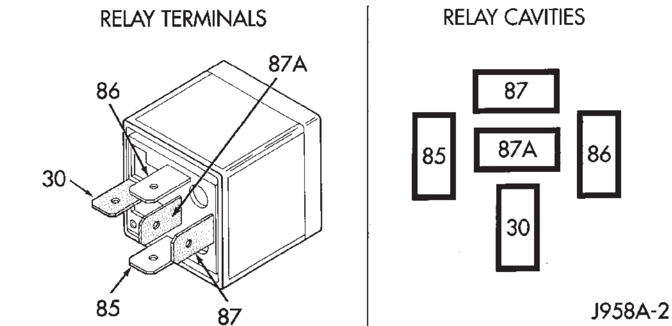
RELAY CIRCUIT TEST

(1) The common feed terminal (30) is connected to battery voltage and should be hot at all times. If OK, go to next step. If not OK, check circuit to fuse F12 in Power Distribution Center (PDC). Repair as required.

(2) The normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to next step.

(3) The normally open terminal (87) is connected to the battery terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coils. There should be continuity between cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to next step. If not OK, repair circuit to solenoid as required.

STARTER RELAY CONNECTIONS



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is in the START position. Check for battery voltage at cavity for relay terminal 86 with ignition switch in the START position. If OK, go to next step. If not OK and vehicle has automatic transmission, refer to Group 8D - Ignition Systems for testing and service of the ignition switch. If not OK and vehicle has manual transmission, refer to Group 6 - Clutch for testing and service of the clutch pedal position switch.

(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. On vehicles with a manual transmission, it is grounded at all times. Check for continuity to ground at cavity for relay terminal 85. If not OK and vehicle has manual transmission, repair circuit as required. If not OK and vehicle has automatic transmission, refer to Group 21 - Transmission and Transfer Case for testing and service of the park/neutral position switch.

IGNITION SWITCH TEST

Refer to Group 8D - Ignition Systems for testing and service of this component.

PARK/NEUTRAL POSITION SWITCH TEST

Refer to Group 21 - Transmission and Transfer Case for testing and service of this component.

CLUTCH PEDAL POSITION SWITCH TEST

Refer to Group 6 - Clutch for testing and service of this component.

CHARGING SYSTEM

GENERAL INFORMATION

The charging system consists of:
- generator
- voltage regulator circuitry (within PCM)
- ignition switch
- battery
- voltmeter
- wiring harness and connections.

Following is a general description of the major charging system components. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

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.

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 wye (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 vehicle electrical system through the generator battery and ground terminals.

The amount of DC current produced by the generator is controlled by the generator voltage regulator (field control) circuitry, contained within the Powertrain Control Module (PCM)(Fig. 20). This circuitry is connected in series with the second rotor field terminal and ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The generator voltage regulator circuitry monitors system line voltage and ambient temperature. It then compensates and regulates generator current output accordingly.

The generator is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced. The generator voltage regulator (field control) circuitry can be serviced only by replacing the entire PCM.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including the generator voltage regulator (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. See Using On-Board Diagnostic System in this group for more information.

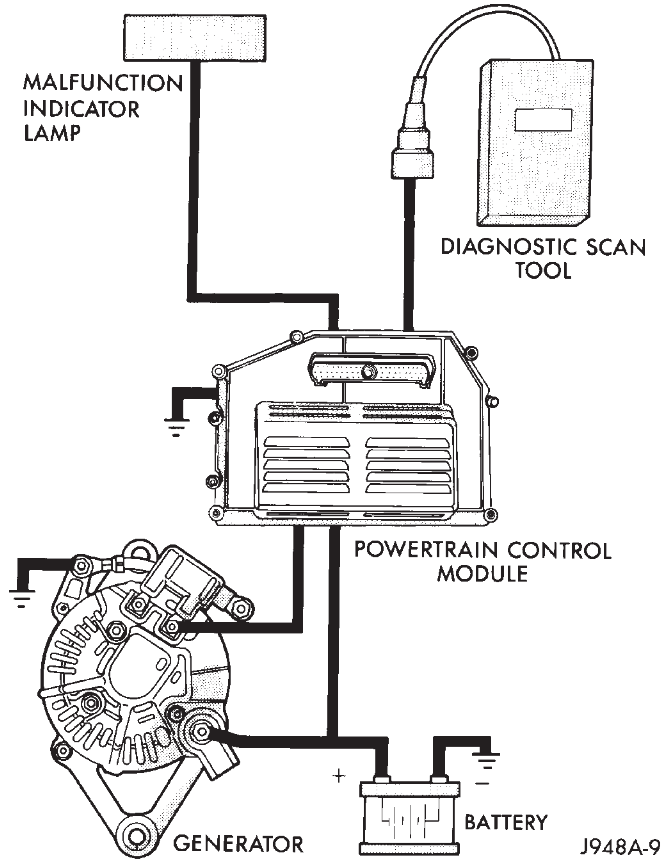


Fig. 20 Charging System Components (Typical)

DIAGNOSIS

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 procedures may be used to diagnose the charging system if:
- 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 in this group).

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 re-

ceptacles. They should be properly installed and tight. Repair or replace as required.

(3) Inspect the electrolyte level in the battery. If cell caps are removable, add water if required. If cell caps are not removable, replace battery if electrolyte level is low.

(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts, if required. Refer to Group 8B - Battery/Starter/Generator Service for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in Group 7 - Cooling System.

(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.

OUTPUT WIRE RESISTANCE TEST

This test will show the amount of voltage drop across the generator output wire, from the generator battery terminal to the battery positive post.

PREPARATION

(1) Before starting test make sure vehicle has a fully-charged battery. See Battery in this group for more information.

(2) Turn ignition switch to OFF.

(3) Disconnect negative cable from battery.

(4) Disconnect generator output wire from generator battery output terminal.

(5) Connect a 0-150 ampere scale DC ammeter (Fig. 21). Install in series between generator battery output terminal and disconnected generator output wire. Connect positive lead to generator battery output terminal and negative lead to disconnected generator output wire.

CHARGING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
LOW OR UNSTEADY CHARGING.	1. Battery discharged or faulty.	1. See Battery, in this group. Charge or replace battery, if required.
	2. Loose or faulty generator drive belt.	2. Refer to Group 7 – Cooling System, for belt inspection and tightening procedures. Replace or tighten belt, if required.
	3. Loose generator mounting.	3. Refer to Group 8B - Battery/Starter/Generator Service, for generator service procedures. Tighten generator mounting, if required.
	4. Loose or corroded charging circuit wiring connections.	4. Inspect all charging circuit connections, including grounds and fuses. Clean or tighten, if required.
	5. High resistance in generator output wire.	5. See Ouput Wire Resistance Test, in this group. Test and repair, if required.
	6. Generator assembly faulty.	6. See Current Output Test, in this group. Test and replace, if required.
	7. Faulty generator field control circuit.	7. See Using On-Board Diagnostic System, in this group. Diagnose and repair, if required.
OVER-CHARGING.	1. Short in generator field control circuit.	1. See Using On-Board Diagnostic System, in this group. Diagnose and repair, if required.
	2. Generator assembly faulty.	2. See Current Output Test, in this group. Test and replace, if required.
GENERATOR NOISY.	1. Loose, worn, or damaged drive belt.	1. Refer to Group 7 – Cooling System, for diagnosis and repair of drive belt problems
	2. Drive belt pulleys misaligned.	2. Refer to Group 7 – Cooling System, for diagnosis and repair of pulley misalignment.
	3. Generator assembly faulty.	3. Refer to Group 8B – Battery/Starter/Generator Service, for generator service procedures.

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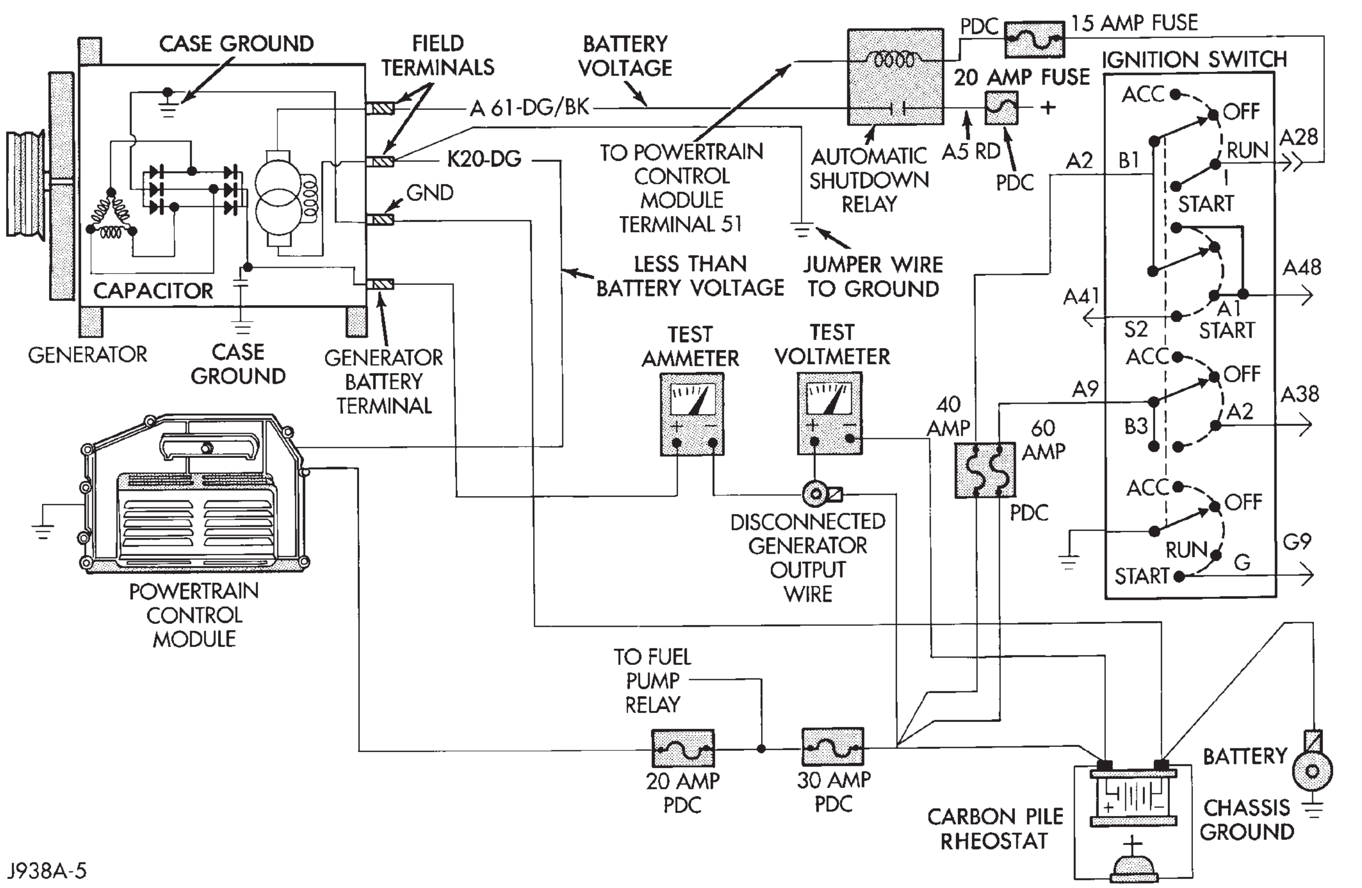


Fig. 21 Generator Output Wire Resistance Test (Typical)

(6) Connect positive lead of a test voltmeter (range 0-18 volts minimum) to disconnected generator output wire. Connect negative lead of test voltmeter to battery positive cable at positive post.

(7) Connect one end of a jumper wire to ground and with other end probe green K20 field wire at back of generator (Fig. 21). This will generate a DTC.

CAUTION: Do not connect green/orange A142 field wire to ground. Refer to Group 8W - Wiring Diagrams for more information.

(8) Connect an engine tachometer, then connect battery negative cable to battery.

(9) Connect a variable carbon pile rheostat between battery terminals. Be sure carbon pile is in OPEN or OFF position before connecting leads. See Load Test in this group for instructions.

TEST

(1) Start engine. Immediately after starting, reduce engine speed to idle.

(2) Adjust engine speed and carbon pile to maintain 20 amperes flowing in circuit. Observe voltmeter reading. Voltmeter reading should not exceed 0.5 volts.

RESULTS

If a higher voltage drop is indicated, inspect, clean and tighten all connections. This includes any connection between generator battery output terminal and battery positive post. A voltage drop test may be performed at each connection to locate the connection with excessive resistance. If resistance tests satisfactorily, reduce engine speed, turn OFF carbon pile and turn OFF ignition switch.

(1) Disconnect negative cable from battery.

(2) Remove test ammeter, voltmeter, carbon pile, and tachometer.

(3) Remove jumper wire.

(4) Connect generator output wire to generator battery output terminal. Tighten nut to 8.5±1.5 N·m (75±15 in. lbs.).

(5) Connect negative cable to battery.

(6) Use DRB scan tool to erase DTC.

CURRENT OUTPUT TEST

The generator current output test determines whether generator can deliver its rated current output.

PREPARATION

(1) Before starting test make sure vehicle has a fully-charged battery. See Battery in this group for more information.

(2) Disconnect negative cable from battery.

(3) Disconnect generator output wire at the generator battery output terminal.

(4) Connect a 0-150 ampere scale DC ammeter (Fig. 22). Install in series between generator battery output terminal and disconnected generator output wire. Connect positive lead to generator battery output terminal and negative lead to disconnected generator output wire.

(5) Connect positive lead of a test voltmeter (range 0-18 volts minimum) to generator battery output terminal.

(6) Connect negative lead of test voltmeter to a good ground.

(7) Connect an engine tachometer, then connect battery negative cable to battery.

(8) Connect a variable carbon pile rheostat between battery terminals. Be sure carbon pile is in OPEN or OFF position before connecting leads. See Load Test in this group for instructions.

(9) Connect one end of a jumper wire to ground and with other end probe green K20 field wire at back of generator (Fig. 22). This will generate a DTC.

CAUTION: Do not connect green/orange A142 field wire to ground. Refer to Group 8W - Wiring Diagrams for more information.

TEST

(1) Start engine. Immediately after starting, reduce engine speed to idle.

(2) Adjust carbon pile and engine speed in increments until a speed of 1250 rpm and voltmeter reading of 15 volts is obtained.

CAUTION: Do not allow voltage meter to read above 16 volts.

(3) The ammeter reading must be within limits shown in Generator Output Voltage Specifications.

RESULTS

(1) If reading is less than specified and generator output wire resistance is not excessive, generator should be replaced. Refer to Group 8B - Battery/Starter/Generator Service.

(2) After current output test is completed, reduce engine speed, turn OFF carbon pile and turn OFF ignition switch.

(3) Disconnect negative cable from battery.

(4) Remove test ammeter, voltmeter, tachometer and carbon pile.

(5) Remove jumper wire (Fig. 22).

(6) Connect generator output wire to generator battery output terminal. Tighten nut to 8.5±1.5 N·m (75±15 in. lbs.).

(7) Connect negative cable to battery.

(8) Use DRB scan tool to erase DTC.

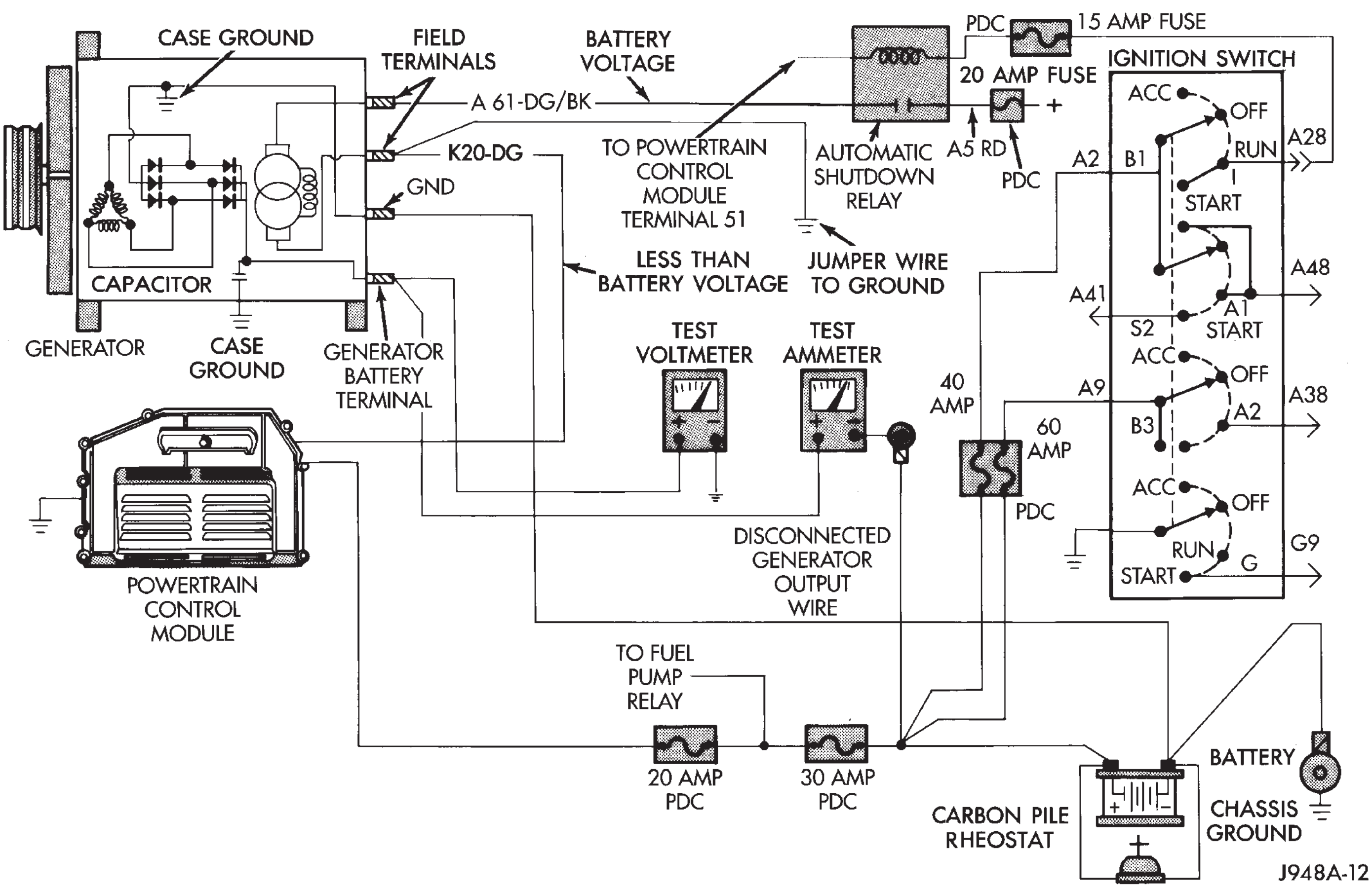


Fig. 22 Generator Current Output Test (Typical)

USING ON-BOARD DIAGNOSTIC SYSTEM

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

Diagnostic Trouble Codes (DTC) are two-digit numbers flashed on the malfunction indicator (Check Engine) lamp that identify which circuit is bad. A DTC description can also be read using the DRB scan tool. Refer to Group 14 - Fuel Systems for more 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.

See Generator Diagnostic Trouble Code chart for DTC's which apply to the charging system. Refer to the Powertrain Diagnostic Procedures manual to diagnose an on-board diagnostic system trouble code.

RETRIEVING DIAGNOSTIC TROUBLE CODES

To start this function, cycle the ignition switch ON-OFF-ON-OFF-ON within 5 seconds. This will cause any DTC stored in the PCM memory to be displayed. The malfunction indicator (Check Engine) lamp will display a DTC by flashing on and off. There is a short pause between flashes and a longer pause between digits. All DTC's displayed are two-digit numbers, with a four-second pause between codes.

An example of a DTC is as follows:

(1) Lamp on for 2 seconds, then turns off.

(2) Lamp flashes 4 times pauses and then flashes 1 time.

(3) Lamp pauses for 4 seconds, flashes 4 times, pauses, then flashes 7 times.

The two DTC's are 41 and 47. Any number of DTC's can be displayed, as long as they are in memory. The lamp will flash until all stored DTC's are displayed (55 = end of test).

GENERATOR DIAGNOSTIC TROUBLE CODE

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
12*	Battery Disconnect	Direct battery input to PCM was disconnected within the last 50 key-on cycles.
41**	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
46**	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
47**	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.
55*	N/A	Completion of fault code display on Check Engine lamp.

* Check Engine lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

J958A-7

SPECIFICATIONS

BATTERY SPECIFICATIONS

BATTERY CLASSIFICATIONS AND RATINGS

Group Size	Cold Crank AMPS	Reserve Capacity (Min.)	Engine
34	600	120	ALL

J938A-11

STARTING SYSTEM SPECIFICATIONS

STARTER SPECIFICATIONS

Manufacturer	Nippondenso
Engine Application	All
Part Number and Power Rating	56004934-5.2L 3302709-4.0L 1.4Kw
Voltage	12
No. of Fields	4
No. of Poles	4
Brushes	4
Drive	Reduction Gear Train
Free Running Test Voltage Amperage Draw Minimum Speed RPM	 11 73 Amps 3601 RPM
Solenoid Closing Voltage	7.5 Volts
Cranking Amperage Draw Test	125-200 Amps*

*Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

J948B-20

STARTER AND SOLENOID TESTING SPECIFICATIONS

Description	Specifications @ 20°C (68°F)
No Load Test With 11.2 volts Max. Amps Min. RPM	 90 2500
Solenoid Hold-in Winding Voltage	3.5 Min.
Pull-in Winding Voltage	7.8 Max.

J928B-25

STARTING SYSTEM COLD CRANKING SPECIFICATIONS

Battery Test Voltage	12.5 Volts
Cold Cranking Voltage (Minimum)	9.6 Volts
Cold Cranking Amps	130 Amps

J918B-17

CHARGING SYSTEM SPECIFICATIONS

OUTPUT VOLTAGE SPECIFICATIONS

Ambient Temperature °C (°F)	Acceptable Voltage Range
−40 to −6.7 (−40 to 20)	14.5 to 15.0
−6.7 to 26.7 (20 to 80)	13.87 to 15.0
26.7 to 60 (80 to 140)	13.25 to 14.37
60 to 71.1 (140 to 160)	13.25 to 13.75

J918C-13

GENERATOR RATINGS

Type	Part Number	Engine	Rating
Nippondenso	56005685	4.0L	90 Amps
Nippondenso	53008647	5.2L	90 Amps

J948B-19

BATTERY/STARTER/GENERATOR SERVICE

CONTENTS

GENERAL INFORMATION

Group 8B covers battery, starter and generator service procedures. For diagnosis of these components and their related systems, refer to Group 8A - Battery/Starting/Charging Systems Diagnostics. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

BATTERY

GENERAL INFORMATION

This section covers battery service procedures only. For battery maintenance procedures, refer to Group 0 - Lubrication and Maintenance. While battery charging can be considered a service or maintenance procedure, this information is located in Group 8A - Battery/Starting/Charging Systems Diagnostics. This was done because the battery must be fully charged before any diagnosis is performed.

It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal discharge, over-charging, or premature failure of the battery must be diagnosed and corrected before a battery is replaced or returned to service. Refer to Group 8A - Battery/Starting/Charging Systems Diagnostics.

The factory installed low-maintenance battery (Fig. 1) has removable battery cell caps. Water can be added to this battery. The battery is not sealed and has vent holes in the cell caps. The chemical composition within the low-maintenance battery reduces battery gassing and water loss at normal charge and discharge rates. Therefore, the battery should not require additional water in normal service.

However, low electrolyte can be caused by an overcharging condition. Be certain to diagnose charging system before returning vehicle to service. Refer to Group 8A - Battery/Starting/Charging Systems Diagnostics for more information.

BATTERY REMOVE/INSTALL

(1) Turn ignition switch to OFF position. Make sure all electrical accessories are off.

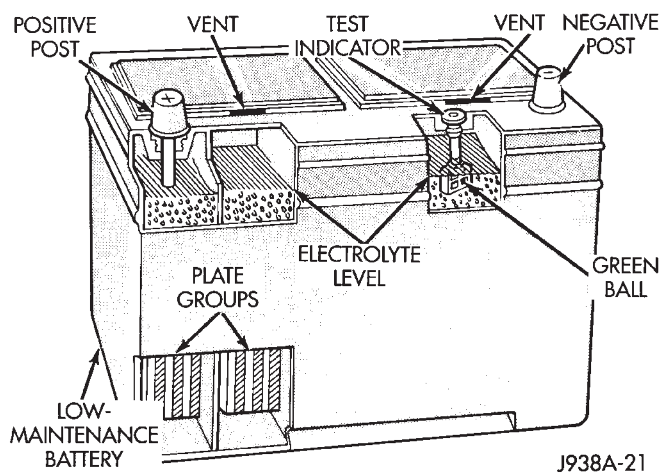


Fig. 1 Low-Maintenance Battery

(2) Loosen the cable terminal clamps and remove both battery cables, negative cable first. If necessary, use a puller to remove terminal clamps from battery posts (Fig. 2).

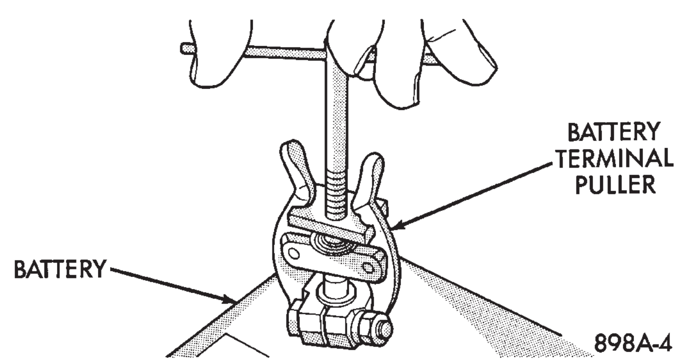


Fig. 2 Remove Battery Terminal Clamp

(3) Inspect the cable terminals for corrosion and damage. Remove corrosion using a wire brush or post

and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 3). Replace cables that have damaged or deformed terminals.

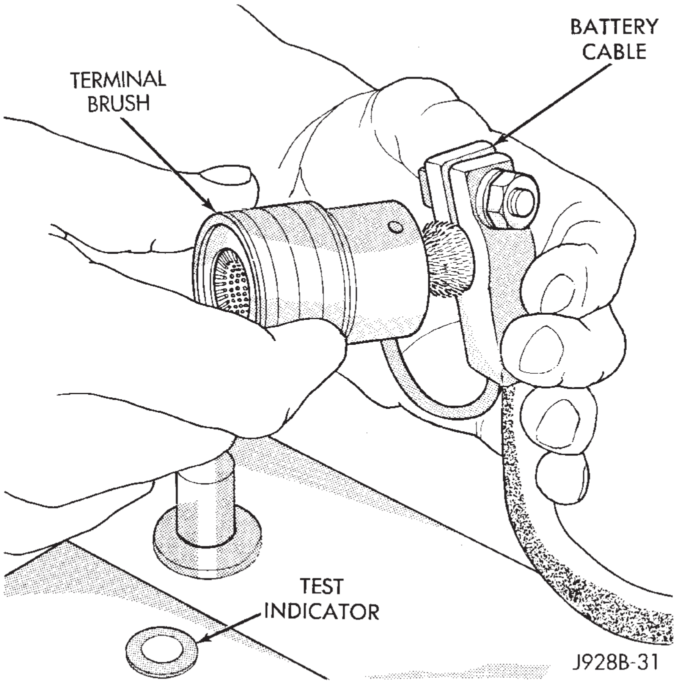


Fig. 3 Clean Battery Cable Terminal

WARNING: WEAR A SUITABLE PAIR OF RUBBER GLOVES (NOT THE HOUSEHOLD TYPE) WHEN REMOVING A BATTERY BY HAND. SAFETY GLASSES SHOULD ALSO BE WORN. IF THE BATTERY IS CRACKED OR LEAKING, THE ELECTROLYTE CAN BURN THE SKIN AND EYES.

(4) Remove battery holddowns (Fig. 4) and remove battery from vehicle.

(5) Inspect battery tray (Fig. 4) and holddowns for corrosion or damage. Remove corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal and replace any damaged parts.

(6) Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also check battery terminal posts for looseness. Batteries with damaged cases or loose posts must be replaced.

(7) Check electrolyte level in the battery. Use a putty knife or other suitable wide-bladed flat tool to pry cell caps off (Fig. 5). Do not use a screwdriver. Add distilled water to each cell until the liquid reaches the bottom of the vent well. DO NOT OVERFILL. If battery is discharged, charge as required. Refer to Group 8A - Battery/Starting/Charging Systems Diagnosis for more information.

(8) If the battery is to be reinstalled, clean outside of battery case and top cover with sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 6) to remove acid film. Flush with clean water.

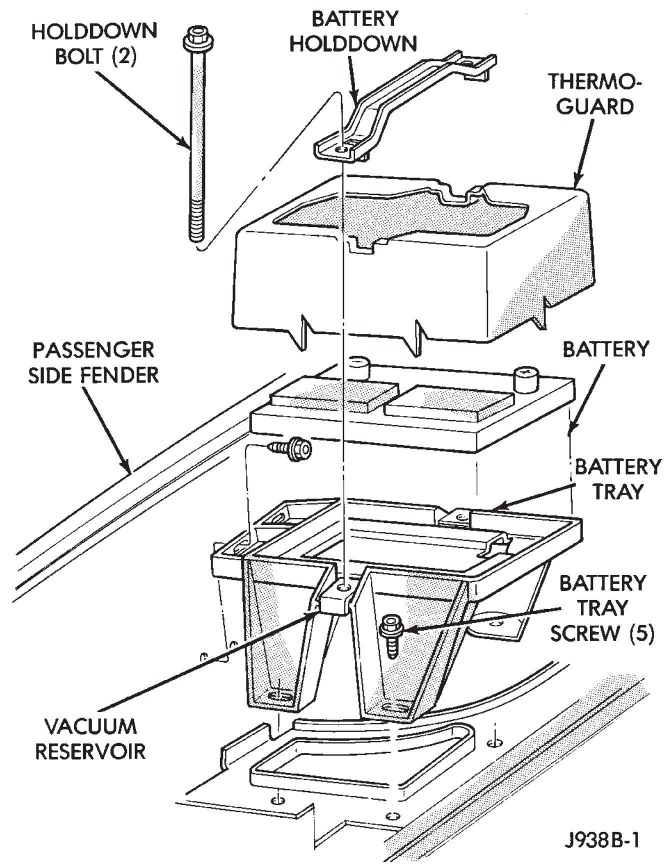


Fig. 4 Battery Tray and Holddown

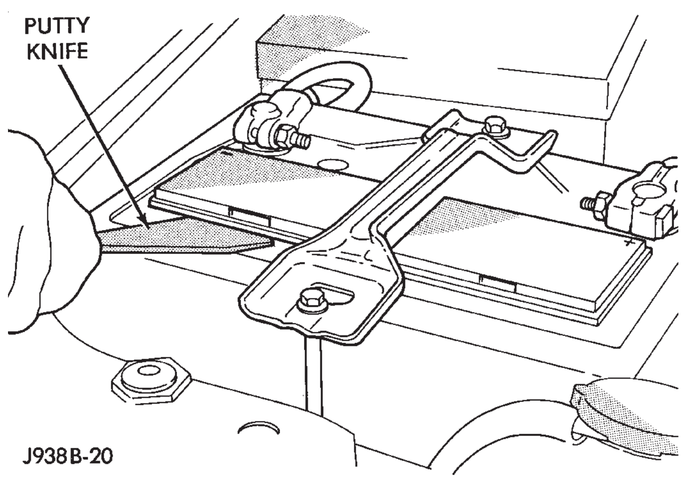


Fig. 5 Removing Cell Cap

Ensure that cleaning solution does not enter cells through the vent holes. If the battery is being replaced, refer to Specifications in Group 8A - Battery/Starting/Charging Systems Diagnostics to confirm replacement has correct classification and ratings for the vehicle.

(9) Clean corrosion from battery posts (Fig. 7) with a wire brush or post and terminal cleaner, and sodium bicarbonate (baking soda) and warm water cleaning solution.

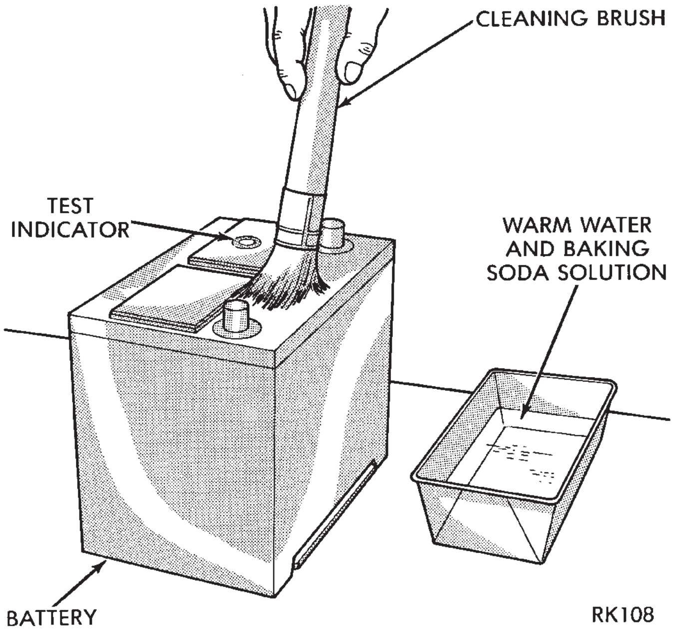


Fig. 6 Clean Battery

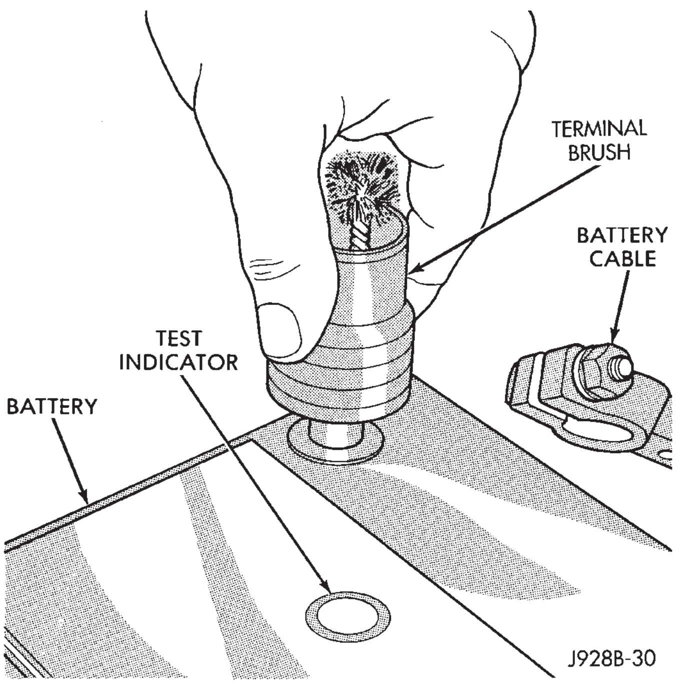


Fig. 7 Clean Battery Post

(10) Position battery in tray. Ensure that positive and negative posts are correctly positioned. The cable terminals must reach the correct battery post without stretching (Fig. 8).

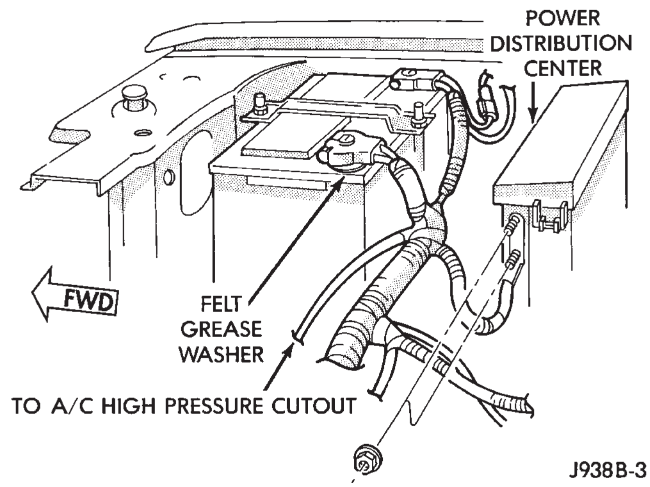


Fig. 8 Battery Cable Connections

(11) Loosely install battery holddown hardware. Ensure that battery base is correctly positioned in tray, then tighten holddowns to 2.2 N·m (20 in. lbs.) torque.

CAUTION: Be certain that battery cables are connected to the correct battery terminals. Reverse polarity can damage electrical components.

(12) Place oiled felt washer on battery positive terminal post.

(13) Install and tighten battery positive cable terminal clamp. Then install and tighten negative cable terminal clamp. Both cable clamp bolts require torque of 8.5 N·m (75 in. lbs.).

(14) Apply a thin coating of petroleum jelly or chassis grease to cable terminals and battery posts.

STARTER AND STARTER RELAY

GENERAL INFORMATION

This section covers starter and starter relay service procedures only. For diagnostic procedures, refer to Group 8A - Battery/Starting/Charging Systems Diagnostics. Service procedures for other starting system components can be found as follows:

- battery - see Battery, in this group
- ignition switch - refer to Group 8D - Ignition Systems
- clutch pedal position switch - refer to Group 6 - Clutch
- park/neutral position switch (automatic transmission) - refer to Group 21 - Transmission and Transfer Case
- wiring harness and connectors - refer to Group 8W - Wiring Diagrams.

STARTER

The starter motor incorporates several features to create a reliable, efficient, compact and lightweight unit. A planetary gear system (intermediate transmission) is used between the electric motor and pinion gear. This feature makes it possible to reduce the dimensions of the starter. At the same time, it allows higher armature rotational speed and delivers increased torque through the pinion gear to the flywheel or drive plate ring gear.

The use of a permanent magnet field on 4.0L engine starters also reduces starter size and weight. This field consists of six high-strength permanent magnets. The magnets are aligned according to their polarity and are permanently fixed in the starter field frame.

The starter motors for all engines are activated by a solenoid mounted to the overrunning clutch housing. However, the starter motor/solenoid are serviced only as a complete assembly. If either component fails, the entire assembly must be replaced.

This unit is highly sensitive to hammering, shocks and external pressure.

CAUTION: The starter motor MUST NOT BE CLAMPED in a vise by the starter field frame. Doing so may damage the magnets. It may be clamped by the mounting flange ONLY.

CAUTION: Do not connect starter motor incorrectly when tests are being performed. The permanent magnets may be damaged and rendered unserviceable.

STARTER RELAY

The starter relay is an International Standards Organization (ISO) type relay, and is located in the Power Distribution Center (PDC). Refer to underside of PDC cover for relay location.

STARTER REMOVE/INSTALL - 4.0L

(1) Disconnect battery negative cable.

(2) Raise and support vehicle.

(3) Disconnect battery wire and solenoid feed wire connector (Fig. 9).

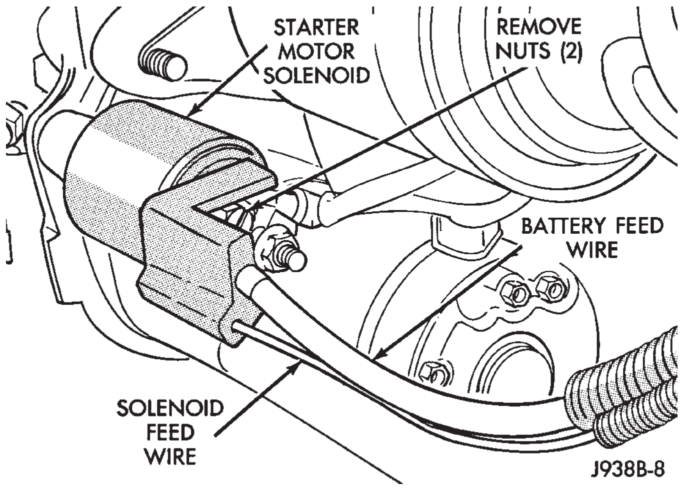


Fig. 9 Solenoid Harness Remove/Install

(4) Remove starter front mounting bolt (Fig. 10).

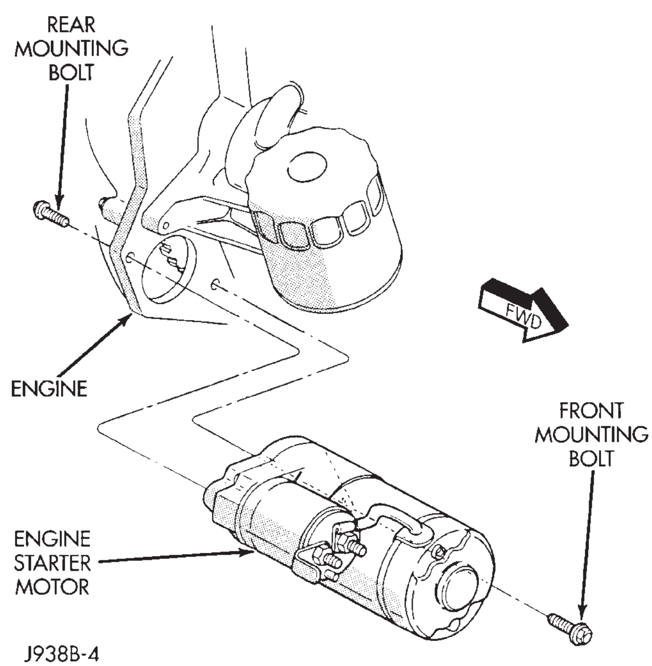


Fig. 10 Starter Remove/Install - Typical

(5) Remove starter rear mounting bolt and remove starter.

(6) Reverse removal procedures to install and tighten mounting hardware as follows:

• starter mounting bolts to 45 N·m (33 ft. lbs.)
• terminal adapter solenoid nut to 6 N·m (55 in. lbs.)
• terminal adapter battery cable nut to 10 N·m (90 in. lbs.).

(7) Remove vehicle support and lower vehicle.
(8) Install negative cable to battery.

STARTER REMOVE/INSTALL - 5.2L

(1) Disconnect battery negative cable.
(2) Raise and support vehicle.
(3) Disconnect the battery wire and solenoid feed wire connector (Fig. 11).

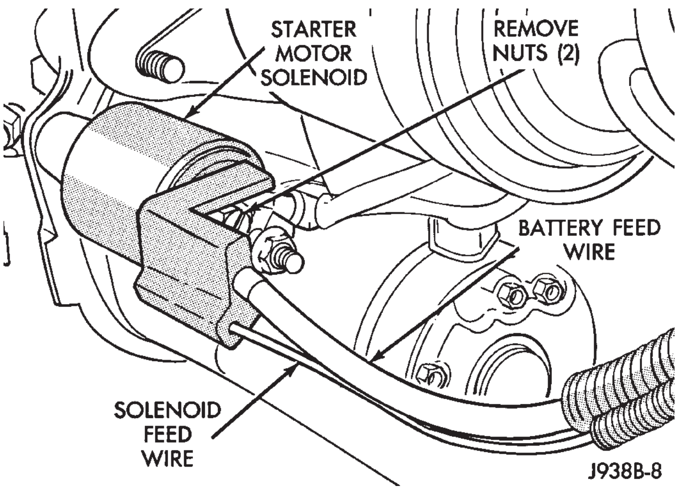


Fig. 11 Solenoid Harness Remove/Install - Typical

(4) Remove lower mounting nut (Fig. 12).
(5) Remove transmission line clip from stud.
(6) Remove upper mounting bolt.
(7) Pull starter forward and remove from vehicle.
(8) Reverse removal procedures to install and tighten mounting hardware as follows:

• starter mounting bolt to 68 N·m (50 ft. lbs.)
• starter mounting nut to 27 N·m (20 ft. lbs.)
• terminal adapter solenoid nut to 6 N·m (55 in. lbs.)
• terminal adapter battery cable nut to 10 N·m (90 in. lbs.).

(9) Remove vehicle support and lower vehicle.
(10) Install negative cable to battery.

STARTER RELAY REMOVE/INSTALL

(1) Disconnect battery negative cable.

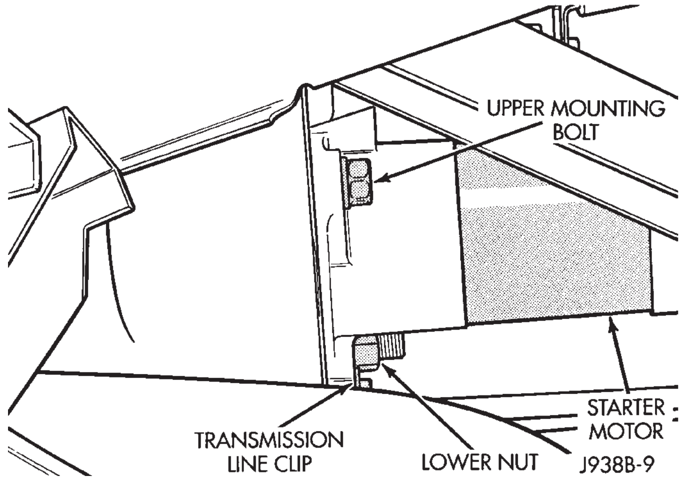


Fig. 12 Starter Remove/Install - Typical

(2) Remove starter relay by unplugging unit from PDC (Fig. 13).

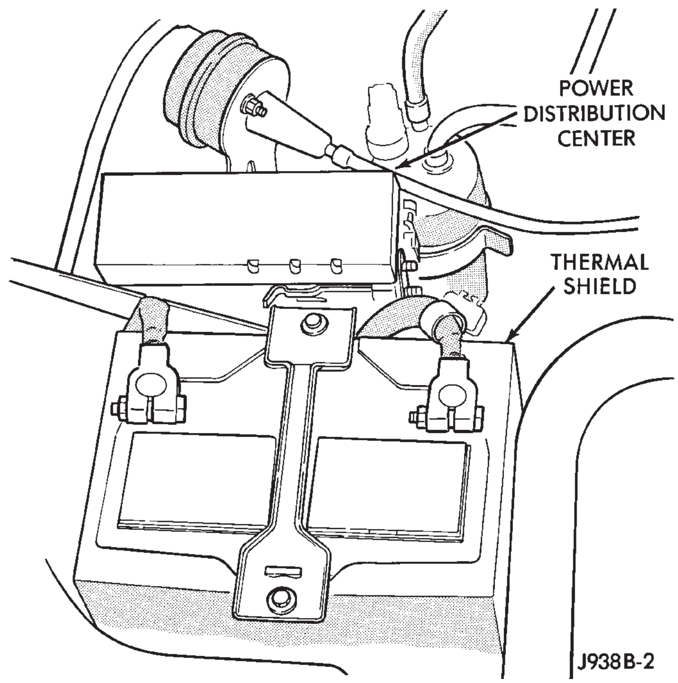


Fig. 13 Power Distribution Center

(3) Install starter relay by aligning relay terminals with cavities in PDC and plugging relay in.
(4) Connect negative cable to battery.
(5) Test relay operation.

GENERATOR

GENERAL INFORMATION

This section covers generator service procedures only. For generator or charging system diagnosis, refer to Group 8A - Battery/Starting/Charging Systems Diagnostics.

The generator is belt-driven by the engine. All engines use serpentine drive. The generator is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

Be certain that the replacement generator has the same output rating as the original unit. Refer to Group 8A - Battery/Starting/Charging Systems Diagnostics and see Specifications.

The generator field control (voltage regulator) circuitry is internal to the Powertrain Control Module (PCM). If faulty, the entire PCM must be replaced. Refer to Group 14 - Fuel System for PCM service procedure.

GENERATOR REMOVE/INSTALL - 4.0L

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY.

(1) Disconnect battery negative cable.
(2) Loosen rear mounting bolts (Fig. 14).

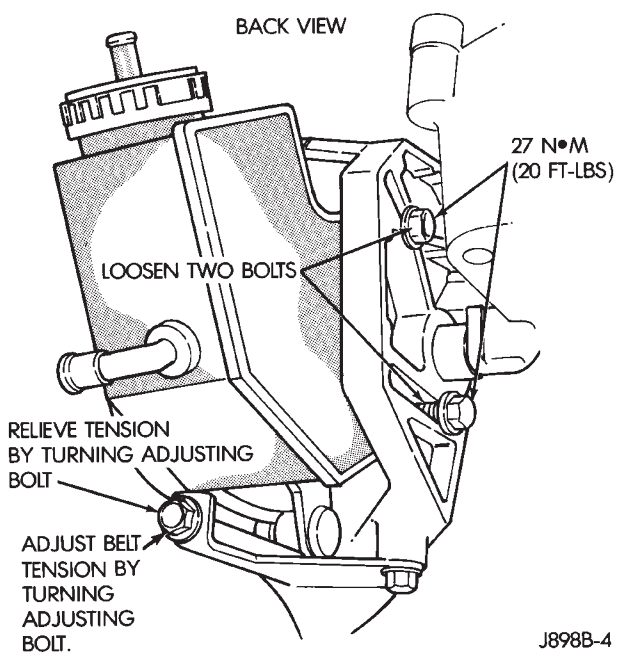


Fig. 14 Power Steering Pump Rear Mounting Bolts

(3) Loosen power steering pump pivot bolt and lock nut (Fig. 15).
(4) Loosen adjusting bolt to remove belt.
(5) Raise and support vehicle.

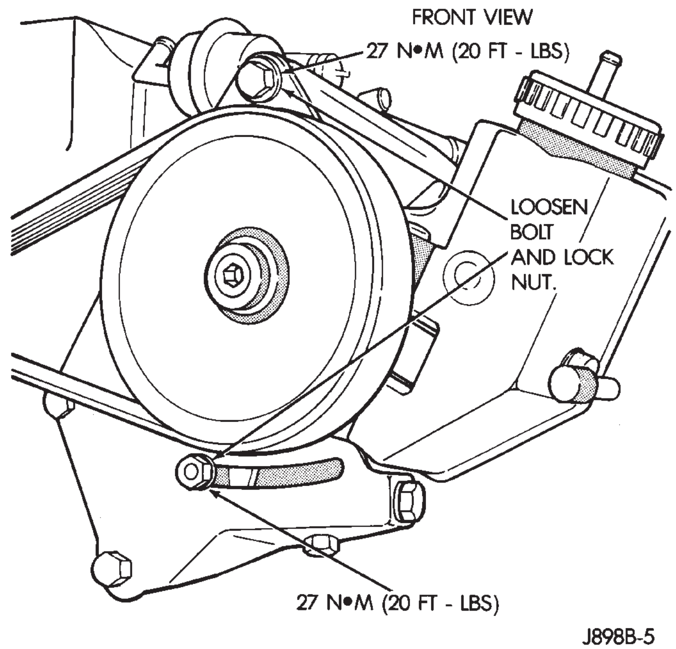


Fig. 15 Power Steering Pump Front Mounting Bolts

(6) Remove generator B+ terminal nut, 2 field terminal nuts, ground and harness holddown nuts (Fig. 16). Remove wire connector assembly.

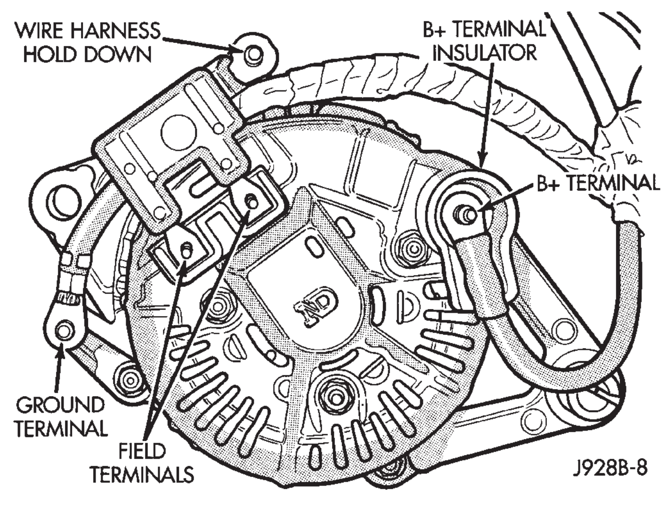


Fig. 16 Connector Remove/Install

(7) Remove 2 generator mounting bolts and remove generator from vehicle.
(8) Install generator with two mounting bolts. Torque bolts to 55 N·m (41 ft. lbs.).
(9) Attach generator wires.

CAUTION: Never force a belt over a pulley rim using a screwdriver as the synthetic fiber may be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to the belt routing label in engine compartment, or refer to Belt Schematics in Group 7 - Cooling System.

(10) Place serpentine belt over pulley.

(11) The 2 rear mounting bolts and the power steering pump pivot bolt should be finger tight.

(12) Turn adjusting bolt until the belt has the correct tension. See Belt Tension in Specifications.

(13) Tighten rear mounting bolts, pivot bolt, and lock nut to 27 N·m (20 ft. lbs.) torque.

(14) Remove support and lower vehicle.

(15) Connect negative cable to the battery.

GENERATOR REMOVE/INSTALL - 5.2L

WARNING: FAILURE TO DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE DISCONNECTING RED (OUTPUT) WIRE CONNECTOR FROM GENERATOR CAN RESULT IN INJURY.

Drive belts on the 5.2L engine are equipped with a spring loaded automatic belt tensioner (Fig. 17). This belt tensioner is used on all belt configurations. For more information, refer to Group 7 - Cooling System, Automatic Belt Tensioner - 5.2L Engines.

(1) Disconnect battery negative cable.

(2) Attach a socket/wrench to the pulley mounting bolt of the automatic tensioner (Fig. 17).

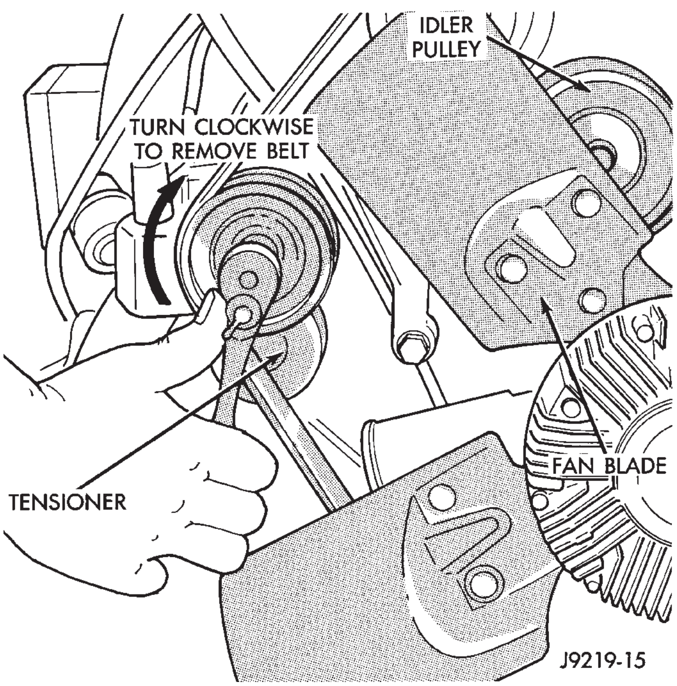


Fig. 17 Belt Remove/Install

(3) Rotate the tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(4) Remove belt from vehicle.

(5) Remove lower generator mounting bolt and nut (Fig. 18).

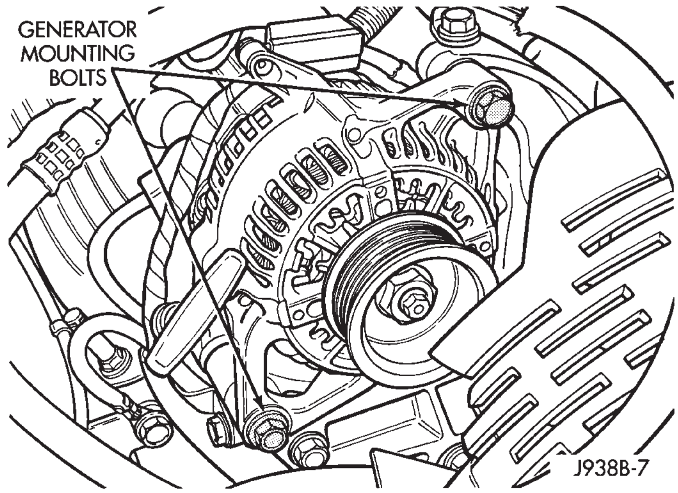


Fig. 18 Generator Mounting Bolts

(6) Remove upper generator mounting bolt and remove generator from bracket.

(7) Remove the battery output terminal nut, 2 field terminal nuts, ground, and harness holddown nuts (Fig. 19). Remove wire connectors.

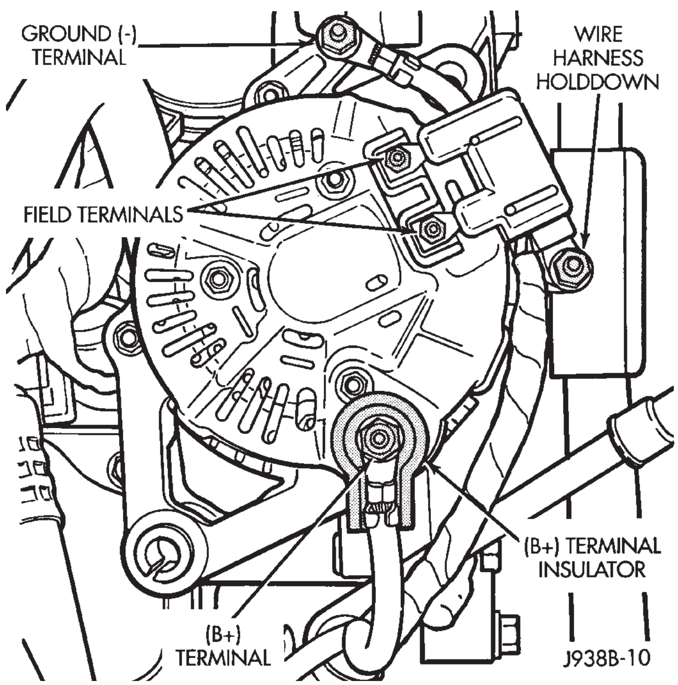


Fig. 19 Connector Remove/Install

(8) Install harness to replacement generator. Tighten hardware as follows:

- ground terminal, battery output terminal and wire harness holddown nuts - 7-10 N·m (60-90 in. lbs.)
- field terminal nuts - 2.5-3 N·m (20-30 in. lbs.).

(9) Install generator. Tighten both bolts to 41 N·m (30 ft. lbs.).

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to the belt routing label in engine compartment, or refer to Belt Schematics in Group 7 - Cooling System.

(10) Position the drive belt over all pulleys except the idler pulley. This pulley is located between the generator and A/C compressor.

(11) Attach a socket/wrench to the pulley mounting bolt of the automatic tensioner.

(12) Rotate the socket/wrench clockwise. Place the belt over the idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(13) Check belt tensioner indexing marks. Refer to Group 7 - Cooling System, Automatic Belt Tensioner.

SPECIFICATIONS

BATTERY SPECIFICATIONS

TORQUE

Description	Torque
Battery Strap Screw	10 N•m (90 in. lbs.)
Battery Tray Screw	10 N•m (90 in. lbs.)

J938A-14

STARTER SPECIFICATIONS

TORQUE - 4.0L

COMPONENTS	TORQUE
Starter Motor Mounting Bolts	Upper 55 N•m (40 ft. lbs.)
	Lower 41 N•m (30 ft. lbs.)
Starter Solenoid Battery Cable Nut	10 N•m (90 in. lbs.)
Starter Solenoid B+ Nut	6 N•m (55 in. lbs.)

J938B-22

GENERATOR SPECIFICATIONS

TORQUE

COMPONENT	TORQUE	
Generator Mounting Bolts 4.0L	55 N•m (41 ft. lbs.)	
Generator Mounting Bolts 5.2L	41 N•m (30 ft. lbs.)	
Power Steering Pump (or Idler Pulley) Mounting Bolts	27 N•m (20 ft. lbs.)	
Belt Tension	New Belt 800-900	N (lbs-f) (180-200)
	Used Belt 623-712	N (lbs-f) (140-160)

J948B-22

OVERHEAD CONSOLE

CONTENTS

GENERAL INFORMATION

Two overhead consoles featuring an electronic compass, thermometer, and a trip computer are available options for Grand Cherokee models. A long version of the overhead console is used in models without a power sunroof option. The long overhead console includes four reading/courtesy lamps (2 front and 2 rear), a remote garage door opener storage compartment, a sunglasses storage compartment, and houses the remote keyless entry receiver.

A short version of the overhead console is used in models with a power sunroof option. The short overhead console includes two reading courtesy lamps and houses the power sunroof switch. Following are general descriptions of major components used in the overhead console. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

TRIP COMPUTER

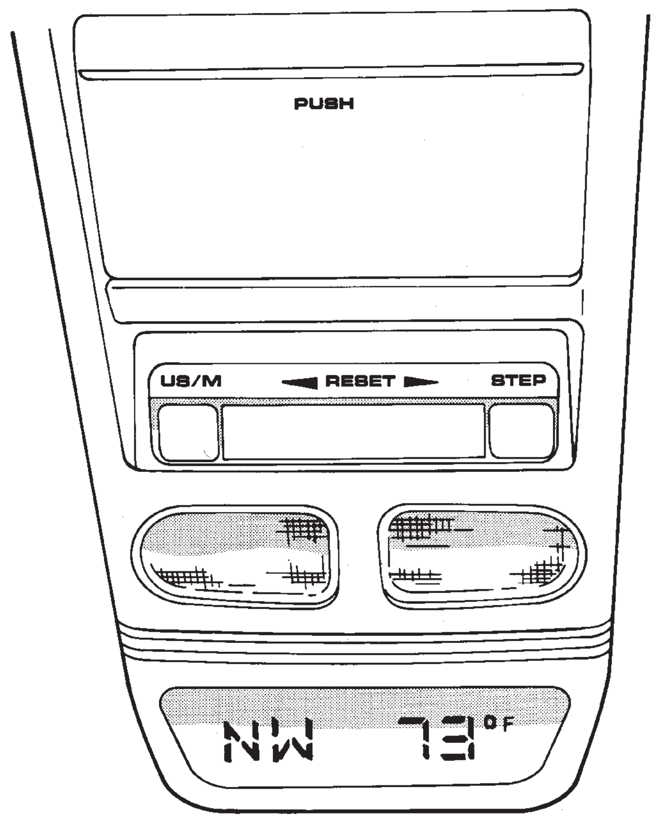
In addition to the thermometer/compass function, the overhead console display can be switched to the following trip computer readouts:

- trip odometer (ODO)
- average miles per gallon (AVG ECO)
- instant miles per gallon (ECO)
- distance to empty (DTE)
- elapsed time (ET)
- blank display.

Momentarily depressing and releasing the STEP button when the ignition switch is in the ON position will cause the overhead console display to step sequentially through the various display options. Input for the trip computer functions is received on the CCD bus lines. If the data displayed is wrong, run self-diagnostics before replacing the computer. The DRB scan tool is recommended for checking the CCD bus lines.

COMPASS

The compass will display the direction in which the vehicle is pointed using the eight major compass headings (Examples: north is N, northeast is NE). It does not display the headings in actual degrees. The



J938C-10

display is turned on or off using the COMP/TEMP button to the left of the display.

The self-calibrating compass unit requires no adjusting in normal use. The only calibration that may prove necessary is to drive the vehicle in 3 complete circles, on level ground, in not less than 48 seconds. This will reorient the unit to its vehicle.

The unit also will compensate for magnetism the body of the vehicle may acquire during normal use. However, avoid placing anything magnetic directly on the roof of the vehicle. Magnetic mounts for an antenna, a repair order hat or a funeral procession flag can exceed the compensating ability of the compass unit if placed on the roof panel. Magnetic bit drivers used on the fasteners that hold the assembly to the roof header can also affect compass operation.

If the front console attaching screw is replaced, the new screw must be a #10 stainless steel.

If the vehicle roof should become magnetized, the demagnetizing and calibration procedures may be required to restore proper operation.

THERMOMETER

The thermometer displays the outside ambient temperature. The temperature displayed can be changed from Fahrenheit to Celsius using the US/METRIC button. The displayed temperature is not an instant reading of conditions, but an average temperature. It may take the unit several minutes to react to a major temperature change such as driving out of a heated garage into winter temperatures.

When the ignition switch is turned OFF, the last displayed temperature reading stays in memory. When the ignition switch is turned ON again, the thermometer will display the memory temperature for one minute; then update the display to the current average temperature reading within five minutes.

When the vehicle is equipped with ATC, ambient temperature data is obtained from the HEVAC module on the CCD bus lines. On vehicles without ATC, the ambient temperature sensor is hard-wired to the trip computer.

READING AND COURTESY LAMPS

All reading and courtesy lamps in the overhead console are activated by the door jamb switches. When all doors and the liftgate are closed, the lamps can be individually activated by depressing the corresponding lens. When a door and/or the liftgate is open, depressing the lamp lens switches will not turn the lamps off. Refer to Group 8L - Lamps, for diagnosis and service of these lamps.

KEYLESS ENTRY RECEIVER

The long overhead console houses the keyless entry receiver. Refer to Group 8P - Power Locks, for diagnosis and service of this component.

REMOTE GARAGE DOOR OPENER STORAGE

A compartment in the long overhead console is designed to hold most remote garage door opener transmitters. The transmitter is mounted within the compartment with an adhesive-backed hook and loop fastener patch. Then one or two pegs are selected and mounted on a post on the inside of the storage compartment door. The pegs may be stacked, if necessary. The peg(s) selected must be long enough to activate the button of the transmitter each time the storage compartment door is depressed.

SUNGLASSES STORAGE

A flocked storage compartment for sunglasses is included in the long overhead console. This compartment features a push/push-type latch and a viscous dampening system for a fluid opening motion.

DIAGNOSIS

Follow the appropriate diagnostic flow chart:

- Chart 1 - Describes the procedures for compass and display problems.
- Chart 2 - Describes the procedures for outside temperature measuring problems.
- Chart 3 - Describes the procedures for illumination lamp problems.

TRIP COMPUTER/COMPASS/DISPLAY SELF-DIAGNOSTIC TEST

This self-diagnostic test is used to determine that the trip computer/compass and all of its display segments are operating properly electrically. It also is used to verify that all CCD bus messages required are being properly received. Initiate the self-diagnostic test as follows:

(1) With the ignition switch in the OFF position, simultaneously press and hold the STEP button and the US/METRIC button.

(2) Turn ignition switch to the ON position.

(3) Continue to hold both buttons until the display performs a walking segment test. In this test all of the compass points are displayed, along with various number combinations. The test will:

(a) Verify that all display segments are functional.

(b) Check internal circuitry.

(c) Check that all CCD bus messages needed are being received.

If tests (a) and (b) are passed, the module will automatically return to normal operation at completion of tests. If any segment should fail to light during test (a), the unit is faulty and requires replacement. If test (b) fails, the display will read FAIL. If test (c) fails, the display will read CCD. Momentarily press and release either button to exit the self-diagnostic mode.

If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the unit to accommodate variations in the earth's magnetic field strength based on geographic location. See Compass Variation Adjustment, in this group.

If the compass display has blanked out and only CAL appears, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. See Compass Demagnetizing, in this group.

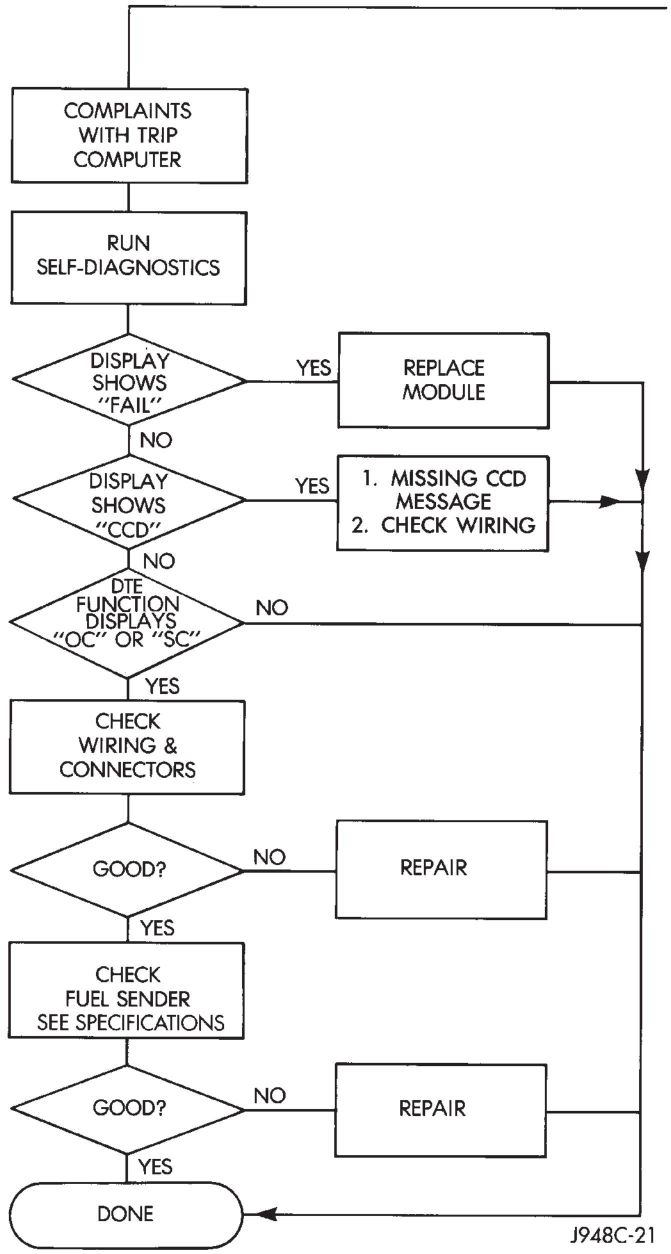


Chart 1

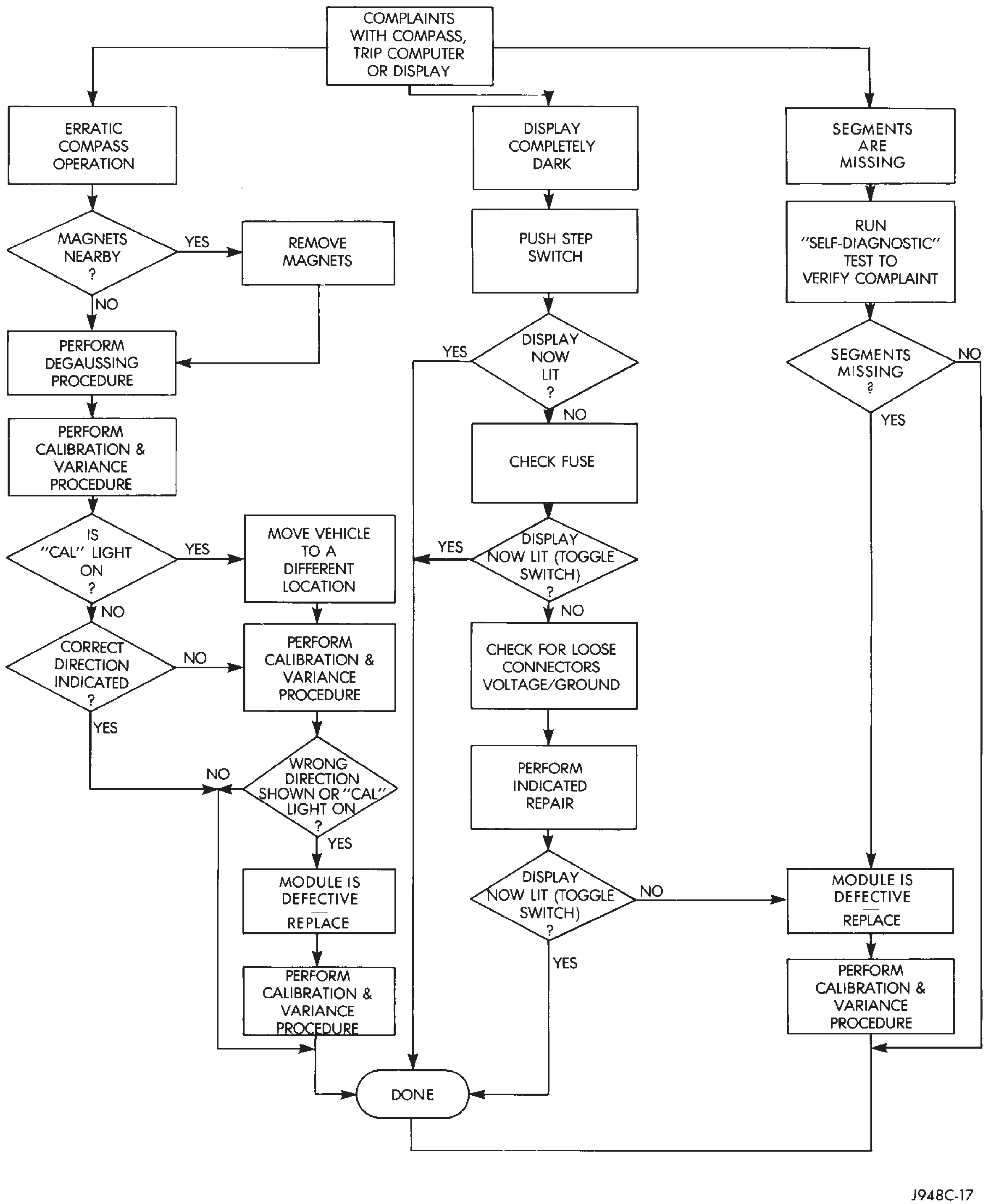


Chart 1 (Continued)

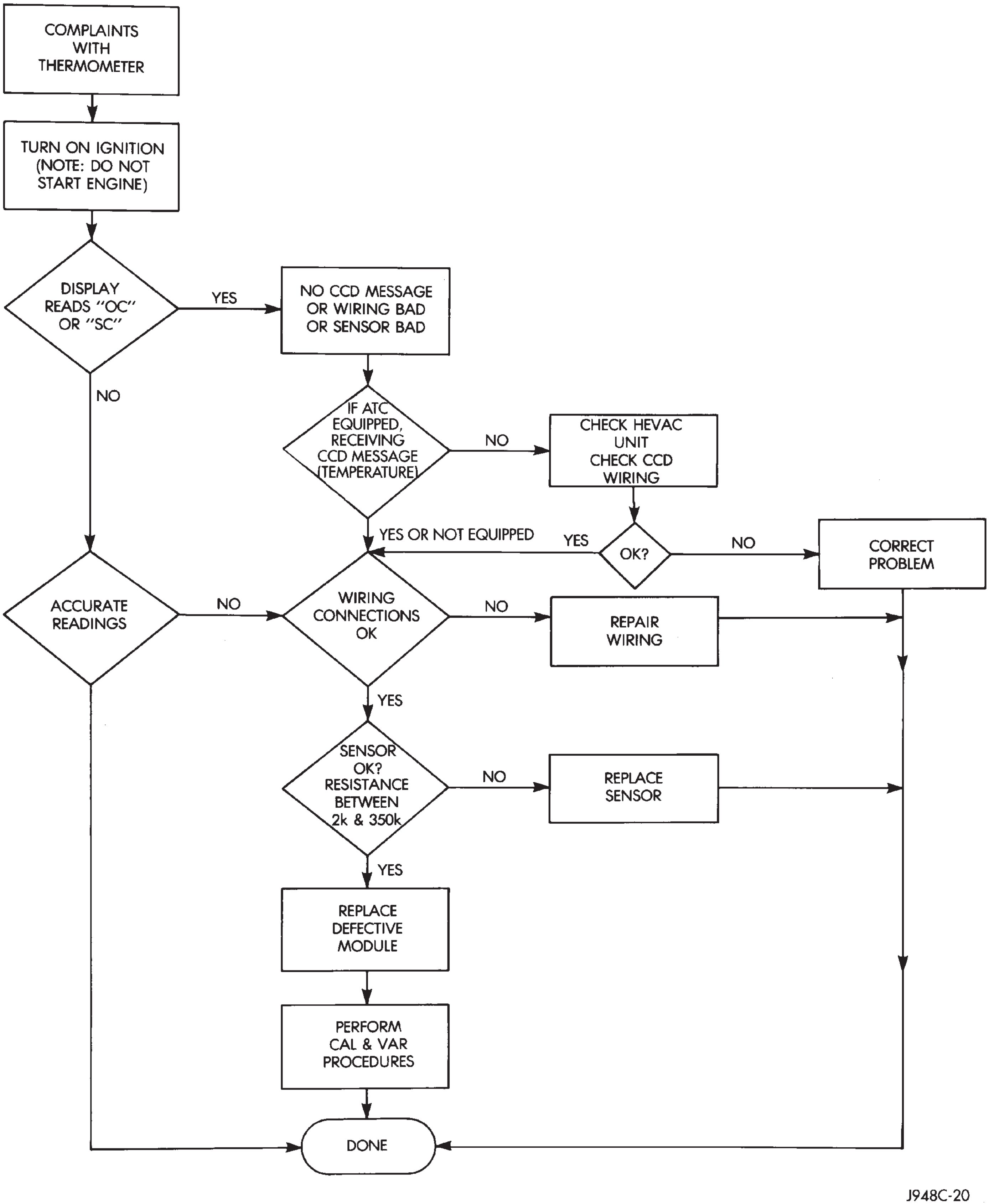

COMPLAINTS WITH THERMOMETER
TURN ON IGNITION (NOTE: DO NOT START ENGINE)
DISPLAY READS "OC" OR "SC"
YES
NO CCD MESSAGE OR WIRING BAD OR SENSOR BAD
NO
IF ATC EQUIPPED, RECEIVING CCD MESSAGE (TEMPERATURE)
NO
CHECK HEVAC UNIT CHECK CCD WIRING
YES OR NOT EQUIPPED
YES
OK?
NO
CORRECT PROBLEM
ACCURATE READINGS
NO
WIRING CONNECTIONS OK
NO
REPAIR WIRING
YES
SENSOR OK? RESISTANCE BETWEEN 2k & 350k
NO
REPLACE SENSOR
YES
REPLACE DEFECTIVE MODULE
PERFORM CAL & VAR PROCEDURES
DONE
J948C-20

Chart 2

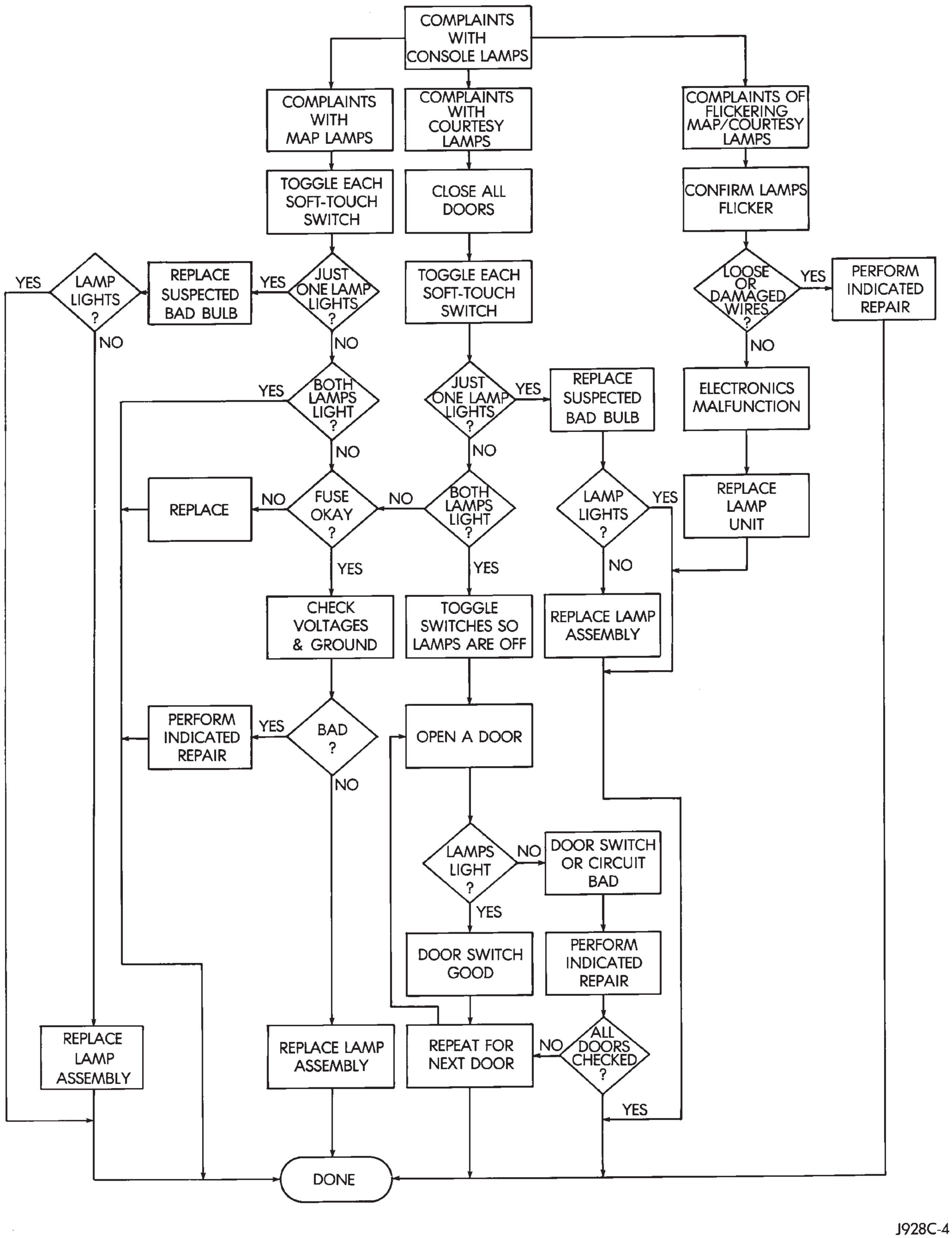

COMPLAINTS WITH CONSOLE LAMPS
COMPLAINTS WITH MAP LAMPS
COMPLAINTS WITH COURTESY LAMPS
COMPLAINTS OF FLICKERING MAP/COURTESY LAMPS
TOGGLE EACH SOFT-TOUCH SWITCH
CLOSE ALL DOORS
CONFIRM LAMPS FLICKER
LAMP LIGHTS ?
REPLACE SUSPECTED BAD BULB
JUST ONE LAMP LIGHTS ?
TOGGLE EACH SOFT-TOUCH SWITCH
LOOSE OR DAMAGED WIRES ?
PERFORM INDICATED REPAIR
BOTH LAMPS LIGHT ?
JUST ONE LAMP LIGHTS ?
REPLACE SUSPECTED BAD BULB
ELECTRONICS MALFUNCTION
REPLACE
FUSE OKAY ?
BOTH LAMPS LIGHT ?
LAMP LIGHTS ?
REPLACE LAMP UNIT
CHECK VOLTAGES & GROUND
TOGGLE SWITCHES SO LAMPS ARE OFF
REPLACE LAMP ASSEMBLY
PERFORM INDICATED REPAIR
BAD ?
OPEN A DOOR
LAMPS LIGHT ?
DOOR SWITCH OR CIRCUIT BAD
DOOR SWITCH GOOD
PERFORM INDICATED REPAIR
REPLACE LAMP ASSEMBLY
REPLACE LAMP ASSEMBLY
REPEAT FOR NEXT DOOR
ALL DOORS CHECKED ?
DONE
YES
NO
J928C-4

Chart 3

THERMOMETER DIAGNOSIS

When the vehicle is equipped with ATC, ambient temperature data is obtained from the HEVAC module on the CCD bus lines. On vehicles without ATC, the ambient temperature sensor is hard-wired to the trip computer.

The thermometer function is supported by a temperature sensor, a wiring circuit and a portion of the overhead console display. The sensor is mounted to the center of the radiator support behind the grille (Fig. 1).

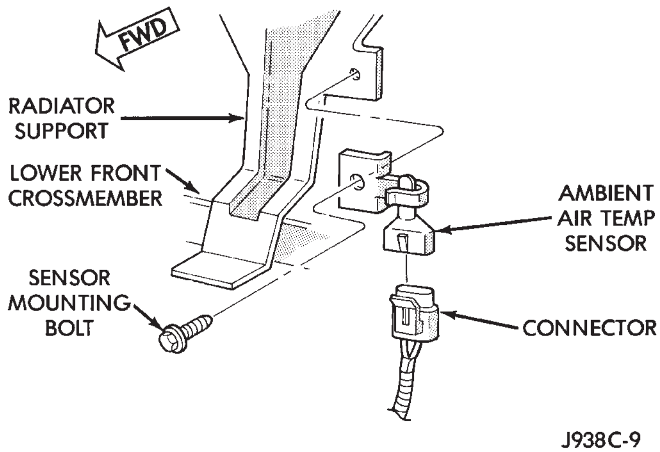


Fig. 1 Temperature Sensor.

If any portion of the circuit fails, it will self-diagnose as an open or short circuit. The system will display SC (short circuit) when the sensor is exposed to temperatures in excess of 55°C (131°F) or if the circuit is shorted. If the temperature is below -40°C (-40°F) or an open circuit exists, the system will display OC (open circuit).

To diagnose the temperature sensor, perform the following procedures.

(1) Turn the ignition switch to OFF. Unplug sensor connector.

(2) Measure resistance of sensor. At -40°F the resistance is 336K ohms. At 140°F the resistance is 2.488K ohms. Sensor resistance should read between these two values. If OK, go to Trip Computer/Compass/Display Self-Diagnostic Test. If not OK, replace the sensor.

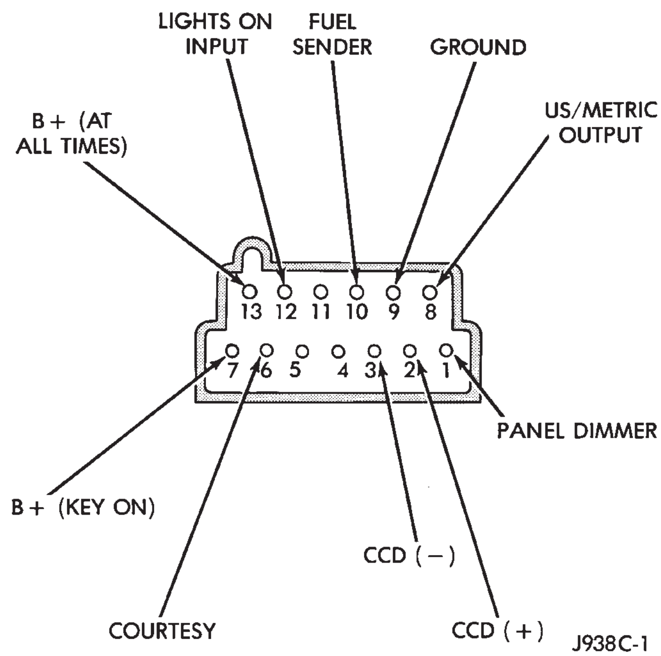


Fig. 2 Overhead Console Harness Connector

SERVICE PROCEDURES

COMPASS VARIATION ADJUSTMENT

Variance is the difference between magnetic north and geographic north. In some areas, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this occurs, the variance must be set.

To set the variance:

(1) Using the map in Fig. 3, find your geographic location and note the zone number.

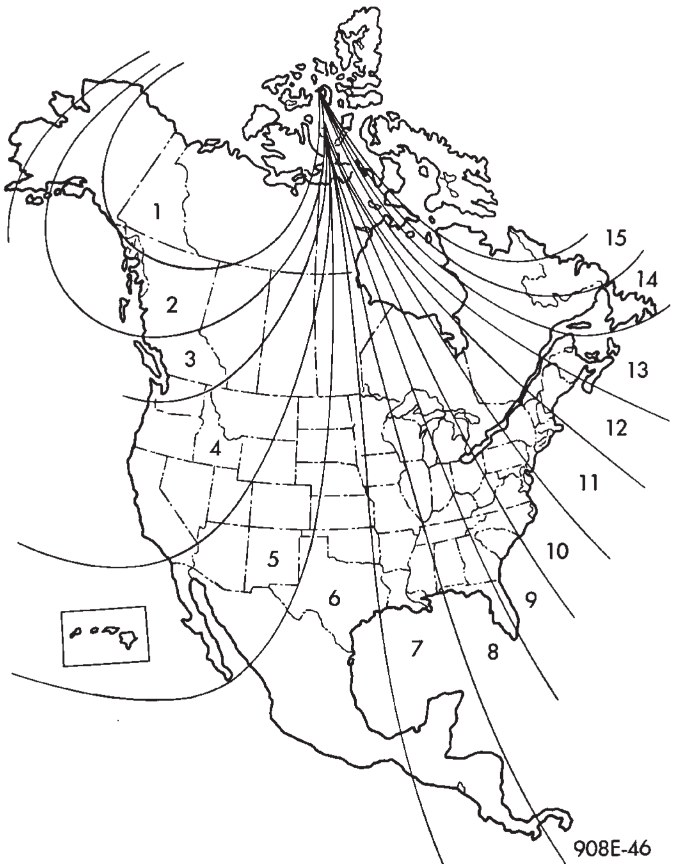


Fig. 3 Variance Settings

(2) Turn ignition switch to the ON position.

(3) Depress both the US/METRIC and STEP buttons. Hold down until VAR is displayed. This takes about 5 seconds.

(4) Release both buttons.

(5) Press the US/METRIC button to step through the numbers until the zone number for your area appears in the display.

(6) Press the STEP button to enter this zone number into compass unit memory.

(7) Confirm correct directions are indicated.

COMPASS CALIBRATION

CAUTION: DO NOT place any external magnets such as magnetic roof mount antennas, in the vicinity of the compass. DO NOT use magnetic tools when servicing the overhead console.

The compass features a self-calibrating design, which simplifies the calibration procedure. This feature automatically updates the compass calibration while the vehicle is being driven. This takes into account small changes in residual magnetism the vehicle may acquire during normal use. Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings or bridges.

Whenever the compass is calibrated manually, the variation number must also be reset. See Variation Adjustment Procedure, in this group.

Calibrate the compass manually as follows:

(1) Start the engine.

(2) Depress both the US/METRIC and STEP buttons. Hold down until CAL is displayed. This takes about 10 seconds and appears about 5 seconds after VAR is displayed.

(3) Release both buttons.

(4) Drive vehicle on a level surface that is away from large metal objects through 3 or more complete circles in not less than 48 seconds. The CAL message will disappear to indicate that the compass is now calibrated.

If CAL message remains in display, either there is excessive magnetism near the compass or the unit is faulty. Repeat the demagnetizing and calibration procedures at least one more time.

If the wrong direction is still indicated, the area selected may be too close to a strong magnetic field. Repeat the calibration procedure in another location.

COMPASS DEMAGNETIZING

The tool used to degauss or demagnetize the forward console attaching screw and roof panel is the Miller Tool 6029. Equivalent units must be rated as continuous duty for 110/115 volts and 60Hz. They must also have a field strength of over 350 gauss at 1/4-inch beyond the tip of the probe.

The degaussing tool is used to demagnetize both the roof panel and the console forward mounting screw, as follows:

(1) Be sure the ignition switch is in the OFF position before you begin the demagnetizing procedure.

(2) Plug in the degaussing tool, while keeping the tool at least 2 feet away from the compass unit.

(3) Slowly approach the head of the forward mounting screw with the plastic coated tip of the degaussing tool. Contact the head of the screw for about 2 seconds.

(4) With the degaussing tool still energized, slowly back it away from the screw until the tool is at least 2 feet from the screw head, then unplug the tool.

(5) Place an 8-1/2 X 11 inch piece of paper, oriented lengthwise from front to rear, on the center line of the roof at the windshield header (Fig. 4). The purpose of the paper is to protect the roof panel from scratches and define the area to be demagnetized.

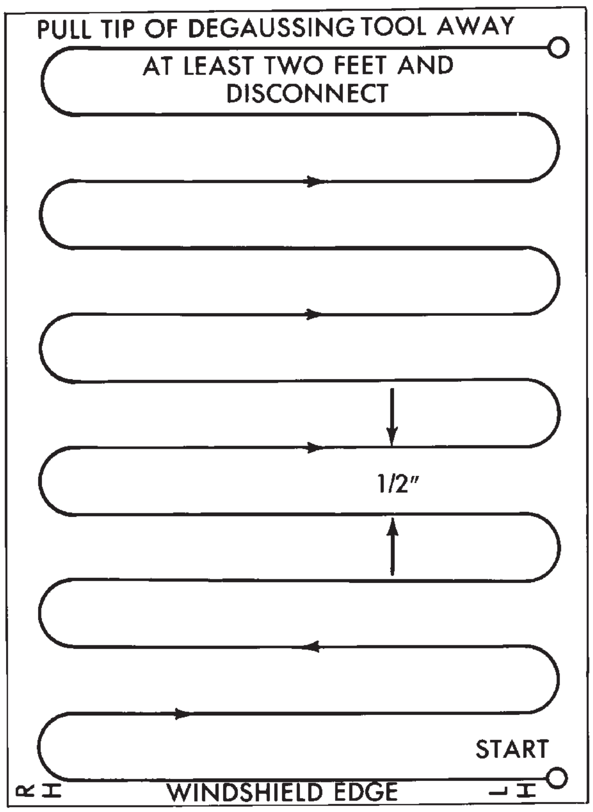


Fig. 4 Roof Demagnetizing Pattern

(6) Plug in the degaussing tool, while keeping the tool at least 2 feet away from the compass unit.

(7) Slowly approach the center line of the roof panel at the windshield header with the degaussing tool plugged in.

(8) Contact the roof panel with the tip of the tool. Be sure template is in place to avoid scratching the roof panel. Using a slow, back and forth sweeping motion and allowing 1/2-inch between passes (Fig. 4), move the tool at least 4 inches either side of the roof center line and 11 inches back from the windshield header.

(9) With the degaussing tool still energized, slowly back it away from the roof panel until the tip is at least 2 feet from the roof. Then unplug the tool.

(10) Calibrate the compass and adjust variance as described in this group.

AMBIENT TEMPERATURE SENSOR REMOVE/INSTALL

(1) Remove the radiator grille (Fig. 5).

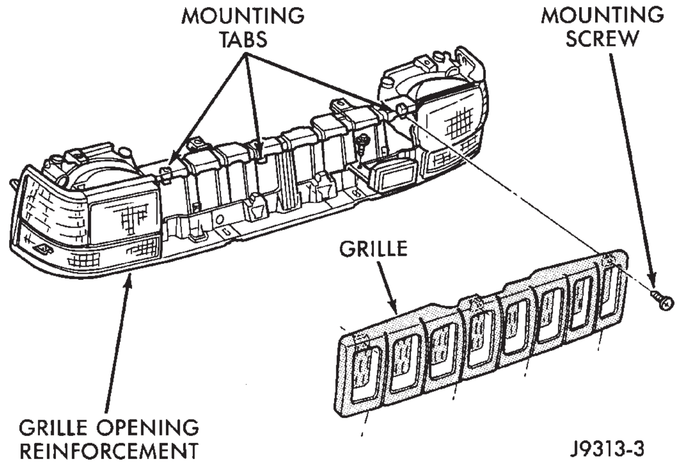


Fig. 5 Radiator Grille Remove/Install

(2) Disconnect sensor wiring connector (Fig. 6).

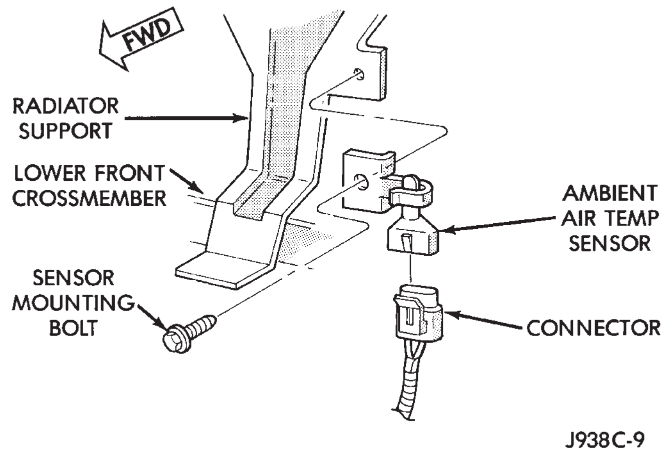


Fig. 6 Ambient Temperature Sensor Remove/Install

(3) Remove sensor mounting bolt and remove sensor.

(4) Reverse removal procedures to install.

OVERHEAD CONSOLE REMOVE/INSTALL

LONG STYLE

(1) Remove console forward mounting screw (Fig. 7).

(2) Slide console forward until the console detaches from the rear mounting bracket.

(3) Disconnect wire harnesses from keyless entry receiver and trip computer (Fig. 8).

(4) Reverse removal procedures to install.

SHORT STYLE

(1) Remove console forward mounting screw (Fig. 9).

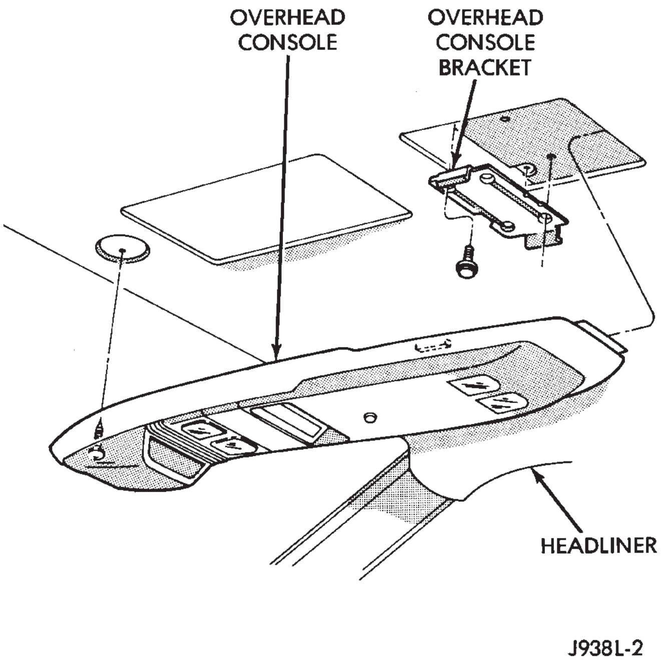


Fig. 7 Long Overhead Console Remove/Install

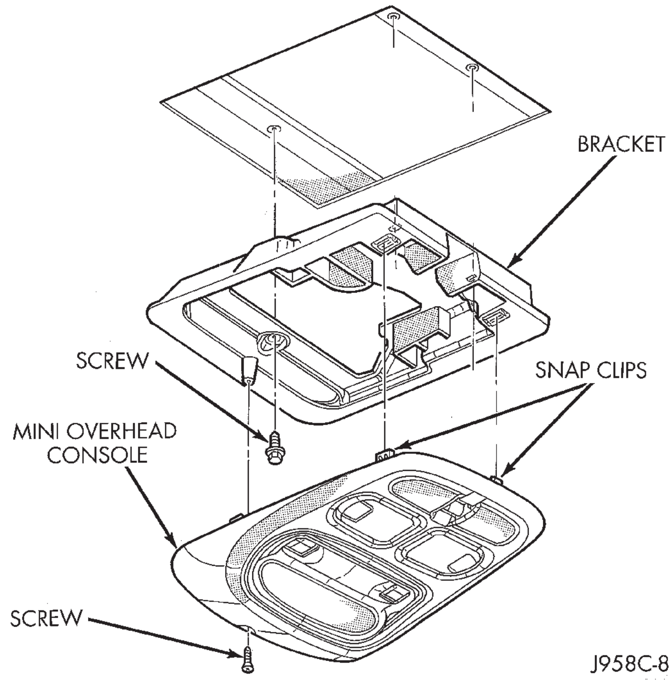


Fig. 9 Short Overhead Console Remove/Install

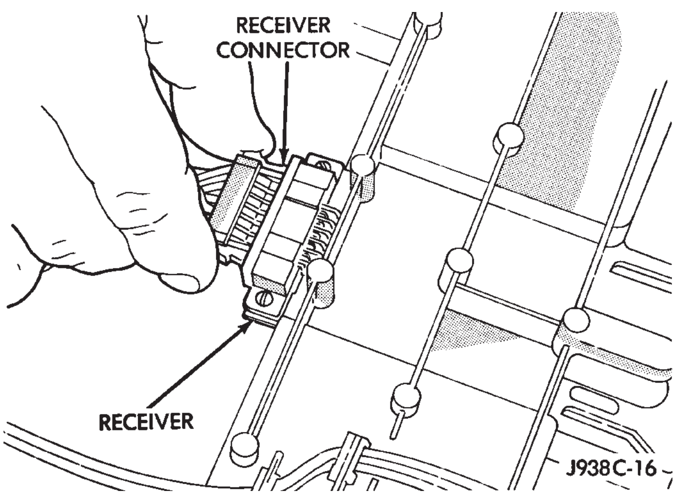


Fig. 8 Keyless Entry Harness Connector

(2) Gently pry downwards at rear of console to release 2 snap clips.

(3) Disconnect wire harnesses from trip computer and power sunroof switch.

(4) Reverse removal procedures to install.

TRIP COMPUTER REMOVE/INSTALL

(1) Remove overhead console and disconnect wiring. See Overhead Console Remove/Install.

(2) Unplug harness connector from trip computer.

(3) Remove 2 screws holding trip computer to console (Fig. 10).

(4) Spread retaining tabs on the sides to remove trip computer from the console.

(5) Reverse removal procedures to install.

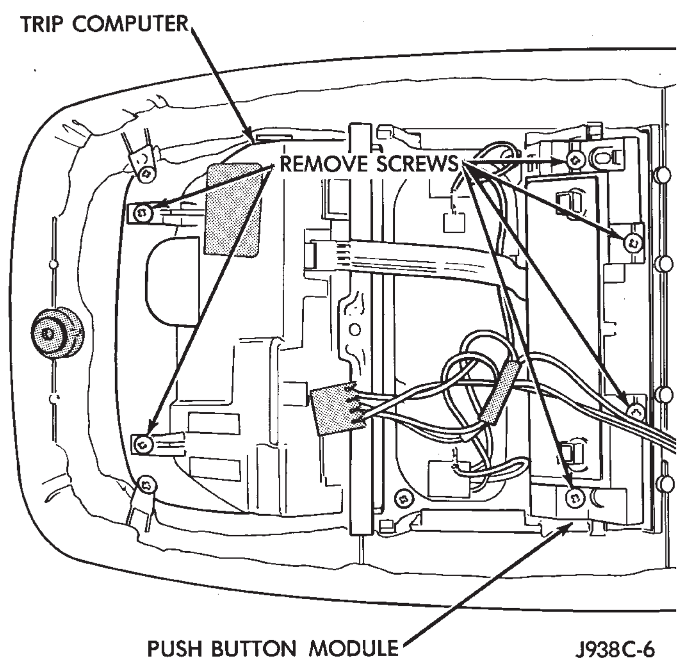


Fig. 10 Trip Computer Remove/Install

PUSH-BUTTON MODULE REMOVE/INSTALL

(1) Remove overhead console and disconnect wiring. See Overhead Console Remove/Install.

(2) Unplug harness connectors from push-button module.

(3) Remove 4 screws holding module to console (Fig. 10).

(4) Remove module from console.

(5) Reverse removal procedures to install.

READING/COURTESY LAMP BULB REMOVE/ INSTALL

(1) Insert a long flat-bladed tool at the notch on the curved edge of the lens. Carefully pry the lens from the housing and pivot the lens down. It may be necessary to move the tool along the edge to free the lens.

(2) Remove bulb by pulling straight down.

(3) Install new bulb by pushing firmly into socket.

(4) Pivot lens up into position and snap in. Test by pressing lens for proper operation and lighting.

KEYLESS ENTRY RECEIVER

Refer to Group 8P - Power Locks for service of this component.

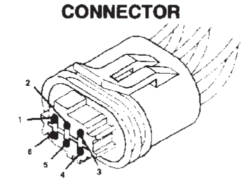
SPECIFICATIONS

TRIP COMPUTER FUEL SENDER CALIBRATION

FUEL LEVEL	*OHMS RESISTANCE
EMPTY	10
1/4	70
1/2	87
3/4	101
FULL	120

*Measured between Pins 2 and 6 of Fuel Pump/Sender Connector

FUEL PUMP/
SENDING UNIT HARNESS
CONNECTOR



CAV	FUNCTION
1	NOT USED
2	SIGNAL GROUND
3	FUEL LEVEL SIGNAL (CLUSTER)
4	FUEL PUMP RELAY OUTPUT
5	FUEL PUMP GROUND
6	FUEL LEVEL SIGNAL (TRIP COMPUTER)

J948C-22

IGNITION SYSTEMS

CONTENTS

COMPONENT IDENTIFICATION/SYSTEM OPERATION

INDEX

GENERAL INFORMATION

Throughout this group, references are made to particular vehicle models by alphabetical designation or by the particular vehicle nameplate. A chart showing a breakdown of alphabetical designations is included in the Introduction group at the beginning of this manual.

This section of the group, Component Identification/System Operation, will discuss ignition system operation and will identify ignition system components.

For diagnostic procedures and adjustments, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of ignition system components, refer to the Component Removal/Installation section of this group.

For other useful information, refer to On-Board Diagnostics in the General Diagnosis sections of Group 14, Fuel System in this manual.

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

An Ignition specifications section is included at the end of this group. A general Maintenance Schedule (mileage intervals) for ignition related items can be found in Group 0, Lubrication and Maintenance. This schedule can also be found in the Owners Manual.

IGNITION SYSTEMS

The distributors used on 4.0L 6-cylinder and 5.2L V-8 engines are basically the same for the 1995 model year. Similarities and differences between the two distributors will be discussed.

A multi-port, fuel injected engine is used on all models. The ignition system is controlled by the powertrain control module (PCM) on all engines. The PCM was formerly referred to as the SBEC or engine controller.

The ignition system consists of:
- Spark plugs
- Ignition coil
- Secondary ignition cables
- Distributor (contains rotor and camshaft position sensor)
- Powertrain control module (PCM)
- Crankshaft position sensor

AUTOMATIC SHUTDOWN (ASD) RELAY

The automatic shutdown (ASD) relay is located in the power distribution center (PDC) near the battery (Fig. 1). As one of its functions, it will supply battery voltage to the ignition coil. The ground circuit for the ASD relay is controlled by the powertrain control module (PCM). The PCM regulates ASD relay operation by switching the ground circuit on-and-off.

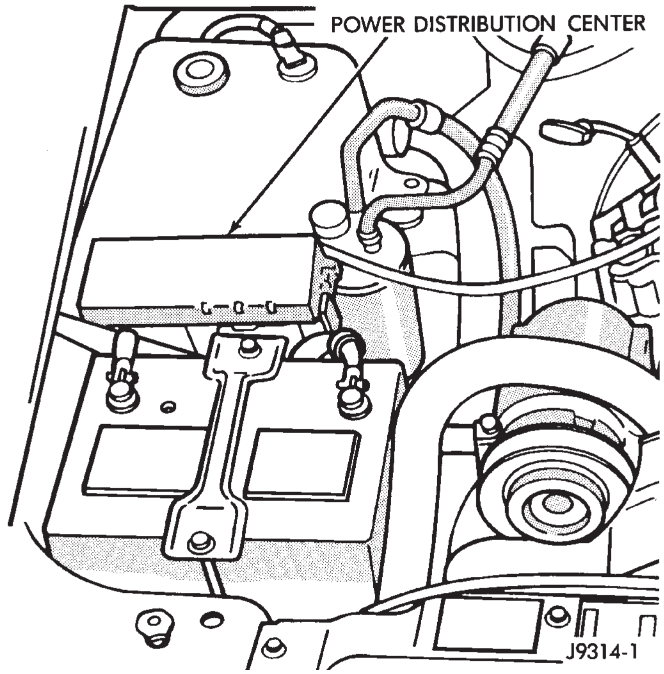


Fig. 1 Power Distribution Center

CAMSHAFT POSITION SENSOR

The camshaft position sensor is located in the distributor (Fig. 2) on all engines. This sensor is similar on both the 4.0L and 5.2L engines for the 1995 model year.

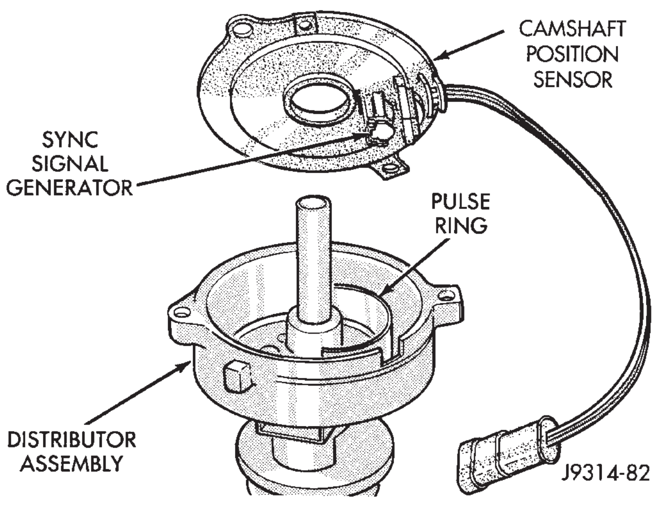


Fig. 2 Camshaft Position Sensor—Typical

The camshaft position sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator (Fig. 2) detects a rotating pulse ring (shutter) on the distributor shaft. The pulse ring rotates 180 degrees 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 pulse ring (shutter) enters the sync signal generator, the following occurs: The interruption of magnetic field causes the voltage to switch high resulting in a sync signal of approximately 5 volts.

When the trailing edge of the pulse ring (shutter) leaves the sync signal generator, the following occurs: The change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

CRANKSHAFT POSITION SENSOR

4.0L 6-CYLINDER ENGINES WITH MANUAL TRANSMISSION:

The crankshaft position sensor is mounted to the transmission bellhousing with two bolts at the left/rear side of the engine block (Fig. 3).

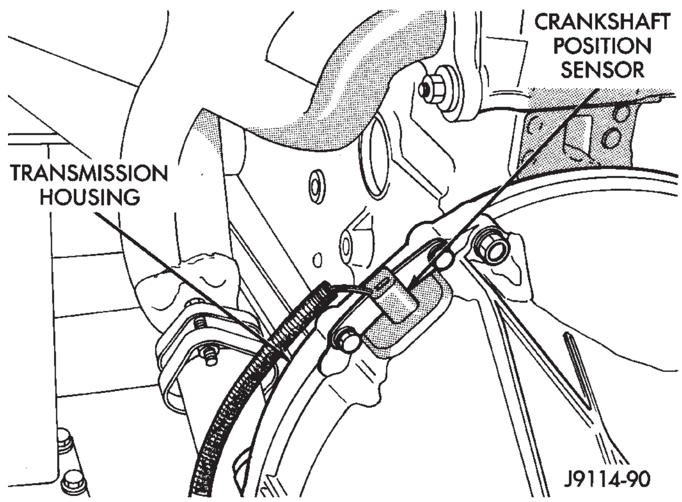


Fig. 3 Crankshaft Position Sensor—4.0L Engine With Manual Transmission

4.0L 6-CYLINDER ENGINES WITH AUTOMATIC TRANSMISSION

The crankshaft position sensor is mounted to the transmission bellhousing with one bolt at the left/rear side of the engine block (Fig. 4).

5.2L V-8 ENGINE

On 5.2L engines, the sensor is bolted to the top of cylinder block near the rear of the right cylinder head (Fig. 5).

Engine speed and crankshaft position are provided through the crankshaft position sensor. The sensor generates pulses that are the input sent to the powertrain control module (PCM). The PCM interprets the sensor input to determine the crankshaft posi-

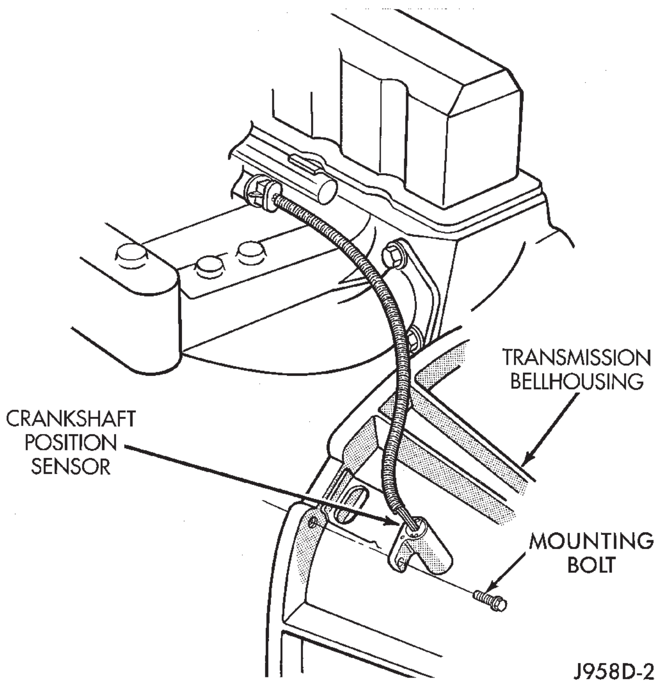


Fig. 4 Crankshaft Position Sensor—4.0L Engine With Automatic Transmission

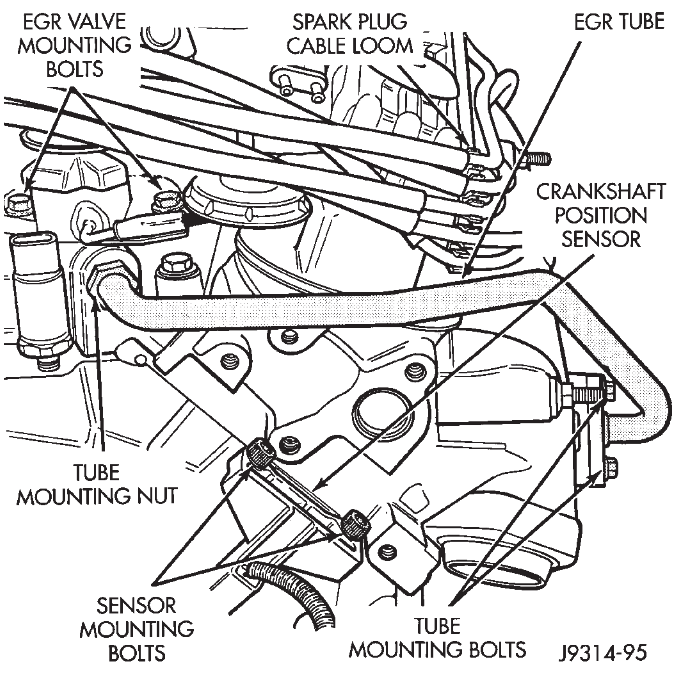


Fig. 5 Crankshaft Position Sensor—5.2L Engine—Typical

tion. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

SENSOR OPERATION—4.0L ENGINE

The flywheel/drive plate has groups of four notches at its outer edge. On 4.0L engines there are three sets of notches (Fig. 6).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution there are there are 3 groups of four pulses generated on 4.0L 6-cylinder engines.

The trailing edge of the fourth notch, which causes the pulse, is four degrees before top dead center (TDC) of the corresponding piston.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this sensor, refer to the Component Removal/Installation section of this group.

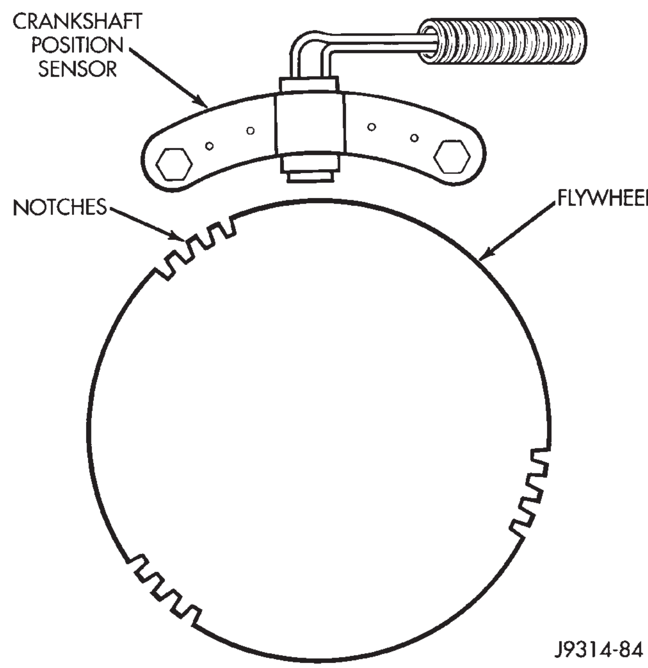


Fig. 6 Sensor Operation—4.0L Engine—Typical

SENSOR OPERATION—5.2L V-8 ENGINE

On 5.2L engines, the flywheel/drive plate has 8 single notches, spaced every 45 degrees, at its outer edge (Fig. 7).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution, there are 8 pulses generated on 5.2L V-8 engines.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

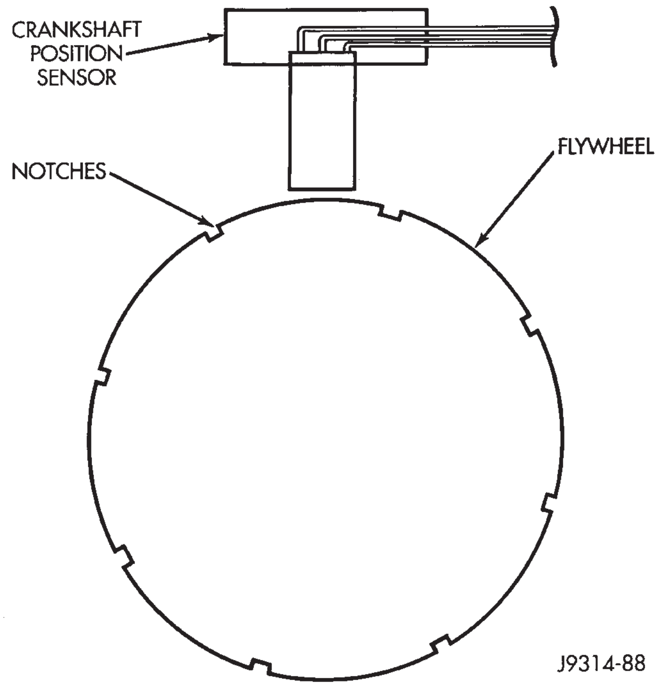


Fig. 7 Sensor Operation—5.2L V-8 Engine

DISTRIBUTORS

All engines are equipped with a camshaft driven mechanical distributor, containing a shaft driven distributor rotor. All distributors are equipped with an internal camshaft position (fuel sync) sensor (Fig. 2). This sensor provides fuel injection synchronization and cylinder identification.

The distributors on 4.0L or 5.2L engines do not have built in centrifugal or vacuum assisted advance. Base ignition timing and all timing advance is controlled by the powertrain control module (PCM). Because ignition timing is controlled by the PCM, **base ignition timing is not adjustable on any of these engines.**

On the 4.0L 6-cylinder engine, the distributor is locked in place by a notch on the distributor housing. The distributor holddown clamp bolt passes through this notch when installed. Because the distributor position is locked when installed, its rotational position can not be changed. **Do not attempt to modify the distributor housing to get distributor rotation. Distributor position will have no effect on ignition timing.**

On the 5.2L V-8 engine, the distributor is held to the engine in the conventional method using a hold-down clamp and bolt. **Although the distributor on the 5.2L engine can be rotated, it will have no effect on ignition timing.**

All distributors contain an internal oil seal that prevents oil from entering the distributor housing. The seal is not serviceable.

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

IGNITION COIL

Battery voltage is supplied to the ignition coil positive terminal from the ASD relay.

The powertrain control module (PCM) opens and closes the ignition coil ground circuit for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

On 4.0L 6-cylinder engines, the ignition coil is mounted to a bracket on the side of the engine (Fig. 8).

On 5.2L V-8 engines, the ignition coil is mounted to a bracket at the front of the right cylinder head (Fig. 9). This bracket is also used to mount the automatic belt tensioner.

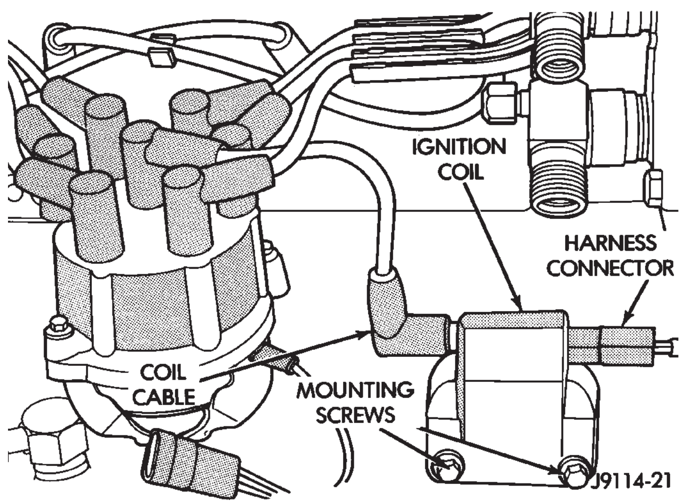


Fig. 8 Ignition Coil—4.0L Engine—Typical

For component testing, refer to the Diagnostics/Service Procedures section of this group.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

ENGINE COOLANT TEMPERATURE SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

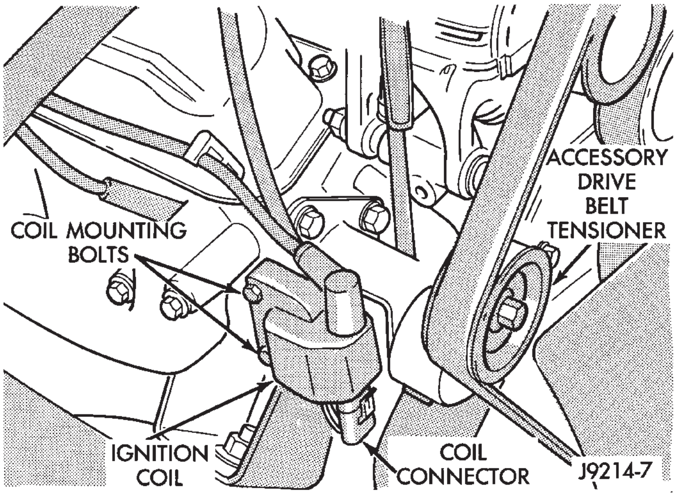


Fig. 9 Ignition Coil—5.2L Engine—Typical

INTAKE MANIFOLD AIR TEMPERATURE SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to the Diagnosis sections of Group 14, Fuel System.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

POWERTRAIN CONTROL MODULE (PCM)

The PCM (formerly called the SBEC or engine controller) is located in the right/rear side of the engine compartment (Fig. 10).

The ignition system is controlled by the PCM.

Base ignition timing by rotation of distributor is not adjustable. The PCM opens and closes the ignition coil ground circuit to operate the ignition coil. This is done to adjust ignition timing, both initial (base) and advance, for changing engine operating conditions.

The amount of electronic spark advance provided by the PCM is determined by five input factors: Engine coolant temperature, engine rpm, intake manifold air temperature, manifold absolute pressure and throttle position.

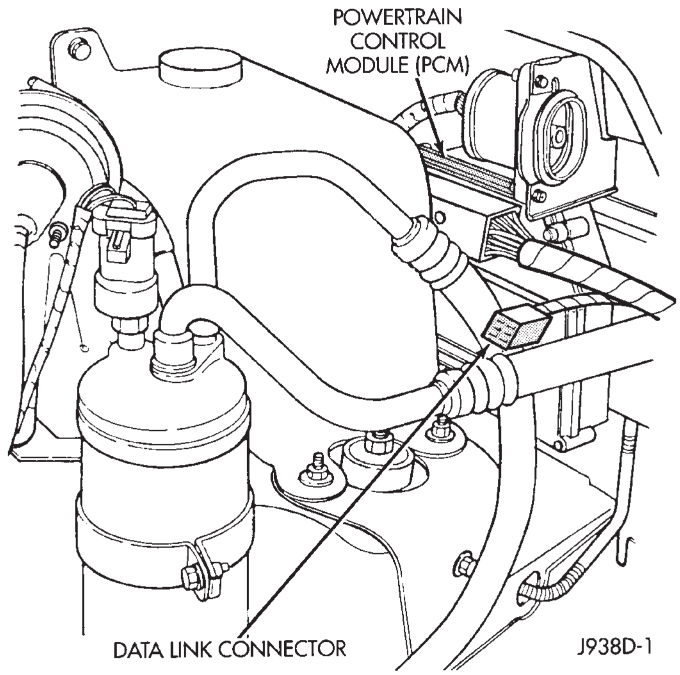


Fig. 10 PCM Location—Typical

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

For diagnostics, refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

THROTTLE POSITION SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

OXYGEN (O2S) SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

DIAGNOSTICS/SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

This section of the group, Diagnostics/Service Procedures, will discuss basic ignition system diagnostics and service adjustments.

For system operation and component identification, refer to the Component Identification/System Operation section of this group.

For removal or installation of ignition system components, refer to the Component Removal/Installation section of this group.

For other useful information, refer to On-Board Diagnostics in the General Diagnosis sections of Group 14, Fuel System in this manual.

For operation of the DRB Scan Tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

AUTOMATIC SHUTDOWN (ASD) RELAY

To perform a complete test of the ASD relay and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to Relays—Operation/Testing in the Group 14, Fuel System section of this service manual.

CAMSHAFT POSITION SENSOR TEST

The camshaft position sensor is located in the distributor on all engines (Fig. 1).

To perform a complete test of this sensor and its circuitry, refer to the DRB scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

4.0L OR 5.2L ENGINE

For this test, an analog voltmeter is needed. Do not remove the distributor connector from the distributor. Using small paper clips, insert them into the backside of the distributor wire harness connector to make contact with the terminals. Be sure that the connector is not damaged when inserting the paper clips. Attach voltmeter leads to these paper clips.

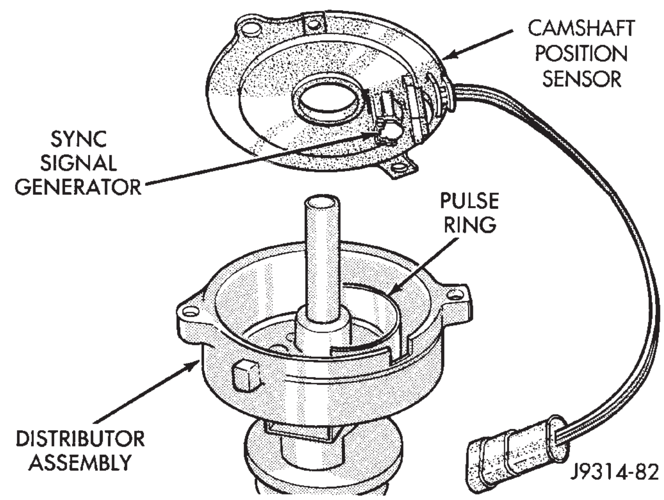


Fig. 1 Camshaft Position Sensor—Typical

(1) Connect the positive (+) voltmeter lead into the sensor output wire. This is at done the distributor wire harness connector. For wire identification, refer to Group 8W, Wiring Diagrams.

(2) Connect the negative (-) voltmeter lead into the ground wire. For wire identification, refer to Group 8W, Wiring Diagrams.

(3) Set the voltmeter to the 15 Volt DC scale.

4.0L Engines: Remove distributor cap. Rotate (crank) engine with starter until rotor is pointed in the 10 o'clock position. The movable pulse ring (Fig. 1) will now be within the magnetic pickup on the camshaft position sensor.

5.2L Engines: Remove coil high-tension cable and all spark plug cables at distributor cap. Note and mark position of cables before removal (Fig. 2). Remove distributor cap from distributor (two screws). Rotate (crank) the engine until the rotor is pointed towards the rear of vehicle. The movable pulse ring (Fig. 1) will now be within the magnetic pickup on the camshaft position sensor.

(4) Turn ignition key to ON position. Voltmeter should read approximately 5.0 volts.

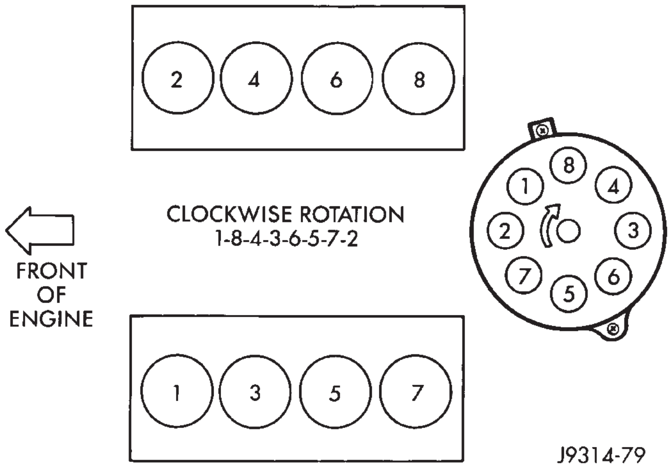


Fig. 2 Engine Firing Order—5.2L Engine

(5) If voltage is not present, check the voltmeter leads for a good connection.

(6) If voltage is still not present, check for voltage at the supply wire. For wire identification, refer to Group 8W, Wiring Diagrams.

(7) If voltage is not present at supply wire, check for voltage at pin-7 of powertrain control module (PCM) 60-way connector. Leave the PCM connector connected for this test.

(8) If voltage is still not present, perform vehicle test using the DRB scan tool.

(9) If voltage is present at pin-7, but not at the supply wire:

(a) Check continuity between the supply wire. This is checked between the distributor connector and pin-7 at the PCM. If continuity is not present, repair the harness as necessary.

(b) Check for continuity between the camshaft position sensor output wire and pin-44 at the PCM. If continuity is not present, repair the harness as necessary.

(c) Check for continuity between the ground circuit wire at the distributor connector and ground. If continuity is not present, repair the harness as necessary.

(10) While observing the voltmeter, crank the engine with ignition switch. The voltmeter needle should fluctuate between 0 and 5 volts while the engine is cranking. This verifies that the camshaft position sensor is operating properly and a sync pulse signal is being generated.

If a sync pulse signal is not present, replacement of the camshaft position sensor is necessary.

For removal or installation of ignition system components, refer to the Component Removal/Installation section of this group.

For system operation and component identification, refer to the Component Identification/System Operation section of this group.

CRANKSHAFT POSITION SENSOR TEST

To perform a complete test of this sensor and its circuitry, refer to the DRB scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

On the 4.0L engine, the sensor is located on the transmission bellhousing at the left/rear side of the engine block (Figs. 3 or 4).

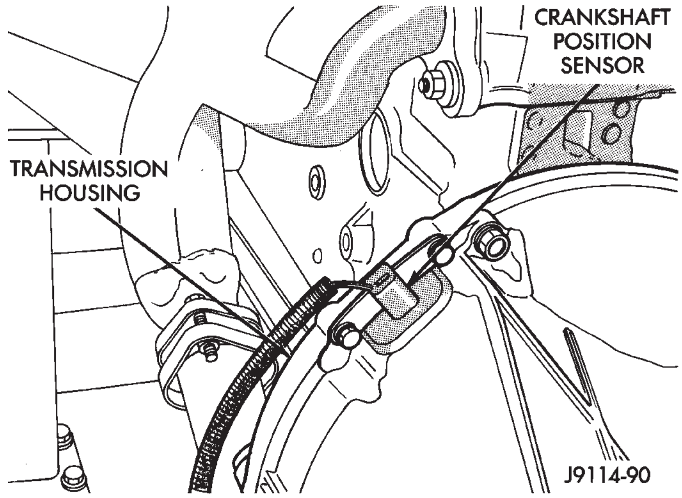


Fig. 3 Crankshaft Position Sensor—4.0L Engine With Manual Transmission

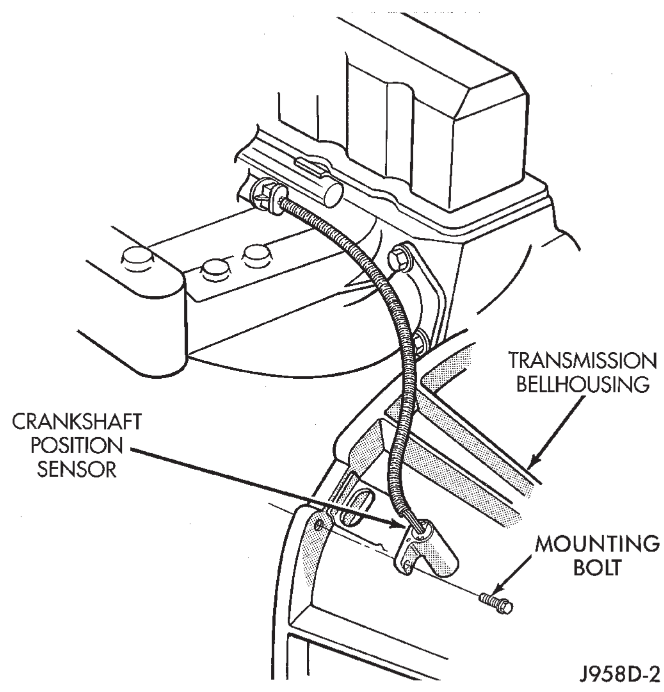


Fig. 4 Crankshaft Position Sensor—4.0L Engine With Automatic Transmission

On the 5.2L engine, the sensor is located on the top of cylinder block near the rear of right cylinder head (Fig. 5).

(1) Near the rear of intake manifold, disconnect sensor pigtail harness connector from main wiring harness.

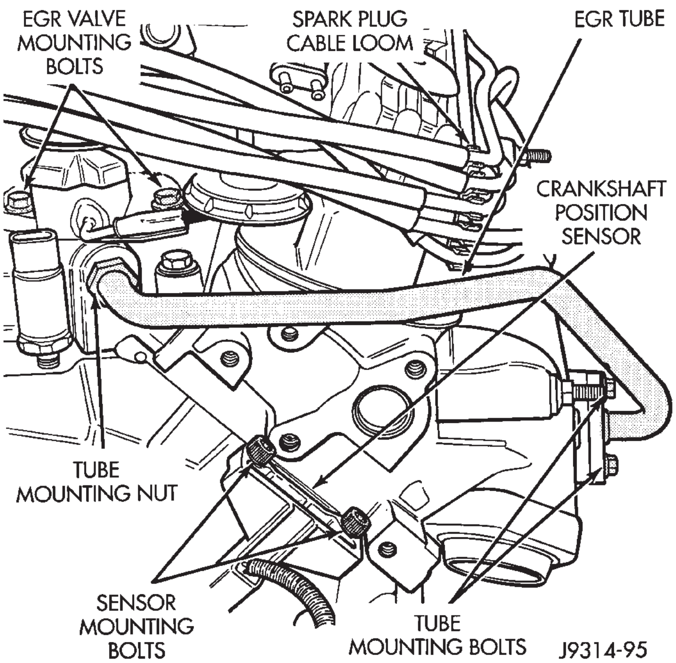


Fig. 5 Crankshaft Position Sensor—5.2L Engine—Typical

(2) Place an ohmmeter across terminals B and C (Fig. 6). Ohmmeter should be set to 1K-to-10K scale for this test. The meter reading should be open (no resistance). Replace sensor if a low resistance is indicated.

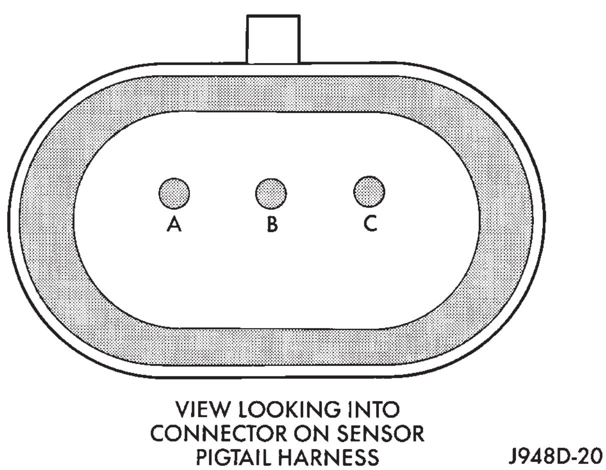


Fig. 6 Crankshaft Position Sensor Connector

DISTRIBUTOR CAP

INSPECTION

Remove the distributor cap and wipe it clean with a dry lint free cloth. Visually inspect the cap for cracks, carbon paths, broken towers, or damaged rotor button (Figs. 7 and 8). Also check for white deposits on the inside (caused by condensation entering the cap through cracks). Replace any cap that displays charred or eroded terminals. The inside flat surface of a terminal end (faces toward rotor) will indicate some evidence of erosion from normal operation. Examine the terminal ends for evidence of mechanical interference with the rotor tip.

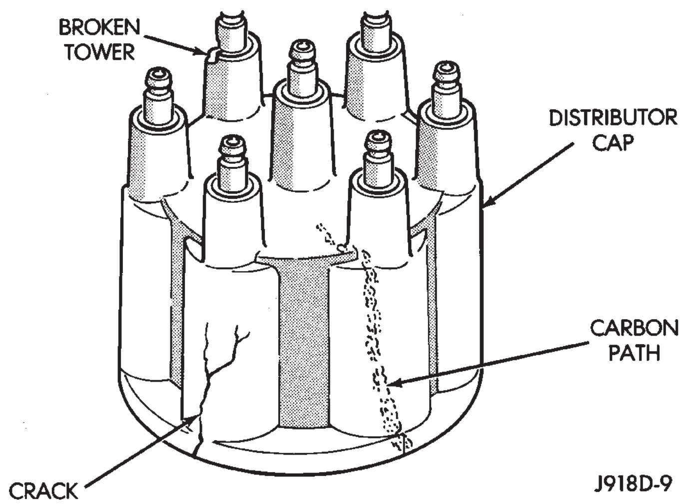


Fig. 7 Cap Inspection—External—Typical

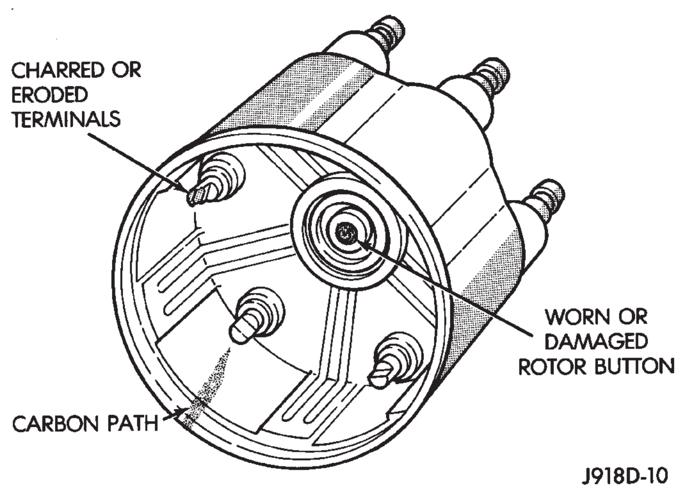


Fig. 8 Cap Inspection—Internal—Typical

If replacement of the distributor cap is necessary, transfer spark plug cables from the original cap to the new cap. This should be done one cable at a time. Each cable is installed onto the tower of the new cap that corresponds to its tower position on the original cap. Fully seat the cables onto the towers. If necessary, refer to the Engine Firing Order diagrams (Figs. 9 or 10).

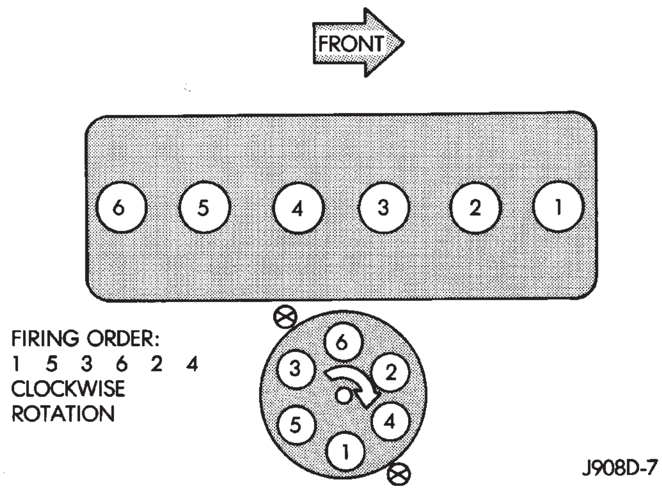


Fig. 9 Engine Firing Order—4.0L 6-Cylinder Engine

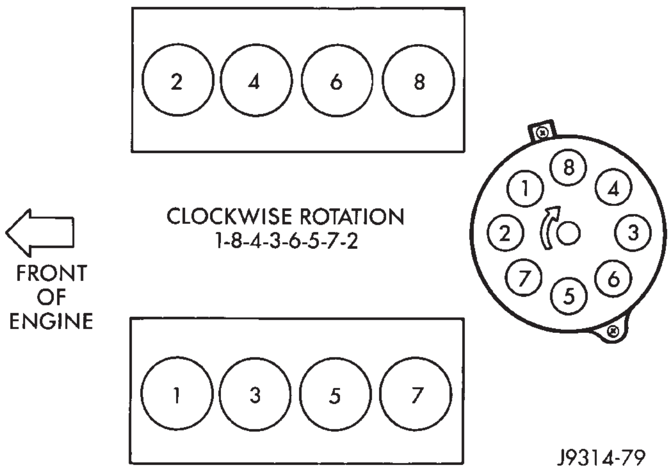


Fig. 10 Engine Firing Order—5.2L V-8 Engine

DISTRIBUTOR ROTOR

Visually inspect the rotor (Fig. 11) for cracks, evidence of corrosion, or the effects of arcing on the metal tip. Also check for evidence of mechanical interference with the cap. Some charring is normal on the end of the metal tip. The silicone-dielectric-varnish-compound applied to the rotor tip for radio interference noise suppression, will appear charred. This is normal. **Do not remove the charred compound.** Test the spring for insufficient tension. Replace a rotor that displays any of these adverse conditions.

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

IGNITION COIL

To perform a complete test of the ignition coil and its circuitry, refer to the DRB scan tool. Also refer to

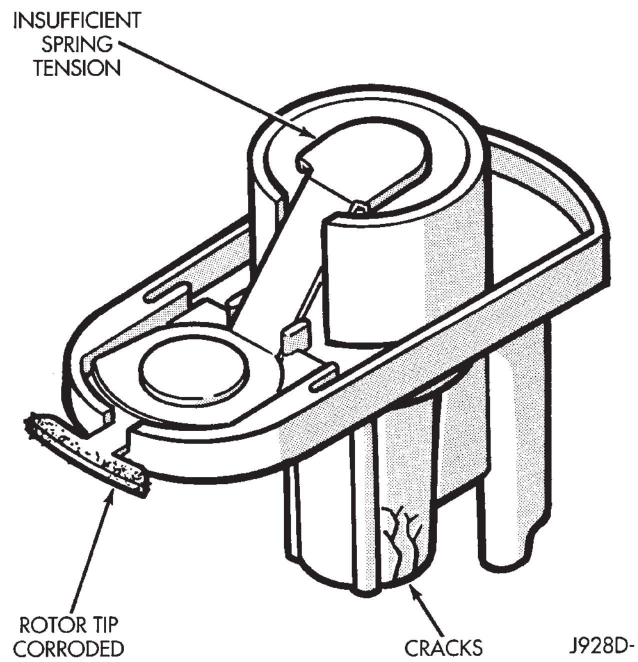


Fig. 11 Rotor Inspection—Typical

the appropriate Powertrain Diagnostics Procedures manual. To test the coil only, refer to the following:

The ignition coil (Figs. 12 or 13) is designed to operate without an external ballast resistor.

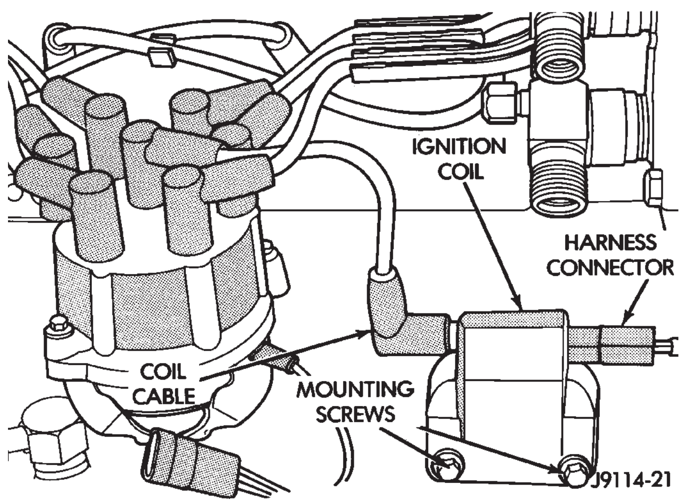


Fig. 12 Ignition Coil—4.0L Engine—Typical

Inspect the ignition coil for arcing. Test the coil according to coil tester manufacturer's instructions. Test the coil primary and secondary resistance. Replace any coil that does not meet specifications. Refer to the Ignition Coil Resistance chart.

If the ignition coil is being replaced, the secondary spark plug cable must also be checked. Replace cable if it has been burned or damaged.

Arcing at the tower will carbonize the cable nipple, which if it is connected to a new ignition coil, will cause the coil to fail.

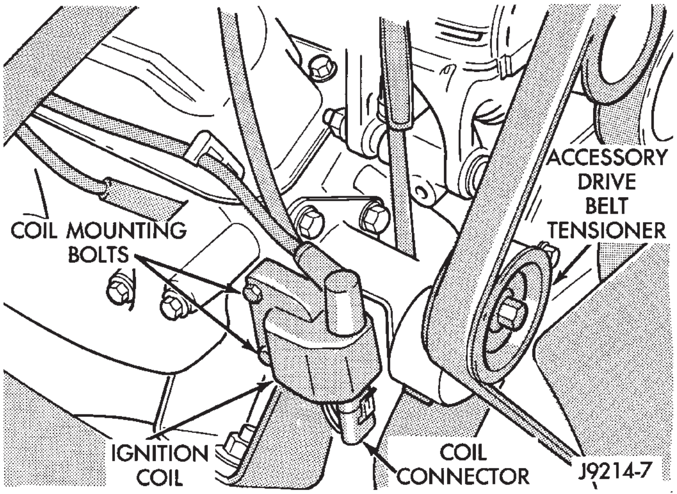


Fig. 13 Ignition Coil—5.2L Engine

If the secondary coil cable shows any signs of damage, it should be replaced with a new cable and new terminal. Carbon tracking on the old cable can cause arcing and the failure of a new ignition coil.

ENGINE COOLANT TEMPERATURE SENSOR TEST

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

IGNITION SECONDARY CIRCUIT DIAGNOSIS

CHECKING FOR SPARK

CAUTION: When disconnecting a high voltage cable from a spark plug or from the distributor cap, twist the rubber boot slightly (1/2 turn) to break it loose (Fig. 14). Grasp the boot (not the cable) and pull it off with a steady, even force.

(1) Disconnect the ignition coil secondary cable from center tower of the distributor cap. Hold the cable terminal approximately 12 mm (1/2 in.) from a good engine ground (Fig. 15).

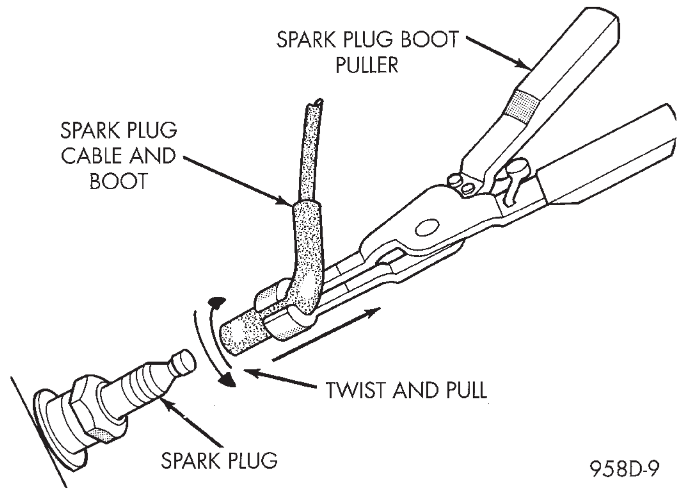


Fig. 14 Cable Removal

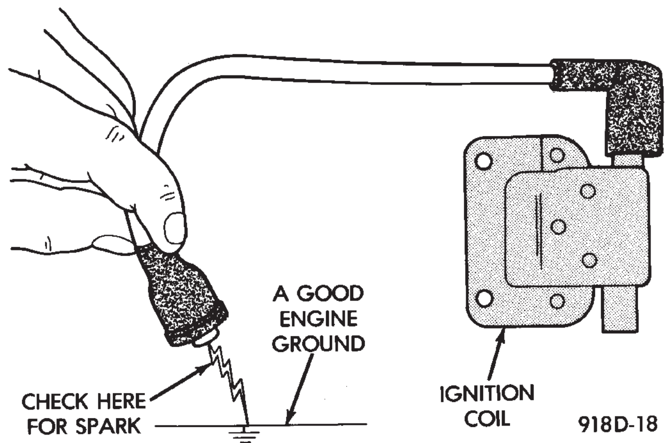


Fig. 15 Checking for Spark—Typical

WARNING: BE VERY CAREFUL WHEN THE ENGINE IS CRANKING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE FITTING CLOTHING.

(2) Rotate (crank) the engine with the starter motor and observe the cable terminal for a steady arc. If steady arcing does not occur, inspect the secondary coil cable. Refer to Spark Plug Cables in this group. Also inspect the distributor cap and rotor for cracks

IGNITION COIL RESISTANCE

COIL (MANUFACTURER)	PRIMARY RESISTANCE 21–27°C (70–80°F)	SECONDARY RESISTANCE 21–27°C (70–80°F)
Diamond	0.97 - 1.18 Ohms	11,300 - 15,300 Ohms
Toyodenso	0.95 - 1.20 Ohms	11,300 - 13,300 Ohms

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or burn marks. Repair as necessary. If steady arcing occurs, connect ignition coil cable to the distributor cap.

(3) Remove a cable from one spark plug.

(4) Using insulated pliers, hold the cable terminal approximately 12 mm (1/2 in.) from the engine cylinder head or block while rotating the engine with the starter motor. Observe the spark plug cable terminal for an arc. If steady arcing occurs, it can be expected that the ignition secondary system is operating correctly. **(note that if the ignition coil cable is removed for this test, instead of a spark plug cable, the spark intensity will be much higher.)** If steady arcing occurs at the spark plug cables, but the engine will not start, connect the DRB scan tool. Refer to the Powertrain Diagnostic Procedures service manual.

FAILURE TO START TEST

To prevent unnecessary diagnostic time and wrong test results, the previous Checking For Spark test should be performed prior to this test.

WARNING: SET PARKING BRAKE OR BLOCK THE DRIVE WHEELS BEFORE PROCEEDING WITH THIS TEST.

(1) Unplug the ignition coil harness connector at the coil (Figs. 16 or 17).

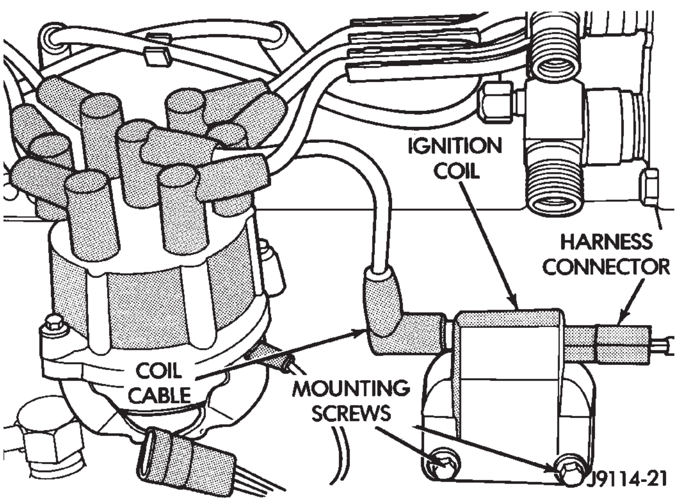

Fig. 16 Coil Harness Connector—4.0L Engine—Typical

(2) Connect a set of small jumper wires (18 gauge or smaller) between the disconnected harness terminals and the ignition coil terminals. To determine polarity at connector and coil, refer to the Wiring Diagrams section.

(3) Determine that sufficient battery voltage (12.4 volts) is present for the starting and ignition systems.

(4) Crank the engine for 5 seconds while monitoring the voltage at the coil positive terminal:

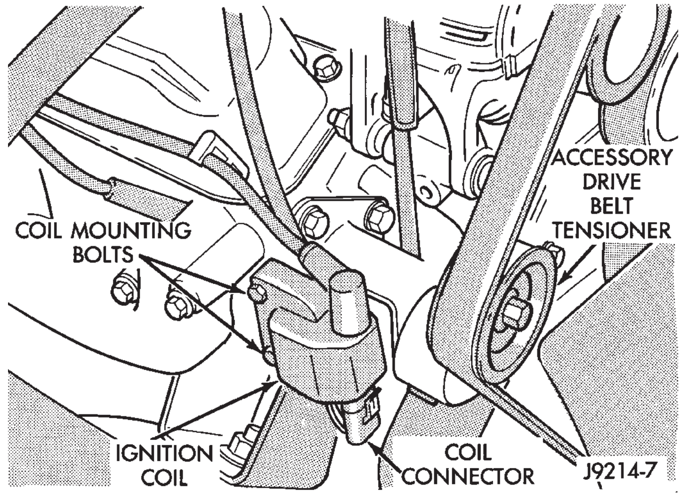

Fig. 17 Coil Harness Connector—5.2L Engine—Typical

• If the voltage remains near zero during the entire period of cranking, refer to On-Board Diagnostics in Group 14, Fuel Systems. Check the powertrain control module and auto shutdown relay.

• If voltage is at or near battery voltage and drops to zero after 1-2 seconds of cranking, check the camshaft position sensor-to-powertrain control module circuit. Refer to On-Board Diagnostics in group 14, Fuel Systems.

• If voltage remains at or near battery voltage during the entire 5 seconds, turn the key off. Remove the 60-way connector (Fig. 18) from the powertrain control module (PCM). Check 60-way connector for any spread terminals.

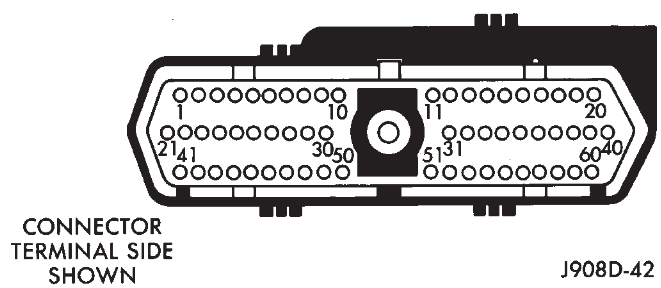

Fig. 18 PCM 60-Way Connector

(5) Remove test lead from the coil positive terminal. Connect an 18 gauge jumper wire between the battery positive terminal and coil positive terminal.

(6) Make the special jumper shown in figure 19. Using the jumper, **momentarily** ground terminal-19 of the 60-way connector. A spark should be generated at the coil cable when the ground is removed.

(7) If spark is generated, replace the powertrain control module (PCM).

(8) If spark is not seen, use the special jumper to ground the coil negative terminal directly.

(9) If spark is produced, repair wiring harness for an open condition.

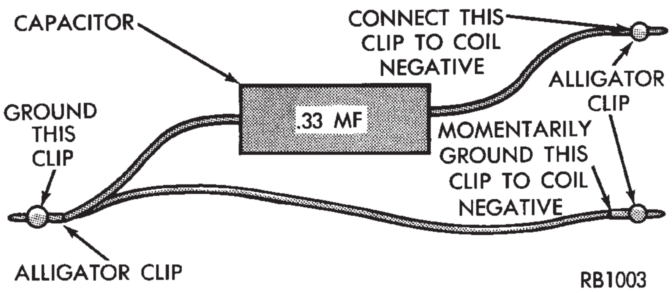

Fig. 19 Special Jumper Ground-to-Coil Negative Terminal

(10) If spark is not produced, replace the ignition coil.

IGNITION TIMING

Base (initial) ignition timing is NOT adjustable on any of the 4.0L 6-cylinder or 5.2L V-8 engines. Do not attempt to adjust ignition timing by rotating the distributor.

All ignition timing functions are controlled by the powertrain control module (PCM). Refer to On-Board Diagnostics in the Multi-Port Fuel Injection—General Diagnosis section of Group 14, Fuel Systems for more information. Also refer to the appropriate Powertrain Diagnostics Procedures service manual for operation of the DRB Scan Tool.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR TEST

For an operational description, diagnosis and removal/installation procedures, refer to the Diagnosis sections of Group 14, Fuel System.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

POWERTRAIN CONTROL MODULE (PCM)

The PCM (formerly called the SBEC or engine controller) is located in the right/rear side of the engine compartment (Fig. 20).

The ignition system is controlled by the PCM.

For diagnostics, refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

For removal and installation of this component, refer to the Component Removal/Installation section of this group.

SPARK PLUGS

For spark plug removal, cleaning, gap adjustment and installation, refer to the Component Removal/Installation section of this group.

5.2L V-8 Engine Only: Spark plug heat shields

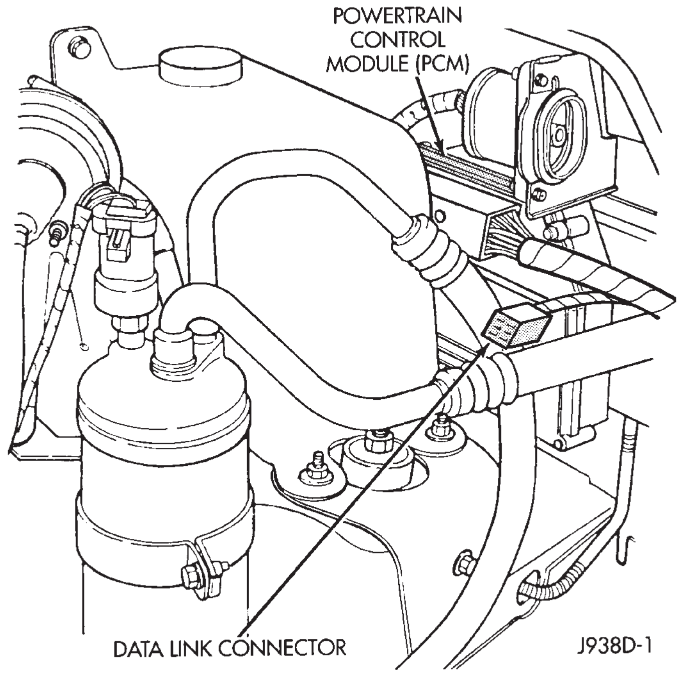

Fig. 20 PCM Location—Typical

are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 21). These shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 21).

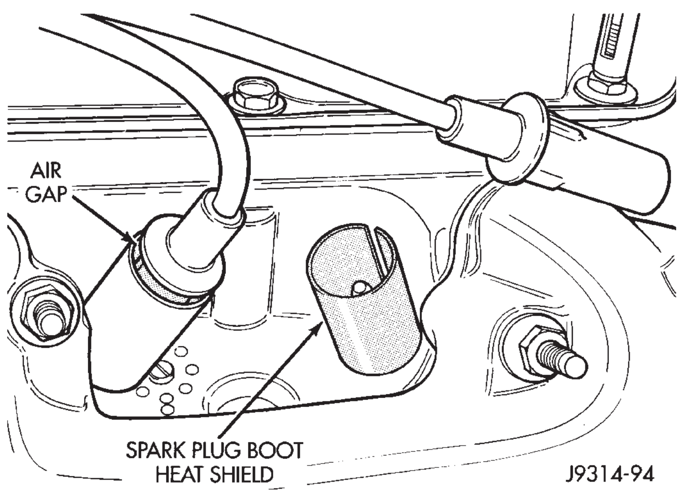

Fig. 21 Heat Shields—5.2L V-8 Engine

Faulty carbon and/or gas fouled plugs generally cause hard starting, but they will clean up at higher engine speeds. Faulty plugs can be identified in a number of ways: poor fuel economy, power loss, decrease in engine speed, hard starting and, in general, poor engine performance.

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 maintenance chart in Group 0, Lubrication and Maintenance.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective. Refer to the following Spark Plug Condition section of this group.

CONDITION

NORMAL OPERATING

The few deposits present on the spark plug will probably be light tan or slightly gray in color. This is evident with most grades of commercial gasoline (Fig. 22). 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. Spark plugs that have normal wear can usually be cleaned, have the electrodes filed, have the gap set and then be installed.

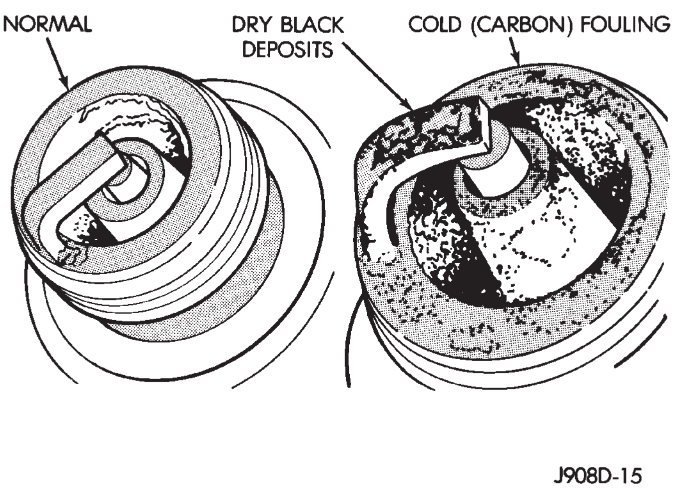

Fig. 22 Normal Operation and Cold (Carbon) Fouling

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT causes the entire tip of the spark plug to be coated with a rust colored deposit. This rust color can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance is not affected by MMT deposits.

COLD FOULING/CARBON FOULING

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 22). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set of spark plugs may be caused by a clogged air cleaner element or repeated short operating times (short trips).

WET FOULING OR GAS FOULING

A spark plug coated with excessive wet fuel or oil is wet fouled. In older engines, worn piston rings, leaking valve guide seals or excessive cylinder wear can cause wet fouling. In new or recently overhauled engines, wet fouling may occur before break-in (normal oil control) is achieved. This condition can usually be resolved by cleaning and reinstalling the fouled plugs.

OIL OR ASH ENCRUSTED

If one or more spark plugs are oil or oil ash encrusted (Fig. 23), evaluate engine condition for the cause of oil entry into that particular combustion chamber.

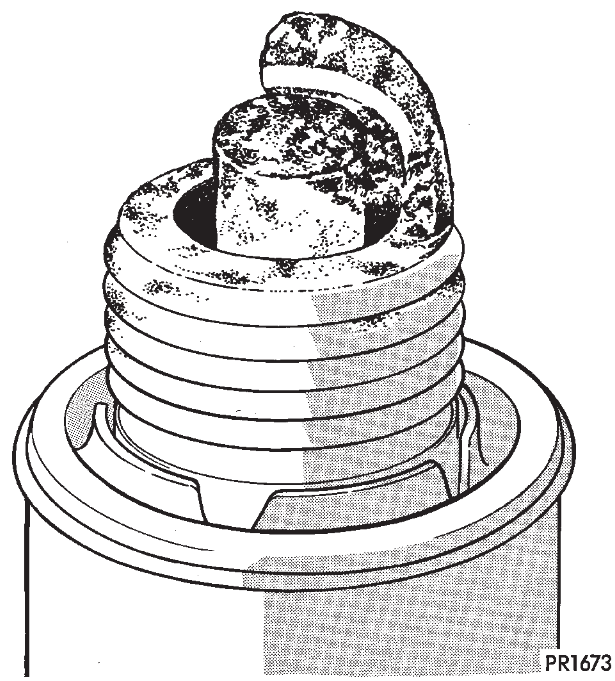

Fig. 23 Oil or Ash Encrusted

ELECTRODE GAP BRIDGING

Electrode gap bridging may be traced to loose deposits in the combustion chamber. These deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, deposits partially liquefy and bridge the gap between electrodes (Fig. 24). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 25). They may appear to be harmful, but this is a normal condition caused by chemical addi-

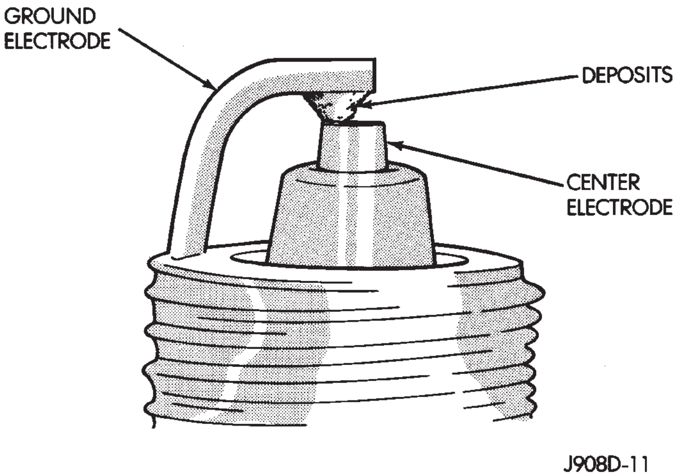

Fig. 24 Electrode Gap Bridging

tives 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 and can be cleaned using standard procedures.

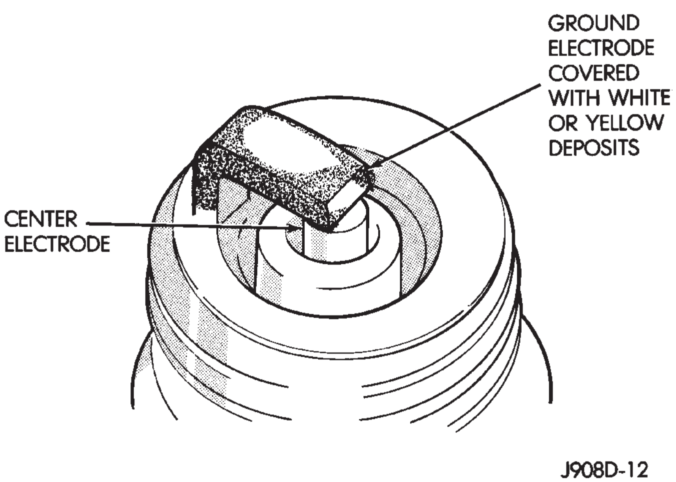

Fig. 25 Scavenger Deposits

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 can also separate the insulator from the center electrode (Fig. 26). Spark plugs with this condition must be replaced.

PREIGNITION DAMAGE

Preignition damage is usually caused by excessive combustion chamber temperature. The center electrode dissolves first and the ground electrode dissolves somewhat latter (Fig. 27). Insulators appear relatively deposit free. Determine if the spark plug

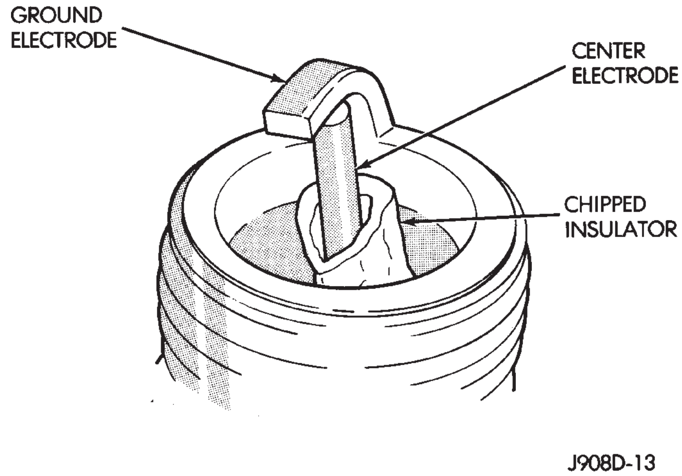

Fig. 26 Chipped Electrode Insulator

has the correct heat range rating for the engine. Determine if ignition timing is over advanced, or if other operating conditions are causing engine overheating. (The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges. This depends upon the thickness and length of the center electrodes porcelain insulator.)

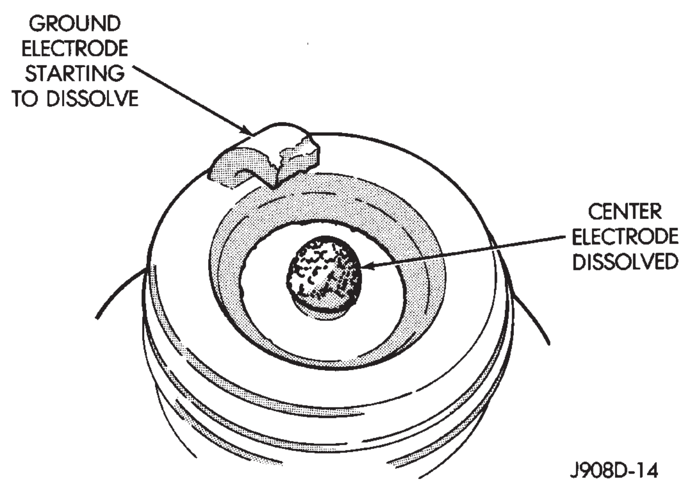

Fig. 27 Preignition Damage

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 28). The increase in electrode gap will be considerably in excess of 0.001 inch per 1000 miles of operation. This suggests that a plug with a cooler heat range rating should be used. Over advanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

SPARK PLUG SECONDARY CABLES

5.2L V-8 Engine Only: Spark plug heat shields are pressed into the cylinder head to surround each

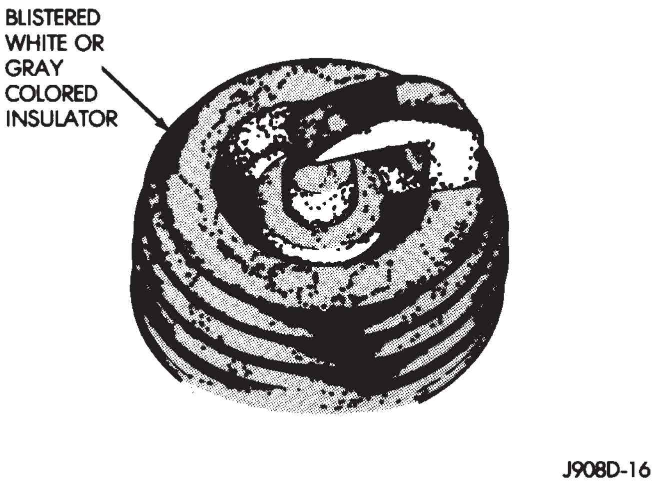

Fig. 28 Spark Plug Overheating

spark plug cable boot and spark plug (Fig. 29). These shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 29).

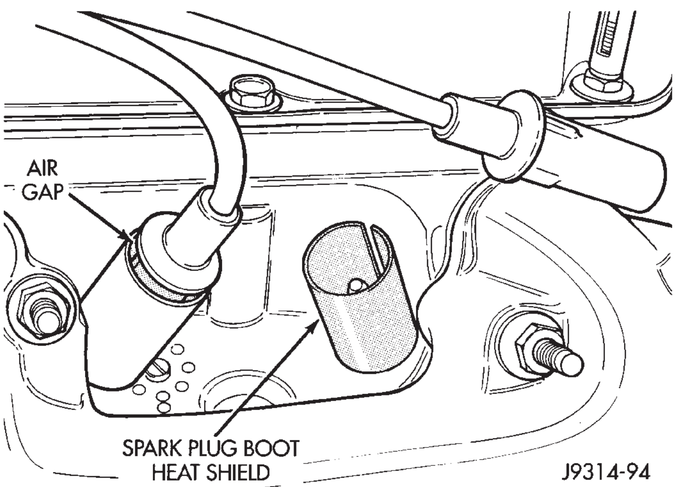

Fig. 29 Heat Shields—5.2L V-8 Engine

TESTING

Spark plug cables are sometimes referred to as secondary ignition cables or secondary wires. The cables transfer electrical current from the distributor to individual spark plugs at each cylinder. The spark plug cables are of nonmetallic construction and have a built in resistance. The cables provide suppression of radio frequency emissions from the ignition system.

Check the high-tension cable connections for good contact at the ignition coil, distributor cap towers and spark plugs. Terminals should be fully seated. The terminals and spark plug covers should be in good condition. Terminals should fit tightly to the ignition coil, distributor cap and spark plugs. The spark plug cover (boot) of the cable should fit tight around the spark plug insulator. Loose cable connections can cause corrosion and increase resistance, resulting in shorter cable service life.

Clean the high tension cables with a cloth moistened with a nonflammable solvent and wipe dry. Check for brittle or cracked insulation.

When testing secondary cables for damage with an oscilloscope, follow the instructions of the equipment manufacturer.

If an oscilloscope is not available, spark plug cables may be tested as follows:

CAUTION: Do not leave any one spark plug cable disconnected for longer than necessary during testing. This may cause possible heat damage to the catalytic converter. Total test time must not exceed ten minutes.

With the engine not running, connect one end of a test probe to a good ground. Start the engine and run the other end of the test probe along the entire length of all spark plug cables. If cables are cracked or punctured, there will be a noticeable spark jump from the damaged area to the test probe. The cable running from the ignition coil to the distributor cap can be checked in the same manner. Cracked, damaged or faulty cables should be replaced with resistance type cable. This can be identified by the words ELECTRONIC SUPPRESSION printed on the cable jacket.

Use an ohmmeter to test for open circuits, excessive resistance or loose terminals. Remove the distributor cap from the distributor. **Do not remove cables from cap.** Remove cable from spark plug. Connect ohmmeter to spark plug terminal end of cable and to corresponding electrode in distributor cap. Resistance should be 250 to 1000 Ohms per inch of cable. If not, remove cable from distributor cap tower and connect ohmmeter to the terminal ends of cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, replace the cable. Test all spark plug cables in this manner.

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

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To test ignition coil-to-distributor cap cable, do not remove the cable from the cap. Connect ohmmeter to rotor button (center contact) of distributor cap and terminal at ignition coil end of cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, remove the cable from the distributor cap. Connect the ohmmeter to the terminal ends of the cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, replace the cable. Inspect the ignition coil tower for cracks, burns or corrosion.

For removal and installation of spark plug cables, refer to Spark Plug Secondary Cables in the Component Removal/Installation section.

THROTTLE POSITION SENSOR TEST

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

OXYGEN SENSOR TESTS

For an operational description, diagnostics and removal/installation procedures, refer to Group 14, Fuel Systems, in this manual.

ON-BOARD DIAGNOSTICS

FOR CERTAIN IGNITION SYSTEM COMPONENTS

The powertrain control module (PCM) performs an On-Board Diagnostic (OBD) check for certain ignition system components on all vehicles. This is done by setting a diagnostic trouble code (DTC).

A DTC can be obtained in two different ways. One of the ways is by connecting the DRB scan tool to the data link connector. This connector is located in the engine compartment (Fig. 30). Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool. The other way is to cycle the ignition key and observe the malfunction indicator lamp (MIL). The MIL lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 31). This lamp will flash a numeric code. If a numeric code number 11 (for the crankshaft position sensor) or 42 (for the ASD relay) is observed, a problem has been found in the ignition system.

Note that the CHECK ENGINE lamp will illuminate initially for approximately two seconds each time the ignition key is turned to the ON position. This is done for a bulb test.

For a complete operational description of all DTC's, for accessing a DTC and for erasing a DTC, refer to On-Board Diagnostics. This can be found in the General Diagnosis sections of Group 14, Fuel System. For numeric flash lamp code charts, refer to Diagnostic Trouble Code (DTC). This can also be found in the General Diagnosis sections of Group 14, Fuel System.

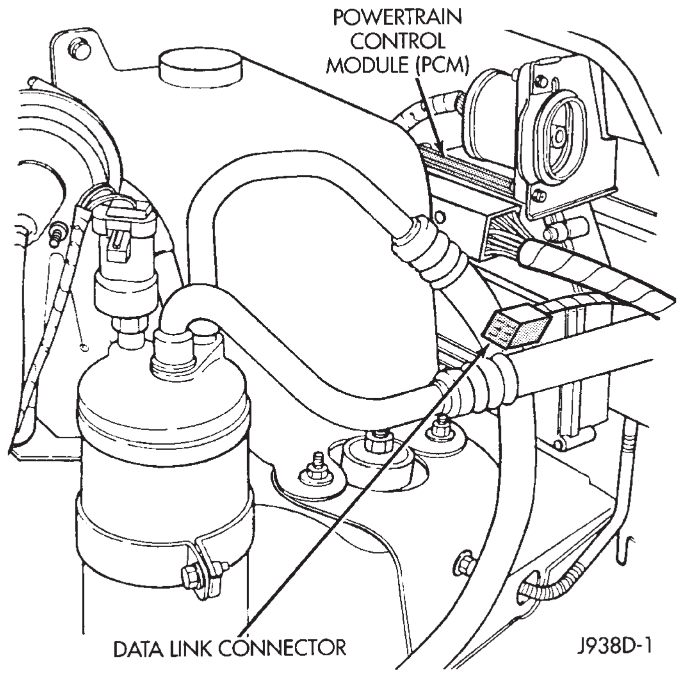


Fig. 30 Data Link Connector—Typical

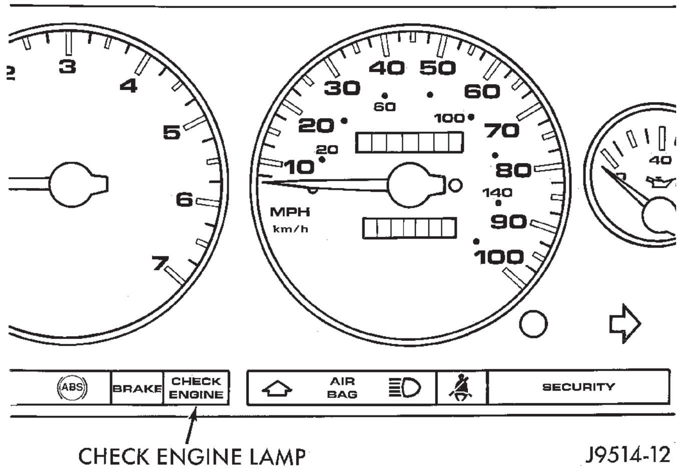


Fig. 31 Check Engine Lamp Location

COMPONENT REMOVAL/INSTALLATION

INDEX

GENERAL INFORMATION

This section of the group, Component Removal/Installation, will discuss the removal and installation of ignition system components.

For basic ignition system diagnostics and service adjustments, refer to the Diagnostics/Service Procedures section of this group.

For system operation and component identification, refer to the Component Identification/System Operation section of this group.

AUTOMATIC SHUTDOWN (ASD) RELAY

The ASD relay is installed in the power distribution center (PDC) (Fig. 1). Relay location is printed on the PDC cover.

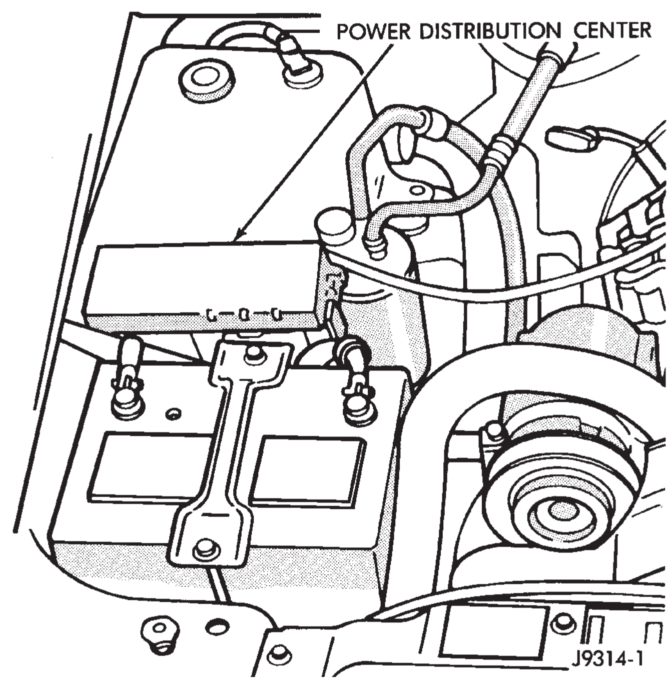


Fig. 1 Power Distribution Center

REMOVAL

(1) Disconnect negative battery cable at battery.
(2) Remove the PDC cover.
(3) Remove the relay by lifting straight up.

INSTALLATION

(1) Inspect the relay terminals in the PDC and repair as necessary.
(2) Push the relay into the connector.
(3) Install the relay cover.
(4) Connect battery cable at battery.

CAMSHAFT POSITION SENSOR

The camshaft position sensor is located in the distributor (Fig. 2).

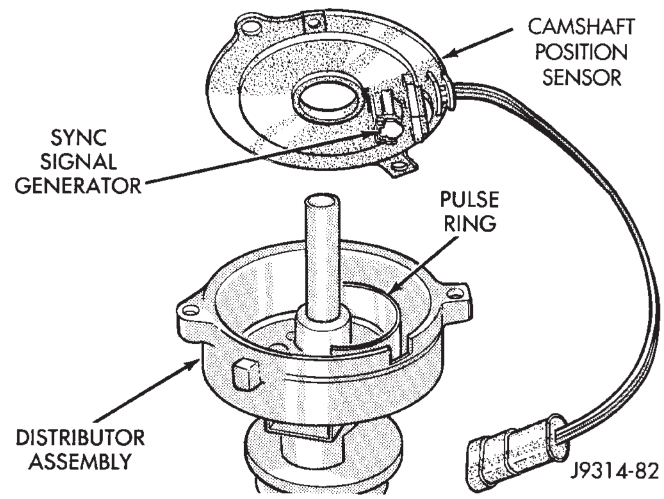


Fig. 2 Camshaft Position Sensor—Typical

REMOVAL—4.0L 6-CYLINDER ENGINE

Distributor removal is not necessary to remove camshaft position sensor.
(1) Disconnect negative battery cable at battery.
(2) Remove distributor cap from distributor (two screws).
(3) Disconnect camshaft position sensor wiring harness from main engine wiring harness.
(4) Remove distributor rotor from distributor shaft.
(5) Lift the camshaft position sensor assembly from the distributor housing (Fig. 2).

INSTALLATION

(1) Install camshaft position sensor to distributor. Align sensor into notch on distributor housing.

(2) Connect wiring harness.
(3) Install rotor.
(4) Install distributor cap. Tighten mounting screws.
(5) Connect negative battery cable at battery.

REMOVAL—5.2L V-8 ENGINE

Distributor removal is not necessary to remove camshaft position sensor.

(1) Disconnect negative battery cable at battery.
(2) Remove coil high-tension cable and all spark plug cables at distributor cap. Note and mark position of cables (Fig. 3) before removal.

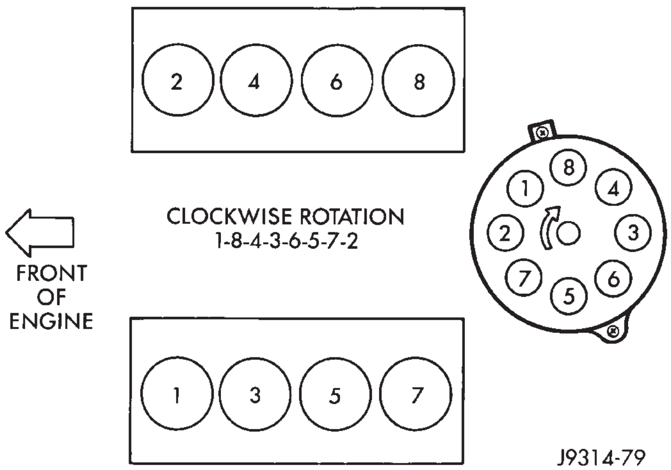


Fig. 3 Engine Firing Order—5.2L V-8 Engine

(3) Remove distributor cap from distributor (two screws).
(4) Disconnect camshaft position sensor wiring harness from main engine wiring harness.
(5) Remove distributor rotor from distributor shaft.
(6) Lift the camshaft position sensor assembly from the distributor housing (Fig. 2).

INSTALLATION

(1) Install camshaft position sensor to distributor. Align sensor into notch on distributor housing.
(2) Connect wiring harness.
(3) Install rotor.
(4) Install distributor cap. Tighten mounting screws.
(5) Install spark plug cables in correct firing order (Fig. 3) to distributor cap. Be sure all spark plug cables are firmly connected into distributor cap towers.
(6) Connect negative battery cable at battery.

CRANKSHAFT POSITION SENSOR

REMOVAL—4.0L 6-CYLINDER ENGINE WITH MANUAL TRANSMISSION

The crankshaft position sensor is mounted to the transmission bellhousing with two bolts at the left/rear side of the engine block (Fig. 4).

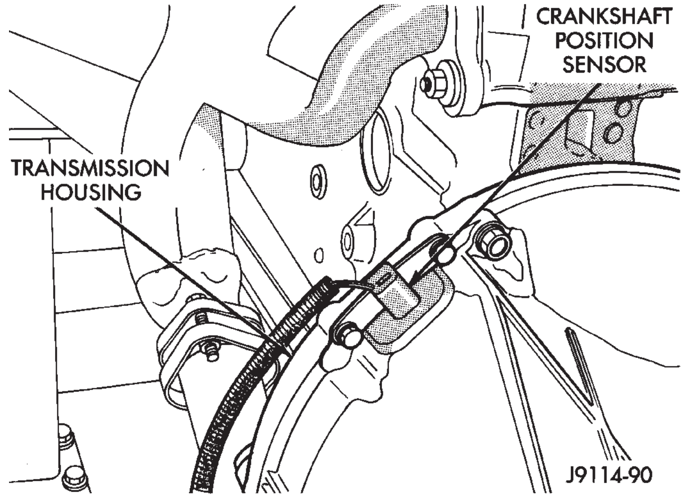


Fig. 4 Crankshaft Position Sensor—4.0L Engine With Manual Transmission

(1) Near the rear of the intake manifold, disconnect the pigtail harness on the sensor from the main electrical harness.
(2) Raise and support the vehicle.
(3) Remove the two sensor mounting bolts (Fig. 4).
(4) Remove the sensor.
(5) Remove clip from sensor wire harness.

INSTALLATION

(1) Install the sensor flush against the opening in the transmission housing.
(2) Install and tighten the two sensor mounting bolts to 19 N·m (14 ft. lbs.) torque.

CAUTION: The two bolts used to secure the sensor to the transmission are specially machined to correctly space the unit to the flywheel. Do not attempt to install any other bolts.

(3) Lower the vehicle.
(4) Connect the electrical connector to the sensor.
(5) Install clip on sensor wire harness.

REMOVAL—4.0L ENGINE WITH AUTOMATIC TRANSMISSION

The crankshaft position sensor is mounted to the transmission bellhousing with a single bolt. It is located at the left/rear side of the engine block (Fig. 5). The slotted adjustment hole is not used for the 1995 model year.

(1) Near the rear of the intake manifold, disconnect the pigtail harness (on the sensor) from the main electrical harness.
(2) Remove the nut holding sensor wire clip to fuel rail mounting stud.
(3) Remove the one sensor mounting bolt.
(4) Remove the sensor.
(5) Remove clip from sensor wire harness.

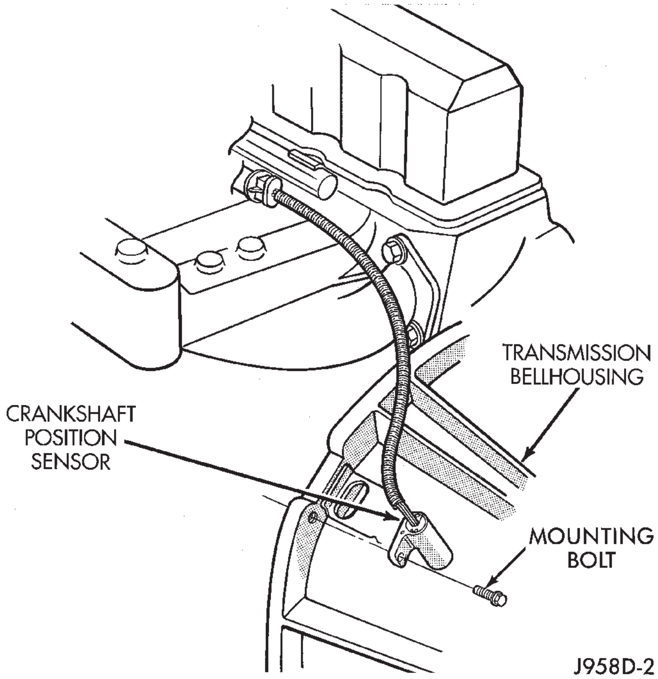


Fig. 5 Crankshaft Position Sensor—4.0L Engine With Automatic Transmission

INSTALLATION

(1) Install the sensor into the access hole on the transmission.

(2) Install sensor mounting bolt (Fig. 5).

(3) Tighten sensor mounting bolt to 6-to-8 N·m (50-to-70 in. lbs.) torque.

(4) Connect the electrical connector to sensor.

(5) Install the clip to sensor wire harness.

(6) Install clip over fuel rail mounting stud. Install clip mounting nut.

REMOVAL—5.2L V-8 ENGINE

The sensor is bolted to the top of the cylinder block near the rear of right cylinder head (Fig. 6).

(1) Remove the spark plug cable loom and spark plug cables from valve cover mounting stud at rear of right valve cover (Fig. 6). Position spark plug cables to top of valve cover.

(2) Remove the right exhaust manifold heat shield nuts/bolts and remove heat shield (Fig. 7).

(3) Disconnect 2 hoses at exhaust gas recirculation (EGR) valve. Note position of hoses at EGR valve before removal.

(4) Disconnect electrical connector and hoses at EGR valve control. Note position of hoses at valve control before removal.

(5) Remove 2 EGR valve mounting bolts (Fig. 6) and remove EGR valve. Discard old EGR gasket.

(6) Disconnect electrical connector at engine oil pressure sending unit.

(7) To prevent damage to oil pressure sending unit, a special tool, such as number C-4597 must be used (Fig. 8). Remove sending unit from engine.

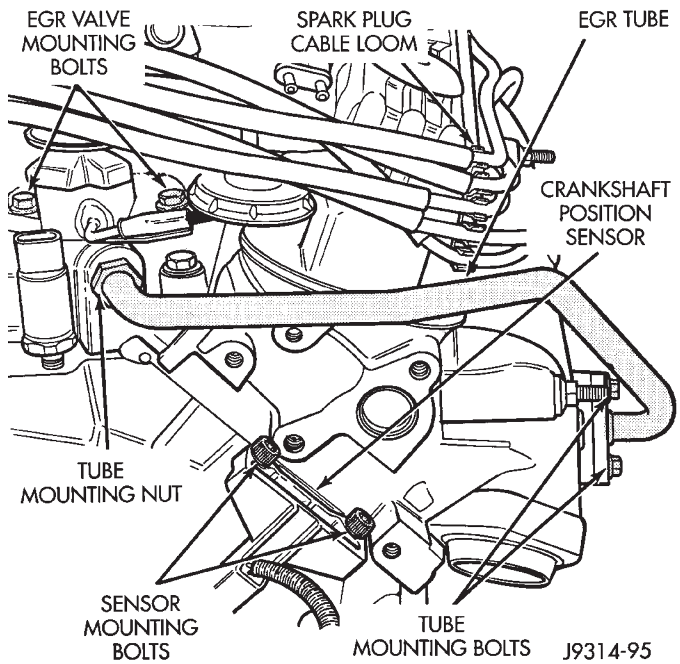


Fig. 6 Crankshaft Position Sensor—5.2L V-8 Engine

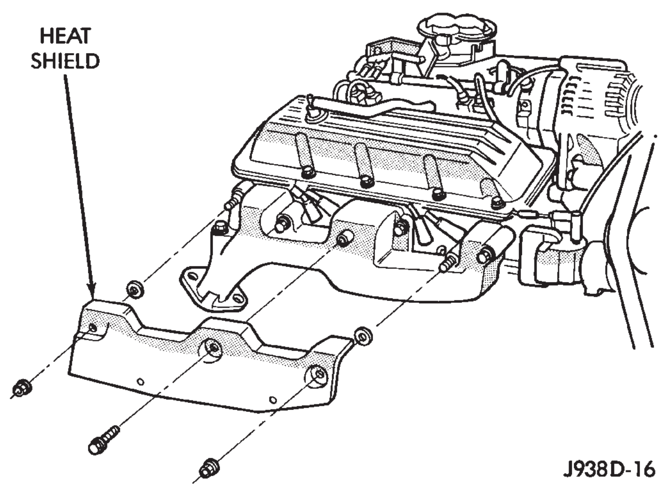


Fig. 7 Exhaust Manifold Heat Shield—5.2L Engine

(8) Loosen EGR tube mounting nut at intake manifold (Fig. 6).

(9) Remove 2 EGR tube mounting bolts at exhaust manifold (Fig. 6) and remove EGR tube. Discard old gasket at exhaust manifold.

(10) Disconnect crankshaft position sensor pigtail harness from main wiring harness.

(11) Remove 2 sensor (recessed hex head) mounting bolts (Fig. 6) and remove sensor.

INSTALLATION—5.2L ENGINE

(1) Position crankshaft position sensor to engine and install mounting bolts. Tighten bolts to 8 N·m (70 in. lbs.) torque.

(2) Connect main harness electrical connector to sensor.

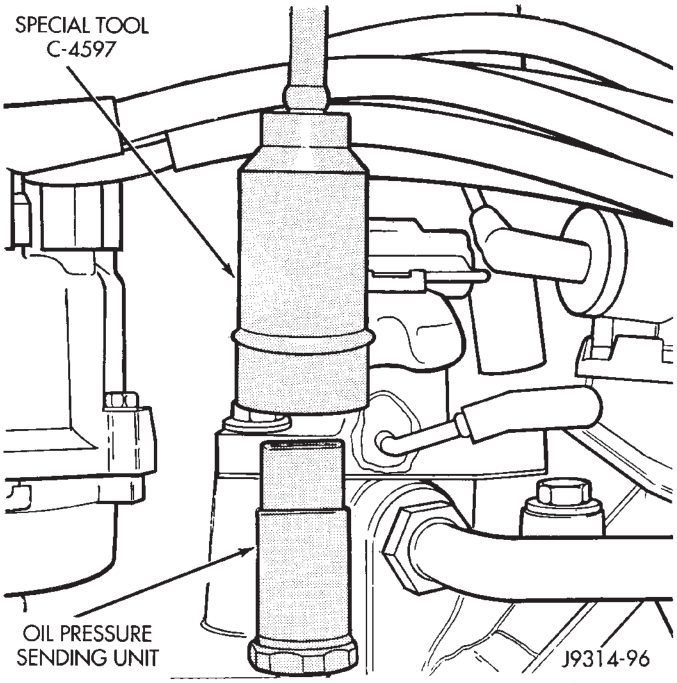


Fig. 8 Oil Pressure Sending Unit—Removal/ Installation

(3) Clean the EGR tube and exhaust manifold (at EGR tube mounting point) of any old gasket material.

(4) Install a new gasket to exhaust manifold end of EGR tube and install EGR tube to both manifolds. Tighten tube mounting nut at intake manifold. Tighten 2 mounting bolts at exhaust manifold to 23 N·m (204 in. lbs.) torque.

(5) Coat the threads of the oil pressure sending unit with thread sealant. Do not allow any of the thread sealant to get into the sending unit opening, or the opening at the engine. Install sending unit to engine and tighten to 14 N·m (130 in. lbs.) torque. Install electrical connector to sending unit.

(6) Clean the intake manifold and EGR valve of any old gasket material.

(7) Install a new EGR valve gasket at intake manifold.

(8) Install EGR valve to intake manifold. Tighten 2 EGR bolts to 23 N·m (200 in. lbs.) torque.

(9) Position EGR valve control and install its electrical connector. Connect hoses between EGR valve and EGR valve control. Connect hose between main engine vacuum harness and valve control.

(10) Install spark plug cable loom and spark plug cables to valve cover mounting stud.

(11) Install heat shield at right exhaust manifold.

ENGINE COOLANT TEMPERATURE SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

DISTRIBUTORS

All distributors contain an internal oil seal that prevents oil from entering the distributor housing. The seal is not serviceable. The camshaft position sensor is located in the distributor on all engines.

4.0L 6-Cylinder Engine Only: Factory replacement distributors are equipped with a plastic alignment pin already installed. The pin is located in an access hole on the bottom of the distributor housing (Fig. 9). It is used to temporarily lock the rotor to the cylinder number 1 position during installation. The pin must be removed after installing the distributor.

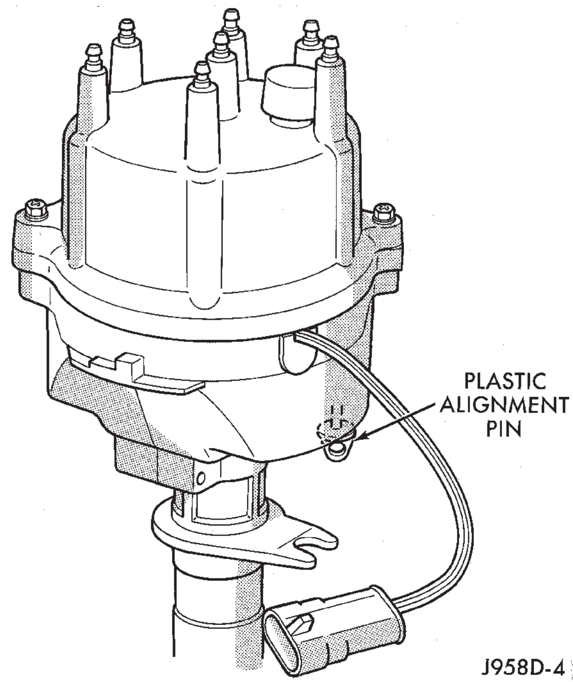


Fig. 9 Plastic Alignment Pin—4.0L Engine

The camshaft position sensor is located in the distributor on all engines (Fig. 10). For removal/installation procedures, refer to Camshaft Position Sensor in this group. Distributor removal is not necessary for sensor removal.

Refer to figure 11 for an exploded view of the distributor with the 4.0L engine.

4.0L 6-Cylinder Engine Only: A fork with a slot is supplied on the bottom of the distributor housing where the housing base seats against the engine block (Fig. 11). The centerline of the slot aligns with the distributor holddown bolt hole in the engine block. Because of the fork, the distributor cannot be rotated. Distributor rotation is not necessary as all ignition timing requirements are handled by the powertrain control module (PCM). **Do not attempt to modify this fork to attain ignition timing.**

All Engines: The rotational position of the distributor determines fuel synchronization only. It does not determine ignition timing.

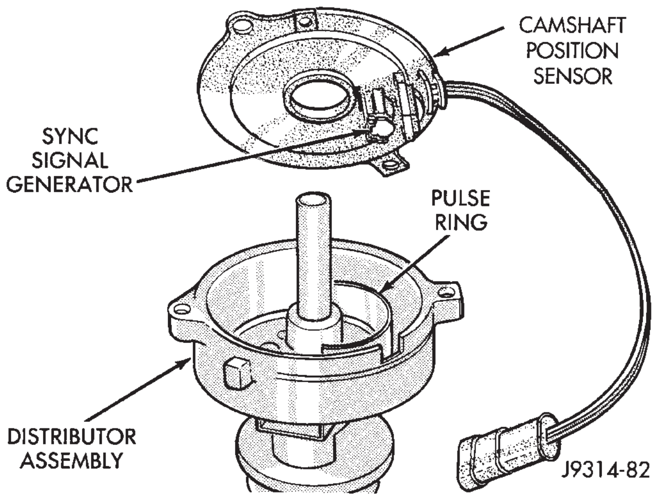


Fig. 10 Camshaft Position Sensor—All Engines—Typical

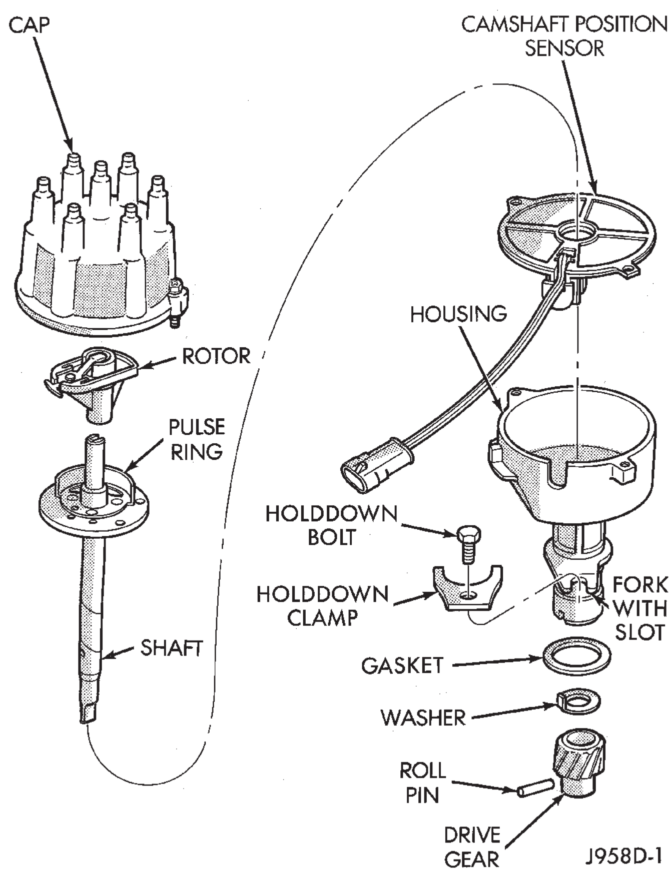


Fig. 11 Distributor—4.0L Engines—Typical

REMOVAL—4.0L 6-CYLINDER ENGINE

(1) Disconnect the negative battery cable at the battery.

(2) Disconnect coil secondary cable at coil.

(3) Remove distributor cap from distributor (2 screws). Do not remove cables from cap. Do not remove rotor.

(4) Disconnect the distributor wiring harness from the main engine harness.

(5) Remove the cylinder number 1 spark plug.

(6) Hold a finger over the open spark plug hole. Rotate the engine at the vibration dampener bolt until compression (pressure) is felt.

Slowly continue to rotate the engine. Do this until the timing index mark on the vibration damper pulley aligns with the top dead center (TDC) mark (0 degree) on timing degree scale (Fig. 12). Always rotate the engine in direction of normal rotation. Do not rotate the engine backward to align the timing marks.

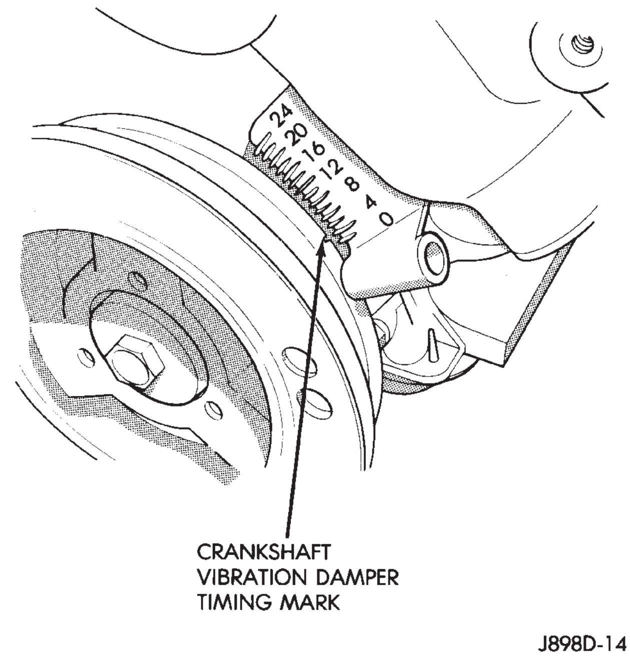


Fig. 12 Align Timing Marks

(7) Remove the distributor holddown bolt and clamp (Fig. 11).

(8) Remove the distributor from engine by slowly lifting straight up.

Note that the rotor will rotate slightly in a counterclockwise direction while lifting up the distributor. The oil pump gear will also rotate slightly in a counterclockwise direction while lifting up the distributor. This is due to the helical cut gears on the distributor and camshaft.

Note the removed position of the rotor during distributor removal. During installation, this will be referred to as the Pre-position.

Observe the slot in the oil pump gear through the hole on the side of the engine. It should be slightly before (counterclockwise of) the 11 o'clock position (Fig. 13).

(9) Remove and discard the old distributor-to-engine block gasket (Fig. 11).

INSTALLATION—4.0L 6-CYLINDER ENGINE

(1) If the engine crankshaft has been rotated after distributor removal, cylinder number 1 must be re-

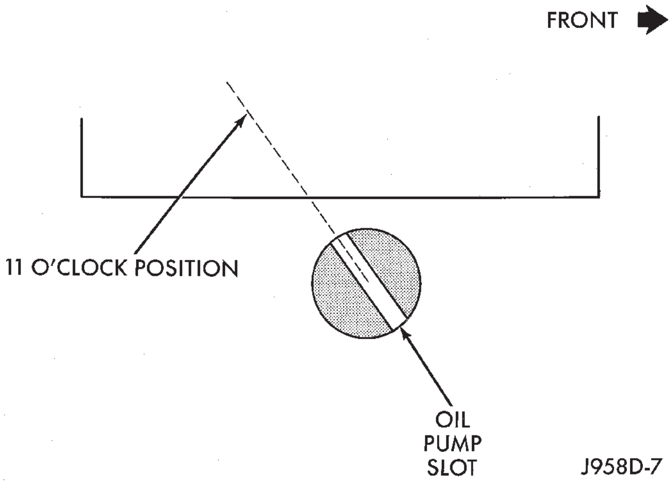


Fig. 13 Slot At 11 O'clock Position—4.0L Engine

turned to its proper firing stroke. Refer to the previous REMOVAL steps number 5 and 6. These steps must be done before installing distributor.

(2) Check the position of the slot on the oil pump gear. It should be just slightly before (counterclockwise of) the 11 o'clock position (Fig. 13). If not, place a flat blade screwdriver into the oil pump gear and rotate it into the proper position.

(3) Factory replacement distributors are equipped with a plastic alignment pin already installed (Fig. 9). This pin is used to temporarily hold the rotor to the cylinder number 1 firing position during distributor installation. If this pin is in place, proceed to step number 8. If not, proceed to step number 4.

(4) If the original distributor is to be reinstalled, such as during engine overhaul, the plastic pin will not be available. A 3/16 inch drift pin punch tool may be substituted for the plastic pin.

(5) Remove the camshaft position sensor from the distributor housing. Lift straight up.

(6) Four different alignment holes are provided on the plastic ring (Fig. 14). For this application, use "4.0L 6-CYLINDER ENGINE ALIGN. HOLE" as shown in figure 14.

Rotate the distributor shaft and install the pin punch tool through the proper alignment hole in the plastic ring (Fig. 14) and into the mating access hole in the distributor housing. This will prevent the distributor shaft and rotor from rotating.

(7) Clean the distributor mounting hole area of the engine block.

(8) Install a new distributor-to-engine block gasket (Fig. 11).

(9) Install the rotor to the distributor shaft.

(10) Pre-position the distributor into the engine while holding the centerline of the base slot in the 1 o'clock position (Fig. 15). Continue to engage the distributor into the engine. The rotor and distributor will rotate clockwise during installation. This is due to the helical cut gears on the distributor and camshaft. When the distributor is fully seated to the engine block, the centerline of the base slot should be aligned to the clamp bolt mounting hole on the engine (Fig. 16). The rotor should also be pointed at the 5 o'clock position.

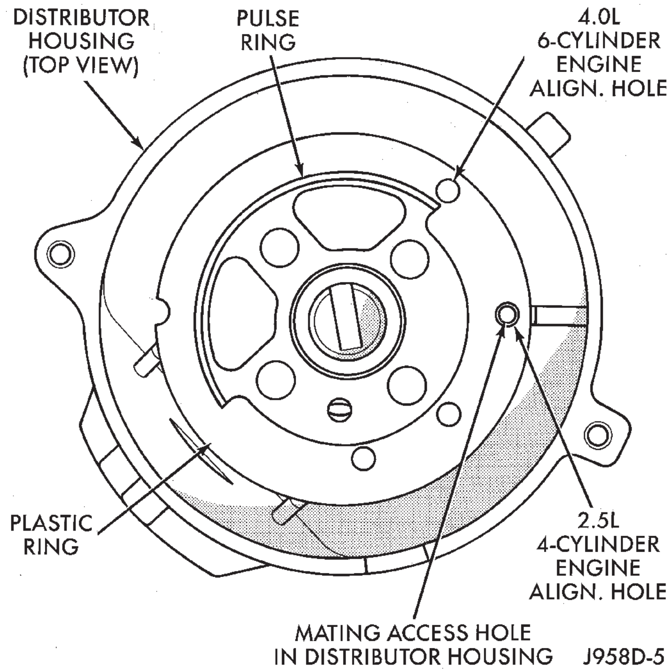


Fig. 14 Pin Alignment Holes

It may be necessary to rotate the rotor and distributor shaft (very slightly) to engage the distributor shaft with the slot in the oil pump gear. The same may have to be done to engage the distributor gear with the camshaft gear.

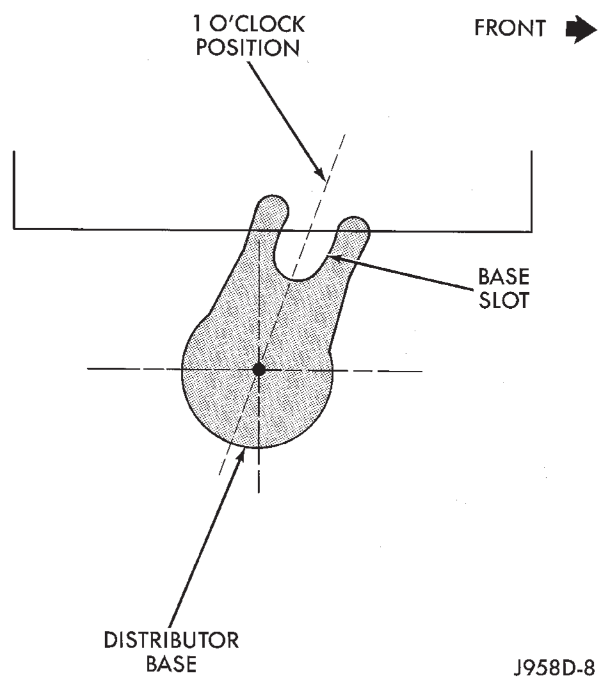


Fig. 15 Distributor Pre-position—4.0L Engine

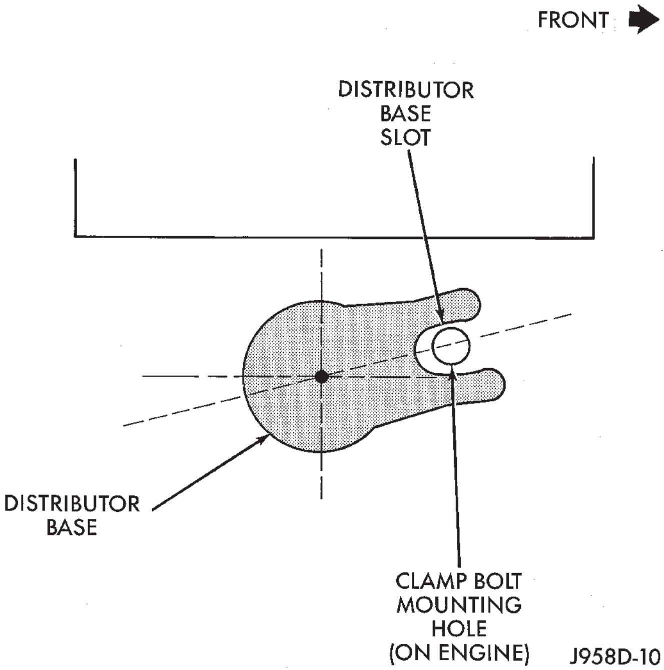


Fig. 16 Distributor Engaged Position—4.0L Engine

The distributor is correctly installed when:

- the rotor is pointed at the 5 o'clock position.
- the plastic alignment pin (or pin punch tool) is still installed to distributor.
- the number 1 cylinder piston is set at top dead center (TDC) (compression stroke).
- the centerline of the slot at the base of the distributor is aligned to the centerline of the distributor holddown bolt hole on the engine. In this position, the holddown bolt should easily pass through the slot and into the engine.

No adjustments are necessary. Proceed to next step.

(11) Install the distributor holddown clamp and bolt. Tighten the bolt to 23 N·m (17 ft. lbs.) torque.

(12) Remove the pin punch tool from the distributor. Or, if the plastic alignment pin was used, remove it straight down from the bottom of the distributor. Discard plastic pin.

(13) If removed, install the camshaft position sensor to the distributor. Align the wiring harness grommet to the notch in the distributor housing.

(14) Install the rotor.

CAUTION: If the distributor cap is incorrectly positioned on distributor housing, the cap or rotor may be damaged when engine is started.

(15) Install the distributor cap. Tighten distributor cap holddown screws to 3 N·m (26 in. lbs.) torque.

(16) If removed, install the spark plug cables to the distributor cap. For proper firing order, refer to the Specifications section at the end of this group. See Engine Firing Order.

(17) Connect the distributor wiring harness to the main engine harness.

(18) Connect battery cable to battery.

REMOVAL—5.2L V-8 ENGINE

CAUTION: Base ignition timing is not adjustable on the 5.2L V-8 engine. Distributors do not have built in centrifugal or vacuum assisted advance. Base ignition timing and timing advance are controlled by the powertrain control module (PCM). Because a conventional timing light can not be used to adjust distributor position after installation, note position of distributor before removal.

(1) Disconnect negative battery cable at battery.

(2) Remove coil high-tension cable and all spark plug cables at distributor cap. Note and mark position of cables (Fig. 17) before removal.

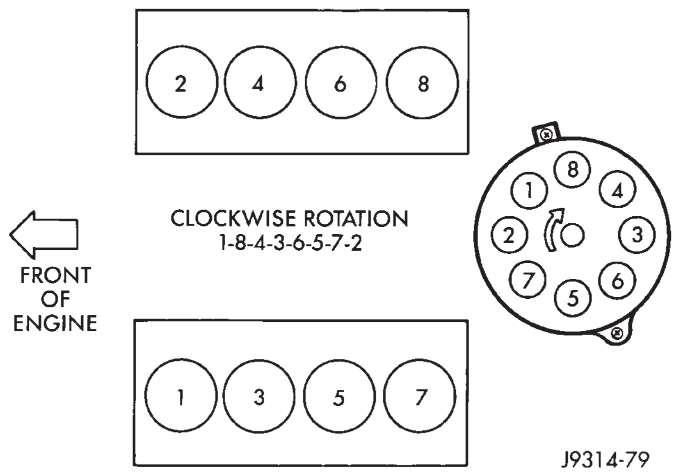


Fig. 17 Engine Firing Order—5.2L Engine

(3) Remove distributor cap from distributor (two screws).

(4) Mark the position of distributor housing in relationship to engine or dash panel. This is done to aid in installation.

Before distributor is removed, the number one cylinder must be brought to the top dead center (TDC) firing position.

(5) Attach a socket to the crankshaft vibration damper mounting bolt.

(6) Slowly rotate engine clockwise, as viewed from front, until indicating mark on crankshaft vibration damper is aligned to 0 degree (TDC) mark on timing chain cover (Fig. 18).

(7) The distributor rotor should now be aligned to the CYL. NO. 1 alignment mark (stamped) into the camshaft position sensor (Fig. 19). If not, rotate the crankshaft through another complete 360 degree turn. Note the position of the number one cylinder spark plug cable (on the cap) in relation to rotor. Rotor should now be aligned to this position.

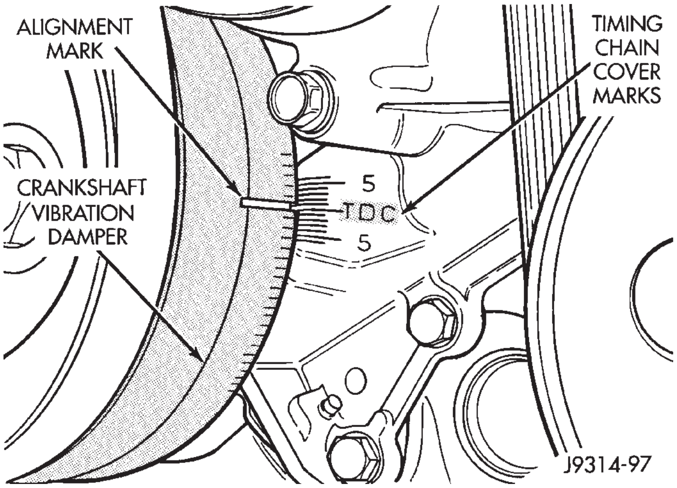


Fig. 18 Damper-To-Timing Chain Cover Alignment Marks—5.2L Engine

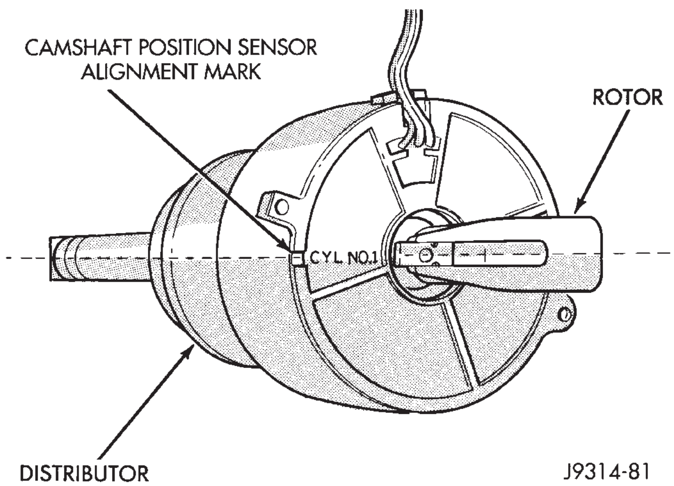


Fig. 19 Rotor Alignment Mark—5.2L Engine

(8) Disconnect camshaft position sensor wiring harness from main engine wiring harness.

(9) Remove distributor rotor from distributor shaft.

(10) Remove distributor holddown clamp bolt and clamp (Fig. 20). Remove distributor from vehicle.

CAUTION: Do not crank engine with distributor removed. Distributor/crankshaft relationship will be lost.

INSTALLATION—5.2L ENGINE

If engine has been cranked while distributor is removed, establish the relationship between distributor shaft and number one piston position as follows:

Rotate crankshaft in a clockwise direction, as viewed from front, until number one cylinder piston is at top of compression stroke (compression should be felt on finger with number one spark removed). Then continue to slowly rotate engine clockwise until indicating mark (Fig. 18) is aligned to 0 degree (TDC) mark on timing chain cover.

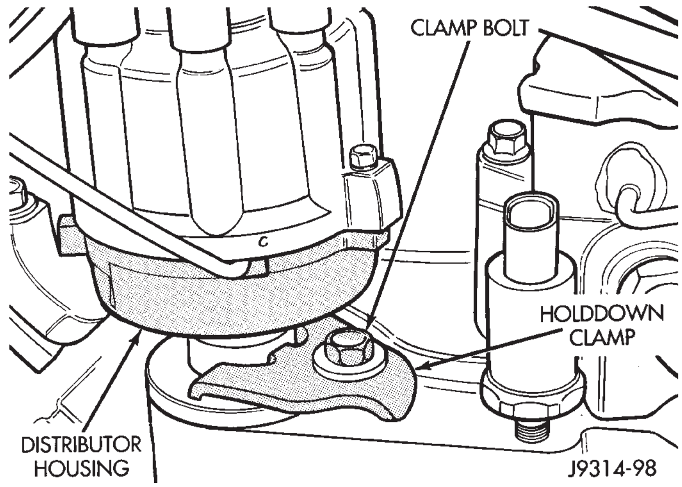


Fig. 20 Distributor Holddown Clamp—5.2L Engine

(1) Clean top of cylinder block for a good seal between distributor base and block.

(2) Lightly oil the rubber o-ring seal on the distributor housing.

(3) Install rotor to distributor shaft.

(4) Position distributor into engine to its original position. Engage tongue of distributor shaft with slot in distributor oil pump drive gear. Position rotor to the number one spark plug cable position.

(5) Install distributor holddown clamp and clamp bolt. Do not tighten bolt at this time.

(6) Rotate the distributor housing until rotor is aligned to CYL. NO. 1 alignment mark on the camshaft position sensor (Fig. 19).

(7) Tighten clamp holddown bolt (Fig. 20) to 22.5 N·m (200 in. lbs.) torque.

(8) Connect camshaft position sensor wiring harness to main engine harness.

(9) Install distributor cap. Tighten mounting screws.

(10) Install spark plug cables in correct firing order (Fig. 17) to distributor cap. Be sure all spark plug cables are firmly connected into distributor cap towers.

(11) Refer to the following, Checking Distributor Position.

CHECKING DISTRIBUTOR POSITION—5.2L ENGINE ONLY

To verify correct distributor rotational position, connect the DRB scan tool to the data link connector. The data link connector is located in the engine compartment. Gain access to the SET SYNC screen on the DRB.

WARNING: WHEN PERFORMING THE FOLLOWING TEST, THE ENGINE WILL BE RUNNING. BE CAREFUL NOT TO STAND IN LINE WITH THE FAN BLADES OR FAN BELT. DO NOT WEAR LOOSE CLOTHING.

Follow the directions on the DRB screen and start the engine. With the engine running, the words IN RANGE should appear on the screen along with 0°. This indicates correct distributor position.

If a plus (+) or a minus (-) is displayed next to the degree number, and/or the degree displayed is not zero, loosen but do not remove the distributor hold-down clamp bolt. Rotate the distributor until IN RANGE appears on the screen. Continue to rotate the distributor until achieving as close to 0° as possible. After adjustment, tighten clamp bolt to 22.5 N·m (200 in. lbs.) torque.

The degree scale on the SET SYNC screen of the DRB is referring to fuel synchronization only. **It is not referring to ignition timing.** Because of this, do not attempt to adjust ignition timing using this method. Rotating the distributor will have no effect on ignition timing. All ignition timing values are controlled by the powertrain control module (PCM).

IGNITION COIL

The ignition coil is an epoxy filled type. If the coil is replaced, it must be replaced with the same type.

REMOVAL—4.0L 6-CYLINDER ENGINE

The ignition coil is mounted to the right side of the 4.0L engine block next to the distributor (Fig. 21).

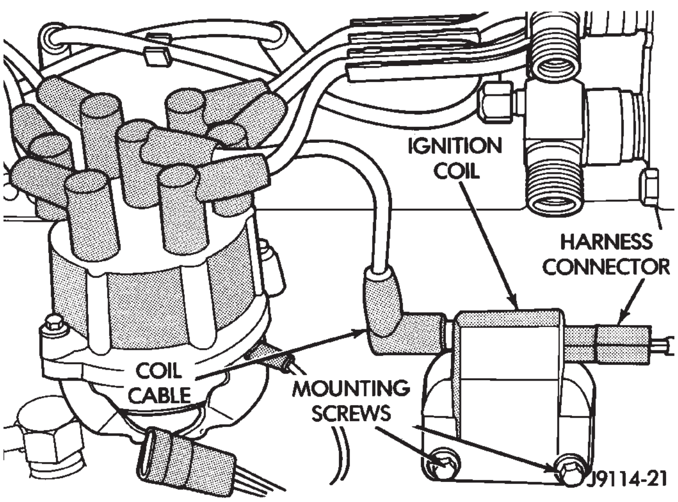


Fig. 21 Ignition Coil—4.0L Engine

(1) Disconnect the ignition coil secondary cable from ignition coil (Fig. 21).

(2) Disconnect engine harness connector from ignition coil.

(3) Remove ignition coil mounting bolts. Remove coil.

INSTALLATION—4.0L ENGINE

(1) Install ignition coil to bracket on cylinder block with mounting bolts.

(2) Connect engine harness connector to coil.

(3) Connect ignition coil cable to ignition coil.

REMOVAL—5.2L V-8 ENGINE

The ignition coil is mounted to a bracket near the front of the right engine cylinder head on 5.2L engines (Fig. 22).

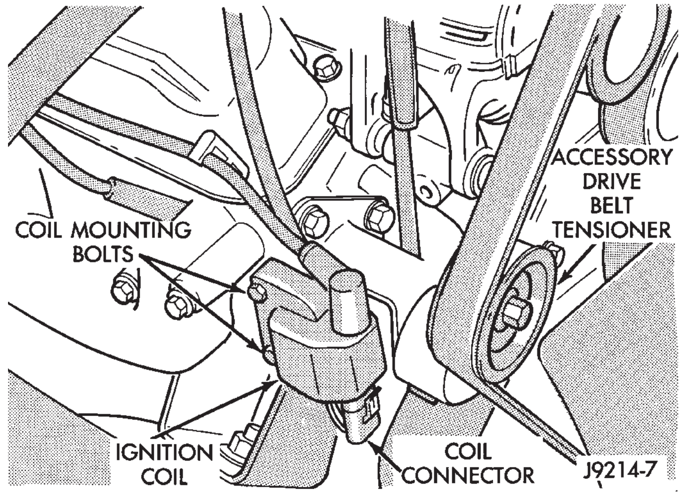


Fig. 22 Ignition Coil—5.2L Engine—Typical

(1) Disconnect the wiring and secondary cable from the ignition coil (Fig. 22).

WARNING: DO NOT REMOVE THE COIL MOUNTING BRACKET-TO-CYLINDER HEAD MOUNTING BOLTS. THE COIL MOUNTING BRACKET IS UNDER ACCESSORY DRIVE BELT TENSION. IF THIS BRACKET IS TO BE REMOVED FOR ANY REASON, ALL BELT TENSION MUST FIRST BE RELIEVED. REFER TO THE BELT SECTION OF GROUP 7, COOLING SYSTEM.

(2) Remove ignition coil from coil mounting bracket (two bolts).

INSTALLATION—5.2L ENGINE

(1) Install the ignition coil to coil bracket. If nuts and bolts are used to secure coil to coil bracket, tighten to 11 N·m (100 in. lbs.) torque. If the coil mounting bracket has been tapped for coil mounting bolts, tighten bolts to 5 N·m (50 in. lbs.) torque.

(2) Connect all wiring to ignition coil.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to the Diagnosis sections of Group 14, Fuel System.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

OXYGEN (O2S) SENSOR

For an operational description, diagnostics and removal/installation procedures, refer to Group 14, Fuel Systems, in this manual.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is located on the cowl panel in the right/rear side of the engine compartment (Fig. 23).

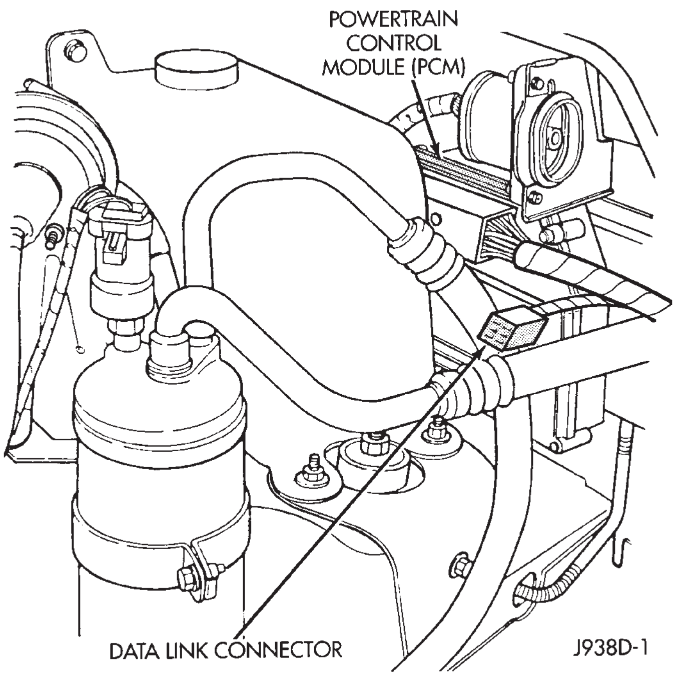


Fig. 23 PCM Location

REMOVAL

(1) Disconnect the negative battery cable at battery.

(2) Remove the coolant reserve/overflow tank (one bolt and two nuts) (Fig. 24)

(3) Loosen the 60-Way connector mounting bolt (Fig. 25).

(4) Remove the electrical connector by pulling straight back.

(5) Remove the three PCM mounting bolts (Fig. 25).

(6) Remove PCM.

INSTALLATION

(1) Check the pins in the PCM 60-way electrical connector for damage. Repair as necessary.

(2) Install PCM. Tighten three mounting bolts to 1 N·m (9 in. lbs.) torque.

(3) Engage 60-way connector into PCM. Tighten connector mounting bolt to 4 N·m (35 in. lbs.) torque.

(4) Install coolant reserve/overflow tank (Fig. 24).

(5) Connect negative cable to battery.

SPARK PLUGS

5.2L V-8 ENGINE ONLY: Spark plug cable heat shields are pressed into the cylinder head to surround each cable boot and spark plug (Fig. 26). These shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 26).

If removal of the heat shield(s) is necessary, remove the spark plug cable and compress the sides of shield for removal. Each shield is slotted to allow for compression and removal. To install the shields, align

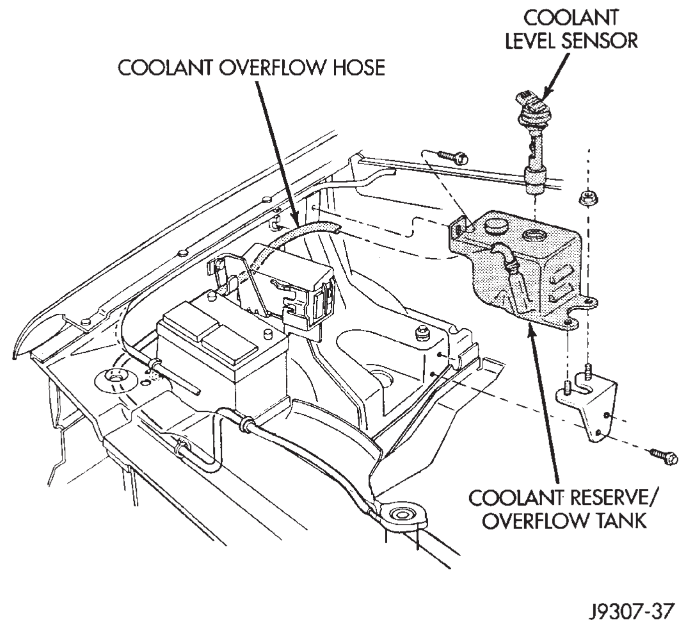


Fig. 24 Coolant Reserve/Overflow Tank Mounting

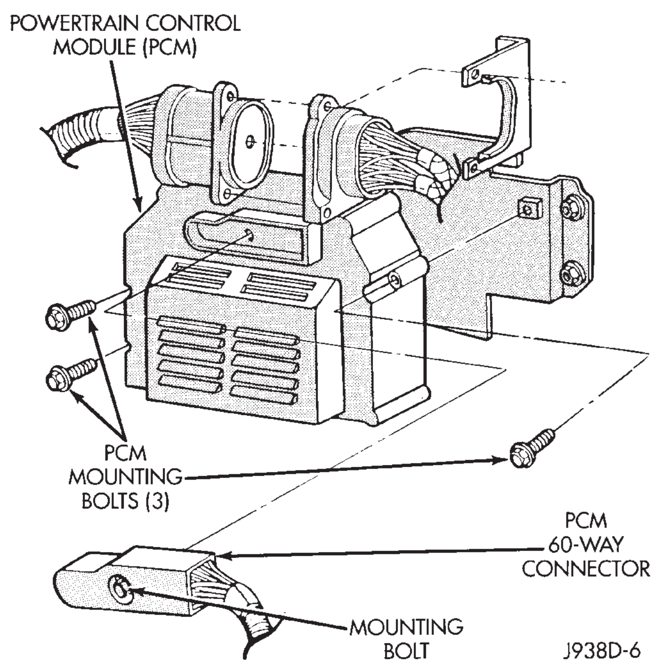


Fig. 25 PCM Mounting

shield to machined opening in cylinder head and tap into place with a block of wood.

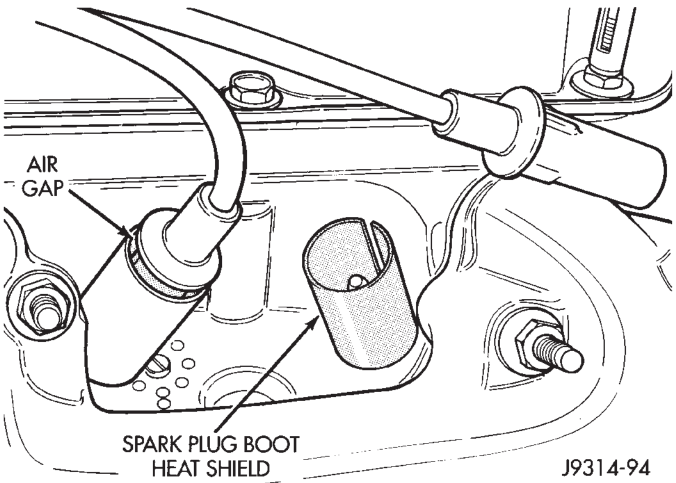


Fig. 26 Heat Shields—5.2L Engine

PLUG REMOVAL

ALL ENGINES

(1) Always remove spark plug or ignition coil cables by grasping at the cable boot (Fig. 27). Turn the cable boot 1/2 turn and pull straight back in a steady motion. Never pull directly on the cable. Internal damage to cable will result.

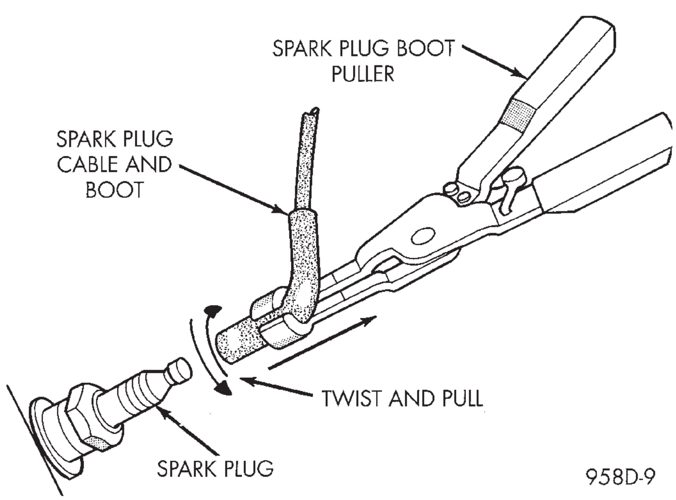


Fig. 27 Cable Removal

(2) Prior to removing the spark plug, spray compressed air around the spark plug hole and the area around the spark plug. This will help prevent foreign material from entering the combustion chamber.

(3) Remove the spark plug using a quality socket with a rubber or foam insert.

(4) Inspect the spark plug condition. Refer to Spark Plugs in the Diagnostics/Service Procedures section of this group.

PLUG CLEANING

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file the center electrode flat with a small point file or jewelers file before adjusting gap.

CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

PLUG GAP ADJUSTMENT

Check the spark plug gap with a gap gauge tool. If the gap is not correct, adjust it by bending the ground electrode (Fig. 28). **Never attempt to adjust the gap by bending the center electrode.**

SPARK PLUG GAP

- 4.0L Engine Spark Plug Gap: .89 mm (.035 in).
- 5.2L Engine Spark Plug Gap: .89 mm (.035 in).

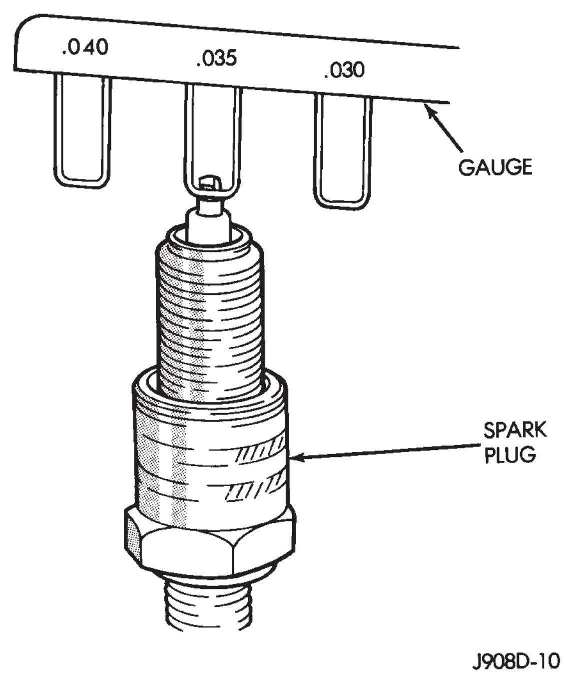


Fig. 28 Setting Spark Plug Gap—Typical

PLUG INSTALLATION

Always tighten spark plugs to the specified torque. Over tightening can cause distortion. This may result in a change in the spark plug gap or a cracked porcelain insulator.

When replacing the spark plug and ignition 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. It could cause cross ignition of the spark plugs, or short circuit the cables to ground.

(1) Start the spark plug into the cylinder head by hand to avoid cross threading.

(2) Tighten the spark plugs to 35-41 N·m (26-30 ft. lbs.) torque.

(3) Install spark plug cables over spark plugs.

SPARK PLUG SECONDARY CABLES

CAUTION: When disconnecting a high voltage cable from a spark plug or from the distributor cap, twist the rubber boot slightly (1/2 turn) to break it loose. Grasp the boot (not the cable) and pull it off with a steady, even force.

Install cables into the proper engine cylinder firing order (Figs. 29 or 30).

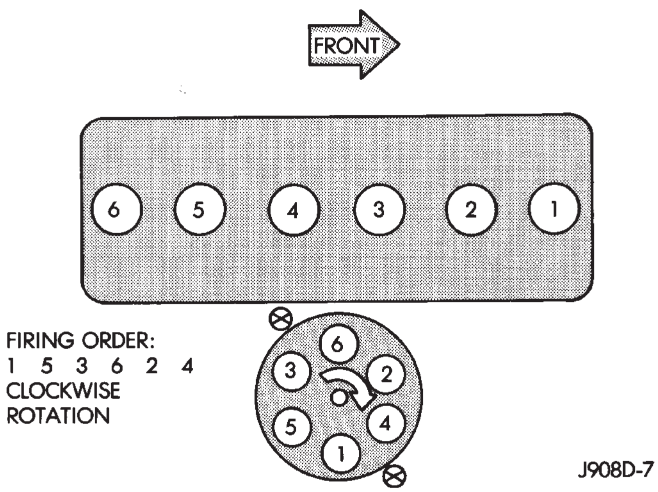


Fig. 29 Engine Firing Order—4.0L Engine

When replacing the spark plug and coil cables, route the cables correctly and secure in the proper retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise. It could also cause cross ignition of the plugs, or short circuit the cables to ground.

When installing new cables, make sure a positive connection is made. A snap should be felt when a good connection is made between the plug cable and the distributor cap tower.

5.2L V-8 Engine: Spark plug cable boot heat shields are pressed into the cylinder head to surround each cable boot and spark plug (Fig. 31). These

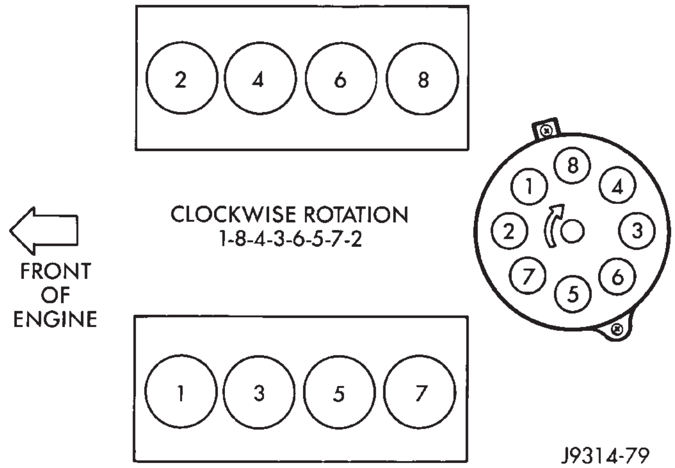


Fig. 30 Engine Firing Order—5.2L Engine

shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 31).

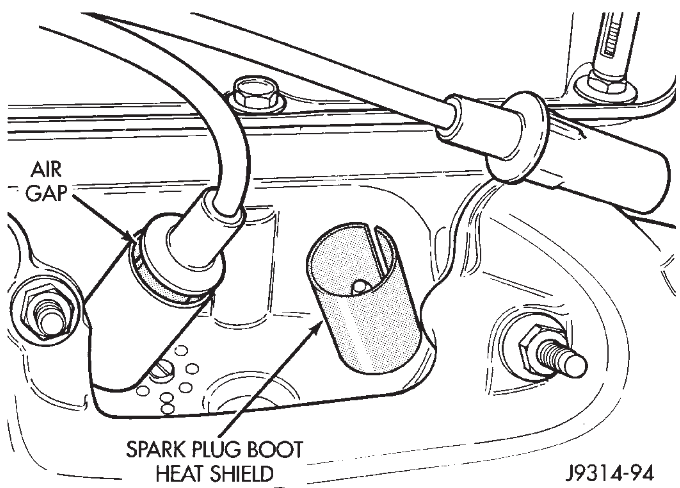


Fig. 31 Heat Shields—5.2L V-8 Engine

THROTTLE POSITION SENSOR (TPS)

For an operational description, diagnosis and removal/installation procedures, refer to Group 14, Fuel System.

IGNITION SWITCH

IGNITION SWITCH AND KEY CYLINDER SERVICE

The ignition switch is located in the steering column. The Key-In-Switch and Halo Light are integral with the ignition switch. Refer to Group 8U for Key-In-Switch and Halo Light diagnosis.

Refer to Group 8, Wiring for ignition switch schematics.

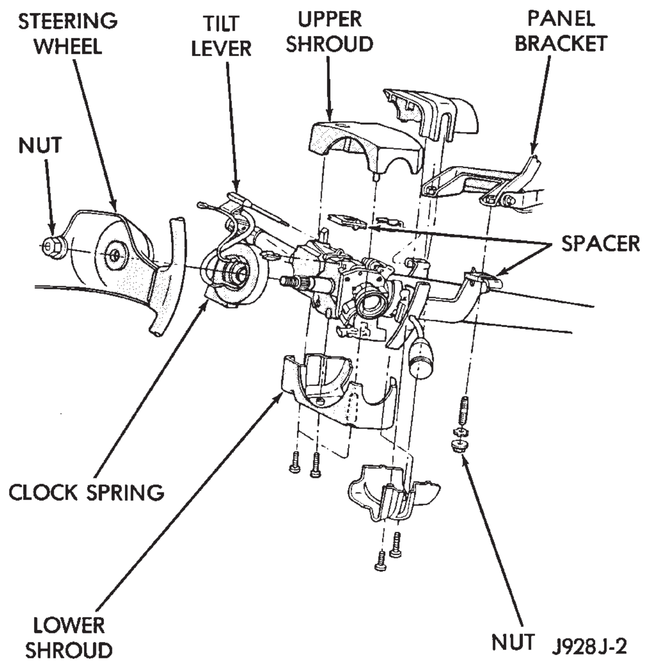


Fig. 1 Shroud Removal/Installation—Typical

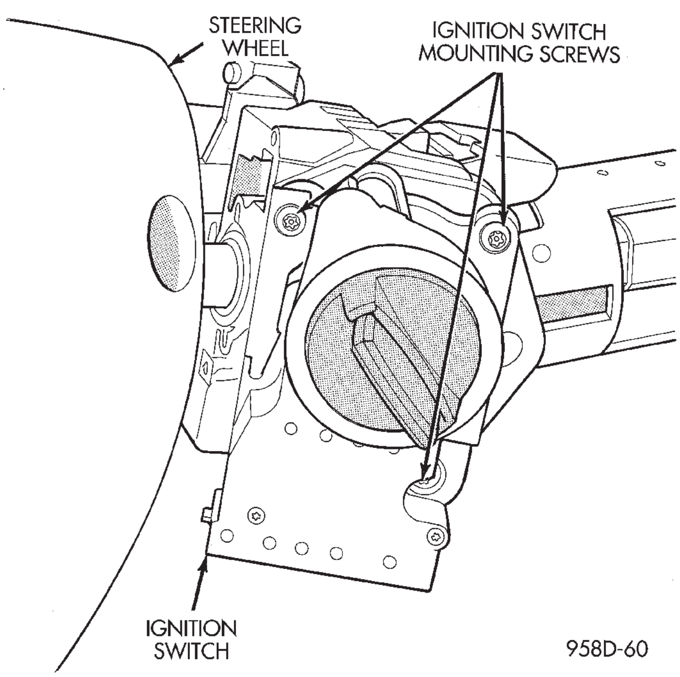


Fig. 2 Ignition Switch Screw Removal

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) If vehicle has a tilt column, remove tilt lever by turning it counterclockwise.

(3) Remove upper and lower covers from steering column (Fig. 1).

(4) Remove ignition switch mounting screws. Use tamper proof torx bit Snap-on TTXR20A2 or equivalent to remove the screws (Fig. 2 or 3).

(5) Gently pull switch away from column. Release connector locks on 7-terminal wiring connector, then remove connector from ignition switch.

(6) Release connector lock on 4-terminal connector, then remove connector from ignition switch (Fig. 4).

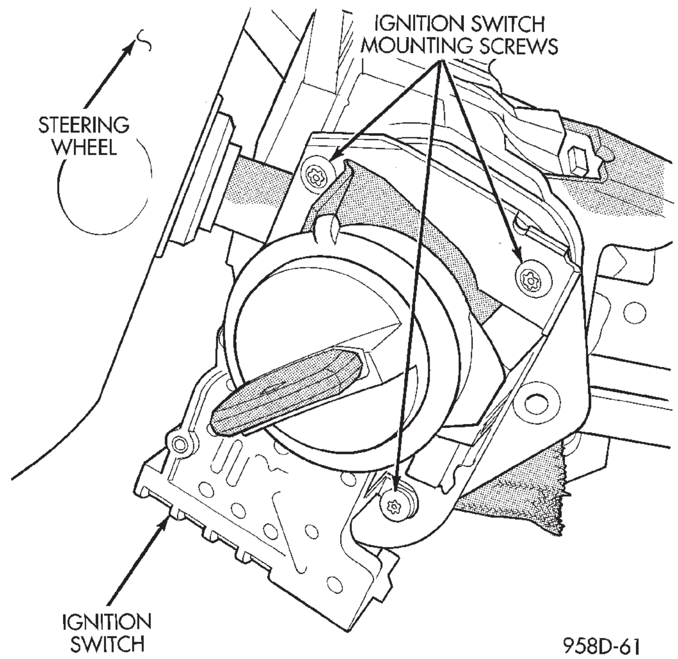


Fig. 3 Ignition Switch Screw Removal

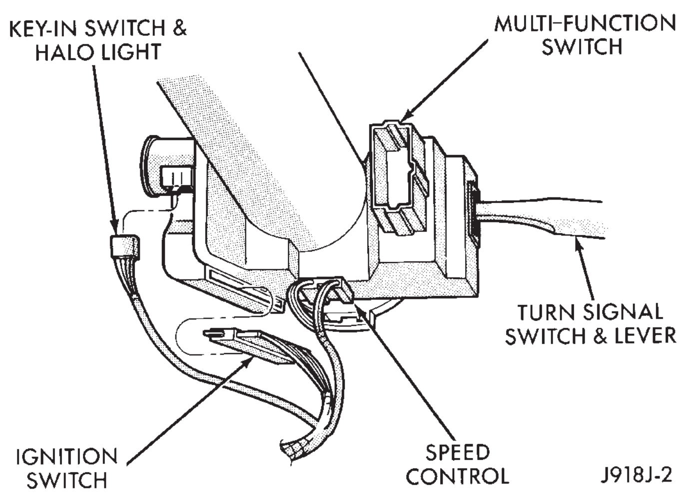


Fig. 4 Key-In-Switch and Halo Lamp Connector

(7) To remove key cylinder from ignition switch:

(a) Insert key in ignition switch. Turn key to LOCK position. Using a TTXR20A2 or equivalent torx bit, remove key cylinder retaining screw and bracket (Fig. 5 or 6).

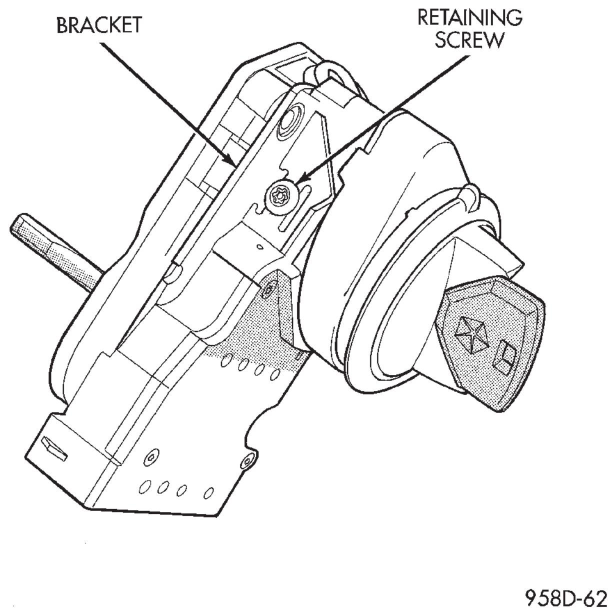


Fig. 5 Key Cylinder Retaining Screw

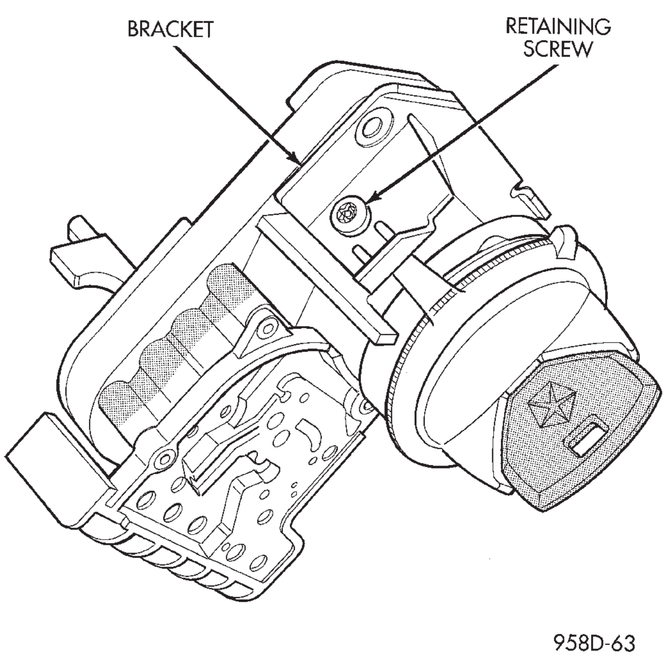


Fig. 6 Key Cylinder Retaining Screw

(b) Rotate key clockwise to the OFF position. Key cylinder will unseat from ignition switch (Fig. 7). When key cylinder is unseated, it will be approximately 1/8 inch away from ignition switch halo light ring. **Do not attempt to remove key cylinder at this time.**

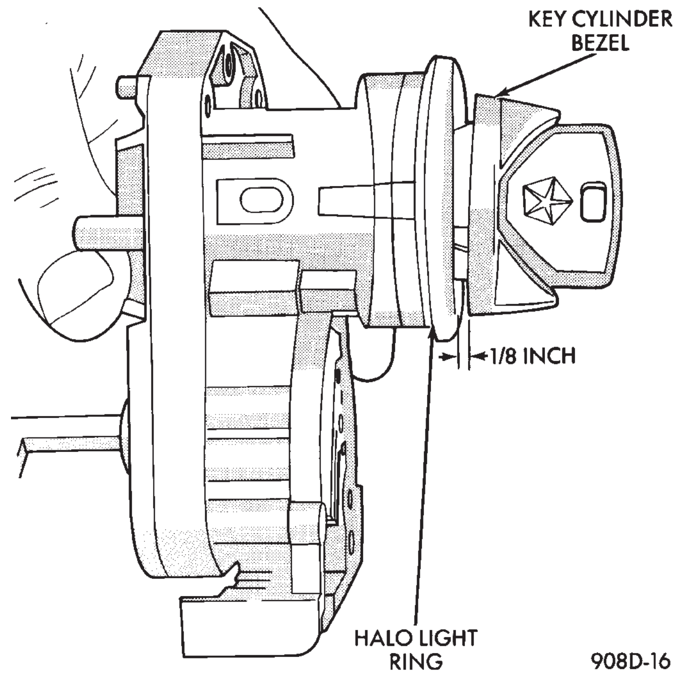


Fig. 7 Unseated Key Cylinder

(c) With key cylinder in unseated position, rotate key counterclockwise to the lock position and remove key.

(d) Remove key cylinder from ignition switch (Fig. 8).

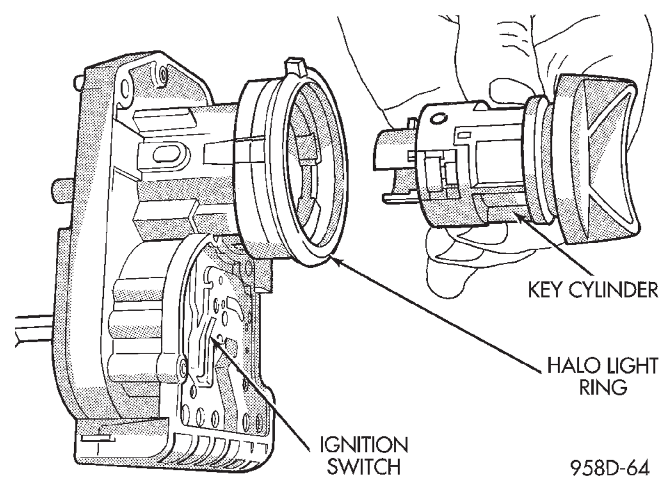


Fig. 8 Key Cylinder Removal

INSTALLATION

(1) Connect electrical connectors to ignition switch. Make sure that switch locking tabs are fully seated in wiring connectors.

(2) Before attaching ignition switch to a tilt steering column, the transmission shifter must be in Park position. The park lock dowel pin and column lock flag must also be properly indexed before installing switch (Fig. 9).

(a) Place transmission shifter in PARK position.

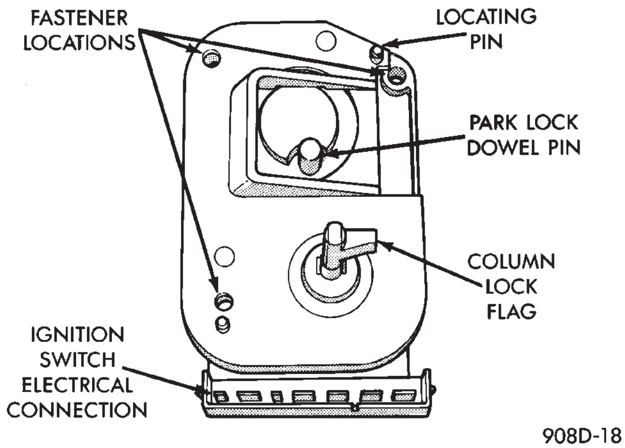


Fig. 9 Ignition Switch View From Column

(b) Place ignition switch in lock position. The switch is in the lock position when column lock flag is parallel to ignition switch terminals (Fig. 9).

(c) Position ignition switch park lock dowel pin so it will engage steering column park lock slider linkage (Fig. 10).

(d) Apply a light coating of grease to column lock flag and park lock dowel pin.

(3) Place ignition switch against lock housing opening on steering column. Ensure that ignition switch park lock dowel pin enters slot in park lock slider linkage in steering column.

(4) Install retaining bracket and ignition switch mounting screws. Tighten screws to 3±.5 N·m (26±4 in. lbs.) torque.

(5) Install ignition lock cylinder:

(a) With lock cylinder and ignition switch in Lock position, insert lock cylinder into ignition switch until it bottoms.

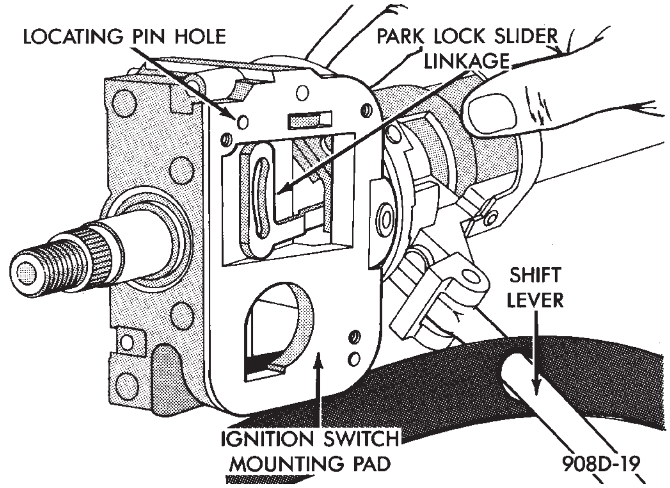


Fig. 10 Ignition Switch Mounting Pad

(b) Insert ignition key into lock cylinder. While gently pushing lock cylinder in toward ignition switch, rotate ignition key to end of travel.

(6) Install retaining screw into bracket and lock cylinder. Tighten screw to 3±.5 N·m (26±4 in. lbs.) torque.

(7) Install steering column covers. Tighten screws to 2 N·m (17 in. lbs.) torque.

(8) If vehicle is equipped with a tilt steering column, install tilt lever.

(9) Connect negative cable to battery.

(10) Check for proper operation of halo light, shift lock (if applicable), and column lock. Also check for proper operation of ignition switch accessory, lock, off, run, and start positions.

SPECIFICATIONS

GENERAL INFORMATION

The following specifications are published from the latest information available at the time of publication. **If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label.** The VECI label is located in the engine compartment.

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
4.0L 6 Cylinder	RC12LYC	0.089mm (0.035 in.)
5.2L V-8	RC12YC	0.089 mm (0.035 in.)

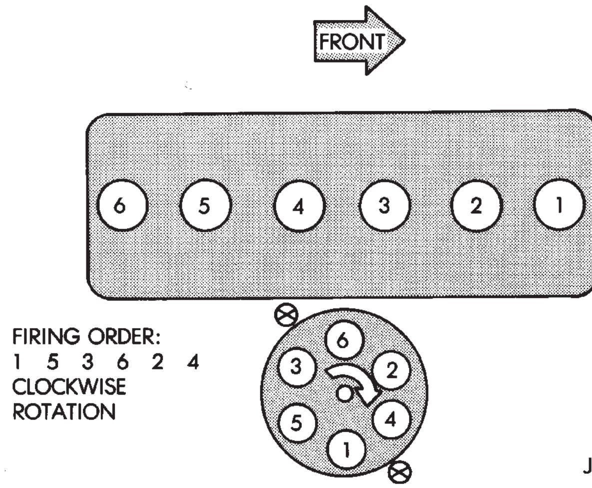
J9314-90

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

J908D-43

ENGINE FIRING ORDER—4.0L ENGINE



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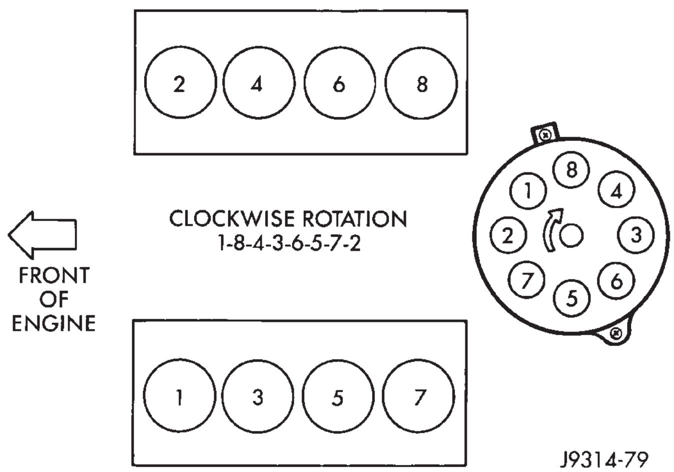
ENGINE FIRING ORDER—5.2L ENGINE



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IGNITION COIL RESISTANCE

COIL (MANUFACTURER)	PRIMARY RESISTANCE 21–27°C (70–80°F)	SECONDARY RESISTANCE 21–27°C (70–80°F)
Diamond	0.97 - 1.18 Ohms	11,300 - 15,300 Ohms
Toyodenso	0.95 - 1.20 Ohms	11,300 - 13,300 Ohms

J918D-2

TORQUE

DESCRIPTION	TORQUE
Coolant Temperature Sensor (6 Cylinder)	28 N·m (21 ft. lbs.)
Coolant Temperature Sensor (V-8)	7 N·m (5 ft. lbs.)
Crankshaft Position Sensor Mounting Bolts (6 Cyl.)	19 N·m (14 ft. lbs.)
Crankshaft Position Sensor Mounting Bolts (V-8)	8 N·m (70 in. lbs.)
Distributor Hold Down Bolt	23 N·m (17 ft. lbs.)
Intake Manifold Air Temperature Sensor	13 N·m (10 ft. lbs.)
Oxygen Sensor	30 N·m (22 ft. lbs.)
Powertrain Control Module (PCM) Mounting Screws	1 N·m (9 in. lbs.)
Powertrain Control Module (PCM) Elect. Connector	4 N·m (35 in. lbs.)
Spark Plugs 6 or 8 Cylinder	35-41 N·m (26-30 ft. lbs.)

J9414-13

INSTRUMENT PANEL AND GAUGES

CONTENTS

GENERAL INFORMATION

Following are general descriptions of major instrument panel components. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

INSTRUMENT PANEL

Modular instrument panel construction allows all gauges and controls to be serviced from the front of the panel. In addition, most instrument panel wiring or heater and air conditioning components can be accessed without complete instrument panel removal.

Removal of the dash pad and center cluster bezel allows access to the cluster assembly, the climate controls, the graphic display module/vehicle information center, and the radio. Removal of the cluster assembly allows access to the individual gauges, illumination and indicator lamp bulbs, printed circuit, and most wiring.

Removal of the lower instrument panel trim, knee blocker, and glove box module allows access to the left and right switch pods, heater and air conditioning components, wiring, and steering column mounts. A cover inside the glove box conceals the relay center, and a cover on the right end of the instrument panel conceals the fuseblock module.

INSTRUMENT CLUSTERS

One basic instrument cluster is offered on all Grand Cherokee models. The cluster is served by a single printed circuit and wiring connector. The cluster also includes a message center area containing up to 13 indicator lamps. The message center is served by the same printed circuit and wiring connector as the cluster. Some variations of the cluster exist due to optional equipment and regulatory requirements.

The instrument cluster includes the following gauges:

- coolant temperature gauge
- fuel gauge
- oil pressure gauge
- speedometer/odometer
- tachometer
- trip odometer
- voltmeter.

The cluster includes provisions for the following indicator lamps:

- airbag indicator lamp
- anti-lock brake system lamp
- brake warning lamp
- hazard warning indicator (export)
- headlamp high beam indicator lamp
- low fuel warning lamp
- malfunction indicator (Check Engine) lamp
- master lighting indicator (export)
- seat belt reminder lamp
- security lamp
- turn signal indicator lamps
- upshift indicator lamp.

GAUGES

With the ignition switch in the ON or START position, voltage is supplied to all gauges through the instrument cluster printed circuit. With the ignition switch in the OFF position, voltage is not supplied to the gauges. A gauge pointer may remain within the gauge scale after the ignition switch is OFF. However, the gauges do not accurately indicate any vehicle condition unless the ignition switch is ON.

All gauges except the odometer are air core magnetic units. Two fixed electromagnetic coils are located within the gauge. These coils are wrapped at right angles to each other around a movable permanent magnet. The movable magnet is suspended within the coils on one end of a shaft. The gauge needle is attached to the other end of the shaft.

One of the coils has a fixed current flowing through it to maintain a constant magnetic field strength. Current flow through the second coil changes, which causes changes in its magnetic field strength. The current flowing through the second coil can be changed by:

- a variable resistor-type sending unit (fuel level, coolant temperature, or oil pressure)
- changes in electrical system voltage (voltmeter)

• electronic control circuitry (speedometer/odometer, tachometer).

The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets.

COOLANT TEMPERATURE GAUGE

The coolant temperature gauge gives an indication of engine coolant temperature. The coolant temperature sending unit is a thermistor that changes electrical resistance with changes in engine coolant temperature. High sending unit resistance causes low coolant temperature readings. Low resistance causes high coolant temperature readings. Sending unit resistance values are shown in a chart in Specifications.

FUEL GAUGE

The fuel gauge gives an indication of the level of fuel in the fuel tank. The fuel gauge sending unit has a float attached to a swing-arm in the fuel tank. The float moves up or down within the fuel tank as fuel level changes. As the float moves, an electrical contact on the swing-arm wipes across a resistor coil, which changes sending unit resistance. High sending unit resistance causes low fuel level readings. Low resistance causes high fuel level readings. Sending unit resistance values are shown in a chart in Specifications.

OIL PRESSURE GAUGE

The oil pressure gauge gives an indication of engine oil pressure. The oil pressure sending unit contains a flexible diaphragm. The diaphragm moves in response to changes in engine oil pressure. As the diaphragm moves, resistance increases or decreases. High resistance in sending unit causes high oil pressure readings. Low resistance causes low oil pressure readings. Sending unit resistance values are shown in a chart in Specifications.

SPEEDOMETER/ODOMETER

The speedometer/odometer gives an indication of vehicle speed and travel distance. The speedometer receives a vehicle speed pulse signal from the Vehicle Speed Sensor (VSS). An electronic integrated circuit contained within the speedometer reads and analyzes the pulse signal. It then adjusts the ground path resistance of one electromagnet in the gauge to control needle movement. It also sends signals to an electric stepper motor to control movement of the odometer number rolls. Frequency values for the pulse signal are shown in a chart in Specifications.

The VSS is mounted to an adapter near the transmission or transfer case output shaft. The sensor is driven through the adapter by a speedometer pinion gear. The adapter and pinion vary with transmission, transfer case, axle ratio and tire size. Refer to Group 21 - Transmission and Transfer Case for more information.

TACHOMETER

The tachometer gives an indication of engine speed in Revolutions-Per-Minute (RPM). With the engine running, the tachometer receives an engine speed pulse signal from the Powertrain Control Module (PCM). An electronic integrated circuit contained within the tachometer reads and analyzes the pulse signal. It then adjusts the ground path resistance of one electromagnet in the gauge to control needle movement. Frequency values for the pulse signal are shown in a chart in Specifications.

TRIP ODOMETER

The trip odometer is driven by the same electronic integrated circuit as the speedometer/odometer. However, by depressing the trip odometer reset knob on the face of the speedometer, the trip odometer can be reset to zero. The trip odometer is serviced only as a part of the speedometer/odometer gauge assembly.

VOLTMETER

The voltmeter is connected in parallel with the battery. With the ignition switch ON, the voltmeter indicates battery or generator output voltage, whichever is greater.

INDICATOR LAMPS

Indicator lamps are located in several areas of the cluster. All lamps within the cluster are served by the cluster printed circuit and cluster connector.

AIRBAG INDICATOR LAMP

The airbag indicator lamp is switched to ground by the Airbag Control Module (ACM). The lamp lights for 6 to 8 seconds each time the ignition switch is turned to the ON position as a bulb test and to indicate a system self-test is in process. If the lamp remains on after the self-test or comes on while driving, it may indicate that the ACM has detected a system malfunction or that the system has become inoperative. Refer to Group 8M - Restraint Systems for more information.

ANTI-LOCK BRAKE SYSTEM LAMP

The Anti-Lock Brake System (ABS) lamp is switched to ground by the ABS module. The module lights the lamp when the ignition switch is turned to the START position as a bulb test. The lamp will stay on for 3 to 5 seconds after vehicle start-up to indicate a system self-test is in process. If the lamp remains on after start-up, or comes on and stays on while driving, it may indicate that the ABS module has detected a system malfunction or that the system has become inoperative. Refer to Group 5 - Brakes for more information.

BRAKE WARNING LAMP

The brake warning lamp warns the driver that the parking brake is applied or that the pressures in the two halves of the split brake hydraulic system are unequal. With the ignition switch turned ON, battery voltage is supplied to one side of the indicator bulb. A ground path for the bulb is provided by 3 switches. The bulb will light when:

- the brake warning switch is closed (indicating unequal brake system hydraulic pressures possibly due to brake fluid leakage)
- the ignition switch is in the START position (bulb test)
- the parking brake switch is closed (parking brake is applied).

Refer to Group 5 - Brakes for more information.

HAZARD WARNING INDICATOR

This lamp is required for certain export applications. The lamp is energized when the hazard warning flasher system is operating.

HEADLAMP HIGH BEAM INDICATOR LAMP

The high beam indicator lamp is controlled by the headlamp dimmer (multi-function) switch. One side of the indicator bulb is grounded at all times. The other side of the bulb receives battery feed through the contacts of the dimmer switch when the multi-function switch stalk is actuated to turn the headlamp high beams on. Refer to Group 8L - Lamps for more information.

LOW FUEL WARNING LAMP

The low fuel warning lamp will light when the fuel level falls below approximately 4 gallons. One side of the low fuel warning bulb is grounded at all times. A low fuel warning module attached to the rear of the tachometer provides battery voltage to the lamp when the fuel level is low. The low fuel warning module receives a signal from the fuel level sending unit that is the same signal used for the fuel gauge.

MALFUNCTION INDICATOR LAMP

The CHECK ENGINE or Malfunction Indicator Lamp (MIL) lights each time the ignition switch is turned ON, and stays on for 3 seconds as a bulb test. If the Powertrain Control Module (PCM) receives an incorrect signal or no signal from certain fuel or emission system related circuits or components, the lamp is turned on. This will indicate that the PCM has recorded a Diagnostic Trouble Code (DTC) in electronic memory for a circuit or component malfunction. Refer to Group 14 - Fuel System for more information.

MASTER LIGHTING INDICATOR

This lamp is required for certain export applications. The lamp is energized when the park lamps or head lamps are operating.

SEAT BELT REMINDER LAMP

The seat belt reminder lamp lights for 4 to 8 seconds after the ignition switch is turned to the ON position. A timer in the chime/buzzer module controls ignition-switched battery feed to the lamp. Refer to Group 8U - Chime/Buzzer Warning Systems for more information.

SECURITY LAMP

The security lamp is controlled by the vehicle theft alarm system. It gives the driver an indication of the status of the theft alarm system. Refer to Group 8Q - Vehicle Theft Alarm for more information.

TURN SIGNAL INDICATOR LAMPS

The left and right turn signal indicator lamps are controlled by the turn signal and hazard warning (multi-function) switches. One side of the bulb for each lamp is grounded at all times. The other side of the bulb receives battery feed through the contacts of the multi-function switch when the turn signal lever (multi-function switch stalk) or hazard warning button are actuated. Refer to Group 8J - Turn Signal and Hazard Warning Systems for more information.

UPSHIFT INDICATOR LAMP

Vehicles equipped with manual transmissions have an optional upshift indicator lamp. Ground feed for the lamp is switched by the Powertrain Control Module (PCM). The lamp lights to indicate when the driver should shift to the next highest gear for best fuel economy. The PCM will turn the lamp off after 3 to 5 seconds if the upshift is not performed. The lamp will remain off until the vehicle stops accelerating and is brought back to the range of lamp operation, or until the transmission is shifted into another gear.

The indicator lamp is normally on when the ignition switch is turned ON and is turned off when the engine is started. The lamp will be turned on during vehicle operation according to engine speed and load.

CLUSTER ILLUMINATION LAMPS

All cluster illumination lamps receive battery feed from the instrument lamps fuse in the fuseblock module through the instrument panel dimming module and the headlamp switch. When the park or headlamps are on, the cluster illumination lamps light. Illumination brightness can be adjusted by moving the sliding dimmer switch knob (left to dim, right to brighten). Refer to Body Diagnostic Procedures manual for diagnosis of the instrument panel lamps dimming module.

GRAPHIC DISPLAY MODULE

A four-wheel drive Graphic Display Module (GDM) is standard equipment on all Grand Cherokee 4WD models, unless the optional Vehicle Information Center (described elsewhere in this group) has been selected. The module is mounted in the lower center area of the instrument panel, above the ash receiver and below the climate controls.

The display consists of a back-lit screen with a vehicle outline, and bulbs that light the four wheels appropriately as determined by the state of a transfer case switch to indicate the four-wheel drive system mode of operation. The display also includes up to three indicator lamps labeled Part-Time, Full-Time, and Lo.

The bulbs, wiring, and transfer case switches are available for service. However, if the GDM screen, housing or internal circuitry are damaged or faulty the entire module must be replaced.

VEHICLE INFORMATION CENTER

The Vehicle Information Center (VIC) is an available option on Grand Cherokee models. The VIC consists of multi-colored vacuum-fluorescent display screen with a vehicle outline. It is mounted in the lower center area of the instrument panel, above the ash receiver and below the climate controls. The VIC replaces the standard equipment Graphic Display Module (GDM), which is covered elsewhere in this group. The VIC module can not be repaired. If faulty or damaged, the entire module must be replaced.

The VIC is able to display four functions in a choice of five languages (English, French, German, Italian or Spanish) and using U.S. or metric measurements. These functions include:

• display the current time, day, and date
• monitor specific vehicle operating systems and alert the driver if a malfunction occurs
• display a service reminder or the distance to the next service interval
• display the selected 4WD transfer case mode of operation.

When the ignition switch is turned ON, the module will display a MILES (KM)-TO-SERVICE message for 6 seconds. If the distance remaining to service is zero, the module will instead display a PERFORM SERVICE message for 11 seconds. Then an audible alarm will pulse 6 sequences of warning beeps. The PERFORM SERVICE message will continue for an additional 2 seconds.

Next, if no monitored system faults exist and the time/date has been previously set, the module will display the current time and date. If a service fault exists, the module will begin to display the fault message. If more than one message has to be displayed, the module will display up to 2 messages. Then the clock function will pulse (unless a door is open and vehicle is at critical speed) continuously at 3 second intervals.

CONTROLS

On the right side of the VIC module are the VIC SET and SELECT buttons. These buttons are used to control and customize the VIC display during the initial set-up procedure, to enter the VIC into its self-diagnostic mode, and for certain other functions. The VIC display can also be switched from U.S. customary to metric measurement using the US/METRIC button in the overhead console. See the VIC Initial Set-Up chart in this group, or refer to the vehicle Owner's Manual for more information on the use and operation of the VIC controls.

CLOCK/CALENDAR DISPLAY

The clock/calendar function will be displayed during normal vehicle operation, unless a warning or service system fault is detected. The clock/calendar display will include the following:

• time (hours and minutes with AM and PM, except 24 hour clock mode)
• day of week (Monday through Sunday)
• date (month and day).

OPERATING SYSTEMS MONITOR

The VIC monitors 11 vehicle operating systems. The specific vehicle operating systems monitored by the VIC are:

• right front door ajar switch
• left front door ajar switch
• right rear door ajar switch
• left rear door ajar switch
• liftgate/flipper glass ajar switch
• rear lamp outage module
• turn signal system
• washer fluid level sensor
• coolant level sensor
• electrical system voltage
• 4WD transfer case switch.

If a fault is detected in any of these systems, an area of the vehicle display outline will illuminate and a message will be displayed. To alert the driver, an audible warning signal (beeps) will occur the first time the message appears as indicated in the following paragraphs.

DOOR AJAR/LIFTGATE OPEN

These messages are displayed when a door jamb or liftgate/flipper glass ajar switch is grounded (closed). For the left front door only, when the door is open and the vehicle speed is greater that 10 MPH, the audible signal will sound. This same warning will be sounded when the right front or either rear door is open, and the vehicle speed is greater that 2 MPH.

REAR LAMP FAILURE

This message is displayed when the lamp outage module input is open for 1/2 second. This display is latched on until the ignition switch is cycled to OFF and ON, following correction.

TURN SIGNAL ON

This message is turned on if 1 mile has elapsed with a turn signal left on.

CHECK BATTERY

This message is turned on when the ignition voltage is not between 11.5 and 15.1 volts. The reading is checked every 15 seconds for an over or under battery voltage. It takes 2 consecutive 15 second average readings to turn the message on and 1 average reading to remove it.

WASHER FLUID LOW

This message is turned on when the signal from the washer fluid level sensor indicates a low fluid condition. It takes 30 consecutive low averaged samples to determine the washer fluid level is low. This display is latched on until the ignition switch is cycled to OFF and ON, following correction.

COOLANT LEVEL LOW

The module will test the coolant level sensor input immediately after ignition ON and determine if there is a fault. Thereafter, the input is checked every 1 second. It takes 30 consecutive low averaged samples to determine the coolant level is low. This display is latched on until the ignition switch is cycled to OFF and ON, following correction.

SERVICE REMINDERS

The VIC system includes a distance-to-service counter and detects faulty sensors. See the VIC Reset Procedures chart in this group for information on resetting the distance-to-service counter. See the VIC Initial Set-Up chart in this group for information on setting the desired service interval. The following paragraphs describe the service messages that will be displayed if a fault is detected.

PERFORM SERVICE

This message is displayed at ignition ON any time the distance-to-service counter is equal to zero.

XXXX MILES (KM)-TO-SERVICE

This message is displayed at ignition ON or when SELECT is pressed after the time/date has been set. The distance-to-service counter must not equal zero for the message to display. The distance is expressed in MILES or KILOMETERS (km) depending on the state of the US/METRIC switch in the overhead console.

COOLANT LEVEL SENSOR BAD

The module displays a Coolant Sensor Bad message as part of the warning message when it detects an open or short circuit to the coolant level sensor. See VIC Fluid Level Fault Diagnosis chart in this group for more information.

WASHER SENSOR BAD

The module displays a Washer Sensor Bad message as part of the warning message when it detects an open or short circuit to the washer fluid level sensor. See VIC Fluid Level Fault Diagnosis chart in this group for more information.

FOUR-WHEEL DRIVE DISPLAY

The VIC will light the wheels of the vehicle outline and nomenclature as outlined in the VIC 4WD Display Characteristics chart in this group.

VIC SELF-DIAGNOSTICS

The module will perform certain self-tests without the use of special tools. See VIC Self-Diagnosis chart in this group for more information. The VIC program will stay in self-diagnostics mode until all the tests pass or the ignition switch is turned OFF.

The self-diagnostic routine is able to perform the following checks:

- microcomputer ram/rom/timer test
- display screen test
- coolant/washer/rear lamp/four-wheel drive sensor input tests.

DIAGNOSIS

GAUGES

If an individual gauge is inoperative, see the diagnostic procedure under the heading for that gauge. If more than one gauge is inoperative, perform the following:

(1) Check fuse 22 in the fuseblock module. If OK, go to next step. If not OK, replace fuse.

(2) Check for battery voltage at fuse 22 with ignition switch in ON position. If OK, go to next step. If not OK, repair open in circuit from ignition switch and/or refer to Group 8D - Ignition Systems for testing of ignition switch.

(3) Turn ignition switch to OFF. Disconnect battery negative cable. Remove dash pad and cluster assembly. Disconnect printed circuit connector.

(4) Connect battery negative cable. Turn ignition switch to ON. Check for battery voltage at cavity C12 of printed circuit connector. If OK, go to next step. If not OK, repair open in circuit from fuse as required.

(5) Turn ignition switch to OFF. Disconnect battery negative cable. Probe ground cavity of printed circuit connector. Check for continuity to a good ground. There should be continuity. If OK, replace printed circuit. If not OK, repair open circuit to ground as required.

COOLANT TEMPERATURE GAUGE

The diagnosis found here addresses an inoperative gauge condition. If the problem being diagnosed is related to gauge accuracy, be certain to confirm that problem is with gauge and not with cooling system performance. Actual engine coolant temperature should be checked with a test gauge or thermometer and compared to gauge readings before you proceed with gauge diagnosis. Refer to Group 7 - Cooling System for more information.

(1) Turn ignition switch to ON. Disconnect coolant temperature sending unit connector (Fig. 1 or 2). The gauge needle should move to low end of gauge scale. If OK, go to next step. If not OK, go to step 3.

(2) Install a jumper wire from sending unit wiring to ground. The gauge needle should move to high end of gauge scale. If OK, replace sending unit. If not OK, remove jumper wire and go to next step.

(3) Turn ignition switch to OFF. Disconnect battery negative cable. Remove dash pad and cluster assembly. Disconnect printed circuit connector.

(4) Probe cavity D11 of printed circuit connector. Check for continuity to a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short in circuit as required.

(5) Still probing cavity D11 of printed circuit connector, check for continuity to sending unit wiring connector. There should be continuity. If OK, replace gauge. If not OK, repair open in circuit as required.

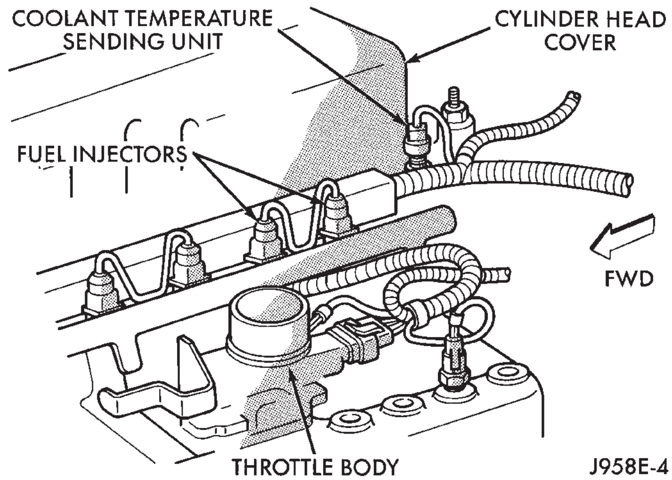


Fig. 1 Coolant Temperature Sending Unit - 4.0L Engine

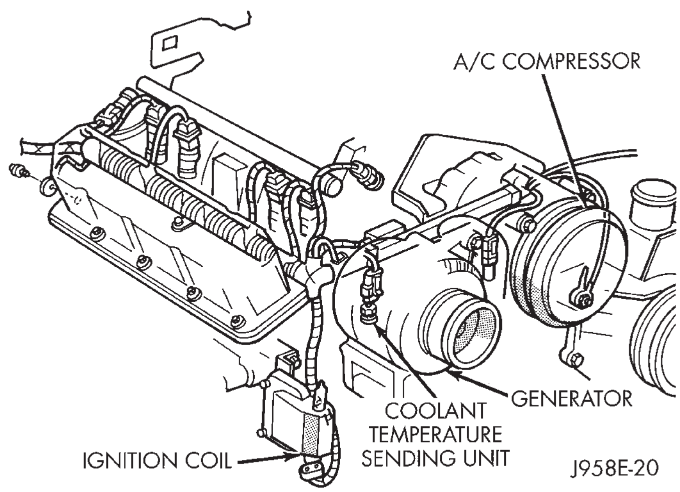


Fig. 2 Coolant Temperature Sending Unit - 5.2L Engine

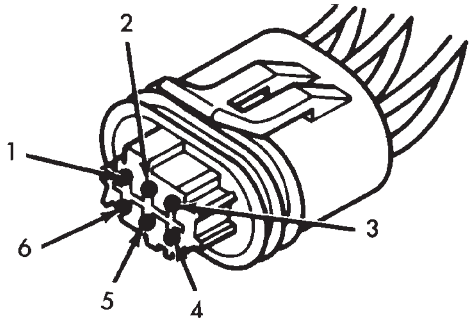
FUEL GAUGE

The diagnosis found here addresses an inoperative gauge condition. If the problem being diagnosed is related to gauge accuracy, be certain to confirm that problem is with gauge and not with fuel tank. Inspect fuel tank for signs of damage or distortion that could affect sending unit performance before you proceed with gauge diagnosis. Refer to Group 14 - Fuel System for more information.

(1) Turn ignition switch to ON. Disconnect fuel gauge sending unit connector. Connector is located on top of the fuel tank. The gauge needle should move to low end of gauge scale. If OK, go to next step. If not OK, go to step 4.

(2) Connect a jumper wire between sending unit connector cavity 2 and cavity 3 (Fig. 3) in the body half of the fuel gauge sending unit connector. The gauge needle should move to high end of gauge scale.

If OK, refer to Group 14 - Fuel System for procedure to replace sending unit. If not OK, remove jumper wire and go to next step.



CAV	FUNCTION
1	NOT USED
2	SIGNAL GROUND
3	FUEL LEVEL SIGNAL (CLUSTER)
4	FUEL PUMP RELAY OUTPUT
5	FUEL PUMP GROUND
6	FUEL LEVEL SIGNAL (TRIP COMPUTER)

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Fig. 3 Fuel Gauge Sending Unit Connector

(3) Turn ignition switch to OFF. Disconnect battery negative cable. Check for continuity between fuel gauge sending unit connector cavity 2 in the body half of connector and a good ground. There should be continuity. If OK, go to next step. If not OK, repair circuit to ground as required.

(4) Remove dash pad and cluster assembly. Disconnect printed circuit connector.

(5) Probe cavity D6 of printed circuit connector. Check for continuity to a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short circuit as required.

(6) Still probing cavity D6 of printed circuit connector, check for continuity to fuel gauge sending unit connector cavity 3. There should be continuity. If OK, replace gauge. If not OK, repair open circuit as required.

OIL PRESSURE GAUGE

The diagnosis found here addresses an inoperative gauge condition. If the problem being diagnosed is related to gauge accuracy, be certain to confirm that problem is with gauge and not with engine oiling system performance. Actual engine oil pressure should be checked with a test gauge and compared to gauge readings before you proceed with gauge diagnosis. Refer to Group 9 - Engines for more information.

(1) Turn ignition switch to ON. Disconnect oil pressure sending unit connector (Fig. 4 or 5). The gauge needle should move to high end of gauge scale. If OK, go to next step. If not OK, go to step 3.

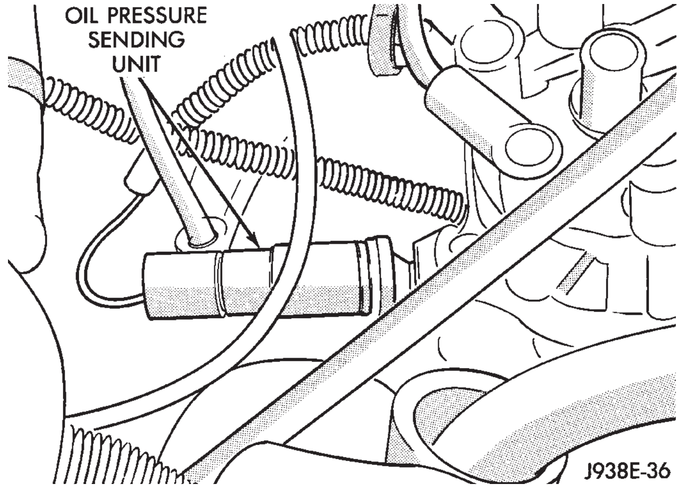


Fig. 4 Oil Pressure Sending Unit - 4.0L Engine

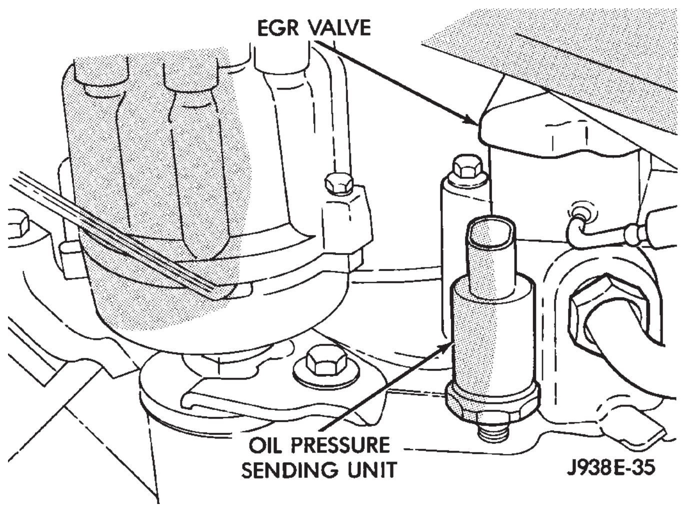


Fig. 5 Oil Pressure Sending Unit - 5.2L Engine

(2) Install a jumper wire from sending unit wire connector to ground. The gauge needle should move to low end of gauge scale. If OK, replace sending unit. If not OK, remove jumper wire and go to next step.

(3) Turn ignition switch to OFF. Disconnect battery negative cable. Remove dash pad and cluster assembly. Disconnect printed circuit connector.

(4) Probe cavity C9 of printed circuit connector and check for continuity to a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short circuit as required.

(5) Still probing cavity C9 of printed circuit connector, check for continuity to sending unit wire connector. There should be continuity. If OK, replace gauge. If not OK, repair open circuit as required.

SPEEDOMETER/ODOMETER

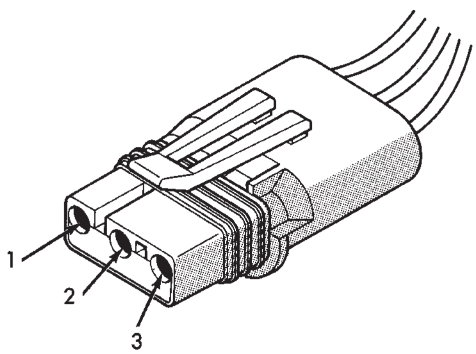
The diagnosis found here addresses an inoperative gauge condition. If the problem being diagnosed is related to gauge accuracy, be certain to confirm that problem is with gauge and not with incorrect speedometer pinion, axle ratio or tire size. Refer to Group 21 - Transmission and Transfer Case for more information.

(1) Perform vehicle speed sensor test as described in the appropriate Powertrain Diagnostic Procedures manual. If OK, go to next step. If not OK, replace vehicle speed sensor.

(2) Disconnect battery negative cable. Unplug vehicle speed sensor, PCM, vehicle information center (if equipped), and transmission control module (if equipped) connectors. Remove dash pad and cluster assembly. Disconnect printed circuit connector.

(3) Probe cavity C7 of printed circuit connector. Check for continuity to a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short circuit as required.

(4) Still probing cavity C7 of printed circuit connector, check for continuity to cavity 1 of vehicle speed sensor connector (Fig. 6). There should be continuity. If OK, replace speedometer/odometer. If not OK, repair open circuit as required.



NO.	IDENTIFICATION
1	VSS SIGNAL
2	SENSOR GROUND
3	SENSOR SUPPLY

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Fig. 6 Vehicle Speed Sensor Connector

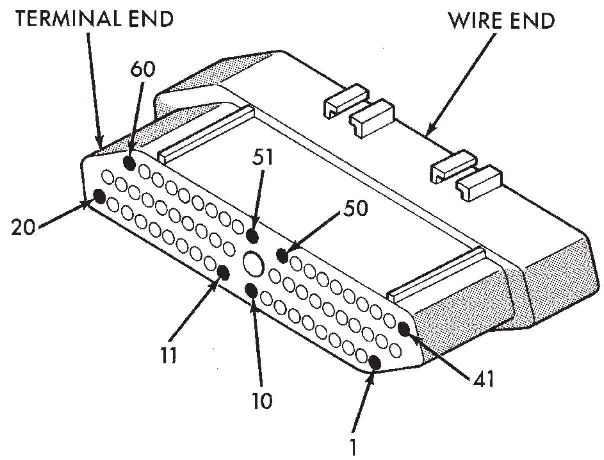
TACHOMETER

(1) With engine running, check for tachometer signal at pin 43 of PCM connector (Fig. 7). See Tachometer Calibration chart in Specifications. If OK, go to next step. If not OK, replace PCM.

(2) Disconnect battery negative cable. Unplug PCM connector. Remove dash pad and cluster assembly. Disconnect printed circuit and transmission control module (if equipped) connectors.

(3) Probe cavity D5 of printed circuit connector. Check for continuity to a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short circuit as required.

(4) Still probing cavity D5 of printed circuit connector, check for continuity to cavity 43 of PCM connector. There should be continuity. If OK, replace tachometer. If not OK, repair open circuit as required.



NO.	IDENTIFICATION
32	MALFUNCTION INDICATOR LAMP
36	GENERATOR WARNING LAMP
43	TACHOMETER SIGNAL
54	UPSHIFT INDICATOR LAMP

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Fig. 7 Powertrain Control Module Connector

TRIP ODOMETER

If the trip odometer is inoperative, but the speedometer/odometer functions are unaffected, replace speedometer assembly. If speedometer/odometer functions are affected, see Speedometer/Odometer diagnosis in this section.

VOLTMETER

(1) Turn ignition switch to ON. Voltmeter should read battery voltage. If all gauges except voltmeter are OK, go to next step. If other gauges are inoperative, see Gauges in this section for diagnosis.

(2) Using an accurate test voltmeter, measure battery voltage at battery. Compare this reading to instrument cluster voltmeter reading. Now see Voltmeter Calibration chart in Specifications. If voltmeter does not perform to specification, replace voltmeter.

INDICATOR LAMPS

If an individual indicator lamp is inoperative, see the diagnostic procedure under the heading for that lamp. If more than one indicator lamp or a combination of lamps and gauges in the instrument cluster or message center is inoperative, see Gauges in this section for diagnosis.

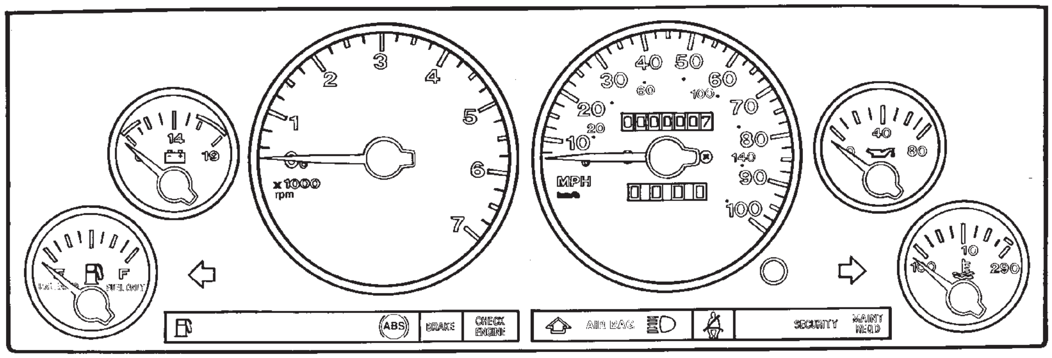
AIRBAG INDICATOR LAMP

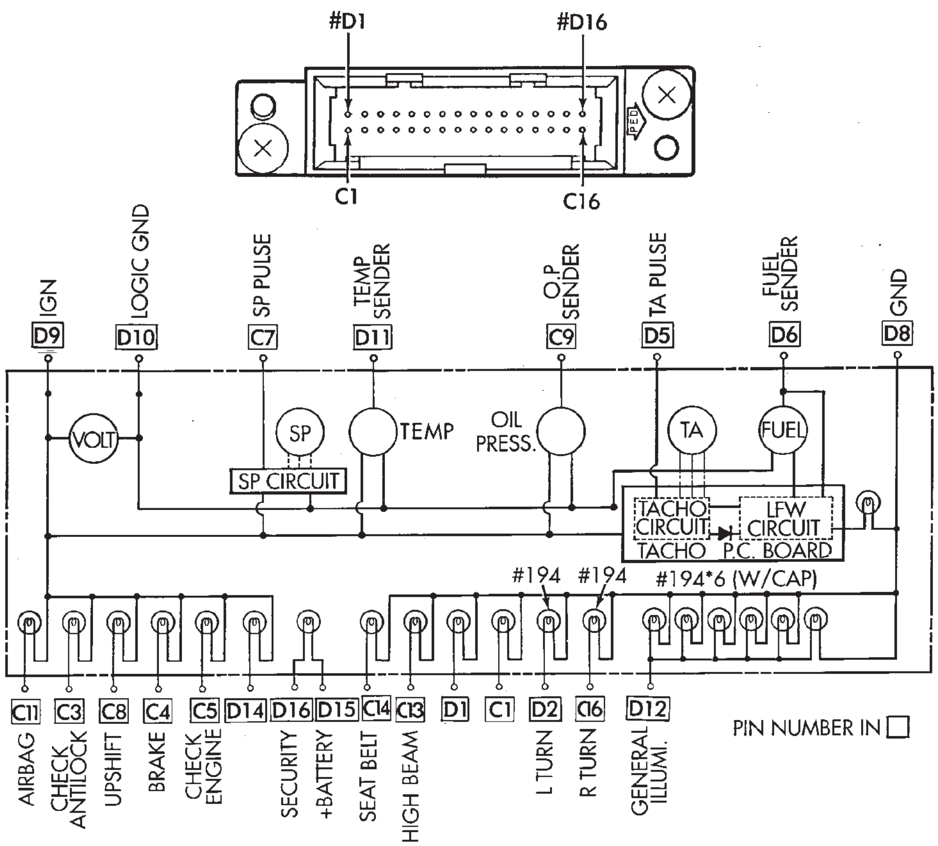
(1) Remove dash pad and cluster assembly. Do not unplug cluster connector.

(2) Turn ignition switch to ON position. Ground instrument cluster connector pin C11. Lamp should light. If OK, go to next step. If not OK, replace bulb.

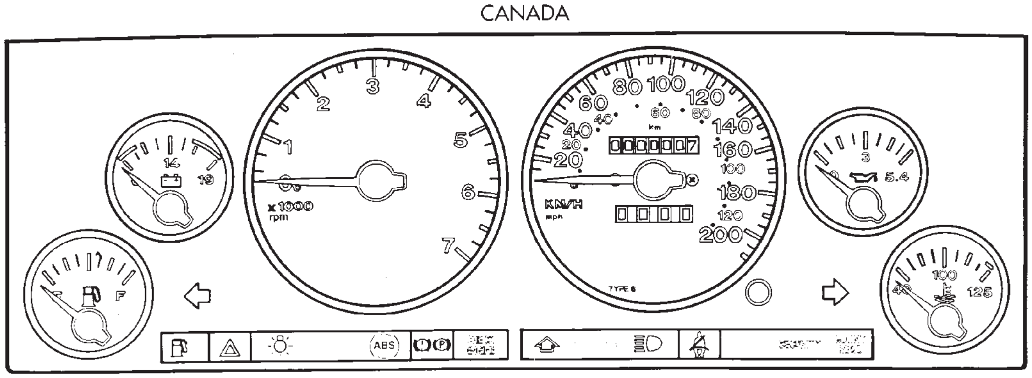
INSTRUMENT CLUSTER

U.S.A.





CANADA



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(3) Turn ignition switch to OFF position. Disconnect and isolate the battery negative (ground) cable. Check for continuity between connector pin C11 and pin 3 of the airbag control module (ACM) connector. There should be continuity. If OK, refer to Group 8M - Restraint Systems for diagnosis of ACM. If not OK, repair open circuit as required.

ANTI-LOCK BRAKE SYSTEM LAMP

The diagnosis found here addresses an inoperative lamp condition. If the ABS lamp stays on with the ignition switch in the ON position, or comes on and stays on while driving, refer to Group 5 - Brakes for diagnosis. If no ABS problem is found, the following procedure will help locate a short or open in the ABS lamp circuit.

(1) Turn ignition switch to ON.

(2) Jump instrument cluster connector terminal C3 to ground. Lamp should light. If bulb is OK, check for continuity between C3 and the ABS module connector. Refer to Group 5 - Brakes.

BRAKE WARNING LAMP

The diagnosis found here addresses an inoperative lamp condition. If the brake warning lamp stays on with the ignition switch in the ON position and the parking brake released, refer to Group 5 - Brakes for diagnosis. If no service brake or parking brake problem is found, the following procedure will help locate a short circuit or faulty switch.

(1) Turn ignition switch to START position. Lamp should light. Release ignition switch to ON position. Lamp should go OFF. If not OK, go to next step.

(2) Jump cluster connector terminal C4 to ground. Lamp should light. If bulb is OK, check for continuity to brake pressure warning switch and park brake switch.

HEADLAMP HIGH BEAM INDICATOR LAMP

(1) Check that headlamp high beams are functional. If OK, go to next step. If not OK, refer to Group 8L - Lamps for diagnosis of headlamp system.

(2) Disconnect battery negative cable. Remove dash pad and cluster assembly. Unplug printed circuit connector. Connect battery negative cable. Turn headlamps on and select high beam. Check for battery voltage at cavity C13 of printed circuit connector. If OK, replace indicator bulb. If not OK, refer to Body Diagnostic Procedures manual for diagnosis of instrument panel lamps dimming module.

LOW FUEL WARNING LAMP

(1) Perform diagnosis for fuel gauge. The fuel gauge and low fuel warning lamp use the same circuit and sending unit. If wiring and sending unit are OK, go to next step. If not OK, repair as required.

(2) Remove dash pad and instrument cluster. Replace low fuel warning bulb. Test operation. If not OK, replace low fuel warning module.

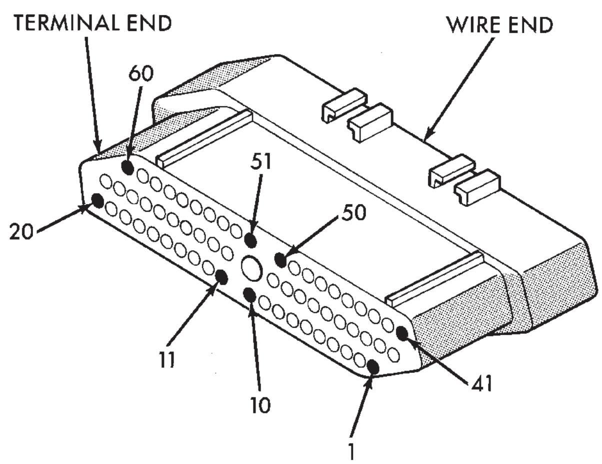
The low fuel warning module is serviced as part of the tachometer assembly. If faulty, replace the tachometer.

MALFUNCTION INDICATOR LAMP

The diagnosis found here addresses an inoperative lamp condition. If the lamp comes on and stays on with engine running, refer to Group 14 - Fuel System for diagnosis. If no fuel or emission system problem is found, the following procedure will help locate a short or open in the lamp circuit.

(1) Disconnect battery negative cable. Unplug PCM connector. Install a jumper wire between cavity 32 of PCM connector (Fig. 8) and a good ground. Connect battery negative cable. Turn ignition switch to ON. Lamp should light. Remove jumper wire and lamp should go OFF. If OK, refer to Powertrain Diagnostic Procedures to check PCM. If not OK, go to next step.

(2) Turn ignition switch to OFF. Disconnect battery negative cable. Remove dash pad and cluster assembly. Install a jumper wire between cavity C5 of printed circuit connector and a good ground. Connect battery negative cable. Turn ignition switch to ON. Lamp should light. If OK, go to next step. If not OK, replace bulb.



NO.	IDENTIFICATION
32	MALFUNCTION INDICATOR LAMP
36	GENERATOR WARNING LAMP
43	TACHOMETER SIGNAL
54	UPSHIFT INDICATOR LAMP

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Fig. 8 Powertrain Control Module Connector

(3) Turn ignition switch to OFF. Disconnect battery negative cable. Unplug printed circuit connector. Check for continuity between cavity C5 of printed circuit connector and a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short circuit to PCM as required.

(4) Check continuity between cavity C5 of printed circuit connector and cavity 32 of PCM connector. There should be continuity. If not OK, repair open circuit to PCM as required.

SEAT BELT REMINDER LAMP

(1) Refer to Group 8U - Chime/Buzzer Warning Systems to check chime/buzzer module operation. If OK, go to next step. If not OK, replace chime/buzzer module.

(2) Disconnect battery negative cable. Remove dash pad and cluster assembly. Install a jumper wire between cavity C14 of printed circuit connector and 12 volts. Bulb should light. If OK, repair circuit to chime/buzzer module. If not OK, replace bulb.

SECURITY LAMP

(1) Remove dash pad and cluster assembly. Do not unplug cluster connector.

(2) Jump cluster connector terminal D16 to ground. Lamp should light. If OK, check circuit to vehicle theft alarm module. If not OK, replace bulb.

TURN SIGNAL INDICATOR LAMPS

(1) Disconnect battery negative cable. Remove dash pad and cluster assembly. Probe cavity D8 of printed circuit connector. Check for continuity to a good ground. There should be continuity. If OK, go to next step. If not OK, repair open circuit to ground.

(2) Connect battery negative cable. Install a jumper wire from cavity D2 (left indicator) or cavity C16 (right indicator) of printed circuit connector to a 12-volt battery feed. Lamp should light. If OK, continue to next step. If not OK, replace bulb.

(3) Disconnect battery negative cable. Check for continuity between cavity D2 (left indicator) or cavity C16 (right indicator) of printed circuit connector and left front turn signal or right front turn signal wiring. There should be continuity. If OK, refer to Group 8J - Turn Signal and Hazard Warning Systems for further diagnosis. If not OK, repair open circuit as required.

UPSHIFT INDICATOR LAMP

(1) Disconnect battery negative cable. Unplug PCM connector. Connect battery negative cable. Turn ignition switch to ON. Install a jumper wire from cavity 54 of PCM connector to a good ground. Lamp should light. Remove jumper from ground. Lamp should go off. If OK, refer to Powertrain Diagnostic Procedures manual to diagnose PCM. If not OK, turn ignition switch to OFF and go to next step.

(2) Disconnect battery negative cable. Remove dash pad and cluster assembly. Install a jumper wire from cavity C8 of cluster connector to a good ground. Connect battery negative cable. Turn ignition switch to ON. Lamp should light. If OK, go to next step. If not OK, replace bulb.

(3) Turn ignition switch to OFF. Disconnect battery negative cable. Unplug cluster connector. Check for continuity between cavity C8 of cluster connector and a good ground. There should be no continuity. If OK, go to next step. If not OK, repair short circuit as required.

(4) Check for continuity between cavity C8 of cluster connector and cavity 54 of PCM connector. There should be continuity. If not OK, repair open circuit as required.

CLUSTER ILLUMINATION LAMPS

(1) Check fuse 24 in fuseblock module. If OK, go to next step. If not OK, replace fuse.

(2) Remove dash pad and cluster assembly. Install a jumper wire from cluster connector cavity D12 to a 12-volt battery feed. Lamps should light. If OK, refer to Body Diagnostic Procedures manual for diagnosis of instrument panel lamps dimming module. If not OK, replace bulbs.

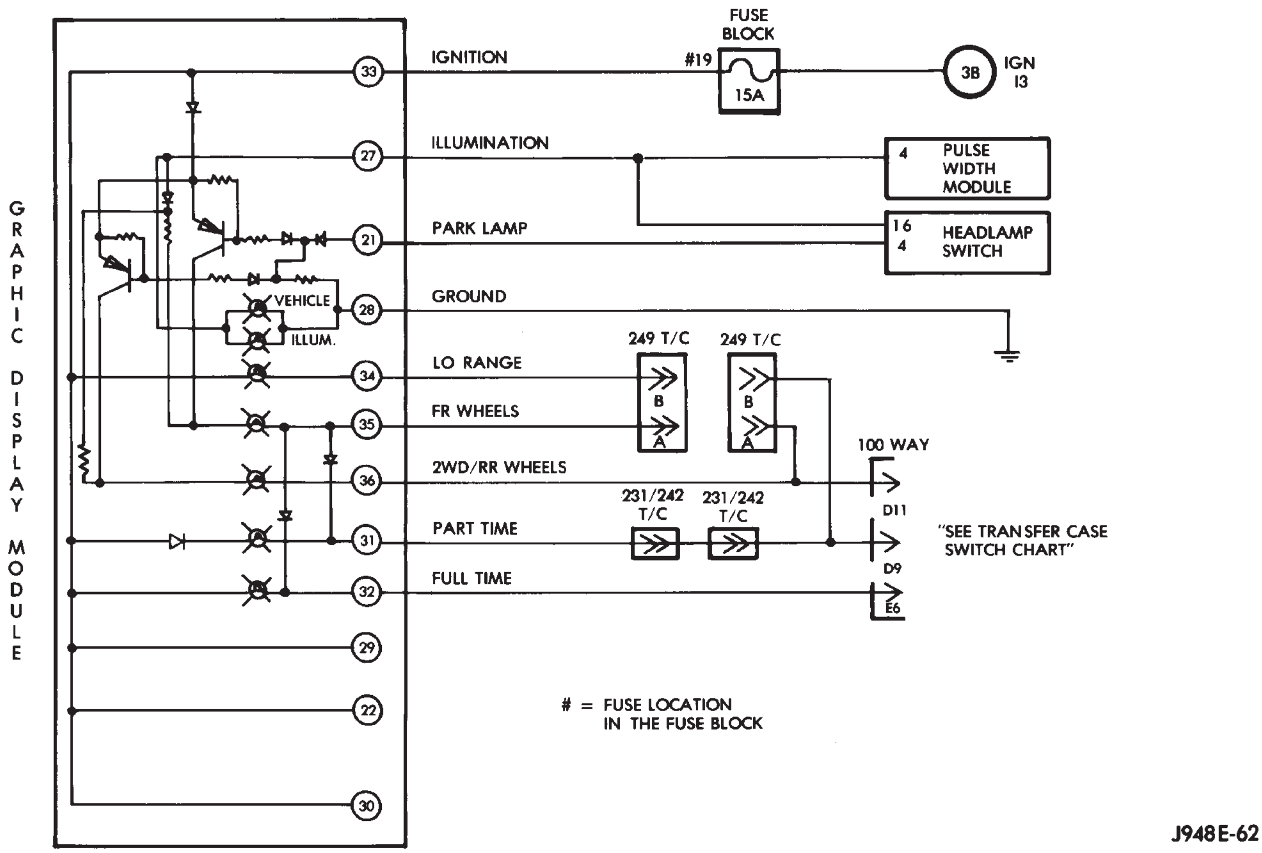
GRAPHIC DISPLAY MODULE

If part of the GDM will not light or is not operating properly, use the Graphic Display Module Schematic and Group 8 - Wiring Diagrams to check circuit continuity between the GDM connector and the appropriate signal source. If there is continuity and the sending device is operating properly, replace the GDM unit.

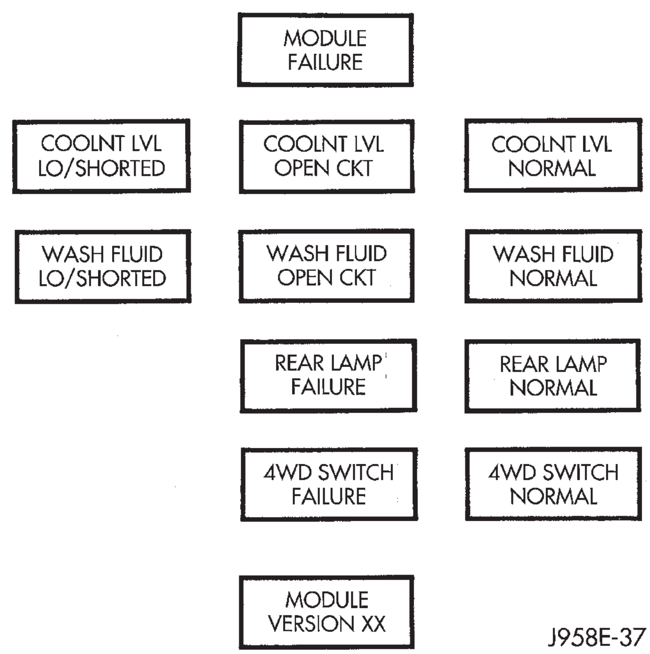
VEHICLE INFORMATION CENTER

Problems with the VIC module can be diagnosed using a combination of the diagnostic charts and schematics that follow. Also included are charts describing the procedures for initial VIC set-up and resetting of the VIC clock/calendar and service reminder functions.

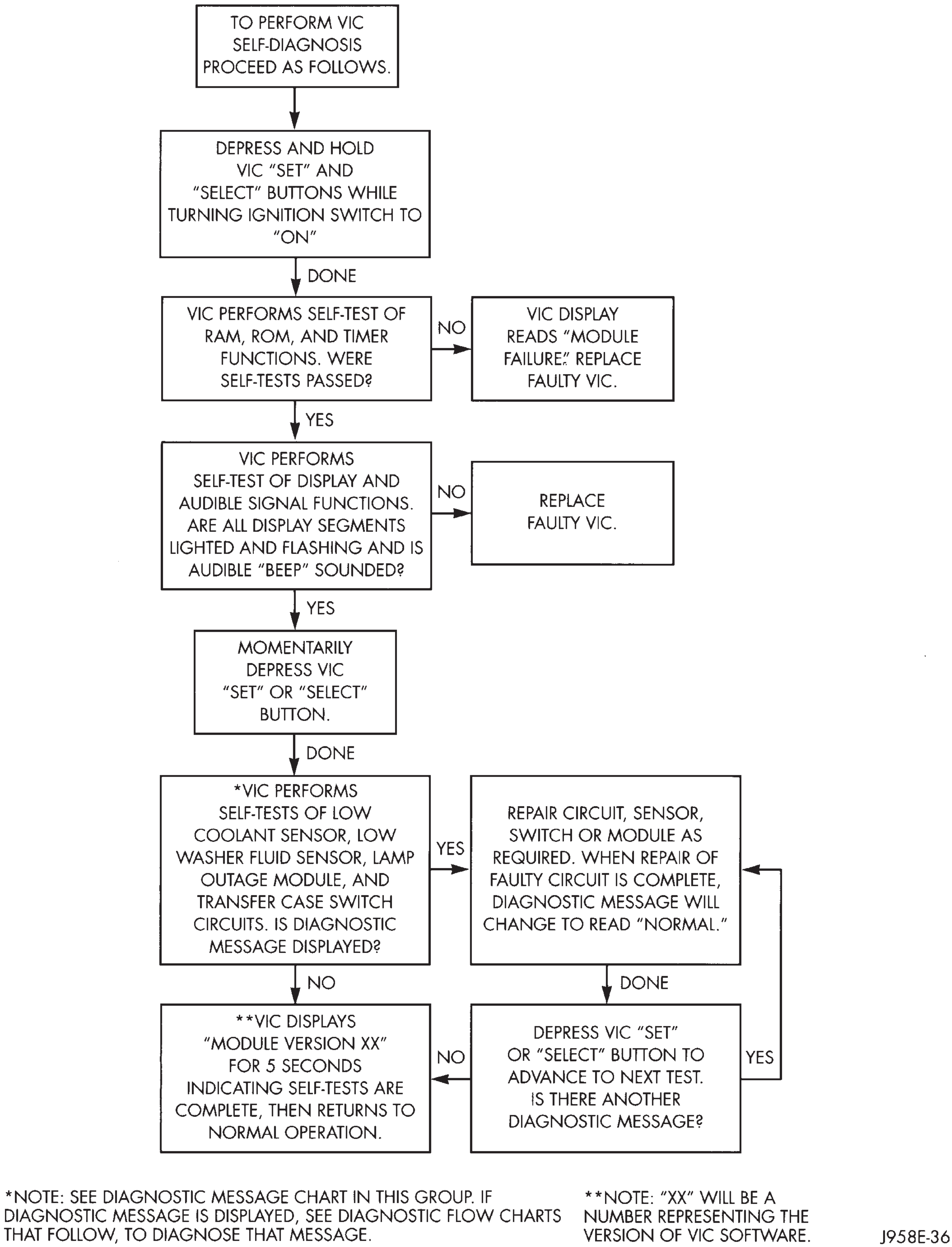
GRAPHIC DISPLAY MODULE SCHEMATIC



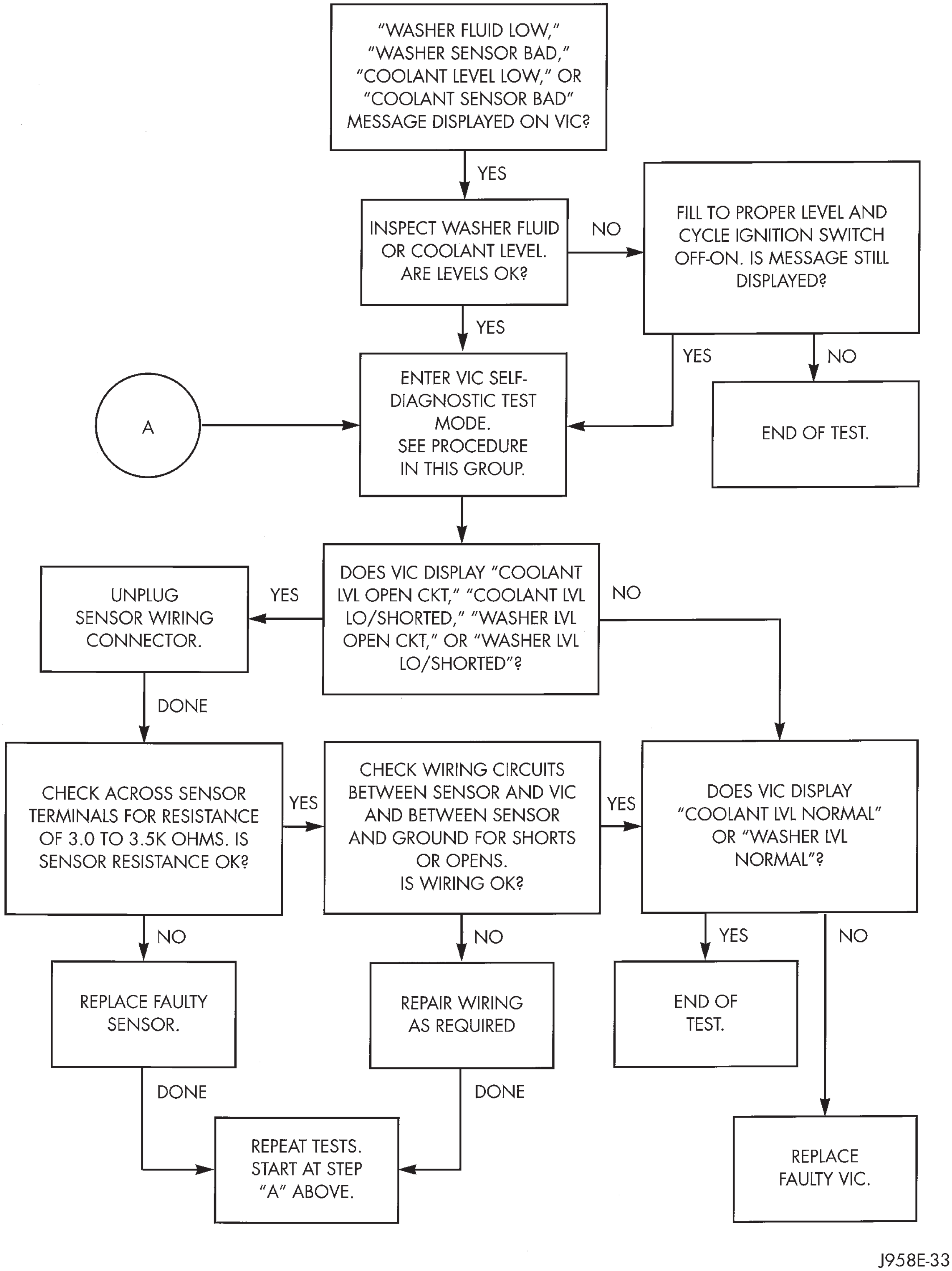
VIC DIAGNOSTIC MESSAGES



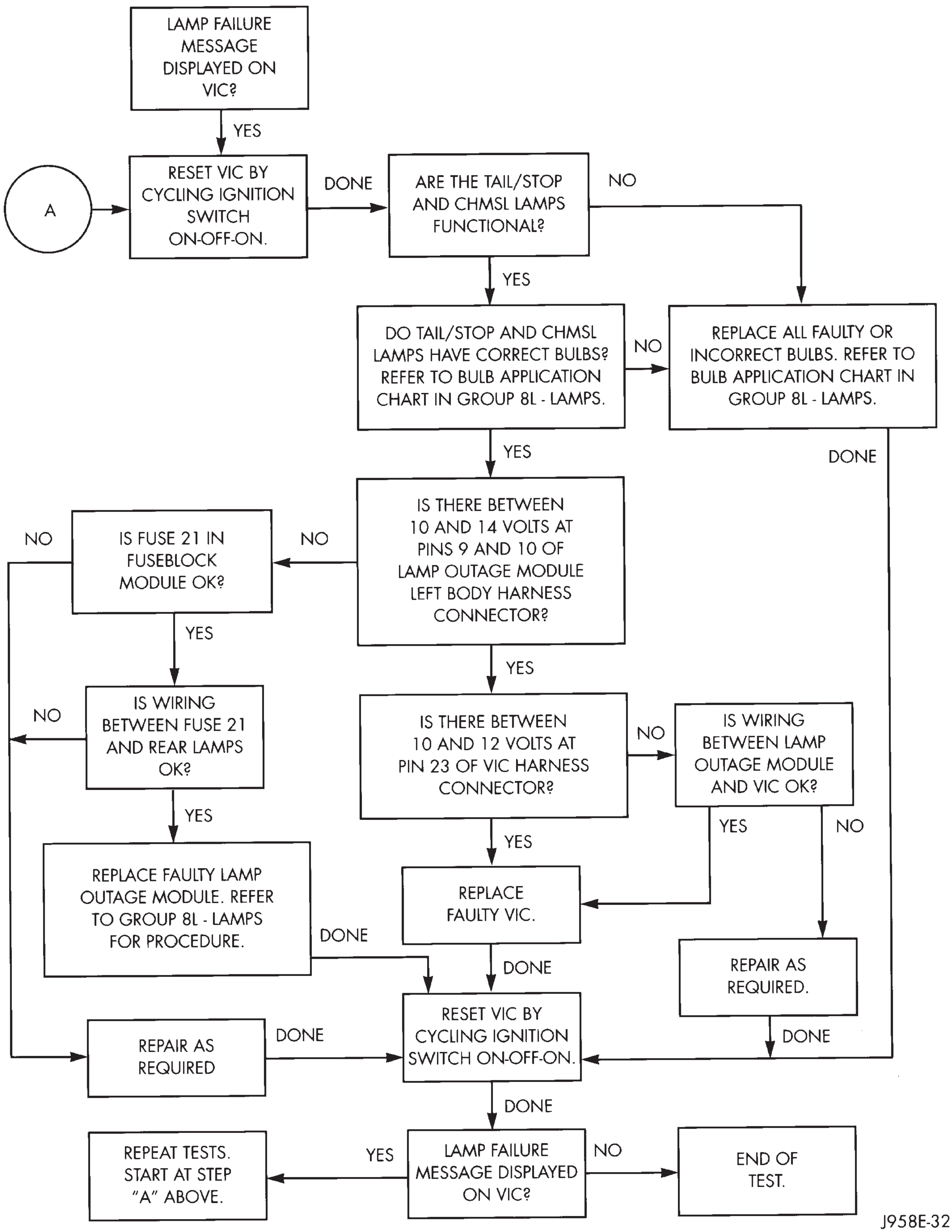
VIC SELF-DIAGNOSIS



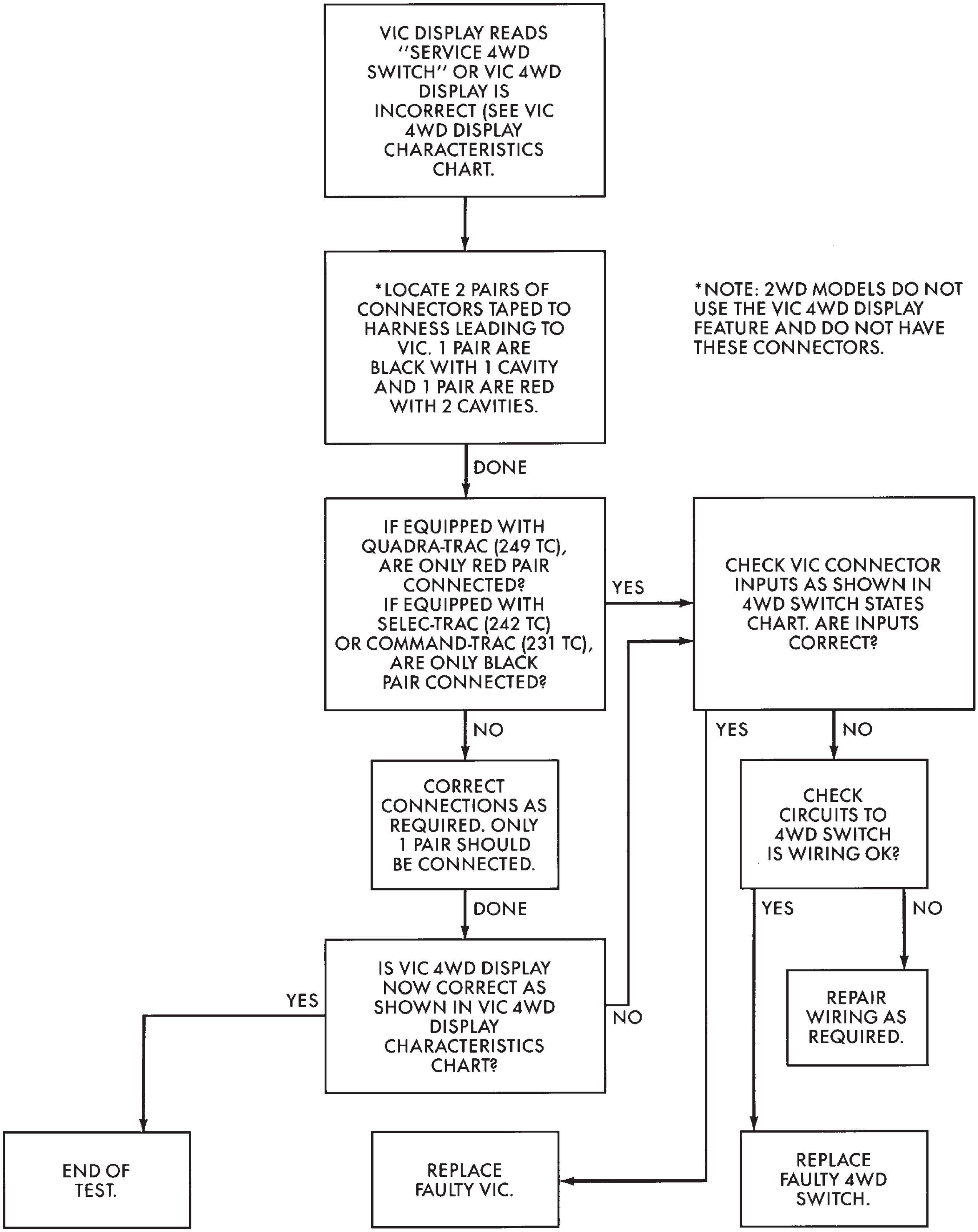
VIC FLUID LEVEL FAULT DIAGNOSIS

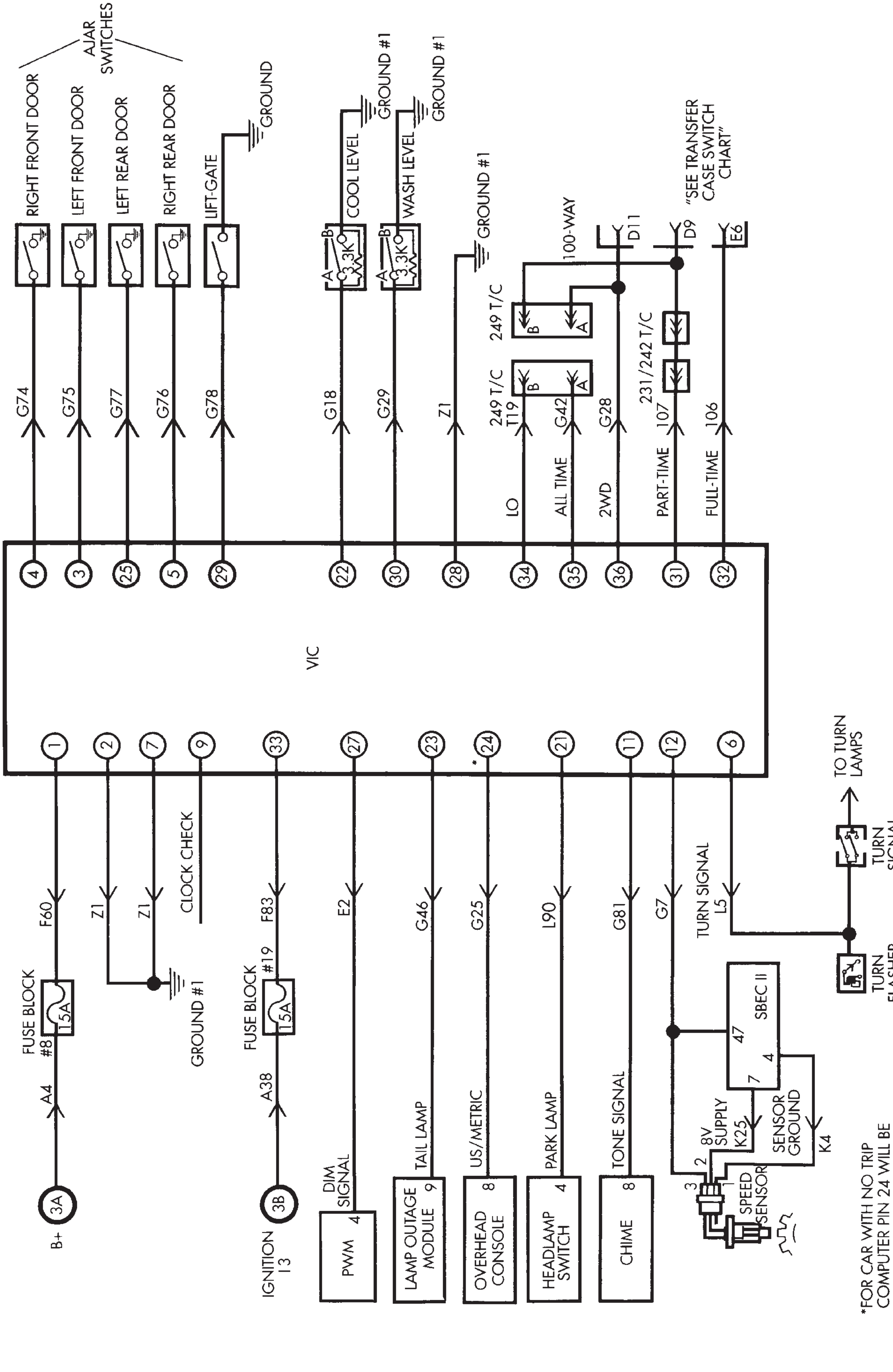


VIC REAR LAMP FAULT DIAGNOSIS



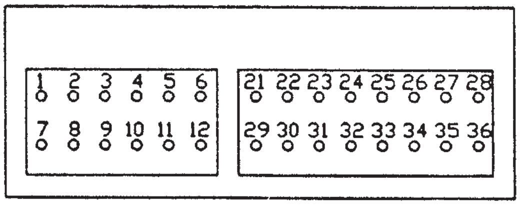
VIC 4WD DISPLAY FAULT DIAGNOSIS





VIC SYSTEM SCHEMATIC

VIC CONNECTOR



PIN #	SIGNAL	PIN #	SIGNAL
1	BATTERY	7	GROUND
2	GROUND	8	NOT CONNECTED
3	DRIVER DOOR	9	NOT CONNECTED
4	PASSENGER DOOR	10	NOT CONNECTED
5	RIGHT REAR DOOR	11	TONE
6	TURN SIGNAL	12	SPEED
21	PARK LAMP	29	LIFT-GATE
22	COOLANT	30	WASHER
23	LAMP OUT	31	PART-TIME
24	US / M	32	FULL-TIME
25	LEFT REAR DOOR	33	IGNITION
26	NOT CONNECTED	34	LO
27	ILLUMINATION	35	ALL-TIME
28	GROUND (GND)	36	2 WHEEL DRIVE (2WD)

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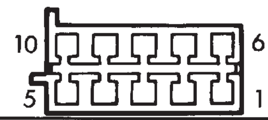
4WD SWITCH STATES

TRANSFER CASE SHIFT LEVER POSITION	VOLTS @ VIC CONNECTOR				
	PIN 36	PIN 35	PIN 34	PIN 32	PIN 31
4WD LO	0	0	0	5	5
ALL TIME	0	0	5	5	5
FULL TIME	0	5	5	0	5
PART TIME	0	5	5	5	0
2WD	0	5	5	5	5
NEUTRAL	5	5	5	5	5

J958E-35

LAMP OUTAGE MODULE CONNECTOR



LEFT BODY HARNESS LAMP OUTAGE MODULE	
NO.	IDENTIFICATION
1	NOT USED
2	BRAKE LAMP SWITCH OUTPUT
3	PARK LAMP SWITCH OUTPUT
4	PARK LAMP SWITCH OUTPUT
5	PARK LAMP SWITCH OUTPUT
6	BRAKE LAMP SWITCH OUTPUT
7	BRAKE LAMP SWITCH OUTPUT
8	BRAKE LAMP SWITCH OUTPUT
9	BRAKE LAMP OUT INDICATOR DRIVER
10	FUSED IGNITION SWITCH OUTPUT

J958E-44

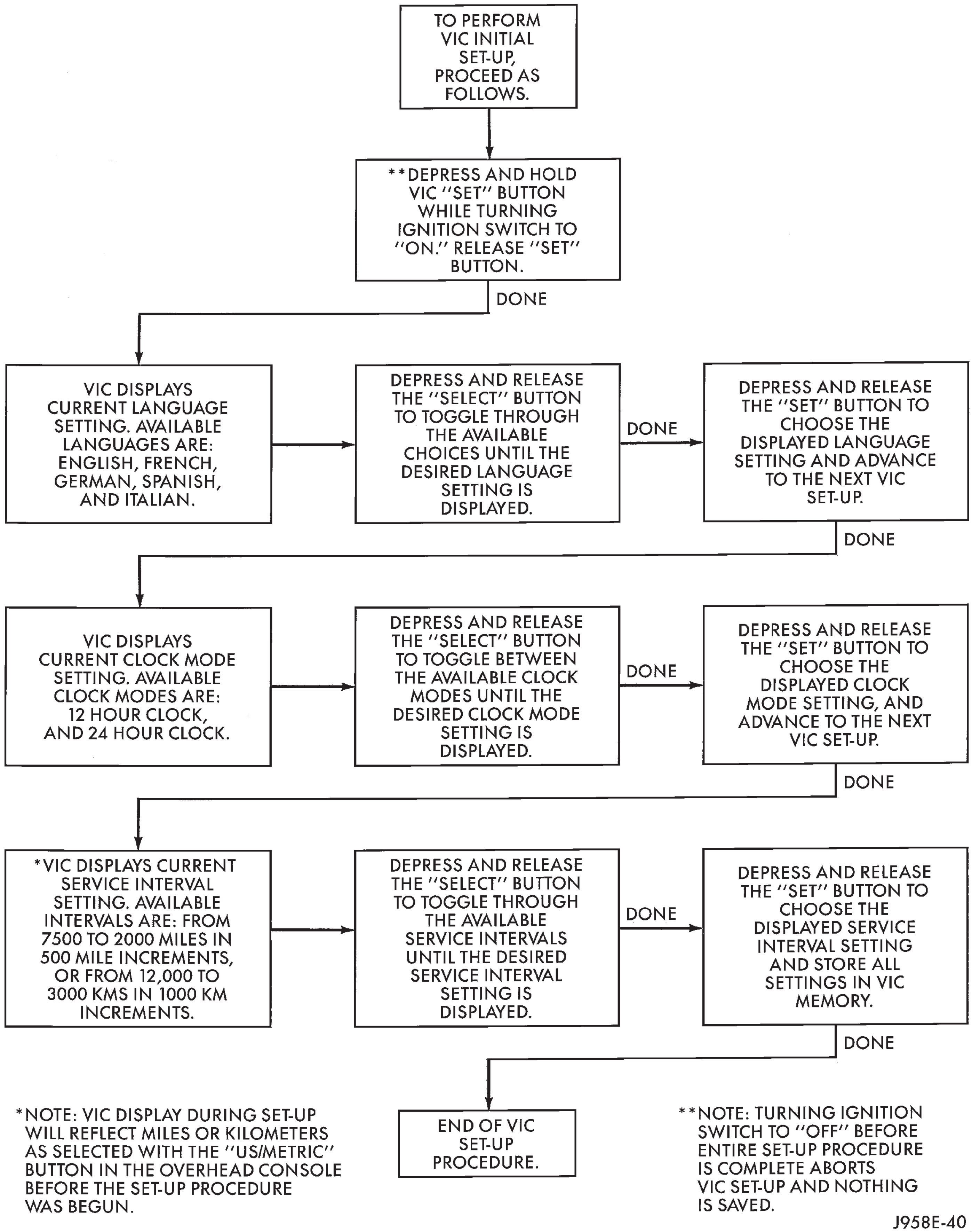
VIC 4WD DISPLAY CHARACTERISTICS

DRIVE SYSTEM (TRANSFER CASE)	VIC 4WD DISPLAY CHARACTERISTICS	TRANSFER CASE SHIFT LEVER POSITION				
		2WD	4 PART TIME	4 FULL/ALL TIME	NEUTRAL	4 LO
4WD QUADRA-TRAC (NP249)	Nomenclature	N/A	N/A	None	None	“LO”
	Lighted Wheels	N/A	N/A	All	None	All
4WD SELEC-TRAC (NP242)	Nomenclature	None	“PART TIME”	“FULL TIME”	None	“PART TIME”
	Lighted Wheels	Rear	All	All	None	All
4WD COMMAND- TRAC (NP231)	Nomenclature	None	“PART TIME”	N/A	None	“PART TIME”
	Lighted Wheels	Rear	All	N/A	None	All
2WD (NONE)	Nomenclature	None	N/A	N/A	N/A	N/A
	Lighted Wheels	None	N/A	N/A	N/A	N/A

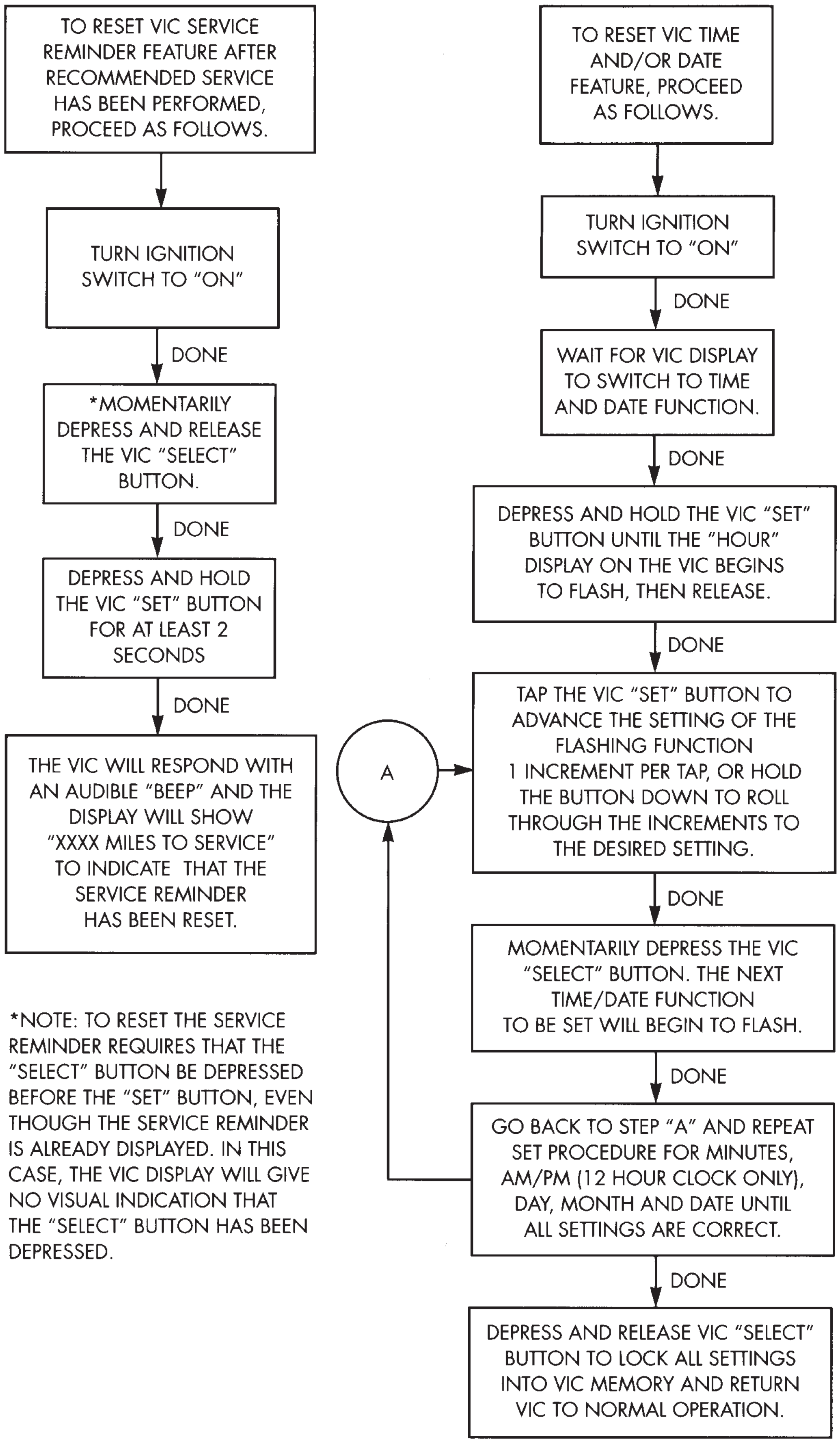
N/A=Not Applicable

J958E-42

VIC INITIAL SET-UP

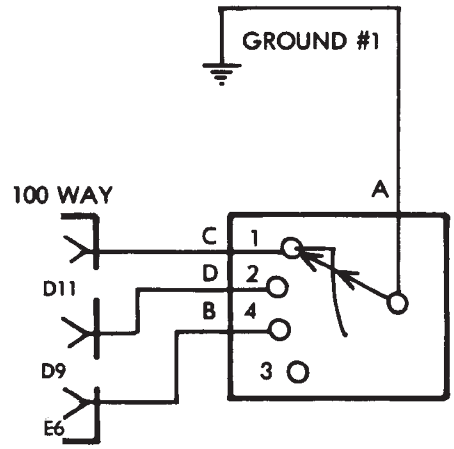


VIC RESET PROCEDURES



J958E-34

TRANSFER CASE SWITCHES



231 TRANSFER CASE (COMMAND-TRAC)

T/C POSITION	SWITCH POSITION
2WD	1
4 PART TIME	2
N	3
4 LO	2

242 TRANSFER CASE (SELEC-TRAC)

T/C POSITION	SWITCH POSITION
2WD	1
4 PART TIME	2
4 FULL TIME	4
N	3
4 LO	2

249 TRANSFER CASE (QUADRA-TRAC)

T/C POSITION	SWITCH POSITION
4 ALL TIME	1
N	3
4 LO	2

J948E-63

TRANSFER CASE SWITCHES

The transfer case switches used for the GDM and the VIC are the same. See the Transfer Case Switches chart to check switch operation for the appropriate transfer case. If switch is OK, see diagnosis for the GDM or VIC in this group, as required. Refer to Group 21 - Transmission and Transfer Case for switch service procedures.

SERVICE PROCEDURES

INSTRUMENT CLUSTER REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding center cluster bezel (Fig. 9).

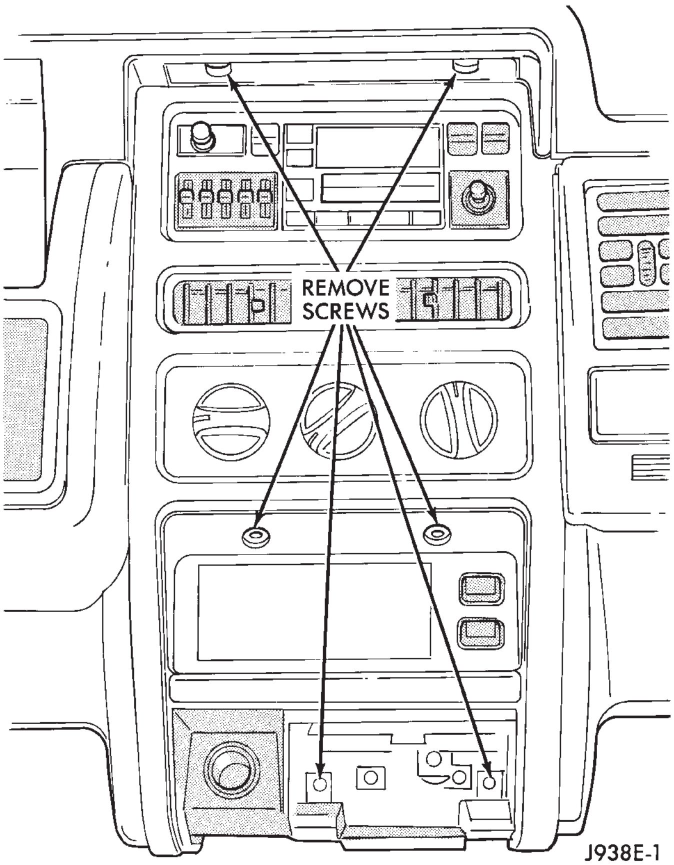


Fig. 9 Center Bezel Retaining Screws

(4) Remove center bezel.

(5) Remove 2 screws that were behind center bezel holding dash pad.

(6) Gently pry defroster grille out of dash pad.

(7) Unplug auto headlamp and sun sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 10).

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 11).

(10) Open glove box and remove 2 screws holding dash pad.

(11) Remove dash pad by pulling up to unsnap end clips.

(12) Remove 3 screws from the top of the cluster (Fig. 12).

(13) Lift cluster straight up far enough to allow access to connector. Unplug connector and remove cluster.

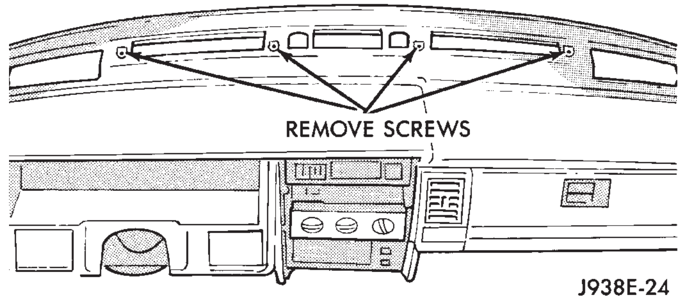


Fig. 10 Upper Dash Pad Attaching Screws

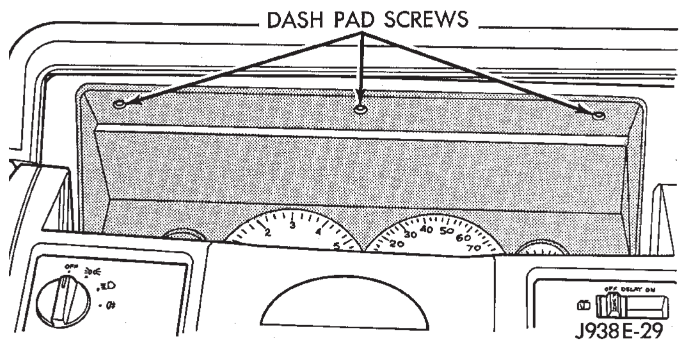


Fig. 11 Remove Screws Holding Dash Pad

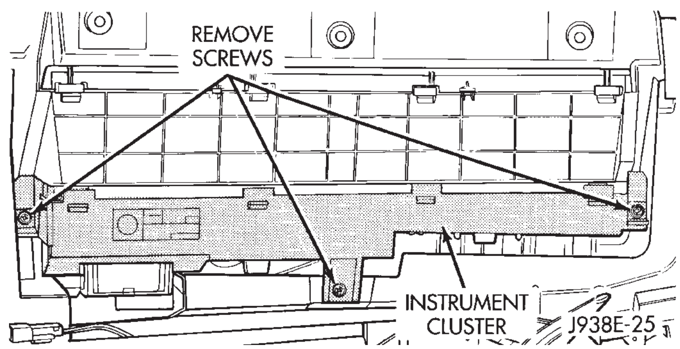


Fig. 12 Instrument Cluster Attaching Screws

(14) Reverse removal procedures to install.

GAUGES REMOVE/INSTALL

(1) Remove instrument cluster as described in Instrument Cluster Remove/Install.

(2) Remove 4 screws from bottom of lens and lift lens off from bottom (Fig. 13).

(3) Pull off trip odometer reset knob.

(4) Remove mask by lifting from bottom. Mask is snapped in along the top.

CAUTION: Do not touch the face of a gauge or the back of the lens with your finger. It will leave a permanent finger print.

(5) Remove the required gauge set attaching screws from the rear of mounting bezel (Fig. 14). Remove coolant temperature/oil pressure or voltmeter/

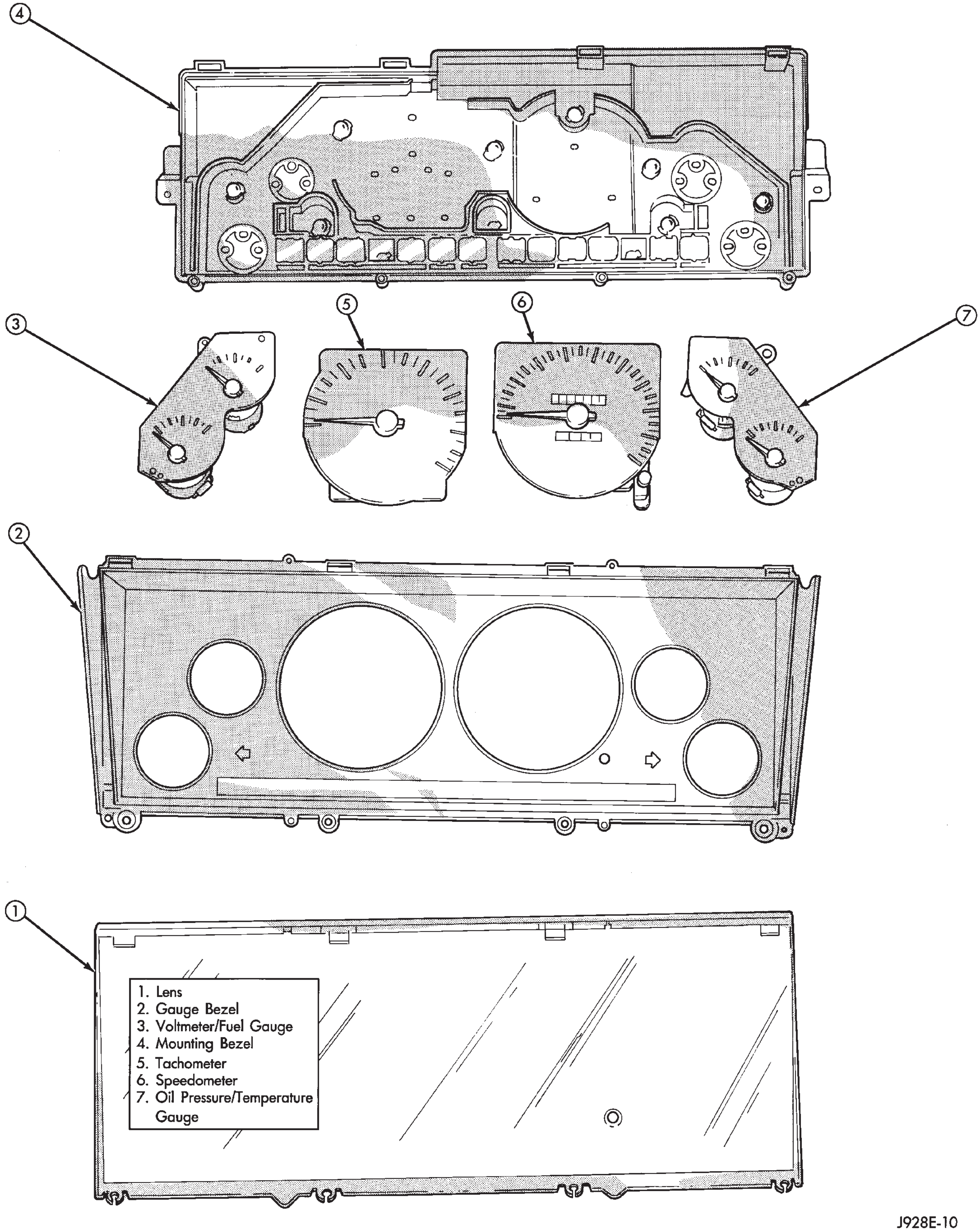


Fig. 13 Instrument Cluster

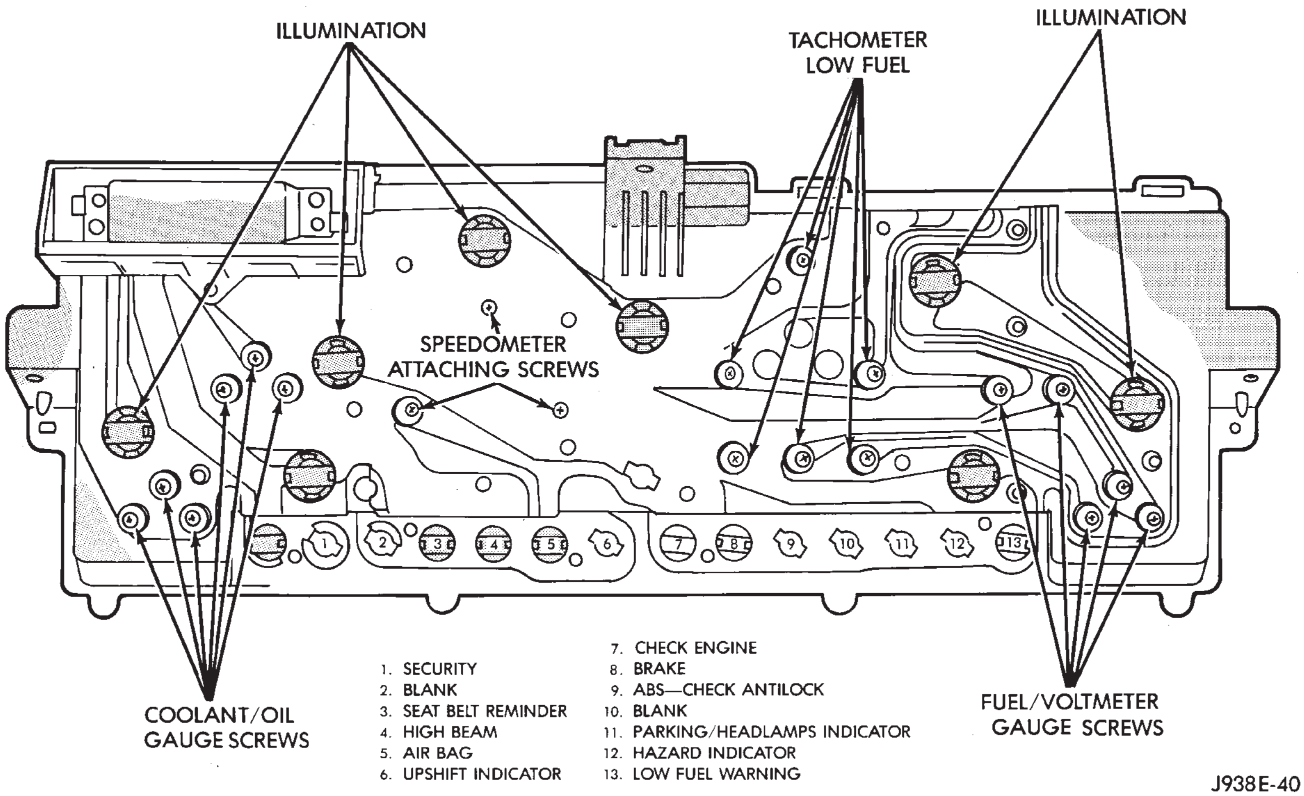


Fig. 14 Printed Circuit Remove/Install

fuel gauge set from front. Remove tachometer with printed circuit or speedometer/odometer with printed circuit from the back.

(6) Reverse removal procedures to install.

PRINTED CIRCUIT REMOVE/INSTALL

(1) Remove instrument cluster as described in Instrument Cluster Remove/Install.

(2) Remove 4 screws from bottom of lens and lift lens off from bottom.

(3) Pull off trip odometer reset knob.

(4) Remove mask by lifting from bottom. Mask is snapped in along the top.

CAUTION: Do not touch the face of a gauge or the back of the lens with your finger. It will leave a permanent finger print.

(5) Remove all attaching screws for gauges, tachometer, and speedometer that are contacting the printed circuit (Fig. 14).

(6) Remove 2 screws holding the cluster connector to the bezel (Fig. 15).

(7) Remove the lamp sockets from the circuit board.

(8) Lift the connector up to unfold the printed circuit (Fig. 16). Remove the printed circuit including the connector.

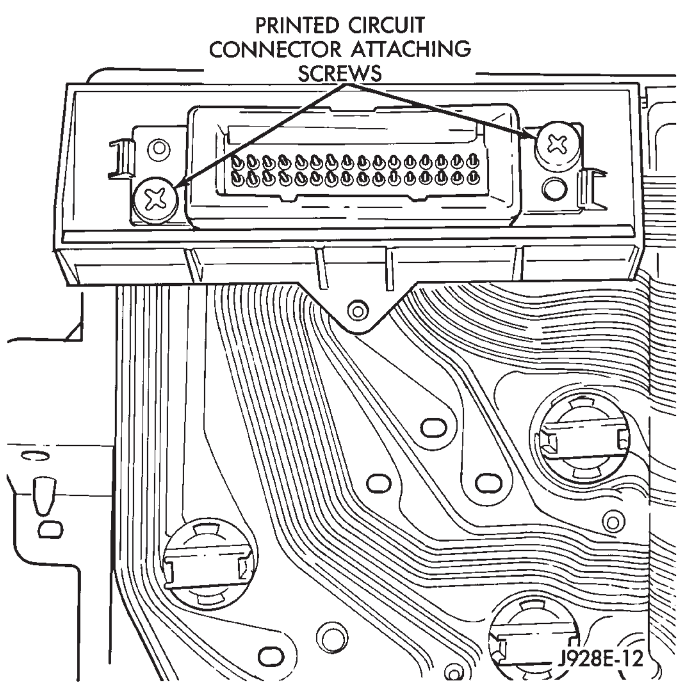


Fig. 15 Cluster Connector Retaining Screws

(9) Reverse the removal procedures to install.

SWITCH PODS REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

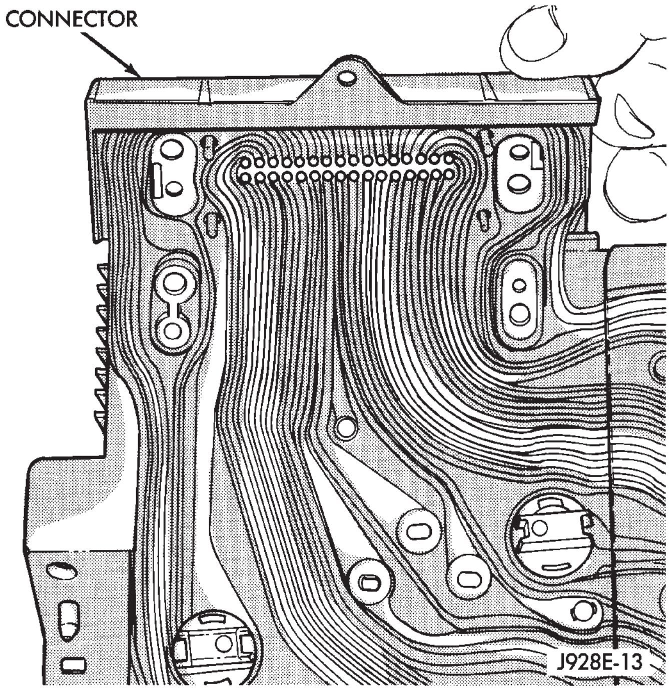


Fig. 16 Printed Circuit and Cluster Connector

(3) Remove 6 screws holding center cluster bezel (Fig. 17).

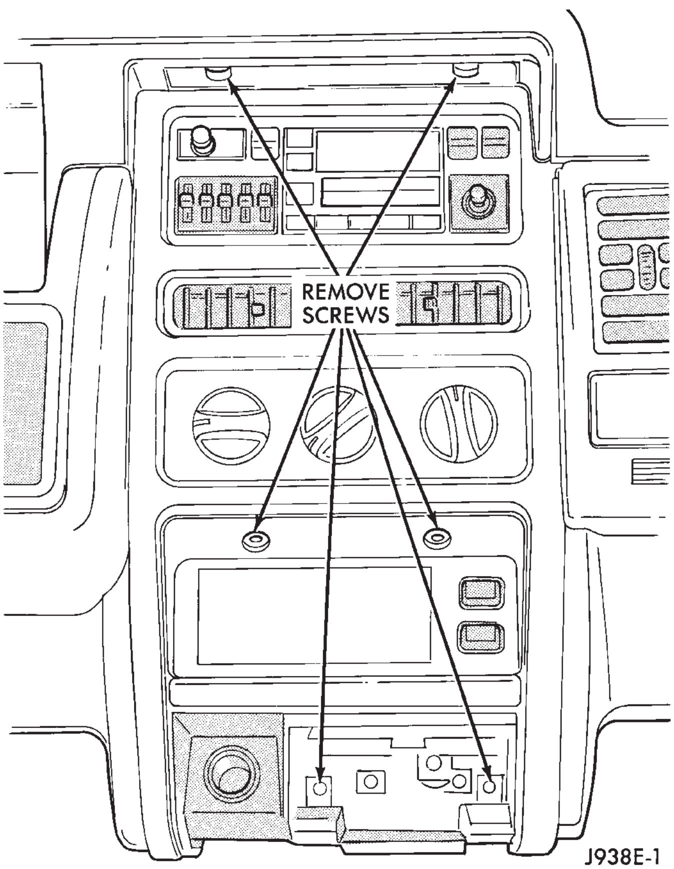


Fig. 17 Center Bezel Retaining Screws

(4) Remove center bezel.

(5) Remove 2 screws holding dash pad located behind top of center bezel.

(6) Gently pry defroster grille out of dash pad.

(7) Unplug automatic headlamp and sun sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 18).

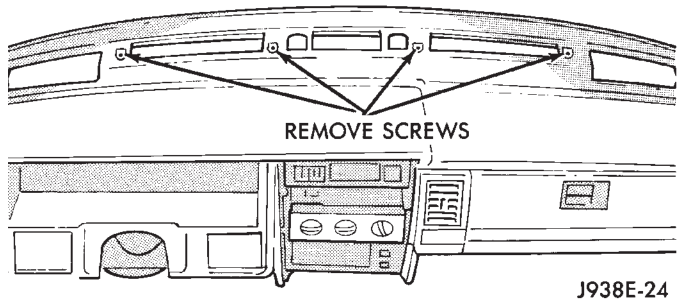


Fig. 18 Upper Dash Pad Attaching Screws

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 19).

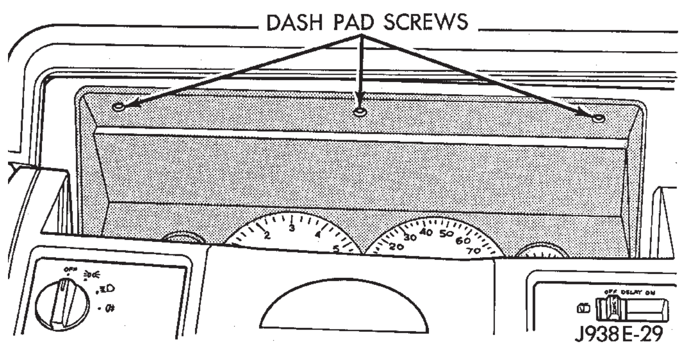


Fig. 19 Remove Screws Holding Dash Pad

(10) Open glove box and remove 2 screws holding dash pad.

(11) Remove dash pad by pulling up to unsnap end clips.

(12) With left front door open, remove 1 screw from the side of the lower trim panel (Fig. 20).

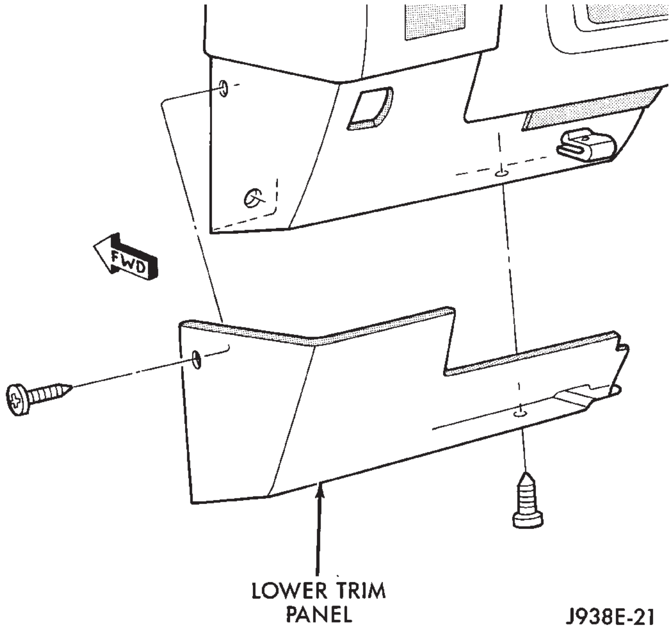


Fig. 20 Lower Trim Panel

(13) Remove 4 screws holding the steering column cover (Fig. 21).

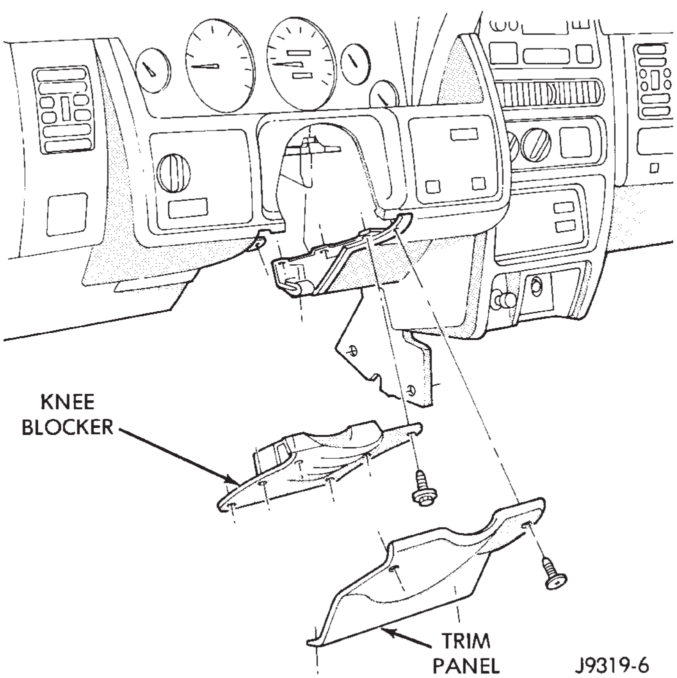


Fig. 21 Steering Column Cover and Knee Blocker

(14) Remove 1 screw from bottom of lower trim panel and pull panel off. There is also a clip holding the panel to the instrument panel.

(15) Remove 6 screws holding knee blocker.

(16) Remove steering column retaining nuts.

(17) Remove 3 screws holding bottom of bezels (Fig. 22).

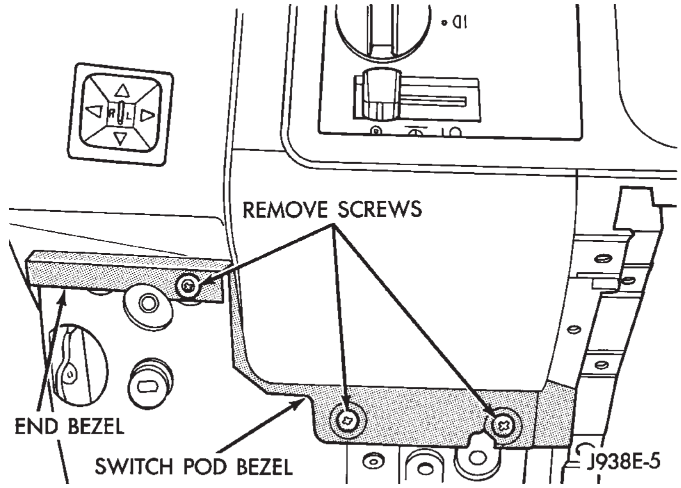


Fig. 22 Remove Screws Holding Bottom Of Bezels

(18) Remove 2 screws holding top of end and switch pod bezels (Fig. 23). The end bezel can now be removed.

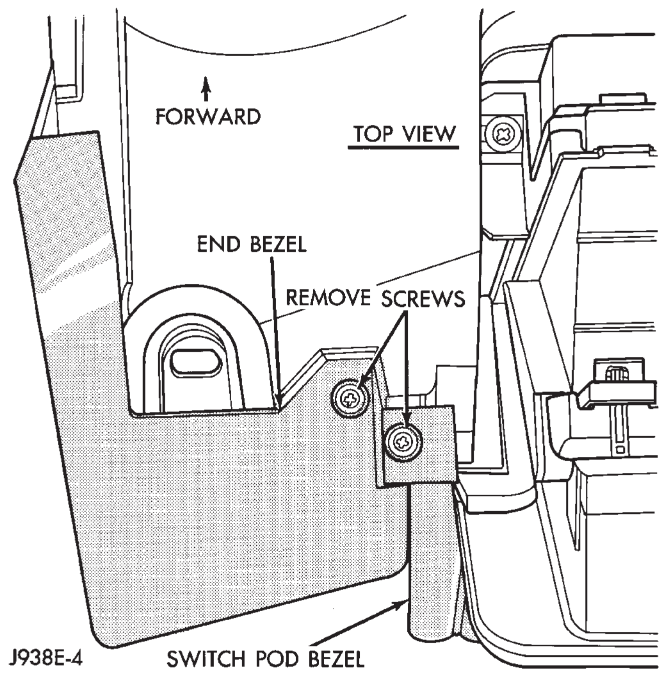


Fig. 23 Remove Screws Holding Top Of Bezels

(19) Remove 2 screws holding left side of switch pod bezel (Fig. 24).

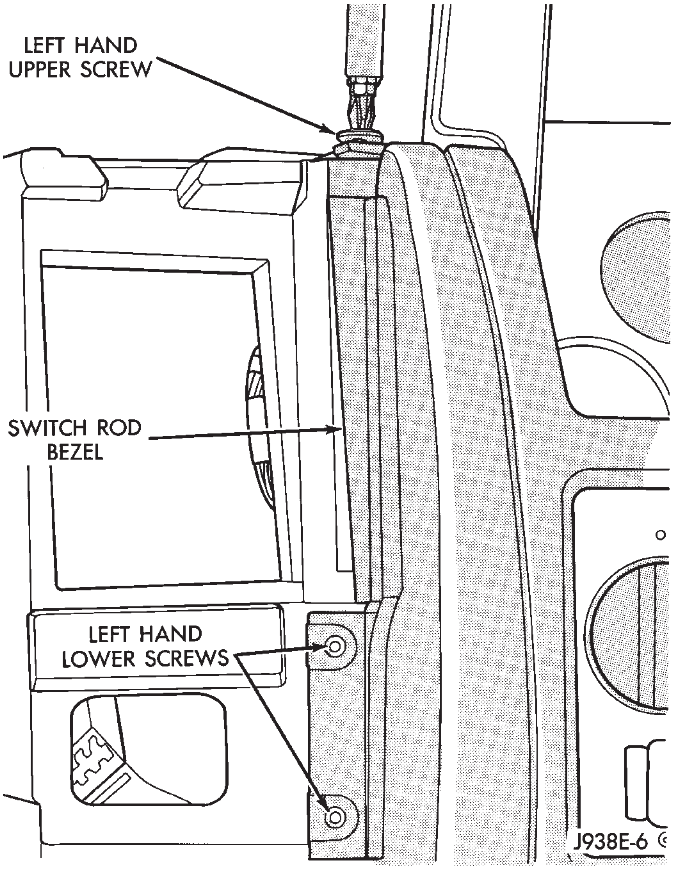


Fig. 24 Left Switch Pod Bezel Screws

(20) Remove 3 screws holding right side of switch pod bezel (Fig. 25).

(21) Pull switch pod bezel out far enough to remove switch connectors. Disconnect connectors from each switch pod and remove bezel (Fig. 26).

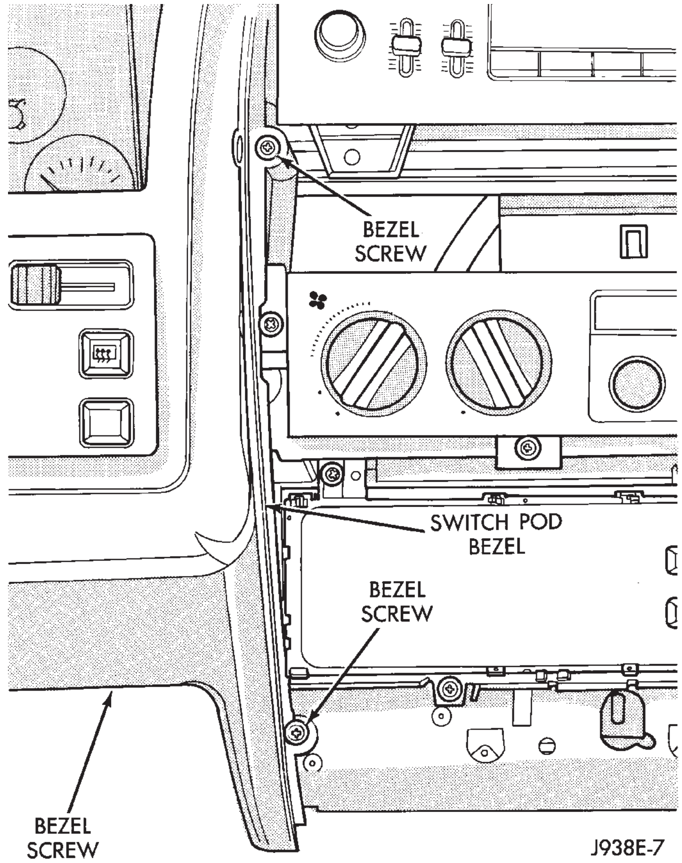


Fig. 25 Right Switch Pod Bezel Screws

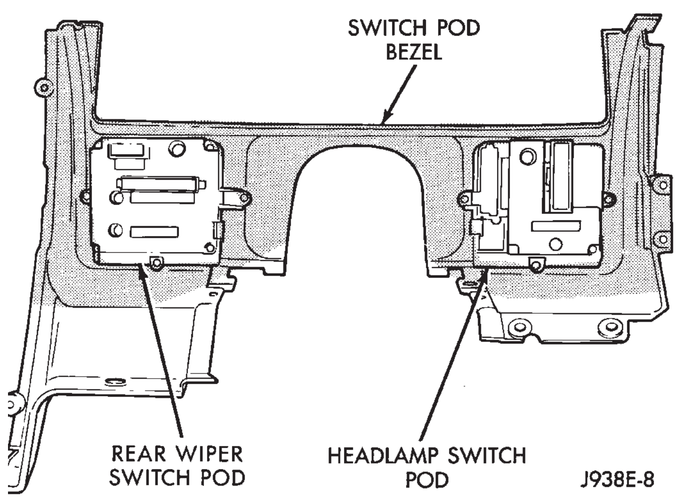


Fig. 26 Rear View of Switch Pod Bezel

(22) Remove required switch attaching screws and switch.

(23) Reverse removal procedures to install. Tighten steering column retaining nuts to 105 in. lbs. (12 N·m).

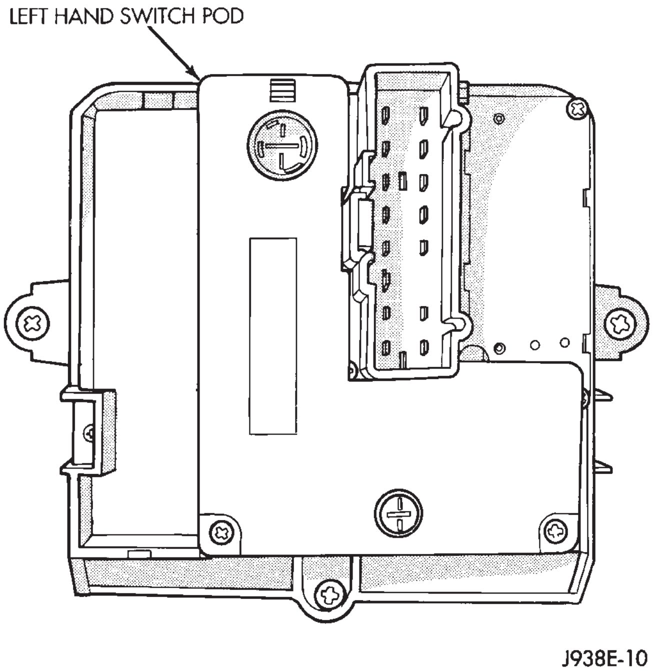


Fig. 27 Rear View of Left Switch Pod

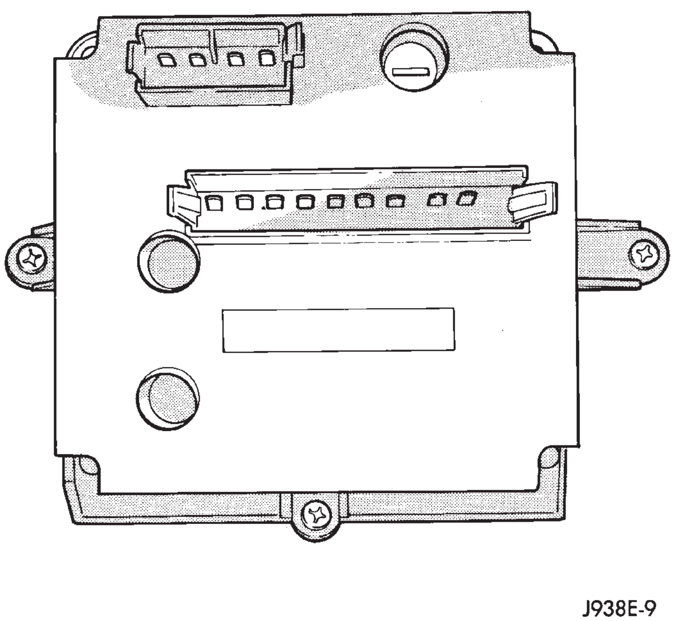


Fig. 28 Rear View of Right Switch Pod

GDM/VIC REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding center cluster bezel (Fig. 29).

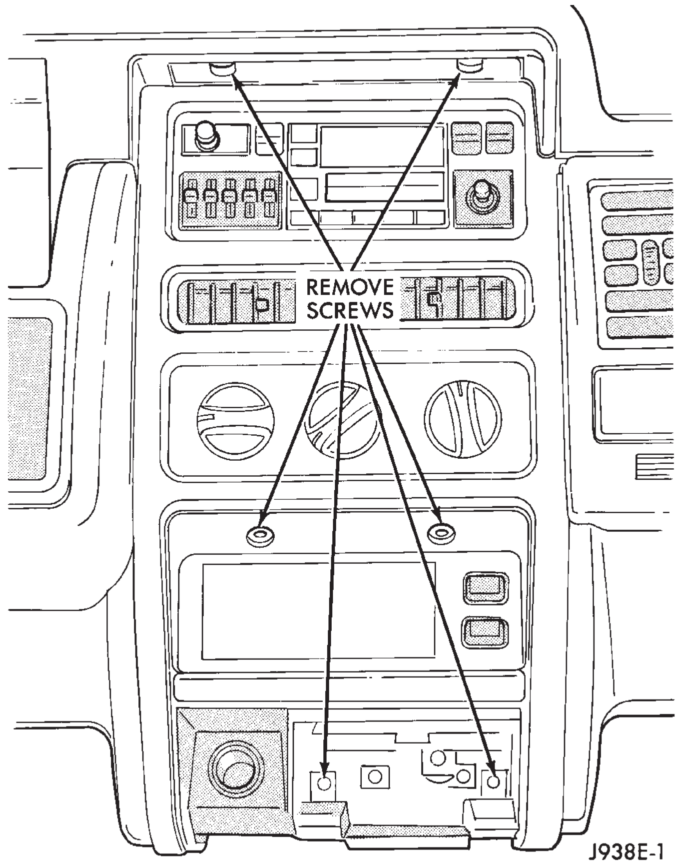


Fig. 29 Remove Center Bezel Retaining Screws

(4) Remove center bezel.

(5) Remove 3 screws holding GDM/VIC (Fig. 30).

(6) Pull module out far enough to unplug connector. Remove module.

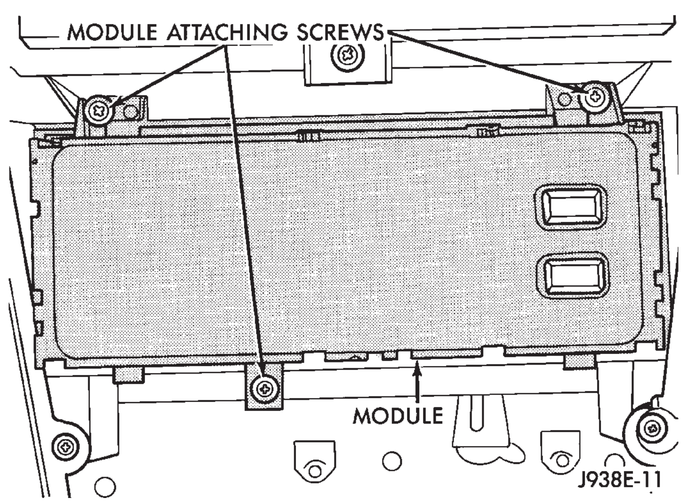
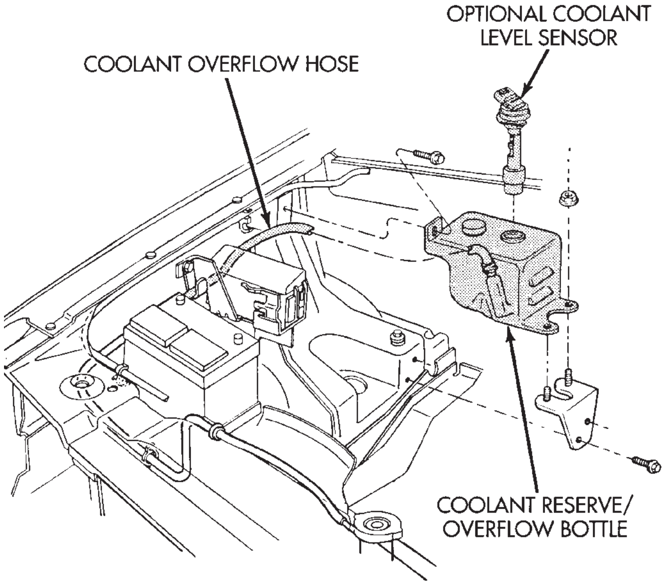
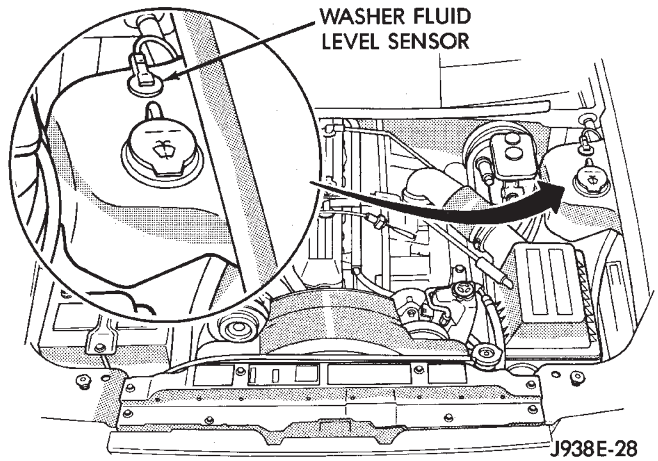


Fig. 30 Module Attaching Screws

COOLANT LEVEL SENSOR REMOVE/INSTALL



WASHER FLUID LEVEL SENSOR REMOVE/ INSTALL



SPECIFICATIONS

OIL PRESSURE GAUGE CALIBRATION

POINTER POSITION	RESISTANCE
0 psi Grad. ± 2°	1 ohm
40 psi Grad. ± 3½°	46.5 ohms
80 psi Grad. ± 3°	87 ohms

TEMPERATURE GAUGE CALIBRATION

POINTER POSITION	RESISTANCE
100°F Grad. ± 3½°	1365 ohms
210°F Grad. ± 2½°	115 ohms
260°F Grad. ± 2½°	55.1 ohms

FUEL GAUGE CALIBRATION

POINTER POSITION	RESISTANCE
Empty Grad. +0° −5°	105 ohm
1/2 Full Grad. ± 5°	32.5 ohms
Full Grad. + 5° −0°	5 ohms

VOLTMETER CALIBRATION

VOLTAGE INPUT	POINTER POSITION
12V	12V Grad. ± 6°
16V	16V Grad. ± 3°

TACHOMETER CALIBRATION

FREQUENCY	INDICATION
66.7 HZ	2000 RPM ± 140
166.7 HZ	5000 RPM ± 140

SPEEDOMETER CALIBRATION

FREQUENCY	INDICATION
44.4 HZ	20 mph −1.5 +4.5
88.8 HZ	40 mph −1 +4
122.2 HZ	55 mph −.3 +3.3

J928E-7

AUDIO SYSTEMS

CONTENTS

GENERAL INFORMATION

Following are general descriptions of major components used in Grand Cherokee audio systems. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

RADIOS

Radio options for the Grand Cherokee models include an AM/FM/cassette, an AM/FM/CD with 5 band graphic equalizer, or an AM/FM/cassette with 5 band graphic equalizer. All receivers are stereo Electronically-Tuned Radios (ETR) and include a clock function. For more information on radio features, setting procedures, and control functions refer to the Sound System manual. The Sound System manual is included with the owner's manual in the vehicle glove box.

IGNITION-OFF DRAW FUSE

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is removed when the vehicle is shipped from the factory. This fuse feeds various accessories that require current when the ignition switch is in the OFF position, including the clock and radio station preset memory functions. The fuse is removed to prevent battery discharge during vehicle storage.

The IOD fuse should be checked if the radio station preset memory or clock functions are erratic or inoperative. The IOD fuse is located in the Power Distribution Center (PDC). Refer to label under PDC cover for IOD fuse identification.

SPEAKERS

The standard equipment speaker system includes four door-mounted full-range speakers. The premium Infinity Gold speaker option upgrades all the speakers to Infinity models. The Infinity Gold package includes two instrument panel-mounted tweeters, two front door-mounted mid-range, and two rear door-mounted coaxial speakers. The Infinity speakers are powered by a 120 watt amplifier mounted under the rear seat cushion.

ANTENNA

Standard equipment is a fixed-length stainless steel rod-type antenna mast, installed at the right front fender of the vehicle. A power antenna is included in the Infinity Gold speaker package. The antenna mast is connected to the center wire of the coaxial antenna cable and is not grounded to any part of the vehicle.

To eliminate static, the antenna base must have a good ground. The coaxial antenna cable shield (the outer wire mesh of the cable) is grounded to the antenna base and the radio chassis.

The power antenna is designed to raise automatically when both the ignition switch and the radio are turned ON. When the ignition is turned ON and the radio is turned OFF, the antenna will return to, or remain in, the retracted position. The power antenna is a telescoping type antenna, extended and retracted by a reversible electric motor.

The antenna is controlled by a combination of an external relay located in the relay center and two limit switches that are built into the antenna motor housing. There is a gear-operated cam system to activate the switches. The limit switches are used to open the motor circuits when the antenna mast reaches the full up or full down position.

The antenna cannot be adjusted to an intermediate position. It must be fully extended or retracted.

When the radio or ignition switch is turned OFF, the power antenna relay is de-energized. With the coil de-energized, battery voltage switches to the motor through the closed lower limit switch. The antenna then retracts until the lower limit switch opens.

The factory installed ETRs automatically compensate for radio antenna trim. Therefore, no antenna trimmer adjustment is required or possible when replacing the receiver or the antenna.

RADIO NOISE SUPPRESSION

Radio Frequency Interference (RFI) and Electro-Magnetic Interference (EMI) noise suppression is accomplished primarily through circuitry internal to the radio receivers. These internal suppression devices are only serviced as a part of the radio receiver.

External suppression devices that are serviceable and should be checked in the case of RFI or EMI noise complaints include the following:

- radio antenna base ground
- engine-to-body ground strap
- resistor-type spark plugs
- radio suppression-type secondary ignition wiring.

In addition, if the source of RFI or EMI noise is identified as a component on the vehicle (i.e.:generator, blower motor, etc.), the ground path for that component should be checked. If excessive resistance is found in that circuit, repair as required before considering any component replacement.

Fleet vehicles are available with an extra-cost RFI-suppressed Powertrain Control Module (PCM). This unit reduces interference generated by the PCM on some radio frequencies used in two-way radio communications. However, this unit will not resolve complaints of RFI in the commercial AM or FM radio frequency ranges.

ON-BOARD DIAGNOSTIC SYSTEM

The DRB scan tool may be used to test the audio system. Refer to the appropriate Diagnostic Procedures manual for more information.

DIAGNOSIS

POWER ANTENNA

(1) Remove power antenna relay from relay center. Turn ignition switch to ON position. Connect a jumper wire between the relay connector cavities 2 and 4. Continue with next step.

(2) Connect another jumper wire between relay connector cavities 6 and 1. The antenna should go up. If not OK, replace power antenna.

(3) Move the jumper wire between relay connector cavities 2 and 4 to between cavities 2 and 5. Continue with next step.

(4) Move the jumper wire between relay connector cavities 6 and 1 to between cavities 4 and 1. The antenna should go down. If not OK, replace power antenna. If antenna operates up and down, replace the antenna relay.

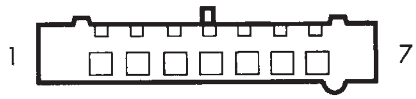
POWER ANTENNA RELAY

(1) Remove power antenna relay from relay center. Turn ignition switch to ON position and turn radio on. Measure the voltage at relay connector cavity 2. There should be 12 volts. If not, repair open to fuse 1.

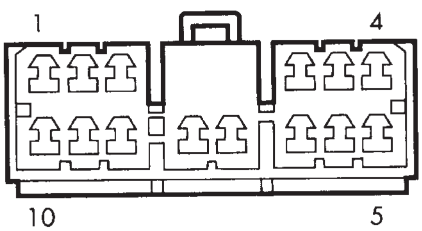
(2) Measure the voltage at relay connector cavity 3. There should be 12 volts. If not, repair open to right radio connector cavity 7.

(3) Turn radio off. Measure resistance between relay connector cavity 1 and a good ground. Meter should read zero ohms. If OK, go to Power Antenna diagnosis in this group. If not OK, repair open to ground.

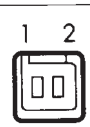
AUDIO SYSTEM CONNECTORS



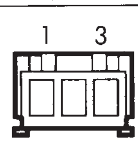
LEFT (GRAY) RADIO CONNECTOR	
NO.	CIRCUIT IDENTIFICATION
1	FUSED B+
2	ACCESSORY
3	PANEL LAMPS DRIVER
4	PARK LAMP SWITCH OUTPUT
5	RIGHT FRONT SPKR RETURN (–)
6	LEFT FRONT SPKR RETURN (–)
7	NOT USED



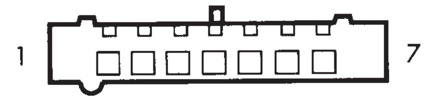
AMPLIFIER LT BODY HARNESS (14 PIN)	
NO.	CIRCUIT IDENTIFICATION
1	AMPLIFIED LEFT REAR FEED (+)
2	FUSED FEED TO AMPLIFIER
3	AMPLIFIED LEFT FRONT FEED (+)
4	NOT USED
5	LEFT REAR (+) FROM RADIO
6	LEFT FRONT (+) FROM RADIO
7	LEFT FRONT (–) FROM RADIO
8	LEFT REAR (–) FROM RADIO
9	NOT USED
10	GROUND
11	GROUND
12	AMPLIFIED LEFT FRONT RET (–)
13	FUSED FEED TO AMPLIFIER
14	AMPLIFIED LEFT REAR RET (–)



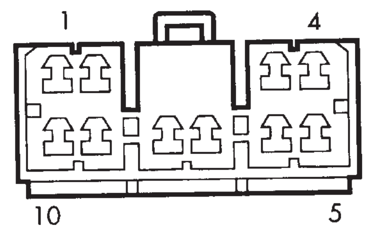
INSTRUMENT PANEL SPEAKER	
NO.	CIRCUIT IDENTIFICATION
1	AMPLIFIED RT/LT FRONT RET (–)
2	AMPLIFIED RT/LT FRONT FEED (+)



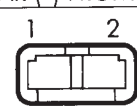
POWER ANTENNA MOTOR	
NO.	CIRCUIT IDENTIFICATION
1	PWR ANTENNA UP CONTROL
2	PWR ANTENNA DOWN CONTROL
3	PWR ANTENNA MOTOR (+/–)



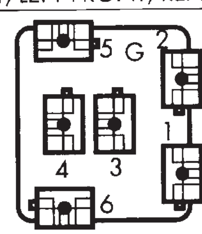
RIGHT (BLACK) RADIO CONNECTOR	
NO.	CIRCUIT IDENTIFICATION
1	RIGHT REAR SPKR RETURN (–)
2	LEFT REAR SPKR RETURN (–)
3	RIGHT FRONT SPKR FEED (+)
4	LEFT FRONT SPKR FEED (+)
5	RIGHT REAR SPKR FEED (+)
6	LEFT REAR SPKR FEED (+)
7	RADIO 12 VOLT OUTPUT



AMPLIFIER RT BODY HARNESS (14 PIN)	
NO.	CIRCUIT IDENTIFICATION
1	AMPLIFIED RIGHT FRONT FEED (+)
2	AMPLIFIED RIGHT FRONT RET (–)
3	AMPLIFIED RIGHT REAR FEED (+)
4	RIGHT FRONT (+) FROM RADIO
5	RIGHT FRONT (–) FROM RADIO
6	AMPLIFIED RIGHT REAR RET (–)
7	ENABLE SIGNAL TO AMPLIFIER
8	NOT USED
9	RIGHT REAR (+) FROM RADIO
10	RIGHT REAR (–) FROM RADIO



FRONT/REAR DOOR SPEAKER	
NO.	CIRCUIT IDENTIFICATION
1	RIGHT/LEFT FRONT/REAR FEED (+)
2	RIGHT/LEFT FRONT/REAR RET (–)



PWR ANTENNA RELAY (RELAY CENTER)	
NO.	CIRCUIT IDENTIFICATION
G1	GROUND
G2	FUSED B+
G3	RADIO 12 VOLT OUTPUT
G4	POWER ANTENNA MOTOR (+/–)
G5	PWR ANTENNA DOWN CONTROL
G6	PWR ANTENNA UP CONTROL

J958F-9

RADIO DIAGNOSIS

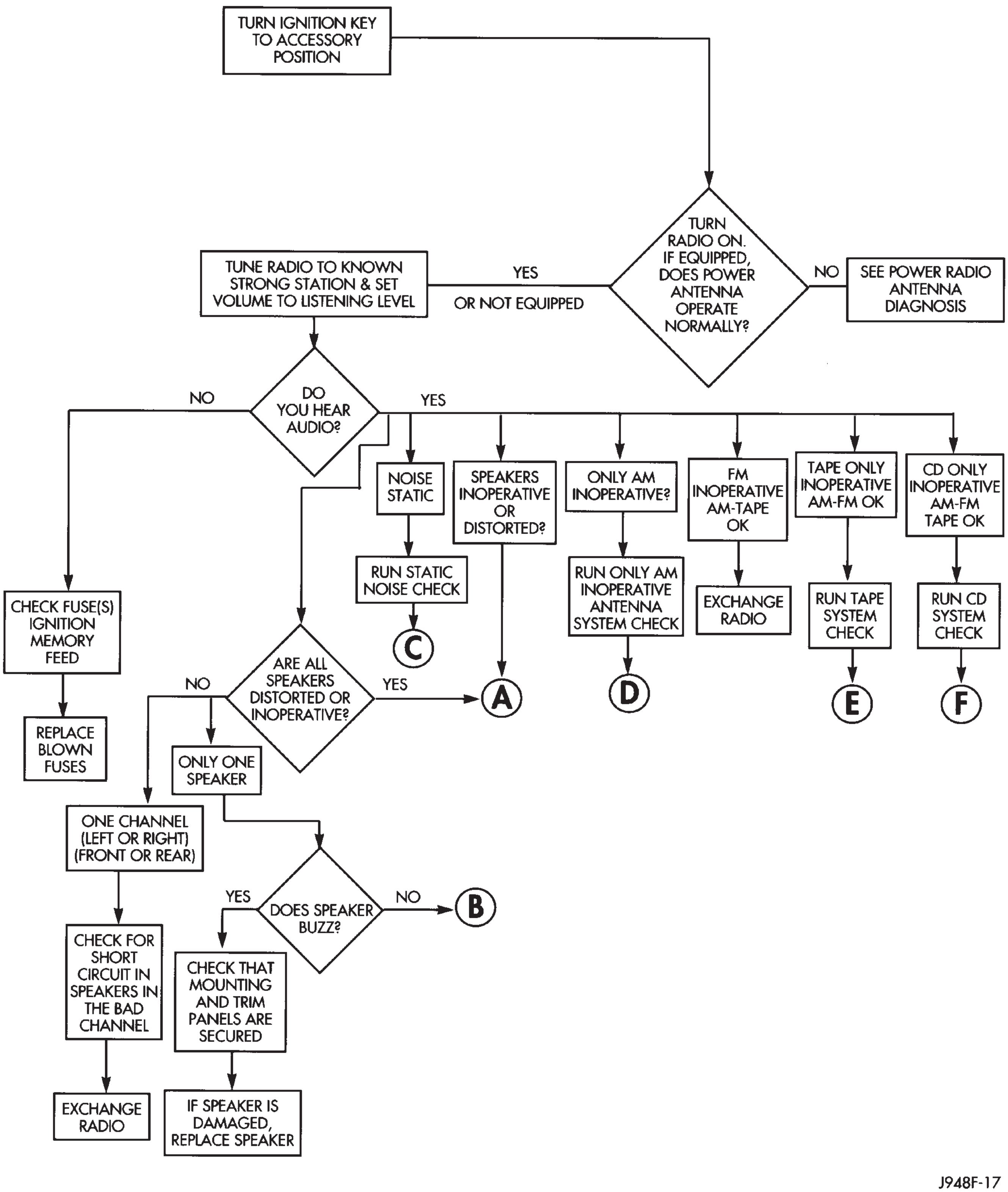


CHART A — INFINITY

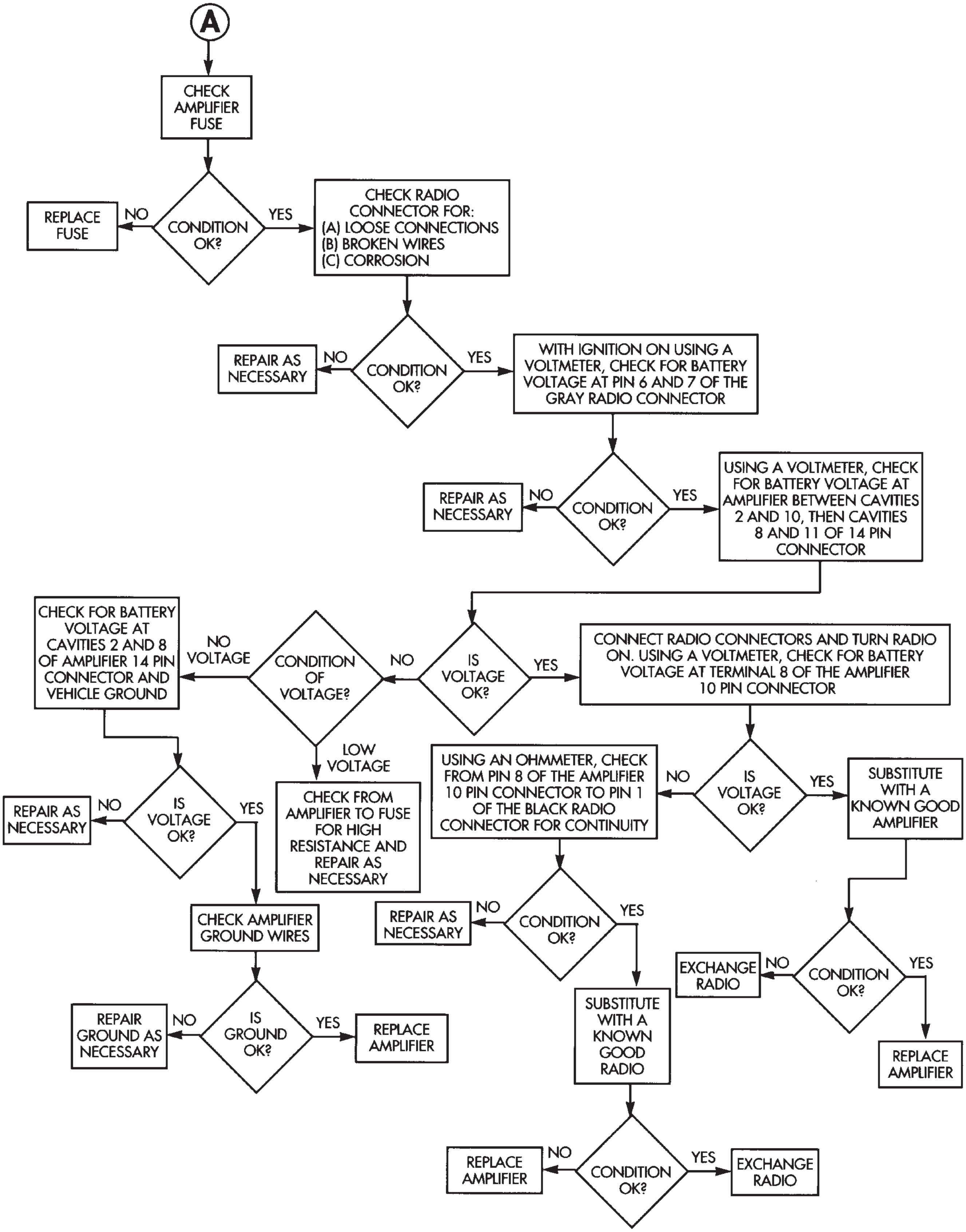


CHART B — INFINITY

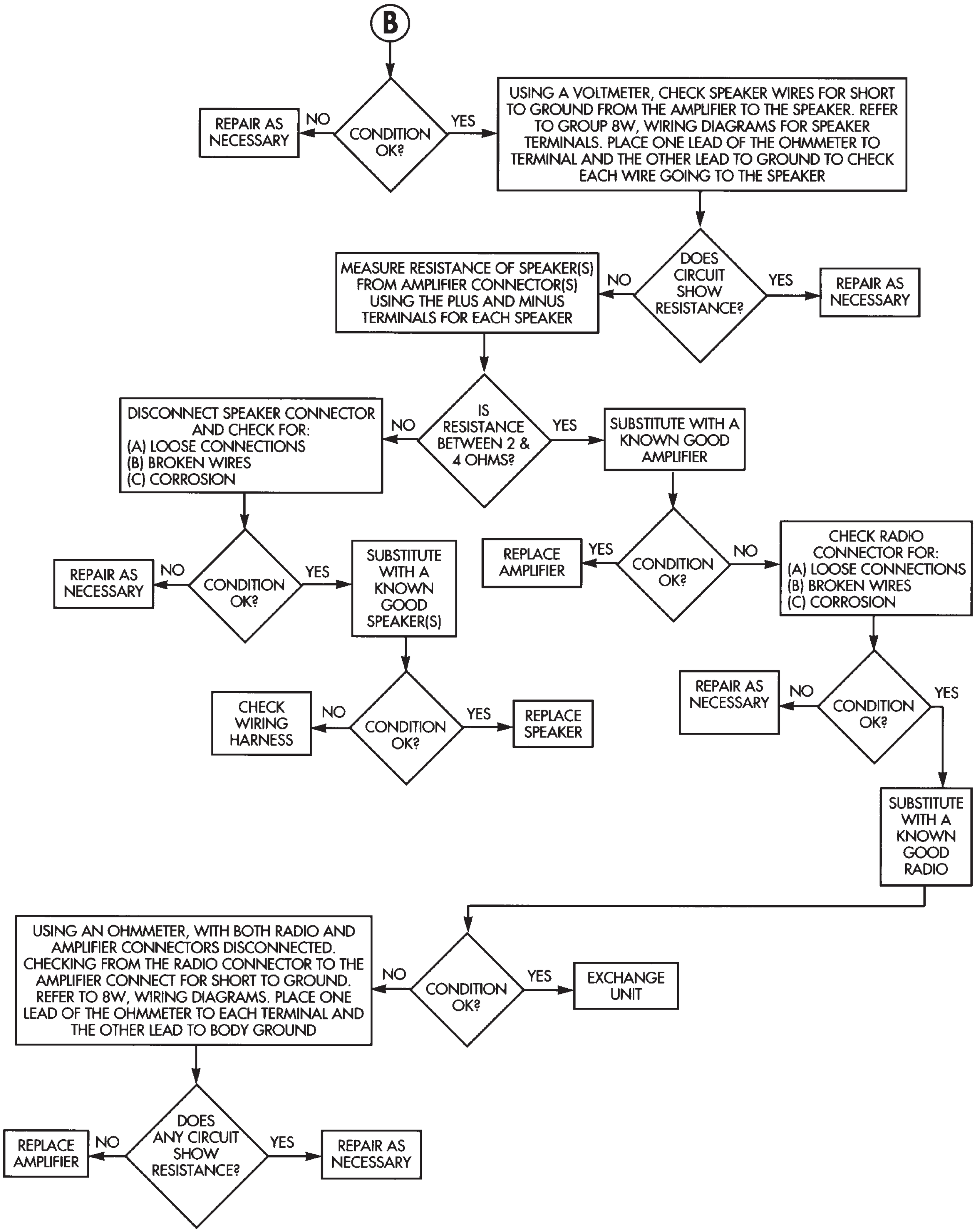


CHART A AND B — NON-INFINITY

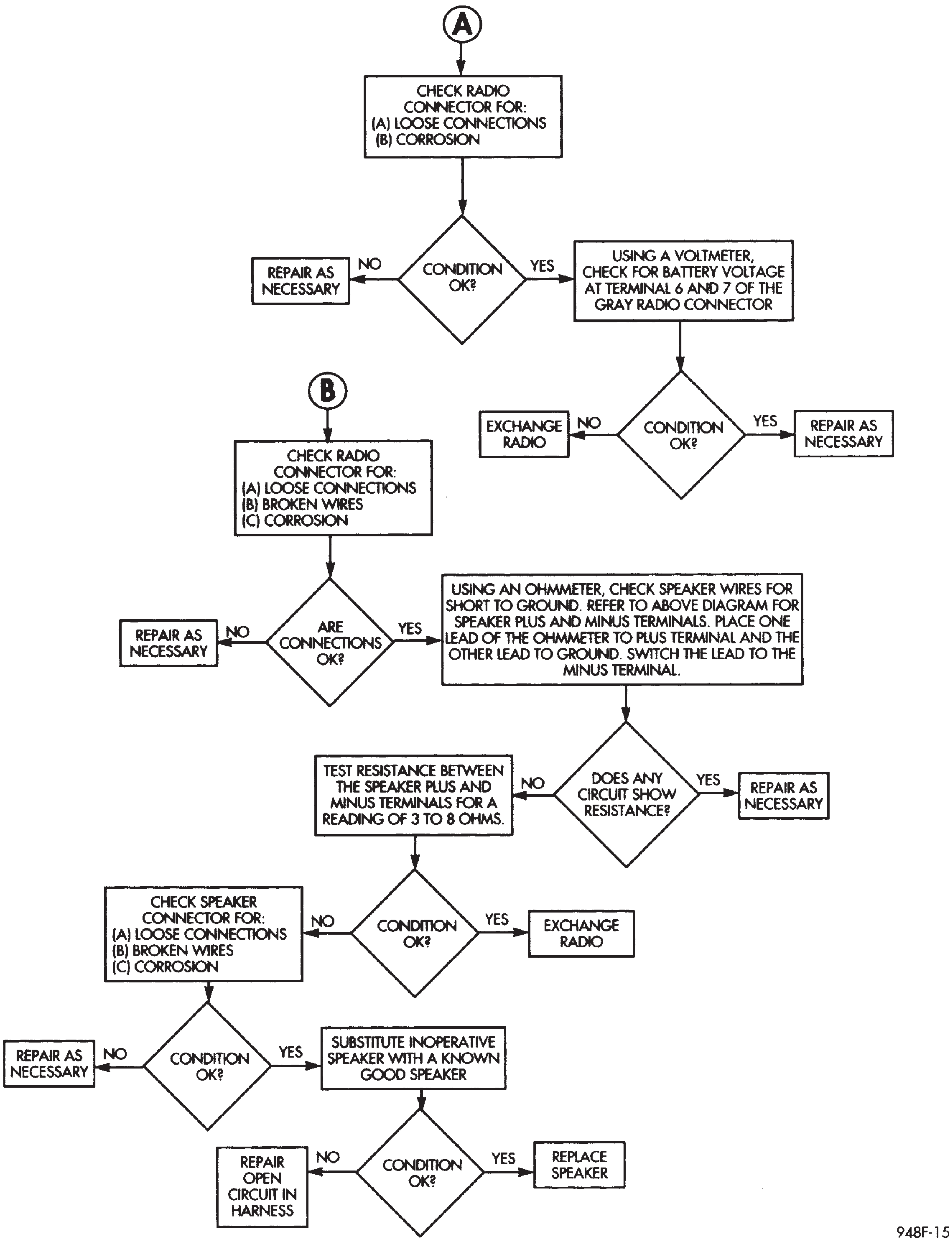


CHART C AND D — ALL RADIOS

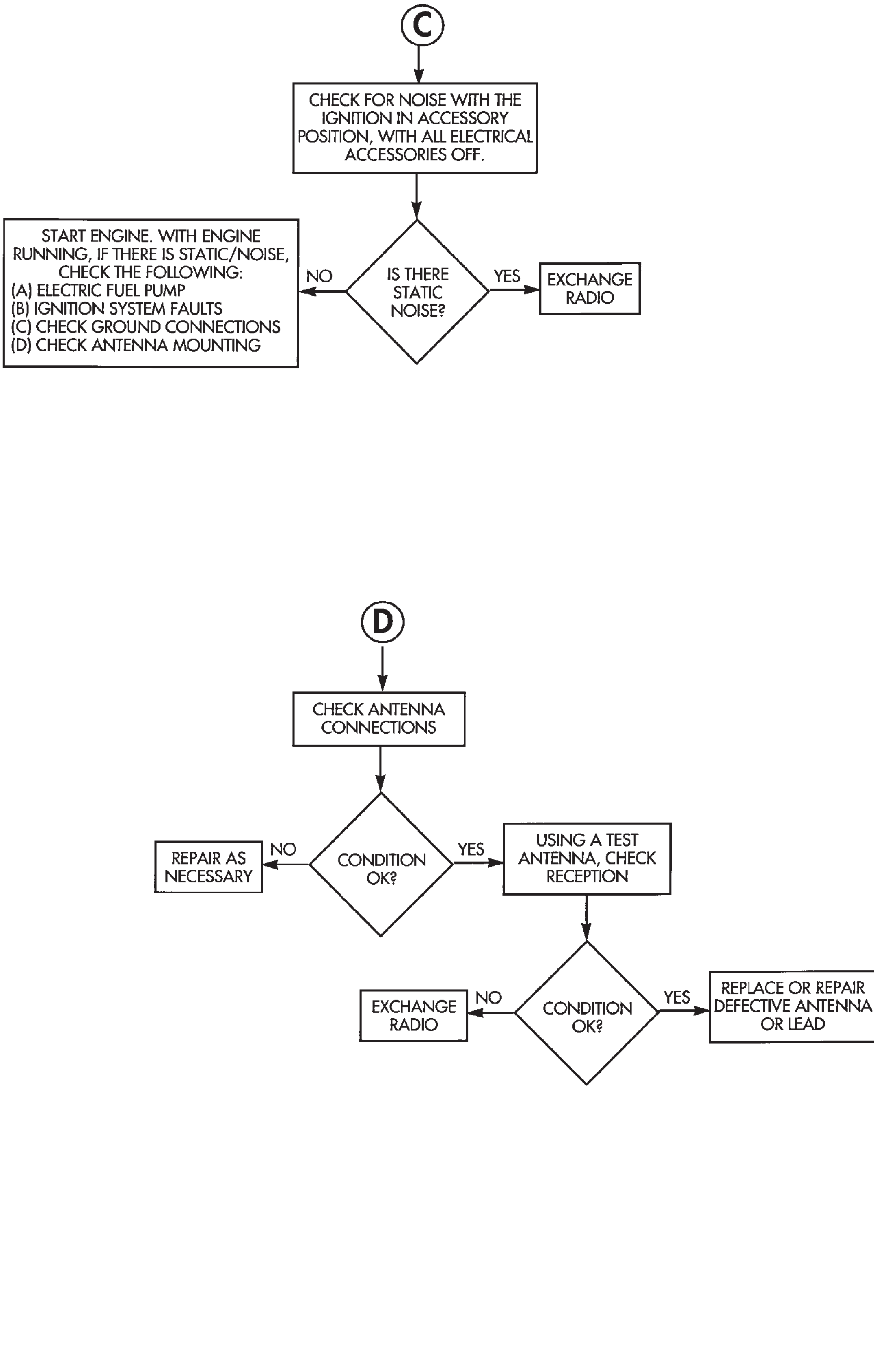


CHART E — ALL CASSETTE TAPE PLAYERS

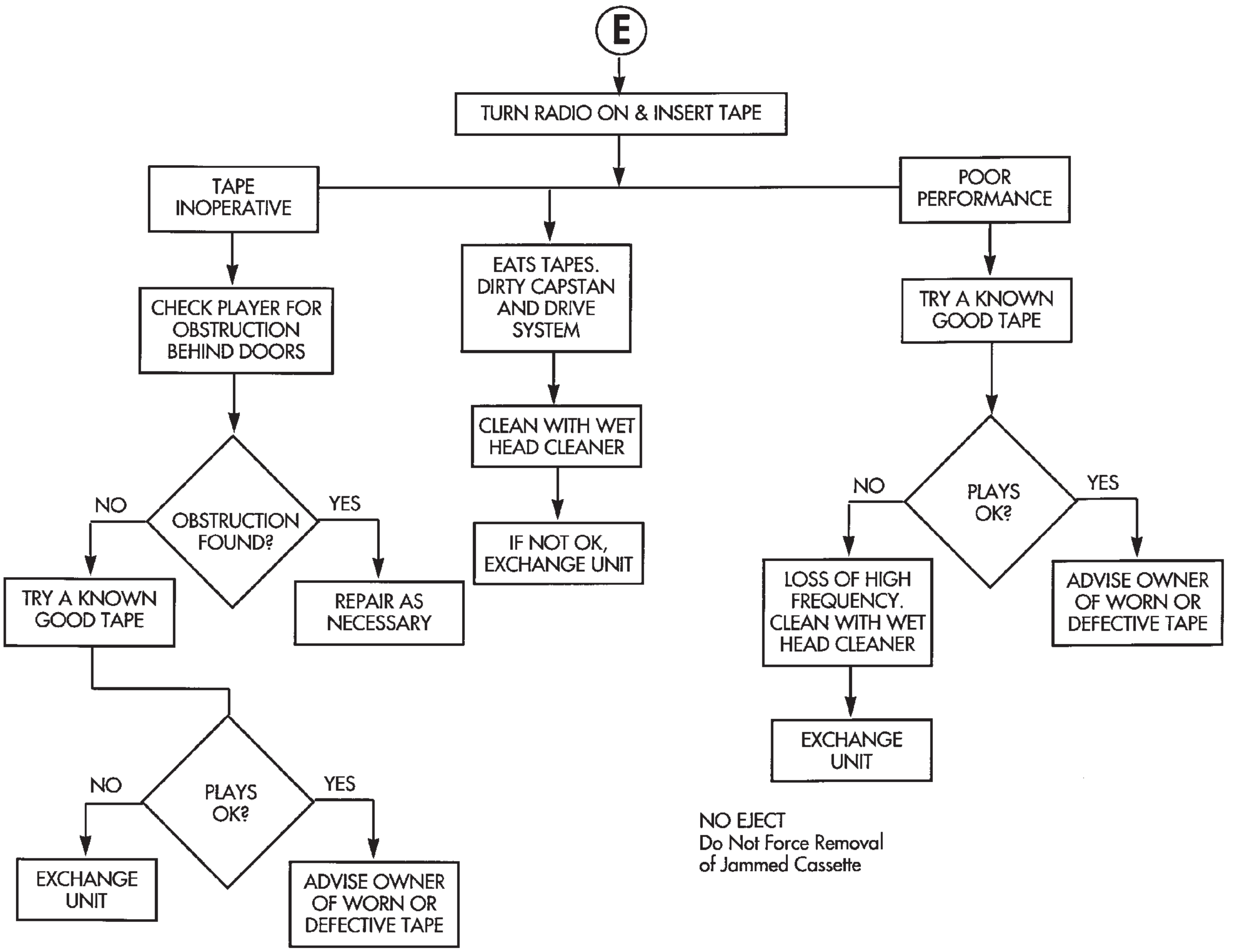
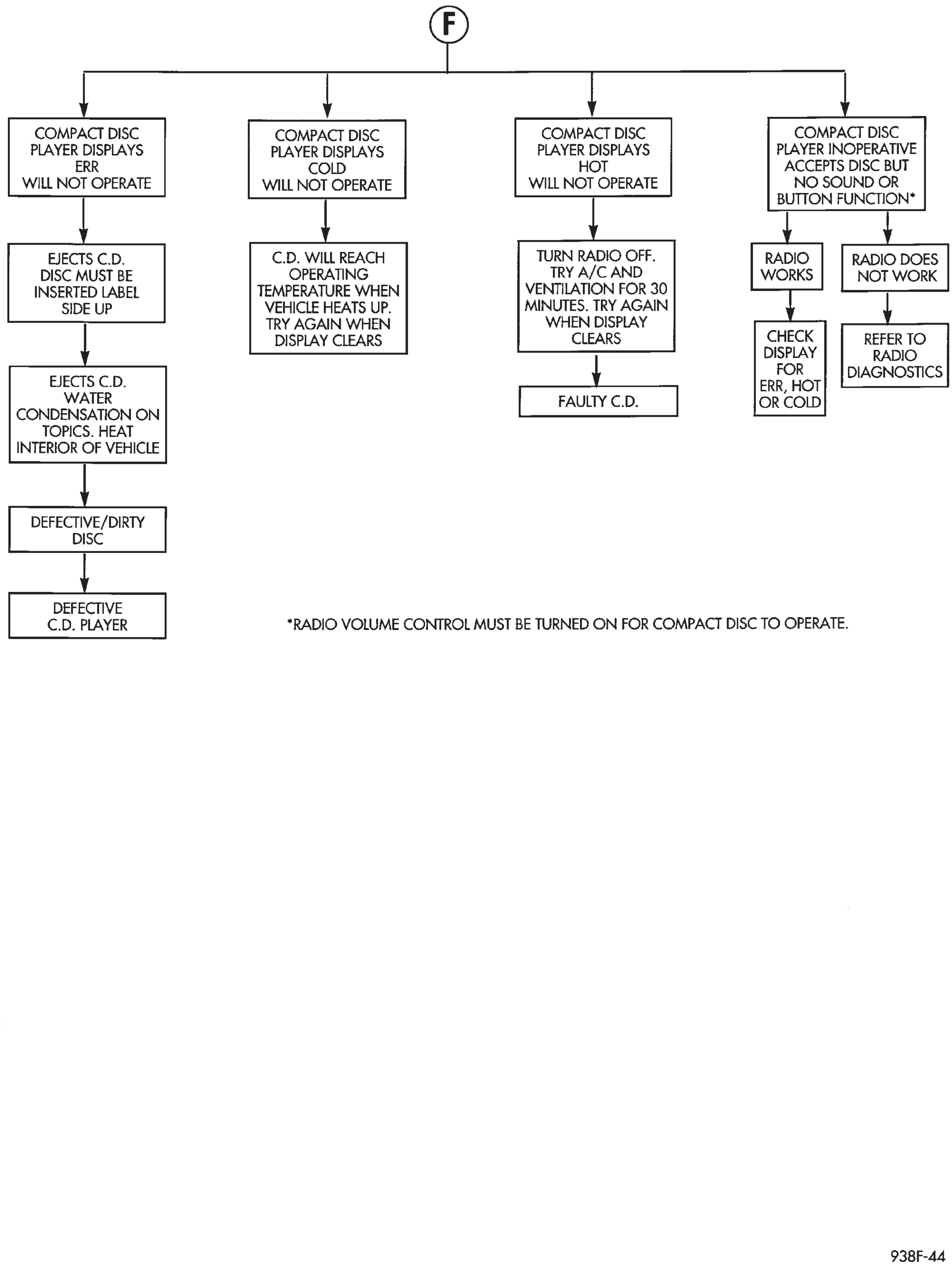


CHART F — ALL COMPACT DISC PLAYERS



SERVICE PROCEDURES

RADIO REMOVE/INSTALL

(1) Disconnect battery negative cable.
(2) Remove ash receiver.
(3) Remove 6 screws from center instrument cluster bezel assembly (Fig. 1).

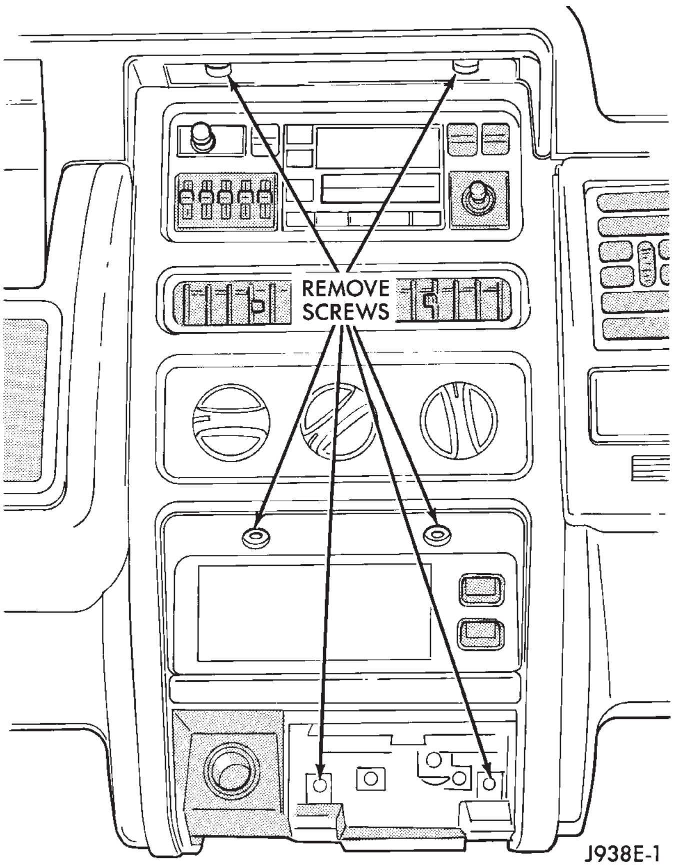


Fig. 1 Remove Center Bezel Retaining Screws

(4) Remove center bezel.
(5) Remove 2 screws from radio (Fig. 2).

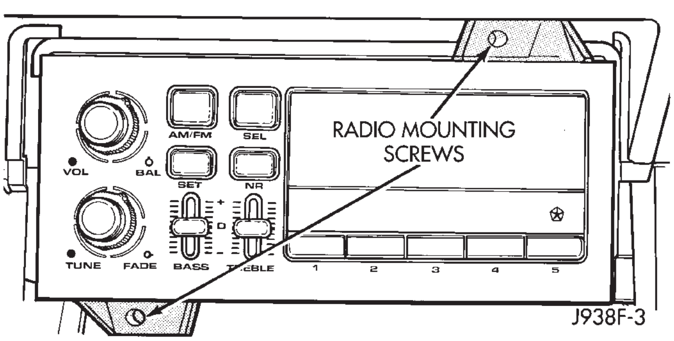


Fig. 2 Radio Remove/Install

(6) Pull radio out far enough to gain access to the ground terminal on the rear of the radio.
(7) Remove ground clip from terminal on rear of radio and remove radio.
(8) Reverse removal procedures to install.

AMPLIFIER REMOVE/INSTALL

(1) Disconnect battery negative cable.
(2) Disengage left rear seat cushion by pulling upward on release strap.
(3) Tilt seat cushion forward.
(4) Lift the carpeting in the underseat area far enough to access amplifier.
(5) Disconnect two wire harness connectors from amplifier (Fig. 3).

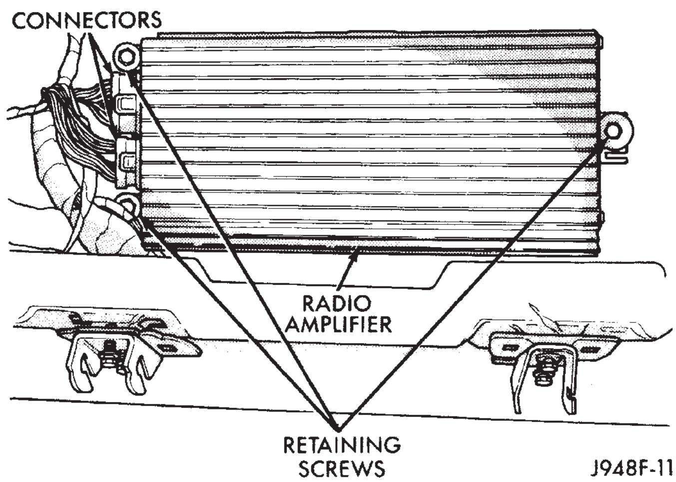


Fig. 3 Amplifier Remove/Install

(6) Remove three screws retaining amplifier to floor pan.
(7) Reverse removal procedures to install.

SPEAKERS REMOVE/INSTALL

DOORS

(1) Remove screw from demister opening at front of door (front door).
(2) Remove screw at top of trim panel near mirror (Fig. 4).
(3) Remove screw and door handle cover.
(4) Remove screw from under armrest.
(5) Remove screw from bottom of hand hold in armrest.
(6) Remove the trim panel with a wide, flat-bladed tool (Fig. 5).

To aid in removal of the trim panel, start at the bottom of the panel.

(7) Remove screws holding speaker in door.
(8) Pull speaker out far enough to unplug connector.

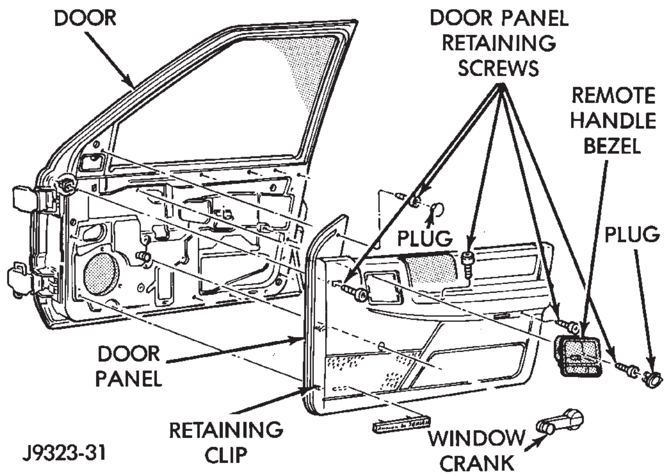


Fig. 4 Door Trim Panel Remove/Install

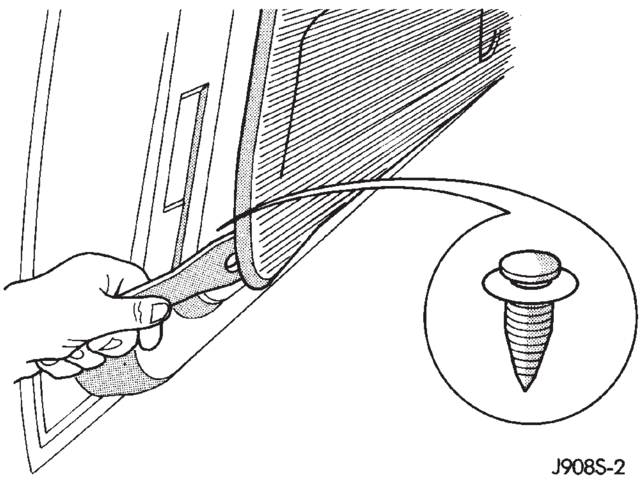


Fig. 5 Door Trim Panel Removal

(9) Reverse removal procedures to install.

INSTRUMENT PANEL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding center instrument cluster bezel (Fig. 6).

(4) Remove center bezel.

(5) Remove 2 screws holding dash pad located behind top of center bezel.

(6) Gently pry defroster grille out of dash pad.

(7) Unplug auto headlamp and sun sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 7).

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 8).

(10) Open glove box and remove 2 screws holding dash pad.

(11) Remove dash pad.

(12) Remove 2 screws holding tweeter (Fig. 9).

(13) Unplug tweeter connection and remove tweeter.

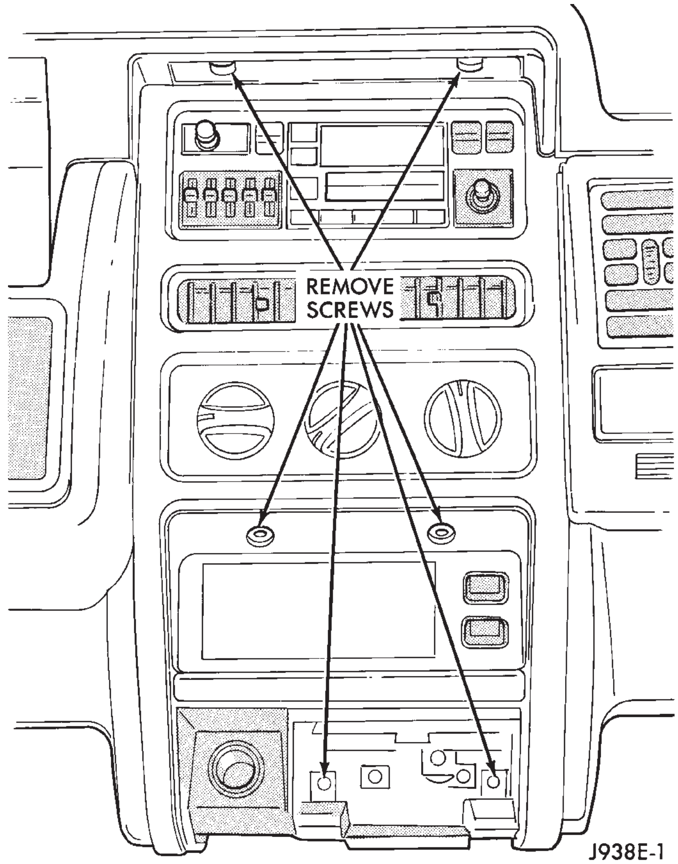


Fig. 6 Remove Center Bezel Retaining Screws

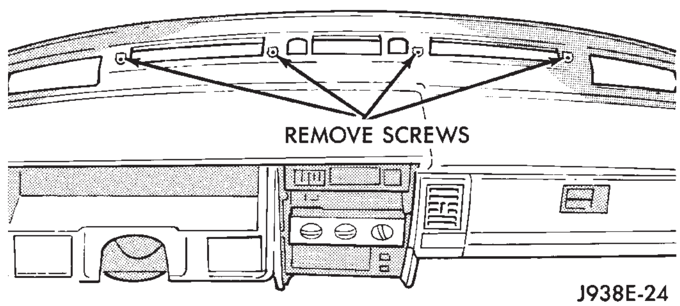


Fig. 7 Upper Dash Pad Attaching Screws

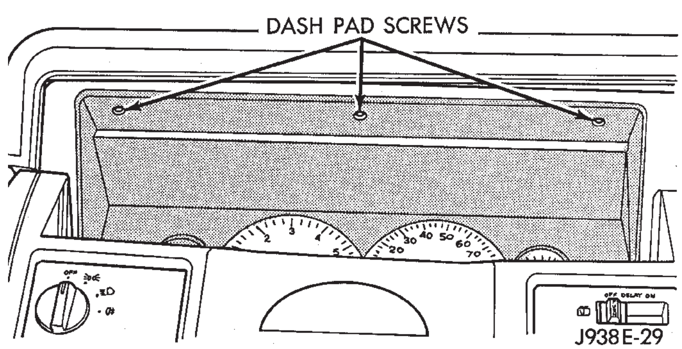


Fig. 8 Cluster Bezel to Dash Pad Screws

(14) Reverse removal procedures to install.

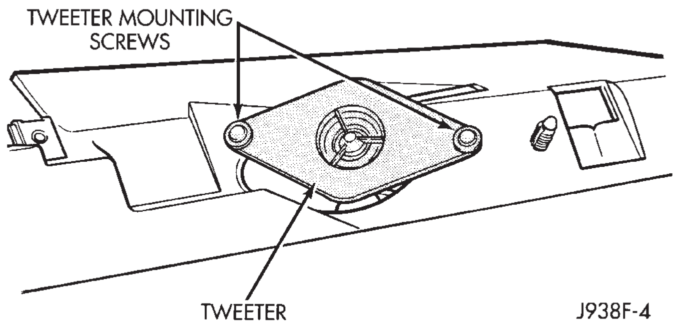


Fig. 9 Tweeter Remove/Install

ANTENNA REMOVE/INSTALL

FIXED

(1) Remove the right fender inner splash shield to gain access to the antenna base and cable.

(2) Remove the antenna mast, cap nut and escutcheon from the top of the fender (Fig. 10).

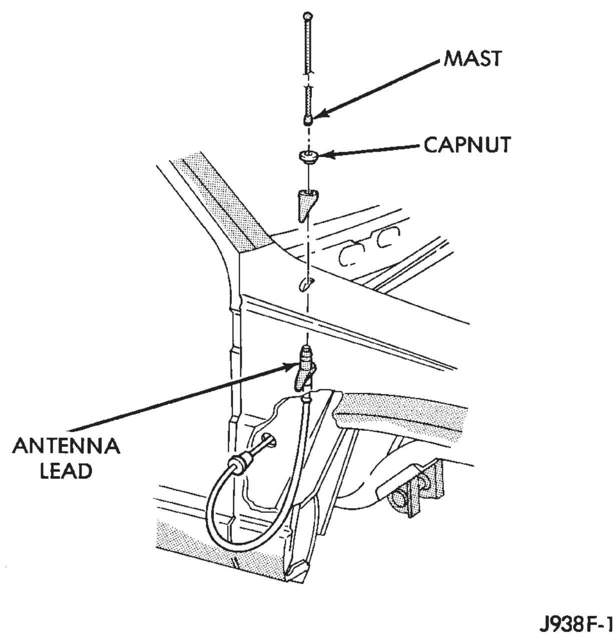


Fig. 10 Remove/Install Nut and Escutcheon

(3) Remove the passenger side cowl side trim panel.

(4) Disconnect the antenna lead (Fig. 11) by pulling apart while twisting the metal connectors. DO NOT PULL ON THE COAX CABLE.

(5) Pull the rubber grommet out of the cowl side panel.

(6) Remove the antenna assembly from inside the right fender wheel opening.

(7) Reverse removal procedures to install.

(8) Verify antenna and radio operation.

POWER

(1) Remove the right fender inner splash shield to gain access to the power antenna mounting screws.

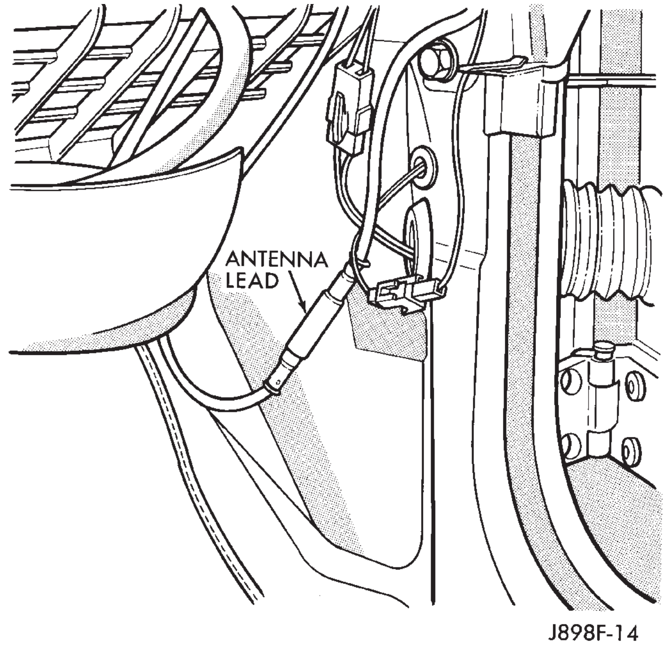


Fig. 11 Disconnect Antenna Lead—Typical

(2) Remove the cap nut and escutcheon from the top of the fender (Fig. 12).

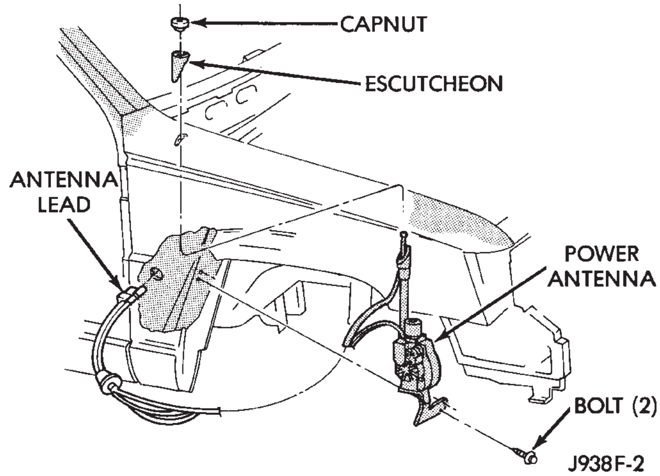


Fig. 12 Remove/Install Escutcheon and Antenna Pad

(3) Remove the passenger side cowl side trim panel.

(4) Disconnect the antenna lead (Fig. 11) by pulling apart while twisting the metal connectors. DO NOT PULL ON THE COAX CABLE.

(5) Disconnect the power antenna wire harness connector.

(6) Remove the antenna mounting bolts and washers (Fig. 12).

(7) Pull the rubber grommet out of the cowl side panel.

(8) Pull the antenna motor harness through the hole in the cowl side panel.

(9) Remove the antenna assembly from inside the right fender wheel opening.

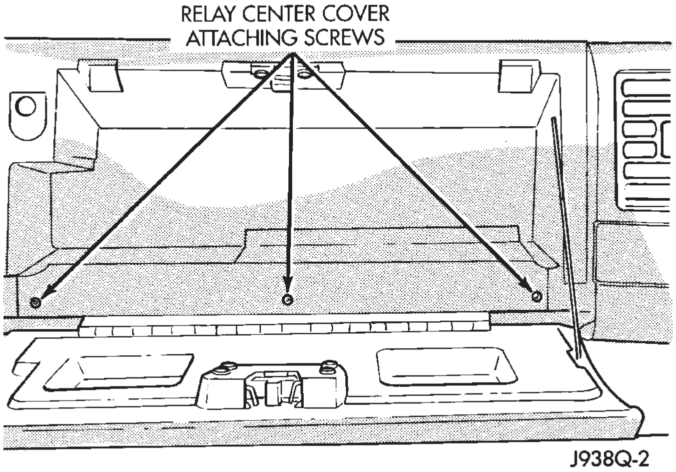


Fig. 13 Relay Center Cover Remove/Install

(10) Reverse removal procedures to install.
(11) Verify antenna and radio operation.

POWER ANTENNA RELAY REMOVE/INSTALL

(1) Open glove box and remove 3 screws holding relay center cover (Fig. 13).

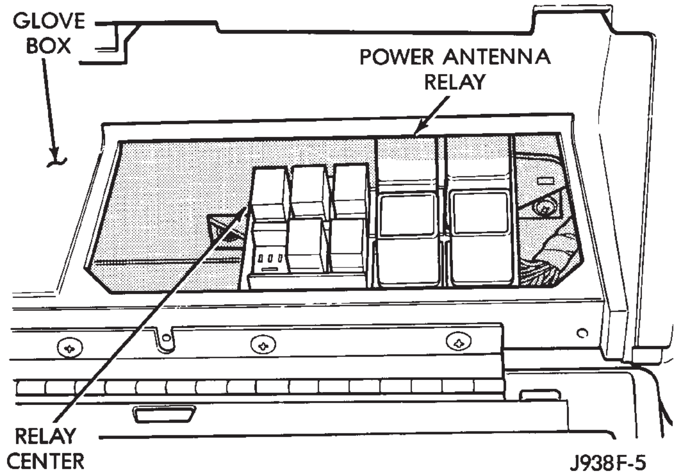


Fig. 14 Power Antenna Relay

(2) Remove power antenna relay (Fig. 14)
(3) Reverse removal procedures to install.

HORNS

CONTENTS

GENERAL INFORMATION

Following are general descriptions of the major components in the Grand Cherokee horn system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

HORN SWITCH

Two horn switches are installed in the steering wheel, one on each side of the center-mounted driver's airbag module. When either switch is depressed it completes a circuit to ground for the coil side of the horn relay. The steering wheel and steering column must be properly grounded for the horn switches to function. The horn switches are only serviced as a set with their wiring. If either switch should fail, both switches must be replaced.

HORN RELAY

The horn relay is a mini-relay installed in the relay center, which is under a cover inside the glove box. One side of the horn relay electromagnetic coil receives battery voltage at all times. When a horn switch is depressed, the other side of the relay coil is grounded. The energized relay coil causes the normally open relay contacts to close, providing battery voltage to the horn.

If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the relay center until further diagnosis is completed.

HORNS

The standard dual note, diaphragm-type horns are mounted to a bracket beneath the right radiator closure extension panel and forward of the right front inner wheelhouse. They are grounded through the mounting bracket and are connected in parallel to receive battery feed through the closed contacts of the horn relay.

DIAGNOSIS

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M - RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Inspect fuse 13 in fuseblock module and F14 in PDC. Replace fuses, as required.

(2) Remove the horn relay from the relay center. See Horn Relay Connections (Fig. 1) and perform the following tests.

• The common feed terminal (30) is connected to battery voltage and should be hot at all times. If battery voltage is not present at relay cavity 30, check circuit to fuse 13. Repair as required.

• The normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application.

• The normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the horn. There should be continuity between relay cavity 87 and the horn terminal at all times. If not, repair wiring or connections as required.

• The coil battery terminal (86) is connected to the electromagnet in the relay, and battery voltage should be present at all times. If battery voltage is not present at relay cavity 86, check circuit to fuse 13. Repair as required.

• The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded when the horn switch is depressed. Check for continuity to ground at relay cavity 85 with the horn switch depressed. If no continuity is found with horn switch depressed or, if continuity is found with horn switch released, repair horn switch or wiring as required. See Horn Switch Remove/Install in this group for service procedures.

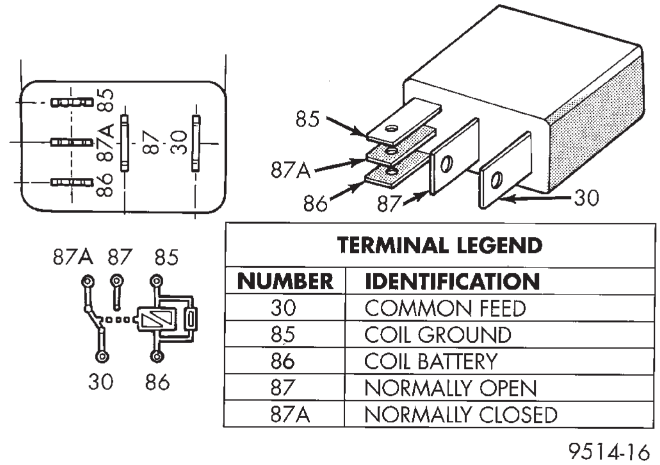
If all relay connections check OK, proceed to next step.

(3) With the horn relay still removed, check the horn relay by performing the following tests.

- A relay in the de-energized position should have continuity between terminal 87A and terminal 30, and no continuity between terminal 87 and terminal 30.
- Resistance value between terminals 85 and 86 (electromagnet) is 75±5 ohms.
- Connect a battery to terminals 85 and 86. There should now be continuity between terminal 87 and terminal 30.

If relay fails any of the above tests, replace faulty relay. If relay checks OK, reinstall and proceed to next step.

(4) Disconnect wiring at horn terminal. Depress horn switch. There should be battery voltage at the horn wiring connector. If not, repair wiring to relay. If OK, proceed to next step.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 1 Horn Relay Connections

(5) Measure the resistance between the horn bracket and a good chassis ground. The meter should read zero ohms. If not, clean and tighten ground connection between horn mounting screw and bracket. If OK, replace faulty horn(s).

SERVICE PROCEDURES

HORN SWITCH REMOVE/INSTALL

WARNING: BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION, REMOVE AND ISOLATE THE NEGATIVE (-) CABLE FROM THE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE INJURY. WAIT 2 MINUTES FOR THE RESERVE CAPACITOR TO DISCHARGE BEFORE REMOVING OR WORKING ON ANY AIRBAG SYSTEM COMPONENTS.

(1) Disconnect and isolate the battery negative cable.

(2) Remove 4 retaining nuts from back of steering wheel (Fig. 2). Remove air bag module.

(3) Disconnect wire from rear of air bag module.

(4) Place air bag module on a clean level surface with pad facing upward.

(5) To remove horn switch assembly from steering, pry out 2 trim cover buttons on back of steering wheel to access retaining screws for the horn switch.

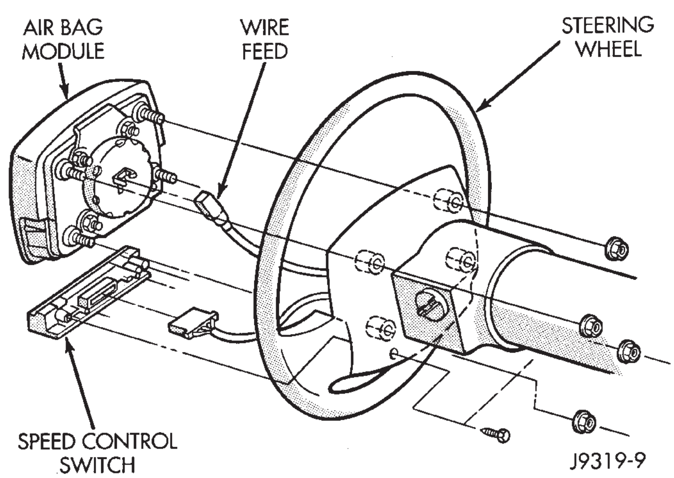


Fig. 2 Horn Switch Remove/Install

(6) Remove 2 screws and disconnect horn wires located in the lower portion of steering wheel. Push wires through the access holes and remove horn switch.

(7) Reverse removal procedures to install. Use caution not to pinch wires. Tighten airbag module mounting nuts to 1.5 N·m (15 in. lbs.) torque.

HORNS REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the splash shield from passenger side of vehicle.

(4) Disconnect wire harness connector from the horn (Fig. 3).

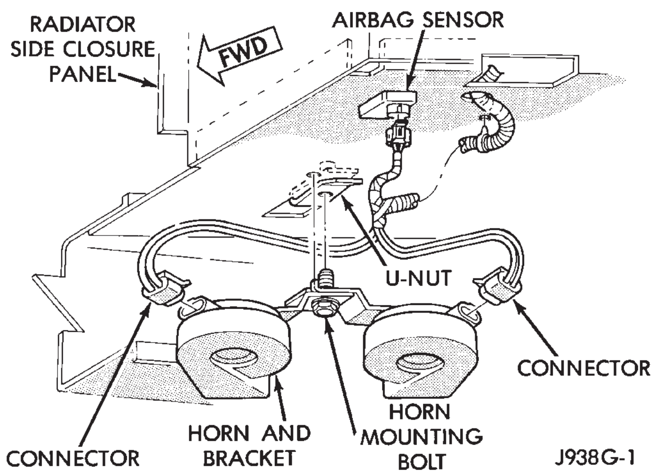


Fig. 3 Horn Remove/Install

(5) Remove horn mounting bolt, mounting brackets and horns. Each horn and bracket is removed as an assembly.

(6) Reverse removal procedures to install. Tighten horn bracket mounting bolt to 30 N·m (22 ft. lbs.).

HORN RELAY REMOVE/INSTALL

(1) Open glove box and remove 3 screws holding relay center cover (Fig. 4).

(2) Remove horn relay (Fig. 5)

(3) To install, align relay pins with cavities in relay center and push relay into place.

(4) Install relay center cover.

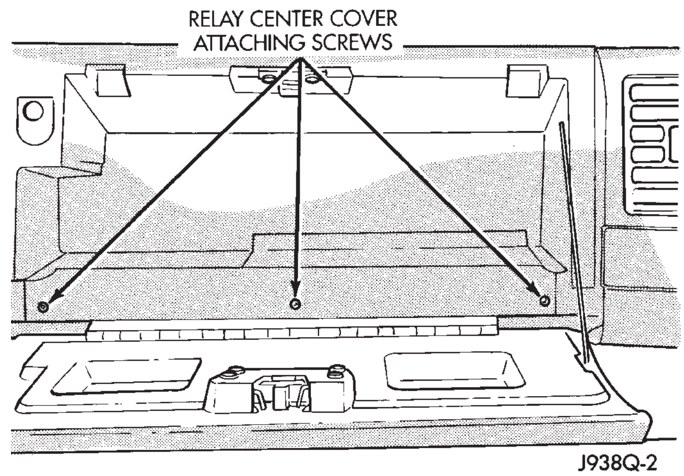


Fig. 4 Relay Center Cover

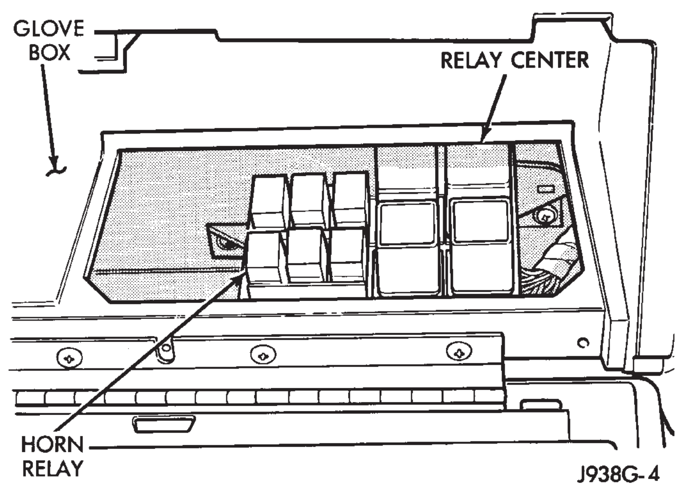


Fig. 5 Horn Relay

VEHICLE SPEED CONTROL SYSTEM

CONTENTS

GENERAL INFORMATION

The vehicle speed control system (Fig. 1) is an available option on all Grand Cherokee models. The system is electronically controlled and vacuum operated. Following are general descriptions of the major components in the vehicle speed control system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

SPEED CONTROL SERVO

The speed control servo is mounted to a bracket on the right side inner fender shield in the engine compartment. The servo unit consists of a solenoid valve body, a vacuum servo and the mounting bracket. 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.

SPEED CONTROL SWITCH

The speed control switch module is mounted to the center of the steering wheel below the driver's airbag module. The PCM monitors the state of the speed control switches. The individual switches are labeled: OFF/ON, RESUME/ACCEL, SET/DECEL. 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.

STOP LAMP SWITCH

Vehicles with the speed control option use a dual function stop lamp switch. The switch is mounted in the same location as the conventional stop lamp switch, on the brake pedal mounting bracket under the instrument panel. The PCM monitors the state of the dual function stop lamp switch. Refer to Group 5 - Brakes for more information on stop lamp switch service and adjustment procedures.

SERVO CABLE

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle control linkage. 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

The speed control electronic control circuitry is integrated into the Powertrain Control Module (PCM). The PCM is located in the engine compartment on the right side of the dash panel. 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. See Using On-Board Diagnostic System in this group for more information. The PCM cannot be repaired and must be replaced if faulty.

VACUUM RESERVOIR

The vacuum reservoir is mounted under the battery tray. 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 SENSOR

The Vehicle Speed Sensor (VSS) is a pulse generator mounted to an adapter near the transmission (two-wheel drive) or transfer case (four-wheel drive) output shaft. The sensor is driven through the adapter by a speedometer pinion gear. The VSS pulse signal to the speedometer/odometer is monitored by the PCM speed control circuitry to determine vehicle speed and to maintain speed control set speed. Refer to the appropriate Powertrain Diagnostic Procedures manual for testing of this component. Refer to Group 14 - Fuel System for service of this component.

WARNING: THE USE OF VEHICLE 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.

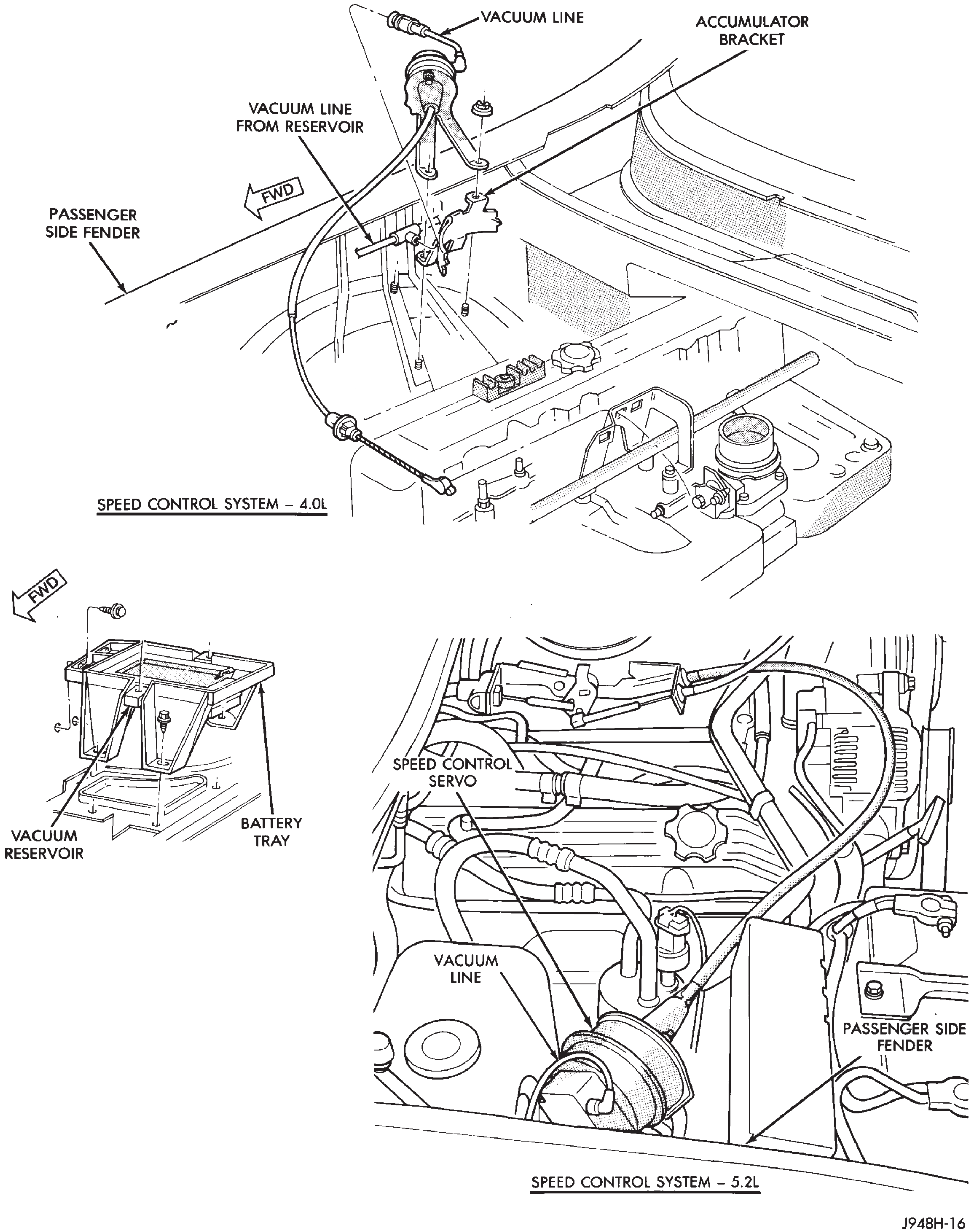


Fig. 1 Vehicle Speed Control System

DIAGNOSIS

Before beginning diagnosis, 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 Group 8E - Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

(1) 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.

(2) Correct installation of the vacuum check valve in the hose from servo to vacuum source. The word VAC on the valve must point toward the vacuum source.

(3) Loose or leaking vacuum hoses or connections.

(4) Secure attachment of both ends of the speed control servo cable.

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.

USING ON-BOARD DIAGNOSTIC SYSTEM

The Powertrain Control Module (PCM) monitors critical input and output circuits of the speed control system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (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

Diagnostic Trouble Codes (DTC) are two-digit numbers flashed on the malfunction indicator (Check Engine) lamp that identify which circuit is bad. A DTC description can also be read using the DRB scan tool. Refer to Group 14 - Fuel Systems for more 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.

See Speed Control Diagnostic Trouble Code chart for DTC's which apply to the speed control system. Refer to the Powertrain Diagnostic Procedures manual to diagnose an on-board diagnostic system trouble code.

RETRIEVING DIAGNOSTIC TROUBLE CODES

To start this function, cycle the ignition switch ON-OFF-ON-OFF-ON within 5 seconds. This will cause any DTC stored in the PCM memory to be displayed. The malfunction indicator (Check Engine) lamp will display a DTC by flashing on and off. There is a short pause between flashes and a longer pause between digits. All DTC's displayed are two-digit numbers, with a four-second pause between codes.

An example of a DTC is as follows:

(1) Lamp on for 2 seconds, then turns off.

(2) Lamp flashes 1 time pauses and then flashes 5 times.

(3) Lamp pauses for 4 seconds, flashes 3 times, pauses, then flashes 4 times.

The two DTC's are 15 and 34. Any number of DTC's can be displayed, as long as they are in memory. The lamp will flash until all stored DTC's are displayed (55 = end of test).

If a DTC 15 is observed, see diagnosis for Vehicle Speed Sensor in this group. If a DTC 34 is observed, see diagnosis for Speed Control Servo and Powertrain Control Module in this group. Correct any problems found in your diagnosis, then recheck for DTC after corrections are completed.

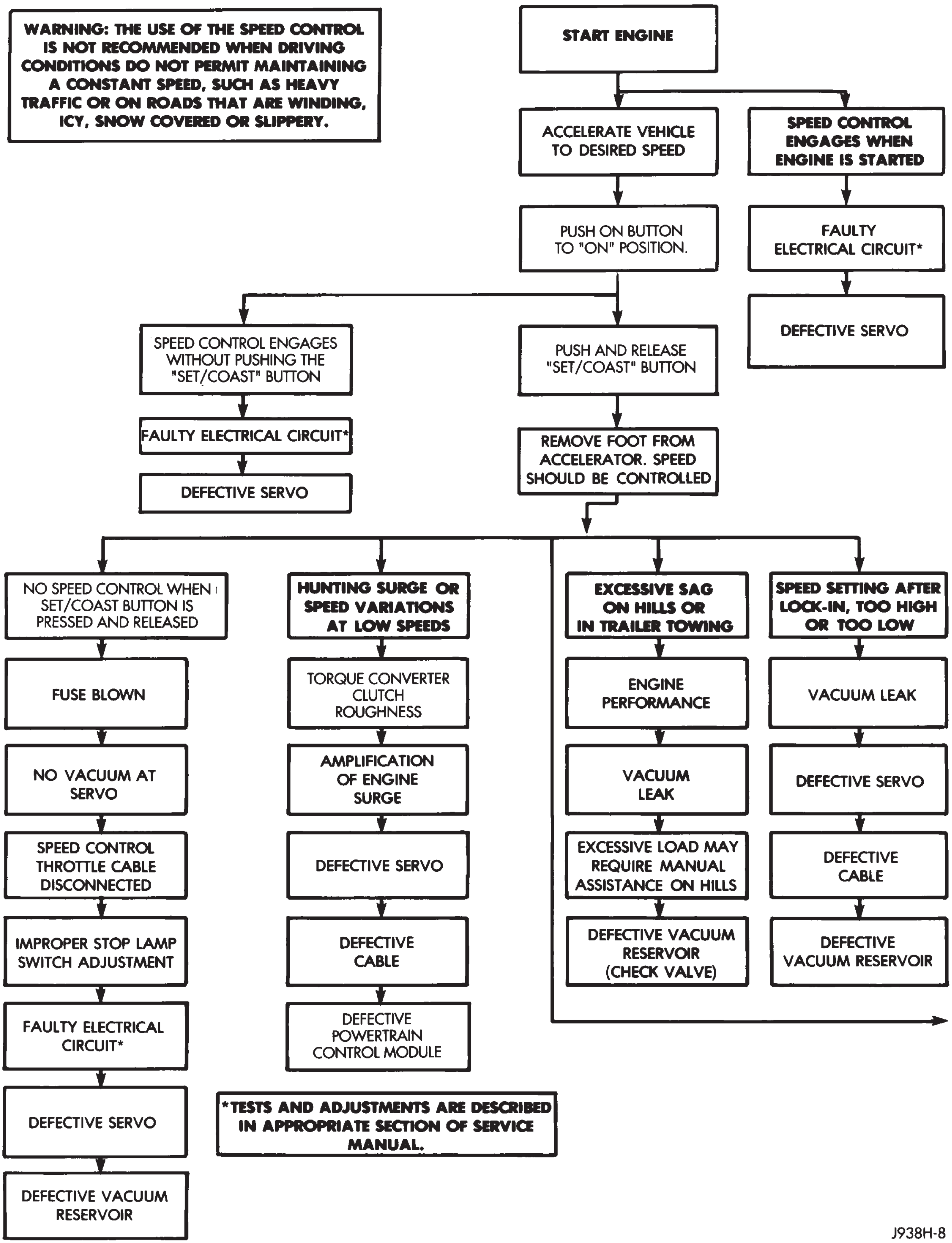
VEHICLE SPEED SENSOR

For diagnosis of the VSS, refer to the appropriate Powertrain Diagnostic Procedures manual.

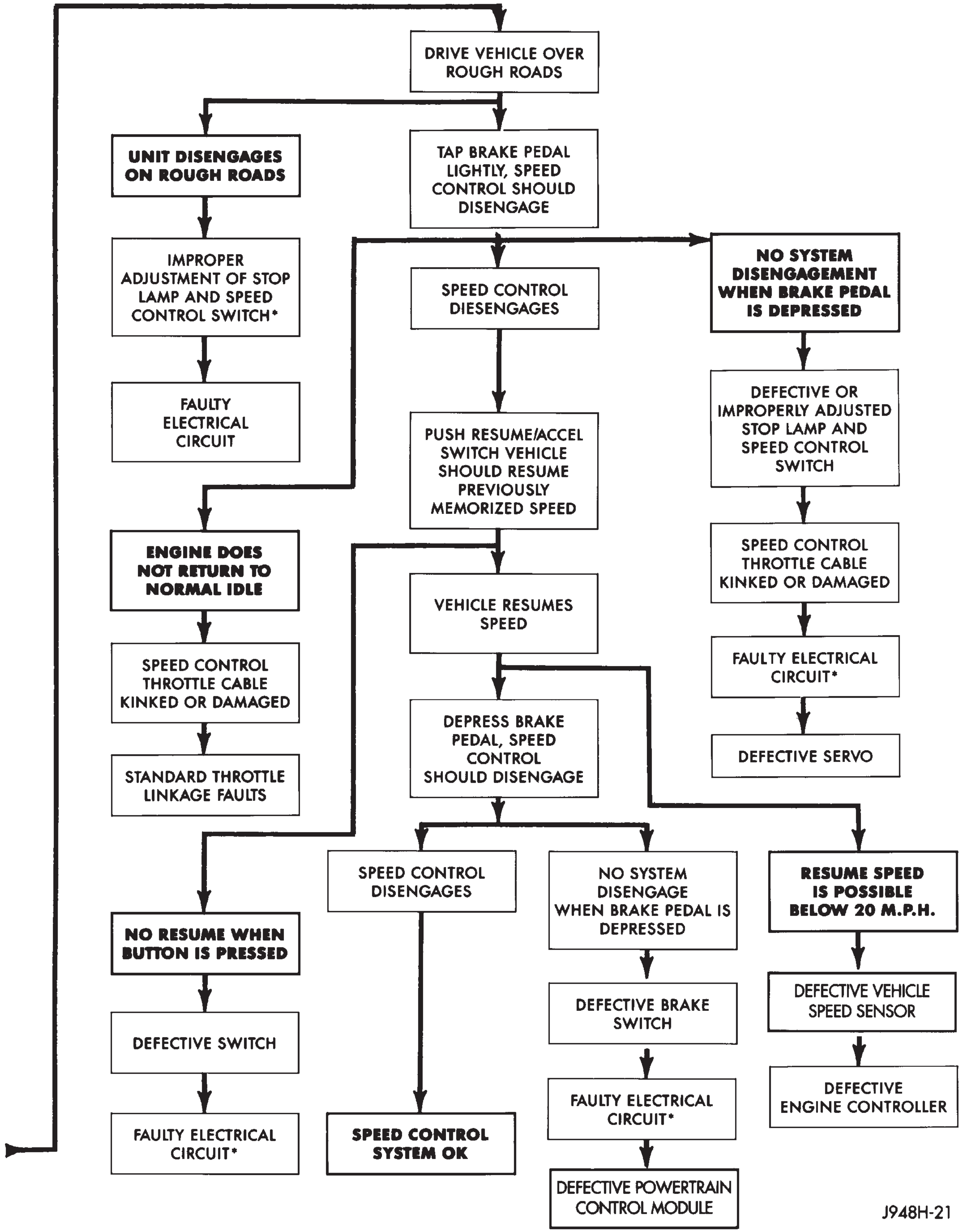
SPEED CONTROL SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M - RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

DIAGNOSIS CHART 1



DIAGNOSIS CHART 2



SPEED CONTROL DIAGNOSTIC TROUBLE CODE

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
15**	No Vehicle Speed Sensor Signal	No vehicle distance (speed) sensor signal detected during road load conditions.
34*	Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
	or Speed Control Switch Always Low	Speed Control switch input below the minimum acceptable voltage.
	or Speed Control Switch Always High	Speed Control switch input above the maximum acceptable voltage.
55*	N/A	Completion of fault code display on Check Engine lamp.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

J948H-17

(1) Disconnect battery negative cable. Remove speed control switch from steering wheel.

(2) Check speed control switch continuity as shown in chart (Fig. 2). If OK, reinstall switch. If not OK, replace switch.

STOP LAMP SWITCH

(1) Remove the stop lamp switch from the mounting bracket. Refer to Group 5 - Brakes.

(2) Disconnect switch from wiring harness.

(3) Using an ohmmeter, check switch continuity (Fig. 3) as follows:

(a) With switch plunger released, there should be continuity between pin 5 and pin 6.

(b) With switch plunger depressed, there should be continuity between pin 1 and pin 2.

(c) With switch plunger still depressed, there should be continuity between pin 3 and pin 4.

(4) If the switch fails the above continuity tests, it is faulty. Replace switch. If switch is OK, reinstall and check adjustment. Refer to Group 5 - Brakes for correct installation and adjustment procedures.

VACUUM SUPPLY TEST

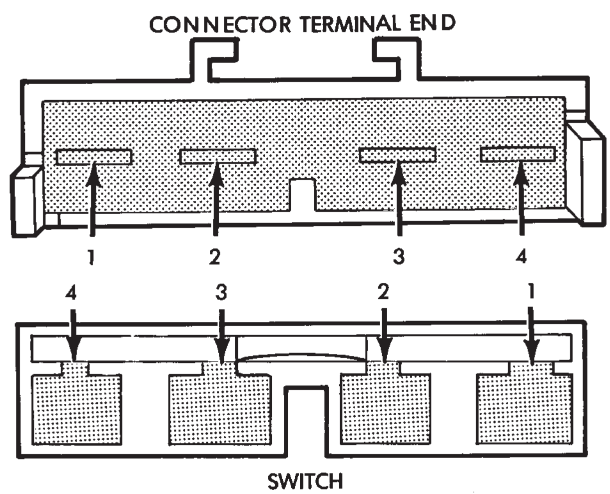
(1) Disconnect vacuum hose at the servo and install a vacuum gauge in the hose.

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.

(3) If vacuum does not meet this requirement, check for vacuum leaks or poor engine performance.

SPEED CONTROL SERVO

(1) Check fuse 20 in the fuseblock module. If OK, go to next step. If not OK, replace fuse.



SPEED CONTROL SWITCH CONTINUITY	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN 1 AND PIN 4
ON	PIN 1 AND PIN 4 PIN 1 AND PIN 2 PIN 2 AND PIN 4
ON AND SET	PIN 1 AND PIN 2
ON AND RESUME	PIN 1 AND PIN 3

J928H-4

Fig. 2 Speed Control Switch Continuity

(2) Turn ignition switch to the ON position. Check for battery voltage at fuse 20. If OK, go to next step. If not OK, repair open circuit to ignition switch as required.

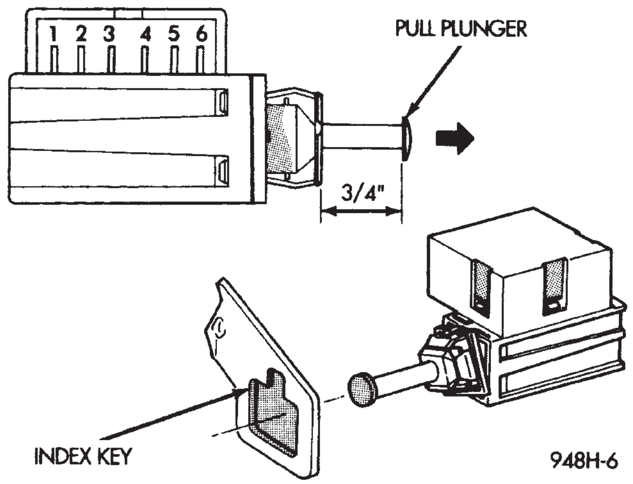


Fig. 3 Stop Lamp Switch

(3) Connect the negative lead of a voltmeter to a good chassis ground near the servo. Unplug the 4-way connector going to the servo (Fig. 4). Push the speed control switch to the ON position. Check for battery voltage at servo harness connector cavity for pin 2 (Fig. 5). If OK, go to next step. If not OK, see diagnosis for Stop Lamp Switch.

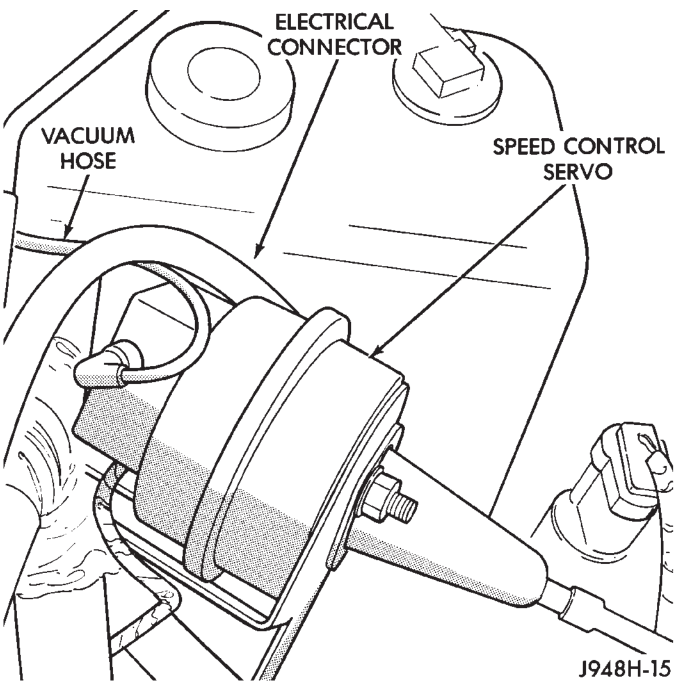


Fig. 4 Speed Control Servo

(4) Connect a jumper wire between servo harness connector cavity for pin 2 and pin 2 of the servo. Check for battery voltage at pins 1, 3 and 4 of the servo. If OK, go to next step. If not OK, replace the servo.

(5) Turn ignition switch to OFF position. Check for continuity between servo harness connector cavity for pin 1 and a good ground. There should be continuity. If not OK, repair open circuit to ground as required.

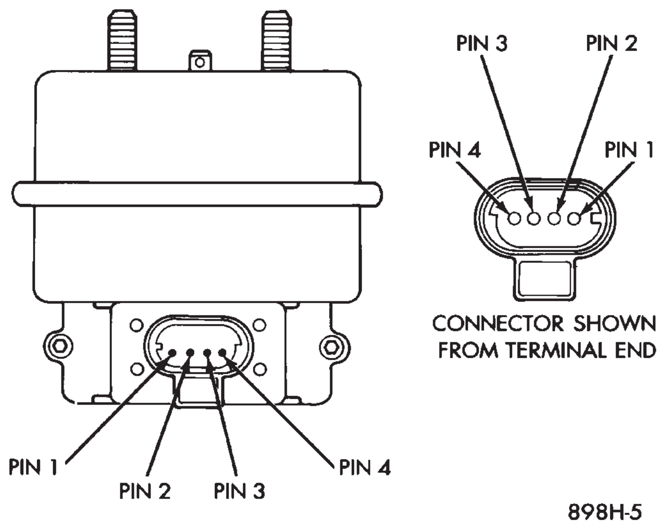


Fig. 5 Servo Harness Connector

POWERTRAIN CONTROL MODULE

(1) Disconnect 60-way connector from the PCM, located on the right side dash panel in the engine compartment (Fig. 6).

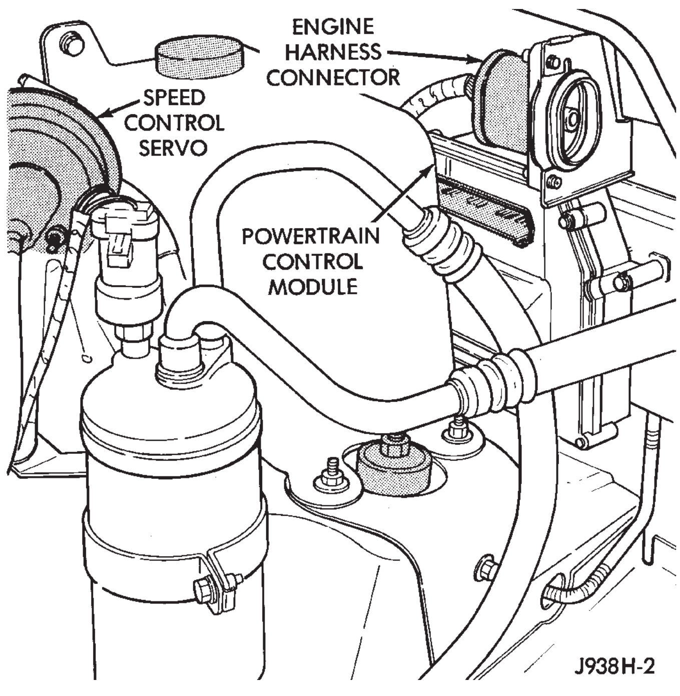


Fig. 6 Powertrain Control Module

(2) Connect negative lead of voltmeter to a good body ground near the module.

(3) For the following tests, the ignition switch must be in the ON position. See Fig. 7 for controller terminal locations. Touch the positive lead of the voltmeter to the terminal in cavity number 33. With the speed control switch in the OFF position, the voltmeter should read zero volts. With the speed con-

trol switch in the ON position, the voltmeter should read battery voltage. If not, repair the main harness as necessary.

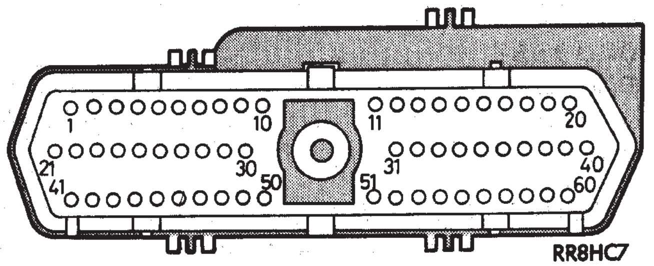


Fig. 7 PCM 60-Way Connector - Terminal End

(4) Touch the positive lead of the voltmeter to the terminal in cavity number 53. As in step (3), the voltmeter should read zero volts with the switch in the OFF position, and battery voltage with the switch in the ON position.

(5) Touch the positive lead of the voltmeter to the terminal in cavity number 48. With the speed control switch in the OFF position, the voltmeter should read zero volts. With the switch in the ON position, the voltmeter should read battery voltage. Pressing the SET/DECEL button should cause the voltmeter to change from battery voltage to zero volts for as long as the switch is held. If not, see diagnosis for Speed Control Switch. If the switch is not at fault, then check the main harness and repair as necessary.

(6) Touch the positive lead of the voltmeter to the terminal in cavity number 50. The voltmeter should read zero volts with the speed control switch in either the OFF or ON position. With switch in either RESUME or SET position, the voltmeter should read battery voltage. If not, see diagnosis for Speed Control Switch. If the switch is not at fault, then check the main harness and repair as necessary.

(7) Touch the positive lead of the voltmeter to the terminal in cavity number 49. The voltmeter should read zero volts with the switch in the OFF position. With the switch in the ON position, the voltmeter should read battery voltage. The voltmeter will continue to read battery voltage when either the SET or RESUME switch is pressed. If not, see diagnosis for Speed Control Switch. If the switch is not at fault, then check the main harness and repair as necessary.

(8) Turn ignition switch OFF. Using an ohmmeter, connect one lead to a good body ground and touch the other lead to the terminal in cavity number 29. With the brake pedal released, the meter should show continuity. When the pedal is depressed, the meter should show an open circuit.

SERVICE PROCEDURES

SPEED CONTROL SERVO REMOVE/INSTALL

4.0L ENGINES

(1) Disconnect vacuum hose at servo.
(2) Unplug electrical connector at servo.
(3) Remove 2 nuts holding servo cable sleeve.
(4) Pull speed control cable sleeve away from servo to expose cable retaining clip.
(5) Remove clip attaching cable to servo.
(6) Remove servo from mounting bracket.
(7) Reverse removal procedures to install. Block throttle to full open position to align hole in cable connector with hole in servo pin and install retaining clip. Tighten servo mounting nuts to 8.5 N·m (75 in. lbs.).

CAUTION: The cable sleeve must be installed on the OUTSIDE face of the bracket to avoid possible binding of the cable.

5.2L ENGINES

(1) Disconnect vacuum hose at servo.
(2) Unplug electrical connector at servo.
(3) Remove 2 nuts from servo mounting bracket.
(4) Remove and discard push nuts on servo studs.
(5) Remove servo from mounting bracket.
(6) Pull speed control cable sleeve away from servo to expose cable retaining clip.
(7) Remove clip attaching cable to servo.
(8) Reverse removal procedures to install. Block throttle to full open position to align hole in cable connector with hole in servo pin and install retaining clip. Install new push nuts on servo studs. Tighten servo mounting nuts to 8.5 N·m (75 in. lbs.).

CAUTION: The cable sleeve must be installed BETWEEN the servo and bracket to avoid possible binding of the cable.

SPEED CONTROL SWITCH REMOVE/INSTALL

WARNING: BEFORE BEGINNING ANY AIR BAG SYSTEM COMPONENT REMOVAL OR INSTALLATION, REMOVE AND ISOLATE THE NEGATIVE (-) CABLE FROM THE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. THEN WAIT TWO MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT AND POSSIBLE INJURY.

(1) Disconnect battery negative cable.
(2) Remove 2 screws from back side of steering wheel (Fig. 8).
(3) Rock switch away from horn pad while lifting switch out of steering wheel.
(4) Disconnect 4-way electrical connector from clockspring.

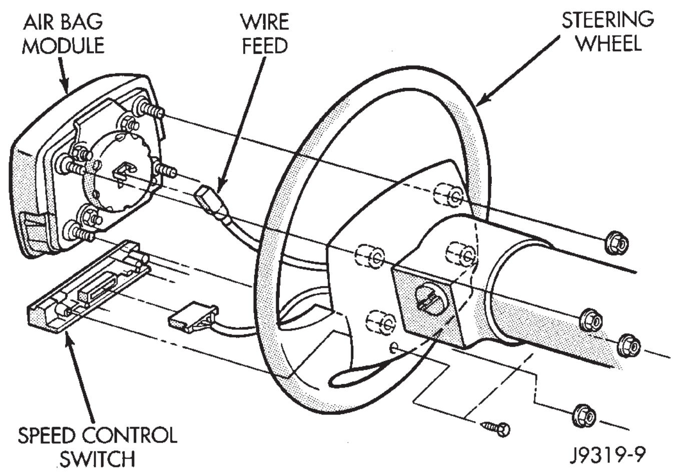


Fig. 8 Speed Control Switch Remove

(5) Reverse removal procedures to install. When placing switch in steering wheel, slide the forward edge of switch under horn pad. Line up locating pins on switch with holes in steering wheel frame. Attach switch to wheel with 2 screws starting with the screw at the left end of the switch.

SERVO CABLE REMOVE/INSTALL

CAUTION: Use finger pressure only to remove the speed control cable connector at the bellcrank. Pliers or screwdriver can break the connector requiring complete cable replacement.

(1) Using finger pressure only, remove speed control cable connector at bell crank by pushing connector off the bellcrank (Fig. 9 or 10). DO NOT try to pull connector off perpendicular to the bellcrank.
(2) Squeeze tabs on speed control cable and push out of locking plate (Fig. 11).
(3) Pull cable out of locking plate.
(4) Remove cable from servo as described in Speed Control Servo Remove/Install procedure.
(5) Reverse the removal procedures to install.

VACUUM RESERVOIR REMOVE/INSTALL

(1) Disconnect both battery cables, negative cable first.
(2) Remove battery holddowns.
(3) Remove battery from battery tray.
(4) Remove 5 screws securing battery tray.

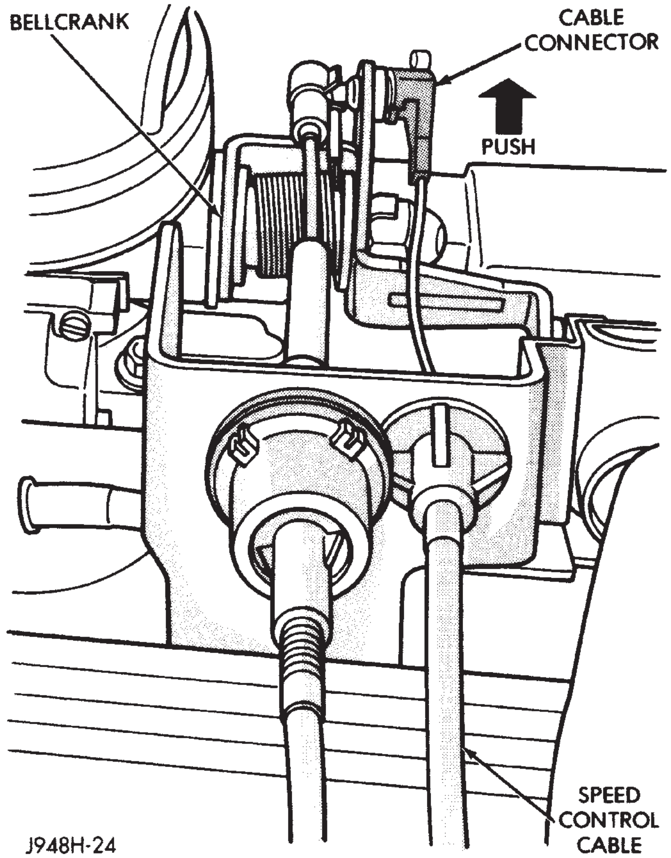


Fig. 9 Remove Bellcrank Connector - 4.0L Engines

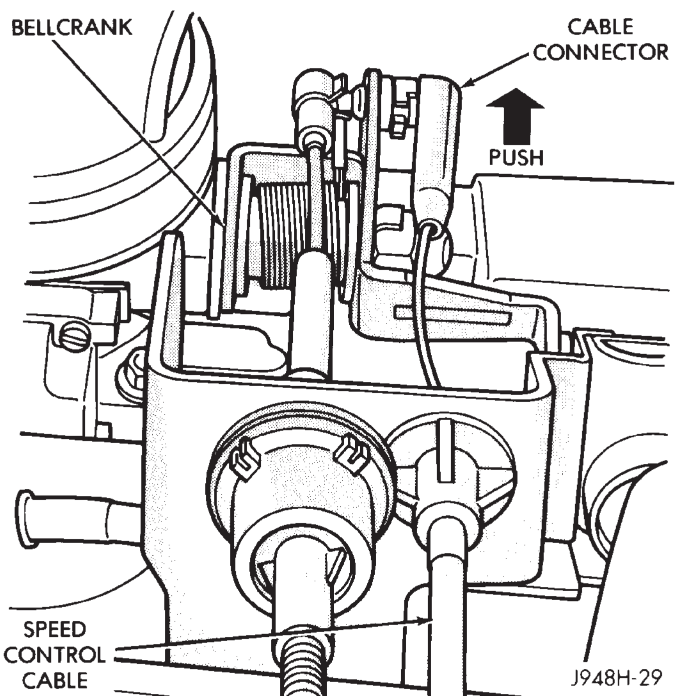


Fig. 10 Remove Bellcrank Connector - 5.2L Engines

(5) Pull up battery tray and remove vacuum line from reservoir (Fig. 12).

(6) Remove 2 screws holding reservoir to battery tray.

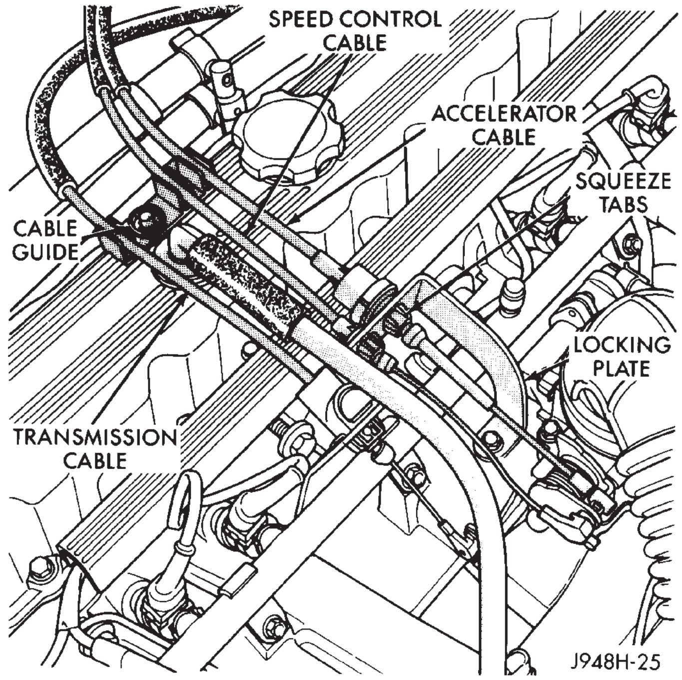


Fig. 11 Speed Control Cable Locking Plate - Typical

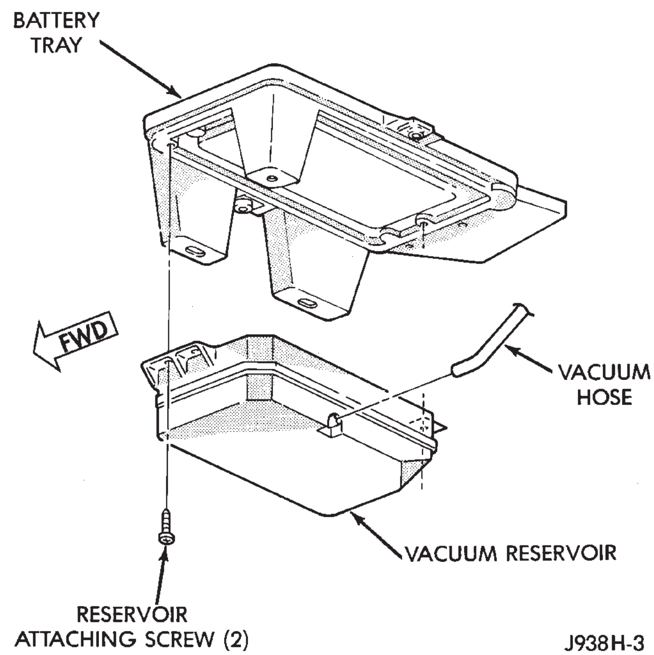


Fig. 12 Vacuum Reservoir

(7) Reverse removal procedures to install. Tighten hardware as follows:

- battery tray mounting screws to 10 N·m (90 in. lbs.)
- battery holddown bolts to 10 N·m (90 in. lbs.)
- battery cable clamp bolts to 8.5 N·m (75 in. lbs.).

TURN SIGNAL AND HAZARD WARNING SYSTEMS

CONTENTS

GENERAL INFORMATION

Following are general descriptions of the major components in the Grand Cherokee model turn signal and hazard warning systems. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

TURN SIGNAL SYSTEM

With the ignition switch in the ON or ACCESSORY position and the multi-function switch control lever moved up (right turn) or down (left turn), the turn signal system is activated.

When the turn signal system is activated, the selected (right or left) turn signal indicator lamp, front park/turn signal lamp and rear tail/stop/turn signal lamp bulb filaments will flash. With the headlamp switch in the OFF position, the turn and front side marker lamps flash in unison. With the headlamp switch in the ON position, the turn and front side marker lamps flash alternately.

HAZARD WARNING SYSTEM

The hazard warning is activated by a switch button located on the top of the steering column between the steering wheel and the instrument panel. The combination flasher receives battery feed at all times, and the system is functional regardless of ignition switch position. The hazard warning switch button is identified with a double triangle. Push in on the switch button to latch the switch and activate the hazard warning system, and push in on the switch button again to unlatch the switch and turn the system off.

When the hazard warning system is activated, all (right and left) turn signal indicator, front park/turn signal lamp and rear tail/stop/turn signal lamp bulb filaments will flash.

COMBINATION FLASHER

The combination flasher functions as both the turn signal and hazard warning flasher on Grand Cherokee models. The combination flasher is a smart relay that is located in the relay center under a cover in the bottom of the glove box. The combination flasher can not be repaired. If faulty, it must be replaced.

The combination flasher is designed to handle the current flow requirements of the factory installed lighting. If supplemental lighting is added to the turn signal circuits such as when towing a trailer with lights, the combination flasher will automatically compensate. This allows the flash rate to remain the same, regardless of electrical load increases. However, if a bulb fails in the turn signal or hazard warning circuits, the flash rate of the remaining bulbs in that circuit will increase to 120 flashes per minute or higher.

MULTI-FUNCTION SWITCH

The multi-function switch assembly (Fig. 1) is mounted to the left side of the steering column. This switch contains electrical circuitry for the following functions:

- turn signals
- hazard warning
- headlamp beam selection
- headlamp optical horn
- windshield wipers
- windshield washers.

The information contained in this group addresses only the switch functions for the turn signal and hazard warning circuits. For information relative to other switch functions, refer to the appropriate group. However, the multi-function switch can not be repaired. If any function of the switch is faulty, the entire switch assembly must be replaced.

TURN SIGNAL INDICATOR LAMPS

These lamps are located in the instrument cluster. They flash with the exterior turn signal lamps to give the driver a visual indication that a turn signal or the hazard warning circuit is operating. For diagnosis and service of this component, refer to Group 8E - Instrument Panel and Gauges.

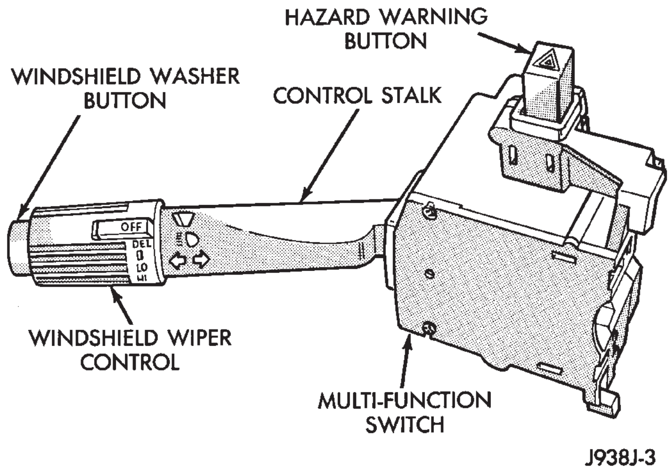


Fig. 1 Multi-Function Switch

TURN SIGNAL LAMPS

The exterior lamps included in the turn signal and hazard warning circuits include: the front park/turn signal, and the rear tail/stop/turn signal. For diagnosis and service of these lamps, refer to Group 8L - Lamps.

DIAGNOSIS

When diagnosing the turn signal or hazard warning circuits, remember that high generator output can burn out bulbs rapidly and repeatedly. If this is a problem on the vehicle being diagnosed, refer to Group 8A - Battery/Starting/Charging Systems Diagnostics to test charging system.

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M - RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

TURN SIGNAL/HAZARD WARNING SYSTEM

(1) Turn ignition switch to ON position. Actuate the turn signal lever or hazard warning button. Observe the turn indicator lamp(s) in the instrument cluster. If the flash rate is very high, check for a turn signal bulb that is not lit. Replace that bulb or repair circuits to that lamp, as required. Test operation. If turn indicator does not light, continue to next step.

(2) Remove and inspect fuse 16 (turn signals) or fuse 3 (hazard warning) in fuseblock module. Replace fuse, if required.

(3) Remove combination flasher from relay center and replace with a known good unit. Test operation of turn signal and hazard warning systems. If OK, replace faulty combination flasher. If not OK, remove test flasher and go to next step.

(4) With ignition switch in ON position, check for battery voltage at cavity for flasher terminal J1 (Fig. 2). If OK, go to next step. If not OK, repair circuit to ignition switch as required.

(5) With ignition switch in OFF position, check for battery voltage at cavity for flasher terminal J2. If OK, go to next step. If not OK, repair circuit to fuseblock module as required.

(6) With ignition switch in OFF position, check for continuity between cavity for flasher terminal J5 and a good ground. There should be continuity. If OK, go to next step. If not OK, repair circuit to ground as required.

(7) Locate the multi-function switch connector. See Multi-Function Switch, in this group. Check for continuity between cavity for flasher terminal J3 and cavity 13 of the multi-function switch connector. There should be continuity. If OK, go to next step. If not OK, repair open circuit as required.

(8) Check for continuity between cavity for flasher terminal J4 and cavity 17 of the multi-function switch connector. There should be continuity. If OK, test multi-function switch. If not OK, repair open circuit as required.

MULTI-FUNCTION SWITCH

(1) Access multi-function switch connector and remove. See service procedures for Multi-Function Switch, in this group.

(2) Using an ohmmeter, perform switch continuity checks at the switch terminals as shown in the chart (Fig. 3).

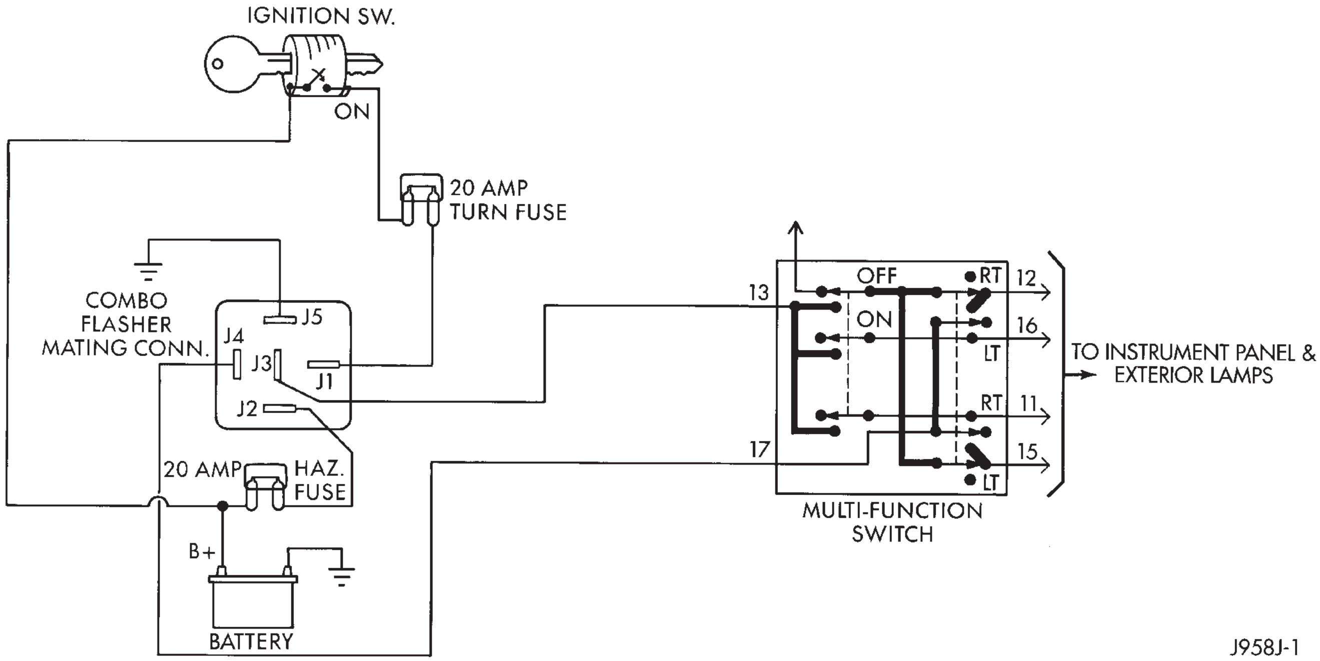
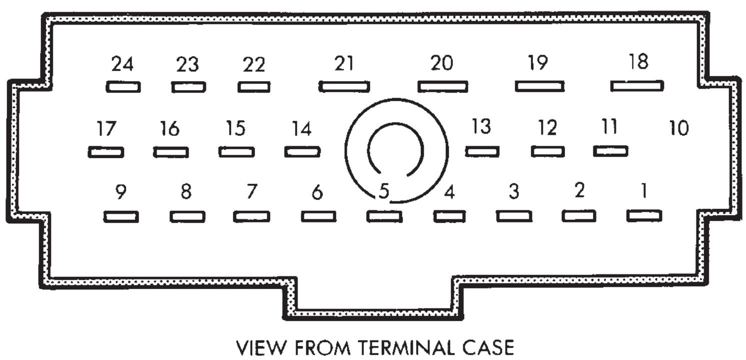


Fig. 2 Combination Flasher Circuit



SWITCH POSITIONS TURN SIGNAL	HAZARD WARNING	CONTINUITY BETWEEN
NEUTRAL	OFF	12 AND 14 AND 15
LEFT LEFT LEFT	OFF OFF OFF	15 AND 16 AND 17 12 AND 14 22 AND 23 WITH OPTIONAL CORNER LAMPS
RIGHT RIGHT RIGHT	OFF OFF OFF	11 AND 12 AND 17 14 AND 15 23 AND 24 WITH OPTIONAL CORNER LAMPS
NEUTRAL	ON	11 AND 12 AND 13 AND 15 AND 16

908J-4

Fig. 3 Multi-Function Switch Continuity

SERVICE PROCEDURES

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M - RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

MULTI-FUNCTION SWITCH REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove tilt lever (if equipped).

(3) Remove both upper and lower shrouds from column (Fig. 4). Requires removal of 3 screws (Torx T-20).

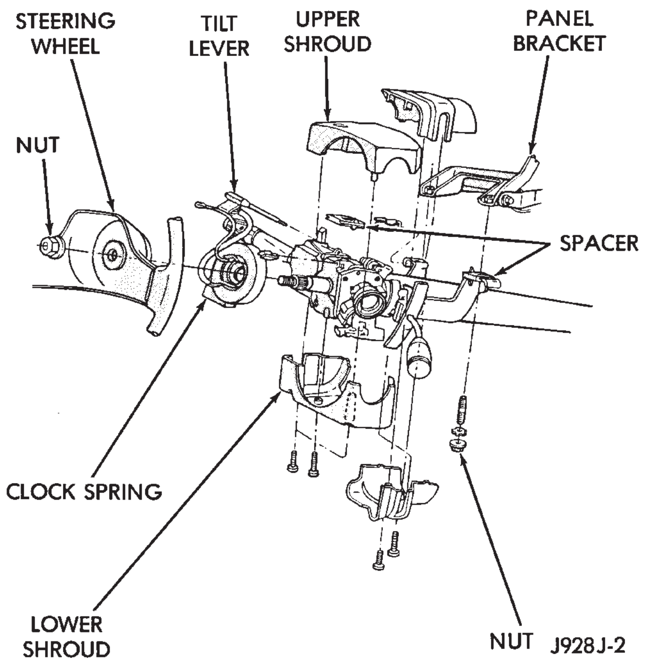


Fig. 4 Steering Column Shrouds Remove/Install

(4) Remove 4 screws holding steering column trim panel (Fig. 5).

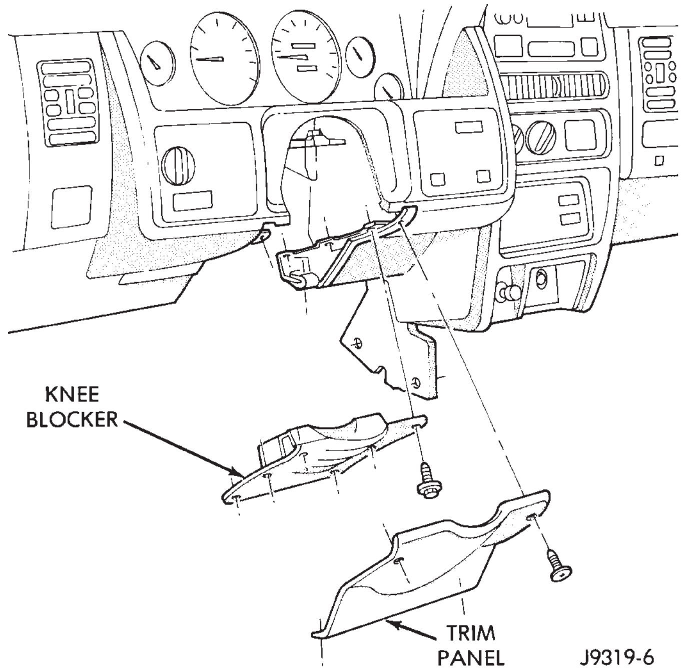


Fig. 5 Steering Column Trim and Knee Blocker

(5) Remove 6 screws holding knee blocker.

(6) Remove steering column retaining nuts.

(7) Lower steering column.

(8) Remove multi-function switch tamper proof mounting screws (tamper proof Torx bit Snap-On TTXR20B2 or equivalent required).

(9) Gently pull switch away from column. Loosen connector screw. The screw will remain in the connector (Figs. 6 and 7).

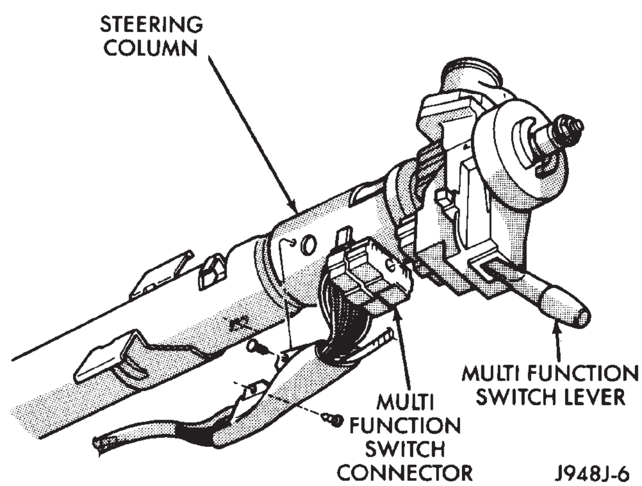


Fig. 6 Multi-Function Switch Connector

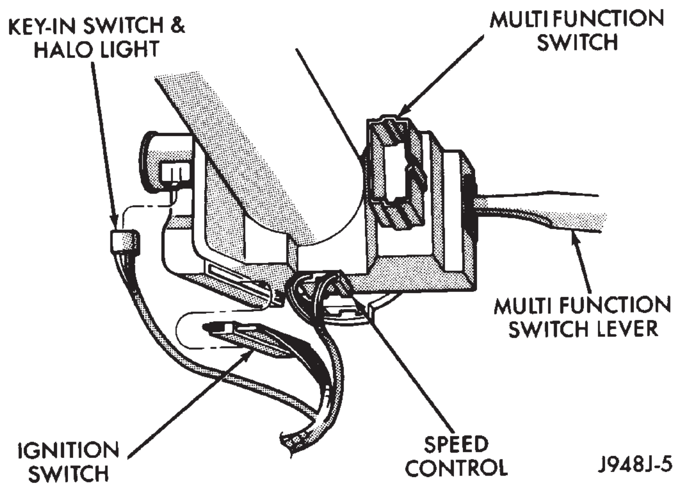


Fig. 7 Steering Column Connectors

(10) Remove wiring connector from multi-function switch (Fig. 8).

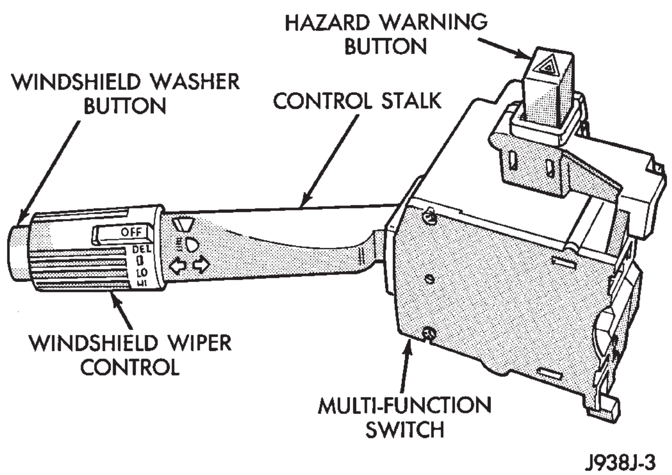


Fig. 8 Multi-Function Switch

(11) Reverse removal procedures to install. Tighten fasteners as follows:

• multi-function switch connector screw - 1.9 N·m (17 in. lbs.)
• multi-function switch retaining screws - 1.9 N·m (17 in. lbs.)
• steering column upper bracket nuts - 12 N·m (110 in. lbs.)
• steering column shroud screws - 1.9 N·m (17 in. lbs.).

COMBINATION FLASHER REMOVE/INSTALL

(1) Open glove box and remove 3 screws holding relay center cover (Fig. 9).

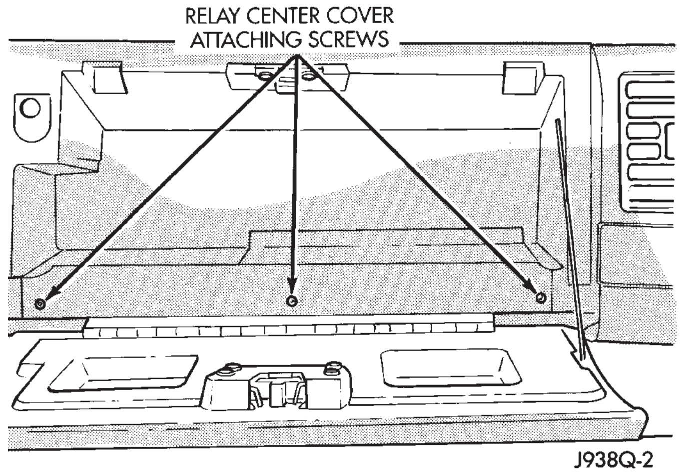


Fig. 9 Relay Center Cover

(2) Remove combination flasher (Fig. 10).

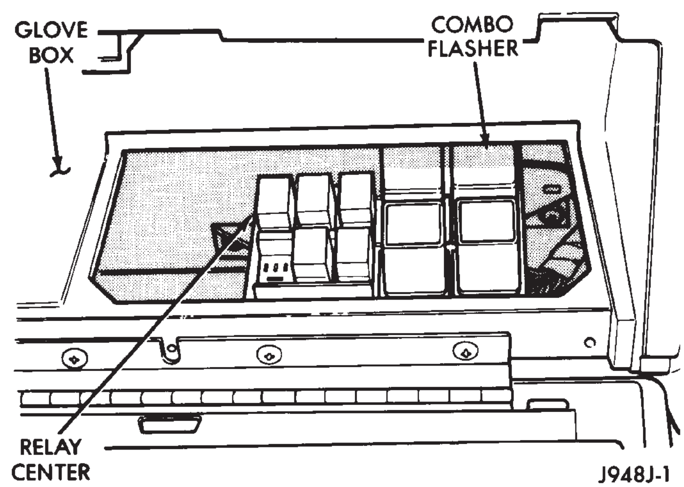


Fig. 10 Combination Flasher

(3) Align combination flasher pins with cavities in relay center and push flasher into place.

(4) Re-install relay center cover.

WIPER AND WASHER SYSTEMS

CONTENTS

GENERAL INFORMATION

Following are general descriptions of the major components in the Grand Cherokee wiper and washer systems. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

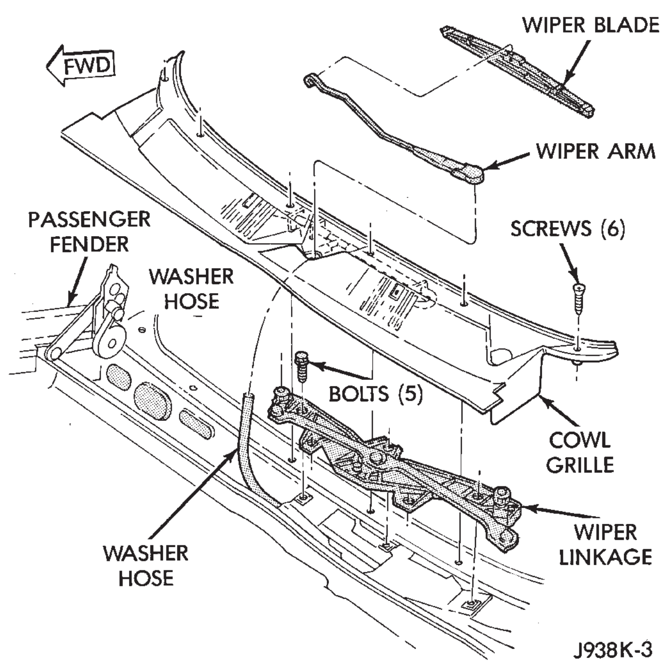
WINDSHIELD WIPER SYSTEM

An intermittent wiper system is standard equipment on all Grand Cherokee models. The intermittent wipe system allows the driver to select from two wiper speeds or an intermittent wipe feature that allows a delay between wipes of 2 to 15 seconds. Refer to the owner's manual for more information on wiper system controls and operation.

The wipers will operate only when the ignition switch is in the ACCESSORY or ON position. A circuit breaker in the fuseblock module protects the circuitry of the wiper system.

CAUTION: The wiper arms and blades must never be moved manually from side to side or damage may result.

WINDSHIELD WIPER AND WASHER SYSTEM



WINDSHIELD WASHER SYSTEM

A electrically-operated windshield washer system is standard equipment on all Grand Cherokee models. The washers will operate only when the ignition switch is in the ACCESSORY or ON position. A circuit breaker in the fuseblock module protects the circuitry of the washer system. Refer to the owner's manual for more information on washer system controls and operation.

LIFTGATE WIPER/WASHER SYSTEM

A liftgate wiper/washer system is standard equipment on Grand Cherokee models. The liftgate wiper system provides four operating modes:
- intermittent wipe with a 5 to 8 second delay between sweeps
- continuous wipe
- a park mode that operates the wiper until it reaches its park position when the liftgate wiper switch is turned off
- a rear washer mode that provides 2-3 wiper sweeps before returning to one of the three previously selected operating modes.

A single switch on the instrument panel right switch pod controls all liftgate wiper and washer functions. These systems will operate only when the ignition switch is in the ACCESSORY or ON position. A fuse in the fuseblock module protects the circuitry of both the liftgate wiper and washer systems.

The liftgate wiper motor is wired to the liftgate and/or optional liftgate flipper glass ajar circuits. When the liftgate or liftgate glass are open (liftgate and/or liftgate glass ajar switch closed) a ground signal causes the liftgate wiper to return to the park position. The blade parks on a ramp located on the liftgate panel below the liftgate glass. Refer to the owner's manual for more information on liftgate wiper/washer system controls and operation.

WIPER ARMS, BLADES, AND ELEMENTS

All Grand Cherokee models have two 20-inch windshield wiper blades with replaceable rubber elements (squeegees). The liftgate wiper uses a single 12-inch wiper blade with a replaceable rubber element (squeegee).

Caution should be exercised to protect the rubber squeegees from any petroleum-based cleaners or contaminants, which will rapidly deteriorate the squeegee rubber. If squeegees are damaged, worn or contaminated they must be replaced.

Wiper squeegees exposed to the weather for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove deposits of salt and road film. The wiper blades, arms and windshield or liftgate glass should be cleaned with a sponge or cloth and a mild detergent or non-abrasive cleaner. If the squeegees continue to streak or smear, they should be replaced.

The blades are mounted to spring-loaded wiper arms. Spring tension of the wiper arms controls the pressure applied to the blades on the glass. The windshield wiper arms are attached by an integral latch to the two wiper pivots on the cowl grille panel at the base of the windshield. The liftgate wiper arm is attached by a nut under the blade pivot end cover directly to the liftgate wiper motor output shaft on the liftgate panel. The wiper arms and blades can not be adjusted or repaired. If faulty, they must be replaced.

WIPER LINKAGE AND PIVOTS

The wiper linkage, pivots, and motor are installed in the vehicle and removed as a unit. These components are all mounted to a bracket, which is bolted to another bracket in the cowl plenum area beneath the cowl plenum screen. The linkage, pivots, and bracket are serviced only as an assembly. The wiper motor is available as a separate service item.

WINDSHIELD WIPER MOTOR

The two-speed permanent magnet wiper motor has an integral transmission and park switch. The motor is mounted to the wiper linkage module with 3 screws and a nut that secures the crank arm to the motor output shaft.

Wiper speed is controlled by current flow to the appropriate set of brushes. The wiper motor completes its wipe cycle when the switch is turned OFF. An internal park switch maintains current to the motor brushes until the wiper arms reach the lowest portion of the wipe pattern. The wiper motor assembly can not be repaired. If faulty, the entire motor assembly must be replaced. The crank arm, mounting bracket, and other linkage are serviced only as an assembly.

LIFTGATE WIPER MOTOR

The liftgate wiper motor contains integral electronic controls and a transmission to provide four operating modes:

- intermittent wipe with a fixed 5 to 8 second delay between wipes
- continuous wipe
- a park mode that operates the wiper until it reaches its park position when the liftgate wiper switch is turned off
- a rear washer mode that provides 2-3 wiper sweeps before returning to one of the three previously selected operating modes.

The liftgate wiper motor can not be repaired. If faulty, the entire assembly must be replaced.

WINDSHIELD WIPER/WASHER SWITCH

Controls for the windshield wiper and washer systems are contained in the multi-function switch control lever. The multi-function switch is mounted on the left side of the steering column between the steering wheel and the instrument panel. This switch also controls many other functions. The multi-function switch can not be repaired. If any function of the switch is faulty, the entire switch must be replaced.

LIFTGATE WIPER/WASHER SWITCH

The single two-function switch on the instrument panel right of the steering column controls the liftgate wiper and washer functions. The sliding-type switch features a detent in the ON and DELAY positions. The switch knob is pushed in to activate the WASH function. Both the liftgate wiper and liftgate washer motors will operate continuously for as long as the switch is held in the WASH position. The switch can not be repaired; if faulty, it must be replaced.

INTERMITTENT WIPE MODULE

In addition to low and high speed, the intermittent wipe system has a delay mode. The delay mode has a range of 2 to 20 seconds. The length of the delay is selected with a variable resistor in the wiper (multi-function) switch and is accomplished by electronic circuitry within the intermittent wipe module. If the washer knob is depressed while the wiper (multi-function) switch is in the OFF position, the intermittent wipe module will operate the wiper motor for approximately 2 wipes and automatically turn the motor off.

The intermittent wipe module is mounted to the left cowl side panel under the instrument panel and behind the cowl side trim with a hook and loop fastener patch. The module can not be repaired.

WINDSHIELD WASHER NOZZLES

The two fluidic washer nozzles are snapped into openings in the cowl grille panel below the windshield and are not adjustable. Washer fluid is fed to the nozzles through hoses clipped to the underside of the cowl grille panel. The nozzles can not be repaired and, if faulty, should be replaced.

LIFTGATE WASHER NOZZLE

The single liftgate washer nozzle snaps into a hole in the center of the upper liftgate panel above the liftgate glass. Washer fluid is fed to the nozzle from the washer reservoir in the engine compartment. A liftgate washer hose system is routed through the body of the vehicle with the left body wiring harness from the reservoir to the liftgate. The nozzle can not be repaired and, if faulty, should be replaced.

WASHER RESERVOIR

The washer solvent reservoir is mounted to the left front inner fender shield near the cowl panel. The same reservoir is used for both the windshield and liftgate washer systems. It also has a provision for a low washer fluid level sensor. Refer to Group 8E - Instrument Panel and Gauges for diagnosis and service of the sensor. The reservoir and filler cap are available for service.

WASHER PUMPS

Two washer pump and motor units are mounted near the bottom of the washer reservoir, one each for the windshield and liftgate washer systems. A threaded nipple on the pump is installed through a grommet in the bottom of the single reservoir. A filter/nut is installed through the reservoir filler opening to the threaded nipple to hold the pump/motor unit in place. A permanently lubricated and sealed motor is coupled to the rotor-type pump. Washer fluid is gravity fed from the reservoir to the pump. The pump then pressurizes the fluid and forces it through the plumbing to the nozzles when the motor is energized. The pump and motor can not be repaired. If faulty, the entire assembly must be replaced.

DIAGNOSIS

WINDSHIELD WIPER SYSTEM

(1) Remove circuit breaker from fuseblock module and turn ignition switch to ACCESSORY or ON.

(a) Measure voltage at battery side of circuit breaker cavity. Meter should read battery voltage. If not OK, repair wiring from ignition switch.

(b) Measure resistance across circuit breaker terminals. Meter should read zero ohms. If not OK, replace failed circuit breaker.

(2) Unplug wiper (multi-function) switch side of wiring harness connector from intermittent wipe module and turn ignition switch to ACCESSORY or ON.

(a) Measure voltage at unplugged connector terminal D. Meter should read battery voltage. If not OK, repair wiring from circuit breaker through multi-function switch connector cavity 4. See Windshield Wiper/Washer Switch diagnosis for more information.

(b) Turn wiper switch to LOW. Measure voltage at unplugged connector terminal E. Meter should read battery voltage. If not OK, repair wiring from wiper switch and/or see Windshield Wiper/Washer Switch diagnosis.

(c) Turn wiper switch to HIGH. Measure voltage at unplugged connector terminal C. Meter should read battery voltage. If not OK, repair wiring from wiper switch and/or see Windshield Wiper/Washer Switch diagnosis.

(3) With ignition switch OFF and wiring harness connector (multi-function switch side) still unplugged.

(a) Measure resistance between unplugged connector terminals A and G while rotating wiper switch from minimum to maximum DELAY. Meter should read from zero to 300K ohms. If not OK, repair wiring from wiper switch and/or see Windshield Wiper/Washer Switch diagnosis.

(b) Measure resistance between unplugged connector terminals D and G while rotating wiper switch from minimum to maximum DELAY. Meter should read from zero to 300K ohms. If not OK, repair wiring from wiper switch and/or see Windshield Wiper/Washer Switch diagnosis.

(4) Unplug wiring harness connector (wiper motor side) from intermittent wipe module. Turn wiper switch to LOW or HIGH, then plug both unplugged harness connectors into each other. Turn ignition switch to ACCESSORY or ON.

CAUTION: DO NOT move the wiper switch to DELAY with the intermittent wiper module removed from the circuit. If the switch is moved to the DELAY position during the next step, the switch will be damaged.

(a) Test wiper operation in LOW and HIGH speed modes, and test washer operation. If these modes were inoperative, but are OK now, replace failed intermittent wipe module. If not OK, reinstall intermittent wipe module and go to next step.

CAUTION: When replacing intermittent wipe module, be certain to use the correct replacement module. If an incorrect substitution is used, the wiper delay will be incorrect.

(5) Turn ignition switch to ACCESSORY or ON, and turn wiper switch to LOW or HIGH. Measure voltage at either intermittent wipe module connector terminal F and move wiper switch to OFF. Meter should show battery voltage until wipers park, and then zero volts. If OK, go to step 6. If not OK, check wiring to wiper motor and perform Windshield Wiper/Washer Switch diagnosis, then go to step 6.

(6) To test the wiper motor, turn the ignition switch to ACCESSORY or ON. Position the wiper switch and probe the motor connector (Fig. 1) as indicated in the following steps.

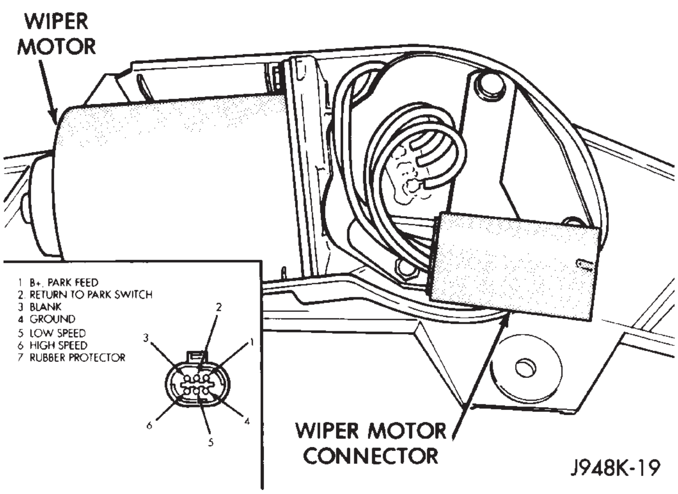


Fig. 1 Wiper Motor Connector

(a) Wiper switch in OFF position, measure resistance between terminal 4 and a good ground. Meter should read zero ohms. If not OK, repair wiring to ground.

(b) Wiper switch in any position, measure voltage at terminal 1. Meter should read battery voltage. If not OK, repair wiring to intermittent wipe module.

(c) Wiper switch in LOW, measure voltage at terminal 5. Meter should read battery voltage. If OK, but wipers do not operate, replace failed wiper motor. If not OK, repair wiring to intermittent wipe module.

(d) Wiper switch in HIGH, measure voltage at terminal 6. Meter should read battery voltage. If OK, but wipers do not operate, replace failed wiper motor. If not OK, repair wiring to intermittent wipe module.

(e) Wiper switch in LOW or HIGH, voltmeter connected to terminal 2. Turn wiper switch to OFF and observe meter. Meter should read battery voltage when switch goes to OFF, then zero volts after wipers park. If battery voltage present, but wipers fail to park, replace failed wiper motor. If no battery voltage present, repair wiring to intermittent wipe module.

WINDSHIELD WASHER SYSTEM

(1) With ignition switch in OFF position, unplug front washer pump wiring connector. Measure resistance from terminal A of front pump connector to a good ground. Meter should read zero ohms. If not OK, repair wiring to ground.

(2) Remove circuit breaker from fuseblock module and turn ignition switch to ACCESSORY or ON.

(a) Measure voltage at battery side of circuit breaker cavity. Meter should read battery voltage. If not OK, repair wiring from ignition switch.

(b) Measure resistance across circuit breaker terminals. Meter should read zero ohms. If OK, reinstall circuit breaker. If not OK, replace failed circuit breaker.

(3) Unplug wiring harness connector (multi-function switch side) from intermittent wipe module, and turn ignition switch to ACCESSORY or ON. Measure voltage at unplugged connector terminal B while washer switch is depressed. Meter should read battery voltage. If OK, reinstall connector. If not OK, repair wiring back to circuit breaker and/or see Windshield Wiper/Washer Switch diagnosis.

(4) Unplug wiring harness connector (washer pump side) from intermittent wipe module, and turn ignition switch to ACCESSORY or ON. Measure voltage at unplugged connector terminal B while washer switch is depressed. Meter should read battery voltage. If OK, reinstall connector. If not OK, replace failed intermittent wipe module.

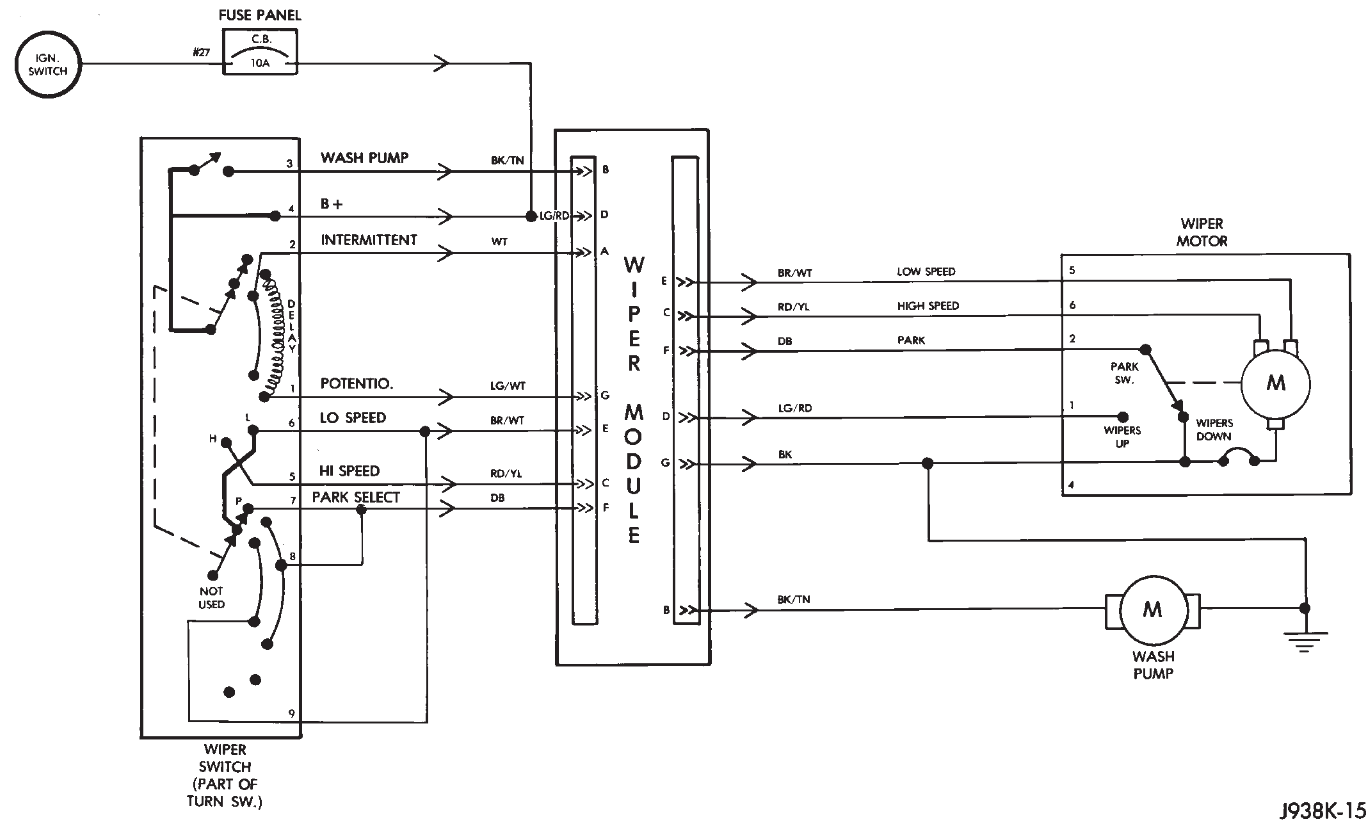
CAUTION: When replacing intermittent wiper module, be certain to use the correct replacement module. If an incorrect substitution is used, the wiper delay will be incorrect.

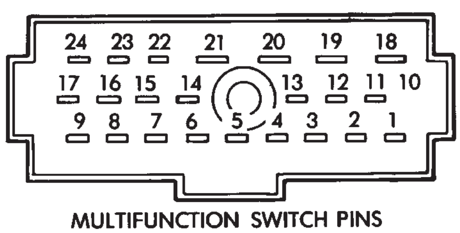
(5) With ignition switch in ACCESSORY or ON, unplug connector at front washer pump. Measure voltage at washer pump connector terminal A while washer switch is depressed. Meter should read battery voltage. If OK, replace failed front washer pump. If not OK, repair wiring from intermittent wipe module.

WINDSHIELD WIPER/WASHER SWITCH

Use an ohmmeter to test for continuity (no resistance) between the terminals of the switch as shown in the Multi-Function Switch Continuity chart (Fig. 2). If not OK, replace the switch.

WINDSHIELD WIPER/WASHER SYSTEM SCHEMATIC





SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN 6 AND PIN 7
DELAY	PIN 8 AND PIN 9 PIN 2 AND PIN 4 PIN 1 AND PIN 2 PIN 1 AND PIN 4
LOW	PIN 4 AND PIN 6
HIGH	PIN 4 AND PIN 5
WASH	PIN 3 AND PIN 4
*RESISTANCE AT MAXIMUM DELAY POSITION SHOULD BE BETWEEN 270,000 OHMS AND 330,000 OHMS. *RESISTANCE AT MINIMUM DELAY POSITION SHOULD BE ZERO WITH OHMMETER SET ON HIGH OHM SCALE.	

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Fig. 2 Multi-Function Switch Continuity

INTERMITTENT WIPE MODULE

The intermittent wipe module is non-serviceable. Refer to Group 8W - Wiring Diagrams for more information.

The intermittent wipe module is attached to the left cowl side panel beneath the instrument panel and behind the cowl side trim panel with a hook and loop fastener patch.

The following tests are to be performed if a problem with wiper system is only evident in the DELAY mode. These tests involve disconnecting the intermittent wipe module.

CONDITION

Excessive delay (more than 30 seconds) or inadequate variation in delay.

PROCEDURE

Variations in delay should be as follows:

(1) Minimum delay (delay control to extreme counterclockwise position before first detent) 1/2 to 2 seconds.

(2) Maximum delay (delay control to extreme clockwise position before off detent) 10 to 30 seconds.

(3) If there is excessive delay or no variations in delay, see Windshield Wiper/Washer Switch diagnosis.

CONDITION

In DELAY mode wipers run continually when washers are operated, but do not provide an extra wipe when the wash switch is released.

PROCEDURE

Replace the intermittent wipe module.

CAUTION: When replacing intermittent wipe module, be certain to use the correct replacement module. If an incorrect substitution is used, the wiper delay will be incorrect.

CONDITION

Wipers start erratically during DELAY mode.

PROCEDURE

(1) Verify that the ground connection at the instrument panel is making good connection (free from paint) and is tight.

(2) Verify that the wiring ground connections are tight and have good contact.

(3) Verify that the wiring ground connections for the intermittent wipe module and the windshield wiper/washer switch are tight.

(4) If condition is not corrected, replace intermittent wipe module.

CAUTION: When replacing intermittent wipe module, be certain to use the correct replacement module. If an incorrect substitution is used, the wiper delay will be incorrect.

LIFTGATE WIPER SYSTEM

(1) Remove and inspect 20 amp fuse 9 in the fuseblock module. If OK, re-install fuse and go to next step. If not OK, replace fuse.

(2) Remove liftgate cover. See Liftgate Wiper Motor service procedures.

(3) Measure resistance between rear wiper motor connector terminal 3 and ground. Meter should read zero ohms. If OK, go to next step. If not OK, repair wiring to ground.

(4) With liftgate and liftgate glass closed, check for continuity between rear wiper motor connector terminal 6 and ground. There should be no continuity. If OK, go to next step. If not OK, repair liftgate or liftgate glass ajar switch and wiring as necessary.

(5) Turn ignition switch to ON and place liftgate wiper switch in WASH. Measure voltage at rear wiper motor connector terminal 5. Meter should read battery voltage. If OK, go to next step. If not OK, go to step 7.

(6) Place liftgate wiper switch in ON. Measure voltage at liftgate wiper motor connector terminal 2. Meter should read battery voltage. If not OK, go to step 7.

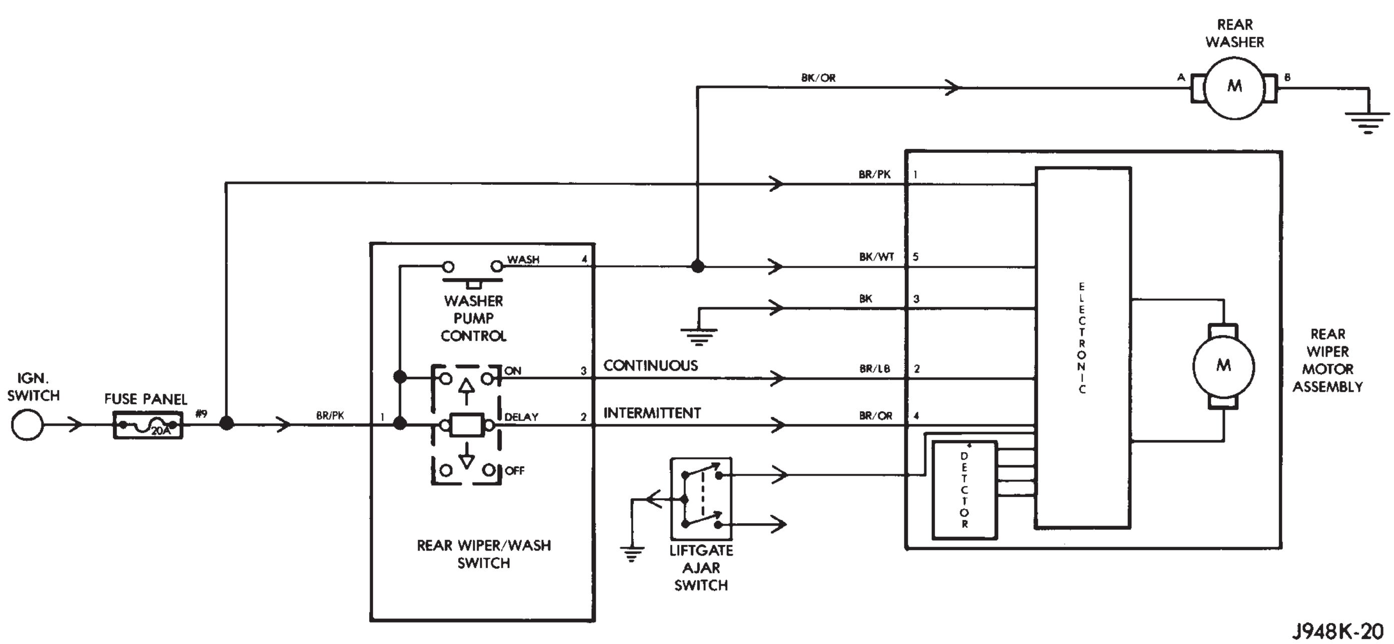
(7) Remove liftgate wiper switch and reconnect below instrument panel. Back probe liftgate wiper switch connector with ignition switch in ON position.

(8) Measure voltage at liftgate wiper switch connector terminal 1. Meter should read battery voltage. If not OK, repair open to fuse 9.

(9) Push liftgate wiper switch to WASH. Measure voltage at liftgate wiper switch connector terminal 4. Meter should read battery voltage. If OK, repair open to liftgate wiper motor terminal 5. If not OK, replace switch.

(10) Move liftgate wiper switch to ON. Measure voltage at liftgate wiper switch connector terminal 3.

LIFTGATE WIPER/WASHER SYSTEM SCHEMATIC



Meter should read battery voltage. If OK, repair open to liftgate wiper motor terminal 2. If not OK, replace switch.

(11) Move liftgate wiper switch to DELAY. Measure voltage at switch connector terminal 2. Meter should read battery voltage. If OK, repair open to liftgate wiper motor terminal 4. If not, replace switch.

LIFTGATE WASHER SYSTEM

(1) Turn ignition switch to ON and place liftgate wiper switch in ON. If motor does not operate check fuse 9 in the fuseblock module.

(2) Unplug liftgate washer pump connector.

(3) Measure resistance at pump connector terminal B (ignition switch OFF). Meter should read zero ohms. If not OK, repair wiring to ground.

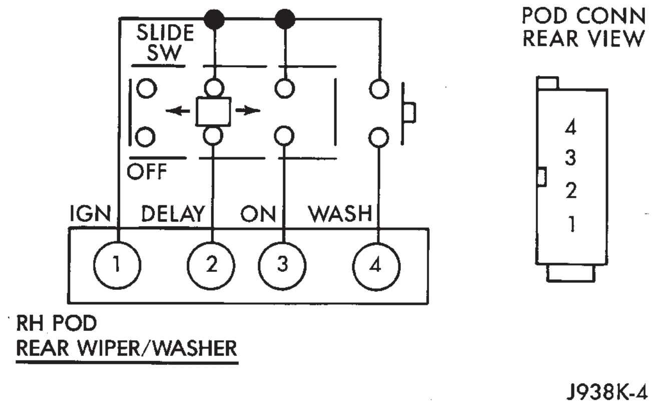
(4) Turn ignition switch to ON.

(5) Measure voltage at pump connector terminal A, liftgate wiper switch in WASH. Meter should read battery voltage. If OK, replace pump. If not OK, go to next step.

(6) Remove liftgate wiper switch and reconnect below instrument panel. Back probe liftgate wiper switch connector with ignition switch in ON.

(7) Measure voltage at liftgate wiper switch connector terminal 1. Meter should read battery voltage. If not, repair wiring to fuse 9.

LIFTGATE WIPER/WASHER SWITCH



(8) Measure voltage at liftgate wiper switch connector terminal 4, switch in WASH. Meter should read battery voltage. If not OK, replace switch.

LIFTGATE WIPER/WASHER SWITCH

Use an ohmmeter to test switch resistance as shown in the following chart. If switch fails to perform as shown, replace faulty switch.

SERVICE PROCEDURES

WINDSHIELD WIPER MOTOR REMOVE/INSTALL

(1) Remove wiper arms by lifting up wiper arm and slide tab out.

(2) Remove 6 screws holding the cowl grille (Fig. 3).

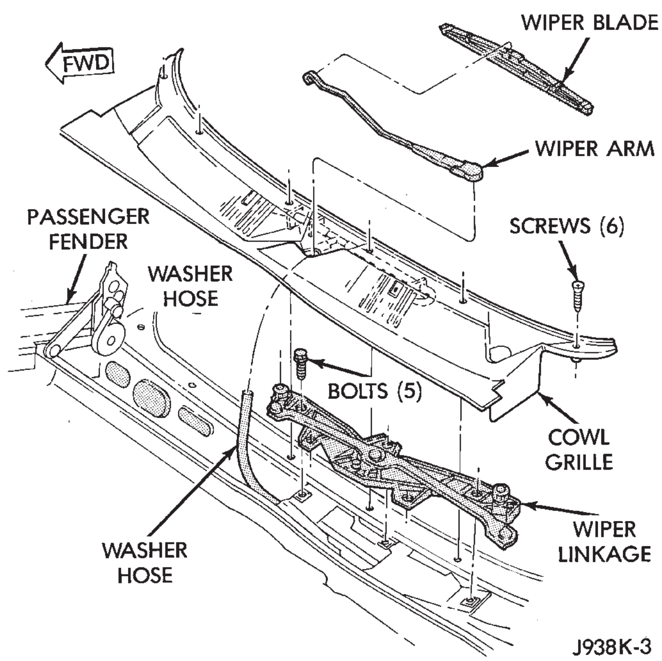


Fig. 3 Wiper Linkage Remove/Install

(3) Disconnect washer hose and set cowl grille aside.

(4) Remove 5 bolts holding wiper linkage assembly.

(5) Turn linkage over and remove the nut holding the crank arm to the motor.

(6) Remove 3 screws holding motor to linkage (Fig. 4) and remove motor.

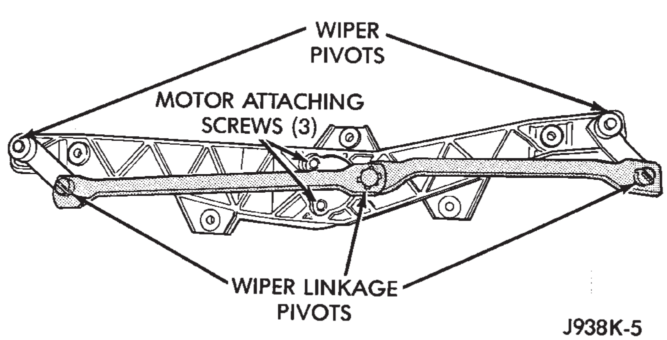


Fig. 4 Windshield Wiper Motor Remove/Install

(7) Reverse removal procedures to install. Index wiper arms as shown in Fig. 5. Tighten hardware as follows:

- motor screws to 5-7 N·m (44-62 in. lbs.)
- crank arm to motor nut to 10-12 N·m (88-106 in. lbs.)
- linkage assembly screws to 8 N·m (72 in. lbs.).

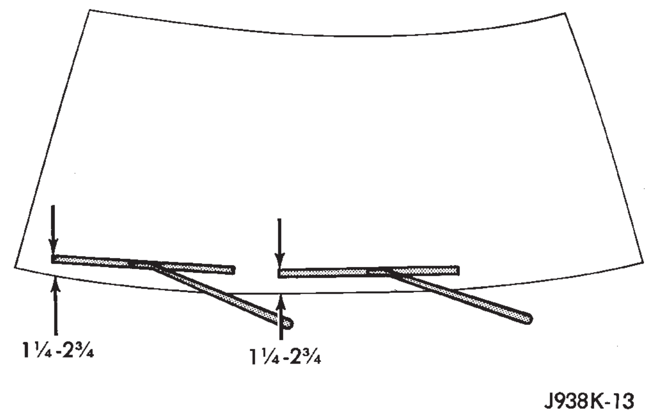


Fig. 5 Windshield Wiper Arms Install

LIFTGATE WIPER MOTOR REMOVE/INSTALL

(1) Lift cover off wiper arm pivot (Fig. 6).

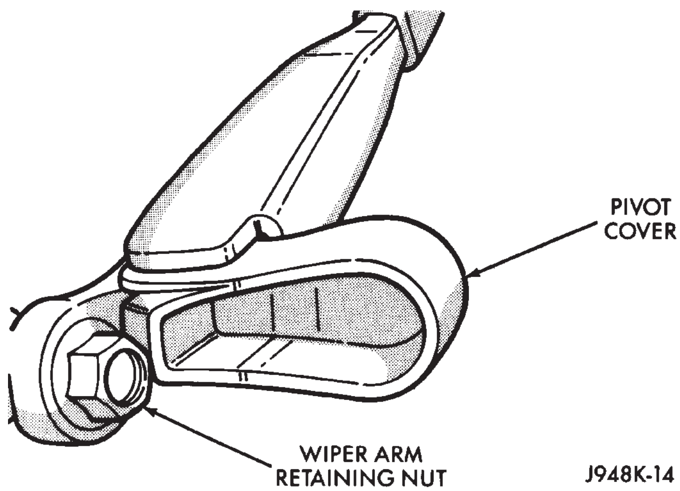


Fig. 6 Liftgate Wiper Arm Remove

(2) Remove wiper arm retaining nut and wiper arm.

(3) Remove motor retaining nut (Fig. 7).

(4) Remove external bezel.

(5) Remove screws holding liftgate interior trim panel.

(6) Remove the trim panel with a wide, flat-bladed tool (Fig. 8).

(7) Unplug harness connector from rear wiper motor.

(8) Remove 2 wiper motor mounting bolts.

(9) Remove wiper motor.

(10) Reverse removal procedures to install. Position wiper blade as shown in Fig. 9. Tighten hardware as follows:

- motor mounting bolts to 1-1.7 N·m (10-15 in. lbs.)
- motor mounting nut to 4-5.6 N·m (35-50 in. lbs.)
- wiper arm retaining nut to 18 N·m (160 in. lbs.).

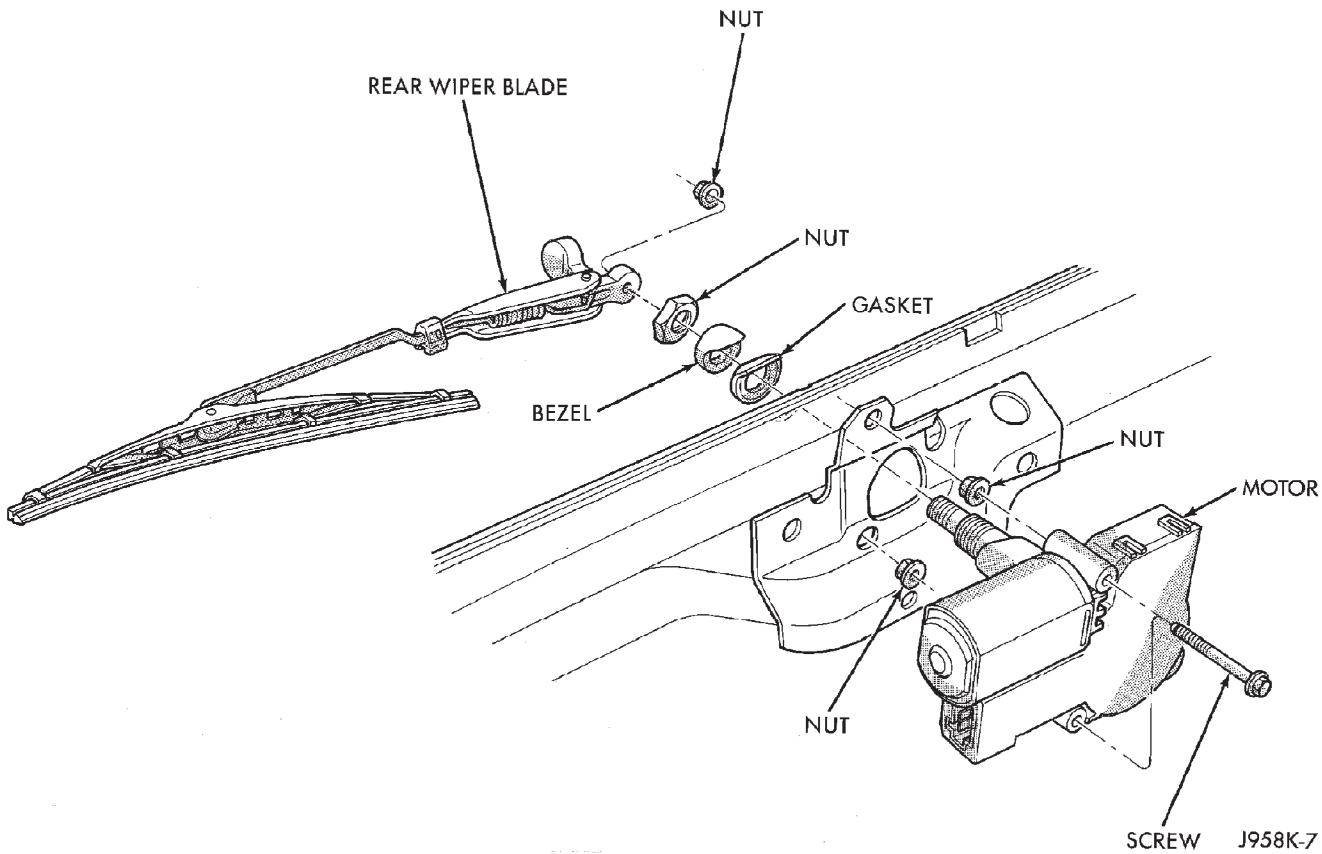


Fig. 7 Liftgate Wiper Motor Remove/Install

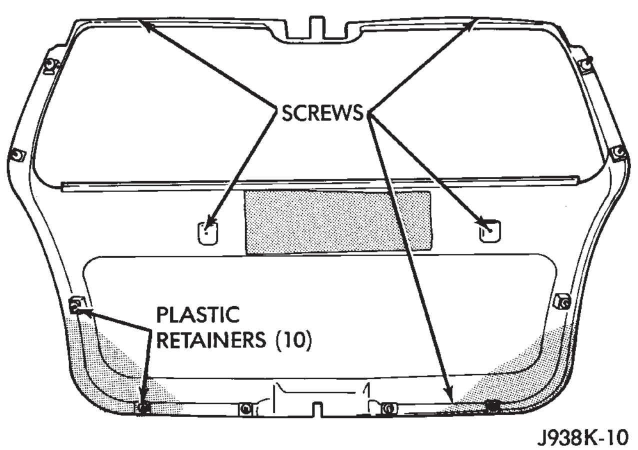


Fig. 8 Liftgate Trim Panel Remove **To aid in removal of the trim panel, start at the bottom of the panel.**

WINDSHIELD WIPER/WASHER SWITCH REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove tilt lever (tilt column only).

(3) Remove both upper and lower steering column covers. Requires removal of 3 screws (Torx T-20).

(4) Remove 4 screws holding steering column trim panel (Fig. 10).

(5) Remove 6 screws holding knee blocker.

(6) Remove steering column retaining nuts.

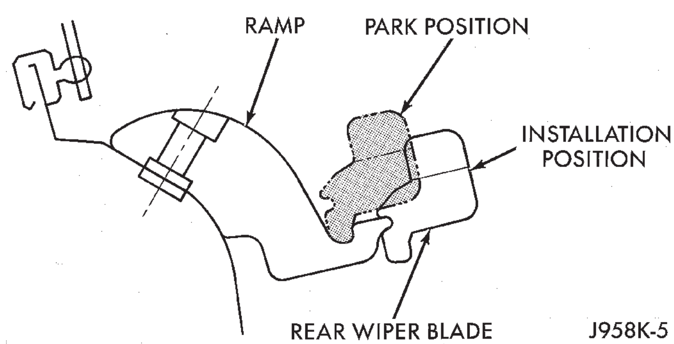


Fig. 9 Liftgate Wiper Arm Positioning

(7) Lower steering column to gain access to rear of multi-function switch.

(8) Remove multi-function switch tamper proof mounting screws (tamper proof torx bit Snap-On TTXR20B2 or equivalent required).

(9) Gently pull switch away from column. Loosen connector screw. The screw will remain in the connector.

(10) Remove wiring connector from multi-function switch (Fig. 11).

(11) Reverse removal procedures to install. Tighten hardware as follows:

- switch connector retaining screw to 2 N·m (17 in. lbs.)
- switch retaining screws to 2 N·m (17 in. lbs.)
- steering column nuts to 12 N·m (105 in. lbs.)

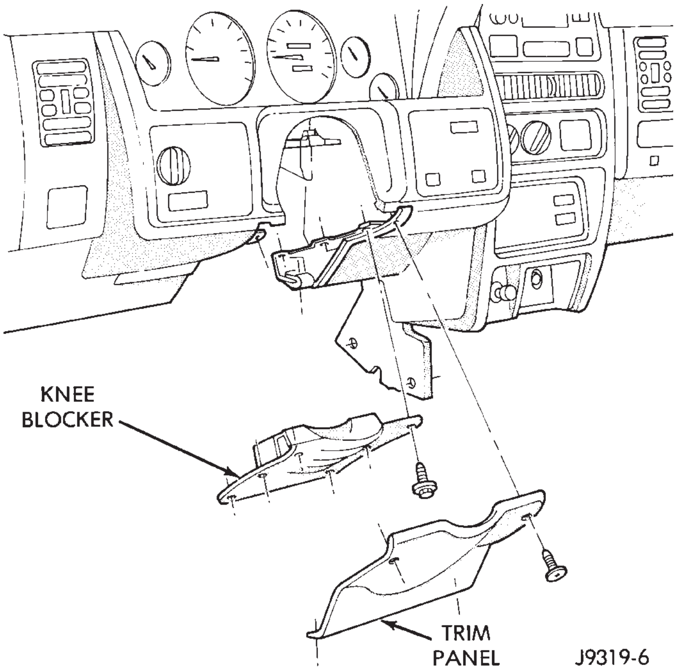


Fig. 10 Steering Column Trim and Knee Blocker

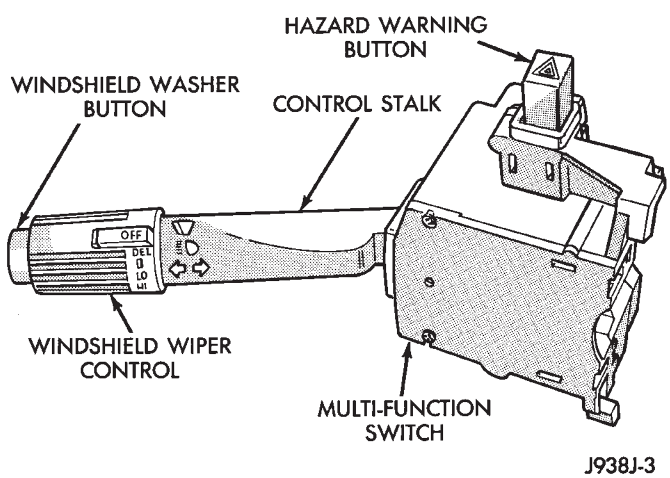


Fig. 11 Multi-Function Switch

- steering column cover screws to 2 N·m (17 in. lbs.).

LIFTGATE WIPER/WASHER SWITCH REMOVE/ INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding center cluster bezel (Fig. 12).

(4) Remove center bezel.

(5) Remove 2 screws holding dash pad located behind top of center bezel.

(6) Gently pry defroster grille out of dash pad.

(7) Unplug sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 13).

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 14).

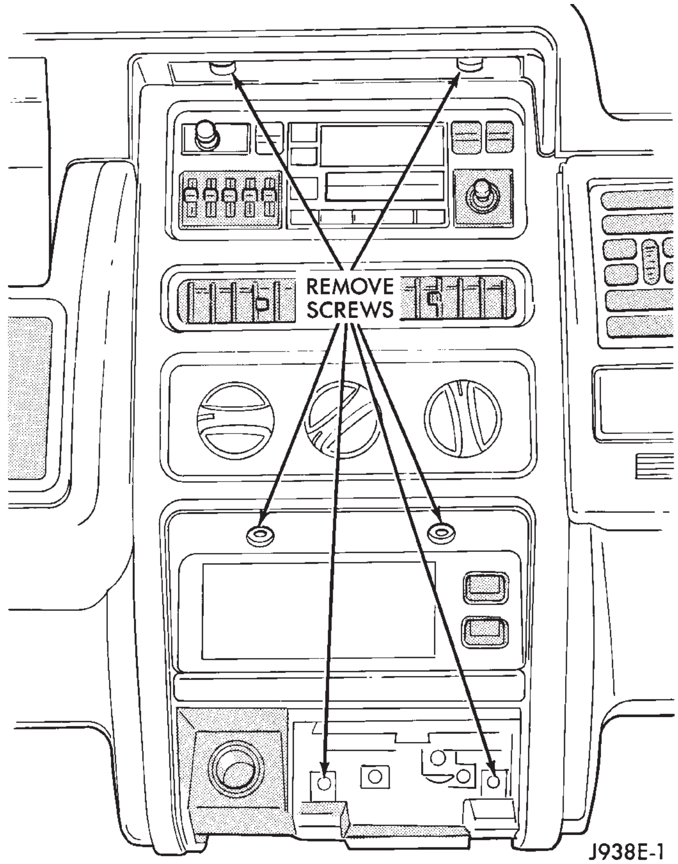


Fig. 12 Remove Center Bezel Upper Screws

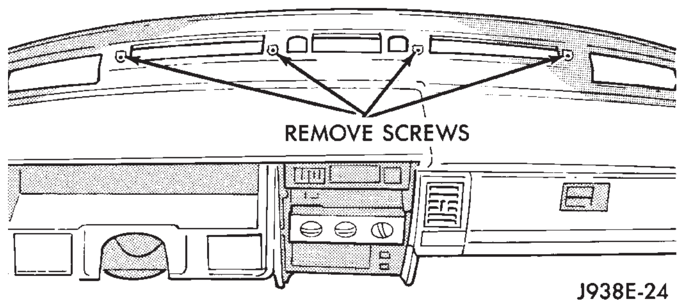


Fig. 13 Upper Dash Pad Attaching Screws

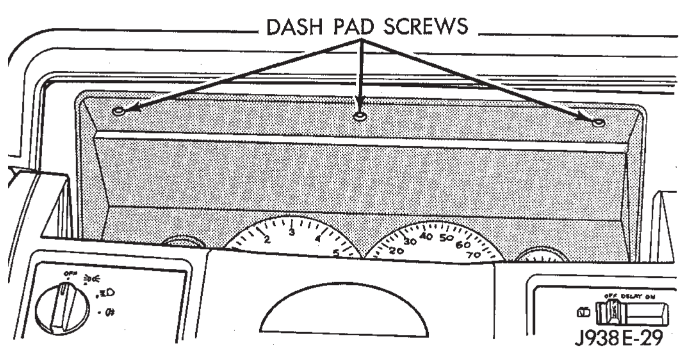


Fig. 14 Remove Screws Holding Dash Pad

(10) Open glove box and remove 2 screws holding dash pad.

(11) Remove dash pad pulling up to unsnap end clips.

(12) With left front door open, remove 1 screw from the side of the lower trim panel (Fig. 15).

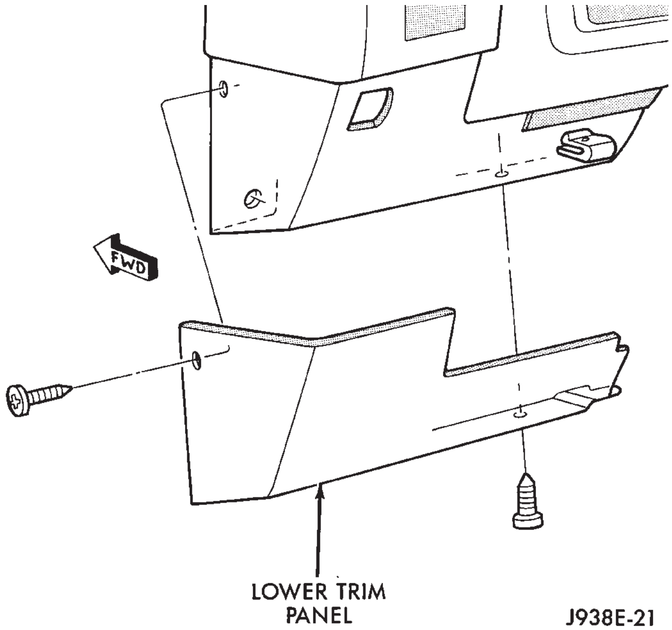


Fig. 15 Lower Trim Panel

(13) Remove 4 screws holding the steering column cover (Fig. 16).

(14) Remove 1 screw from bottom of lower trim panel and pull panel off. There is also a clip holding the panel to the instrument panel.

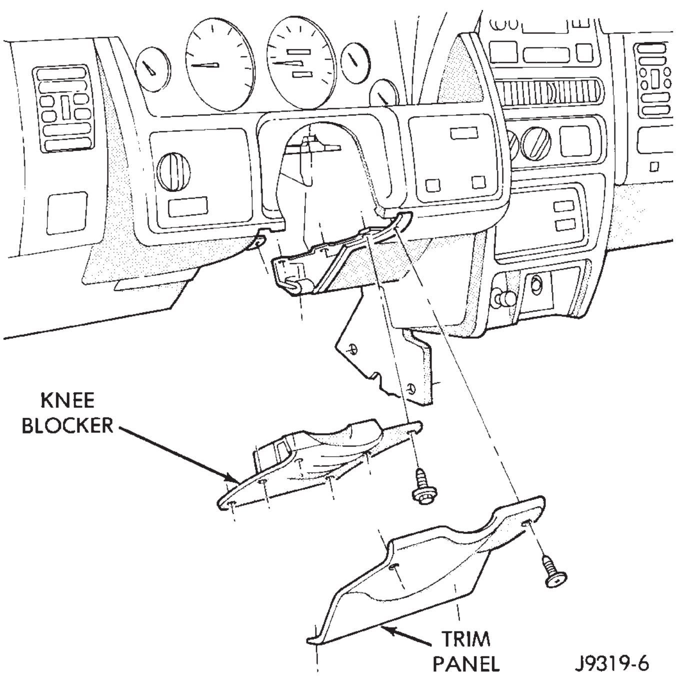


Fig. 16 Steering Column Cover and Knee Blocker

(15) Remove 6 screws holding knee blocker.

(16) Remove steering column retaining nuts.

(17) Remove 3 screws holding bottom of bezels (Fig. 17).

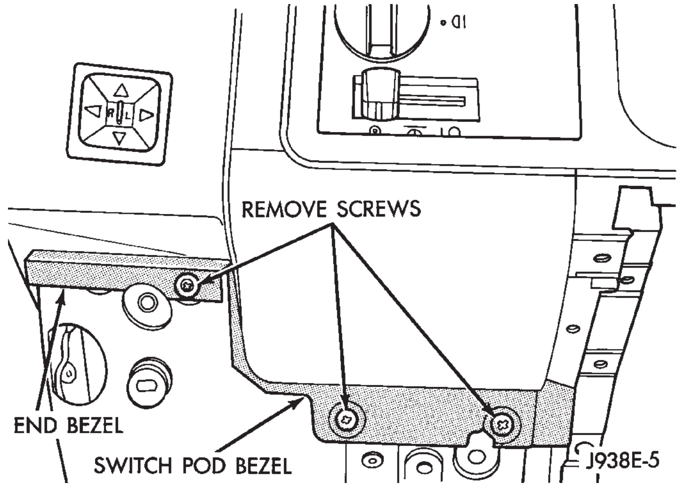


Fig. 17 Remove Screws Holding Bottom Of Bezels

(18) Remove 2 screws holding top of end and switch pod bezels (Fig. 18). The end bezel can now be removed.

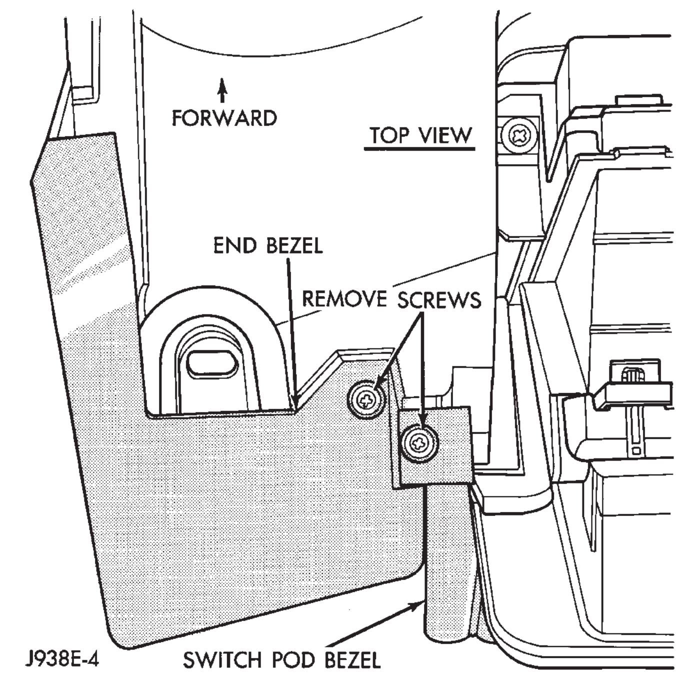


Fig. 18 Remove Screws Holding Top of Bezels

(19) Remove 2 screws holding left side of switch pod bezel (Fig. 19).

(20) Remove 3 screws holding right side of switch pod bezel (Fig. 20).

(21) Pull switch pod bezel out far enough to remove switch connectors. Disconnect connectors from each switch pod and remove bezel (Fig. 21).

(22) Remove required switch attaching screws and switch.

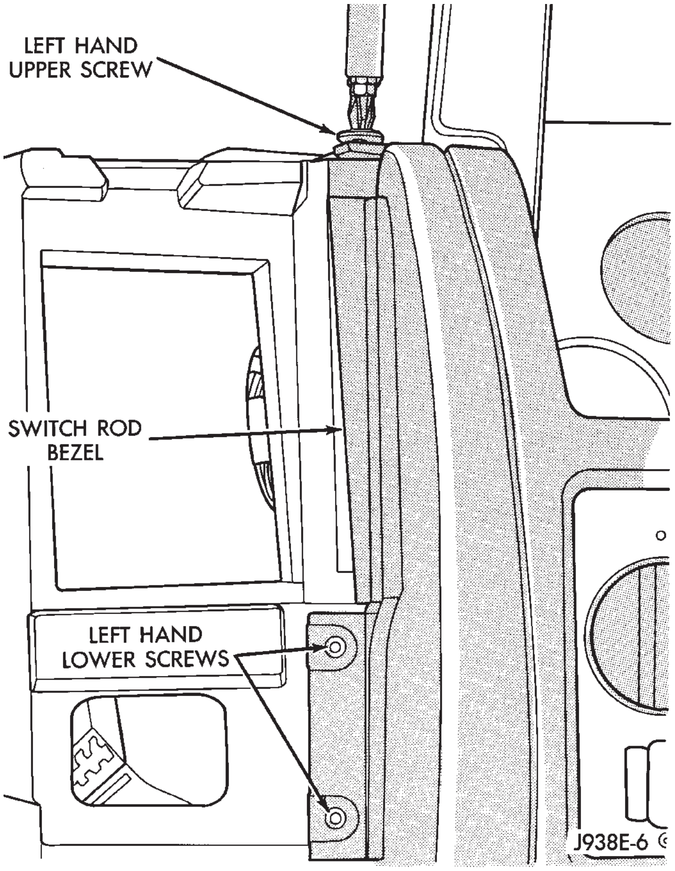


Fig. 19 Left Switch Pod Bezel Screws

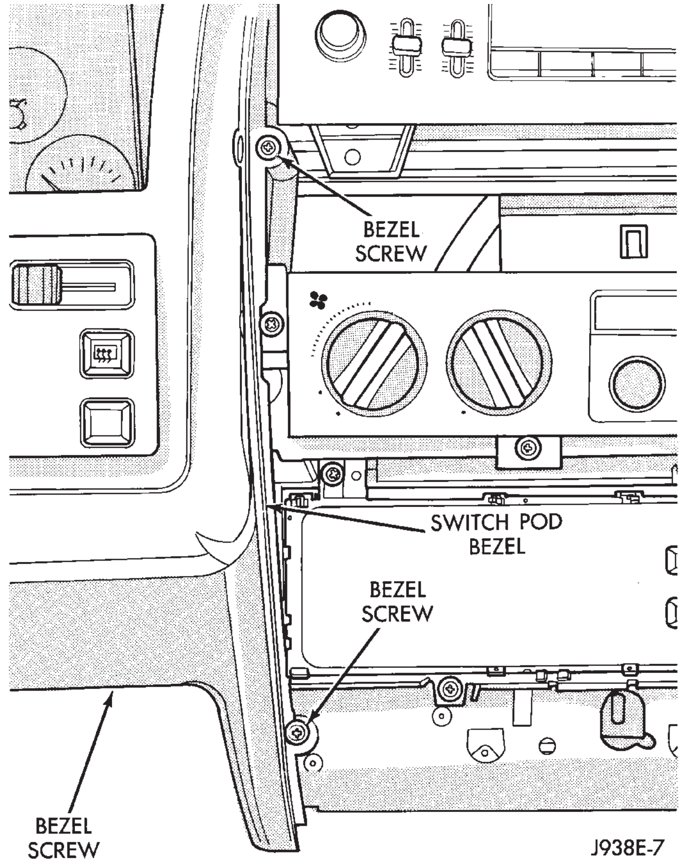


Fig. 20 Right Switch Pod Bezel Screws

(23) Reverse the removal procedures to install a new switch. Tighten steering column retaining nuts to 105 in. lbs.

WASHER PUMP/RESERVOIR REMOVE/INSTALL

(1) Remove 3 screws holding washer reservoir to left inner fender shield (Fig. 22).

(2) Disconnect hose from pump(s).

(3) Drain solvent from reservoir into a clean container for re-use.

(4) Using a deep socket, remove filter/nut(s) from bottom inside reservoir and remove pump(s).

(5) Reverse removal procedures to install.

WASHER NOZZLE REMOVE/INSTALL

To remove the washer nozzle, push up on the nozzle (Fig. 23). There is a small tang that will release, which allows the nozzle to be removed.

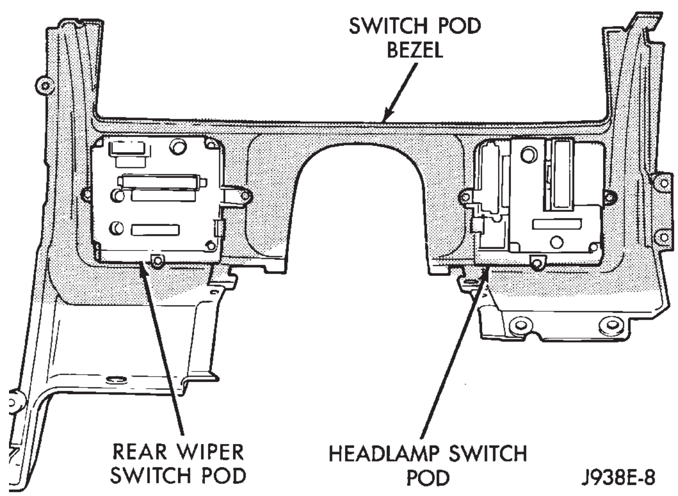


Fig. 21 Rear View Of Switch Pod Bezel

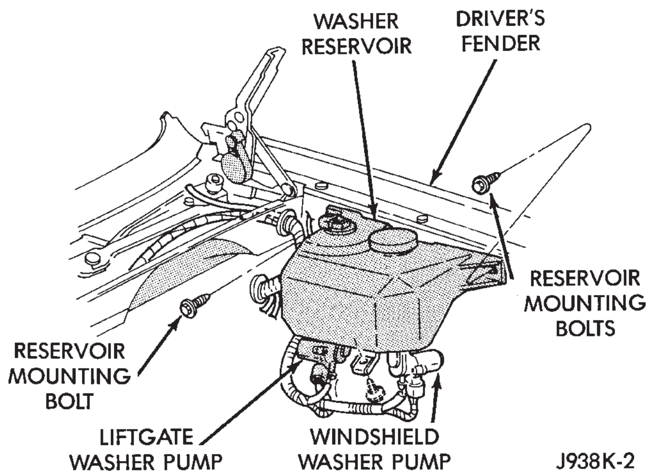


Fig. 22 Washer Reservoir Mounting

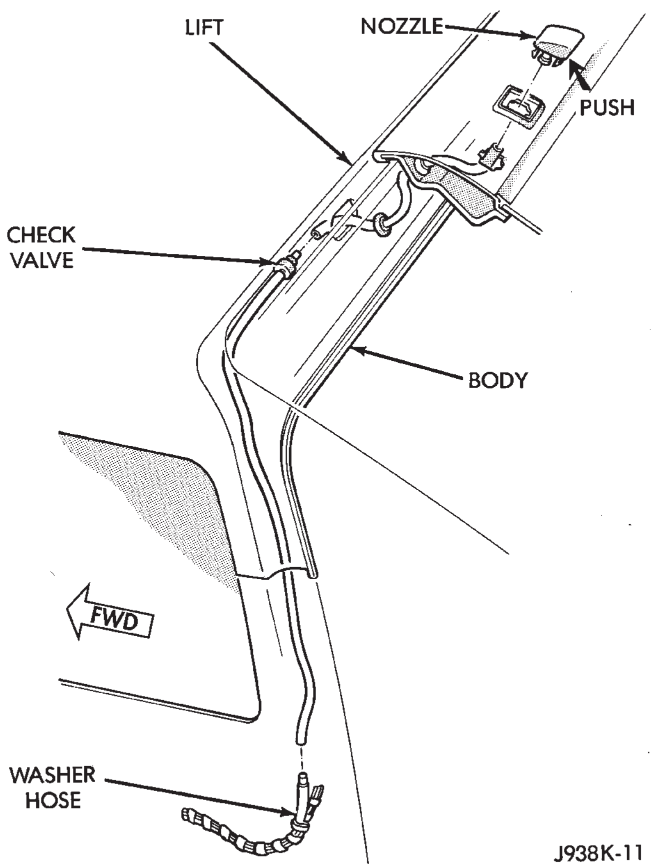


Fig. 23 Liftgate Washer Nozzle and Hose - Typical

LAMPS

CONTENTS

GENERAL INFORMATION

Each vehicle is equipped with various lamp assemblies. A good ground is necessary for proper lighting operation. Grounding is provided by the lamp socket when it comes in contact with the metal body, or through a separate ground wire.

When changing lamp bulbs check the socket for corrosion. If corrosion is present, clean it with a wire brush. Coat the inside of the socket lightly with Mopar Multi-Purpose Grease or equivalent.

Aero headlamps use a replaceable bulb that is mounted in a molded plastic lens.

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.

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to Group 8W, Wiring Diagrams.

HEADLAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables. 2. Loose or worn generator drive belt. 3. Charging system output too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground. 7. Both headlamp bulbs defective.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace generator drive belt. 3. Test and repair charging system, refer to Group 8A. 4. Test battery state-of-charge, refer to Group 8A. 5. Load test battery, refer to Group 8A. 6. Test for voltage drop across Z1-ground locations, refer to Group 8W. 7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT FREQUENTLY.	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system, refer to Group 8A. 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. 2. Poor headlamp circuit ground. 3. High resistance in headlamp circuit. 4. Both headlamp bulbs defective.	1. Test and repair charging system, refer to Group 8A. 2. Test voltage drop across Z1-ground, refer to Group 8W. 3. Test amperage draw of headlamp circuit. 4. Replace both headlamp bulbs.
HEADLAMPS FLASH RANDOMLY.	1. Poor headlamp circuit ground. 2. High resistance in headlamp circuit. 3. Faulty headlamp switch circuit breaker. 4. Loose or corroded terminals or splices in circuit.	1. Repair circuit ground, refer to Group 8W. 2. Test amperage draw of headlamp circuit. 3. Replace headlamp switch. 4. Repair connector terminals or splices, refer to Group 8W.
HEADLAMPS DO NOT ILLUMINATE.	1. No voltage to headlamps. 2. No ground at headlamps. 3. Faulty headlamp switch. 4. Faulty headlamp dimmer switch. 5. Broken connector terminal or wire splice in headlamp circuit.	1. Replace fuse, refer to group 8W. 2. Repair circuit ground, refer to Group 8W. 3. Replace headlamp switch. 4. Replace headlamp dimmer switch. 5. Repair connector terminal or wire splices.

* Canada vehicles must have lamps ON.

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FOG LAMP DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables. 2. Loose or worn generator drive belt. 3. Charging system output too low. 4. Battery has insufficient charge. 5. Battery is sulfated or shorted. 6. Poor lighting circuit Z1-ground. 7. Both fog lamp bulbs defective.	1. Clean and secure battery cable clamps and posts. 2. Adjust or replace generator drive belt. 3. Test and repair charging system, refer to Group 8A. 4. Test battery state-of-charge, refer to Group 8A. 5. Load test battery, refer to Group 8A. 6. Test for voltage drop across Z1-ground locations, refer to Group 8W. 7. Replace both lamp bulbs.
FOG LAMP BULBS BURN OUT FREQUENTLY.	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system, refer to Group 8A. 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. 2. Poor fog lamp circuit ground. 3. High resistance in fog lamp circuit. 4. Both fog lamp bulbs defective.	1. Test and repair charging system, refer to Group 8A. 2. Test voltage drop across Z1-ground, refer to Group 8W. 3. Test amperage draw of fog lamp circuit. 4. Replace both fog lamp bulbs.
FOG LAMPS FLASH RANDOMLY.	1. Poor fog lamp circuit ground. 2. High resistance in fog lamp circuit. 3. Faulty fog lamp switch circuit breaker. 4. Loose or corroded terminals or splices in circuit.	1. Repair circuit ground, refer to Group 8W. 2. Test amperage draw of fog lamp circuit. 3. Replace fog lamp switch. 4. Repair connector terminals or splices, refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE.	1. Blown fuse for fog lamps. 2. No ground at fog lamps. 3. Faulty fog lamp switch. 4. Broken connector terminal or wire splice in fog lamp circuit.	1. Replace fuse, refer to group 8W. 2. Repair circuit ground, refer to Group 8W. 3. Replace fog lamp switch. 4. Repair connector terminal or wire splices.

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MULTI-FUNCTION SWITCH TESTING PROCEDURES

The multi-function switch contains electrical circuitry for:

- Auto Headlamps
- Headlamp Dimmer Switch.
- Passing Lights.
- Turn Signals.
- Hazard Warning.
- Windshield Wiper.
- Pulse Wiper.
- Windshield Washer.

This integrated switch is mounted to the left hand side of the steering column. Should any function of the switch fail, the entire switch must be replaced.

The multi-function switch also serves as a fog lamp lock-out circuit. The circuit to the fog lamp switch is completed only when the dimmer switch is in the low beam position.

SWITCH TEST

(1) Disconnect battery negative cable.

(2) Remove lower instrument panel screws along bottom edge of steering column (Fig. 1).

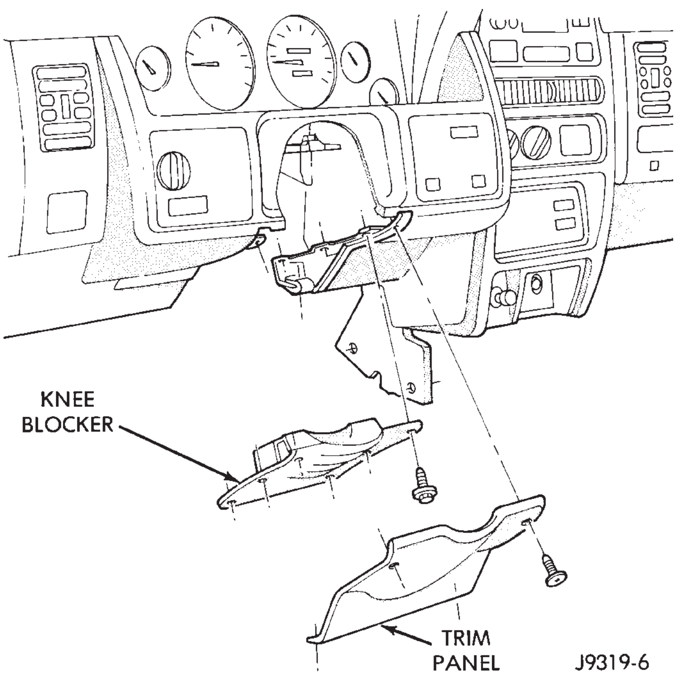


Fig. 1 Lower Instrument Panel/Knee Blocker

(3) Remove lower instrument panel and knee blocker.

(4) Remove tilt lever.

(5) Remove upper and lower column shrouds to gain access to the switch connector (Fig. 2).

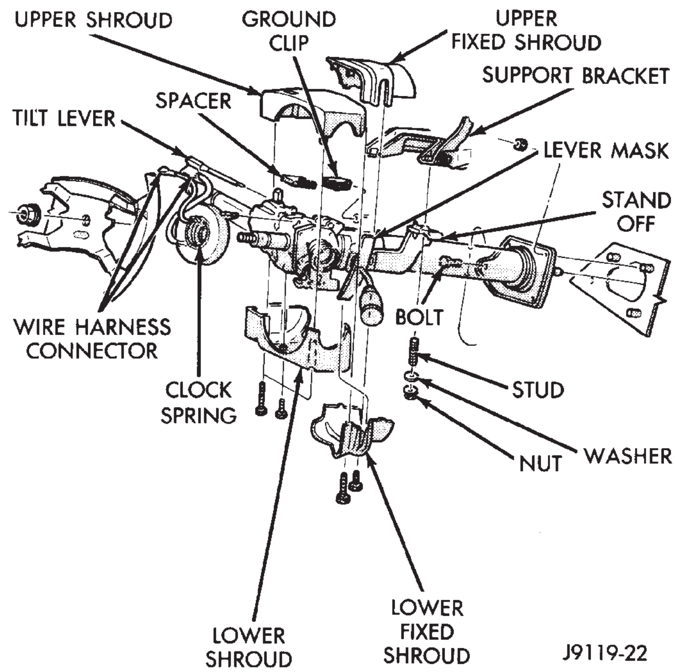


Fig. 2 Steering Column Shrouds

(6) Remove lower fixed column shroud.

(7) Loosen steering column upper bracket nuts. Do not remove nuts.

(8) Move upper fixed column shroud to gain access to rear of multi-function switch.

(9) Remove switch connector (Fig. 3 and 4).

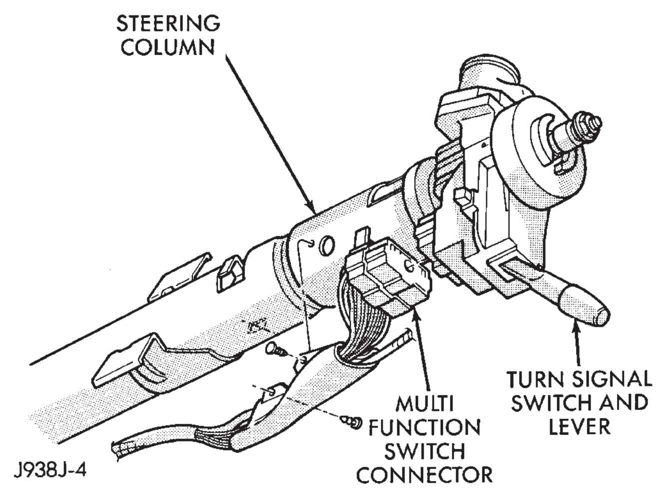


Fig. 3 Multi-function Switch Connector

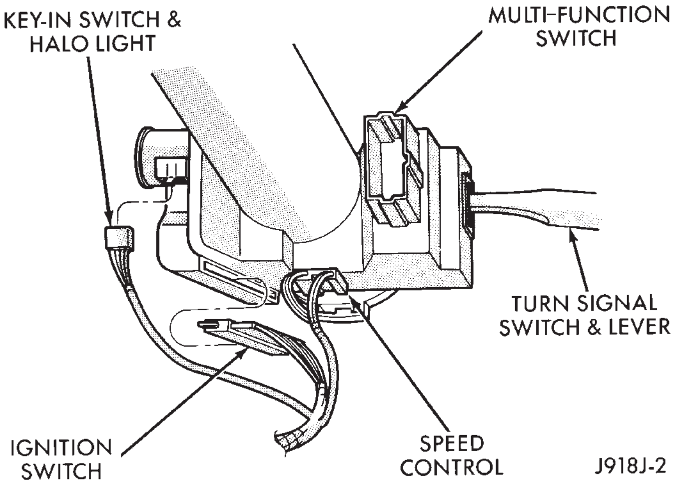
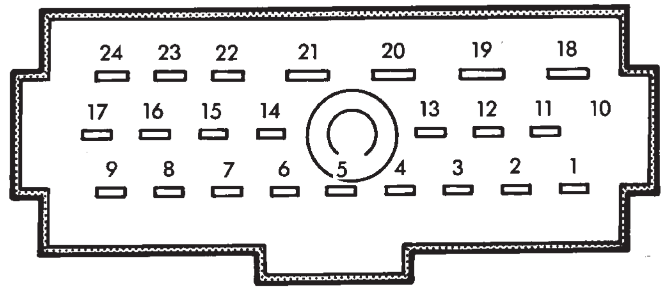


Fig. 4 Steering Column Connectors

(10) Use an ohmmeter to test for continuity between the terminals of the switch as shown in the continuity chart (Fig. 5).



SWITCH POSITION	CONTINUITY BETWEEN
LOW BEAM	18 AND 19
HIGH BEAM	19 AND 20
OPTICAL HORN	20 AND 21

908J-5

Fig. 5 Dimmer Switch Continuity Chart

(11) Refer to Service Procedures for assembly.

SERVICE PROCEDURES

INDEX

HEADLAMP ALIGNMENT

Headlamps can be aligned using the screen method provided in this section. Alignment Tool C4466-A or equivalent can also be used. Refer to instructions provided with the tool for proper procedures. **The preferred headlamp alignment setting is 0 for the left/right adjustment and 1″ down for the up/down adjustment.**

HEADLAMP ALIGNMENT PREPARATION

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Correct defective components that could hinder 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.

HEADLAMP/FOG LAMP 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.

(2) If necessary, tape a line on the floor 7.62 meters (25 ft) away from and parallel to the wall (Fig. 1).

(3) 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 to verify accuracy of line placement.

(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 floor. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(7) 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.

HEADLAMP ADJUSTMENT

A properly aimed low beam will project the top edge of high intensity pattern on the screen from 50 mm (2 in.) above to 50 mm (2 in.) below headlamp centerline. The side-to-side left edge of high intensity pattern should be from 50 mm (2 in.) left to 50 mm (2 in.) right of headlamp centerline (Fig. 1). **The preferred headlamp alignment is 0 for the left/right adjustment and 1″ down for the up/down adjustment.** 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 aim, rotate alignment screws (Fig. 2).

FOG LAMP ADJUSTMENT

Prepare an alignment screen. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp centerline and straight ahead (Fig. 3).

HEADLAMP BULB REMOVAL

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Lift hood to access lamps.

(2) Reach into engine compartment and locate lock ring supporting the headlamp bulb assembly.

(3) Rotate the lock ring 1/8 turn counterclockwise (Fig. 4).

(4) Pull the bulb straight out from the housing.

(5) Install new bulb.

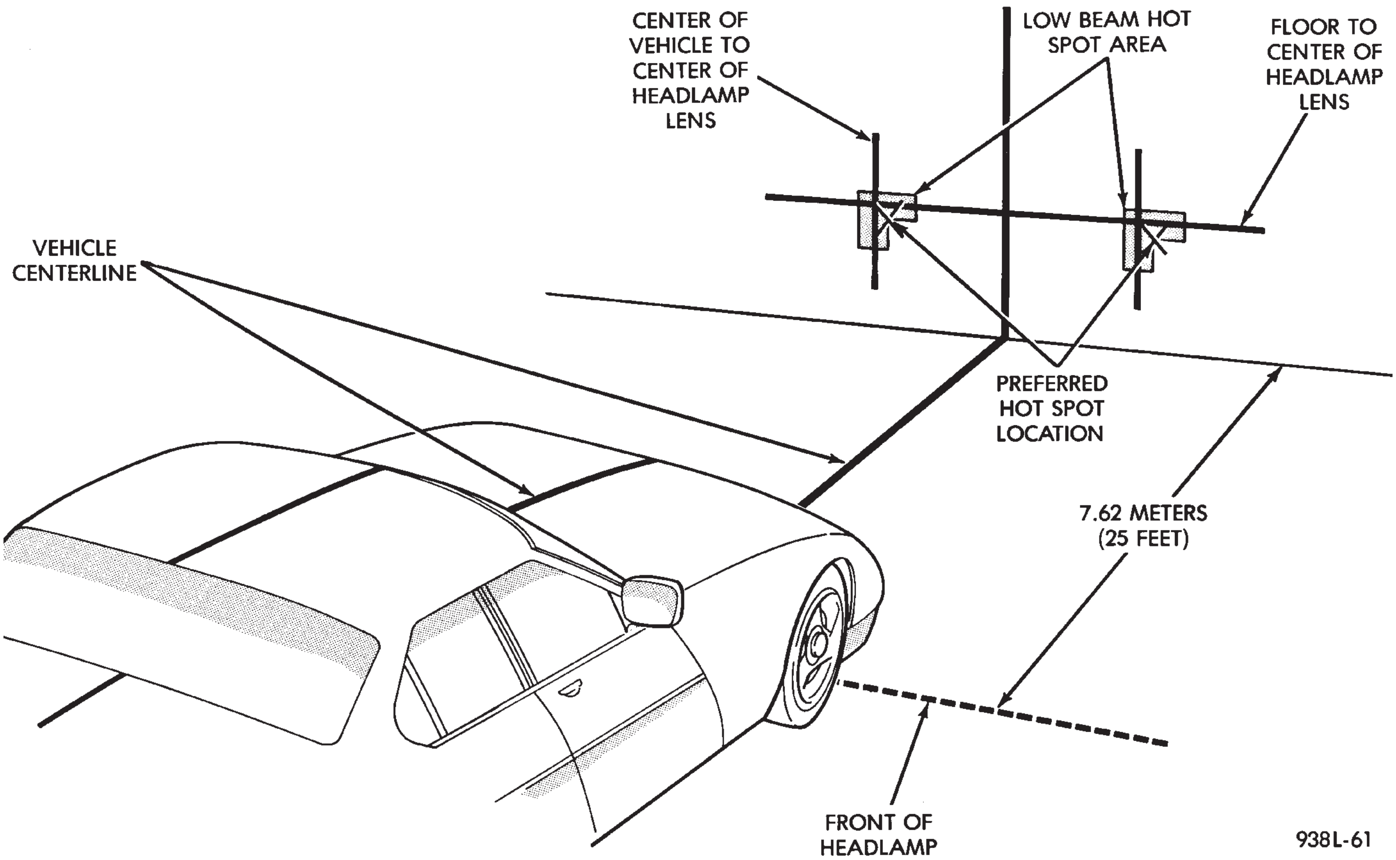


Fig. 1 Headlamp Alignment Screen —Typical

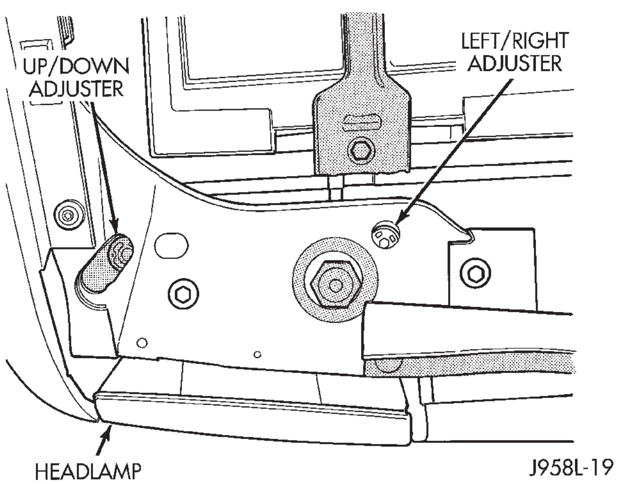


Fig. 2 Aero Headlamp Alignment

(6) Replace by seating the assembly in the lamp housing and turning the lock ring 1/8 turn clockwise to secure.

If clearance is minimal behind the headlamp assembly, use the following procedure:

• Grasp lower edge of headlamp lens. Pull straight back (away) from grille opening reinforcement (GOR). Disengage lower adjuster pivots from lens assembly (Fig. 5).

• Grasp upper edge of headlamp lens. Pull straight back (away) from grille opening reinforcement (GOR). Disengage upper adjuster pivot from lens assembly.

• Locate and disconnect the 3 wire connector behind headlamp.

• Rotate bulb ring counterclockwise. Remove ring and bulb from lens (Fig. 4).

• Install new bulb.

• Replace by seating the assembly in the lamp housing and turning the lock ring 1/8 turn clockwise to secure.

• Align upper adjust pivot into headlamp opening and snap into place.

• Snap lower adjuster pivots into place.

PARKING LAMP BULB/LENS REPLACEMENT

The parking lamp is mounted on the side of the GOR next to headlamp assembly.

(1) Open hood.

(2) Remove screws which hold the parking lamp in position (Fig. 6).

(3) Disengage lamp from vehicle, rotate socket counterclockwise and pull socket from lamp. Pull bulb to remove.

To install, reverse the removal procedure.

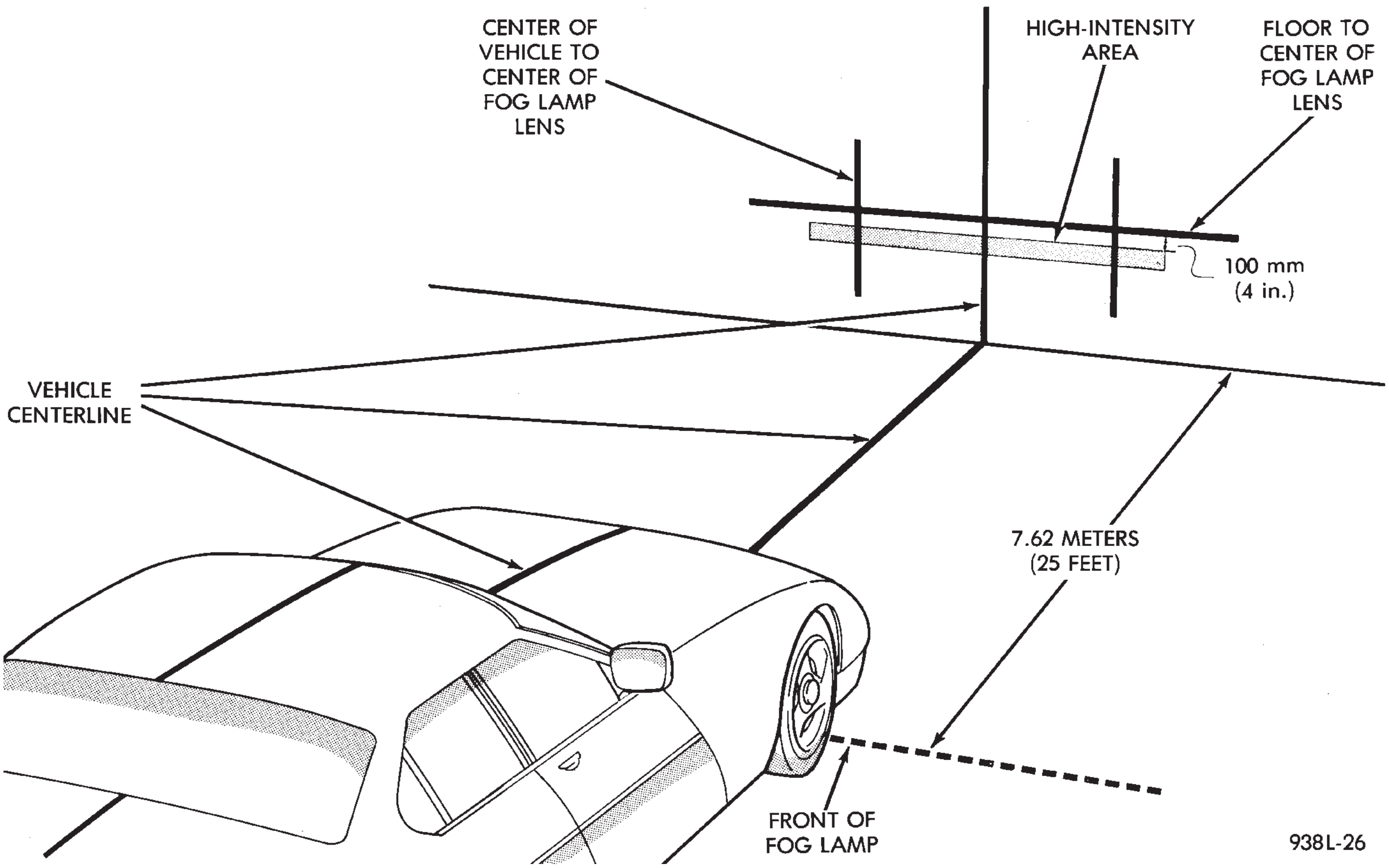


Fig. 3 Fog Lamp Alignment —Typical

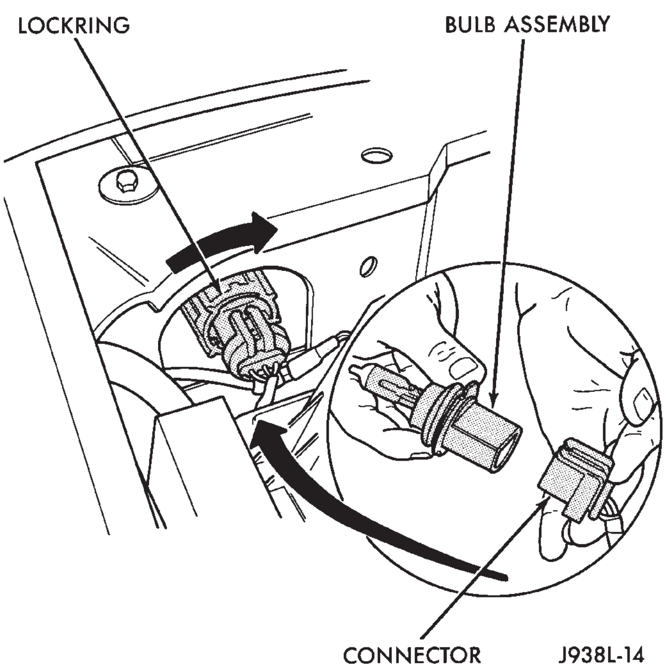


Fig. 4 Headlamp Bulb Removal

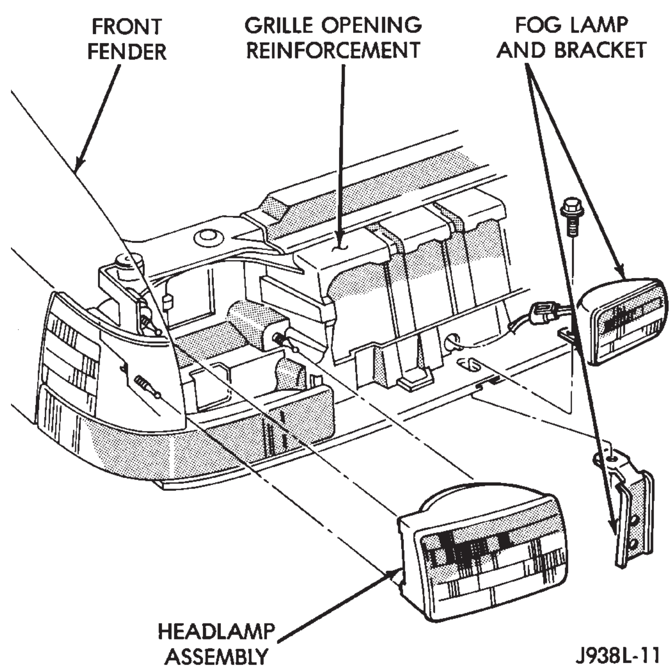


Fig. 5 Headlamp Removal

TURN SIGNAL AND SIDE MARKER LAMP

(1) The parking lamp must be removed to get to attaching screws for this lamp.

(2) Remove the screws and slide lamp outboard to expose the socket (Fig. 7).

(3) To replace turn signal bulb, rotate socket counterclockwise press in on bulb and rotate 1/4 turn to remove.

(4) To replace sidemarker bulb rotate socket counterclockwise grasp and pull from lamp.

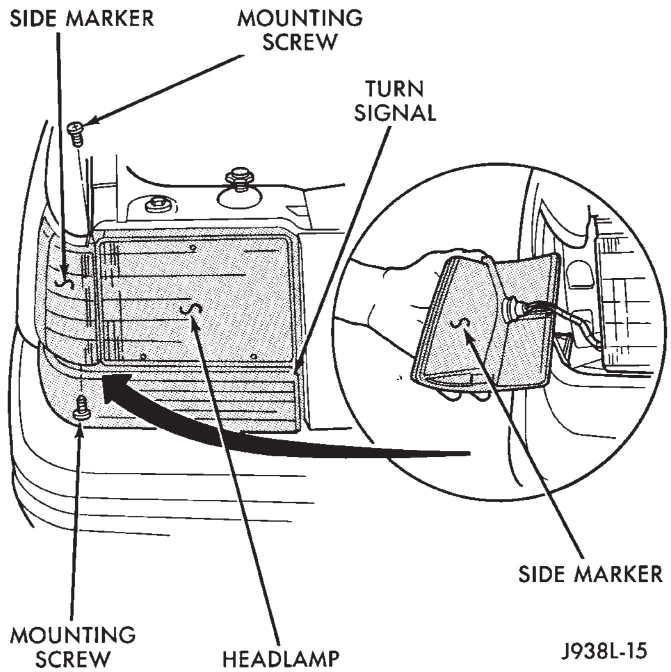


Fig. 6 Parking Lamp Removal

(5) After replacing bulb, slide lamp into slot provided on inboard side of headlamp assembly. Replace two screws and replace parking lamp.

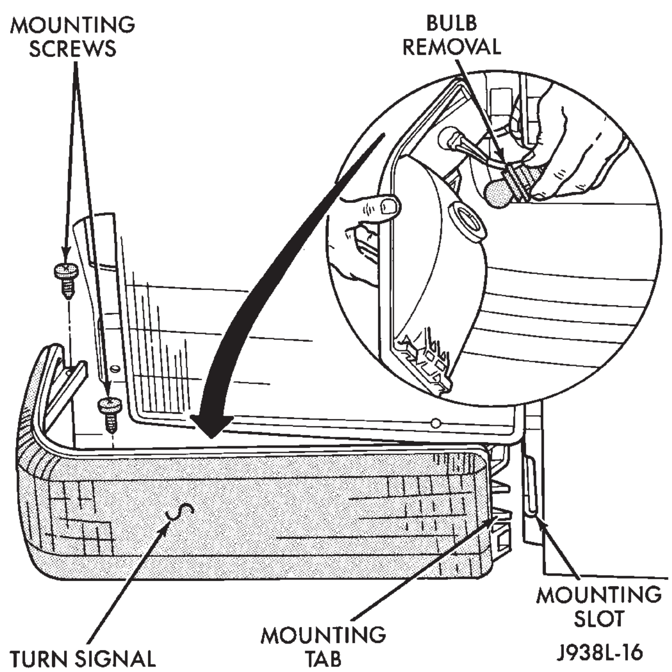


Fig. 7 Turn Signal And Side Marker

FOG LAMPS

Fog lamps are turned OFF by the circuit relay when high beam headlamps are turned ON.

Fog lamps may be operated ONLY when low beam headlamps are ON. If the headlamps are switched to high beam, the fog lamps will turn OFF. The fog lamps will go back on when the high beams are switched OFF.

FOG LAMP BULB/LENS REPLACEMENT

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Use a short phillips screwdriver, remove the screws attaching the lens to the lamp housing.

(2) Separate lens from lamp housing.

(3) Remove spring clip holding bulb to lens.

(4) Disconnect wire connectors at bulb.

(5) Remove bulb element from lens.

(6) To install, reverse the removal procedure.

HEADLAMP SWITCH

To remove or replace headlamp switch. Refer to Group 8E, Instrument Panel and Gauges.

TURN SIGNAL/DIMMER SWITCH

To remove or replace dimmer switch, Refer to Group 8J, Turn Signals and Hazard Flasher.

FOG LAMP SWITCH REPLACEMENT

The fog lamp switch is integrated into the headlamp switch, and is located on the left hand side of instrument panel. To remove or replace headlamp switch. Refer to Group 8E, Instrument Panel and Gauges.

TAIL AND STOP LAMPS

BULB REMOVAL

(1) Remove lamp screws and separate lamp from body (Fig. 8).

(2) Grip top bulb socket and rotate counterclockwise. Separate socket and bulb from lens (Fig. 9).

(3) Rotate bulb in socket counterclockwise. Remove bulb from socket.

To install, reverse the removal procedures.

BACKUP LAMPS

To remove or replace backup lamp bulbs:

(1) Remove lamp screws and separate lamp from the body (Fig. 8).

(2) Grip second bulb socket from top and rotate counterclockwise. Separate socket from lamp (Fig. 9).

(3) Rotate bulb in the socket counterclockwise. Remove bulb from socket.

To install reverse the removal procedures.

BACKUP LAMP SWITCH

The backup lamp switch service instructions can be found in Group 21, Transmission.

TURN SIGNAL LAMP

(1) Remove lamp screws and separate the lamp from body (Fig. 8).

(2) Grip bottom bulb socket and rotate counterclockwise. Separate socket from lamp (Fig. 9).

(3) Rotate bulb in socket counterclockwise. Remove bulb from socket.

To install, reverse the removal procedure.

REAR SIDE MARKER LAMP

The rear side marker lamp is incorporated into the tail lamp.

(1) Remove lamp screws and separate lamp from body (Fig. 8).

(2) Grip socket located on the side of lens. Rotate counterclockwise. Separate socket from lamp (Fig. 9).

(3) Grasp bulb and pull to remove (Fig. 9).

To install, reverse the removal procedure.

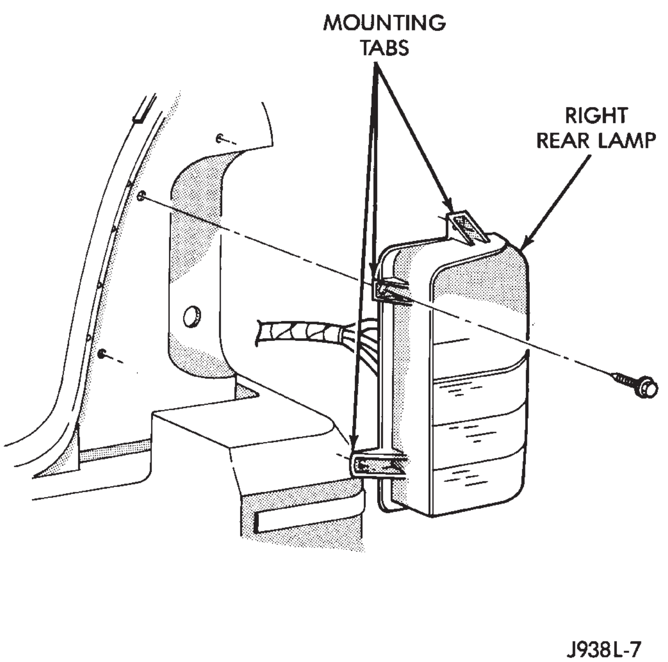


Fig. 8 Rear Lamps

LICENSE PLATE LAMP

REMOVAL

(1) Remove screws and from license plate lamp from license plate tub.

(2) Grip socket and rotate counterclockwise and separate from license plate housing.

INSTALLATION

(1) Install a bulb in lamp socket.

(2) Position socket in license plate housing and turn clockwise.

(3) Position license plate in license plate tub and install screws.

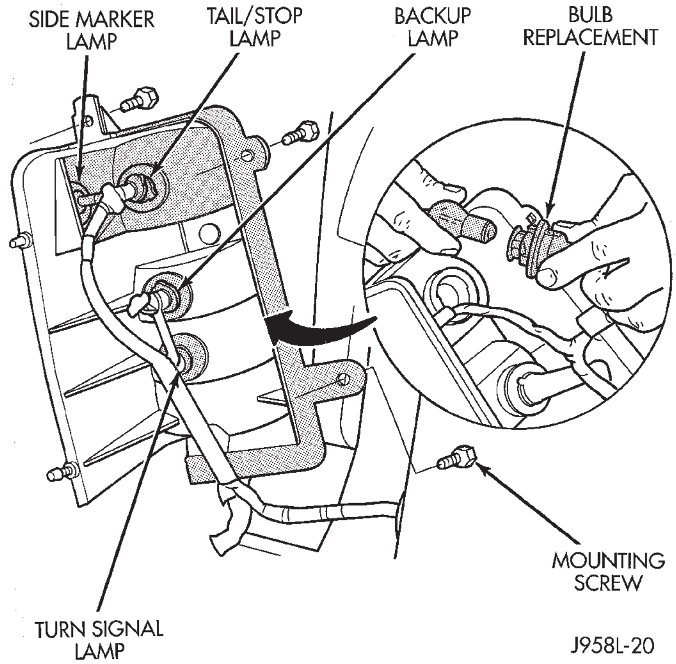


Fig. 9 Bulb Replacement/Rear Lamps

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

The CHMSL is mounted at the top of the rear window (Fig. 10).

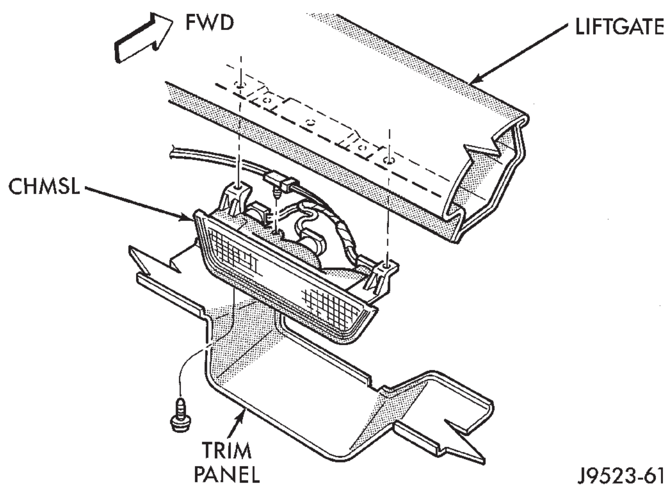


Fig. 10 Center High Mounted Stop Lamp

(1) Raise liftgate.

(2) Remove upper liftgate trim panels.

(3) Remove CHMSL lamp mounting screws.

(4) Remove CHMSL lamp.

(5) Turn socket 1/4 turn counterclockwise.

(6) Replace bulbs if necessary.

To install, reverse removal procedure.

UNDERHOOD LAMP

When equipped, the underhood lamp is installed on the hood right, rear panel (Fig. 11). The lamp is on when hood is opened by way of liquid ON/OFF switch that is integral with lamp base (Fig. 12).

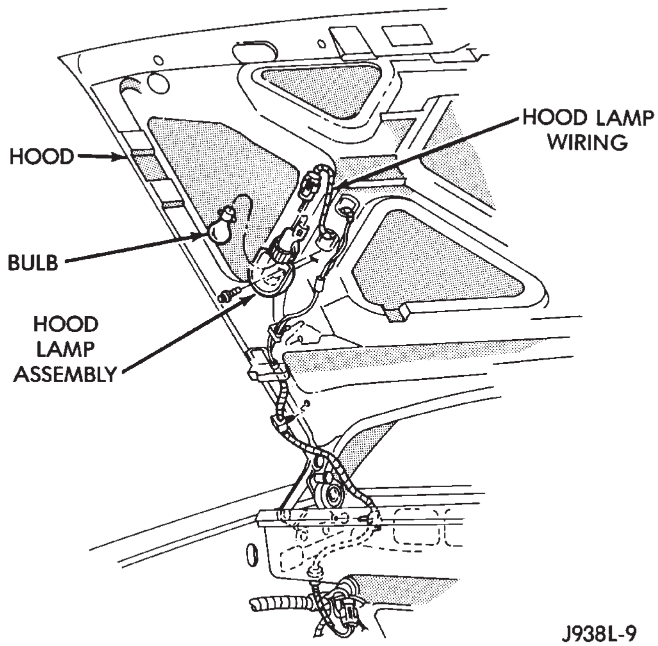


Fig. 11 Underhood Lamp

BULB REMOVAL

(1) Disconnect wire harness connector from underhood lamp (Fig. 11).

(2) Rotate bulb counterclockwise. Remove it from lamp base socket.

BULB INSTALLATION

(1) Insert replacement bulb in lamp base socket. Rotate it clockwise.

(2) Connect wire harness connector to lamp.

HOUSING REMOVAL

(1) Disconnect wire harness connector from lamp.

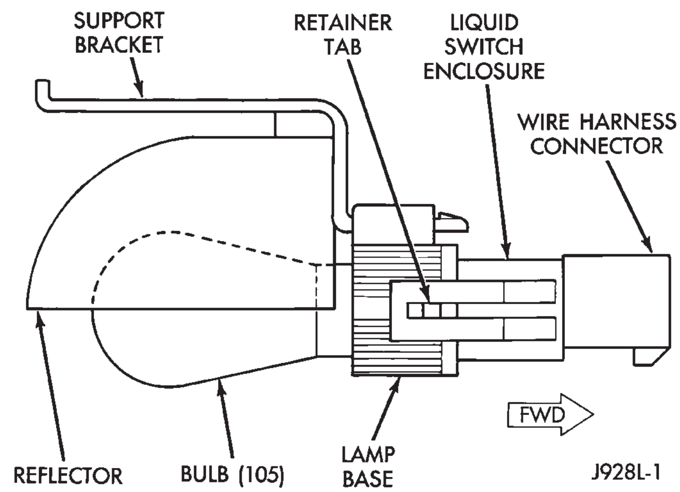


Fig. 12 Underhood Lamp Components

(2) Rotate bulb counterclockwise. Remove it from lamp base socket.

(3) Remove screw that attaches lamp reflector bracket to hood inner panel (Fig. 12).

(4) Remove lamp from hood inner panel.

HOUSING INSTALLATION

(1) Position underhood lamp on the hood inner panel.

(2) Install screw through lamp and into the hood panel.

(3) Insert bulb in lamp base socket and rotate it clockwise.

(4) Connect wire harness connector to lamp.

INTERIOR LAMPS

INDEX

DOME/COURTESY LAMP SERVICE INFORMATION

The interior lamp bulbs illuminate when they are connected to vehicle body ground. By way of applicable switch:

- Dome lamp switch.
- Glove box switch.
- Door pillar switch.
- Liftgate switch (if the cargo lamp is ON).

If equipped with Security Alarm Module, refer to Group 8Q, Vehicle Theft Security System.

DOME/COURTESY LAMP TROUBLE DIAGNOSIS

ALL LAMPS INOPERATIVE

(1) Slide the I/P illumination rheostat to the right. The lamps should light. If not, remove, inspect and test the dome lamp fuse.

(2) If fuse is OK, repair open circuit in the wire harness to vehicle body ground.

(3) Replace left hand pod switch if dome lamp switch fails.

ONE LAMP INOPERATIVE

(1) Measure the resistance across the bulb holder terminals. The ohmmeter should indicate approximately zero ohms. If not, replace bulb.

(2) Measure voltage between voltage side of the bulb holder and vehicle body ground. The voltmeter should indicate battery voltage. If not, repair the open circuit in the wire harness to the splice.

LAMPS INOPERATIVE WITH ONE OR MORE DOORS OPENED

(1) Remove the faulty switch from the door pillar and connect switch wire directly to ground. The lamp should light.

(2) If not, check for an open circuit in ground wire. Repair as necessary. If lamps still do not light, replace switch.

LIGHTED VANITY MIRROR

SERVICE INFORMATION

Both the driver and the front passenger sunvisor can be equipped with a lighted vanity mirror. A lamp is located at each side of the vanity mirror. The lamps are switched ON automatically when the mirror cover is lifted (Fig. 1).

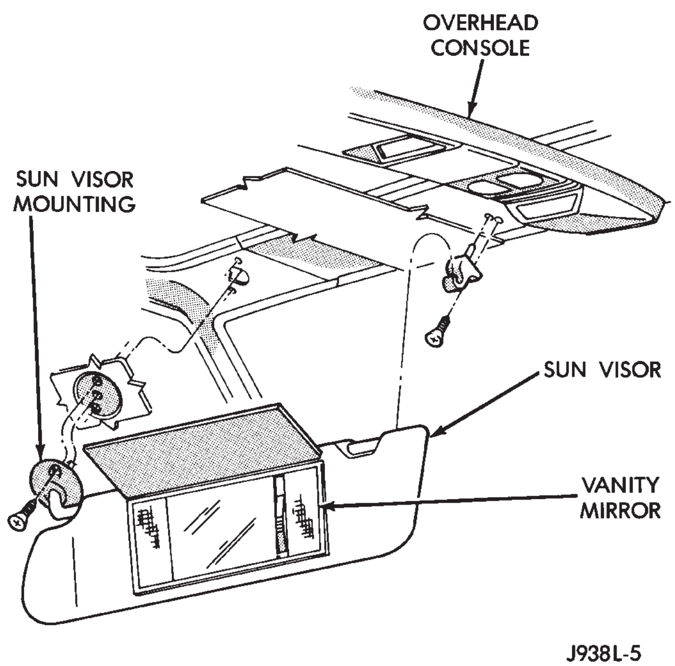


Fig. 1 Lighted Vanity Mirror

Voltage is applied directly to the vanity lamp bulbs by way of the dome lamp fuse.

LIGHTED VANITY MIRROR TROUBLE DIAGNOSIS

VANITY LAMPS INOPERATIVE

(1) Remove, inspect and test dome lamp fuse. Replace if defective.

(2) Test dome lamp operation. If OK, go to next step. If not OK, repair the open circuit in the wire harness from the splice.

(3) Measure the voltage between the pink wire on switch connector and vehicle body ground. The voltmeter should indicate battery voltage. If not OK, repair the open circuit in wire harness from splice.

(4) Connect a jumper wire from the ground side of the switch to a good vehicle body ground. Measure the resistance to vehicle body ground. The ohmmeter should indicate approximately zero ohms. If not, repair the open circuit in the wire harness to vehicle body ground.

DOME/READING LAMP

REMOVAL

(1) Insert a flat blade screwdriver in slot at the center of the lamp housing. Rotate screwdriver upward and unsnap dome lamp lens.

(2) Pull lens downward. Remove it from lamp housing.

(3) Remove the lamp housing retaining screws (Fig. 2).

(4) Push housing forward and release housing from bracket.

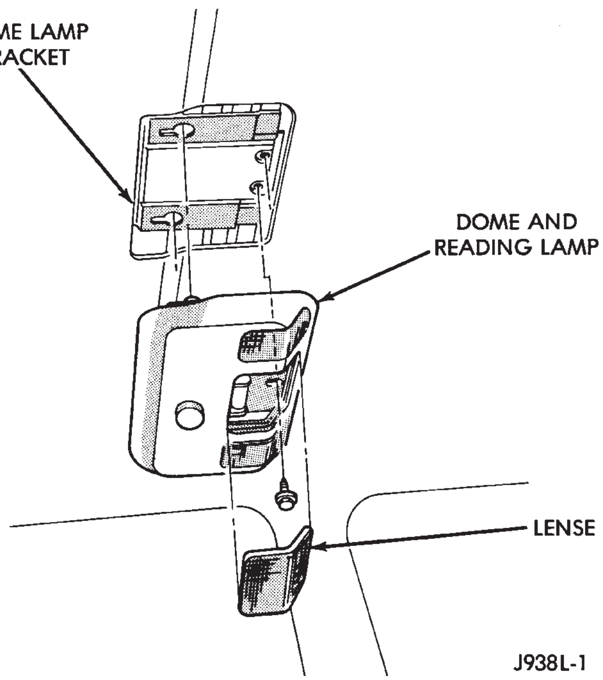


Fig. 2 Dome/Reading Lamp

(5) Disconnect wire harness connectors.

(6) Remove lamp housing from headliner cavity.

INSTALLATION

(1) Position dome/reading lamp housing at headliner cavity.

(2) Connect wire harness connectors.

(3) Locate rear pods of the lamp in the slots of the dome lamp bracket. Push lamp housing up and to rear.

(4) Install the lamp housing screws (Fig. 2).

(5) Position dome lamp lens at lamp housing. Snap lens into housing.

DOME LAMP BULB

REMOVAL

(1) Insert a flat blade screwdriver in slot at front of lens.

(2) Rotate the screwdriver until lens snaps out of the housing.

(3) Remove lens from housing.

(4) Remove bulb from terminals.

INSTALLATION

(1) Insert bulb into reading lamp terminals.

(2) Replace lens by holding lens level and pushing rearward into housing.

(3) Push lens up to snap into housing.

OVERHEAD CONSOLE

To service overhead console refer to Group 8C, Overhead Console.

OVERHEAD CONSOLE READING LAMP BULB

REMOVAL

(1) Insert a flat blade screwdriver in slot at front of lens (Fig. 3).

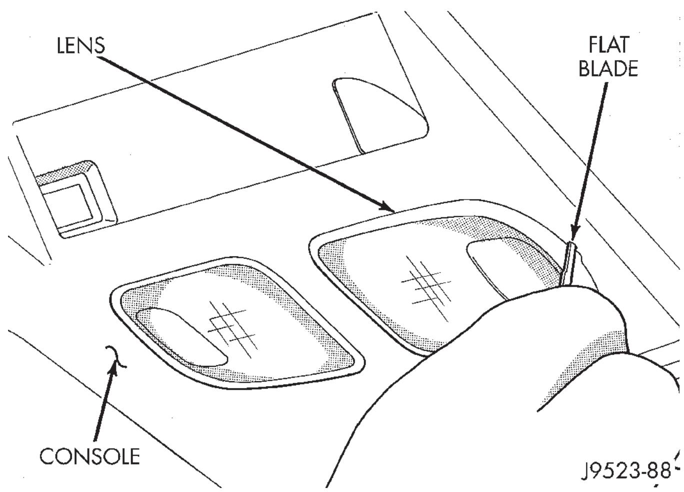


Fig. 3 Overhead Console Reading Lamp Bulb Removal

(2) Rotate the screwdriver until lens snaps out of the housing.

(3) Remove lens from housing.

(4) Remove bulb from terminals.

INSTALLATION

(1) Insert bulb into reading lamp terminals.

(2) Replace lens by holding lens level and pushing rearward into housing.

(3) Push lens up to snap into housing.

MINI OVERHEAD CONSOLE

Sunroof equipped vehicles contain an overhead mini console (Fig. 4). Refer to Group 8C, Overhead Console for service procedures.

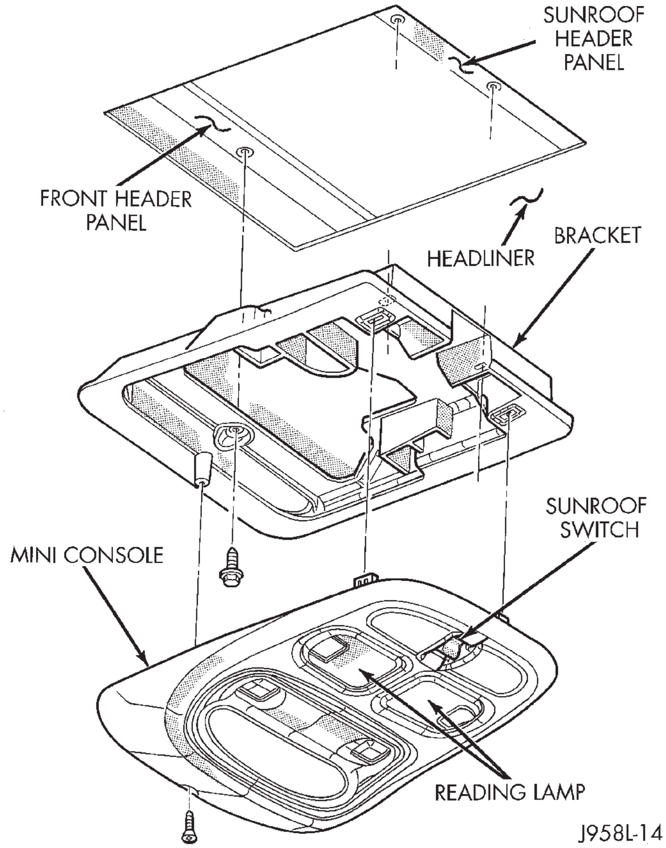


Fig. 4 Mini Overhead Console

MINI OVERHEAD CONSOLE READING LAMP BULB

Refer to overhead console reading lamp bulb removal/installation procedures.

CARGO LAMP/BULB

The cargo lamp bulb housing is integral with the upper rear headliner trim moulding. To replace bulb housing the trim moulding must be replaced.

REMOVAL

(1) Insert a flat blade screwdriver in slots provided at lower portion of lens.

(2) Rotate screwdriver upward until lens snaps out of housing.

(3) Remove lens from housing (Fig. 5).

(4) Remove bulb from bulb holder.

INSTALLATION

(1) Install bulb in holder.

(2) Insert upper tabs of lens into lens housing.

(3) Snap lower portion of lens into slots at lens housing (Fig. 5).

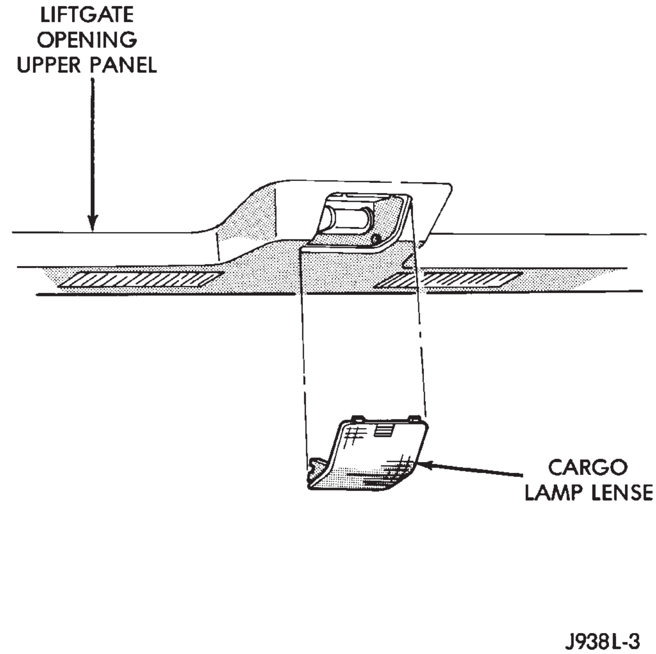


Fig. 5 Cargo Lamp

DOOR COURTESY LAMP

REMOVAL

(1) Remove door panel. Refer to Group 23, Body Components for service procedure.

(2) Disconnect wiring harness connector (Fig. 6).

(3) Carefully insert a thin flat blade screwdriver between lens and door trim panel.

(4) Rotate screwdriver to remove lens.

(5) Push door courtesy lamp housing through door trim panel.

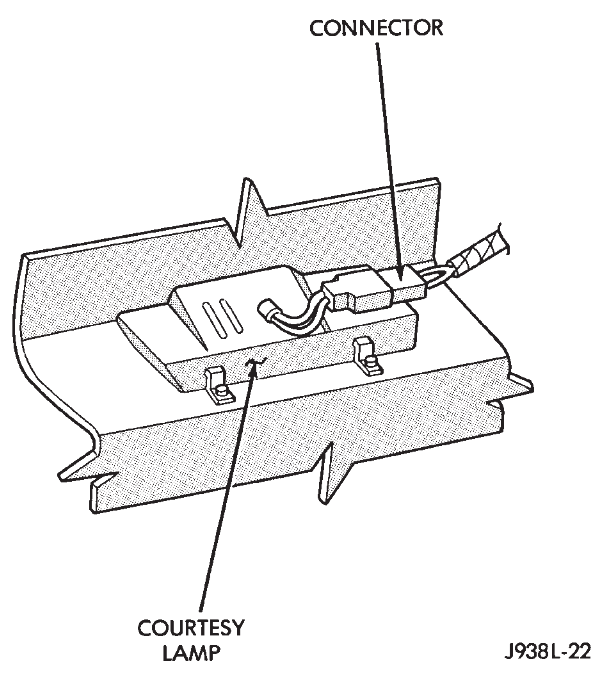


Fig. 6 Door Courtesy Lamp

INSTALLATION

(1) Connect wiring harness.

(2) Insert door courtesy lamp into door trim panel.

(3) Install door trim panel.

UNDER PANEL LAMP

REMOVAL

(1) Remove 1 mounting screw (Fig. 7).

(2) Disconnect wiring harness connector.

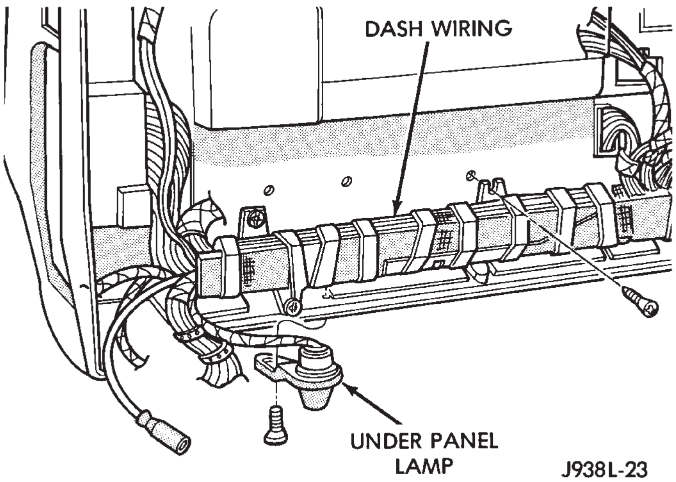


Fig. 7 Under Panel Lamp—Rear View

INSTALLATION

For installation, reverse removal procedure.

ILLUMINATED ENTRY SYSTEM SERVICE INFORMATION

The Illuminated Entry System is activated by the system relay. The relay is located in the relay center behind instrument panel. The relay receives input from door pillar switches, the keyless entry system, and the ignition switch (when in the RUN position). When input is received, the timer in the relay immediately begins the timing-out process. The timing-out process requires approximately 30 seconds. Interior lamps are turned off either when the 30 second time-out is completed or when the ignition switch is turned ON. If a door remains open for more than 30 seconds, the interior lamps will stay on until the door is closed.

The illuminated entry system also operates when a door is opened to exit vehicle. When door is closed the lamps will stay on for remaining portion of the 30 seconds.

ILLUMINATED ENTRY RELAY

To remove or replace relay, refer to Auto Headlamp Module procedure located in this section.

EXTERIOR LAMP SYSTEMS

INDEX

DAYTIME RUNNING LIGHT MODULE

The headlamps on vehicles sold in Canada, will go ON when the ignition is turned ON. This provides a constant Lights On condition while the ignition switch is in the run position and the park brake is NOT engaged. The lamps illuminate at less than 50% of normal intensity.

The Daytime Running Light Module (DRL) is located on a bracket, to the left of the steering column, on the underside of the instrument panel.

(1) Remove screws holding module and bracket to vehicle (Fig. 1).

(2) Disconnect electrical connector.

To install module, reverse the removal procedures.

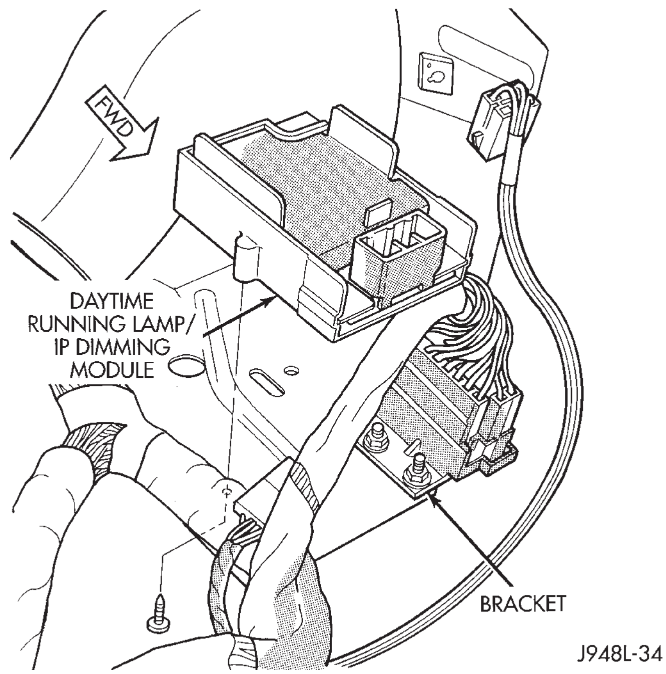


Fig. 1 Daytime Running Light Module

AUTO HEADLAMPS

This system automatically turns the lamps on and off according to light conditions. The system also keeps the lights on for a selected amount of time after driver has parked and left vehicle. The system can be turned off to give driver manual control of headlamps.

AUTO HEADLAMP SYSTEM DIAGNOSIS

Perform the system check in the order shown. When a fault is found, refer to Diagnosis chart and/or Group 8W, Wiring Diagrams for circuit information. If a normal result is found at each and every step of the System Check, the fault may be intermittent.

To find an intermittent fault, check the mating terminals at each component and connector for a poor connection. Also check that each terminal of mating connectors is properly seated. If the connections appear to be reliable, try the System Check again while moving the wire harness from side to side at each component. Once a fault has been corrected, perform the System Check to verify the diagnosis.

AUTO HEADLAMP SYSTEM CHECK

ACTION	NORMAL RESULTS
• Headlamp switch to OFF position. • Apply a bright light to the Photocell Light Sensor. • Ignition switch to RUN.	Tail and license lamps OFF. Front park and headlights OFF.
• Headlamp switch to AUTO position. • Cover Photocell Light Sensor. • Wait 30 seconds.	Tail and license lamps ON. Front park and headlights ON.
• Apply a bright light to the Photocell Light Sensor. • Wait 30 seconds.	Tail, license, front park and headlights OFF.
• Cover the Photocell Light Sensor and wait for lights to turn ON. • Wait 15 seconds, turn ignition switch OFF.	Lights turn OFF after a time delay.

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AUTO HEADLAMP SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS STAY ON ALL THE TIME	1. Photocell circuit open, check resistance between pin 8 and 10. 2. Photocell not plugged in. 3. Resistance between pin 8 and 10 is less than 1k and headlamps on.	1. Repair wiring. Refer to Group 8W for wire location. 2. Connect photocell connector. 3. Replace module.
HEADLAMPS DO NOT ILLUMINATE	1. Blown fuse. 2. Pin 9 not grounded when switched to auto headlamp position. 3. Resistance between pin 8 and 10 is more than 10k and headlamps off.	1. Replace fuse. 2. Repair circuit ground. Refer to Group 8W for circuit location. 3. Replace module.
HEADLAMPS ACTIVATE PREMATURELY OR EXPERIENCE DELAYED DEACTIVATION	1. Faulty photocell.	1. Replace photocell.
HEADLAMPS FLASH IMMEDIATELY WHILE DRIVING BETWEEN SHADOWS AND LIGHT WITH HEADLAMP SWITCH IN AUTO POSITION	1. Faulty module.	1. Replace module.

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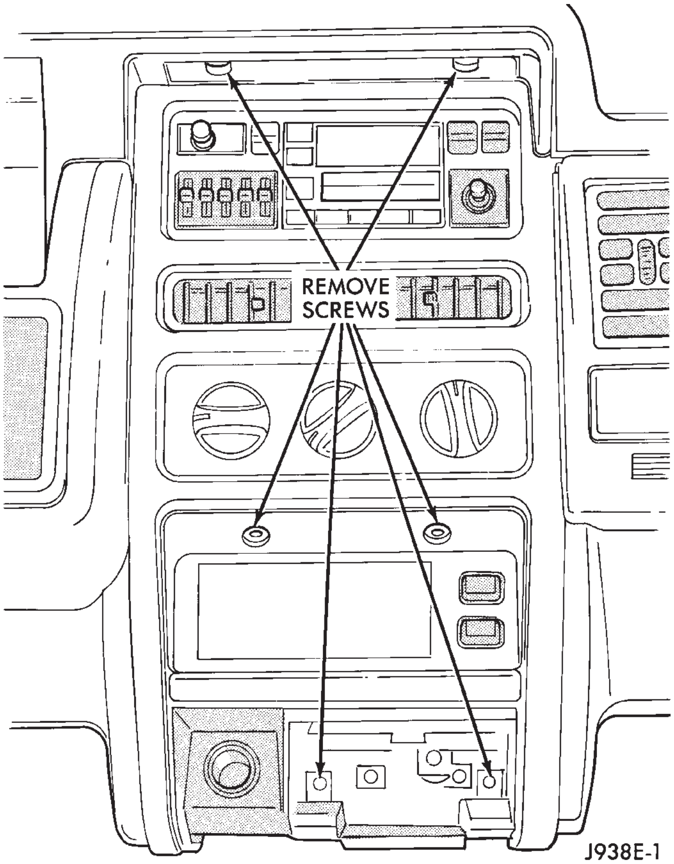


Fig. 2 Center Bezel Upper Screws

AUTO HEADLAMP MODULE

The module receives inputs from the auto headlamp switch and auto headlamp sensor. Based on

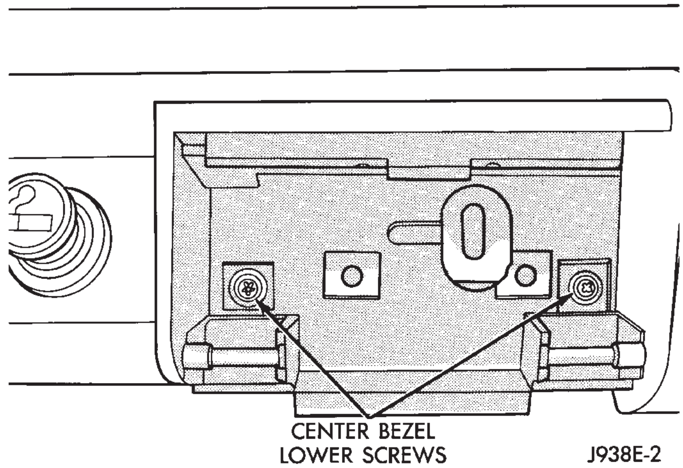


Fig. 3 Center Bezel Lower Screws

these inputs the module will control the lamps. The auto headlamp module is located behind the glove box to the right of the security alarm module.

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove two screws holding top of center cluster bezel (Fig. 2).

(3) Remove ash tray.

(4) Remove two screws holding center of bezel.

(5) Remove two screws holding bottom of bezel (Fig. 3).

(6) Remove center bezel.

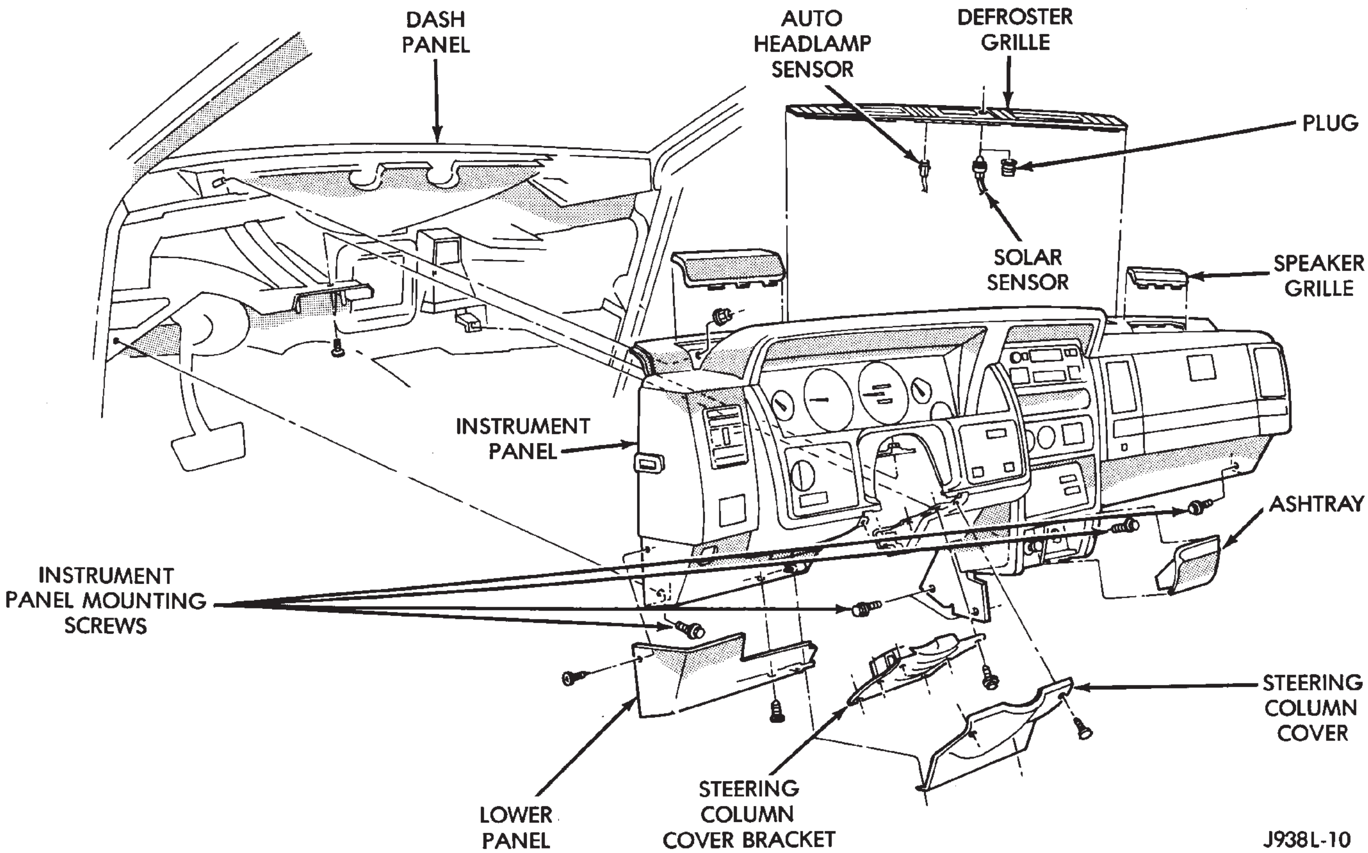


Fig. 4 Instrument Panel

(7) Remove two screws holding dash pad located behind center bezel.

(8) Gently pry defroster bezel out of dash pad (Fig. 4).

(9) Unplug sensor(s) and set defroster bezel aside.

(10) Remove screws in defroster duct opening holding dash pad.

(11) Remove speaker grilles. Remove screws behind speaker grilles.

(12) Remove screws above IP cluster holding dash pad (Fig. 5).

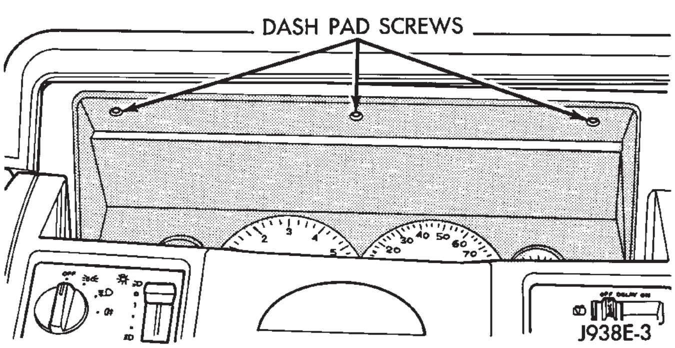


Fig. 5 Dash Pad Screws

(13) Open glove box and remove 2 screws holding dash pad.

(14) Pull up on dash pad to unsnap clips and then remove dash pad.

(15) Remove four screws holding glove box bottom (Fig. 6).

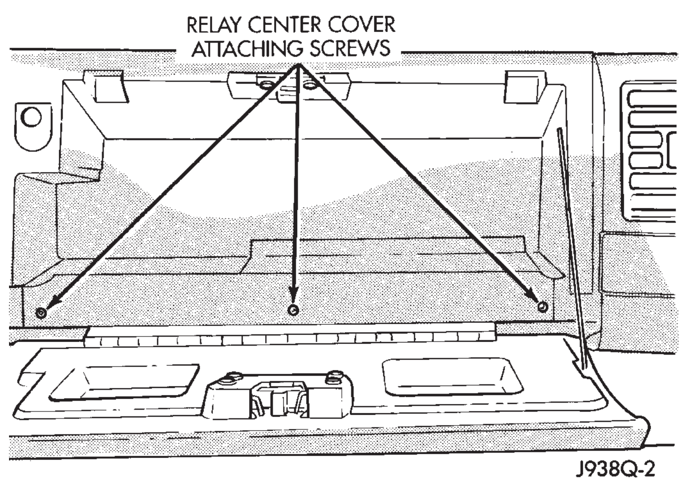


Fig. 6 Glove Box

(16) Remove four screws from top of glove box bezel (Fig. 7).

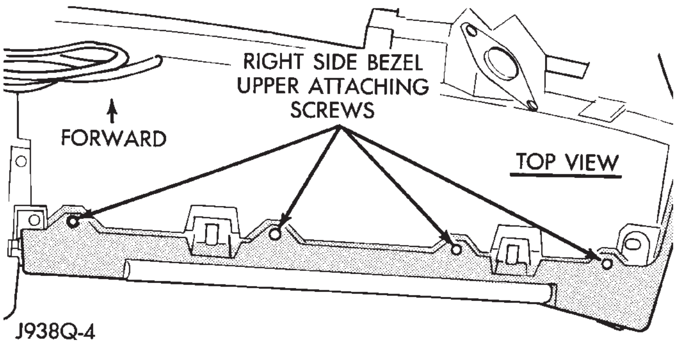


Fig. 7 Right Side Bezel

(17) Remove one screw holding the bezel to the center armature (Fig. 8).

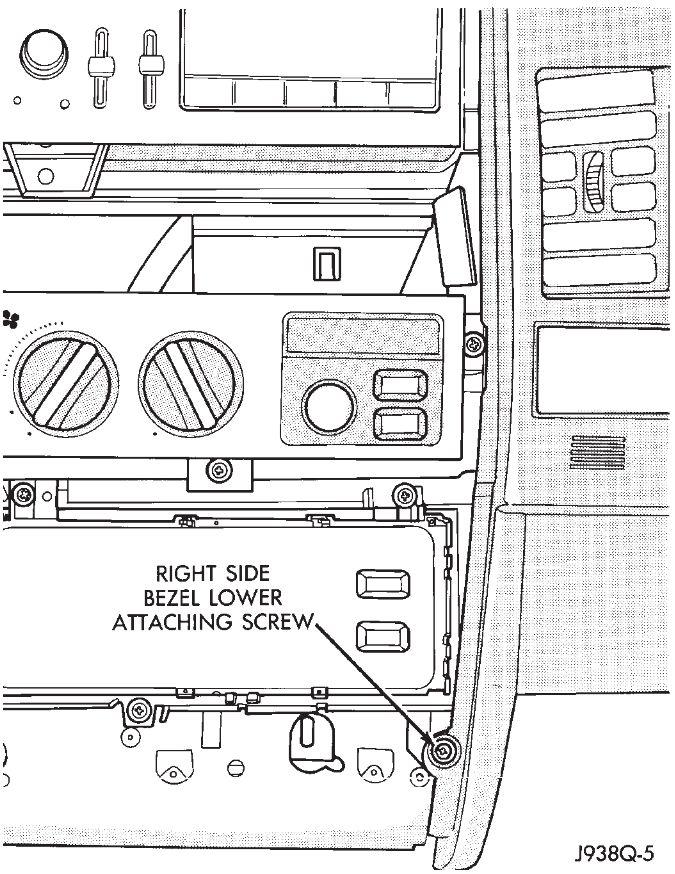


Fig. 8 Right Side Lower Screw

(18) Remove bezel from instrument panel. Disconnect glove box light switch.

(19) Remove 2 screws holding auto headlamp module (Fig. 9).

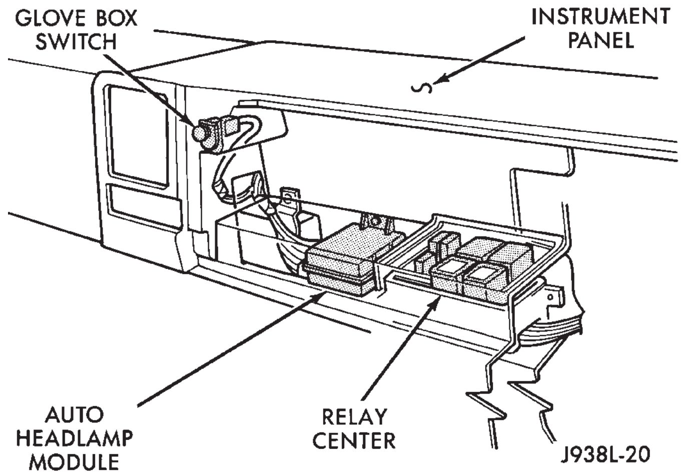


Fig. 9 Auto Headlamp Module

(20) Remove connector from module.

For installation, reverse removal procedure.

AUTO HEADLAMP SENSOR

The auto headlamp sensor is the key sensor for the auto headlamp system. The module utilizes the sensor input to determine when to turn the headlamps on or off. The sensor is located in the center of the defroster grille at the base of the windshield.

REMOVAL (FIG. 10)

(1) Gently pry defroster bezel out of dash pad.

(2) Unplug auto headlamp sensor connector.

(3) Snap out sensor from bezel.

For installation, reverse the removal procedure.

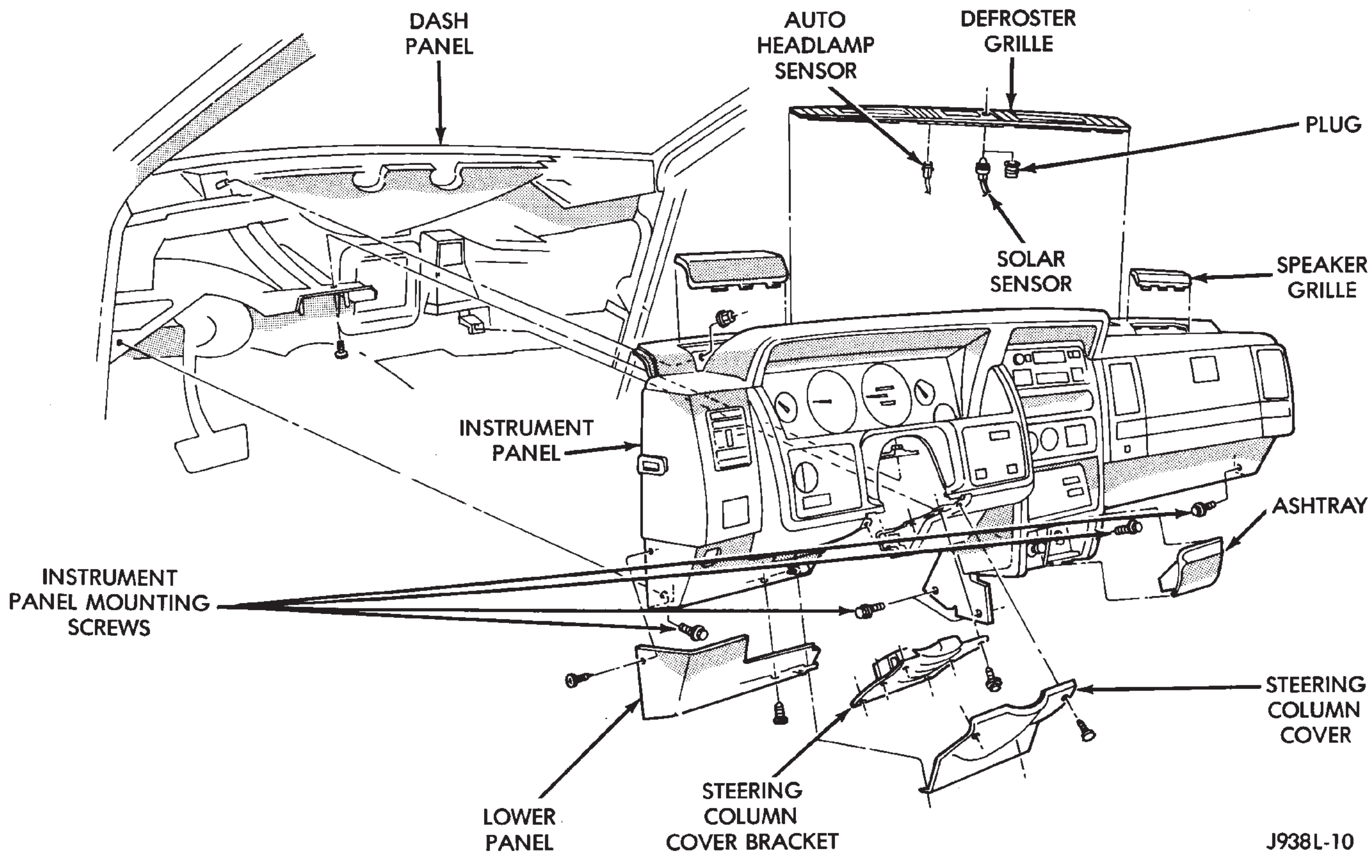


Fig. 10 Instrument Panel

LAMP OUTAGE MODULE

Details for the lamp outage module can be found in the Group 8E, Vehicle Information Center. For circuit information, refer to Group 8W, Wiring Diagrams.

Connecting trailer lights to the body harness at the rear of the vehicle can cause damage to the lamp outage module. The lamp outage module is designed to handle a 5 amp current load. This is adequate for the operation of the vehicles lighting system. When additional lights are added to the system such as trailer lights, the 5 amp limit can be exceeded. This can cause failure of the lamp outage module.

If trailer towing is required and the vehicle is not equipped with a trailer tow package, the MOPAR accessory trailer towing harnesses are the only approved method to provide additional trailer lights. These harnesses are designed to provide current to the trailer lights but bypass the lamp outage module.

REMOVAL

(1) Remove battery negative cable.
(2) Remove spare tire from carrier.
(3) Remove access door (Fig. 11).
(4) Remove wiring connectors at top of module.
(5) Remove screw holding module to inner quarter panel.
(6) Remove lamp outage module.

For installation, reverse the removal procedure.

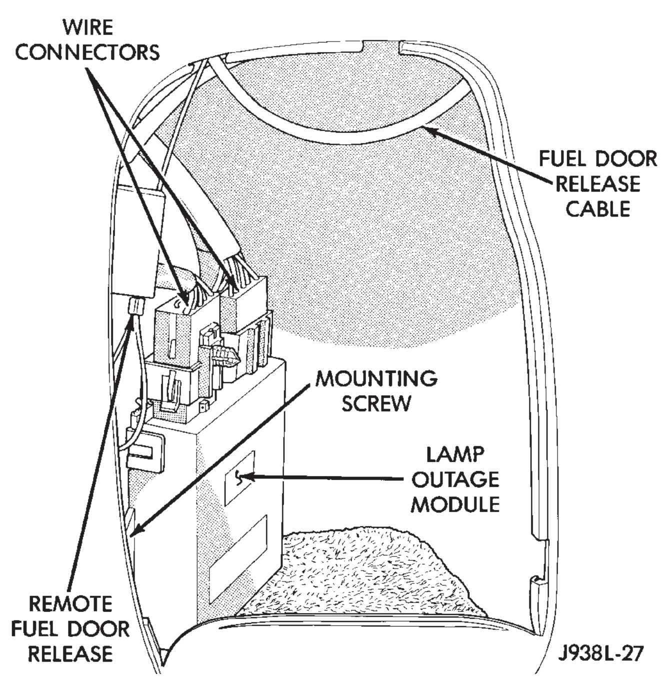


Fig. 11 Lamp Outage Module

BULB APPLICATION

GENERAL INFORMATION

The following Bulb Application Table lists the lamp title on the left side of the column and trade number or part number on the right.

CAUTION: Do not use bulbs that have a higher candle power than bulb listed in the Bulb Application Table. Damage to lamp can result. Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

EXTERIOR LAMPS

Back-up 1156
Center High Mounted Stop Lamp 921
Fog H3
Front Turn Signal 1295NA
Front Side Marker 194NA
Headlamp/Aero 9004
License Plate 168
Rear/Stop/Tail 2057
Rear Turn Signal 1156
Underhood Lamp 105

INTERIOR LAMPS

Service procedures for most of the lamps in the instrument panel, are located in Group 8E. Some components have lamps that can only be serviced by an Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC.

A/C Heater 4720843
Ash Receiver 37
Cigarette Lighter 53
Climate Control 74
Console Floor Shifter 194
Dome/Reading 561
Door Courtesy 168
Front Reading 906
Glove Compartment 194
Hazard Lamp 74
Heater 194
Overhead Console 212
Radio ....ASC
Rear Cargo 212
Rocker Switch 37
Shift Lamp 74
Transfer Case Shifter 194
Theft Alarm 74
Under Panel Courtesy 89
Vanity Mirror 6501966

RESTRAINT SYSTEMS

CONTENTS

AIRBAG SYSTEM

WARNING: THIS SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM OR RELATED STEERING WHEEL AND STEERING COLUMN COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT 2 MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIRBAG MODULE INFLATOR ASSEMBLY CONTAINS SODIUM AZIDE AND POTASSIUM NITRATE. THESE MATERIALS ARE POISONOUS AND EXTREMELY FLAMMABLE. CONTACT WITH ACID, WATER OR HEAVY METALS MAY PRODUCE HARMFUL AND IRRITATING GASES (SODIUM HYDROXIDE IS FORMED IN THE PRESENCE OF MOISTURE) OR COMBUSTIBLE COMPOUNDS. DO NOT ATTEMPT TO DISMANTLE THE MODULE OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURES EXCEEDING 200°F.

WARNING: REPLACE AIRBAG SYSTEM COMPONENTS WITH PARTS SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG ONLY. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION. THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE AIRBAG COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG 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 SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG.

WARNING: WHEN A STEERING COLUMN HAS AN AIRBAG MODULE ATTACHED, NEVER PLACE THE COLUMN ON THE FLOOR OR OTHER SURFACE WITH THE STEERING WHEEL OR AIRBAG MODULE FACE DOWN.

GENERAL INFORMATION

The airbag system is a standard equipment safety device on Grand Cherokee models. It is designed to protect the driver from serious injury, caused by a frontal impact of the vehicle. To inspect this system use Airbag System - Body Diagnostic Procedures manual. If the airbag module assembly is defective and non-deployed, refer to Chrysler Corporation current return list for proper handling procedures.

Following are general descriptions of the major components in the airbag system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

AIRBAG MODULE

The airbag module protective cover is the most visible part of the system. The module is mounted directly to the steering wheel. Under the airbag module cover, the airbag cushion and its supporting components are contained. The airbag module contains a housing to which the cushion and inflator are attached and sealed. The airbag module is non-serviceable, and must be replaced if deployed or damaged in any way.

The inflator assembly is mounted to the back of the module. The inflator seals the hole in the airbag cushion so it can discharge the gas it produces directly into the cushion when supplied with the proper electrical signal. The protective cover is fitted to the front of the airbag module and forms a decorative cover in the center of the steering wheel. Upon airbag deployment, this cover will split horizontally.

STORAGE

The airbag module must be stored in its original, special container until used for service. Also, it must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store the module on a surface with the trim cover facing up to minimize movement in case of accidental deployment.

IMPACT SENSOR

The impact sensors provide verification of the direction and severity of the impact. Three impact sensors are used. One is called a safing sensor. It is located inside the airbag control module (ACM), which is mounted under the center floor console. The other two sensors are mounted on the radiator closure panel on the left and right side of the vehicle.

The impact sensors are threshold sensitive switches that complete an electrical circuit when an impact provides a sufficient deceleration force to close the switch. The sensors are calibrated for the specific vehicle, and react to the severity and direction of the impact.

CLOCKSPRING

The clockspring is mounted on the steering column behind the steering wheel. It is used to maintain a continuous electrical circuit between the wiring harness and the driver's side airbag module. This assembly consists of a flat, ribbon-like electrically conductive tape which winds and unwinds with the steering wheel rotation.

AIRBAG CONTROL MODULE

The airbag control module (ACM) contains the safing sensor, and monitors the system to determine its readiness. The ACM contains on-board diagnostics (OBD), and will light the airbag warning lamp in the instrument cluster when a monitored airbag system fault occurs.

The ACM also contains an energy storage capacitor. This capacitor stores enough electrical energy to deploy the airbag for up to 2 minutes following a battery disconnect or failure. The purpose of this unit is to provide airbag protection in a severe secondary impact if the initial impact has damaged or disconnected the battery, but was not severe enough to deploy the airbag.

DIAGNOSIS

A DRB scan tool is required for diagnosis of the airbag system. Refer to Airbag System - Body Diagnostic Procedures manual for more information.

AIRBAG SYSTEM CHECK

(1) Disconnect battery negative cable and isolate.

(2) Connect DRB scan tool to ACM diagnostic 6-way connector. The connector is located under the right front seat at the forward left corner of the seat riser, under the floor carpet.

(3) From right side of vehicle (away from airbag in case of accidental deployment), turn the ignition switch to the ON position. Exit vehicle with DRB. Use the latest version of the proper DRB cartridge.

(4) After checking that nobody is inside the vehicle, reconnect the negative battery terminal.

(5) Using the DRB, read and record active diagnostic trouble code (DTC) data.

(6) Read and record any stored DTC.

(7) Refer to the Airbag System - Body Diagnostic Procedures manual, if any DTC is found in steps 5 or 6.

(8) Erase stored DTC, if there are no active fault codes. If problems remain, DTC will not erase.

(9) With the ignition switch in the ON position, make sure nobody is in the vehicle.

(10) From right side of vehicle, turn the ignition switch to OFF then ON. Observe airbag warning lamp on the instrument cluster. It should light for 6 to 8 seconds, then go out; indicating system is functioning normally.

If the airbag warning lamp fails to light, or lights and stays on, there is a system malfunction. Refer to the Airbag System - Body Diagnostic Procedures manual to diagnose the problem.

SERVICE PROCEDURES

AIRBAG SYSTEM SERVICE (DEPLOYED)

Any vehicle which is to be returned to use after an airbag deployment, must have the airbag module and clockspring replaced. These are one-time components and cannot be reused. Other airbag system components are replaced as required by the extent of damage.

In addition, the airbag module should be disarmed whenever the steering wheel or steering column requires service or removal. Failure to observe this warning could result in accidental airbag deployment and possible personal injury. Refer to Group 19 - Steering for additional service procedures on steering wheel and steering column.

AIRBAG MODULE HANDLING

UNDEPLOYED

At no time should any source of electricity be permitted near the inflator on the back of the module. When carrying an undeployed module, the trim cover should be pointed away from the body to minimize injury in the event of accidental deployment. If the module is placed on a bench or other surface, the plastic trim cover should be face up to minimize movement in case of accidental deployment.

DEPLOYED

Following an airbag deployment, the vehicle interior will contain a powdery residue. This residue is primarily sodium bicarbonate (baking soda), used as an airbag cushion lubricant. However, there will also be traces of sodium hydroxide powder, a chemical byproduct of the generant used for airbag deployment. Since this powder can irritate the skin, eyes, nose or throat, be sure to wear safety glasses, rubber gloves and a long-sleeved shirt during cleanup (Fig. 1).

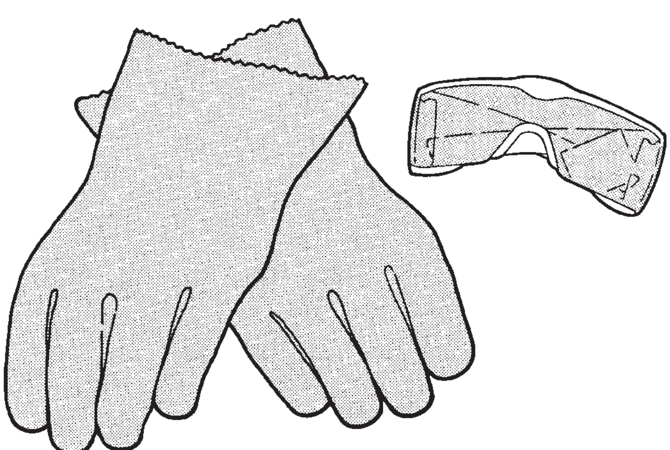


Fig. 1 Wear Safety Glasses And Rubber Gloves

If you experience skin irritation during cleanup, run cool water over the affected area. Also, if you experience irritation of the nose or throat, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

CLEANUP PROCEDURE

Begin cleanup by putting tape over the airbag exhaust vent (Fig. 2) so that no more powder will find its way into the vehicle interior. Then remove the airbag and airbag module from the vehicle.

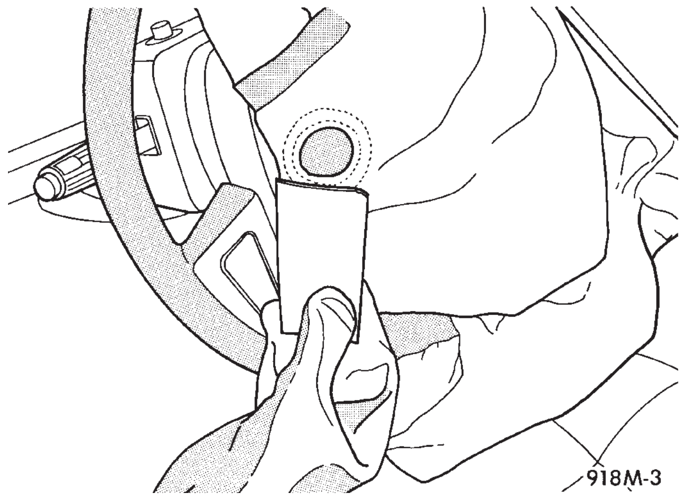


Fig. 2 Airbag Exhaust Vent Sealing

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on an uncleaned area.

Be sure to vacuum the heater and A/C outlets as well (Fig. 3). Run the blower on low and vacuum any powder expelled from the plenum. You may need to vacuum the interior of the car a second time to recover all of the powder.

Place the deployed airbag and module in your vehicular scrap pile.

AIRBAG MODULE REMOVE/INSTALL

WARNING: THIS SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT 2 MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

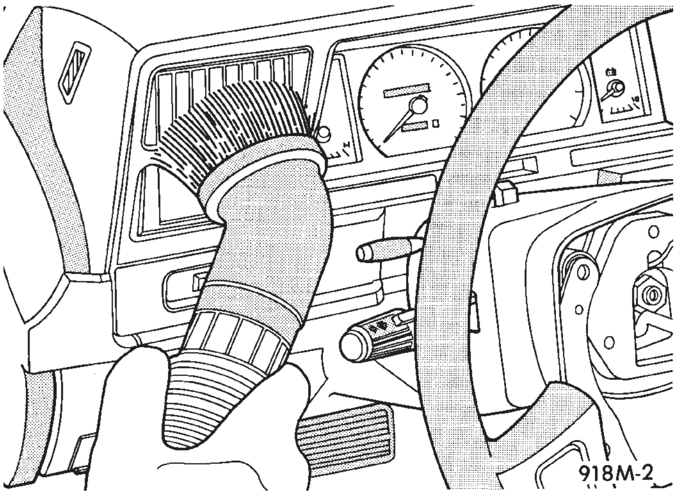


Fig. 3 Vacuum Heater and A/C Outlets

When removing a deployed airbag module, rubber gloves, eye protection and long-sleeved shirt should be worn. There may be deposits on the airbag module and other interior surfaces, which can cause irritation to the skin and eyes in large doses.

(1) Disconnect battery negative cable and isolate. If airbag module is undeployed, wait 2 minutes for system capacitor to discharge before further service.

(2) Remove 4 nuts attaching airbag module from back side of steering wheel (Fig. 4).

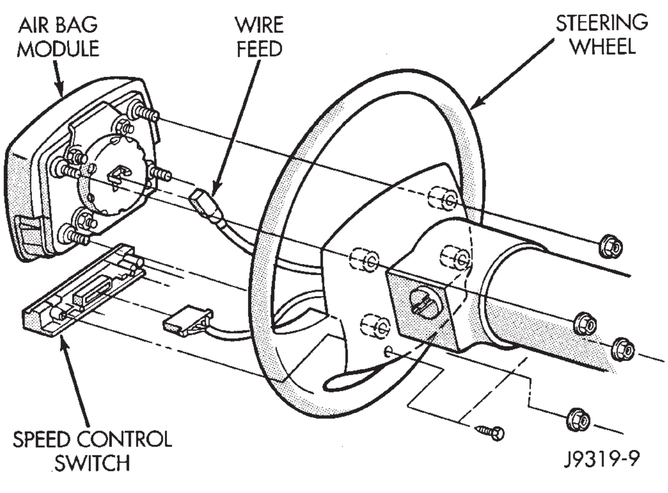


Fig. 4 Airbag Module

(3) Lift module, and unplug electrical connector by spreading apart the external latching arms and prying upward on the connector.

(4) Remove module.

(5) If replacing a deployed module, the clockspring must also be replaced. Refer to Airbag Clockspring Service for proper procedure.

(6) When installing, connect clockspring wiring connector to the module by pressing straight in on the connector. The connector should latch securely beneath the module connector locking clip to assure positive connection.

(7) Install 4 nuts and torque to 9-11 N·m (80-100 in. lbs.).

(8) Do not connect negative battery cable at this time. Refer to Airbag System Check for proper procedure.

IMPACT SENSOR REMOVE/INSTALL

The impact sensors are located on the wheelhouse extensions behind the grille opening reinforcement.

(1) Disconnect battery negative cable and isolate. If airbag module is undeployed, wait 2 minutes for system capacitor to discharge before further service.

(2) Remove the 3 screws and the grille (Fig. 5) from the grille opening reinforcement.

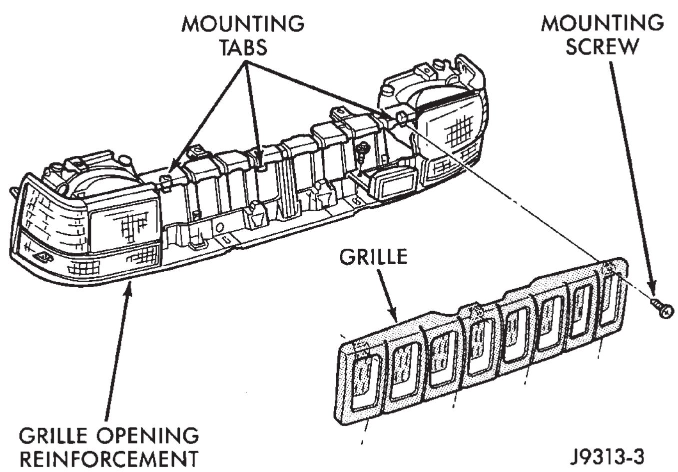


Fig. 5 Grille Remove/Install

(3) Remove turn signal, side marker and head lamps. Refer to Group 8L - Lamps for procedures.

(4) Remove 6 retainers at front fascia (Fig. 6).

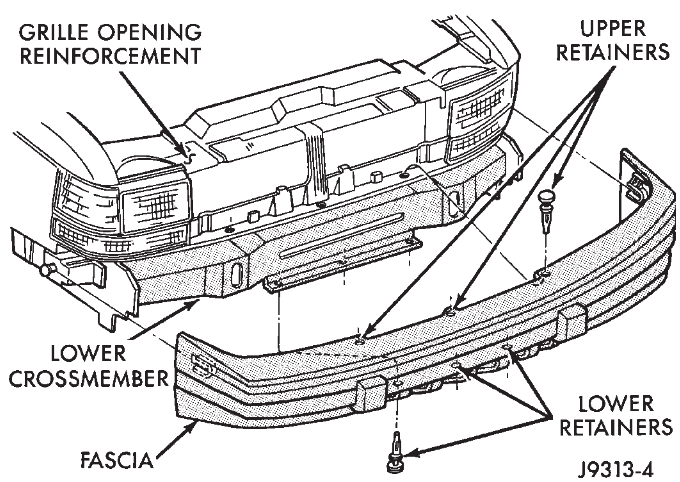


Fig. 6 Lower Fascia Remove/Install

(5) Remove 3 push-in retainers at each front wheel opening (Fig. 7).

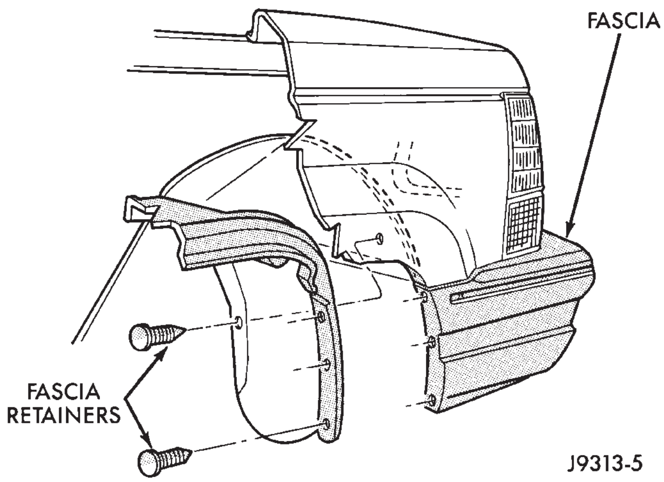


Fig. 7 Wheel Opening Retainers

(6) Slide fascia off retainer pegs at side of lower crossmember. Using a small screwdriver, pull up on locating tangs under turn signal lamp mounting locations.

(7) Remove fascia from lower crossmember (Fig. 6).

(8) Remove 3 screws holding sensor to front wheelhouse extension. Remove sensor (Fig. 8).

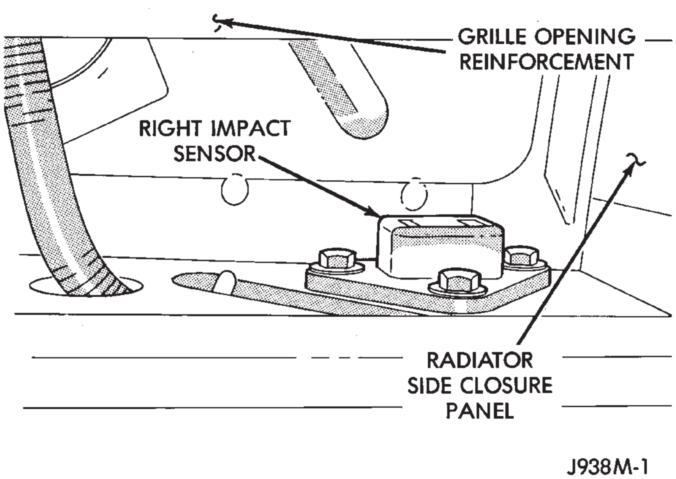


Fig. 8 Airbag Impact Sensor - Typical

(9) Unplug connector from sensor and remove sensor (Fig. 9).

(10) To install, plug impact sensor wiring harness into connector on body of sensor.

(11) Mount sensor (arrow pointed forward) using 3 screws provided with new sensor. Tighten screws to 4-5 N·m (35-45 in. lbs.).

(12) Install fascia and grille by reversing the removal procedures.

(13) Do not connect negative battery cable at this time. Refer to Airbag System Check for proper procedure.

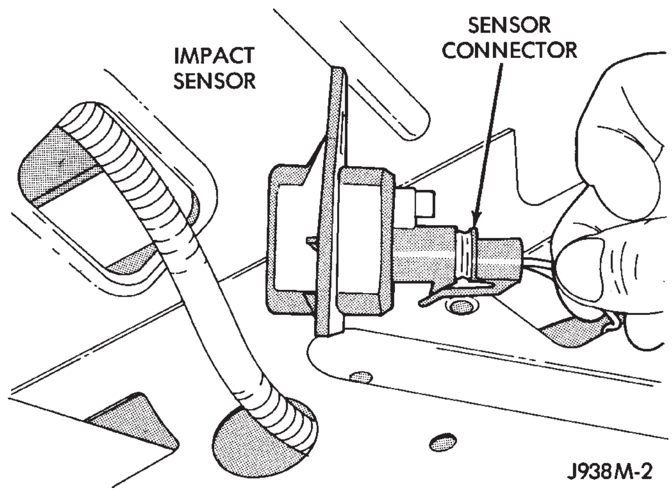


Fig. 9 Airbag Impact Sensor Connector

AIRBAG CONTROL MODULE REMOVE/INSTALL

WARNING: THE ACM CONTAINS ONE OF THE IMPACT SENSORS WHICH ENABLE THE SYSTEM TO DEPLOY THE AIRBAG. TO AVOID ACCIDENTAL DEPLOYMENT, NEVER CONNECT ACM ELECTRICALLY TO THE SYSTEM UNLESS IT IS BOLTED TO VEHICLE. BEFORE BEGINNING ANY AIRBAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) CABLE FROM THE VEHICLE BATTERY. THEN WAIT 2 MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. 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.

(1) Disconnect battery negative cable and isolate. If airbag is undeployed, wait 2 minutes for system capacitor to discharge before further service.

(2) Remove 2 screws from bottom of center console storage bin (Figs. 10, 11 and 12).

(3) Remove transmission shift handle by pulling it up sharply.

(4) Remove transmission shift bezel, there are 2 snap clips on each side.

(5) Remove lamp from bezel.

(6) Remove 4 screws under transmission shift bezel (Fig. 13).

(7) Remove bezel under parking brake handle.

(8) Move transfer case and transmission shift levers rearward.

(9) Lift console up to remove it. There is a lamp at the rear end of the transfer case bezel.

(10) Disconnect wiring at ACM (Fig. 14).

(11) Remove 4 screws holding the ACM.

(12) Remove ACM.

(13) To install, position the ACM with the arrow pointing forward.

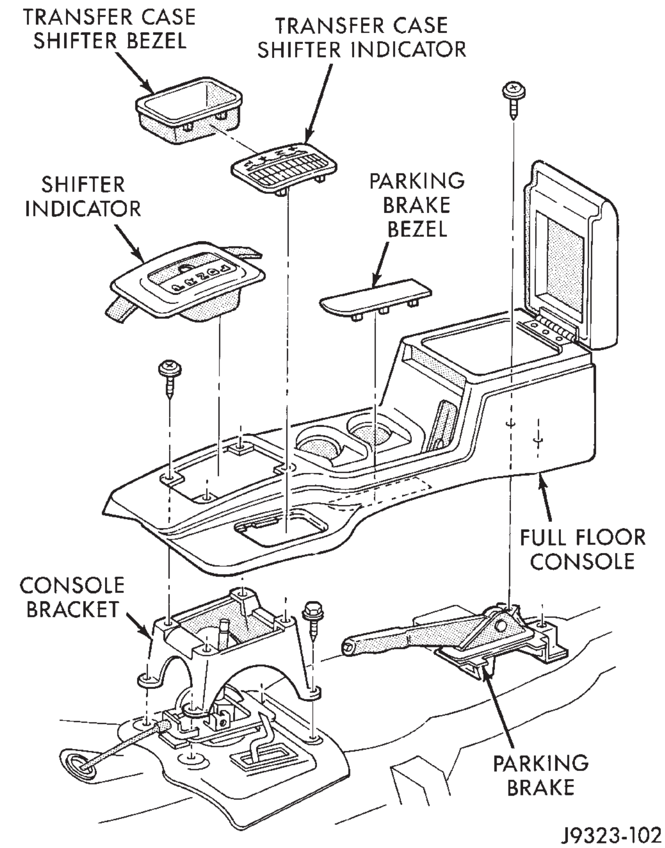


Fig. 10 Center Console

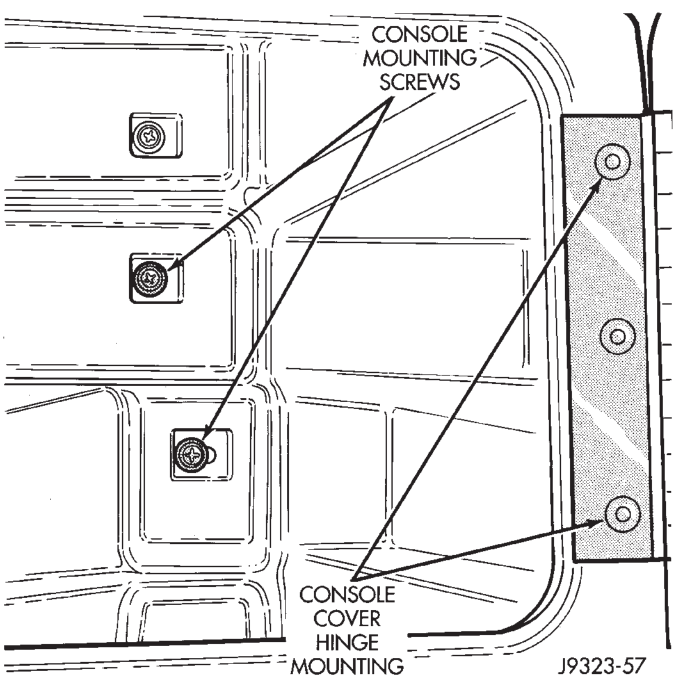


Fig. 11 Console Remove/Install

(14) Attach the ACM to the park brake bracket and floor pan with the 4 screws supplied. Tighten screws to 5.5-7 N·m (50-60 in. lbs.).

(15) Connect wiring at ACM, making sure both connectors are seated and locking tabs engaged.

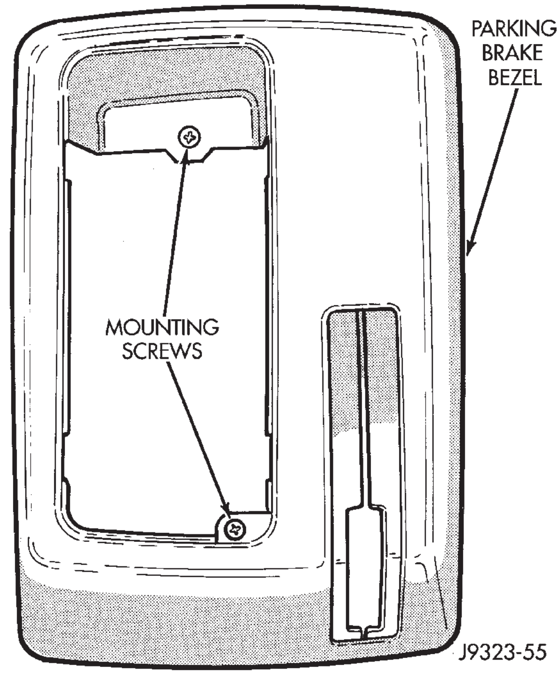


Fig. 12 Parking Brake Bezel Remove/Install

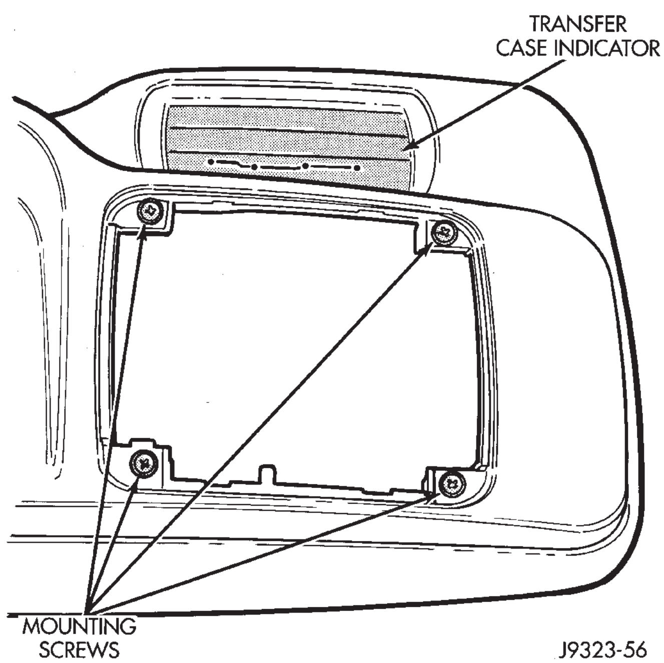


Fig. 13 Center Console Forward Mounting Screws

(16) Install center floor console.

(17) Do not connect negative battery cable at this time. Refer to Airbag System Check for proper procedure.

CLOCKSPRING REMOVE/INSTALL

(1) Place the front wheels in the straight-ahead position before starting the repair.

(2) Disconnect battery negative cable and isolate. If airbag is undeployed, wait 2 minutes for system capacitor to discharge before further service.

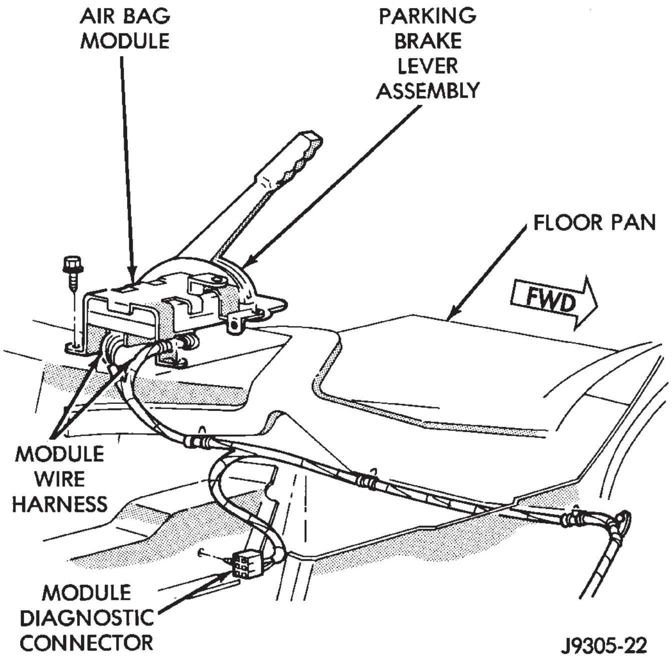


Fig. 14 Airbag Control Module

(3) Remove the airbag module. See Airbag Module Remove/Install.

(4) Remove speed control switch and connector, if equipped.

(5) Remove the steering wheel with steering wheel puller tool (C-3428B).

(6) Unplug wiring connectors from horn switches.

(7) Remove upper and lower steering column shrouds to gain access to clockspring wiring (Fig. 15).

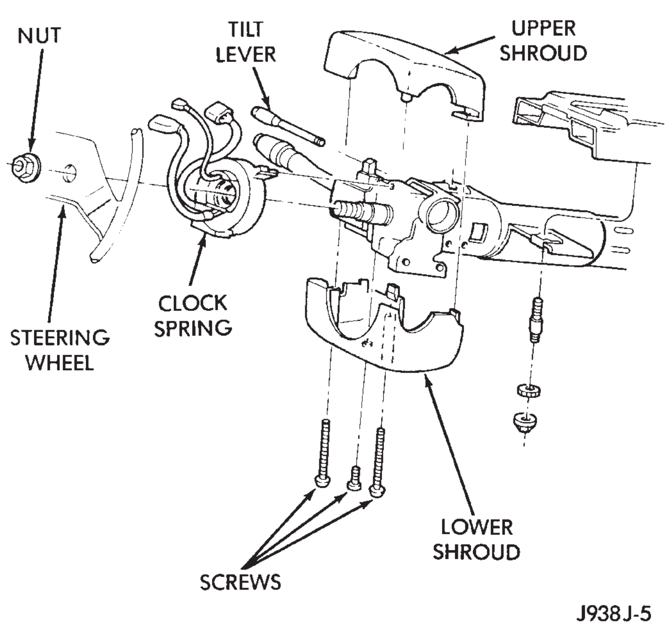


Fig. 15 Steering Column Shrouds Remove/Install

(8) Disconnect the 2-way connector between the clockspring and the instrument panel wiring harness at the base of the steering column.

(9) To remove, pull clockspring assembly from steering column by lifting locating fingers as necessary. The clockspring cannot be repaired. It must be replaced if faulty, or if airbag has been deployed.

(10) When installing, snap clockspring onto the steering column. If the clockspring is not properly positioned, see Clockspring Centering before installing steering wheel.

(11) Connect the clockspring assembly to the instrument panel wiring harness. Make sure wiring locator clips are properly seated on the outside of the wiring trough and locking tabs are engaged.

(12) Reinstall steering column shrouds. Be sure airbag wire is inside the shrouds.

(13) Front wheels should still be in the straight-ahead position. Install steering wheel making sure to fit the flats on the hub of the steering wheel with the formations on the inside of clockspring. Pull the horn wiring through the upper, smaller hole in steering wheel hub. Pull the airbag and speed control wiring through the bottom, larger hole in the steering wheel hub. Make sure not to pinch wiring between the steering wheel and nut.

(14) Connect the horn switch wire, then the airbag wire to the airbag module. To assure complete connection, latching arms must be visibly on top of connector housing.

(15) Install the airbag module, and torque nuts to 9 to 11 N·m (80 to 100 in. lb.).

(16) Do not connect negative battery cable at this time. See Airbag System Check for proper procedure.

CLOCKSPRING CENTERING

If the rotating tape within the clockspring is not positioned properly in relation to the steering wheel and the front wheels, the clockspring may fail during use. The clockspring MUST BE CENTERED, if it is not known to be properly positioned, or if the front wheels were moved from the straight-ahead position.

(1) Place front wheels in the straight-ahead position.

(2) Disconnect battery negative cable and isolate. If airbag is undeployed, wait 2 minutes for system capacitor to discharge before further service.

(3) Remove airbag module. Remove steering wheel with steering wheel puller tool (C-3428B).

(4) Depress the two plastic auto-locking tabs (Fig. 16).

(5) Keeping locking mechanism disengaged, rotate the clockspring rotor CLOCKWISE to the end of its travel. Do not apply excessive torque.

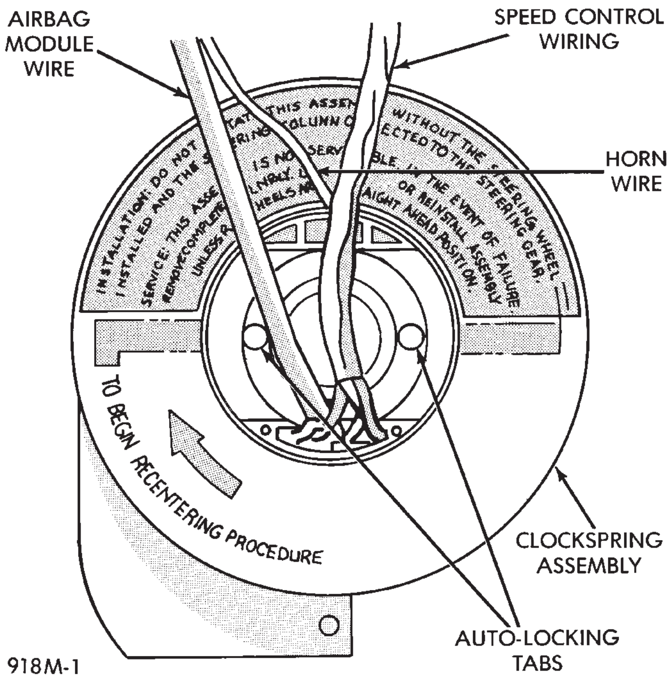


Fig. 16 Clockspring Auto-Locking Tabs

(6) From the end of travel, rotate the rotor two and one-half turns COUNTER CLOCKWISE. The horn wire should end up at the top, and the airbag wire at the bottom.

(7) Reinstall steering wheel.

(8) Install airbag module. Torque nuts to 9 to 11 N·m (80 to 100 in. lbs.).

(9) Do not connect battery negative cable at this time. See Airbag System Check for proper procedure.

REAR WINDOW DEFOGGER

CONTENTS

GENERAL INFORMATION

The electrically-heated rear window defogger is standard equipment on Grand Cherokee models. Following are general descriptions of the major components in the rear window defogger system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

REAR WINDOW GLASS GRID

The heated rear window glass has two electrically-conductive vertical bus bars and a series of horizontal grid lines made of a silver-ceramic material, which is baked on and bonded to the inside surface of the glass. The grid lines and bus bars comprise a parallel electrical circuit.

When the rear window defogger switch is placed in the ON position, current is directed to the rear window grid lines through the bus bars. The grid lines heat the rear window to clear the surface of fog or snow. Circuit protection for the heated grid circuit is provided by a circuit breaker in cavity 28 of the fuseblock module.

The grid lines and bus bars are highly resistant to abrasion. However, it is possible for an open to occur in an individual grid line resulting in no current flow through the line. The grid lines can be damaged or scraped off with sharp instruments. Care should be taken in cleaning the glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

A repair kit is available to repair the grid lines and bus bars, or to reinstall the heated glass pigtail wires.

DEFOGGER SWITCH

The rear window defogger switch is mounted in the right instrument panel switch pod. The switch circuit is protected by fuse 23 in the fuseblock module. Actuating the switch energizes the relay and electronic timer. A light-emitting diode (LED) with an amber lens in the switch illuminates to indicate when the system is turned on. The defogger switch can not be repaired. If faulty, the switch must be replaced.

DEFOGGER RELAY/TIMER

The defogger relay/timer is located in the relay center, which is under a cover in the glove box. When the rear defogger switch is actuated, the rear defogger relay is energized. This causes current to flow through the grid circuit for approximately 10 minutes, or until the rear window defogger switch or ignition switch are turned off. Power for the relay is protected by fuse 19 in the fuseblock module. The defogger relay/timer can not be repaired and, if faulty, must be replaced.

DIAGNOSIS

SYSTEM TESTS

Electrically-heated rear window defogger operation can be confirmed in the following manner:

(1) Turn the ignition switch to the ON position.

(2) Turn rear window defogger control switch ON.

(3) Monitor vehicle voltmeter. With the control switch ON, a distinct needle deflection 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 within 3 to 4 minutes of operation.

(5) Using a DC voltmeter, contact terminal A (Fig. 1) (passenger side) with the negative lead, and terminal B (driver side) with the positive lead. The voltmeter should read 10-14 volts.

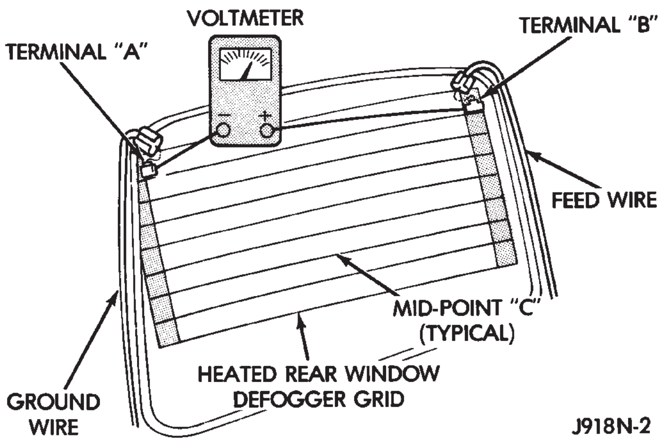


Fig. 1 Rear Window Glass Grid Test

Steps 3, 4 or 5 above will confirm system operation. Indicator light illumination means that there is power available at the output of the switch, but does not confirm that power is reaching the rear window grid lines.

If the rear window defogger does not operate, the problem should be isolated in the following manner:

(1) Confirm that ignition switch is in ON position.

(2) Ensure that the heated rear window feed and ground wires are connected to the glass. Confirm that the ground wire has continuity to ground.

(3) Check fuses 19 and 23, and circuit breaker 28 in the fuseblock module. Fuses and circuit breaker must be tight in their receptacles and all electrical connections must be secure.

When the above steps have been completed and the system is still inoperative, one or more of the following is faulty:

- defogger switch
- relay/timer
- rear window grid lines (all grid lines would have to be broken or one of the feed wires disconnected for the entire system to be inoperative).

If turning the switch ON produces severe voltmeter deflection, check for a short circuit.

REAR WINDOW GLASS GRID

To detect breaks in grid lines, the following procedure is required:

(1) Turn ignition switch to the ON position. Turn rear defogger switch ON. The indicator lamp should light.

(2) Using a 12-volt DC voltmeter, contact ground side vertical bus bar (point A of Fig. 1) with negative lead of voltmeter. With positive lead of voltmeter, contact feed side vertical bus bar (point B of Fig. 1). The voltmeter should read 10-14 volts.

(3) With negative lead of voltmeter, contact a good body ground point. The voltage reading should not change. A different reading indicates a poor ground connection.

(4) Connect negative lead of voltmeter to point A on ground side bus bar 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 zero volts indicates a break in the grid line between mid-point C and point B. A reading of 10-14 volts indicates a break between mid-point C and point A. Move toward break and voltage will change as soon as break is crossed.

DEFOGGER SWITCH

(1) Remove defogger switch from instrument panel. Use a jumper wire to apply 12 volts to terminal 1 of switch (Fig. 2). Using another jumper wire connect terminal 3 of switch to ground. The indicator lamp should light. If OK, go to next step. If not OK, replace switch.

(2) Remove jumper wires and connect an ohmmeter to terminals 2 and 3 of switch. Push the switch button. Ohmmeter should read less than 1 ohm. If OK, go to next step. If not OK, replace switch.

(3) Check defogger switch wiring circuits as follows:

- between switch connector cavity 1 and fuse 23
- between switch connector cavity 3 and ground
- between switch connector cavity 2 and terminal 3 of the relay.

Repair switch wiring shorts or opens as required.

DEFOGGER RELAY

(1) Remove defogger relay from relay center and turn ignition switch to ON position. Measure voltage at relay center cavity for defogger relay terminal 5. Meter should show battery voltage. If OK, go to next step. If not OK, repair circuit to fuse 19 as required.

(2) Measure voltage at relay center cavity for defogger relay terminal 4. The meter should read battery voltage. If OK, go to next step. If not OK, repair open from circuit breaker 28.

(3) Turn ignition switch to OFF position. Measure resistance between relay center cavity for defogger relay terminal 1 and left (driver's) side of defogger grid. The meter should read zero ohms. If OK, go to next step. If not OK, repair circuit between relay and defogger grid.

(4) Measure resistance between relay center cavity for defogger relay terminal 2 and a good ground. The meter should read zero ohms. If OK, go to next step. If OK, go to next step. If not OK, repair circuit between relay center and ground.

(5) Install defogger relay in relay center. Turn ignition switch to ON position. Measure voltage at relay terminal 3. The meter should read near 5 volts. If not OK, replace defogger relay.

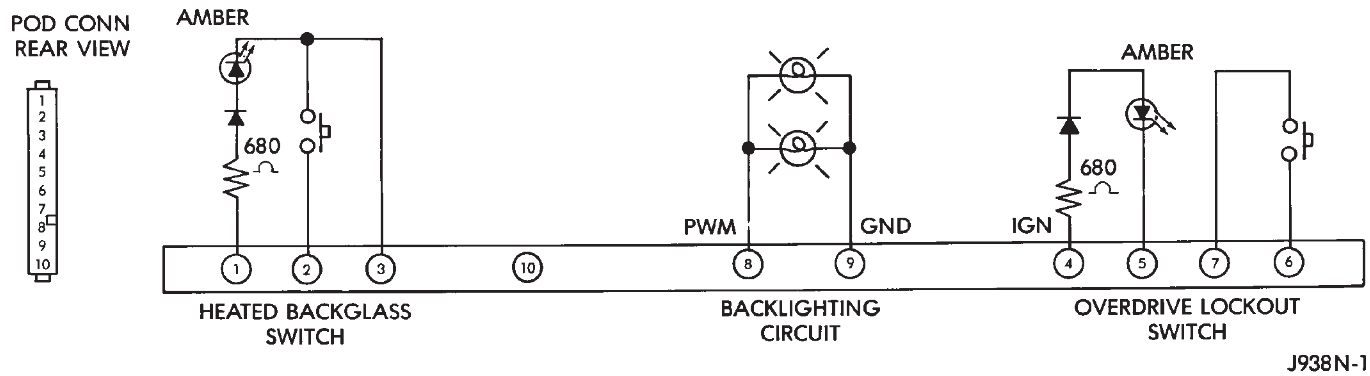
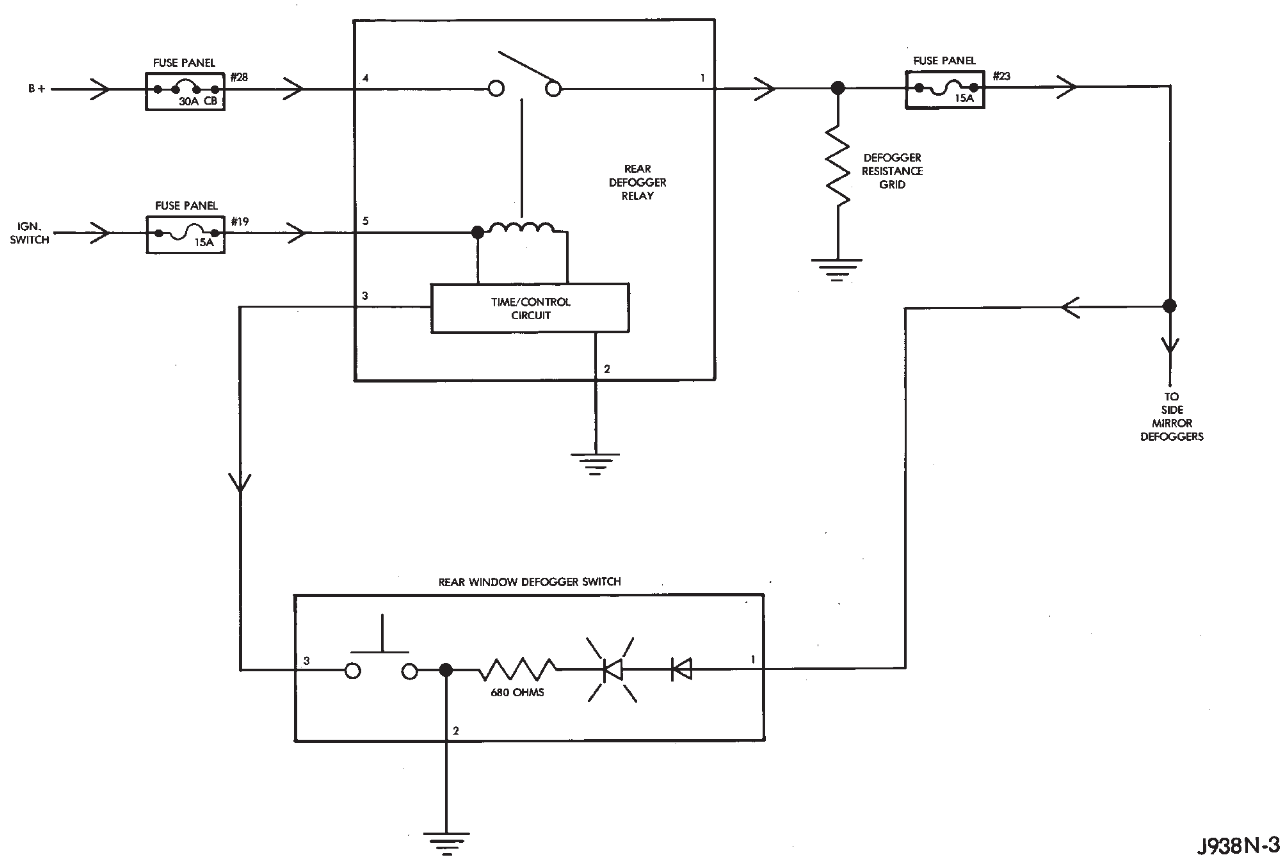


Fig. 2 Defogger Switch Circuit

REAR WINDOW DEFOGGER SYSTEM SCHEMATIC



SERVICE PROCEDURES

REAR WINDOW GLASS GRID REPAIRS

The repair of grid lines, bus bars or pigtail wires can be accomplished using the MOPAR Rear Window Defogger Repair Kit (P/N 4267922) or equivalent.

WARNING: MATERIALS CONTAINED IN REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION. CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, HARMFUL IF SWALLOWED. AVOID CONTACT WITH SKIN AND EYES. FOR SKIN, WASH AFFECTED AREAS WITH SOAP AND WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING; CALL A PHYSICIAN IMMEDIATELY. IF IN CONTACT WITH EYES, FLUSH WITH PLENTY OF WATER. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTENTS CONTAIN 3% FLAMMABLE SOLVENTS. KEEP OUT OF REACH OF CHILDREN.

(1) Mask repair area so that the conductive epoxy can be applied neatly. Extend epoxy application onto the grid line or the bus bar (Fig. 3) on either side of the break.

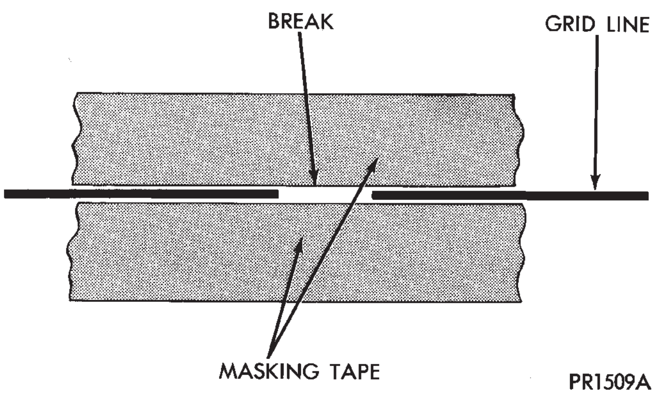


Fig. 3 Grid Line Repair (Typical)

(2) Follow instructions in repair kit for preparing damaged area.

(3) Remove package separator clamp and mix two conductive epoxy components thoroughly within packaging. Fold package in half and cut center corner to dispense epoxy.

(4) For grid line, mask area to be repaired with masking tape or a template (Fig. 3).

(5) Apply epoxy through slit in masking tape or template. Overlap both ends of the break by at least 19mm (.75 in.).

(6) 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 or pigtail was fastened and onto adjacent grid line.

(7) Apply a thin layer of conductive epoxy to terminal or bare wire end of pigtail and place in desired location. To prevent terminal or pigtail from moving while the epoxy is curing, it must be wedged or clamped.

(8) Carefully remove masking tape from grid line.

CAUTION: Do not allow the glass surface to exceed 400°F, glass may fracture.

(9) Allow epoxy to cure 24 hours at room temperature or use heat gun with a 260°-371°C (500°-700°F) range for 15 minutes. Hold gun approximately 254mm (10 inches) from repaired area.

(10) After conductive epoxy is properly cured remove wedge or clamp from terminal or pigtail and check operation of rear window defogger. Do not attach connectors until curing is complete.

DEFOGGER SWITCH REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding instrument panel center bezel (Fig. 4).

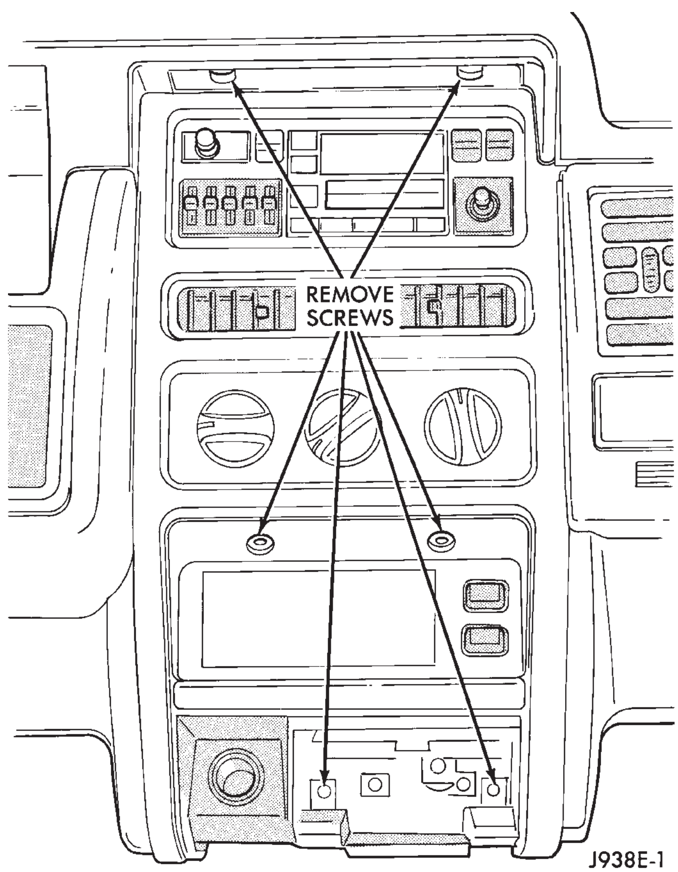


Fig. 4 Instrument Panel Center Bezel

(4) Remove center bezel.

(5) Remove 2 screws holding dash pad located behind top of center bezel.

(6) Gently pry defroster grille out of dash pad.

(7) Unplug auto head lamp and sun sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 5).

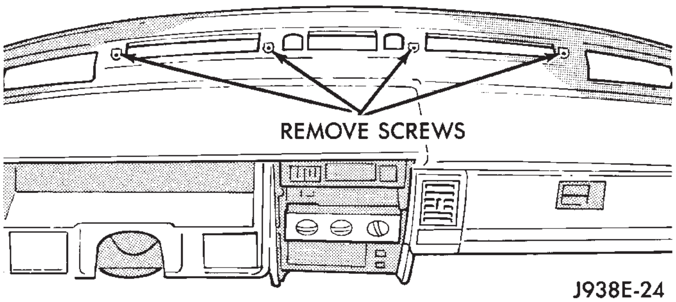


Fig. 5 Upper Dash Pad Attaching Screws

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 6).

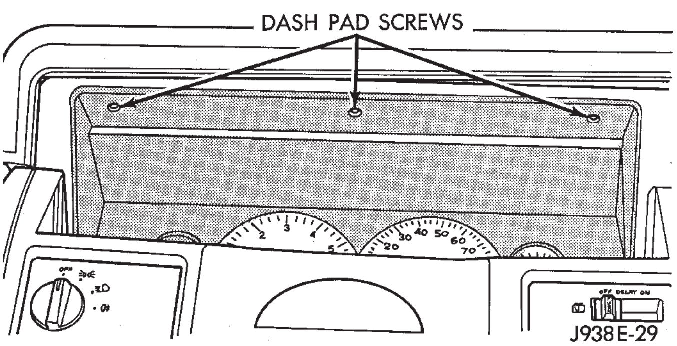


Fig. 6 Remove Screws Holding Dash Pad

(10) Open glove box and remove 2 screws holding dash pad.

(11) Remove dash pad by pulling up to unsnap end clips.

(12) With left front door open, remove 1 screw from the side of the lower instrument panel trim (Fig. 7).

(13) Remove 4 screws holding the steering column cover (Fig. 8).

(14) Remove 1 screw from bottom of lower instrument panel trim and pull panel off. There is also a clip holding the panel to the instrument panel.

(15) Remove 6 screws holding knee blocker.

(16) Remove steering column retaining nuts.

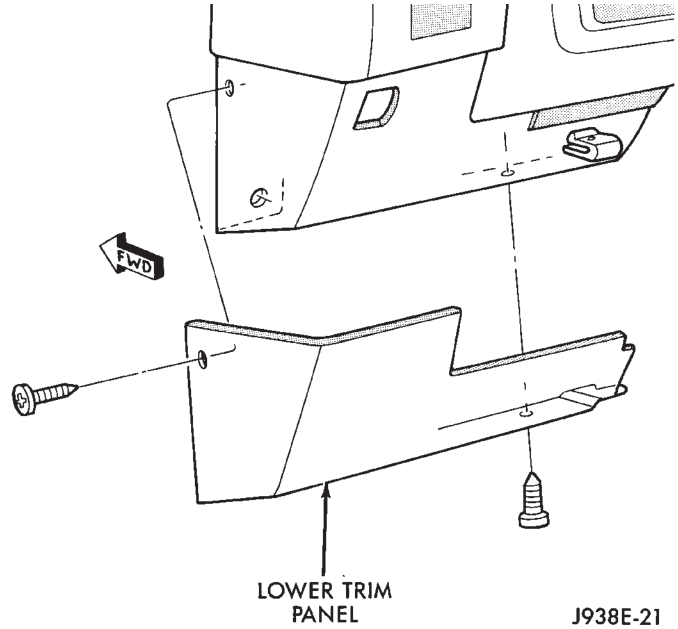


Fig. 7 Lower Instrument Panel Trim

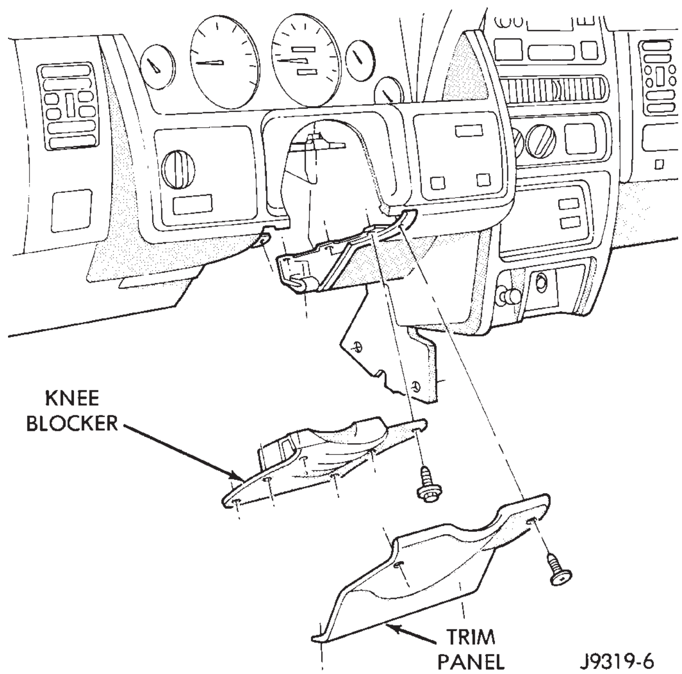


Fig. 8 Steering Column Cover and Knee Blocker

(17) Remove 3 screws holding bottom of bezels (Fig. 9).

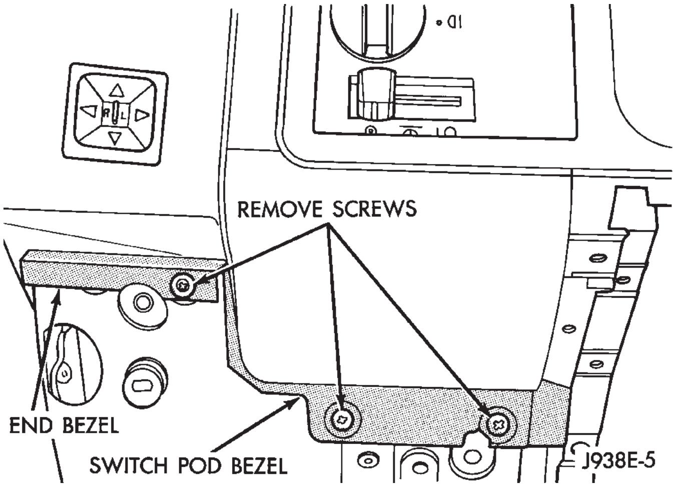


Fig. 9 Remove Screws Holding Bottom Of Bezels

(18) Remove 2 screws holding top of end and switch pod bezels (Fig. 10). The end bezel can now be removed.

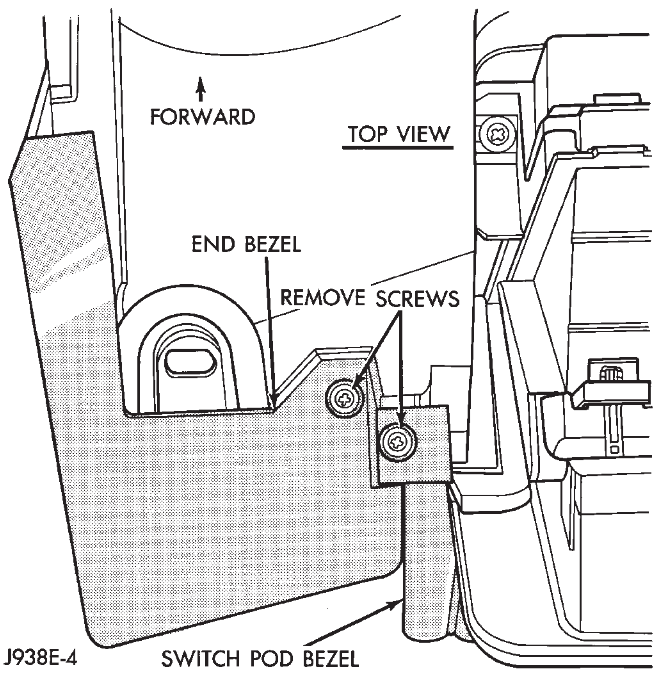


Fig. 10 Remove Screws Holding Top of Bezels

(19) Remove 2 screws holding left switch pod bezel (Fig. 11).

(20) Remove 3 screws holding right switch pod bezel (Fig. 12).

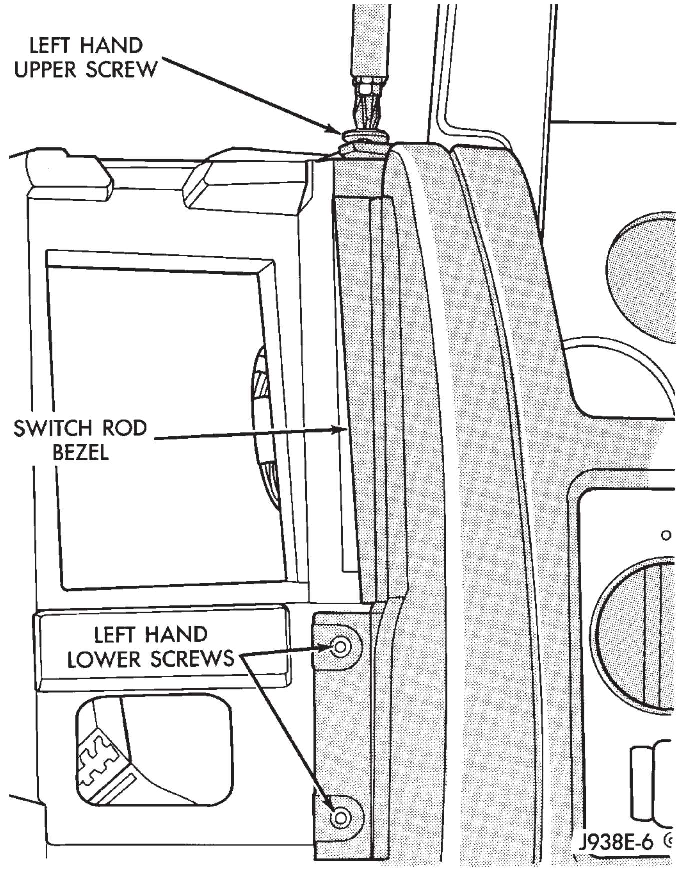


Fig. 11 Left Switch Pod Bezel Screws

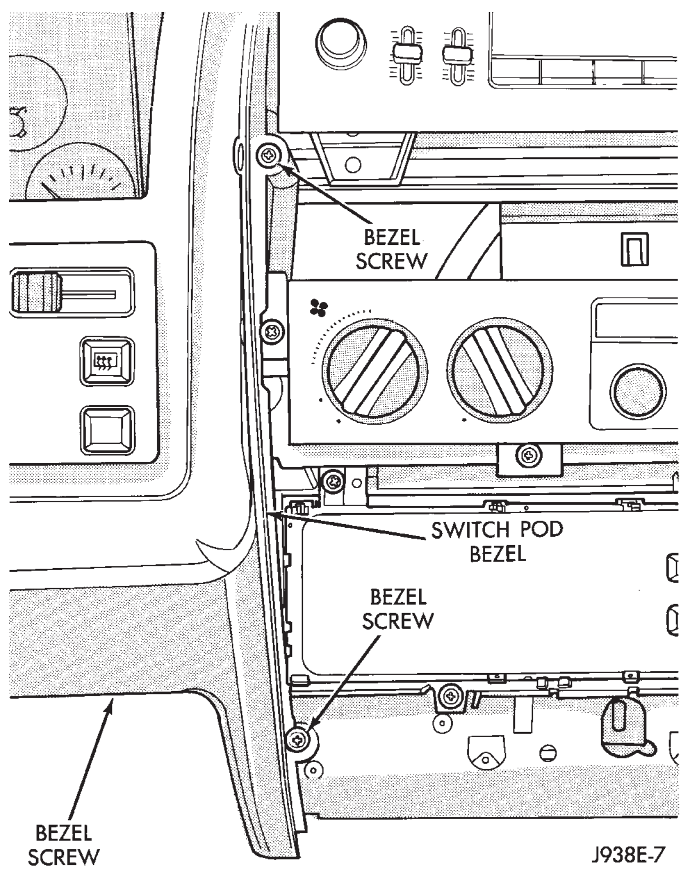


Fig. 12 Right Switch Pod Bezel Screws

(21) Pull switch pod bezel out far enough to remove switch connectors. Disconnect connectors from each switch pod and remove bezel (Fig. 13).

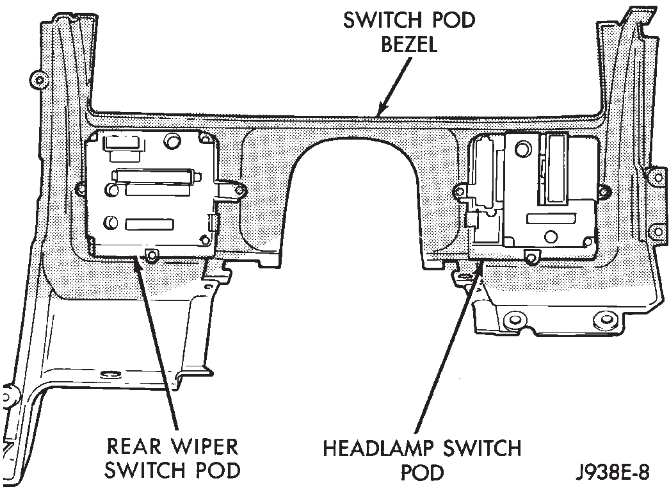


Fig. 13 Rear View Of Switch Pod Bezel

(22) Remove required switch pod attaching screws and switch pod.

(23) Reverse the removal procedures to install. Tighten steering column retaining nuts to 12 N·m (105 in. lbs.).

DEFOGGER RELAY/TIMER REMOVE/INSTALL

(1) Open glove box and remove 3 screws holding relay center cover (Fig. 14).

(2) Remove the red relay from the relay center (Fig. 15).

(3) Align relay terminals with cavities in relay center and push relay into place.

(4) Re-install relay center cover.

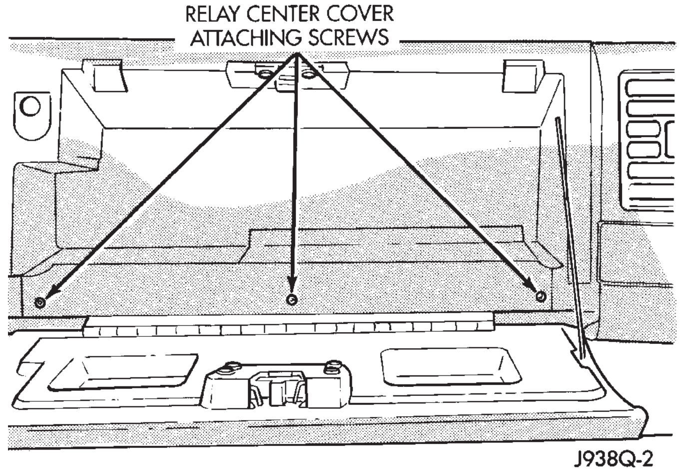


Fig. 14 Relay Center Cover

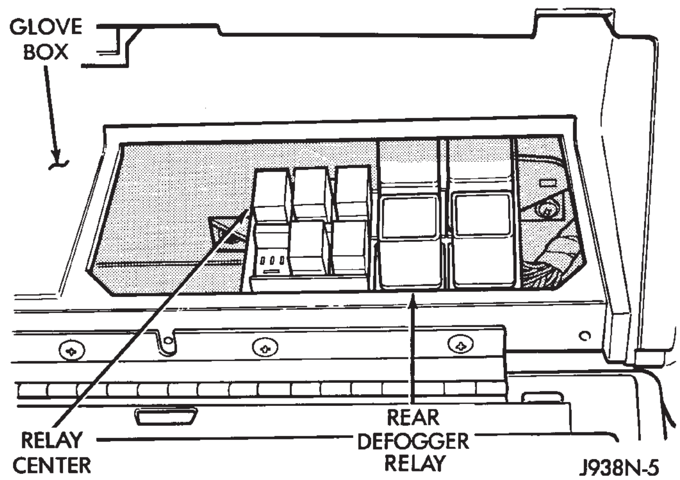


Fig. 15 Rear Window Defogger Relay

POWER LOCKS

CONTENTS

GENERAL INFORMATION

Power locks are standard equipment on Grand Cherokee models. Power windows and the keyless entry system are included on vehicles equipped with power locks. All doors and the liftgate can be locked and unlocked electrically by operating the switch on either front door panel, or by operating the lock and unlock buttons of the remote keyless entry transmitter. The power lock and keyless entry systems operate with battery power supplied independent of the ignition switch.

A liftgate liftglass is an option on the Grand Cherokee model. The liftglass latch operates with battery power supplied independent of the ignition switch. The liftglass latch solenoid is mounted near the liftgate wiper motor inside the liftgate. The liftglass latch release switch is mounted in the top of the license plate tub. A limit switch in the liftgate latch opens to prevent unauthorized liftglass latch operation when the liftgate latch is locked with a power lock switch, the keyless entry transmitter or the liftgate lock key cylinder. Refer to Group 23 - Body Components for service of the liftglass latch components.

Following are general descriptions of the major components in the power lock and keyless entry systems. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams. Refer to the owner's manual for more information on the features and use of these systems.

POWER LOCK SWITCH

The power locks are controlled by a two-way switch mounted on the trim panel of each front door. The switch controls battery feed to the lock and unlock relays. The door lock switches can not be repaired. If faulty, the entire switch must be replaced.

POWER LOCK/UNLOCK RELAYS

The power lock and unlock relays are located in the relay center. The relay center is located under a cover in the bottom of the glove box. The relays respond to inputs from the power lock switches and the keyless entry module by sending the correct battery and ground feeds to the lock motors. The lock and unlock relays can not be repaired. If faulty, they must be replaced.

POWER LOCK MOTOR

The locks are actuated by a reversible motor mounted within each door. The motor direction is controlled by the battery and ground feeds from the power lock/unlock relays. The motor can not be repaired. If faulty, the entire motor must be replaced.

KEYLESS ENTRY TRANSMITTER

The keyless entry transmitter is equipped with two buttons labeled Lock and Unlock. It is also designed to serve as a key fob and is equipped with a key ring. Each transmitter has a different vehicle access code, which must be programmed into the memory of the keyless entry module in the vehicle in order to operate the locks. The operating range of the infrared transmitter signal is up to 4.75 meters (15 feet) from the receiver.

The transmitter operates on two CR1616 3-volt (or equivalent) batteries. Typical battery life is from one to two years.

KEYLESS ENTRY MODULE

The keyless entry module is mounted in the dome lamp housing on the headliner, or inside and towards the rear of the overhead console (if equipped). This module contains the keyless entry receiver and program logic for the keyless entry system.

The keyless entry module has a memory function to retain the vehicle access code of at least one, and up to four transmitters. The module receives input from the remote keyless entry transmitter. In response to that input, it is programmed to control outputs to the lock and unlock relays. The module can not be repaired and, if faulty, must be replaced.

DIAGNOSIS

As a preliminary system diagnosis, note system operation while you actuate both the Lock and Unlock functions with the power lock switches and the keyless entry transmitter. Then, proceed as follows:

- If system fails to function with either the switches or the transmitter, see Power Lock System diagnosis.
- If system functions with both switches, but not the transmitter, see Keyless Entry Transmitter diagnosis.
- If system functions with transmitter, but not with one or both switches, see Power Lock System diagnosis.
- If one lock fails to operate with the switches or transmitter, see Power Lock Motor diagnosis.

POWER LOCK SYSTEM

(1) Inspect fuses 8 and 14 in fuseblock module. Replace if necessary. If OK, measure voltage at battery side of fuse. There should be 12 volts. If not OK, repair open from Power Distribution Center.

(2) Remove door switch(es) and measure voltage at terminal 4. Meter should read battery voltage. If OK, go to next step. If not OK, repair open to fuse 8 in fuseblock module.

(3) Remove glove box bottom to access the relay center.

(4) Measure resistance between lock and unlock relay terminal 4 and ground. Also measure resistance at terminal 5 of the unlock relay. Meter should read zero ohms. If OK, go to next step. If not OK, repair circuit to ground.

(5) Measure voltage at terminal 2 of both the lock and unlock relays. Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to fuse 14 in fuseblock module.

(6) Measure resistance at terminal 5 of the lock relay. Meter should read zero ohms with left front door closed. If OK, go to next step. If not OK, repair circuit to chime module and/or see Group 8U - Chime/Buzzer Warning Systems for further diagnosis.

(7) Hold left switch in LOCK position. Measure voltage at lock switch terminal 5. Meter should read battery voltage. If OK, go to next step. If not OK, replace faulty switch.

(8) Hold left switch in UNLOCK position. Measure voltage at lock switch terminal 1. Meter should read battery voltage. If OK, go to next step. If not OK, replace faulty switch.

(9) Hold left switch in LOCK position. Measure voltage at lock relay terminal 3. Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to left switch.

(10) Hold left switch in UNLOCK position. Measure voltage at unlock relay terminal 3. Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to left switch.

(11) Hold left switch in LOCK position. Measure voltage at lock relay terminal 1. Meter should read battery voltage. If OK, go to next step. If not OK, replace faulty lock relay.

(12) Hold left switch in UNLOCK position. Measure voltage at unlock relay terminal 1. Meter should read battery voltage. If OK, check circuit to door lock motor and see Power Lock Motor. If not OK, replace faulty unlock relay.

(13) Repeat steps 7 through 12 for right door lock switch.

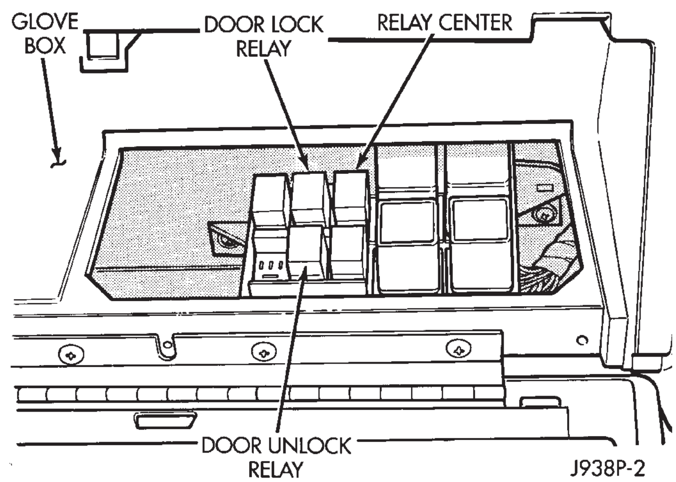


Fig. 1 Door Lock/Unlock Relays

POWER LOCK MOTOR

(1) Once it is determined which lock motor is inoperative, that motor can be tested. Disconnect the wire connector at the motor. Apply 12 volts to the motor terminals to check its operation in one direction. Reverse the polarity to check the operation in the other direction. If OK, repair circuits to power lock/unlock relays as required. If not OK, replace the motor.

(2) If all lock motors are inoperative, the problem may be caused by one shorted motor. Disconnecting a shorted motor will allow the good motors to operate. Disconnect each motor connector, one at a time, and re-check both lock and unlock functions while operating the door lock switch. If disconnecting one motor causes the other motors to become functional, go back to step 1 to test the disconnected motor.

KEYLESS ENTRY TRANSMITTER

(1) Depress either transmitter button and note whether red Light-Emitting Diode (LED) on transmitter case lights. If OK, go to next step. If not OK, replace batteries as described under Keyless Entry Transmitter in Service Procedures. Test transmitter operation. If OK, discard faulty batteries. If not OK, go to next step.

(2) Perform transmitter program procedure with suspect transmitter and another known good transmitter, as described in Service Procedures. Test operation with both transmitters. If both transmitters fail to operate power locks, see Keyless Entry Module diagnosis. If known good transmitter operates power locks and suspect transmitter does not, replace faulty transmitter. Be certain to perform transmitter program procedure again when replacing faulty transmitter and to erase test transmitter access code from keyless entry module.

KEYLESS ENTRY MODULE

(1) Check fuse 8 in fuseblock module. If OK, go to next step. If not OK, replace fuse.

(2) Check for battery voltage at fuse 8. If OK, go to next step. If not OK, repair circuit from power distribution center.

(3) Access keyless entry module connectors as described in Keyless Entry Module Remove/Install. Unplug connector and check connector and receptacle in module for loose, corroded, or damaged terminals and pins. If OK, go to next step. If not OK, repair as required.

(4) Check resistance between connector cavity for module terminal 10 and a good ground. Meter should read zero ohms. If OK, go to next step. If not OK, repair circuit to ground.

(5) Probe connector cavity for module terminal 1 and check for battery voltage. If OK, go to next step. If not OK, repair circuit to fuse 8 as required.

(6) Install a jumper wire from connector cavity for module terminal 1 to connector cavity for module terminal 3. Doors should lock. If OK, go to step 8. If not OK, go to next step.

(7) Check for continuity between connector cavity for module terminal 3 and lock relay terminal 3 (86). There should be continuity. If OK, replace lock relay. If not OK, repair circuit as required.

(8) Install a jumper wire from connector cavity for module terminal 1 to connector cavity for module terminal 4. Doors should unlock. If OK, replace module. If not OK, go to next step.

(9) Check for continuity between connector cavity for module terminal 4 and unlock relay terminal 3 (86). There should be continuity. If OK, replace unlock relay. If not OK, repair circuit as required.

SERVICE PROCEDURES

KEYLESS ENTRY TRANSMITTER

To replace transmitter batteries, separate transmitter case by prying gently with a trim stick or other wide flat-bladed tool at center seam (Fig. 2). Case snaps open and shut. Replace with CR1616 3-volt batteries or equivalent (Fig. 3).

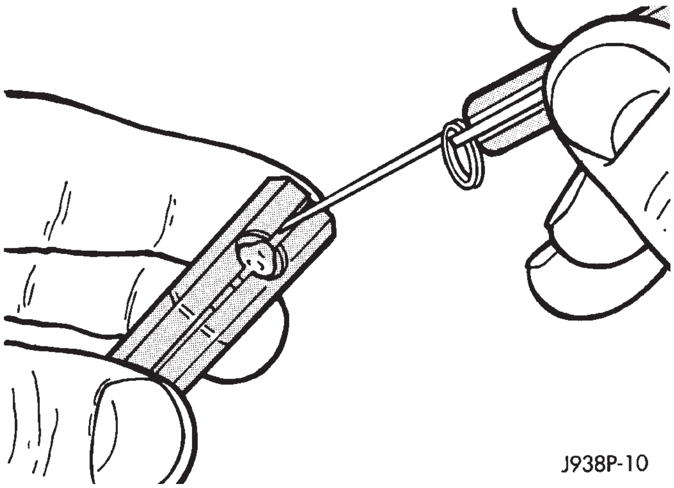


Fig. 2 Separate Transmitter Halves

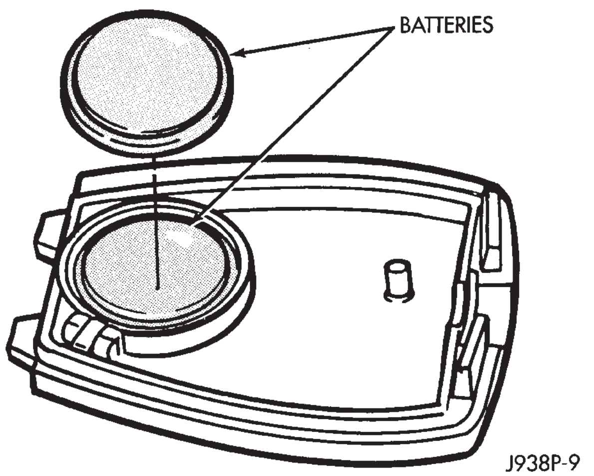


Fig. 3 Battery Install

TRANSMITTER PROGRAMMING PROCEDURE

(1) Open the driver's door of the vehicle. Leave it open through the programming procedure.

(2) Move the mechanical door lock lever to the LOCK position.

(3) Turn the ignition switch to the ON position.

(4) Within 20 seconds, aim a transmitter at the keyless entry module receiver dome and press the LOCK button for at least 5 seconds. Once the module accepts the programming code, the driver's door will unlock.

(5) Once the first transmitter has been programmed, additional transmitters (up to 4) may be programmed into the module. Within 20 seconds of the previous transmitter programming, move the mechanical door lock lever to the LOCK position. Aim another transmitter at the receiver dome and press the LOCK button for at least 5 seconds. The door lock will cycle again.

(6) To lock the programmed codes into the module, the ignition switch must be turned OFF and back ON within 20 seconds after programming the last transmitter's code. At that time, all previous codes are erased from the module.

POWER LOCK SWITCH REMOVE/INSTALL

(1) Remove screw at top of trim panel near mirror (Fig. 4).

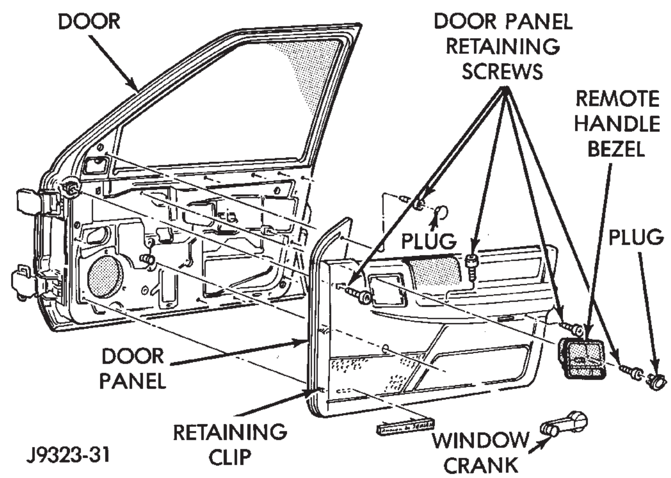


Fig. 4 Front Door Trim Panel Remove

(2) Remove screw from demister opening at front of door.

(3) Remove screw and door handle cover.

(4) Remove screw from under armrest.

(5) Remove screw from bottom of hand hold cup in armrest.

CAUTION: The wiring harness to the door switches is just long enough to allow installation. If trim panel is pulled off by hand the switch may be pulled apart. Use a door clip tool to prevent damaging the switches.

(6) Remove the trim panel with a wide, flat-bladed tool (Fig. 5).

To aid in removal of the trim panel, start at the bottom of the panel.

(7) Unplug electrical connector from switch.

(8) Remove switch from door panel.

(9) Reverse removal procedures to install.

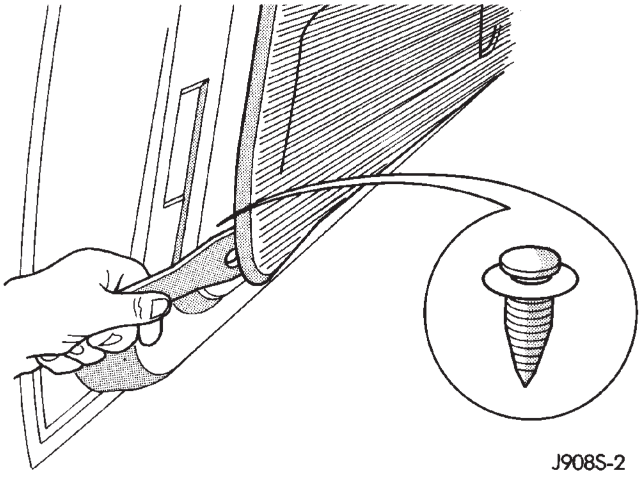


Fig. 5 Trim Panel Remove - Typical

POWER LOCK MOTOR REMOVE/INSTALL

FRONT DOORS

(1) Remove front door trim panel as described in Power Lock Switch Remove/Install.

(2) Remove 1 bolt holding bottom of window track to door (Fig. 6).

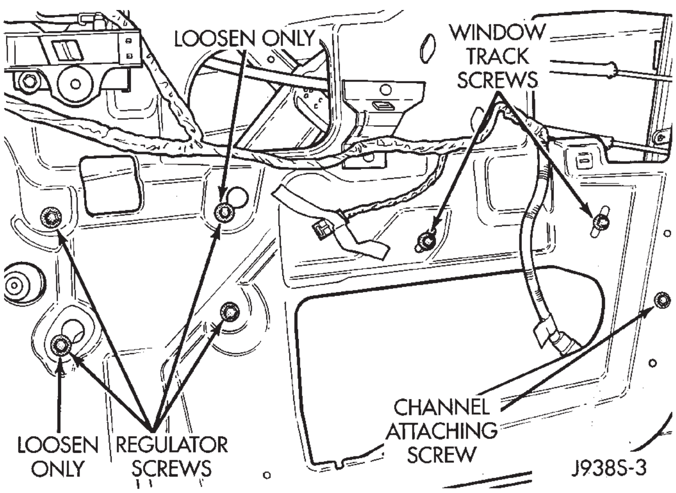


Fig. 6 Window Track Attaching Bolts - Front Door

(3) Disconnect 4 linkage rods from their clips (Fig. 7).

(4) Unplug wire harness connector from lock actuator motor.

(5) Remove 3 torx head screws retaining the latch (Fig. 8).

(6) Place the lock actuator motor, latch and remote control rods in the door.

(7) Attach the lock actuator motor to the door panel with 3 torx head screws. Tighten screws to 11 N·m (95 in. lbs.).

(8) Install 4 linkage rods.

(9) Insert a 5/32-inch hex wrench through access hole into latch adjustment screw (Fig. 8). Loosen screw.

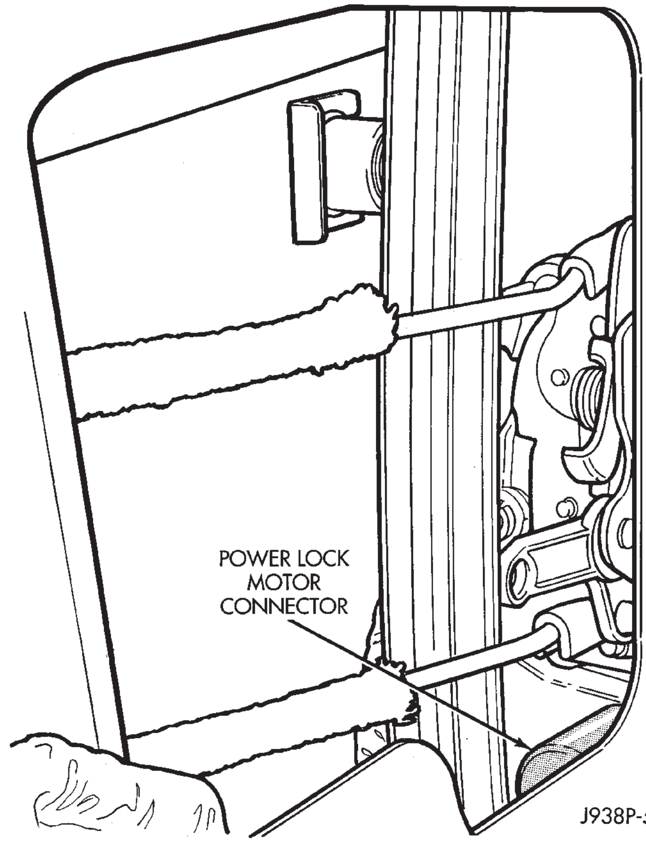


Fig. 7 Lock Actuator Motor - Front Door

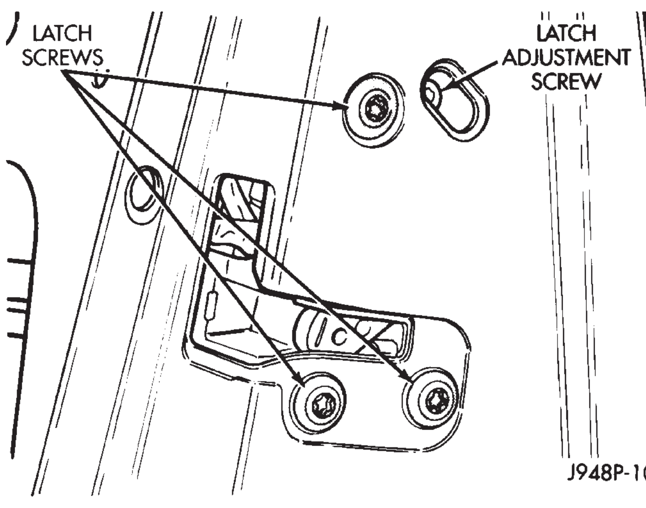


Fig. 8 Latch Remove/Install - Typical

(10) Operate outside latch handle button several times to release any restriction or tension caused by improper adjustment.

(11) Tighten latch adjustment screw to 3 N·m (30 in. lbs.).

(12) Test outside latch handle button and lock cylinder for proper operation.

(13) Using 3M 08044 or 3M 08041 adhesive/sealant, install the plastic inner door water shield.

(14) Reverse remaining removal procedures to complete installation.

REAR DOORS

(1) Remove screw and door handle cover (Fig. 9).

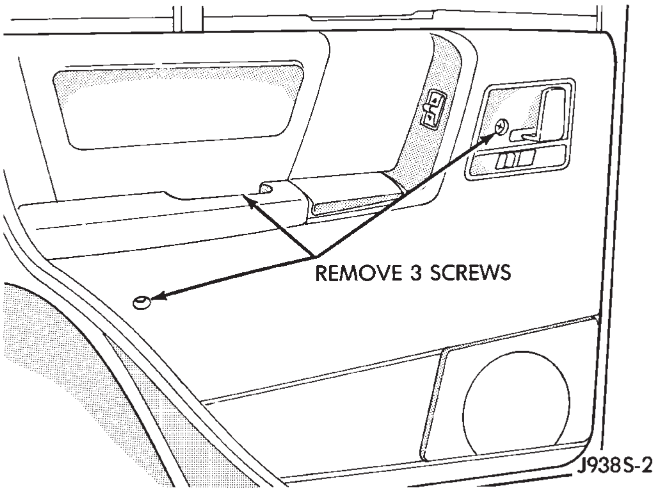


Fig. 9 Rear Door Trim Panel Attachment

(2) Remove screw from under armrest.

(3) Remove screw from bottom of hand hold in armrest.

CAUTION: The wiring harness to the door switches is just long enough to allow installation. If trim panel is pulled off by hand the switch may be pulled apart. Use a door clip tool to prevent damaging the switches.

(4) Remove the trim panel with a wide, flat-bladed tool (Fig. 5).

To aid in removal of the trim panel, start at the bottom of the panel.

(5) Remove 1 bolt holding bottom of window track to door (Fig. 10).

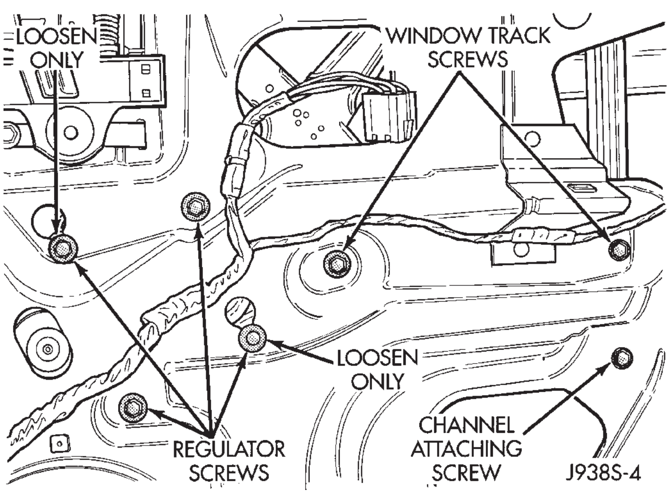


Fig. 10 Window Track Attaching Bolts - Rear Door

(6) Disconnect 4 linkage rods from their clips (Fig. 11).

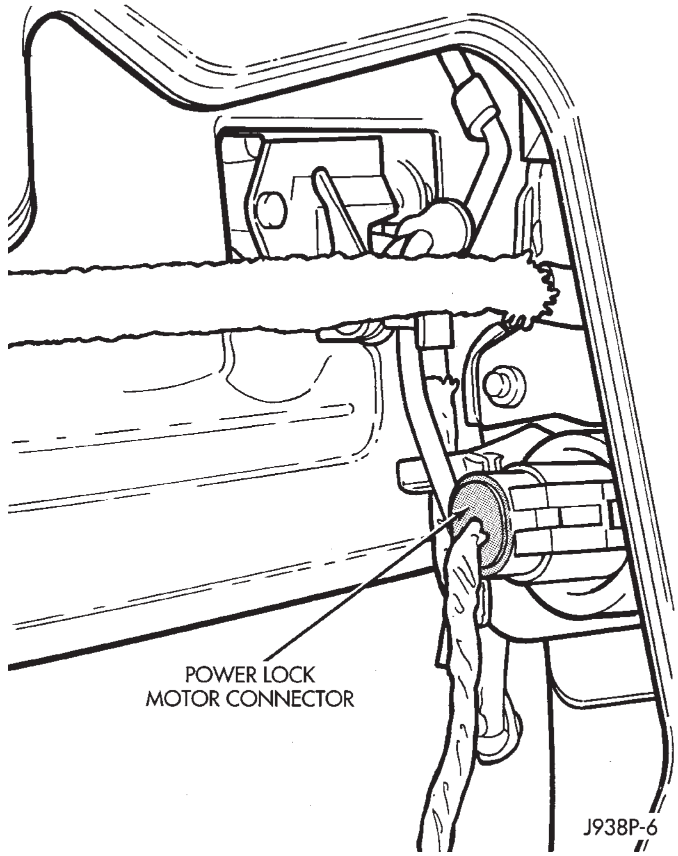


Fig. 11 Lock Actuator Motor - Rear Door

(7) Unplug wire harness connector from lock actuator motor.

(8) Remove 3 torx head screws retaining the latch (Fig. 12).

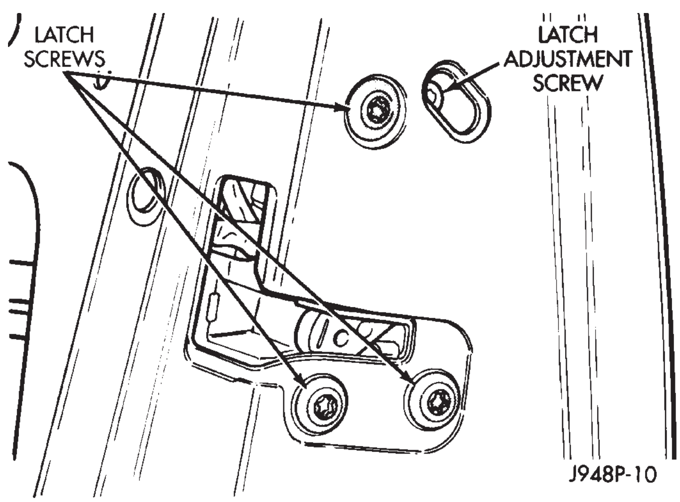


Fig. 12 Latch Remove/Install - Typical

(9) Place the lock actuator motor, latch and remote control rods in the door.

(10) Attach the lock actuator motor to the door panel with 3 torx head screws. Tighten screws to 11 N·m (95 in. lbs.).

(11) Install 4 linkage rods.

(12) Insert a 5/32-inch hex wrench through access hole into latch adjustment screw (Fig. 12). Loosen screw.

(13) Operate outside latch handle button several times to release any restriction or tension caused by improper adjustment.

(14) Tighten latch adjustment screw to 3 N·m (30 in. lbs.).

(15) Test outside latch handle button for proper operation.

(16) Using 3M 08044 or 3M 08041 adhesive/sealant, install the plastic inner door water shield.

(17) Reverse remaining removal procedures to complete installation.

LIFTGATE

(1) Remove 5 screws holding liftgate interior trim panel.

(2) Remove the trim panel with a wide, flat-bladed tool (Fig. 13).

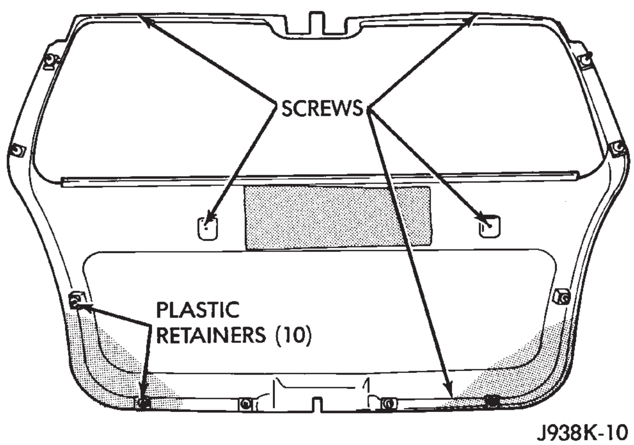


Fig. 13 Liftgate Trim Panel Remove

To aid in removal of the trim panel, start at the bottom of the panel.

(3) Disconnect the lock actuator motor linkage clip at the handle (Fig. 14).

(4) Remove 2 lock actuator motor retaining screws (Fig. 15).

(5) Remove the lock actuator motor.

(6) Reverse the removal procedures to install. Tighten the lock actuator motor retaining screws to 3 N·m (28 in. lbs.).

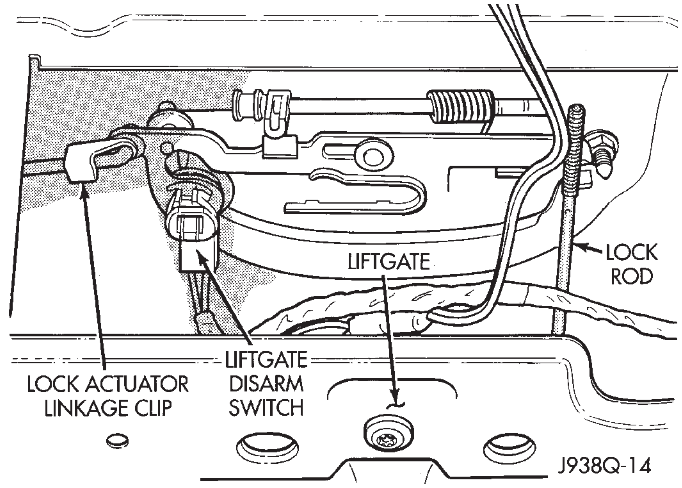


Fig. 14 Lock Actuator Motor Linkage Clip

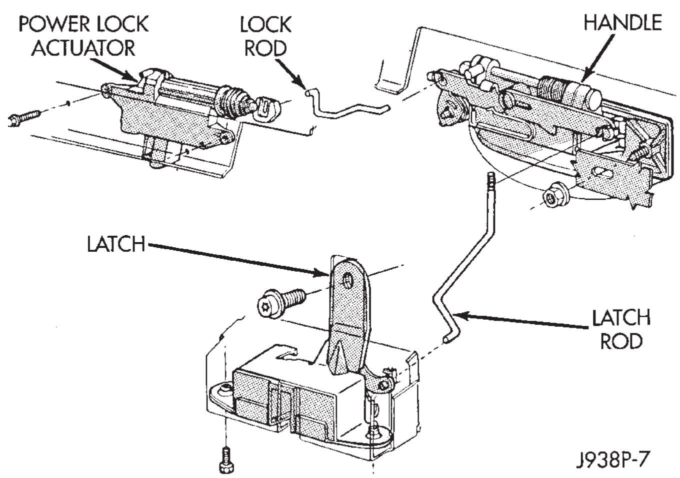


Fig. 15 Liftgate Lock Actuator Motor Remove/Install

KEYLESS ENTRY MODULE REMOVE/INSTALL

WITH OVERHEAD CONSOLE AND WITHOUT SUNROOF

(1) Remove console forward mounting screw (Fig. 16).

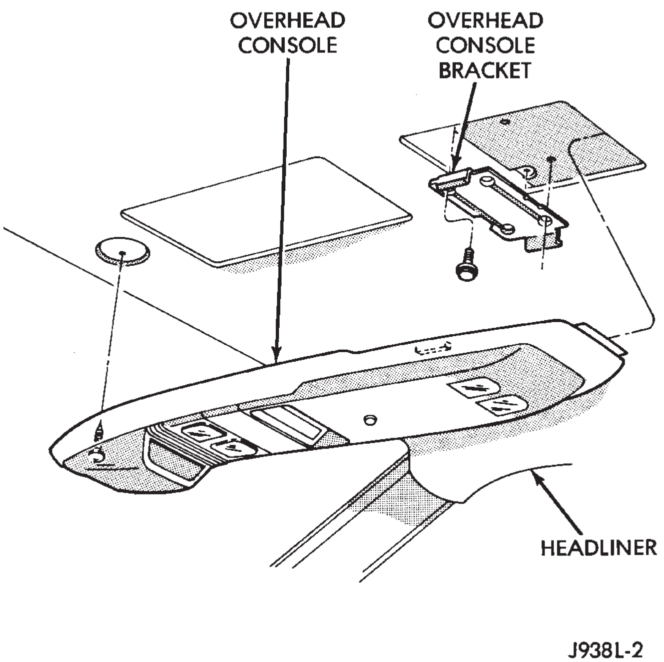


Fig. 16 Remove/Install Overhead Console

(2) Unplug trip computer harness connector.

(3) Slide console forward until the console retainers detach from the rear mounting bracket.

(4) Unplug keyless entry receiver harness connector (Fig. 17).

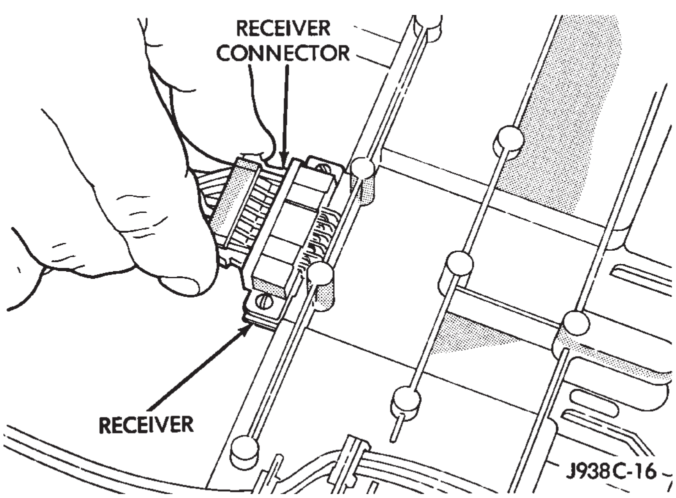


Fig. 17 Keyless Entry Receiver Harness Connector

(5) Remove 6 screws holding rear half of console (Fig. 18).

(6) Release 4 clips and separate cover panel out from console.

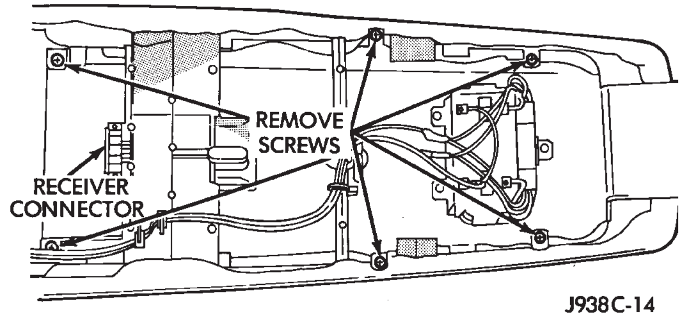


Fig. 18 Rear Overhead Console Panel Remove

(7) Remove the screw and the printed circuit board can be removed (Fig. 19).

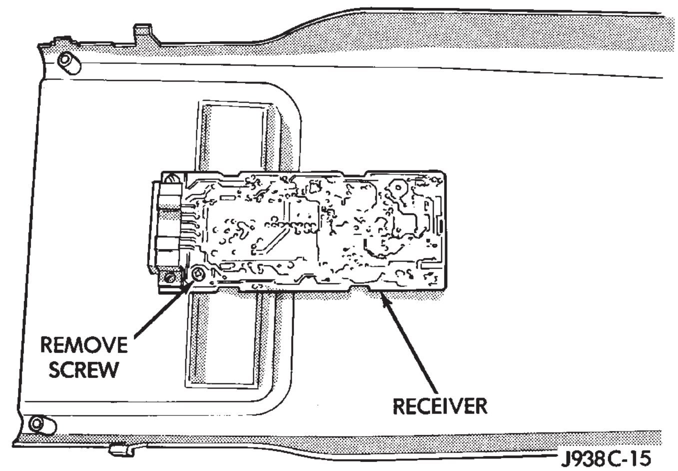


Fig. 19 Keyless Entry Receiver Remove/Install

(8) Reverse removal procedures to install.

WITH SUNROOF OR WITHOUT OVERHEAD CONSOLE

(1) Remove dome lamp lens, then remove 2 screws attaching the dome lamp housing to the roof (Fig. 20).

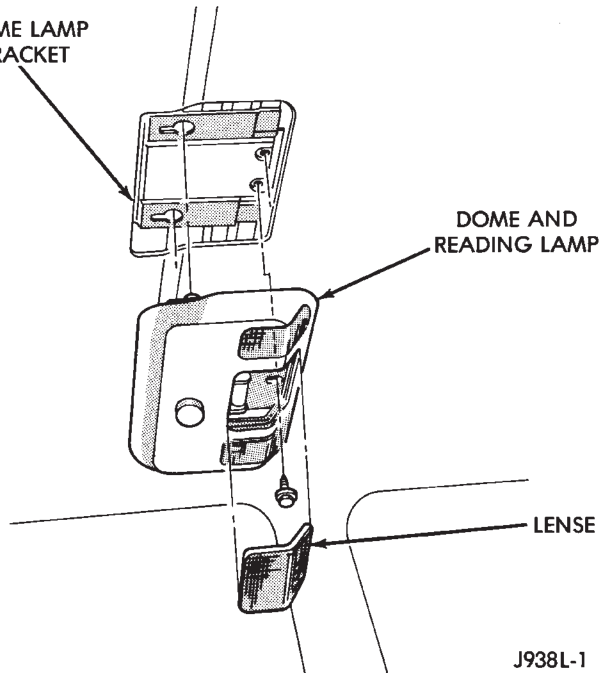


Fig. 20 Remove/Install Dome Lamp Housing

(2) Push the housing toward the front of the vehicle to disengage retainers.

(3) Unplug the harness connectors.

(4) Release the receiver circuit board connector from its mounting location (Fig. 21).

(5) Remove circuit board from housing by releasing 4 retainer clips (Fig. 21).

(6) Reverse removal procedures to install.

POWER LOCK/UNLOCK RELAY REMOVE/INSTALL

(1) Open glove box and remove 3 screws holding relay center cover (Fig. 22).

(2) Remove lock or unlock relay as required (Fig. 23).

(3) To install, align relay terminals with cavities in relay center and push relay into place.

(4) Re-install relay center cover.

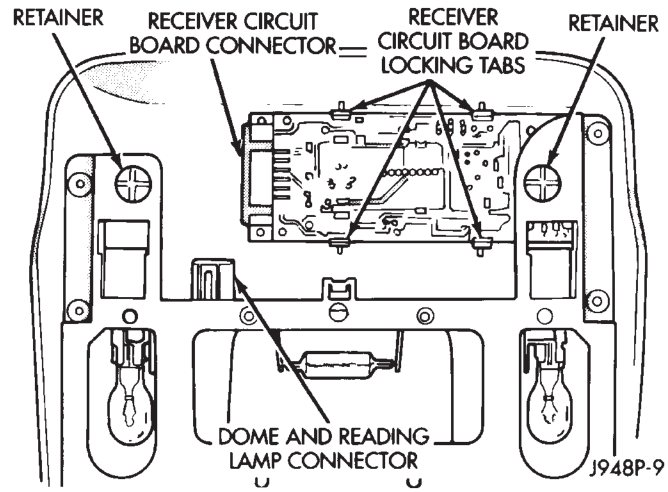


Fig. 21 Keyless Entry Receiver Remove/Install

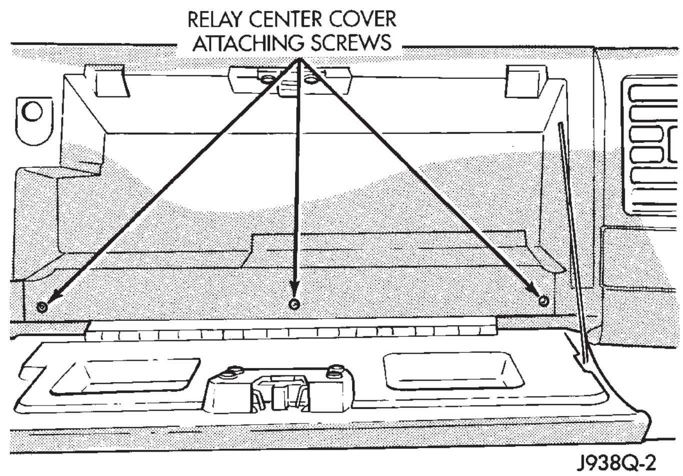


Fig. 22 Relay Center Cover

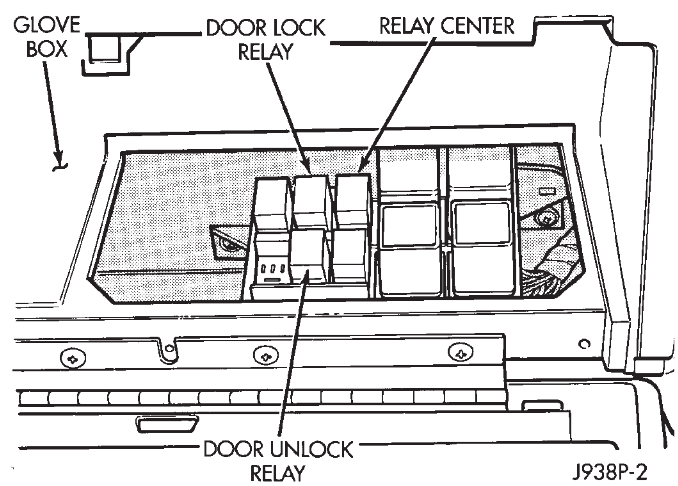


Fig. 23 Power Lock/Unlock Relays

VEHICLE THEFT ALARM

CONTENTS

GENERAL INFORMATION

The Vehicle Theft Alarm (VTA) system is an available option on Grand Cherokee models. This system is designed to protect against vehicle theft by monitoring vehicle doors, hood, liftgate and ignition action for unauthorized operation. When unauthorized operation is detected, the VTA system responds by sounding the horn, flashing the headlamps, park and tail lamps and providing an engine no-run feature. Following are general descriptions of the features of the VTA system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

ARMING

Passive arming occurs upon normal vehicle exit (ignition OFF, open door, lock with power lock switch, close door). The alarm system will not arm if the doors are manually locked, providing a manual override of alarm.

Active arming occurs when the remote keyless entry transmitter is used to lock the vehicle doors, whether the doors are open or closed. If one or more doors are open, the arming sequence is completed only after all doors and the liftgate are closed.

After active or passive arming, the security lamp in the instrument panel will flash for 15 seconds, showing that arming is in progress. Note that this 15 second arming period will start after the illuminated entry system has timed out (courtesy lamps off). If no monitored systems are activated during this period, the system will arm.

If the hood switch is not seen by the system, the security lamp will remain steadily lit during the arming process. While the system will still arm, the engine compartment will not be protected from entry when the security lamp remains steadily lit during the arming process.

DISARMING

Passive disarming occurs upon normal vehicle entry (unlocking either front door or liftgate, with the key). This disarming also will halt the alarm, once it has been activated.

Active disarming occurs when the remote keyless entry transmitter is used to unlock the vehicle doors. This disarming also will halt the alarm, once it has been activated.

POWER-UP MODE

When the battery is disconnected and then reconnected, or when the battery has been drained and the vehicle is being jump started, the VTA system enters its power-up alarm mode which:

- flashes the headlamps
- flashes the park and tail lamps
- prevents the engine from running.

The alarm system must be actively or passively disarmed to exit the power-up mode after any battery reconnection.

TAMPER ALERT

A tamper alert feature notifies the driver that the alarm had been activated, and has since timed-out (alarmed for more than 18 minutes). This alert gives 3 horn pulses when the system is actively or passively disarmed.

ON-BOARD DIAGNOSTIC SYSTEM

The DRB scan tool may be used to test the VTA system. Refer to the appropriate Diagnostic Procedures manual for more information.

DIAGNOSIS

SELF-DIAGNOSIS

A self-diagnosis mode is available in the VTA system to verify operation of all monitored switches or circuits. To enter this mode, cycle the ignition switch ACCESSORY-OFF-ACCESSORY-OFF-ACCESSORY, leaving the switch in the ACCESSORY position.

Upon entering the self-diagnosis mode the headlamps, park and tail lamps will begin flashing to verify their operation. In addition, the horn will sound twice. Returning the ignition to the OFF position will stop the lamps from flashing while keeping the system in the diagnostic mode.

Also note that vehicles equipped with VTA are equipped with the illuminated entry system. When in the diagnostic mode it is recommended that the illuminated entry relay be removed. Otherwise, it is necessary to wait 30 second for the illuminated entry system to time out after each door opening or closure.

While in the diagnostic mode, a horn pulse should occur at each of the following events indicating proper operation. However, if a switch is cycled too quickly and does not remain open or closed for at least 1 second, the horn will not sound to confirm operation.

(1) Beginning with all doors closed, open then close each door. The horn will sound when the door jamb switch closes, and again when the switch opens. There must be a 1 second delay between closing and opening the switch.

(2) Open, then close the hood. The horn will sound when the hood is opened, and again when it is closed.

(3) Activate the power door locks in both the lock and unlock directions. The horn will sound after each activation.

(4) Rotate the key in each door lock cylinder to the lock position, then to the unlock position. The horn will sound as the switch closes, and again when it opens. There must be a 1 second delay between changing switch states, or the horn will not sound.

(5) Activate the remote keyless entry in both the lock and unlock directions. The horn will sound after each activation.

(6) Cycle the ignition key to the ignition switch ON position. A single horn pulse will indicate proper operation of the ignition input. This also will take the module out of the diagnostic mode.

The lack of a horn pulse response to any of the above tests indicates:

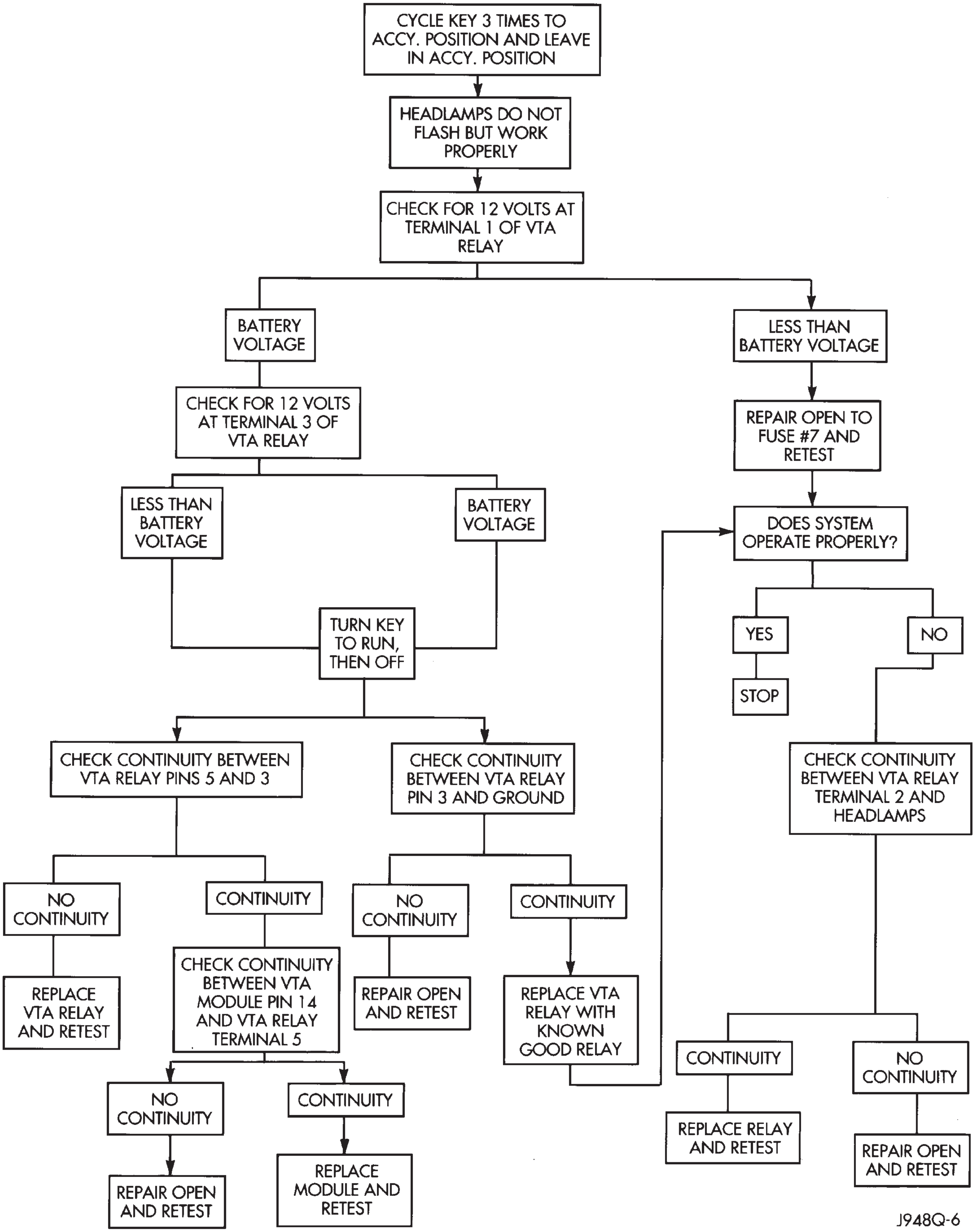
- a switch failure
- an open or shorted circuit between the switch and the VTA module
- an internal VTA module failure.

Check for continuity at the switch. If OK, check for an open or shorted wire between the switch and VTA module. Also, check if the powertrain control module (PCM) has been replaced recently. For the first 20 engine starts with a new PCM, the VTA will function normally except for the engine no-run feature.

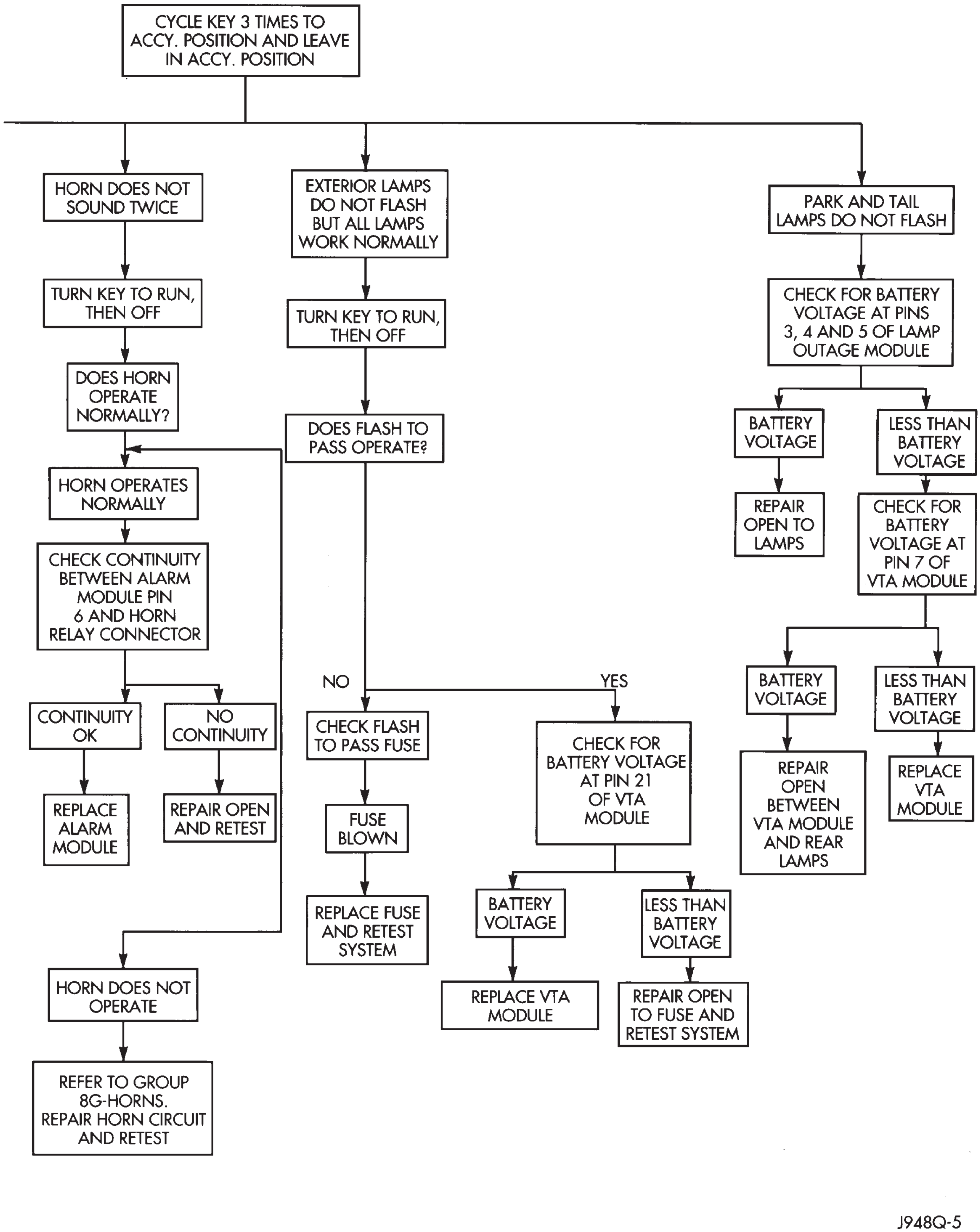
A PCM from a vehicle equipped with VTA cannot be used in a vehicle that is not equipped with VTA.

If the security lamp comes on after ignition ON and stays on, the CCD bus communication with the PCM has been lost.

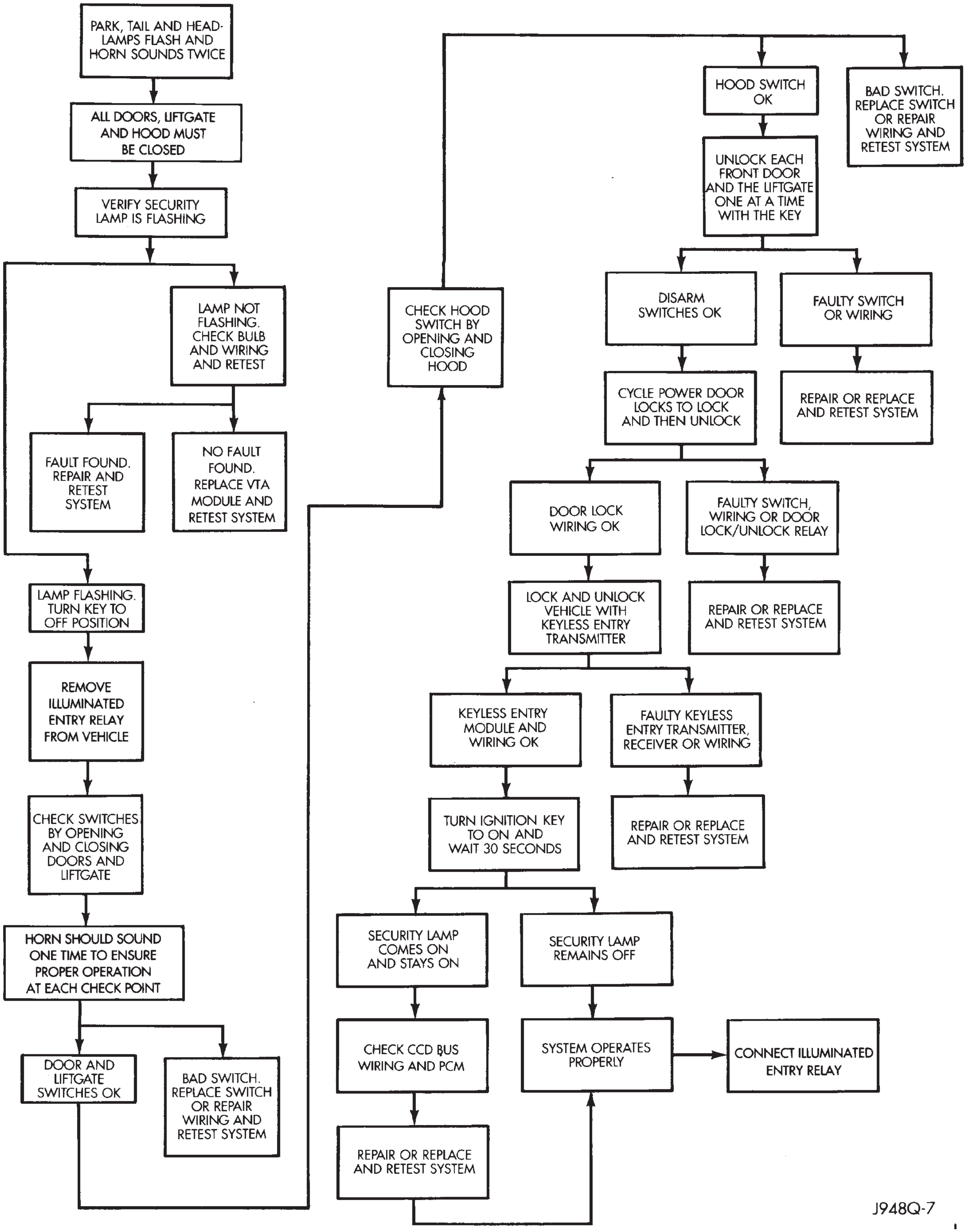
VEHICLE THEFT ALARM DIAGNOSIS



VEHICLE THEFT ALARM DIAGNOSIS (CONTINUED)



VEHICLE THEFT ALARM DIAGNOSIS (CONTINUED)



SERVICE PROCEDURES

VTA MODULE REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding center cluster bezel (Fig. 1).

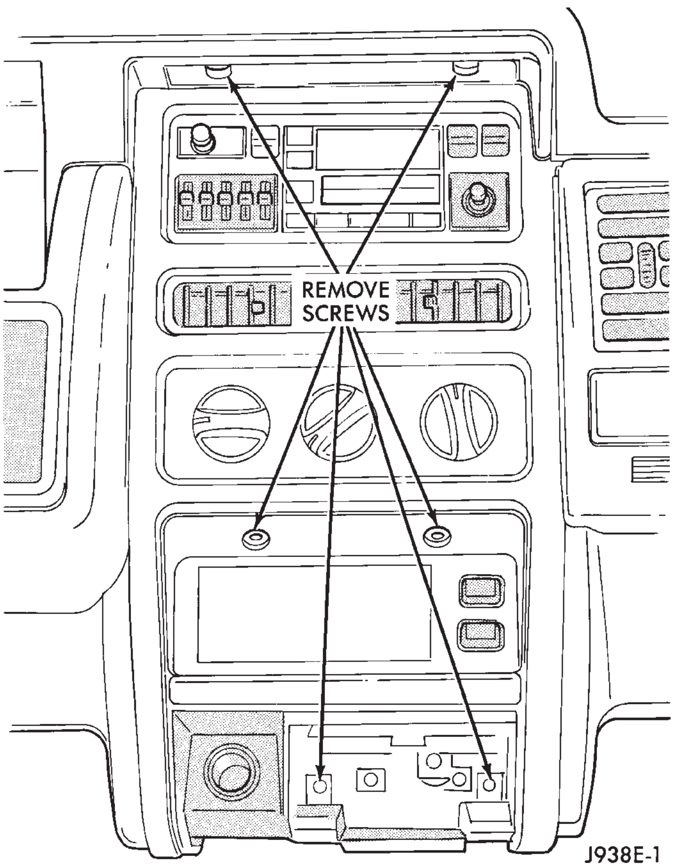


Fig. 1 Remove Center Bezel Retaining Screws

(4) Remove center bezel.

(5) Remove 2 screws holding dash pad located behind top of center bezel.

(6) Gently pry defroster bezel out of dash pad.

(7) Unplug automatic headlamp and sun sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 2).

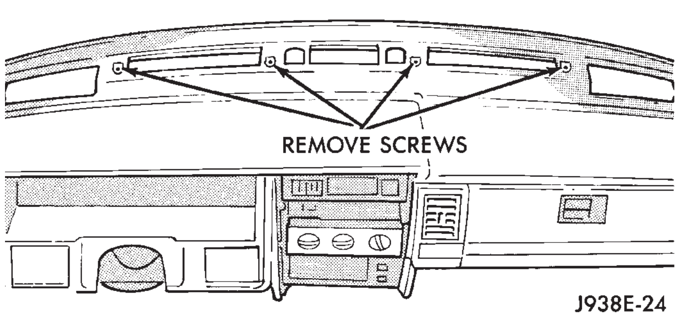


Fig. 2 Upper Dash Pad Attaching Screws

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 3).

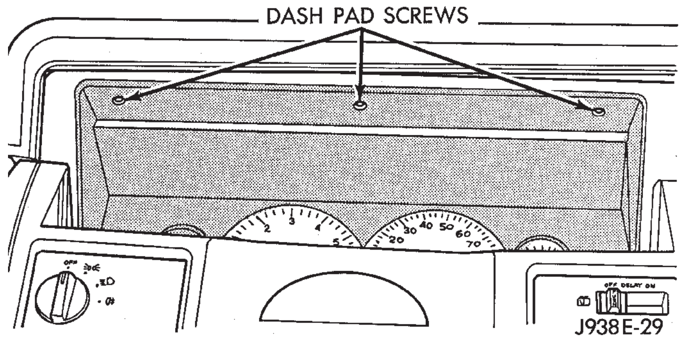


Fig. 3 Remove Screws Holding Dash Pad

(10) Open glove box and remove 2 screws holding dash pad (Fig. 4).

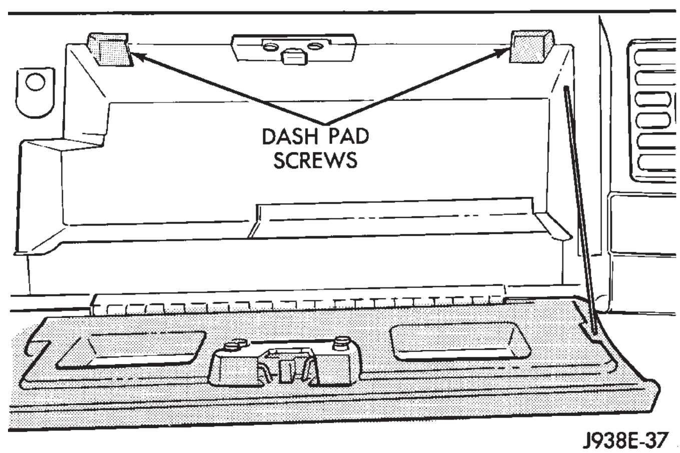


Fig. 4 Remove Screws Holding Dash Pad

(11) Remove dash pad prying gently on each end to unsnap end clips.

(12) Remove 4 screws from bottom of glove box bezel (Fig. 5).

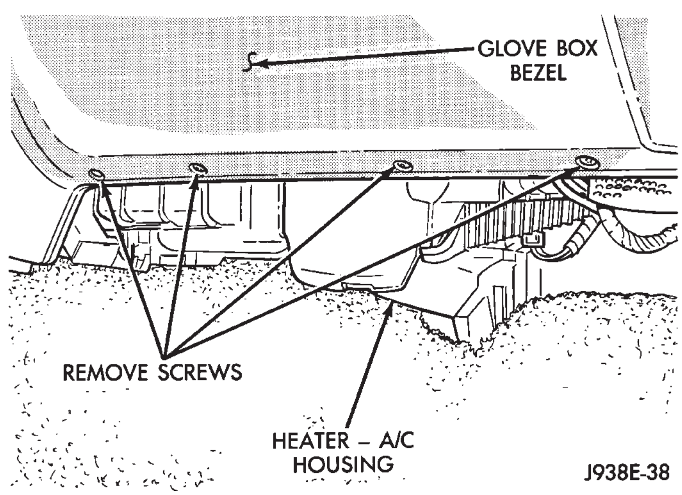


Fig. 5 Right Side Bezel Attaching Screws

(13) Remove 4 screws from top of glove box bezel (Fig. 6).

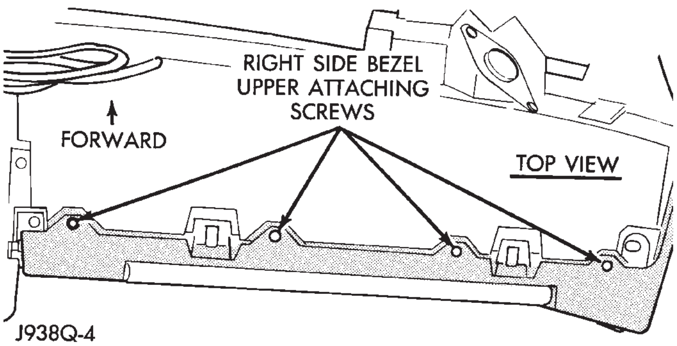


Fig. 6 Right Side Bezel Upper Screws

(14) Remove 1 screw holding the bezel to the center console (Fig. 7).

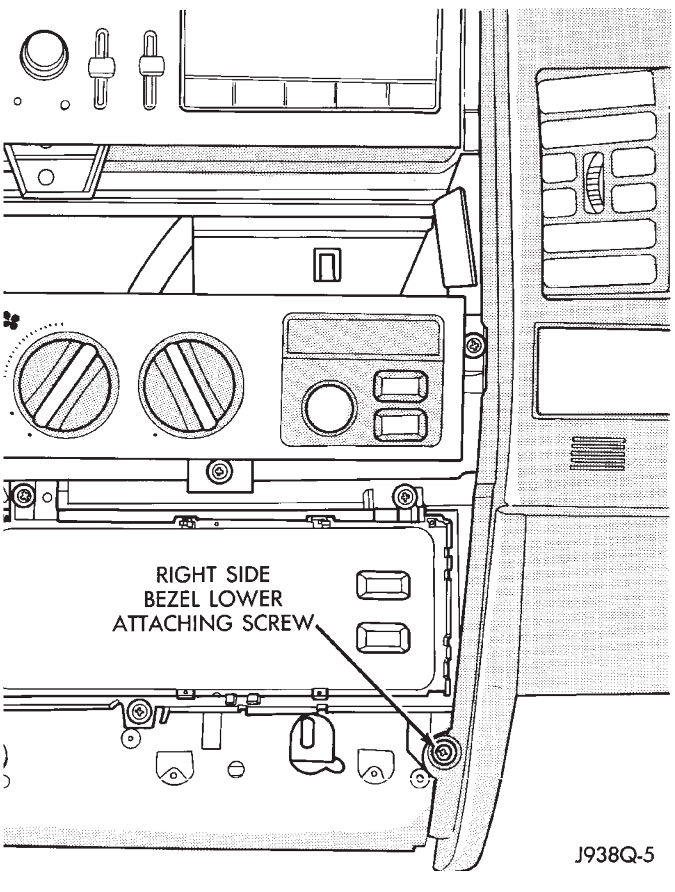


Fig. 7 Right Side Lower Screw

(15) Remove side window demister boot from glove box bezel.

(16) Remove right side bezel from instrument panel.

(17) Unplug glove box light and switch connector.

(18) Remove 2 screws holding VTA module to instrument panel (Fig. 8).

(19) Pull module out and unplug connector.

(20) Reverse removal procedures to install.

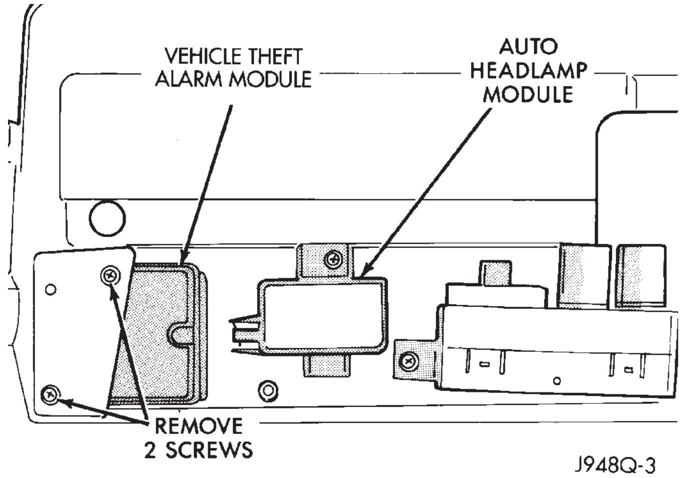


Fig. 8 VTA Module Remove/Install

VTA MODULE RELAY REMOVE/INSTALL

(1) Open glove box and remove 3 screws holding relay center cover (Fig. 9).

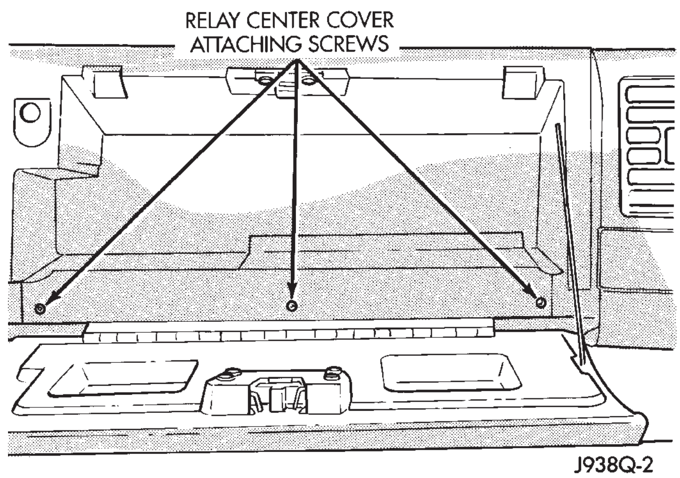


Fig. 9 Relay Center Cover

(2) Remove VTA module relay (Fig. 10).

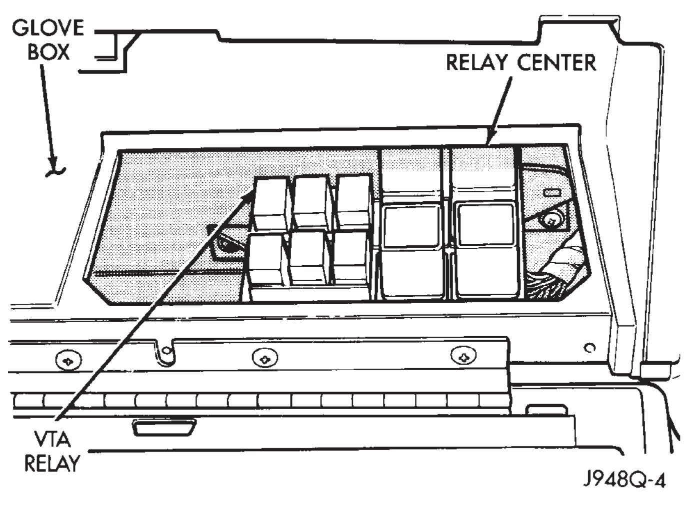


Fig. 10 VTA Module Relay

(3) To install, align relay terminals with cavities in relay center and push relay into place.

(4) Re-install relay center cover.

HOOD SWITCH REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove sheet metal screw securing switch to right inner fender (Fig. 11).

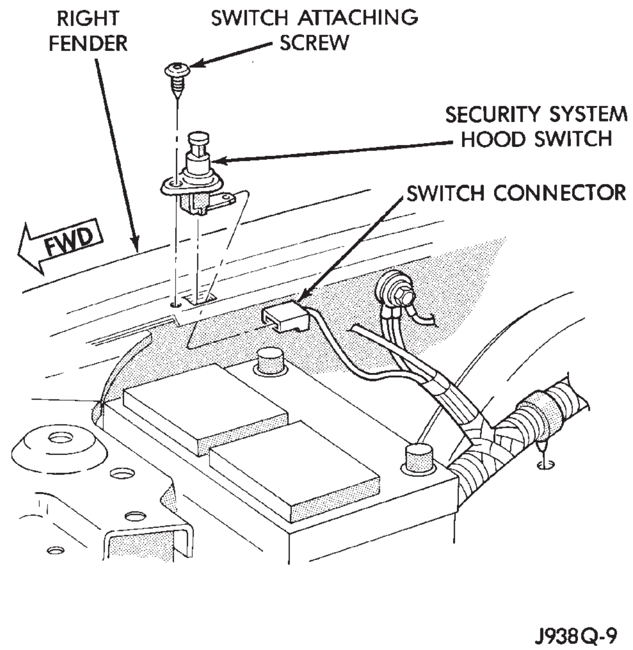


Fig. 11 VTA Hood Switch

(3) Disconnect wire from switch.

(4) Remove switch.

(5) Reverse removal procedures to install.

DOOR DISARM SWITCH REMOVE/INSTALL

(1) Remove screw from demister opening at front of door.

(2) Remove screw and door handle cover.

(3) Remove screw from under armrest.

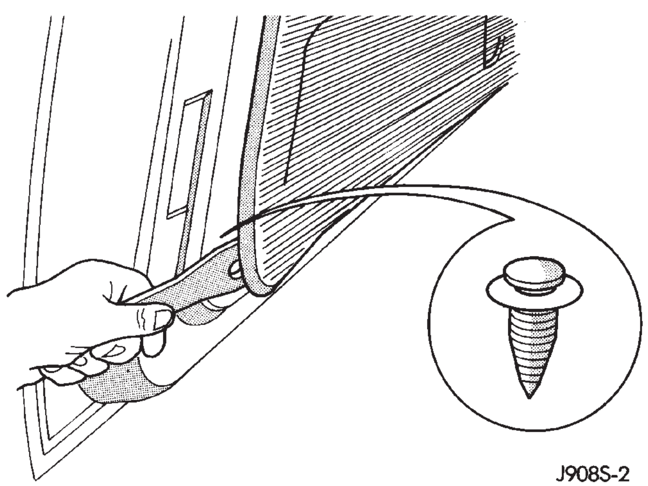


Fig. 12 Trim Panel Remove

(4) Remove screw from bottom of hand hold in armrest.

(5) Remove the trim panel with a wide, flat-bladed tool (Fig. 12).

To aid in removal of the trim panel, start at the bottom of the panel.

(6) Remove the plastic water shield.

(7) Remove the U-clip holding the lock cylinder and disarm switch (Figs. 13 and 14).

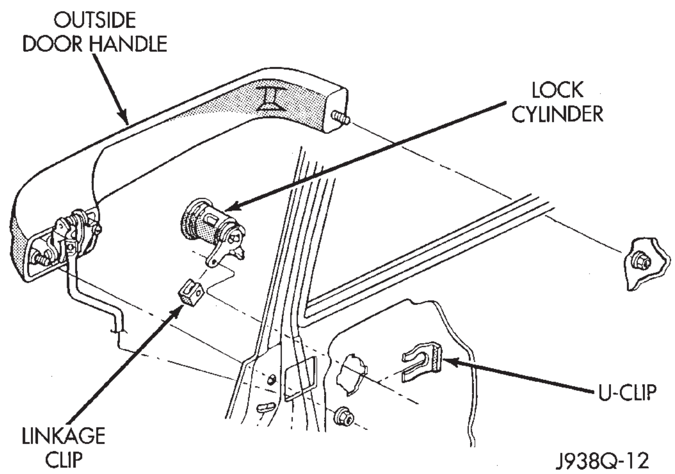


Fig. 13 Lock Cylinder Remove

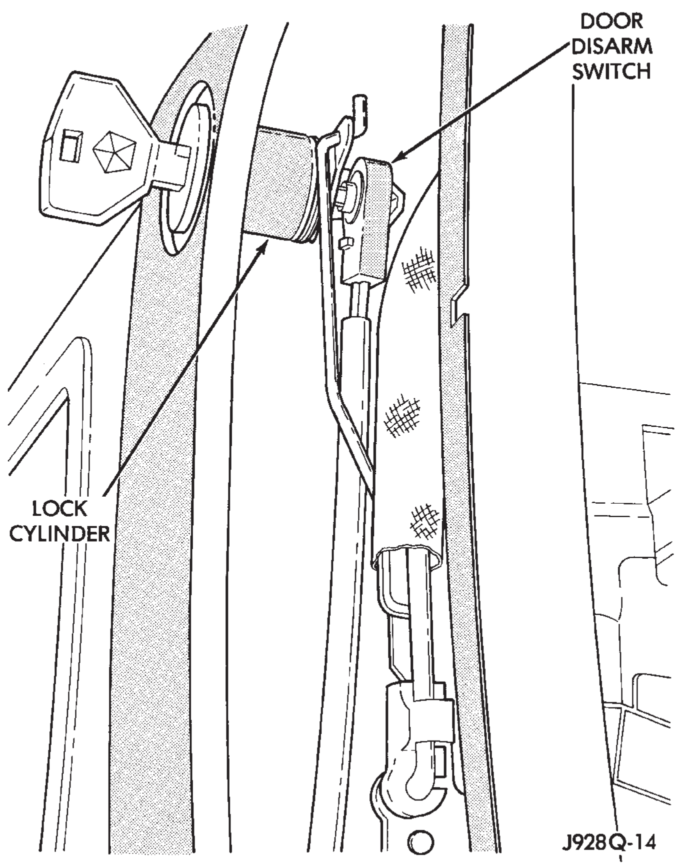


Fig. 14 Door Disarm Switch - Typical

(8) Pull the lock cylinder out of the door.

(9) Pry the door disarm switch off the back of the lock cylinder.

(10) Remove harness clip from door sheet metal.

(11) Unplug the harness connector and remove the switch.

(12) Reverse removal procedures to install.

LIFTGATE DISARM SWITCH REMOVE/INSTALL

(1) Remove 5 screws holding liftgate interior trim panel.

(2) Remove the trim panel with a wide, flat-bladed tool (Fig. 15).

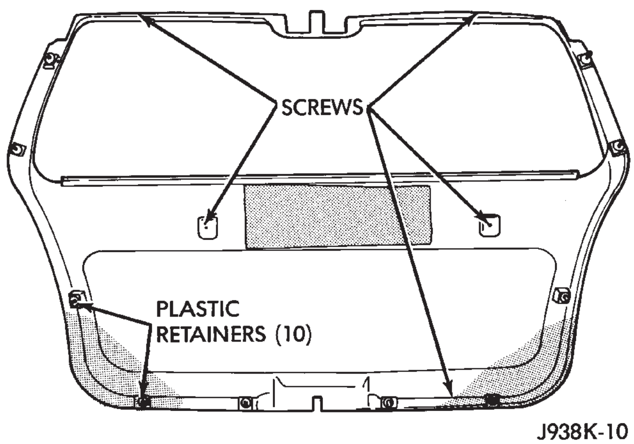


Fig. 15 Liftgate Trim Panel Remove

To aid in removal of the trim panel, start at the bottom of the panel.

(3) Remove the disarm switch from the liftgate lock cylinder (Fig. 16).

(4) Unplug the harness connector and remove the switch.

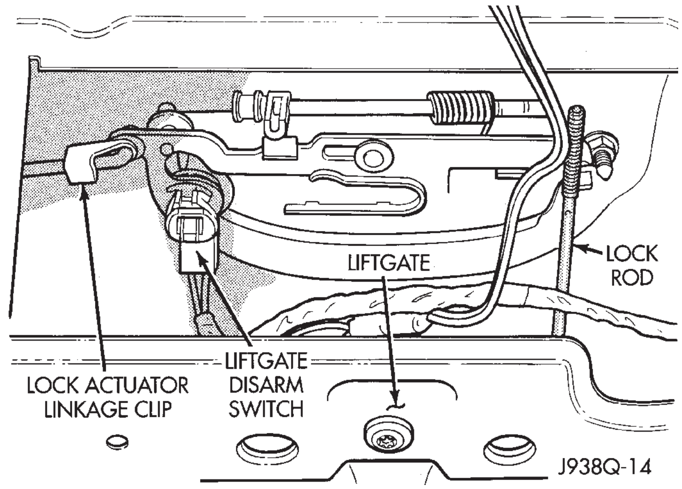
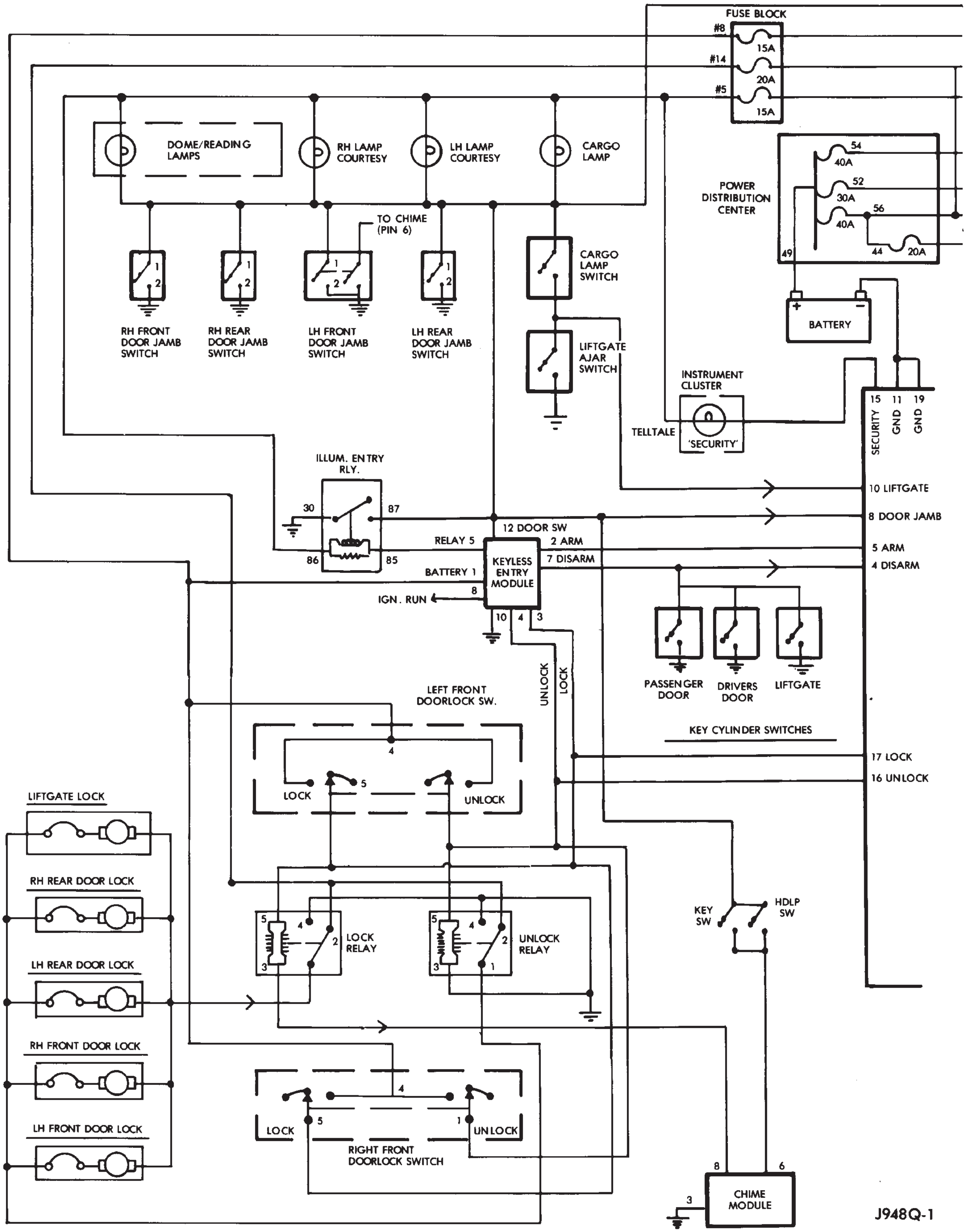


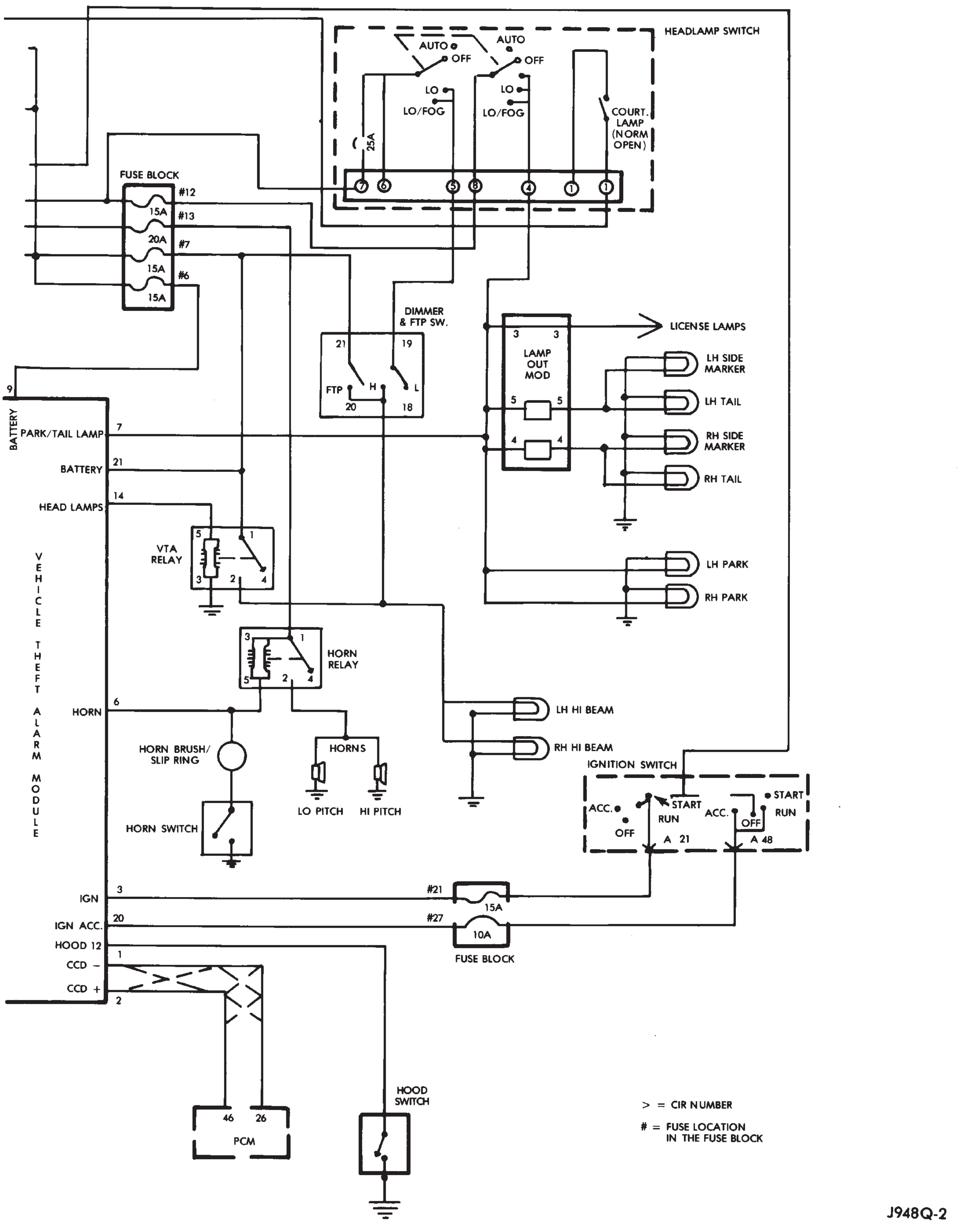
Fig. 16 Liftgate Disarm Switch

(5) Reverse removal procedures to install.

VEHICLE THEFT ALARM SCHEMATIC



VEHICLE THEFT ALARM SCHEMATIC (CONTINUED)



POWER SEATS

CONTENTS

GENERAL INFORMATION

Six-way power front seats are an available option on Grand Cherokee models. The power seat system receives battery feed through circuit breaker 25 in the fuseblock module at all times.

Following are general descriptions of the major components in the power seat system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER SEAT SWITCH

The power seats can be adjusted in six different ways using the power seat switch (Fig. 1). The switch is located on the lower outboard side of the seat cushion. Refer to the owner's manual for more information on power seat switch functions and seat adjusting procedures. The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

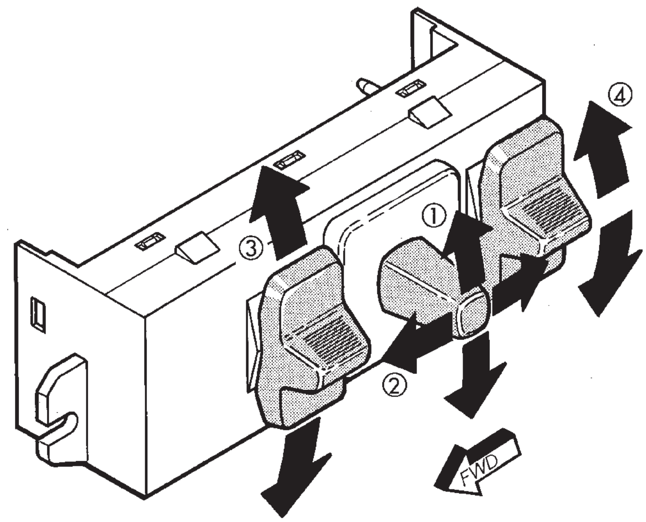


Fig. 1 Power Seat Switch

POWER SEAT ADJUSTER/MOTORS

There are three reversible motors that operate the power seat adjuster. The motors are connected to worm-drive gearboxes in the adjuster by drive cables.

The front and rear of a seat are operated by different motors. They can be raised or lowered independently of each other. When the center seat switch is pushed to the UP or DOWN position, both front and rear motors operate in unison, moving the entire seat up or down. The forward-rearward motor is operated by pushing the center seat switch to the FORWARD or REARWARD position.

When a switch is actuated, battery feed and a ground path are applied through the switch contacts to the motor(s). The motor(s) operate to move the seat in the selected direction until the switch is released, or until the travel limit of the power seat adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor(s) are reversed through the switch contacts. This causes the motor to run in the opposite direction.

Each motor contains a self-resetting circuit breaker to protect it from overload. Consecutive or frequent resetting must not be allowed to continue or the motors may be damaged. Make the necessary repairs.

The power seat adjuster and motors can not be repaired, and are serviced only as a complete unit. If any component in this unit should fail, the entire assembly must be replaced.

DIAGNOSIS

Before any testing is attempted the battery should be fully charged and all connections and pins cleaned and tightened to ensure proper continuity and grounds.

With the dome lamp on, apply switch in direction of the failure. If the dome lamp dims, the seat may be jamming. Check for binding or obstructions. If the dome lamp does not dim, then proceed with the following electrical tests.

POWER SEAT ADJUSTER/MOTORS

Operate the power seat switch to move all three seat motors. The seat should move in all directions. If not OK, proceed as follows. If one or more motors operate, see diagnosis for Power Seat Switch.

(1) Check circuit breaker 25 in the fuseblock module. If OK, go to next step. If not OK, replace circuit breaker.

(2) Remove switch mounting screws and check for battery voltage at red wire at switch connector. If OK, go to next step. If not OK, repair wiring to circuit breaker.

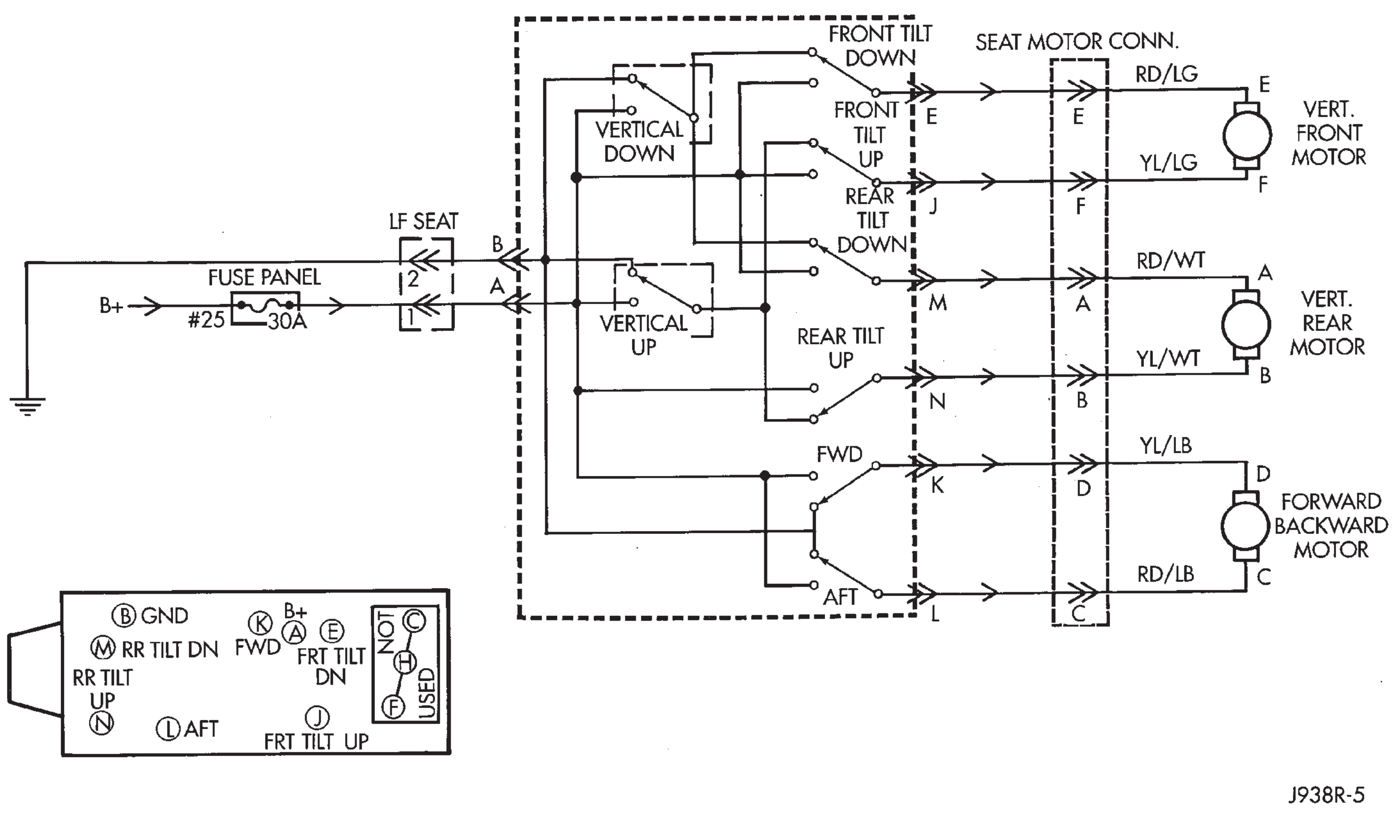
(3) Check for continuity between black wire at switch connector and a good ground. There should be continuity. If OK, go to next step. If not OK, repair wiring to ground.

(4) See diagnosis for Power Seat Switch. If switch continuity checks OK, replace faulty motor/adjuster assembly. If switch continuity is not OK, replace faulty switch.

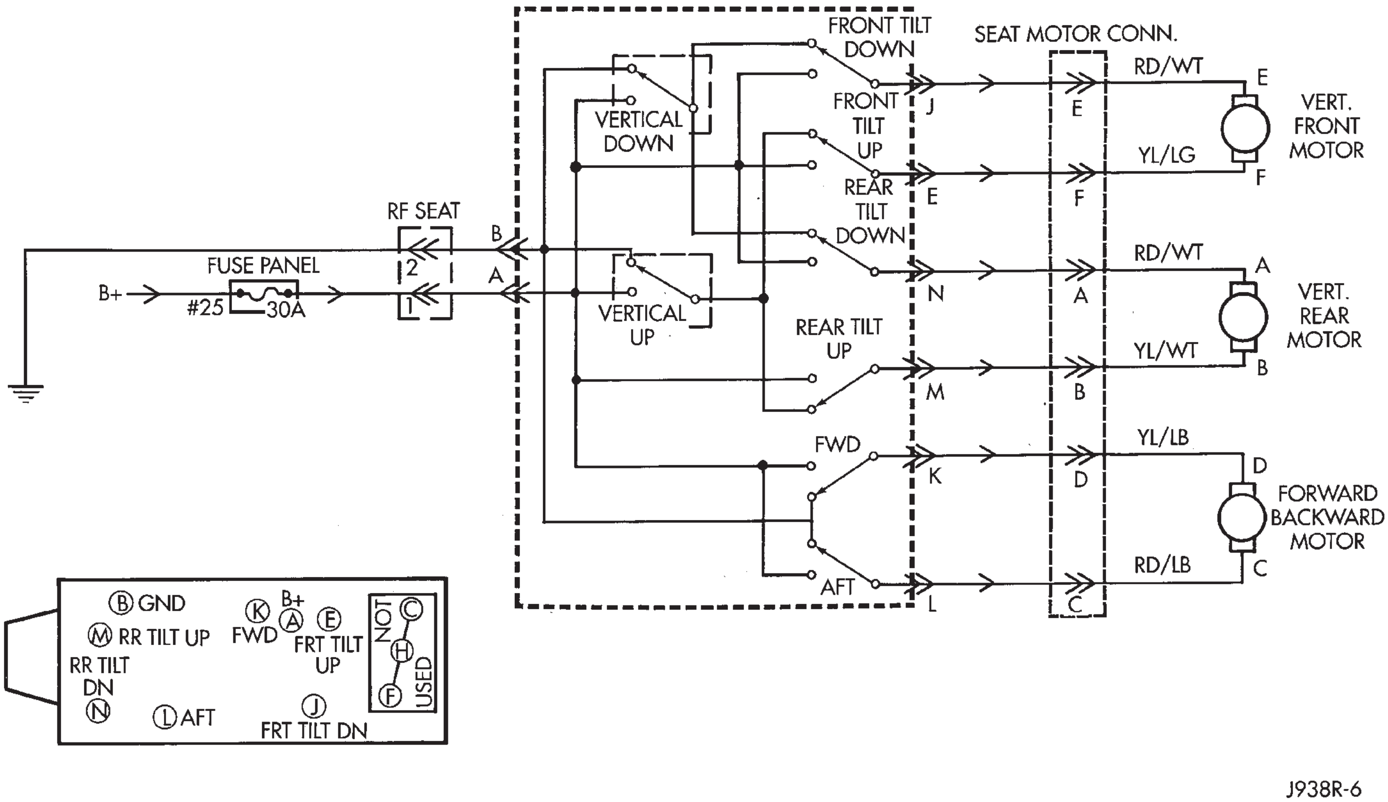
POWER SEAT SWITCH

To check the power seat switch, remove the switch from its mounting position. Use an ohmmeter and see Power Seat Switch Continuity chart. Determine if switch continuity is correct. If OK, see Power Seat Adjuster/Motors diagnosis. If not OK, replace faulty switch assembly.

POWER SEAT SWITCH CONTINUITY (LEFT)



POWER SEAT SWITCH CONTINUITY (RIGHT)



SERVICE PROCEDURES

POWER SEAT SWITCH REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove screws securing outboard seat side trim.

(3) Pull seat trim away from side of seat far enough to access multiple terminal block on switch.

(4) Carefully release locking tabs securing multiple terminal block to switch and remove wiring from switch.

(5) Remove screws securing switch to back of seat side trim and remove switch.

(6) Reverse removal procedures to install.

POWER SEAT ADJUSTER/MOTORS REMOVE/ INSTALL

(1) Remove 2 screws and the rear track covers.

(2) Remove 4 screws holding seat to floor pan (Fig. 2). Move adjuster as required for access.

(3) Disconnect wiring harness power lead at carpet.

(4) Remove seat assembly from vehicle.

(5) Disconnect seat switch wiring harness from motors.

(6) Remove screws securing motor/adjuster assembly to seat frame (Fig. 3) and remove.

(7) Reverse removal procedures to install. Tighten seat frame to motor/adjuster bolts and seat mounting bolts to 20 N·m (15 ft. lbs.).

Fig. 2 Power Seat Remove - Typical

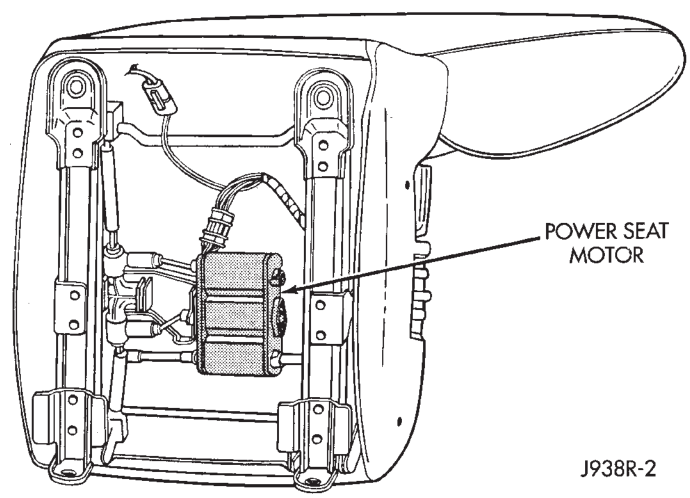


Fig. 3 Power Seat Motor/Adjuster - Typical

POWER WINDOWS

CONTENTS

GENERAL INFORMATION

Power door windows are standard equipment on Grand Cherokee models. The power windows operate only with the ignition switch in the ON position. This group covers diagnosis and service of the electrical components peculiar to the power window system. For service of mechanical components such as the regulator, lift plate or window tracks refer to Group 23 - Body Components.

Following are general descriptions of the major components in the power window system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER WINDOW SWITCH

Both front and rear door windows can be raised or lowered electrically by operating the four two-way switches on the driver's door panel. A single two-way switch on each passenger's door panel operates only the window on that passenger's door. The switches cannot be repaired. If faulty, they must be replaced.

POWER WINDOW MOTOR

A permanent magnet reversible motor moves the window regulator through an integral gearbox mechanism. A positive and negative battery connection to 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. In addition, each power window motor is equipped with an integral automatic re-setting circuit breaker to protect the motor from overloads. The power window motor and gearbox assembly cannot be repaired. If faulty, the entire assembly must be replaced.

CIRCUIT BREAKER

An automatic re-setting circuit breaker in the fuseblock module is used to protect the power window system circuit. The circuit breaker can protect the system from a short circuit, and can also protect the system from an overload condition caused by an obstructed or stuck window glass or regulator. The circuit breaker can not be repaired. If faulty, it must be replaced.

DIAGNOSIS

It is necessary that the window be free to slide up and down for the power window system to function properly. If the window is not free to move up and down, the motor will overload and trip the circuit breaker. To determine if the glass is free, disconnect regulator plate from the glass and slide window up and down by hand.

An alternate method is to shake the glass in the door, with the glass positioned between the up and down stop positions. Check that the glass can be moved slightly from side to side, front to rear, and up and down. Then check that window is not bound tight in the tracks. If window is free, proceed with diagnosis that follows. If window is not free, refer to Group 23 - Body Components for service procedures.

CIRCUIT BREAKER

Locate correct circuit breaker in fuseblock module. Pull out slightly, but be sure that circuit breaker terminals still contact terminals in fuseblock module. Turn ignition switch to ON position. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive lead, check both terminals of circuit breaker for battery voltage. If only one terminal has battery voltage, circuit breaker is faulty and must be replaced. If neither terminal has battery voltage, repair circuit from ignition switch as required.

POWER WINDOW SYSTEM

Before you proceed with this diagnosis, confirm proper circuit breaker operation. See Circuit Breaker diagnosis.

NO WINDOWS OPERATE

(1) Turn ignition switch to ON position. Measure voltage at 30 amp circuit breaker 26 at fuseblock module. Meter should read battery voltage. If OK, go to next step. If not OK, replace circuit breaker or repair open to ignition switch or fuse 13 in PDC as required.

(2) Turn ignition switch to OFF position. Measure resistance from ground lug on left side kick panel to ground. Meter should read zero ohms. If OK, go to next step. If not OK, repair circuit to ground.

(3) Remove master power window switch on left front door (see Service Procedures). Measure resistance at black wire (terminal 1 of green connector). Meter should read zero ohms. If OK, go to next step. If not OK, repair circuit to ground.

(4) Turn ignition switch to ON position. Measure voltage at tan wire (terminal 5 of black connector). Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to circuit breaker 26 in fuseblock module.

(5) Close master window switch. Measure voltage at yellow wire (terminal 1 of black connector). Meter should read battery voltage. If OK, go to next step. If not OK, replace switch.

(6) Operate window switch. All windows should operate. If there are still inoperative windows go to One Window Inoperative.

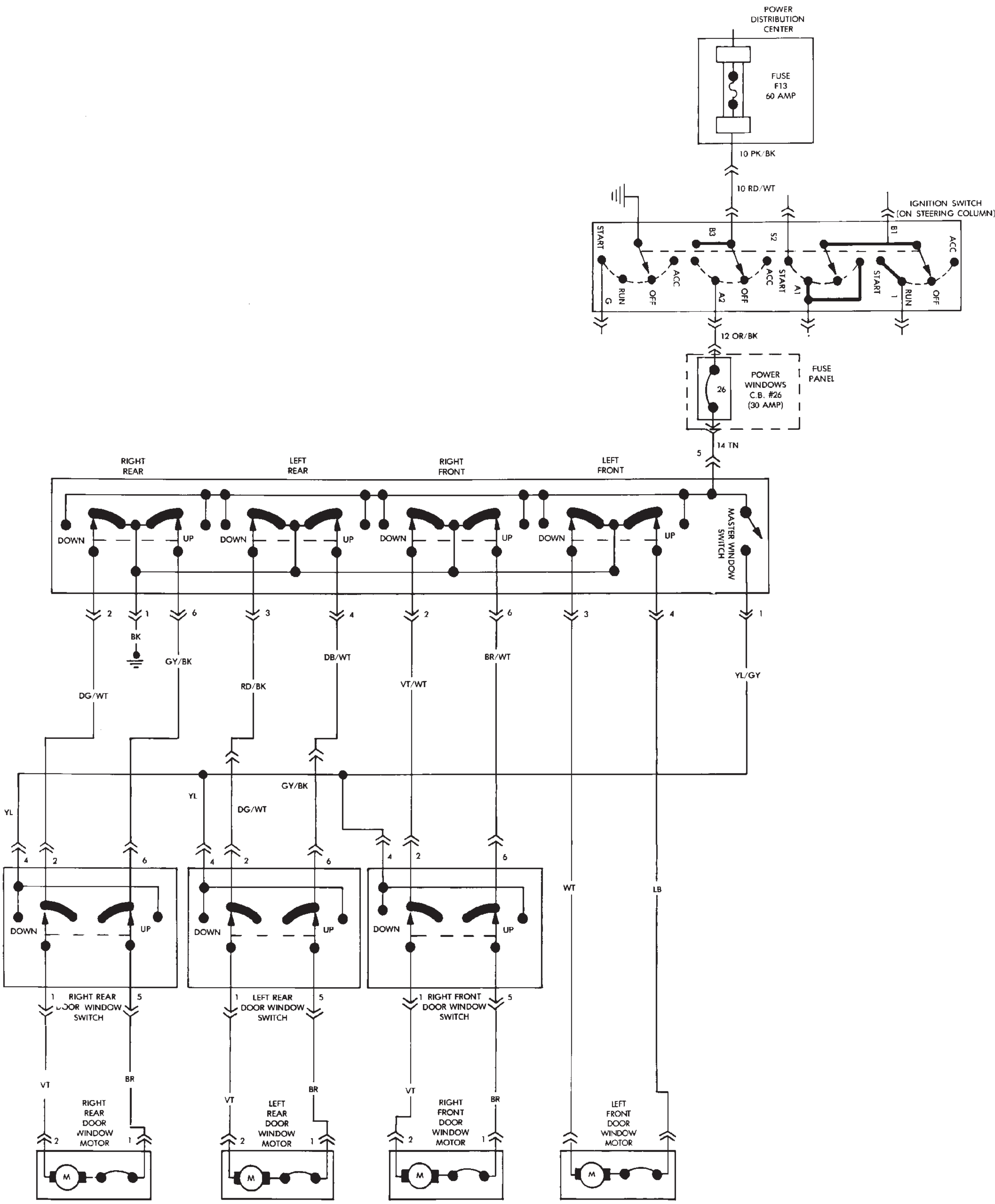
ONE WINDOW INOPERATIVE

Remove door trim panel of inoperative window and probe harness side of switch connector.

(1) Turn ignition switch to ON position. Measure voltage at terminal 2 of connector while holding corresponding master switch in the DOWN position. Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to master switch.

(2) With master switch still in DOWN position, measure voltage at terminal 6 of connector. Meter should read battery voltage. If OK, repair circuit back to master switch. If not OK, go to next step.

(3) With master switch still in DOWN position, check for battery voltage at motor terminals. If OK, replace motor/gearbox assembly or regulator as required. If not OK, repair circuit back to switch.



J938S-1

Fig. 1 Power Window System Schematic

SERVICE PROCEDURES

POWER WINDOW SWITCH REMOVE/INSTALL

FRONT DOOR

(1) Remove screw at top of trim panel near mirror (Fig. 2).

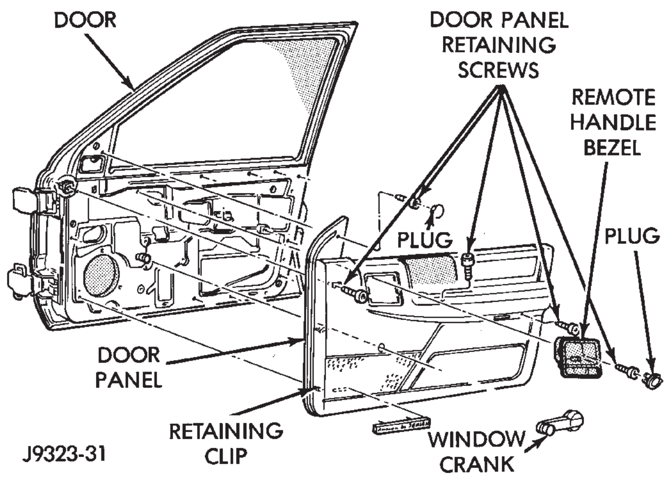


Fig. 2 Front Door Trim Panel Remove

(2) Remove screw from demister opening at front of door.

(3) Remove screw and door handle cover.

(4) Remove screw from under armrest.

(5) Remove screw from bottom of hand hold cup in armrest.

CAUTION: The wiring harness to the door switches is just long enough to allow installation. If trim panel is pulled off by hand the switch may be pulled apart. Use a door clip tool to prevent damaging the switches.

(6) Remove the trim panel with a wide, flat-bladed tool (Fig. 3).

To aid in removal of the trim panel, start at the bottom of the panel.

(7) Unplug electrical connector from switch.

(8) Remove switch from door panel.

(9) Reverse removal procedures to install.

REAR DOOR

(1) Remove screw and door handle cover (Fig. 4).

(2) Remove screw from under armrest.

(3) Remove screw from bottom of hand hold in armrest.

CAUTION: The wiring harness to the door switches is just long enough to allow installation. If trim panel is pulled off by hand the switch may be pulled apart. Use a door clip tool to prevent damaging the switches.

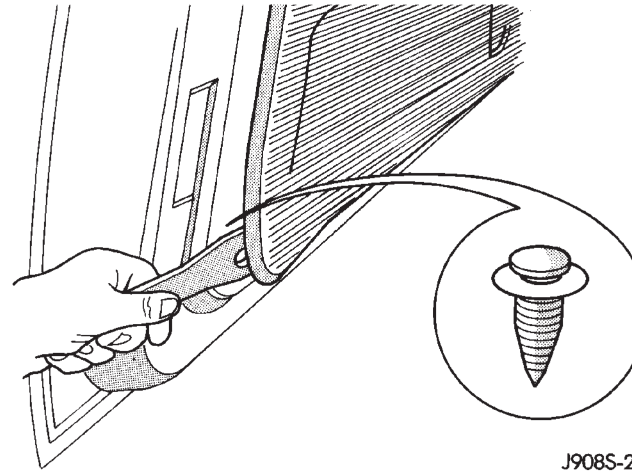


Fig. 3 Trim Panel Remove - Typical

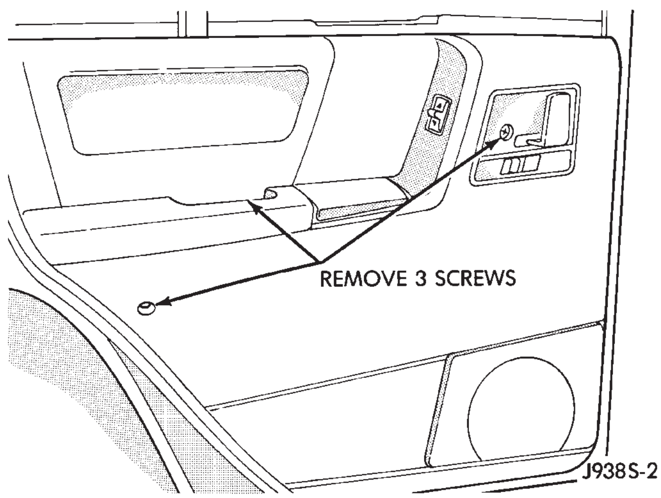


Fig. 4 Rear Door Trim Panel Remove

(4) Remove the trim panel with a wide, flat-bladed tool (Fig. 3).

To aid in removal of the trim panel, start at the bottom of the panel.

(5) Unplug electrical connector from switch.

(6) Remove switch from door panel.

(7) Reverse removal procedures to install.

POWER WINDOW MOTOR REMOVE/INSTALL

To service power window motor or regulator, remove door trim panel as described in Power Window Switch Remove/Install then proceed as follows.

FRONT DOOR

(1) Loosen 2 nuts holding glass to window regulator (Fig. 5).

(2) Slide glass rearward to remove from nuts.

(3) Pull glass to the full up position and tape glass to the door.

(4) Unplug wire harness connector from power window regulator.

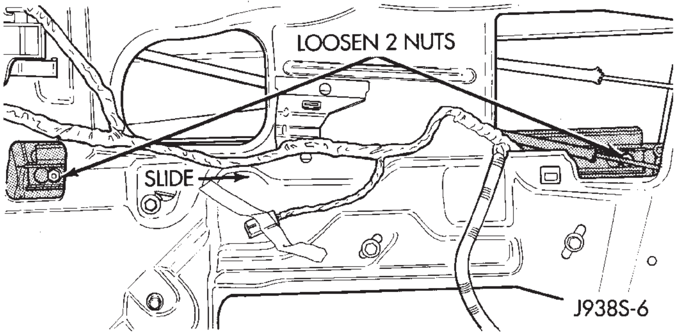


Fig. 5 Remove/Install Glass Attaching Nuts

(5) Remove 4 window regulator screws (Fig. 6).

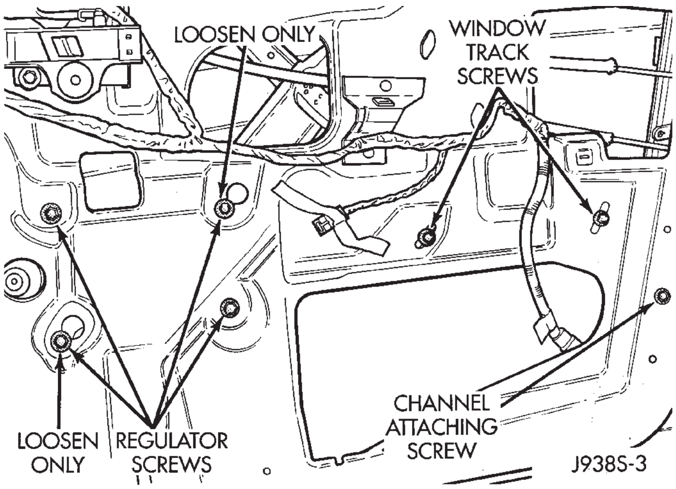


Fig. 6 Window Regulator Remove - Front Door

(6) Loosen last 2 window track screws (Fig. 6).

(7) Remove window regulator.

(8) To install, place regulator inside door by sliding 2 loose screws in slots in door.

(9) Install remaining screws and tighten to 12 N·m (105 in. lbs.).

(10) Move glass as far rearward into channel as possible and push down. Tighten 2 window track screws to 12 N·m (105 in. lbs.).

(11) Attach door glass by sliding 2 nuts into the slots on the regulator (Fig. 5). Tighten door glass nuts to 12 N·m (105 in. lbs.).

(12) Connect wire harness connector to regulator.

(13) Using 3M 08044 or 3M 08041 adhesive/sealant, install plastic water shield.

(14) Reverse remaining removal procedures to complete installation.

REAR DOOR

(1) Lower window until 2 nuts holding the glass to the regulator are visible (Fig. 7).

(2) Remove screws holding speaker.

(3) Pull speaker from door and unplug connector.

(4) Loosen 2 nuts holding glass to window regulator (Fig. 7).

(5) Slide glass forward to remove from nuts.

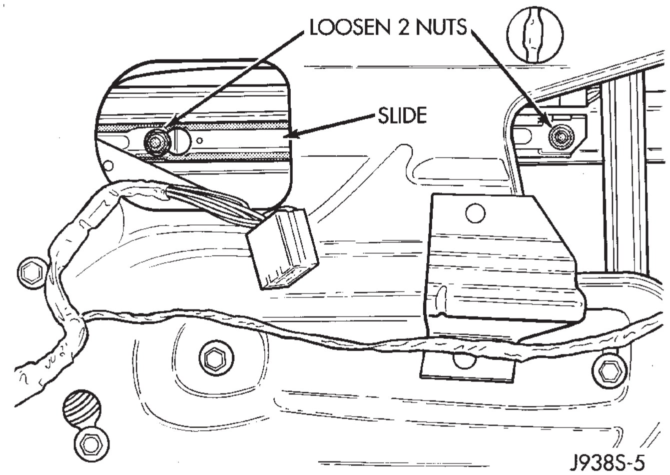


Fig. 7 Remove Glass Attaching Screw - Rear Door

(6) Pull glass to full up position and tape glass to door.

(7) Unplug wire harness connector from power window regulator.

(8) Remove 4 window regulator screws (Fig. 8).

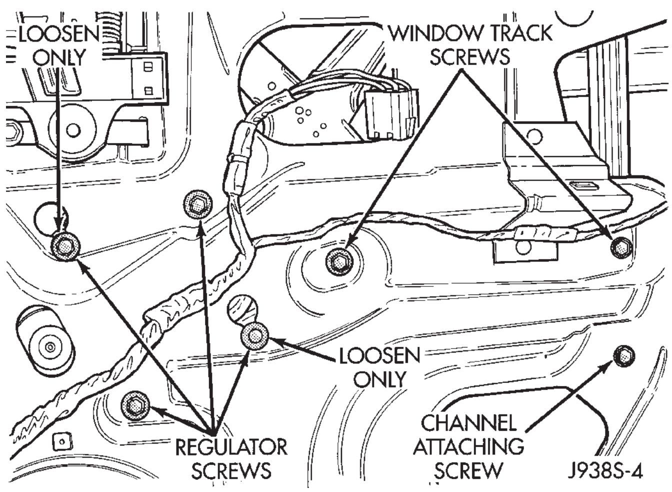


Fig. 8 Window Regulator Remove - Rear Door

(9) Loosen 2 remaining window track screws (Fig. 8).

(10) Remove window regulator.

(11) To install, place regulator inside door by sliding 2 loose screws in slots in door.

(12) Install remaining screws and tighten to 12 N·m (105 in. lbs.).

(13) Move glass as far rearward into channel as possible and push down. Tighten 2 window track screws to 12 N·m (105 in. lbs.).

(14) Attach door glass by sliding the 2 nuts into slots on regulator (Fig. 7). Tighten door glass nuts to 12 N·m (105 in. lbs.).

(15) Connect wire harness connector to regulator.

(16) Install speaker.

(17) Using 3M 08044 or 3M 08041 adhesive/sealant, install plastic water shield.

(18) Reverse remaining removal procedures to complete installation.

POWER MIRRORS

CONTENTS

GENERAL INFORMATION

This group covers power outside mirrors and the automatic day/night inside rear view mirror, which are available options on Grand Cherokee models. Following are general descriptions of the major components in the power outside mirror and automatic day/night inside rear view mirror systems. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER MIRROR

The power mirrors are connected to battery feed at all times. Each mirror head contains two electric motors, two drive mechanisms and the mirror glass. One motor and drive controls mirror up-and-down movement, and the other controls right-and-left movement.

The mirror glass is the only serviced replacement part for the power mirror assembly. If any other component of the mirror unit is faulty or damaged, the entire assembly must be replaced.

HEATED MIRROR

The heated mirror option is controlled by the rear window defogger switch. The heater elements in the mirror are activated only when the rear window defogger switch is in the ON position. Refer to Group 8N - Rear Window Defogger for diagnosis of this system.

POWER MIRROR SWITCH

Both the right and left mirror are controlled by a multi-function switch located on the lower left end of the instrument panel, directly below the left spot cooler (Fig. 1). The selector switch is moved right (right mirror control), left (left mirror control), or center to turn power mirrors off. Then one of four directional control buttons is depressed to control movement of the selected mirror up, down, right, or left. The power mirror switch is serviced only as a complete unit.

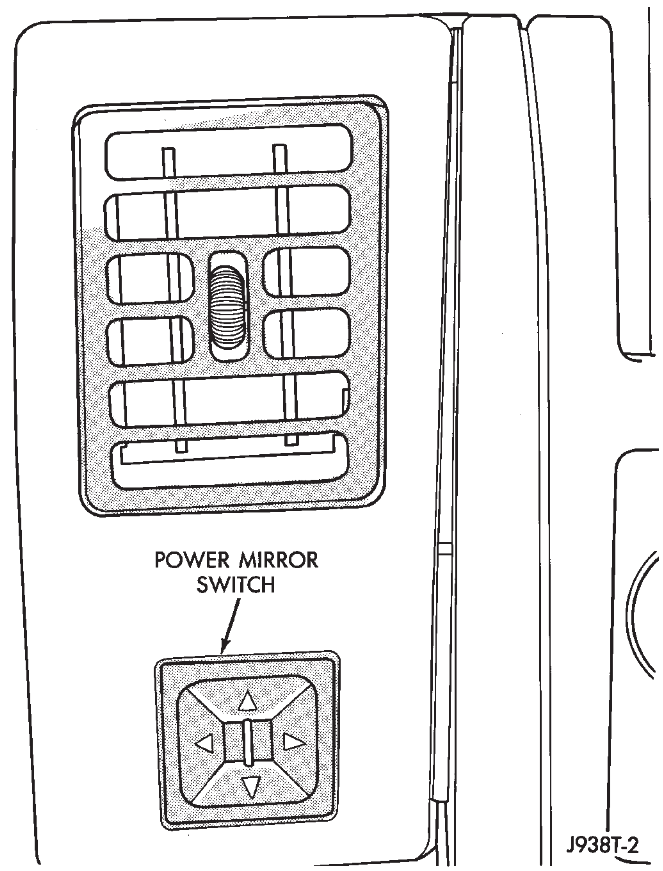


Fig. 1 Power Mirror Switch

AUTOMATIC DAY/NIGHT MIRROR

The automatic day/night mirror automatically changes its reflectance to reduce glare in all types of driving conditions. A thin layer of electrochromic material between two pieces of conductive glass make up the face of the mirror. As light conditions change, two photocell sensors adjust the reflectance while reducing glare from headlamps approaching from the rear.

The mirror incorporates 2 sensors. The ambient sensor (forward facing) detects normal outside light levels. The headlamp sensor (rear facing) detects light levels received at the rear window side of the mirror. When the difference between the two levels becomes too great (light level received at rear of mirror is much higher than front of mirror), the mirror begins to darken.

The mirror switch controls whether the automatic dimming feature is on or off. When on is selected, the switch is lighted by an integral LED. The mirror will only operate when the ignition switch is in the ON position. The mirror also senses the back-up lamp circuit and turns off whenever the transmission (manual or automatic) is in reverse.

The automatic day/night mirror can not be repaired. If faulty, the entire assembly must be replaced.

DIAGNOSIS

POWER MIRRORS

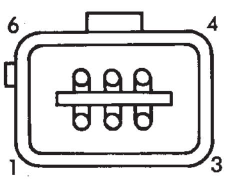
(1) Remove the door trim panel as described in Power Mirror Remove/Install.

(2) Unplug power mirror door wiring harness connector.

(3) Connect a jumper wire to a 12-volt source.

(4) Connect another jumper wire to a good body ground.

(5) Refer to Power Mirror Motor Test for appropriate pin numbers (Fig. 2).



DOOR CONNECTOR		
12 Volts	Ground	MIRROR REACTION
PIN 3	PIN1	UP
PIN 1	PIN 3	DOWN
PIN 3	PIN 2	RIGHT
PIN 2	PIN 3	LEFT
PIN 4	PIN 5	HEATER

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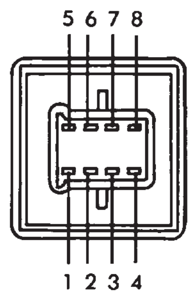
Fig. 2 Power Mirror Motor Test

POWER MIRROR SWITCH

(1) Remove power mirror switch from mounting position.

(2) Unplug wiring harness connector.

(3) Using an ohmmeter, test for continuity between the terminals of the switch as shown in the Power Mirror Switch Test (Fig. 3).



MIRROR SWITCH CONTINUITY TYPE III	
Mirror Switch Knob in "L" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 6 AND 8 PINS 5 TO 1 AND 4
►	PINS 6 AND 1 PINS 5 AND 4
▼	PINS 6 AND 1 PINS 5 AND 8
◄	PINS 6 AND 4 PINS 5 TO 1 AND 8
Mirror Selector Knob in "R" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	PINS 6 AND 7 PINS 5 TO 1 AND 3
►	PINS 6 AND 1 PINS 5 AND 3
▼	PINS 5 AND 7 PINS 6 AND 1
◄	PINS 6 AND 3 PINS 5 TO 1 AND 7

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Fig. 3 Power Mirror Switch Test

AUTOMATIC DAY/NIGHT MIRROR

(1) Check fuse 19 in fuseblock module. If OK, go to next step. If not OK, replace fuse.

(2) Turn ignition switch to the ON position. Check for battery voltage at fuse 19 in fuseblock module. If OK, go to next step. If not OK, repair circuit from fuse to ignition switch as required.

(3) Unplug harness connector from mirror (Fig. 4). With ignition switch ON, check for battery voltage at connector cavity with yellow wire. If OK, go to next step. If not OK, repair circuit to fuse 19 as required.

(4) Turn ignition switch to OFF position. Check for continuity between connector cavity with black wire

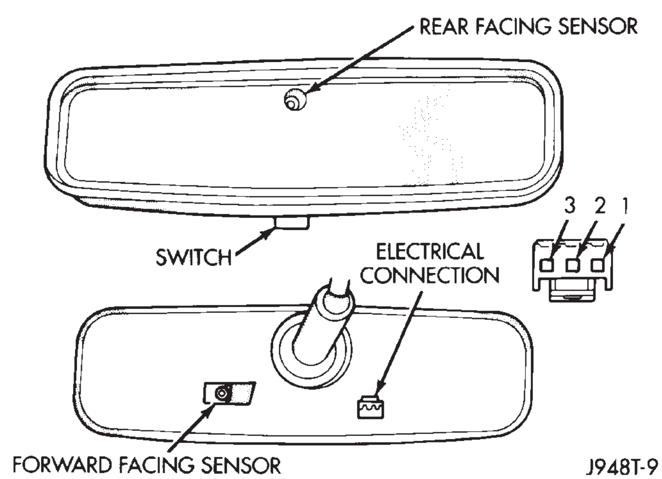
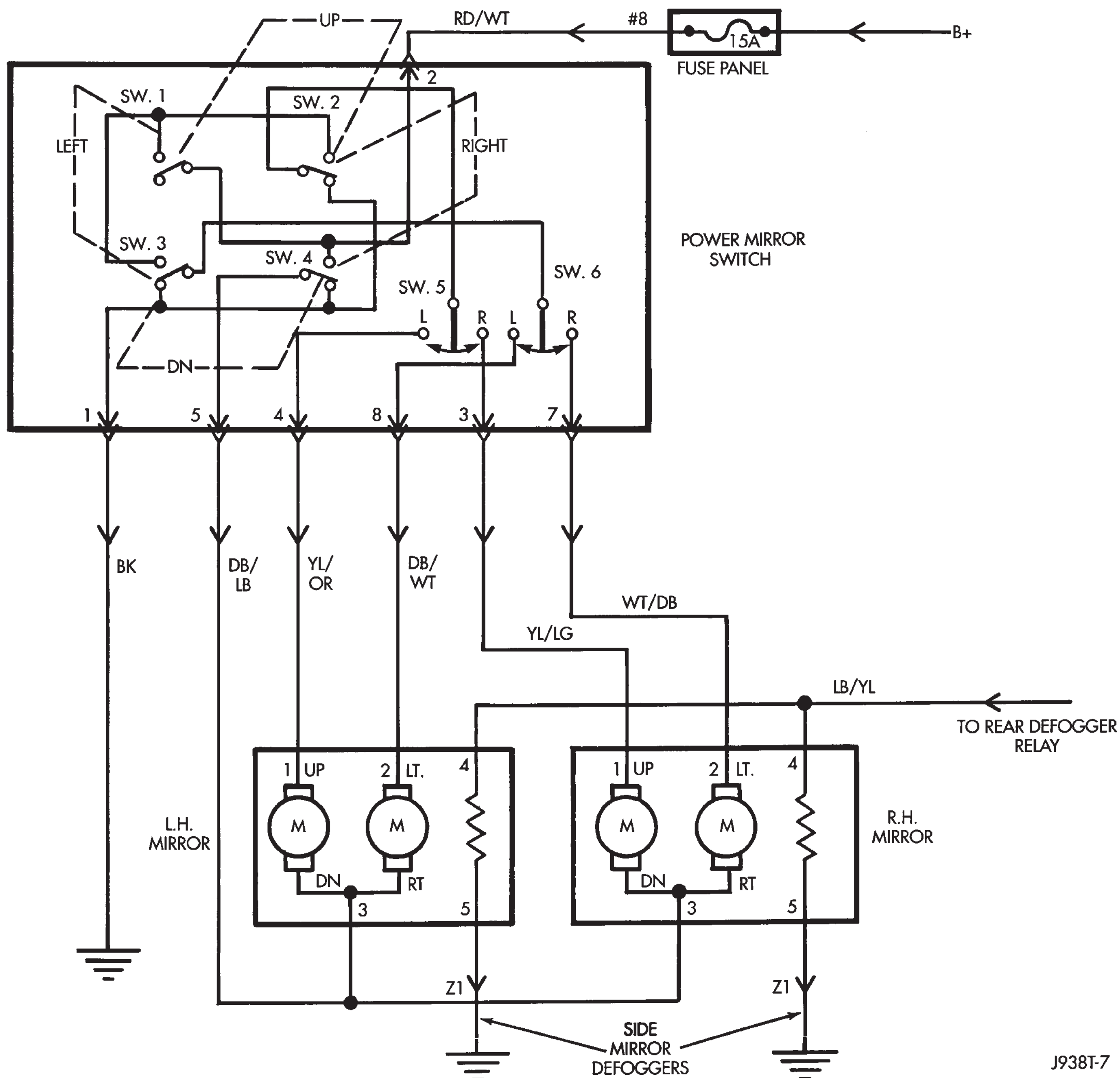


Fig. 4 Automatic Rear View Mirror

POWER MIRROR SCHEMATIC



and a good ground. There should be continuity. If OK, go to next step. If not OK, repair circuit to ground as required.

(5) Turn ignition switch to ON position. Set parking brake. Place transmission gear selector in Reverse position. Check for battery voltage at connector cavity with brown/light green wire. If OK, plug mirror connector back in and go to next step. If not OK, repair circuit to back-up lamps as required.

(6) Place transmission gear selector in Neutral. Place mirror switch in ON (switch lighted) position. Cover the forward facing sensor to keep out any ambient light. **Light sensor must be covered completely so that no light reaches the sensor. Use only one finger pressed tightly against sensor, or cover sensor completely with electrical tape.**

(7) Shine a light into the rear facing sensor. The mirror should darken. If OK, go to next step. If not OK, replace mirror

(8) With the mirror darkened, place the transmission gear selector in Reverse. The mirror should return to its normal condition. If not OK, replace mirror.

SERVICE PROCEDURES

POWER MIRROR SWITCH REMOVE/INSTALL

(1) Disconnect battery negative cable.

(2) Remove ash receiver.

(3) Remove 6 screws holding instrument panel center bezel (Fig. 5).

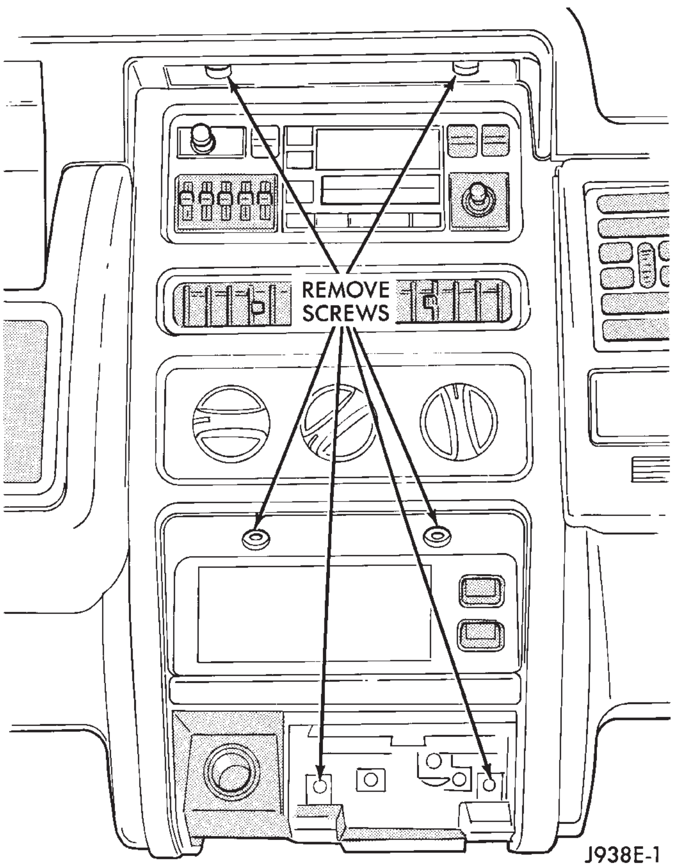


Fig. 5 Instrument Panel Center Bezel

(4) Remove center bezel.

(5) Remove 2 screws holding dash pad located behind top of center bezel.

(6) Gently pry defroster grille out of dash pad.

(7) Unplug auto headlamp and/or solar sensors (if equipped) and set defroster grille aside.

(8) Remove 4 screws in defroster duct opening holding dash pad (Fig. 6).

(9) Remove 3 screws above instrument panel cluster holding dash pad (Fig. 7).

(10) Open glove box and remove 2 screws holding dash pad.

(11) Remove dash pad by pulling up to unsnap end clips.

(12) Remove 4 screws holding the steering column cover (Fig. 8).

(13) With left front door open, remove 1 screw from the side of the lower instrument panel trim (Fig. 9).

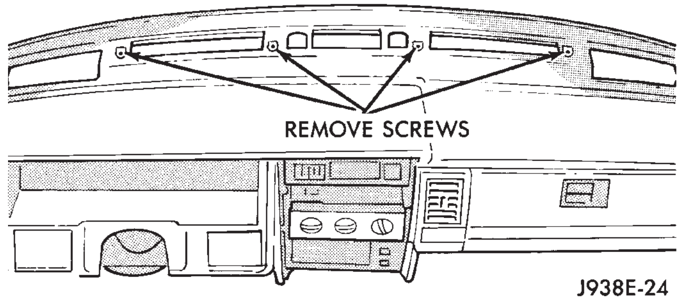


Fig. 6 Upper Dash Pad Attaching Screws

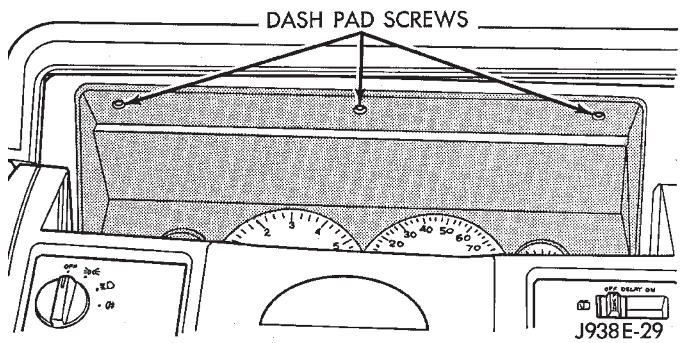


Fig. 7 Cluster to Dash Pad Screws

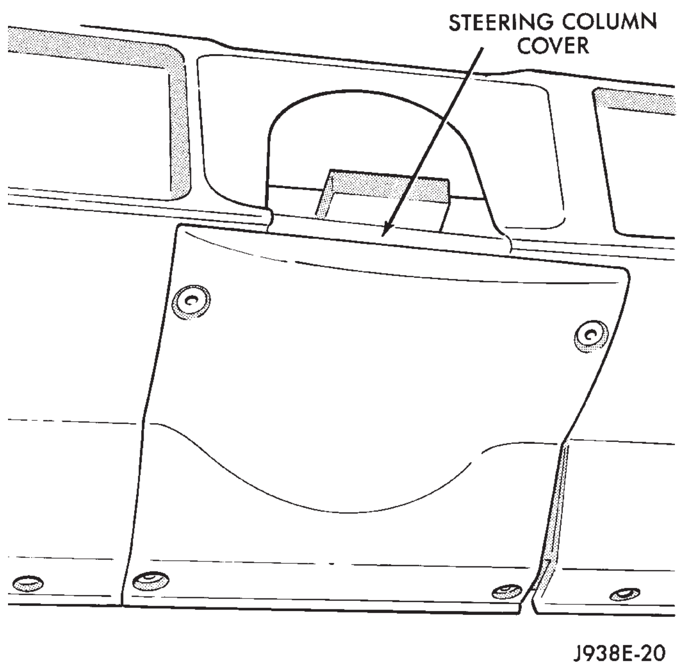


Fig. 8 Steering Column Cover

(14) Remove 1 screw from bottom of lower instrument panel trim and pull panel off. There is also a clip holding the panel to the instrument panel.

(15) Remove 1 screw holding top of mirror switch bezel (Fig. 10).

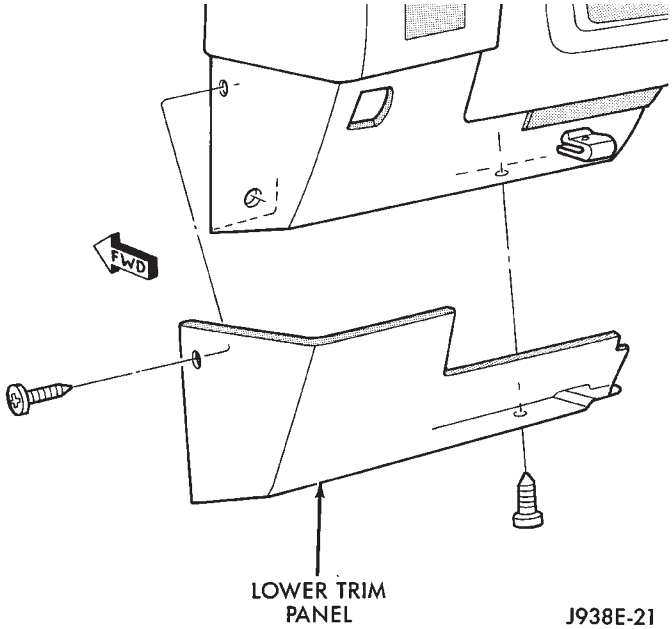


Fig. 9 Lower Instrument Panel Trim

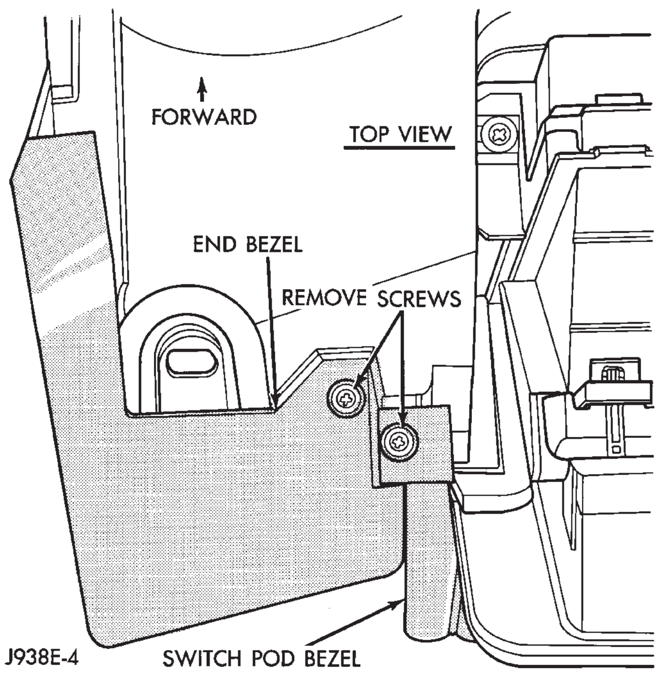


Fig. 10 Power Mirror Bezel Top Screw

(16) Remove 1 screw holding bottom of bezel (Fig. 11). Remove the mirror switch bezel far enough to unplug connector.

(17) Depress locking tabs and remove switch from bezel (Fig. 12).

(18) Reverse removal procedures to install.

POWER MIRROR REMOVE/INSTALL

(1) Remove screw at top of door trim panel near mirror (Fig. 13).

(2) Remove screw from demister opening.

(3) Remove screw and door handle cover.

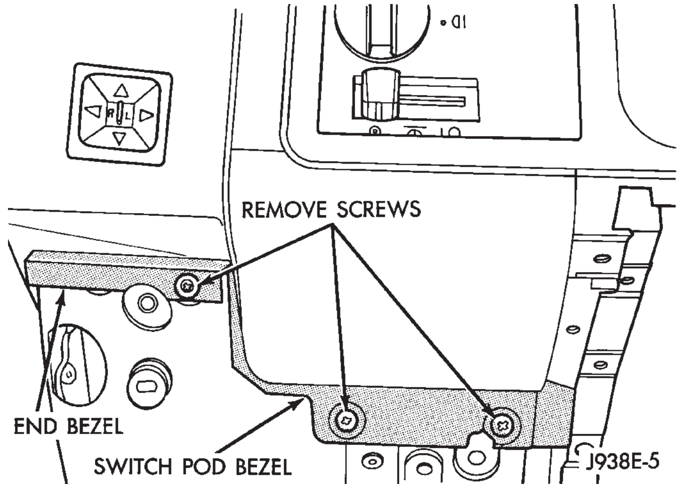


Fig. 11 Power Mirror Bezel Bottom Screw

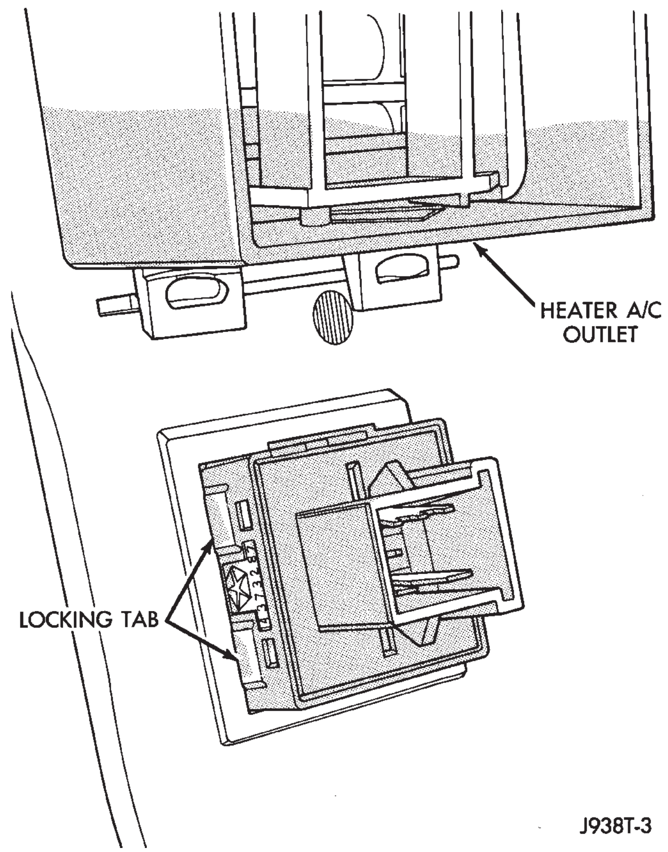


Fig. 12 Power Mirror Switch Remove

(4) Remove screw from under door armrest.

(5) Remove screw from bottom of hand hold in door armrest.

CAUTION: The wiring harness to the door switches is just long enough to allow installation. If trim panel is pulled off by hand the switches may be pulled apart. Use a door clip tool to prevent damaging the switches.

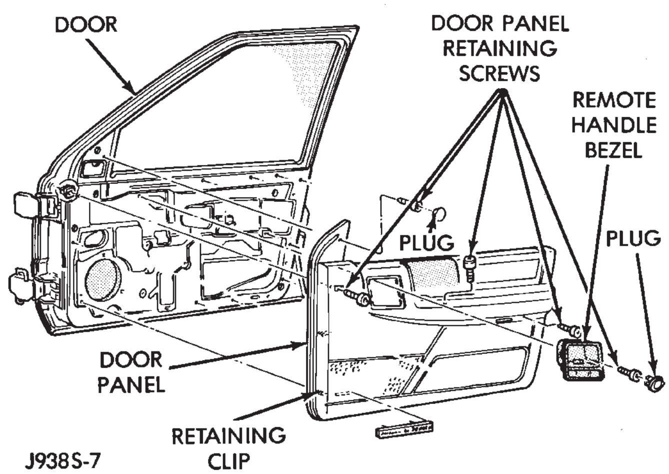


Fig. 13 Door Trim Panel Remove

(6) Remove the door trim panel with a wide, flat-bladed tool (Fig. 14).

To aid in removal of the trim panel, start at the bottom of the panel.

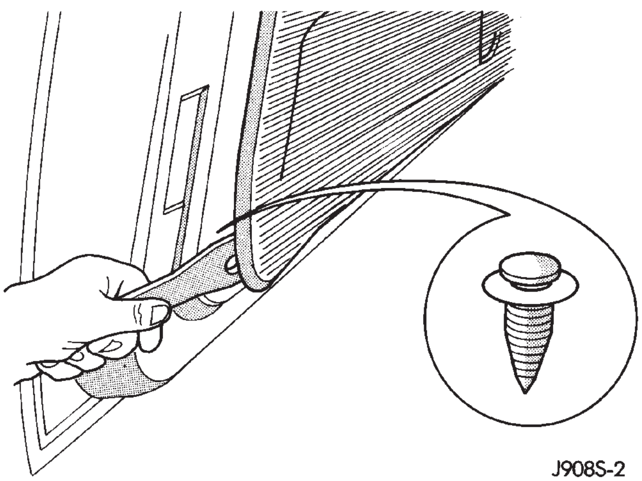


Fig. 14 Door Trim Panel Remove

(7) Unplug mirror wiring from door harness at connector (Fig. 15).

(8) Remove 3 nuts holding mirror to door panel and remove mirror.

(9) Reverse removal procedures to install.

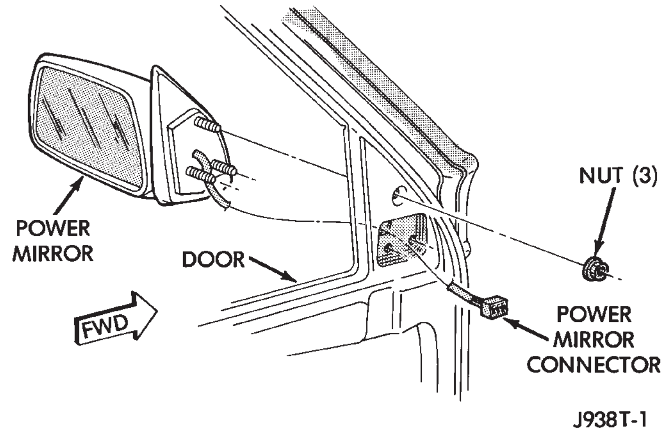


Fig. 15 Power Mirror Remove/Install

AUTOMATIC DAY/NIGHT MIRROR REMOVE/ INSTALL

(1) Remove wire cover by grasping lower portion of wire cover and sliding into upper portion and off of mirror base (Fig. 16).

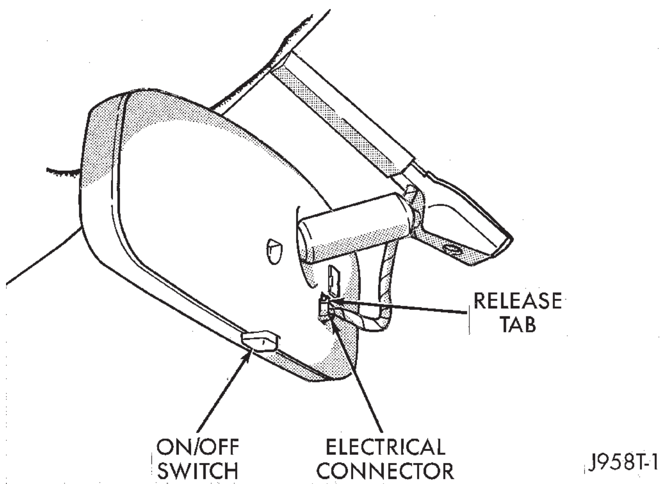


Fig. 16 Automatic Rear View Mirror Remove/Install

(2) Unplug connector behind mirror.

(3) Remove screw holding mirror to windshield.

(4) Push mirror up far enough to clear the support and remove mirror.

(5) Reverse removal procedures to install.

CHIME/BUZZER WARNING SYSTEMS

CONTENTS

GENERAL INFORMATION

This group covers the standard equipment chime warning system on Grand Cherokee models. The system provides an audible warning to the driver when it monitors the following conditions:

- key is in ignition switch with the driver's door open (On some vehicles, a warning will not sound if the ignition switch is in the ON position when the left front door is open)
- exterior lamps are ON when the ignition switch is OFF, key is removed from ignition lock cylinder, and left front door is open
- driver's seat belt is not buckled with ignition switch in ON position
- an input from the vehicle information center is received.

There is also a power door lock inhibit feature on vehicles with the chime module. If the key is in the ignition lock cylinder or exterior lamps are ON, while the left front door is open, the power lock/keyless entry systems will not operate.

Following are general descriptions of the major components in the chime warning system. Refer to Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

CHIME MODULE

The chime module is located on a bracket under the left end of the instrument panel (Figs. 1 and 2). It receives battery voltage at all times from fuse 8 in the fuseblock module. It also receives a second battery feed through fuse 9 when the ignition switch is in the ON or START position.

Other inputs to the module include the driver's door jamb switch, the driver's seat belt switch, the ignition key-in switch, the headlamp switch, and the tone line from the vehicle information center (if equipped). The only output of the module is a timed 4 to 8 second feed to the seat belt reminder lamp in the message center of the instrument cluster. The timer function begins after the ignition switch is turned to the ON position.

The chime module can not be repaired. If faulty, it must be replaced.

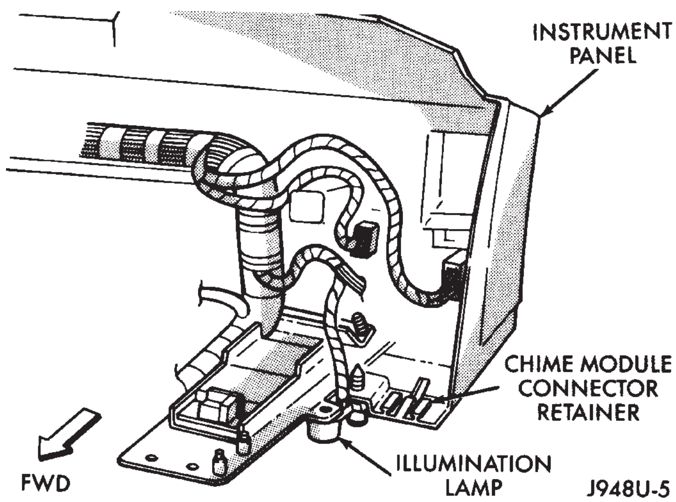


Fig. 1 Chime Module Location

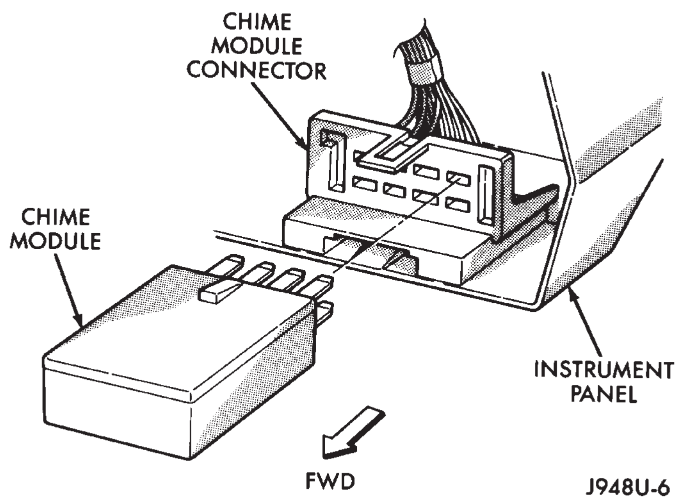


Fig. 2 Chime Module and Connector

DRIVER'S DOOR JAMB SWITCH

The driver's door jamb switch is mounted to the driver's door hinge pillar. The switch closes a path to ground for the chime module through the key-in switch or headlamp switch when the driver's door is opened, and opens when the driver's door is closed. This switch can not be repaired. If faulty, it must be replaced.

IGNITION KEY-IN SWITCH

The key-in switch is integral to the ignition switch, which is mounted on the right side of the steering column. It closes a path to ground for the chime module when the ignition key is inserted in the ignition lock cylinder and the driver's door jamb switch is closed (door open). The switch opens when the key is removed from the ignition lock cylinder. This switch can not be repaired. If faulty, the entire ignition switch must be replaced. Refer to Group 8D - Ignition Systems for service procedures.

HEADLAMP SWITCH

The headlamp switch is located in the instrument panel. It closes a path to ground for the chime module when the park or headlamps are on and the driver's door jamb switch is closed (door open). The switch opens the ground path when the park and headlamps are turned off. The headlamp switch can not be repaired. If faulty, it must be replaced. Refer to Group 8E - Instrument Panel and Gauges for service procedures.

DRIVER'S SEAT BELT SWITCH

The driver's seat belt switch is integral to the driver's seat belt buckle-half assembly. The switch is normally closed, providing a ground path to the chime module. When the tip-half of the seat belt is inserted into the seat belt buckle, the switch opens the chime module ground path. The seat belt switch can not be repaired. If faulty, the entire driver's seat belt buckle-half must be replaced. Refer to Group 23 - Body Components for service procedures.

VEHICLE INFORMATION CENTER TONE LINE

If the vehicle is equipped with the optional Vehicle Information Center (VIC), an output from the VIC provides a ground signal to the chime module when it detects a fault. This signal causes the chime module to sound an audible signal to the driver. Refer to Group 8E - Instrument Panel and Gauges for more information on the VIC system.

POWER DOOR LOCK INHIBIT

Pin 8 of the chime module provides the ground for the coil side of the power door lock relay. The LOCK function will not operate if:

- the chime module is not plugged in
- the key is in the ignition lock cylinder, or exterior lamps are ON, while the left front door is open
- the power door lock inhibit feature of the chime module is inoperable due to defective electronics in the chime module. (In this case, the power door lock operation is unpredictable.)

DIAGNOSIS

CHIME WARNING SYSTEM

If the chime module does not operate as described, check the two fuses for pins 1 and 7 (Figs. 3, 4) and replace as required. If the fuses are not defective, perform the following tests to determine if the problem is in the module or in the wiring.

(1) Remove the module and replace with a known good module. Now, check operation again. If the problem is not corrected by replacing the module, re-install original module and go to next step.

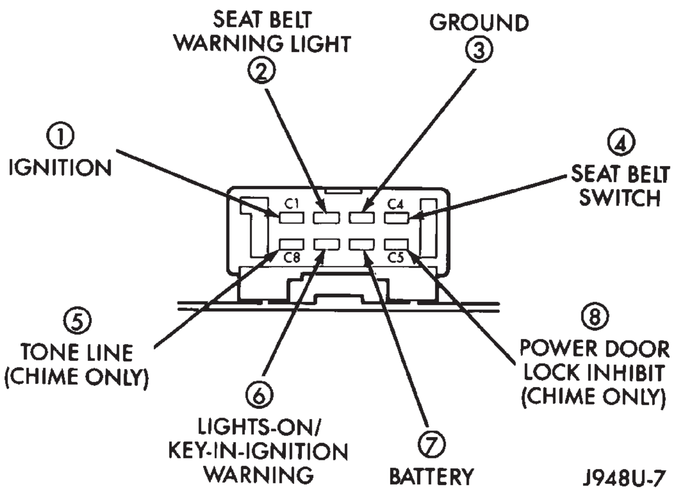


Fig. 3 Chime Module Connector Terminal Identification

(2) Turn ignition switch to ON position. Measure voltage at chime module connector pin 1. Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to ignition switch as required.

(3) Turn ignition switch to OFF and remove key from ignition lock cylinder. Measure voltage at chime module connector pin 7. Meter should read battery voltage. If OK, go to next step. If not OK, repair circuit to fuseblock module as required.

(4) Turn ignition switch to OFF position. Disconnect battery negative cable. Check resistance between chime module connector pin 2 and a good ground. Meter should read almost zero ohms (bulb filament). If OK, go to next step. If not OK, repair circuit to seat belt warning lamp or replace bulb as required.

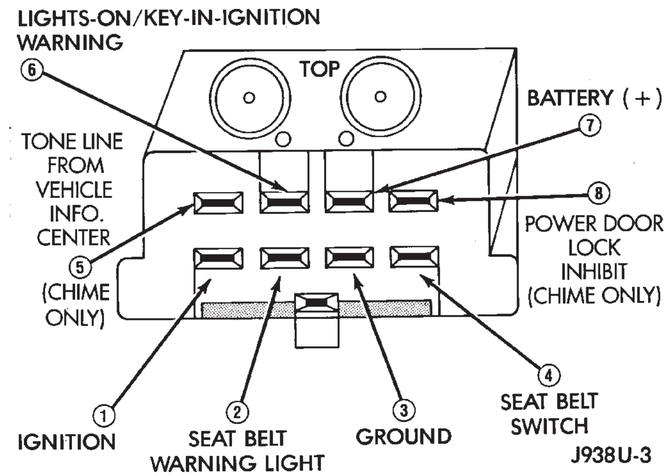


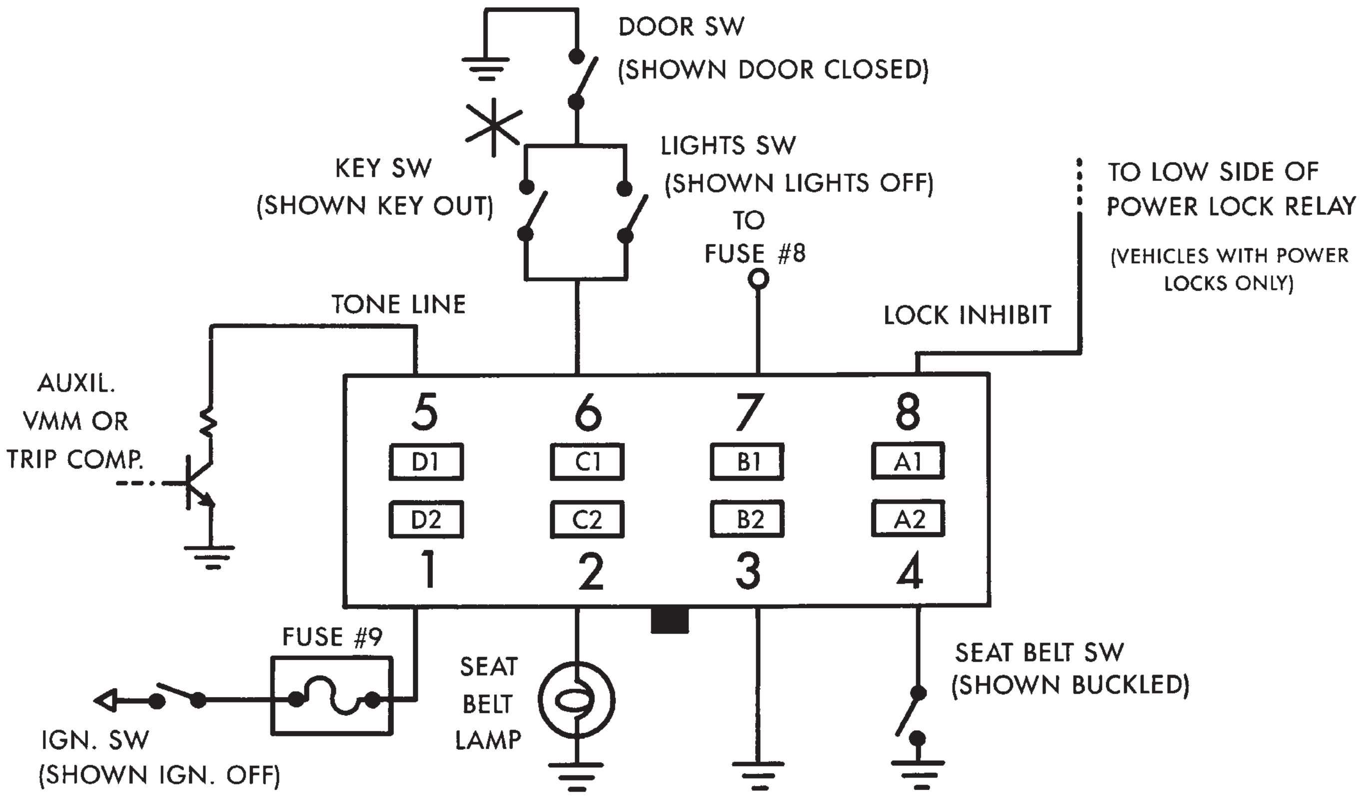
Fig. 4 Chime Module Terminal Identification

(5) Check resistance between chime module connector pin 3 and a good ground. Meter should read zero ohms. If OK, go to next step. If not OK, repair circuit to ground as required.

(6) Check resistance between chime module connector pin 4 and a good ground. Meter should read zero ohms with left front seat belt unbuckled and open circuit with belt buckled. If OK, go to next step. If not OK, repair circuit to seat belt switch or replace seat belt buckle half as required.

(7) Open left front door. Check resistance between chime module connector pin 6 and a good ground. Meter should read open circuit. Insert key ignition lock cylinder and meter should read zero ohms. If OK, go to next step. If not OK, repair circuit to key-in-ignition switch or replace key-in ignition switch as required.

(8) Remove key from ignition lock cylinder. Open left front door and turn headlamp switch ON. Check resistance between chime module connector pin 6 and a good ground. Meter should read zero ohms. If OK, replace faulty chime module. If not OK, repair circuit to headlamp switch or replace headlamp switch as required.



PIN 8 (POWER LOCKS INHIBIT): LOW WHEN PIN 6 IS HI. AND OPEN WHEN PIN 6 IS LOW.

N/A = NOT APPLICABLE. X = DON'T CARE.

FUNCTION	DESCRIPTION	IGN.	SEAT BELT	TRIP COMP	DRIVER'S DOOR	KEY	HEAD LAMPS
SEAT BELT REMINDER	4 TO 8 SEC. CHIME AND LAMP OUTPUT	OFF → ON	NOT BCKLD	X	X	X	X
	4 TO 8 SEC. LAMP OUTPUT ONLY	OFF → ON	BCKLD	X	X	X	X
TRIP COMPUTER	CONTINUOUS. STEADY TONE	ON	X	LOW	X	X	X
KEY & HEAD LAMP REMINDER	PULSD. FAST-RATE CHIMES	OFF	X	X	OPEN	IN	X
						X	ON
DOOR LOCK INHIBIT	POWER LOCKS INHIBITED	OFF	X	X	OPEN	IN	X
						X	ON

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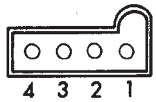
Fig. 5 Chime Module Schematic



WIRE CAVITY	APPLICATION	CONTINUITY BETWEEN
1 2	Halo lamp Halo lamp	1 & 2 Almost zero ohms (bulb filament)
3 4	Key-in warning switch Key-in warning switch	3 & 4 with key in ignition

J918M-3

Fig. 6 Halo Lamp And Key-In-Ignition Switch Continuity Chart

SERVICE PROCEDURES

Service procedures for components of the chime warning system can be found in the appropriate group as follows:

- driver's door jamb switch - refer to Group 8L - Lamps
- ignition key-in switch - refer to Group 8D - Ignition Systems
- headlamp switch - refer to Group 8E - Instrument Panel and Gauges
- driver's seat belt switch - refer to Group 23 - Body Components.

WIRING DIAGRAMS

CONTENTS

HOW TO USE THIS GROUP

The purpose of this group is to show the electrical circuits in a clear, simple fashion and to make troubleshooting easier. Components that work together are shown together. All electrical components used in a specific system are shown on one diagram. The feed for a system is shown at the top of the page. All wires, connectors, splices, and components are shown in the flow of current to the bottom of the page. Wiring which is not part of the circuit represented is referenced to another page/section, where the complete circuit is shown. In addition, all switches, components, and modules are shown in the **at rest position with the doors closed and the key removed from the ignition.**

If a component is part of several different circuits, it is shown in the diagram for each. For example, the headlamp switch is the main part of the exterior lighting, but it also affects the interior lighting and the chime warning system.

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.

The wiring diagram show circuits for all wheel-bases. If there is a difference in systems or components between wheel-bases, an identifier is placed next to the component.

SECTION IDENTIFICATION

Sections in Group 8W are organized by sub-systems. The sections contain circuit operation descriptions, helpful information, and system diagrams. The intention is to organize information by system, consistently from year to year.

CONNECTOR LOCATIONS

Section 8W-90 contains Connector Location illustrations. The illustrations contain the connector number and component identification. Connector 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 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.

GENERAL INFORMATION - WIRING DIAGRAMS

INDEX

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.

ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER, AND MUFFLER.

DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING.

WIRE CODE IDENTIFICATION

Each wire shown in the diagrams contains a code (Fig. 1) which identifies the main circuit, part of the main circuit, gauge of wire, and color. The color is shown as a two letter code which can be identified by referring to the Wire Color Code Chart (Fig. 2).

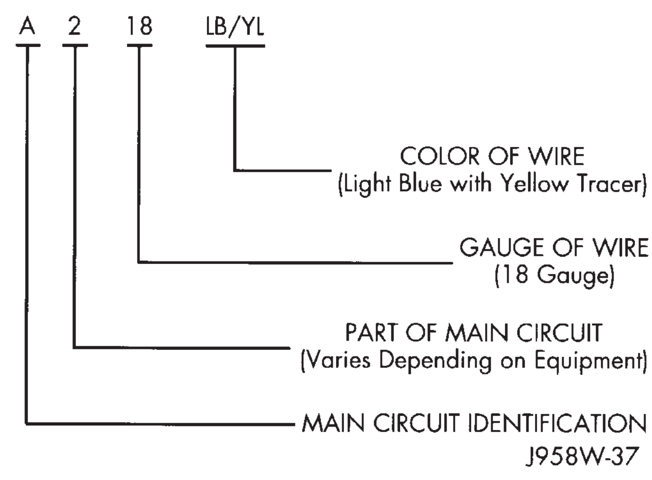


Fig. 1 Wire Color Code Identification

CIRCUIT IDENTIFICATION

All circuits in the diagrams use an alpha/numeric code to identify the wire and its function (Fig. 3). To

COLOR CODE	COLOR	STANDARD TRACER COLOR	COLOR CODE	COLOR	STANDARD TRACER CODE
BL	BLUE	WT	OR	ORANGE	BK
BK	BLACK	WT	PK	PINK	BK OR WT
BR	BROWN	WT	RD	RED	WT
DB	DARK BLUE	WT	TN	TAN	WT
DG	DARK GREEN	WT	VT	VIOLET	WT
GY	GRAY	BK	WT	WHITE	BK
LB	LIGHT BLUE	BK	YL	YELLOW	BK
LG	LIGHT GREEN	BK	*	WITH TRACER	

918W-136

Fig. 2 Wire Color Code Chart

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	FUNCTION
A	Battery Feed
B	Brake Controls
C	Climate Controls
D	Diagnostic Circuits
E	Dimming Illumination Circuits
F	Fused Circuits (Secondary Feed)
G	Monitoring Circuits (Gauges)
H	Open
I	Not Used
J	Open
K	Powertrain Control Module
L	Exterior Lighting
M	Interior Lighting
N	ESA Module
O	Not Used
P	Power Option (Battery Feed)
Q	Power Options (Battery Feed)
R	Passive Restraint
S	Suspension/Steering
T	Transmission/Transaxle/Transfer Case
U	Open
V	Speed Control, Washer/Wiper
W	Open
X	Audio Systems
Y	Open
Z	Grounds

948W-190

Fig. 3 Circuit Identification

CONNECTORS

Connectors shown in the diagrams are identified using the international standard arrows for male and female terminals (Fig. 4). A connector identifier is placed next to the arrows to indicate the connector number (Fig. 4).

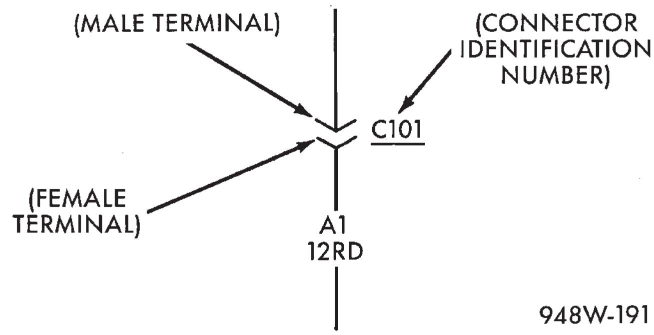


Fig. 4 Connector Identification

For viewing connector pin outs, with two terminals or greater, refer to section 8W-80. This section identifies the connector by number and provides terminal numbering, circuit identification, wire colors, and functions.

All connectors are viewed from the terminal end unless otherwise specified. To find the connector location in the vehicle refer to section 8W-90. This section uses the connector identification number from the wiring diagrams to provide a figure number reference.

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.

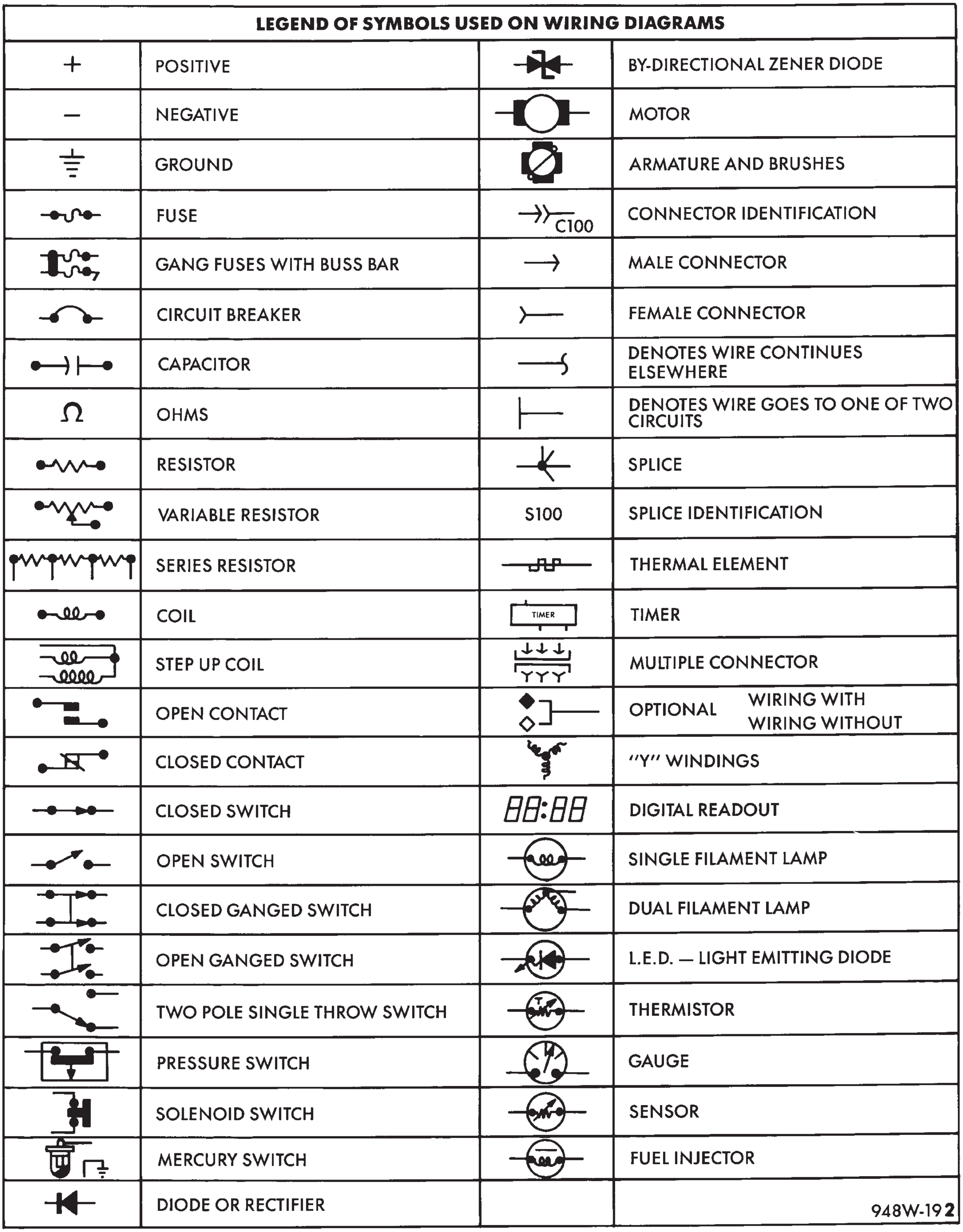
SYMBOLS

Various symbols are used throughout the Wiring Diagrams. These symbols can be identified by referring to the symbol identification chart (Fig. 5).

ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 6) 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.



LEGEND OF SYMBOLS USED ON WIRING DIAGRAMS			
+	POSITIVE		BY-DIRECTIONAL ZENER DIODE
−	NEGATIVE		MOTOR
	GROUND		ARMATURE AND BRUSHES
	FUSE	C100	CONNECTOR IDENTIFICATION
	GANG FUSES WITH BUSS BAR		MALE CONNECTOR
	CIRCUIT BREAKER		FEMALE CONNECTOR
	CAPACITOR		DENOTES WIRE CONTINUES ELSEWHERE
Ω	OHMS		DENOTES WIRE GOES TO ONE OF TWO CIRCUITS
	RESISTOR		SPLICE
	VARIABLE RESISTOR	S100	SPLICE IDENTIFICATION
	SERIES RESISTOR		THERMAL ELEMENT
	COIL	TIMER	TIMER
	STEP UP COIL		MULTIPLE CONNECTOR
	OPEN CONTACT		OPTIONAL — WIRING WITH / WIRING WITHOUT
	CLOSED CONTACT		"Y" WINDINGS
	CLOSED SWITCH	88:88	DIGITAL READOUT
	OPEN SWITCH		SINGLE FILAMENT LAMP
	CLOSED GANGED SWITCH		DUAL FILAMENT LAMP
	OPEN GANGED SWITCH		L.E.D. — LIGHT EMITTING DIODE
	TWO POLE SINGLE THROW SWITCH		THERMISTOR
	PRESSURE SWITCH		GAUGE
	SOLENOID SWITCH		SENSOR
	MERCURY SWITCH		FUEL INJECTOR
	DIODE OR RECTIFIER		948W-192

Fig. 5 Symbol Identification

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written diagnostic 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.

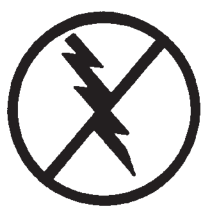


Fig. 6 Electrostatic Discharge Symbol

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.

• 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. 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.

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 7). 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.

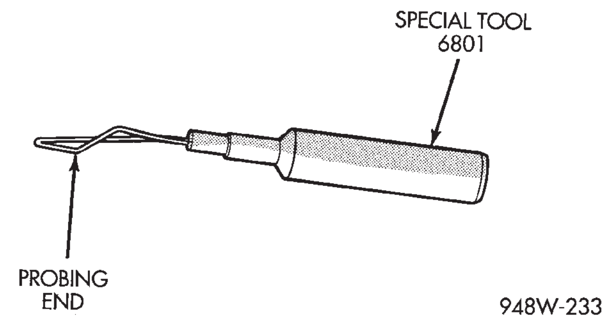


Fig. 7 Probing Tool

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

• Wiring broke inside of the insulation

TROUBLESHOOTING TESTS

Before beginning any tests on a vehicle's electrical system, use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems section in this section.

TESTING FOR VOLTAGE

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 8).

(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.

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. 9).

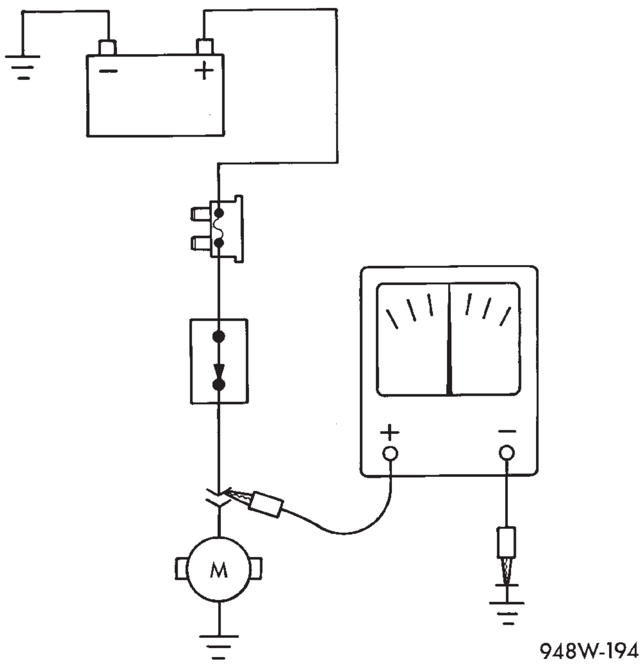


Fig. 8 Testing for Voltage

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

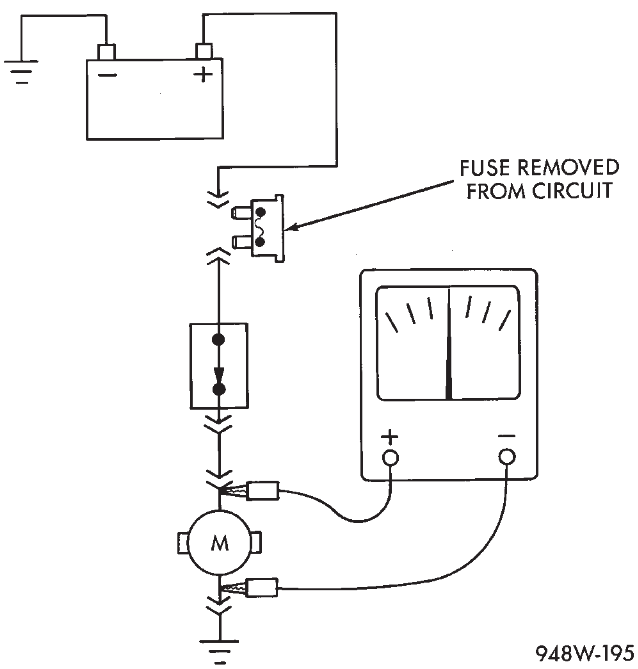


Fig. 9 Testing for Continuity

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 fused circuit.

(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. 10).

(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.

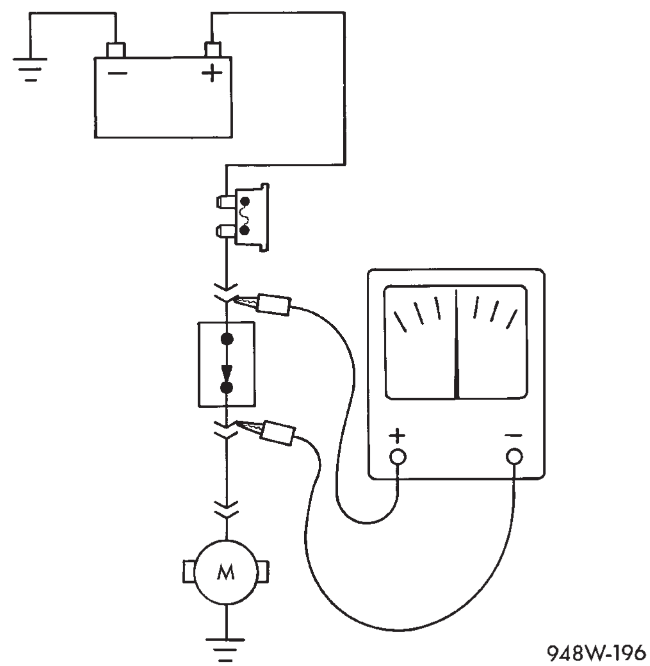


Fig. 10 Testing for Voltage Drop

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.

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gauge 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 wires (Fig. 11 example 1).
(5) Push the two ends of wire together until the strands of wire are close to the insulation (Fig. 11 example 2).
(6) Twist the wires together (Fig. 11 example 3).
(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.

TERMINAL/CONNECTOR REPAIR—MOLEX CONNECTORS

(1) Disconnect battery.
(2) Disconnect the connector from its mating half/component.
(3) Insert the terminal releasing special tool 6742 into the terminal end of the connector (Fig. 12).
(4) Using special tool 6742, release the locking fingers on the terminal (Fig. 13).
(5) Pull on the wire to remove it from the connector.
(6) Repair or replace the connector or terminal as necessary.

CONNECTOR REPLACEMENT

(1) Disconnect battery.

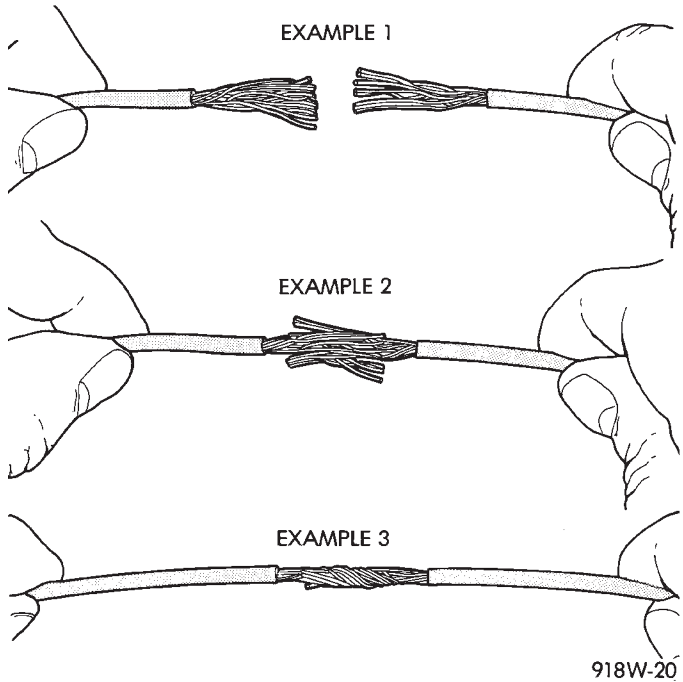


Fig. 11 Wire Repair

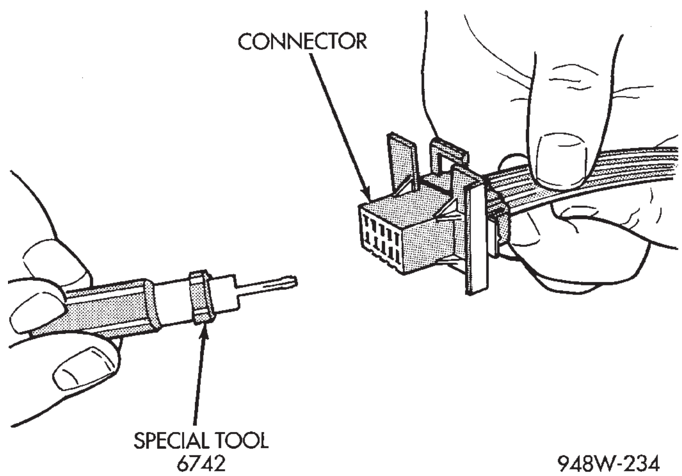


Fig. 12 Molex Connector Repair

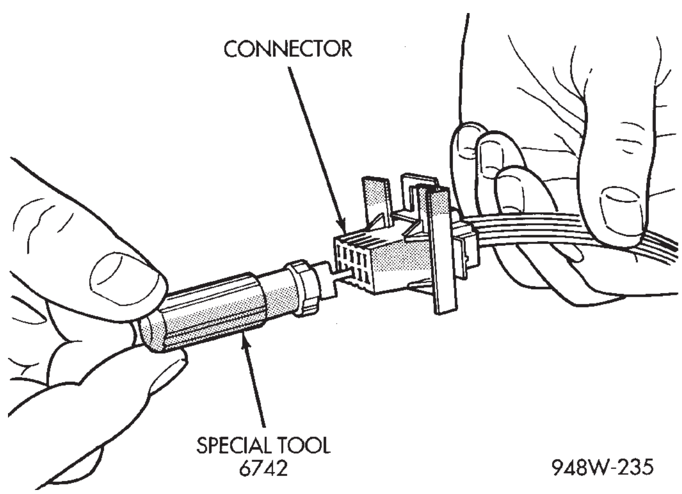


Fig. 13 Using Special Tool 6742

(2) Disconnect the connector that is to be repaired from its mating half/component.

(3) Remove connector locking wedge, if required (Fig. 14).

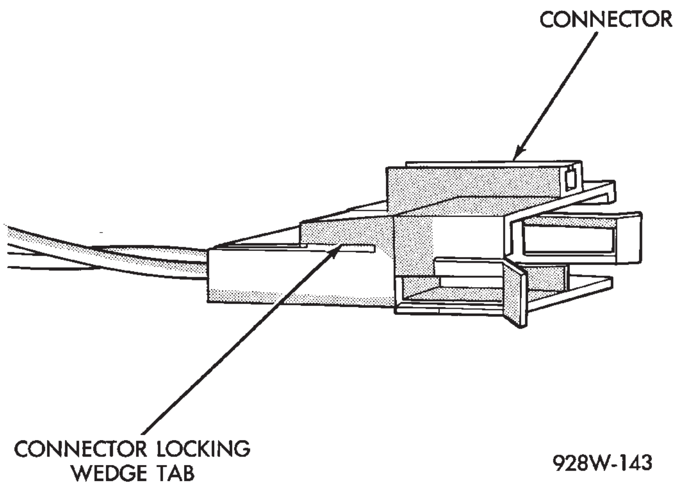


Fig. 14 Connector Locking Wedge Tab (Typical)

(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. 15, and Fig. 16).

(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.

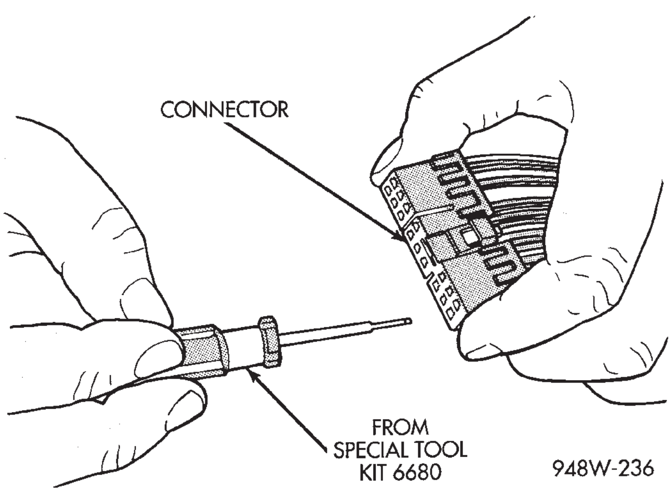


Fig. 15 Terminal Removal

CONNECTOR AND TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector (that is to be repaired) from its mating half/component.

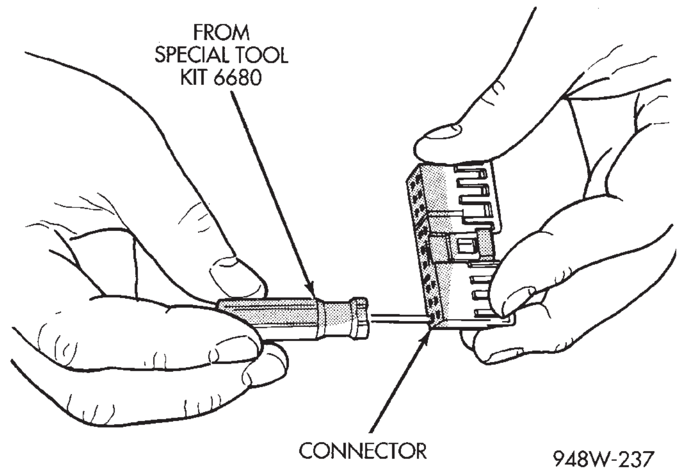


Fig. 16 Terminal Removal Using Special Tool

(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. 17).

(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. 17).

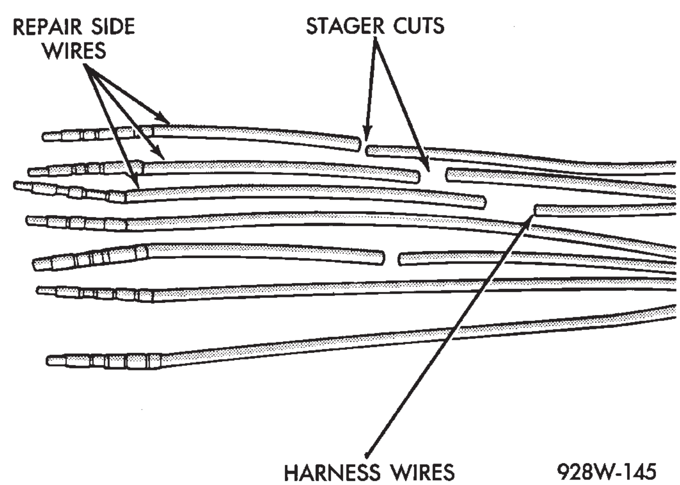


Fig. 17 Stagger Cutting Wires (Typical)

(7) Remove 1 inch of insulation from each wire.

(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 (Fig. 11 example 1).

(10) Push the two ends of wire together until the strands of wire are close to the insulation (Fig. 11 example 2).

(11) Twist the wires together (Fig. 11 example 3).

(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 REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector being repaired from its mating half.

(3) Remove connector locking wedge, if required (Fig. 14).

(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 (Figs. 15 and 16).

(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 (Fig. 11 example 1).

(11) Push the two ends of wire together until the strands of wire are close to the insulation (Fig. 11 example 2).

(12) Twist the wires together (Fig. 11 example 3).

(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 the 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. 18).

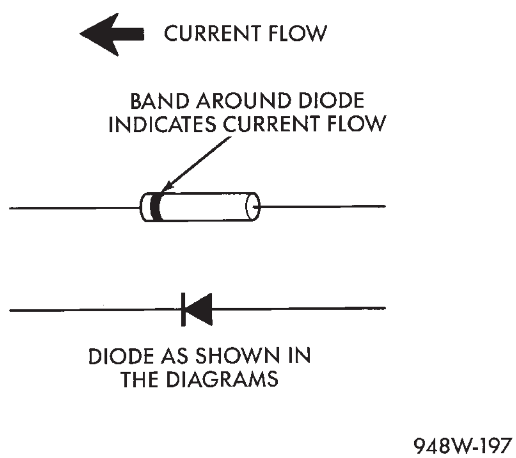


Fig. 18 Diode Identification

(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. Make sure the diode is completely sealed from the elements.

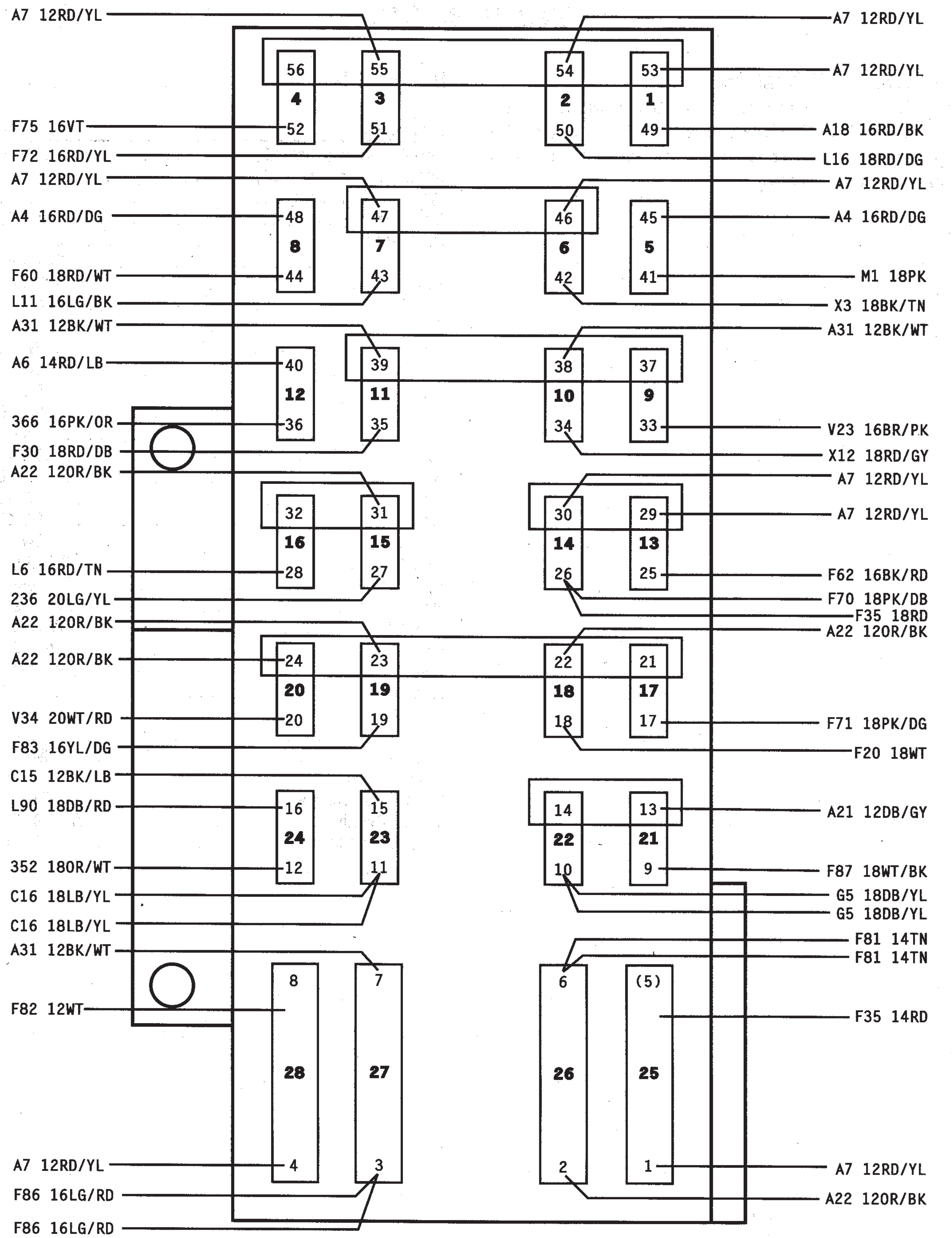
(8) Re-connect the battery, and test affected systems.

FUSE BLOCK

GENERAL INFORMATION

This section covers the Fuse Block and all related circuits involved with it. For additional information on system operation, refer to the appropriate section of the wiring diagrams

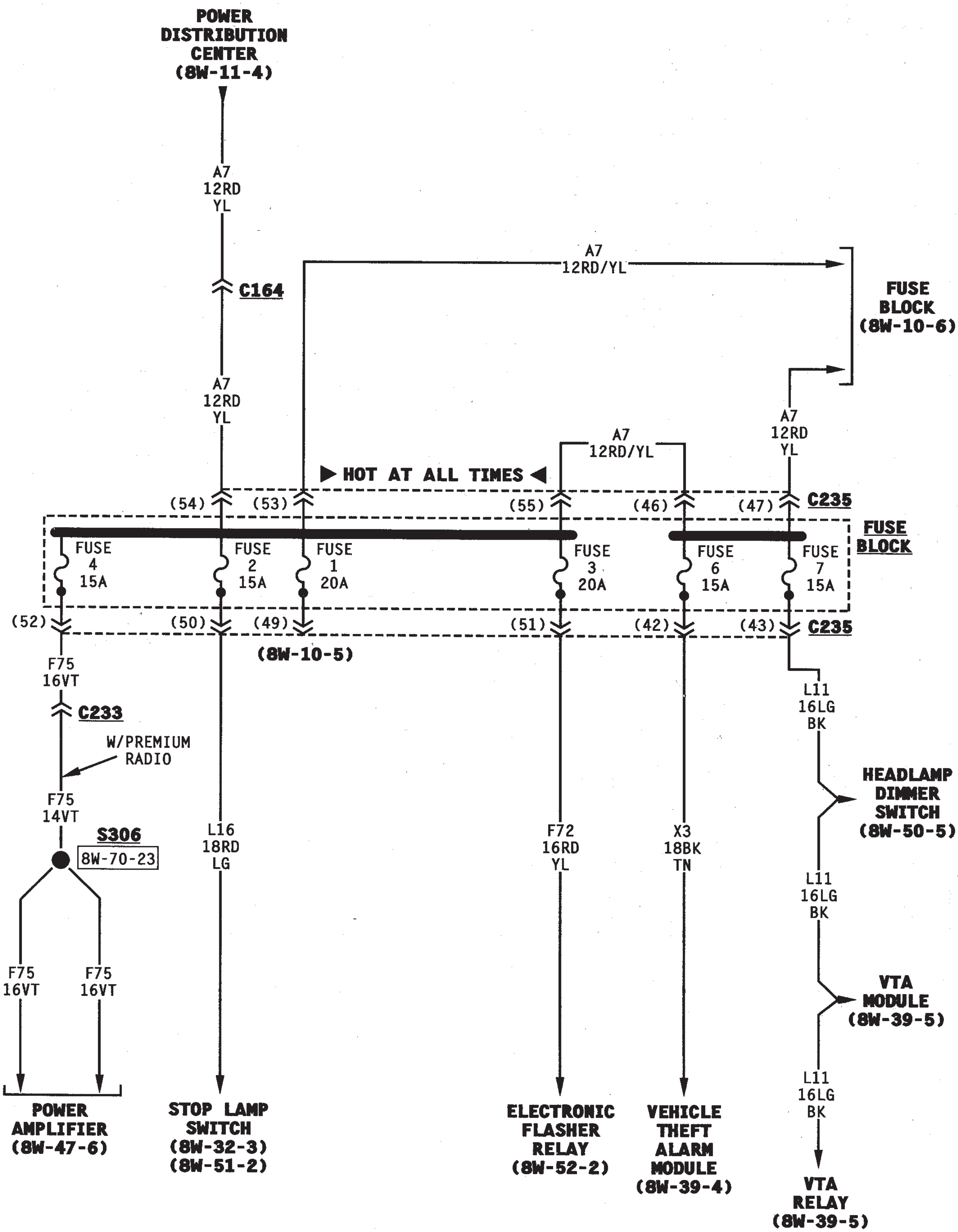
DIAGRAM INDEX



FRONT OF FUSE BLOCK

J958W-3

FUSE #	AMPS	COLOR	SECTION/PAGE
1	20	YELLOW	8W-10-5, 8W-47-7, 8W-53-3, 8W-53-5, 8W-54-2, 8W-54-4
2	15	LIGHT BLUE	8W-10-4, 8W-32-3, 8W-51-2
3	20	YELLOW	8W-10-4, 8W-52-2
4	15	LIGHT BLUE	8W-10-4, 8W-47-6
5	15	LIGHT BLUE	8W-10-7, 8W-44-4, 8W-44-5, 8W-44-6, 8W-44-10
6	15	LIGHT BLUE	8W-10-4, 8W-39-4
7	15	LIGHT BLUE	8W-10-4, 8W-52-3, 8W-52-4
8	15	LIGHT BLUE	8W-10-6, 8W-44-8, 8W-44-11, 8W-46-6, 8W-47-3, 8W-47-5, 8W-61-2, 8W-61-5, 8W-61-8, 8W-62-4
9	20	YELLOW	8W-10-8, 8W-53-5
10	10	RED	8W-10-8, 8W-47-3, 8W-47-5
11	15	LIGHT BLUE	8W-10-8, 8W-41-2
12	15	LIGHT BLUE	8W-10-7, 8W-10-12, 8W-39-3, 8W-46-4, 8W-47-3, 8W-47-5, 8W-49-4, 8W-50-6, 8W-50-7, 8W-50-9, 8W-50-10, 8W-51-3, 8W-51-5, 8W-51-6, 8W-54-3, 8W-54-4
13	20	YELLOW	8W-10-6, 8W-41-2
14	20	YELLOW	8W-10-6, 8W-40-8, 8W-61-5, 8W-61-6
15	3	VIOLET	8W-10-9, 8W-32-4
16	20	YELLOW	8W-10-9, 8W-52-2
17	7.5	BROWN	8W-10-10, 8W-42-6, 8W-42-11
18	15	LIGHT BLUE	8W-10-10, 8W-43-2
19	15	LIGHT BLUE	8W-10-10, 8W-10-11, 8W-44-9, 8W-44-11, 8W-46-4, 8W-49-3, 8W-50-9, 8W-50-10, 8W-61-2, 8W-62-2
20	10	RED	8W-10-10, 8W-33-2
21	15	LIGHT BLUE	8W-10-8, 8W-31-5, 8W-32-3, 8W-39-3, 8W-40-7, 8W-43-2, 8W-48-3, 8W-51-8
22	15	LIGHT BLUE	8W-10-8, 8W-40-4, 8W-43-2
23	15	LIGHT BLUE	8W-10-11, 8W-48-3, 8W-62-3
24	7.5	TAN	8W-10-12, 8W-50-10
25	30	SILVER	8W-10-6, 8W-63-3, 8W-63-4
26	30	SILVER	8W-10-9, 8W-60-3, 8W-64-2
27	10	SILVER	8W-10-8, 8W-39-3, 8W-53-3
28	30	SILVER	8W-10-6, 8W-10-11, 8W-48-2, 8W-62-2


POWER
DISTRIBUTION
CENTER
(8W-11-4)
A7
12RD
YL
C164
A7
12RD
YL
A7
12RD/YL
FUSE
BLOCK
(8W-10-6)
A7
12RD/YL
A7
12RD
YL
HOT AT ALL TIMES
(54)
(53)
(55)
(46)
(47)
C235
FUSE
BLOCK
FUSE
4
15A
FUSE
2
15A
FUSE
1
20A
FUSE
3
20A
FUSE
6
15A
FUSE
7
15A
(52)
(50)
(49)
(51)
(42)
(43)
C235
(8W-10-5)
F75
16VT
C233
W/PREMIUM
RADIO
F75
14VT
S306
8W-70-23
F75
16VT
F75
16VT
L16
18RD
LG
F72
16RD
YL
X3
18BK
TN
L11
16LG
BK
HEADLAMP
DIMMER
SWITCH
(8W-50-5)
L11
16LG
BK
VTA
MODULE
(8W-39-5)
L11
16LG
BK
POWER
AMPLIFIER
(8W-47-6)
STOP LAMP
SWITCH
(8W-32-3)
(8W-51-2)
ELECTRONIC
FLASHER
RELAY
(8W-52-2)
VEHICLE
THEFT
ALARM
MODULE
(8W-39-4)
VTA
RELAY
(8W-39-5)

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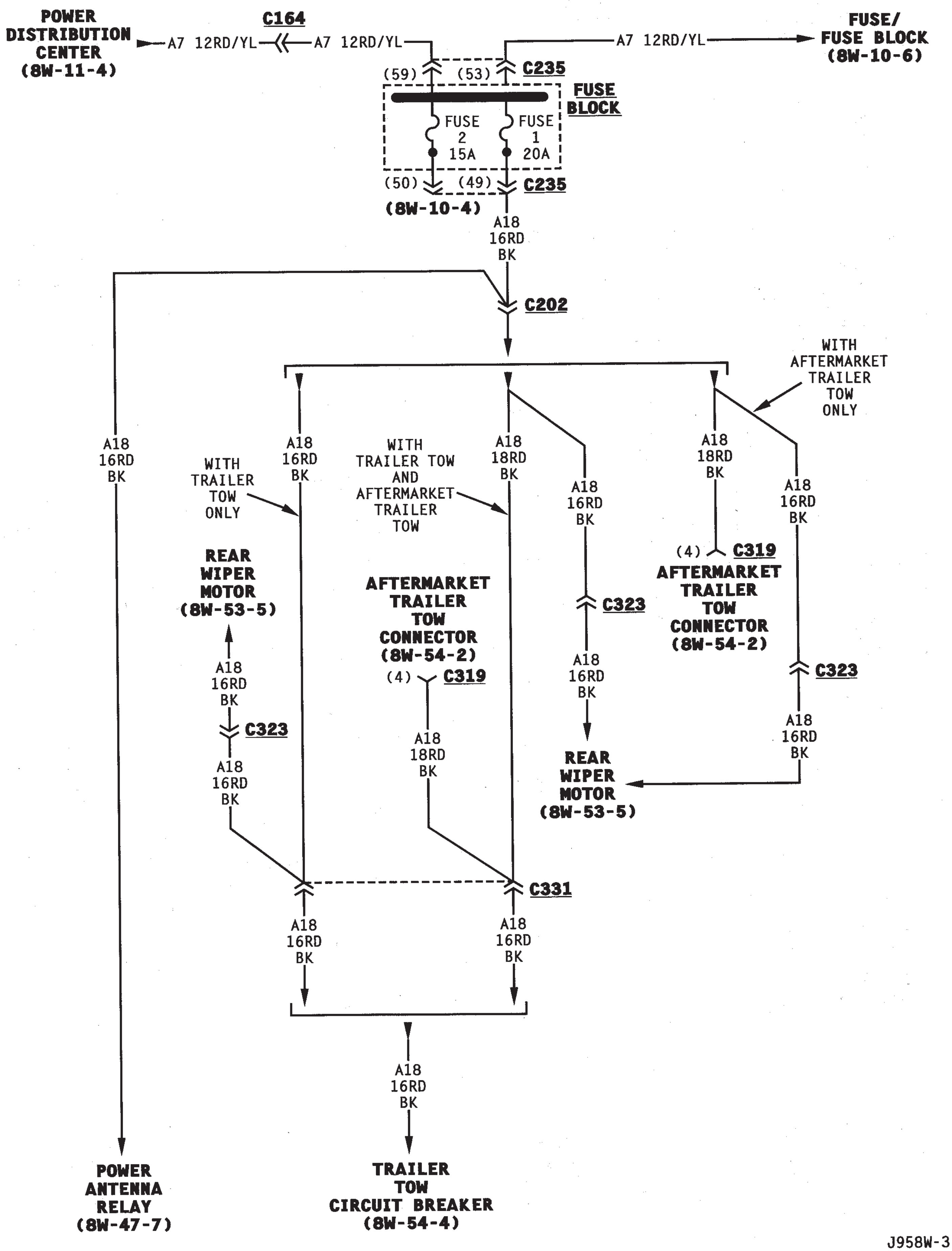
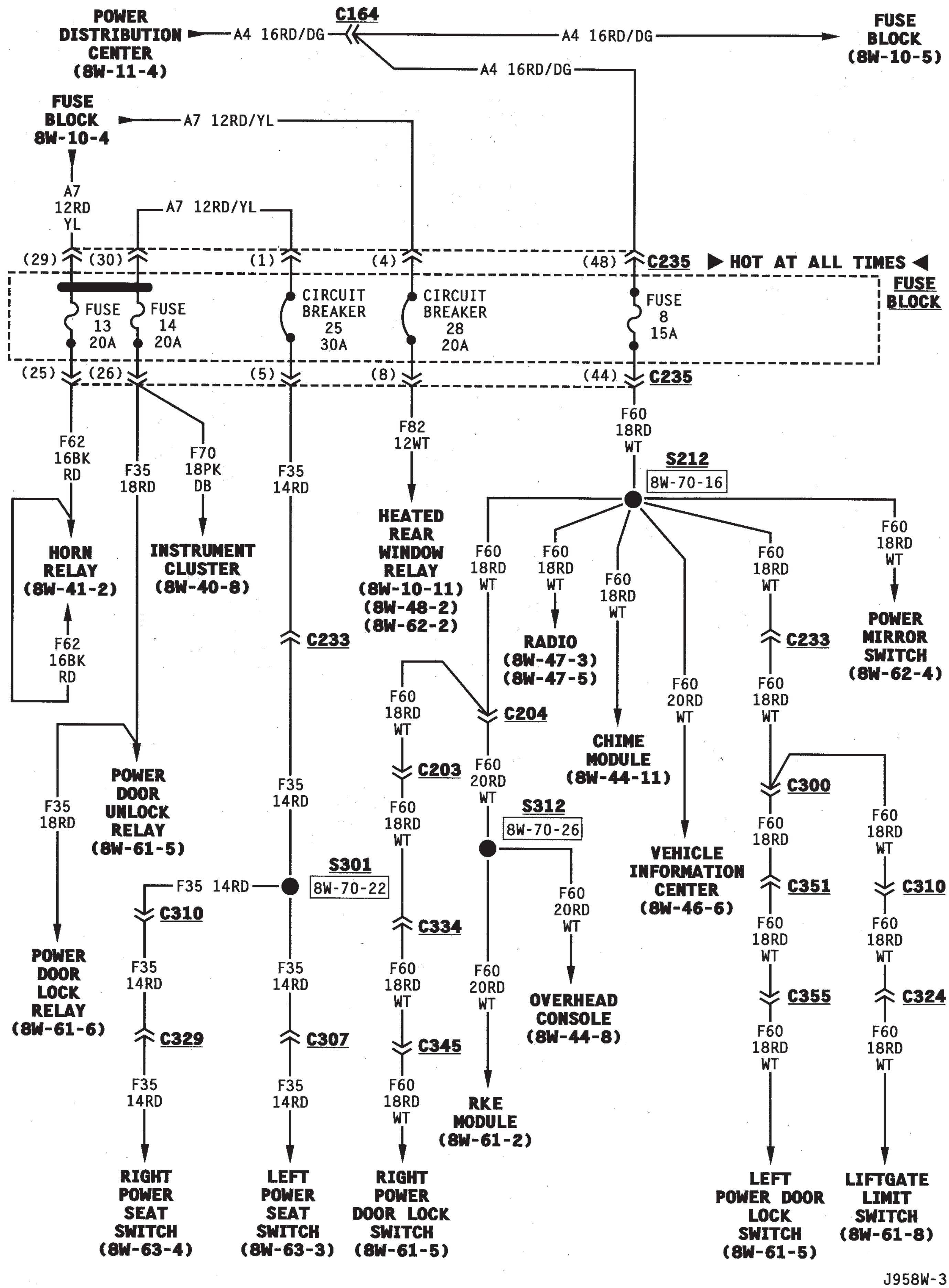
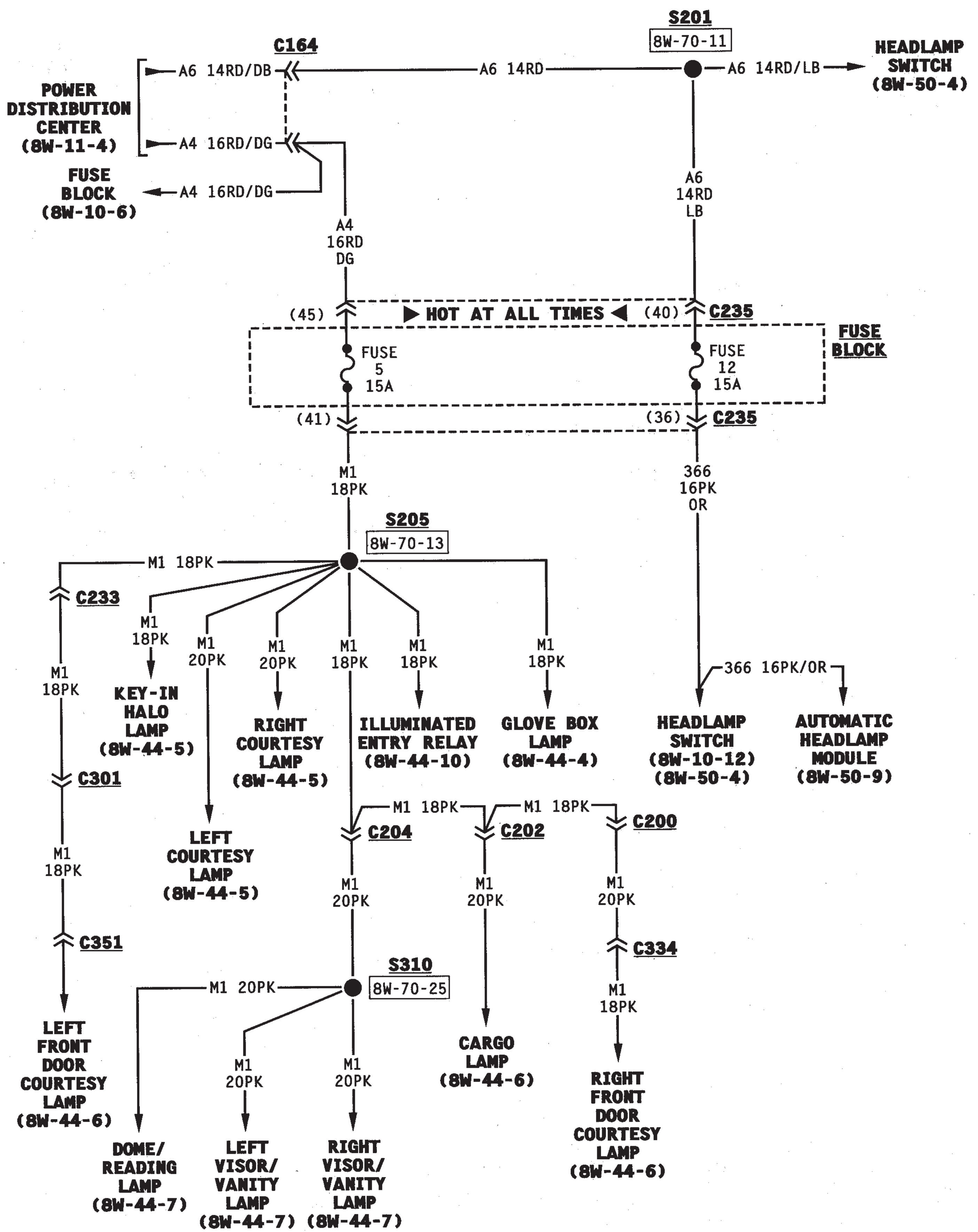
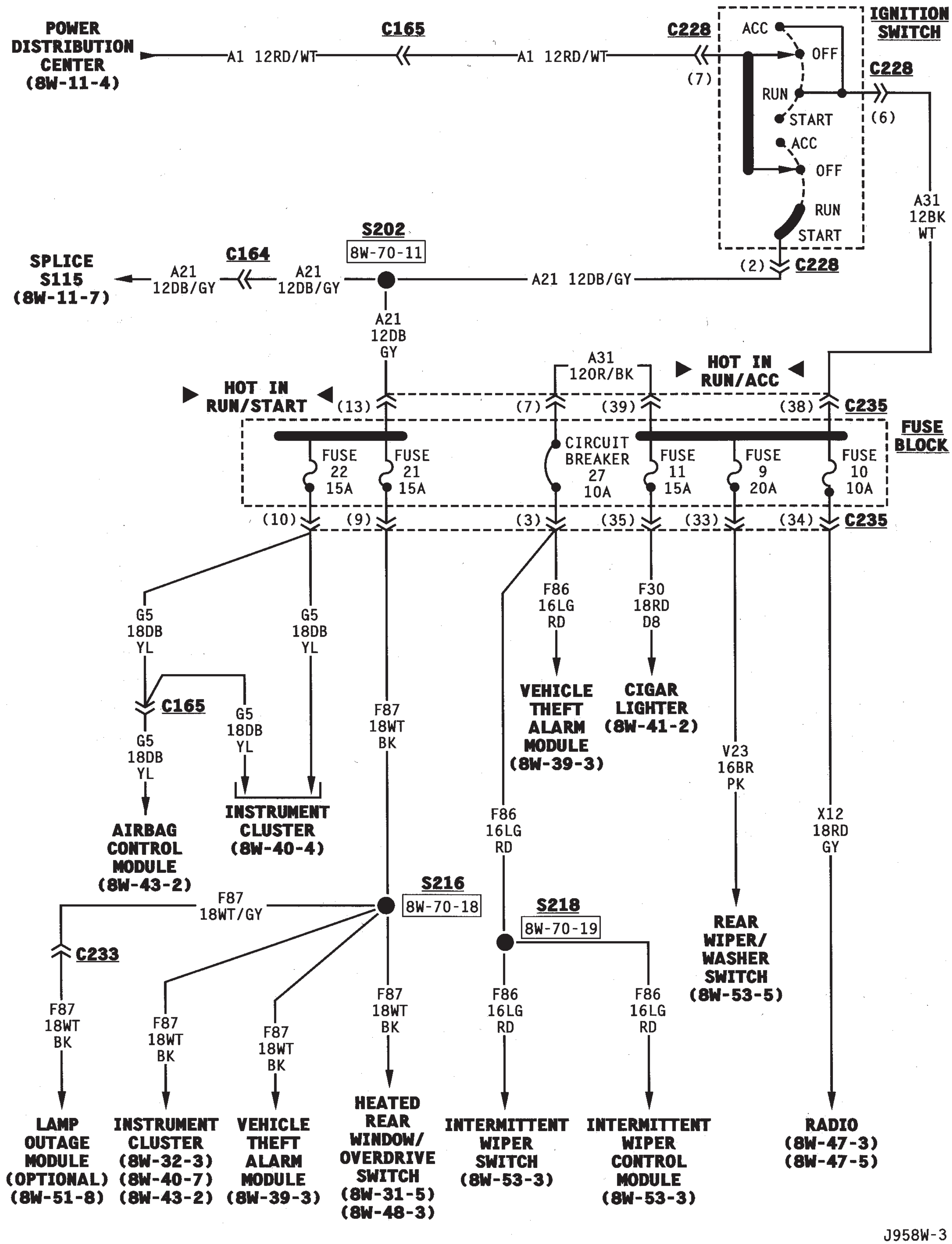

POWER DISTRIBUTION CENTER (8W-11-4)
A7 12RD/YL
C164
A7 12RD/YL
A7 12RD/YL
FUSE/ FUSE BLOCK (8W-10-6)
(59)
(53)
C235
FUSE BLOCK
FUSE 2 15A
FUSE 1 20A
(50)
(49)
C235
(8W-10-4)
A18 16RD BK
C202
WITH AFTERMARKET TRAILER TOW ONLY
A18 16RD BK
WITH TRAILER TOW ONLY
A18 16RD BK
WITH TRAILER TOW AND AFTERMARKET TRAILER TOW
A18 18RD BK
A18 16RD BK
A18 18RD BK
A18 16RD BK
(4) C319
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-2)
REAR WIPER MOTOR (8W-53-5)
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-2)
(4) C319
C323
A18 16RD BK
C323
A18 16RD BK
A18 16RD BK
C323
A18 16RD BK
A18 18RD BK
REAR WIPER MOTOR (8W-53-5)
C331
A18 16RD BK
A18 16RD BK
A18 16RD BK
POWER ANTENNA RELAY (8W-47-7)
TRAILER TOW CIRCUIT BREAKER (8W-54-4)
J958W-3

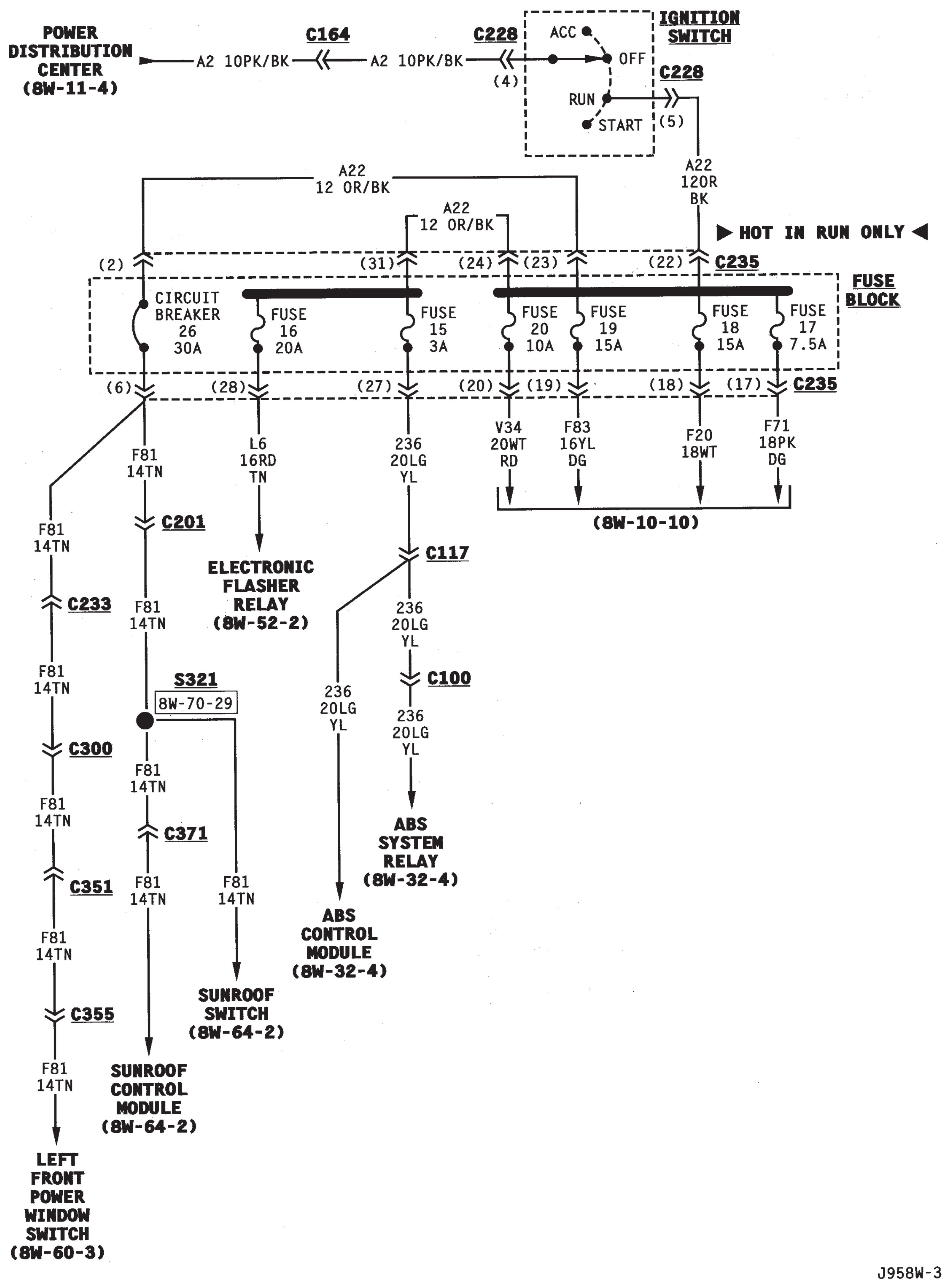

POWER DISTRIBUTION CENTER (8W-11-4)
C164
A4 16RD/DG
FUSE BLOCK (8W-10-5)
FUSE BLOCK 8W-10-4
A7 12RD/YL
A7 12RD YL
(29) (30) (1) (4) (48) C235
HOT AT ALL TIMES
FUSE BLOCK
FUSE 13 20A
FUSE 14 20A
CIRCUIT BREAKER 25 30A
CIRCUIT BREAKER 28 20A
FUSE 8 15A
(25) (26) (5) (8) (44) C235
F62 16BK RD
F35 18RD
F70 18PK DB
F35 14RD
F82 12WT
F60 18RD WT
S212
8W-70-16
HORN RELAY (8W-41-2)
INSTRUMENT CLUSTER (8W-40-8)
HEATED REAR WINDOW RELAY (8W-10-11) (8W-48-2) (8W-62-2)
F60 18RD WT
F60 20RD WT
RADIO (8W-47-3) (8W-47-5)
POWER MIRROR SWITCH (8W-62-4)
C233
C204
C203
C300
CHIME MODULE (8W-44-11)
S312
8W-70-26
POWER DOOR UNLOCK RELAY (8W-61-5)
S301
8W-70-22
F35 14RD
C310
C334
C351
VEHICLE INFORMATION CENTER (8W-46-6)
POWER DOOR LOCK RELAY (8W-61-6)
C329
C307
C345
C355
C324
F60 18RD
OVERHEAD CONSOLE (8W-44-8)
RKE MODULE (8W-61-2)
RIGHT POWER SEAT SWITCH (8W-63-4)
LEFT POWER SEAT SWITCH (8W-63-3)
RIGHT POWER DOOR LOCK SWITCH (8W-61-5)
LEFT POWER DOOR LOCK SWITCH (8W-61-5)
LIFTGATE LIMIT SWITCH (8W-61-8)
J958W-3

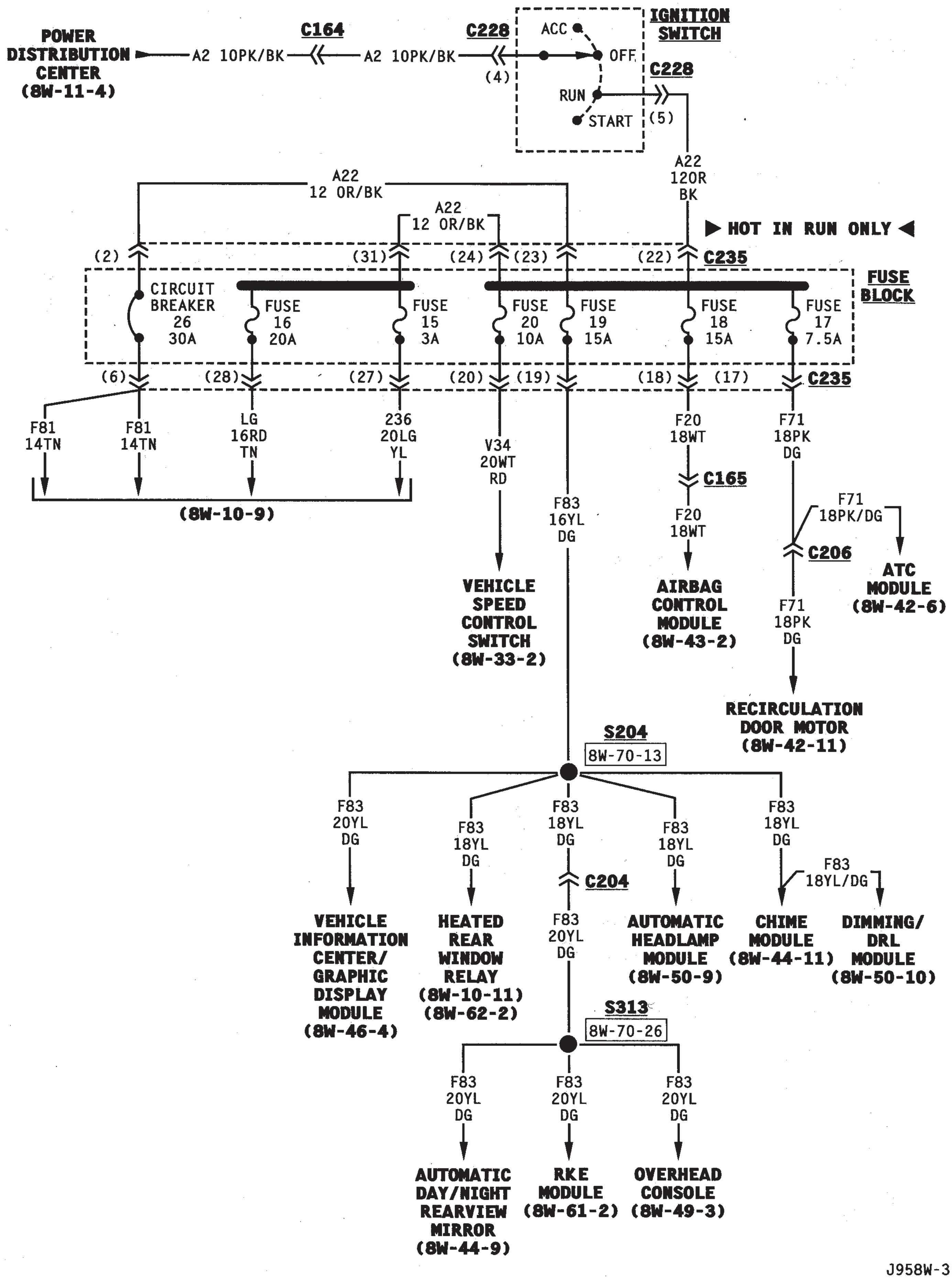

S201
8W-70-11
C164
A6 14RD/DB
A6 14RD
A6 14RD/LB
HEADLAMP SWITCH (8W-50-4)
POWER DISTRIBUTION CENTER (8W-11-4)
A4 16RD/DG
A4 16RD/DG
FUSE BLOCK (8W-10-6)
A4 16RD/DG
A4 16RD DG
A6 14RD LB
HOT AT ALL TIMES
(45)
(40)
C235
FUSE BLOCK
FUSE 5 15A
FUSE 12 15A
(41)
(36)
C235
M1 18PK
366 16PK OR
S205
8W-70-13
M1 18PK
C233
M1 18PK
M1 20PK
M1 20PK
M1 18PK
M1 18PK
M1 18PK
KEY-IN HALO LAMP (8W-44-5)
RIGHT COURTESY LAMP (8W-44-5)
ILLUMINATED ENTRY RELAY (8W-44-10)
GLOVE BOX LAMP (8W-44-4)
366 16PK/OR
HEADLAMP SWITCH (8W-10-12) (8W-50-4)
AUTOMATIC HEADLAMP MODULE (8W-50-9)
M1 18PK
C301
LEFT COURTESY LAMP (8W-44-5)
M1 18PK
M1 18PK
C204
C202
C200
M1 18PK
M1 20PK
M1 20PK
M1 20PK
C351
C334
S310
8W-70-25
M1 20PK
M1 18PK
LEFT FRONT DOOR COURTESY LAMP (8W-44-6)
M1 20PK
M1 20PK
CARGO LAMP (8W-44-6)
RIGHT FRONT DOOR COURTESY LAMP (8W-44-6)
DOME/ READING LAMP (8W-44-7)
LEFT VISOR/ VANITY LAMP (8W-44-7)
RIGHT VISOR/ VANITY LAMP (8W-44-7)

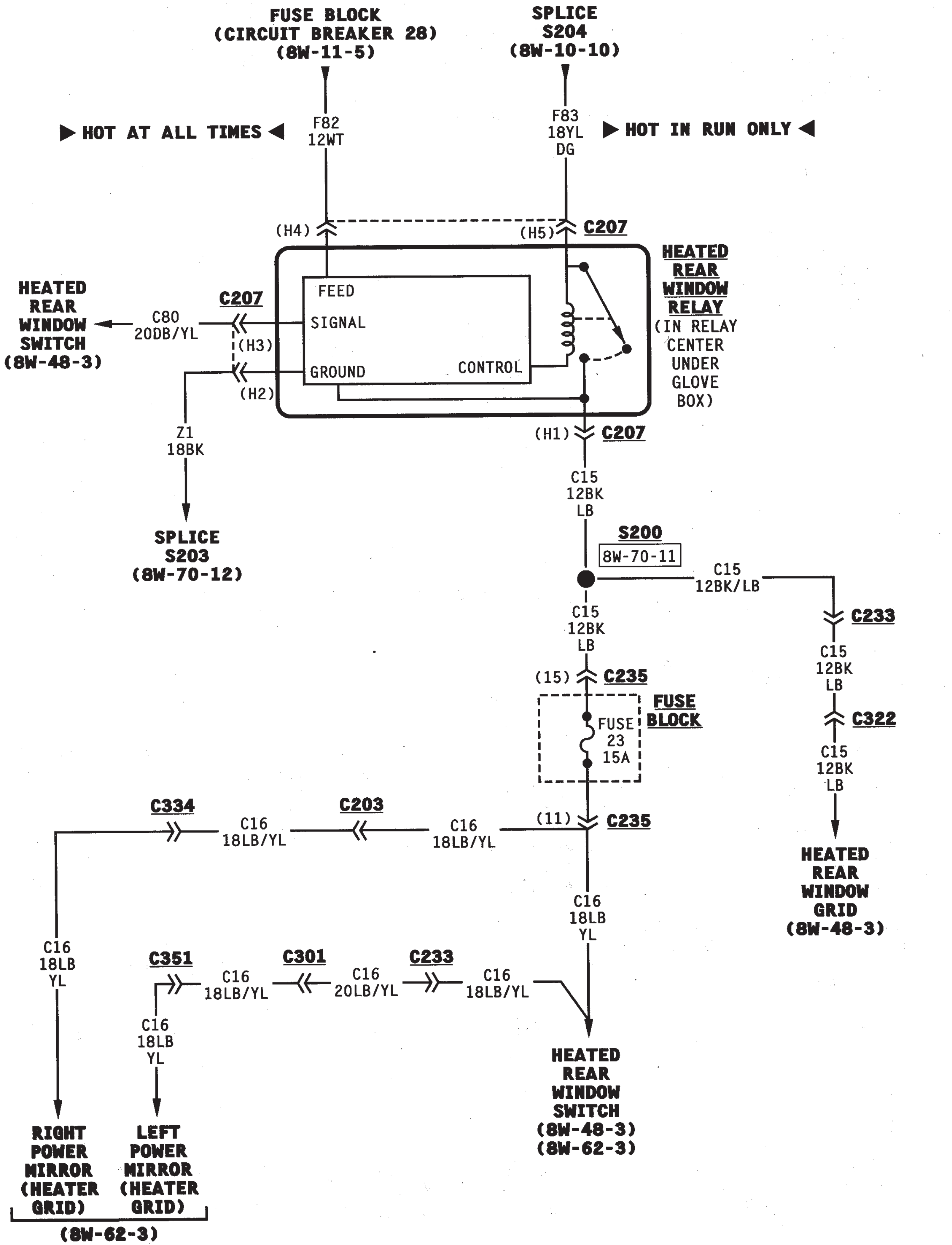
J958W-3



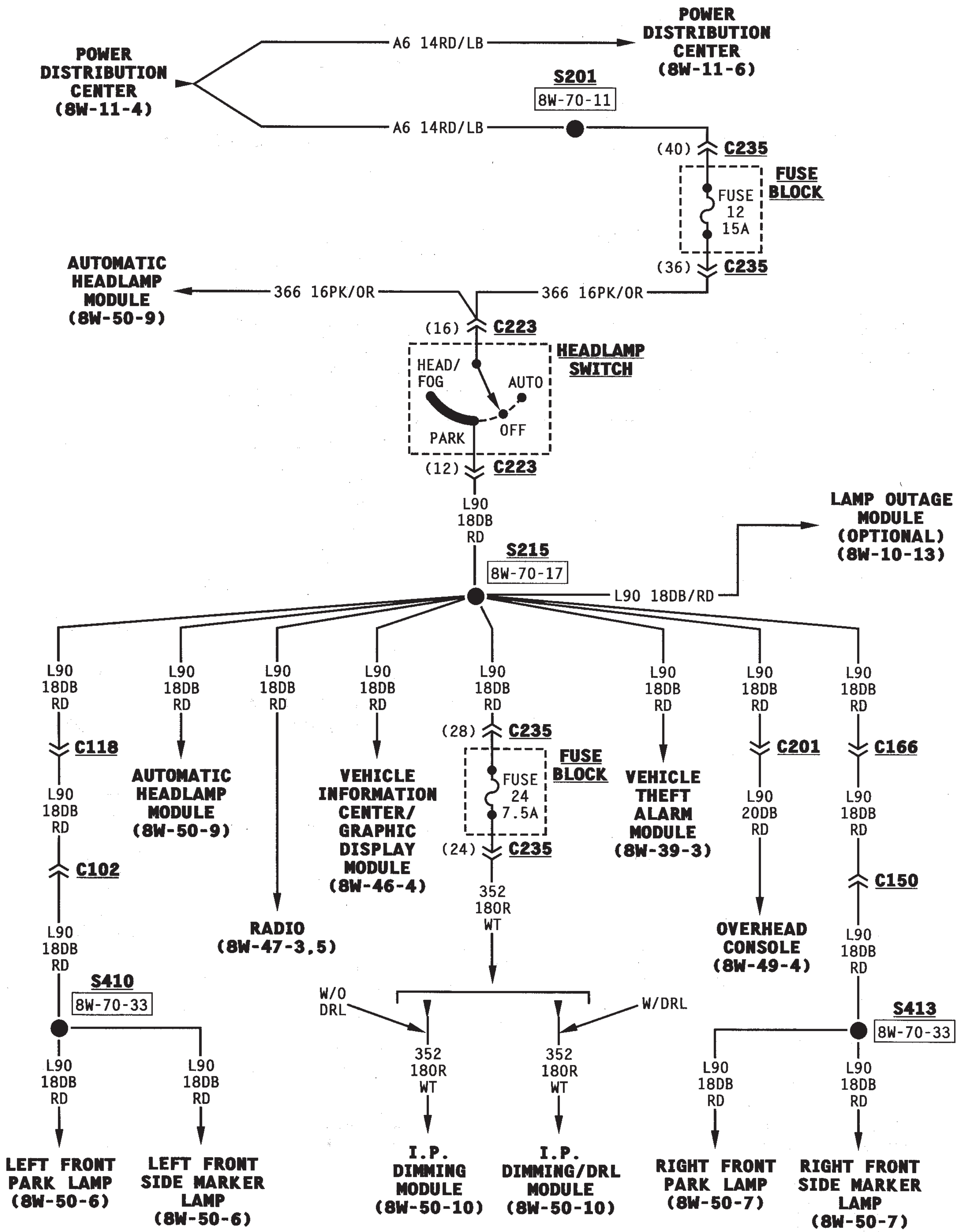
POWER DISTRIBUTION CENTER (8W-11-4)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
ACC
OFF
RUN
START
ACC
OFF
RUN
START
IGNITION SWITCH
C228
(6)
A31 12BK WT
SPLICE S115 (8W-11-7)
A21 12DB/GY
C164
A21 12DB/GY
S202
8W-70-11
A21 12DB/GY
(2)
C228
A21 12DB GY
A31 12OR/BK
HOT IN RUN/ACC
HOT IN RUN/START
(13)
(7)
(39)
(38)
C235
FUSE BLOCK
FUSE 22 15A
FUSE 21 15A
CIRCUIT BREAKER 27 10A
FUSE 11 15A
FUSE 9 20A
FUSE 10 10A
(10)
(9)
(3)
(35)
(33)
(34)
C235
G5 18DB YL
G5 18DB YL
F86 16LG RD
F30 18RD DB
C165
G5 18DB YL
G5 18DB YL
F87 18WT BK
VEHICLE THEFT ALARM MODULE (8W-39-3)
CIGAR LIGHTER (8W-41-2)
V23 16BR PK
AIRBAG CONTROL MODULE (8W-43-2)
INSTRUMENT CLUSTER (8W-40-4)
F86 16LG RD
X12 18RD GY
F87 18WT/GY
S216
8W-70-18
S218
8W-70-19
REAR WIPER/ WASHER SWITCH (8W-53-5)
C233
F87 18WT BK
F87 18WT BK
F87 18WT BK
F87 18WT BK
F86 16LG RD
F86 16LG RD
LAMP OUTAGE MODULE (OPTIONAL) (8W-51-8)
INSTRUMENT CLUSTER (8W-32-3) (8W-40-7) (8W-43-2)
VEHICLE THEFT ALARM MODULE (8W-39-3)
HEATED REAR WINDOW/ OVERDRIVE SWITCH (8W-31-5) (8W-48-3)
INTERMITTENT WIPER SWITCH (8W-53-3)
INTERMITTENT WIPER CONTROL MODULE (8W-53-3)
RADIO (8W-47-3) (8W-47-5)
J958W-3


POWER DISTRIBUTION CENTER (8W-11-4)
A2 10PK/BK
C164
A2 10PK/BK
C228
(4)
ACC
OFF
RUN
START
IGNITION SWITCH
C228
(5)
A22 12 OR/BK
A22 12 OR/BK
A22 12OR BK
HOT IN RUN ONLY
(2)
(31)
(24)
(23)
(22)
C235
FUSE BLOCK
CIRCUIT BREAKER 26 30A
FUSE 16 20A
FUSE 15 3A
FUSE 20 10A
FUSE 19 15A
FUSE 18 15A
FUSE 17 7.5A
(6)
(28)
(27)
(20)
(19)
(18)
(17)
C235
V34 20WT RD
F83 16YL DG
F20 18WT
F71 18PK DG
(8W-10-10)
F81 14TN
L6 16RD TN
236 20LG YL
C201
C117
ELECTRONIC FLASHER RELAY (8W-52-2)
F81 14TN
C233
F81 14TN
236 20LG YL
F81 14TN
C100
S321
8W-70-29
236 20LG YL
236 20LG YL
C300
F81 14TN
F81 14TN
C371
ABS SYSTEM RELAY (8W-32-4)
C351
F81 14TN
F81 14TN
F81 14TN
ABS CONTROL MODULE (8W-32-4)
SUNROOF SWITCH (8W-64-2)
C355
F81 14TN
SUNROOF CONTROL MODULE (8W-64-2)
LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
J958W-3


POWER DISTRIBUTION CENTER (8W-11-4)
A2 10PK/BK
C164
A2 10PK/BK
C228
(4)
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(5)
A22 12OR BK
A22 12 OR/BK
A22 12 OR/BK
HOT IN RUN ONLY
(2)
(31)
(24)
(23)
(22)
C235
FUSE BLOCK
CIRCUIT BREAKER 26 30A
FUSE 16 20A
FUSE 15 3A
FUSE 20 10A
FUSE 19 15A
FUSE 18 15A
FUSE 17 7.5A
(6)
(28)
(27)
(20)
(19)
(18)
(17)
C235
F81 14TN
F81 14TN
LG 16RD TN
236 20LG YL
V34 20WT RD
F83 16YL DG
F20 18WT
F71 18PK DG
(8W-10-9)
C165
F20 18WT
F71 18PK/DG
C206
ATC MODULE (8W-42-6)
VEHICLE SPEED CONTROL SWITCH (8W-33-2)
AIRBAG CONTROL MODULE (8W-43-2)
F71 18PK DG
RECIRCULATION DOOR MOTOR (8W-42-11)
S204
8W-70-13
F83 20YL DG
F83 18YL DG
F83 18YL DG
F83 18YL DG
F83 18YL DG
C204
F83 18YL/DG
VEHICLE INFORMATION CENTER/ GRAPHIC DISPLAY MODULE (8W-46-4)
HEATED REAR WINDOW RELAY (8W-10-11) (8W-62-2)
F83 20YL DG
AUTOMATIC HEADLAMP MODULE (8W-50-9)
CHIME MODULE (8W-44-11)
DIMMING/ DRL MODULE (8W-50-10)
S313
8W-70-26
F83 20YL DG
F83 20YL DG
F83 20YL DG
AUTOMATIC DAY/NIGHT REARVIEW MIRROR (8W-44-9)
RKE MODULE (8W-61-2)
OVERHEAD CONSOLE (8W-49-3)
J958W-3


FUSE BLOCK
(CIRCUIT BREAKER 28)
(8W-11-5)
SPLICE
S204
(8W-10-10)
HOT AT ALL TIMES
F82
12WT
F83
18YL
DG
HOT IN RUN ONLY
(H4)
(H5)
C207
HEATED
REAR
WINDOW
RELAY
(IN RELAY
CENTER
UNDER
GLOVE
BOX)
HEATED
REAR
WINDOW
SWITCH
(8W-48-3)
C80
20DB/YL
C207
FEED
SIGNAL
(H3)
GROUND
CONTROL
(H2)
Z1
18BK
SPLICE
S203
(8W-70-12)
(H1)
C207
C15
12BK
LB
S200
8W-70-11
C15
12BK/LB
C233
C15
12BK
LB
(15)
C235
FUSE
BLOCK
FUSE
23
15A
C322
C334
C203
C16
18LB/YL
C16
18LB/YL
(11)
C235
C16
18LB
YL
HEATED
REAR
WINDOW
GRID
(8W-48-3)
C351
C301
C233
C16
18LB/YL
C16
20LB/YL
C16
18LB/YL
C16
18LB
YL
HEATED
REAR
WINDOW
SWITCH
(8W-48-3)
(8W-62-3)
RIGHT
POWER
MIRROR
(HEATER
GRID)
LEFT
POWER
MIRROR
(HEATER
GRID)
(8W-62-3)

J958W-3


POWER DISTRIBUTION CENTER (8W-11-4)
A6 14RD/LB
POWER DISTRIBUTION CENTER (8W-11-6)
S201
8W-70-11
A6 14RD/LB
(40) C235
FUSE BLOCK
FUSE 12 15A
(36) C235
AUTOMATIC HEADLAMP MODULE (8W-50-9)
366 16PK/OR
366 16PK/OR
(16) C223
HEADLAMP SWITCH
HEAD/ FOG
AUTO
PARK
OFF
(12) C223
L90 18DB RD
S215
8W-70-17
L90 18DB/RD
LAMP OUTAGE MODULE (OPTIONAL) (8W-10-13)
L90 18DB RD
C118
L90 18DB RD
C102
L90 18DB RD
S410
8W-70-33
L90 18DB RD
L90 18DB RD
LEFT FRONT PARK LAMP (8W-50-6)
LEFT FRONT SIDE MARKER LAMP (8W-50-6)
L90 18DB RD
AUTOMATIC HEADLAMP MODULE (8W-50-9)
L90 18DB RD
RADIO (8W-47-3,5)
L90 18DB RD
VEHICLE INFORMATION CENTER/ GRAPHIC DISPLAY MODULE (8W-46-4)
L90 18DB RD
(28) C235
FUSE BLOCK
FUSE 24 7.5A
(24) C235
352 18OR WT
W/O DRL
W/DRL
352 18OR WT
352 18OR WT
I.P. DIMMING MODULE (8W-50-10)
I.P. DIMMING/DRL MODULE (8W-50-10)
L90 18DB RD
VEHICLE THEFT ALARM MODULE (8W-39-3)
L90 18DB RD
C201
L90 20DB RD
OVERHEAD CONSOLE (8W-49-4)
L90 18DB RD
C166
L90 18DB RD
C150
L90 18DB RD
S413
8W-70-33
L90 18DB RD
L90 18DB RD
RIGHT FRONT PARK LAMP (8W-50-7)
RIGHT FRONT SIDE MARKER LAMP (8W-50-7)

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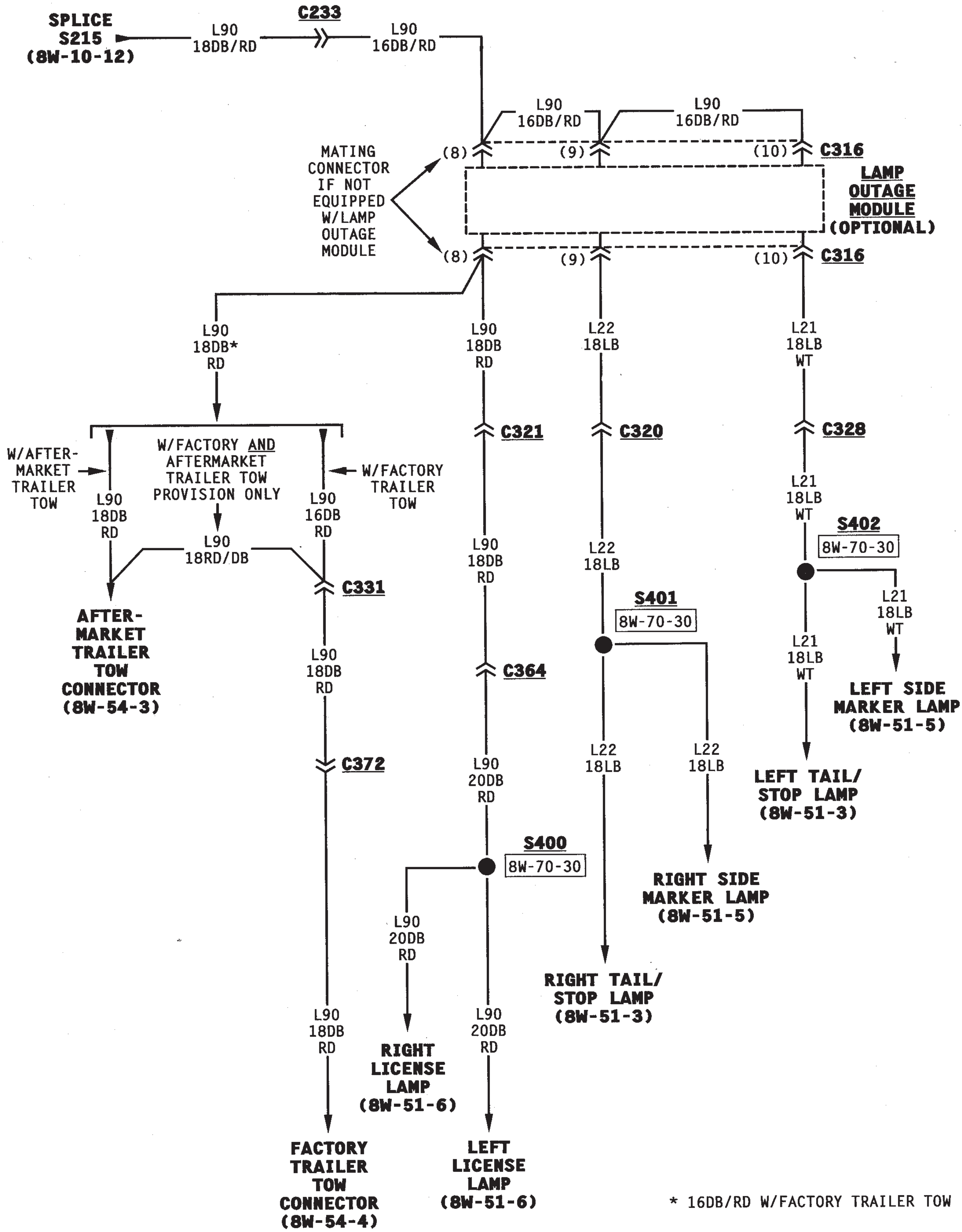
SPLICE
S215
(8W-10-12)
L90
18DB/RD
C233
L90
16DB/RD
L90
16DB/RD
L90
16DB/RD
MATING
CONNECTOR
IF NOT
EQUIPPED
W/LAMP
OUTAGE
MODULE
(8)
(9)
(10)
C316
LAMP
OUTAGE
MODULE
(OPTIONAL)
(8)
(9)
(10)
C316
L90
18DB*
RD
L90
18DB
RD
L22
18LB
L21
18LB
WT
W/AFTER-
MARKET
TRAILER
TOW
W/FACTORY AND
AFTERMARKET
TRAILER TOW
PROVISION ONLY
W/FACTORY
TRAILER
TOW
L90
18DB
RD
L90
16DB
RD
L90
18RD/DB
C321
C320
C328
L90
18DB
RD
L22
18LB
L21
18LB
WT
S402
8W-70-30
C331
AFTER-
MARKET
TRAILER
TOW
CONNECTOR
(8W-54-3)
S401
8W-70-30
L21
18LB
WT
L90
18DB
RD
C364
L21
18LB
WT
LEFT SIDE
MARKER LAMP
(8W-51-5)
C372
L90
20DB
RD
L22
18LB
L22
18LB
LEFT TAIL/
STOP LAMP
(8W-51-3)
S400
8W-70-30
RIGHT SIDE
MARKER LAMP
(8W-51-5)
L90
20DB
RD
RIGHT TAIL/
STOP LAMP
(8W-51-3)
L90
18DB
RD
L90
20DB
RD
RIGHT
LICENSE
LAMP
(8W-51-6)
FACTORY
TRAILER
TOW
CONNECTOR
(8W-54-4)
LEFT
LICENSE
LAMP
(8W-51-6)
* 16DB/RD W/FACTORY TRAILER TOW

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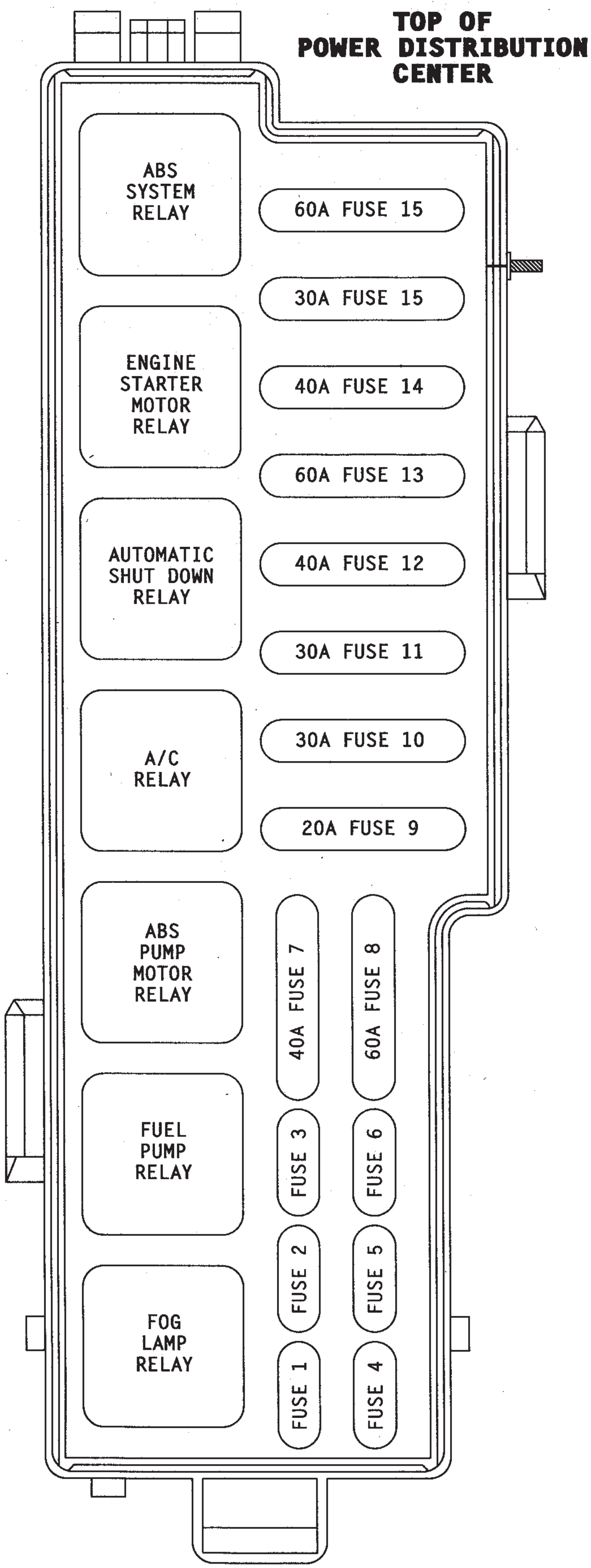
POWER DISTRIBUTION

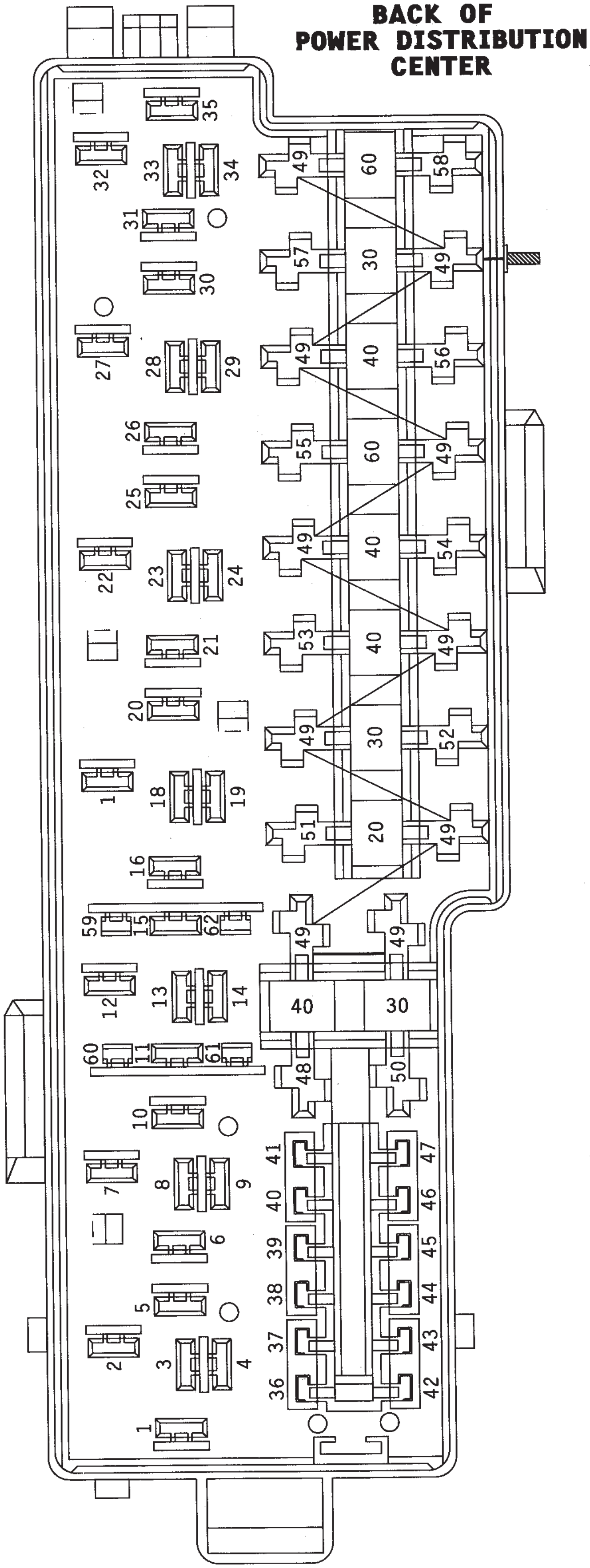
GENERAL INFORMATION

This section covers the power distribution center and all circuits involved with it. For additional information on system operation, refer to the appropriate section of the wiring diagrams.

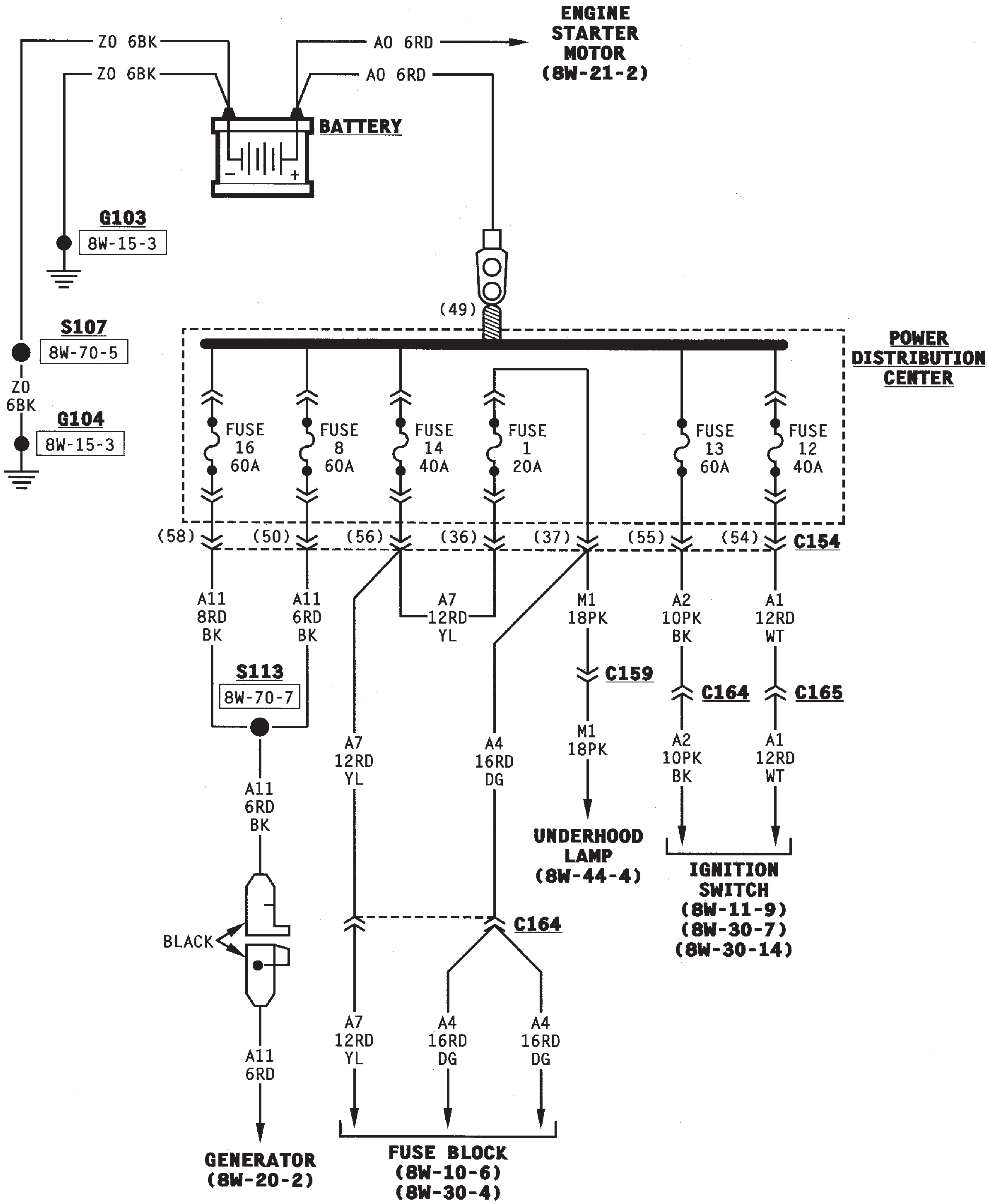
DIAGRAM INDEX


TOP OF
POWER DISTRIBUTION
CENTER
ABS
SYSTEM
RELAY
60A FUSE 15
30A FUSE 15
ENGINE
STARTER
MOTOR
RELAY
40A FUSE 14
60A FUSE 13
AUTOMATIC
SHUT DOWN
RELAY
40A FUSE 12
30A FUSE 11
A/C
RELAY
30A FUSE 10
20A FUSE 9
ABS
PUMP
MOTOR
RELAY
40A FUSE 7
60A FUSE 8
FUEL
PUMP
RELAY
FUSE 3
FUSE 6
FUSE 2
FUSE 5
FOG
LAMP
RELAY
FUSE 1
FUSE 4

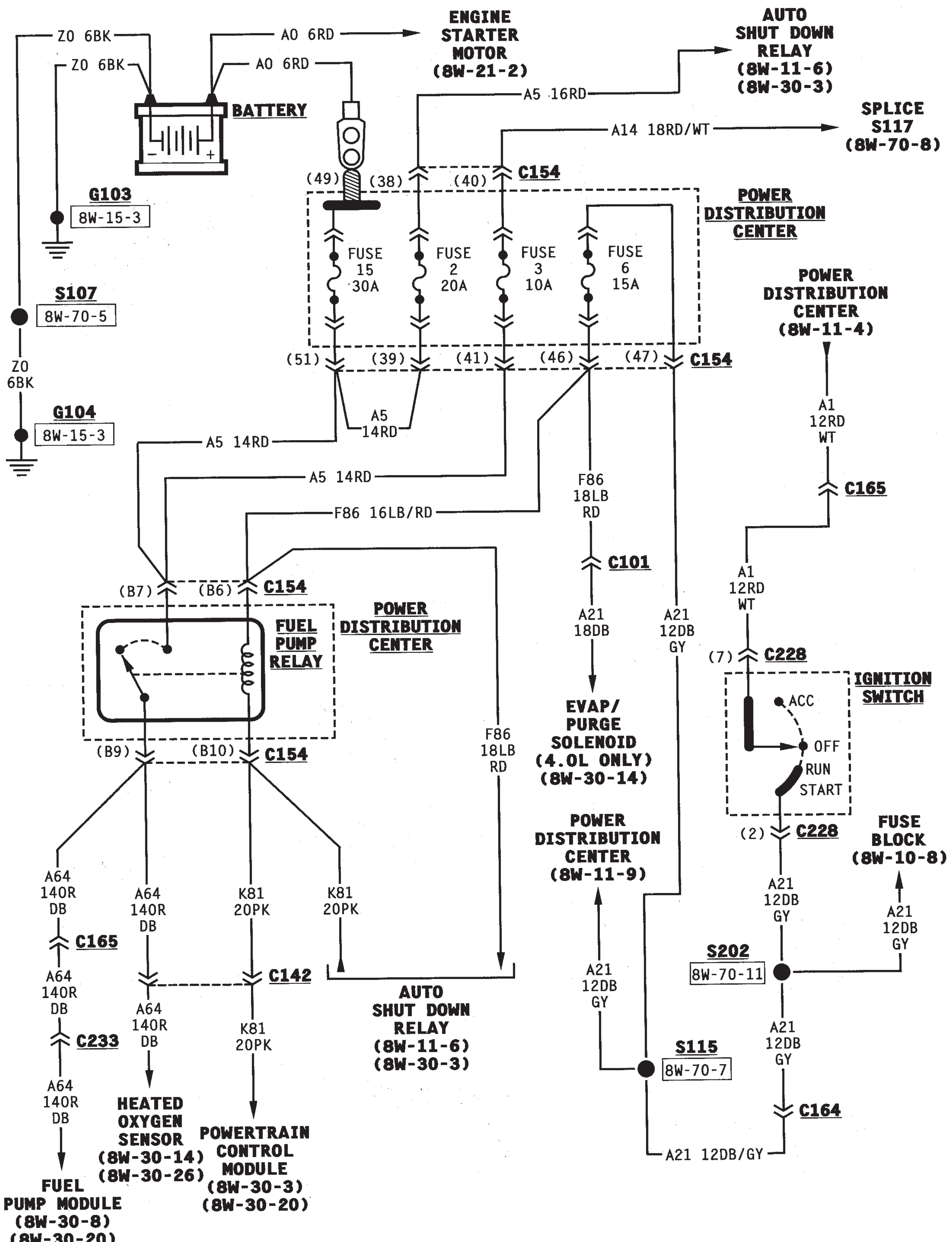
J958W-3


BACK OF
POWER DISTRIBUTION
CENTER
35
32
33
34
31
30
27
28
29
26
25
22
23
24
21
20
1
18
19
16
59
15
62
12
13
14
60
11
61
10
7
8
9
6
5
2
3
4
1
49
60
58
57
30
49
49
40
56
55
60
49
49
40
54
53
40
49
49
30
52
51
20
49
49
49
40
30
48
50
41
40
39
38
37
36
47
46
45
44
43
42

J958W-3


ENGINE STARTER MOTOR (8W-21-2)
Z0 6BK
Z0 6BK
A0 6RD
A0 6RD
BATTERY
G103
8W-15-3
S107
8W-70-5
Z0 6BK
G104
8W-15-3
(49)
POWER DISTRIBUTION CENTER
FUSE 16 60A
FUSE 8 60A
FUSE 14 40A
FUSE 1 20A
FUSE 13 60A
FUSE 12 40A
(58)
(50)
(56)
(36)
(37)
(55)
(54)
C154
A11 8RD BK
A11 6RD BK
A7 12RD YL
M1 18PK
A2 10PK BK
A1 12RD WT
S113
8W-70-7
C159
C164
C165
A11 6RD BK
A7 12RD YL
A4 16RD DG
M1 18PK
A2 10PK BK
A1 12RD WT
UNDERHOOD LAMP (8W-44-4)
IGNITION SWITCH (8W-11-9) (8W-30-7) (8W-30-14)
BLACK
C164
A11 6RD
A7 12RD YL
A4 16RD DG
A4 16RD DG
GENERATOR (8W-20-2)
FUSE BLOCK (8W-10-6) (8W-30-4)

J958W-3


Z0 6BK
Z0 6BK
A0 6RD
A0 6RD
ENGINE STARTER MOTOR (8W-21-2)
BATTERY
AUTO SHUT DOWN RELAY (8W-11-6) (8W-30-3)
A5 16RD
A14 18RD/WT
SPLICE S117 (8W-70-8)
G103
8W-15-3
(49)
(38)
(40)
C154
POWER DISTRIBUTION CENTER
FUSE 15 30A
FUSE 2 20A
FUSE 3 10A
FUSE 6 15A
S107
8W-70-5
Z0 6BK
G104
8W-15-3
(51)
(39)
(41)
(46)
(47)
C154
POWER DISTRIBUTION CENTER (8W-11-4)
A5 14RD
A5 14RD
A5 14RD
A1 12RD WT
C165
F86 16LB/RD
F86 18LB RD
C101
A1 12RD WT
(B7)
(B6)
C154
FUEL PUMP RELAY
POWER DISTRIBUTION CENTER
A21 18DB
A21 12DB GY
(7)
C228
IGNITION SWITCH
ACC
OFF
RUN
START
EVAP/ PURGE SOLENOID (4.0L ONLY) (8W-30-14)
F86 18LB RD
(B9)
(B10)
C154
(2)
C228
POWER DISTRIBUTION CENTER (8W-11-9)
FUSE BLOCK (8W-10-8)
A64 14OR DB
A64 14OR DB
K81 20PK
K81 20PK
A21 12DB GY
A21 12DB GY
C165
S202
8W-70-11
A64 14OR DB
C142
A21 12DB GY
A64 14OR DB
K81 20PK
AUTO SHUT DOWN RELAY (8W-11-6) (8W-30-3)
A21 12DB GY
C233
S115
8W-70-7
A64 14OR DB
HEATED OXYGEN SENSOR (8W-30-14) (8W-30-26)
POWERTRAIN CONTROL MODULE (8W-30-3) (8W-30-20)
C164
A21 12DB/GY
FUEL PUMP MODULE (8W-30-8) (8W-30-20)

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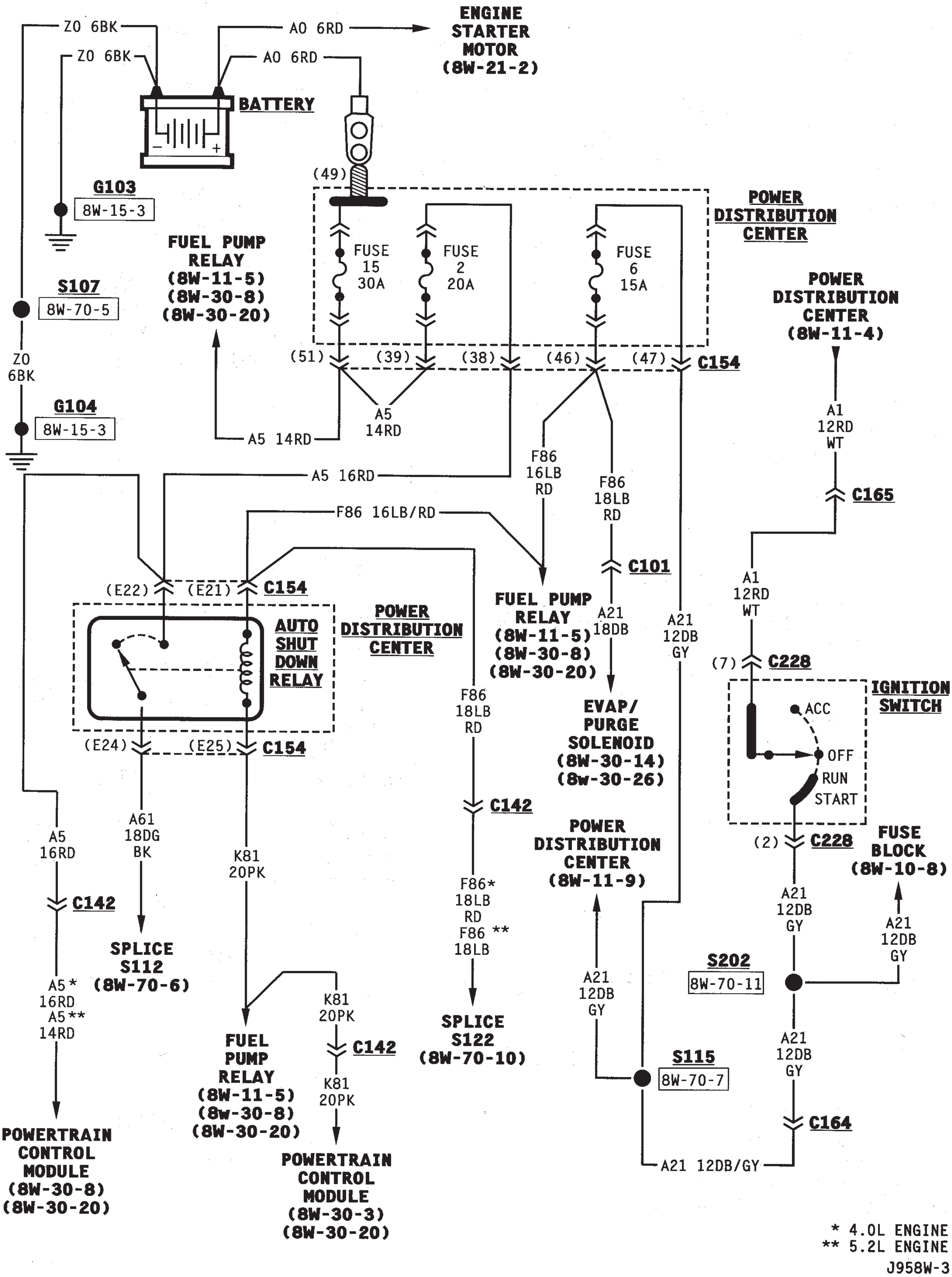
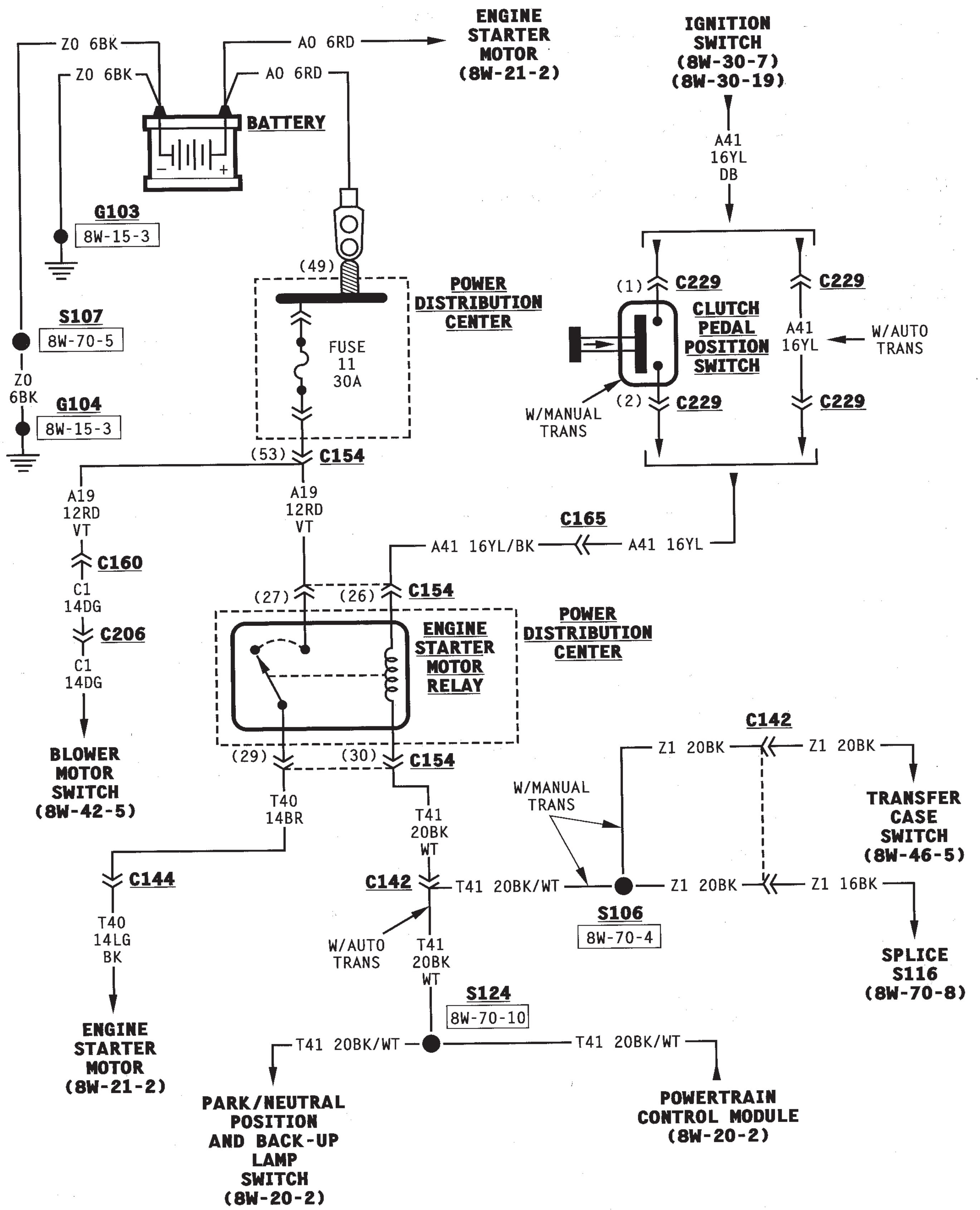
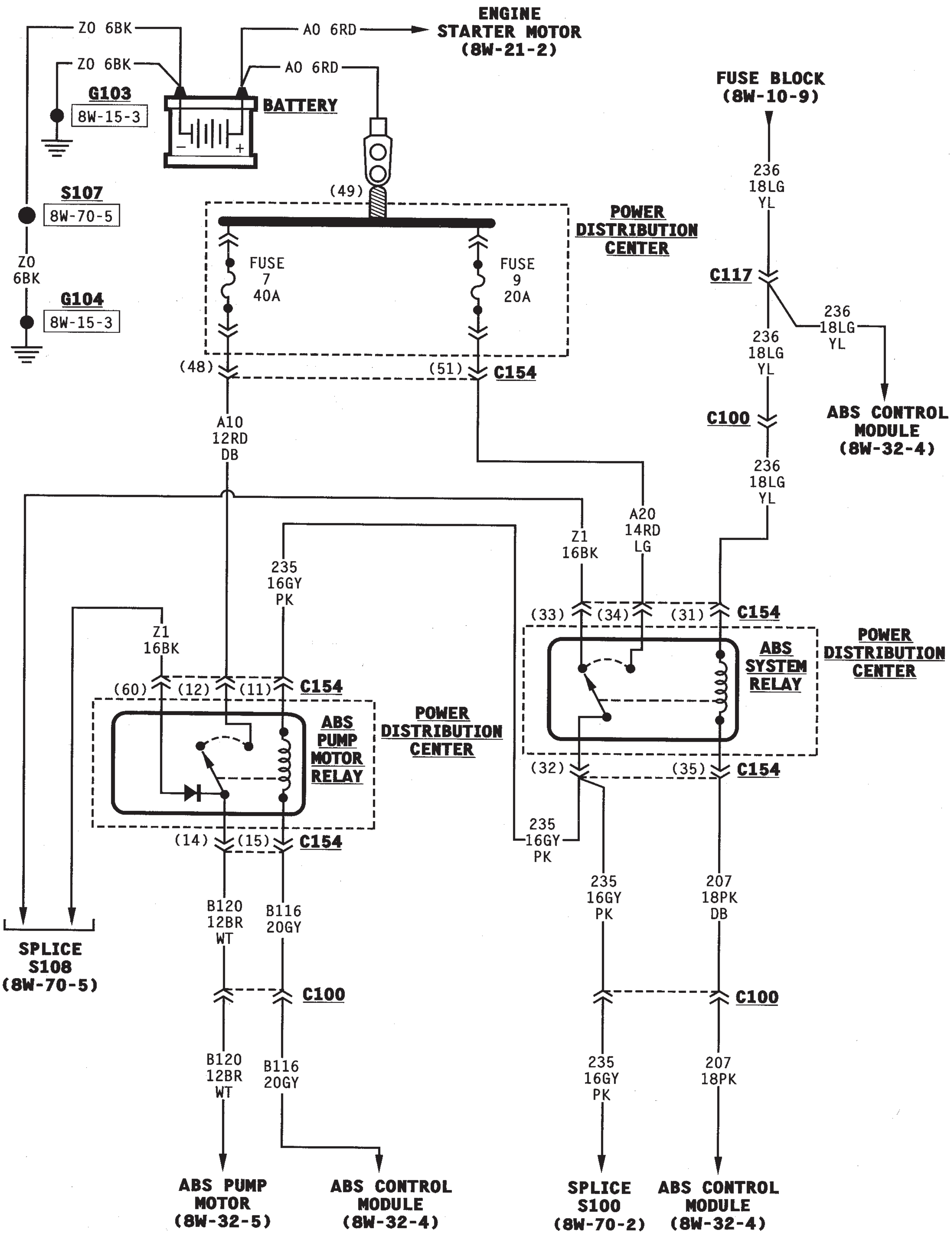


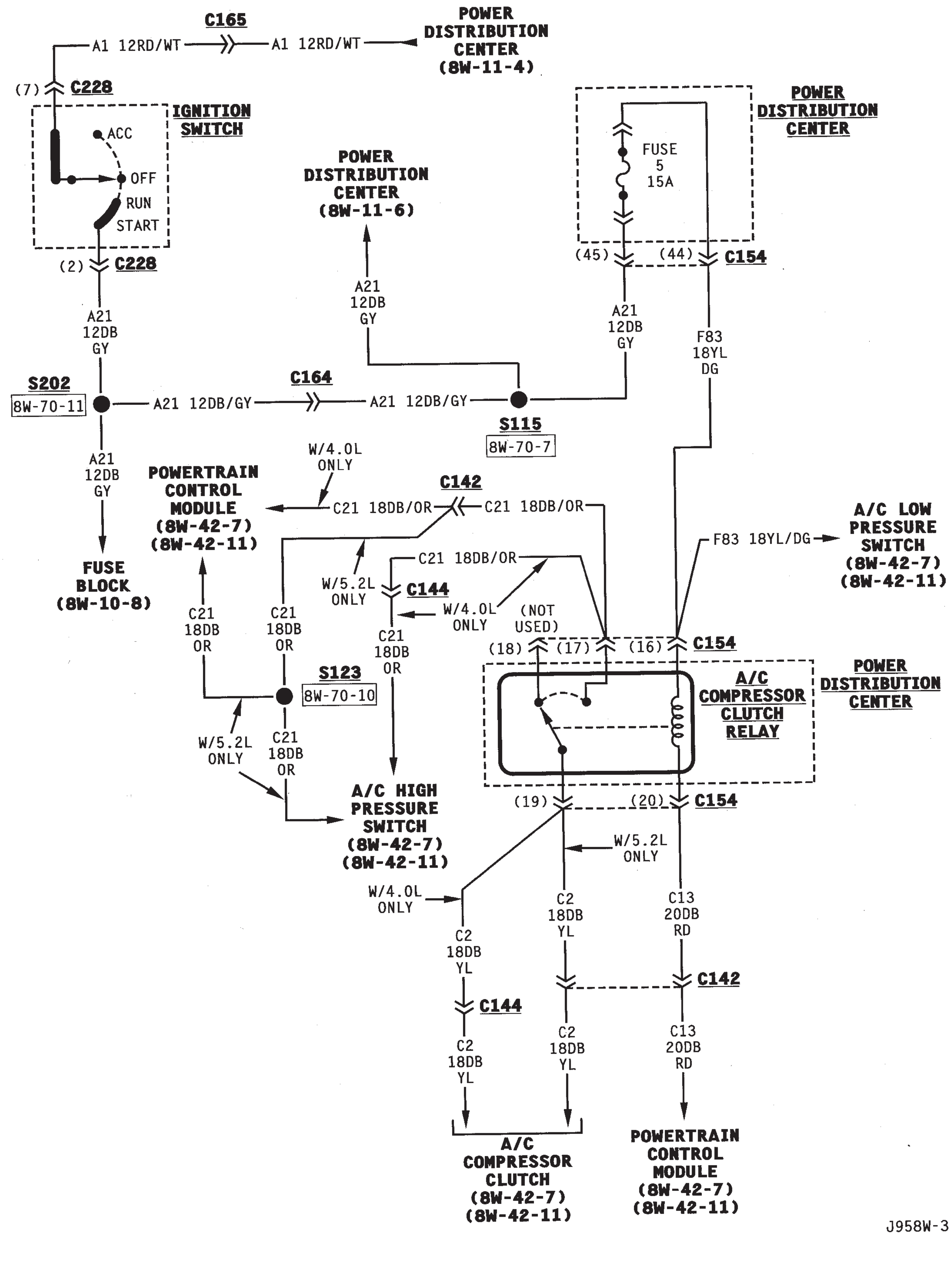
Z0 6BK
A0 6RD
ENGINE STARTER MOTOR (8W-21-2)
BATTERY
G103
8W-15-3
POWER DISTRIBUTION CENTER
FUSE 15 30A
FUSE 2 20A
FUSE 6 15A
(49)
(51) (39) (38) (46) (47)
C154
FUEL PUMP RELAY (8W-11-5) (8W-30-8) (8W-30-20)
S107
8W-70-5
Z0 6BK
G104
8W-15-3
A5 14RD
A5 16RD
F86 16LB RD
F86 18LB RD
F86 16LB/RD
POWER DISTRIBUTION CENTER (8W-11-4)
A1 12RD WT
C165
C101
(E22) (E21) C154
AUTO SHUT DOWN RELAY
POWER DISTRIBUTION CENTER
FUEL PUMP RELAY (8W-11-5) (8W-30-8) (8W-30-20)
A21 18DB
A21 12DB GY
(7) C228
IGNITION SWITCH
ACC
OFF
RUN
START
EVAP/ PURGE SOLENOID (8W-30-14) (8w-30-26)
(E24) (E25) C154
A61 18DG BK
K81 20PK
F86 18LB RD
C142
A5 16RD
POWER DISTRIBUTION CENTER (8W-11-9)
(2) C228
FUSE BLOCK (8W-10-8)
F86* 18LB RD F86 ** 18LB
A21 12DB GY
SPLICE S112 (8W-70-6)
A5* 16RD A5** 14RD
S202
8W-70-11
K81 20PK
C142
FUEL PUMP RELAY (8W-11-5) (8w-30-8) (8W-30-20)
SPLICE S122 (8W-70-10)
S115
8W-70-7
C164
A21 12DB/GY
POWERTRAIN CONTROL MODULE (8W-30-8) (8W-30-20)
POWERTRAIN CONTROL MODULE (8W-30-3) (8W-30-20)
* 4.0L ENGINE
** 5.2L ENGINE
J958W-3


Z0 6BK
Z0 6BK
A0 6RD
A0 6RD
ENGINE STARTER MOTOR (8W-21-2)
IGNITION SWITCH (8W-30-7) (8W-30-19)
BATTERY
A41 16YL DB
G103
8W-15-3
(49)
POWER DISTRIBUTION CENTER
C229
(1)
CLUTCH PEDAL POSITION SWITCH
A41 16YL
W/AUTO TRANS
S107
8W-70-5
FUSE 11 30A
Z0 6BK
G104
8W-15-3
(2)
W/MANUAL TRANS
(53)
C154
A19 12RD VT
A19 12RD VT
C165
A41 16YL/BK
A41 16YL
C160
C1 14DG
(27)
(26)
C154
C206
C1 14DG
ENGINE STARTER MOTOR RELAY
POWER DISTRIBUTION CENTER
BLOWER MOTOR SWITCH (8W-42-5)
(29)
(30)
C154
C142
Z1 20BK
Z1 20BK
W/MANUAL TRANS
TRANSFER CASE SWITCH (8W-46-5)
T40 14BR
T41 20BK WT
C144
C142
T41 20BK/WT
Z1 20BK
Z1 16BK
S106
8W-70-4
T40 14LG BK
W/AUTO TRANS
T41 20BK WT
SPLICE S116 (8W-70-8)
S124
8W-70-10
T41 20BK/WT
T41 20BK/WT
ENGINE STARTER MOTOR (8W-21-2)
PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH (8W-20-2)
POWERTRAIN CONTROL MODULE (8W-20-2)

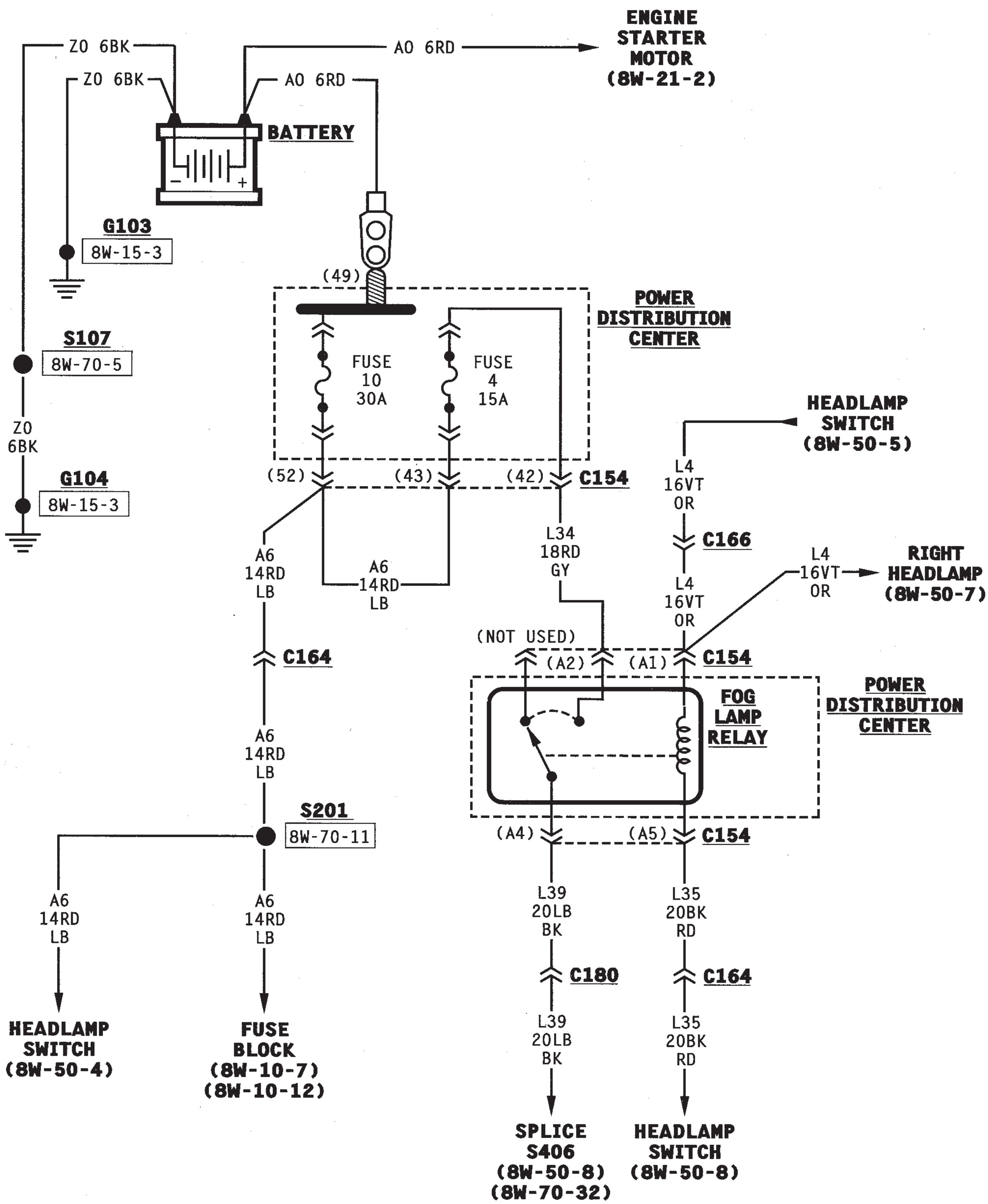
J958W-3


Z0 6BK
A0 6RD
ENGINE STARTER MOTOR (8W-21-2)
Z0 6BK
A0 6RD
G103
8W-15-3
BATTERY
(49)
S107
8W-70-5
Z0 6BK
G104
8W-15-3
POWER DISTRIBUTION CENTER
FUSE 7 40A
FUSE 9 20A
(48)
(51)
C154
FUSE BLOCK (8W-10-9)
236 18LG YL
C117
236 18LG YL
236 18LG YL
C100
ABS CONTROL MODULE (8W-32-4)
236 18LG YL
A10 12RD DB
Z1 16BK
A20 14RD LG
235 16GY PK
(33)
(34)
(31)
C154
ABS SYSTEM RELAY
POWER DISTRIBUTION CENTER
Z1 16BK
(60)
(12)
(11)
C154
ABS PUMP MOTOR RELAY
POWER DISTRIBUTION CENTER
(32)
(35)
C154
(14)
(15)
C154
235 16GY PK
235 16GY PK
207 18PK DB
B120 12BR WT
B116 20GY
SPLICE S108 (8W-70-5)
C100
C100
B120 12BR WT
B116 20GY
235 16GY PK
207 18PK
ABS PUMP MOTOR (8W-32-5)
ABS CONTROL MODULE (8W-32-4)
SPLICE S100 (8W-70-2)
ABS CONTROL MODULE (8W-32-4)

J958W-3


C165
A1 12RD/WT
A1 12RD/WT
POWER DISTRIBUTION CENTER (8W-11-4)
(7) C228
IGNITION SWITCH
ACC
OFF
RUN
START
(2) C228
A21 12DB GY
S202
8W-70-11
A21 12DB/GY
C164
A21 12DB/GY
S115
8W-70-7
POWER DISTRIBUTION CENTER (8W-11-6)
A21 12DB GY
POWER DISTRIBUTION CENTER
FUSE 5 15A
(45)
(44)
C154
A21 12DB GY
F83 18YL DG
A21 12DB GY
FUSE BLOCK (8W-10-8)
POWERTRAIN CONTROL MODULE (8W-42-7) (8W-42-11)
W/4.0L ONLY
C142
C21 18DB/OR
C21 18DB/OR
W/5.2L ONLY
C21 18DB/OR
C144
W/4.0L ONLY
(NOT USED)
F83 18YL/DG
A/C LOW PRESSURE SWITCH (8W-42-7) (8W-42-11)
C21 18DB OR
C21 18DB OR
C21 18DB OR
(18)
(17)
(16)
C154
S123
8W-70-10
A/C COMPRESSOR CLUTCH RELAY
POWER DISTRIBUTION CENTER
W/5.2L ONLY
C21 18DB OR
A/C HIGH PRESSURE SWITCH (8W-42-7) (8W-42-11)
(19)
(20)
C154
W/5.2L ONLY
W/4.0L ONLY
C2 18DB YL
C13 20DB RD
C2 18DB YL
C142
C144
C2 18DB YL
C2 18DB YL
C13 20DB RD
A/C COMPRESSOR CLUTCH (8W-42-7) (8W-42-11)
POWERTRAIN CONTROL MODULE (8W-42-7) (8W-42-11)

J958W-3


Z0 6BK
Z0 6BK
A0 6RD
A0 6RD
ENGINE STARTER MOTOR (8W-21-2)
BATTERY
G103
8W-15-3
(49)
POWER DISTRIBUTION CENTER
S107
8W-70-5
FUSE 10 30A
FUSE 4 15A
Z0 6BK
G104
8W-15-3
(52)
(43)
(42)
C154
HEADLAMP SWITCH (8W-50-5)
L4 16VT OR
C166
L4 16VT OR
L4 16VT OR
RIGHT HEADLAMP (8W-50-7)
A6 14RD LB
A6 14RD LB
L34 18RD GY
(NOT USED)
(A2)
(A1)
C154
C164
A6 14RD LB
FOG LAMP RELAY
POWER DISTRIBUTION CENTER
S201
8W-70-11
(A4)
(A5)
C154
A6 14RD LB
A6 14RD LB
L39 20LB BK
L35 20BK RD
C180
C164
L39 20LB BK
L35 20BK RD
HEADLAMP SWITCH (8W-50-4)
FUSE BLOCK (8W-10-7) (8W-10-12)
SPLICE S406 (8W-50-8) (8W-70-32)
HEADLAMP SWITCH (8W-50-8)

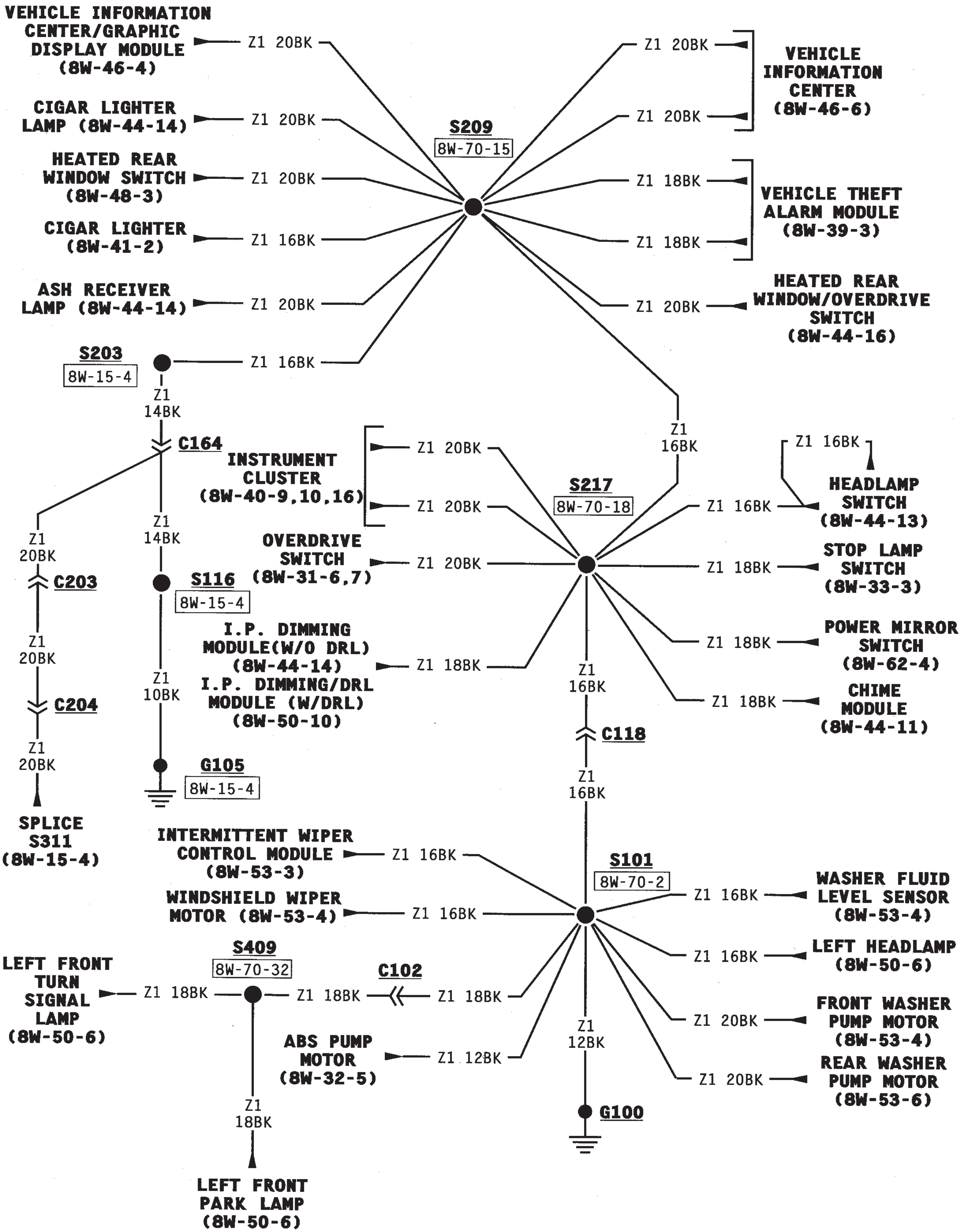
J958W-3

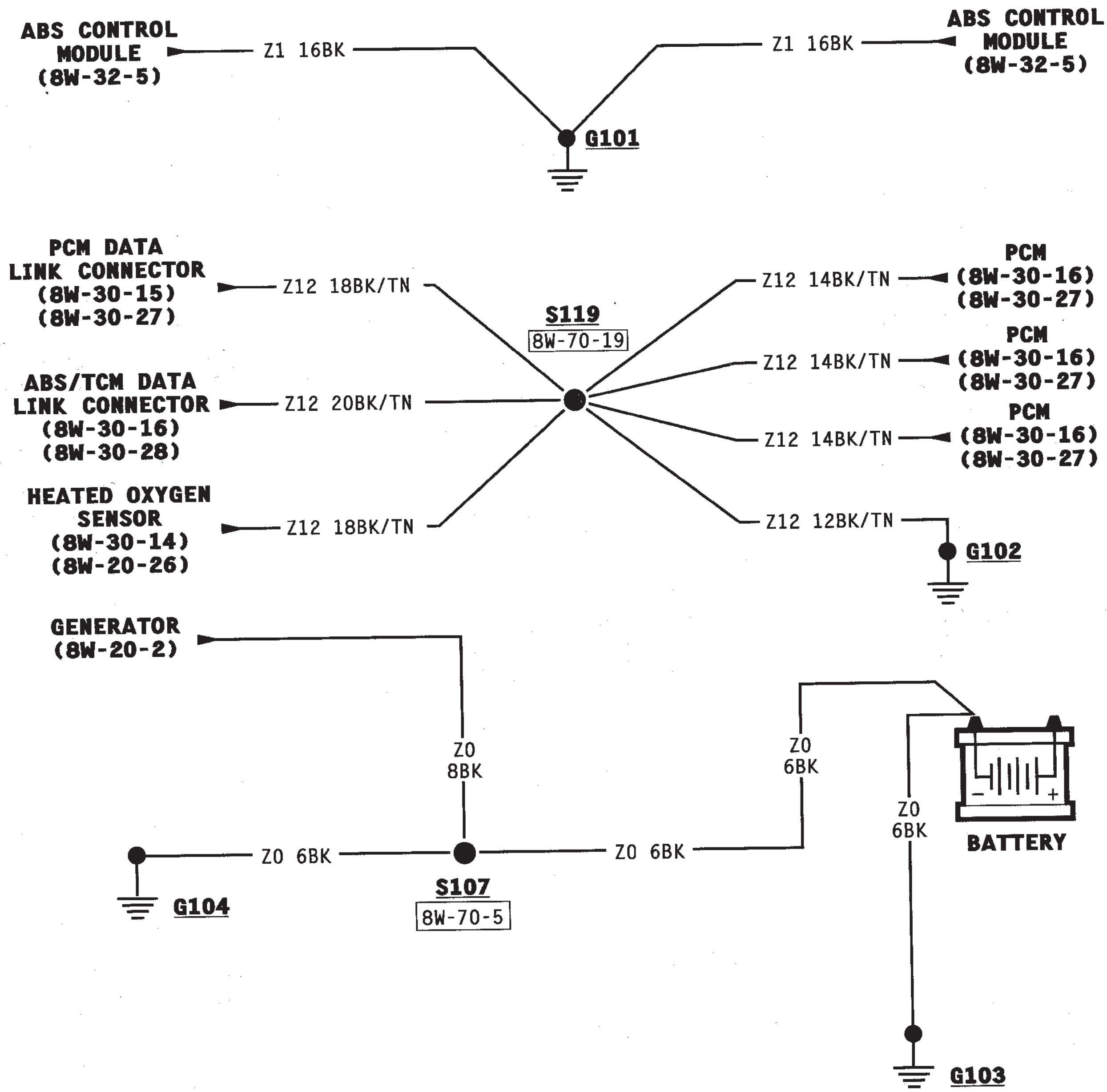
GROUND DISTRIBUTION

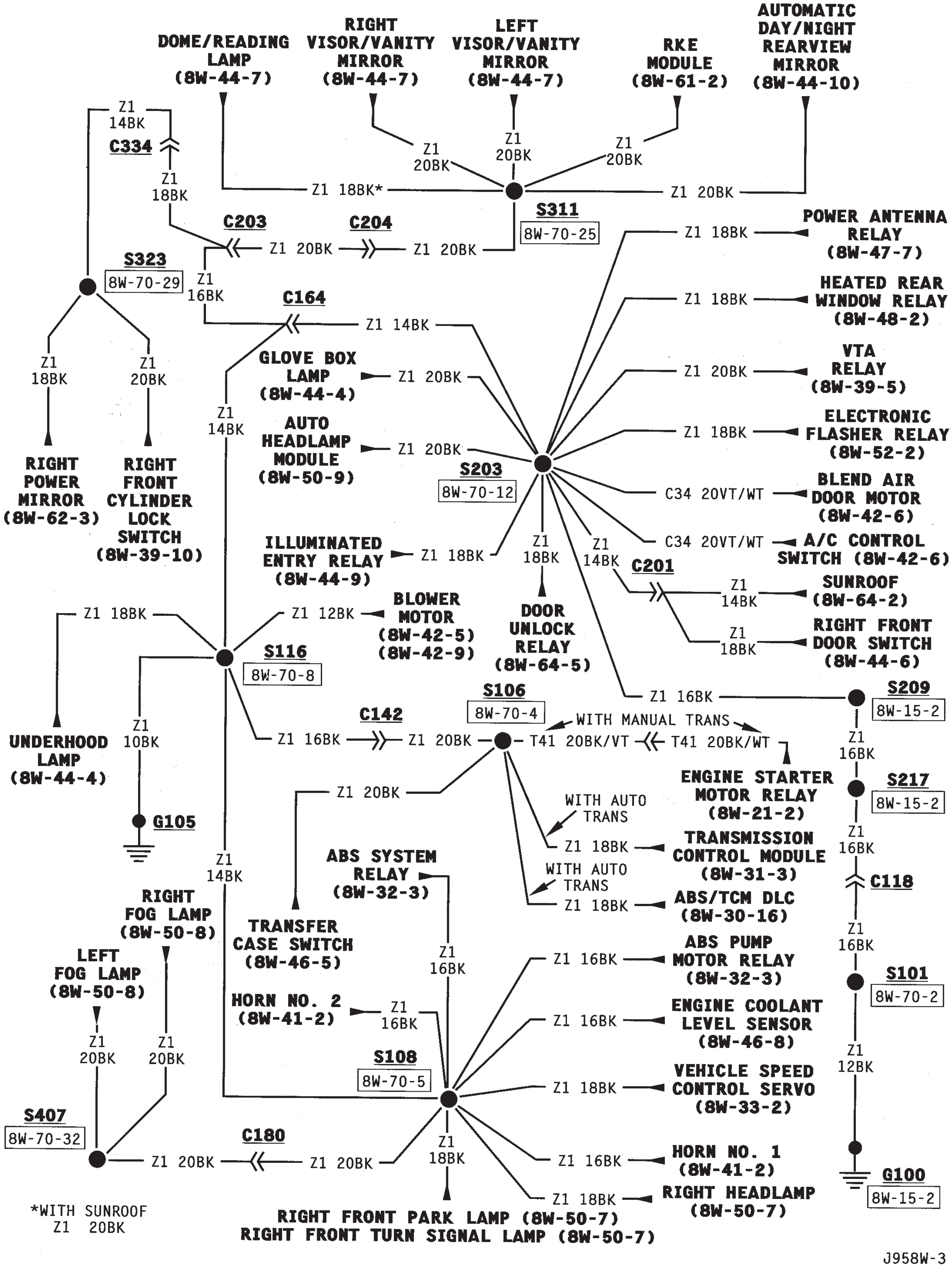
GENERAL INFORMATION

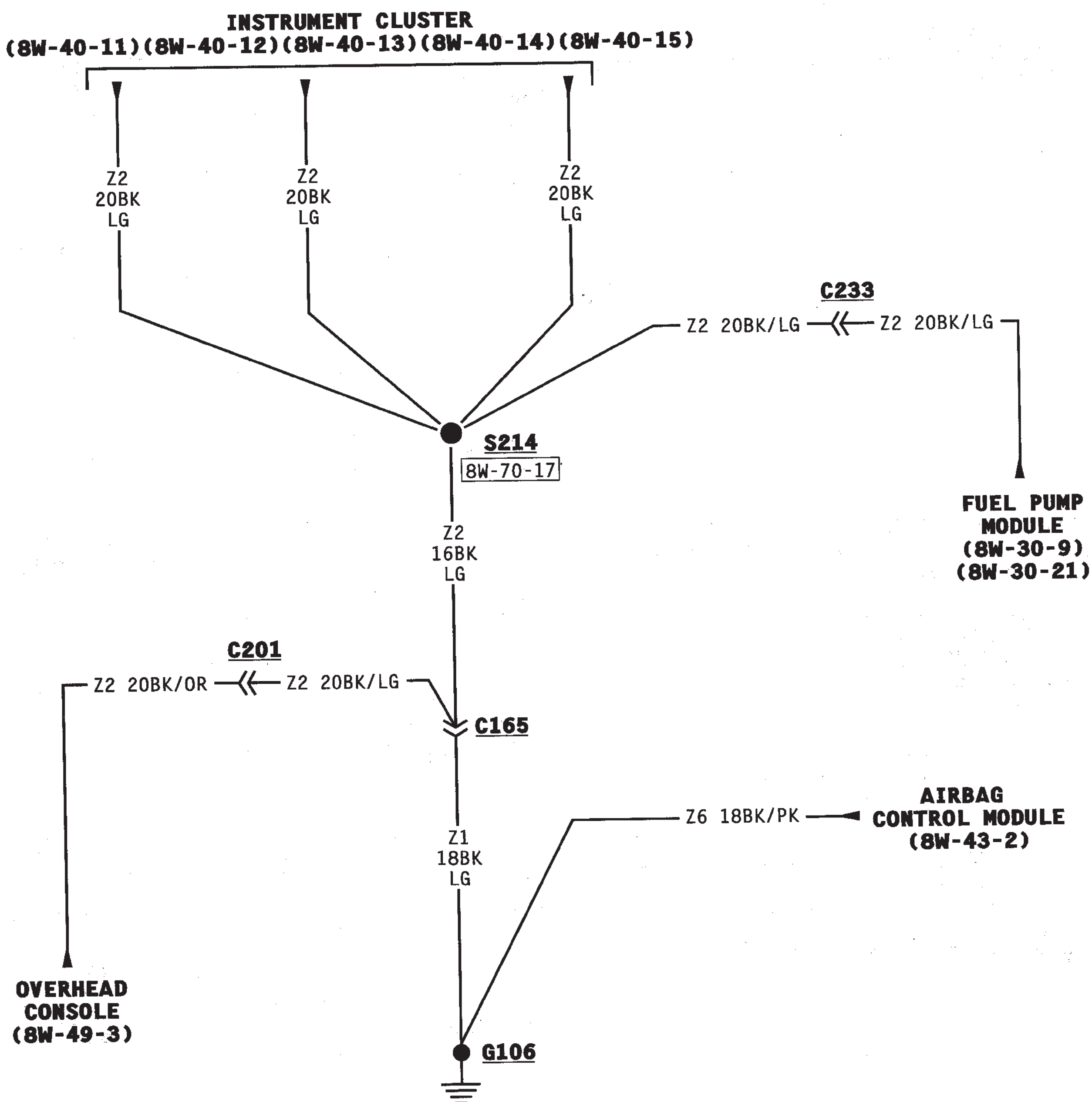
This section identifies the grounds, splices that connect to those grounds, and the components that use those grounds. For additional information on system operation, refer to the appropriate section of the wiring diagrams.

DIAGRAM INDEX

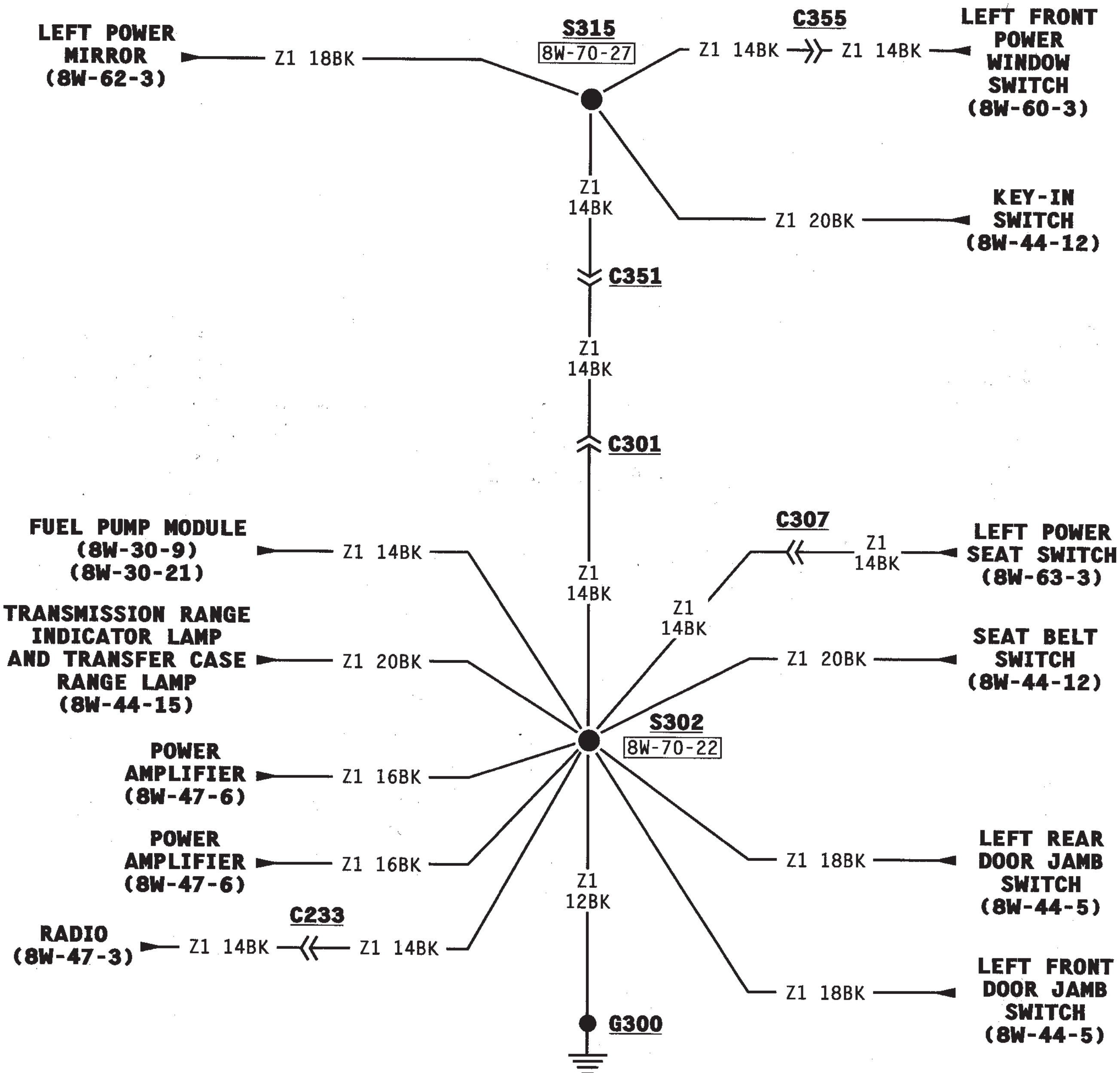

VEHICLE INFORMATION CENTER/GRAPHIC DISPLAY MODULE (8W-46-4)
Z1 20BK
CIGAR LIGHTER LAMP (8W-44-14)
Z1 20BK
HEATED REAR WINDOW SWITCH (8W-48-3)
Z1 20BK
CIGAR LIGHTER (8W-41-2)
Z1 16BK
ASH RECEIVER LAMP (8W-44-14)
Z1 20BK
S203
8W-15-4
Z1 16BK
S209
8W-70-15
Z1 20BK
Z1 20BK
VEHICLE INFORMATION CENTER (8W-46-6)
Z1 18BK
Z1 18BK
VEHICLE THEFT ALARM MODULE (8W-39-3)
Z1 20BK
HEATED REAR WINDOW/OVERDRIVE SWITCH (8W-44-16)
Z1 14BK
C164
Z1 14BK
Z1 20BK
C203
Z1 20BK
C204
Z1 20BK
SPLICE S311 (8W-15-4)
S116
8W-15-4
Z1 10BK
G105
8W-15-4
INSTRUMENT CLUSTER (8W-40-9,10,16)
Z1 20BK
Z1 20BK
OVERDRIVE SWITCH (8W-31-6,7)
Z1 20BK
I.P. DIMMING MODULE(W/O DRL) (8W-44-14)
I.P. DIMMING/DRL MODULE (W/DRL) (8W-50-10)
Z1 18BK
Z1 16BK
S217
8W-70-18
Z1 16BK
Z1 16BK
HEADLAMP SWITCH (8W-44-13)
Z1 18BK
STOP LAMP SWITCH (8W-33-3)
Z1 18BK
POWER MIRROR SWITCH (8W-62-4)
Z1 18BK
CHIME MODULE (8W-44-11)
Z1 16BK
C118
Z1 16BK
INTERMITTENT WIPER CONTROL MODULE (8W-53-3)
Z1 16BK
WINDSHIELD WIPER MOTOR (8W-53-4)
Z1 16BK
S101
8W-70-2
Z1 16BK
WASHER FLUID LEVEL SENSOR (8W-53-4)
Z1 16BK
LEFT HEADLAMP (8W-50-6)
Z1 20BK
FRONT WASHER PUMP MOTOR (8W-53-4)
Z1 20BK
REAR WASHER PUMP MOTOR (8W-53-6)
Z1 12BK
G100
LEFT FRONT TURN SIGNAL LAMP (8W-50-6)
Z1 18BK
S409
8W-70-32
Z1 18BK
C102
Z1 18BK
ABS PUMP MOTOR (8W-32-5)
Z1 12BK
Z1 18BK
LEFT FRONT PARK LAMP (8W-50-6)

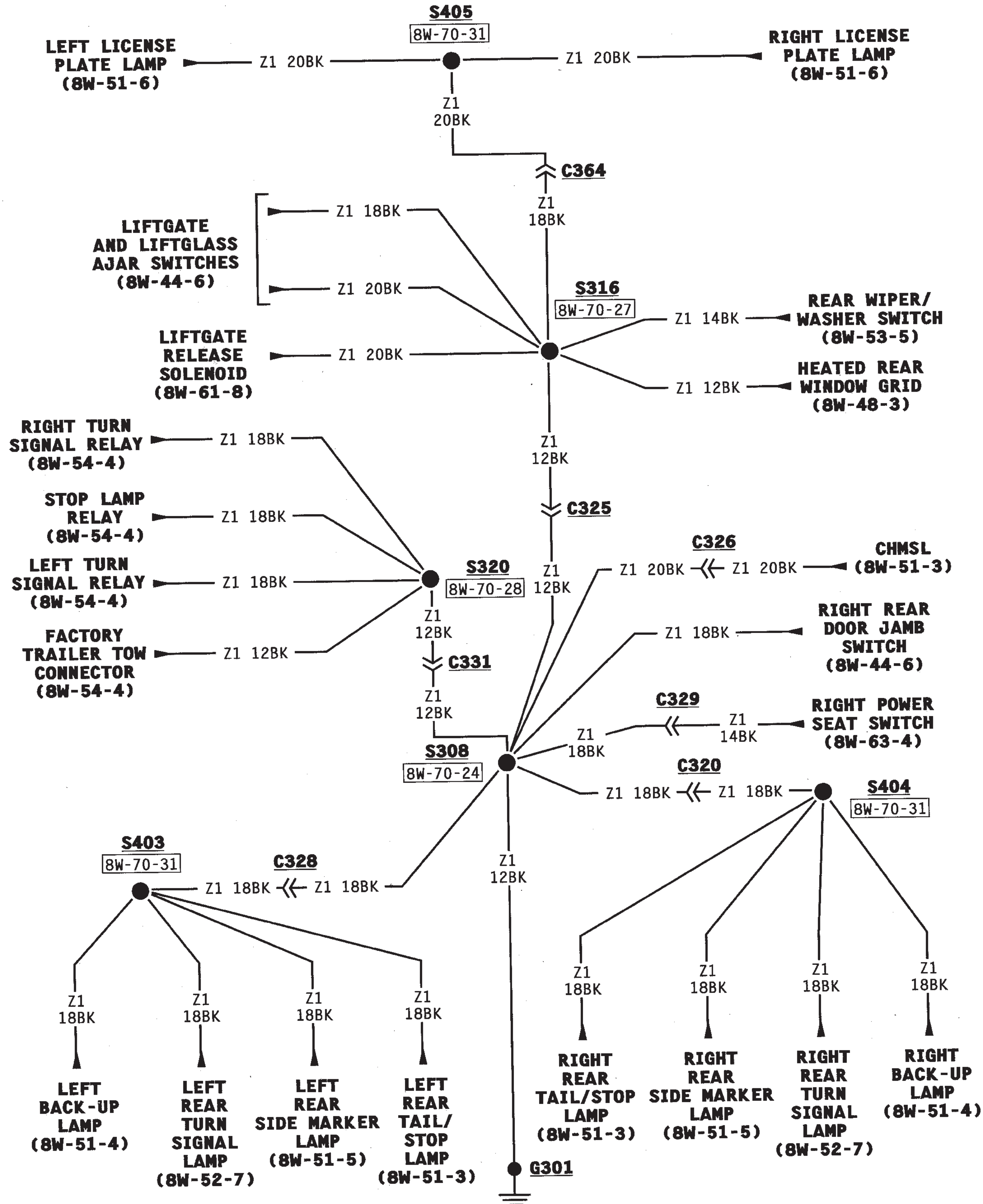

ABS CONTROL MODULE (8W-32-5)
Z1 16BK
Z1 16BK
ABS CONTROL MODULE (8W-32-5)
G101
PCM DATA LINK CONNECTOR (8W-30-15) (8W-30-27)
Z12 18BK/TN
S119
8W-70-19
Z12 14BK/TN
PCM (8W-30-16) (8W-30-27)
Z12 14BK/TN
PCM (8W-30-16) (8W-30-27)
ABS/TCM DATA LINK CONNECTOR (8W-30-16) (8W-30-28)
Z12 20BK/TN
Z12 14BK/TN
PCM (8W-30-16) (8W-30-27)
HEATED OXYGEN SENSOR (8W-30-14) (8W-20-26)
Z12 18BK/TN
Z12 12BK/TN
G102
GENERATOR (8W-20-2)
Z0 8BK
Z0 6BK
Z0 6BK
BATTERY
Z0 6BK
Z0 6BK
G104
S107
8W-70-5
G103


DOME/READING LAMP (8W-44-7)
RIGHT VISOR/VANITY MIRROR (8W-44-7)
LEFT VISOR/VANITY MIRROR (8W-44-7)
RKE MODULE (8W-61-2)
AUTOMATIC DAY/NIGHT REARVIEW MIRROR (8W-44-10)
Z1 14BK
C334
Z1 18BK
Z1 18BK*
Z1 20BK
S311
8W-70-25
C203
C204
Z1 20BK
S323
8W-70-29
Z1 16BK
C164
Z1 14BK
POWER ANTENNA RELAY (8W-47-7)
Z1 18BK
HEATED REAR WINDOW RELAY (8W-48-2)
VTA RELAY (8W-39-5)
ELECTRONIC FLASHER RELAY (8W-52-2)
BLEND AIR DOOR MOTOR (8W-42-6)
C34 20VT/WT
A/C CONTROL SWITCH (8W-42-6)
GLOVE BOX LAMP (8W-44-4)
AUTO HEADLAMP MODULE (8W-50-9)
S203
8W-70-12
RIGHT POWER MIRROR (8W-62-3)
RIGHT FRONT CYLINDER LOCK SWITCH (8W-39-10)
ILLUMINATED ENTRY RELAY (8W-44-9)
DOOR UNLOCK RELAY (8W-64-5)
C201
SUNROOF (8W-64-2)
RIGHT FRONT DOOR SWITCH (8W-44-6)
BLOWER MOTOR (8W-42-5) (8W-42-9)
Z1 12BK
S116
8W-70-8
UNDERHOOD LAMP (8W-44-4)
Z1 10BK
G105
Z1 16BK
S209
8W-15-2
S106
8W-70-4
C142
WITH MANUAL TRANS
T41 20BK/VT
T41 20BK/WT
ENGINE STARTER MOTOR RELAY (8W-21-2)
S217
8W-15-2
WITH AUTO TRANS
TRANSMISSION CONTROL MODULE (8W-31-3)
ABS/TCM DLC (8W-30-16)
C118
ABS SYSTEM RELAY (8W-32-3)
TRANSFER CASE SWITCH (8W-46-5)
RIGHT FOG LAMP (8W-50-8)
LEFT FOG LAMP (8W-50-8)
ABS PUMP MOTOR RELAY (8W-32-3)
S101
8W-70-2
HORN NO. 2 (8W-41-2)
ENGINE COOLANT LEVEL SENSOR (8W-46-8)
S108
8W-70-5
VEHICLE SPEED CONTROL SERVO (8W-33-2)
S407
8W-70-32
C180
HORN NO. 1 (8W-41-2)
RIGHT HEADLAMP (8W-50-7)
G100
8W-15-2
RIGHT FRONT PARK LAMP (8W-50-7)
RIGHT FRONT TURN SIGNAL LAMP (8W-50-7)
*WITH SUNROOF Z1 20BK
J958W-3


INSTRUMENT CLUSTER
(8W-40-11)(8W-40-12)(8W-40-13)(8W-40-14)(8W-40-15)
Z2
20BK
LG
Z2
20BK
LG
Z2
20BK
LG
C233
Z2 20BK/LG
Z2 20BK/LG
S214
8W-70-17
FUEL PUMP
MODULE
(8W-30-9)
(8W-30-21)
Z2
16BK
LG
C201
Z2 20BK/OR
Z2 20BK/LG
C165
AIRBAG
CONTROL MODULE
(8W-43-2)
Z6 18BK/PK
Z1
18BK
LG
OVERHEAD
CONSOLE
(8W-49-3)
G106

J958W-3


LEFT POWER MIRROR (8W-62-3)
Z1 18BK
S315
8W-70-27
C355
Z1 14BK
Z1 14BK
LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
Z1 14BK
Z1 20BK
KEY-IN SWITCH (8W-44-12)
C351
Z1 14BK
C301
FUEL PUMP MODULE (8W-30-9) (8W-30-21)
Z1 14BK
Z1 14BK
C307
Z1 14BK
LEFT POWER SEAT SWITCH (8W-63-3)
Z1 14BK
TRANSMISSION RANGE INDICATOR LAMP AND TRANSFER CASE RANGE LAMP (8W-44-15)
Z1 20BK
Z1 20BK
SEAT BELT SWITCH (8W-44-12)
S302
8W-70-22
POWER AMPLIFIER (8W-47-6)
Z1 16BK
POWER AMPLIFIER (8W-47-6)
Z1 16BK
Z1 12BK
Z1 18BK
LEFT REAR DOOR JAMB SWITCH (8W-44-5)
C233
RADIO (8W-47-3)
Z1 14BK
Z1 14BK
Z1 18BK
LEFT FRONT DOOR JAMB SWITCH (8W-44-5)
G300


S405
8W-70-31
LEFT LICENSE PLATE LAMP (8W-51-6)
Z1 20BK
RIGHT LICENSE PLATE LAMP (8W-51-6)
C364
Z1 18BK
LIFTGATE AND LIFTGLASS AJAR SWITCHES (8W-44-6)
Z1 18BK
Z1 20BK
S316
8W-70-27
REAR WIPER/ WASHER SWITCH (8W-53-5)
Z1 14BK
LIFTGATE RELEASE SOLENOID (8W-61-8)
HEATED REAR WINDOW GRID (8W-48-3)
Z1 12BK
RIGHT TURN SIGNAL RELAY (8W-54-4)
STOP LAMP RELAY (8W-54-4)
LEFT TURN SIGNAL RELAY (8W-54-4)
FACTORY TRAILER TOW CONNECTOR (8W-54-4)
C325
S320
8W-70-28
C331
C326
CHMSL (8W-51-3)
RIGHT REAR DOOR JAMB SWITCH (8W-44-6)
C329
RIGHT POWER SEAT SWITCH (8W-63-4)
S308
8W-70-24
C320
S404
8W-70-31
S403
8W-70-31
C328
LEFT BACK-UP LAMP (8W-51-4)
LEFT REAR TURN SIGNAL LAMP (8W-52-7)
LEFT REAR SIDE MARKER LAMP (8W-51-5)
LEFT REAR TAIL/ STOP LAMP (8W-51-3)
G301
RIGHT REAR TAIL/STOP LAMP (8W-51-3)
RIGHT REAR SIDE MARKER LAMP (8W-51-5)
RIGHT REAR TURN SIGNAL LAMP (8W-52-7)
RIGHT BACK-UP LAMP (8W-51-4)

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CHARGING SYSTEM

CHARGING SYSTEM

The charging system is an integral part of the battery and starting systems. Because all these systems work in conjunction, diagnose and test them together.

Circuit A11 connects to the generator output terminal and splices to fuse F8 and fuse F16 in the Power Distribution Center (PDC). Circuit A0 connects the battery to the PDC.

Circuit Z0 provides ground for the generator. Circuit Z0 attaches to the rear of the right side of the engine, and is spliced to the battery negative terminal.

Power for the field terminal of the generator is supplied by circuit A61. The A61 circuit is connected to the contact side of the Automatic Shut Down (ASD) relay.

Power for the contact side of the relay is supplied by circuit A5. This circuit is protected by a 20 amp fuse located in cavity 2 of the PDC.

When the PCM grounds the ASD relay, contacts inside the relay close and connect circuit A5 from fuse 2 in the PDC to circuit A61. Circuit A61 splices to the generator field terminal.

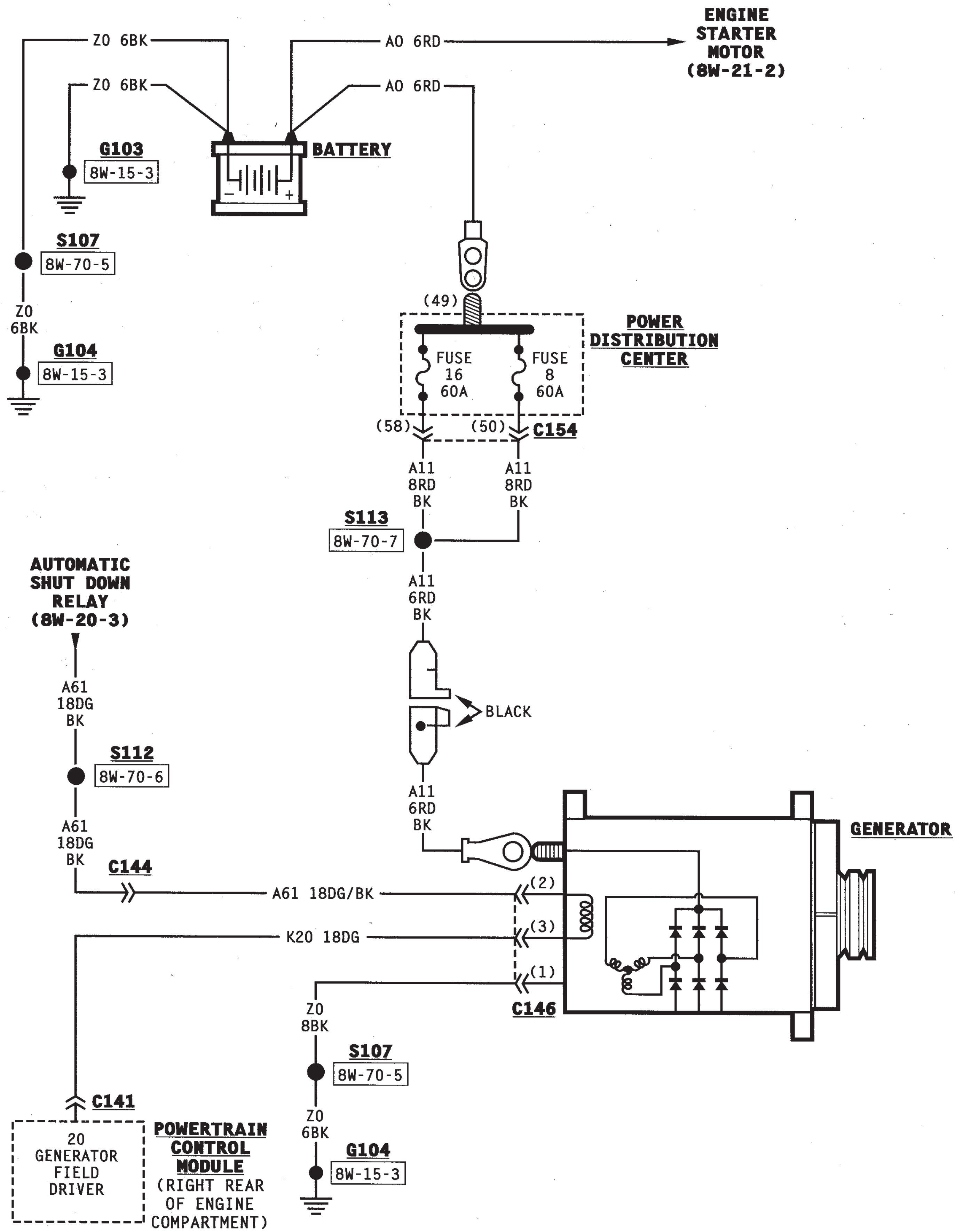
The PCM has an internal voltage regulator that controls generator output. The PCM controls the generator field on circuit K20. Circuit K20 connects to PCM cavity 20.

When the engine operates and there is current in the generator field, the generator produces a B+ voltage. The generator supplies B+ voltage to the battery through the A11 and A0 circuits.

HELPFUL INFORMATION

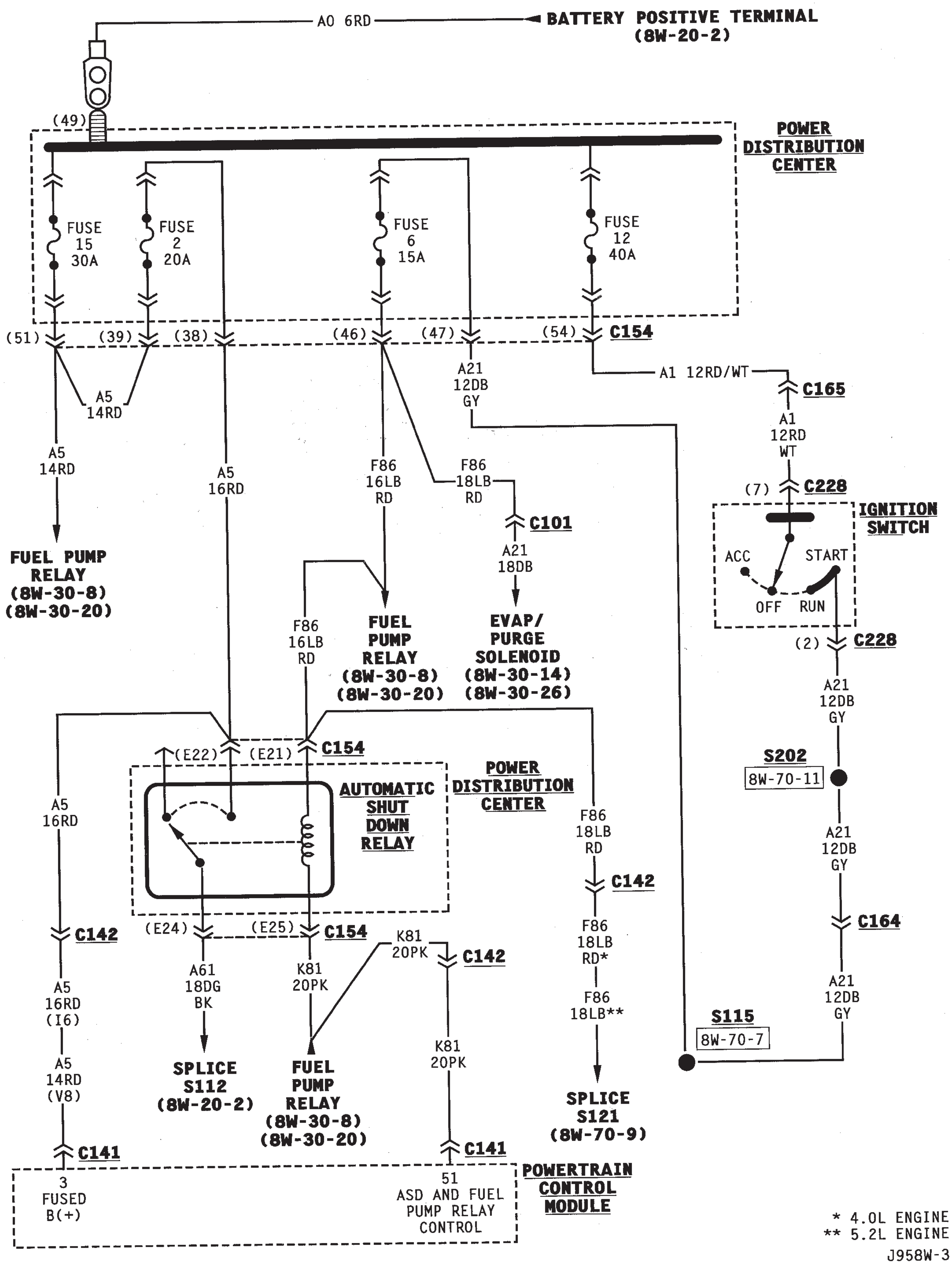
• Check the 20 amp fuse located in cavity 2 of the PDC.
• Circuit A5 also splices to provide power for the fuel pump relay.
• The ASD relay supplies battery voltage for the fuel injectors, ignition coil, and the heated oxygen sensor. The fuel pump relay powers the fuel pump module.
• Refer to the appropriate group of the Service Manual or the appropriate Diagnostic Test Procedures Manual.

DIAGRAM INDEX



Z0 6BK
A0 6RD
ENGINE STARTER MOTOR (8W-21-2)
Z0 6BK
A0 6RD
G103
8W-15-3
BATTERY
S107
8W-70-5
Z0 6BK
G104
8W-15-3
(49)
POWER DISTRIBUTION CENTER
FUSE 16 60A
FUSE 8 60A
(58)
(50)
C154
A11 8RD BK
A11 8RD BK
S113
8W-70-7
A11 6RD BK
AUTOMATIC SHUT DOWN RELAY (8W-20-3)
A61 18DG BK
BLACK
S112
8W-70-6
A61 18DG BK
A11 6RD BK
GENERATOR
C144
A61 18DG/BK
(2)
K20 18DG
(3)
(1)
C146
Z0 8BK
S107
8W-70-5
Z0 6BK
G104
8W-15-3
C141
20 GENERATOR FIELD DRIVER
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3


A0 6RD
BATTERY POSITIVE TERMINAL
(8W-20-2)
(49)
POWER
DISTRIBUTION
CENTER
FUSE
15
30A
FUSE
2
20A
FUSE
6
15A
FUSE
12
40A
(51)
(39)
(38)
(46)
(47)
(54)
C154
A5
14RD
A21
12DB
GY
A1 12RD/WT
C165
A1
12RD
WT
A5
14RD
A5
16RD
F86
16LB
RD
F86
18LB
RD
(7)
C228
IGNITION
SWITCH
C101
A21
18DB
ACC
START
OFF
RUN
FUEL PUMP
RELAY
(8W-30-8)
(8W-30-20)
F86
16LB
RD
FUEL
PUMP
RELAY
(8W-30-8)
(8W-30-20)
EVAP/
PURGE
SOLENOID
(8W-30-14)
(8W-30-26)
(2)
C228
A21
12DB
GY
(E22)
(E21)
C154
S202
8W-70-11
A5
16RD
AUTOMATIC
SHUT
DOWN
RELAY
POWER
DISTRIBUTION
CENTER
F86
18LB
RD
A21
12DB
GY
C142
C142
(E24)
(E25)
C154
K81
20PK
C142
F86
18LB
RD*
C164
A5
16RD
(I6)
A61
18DG
BK
K81
20PK
F86
18LB**
A21
12DB
GY
S115
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A5
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(V8)
K81
20PK
SPLICE
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(8W-20-2)
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C141
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FUSED
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ASD AND FUEL
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CONTROL
POWERTRAIN
CONTROL
MODULE
* 4.0L ENGINE
** 5.2L ENGINE
J958W-3

STARTING SYSTEM

STARTING SYSTEM

AUTOMATIC TRANSMISSIONS

Circuit A0 from the battery is double crimped at the positive battery post. One branch of circuit A0 (battery positive cable) connects to the battery starter motor. The other A0 branch supplies voltage to the buss bar in the Power Distribution Center (PDC).

The PDC supplies battery voltage to the engine starter motor solenoid on circuit T40 when the coil side of the engine starter motor relay energizes. Circuit A1 from fuse 12 in the PDC supplies battery voltage to the contact side of the starter motor relay.

The ignition switch supplies battery voltage to the coil side of the starter motor relay on circuit A41 when the key is moved to the START position and the Park/Neutral position switch is closed. Ground for the coil side of the starter motor relay is supplied by the case grounded Park/Neutral position switch. Circuit T41 connects the coil side of the relay to the Park/Neutral position switch, and is also spliced to the Powertrain Control Module (PCM).

When the starter motor relay energizes and the contacts close, circuit T40 supplies battery voltage to the starter motor solenoid. Circuit A0 from the battery supplies voltage to the starter motor when the solenoid energizes.

MANUAL TRANSMISSIONS

Circuit A0 from the battery is double crimped at the positive battery post. One branch of circuit A0 (battery positive cable) connects to the battery starter motor. The other A0 branch supplies voltage to the buss bar in the Power Distribution Center (PDC).

The PDC supplies battery voltage to the engine starter motor solenoid on circuit T40 when the coil side of the engine starter motor relay energizes. Circuit A1 from fuse 12 in the PDC supplies battery voltage to the contact side of the starter motor relay.

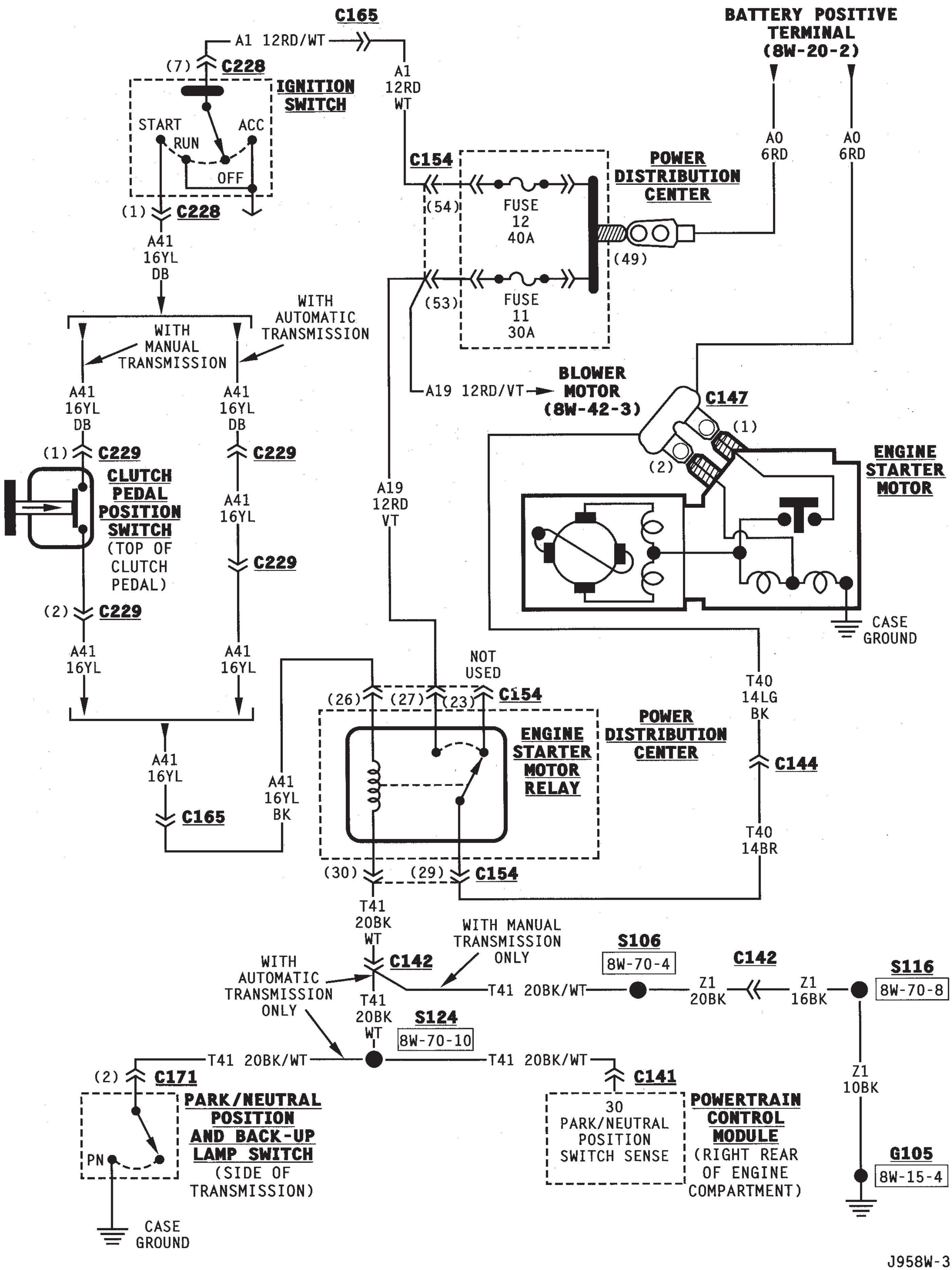
The ignition switch supplies battery voltage to the coil side of the starter motor relay on circuit A41 when the key is moved to the START position. Circuit T41 from the coil side of the relay connects to a Z1 splice. Circuit Z1 provides ground for the starter motor relay and terminates at the right fender side shield.

When the starter motor relay energizes and the contacts close, circuit T40 supplies battery voltage to the starter motor solenoid. Circuit A0 from the battery supplies voltage to the starter motor when the solenoid energizes.

HELPFUL INFORMATION

- The Park/Neutral switch closes when the transmission is in either the PARK or NEUTRAL positions.
- Circuit T41 also connects to cavity 30 of the PCM. This input tells the PCM the operator is starting the vehicle.
- Check the 40 amp fuse located in cavity F12 of the PDC.

DIAGRAM INDEX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(1) C228
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FUEL/IGNITION

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GENERAL INFORMATION

The operation of the fuel/ignition systems for the 4.0L and the 5.2L engines available in this vehicle are similar. The circuit descriptions in this section cover both engine packages.

Where there are differences, for example Powertrain Control Module (PCM) pin-outs, the circuit descriptions will be shown separately.

IGNITION SWITCH

START OR RUN POSITION

When the ignition switch is in either the START or RUN positions, it connects circuit A1 to circuit A21. Circuit A1 is protected by a 40 amp fuse located in cavity 12 of the Power Distribution Center (PDC), and is HOT at all times.

Circuit A21 connects between the ignition switch and the 15 amp fuse located in cavity 6 of the PDC. From the fuse in cavity 6, circuit F86 supplies power to the coil side of the fuel pump relay. At the fuel pump relay, circuit F86 is double pinned and supplies power to the coil side of the Automatic Shut Down (ASD) relay. Circuit F86 also connects to cavity 9 of the Powertrain Control Module (PCM).

Circuit A21 also connects to a bus bar in the fuse block that feeds fuses 21 and 22.

ACCESSORY OR RUN POSITION

When the ignition switch is in either the ACCESSORY or RUN positions, it connects circuit A1 to circuit A31. Circuit A1 is protected by a 40 amp fuse located in cavity 12 of the Power Distribution Center (PDC), and is HOT at all times.

Circuit A31 connects to the fuse block and feeds the circuits connected to fuses 9, 10, and 11.

START POSITION

In the START position, the ignition switch connects circuit A1 from the 40 amp fuse in cavity 12 of the Power Distribution Center (PDC) to circuit A41. Circuit A41 connects to the contact side of the engine starter motor relay.

Also in the START position, the ignition switch connects circuit G9 to ground. Circuit G9 connects to the instrument cluster and park brake switch.

RUN POSITION

In the RUN position, the ignition switch connects circuit A2 from 60 amp fuse 13 in the PDC to circuit A22. Circuit A22 connects to the fuse block and feeds the circuits protected by fuses, 17, 18, 19 and 20. Circuit V34 from fuse 20 in the fuse block supplies battery voltage to the vehicle speed control system.

AUTOMATIC SHUT DOWN (ASD) RELAY

When the ignition switch is in either the START or RUN positions, it connects circuit A1 from fuse 12 in the Power Distribution Center (PDC) to circuit A21. Circuit A21 supplies battery voltage to fuse 6 in the PDC.

From fuse 6, circuit F86 supplies power to the coil side of the fuel pump relay. At the fuel pump relay, circuit F86 is double pinned and supplies power to the coil side of the Automatic Shut Down (ASD) relay. The Powertrain Control Module (PCM) provides ground for the coil sides of the ASD relay and fuel pump relay on circuit K81. Circuit K81 connects to cavity 51 of the PCM.

When the PCM grounds the ASD relay, contacts inside the relay close and connect circuit A5 from fuse 2 in the PDC to circuit A61. Circuit A61 splices to the generator field terminal, fuel injectors, and ignition coil. Circuit A61 also connects to cavity 57 of the PCM.

HELPFUL INFORMATION

• Circuit A5 originates at fuse 15 in the PDC and continues through fuse 2 in the PDC. Circuit A5 also connects to cavity 3 of the PCM.
• Circuit F86 also connects to cavity 9 of the PCM.

BATTERY FEED

Circuit A5 from fuse 15 in the Power Distribution Center (PDC) supplies battery voltage to cavity 3 of the Powertrain Control Module (PCM).

HELPFUL INFORMATION

• Circuit A5 originates at fuse 15 in the PDC and continues through fuse 2 in the PDC. Circuit A5 connects to cavity 3 of the PCM and supplies battery voltage to the contact sides of the fuel pump relay and Automatic Shut Down (ASD) relay.

FUEL INJECTORS

When the Automatic Shut Down (ASD) relay contacts close, they connect circuits A5 and A61. Circuit A61 supplies voltage to the fuel injectors. Each injector has a separate ground circuit controlled by the PCM.

Circuit K11 provides ground for injector number one. The K11 circuit connects to cavity 16 of the PCM.

Circuit K12 provides ground for injector number two. The K12 circuit connects to cavity 15 of the PCM.

Circuit K13 provides ground for injector number three. The K13 circuit connects to cavity 14 of the PCM.

Circuit K14 provides ground for injector number four. The K14 circuit connects to cavity 13 of the PCM.

Circuit K38 provides ground for injector number five. The K38 circuit connects to cavity 38 of the PCM.

Circuit K58 provides ground for injector number six. The K58 circuit connects to cavity 58 of the PCM.

On 5.2L engines, circuit K17 provides ground for injector number seven. The K17 circuit connects to cavity 17 of the PCM.

On 5.2L engines, circuit K18 provides ground for injector number eight. The K18 circuit connects to cavity 18 of the PCM.

HELPFUL INFORMATION

• Circuit A61 splices to supply voltage to the fuel injectors, ignition coil, PCM, generator.
• For information about fuel injector operation, refer to Group 14.

IGNITION COIL

When the Automatic Shut Down (ASD) relay contacts close, they connect circuits A5 and A61. Circuit A61 splices to supply voltage to the ignition coil. The PCM controls the ground path for the ignition coil on circuit K19. Circuit K19 connects to cavity 19 of the PCM.

HELPFUL INFORMATION

Circuit A61 splices to supply voltage to the fuel injectors, ignition coil, PCM, and generator.

FUEL PUMP RELAY

When the ignition switch is in either the START or RUN positions, it connects circuit A1 from fuse 12 in the Power Distribution Center (PDC) to circuit A21. Circuit A21 supplies battery voltage to fuse 6 in the PDC.

From fuse 6, circuit F86 supplies power to the coil side of the fuel pump relay. At the fuel pump relay, circuit F86 is double pinned and supplies power to the coil side of the Automatic Shut Down (ASD) relay. The Powertrain Control Module (PCM) provides ground for the coil sides of the fuel pump relay and ASD relay on circuit K81. Circuit K81 connects to cavity 51 of the PCM.

When the PCM grounds the fuel pump relay, contacts inside the relay close and connect circuit A5 from fuse 15 in the PDC to circuit A64. Circuit A64 connects to the fuel pump (part of the in-tank fuel pump module) and the heated oxygen sensor.

HELPFUL INFORMATION

• Circuit A5 originates at fuse 15 in the PDC and branches to fuse 2 in the PDC. From fuse 2, circuit A5 connects to the contact side of the ASD relay. Circuit A5 also connects to cavity 3 of the PCM.

FUEL PUMP MODULE

FUEL PUMP MOTOR

When the fuel pump relay contacts close, the relay supplies voltage to the fuel pump motor. Circuit A64 from the relay supplies voltage to the fuel pump motor. Circuit Z1 provides ground for the fuel pump motor.

FUEL LEVEL SENSOR

The fuel level sensor is a variable resistor. Circuit G44 connects the fuel level sensor to the overhead console. Circuit K102 connects the fuel level sensor to the fuel gauge in the instrument cluster. Circuit F87 from fuse 21 in the fuse block supplies voltage to the fuel gauge. Circuit Z2 provides the ground path for the fuel level sensor.

HELPFUL INFORMATION

As current flows through the coils in the fuel gauge, it creates a magnetic field. One of the coils in the gauge receives fixed current. The other coil is connected to the level sensor. The magnetic field controls the position of the fuel gauge pointer.

The fuel level sensor contains a variable resistor. As the position of the float arm on the fuel level sensor changes, the resistor changes the current flow through second coil in the fuel gauge. A change in current flow alters the magnetic field in the fuel gauge, which changes the pointer position. Refer to Group 8E, Instrument Panel and Gauges for additional information.

IDLE AIR CONTROL (IAC) MOTOR

The Powertrain Control Module (PCM) operates the idle air control motor through 4 circuits - K39, K40, K59, and K60. Each circuit connects to separate cavities in the PCM connector.

- Circuit K39 connects to cavity 59 of the PCM
- Circuit K40 connects to cavity 40 of the PCM
- Circuit K59 connects to cavity 60 of the PCM
- Circuit K60 connects to cavity 39 of the PCM

VEHICLE SPEED SENSOR

Circuit K25 supplies 8 volts from the Powertrain Control Module (PCM) to the vehicle speed sensor. The K25 circuit connects to cavity 7 of the PCM.

Circuit G7 from the vehicle speed sensor provides an input signal to the PCM. The G7 circuit connects to cavity 47 of the PCM.

The PCM provides a ground for the vehicle speed sensor signal (circuit G7) through circuit K4. Circuit K4 connects to cavity 4 of the PCM.

HELPFUL INFORMATION

- Circuit G7 splices to the speedometer, and vehicle information center.
- Circuit K25 splices to supply 8 volts to the camshaft position sensor and crankshaft position sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Intake air temperature sensor

HEATED OXYGEN SENSOR

When the fuel pump relay contacts close, they connect circuits A5 and A64. Circuit A64 supplies voltage to the heated oxygen sensor.

Circuit K41 delivers the signal from the heated oxygen sensor to the PCM. Circuit K41 connects to cavity 41 of the PCM.

The PCM provides a ground for the heated oxygen sensor signal (circuit K41) through circuit K4. Circuit K4 connects to cavity 4 of the PCM connector.

Circuit Z12 provides ground for the heater circuit in the sensor.

HELPFUL INFORMATION

- Circuit A64 also supplies battery voltage to the in-tank fuel pump.

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

CAMSHAFT POSITION SENSOR

The Powertrain Control Module (PCM) supplies 8 volts to the camshaft position sensor (in distributor) on circuit K25. Circuit K25 connects to cavity 7 of the PCM.

The PCM receives the camshaft position sensor signal on circuit K24. Circuit K24 connects to cavity 44 of the PCM.

The PCM provides a ground for the camshaft position sensor signal (circuit K24) through circuit K4. Circuit K4 connects to cavity 4 of the PCM.

HELPFUL INFORMATION

- Circuit K25 splices to supply 8 volts to the crankshaft position sensor and the vehicle speed sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

CRANKSHAFT POSITION SENSOR

The Powertrain Control Module (PCM) supplies 8 volts to the crankshaft position sensor on circuit K25. Circuit K25 connects to cavity 7 of the PCM.

The PCM receives the crankshaft position sensor signal on circuit K27. Circuit K27 connects to cavity 24 of the PCM.

The PCM provides a ground for the crankshaft position sensor (circuit K27) through circuit K4. Circuit K4 connects to cavity 4 of the PCM.

HELPFUL INFORMATION

• Circuit K25 splices to supply 8 volts to the camshaft position sensor and the vehicle speed sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature sensor provides an input to the Powertrain Control Module (PCM) on circuit K2. From circuit K2, the engine coolant temperature sensor draws up to 5 volts from the PCM. The sensor is a variable resistor. As coolant temperature changes, the resistance in the sensor changes, causing a change in current draw. The K2 circuit connects to cavity 2 of the PCM.

The PCM provides a ground for the engine coolant temperature sensor signal (circuit K2) through circuit K4. Circuit K4 connects to cavity 4 of the PCM connector.

HELPFUL INFORMATION

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

THROTTLE POSITION SENSOR

From the Powertrain Control Module (PCM), circuit K6 supplies 5 volts to the throttle position sensor (TPS). Circuit K6 connects to cavity 6 of the PCM.

Circuit K22 delivers the TPS signal to the PCM. Circuit K22 connects to cavity 22 of the PCM.

The PCM provides a ground for the throttle position sensor signal (circuit K22) through circuit K4. Circuit K4 connects to cavity 4 of the PCM.

HELPFUL INFORMATION

Refer to Group 14 for throttle position sensor operation.

Circuit K6 splices to supply 5 volts to the manifold absolute pressure sensor.

On vehicles equipped with the 4.0L engine and automatic transmission, circuit K22 splices to the transmission control module.

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

MANIFOLD ABSOLUTE PRESSURE SENSOR

From the Powertrain Control Module (PCM), circuit K6 supplies 5 volts to the manifold absolute pressure (MAP) sensor. Circuit K6 connects to cavity 6 of the PCM.

Circuit K70 delivers the MAP signal to the PCM. Circuit K70 connects to cavity 1 of the PCM.

The PCM provides a ground for the MAP sensor signal (circuit K70) through circuit K4. Circuit K4 connects to cavity 4 of the PCM.

HELPFUL INFORMATION

Refer to Group 14 for MAP sensor operation.

Circuit K6 splices to supply 5 volts to the throttle position sensor.

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

INTAKE AIR TEMPERATURE SENSOR

The intake air temperature sensor provides an input to the Powertrain Control Module (PCM) on circuit K21. Circuit K21 connects to cavity 21 of the PCM.

From circuit K21, the intake air temperature sensor draws voltage from the PCM. The sensor is a variable resistor. As intake air temperature changes, the resistance in the sensor changes, causing a change in current draw.

The PCM provides a ground for the intake air temperature sensor signal (circuit K21) through circuit K4. Circuit K4 connects to cavity 4 of the PCM.

HELPFUL INFORMATION

Circuit K4 splices to supply ground for the signals from the following:

- Heated oxygen sensor
- Camshaft position sensor
- Crankshaft position sensor
- Intake air temperature sensor
- Throttle position sensor
- Manifold absolute pressure sensor
- Engine coolant temperature sensor
- Vehicle speed sensor

EVAP/PURGE SOLENOID

Circuit F86 supplies voltage to the EVAP/Purge solenoid. This circuit is HOT in the START and RUN positions only. Circuit F86 also splices to provide power to the data link connector, overdrive solenoid, TCC solenoid, and EGR solenoid (5.2L engine only).

Circuit F86 is protected by a 15 amp fuse located in cavity 6 of the Power Distribution Center (PDC).

The Powertrain control Module (PCM) controls the ground path for the solenoid on circuit K52. Circuit K52 connects to cavity 52 of the PCM connector.

EXHAUST GAS RECIRCULATION SOLENOID—5.2L ENGINE

Circuit F86 supplies voltage to the EGR solenoid. This circuit is HOT in the START and RUN positions only. Circuit F86 also splices to provide power to the data link connector, overdrive solenoid and TCC solenoid, and the EVAP/Purge solenoid.

Circuit F86 is protected by a 15 amp fuse located in cavity F6 of the Power Distribution Center (PDC).

The Powertrain Control Module (PCM) controls the ground path for the solenoid on circuit K35. Circuit K35 connects to cavity 35 of the PCM connector.

PARK/NEUTRAL POSITION SWITCH

When closed, the case-grounded park/neutral position switch provides a ground path on circuit T41 for the coil side of the starter motor relay. Circuit A41 from the ignition switch provides battery voltage to the coil side of the relay.

Circuit T41 splices to cavity 30 of the PCM. The park/neutral position switch provides an input to the Powertrain Control Module (PCM).

TACHOMETER SIGNAL

The Powertrain Control Module (PCM) supplies the signal for the tachometer on circuit G21. Circuit G21 connects to cavity 43 of the PCM. The Transmission Control Module (TCM) also receives the tachometer signal from the PCM.

MALFUNCTION INDICATOR LAMP (MIL)

The Powertrain Control Module (PCM) provides ground for the instrument cluster malfunction indicator lamp on circuit G3. The MIL displays the message CHECK ENGINE when illuminated. Circuit G3 connects to cavity 32 of the PCM.

DATA LINK CONNECTOR

Circuit F86 supplies battery voltage to the data link connector. Circuit F86 originates at fuse 6 in the Power Distribution Center (PDC).

Circuit A21 from the ignition switch powers fuse 6 when the switch is in the START or RUN positions. In the START or RUN position the ignition switch connects circuit A1 from fuse 12 in the PDC with circuit A21.

Circuit D84 connects to cavity 25 of the PCM. Circuit D84 is the SCI receive circuit for the PCM.

Circuit D83 connects to cavity 45 of the PCM. Circuit D83 is the SCI transmit circuit for the PCM.

Circuit Z12 provides ground for the data link connector. Circuit Z12 also connects to cavities 5, 11 and 12 of the PCM to provide the power (device) ground.

HELPFUL INFORMATION

- Circuit Z12 also supplies a ground for the PCM high current drivers.
- If the system loses ground for the Z12 circuits, the vehicle will not operate.
- Circuit F86 splices to supply battery voltage to the heated rear window switch, overdrive switch, vehicle theft alarm module and rear lighting system. Circuit F86 also powers the coil side of the Automatic Shut Down relay and fuel pump relay.

BRAKE SWITCH INPUT

Circuit L53 provides the brake switch input to the PCM. Circuit L53 connects to cavity 29 of the PCM.

POWER (DEVICE) GROUND

Circuit Z12 connects to cavities 5, 11 and 12 of the PCM. The Z12 circuit provides ground for PCM internal drivers that operate high current devices like the injectors and ignition coil.

Internal to the PCM, the power (device) ground circuit connects to the PCM sensor return circuit (from circuit K4).

HELPFUL INFORMATION

- If the system loses ground for the Z12 circuits, the vehicle will not operate. Check the connection at the ganged-ground circuit eyelet.

CCD BUS

On vehicles equipped with the 4.0L engine, circuits D1 and D2 connect the Powertrain Control Module (PCM) to the CCD Bus. Circuit D1 connects to cavity 26 of the PCM. Circuit D2 connects to cavity 46 of the PCM. Circuits D1 and D2 are a twisted pair of wires.

Both circuits D1 and D2 connect to the second data link connector located behind left from side of the center console.

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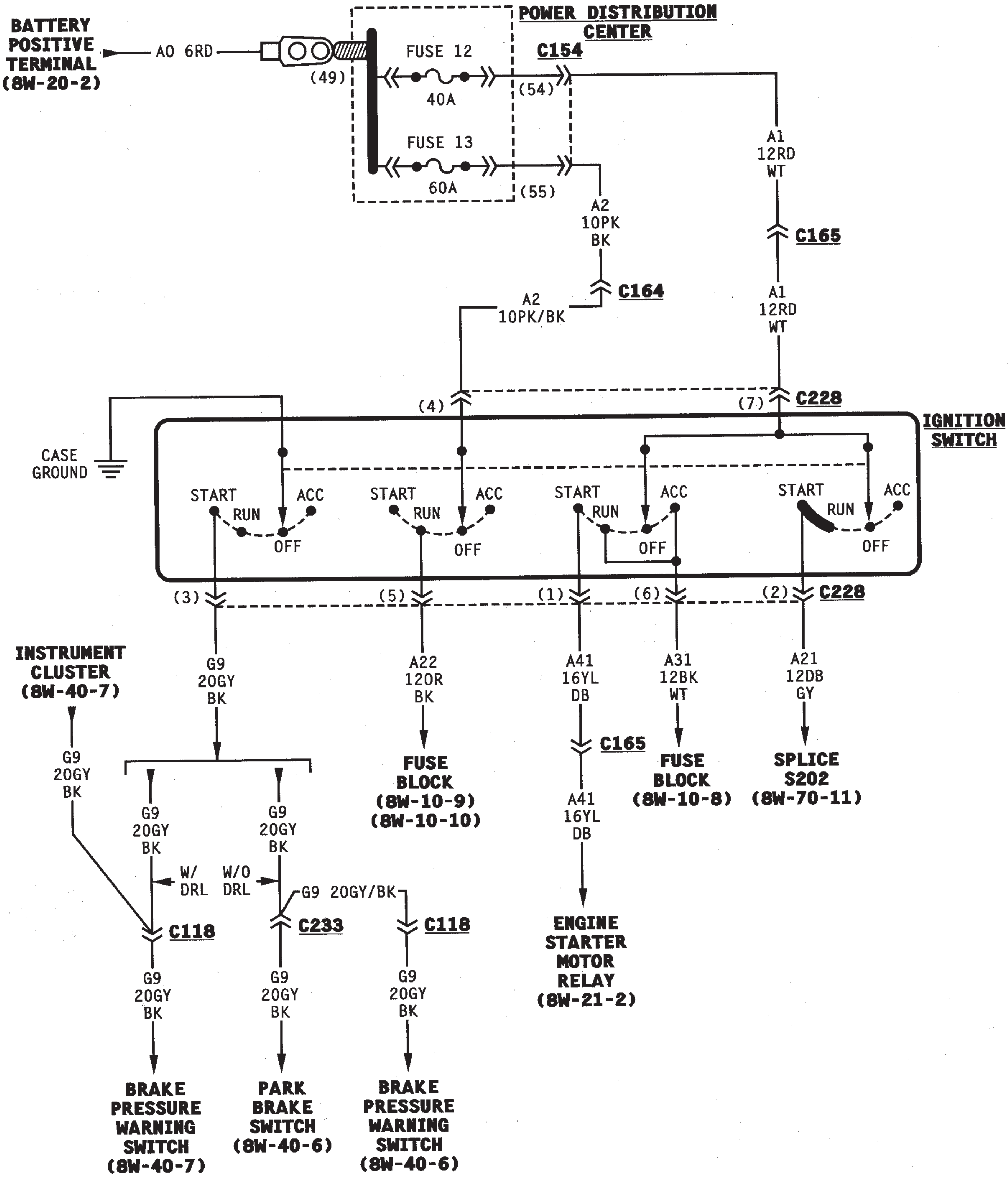
DIAGRAM INDEX—5.2L ENGINE


BATTERY POSITIVE TERMINAL (8W-20-2)
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A2 10PK BK
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PARK BRAKE SWITCH (8W-40-6)
BRAKE PRESSURE WARNING SWITCH (8W-40-6)

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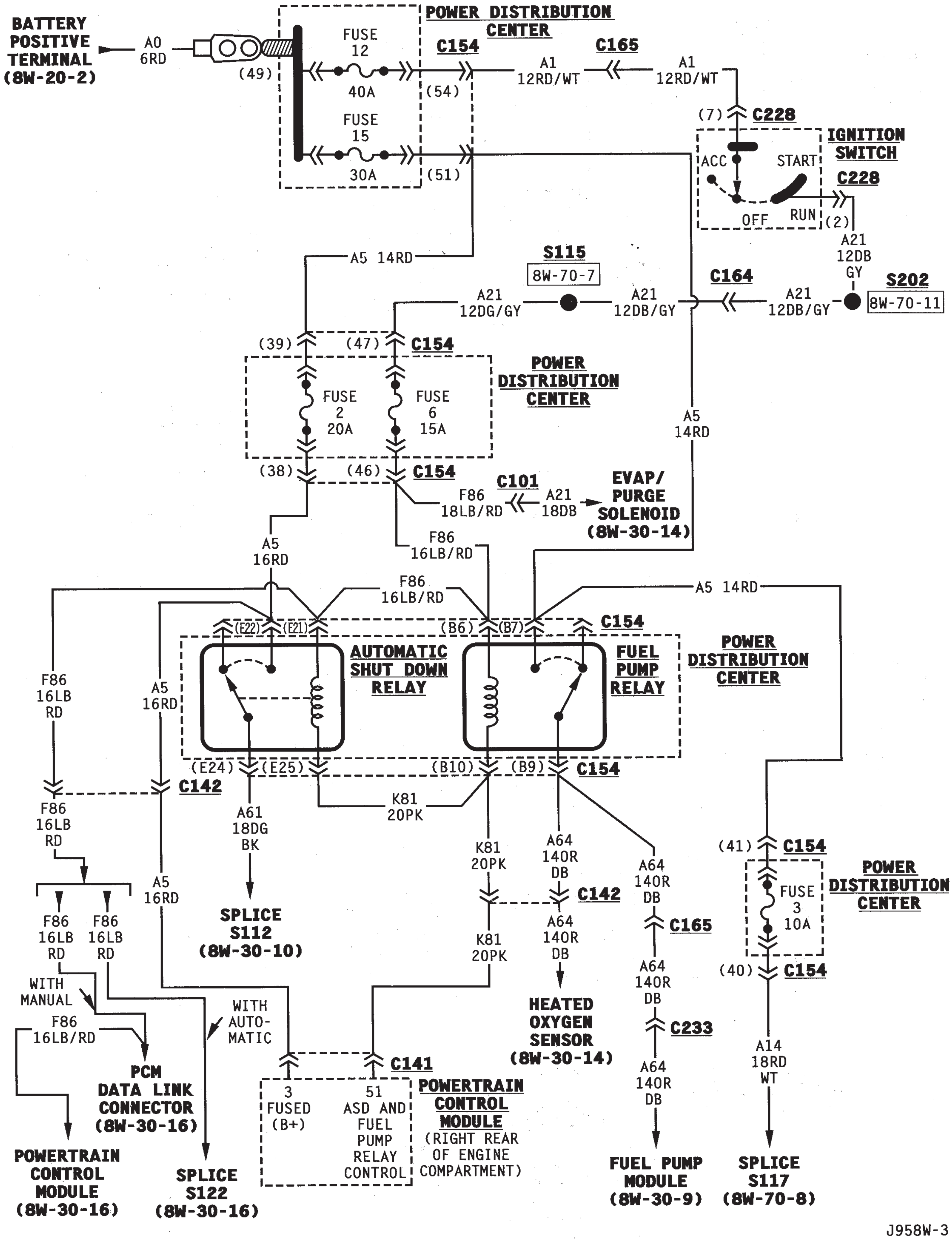
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FUSE 15 30A
C154
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A1 12RD/WT
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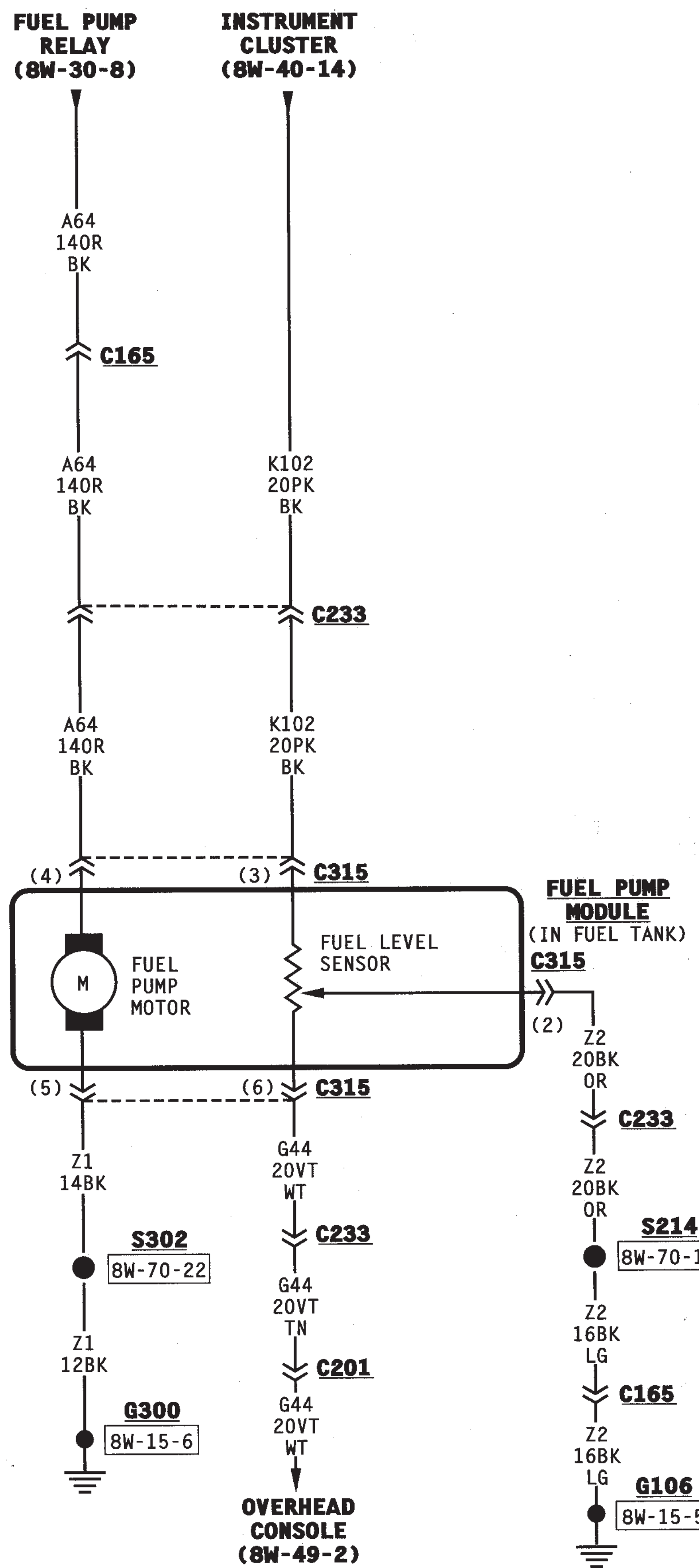
FUEL PUMP
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CLUSTER
(8W-40-14)
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BK
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C233
A64
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K102
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BK
(4)
(3)
C315
FUEL PUMP
MODULE
(IN FUEL TANK)
C315
M
FUEL
PUMP
MOTOR
FUEL LEVEL
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(2)
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OR
(5)
(6)
C315
C233
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14BK
G44
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WT
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20BK
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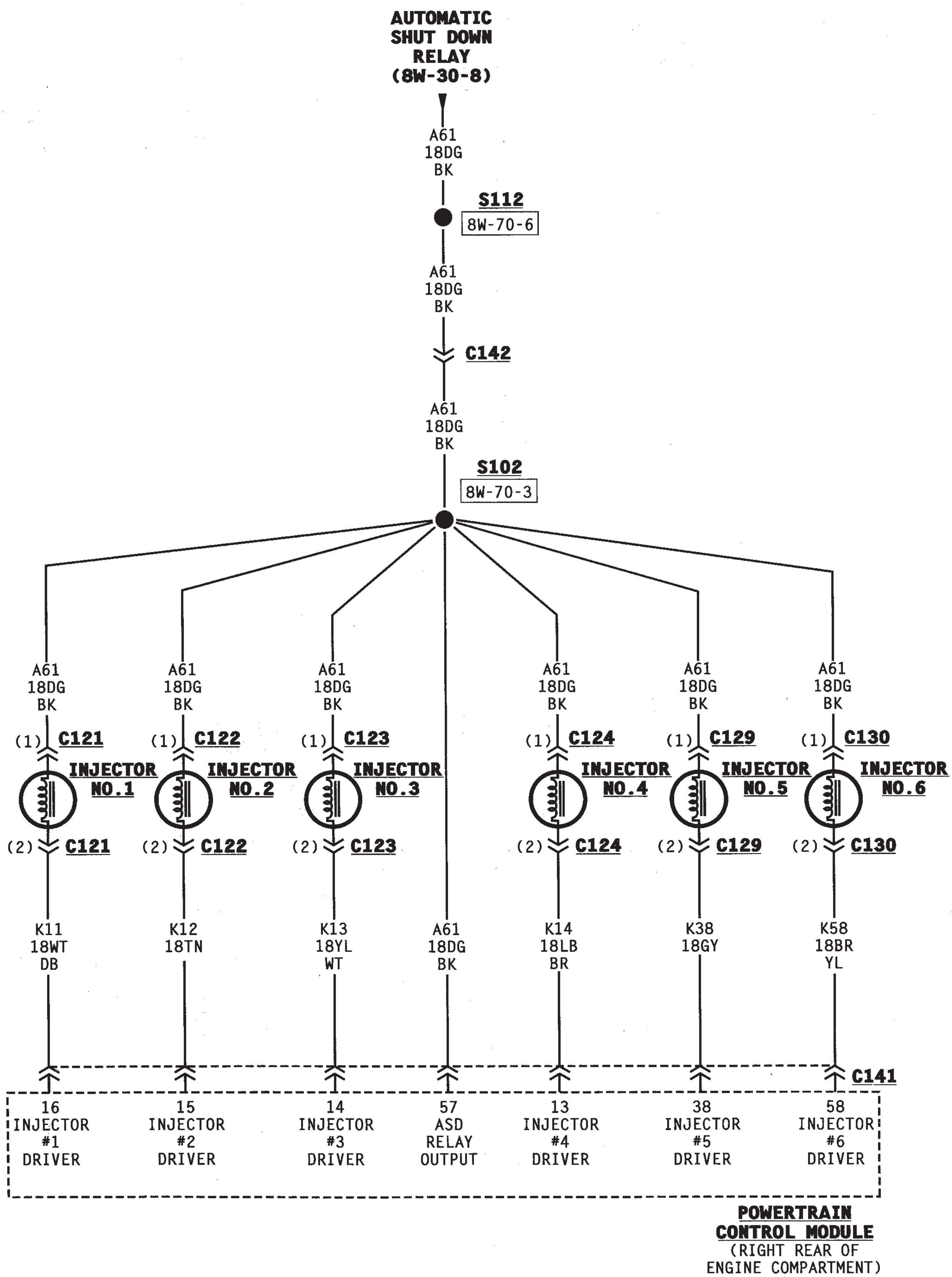
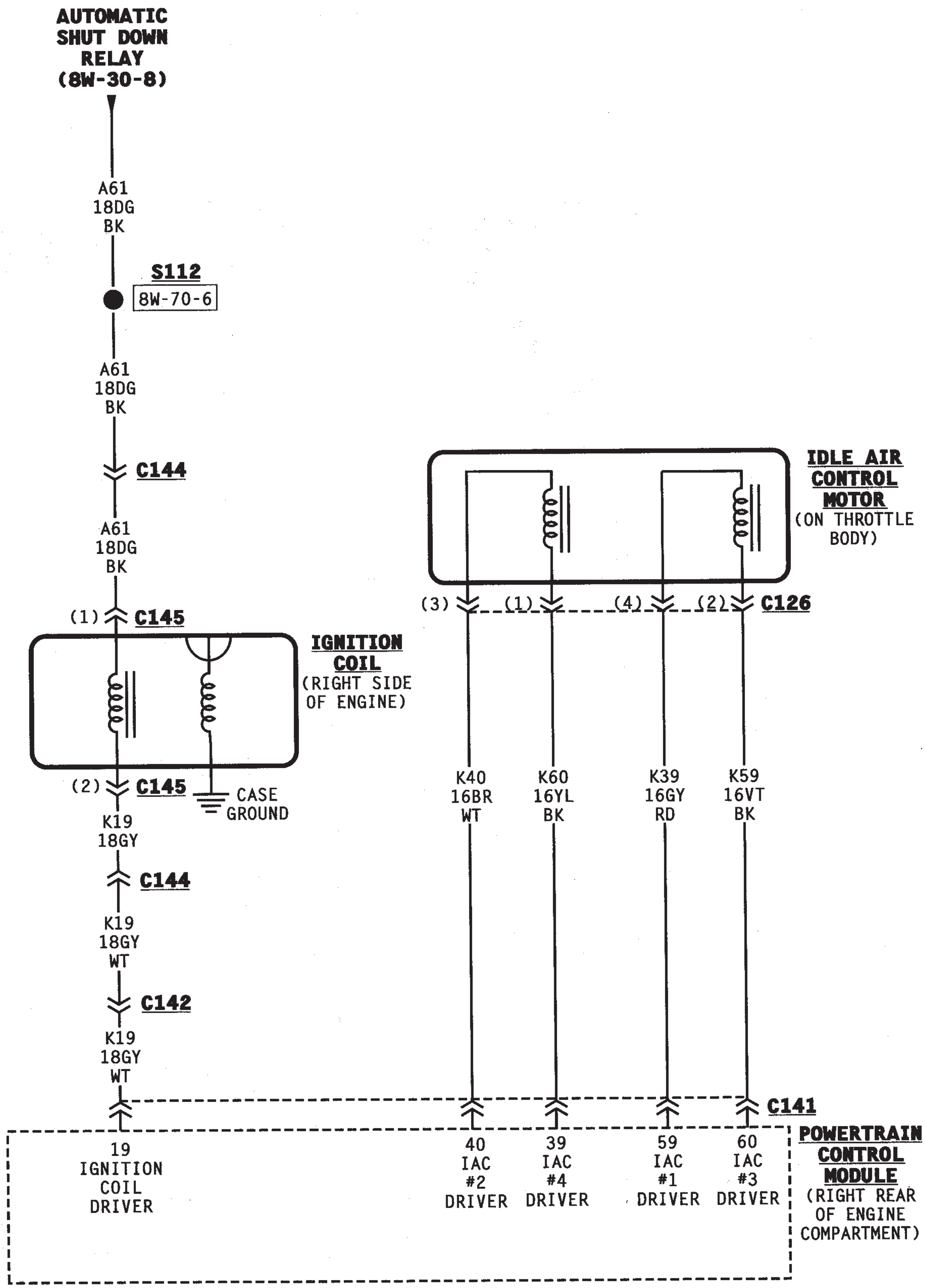
8W-70-22
S214
8W-70-17
G44
20VT
TN
Z1
12BK
Z2
16BK
LG
C201
C165
G300
8W-15-6
G44
20VT
WT
Z2
16BK
LG
G106
8W-15-5
OVERHEAD
CONSOLE
(8W-49-2)

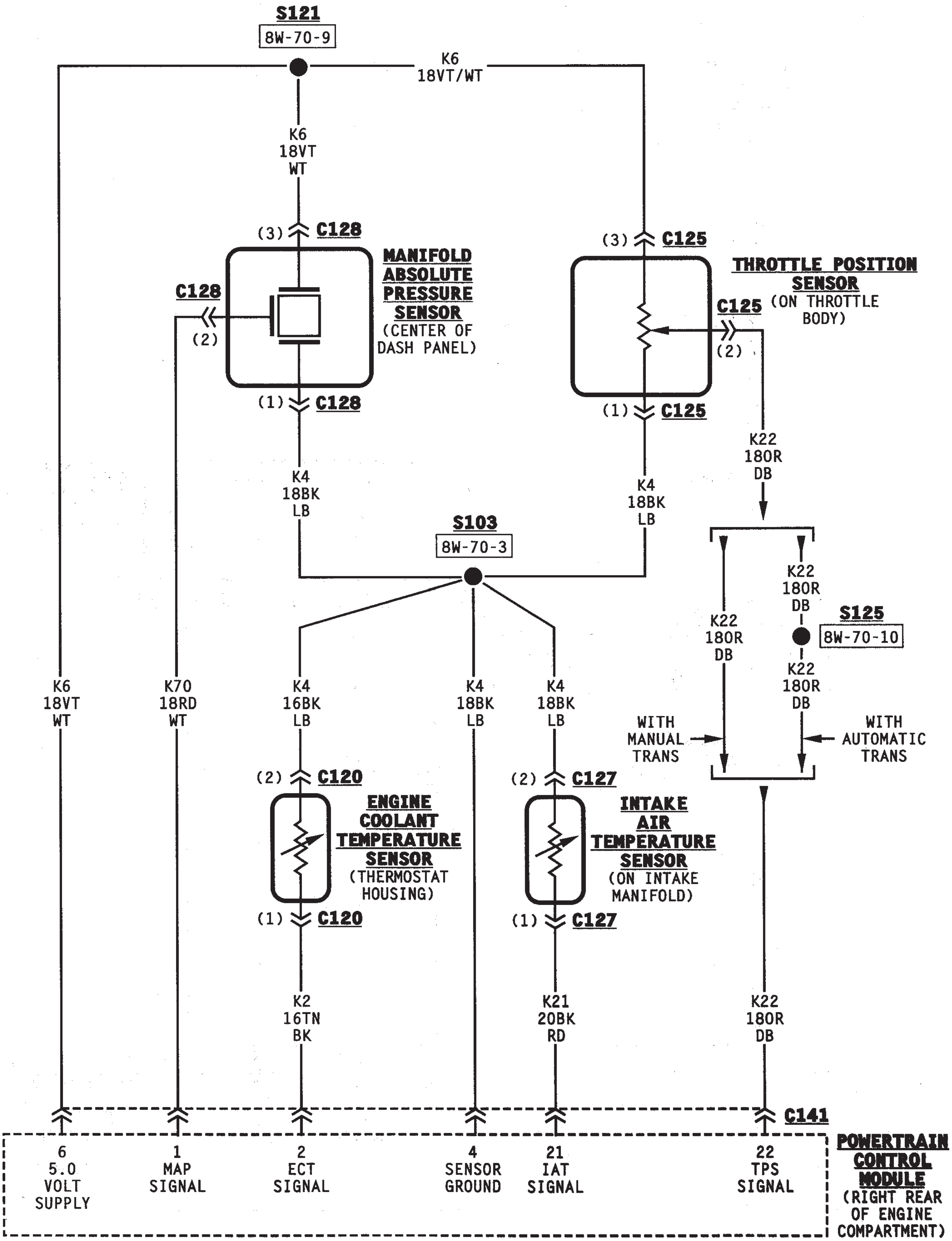
J958W-3


AUTOMATIC
SHUT DOWN
RELAY
(8W-30-8)
A61
18DG
BK
S112
8W-70-6
C142
S102
8W-70-3
(1) C121
INJECTOR NO.1
(2) C121
(1) C122
INJECTOR NO.2
(2) C122
(1) C123
INJECTOR NO.3
(2) C123
(1) C124
INJECTOR NO.4
(2) C124
(1) C129
INJECTOR NO.5
(2) C129
(1) C130
INJECTOR NO.6
(2) C130
K11 18WT DB
K12 18TN
K13 18YL WT
A61 18DG BK
K14 18LB BR
K38 18GY
K58 18BR YL
C141
16 INJECTOR #1 DRIVER
15 INJECTOR #2 DRIVER
14 INJECTOR #3 DRIVER
57 ASD RELAY OUTPUT
13 INJECTOR #4 DRIVER
38 INJECTOR #5 DRIVER
58 INJECTOR #6 DRIVER
POWERTRAIN
CONTROL MODULE
(RIGHT REAR OF
ENGINE COMPARTMENT)

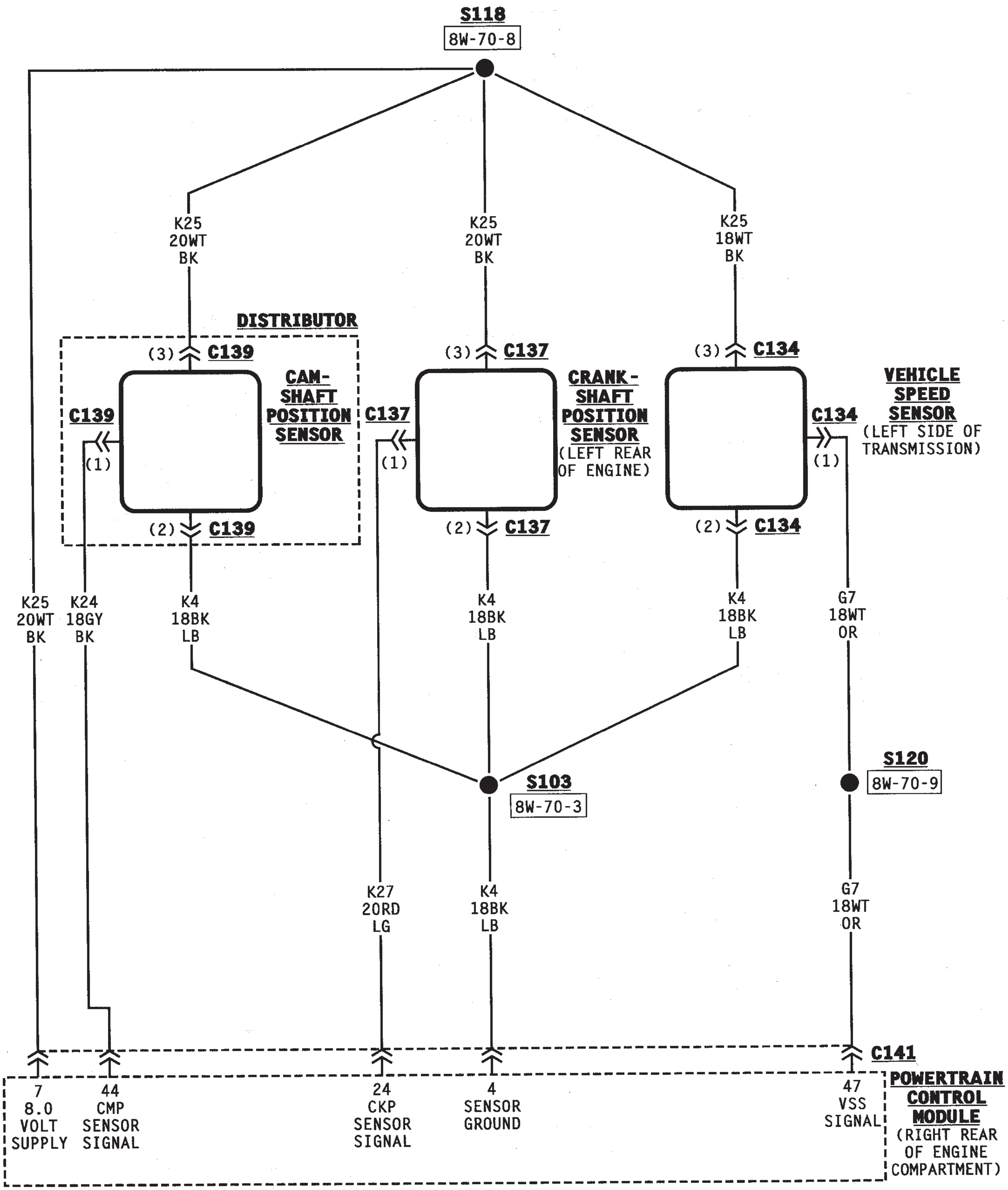
J958W-3


AUTOMATIC SHUT DOWN RELAY (8W-30-8)
A61 18DG BK
S112
8W-70-6
A61 18DG BK
C144
A61 18DG BK
(1) C145
IGNITION COIL (RIGHT SIDE OF ENGINE)
(2) C145
CASE GROUND
K19 18GY
C144
K19 18GY WT
C142
K19 18GY WT
IDLE AIR CONTROL MOTOR (ON THROTTLE BODY)
(3) (1) (4) (2) C126
K40 16BR WT
K60 16YL BK
K39 16GY RD
K59 16VT BK
C141
19 IGNITION COIL DRIVER
40 IAC #2 DRIVER
39 IAC #4 DRIVER
59 IAC #1 DRIVER
60 IAC #3 DRIVER
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3

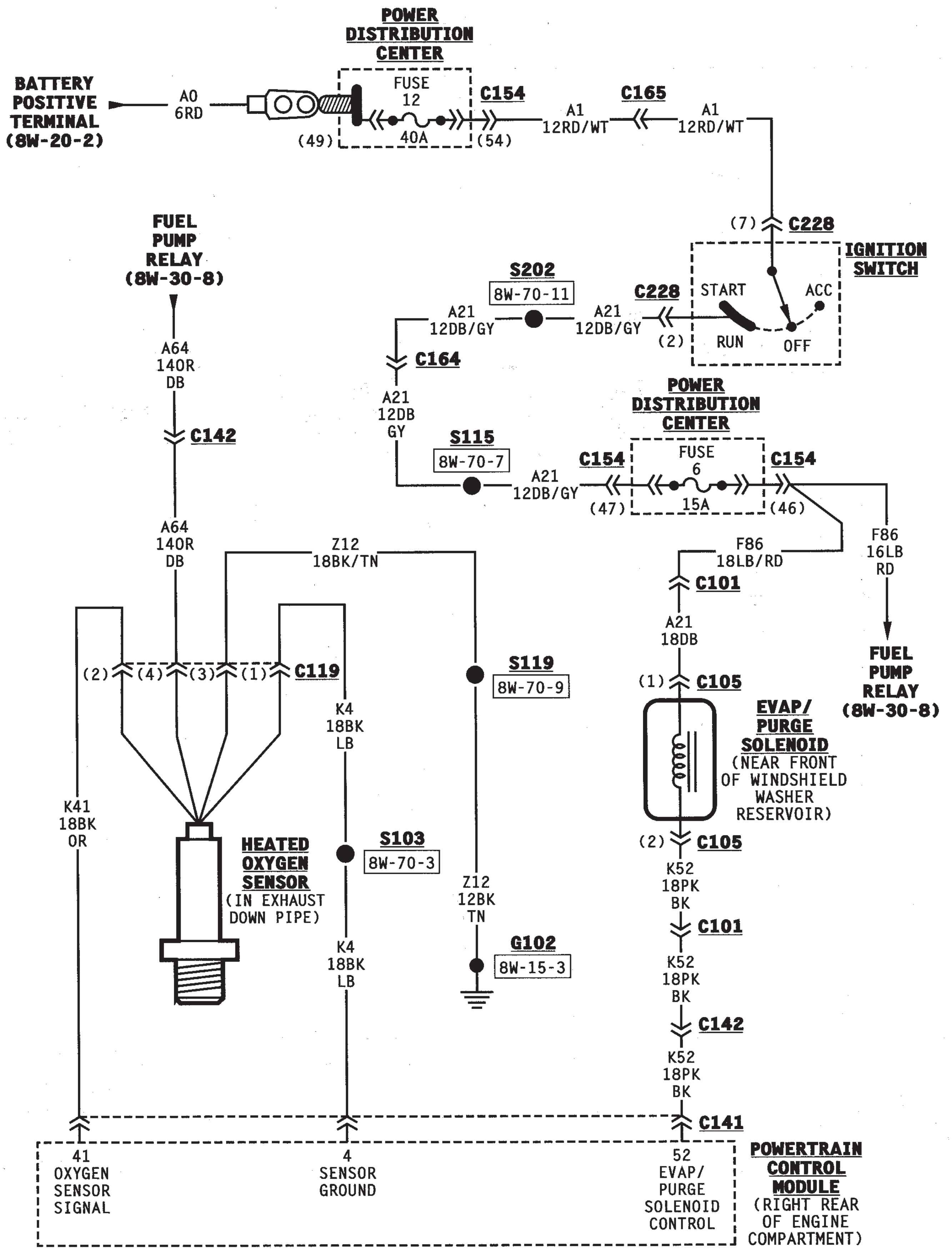

S121
8W-70-9
K6
18VT/WT
K6
18VT
WT
(3) C128
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
(CENTER OF
DASH PANEL)
C128
(2)
(1) C128
(3) C125
THROTTLE POSITION
SENSOR
(ON THROTTLE
BODY)
C125
(2)
(1) C125
K22
18OR
DB
K4
18BK
LB
K4
18BK
LB
S103
8W-70-3
K22
18OR
DB
S125
8W-70-10
K22
18OR
DB
K22
18OR
DB
K6
18VT
WT
K70
18RD
WT
K4
16BK
LB
K4
18BK
LB
K4
18BK
LB
WITH
MANUAL
TRANS
WITH
AUTOMATIC
TRANS
(2) C120
ENGINE
COOLANT
TEMPERATURE
SENSOR
(THERMOSTAT
HOUSING)
(1) C120
(2) C127
INTAKE
AIR
TEMPERATURE
SENSOR
(ON INTAKE
MANIFOLD)
(1) C127
K2
16TN
BK
K21
20BK
RD
K22
18OR
DB
C141
6
5.0
VOLT
SUPPLY
1
MAP
SIGNAL
2
ECT
SIGNAL
4
SENSOR
GROUND
21
IAT
SIGNAL
22
TPS
SIGNAL
POWERTRAIN
CONTROL
MODULE
(RIGHT REAR
OF ENGINE
COMPARTMENT)

J958W-3

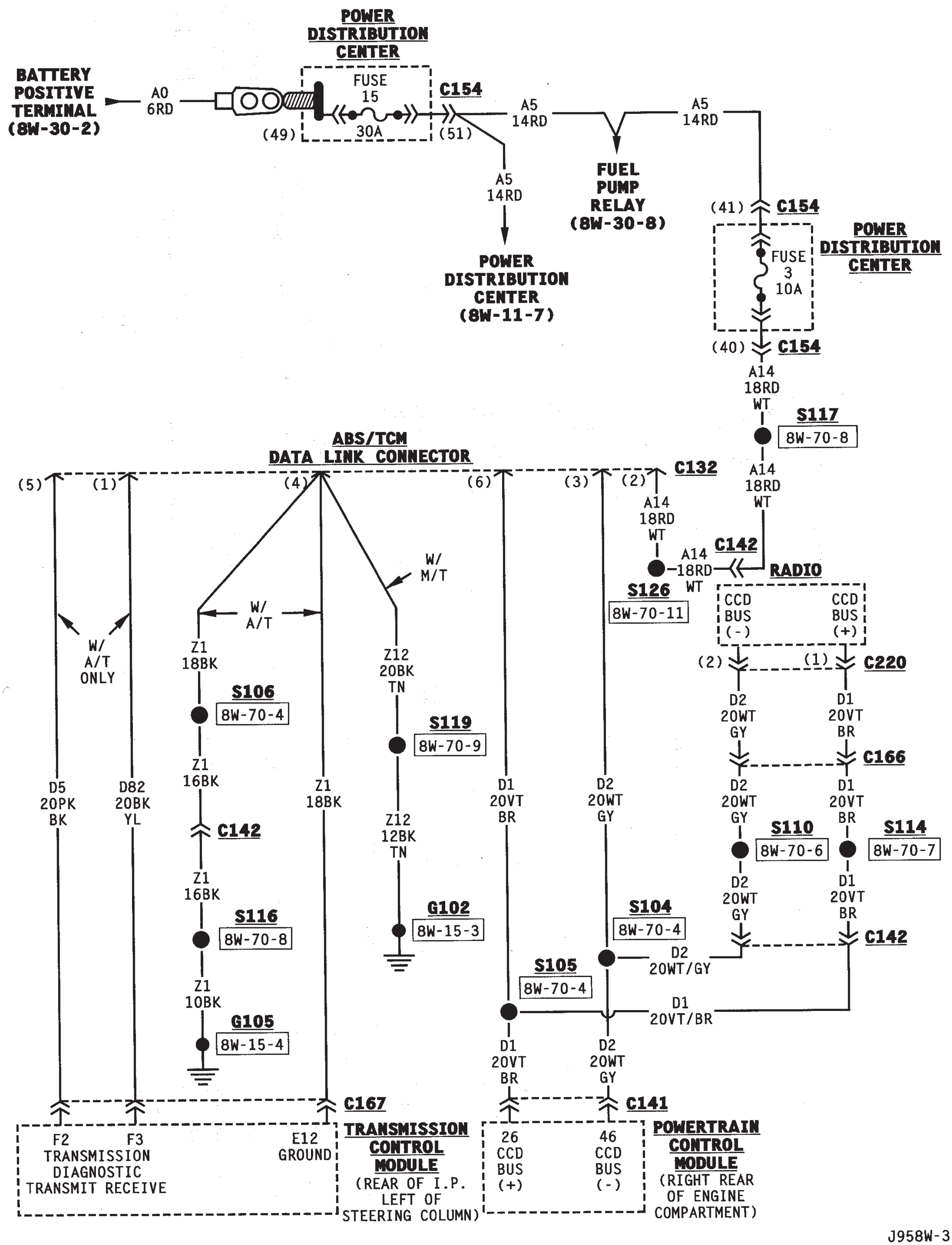


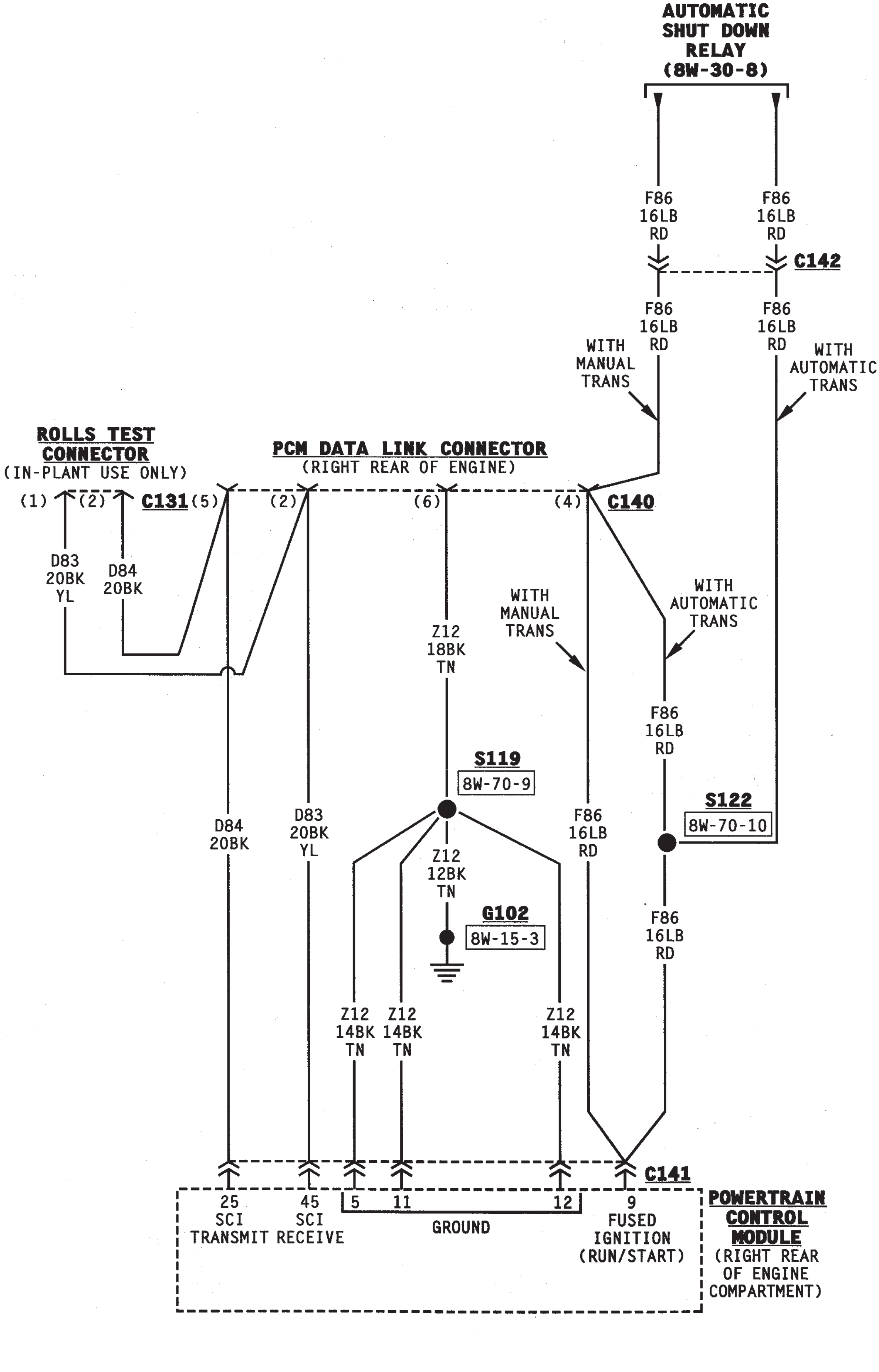
S118
8W-70-8
K25
20WT
BK
K25
20WT
BK
K25
18WT
BK
DISTRIBUTOR
(3) C139
CAM-SHAFT POSITION SENSOR
C139
(1)
(2) C139
(3) C137
C137
(1)
CRANK-SHAFT POSITION SENSOR
(LEFT REAR OF ENGINE)
(2) C137
(3) C134
C134
(1)
VEHICLE SPEED SENSOR
(LEFT SIDE OF TRANSMISSION)
(2) C134
K25
20WT
BK
K24
18GY
BK
K4
18BK
LB
K4
18BK
LB
K4
18BK
LB
G7
18WT
OR
S103
8W-70-3
S120
8W-70-9
K27
20RD
LG
K4
18BK
LB
G7
18WT
OR
C141
7
8.0
VOLT
SUPPLY
44
CMP
SENSOR
SIGNAL
24
CKP
SENSOR
SIGNAL
4
SENSOR
GROUND
47
VSS
SIGNAL
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3

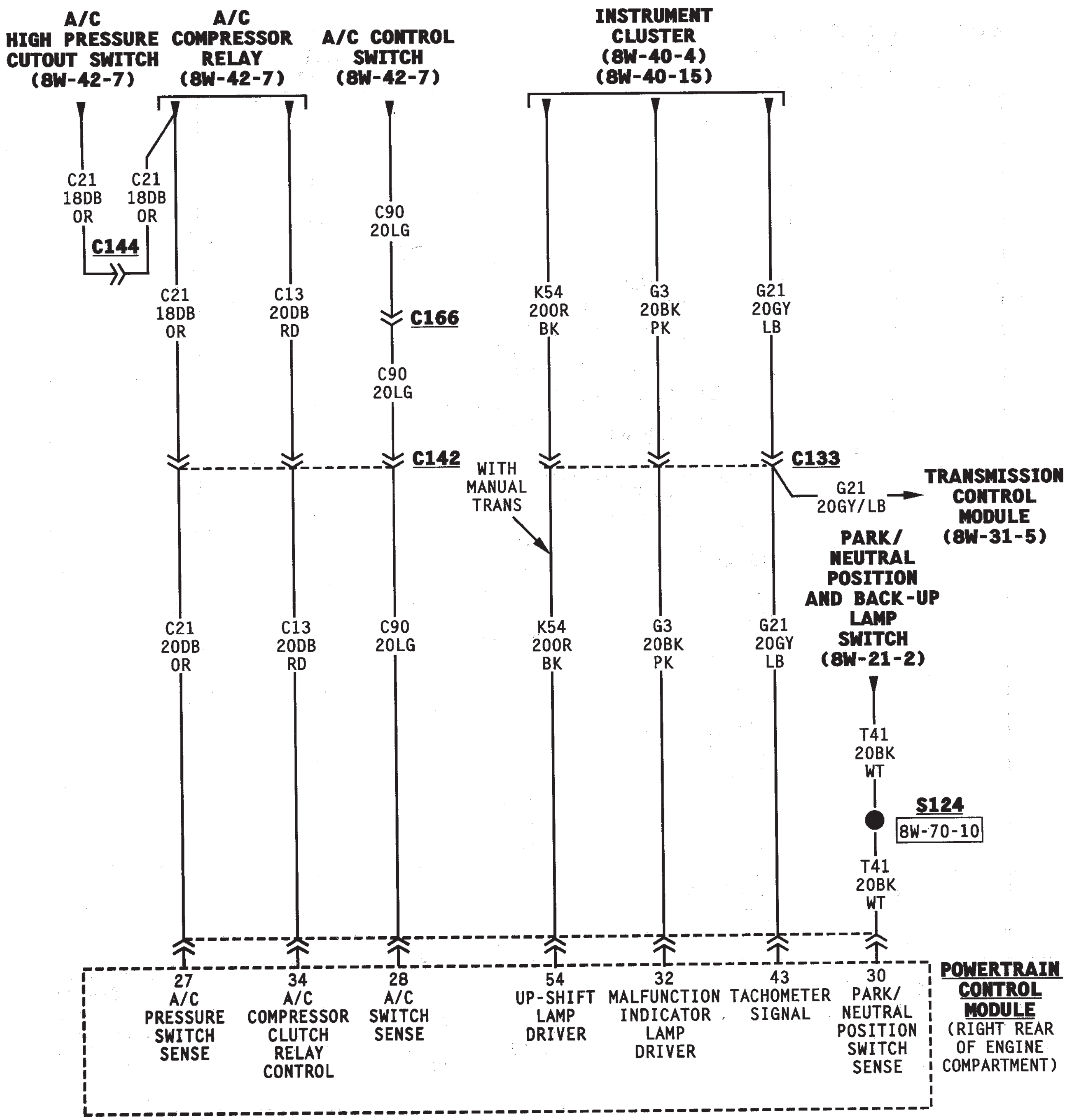

POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
FUSE 12 40A
(49)
(54)
C154
A1 12RD/WT
C165
A1 12RD/WT
(7) C228
IGNITION SWITCH
START
ACC
RUN
OFF
(2)
C228
FUEL PUMP RELAY (8W-30-8)
S202
8W-70-11
A21 12DB/GY
A21 12DB/GY
C164
A21 12DB GY
A64 14OR DB
C142
S115
8W-70-7
A21 12DB/GY
POWER DISTRIBUTION CENTER
C154
FUSE 6 15A
C154
(47)
(46)
F86 16LB RD
F86 18LB/RD
C101
A21 18DB
(1) C105
A64 14OR DB
Z12 18BK/TN
(2) (4) (3) (1) C119
K4 18BK LB
S119
8W-70-9
EVAP/ PURGE SOLENOID
(NEAR FRONT OF WINDSHIELD WASHER RESERVOIR)
FUEL PUMP RELAY (8W-30-8)
K41 18BK OR
HEATED OXYGEN SENSOR
(IN EXHAUST DOWN PIPE)
S103
8W-70-3
(2) C105
K52 18PK BK
Z12 12BK TN
C101
K4 18BK LB
G102
8W-15-3
K52 18PK BK
C142
K52 18PK BK
C141
41 OXYGEN SENSOR SIGNAL
4 SENSOR GROUND
52 EVAP/ PURGE SOLENOID CONTROL
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3

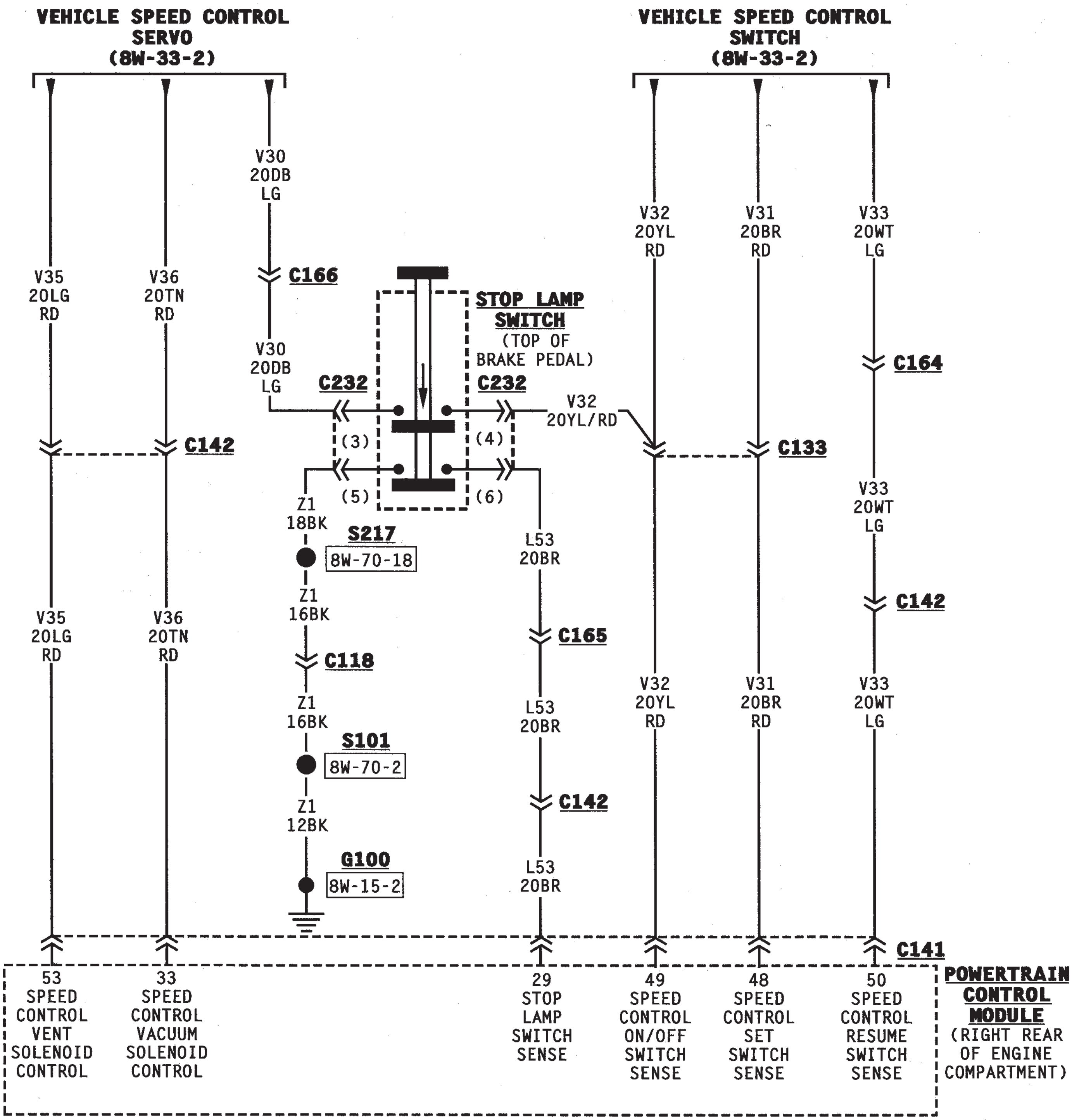

POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-30-2)
A0 6RD
FUSE 15 30A
(49)
C154
(51)
A5 14RD
FUEL PUMP RELAY (8W-30-8)
POWER DISTRIBUTION CENTER (8W-11-7)
(41) C154
FUSE 3 10A
(40) C154
A14 18RD WT
S117 8W-70-8
ABS/TCM DATA LINK CONNECTOR
C132
(5) (1) (4) (6) (3) (2)
W/ M/T
W/ A/T
W/ A/T ONLY
Z1 18BK
S106 8W-70-4
Z1 16BK
C142
S116 8W-70-8
Z1 10BK
G105 8W-15-4
Z12 20BK TN
S119 8W-70-9
Z12 12BK TN
G102 8W-15-3
D5 20PK BK
D82 20BK YL
D1 20VT BR
D2 20WT GY
S126 8W-70-11
RADIO
CCD BUS (-)
CCD BUS (+)
C220
C166
S110 8W-70-6
S114 8W-70-7
S104 8W-70-4
S105 8W-70-4
D2 20WT/GY
D1 20VT/BR
C167
C141
F2 TRANSMISSION DIAGNOSTIC TRANSMIT RECEIVE
F3
E12 GROUND
TRANSMISSION CONTROL MODULE (REAR OF I.P. LEFT OF STEERING COLUMN)
26 CCD BUS (+)
46 CCD BUS (-)
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)
J958W-3


AUTOMATIC SHUT DOWN RELAY (8W-30-8)
F86 16LB RD
F86 16LB RD
C142
F86 16LB RD
F86 16LB RD
WITH MANUAL TRANS
WITH AUTOMATIC TRANS
ROLLS TEST CONNECTOR (IN-PLANT USE ONLY)
PCM DATA LINK CONNECTOR (RIGHT REAR OF ENGINE)
(1) (2) C131 (5) (2) (6) (4) C140
D83 20BK YL
D84 20BK
Z12 18BK TN
WITH MANUAL TRANS
WITH AUTOMATIC TRANS
F86 16LB RD
S119
8W-70-9
S122
8W-70-10
D84 20BK
D83 20BK YL
Z12 12BK TN
F86 16LB RD
G102
8W-15-3
F86 16LB RD
Z12 14BK TN
Z12 14BK TN
Z12 14BK TN
C141
25 SCI TRANSMIT
45 SCI RECEIVE
5 11 12 GROUND
9 FUSED IGNITION (RUN/START)
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

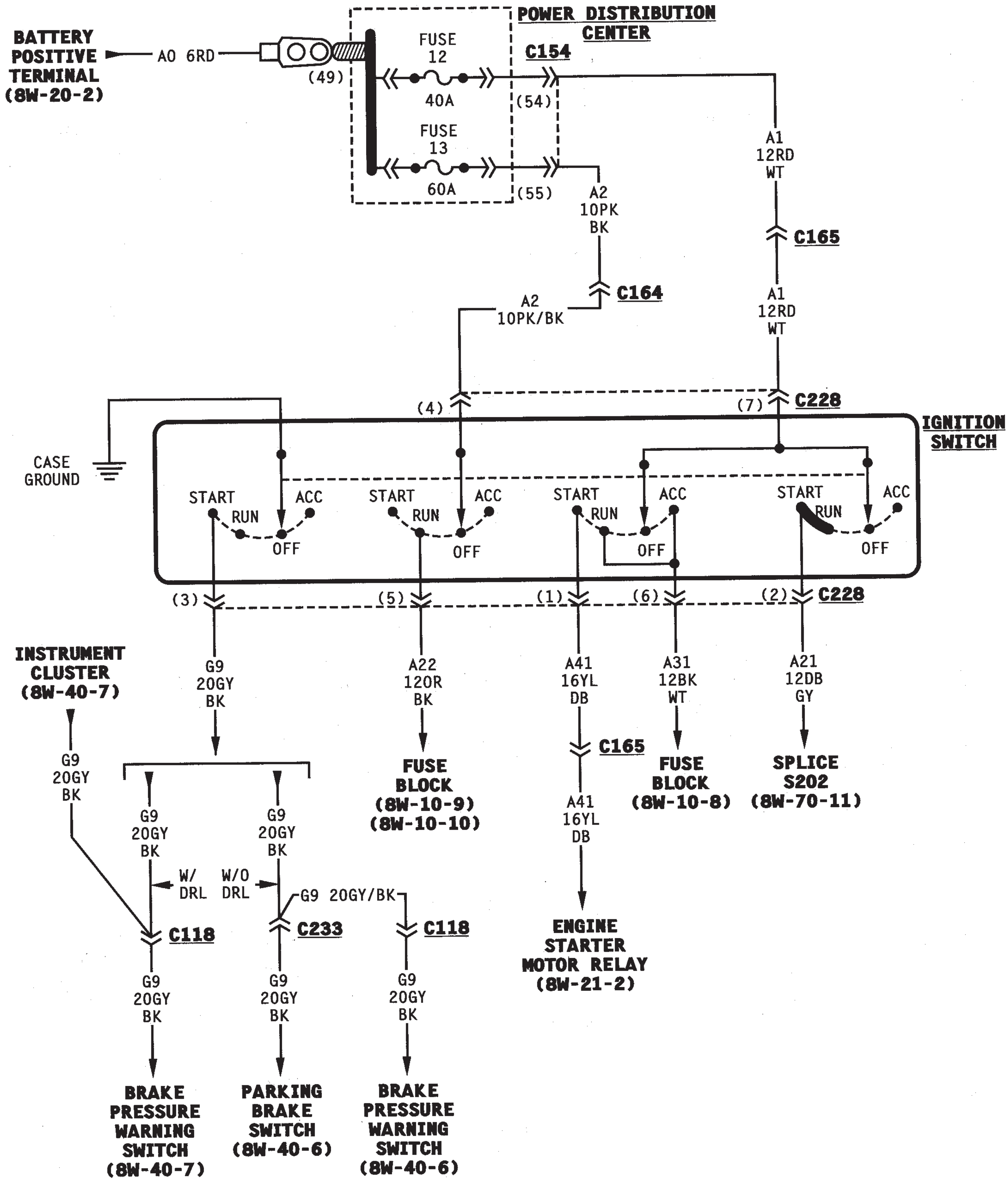
J958W-3


A/C HIGH PRESSURE CUTOUT SWITCH (8W-42-7)
A/C COMPRESSOR RELAY (8W-42-7)
A/C CONTROL SWITCH (8W-42-7)
INSTRUMENT CLUSTER (8W-40-4) (8W-40-15)
C21 18DB OR
C21 18DB OR
C144
C90 20LG
C166
C90 20LG
C21 18DB OR
C13 20DB RD
K54 20OR BK
G3 20BK PK
G21 20GY LB
C142
WITH MANUAL TRANS
C133
G21 20GY/LB
TRANSMISSION CONTROL MODULE (8W-31-5)
PARK/ NEUTRAL POSITION AND BACK-UP LAMP SWITCH (8W-21-2)
C21 20DB OR
C13 20DB RD
C90 20LG
K54 20OR BK
G3 20BK PK
G21 20GY LB
T41 20BK WT
S124
8W-70-10
T41 20BK WT
27 A/C PRESSURE SWITCH SENSE
34 A/C COMPRESSOR CLUTCH RELAY CONTROL
28 A/C SWITCH SENSE
54 UP-SHIFT LAMP DRIVER
32 MALFUNCTION INDICATOR LAMP DRIVER
43 TACHOMETER SIGNAL
30 PARK/ NEUTRAL POSITION SWITCH SENSE
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3

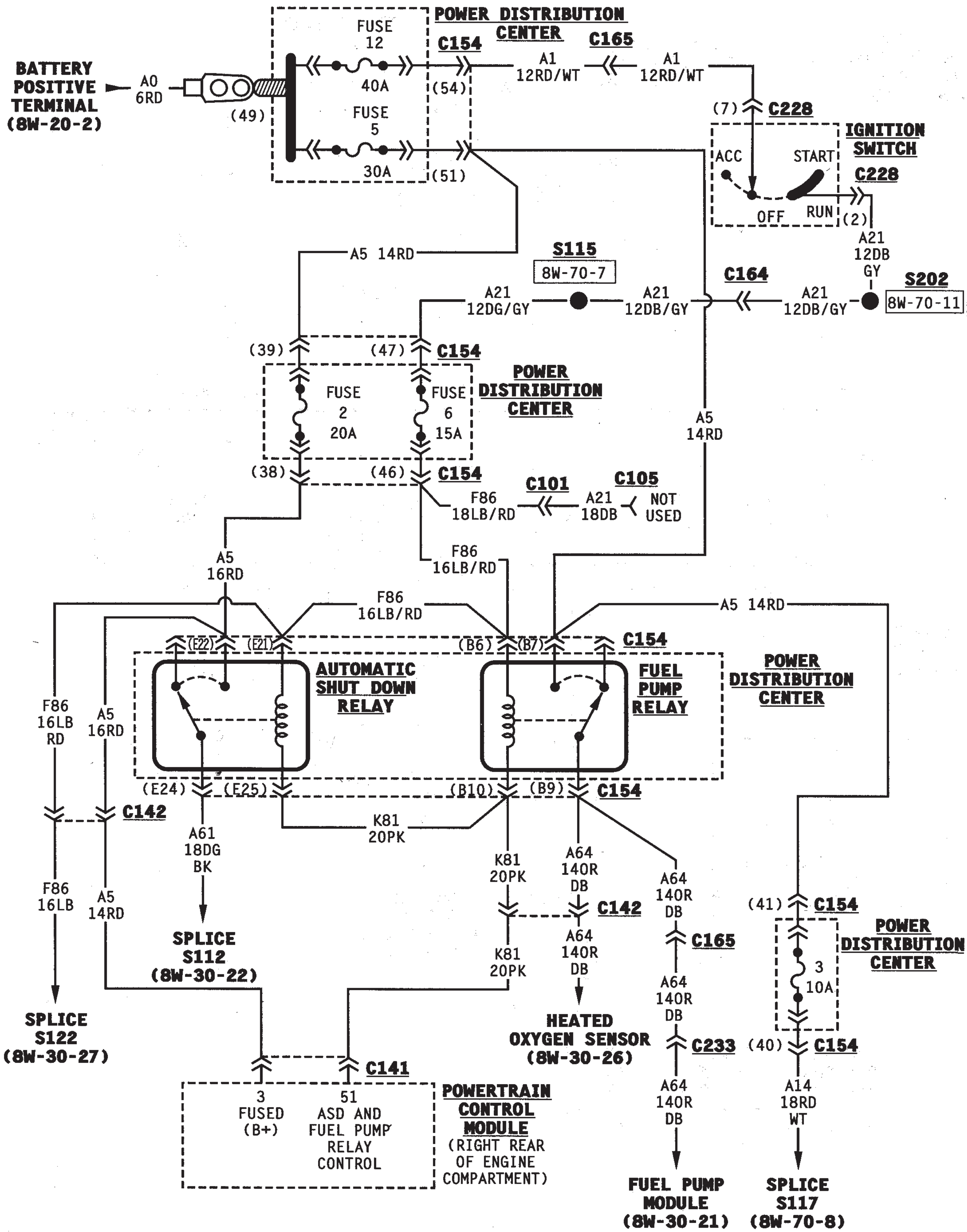

VEHICLE SPEED CONTROL SERVO (8W-33-2)
VEHICLE SPEED CONTROL SWITCH (8W-33-2)
V35 20LG RD
V36 20TN RD
V30 20DB LG
C166
STOP LAMP SWITCH
(TOP OF BRAKE PEDAL)
C232
C232
V32 20YL/RD
(3)
(4)
(5)
(6)
C142
V32 20YL RD
V31 20BR RD
V33 20WT LG
C164
C133
Z1 18BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
L53 20BR
C165
C142
C141
53 SPEED CONTROL VENT SOLENOID CONTROL
33 SPEED CONTROL VACUUM SOLENOID CONTROL
29 STOP LAMP SWITCH SENSE
49 SPEED CONTROL ON/OFF SWITCH SENSE
48 SPEED CONTROL SET SWITCH SENSE
50 SPEED CONTROL RESUME SWITCH SENSE
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3

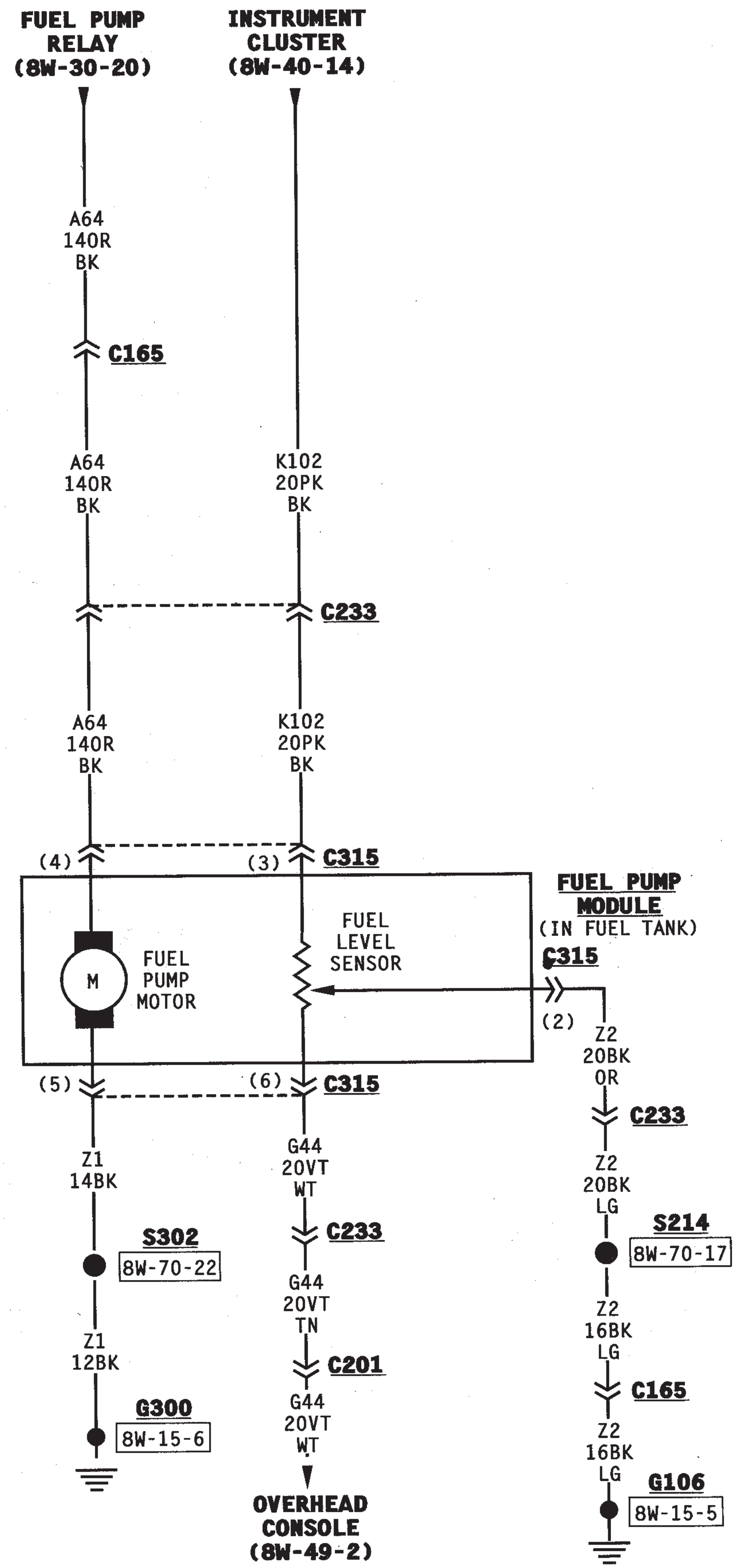


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 12
40A
FUSE 13
60A
C154
(54)
(55)
A1 12RD WT
A2 10PK BK
C165
C164
A2 10PK/BK
A1 12RD WT
(4)
(7)
C228
IGNITION SWITCH
CASE GROUND
START
RUN
ACC
OFF
(3)
(5)
(1)
(6)
(2)
C228
INSTRUMENT CLUSTER (8W-40-7)
G9 20GY BK
A22 12OR BK
A41 16YL DB
A31 12BK WT
A21 12DB GY
C165
FUSE BLOCK (8W-10-9) (8W-10-10)
FUSE BLOCK (8W-10-8)
SPLICE S202 (8W-70-11)
W/ DRL
W/O DRL
G9 20GY/BK
C118
C233
C118
ENGINE STARTER MOTOR RELAY (8W-21-2)
BRAKE PRESSURE WARNING SWITCH (8W-40-7)
PARKING BRAKE SWITCH (8W-40-6)
BRAKE PRESSURE WARNING SWITCH (8W-40-6)

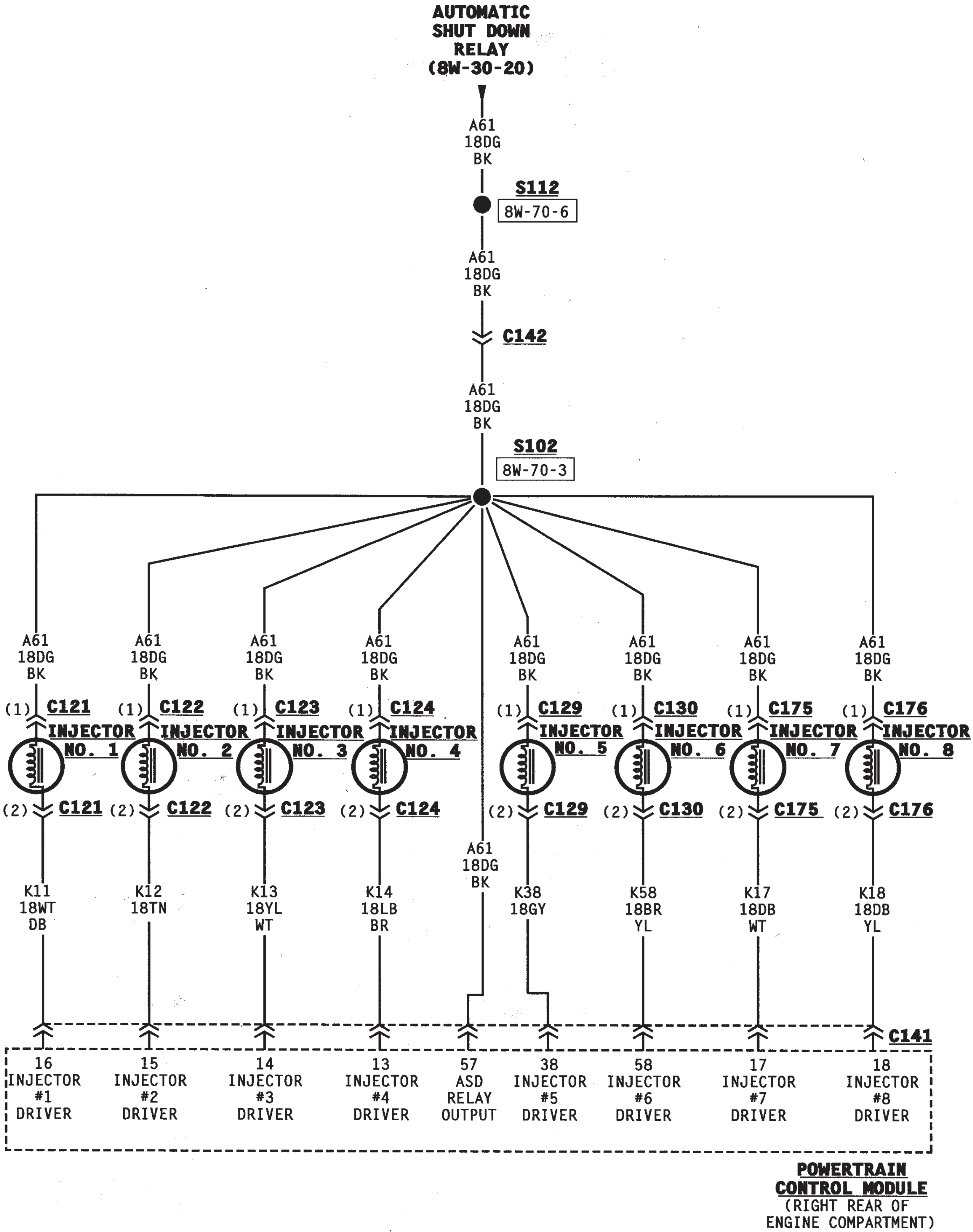
J958W-3


POWER DISTRIBUTION CENTER
FUSE 12
40A
FUSE 5
30A
C154
(54)
(51)
A1 12RD/WT
C165
A1 12RD/WT
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
(7)
C228
IGNITION SWITCH
ACC
START
OFF
RUN
C228
(2)
A21 12DB GY
S202
8W-70-11
A5 14RD
S115
8W-70-7
A21 12DG/GY
A21 12DB/GY
C164
A21 12DB/GY
(39)
(47)
C154
POWER DISTRIBUTION CENTER
FUSE 2 20A
FUSE 6 15A
A5 14RD
(38)
(46)
C154
F86 18LB/RD
C101
A21 18DB
C105
NOT USED
A5 16RD
F86 16LB/RD
F86 16LB/RD
A5 14RD
(E22)
(E21)
(B6)
(B7)
C154
AUTOMATIC SHUT DOWN RELAY
FUEL PUMP RELAY
POWER DISTRIBUTION CENTER
F86 16LB RD
A5 16RD
(E24)
(E25)
(B10)
(B9)
C154
C142
K81 20PK
A61 18DG BK
K81 20PK
A64 140R DB
A64 140R DB
F86 16LB
A5 14RD
SPLICE S112 (8W-30-22)
C142
A64 140R DB
K81 20PK
C165
A64 140R DB
(41)
C154
POWER DISTRIBUTION CENTER
3 10A
SPLICE S122 (8W-30-27)
HEATED OXYGEN SENSOR (8W-30-26)
C233
(40)
C154
A64 140R DB
A14 18RD WT
C141
3 FUSED (B+)
51 ASD AND FUEL PUMP RELAY CONTROL
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)
FUEL PUMP MODULE (8W-30-21)
SPLICE S117 (8W-70-8)

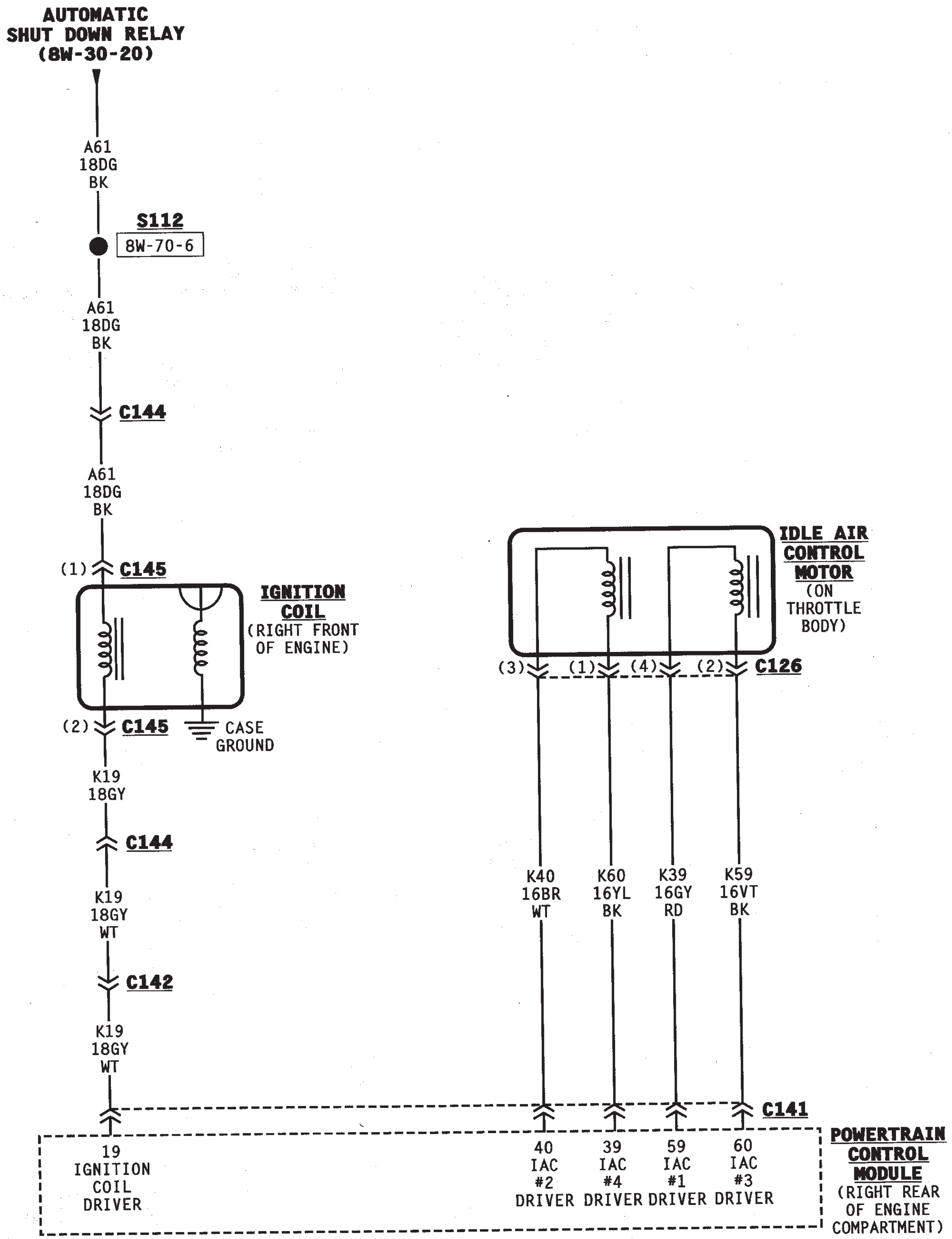
J958W-3


FUEL PUMP RELAY (8W-30-20)
INSTRUMENT CLUSTER (8W-40-14)
A64 14OR BK
C165
A64 14OR BK
K102 20PK BK
C233
A64 14OR BK
K102 20PK BK
(4)
(3)
C315
FUEL PUMP MODULE
(IN FUEL TANK)
FUEL LEVEL SENSOR
C315
M
FUEL PUMP MOTOR
(2)
Z2 20BK OR
(5)
(6)
C315
C233
Z1 14BK
G44 20VT WT
Z2 20BK LG
S302
8W-70-22
C233
S214
8W-70-17
G44 20VT TN
Z1 12BK
C201
Z2 16BK LG
C165
G300
8W-15-6
G44 20VT WT
Z2 16BK LG
G106
8W-15-5
OVERHEAD CONSOLE (8W-49-2)

J958W-3

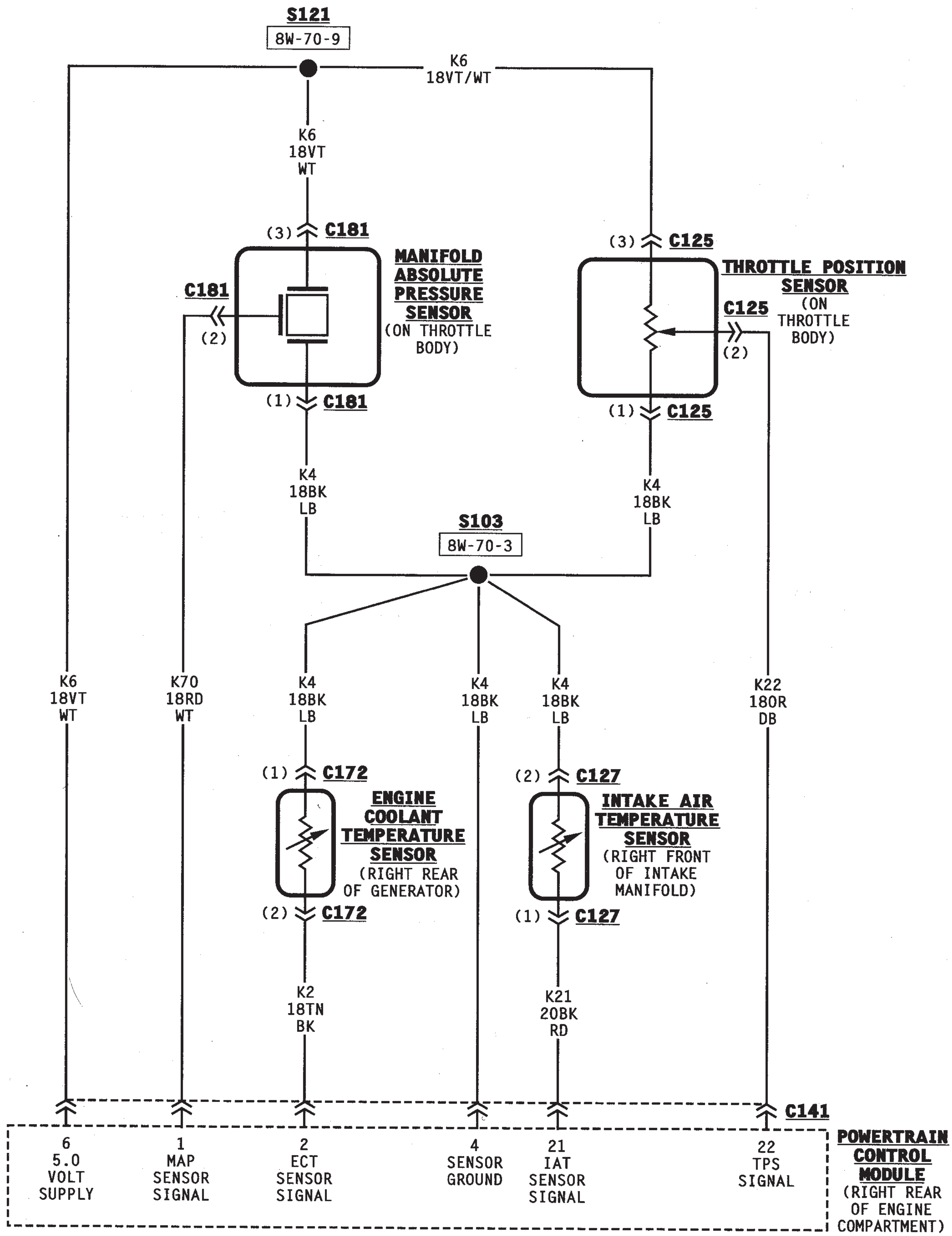

AUTOMATIC
SHUT DOWN
RELAY
(8W-30-20)
A61
18DG
BK
S112
8W-70-6
C142
S102
8W-70-3
(1) C121
INJECTOR
NO. 1
(2) C121
(1) C122
INJECTOR
NO. 2
(2) C122
(1) C123
INJECTOR
NO. 3
(2) C123
(1) C124
INJECTOR
NO. 4
(2) C124
(1) C129
INJECTOR
NO. 5
(2) C129
(1) C130
INJECTOR
NO. 6
(2) C130
(1) C175
INJECTOR
NO. 7
(2) C175
(1) C176
INJECTOR
NO. 8
(2) C176
K11
18WT
DB
K12
18TN
K13
18YL
WT
K14
18LB
BR
K38
18GY
K58
18BR
YL
K17
18DB
WT
K18
18DB
YL
C141
16
INJECTOR
#1
DRIVER
15
INJECTOR
#2
DRIVER
14
INJECTOR
#3
DRIVER
13
INJECTOR
#4
DRIVER
57
ASD
RELAY
OUTPUT
38
INJECTOR
#5
DRIVER
58
INJECTOR
#6
DRIVER
17
INJECTOR
#7
DRIVER
18
INJECTOR
#8
DRIVER
POWERTRAIN
CONTROL MODULE
(RIGHT REAR OF
ENGINE COMPARTMENT)

J958W-3

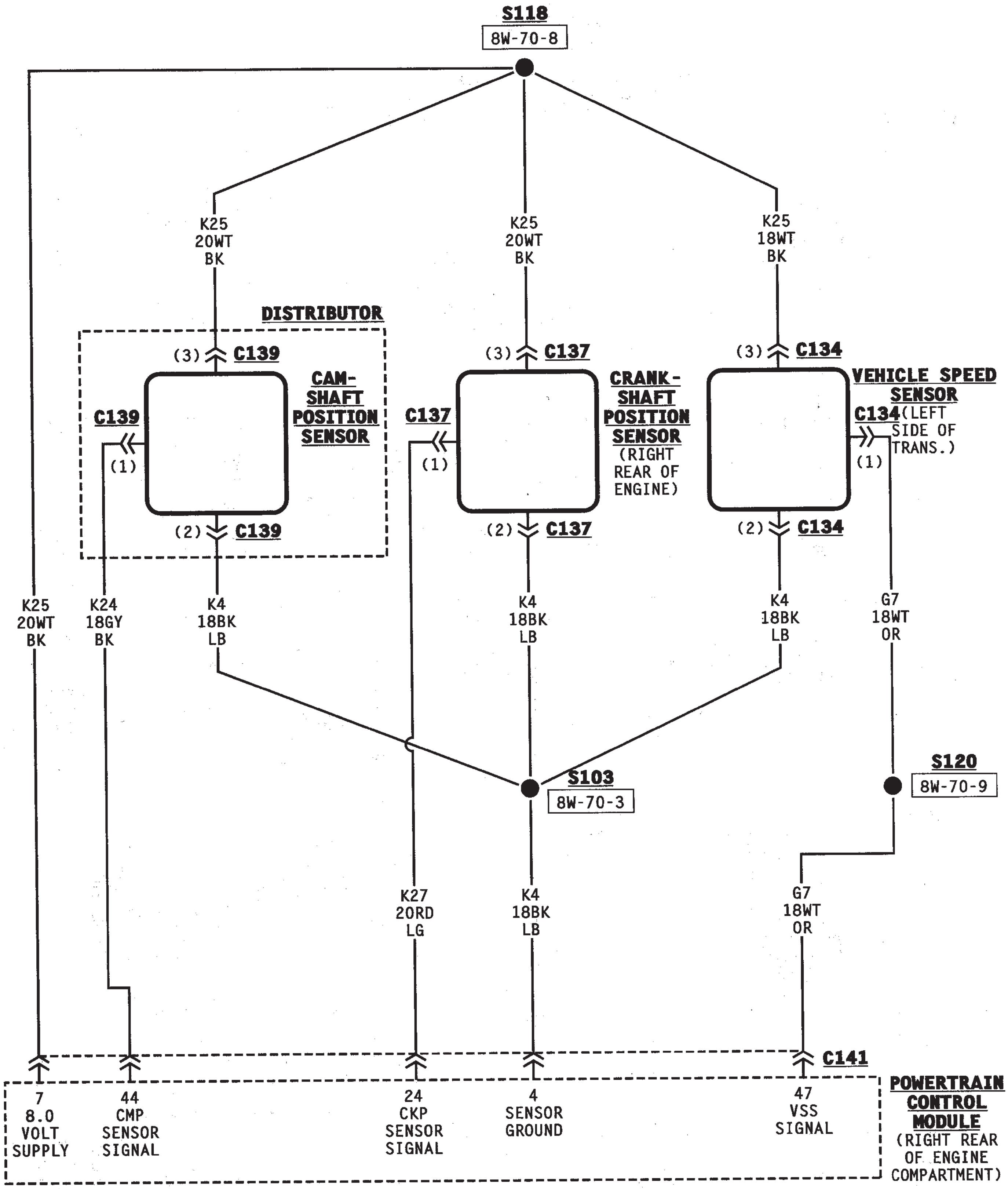


AUTOMATIC
SHUT DOWN RELAY
(8W-30-20)
A61
18DG
BK
S112
8W-70-6
A61
18DG
BK
C144
A61
18DG
BK
(1)
C145
IGNITION
COIL
(RIGHT FRONT
OF ENGINE)
(2)
C145
CASE
GROUND
K19
18GY
C144
K19
18GY
WT
C142
K19
18GY
WT
IDLE AIR
CONTROL
MOTOR
(ON
THROTTLE
BODY)
(3)
(1)
(4)
(2)
C126
K40
16BR
WT
K60
16YL
BK
K39
16GY
RD
K59
16VT
BK
C141
19
IGNITION
COIL
DRIVER
40
IAC
#2
DRIVER
39
IAC
#4
DRIVER
59
IAC
#1
DRIVER
60
IAC
#3
DRIVER
POWERTRAIN
CONTROL
MODULE
(RIGHT REAR
OF ENGINE
COMPARTMENT)

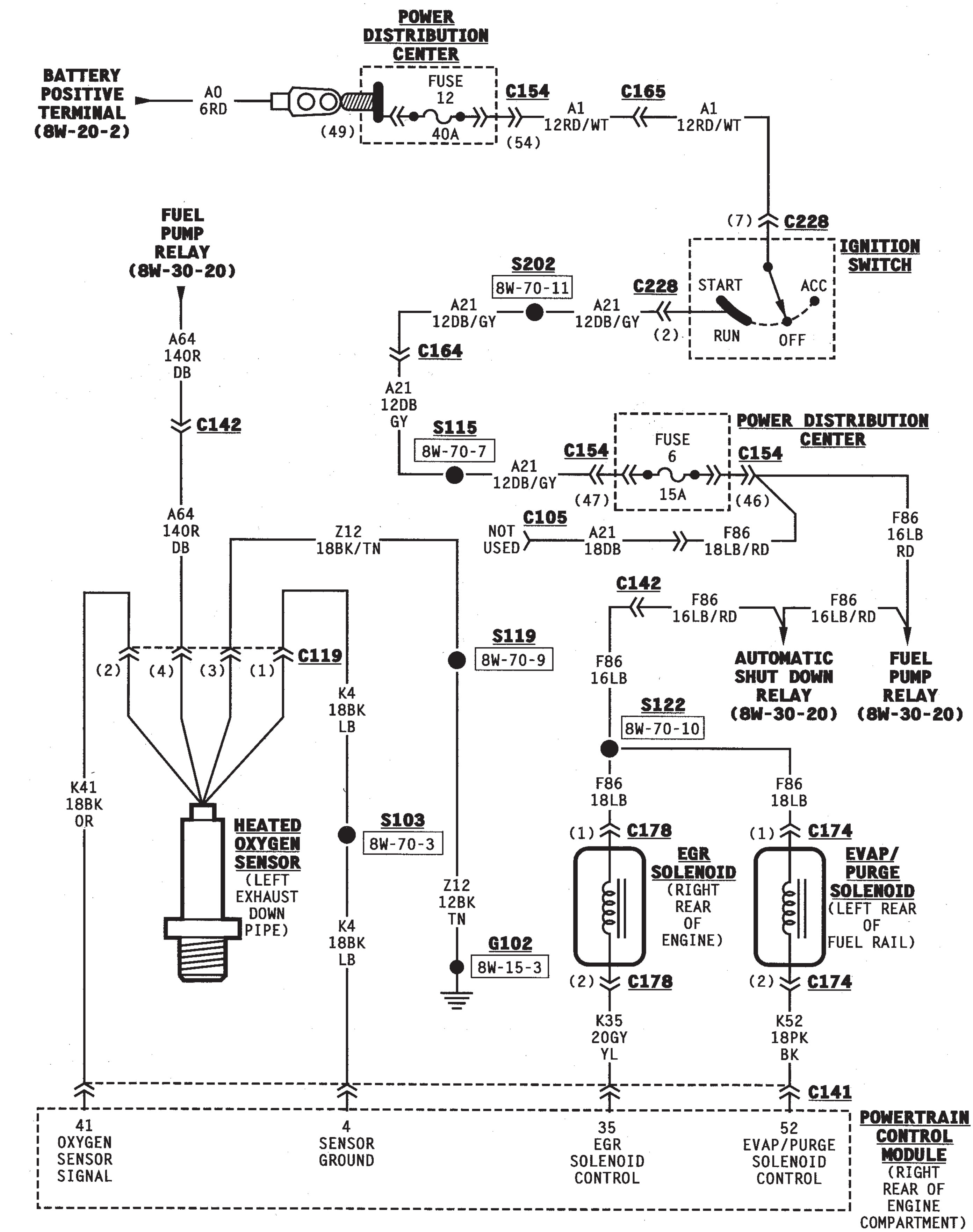
J958W-3


S121
8W-70-9
K6
18VT/WT
K6
18VT
WT
(3) C181
MANIFOLD ABSOLUTE PRESSURE SENSOR
(ON THROTTLE BODY)
C181
(2)
(1) C181
(3) C125
THROTTLE POSITION SENSOR
(ON THROTTLE BODY)
C125
(2)
(1) C125
K4
18BK
LB
S103
8W-70-3
K6
18VT
WT
K70
18RD
WT
K22
18OR
DB
(1) C172
ENGINE COOLANT TEMPERATURE SENSOR
(RIGHT REAR OF GENERATOR)
(2) C172
(2) C127
INTAKE AIR TEMPERATURE SENSOR
(RIGHT FRONT OF INTAKE MANIFOLD)
(1) C127
K2
18TN
BK
K21
20BK
RD
C141
6 5.0 VOLT SUPPLY
1 MAP SENSOR SIGNAL
2 ECT SENSOR SIGNAL
4 SENSOR GROUND
21 IAT SENSOR SIGNAL
22 TPS SIGNAL
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

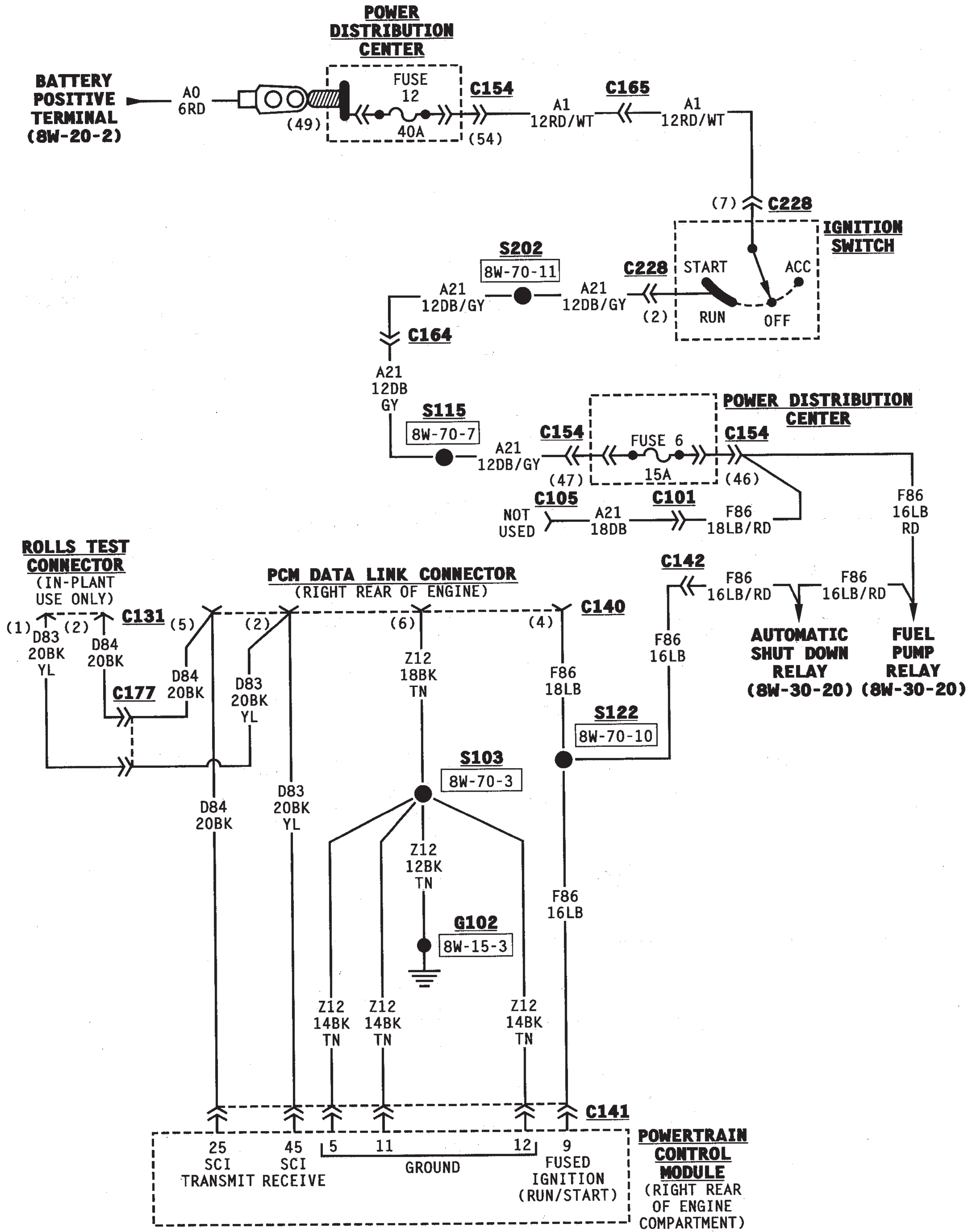
J958W-3


S118
8W-70-8
K25
20WT
BK
K25
20WT
BK
K25
18WT
BK
DISTRIBUTOR
(3) C139
CAM-SHAFT POSITION SENSOR
C139
(1)
(2) C139
(3) C137
CRANK-SHAFT POSITION SENSOR
(RIGHT REAR OF ENGINE)
C137
(1)
(2) C137
(3) C134
VEHICLE SPEED SENSOR
C134 (LEFT SIDE OF TRANS.)
(1)
(2) C134
K25
20WT
BK
K24
18GY
BK
K4
18BK
LB
K4
18BK
LB
K4
18BK
LB
G7
18WT
OR
S103
8W-70-3
S120
8W-70-9
K27
20RD
LG
K4
18BK
LB
G7
18WT
OR
C141
7
8.0 VOLT SUPPLY
44
CMP SENSOR SIGNAL
24
CKP SENSOR SIGNAL
4
SENSOR GROUND
47
VSS SIGNAL
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

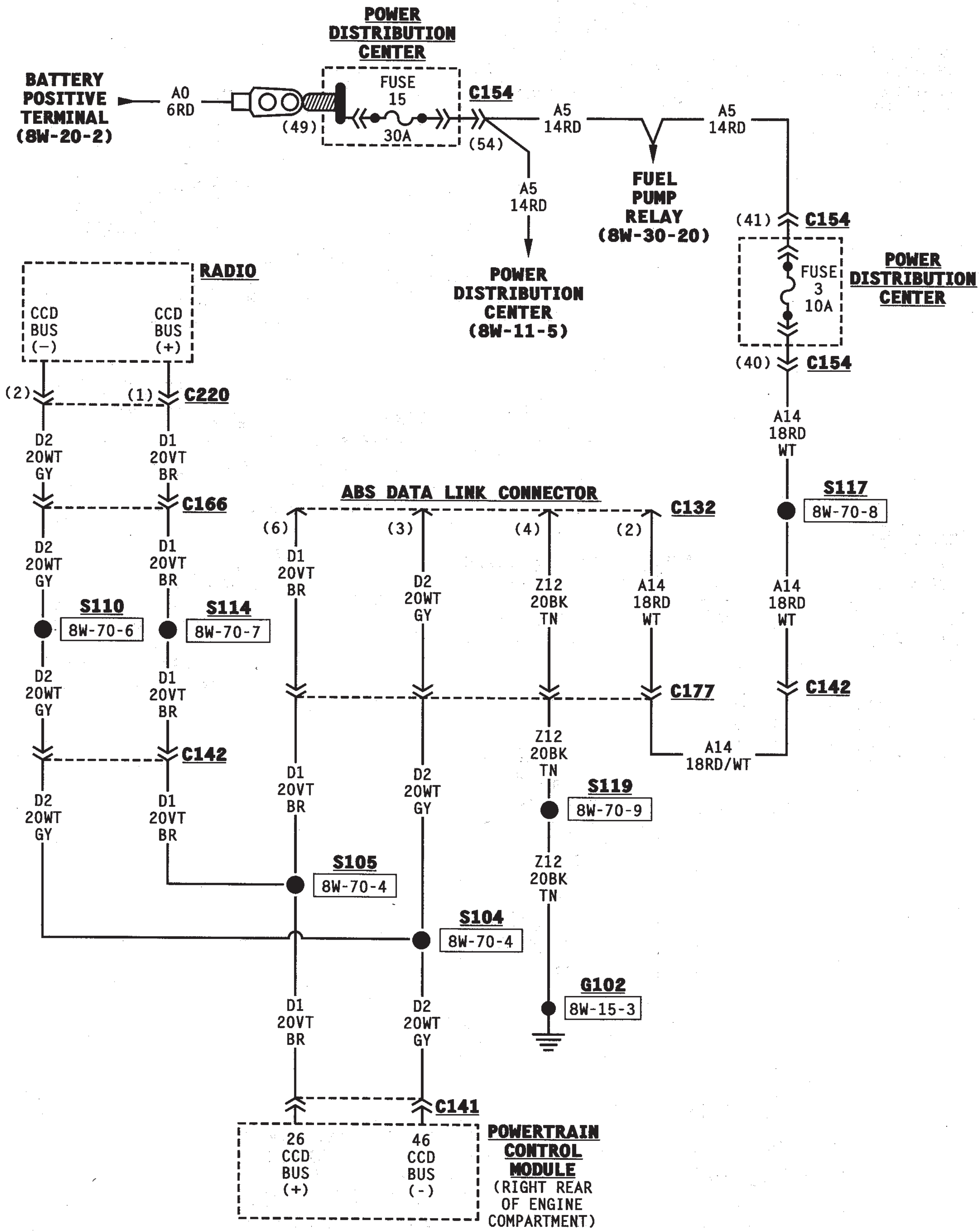
J958W-3


POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
FUSE 12 40A
(49)
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
(7) C228
IGNITION SWITCH
START
ACC
RUN
OFF
FUEL PUMP RELAY (8W-30-20)
S202
8W-70-11
A21 12DB/GY
C228
(2)
C164
A64 14OR DB
C142
A21 12DB GY
S115
8W-70-7
POWER DISTRIBUTION CENTER
FUSE 6 15A
C154
(47)
(46)
A64 14OR DB
Z12 18BK/TN
NOT USED
C105
A21 18DB
F86 18LB/RD
F86 16LB RD
C142
F86 16LB/RD
F86 16LB/RD
(2) (4) (3) (1) C119
S119
8W-70-9
AUTOMATIC SHUT DOWN RELAY (8W-30-20)
FUEL PUMP RELAY (8W-30-20)
K4 18BK LB
F86 16LB
S122
8W-70-10
K41 18BK OR
F86 18LB
F86 18LB
HEATED OXYGEN SENSOR (LEFT EXHAUST DOWN PIPE)
S103
8W-70-3
(1) C178
(1) C174
EGR SOLENOID (RIGHT REAR OF ENGINE)
EVAP/ PURGE SOLENOID (LEFT REAR OF FUEL RAIL)
Z12 12BK TN
K4 18BK LB
G102
8W-15-3
(2) C178
(2) C174
K35 20GY YL
K52 18PK BK
C141
41 OXYGEN SENSOR SIGNAL
4 SENSOR GROUND
35 EGR SOLENOID CONTROL
52 EVAP/PURGE SOLENOID CONTROL
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

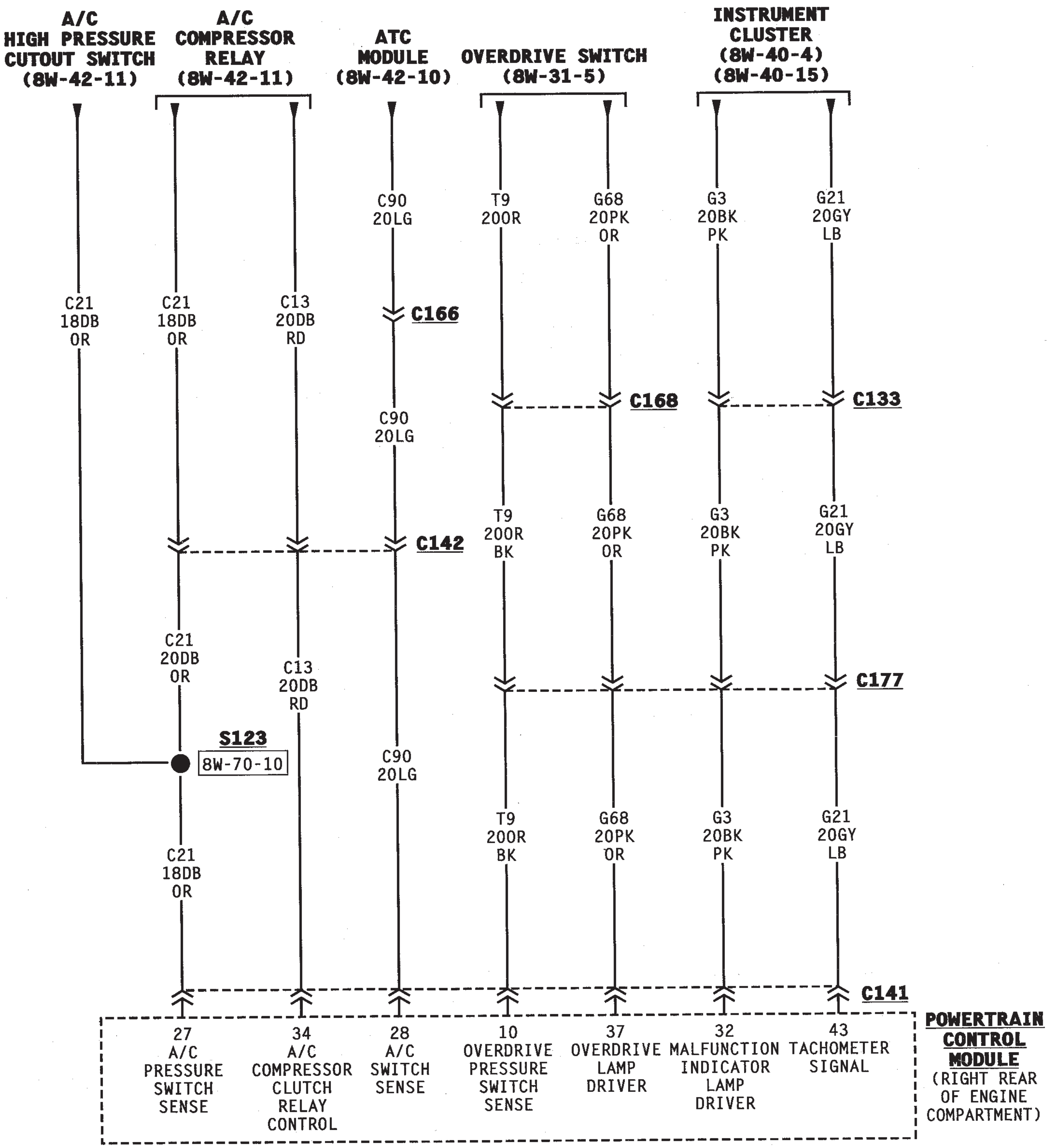
J958W-3


POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 12 40A
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
(7) C228
IGNITION SWITCH
START
ACC
RUN
OFF
C228
(2)
S202
8W-70-11
A21 12DB/GY
A21 12DB/GY
C164
A21 12DB GY
S115
8W-70-7
A21 12DB/GY
C154
(47)
FUSE 6 15A
POWER DISTRIBUTION CENTER
C154
(46)
C105
NOT USED
A21 18DB
C101
F86 18LB/RD
F86 16LB RD
C142
F86 16LB/RD
F86 16LB/RD
AUTOMATIC SHUT DOWN RELAY (8W-30-20)
FUEL PUMP RELAY (8W-30-20)
ROLLS TEST CONNECTOR
(IN-PLANT USE ONLY)
(1)
(2)
C131
D83 20BK YL
D84 20BK
PCM DATA LINK CONNECTOR
(RIGHT REAR OF ENGINE)
(5)
(2)
(6)
(4)
C140
C177
D84 20BK
D83 20BK YL
Z12 18BK TN
F86 18LB
F86 16LB
S122
8W-70-10
S103
8W-70-3
D84 20BK
D83 20BK YL
Z12 12BK TN
G102
8W-15-3
F86 16LB
Z12 14BK TN
Z12 14BK TN
Z12 14BK TN
C141
25 SCI TRANSMIT
45 SCI RECEIVE
5
11
12
GROUND
9 FUSED IGNITION (RUN/START)
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

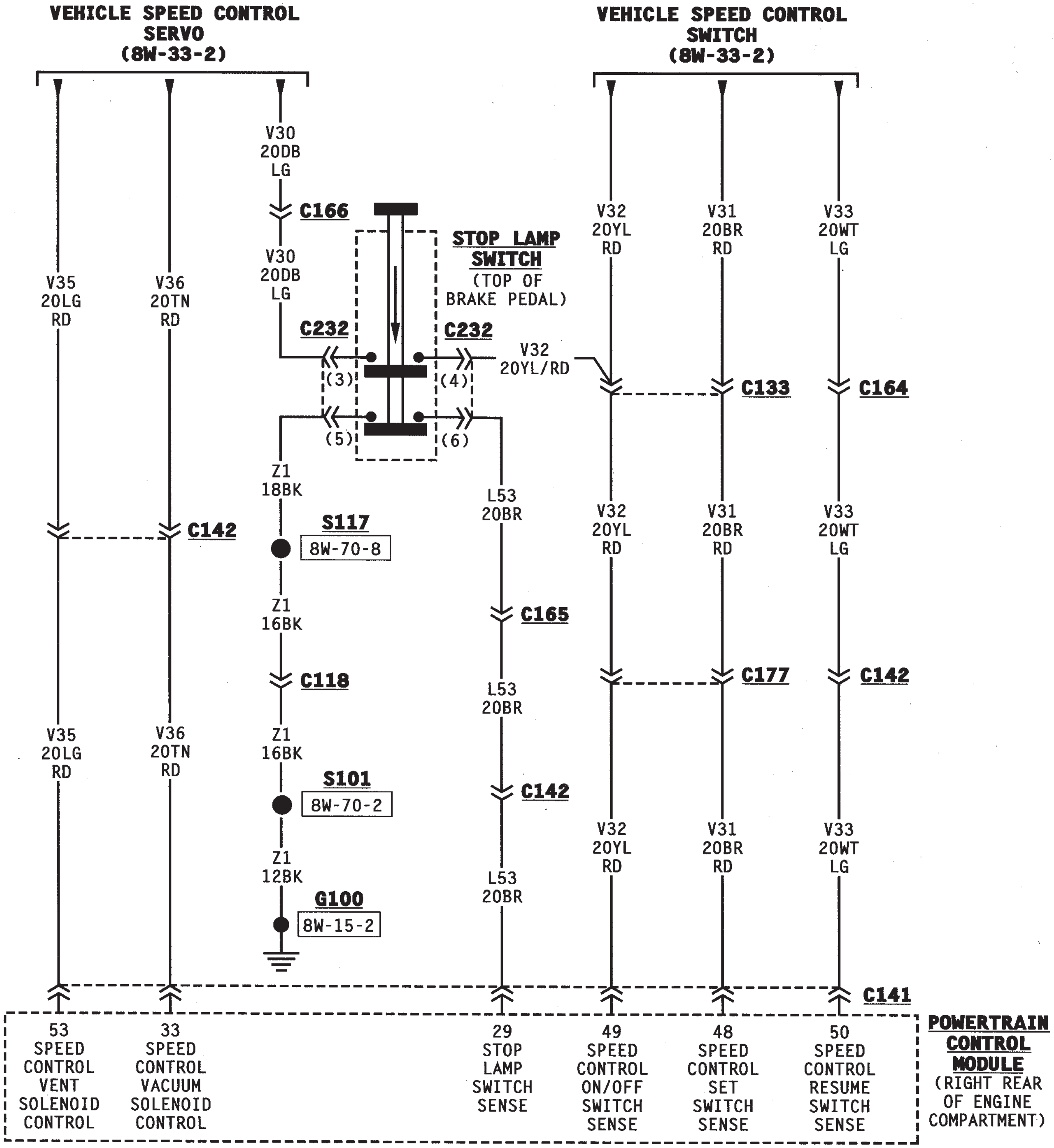
J958W-3

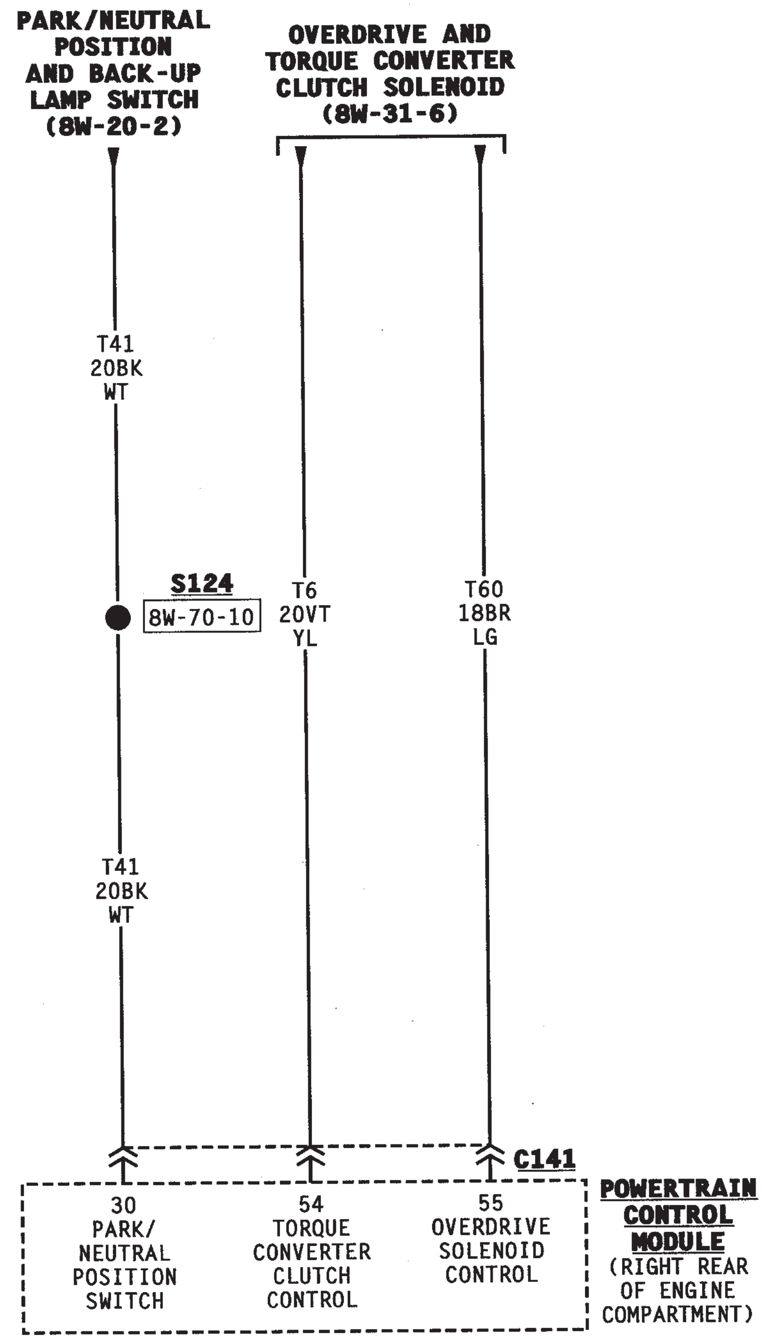

POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 15 30A
C154
(54)
A5 14RD
A5 14RD
A5 14RD
FUEL PUMP RELAY (8W-30-20)
POWER DISTRIBUTION CENTER (8W-11-5)
(41) C154
FUSE 3 10A
POWER DISTRIBUTION CENTER
(40) C154
A14 18RD WT
S117
8W-70-8
A14 18RD WT
C142
A14 18RD/WT
RADIO
CCD BUS (−)
CCD BUS (+)
(2) (1) C220
D2 20WT GY
D1 20VT BR
C166
S110
8W-70-6
S114
8W-70-7
C142
ABS DATA LINK CONNECTOR
C132
(6) (3) (4) (2)
Z12 20BK TN
A14 18RD WT
C177
S119
8W-70-9
S105
8W-70-4
S104
8W-70-4
G102
8W-15-3
C141
26 CCD BUS (+)
46 CCD BUS (-)
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3


A/C
HIGH PRESSURE
CUTOUT SWITCH
(8W-42-11)
A/C
COMPRESSOR
RELAY
(8W-42-11)
ATC
MODULE
(8W-42-10)
OVERDRIVE SWITCH
(8W-31-5)
INSTRUMENT
CLUSTER
(8W-40-4)
(8W-40-15)
C90
20LG
T9
20OR
G68
20PK
OR
G3
20BK
PK
G21
20GY
LB
C21
18DB
OR
C21
18DB
OR
C13
20DB
RD
C166
C168
C133
C90
20LG
T9
20OR
BK
G68
20PK
OR
G3
20BK
PK
G21
20GY
LB
C142
C21
20DB
OR
C13
20DB
RD
C177
S123
8W-70-10
C90
20LG
T9
20OR
BK
G68
20PK
OR
G3
20BK
PK
G21
20GY
LB
C21
18DB
OR
C141
27
A/C
PRESSURE
SWITCH
SENSE
34
A/C
COMPRESSOR
CLUTCH
RELAY
CONTROL
28
A/C
SWITCH
SENSE
10
OVERDRIVE
PRESSURE
SWITCH
SENSE
37
OVERDRIVE
LAMP
DRIVER
32
MALFUNCTION
INDICATOR
LAMP
DRIVER
43
TACHOMETER
SIGNAL
POWERTRAIN
CONTROL
MODULE
(RIGHT REAR
OF ENGINE
COMPARTMENT)

J958W-3


VEHICLE SPEED CONTROL
SERVO
(8W-33-2)
VEHICLE SPEED CONTROL
SWITCH
(8W-33-2)
V30
20DB
LG
C166
V30
20DB
LG
STOP LAMP
SWITCH
(TOP OF
BRAKE PEDAL)
C232
C232
(3)
(4)
(5)
(6)
V32
20YL/RD
V35
20LG
RD
V36
20TN
RD
V32
20YL
RD
V31
20BR
RD
V33
20WT
LG
C133
C164
Z1
18BK
L53
20BR
S117
8W-70-8
C142
Z1
16BK
C165
C118
C177
C142
L53
20BR
Z1
16BK
S101
8W-70-2
C142
Z1
12BK
G100
8W-15-2
L53
20BR
C141
53
SPEED
CONTROL
VENT
SOLENOID
CONTROL
33
SPEED
CONTROL
VACUUM
SOLENOID
CONTROL
29
STOP
LAMP
SWITCH
SENSE
49
SPEED
CONTROL
ON/OFF
SWITCH
SENSE
48
SPEED
CONTROL
SET
SWITCH
SENSE
50
SPEED
CONTROL
RESUME
SWITCH
SENSE
POWERTRAIN
CONTROL
MODULE
(RIGHT REAR
OF ENGINE
COMPARTMENT)


PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH (8W-20-2)
OVERDRIVE AND TORQUE CONVERTER CLUTCH SOLENOID (8W-31-6)
T41 20BK WT
S124
8W-70-10
T6 20VT YL
T60 18BR LG
T41 20BK WT
C141
30 PARK/ NEUTRAL POSITION SWITCH
54 TORQUE CONVERTER CLUTCH CONTROL
55 OVERDRIVE SOLENOID CONTROL
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

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TRANSMISSION CONTROLS

OVERDRIVE SWITCH

Vehicles equipped with an automatic transmission may have an overdrive switch. The operator disables or enables overdrive when the switch is depressed.

The overdrive system consists of a switch connected to the Powertrain Control Module (PCM) and an overdrive ON/OFF indicator lamp.

If overdrive is currently enabled, it is disabled when the operator depresses the overdrive switch. Conversely, if the operator already disabled overdrive, it is enabled when the switch is depressed. The overdrive lamp illuminates when overdrive is disabled.

Circuit T9 from the overdrive switch connects to the Transmission Control Module (TCM) on vehicles equipped with 4.0L engines or the Powertrain Control Module (PCM) on vehicles equipped with 5.2L engines. Circuit T9 provides the overdrive signal. Circuit Z1 provides ground for the switch.

In the START and RUN position, the ignition switch connects circuit A1 from fuse 12 in the Power Distribution Center (PDC) with circuit A21. Circuit A21 powers circuit F87 through fuse 21 in the fuse block. Circuit F87 supplies battery voltage for the overdrive lamp.

On vehicles equipped with 4.0L engines, the TCM turns the overdrive ON/OFF indicator lamp ON or OFF by providing a ground for the lamp on circuit G68.

On vehicles equipped with 5.2L engines, the PCM turns the overdrive ON/OFF indicator lamp ON or OFF by providing a ground for the lamp on circuit G68.

HELPFUL INFORMATION

The overdrive lamp is a Light Emitting Diode (LED).

OVERDRIVE SOLENOID AND TORQUE CONVERTER CLUTCH (TCC) SOLENOID—5.2L ENGINE

The overdrive solenoid and Torque Converter Clutch (TCC) solenoid are molded together. Circuit F86 supplies voltage to both solenoids. The Powertrain Control Module (PCM) provides ground for the overdrive solenoid on circuit T60. Refer to Overdrive Switch in this section.

The Powertrain Control Module (PCM) provides ground for the TCC solenoid on circuit T6.

TRANSMISSION CONTROL MODULE—4.0L ENGINE

The Transmission Control Unit (TCM) operates the 42RE transmission used with 4.0L engines. The TCM controls the electronic governor, overdrive solenoid, and Torque Convertor Clutch (TCC) solenoid.

Circuit A14 from fuse 3 in the Power Distribution Center (PDC) supplies battery voltage to the Transmission Control Module (TCM). Circuit A5 from fuse 15 in the PDC supplies voltage to circuit A14 through PDC fuse 3.

When the ignition switch is in the START or RUN position, circuit A1 from fuse 12 in the PDC connects to circuit A21. Circuit A21 feeds circuit F86 through fuse 6 in the PDC. Circuit F86 connects to the TCM.

The TCM receives the Throttle Position Sensor (TPS) signal on circuit K22. On circuit G7 the TCM receives the vehicle speed sensor signal. The Powertrain Control Module (PCM) supplies 8 volts to the vehicle speed sensor on circuit K25 and 5 volts to the TPS on circuit K6. Circuit K4 from the PCM provides ground for the signals from both sensors.

The TCM provides voltage and ground for the overdrive solenoid, electronic governor, and Torque Converter Clutch (TCC) solenoid. Circuit T20 from the TCM supplies voltage. The TCM provides ground for the overdrive solenoid on circuit T60, the electronic governor on circuit T59 and the TCC solenoid on circuit T22.

On circuit T33, the TCM supplies 5 volts to the transmission temperature sensor, and the governor pressure sensor. The ground path for the sensors is on circuit T35 to the TCM.

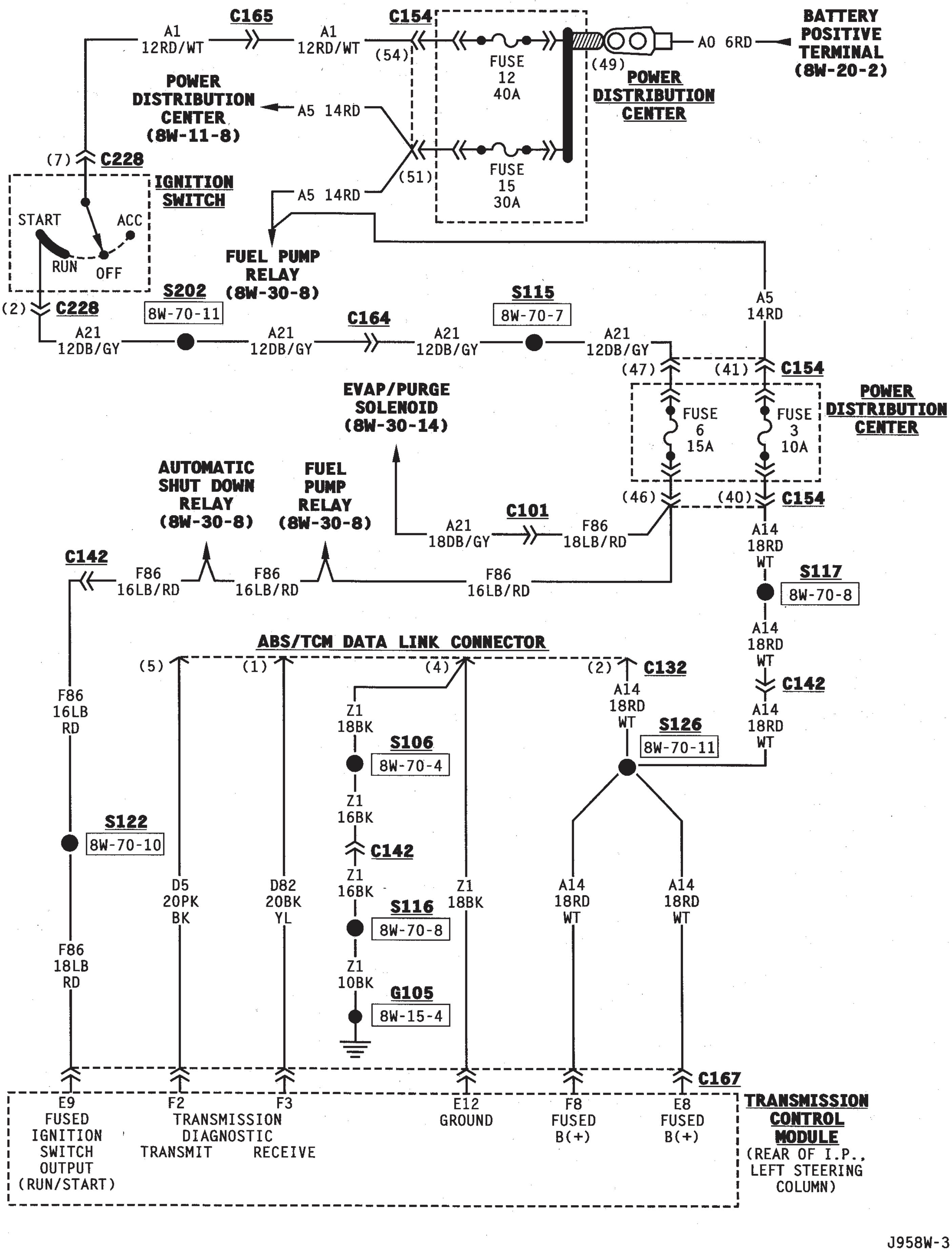
Circuits D5 and D82 from the TCM connect to the data link connector. Circuit Z1 provides ground for the data link connector and TCM. Circuit A14 supplies voltage to the connector for the scan tool.

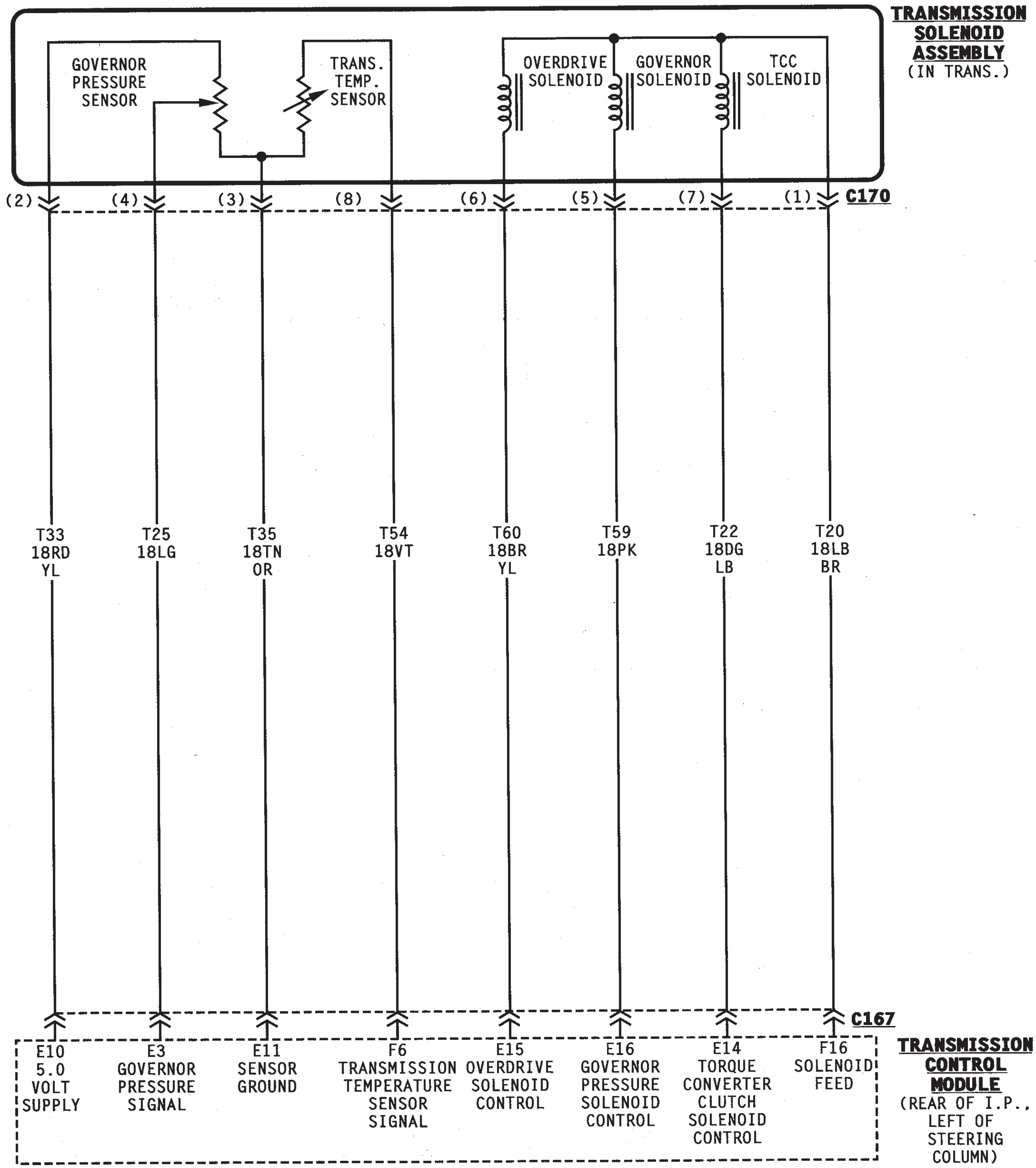
UPSHIFT LAMP

On vehicles equipped with a manual transmission, the PCM grounds the up-shift lamp on circuit K54. Circuit K54 connects to cavity 54 of the PCM.

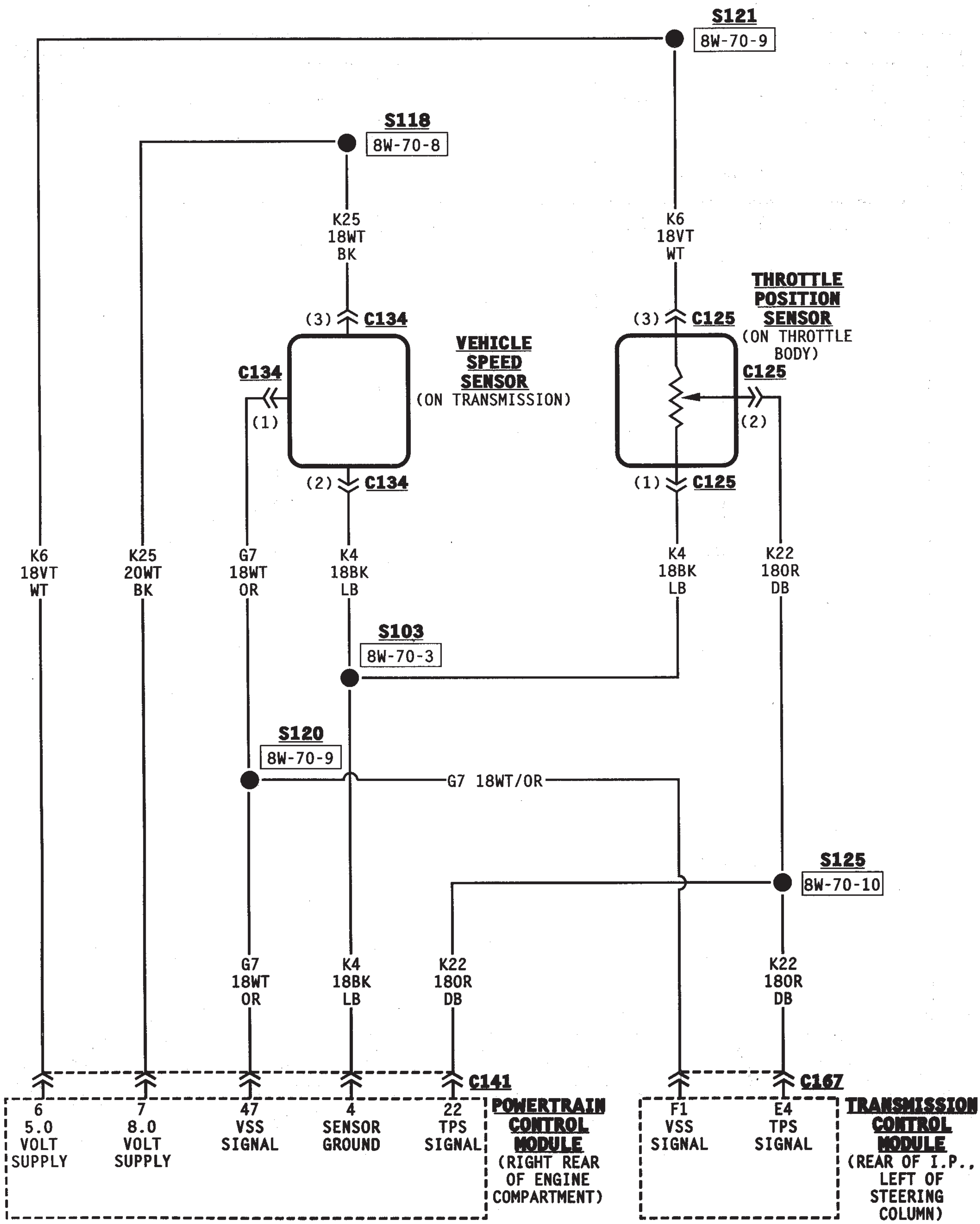
DIAGRAM INDEX

4.0L ENGINE


C165
A1
12RD/WT
A1
12RD/WT
C154
(54)
FUSE
12
40A
(49)
POWER
DISTRIBUTION
CENTER
A0 6RD
BATTERY
POSITIVE
TERMINAL
(8W-20-2)
POWER
DISTRIBUTION
CENTER
(8W-11-8)
A5 14RD
(51)
FUSE
15
30A
A5 14RD
(7)
C228
IGNITION
SWITCH
START
ACC
RUN
OFF
FUEL PUMP
RELAY
(8W-30-8)
(2)
C228
S202
8W-70-11
A21
12DB/GY
C164
S115
8W-70-7
A5
14RD
(47)
(41)
C154
EVAP/PURGE
SOLENOID
(8W-30-14)
FUSE
6
15A
FUSE
3
10A
AUTOMATIC
SHUT DOWN
RELAY
(8W-30-8)
FUEL
PUMP
RELAY
(8W-30-8)
(46)
(40)
C101
A21
18DB/GY
F86
18LB/RD
A14
18RD
WT
C142
F86
16LB/RD
S117
8W-70-8
ABS/TCM DATA LINK CONNECTOR
(5)
(1)
(4)
(2)
C132
Z1
18BK
S106
8W-70-4
Z1
16BK
C142
S116
8W-70-8
Z1
10BK
G105
8W-15-4
S126
8W-70-11
F86
16LB
RD
S122
8W-70-10
D5
20PK
BK
D82
20BK
YL
F86
18LB
RD
C167
E9
FUSED
IGNITION
SWITCH
OUTPUT
(RUN/START)
F2
TRANSMISSION
DIAGNOSTIC
TRANSMIT
F3
RECEIVE
E12
GROUND
F8
FUSED
B(+)
E8
FUSED
B(+)
TRANSMISSION
CONTROL
MODULE
(REAR OF I.P.,
LEFT STEERING
COLUMN)
J958W-3

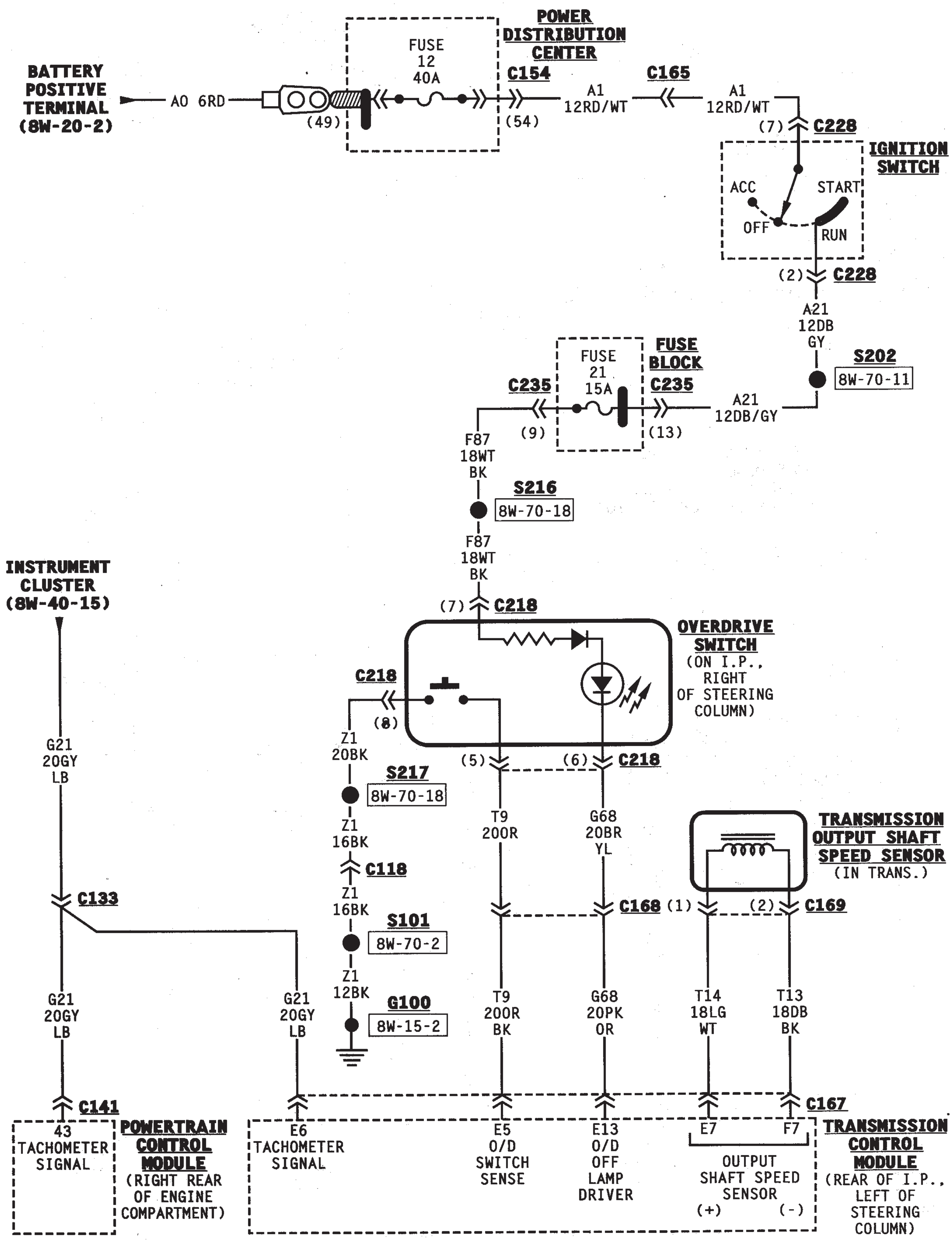

TRANSMISSION SOLENOID ASSEMBLY
(IN TRANS.)
GOVERNOR PRESSURE SENSOR
TRANS. TEMP. SENSOR
OVERDRIVE SOLENOID
GOVERNOR SOLENOID
TCC SOLENOID
C170
(2)
(4)
(3)
(8)
(6)
(5)
(7)
(1)
T33 18RD YL
T25 18LG
T35 18TN OR
T54 18VT
T60 18BR YL
T59 18PK
T22 18DG LB
T20 18LB BR
C167
E10 5.0 VOLT SUPPLY
E3 GOVERNOR PRESSURE SIGNAL
E11 SENSOR GROUND
F6 TRANSMISSION TEMPERATURE SENSOR SIGNAL
E15 OVERDRIVE SOLENOID CONTROL
E16 GOVERNOR PRESSURE SOLENOID CONTROL
E14 TORQUE CONVERTER CLUTCH SOLENOID CONTROL
F16 SOLENOID FEED
TRANSMISSION CONTROL MODULE
(REAR OF I.P., LEFT OF STEERING COLUMN)

4.0L ENGINE



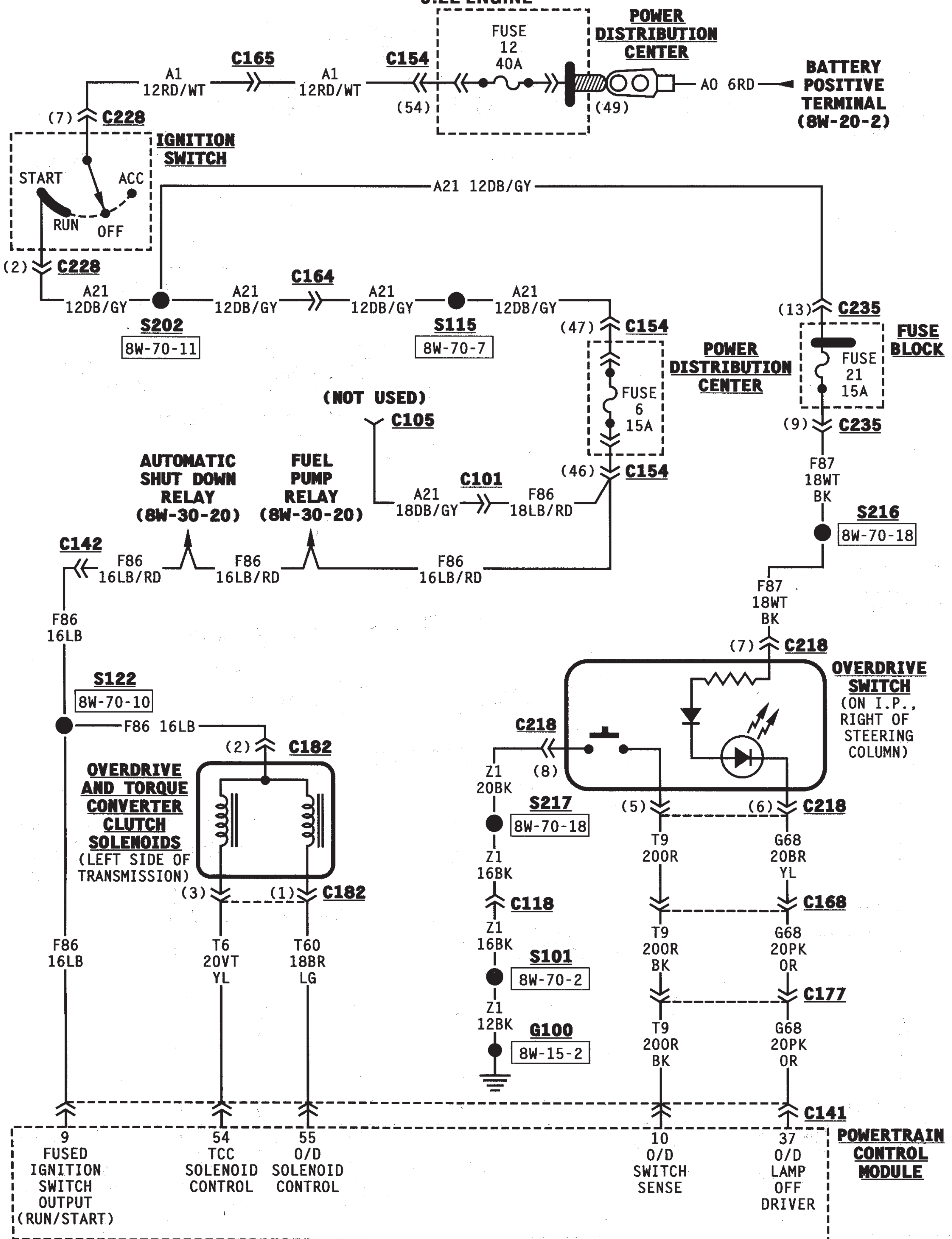
J958W-3

4.0L ENGINE



J958W-3

5.2L ENGINE



J958W-3

ANTI-LOCK BRAKES

INDEX

GENERAL INFORMATION

Three fuses supply power for the Anti-Lock Brake System (ABS); fuses 7 (40 amp) and 9 (20 amp) in the Power Distribution Center (PDC) and fuse 15 (3 amp) in the fuse block. Fuses 7 and 9 in the PDC are connected directly to battery voltage and are HOT all times. Fuse 15 in the fuse block is HOT when the ignition switch is the RUN Position.

In the RUN position, the ignition switch connects circuit A2 from fuse 13 in the PDC with circuit A22. Circuit A22 connects to a bus bar in the fuse block. The bus bar feeds circuit 236 through fuse 15.

Circuit 236 connects to the coil side of the ABS system relay and cavity 53 of the ABS control module.

Circuit Z1 provides ground for the ABS control module. Circuit Z1 connects to cavities 1 and 19 of the ABS control module.

Refer to group 5, Brakes for operational descriptions of ABS system components.

WHEEL SPEED SENSORS

The all wheel anti-lock system uses four wheel speed sensors; one for each wheel. Each sensor converts wheel speed into an electrical signal that it transmits to the ABS control module. A pair of twisted wires connect to each sensor to provide signals to the ABS control module.

Circuits B6 and B7 provide signals to ABS control module from the right front wheel speed sensor. Circuit B6 which provides the LOW signal connects to cavity 29 of the ABS control module. Circuit B7 connects to cavity 47 of the module and provides the HIGH signal.

Circuits B8 and B9 provide signals to ABS control module from the left front wheel speed sensor. Circuit B8, which provides the HIGH signal, connects to cavity 30 of the ABS control module. Circuit B9 connects to cavity 48 of the module and provides the LOW signal.

Circuits B1 and B2 provide signals to ABS control module from the right rear wheel speed sensor. Circuit B1 which provides the HIGH signal connects to cavity 45 of the ABS control module. Circuit B2 connects to cavity 27 of the module and provides the LOW signal.

Circuits B4 and B3 provide signals to ABS control module from the left rear wheel speed sensor. Circuit B3, which provides the LOW signal, connects to cavity 28 of the ABS control module. Circuit B4 connects to cavity 46 of the module and provides the HIGH signal.

ACCELERATION SWITCH

During four-wheel drive operation, the acceleration switch provides deceleration data to the ABS control module. Refer to Group 5, Brakes for additional information.

Circuits B41, B42, and B43 connect the acceleration sensor to the ABS control module. Circuits B41 and B42 provide switch states while circuit B43 provides ground. At the ABS control module, circuit B41 connects to cavity 25, circuit B42 connects to cavity 43 and circuit B43 connects to cavity 26.

ABS SYSTEM RELAY

The ABS system relay is located in the Power Distribution Center (PDC). When the ABS module grounds the ABS system relay on circuit 207, the relay switches to connect circuit A20 from PDC fuse 9 to circuit 235. Circuit 236 from fuse 7 in the fuse block feeds the coil side of the ABS system relay. Circuit 207 connects to cavity 34 of the ABS control module.

Circuit 235 is double crimped at the ABS system relay. One branch of circuit 235 supplies power to the coil side of the ABS pump motor relay. The other branch of circuit 235 splices to cavities 3 and 33 of the ABS control module and to the hydraulic control unit.

ABS PUMP MOTOR RELAY

The ABS pump motor relay in the Power Distribution Center (PDC) supplies voltage to the ABS pump motor. When the ABS power relay energizes, circuit 235 supplies battery voltage to the coil side of the ABS pump motor relay. The ABS control module provides ground for the relay on circuit B116. Circuit B116 connects to cavity 15 of the ABS control module.

When the ABS pump motor energizes, it connects circuit A10 from PDC fuse 7 to circuit B120. Circuit B120 supplies battery voltage to the pump motor. Circuit Z1 provides ground for the pump motor.

PUMP MOTOR SPEED SENSOR

The input from the pump motor speed sensor tells the ABS control module that the pump is operating. Circuits B219 and B220 from the control module connect to the speed sensor.

Circuit B219 connects to cavity 31 of the ABS control module. Circuit B220 connects to cavity 49 of the ABS control module.

BRAKE SWITCH INPUT

Circuit L50 from the stop lamp provides the brake switch input to the ABS control module. When the brake pedal is depressed, the stop lamp switch closes to supply battery voltage from circuit L16 to circuit L50. Circuit L50 connects to cavity 32 of the ABS control module. Circuit L16 originates at fuse 2, a 15 amp, in the fuse block.

HYDRAULIC CONTROL UNIT

When the ABS power relay energizes, two branches of circuit 235 splice to supply voltage to the isolation and dump solenoids in the hydraulic control unit. The hydraulic control unit contains three separate isolation solenoids and three separate dump solenoids. The ABS control module activates the isolation and dump solenoids by providing separate ground paths for each.

The ABS module provides a ground path for the rear isolation solenoid on circuit B251. Circuit B251 connects to cavity 54 of the ABS control module.

For the right front isolation solenoid, the ABS module provides a ground path on circuit B249. Circuit B249 connects to cavity 38 of the ABS control module.

On circuit B245, the ABS module provides ground for the left front isolation solenoid. Circuit B245 connects to cavity 20 of the ABS control module.

The ABS module provides a ground path for the rear dump solenoid on circuit B254. Circuit B254 connects to cavity 36 of the ABS control module.

For the right front dump solenoid, the ABS module provides a ground path on circuit B248. Circuit B248 connects to cavity 21 of the ABS control module.

On circuit B243, the ABS module provides ground for the left dump solenoid. Circuit B243 connects to cavity 2 of the ABS control module.

ABS WARNING LAMP

Circuit F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the ABS warning lamp. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position.

Ground for the ABS warning lamp is provided by either the ABS control module or by the ABS power relay when the relay is not energized. The ABS control module illuminates the lamp by providing ground on circuit 205.

Circuit 205 splices to connect to circuit 235 through a diode. When the ABS power relay is not energized, it connects circuit 235 to circuit Z1. The ground path for the warning lamp is through the diode to circuit 235, through the ABS power relay to ground on circuit Z1.

The diode between circuit 205 and 235 prevents voltage from flowing to the ABS control module when the ABS power relay switches to supply power on circuit 235.

DATA LINK CONNECTOR

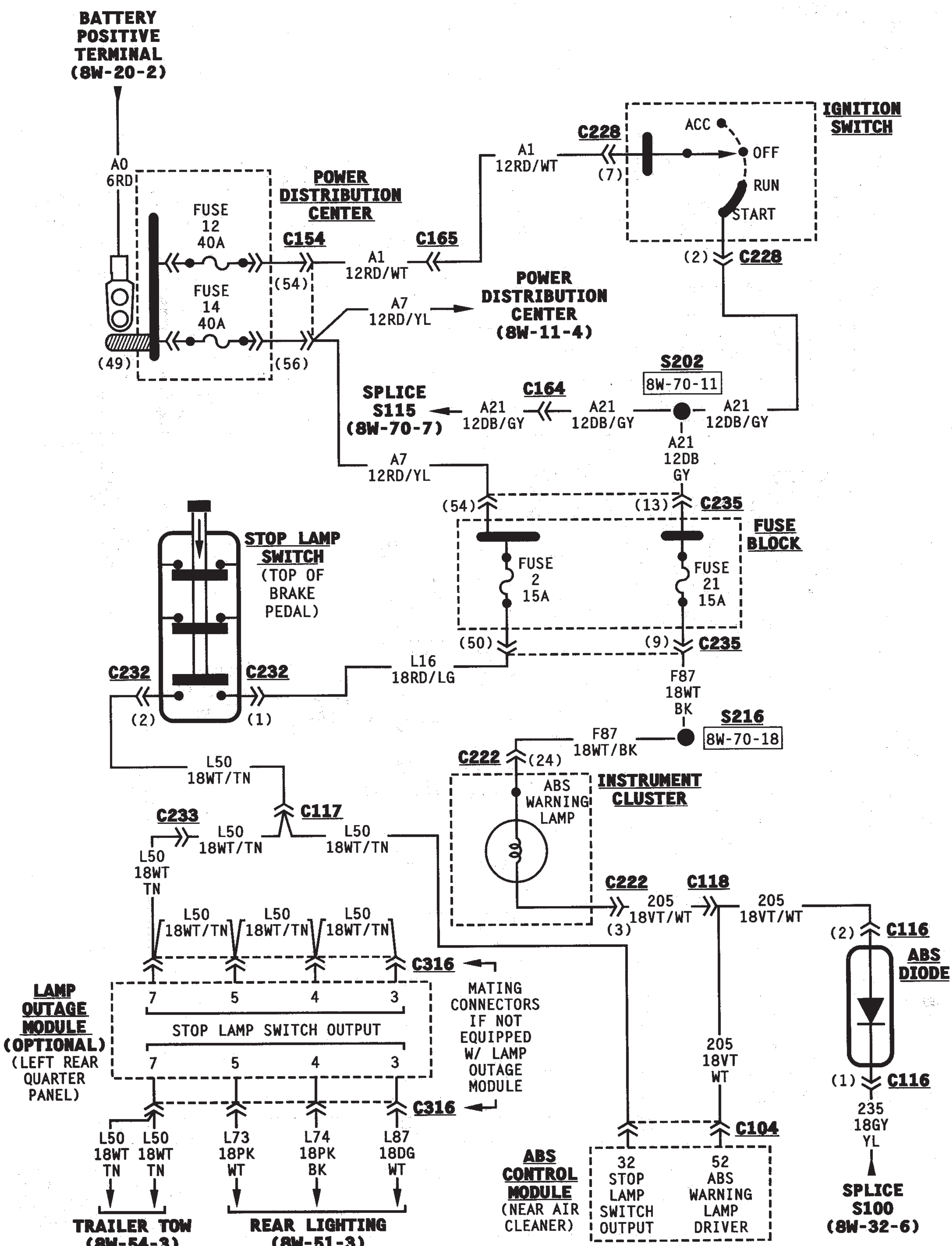
Circuit D1 from cavity 23 of the ABS control module receives data from the DRB scan tool through the data link connector. The ABS control module transmits data to the scan tool through the connector on circuit D2. Circuit D2 originates at cavity 42 of the ABS control module.

Through the data link connector, circuit Z12 provides ground for the DRB scan tool.

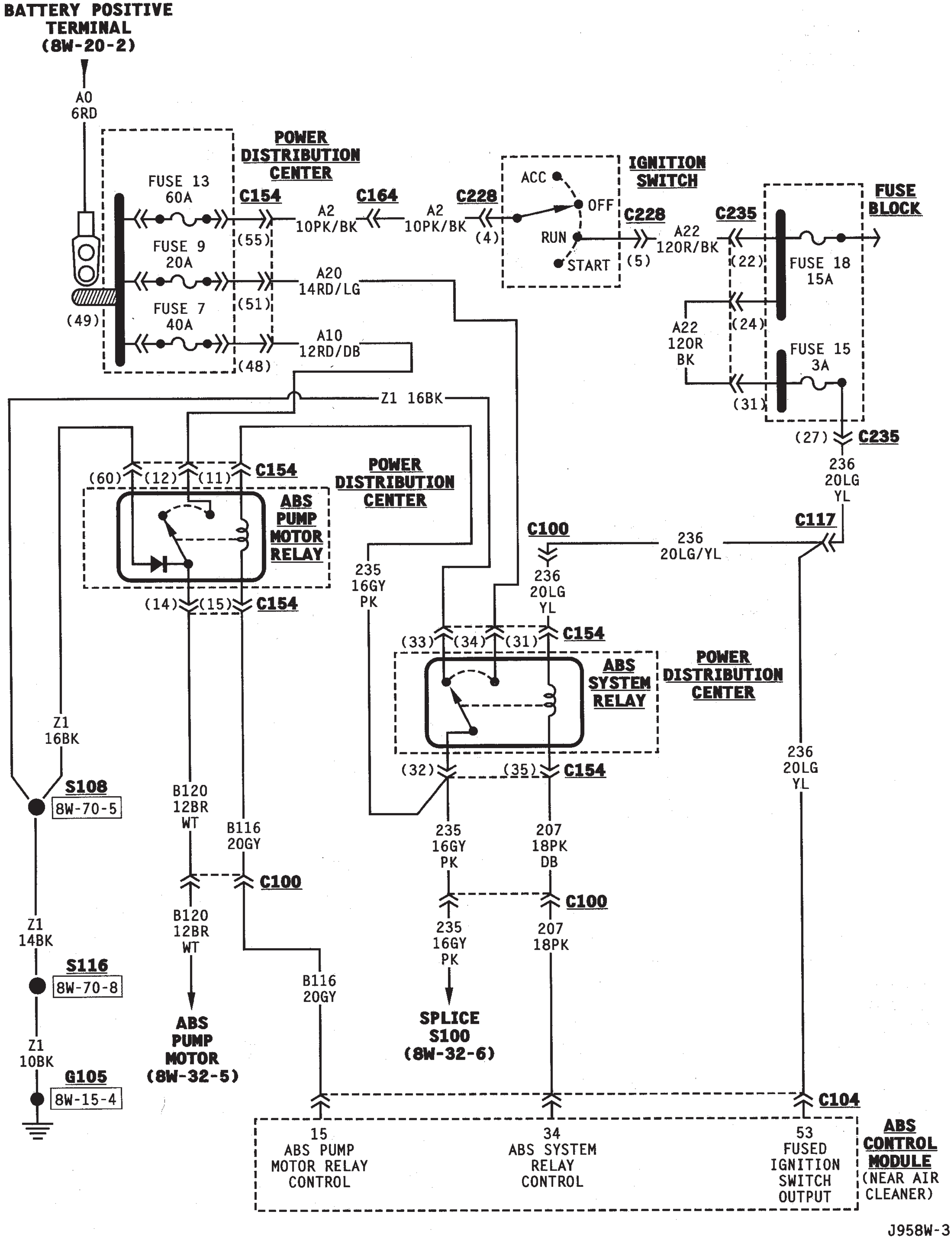
HELPFUL INFORMATION

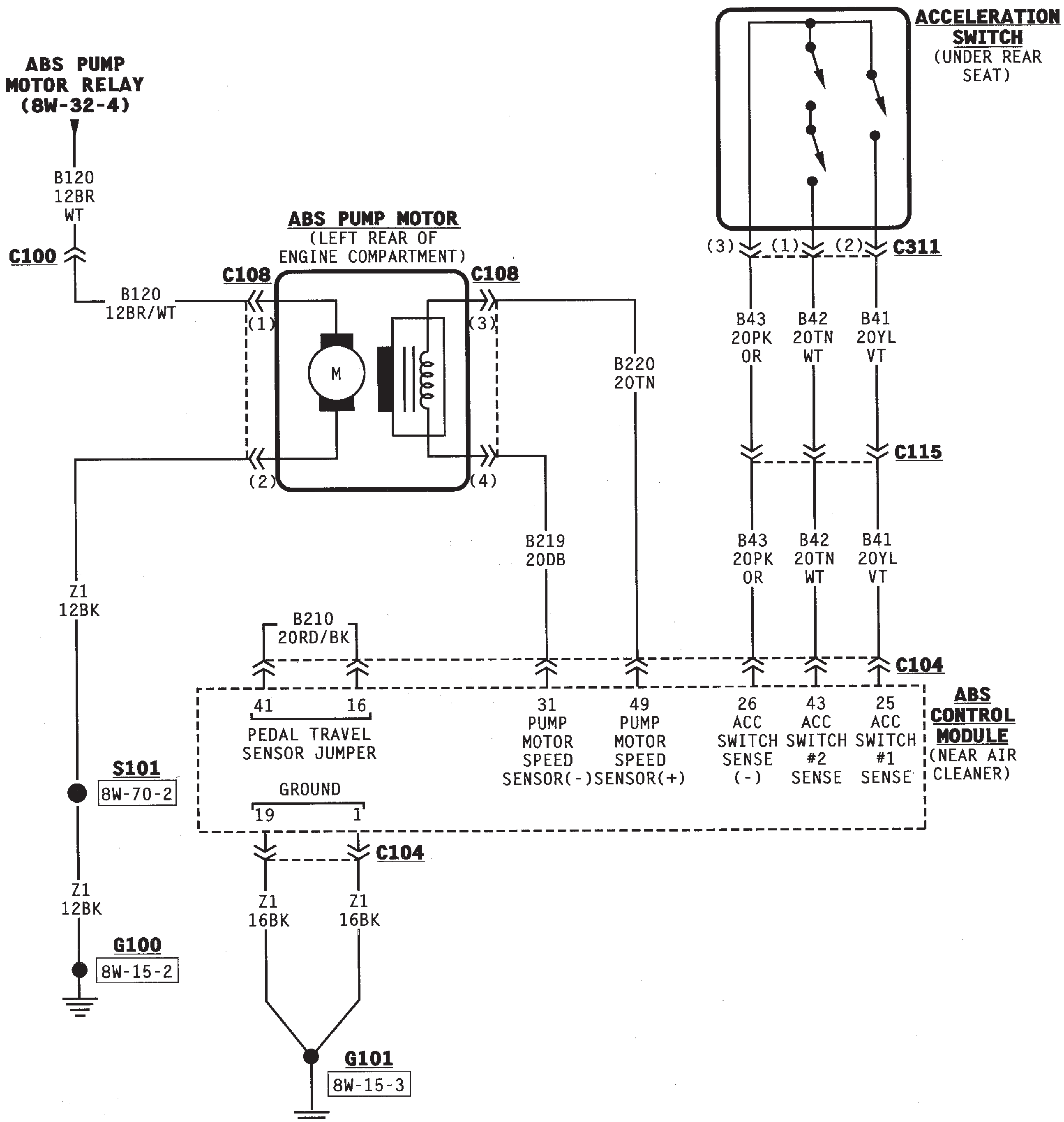
- Check the 40 amp fuse in cavity 7 of the PDC
- Check the 20 amp fuse in cavity 9 of the PDC
- Check the 3 amp fuse in cavity 15 of the fuse block
- Check the grounding points at the left and right fender side shields
- Refer to the appropriate section of the Service Manual or the Diagnostic Test Procedures manual.

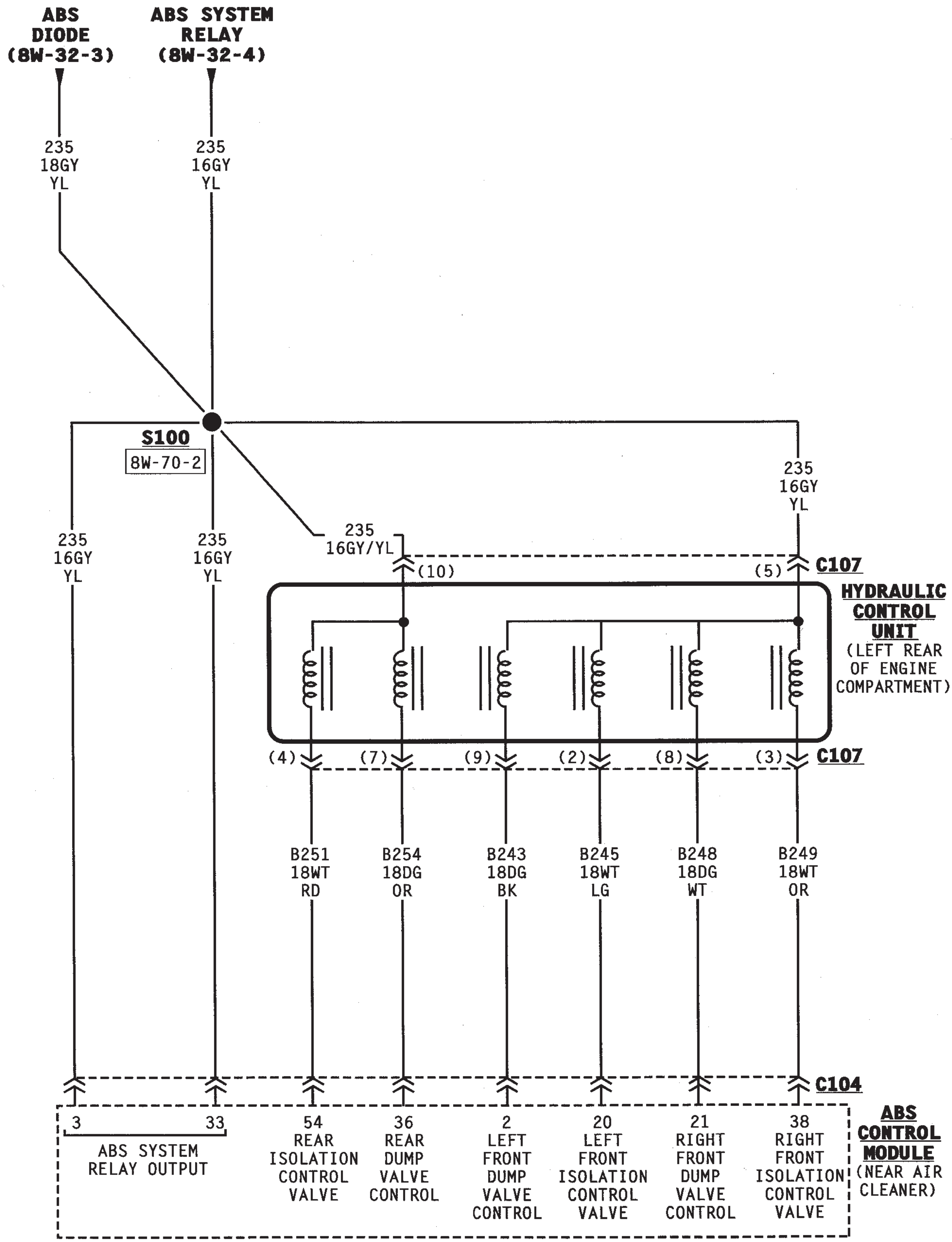
DIAGRAM INDEX


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
POWER DISTRIBUTION CENTER
FUSE 12 40A
FUSE 14 40A
(49)
C154
(54)
(56)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
IGNITION SWITCH
ACC
OFF
RUN
START
(2)
C228
A7 12RD/YL
POWER DISTRIBUTION CENTER (8W-11-4)
S202
8W-70-11
SPLICE S115 (8W-70-7)
C164
A21 12DB/GY
A21 12DB/GY
A21 12DB/GY
A21 12DB GY
A7 12RD/YL
(54)
(13)
C235
FUSE BLOCK
FUSE 2 15A
FUSE 21 15A
(50)
(9)
C235
STOP LAMP SWITCH (TOP OF BRAKE PEDAL)
C232
C232
(2)
(1)
L16 18RD/LG
F87 18WT BK
S216
8W-70-18
F87 18WT/BK
C222
(24)
ABS WARNING LAMP
INSTRUMENT CLUSTER
L50 18WT/TN
C117
C233
L50 18WT/TN
L50 18WT/TN
L50 18WT TN
C222
C118
205 18VT/WT
205 18VT/WT
(3)
(2)
C116
ABS DIODE
L50 18WT/TN
L50 18WT/TN
L50 18WT/TN
C316
MATING CONNECTORS IF NOT EQUIPPED W/ LAMP OUTAGE MODULE
LAMP OUTAGE MODULE (OPTIONAL) (LEFT REAR QUARTER PANEL)
7 5 4 3
STOP LAMP SWITCH OUTPUT
7 5 4 3
C316
205 18VT WT
(1)
C116
235 18GY YL
L50 18WT TN
L50 18WT TN
L73 18PK WT
L74 18PK BK
L87 18DG WT
C104
ABS CONTROL MODULE (NEAR AIR CLEANER)
32 STOP LAMP SWITCH OUTPUT
52 ABS WARNING LAMP DRIVER
TRAILER TOW (8W-54-3)
REAR LIGHTING (8W-51-3)
SPLICE S100 (8W-32-6)

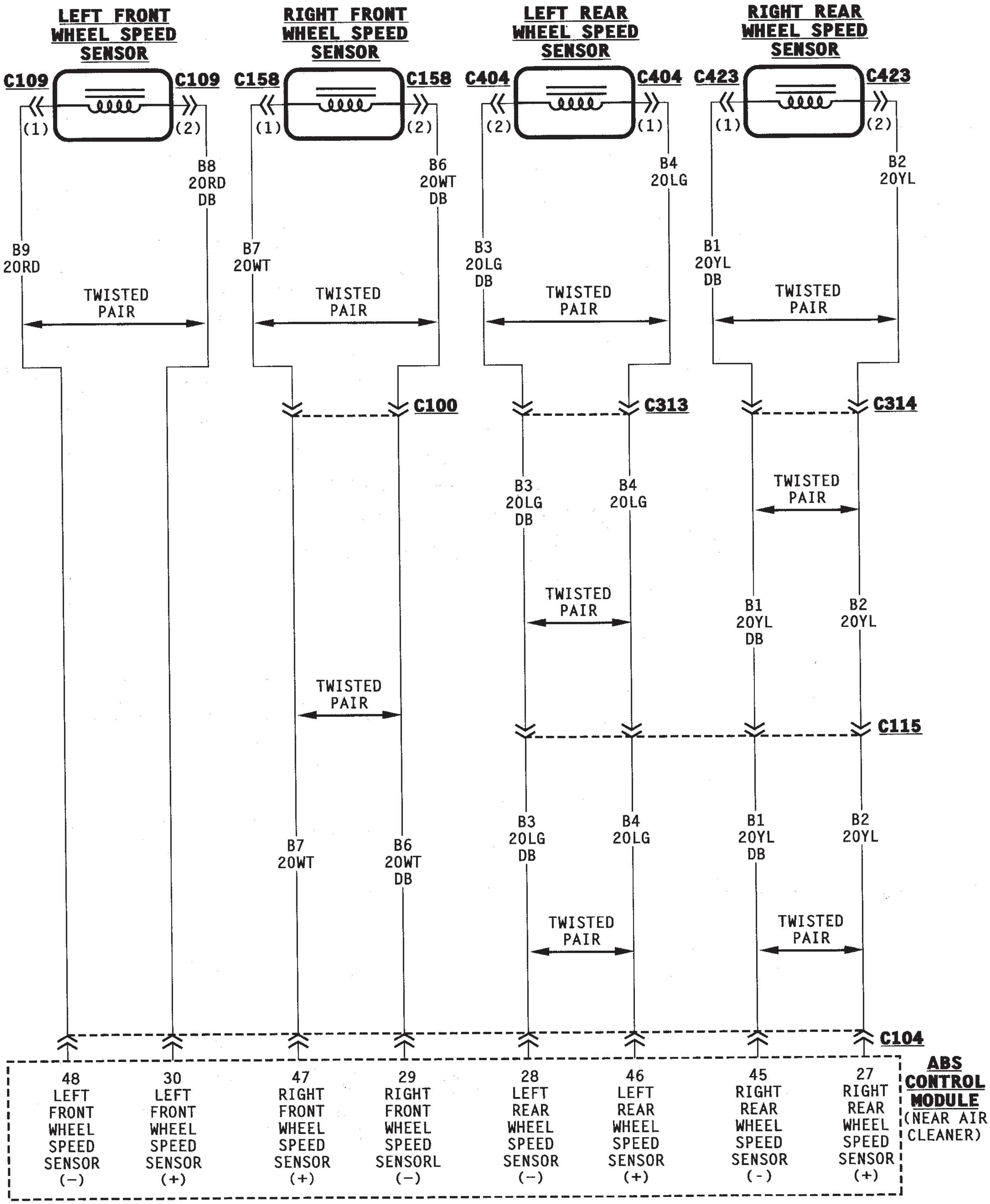
J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
POWER DISTRIBUTION CENTER
FUSE 13 60A
FUSE 9 20A
FUSE 7 40A
(49)
C154
(55)
(51)
(48)
A2 10PK/BK
C164
C228
(4)
A20 14RD/LG
A10 12RD/DB
Z1 16BK
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(5)
A22 12OR/BK
C235
FUSE BLOCK
(22)
FUSE 18 15A
(24)
A22 12OR BK
FUSE 15 3A
(31)
(27)
C235
236 20LG YL
(60)
(12)
(11)
C154
ABS PUMP MOTOR RELAY
POWER DISTRIBUTION CENTER
C100
236 20LG/YL
C117
236 20LG YL
235 16GY PK
(14)
(15)
C154
(33)
(34)
(31)
C154
ABS SYSTEM RELAY
POWER DISTRIBUTION CENTER
Z1 16BK
S108
8W-70-5
(32)
(35)
C154
236 20LG YL
B120 12BR WT
B116 20GY
235 16GY PK
207 18PK DB
C100
C100
Z1 14BK
S116
8W-70-8
B120 12BR WT
235 16GY PK
207 18PK
B116 20GY
SPLICE S100 (8W-32-6)
ABS PUMP MOTOR (8W-32-5)
Z1 10BK
G105
8W-15-4
C104
15 ABS PUMP MOTOR RELAY CONTROL
34 ABS SYSTEM RELAY CONTROL
53 FUSED IGNITION SWITCH OUTPUT
ABS CONTROL MODULE (NEAR AIR CLEANER)
J958W-3

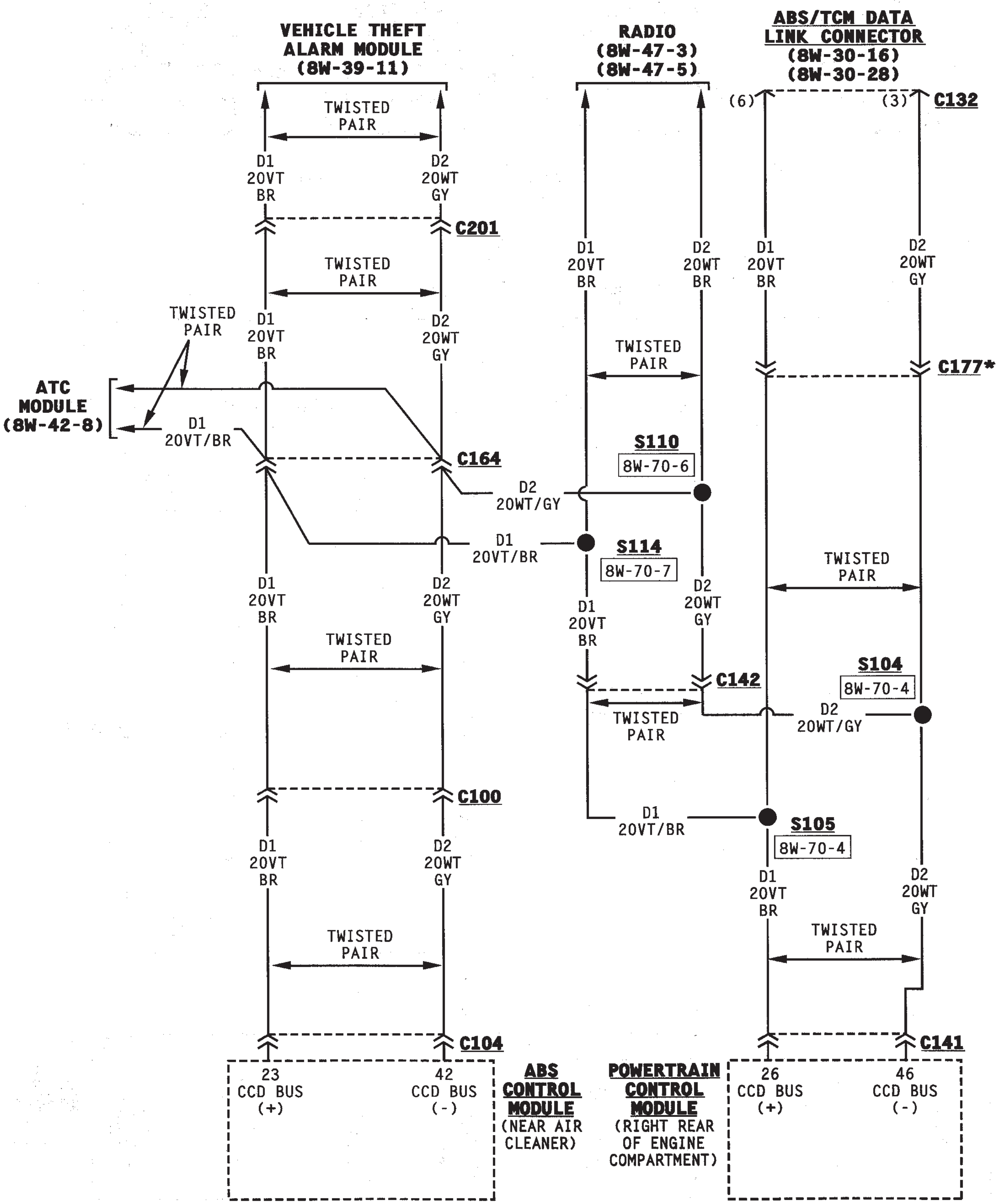

ACCELERATION SWITCH
(UNDER REAR SEAT)
ABS PUMP MOTOR RELAY
(8W-32-4)
B120
12BR
WT
C100
ABS PUMP MOTOR
(LEFT REAR OF ENGINE COMPARTMENT)
C108
C108
B120
12BR/WT
(1)
(2)
(3)
(4)
M
(3)
(1)
(2)
C311
B43
20PK
OR
B42
20TN
WT
B41
20YL
VT
B220
20TN
C115
B219
20DB
Z1
12BK
B210
20RD/BK
C104
ABS CONTROL MODULE
(NEAR AIR CLEANER)
41
16
PEDAL TRAVEL SENSOR JUMPER
31
PUMP MOTOR SPEED SENSOR(-)
49
PUMP MOTOR SPEED SENSOR(+)
26
ACC SWITCH SENSE (-)
43
ACC SWITCH #2 SENSE
25
ACC SWITCH #1 SENSE
GROUND
19
1
S101
8W-70-2
C104
Z1
16BK
Z1
16BK
G100
8W-15-2
G101
8W-15-3


ABS DIODE (8W-32-3)
ABS SYSTEM RELAY (8W-32-4)
235 18GY YL
235 16GY YL
S100
8W-70-2
235 16GY YL
235 16GY YL
235 16GY/YL
235 16GY YL
(10)
(5)
C107
HYDRAULIC CONTROL UNIT
(LEFT REAR OF ENGINE COMPARTMENT)
(4) (7) (9) (2) (8) (3)
C107
B251 18WT RD
B254 18DG OR
B243 18DG BK
B245 18WT LG
B248 18DG WT
B249 18WT OR
C104
3
33
ABS SYSTEM RELAY OUTPUT
54 REAR ISOLATION CONTROL VALVE
36 REAR DUMP VALVE CONTROL
2 LEFT FRONT DUMP VALVE CONTROL
20 LEFT FRONT ISOLATION CONTROL VALVE
21 RIGHT FRONT DUMP VALVE CONTROL
38 RIGHT FRONT ISOLATION CONTROL VALVE
ABS CONTROL MODULE
(NEAR AIR CLEANER)

J958W-3


LEFT FRONT WHEEL SPEED SENSOR
C109
C109
(1)
(2)
B8
20RD
DB
B9
20RD
TWISTED PAIR
RIGHT FRONT WHEEL SPEED SENSOR
C158
C158
(1)
(2)
B6
20WT
DB
B7
20WT
TWISTED PAIR
LEFT REAR WHEEL SPEED SENSOR
C404
C404
(2)
(1)
B4
20LG
B3
20LG
DB
TWISTED PAIR
RIGHT REAR WHEEL SPEED SENSOR
C423
C423
(1)
(2)
B2
20YL
B1
20YL
DB
TWISTED PAIR
C100
C313
C314
B3
20LG
DB
B4
20LG
TWISTED PAIR
TWISTED PAIR
B1
20YL
DB
B2
20YL
TWISTED PAIR
C115
B7
20WT
B6
20WT
DB
B3
20LG
DB
B4
20LG
B1
20YL
DB
B2
20YL
TWISTED PAIR
TWISTED PAIR
C104
48 LEFT FRONT WHEEL SPEED SENSOR (−)
30 LEFT FRONT WHEEL SPEED SENSOR (+)
47 RIGHT FRONT WHEEL SPEED SENSOR (+)
29 RIGHT FRONT WHEEL SPEED SENSORL (−)
28 LEFT REAR WHEEL SPEED SENSOR (−)
46 LEFT REAR WHEEL SPEED SENSOR (+)
45 RIGHT REAR WHEEL SPEED SENSOR (-)
27 RIGHT REAR WHEEL SPEED SENSOR (+)
ABS CONTROL MODULE
(NEAR AIR CLEANER)

J958W-3



* 5.2L ENGINE ONLY

J958W-3

VEHICLE SPEED CONTROL

VEHICLE SPEED CONTROL

The Powertrain Control Module (PCM) operates the vehicle speed control system. The vehicle speed control switches are located in the steering wheel, below the airbag.

Circuit V34 from fuse 20, a 10 amp, in the fuse block supplies battery voltage to the vehicle speed control ON/OFF switch. Circuit A22 supplies voltage to fuse 20 when the ignition switch is in the RUN positions. In the RUN position the ignition switch connects circuit A22 with circuit A2. Fuse 13 in the Power Distribution Center (PDC) protects circuit A2.

The vehicle speed control ON/OFF switch supplies voltage to the SET/COAST and RESUME/ACCEL switches. Both switches send signals to the PCM.

The PCM controls the vent and vacuum functions of the speed control servo on circuits V35 and V36. Depending on the signal it receives from vehicle speed control switches, the PCM either applies vacuum to or vents vacuum from the servo. Circuit V36 from cavity 33 of the PCM sends the vacuum signal to the servo. Circuit V35 from cavity 53 sends the vent signal.

Circuit V32 signals to the PCM that the speed control switch is in the ON position. The V32 circuit connects to cavity 49 of the PCM. Circuit V32 also connects to the stop lamp switch.

In the closed position, the stop lamp switch connects circuit V32 with circuit V30 to power the speed control servo. Circuit Z1 provides ground for the speed control servo.

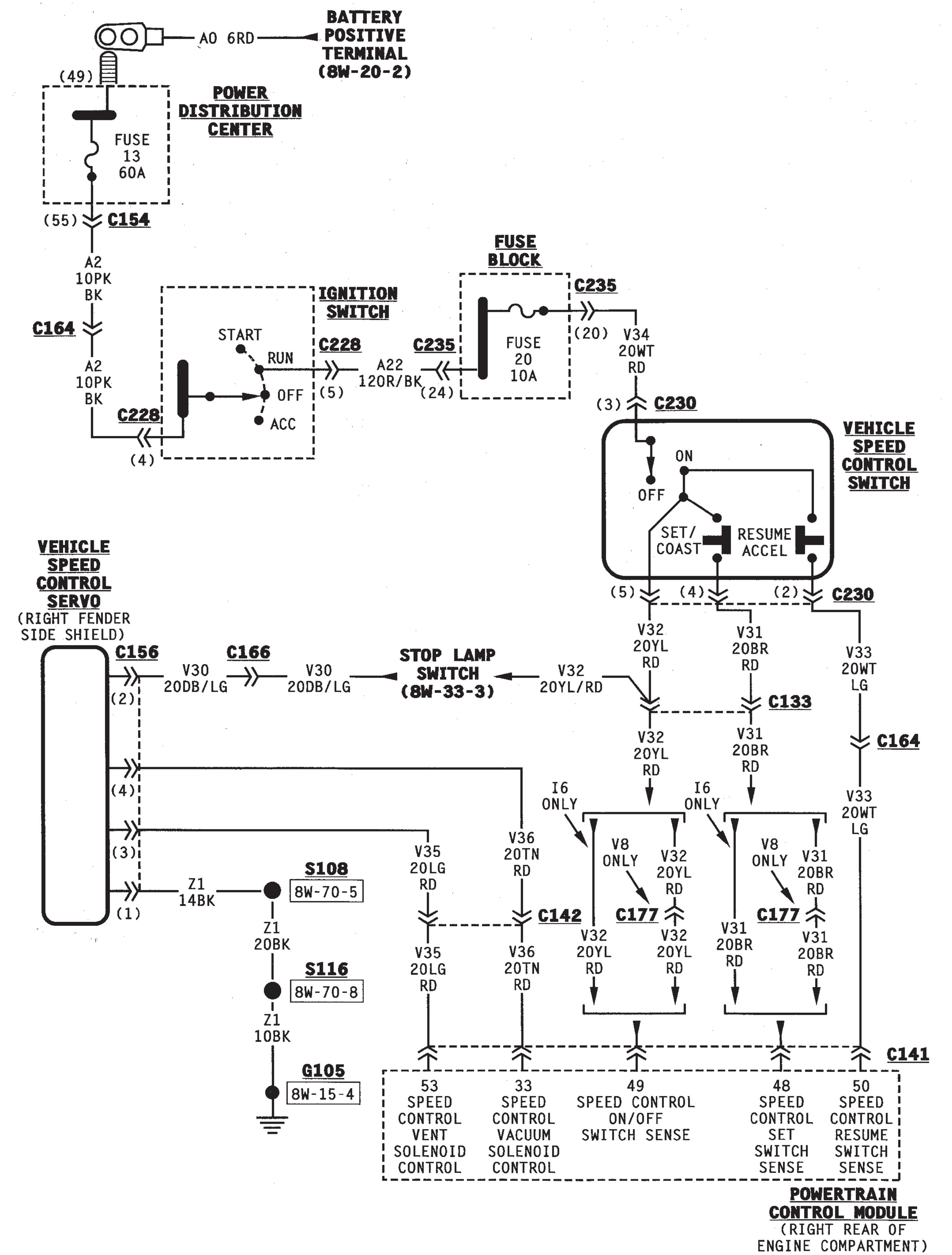
Circuit V31 provides the SET/COAST signal to cavity 48 of the PCM. Circuit V33 sends the RESUME/ ACCELERATE signal to cavity 50 of the PCM.

Circuit L53 connects to cavity 29 of the PCM and to ground through the stop lamp switch. When the stop lamp switch opens, voltage is removed from the servo on circuit V30 and the PCM vents the servo. From the stop lamp switch, circuit Z1 provides ground for circuit L53.

HELPFUL INFORMATION

- Check the 10 amp fuse in cavity 20 of the fuse block
- Check fuse 13 in the PDC

DIAGRAM INDEX


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 13 60A
(55)
C154
A2 10PK BK
C164
A2 10PK BK
C228
(4)
IGNITION SWITCH
START
RUN
OFF
ACC
C228
(5)
A22 12OR/BK
C235
(24)
FUSE BLOCK
FUSE 20 10A
C235
(20)
V34 20WT RD
(3)
C230
VEHICLE SPEED CONTROL SWITCH
ON
OFF
SET/ COAST
RESUME ACCEL
(5)
(4)
(2)
C230
VEHICLE SPEED CONTROL SERVO
(RIGHT FENDER SIDE SHIELD)
C156
(2)
V30 20DB/LG
C166
V30 20DB/LG
STOP LAMP SWITCH (8W-33-3)
V32 20YL/RD
V32 20YL RD
V31 20BR RD
V33 20WT LG
C133
V32 20YL RD
V31 20BR RD
C164
(4)
(3)
I6 ONLY
I6 ONLY
V33 20WT LG
V36 20TN RD
V35 20LG RD
V8 ONLY
V32 20YL RD
V8 ONLY
V31 20BR RD
Z1 14BK
(1)
S108
8W-70-5
C142
C177
C177
Z1 20BK
V35 20LG RD
V36 20TN RD
V32 20YL RD
V32 20YL RD
V31 20BR RD
V31 20BR RD
S116
8W-70-8
Z1 10BK
C141
G105
8W-15-4
53 SPEED CONTROL VENT SOLENOID CONTROL
33 SPEED CONTROL VACUUM SOLENOID CONTROL
49 SPEED CONTROL ON/OFF SWITCH SENSE
48 SPEED CONTROL SET SWITCH SENSE
50 SPEED CONTROL RESUME SWITCH SENSE
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

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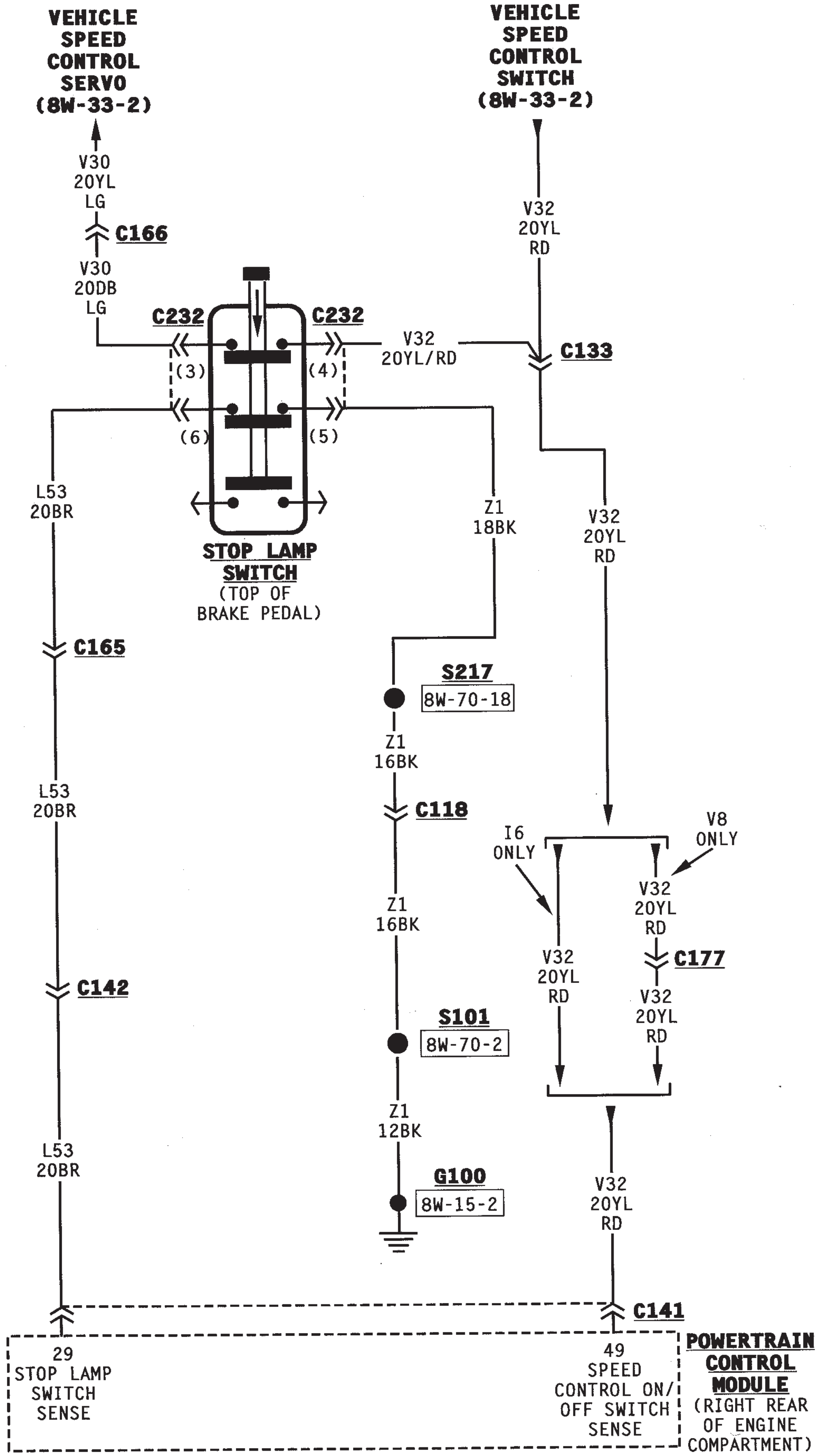
VEHICLE SPEED CONTROL SERVO (8W-33-2)
V30 20YL LG
C166
V30 20DB LG
C232
C232
(3)
(4)
(6)
(5)
V32 20YL/RD
VEHICLE SPEED CONTROL SWITCH (8W-33-2)
V32 20YL RD
C133
V32 20YL RD
STOP LAMP SWITCH (TOP OF BRAKE PEDAL)
L53 20BR
C165
L53 20BR
C142
L53 20BR
Z1 18BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
I6 ONLY
V8 ONLY
V32 20YL RD
C177
V32 20YL RD
V32 20YL RD
V32 20YL RD
C141
29 STOP LAMP SWITCH SENSE
49 SPEED CONTROL ON/ OFF SWITCH SENSE
POWERTRAIN CONTROL MODULE (RIGHT REAR OF ENGINE COMPARTMENT)

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VEHICLE THEFT ALARM

INDEX

SYSTEM OPERATION

The optional Vehicle Theft Alarm (VTA) is used to protect the vehicle from theft by monitoring the vehicle doors, ignition switch, power door lock circuits, and the trunk key cylinder to determine if the alarm should be sounded and the ignition system disabled.

A Vehicle Theft Alarm (VTA) module, and a VTA relay are used to control for the system. The VTA module is located on the left rear side of the glove box, and the relay is located in the relay center under the glove box.

The VTA system uses a SET lamp located in the instrument cluster to indicate when the system is ARMED. The lamp is supplied power on circuit F70 at the instrument cluster. This circuit is protected by a 20 amp fuse located in the fuse block, cavity 14, and HOT at all times. Power for the fuse is supplied by circuit A7 from the Power Distribution Center (PDC) fuse 14.

The VTA module controls ground for the lamp on circuit G69.

For additional information on VTA system operation refer to group 8Q in this Service Manual.

VEHICLE THEFT ALARM MODULE

The Vehicle Theft Alarm (VTA) module controls the operation of the VTA system. Power for the module is supplied from several sources. A constant battery feed is supplied on circuit X3. This circuit is HOT at all times, and protected by a 15 amp fuse located in cavity 6 of the fuse block. Power for the fuse is supplied by circuit A7 from the Power Distribution Center (PDC) fuse 14.

Power is also supplied by circuits F86 and F87. The F86 circuit is HOT in the ACCESSORY and RUN positions. This circuit is protected by a 10 amp circuit breaker located in cavity 27 of the fuse block. Power for the circuit breaker is supplied by circuit A31 from the ignition switch. Circuit F87 supplies power to the module in the START or RUN positions and is protected by a 15 amp fuse located in cavity 21 of the fuse block.

The VTA module uses the CCD bus to communicate with the Powertrain Control Module (PCM). Circuit D1 is the CCD (+) and circuit D2 is the CCD(-).

Ground for the VTA module is supplied on the Z1 circuit from two cavities of the module.

DOOR AJAR SWITCH OPERATION

The VTA system uses the door/liftgate ajar switches to provide an input to the VTA module. These switches are normally OPEN with the doors/liftgate closed. When a door or the liftgate is opened the switch CLOSES completing a path to ground. Circuit M2 is used to monitor the doors. This circuit is also used as the ground circuit for the interior lamps.

The G85 circuit is used for the liftgate ajar switch input to the VTA module.

ARMING INPUT

The keyless entry module is used to supply the VTA module with the arming input. This is accomplished on circuit G49.

DISARM SWITCH OPERATION

There are three switches used to ARM and DISARM the system. Two are located in the left front and right front doors, and the third is located in the liftgate. These switches are normally OPEN. When the switch is CLOSED a path to ground is completed. All of the switches are wired together and a single input is provided to the module on circuit G71.

HOOD SWITCH

The hood ajar switch is normally OPEN and case grounded. When the switch closes, it provides a path to ground on circuit G70.

VEHICLE THEFT ALARM RELAY

The Vehicle Theft Alarm (VTA) relay, located in the relay center under the glove box, is used for headlamp operation when the alarm has been triggered.

When the alarm has been triggered, the VTA module supplies power to the coil side of the VTA relay on circuit G79. This causes the relay to energize connecting circuits L11, which is the feed for the FLASH TO PASS portion of the dimmer switch, to circuit L3.

Circuit L3 is the feed for the high beam headlamps. The VTA module cycles the power to the VTA relay causing the headlamps to flash.

Ground for the coil side of the VTA relay is supplied on circuit Z1.

PARK LAMPS

When the alarm is triggered, the VTA module supplies power to the front and rear parking lamps on circuit L90.

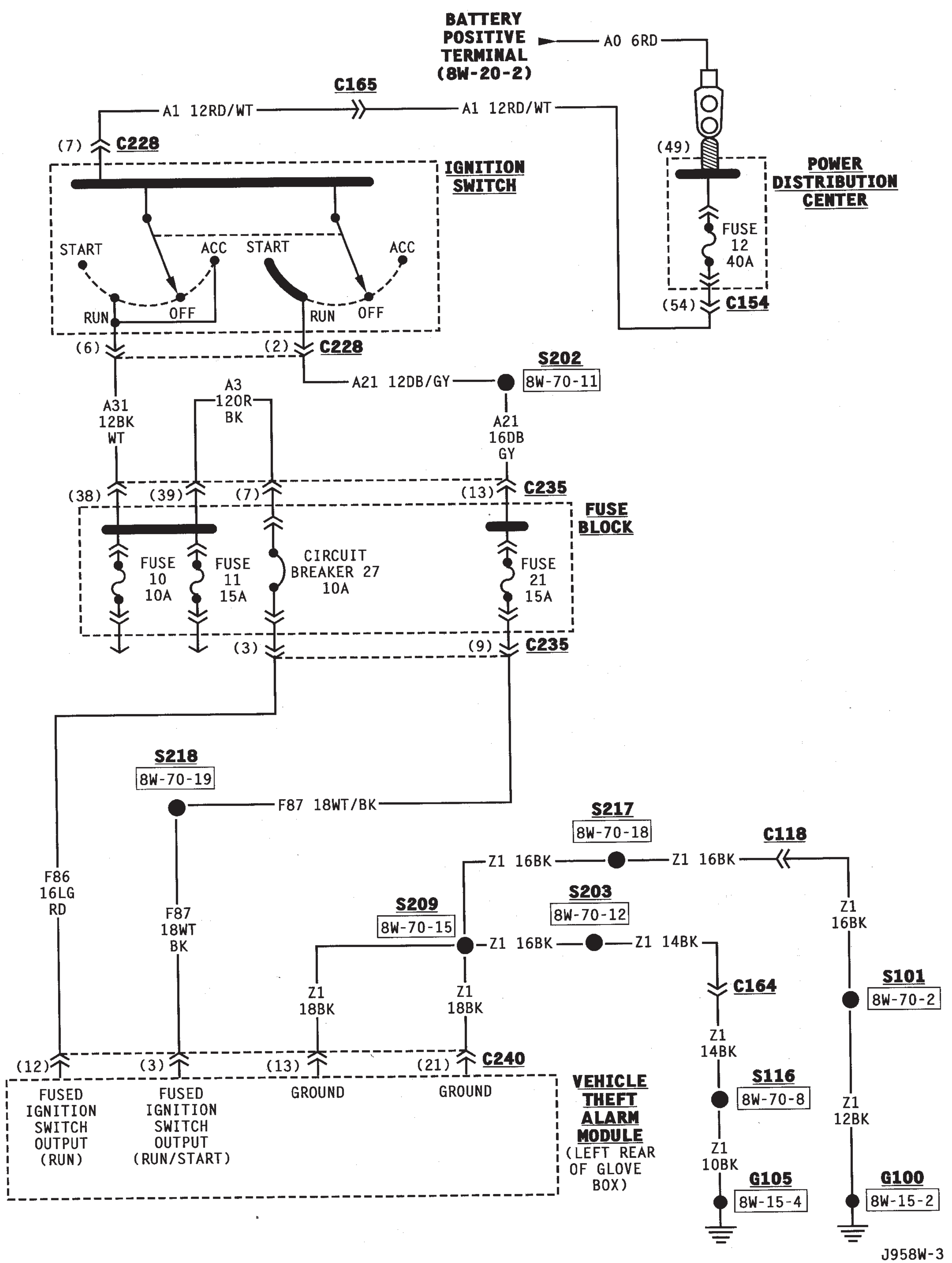
HORN OPERATION

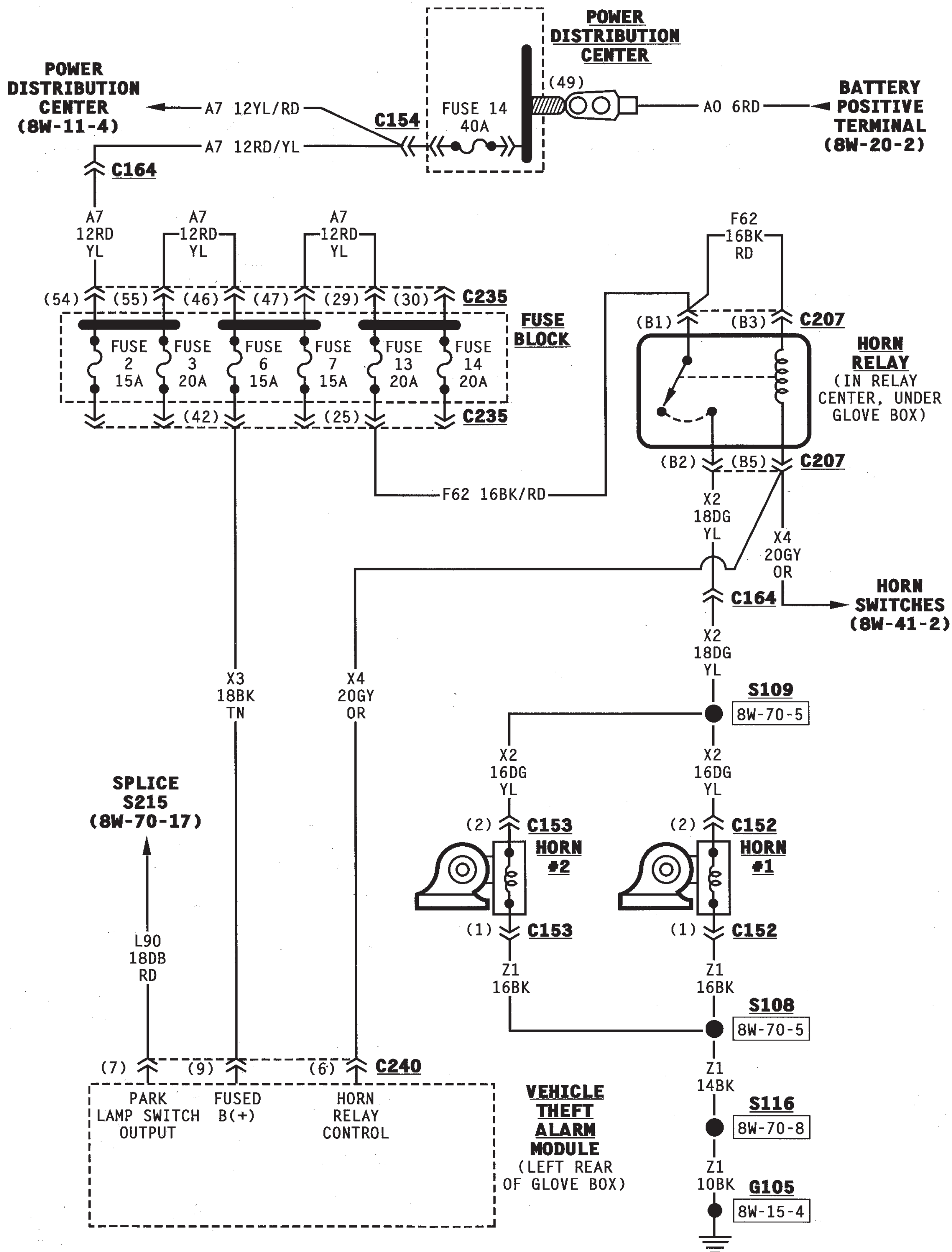
When the alarm is triggered, the VTA module provides ground for the horn relay on circuit X4. This causes the horn relay to energize and the horns to operate.

HELPFUL INFORMATION

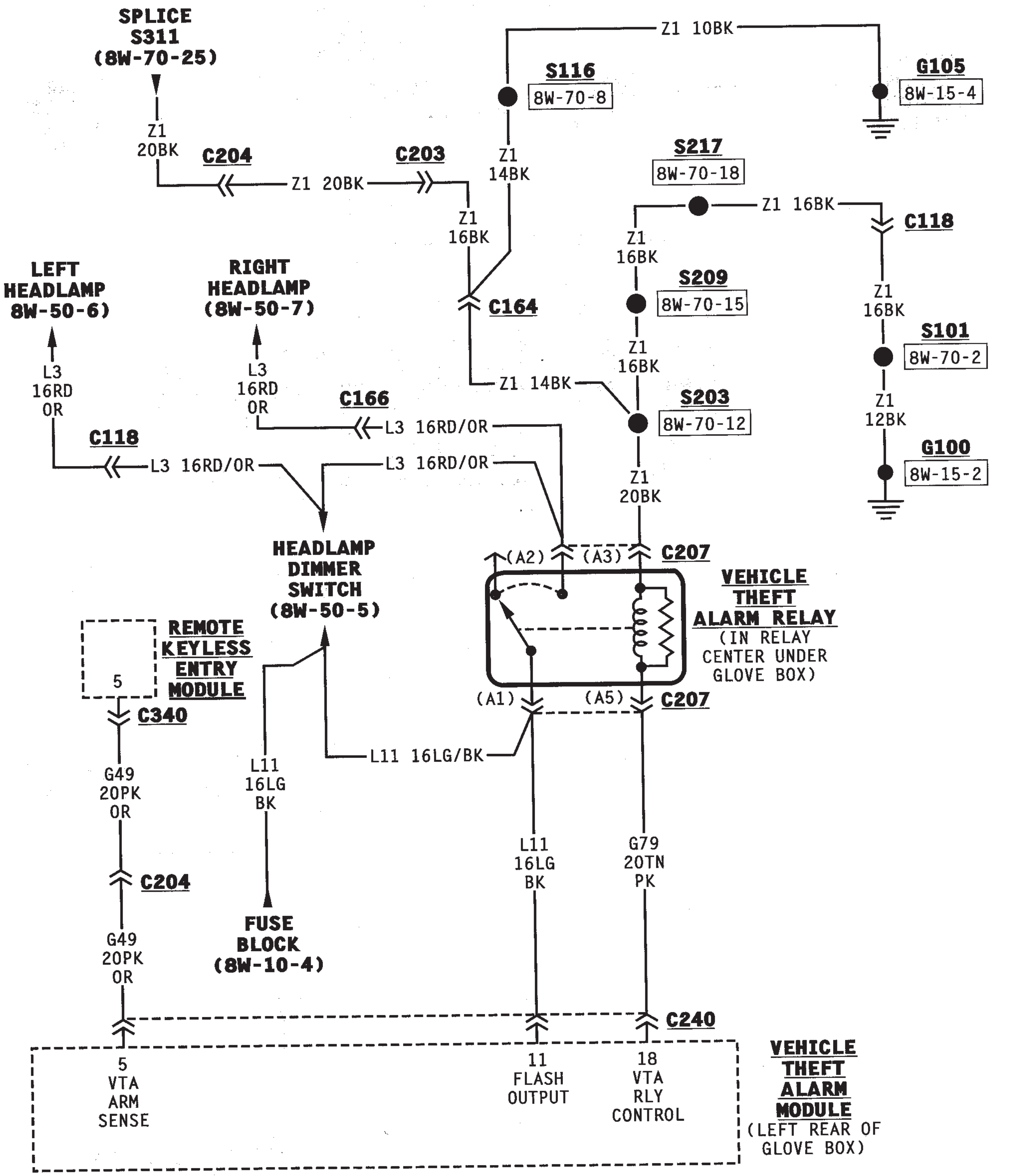
- Check the fuses in cavities 6, 7, and 21 of the fuse block
- Check the 10 amp circuit breaker located in cavity 27 of the fuse block
- Check the door and liftgate ajar switches for a good ground
- Refer to the appropriate group of the Service Manual or the Diagnostic Test Procedures Manual for additional diagnostic procedures

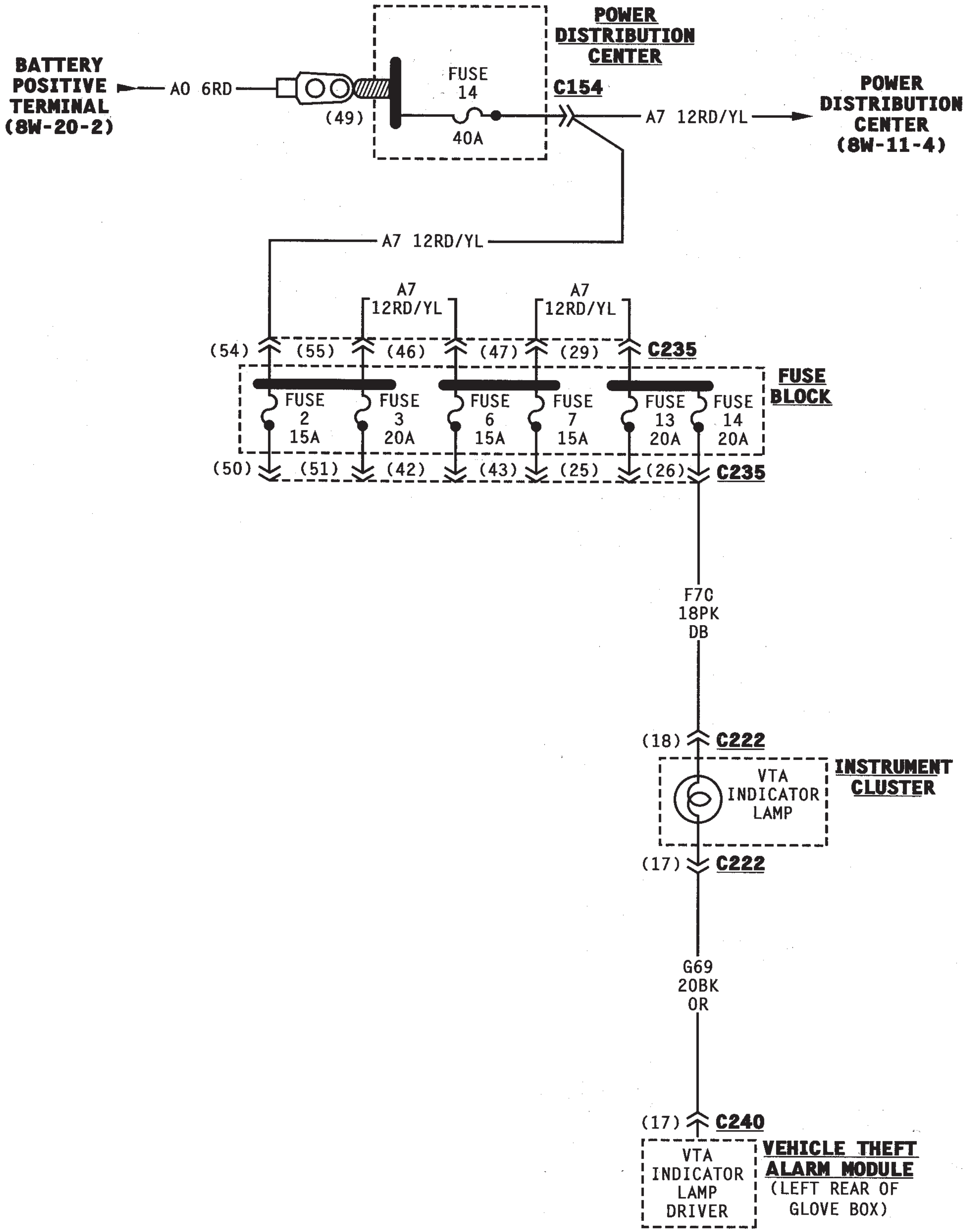
DIAGRAM INDEX


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
C165
A1 12RD/WT
A1 12RD/WT
(7) C228
IGNITION SWITCH
START
ACC
START
ACC
RUN
OFF
RUN
OFF
(6)
(2) C228
A21 12DB/GY
S202
8W-70-11
(49)
POWER DISTRIBUTION CENTER
FUSE 12 40A
(54) C154
A31 12BK WT
A3 12OR BK
A21 16DB GY
(38)
(39)
(7)
(13) C235
FUSE BLOCK
FUSE 10 10A
FUSE 11 15A
CIRCUIT BREAKER 27 10A
FUSE 21 15A
(3)
(9) C235
S218
8W-70-19
F87 18WT/BK
F86 16LG RD
F87 18WT BK
S217
8W-70-18
Z1 16BK
Z1 16BK
C118
S209
8W-70-15
S203
8W-70-12
Z1 16BK
Z1 14BK
Z1 16BK
C164
S101
8W-70-2
Z1 18BK
Z1 18BK
Z1 14BK
(12)
(3)
(13)
(21) C240
FUSED IGNITION SWITCH OUTPUT (RUN)
FUSED IGNITION SWITCH OUTPUT (RUN/START)
GROUND
GROUND
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)
S116
8W-70-8
Z1 12BK
Z1 10BK
G105
8W-15-4
G100
8W-15-2
J958W-3


POWER DISTRIBUTION CENTER
POWER DISTRIBUTION CENTER (8W-11-4)
A7 12YL/RD
A7 12RD/YL
C154
FUSE 14 40A
(49)
A0 6RD
BATTERY POSITIVE TERMINAL (8W-20-2)
C164
A7 12RD YL
A7 12RD YL
A7 12RD YL
F62 16BK RD
(54) (55) (46) (47) (29) (30) C235
FUSE BLOCK
FUSE 2 15A
FUSE 3 20A
FUSE 6 15A
FUSE 7 15A
FUSE 13 20A
FUSE 14 20A
(42) (25) C235
(B1) (B3) C207
HORN RELAY
(IN RELAY CENTER, UNDER GLOVE BOX)
(B2) (B5) C207
F62 16BK/RD
X2 18DG YL
X4 20GY OR
C164
HORN SWITCHES (8W-41-2)
X2 18DG YL
S109
8W-70-5
X3 18BK TN
X4 20GY OR
X2 16DG YL
X2 16DG YL
SPLICE S215 (8W-70-17)
(2) C153
HORN #2
(2) C152
HORN #1
(1) C153
(1) C152
L90 18DB RD
Z1 16BK
Z1 16BK
S108
8W-70-5
(7) (9) (6) C240
PARK LAMP SWITCH OUTPUT
FUSED B(+)
HORN RELAY CONTROL
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)
Z1 14BK
S116
8W-70-8
Z1 10BK
G105
8W-15-4

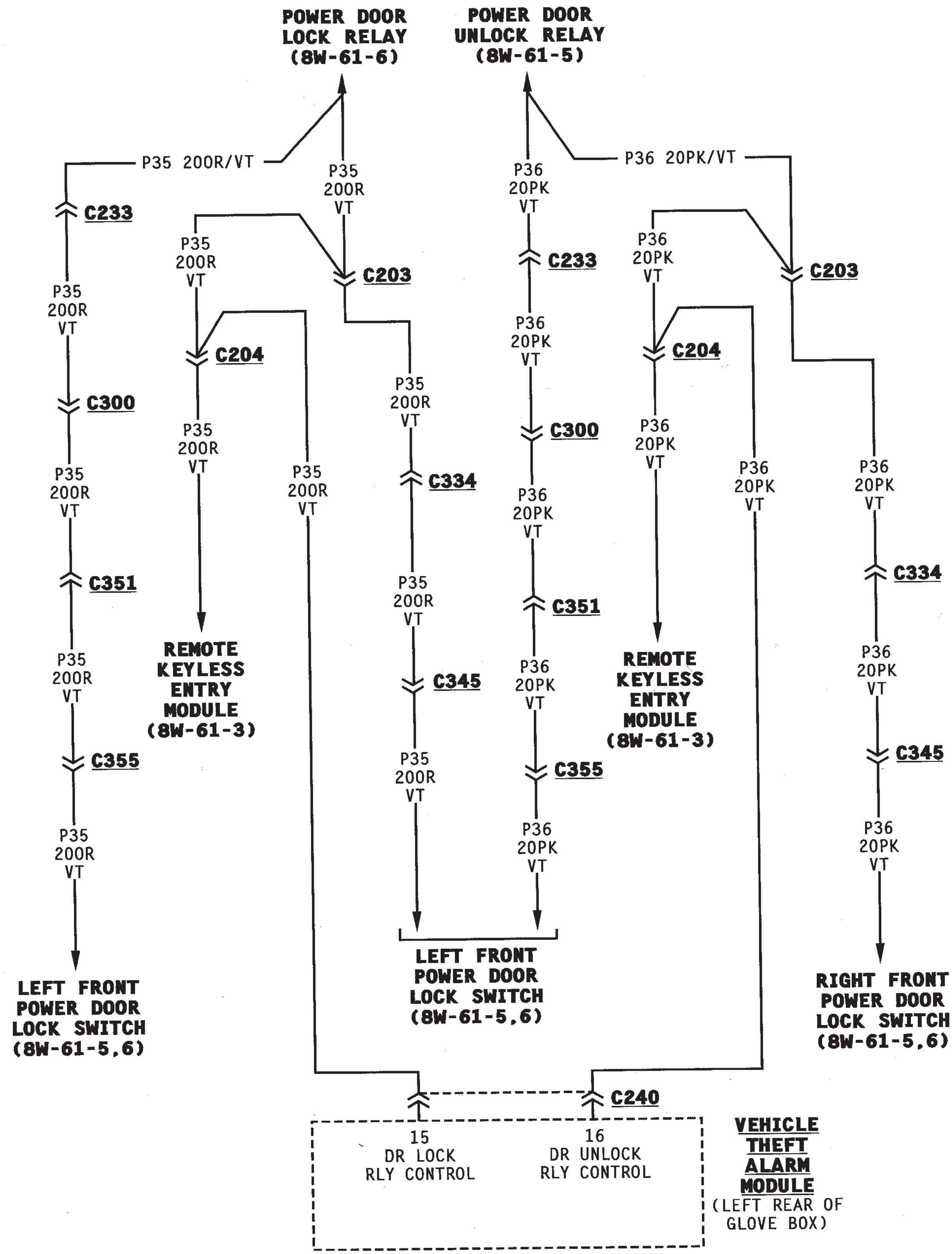
J958W-3


SPLICE
S311
(8W-70-25)
Z1
20BK
C204
Z1 20BK
C203
Z1
16BK
Z1 10BK
S116
8W-70-8
Z1
14BK
G105
8W-15-4
S217
8W-70-18
Z1 16BK
C118
Z1
16BK
S209
8W-70-15
Z1
16BK
S101
8W-70-2
Z1
12BK
G100
8W-15-2
LEFT
HEADLAMP
8W-50-6)
RIGHT
HEADLAMP
(8W-50-7)
C164
L3
16RD
OR
C166
L3 16RD/OR
Z1 14BK
S203
8W-70-12
C118
L3 16RD/OR
Z1
20BK
HEADLAMP
DIMMER
SWITCH
(8W-50-5)
(A2)
(A3)
C207
VEHICLE
THEFT
ALARM RELAY
(IN RELAY
CENTER UNDER
GLOVE BOX)
REMOTE
KEYLESS
ENTRY
MODULE
5
C340
(A1)
(A5)
C207
L11 16LG/BK
G49
20PK
OR
L11
16LG
BK
G79
20TN
PK
C204
FUSE
BLOCK
(8W-10-4)
C240
5
VTA
ARM
SENSE
11
FLASH
OUTPUT
18
VTA
RLY
CONTROL
VEHICLE
THEFT
ALARM
MODULE
(LEFT REAR OF
GLOVE BOX)

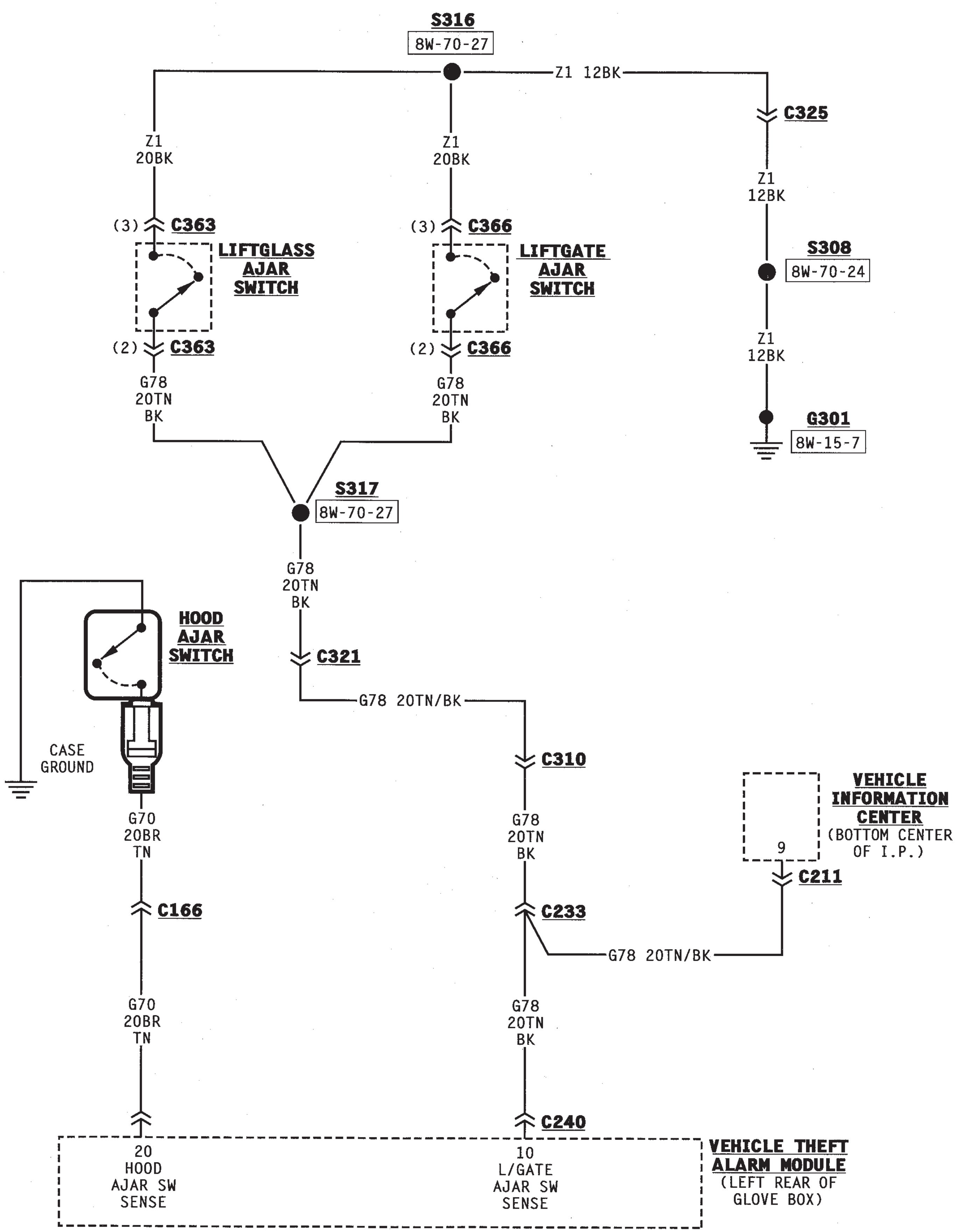


POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 14 40A
C154
A7 12RD/YL
POWER DISTRIBUTION CENTER (8W-11-4)
A7 12RD/YL
A7 12RD/YL
A7 12RD/YL
(54) (55) (46) (47) (29) C235
FUSE BLOCK
FUSE 2 15A
FUSE 3 20A
FUSE 6 15A
FUSE 7 15A
FUSE 13 20A
FUSE 14 20A
(50) (51) (42) (43) (25) (26) C235
F7C 18PK DB
(18) C222
INSTRUMENT CLUSTER
VTA INDICATOR LAMP
(17) C222
G69 20BK OR
(17) C240
VTA INDICATOR LAMP DRIVER
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)

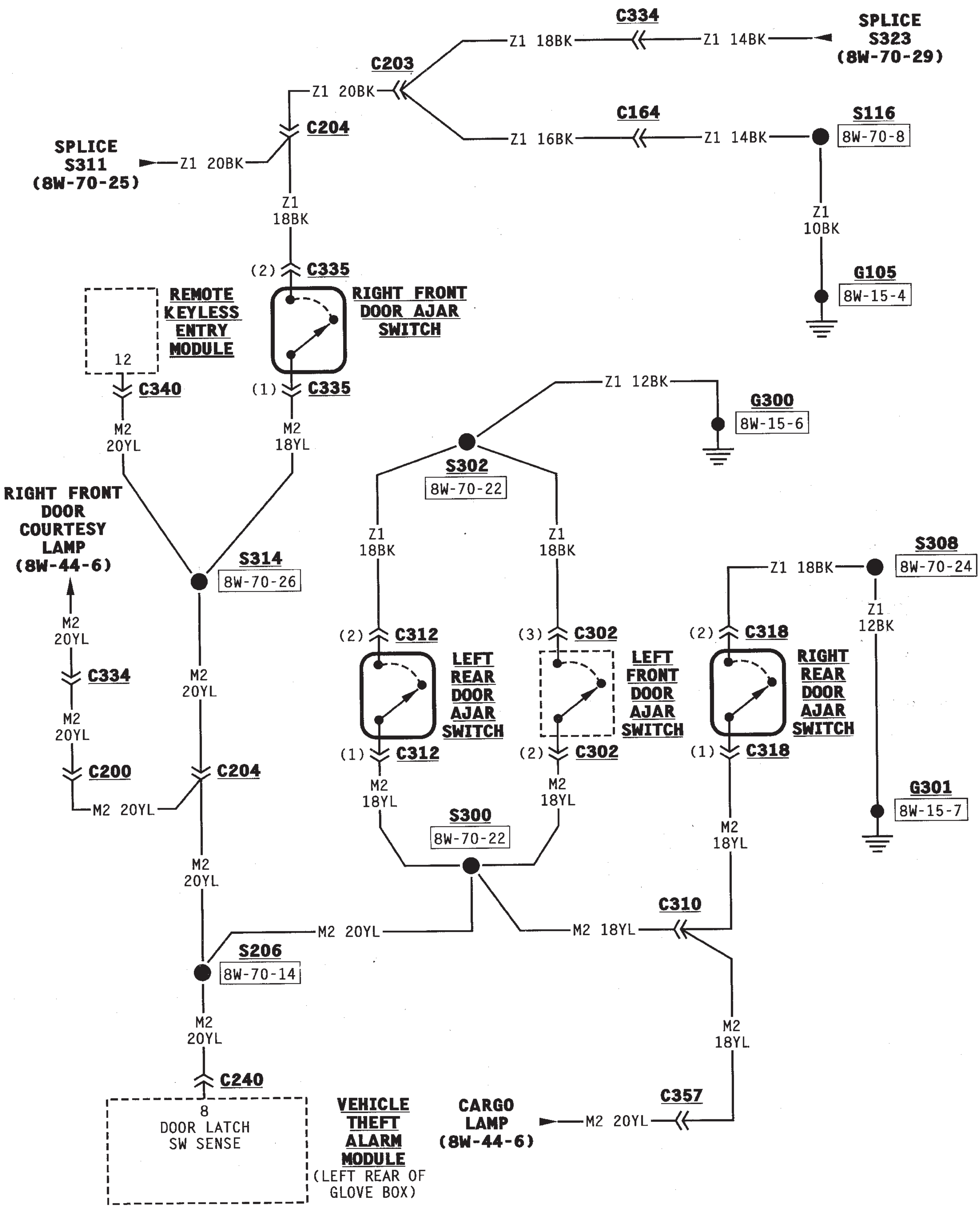
J958W-3


POWER DOOR LOCK RELAY (8W-61-6)
POWER DOOR UNLOCK RELAY (8W-61-5)
P35 20OR/VT
P35 20OR VT
P36 20PK/VT
P36 20PK VT
C233
C203
C204
C300
C334
C351
C345
C355
REMOTE KEYLESS ENTRY MODULE (8W-61-3)
LEFT FRONT POWER DOOR LOCK SWITCH (8W-61-5,6)
RIGHT FRONT POWER DOOR LOCK SWITCH (8W-61-5,6)
C240
15 DR LOCK RLY CONTROL
16 DR UNLOCK RLY CONTROL
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)

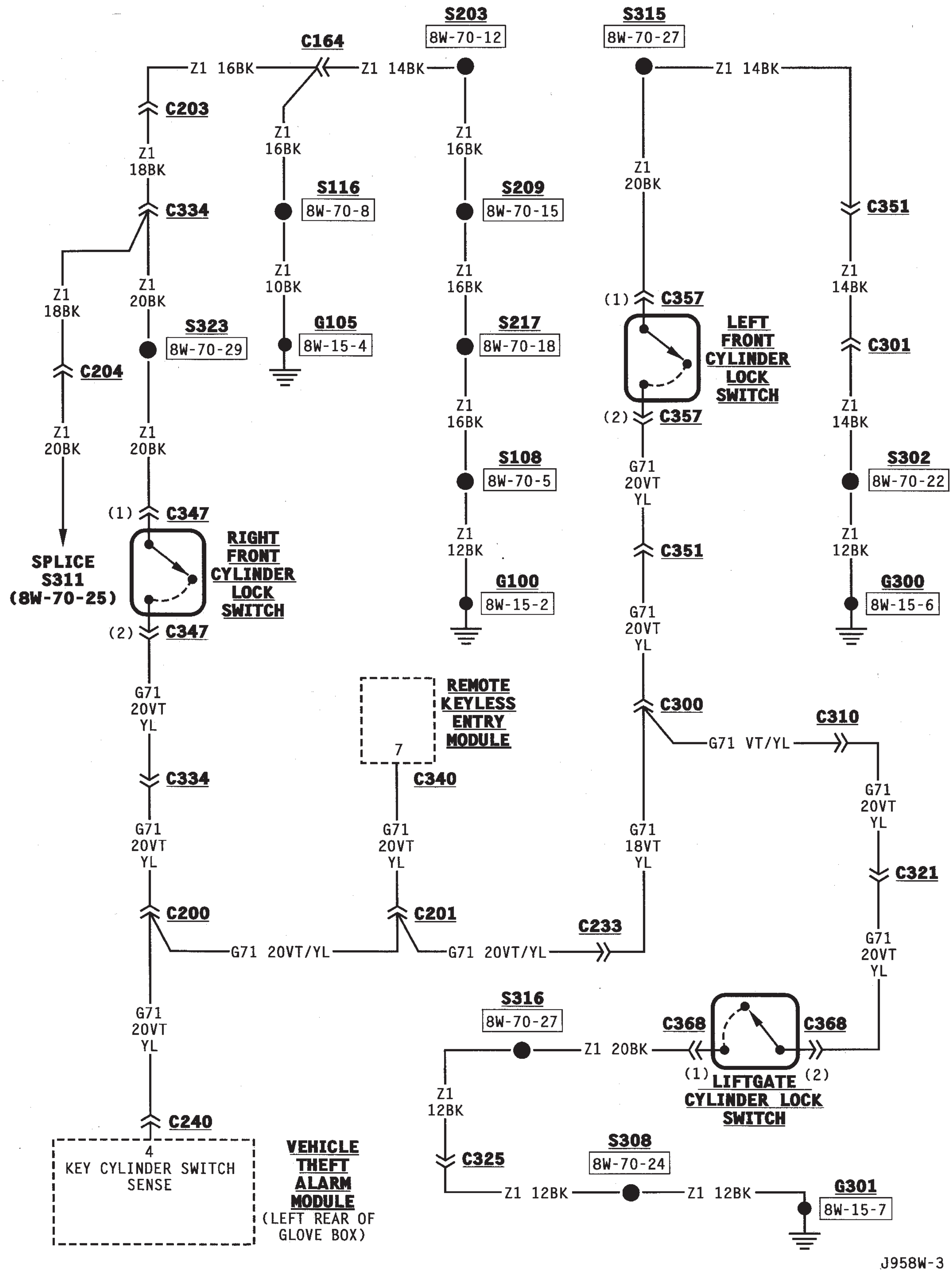
J958W-3

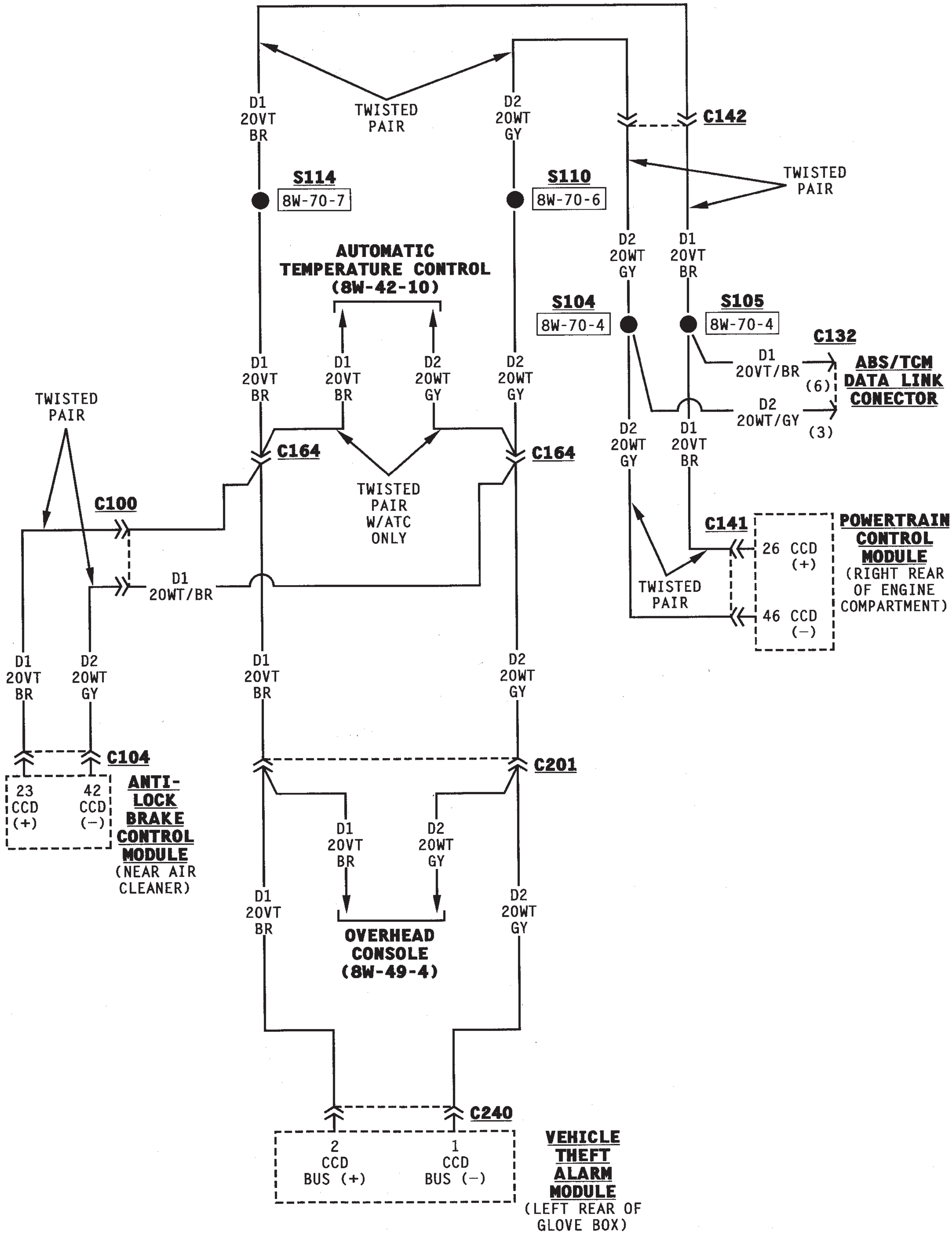

S316
8W-70-27
Z1 12BK
Z1
20BK
Z1
20BK
C325
Z1
12BK
(3) C363
(3) C366
LIFTGLASS AJAR SWITCH
LIFTGATE AJAR SWITCH
S308
8W-70-24
Z1
12BK
(2) C363
(2) C366
G78
20TN
BK
G78
20TN
BK
G301
8W-15-7
S317
8W-70-27
G78
20TN
BK
HOOD AJAR SWITCH
C321
G78 20TN/BK
CASE GROUND
C310
VEHICLE INFORMATION CENTER
(BOTTOM CENTER OF I.P.)
9
C211
G70
20BR
TN
G78
20TN
BK
C166
C233
G78 20TN/BK
G70
20BR
TN
G78
20TN
BK
C240
20
HOOD
AJAR SW
SENSE
10
L/GATE
AJAR SW
SENSE
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)

J958W-3


C334
Z1 18BK
Z1 14BK
SPLICE
S323
(8W-70-29)
C203
Z1 20BK
C164
Z1 16BK
Z1 14BK
S116
8W-70-8
C204
SPLICE
S311
(8W-70-25)
Z1 20BK
Z1
18BK
Z1
10BK
(2) C335
G105
8W-15-4
REMOTE KEYLESS ENTRY MODULE
12
RIGHT FRONT DOOR AJAR SWITCH
C340
(1) C335
Z1 12BK
G300
8W-15-6
M2
20YL
M2
18YL
S302
8W-70-22
RIGHT FRONT DOOR COURTESY LAMP (8W-44-6)
Z1
18BK
Z1
18BK
S314
8W-70-26
S308
Z1 18BK
8W-70-24
Z1
12BK
M2
20YL
(2) C312
(3) C302
(2) C318
C334
M2
20YL
LEFT REAR DOOR AJAR SWITCH
LEFT FRONT DOOR AJAR SWITCH
RIGHT REAR DOOR AJAR SWITCH
M2
20YL
(1) C312
(2) C302
(1) C318
C200
C204
M2 20YL
M2
18YL
M2
18YL
S300
8W-70-22
G301
8W-15-7
M2
18YL
M2
20YL
C310
M2 20YL
M2 18YL
S206
8W-70-14
M2
20YL
M2
18YL
C240
C357
8
DOOR LATCH
SW SENSE
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)
CARGO LAMP
(8W-44-6)
M2 20YL

J958W-3


S203
8W-70-12
S315
8W-70-27
C164
Z1 16BK
Z1 14BK
Z1 14BK
C203
Z1 18BK
Z1 16BK
Z1 16BK
Z1 20BK
S116
8W-70-8
S209
8W-70-15
C351
C334
Z1 10BK
Z1 16BK
Z1 14BK
Z1 18BK
Z1 20BK
(1) C357
G105
8W-15-4
S217
8W-70-18
LEFT FRONT CYLINDER LOCK SWITCH
C301
S323
8W-70-29
C204
Z1 16BK
(2) C357
Z1 14BK
Z1 20BK
Z1 20BK
S108
8W-70-5
G71 20VT YL
S302
8W-70-22
(1) C347
Z1 12BK
C351
Z1 12BK
SPLICE S311 (8W-70-25)
RIGHT FRONT CYLINDER LOCK SWITCH
G100
8W-15-2
G300
8W-15-6
(2) C347
G71 20VT YL
G71 20VT YL
REMOTE KEYLESS ENTRY MODULE
7
C300
C310
G71 VT/YL
C334
C340
G71 20VT YL
G71 20VT YL
G71 20VT YL
G71 18VT YL
C321
C200
C201
C233
G71 20VT/YL
G71 20VT/YL
G71 20VT YL
G71 20VT YL
S316
8W-70-27
C368
C368
Z1 20BK
(1)
(2)
LIFTGATE CYLINDER LOCK SWITCH
Z1 12BK
C240
S308
8W-70-24
C325
4
KEY CYLINDER SWITCH SENSE
VEHICLE THEFT ALARM MODULE
(LEFT REAR OF GLOVE BOX)
Z1 12BK
Z1 12BK
G301
8W-15-7
J958W-3


D1
20VT
BR
TWISTED
PAIR
D2
20WT
GY
C142
S114
8W-70-7
S110
8W-70-6
TWISTED
PAIR
D2
20WT
GY
D1
20VT
BR
AUTOMATIC
TEMPERATURE CONTROL
(8W-42-10)
S104
8W-70-4
S105
8W-70-4
C132
D1
20VT/BR
(6)
ABS/TCM
DATA LINK
CONECTOR
D2
20WT/GY
(3)
TWISTED
PAIR
C164
TWISTED
PAIR
W/ATC
ONLY
C164
C100
D1
20WT/BR
C141
26 CCD
(+)
46 CCD
(−)
POWERTRAIN
CONTROL
MODULE
(RIGHT REAR
OF ENGINE
COMPARTMENT)
C104
23
CCD
(+)
42
CCD
(−)
ANTI-
LOCK
BRAKE
CONTROL
MODULE
(NEAR AIR
CLEANER)
C201
OVERHEAD
CONSOLE
(8W-49-4)
C240
2
CCD
BUS (+)
1
CCD
BUS (−)
VEHICLE
THEFT
ALARM
MODULE
(LEFT REAR OF
GLOVE BOX)

J958W-3

INSTRUMENT CLUSTER

INDEX

INSTRUMENT CLUSTER

The instrument cluster contains the gauges and warning lamps. All gauges have magnetic movements.

When the ignition switch is in the START or RUN position, it connects circuit A1 from fuse 12 in the Power Distribution Center (PDC) to circuit A21. Circuit A21 feeds circuit F87 through fuse 21 in the fuse block. Circuit A21 also powers circuit G5 through fuse 22 in the fuse block. Circuit A1 is HOT at all times.

Circuits F87 and G5 supply power to the instrument cluster for the warning lamps and gauges. Circuit Z1 provides ground for the warning lamps. Circuit Z2 provides ground for the gauges.

HELPFUL INFORMATION

Circuit G5 also connects to the airbag diagnostic connector.

Circuit Z2 also provides ground for the overhead console and fuel gauge level sensor.

INSTRUMENT CLUSTER ILLUMINATION LAMPS

Circuit E2 from the dimming module feeds the illumination lamps. Circuit Z1 provides ground for the illumination lamps.

ENGINE COOLANT TEMPERATURE GAUGE

Circuit G20 connects the engine coolant temperature gauge to the engine coolant temperature sensor. The sensor is a variable resistor and case grounded to the engine.

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the gauge. Circuit Z2 provides the ground path for the gauge.

The gauge uses two coils. Current passing through the coils creates a magnetic field. Position of the gauge needle is controlled by the amount of current passing through the coils to ground at the sensor.

FUEL GAUGE

The fuel level sensor is a variable resistor. Circuit G44 connects the fuel level sensor to the overhead console. Circuit K102 connects the fuel level sensor to the fuel gauge in the instrument cluster. Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the fuel gauge. Circuit Z2 provides the ground path for the fuel level sensor.

The fuel gauge has two coils. As current flows through the coils in the fuel gauge, it creates a magnetic field. One of the coils in the gauge receives fixed current. The other coil is connected to the level sensor. The magnetic field controls the position of the fuel gauge pointer.

As the position of the float arm on the fuel level sensor changes, the resistor changes the current flow through second coil in the fuel gauge. A change in current flow alters the magnetic field in the fuel gauge, which changes the pointer position.

Circuits F87 and G5 also power the low fuel warning lamp. Refer to Group 8E, Instrument Panel and Gauges for additional information.

LOW FUEL WARNING LAMP

Circuit K102 connects the fuel level sensor to the fuel gauge. The low fuel level module at the rear of the gauge monitors resistance in circuit K102. The low fuel level module powers the low fuel warning lamp when the resistance in circuit K102 reaches a calibrated level. Circuit Z2 provides ground for the low fuel warning lamp. Refer to Group 8E for additional information.

OIL PRESSURE GAUGE

The case grounded oil pressure sensor is a variable resistor that connects to circuit G6. Circuit G6 connects to the oil pressure gauge.

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the oil pressure gauge. Circuit Z2 provides the ground path for the gauge.

The oil pressure gauge has two coils. As current flows through the coils in the gauge, it creates a magnetic field. One of the coils in the gauge receives fixed current. The other coil is connected to the oil pressure sensor. The magnetic field controls the position of the gauge pointer.

As oil pressure changes, the sensor alters the current flow through second coil in the fuel gauge. A change in current flow alters the magnetic field in the fuel gauge, which changes the pointer position.

VOLTMETER

Circuit F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the voltmeter. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position. Circuit Z2 provides ground for the voltmeter.

TACHOMETER

The tachometer module in the instrument cluster operates the tachometer. The Powertrain Control Module (PCM) supplies the signal for the tachometer on circuit G21. Circuit G21 connects to cavity 43 of the PCM.

Circuit F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the tachometer module. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position. Circuit Z2 provides ground for the tachometer and module.

Circuit G21 also connects to the transmission control module (TCM).

SPEEDOMETER

The speedometer receives a signal from the vehicle speed sensor on circuit G7. Circuit G7 also connects to the Powertrain Control Module (PCM) at cavity 47.

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the speedometer. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position. Circuit Z2 provides ground for the speedometer.

MALFUNCTION INDICATOR LAMP (MIL)

The PCM provides ground for the instrument cluster malfunction indicator lamp on circuit G3. Circuit G3 connects to cavity 32 of the PCM. The MIL displays the message CHECK ENGINE when illuminated.

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the MIL. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position.

For information regarding diagnostic trouble code access using the MIL lamp, refer to Group 14, Fuel Systems.

SEAT BELT INDICATOR WARNING LAMP

The seat belt indicator warning lamp is activated by the chime module on circuit G13. Circuit G13 supplies power to instrument cluster for the lamp. Circuit Z1 provides ground for the lamp.

The chime/buzzer module powers circuit G11 after it receives an input on circuit G10 indicating the seat belt switch is open.

HIGH BEAM INDICATOR LAMP

Circuit G34 supplies power to the high beam indicator lamp in the instrument cluster. On vehicles not equipped with Daytime Running Lamps (DRL), circuit L3 from the dimmer switch powers circuit G34.

On vehicles equipped with DRL, the DRL/Dimming module powers circuit G34. Circuit Z1 provides ground for the indicator lamp.

TURN SIGNAL INDICATOR LAMPS

Circuits L64 and L65 power from the turns signal switch circuitry in the multi-function switch supply power for the turn signal indicator lamps. Circuit L64 powers the left indicator lamp. Circuit L65 powers the right indicator lamp. Circuit Z1 provides ground for the lamps.

ABS WARNING LAMP

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the ABS warning lamp. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position.

Ground for the ABS warning lamp is provided by either the ABS control module or by the ABS power relay when the relay is not energized. The ABS control module illuminates the lamp by providing ground on circuit 205.

Circuit 205 connects to circuit 235 through a diode. When the ABS power relay is not energized, it connects circuit 235 to circuit Z1. The ground path for the warning lamp is through the diode to circuit 235, through the ABS power relay to ground on circuit Z1.

The diode between circuit 205 and 235 prevents voltage from flowing to the ABS control module when the ABS power relay switches to supply power on circuit 235.

BRAKE WARNING LAMP

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the ABS warning lamp. Circuits F87 and G5 are

HOT when the ignition switch is in the START or RUN position. Circuit G9 provides ground for the brake warning lamp.

On vehicle not equipped with Daytime Running Lamps (DRL), ground for the park brake lamp is supplied either through the case grounded park brake switch or brake warning switch on circuit G9.

On vehicles equipped with DRL, the park brake switch connects to the DRL module on circuit G11. Circuit G9 connects to the DRL module through the brake warning switch. If the park brake switch closes, the DRL module provides ground for brake warning lamp on circuit G9 through the brake warning switch. The case grounded brake warning switch can also connect circuit G9 to ground.

For all vehicles, circuit G9 also connects to the ignition switch. When the case grounded ignition switch is in the START position, it provides ground for the lamp.

MANUAL TRANSMISSION UP-SHIFT LAMP

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the up-shift lamp. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position.

The Powertrain Control Module (PCM) provides ground for the up-shift lamp on circuit K54. Circuit K54 connects to cavity 54 of the PCM.

AIRBAG WARNING LAMP

Circuits F87 from fuse 21 in the fuse block and circuit G5 from fuse 22 in the fuse block supply voltage to the airbag warning lamp. Circuits F87 and G5 are HOT when the ignition switch is in the START or RUN position.

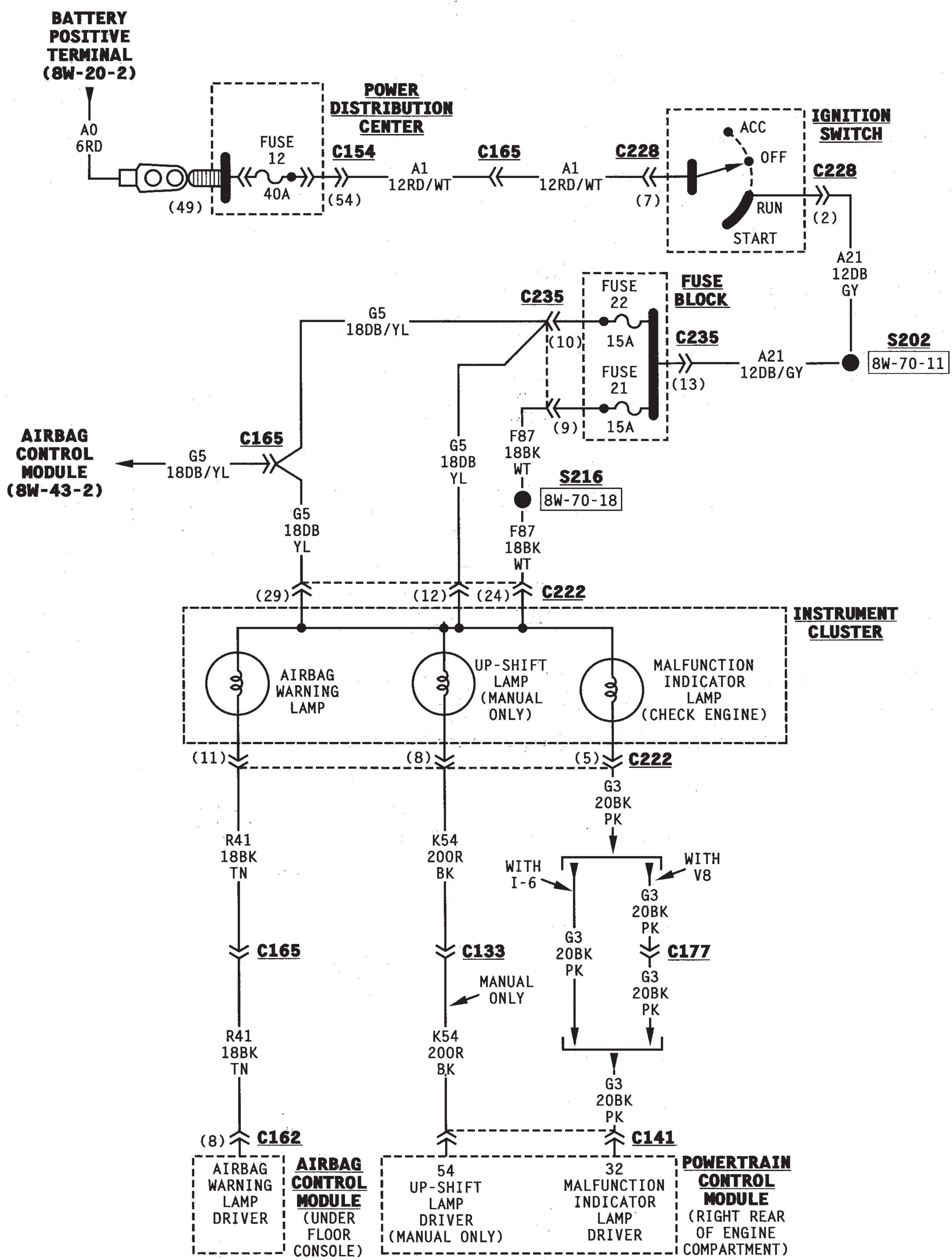
The Airbag Control Module (ACM) provides ground for the up-shift lamp on circuit R41. Circuit R41 connects to cavity 3 of the ACM.

SECURITY LAMP

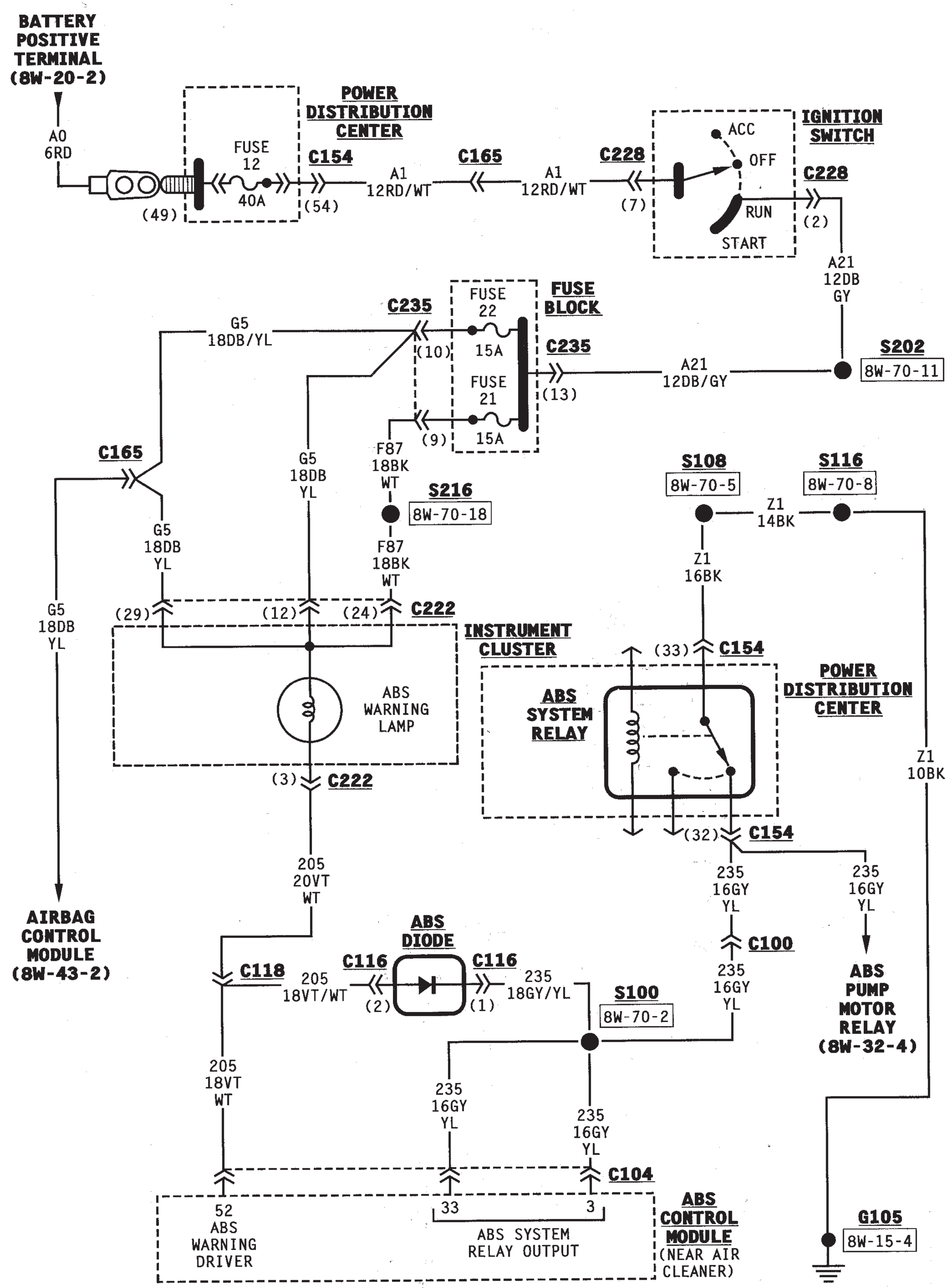
Circuit F70 from fuse 14 in the fuse block supplies power for the security lamp. Circuit A7 from fuse 14 in the PDC supplies power to the fuse block for circuit F70.

Circuit G69 from the Vehicle Theft Alarm (VTA) module supplies ground for the lamp after the VTA system has been properly armed. Refer to Group 8Q, Vehicle Theft Alarm.

DIAGRAM INDEX

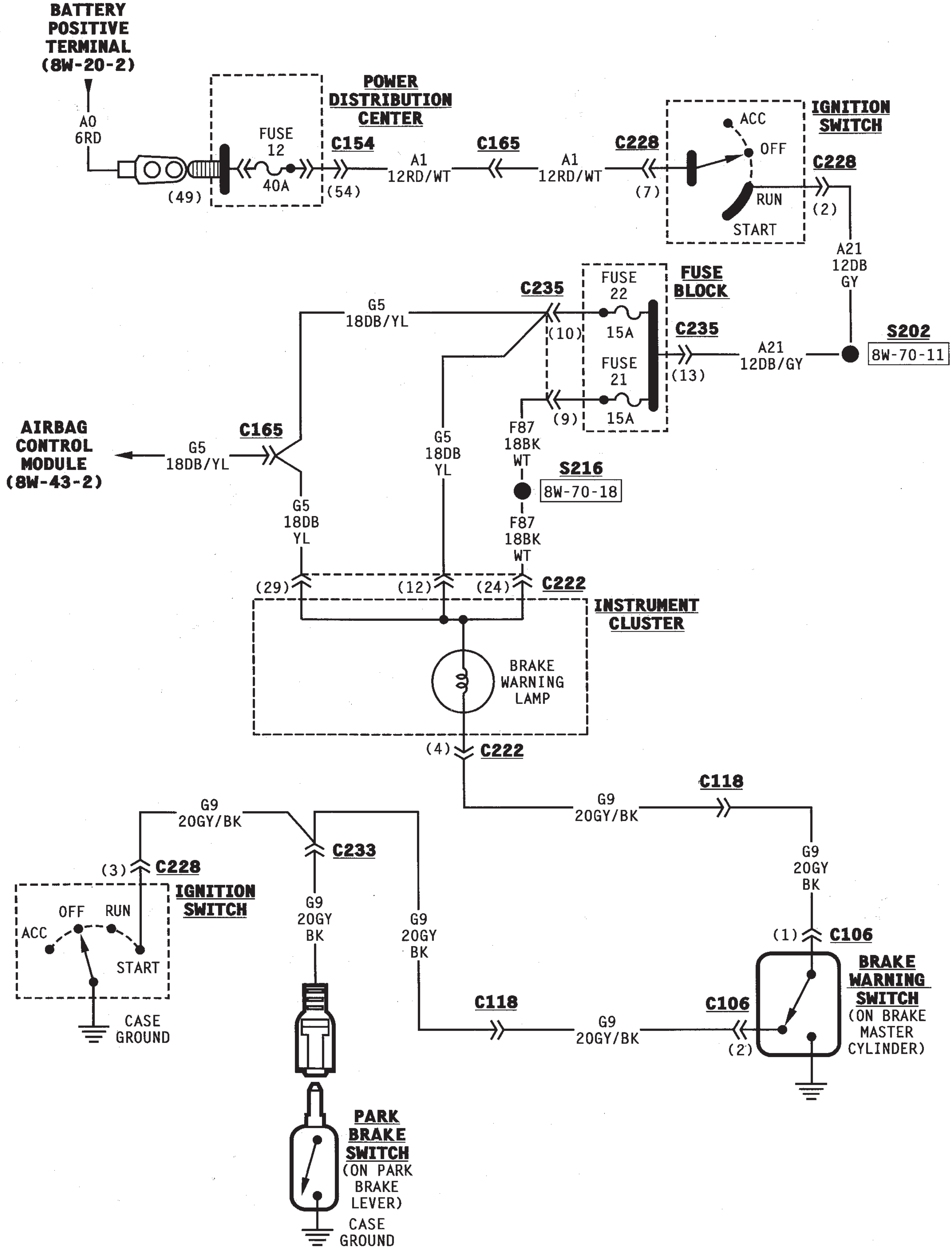

BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A0
6RD
(49)
FUSE
12
40A
POWER
DISTRIBUTION
CENTER
C154
(54)
A1
12RD/WT
C165
A1
12RD/WT
C228
(7)
ACC
OFF
RUN
START
IGNITION
SWITCH
C228
(2)
A21
12DB
GY
FUSE
22
15A
FUSE
21
15A
FUSE
BLOCK
C235
(10)
C235
(13)
A21
12DB/GY
S202
8W-70-11
(9)
G5
18DB/YL
AIRBAG
CONTROL
MODULE
(8W-43-2)
G5
18DB/YL
C165
G5
18DB
YL
G5
18DB
YL
F87
18BK
WT
S216
8W-70-18
F87
18BK
WT
(29)
(12)
(24)
C222
INSTRUMENT
CLUSTER
AIRBAG
WARNING
LAMP
UP-SHIFT
LAMP
(MANUAL
ONLY)
MALFUNCTION
INDICATOR
LAMP
(CHECK ENGINE)
(11)
(8)
(5)
C222
G3
20BK
PK
R41
18BK
TN
K54
20OR
BK
WITH
I-6
WITH
V8
G3
20BK
PK
C165
C133
G3
20BK
PK
C177
G3
20BK
PK
MANUAL
ONLY
R41
18BK
TN
K54
20OR
BK
G3
20BK
PK
(8)
C162
C141
AIRBAG
WARNING
LAMP
DRIVER
AIRBAG
CONTROL
MODULE
(UNDER
FLOOR
CONSOLE)
54
UP-SHIFT
LAMP
DRIVER
(MANUAL ONLY)
32
MALFUNCTION
INDICATOR
LAMP
DRIVER
POWERTRAIN
CONTROL
MODULE
(RIGHT REAR
OF ENGINE
COMPARTMENT)

J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 12 40A
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(2)
A21 12DB GY
FUSE BLOCK
FUSE 22 15A
FUSE 21 15A
C235
(10)
C235
(13)
A21 12DB/GY
S202
8W-70-11
G5 18DB/YL
(9)
F87 18BK WT
S216
8W-70-18
F87 18BK WT
C165
G5 18DB YL
G5 18DB YL
G5 18DB YL
S108
8W-70-5
S116
8W-70-8
Z1 14BK
Z1 16BK
(29)
(12)
(24)
C222
INSTRUMENT CLUSTER
ABS WARNING LAMP
(3)
C222
(33)
C154
POWER DISTRIBUTION CENTER
ABS SYSTEM RELAY
(32)
C154
Z1 10BK
AIRBAG CONTROL MODULE (8W-43-2)
205 20VT WT
235 16GY YL
235 16GY YL
C100
ABS PUMP MOTOR RELAY (8W-32-4)
ABS DIODE
C118
C116
C116
205 18VT/WT
(2)
(1)
235 18GY/YL
S100
8W-70-2
235 16GY YL
205 18VT WT
235 16GY YL
235 16GY YL
C104
52 ABS WARNING DRIVER
33
3
ABS SYSTEM RELAY OUTPUT
ABS CONTROL MODULE (NEAR AIR CLEANER)
G105
8W-15-4

J958W-3

WITHOUT DRL



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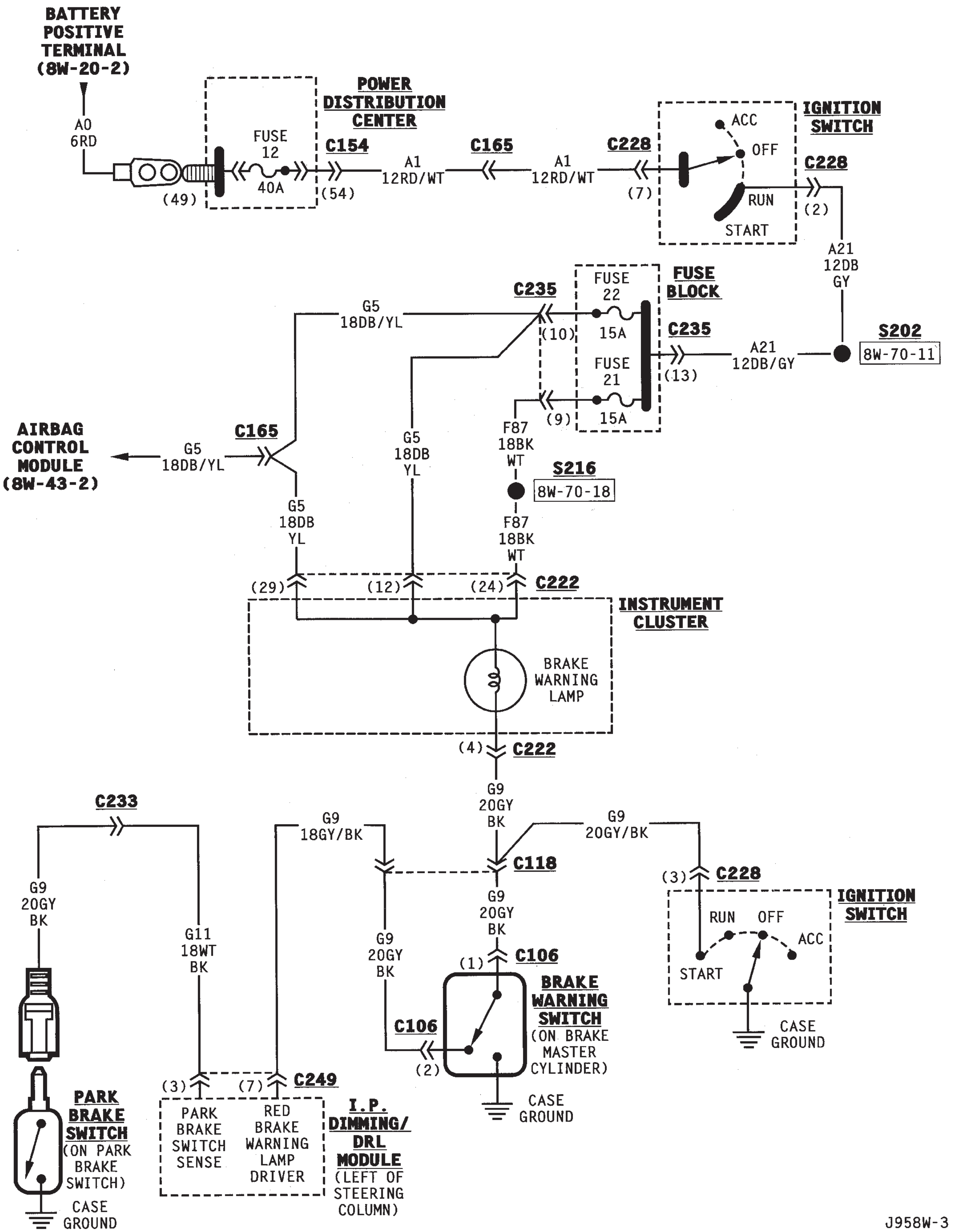
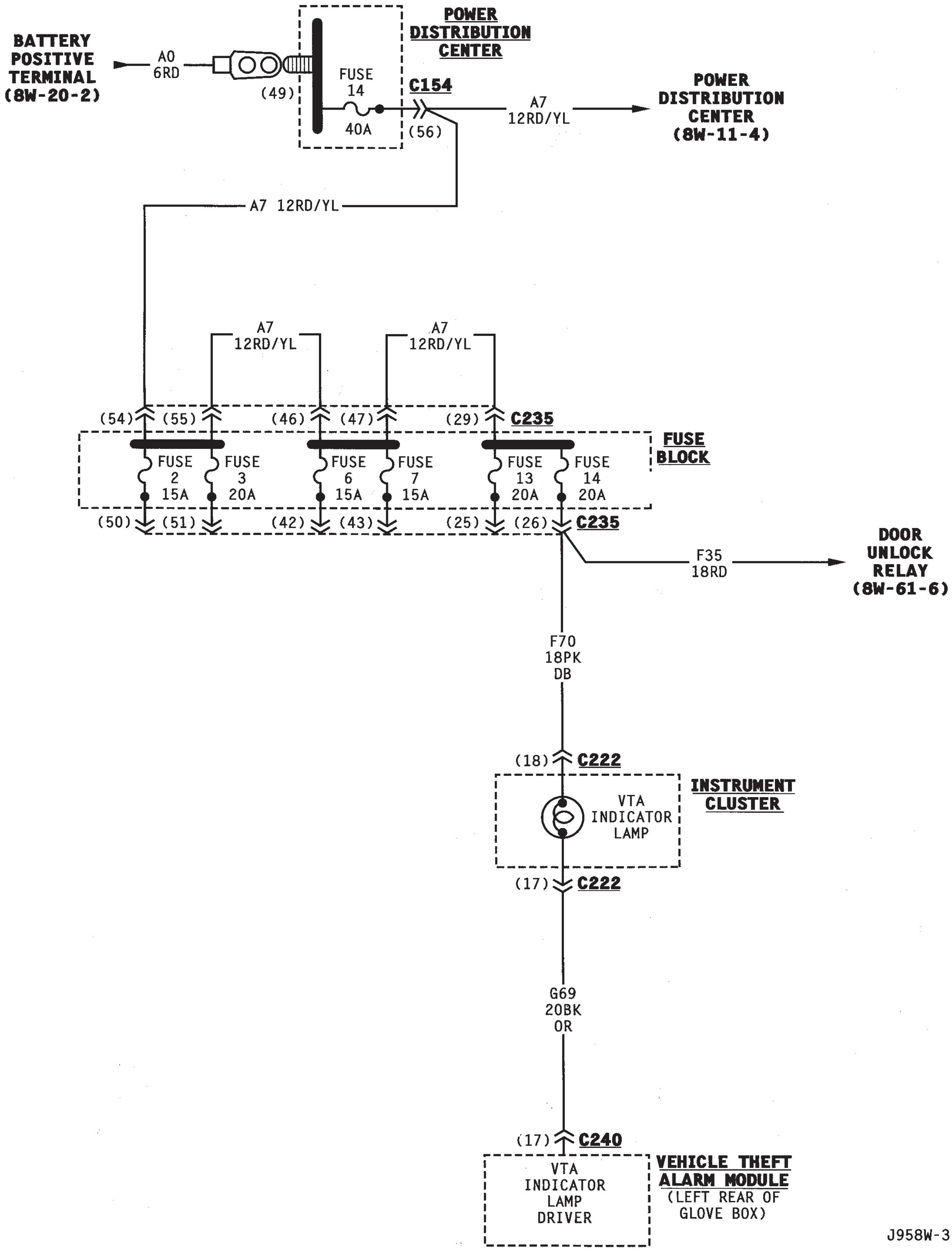
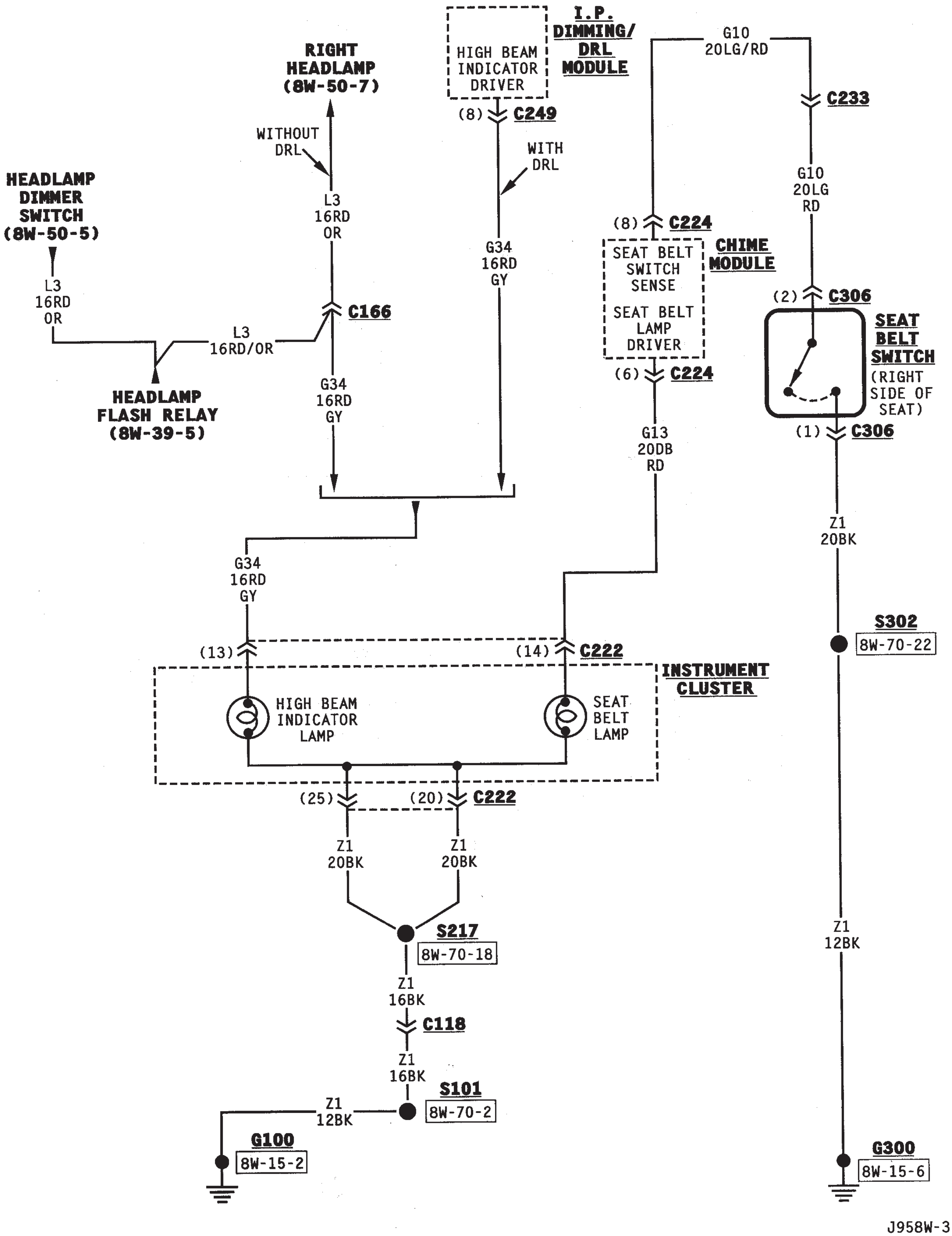
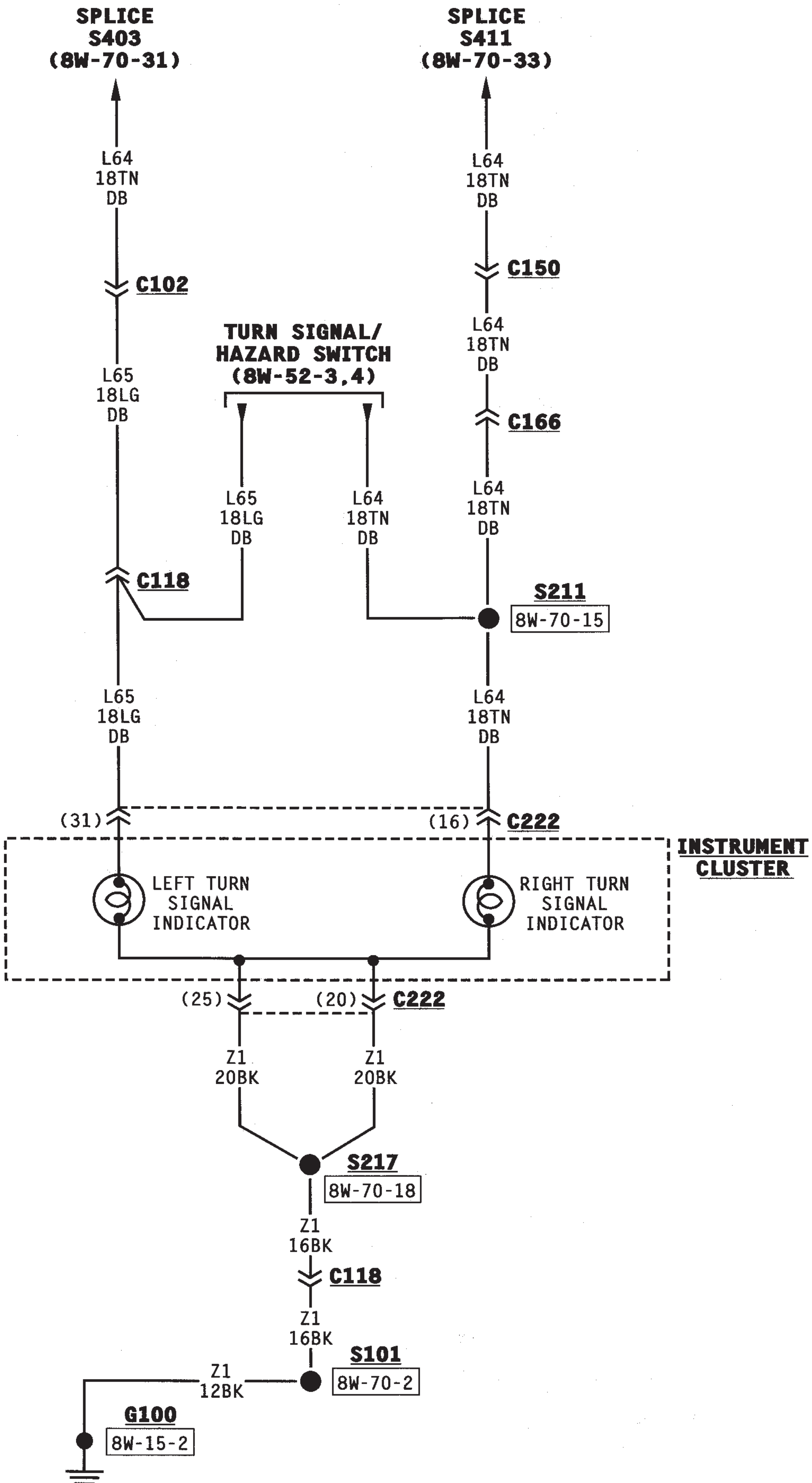

BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 12 40A
POWER DISTRIBUTION CENTER
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
ACC
OFF
RUN
START
IGNITION SWITCH
C228
(2)
A21 12DB GY
FUSE 22 15A
FUSE BLOCK
C235
(10)
C235
A21 12DB/GY
(13)
S202
8W-70-11
FUSE 21 15A
(9)
G5 18DB/YL
AIRBAG CONTROL MODULE (8W-43-2)
G5 18DB/YL
C165
G5 18DB YL
G5 18DB YL
F87 18BK WT
S216
8W-70-18
F87 18BK WT
(29)
(12)
(24)
C222
INSTRUMENT CLUSTER
BRAKE WARNING LAMP
(4)
C222
G9 20GY BK
C233
G9 18GY/BK
G9 20GY/BK
C118
(3)
C228
IGNITION SWITCH
RUN OFF ACC START
CASE GROUND
G9 20GY BK
G11 18WT BK
G9 20GY BK
G9 20GY BK
(1)
C106
BRAKE WARNING SWITCH (ON BRAKE MASTER CYLINDER)
C106
(2)
CASE GROUND
(3)
(7)
C249
PARK BRAKE SWITCH SENSE
RED BRAKE WARNING LAMP DRIVER
I.P. DIMMING/ DRL MODULE (LEFT OF STEERING COLUMN)
PARK BRAKE SWITCH (ON PARK BRAKE SWITCH)
CASE GROUND

J958W-3

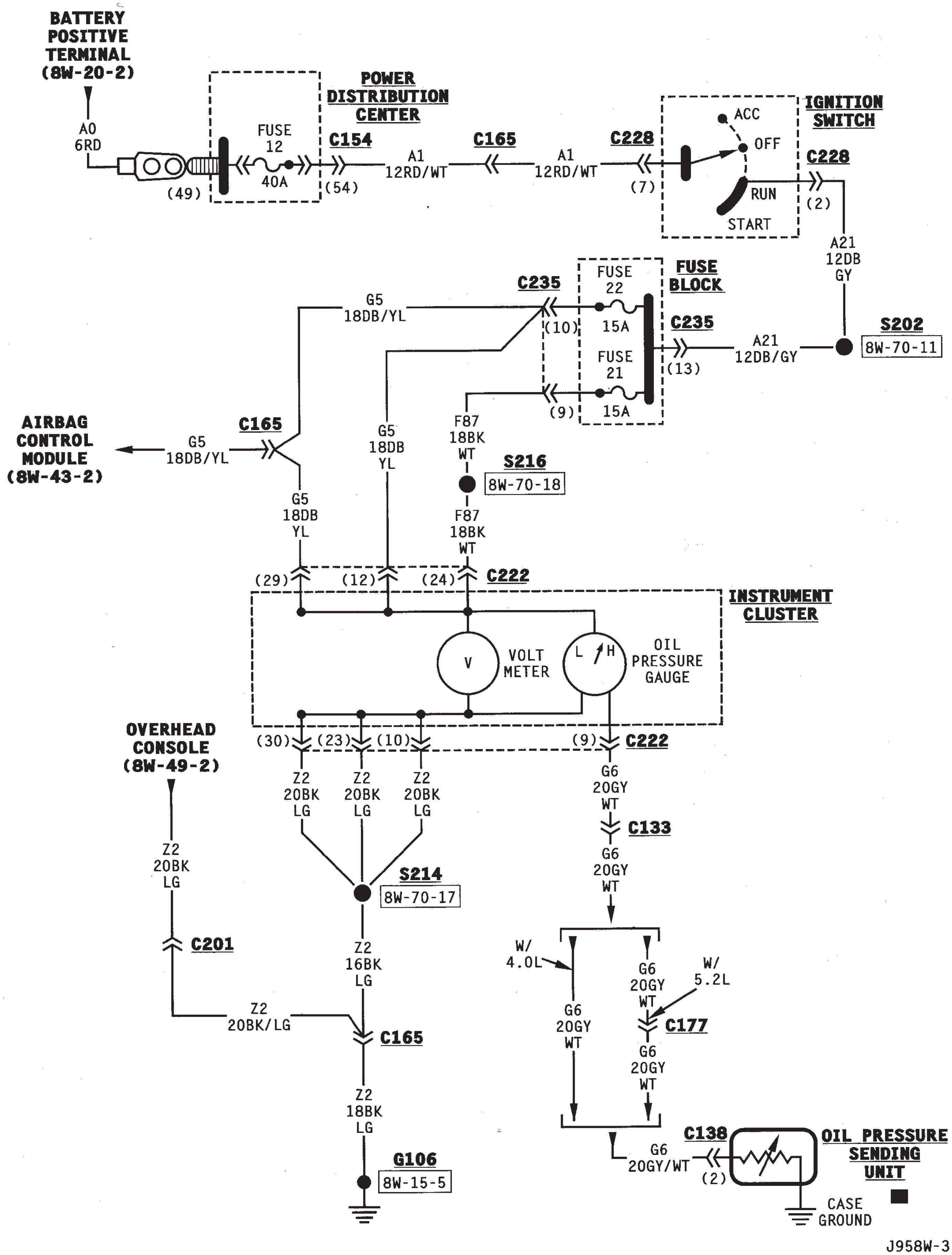

BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A0
6RD
(49)
POWER
DISTRIBUTION
CENTER
FUSE
14
40A
C154
(56)
A7
12RD/YL
POWER
DISTRIBUTION
CENTER
(8W-11-4)
A7 12RD/YL
A7
12RD/YL
A7
12RD/YL
(54)
(55)
(46)
(47)
(29)
C235
FUSE
BLOCK
FUSE
2
15A
FUSE
3
20A
FUSE
6
15A
FUSE
7
15A
FUSE
13
20A
FUSE
14
20A
(50)
(51)
(42)
(43)
(25)
(26)
C235
F35
18RD
DOOR
UNLOCK
RELAY
(8W-61-6)
F70
18PK
DB
(18)
C222
INSTRUMENT
CLUSTER
VTA
INDICATOR
LAMP
(17)
C222
G69
20BK
OR
(17)
C240
VTA
INDICATOR
LAMP
DRIVER
VEHICLE THEFT
ALARM MODULE
(LEFT REAR OF
GLOVE BOX)

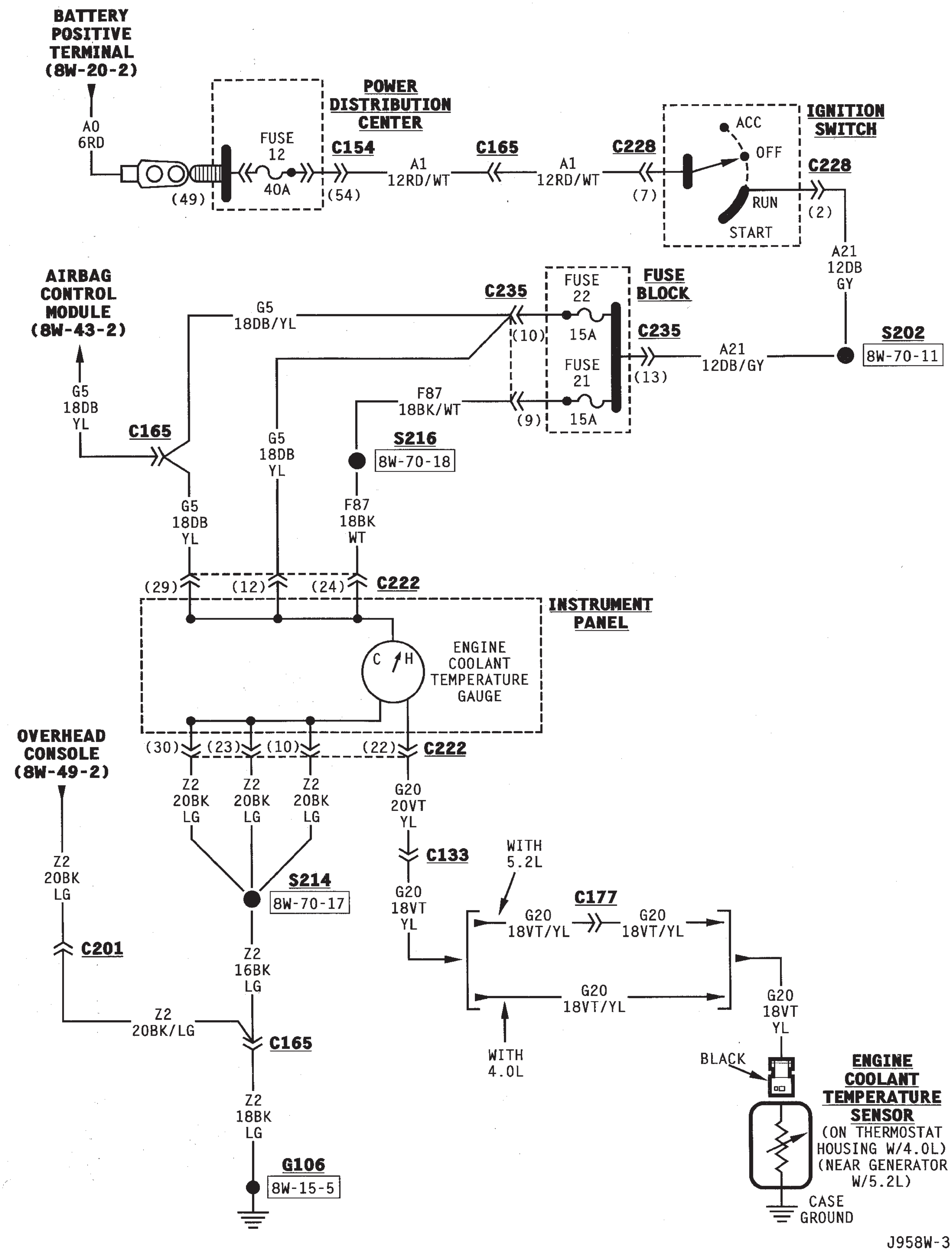
J958W-3

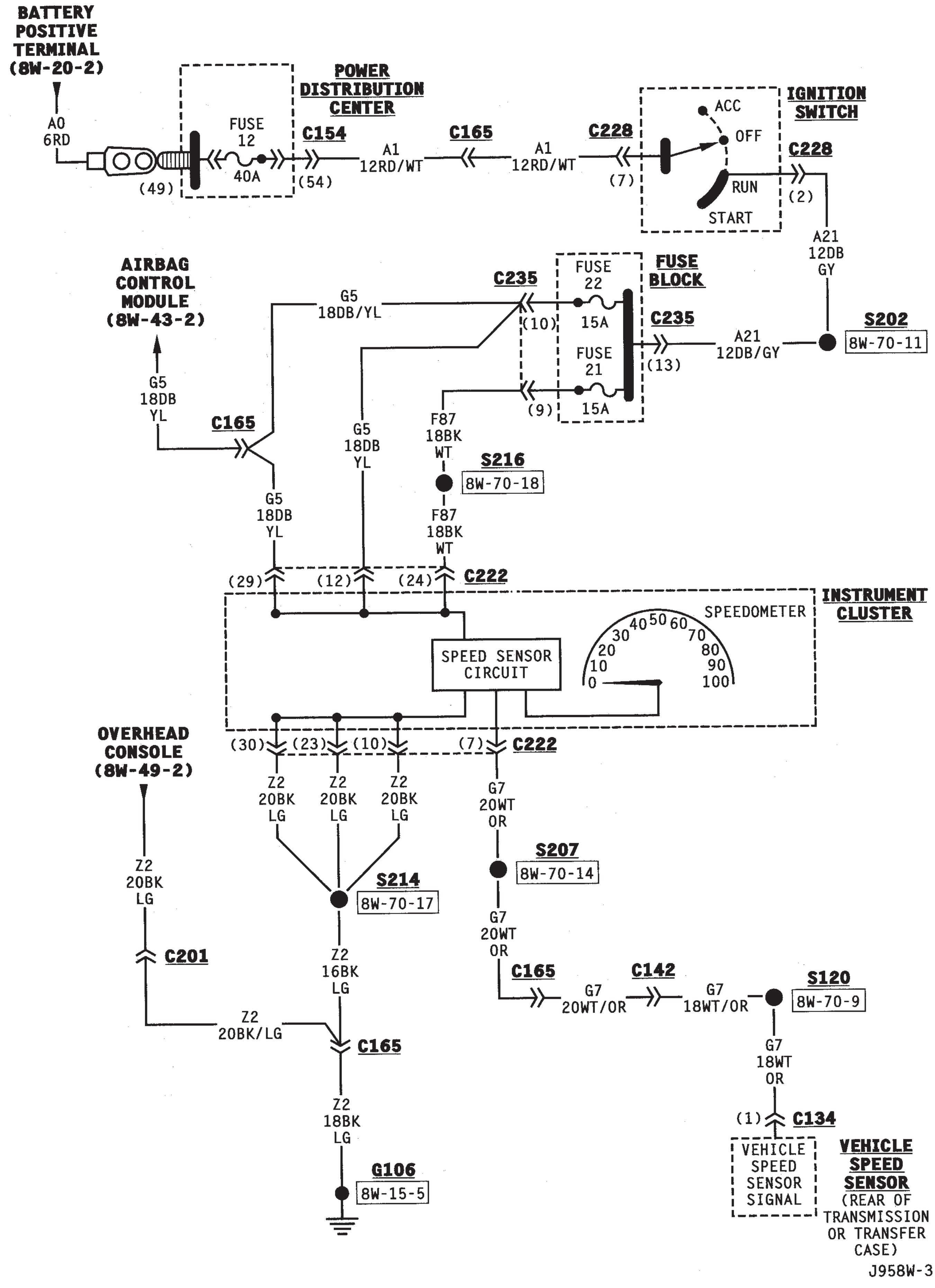

I.P. DIMMING/ DRL MODULE
HIGH BEAM INDICATOR DRIVER
(8) C249
RIGHT HEADLAMP (8W-50-7)
WITHOUT DRL
WITH DRL
HEADLAMP DIMMER SWITCH (8W-50-5)
L3 16RD OR
L3 16RD/OR
C166
HEADLAMP FLASH RELAY (8W-39-5)
G34 16RD GY
G10 20LG/RD
C233
G10 20LG RD
(8) C224
SEAT BELT SWITCH SENSE
SEAT BELT LAMP DRIVER
CHIME MODULE
(6) C224
G13 20DB RD
(2) C306
SEAT BELT SWITCH (RIGHT SIDE OF SEAT)
(1) C306
Z1 20BK
S302
8W-70-22
(13) (14) C222
INSTRUMENT CLUSTER
HIGH BEAM INDICATOR LAMP
SEAT BELT LAMP
(25) (20) C222
Z1 20BK
S217
8W-70-18
Z1 16BK
C118
S101
8W-70-2
Z1 12BK
G100
8W-15-2
Z1 12BK
G300
8W-15-6
J958W-3

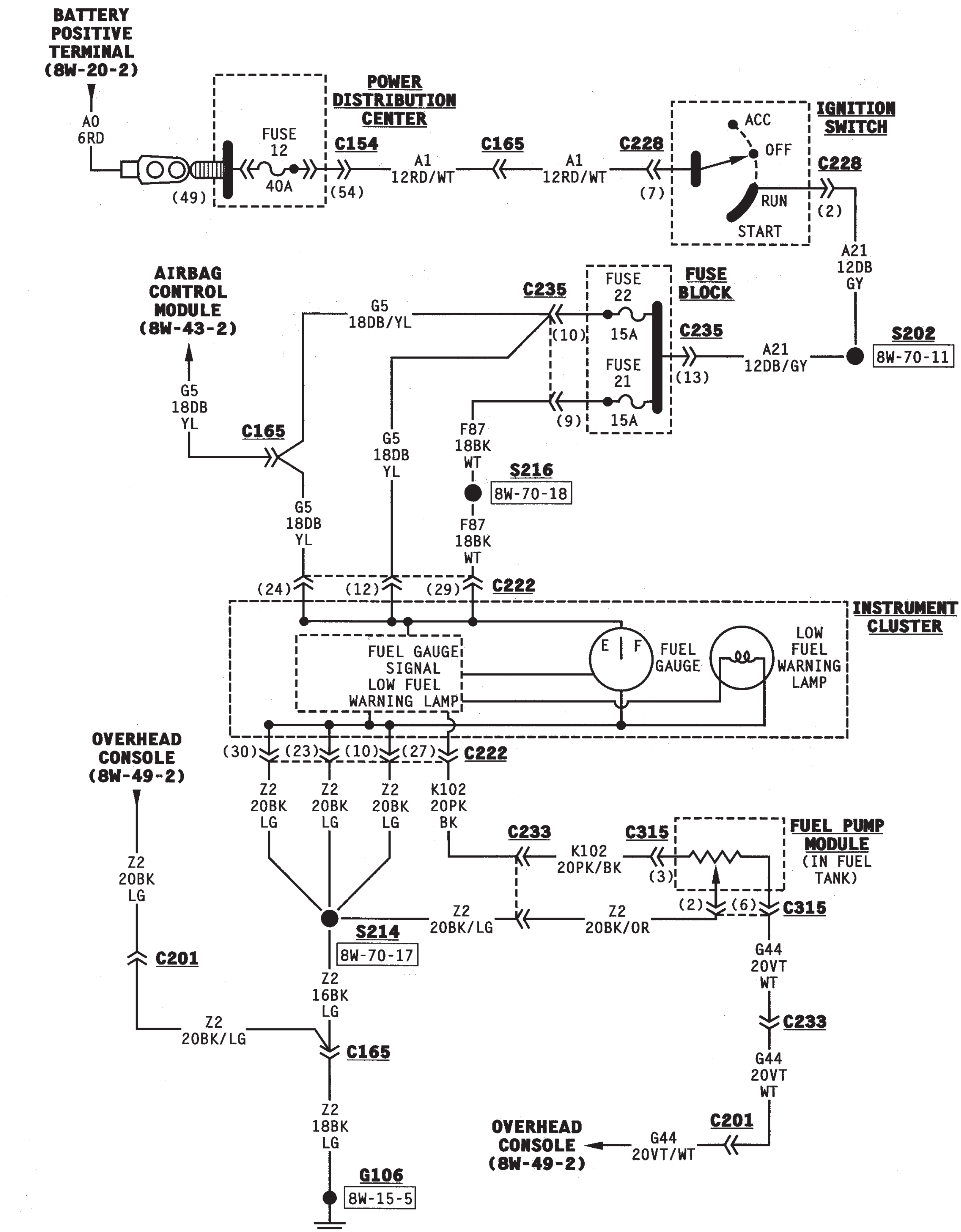

SPLICE
S403
(8W-70-31)
SPLICE
S411
(8W-70-33)
L64
18TN
DB
C102
C150
C166
TURN SIGNAL/
HAZARD SWITCH
(8W-52-3,4)
L65
18LG
DB
C118
S211
8W-70-15
(31)
(16)
C222
INSTRUMENT
CLUSTER
LEFT TURN
SIGNAL
INDICATOR
RIGHT TURN
SIGNAL
INDICATOR
(25)
(20)
Z1
20BK
S217
8W-70-18
Z1
16BK
S101
8W-70-2
Z1
12BK
G100
8W-15-2

J958W-3

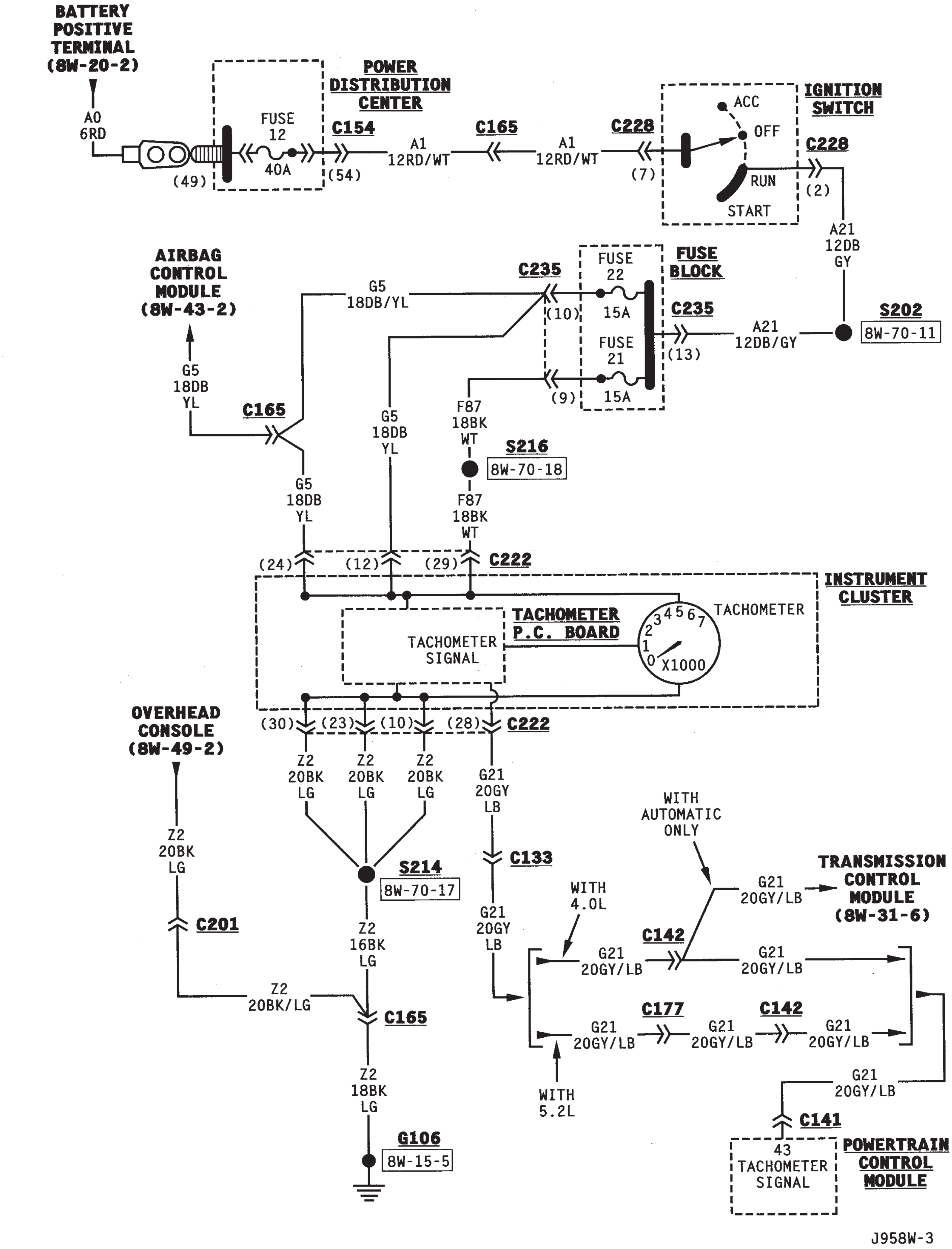

BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 12 40A
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(2)
A21 12DB GY
S202
8W-70-11
FUSE BLOCK
FUSE 22 15A
FUSE 21 15A
C235
(10)
C235
(13)
A21 12DB/GY
(9)
G5 18DB/YL
AIRBAG CONTROL MODULE (8W-43-2)
C165
G5 18DB/YL
G5 18DB YL
G5 18DB YL
F87 18BK WT
S216
8W-70-18
F87 18BK WT
(29)
(12)
(24)
C222
INSTRUMENT CLUSTER
V
VOLT METER
L H
OIL PRESSURE GAUGE
(30)
(23)
(10)
(9)
C222
OVERHEAD CONSOLE (8W-49-2)
Z2 20BK LG
Z2 20BK LG
Z2 20BK LG
Z2 20BK LG
S214
8W-70-17
C201
Z2 16BK LG
Z2 20BK/LG
C165
Z2 18BK LG
G106
8W-15-5
G6 20GY WT
C133
G6 20GY WT
W/ 4.0L
G6 20GY WT
W/ 5.2L
G6 20GY WT
C177
G6 20GY WT
G6 20GY WT
C138
G6 20GY/WT
(2)
OIL PRESSURE SENDING UNIT
CASE GROUND
J958W-3

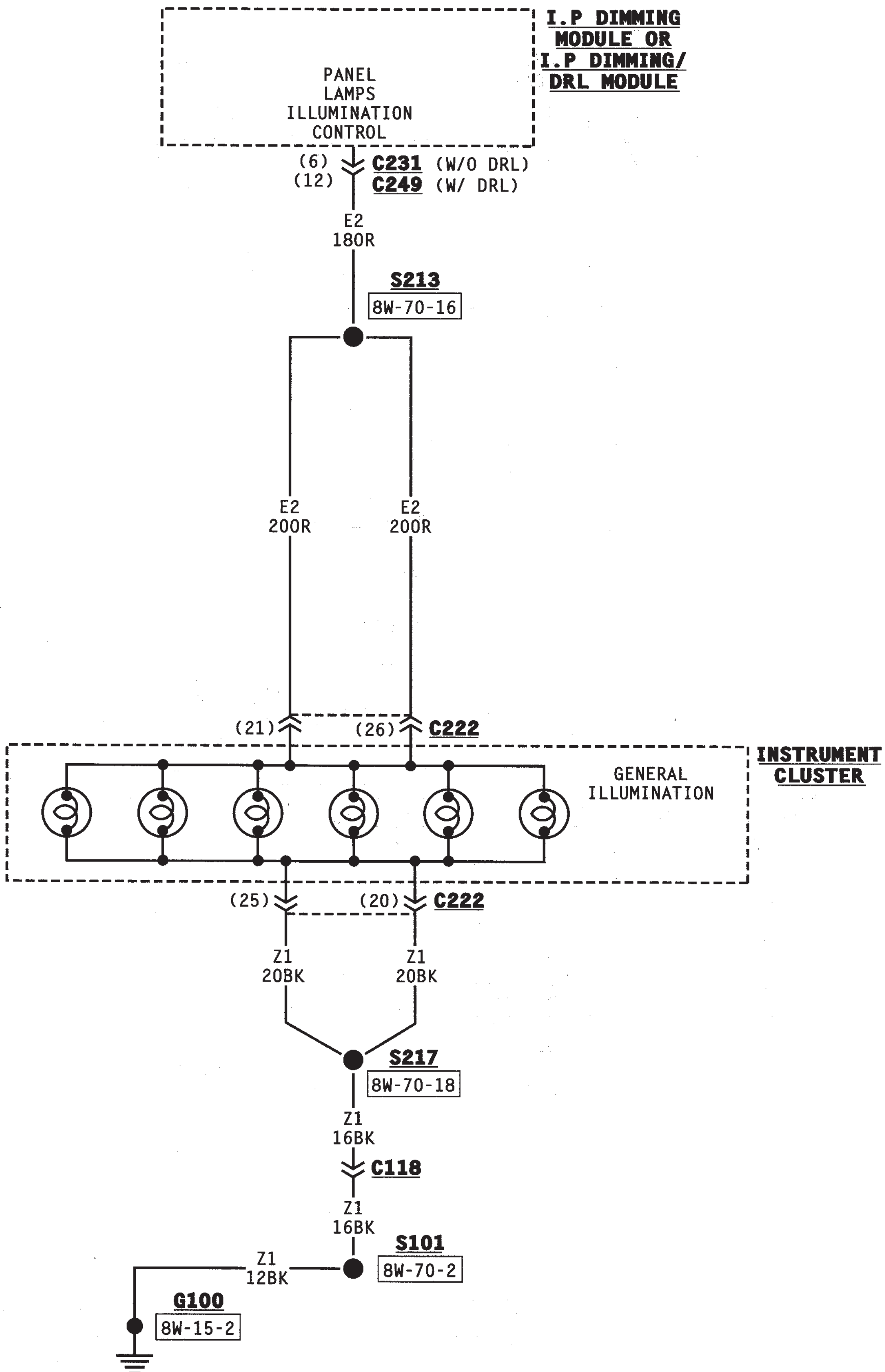

BATTERY POSITIVE TERMINAL (8W-20-2)
A0
6RD
(49)
FUSE 12
40A
POWER DISTRIBUTION CENTER
C154
(54)
A1
12RD/WT
C165
A1
12RD/WT
C228
(7)
ACC
OFF
RUN
START
IGNITION SWITCH
C228
(2)
A21
12DB
GY
AIRBAG CONTROL MODULE (8W-43-2)
G5
18DB/YL
C235
(10)
FUSE 22
15A
FUSE BLOCK
C235
(13)
FUSE 21
15A
A21
12DB/GY
S202
8W-70-11
F87
18BK/WT
(9)
G5
18DB
YL
C165
G5
18DB
YL
S216
8W-70-18
G5
18DB
YL
F87
18BK
WT
(29)
(12)
(24)
C222
INSTRUMENT PANEL
C
H
ENGINE COOLANT TEMPERATURE GAUGE
(30)
(23)
(10)
(22)
C222
OVERHEAD CONSOLE (8W-49-2)
Z2
20BK
LG
Z2
20BK
LG
Z2
20BK
LG
Z2
20BK
LG
G20
20VT
YL
C133
WITH 5.2L
S214
8W-70-17
G20
18VT
YL
C177
G20
18VT/YL
G20
18VT/YL
C201
Z2
16BK
LG
G20
18VT/YL
Z2
20BK/LG
C165
WITH 4.0L
G20
18VT
YL
BLACK
ENGINE COOLANT TEMPERATURE SENSOR
(ON THERMOSTAT HOUSING W/4.0L)
(NEAR GENERATOR W/5.2L)
Z2
18BK
LG
G106
8W-15-5
CASE GROUND
J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 12 40A
POWER DISTRIBUTION CENTER
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
ACC
OFF
RUN
START
IGNITION SWITCH
C228
(2)
A21 12DB GY
S202
8W-70-11
A21 12DB/GY
C235
(13)
FUSE BLOCK
FUSE 22 15A
FUSE 21 15A
C235
(10)
(9)
AIRBAG CONTROL MODULE (8W-43-2)
G5 18DB/YL
G5 18DB YL
C165
G5 18DB YL
G5 18DB YL
F87 18BK WT
S216
8W-70-18
F87 18BK WT
(29)
(12)
(24)
C222
INSTRUMENT CLUSTER
SPEEDOMETER
0 10 20 30 40 50 60 70 80 90 100
SPEED SENSOR CIRCUIT
(30)
(23)
(10)
(7)
C222
OVERHEAD CONSOLE (8W-49-2)
Z2 20BK LG
Z2 20BK LG
Z2 20BK LG
G7 20WT OR
S207
8W-70-14
S214
8W-70-17
Z2 20BK LG
C201
Z2 16BK LG
G7 20WT OR
C165
G7 20WT/OR
C142
G7 18WT/OR
S120
8W-70-9
Z2 20BK/LG
C165
G7 18WT OR
Z2 18BK LG
(1)
C134
VEHICLE SPEED SENSOR SIGNAL
VEHICLE SPEED SENSOR (REAR OF TRANSMISSION OR TRANSFER CASE)
G106
8W-15-5
J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 12 40A
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(2)
A21 12DB GY
AIRBAG CONTROL MODULE (8W-43-2)
G5 18DB/YL
C235
FUSE 22 15A
FUSE BLOCK
(10)
C235
FUSE 21 15A
(13)
A21 12DB/GY
S202
8W-70-11
(9)
G5 18DB YL
C165
G5 18DB YL
F87 18BK WT
S216
8W-70-18
F87 18BK WT
G5 18DB YL
(24) (12) (29) C222
INSTRUMENT CLUSTER
FUEL GAUGE SIGNAL LOW FUEL WARNING LAMP
E F
FUEL GAUGE
LOW FUEL WARNING LAMP
OVERHEAD CONSOLE (8W-49-2)
(30) (23) (10) (27) C222
Z2 20BK LG
Z2 20BK LG
Z2 20BK LG
K102 20PK BK
C233
K102 20PK/BK
C315
(3)
FUEL PUMP MODULE (IN FUEL TANK)
Z2 20BK LG
(2) (6) C315
Z2 20BK/LG
Z2 20BK/OR
S214
8W-70-17
G44 20VT WT
C201
Z2 16BK LG
C233
Z2 20BK/LG
C165
G44 20VT WT
Z2 18BK LG
C201
OVERHEAD CONSOLE (8W-49-2)
G44 20VT/WT
G106
8W-15-5

J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 12 40A
POWER DISTRIBUTION CENTER
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
ACC
OFF
RUN
START
IGNITION SWITCH
C228
(2)
A21 12DB GY
S202
8W-70-11
A21 12DB/GY
C235
(13)
FUSE BLOCK
FUSE 22 15A
FUSE 21 15A
C235
(10)
(9)
AIRBAG CONTROL MODULE (8W-43-2)
G5 18DB/YL
G5 18DB YL
C165
F87 18BK WT
S216
8W-70-18
C222
(24)
(12)
(29)
INSTRUMENT CLUSTER
TACHOMETER P.C. BOARD
TACHOMETER SIGNAL
TACHOMETER
X1000
(30)
(23)
(10)
(28)
C222
OVERHEAD CONSOLE (8W-49-2)
Z2 20BK LG
G21 20GY LB
C201
S214
8W-70-17
Z2 16BK LG
Z2 20BK/LG
C165
Z2 18BK LG
G106
8W-15-5
C133
WITH AUTOMATIC ONLY
TRANSMISSION CONTROL MODULE (8W-31-6)
WITH 4.0L
C142
G21 20GY/LB
C177
C142
WITH 5.2L
C141
43 TACHOMETER SIGNAL
POWERTRAIN CONTROL MODULE
J958W-3



I.P DIMMING MODULE OR I.P DIMMING/ DRL MODULE
PANEL LAMPS ILLUMINATION CONTROL
(6)
(12)
C231 (W/O DRL)
C249 (W/ DRL)
E2 18OR
S213
8W-70-16
E2 20OR
E2 20OR
(21)
(26)
C222
INSTRUMENT CLUSTER
GENERAL ILLUMINATION
(25)
(20)
C222
Z1 20BK
Z1 20BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2

HORNS/CIGAR LIGHTER

HORN

The horn system is powered by a 20-amp fuse located in cavity 13 of the fuse block. The fuse is HOT at all times on circuit F62. This circuit supplies voltage to the coil and to the contact side of the horn relay.

Power for the fuse is supplied on circuit A7 which originates at fuse 14 in the Power Distribution Center (PDC).

When the operator presses the horn switch, a ground path is completed on the coil side of the horn relay through the switch, on circuit X4. The horn relay, located in the relay center, then closes the relay contacts. Voltage is passed through the closed relay contacts on circuit X2 to the horns. Grounding for the horns is on the Z1 circuit.

On vehicles equipped with Vehicle Theft Alarm (VTA), the X4 circuit is spliced to the Vehicle Theft Alarm (VTA) module. For operation of the VTA system, refer to section 8W-39.

HELPFUL INFORMATION

- Check the 20 amp fuse in cavity 13 of the fuse block
- Check fuse 14 in the PDC
- Press the horn switch and listen for the horn relay to click. A clicking relay indicates voltage is present up to the switch

CIGAR LIGHTER

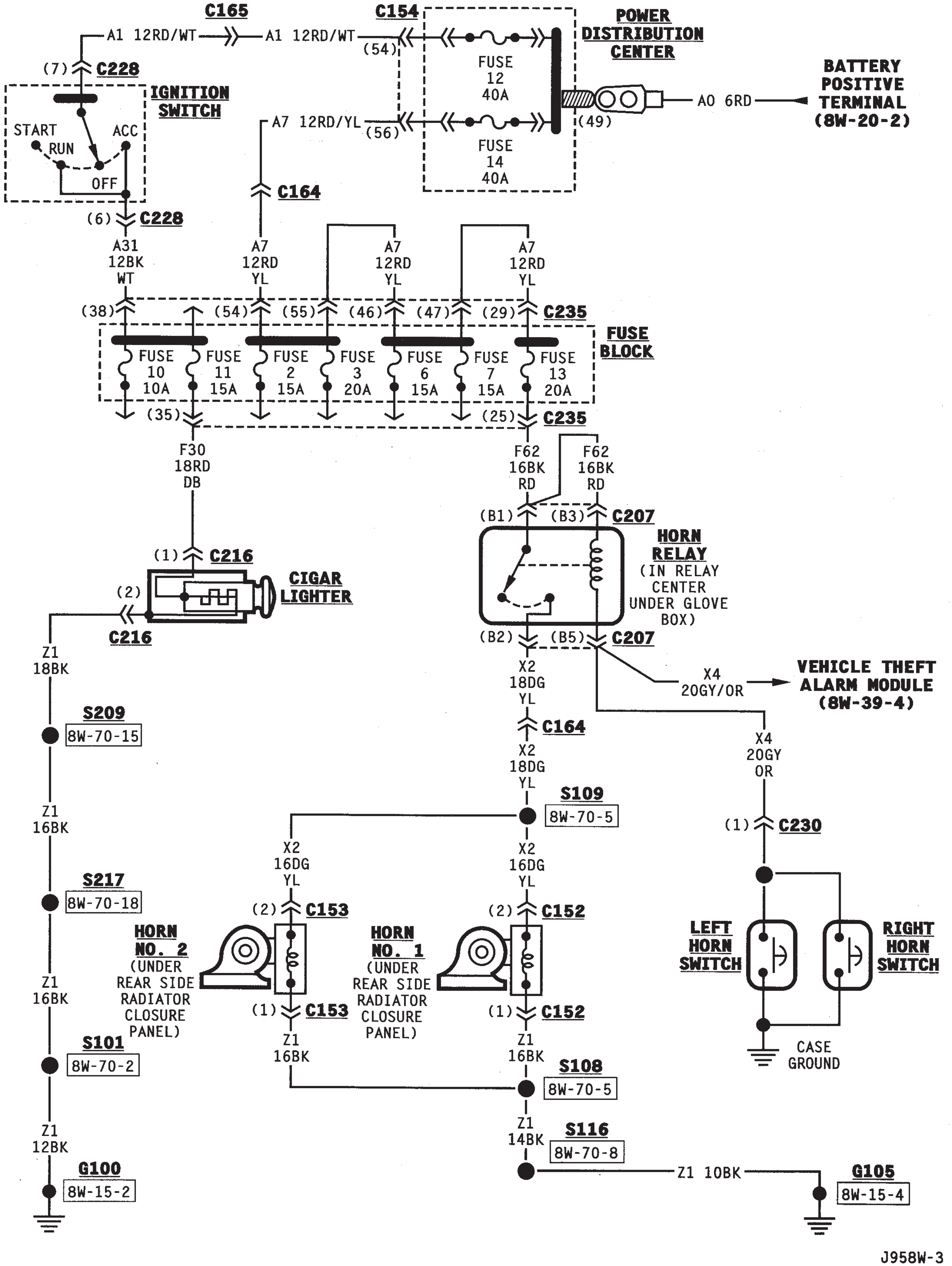
The cigar lighter is powered by a 15 amp fuse located in cavity 11 of the fuse block. This fuse is HOT in the ACCESSORY and RUN positions only. Power for the fuse is supplied on circuit A31 from the ignition switch.

When the operator depresses the lighter, the contacts inside of the lighter element close, and voltage from circuit F30 flows through the heating element to ground. Ground for the lighter is provided on the Z1 circuit.

HELPFUL INFORMATION

- Check the 15 amp fuse located in cavity 11 of the fuse block
- Check the cigar lighter element

DIAGRAM INDEX


C165
C154
POWER DISTRIBUTION CENTER
A1 12RD/WT
A1 12RD/WT
(54)
FUSE 12 40A
(7) C228
IGNITION SWITCH
START
RUN
ACC
OFF
A7 12RD/YL
(56)
(49)
A0 6RD
BATTERY POSITIVE TERMINAL (8W-20-2)
FUSE 14 40A
C164
(6) C228
A31 12BK WT
A7 12RD YL
A7 12RD YL
A7 12RD YL
(38) (54) (55) (46) (47) (29) C235
FUSE BLOCK
FUSE 10 10A
FUSE 11 15A
FUSE 2 15A
FUSE 3 20A
FUSE 6 15A
FUSE 7 15A
FUSE 13 20A
(35)
(25) C235
F30 18RD DB
F62 16BK RD
F62 16BK RD
(B1) (B3) C207
HORN RELAY (IN RELAY CENTER UNDER GLOVE BOX)
(1) C216
CIGAR LIGHTER
(2)
C216
(B2) (B5) C207
Z1 18BK
X2 18DG YL
X4 20GY/OR
VEHICLE THEFT ALARM MODULE (8W-39-4)
S209
8W-70-15
C164
X2 18DG YL
X4 20GY OR
Z1 16BK
S109
8W-70-5
(1) C230
S217
8W-70-18
X2 16DG YL
X2 16DG YL
(2) C153
(2) C152
HORN NO. 2 (UNDER REAR SIDE RADIATOR CLOSURE PANEL)
HORN NO. 1 (UNDER REAR SIDE RADIATOR CLOSURE PANEL)
LEFT HORN SWITCH
RIGHT HORN SWITCH
Z1 16BK
(1) C153
(1) C152
S101
8W-70-2
Z1 16BK
Z1 16BK
CASE GROUND
S108
8W-70-5
Z1 12BK
Z1 14BK
S116
8W-70-8
G100
8W-15-2
Z1 10BK
G105
8W-15-4
J958W-3

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AIR CONDITIONING/HEATER

CONTENTS

GENERAL INFORMATION

This section of the wiring diagrams is divided into two sub-sections; Manual A/C-Heater, and Automatic Temperature Control (ATC). When referring to the circuit descriptions or wiring diagrams, ensure that you use the correct sub-section.

MANUAL A/C-HEATER

INDEX

GENERAL INFORMATION

Several fuses supply power for the manual air conditioning/heater system. When the ignition switch is in the RUN position, it connects circuit A2 from fuse 13 in the Power Distribution Center (PDC) to circuit A22. Circuit A22 powers circuit F71 through fuse 17 in the fuse block. Circuit F71 connects to the A/C control switches and the blend air door motor.

When the ignition switch is in the START or RUN position, it connects circuit A1 to circuit A21. Circuit A21 powers circuit F83 through fuse 5 in the PDC. Circuit F83 powers the coil side of the A/C compressor clutch relay and the A/C low pressure switch.

Circuit E2 from the dimming module powers the illumination lamps in the A/C heater control switch.

BLOWER MOTOR

The blower motor switch has four positions; LOW, MEDIUM 1, MEDIUM 2, AND HIGH. Circuit A19 from fuse 11 in the PDC supplies power to the blower motor. Ground for the blower motor is supplied on circuit C7 through the blower motor resistor block to the blower motor switch, through an internal relay in the A/C-Heater Control head. When the internal relay energizes, it connects the blower motor switch to circuit C1. Circuit C1 connects to ground circuit Z1.

In the HIGH position, the blower motor switch connects circuit C7 from the blower motor directly to ground on circuits C1 and Z1. In the LOW or MEDI-UM positions, the ground path passes through the blower motor resistor block to the switch. The switch connects to circuit C1.

The blower motor resistor block consists of three resistors connected in series. Depending on blower motor switch position, the ground path on circuit C7 from the blower motor passes through one or more resistors to circuit C1.

When the blower motor switch is in the LOW position, the ground path passes through all three resistors in the blower motor resistor block to circuit C4. The blower motor switch connects circuit C4 to circuits C1 and Z1.

In the MEDIUM 1 position, the ground path passes through two resistors in the resistor block to circuit C5. The blower motor switch connects circuit C5 to circuits C1 and Z1.

In the MEDIUM 2 position, the ground path passes through one resistor in the resistor block to circuit C6. The blower motor switch connects circuit C6 to circuits C1 and Z1.

AIR CONDITIONING OPERATION

When the A/C-heater control switch is moved to an A/C position or the defrost position, the Powertrain Control Module (PCM) receives the A/C select signal on circuit C90. Circuit C90 connects to cavity 28 of the PCM.

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If the A/C low pressure and high pressure switches are closed, the PCM receives the A/C request signal on circuit C21. The A/C low pressure and high pressure switches are wired in series. Circuit F83 from fuse 5 in the Power Distribution Center (PDC) supplies battery voltage to the low pressure switch. Circuit C3 from the low pressure switch connects to the high pressure switch. Circuit C21 from the high pressure switch connects to cavity 27 of the PCM and to the contact side of the A/C compressor clutch relay.

After receiving the A/C request signal, the PCM supplies ground for the coil side of A/C compressor clutch relay on circuit C13. Circuit C13 connects to cavity 34 of the PCM. Circuit F83 supplies battery voltage to the coil side of the relay.

When the PCM grounds the A/C compressor clutch relay, the contacts close and connect circuits C21 and C2. Circuit C2 supplies power to the case grounded A/C compressor clutch.

The A/C compressor clutch has a built-in diode. The diode controls the induced voltage that results from the magnetic field collapsing when the clutch disengages. The diode provides a current path to protect other components and systems.

HELPFUL INFORMATION

- Circuit F83 is HOT when the ignition switch is in the RUN or START position.

Circuit F83 is double crimped at the coil side of the A/C compressor clutch relay. The branch of circuit F83 from the relay connects to the A/C low pressure switch.

BLEND AIR DOOR MOTOR

The A/C-Heater control head contains a blend door position sensor. The sensor is a variable resistor that provides the blend door position input to the blend door motor actuator on circuit C36.

Circuit F71 from fuse 17 in the fuse block powers the actuator when the ignition switch is in the RUN position. Circuit C34 splices to connect the blend door motor to ground circuit Z1.

DIAGRAM INDEX

AUTOMATIC TEMPERATURE CONTROL

INDEX

GENERAL INFORMATION

Several fuses supply power for the Automatic Temperature Control (ATC) system. When the ignition switch is in the RUN position, it connects circuit A2 from fuse 13 in the Power Distribution Center (PDC) to circuit A22. Circuit A22 powers circuit F71 through fuse 17 in the fuse block. Circuit F71 connects to the ATC module and the recirculation door motor.

When the ignition switch is in the START or RUN position, it connects circuit A1 from PDC fuse 12 to circuit A21. Circuit A21 powers circuit F83 through fuse 5 in the PDC. Circuit F83 powers the coil side of the A/C compressor clutch relay and the A/C low pressure switch.

Circuit A19 from fuse 11 in the PDC connects to the blower power module and to the coil and contact side of the high speed blower motor relay.

Circuit A4 from fuse 1 in the PDC powers circuit F60 through fuse 8 in the fuse block. Circuit F60 connects to the ATC module.

AUTOMATIC TEMPERATURE CONTROL (ATC) MODULE

Circuits F71 supplies battery voltage to the Automatic Temperature Control (ATC) module when the ignition switch is in the RUN position. Circuit F60 from fuse 8 in the fuse block connects to the ATC module. Circuit F60 is HOT at all times. Refer to General Information. Circuit Z1 provides ground for the ATC module.

Circuit E2 from the dimming module connects to the ATC module. Circuit L90 from the headlamp switch supplies power for illumination to the ATC module when the headlamp switch is in the PARK or ON positions.

Circuit G25 from the US/Metric switch in the overhead console connects to the ATC module. Circuit G25 also connects to the Vehicle Information Center (VIC).

Circuits D1 and D2 for the CCD Bus connect to the ATC module. Circuits D1 and D2 also splice to the Powertrain Control Module (PCM) data link connector.

AMBIENT TEMPERATURE SENSOR

The ambient temperature sensor is a variable resistor. Circuit C8 from the ATC module connects to the ambient temperature sensor. Circuit D41 provides ground for the sensor. Circuit D41 connects to the ATC module.

IN-CAR TEMPERATURE SENSOR

The in-car temperature sensor is a variable resistor. Circuit C47 from the ATC module connects to the in-car temperature sensor. Circuit D41 provides ground for the sensor. Circuit D41 connects to the ATC module.

SOLAR SENSOR

The solar sensor is a variable resistor. Circuit C10 from the ATC module connects to the solar sensor. Circuit D41 provides ground for the sensor. Circuit D41 connects to the ATC module.

AIR CONDITIONING OPERATION

When the A/C-heater control switch is moved to an A/C position or the defrost position, the Automatic Temperature Control (ATC) module sends the A/C select signal to the Powertrain Control Module (PCM) on circuit C90. Circuit C90 connects to cavity 28 of the PCM.

If the A/C low pressure and high pressure switches are closed, the PCM receives the A/C request signal on circuit C21. The A/C low pressure and high pressure switches are wired in series. Circuit F83 from fuse 5 in the Power Distribution Center (PDC) supplies battery voltage to low pressure switch. Circuit C3 from the low pressure switch connects to high pressure switch. Circuit C21 from the high pressure switch connects to cavity 27 of the PCM and to the contact side of the A/C compressor clutch relay.

After receiving the A/C request signal, the PCM supplies ground for the coil side of A/C compressor clutch relay on circuit C13. Circuit C13 connects to cavity 34 of the PCM. Circuit F83 supplies battery voltage to the coil side of the relay.

When the PCM grounds the A/C compressor clutch relay, the contacts close and connect circuits C21 and C2. Circuit C2 supplies power to the case grounded A/C compressor clutch.

The A/C compressor clutch has a built-in diode. The diode controls the induced voltage that results from the magnetic field collapsing when the clutch disengages. The diode provides a current path to protect other components and systems.

HELPFUL INFORMATION

• Circuit F83 is HOT when the ignition switch is in the RUN or START position.

Circuit F83 is double crimped at the coil side of the A/C compressor clutch relay. The branch of circuit F83 from the relay connects to the A/C low pressure switch.

RECIRCULATION DOOR MOTOR

Circuit F71 from fuse 17 in the Power Distribution Center (PDC) supplies power for the recirculation door motor. Circuit F71 also connects to the Automatic Temperature Control (ATC) module. Circuit F71 is HOT when the ignition switch is in the RUN position.

Circuits C32 and C33 from the ATC module connect to the recirculation door motor. Circuits C32 and C33 provide ground for the motor.

MODE DOOR MOTOR

Circuit C40 from the Automatic Temperature Control (ATC) module supplies 5 volts to the position switch in the mode door motor. The ATC module receives the sensor signal from the mode door motor on circuit C39. Circuit D41 provides ground for the mode door position sensor. Circuit D41 connects to the ATC module.

The ATC module operates the mode door motor on circuits C37 and C38.

BLEND DOOR MOTOR

Circuit C40 from the Automatic Temperature Control (ATC) module supplies 5 volts to the position switch in the blend door motor. The ATC module receives the sensor signal from the blend door motor on circuit C39. Circuit D41 provides ground for the mode door position sensor. Circuit D41 connects to the ATC module.

The ATC module operates the mode door motor on circuits C35 and C34.

BLOWER MOTOR

When the operator selects blower motor HIGH speed operation, the Automatic Temperature Control (ATC) module grounds high speed blower motor relay. For any speed other than HIGH, the blower power module supplies battery voltage for the blower motor.

BLOWER MOTOR POWER MODULE

When the operator selects any blower motor speed other than HIGH, the blower motor power module supplies voltage for the blower motor. Circuit A19 from fuse 11 in the Power Distribution Center (PDC) supplies battery voltage to the blower motor power module.

The voltage level fed to the blower motor depends on the blower speed selected by the operator. Slower speed selections provide lower voltage to the motor. The blower motor power module feeds the blower motor on circuit C42. Circuit Z4 provides ground for the blower motor and the blower motor power module.

Circuit C43 from the power module connects to the ATC module. The ATC module controls feedback on circuit C43.

HIGH SPEED BLOWER MOTOR RELAY

Circuit A19 from fuse 11 in the Power Distribution Center supplies battery voltage to the coil and contacts sides of the high speed blower motor relay. The ATC module provides ground for the coil side of the relay on circuit C41.

When the ATC module grounds the high speed blower motor relay, the relay contacts close and connect circuit A19 to circuit C42. Circuit C42 connects to the blower motor and the ATC module. Circuit Z4 provides ground for the blower motor.

DIAGRAM INDEX

MANUAL A/C-HEATER

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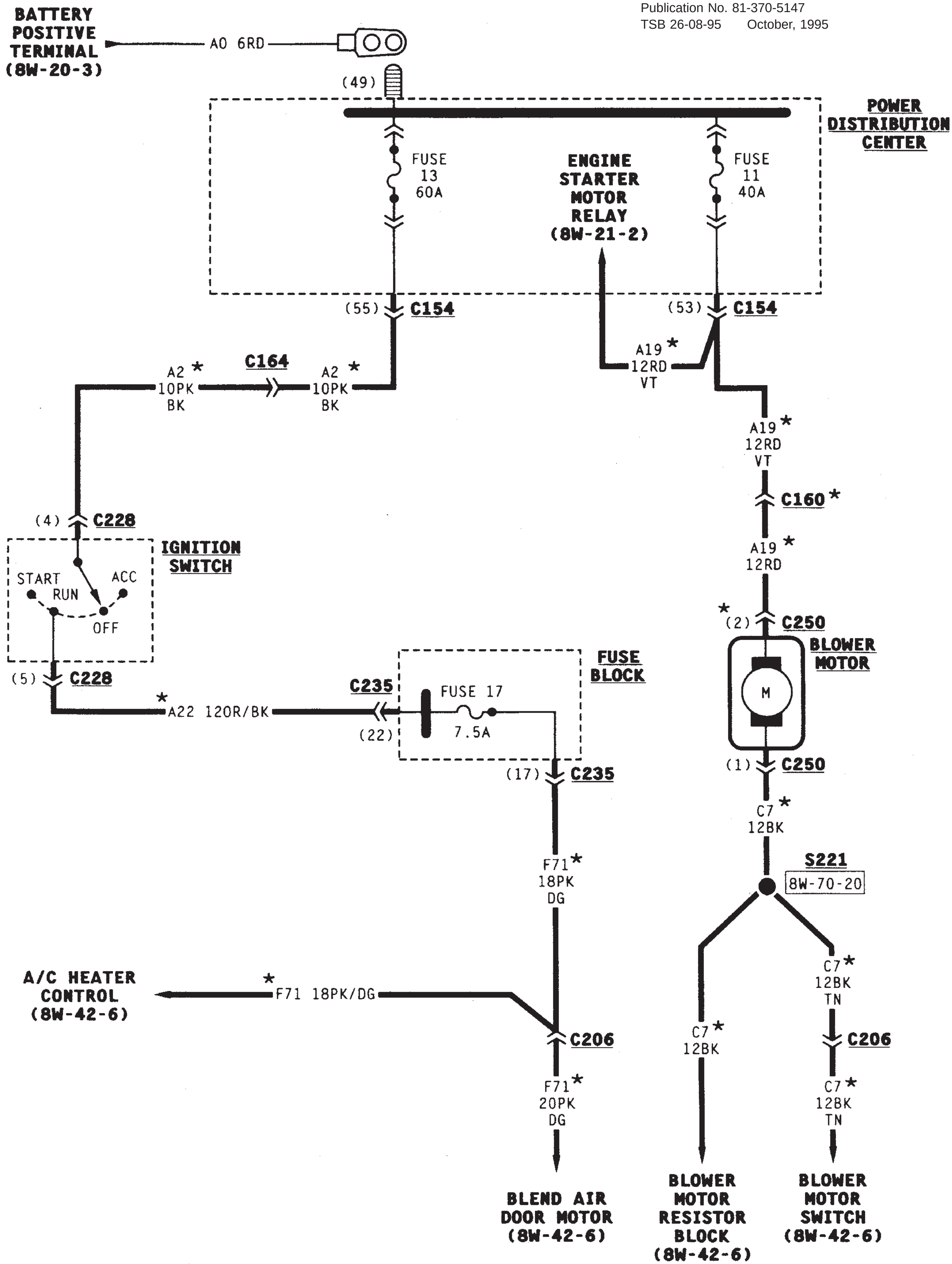

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MANUAL A/C-HEATER

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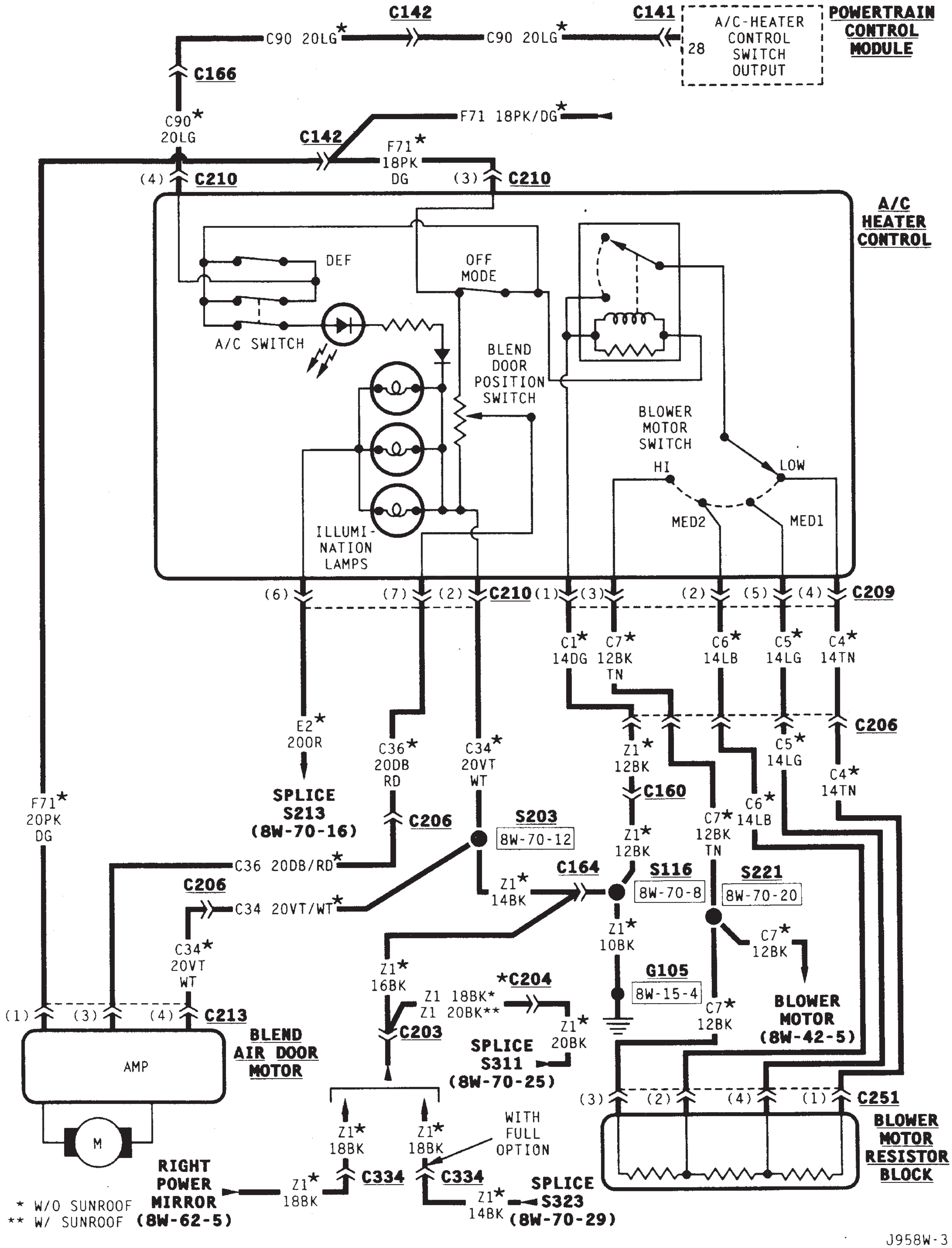
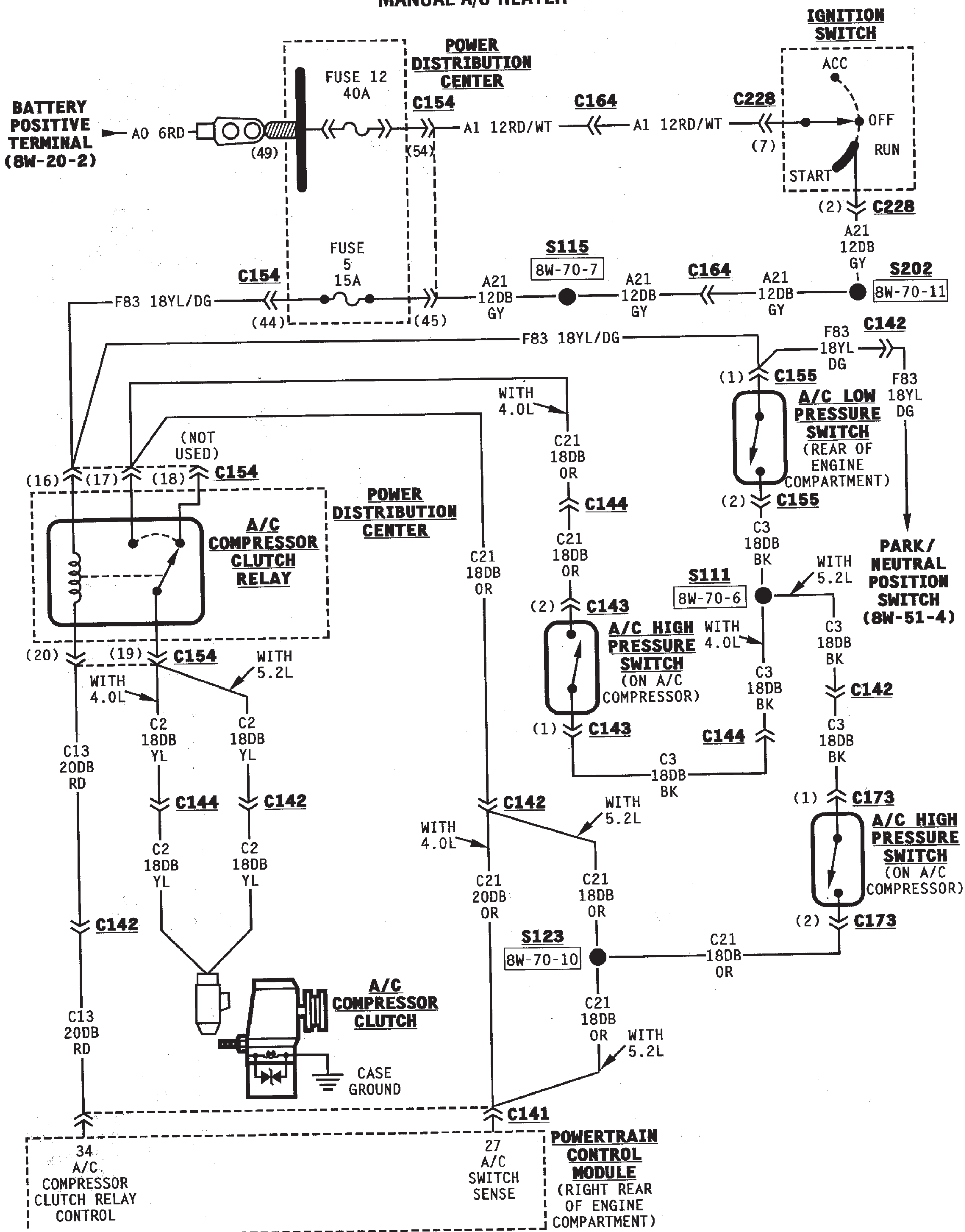
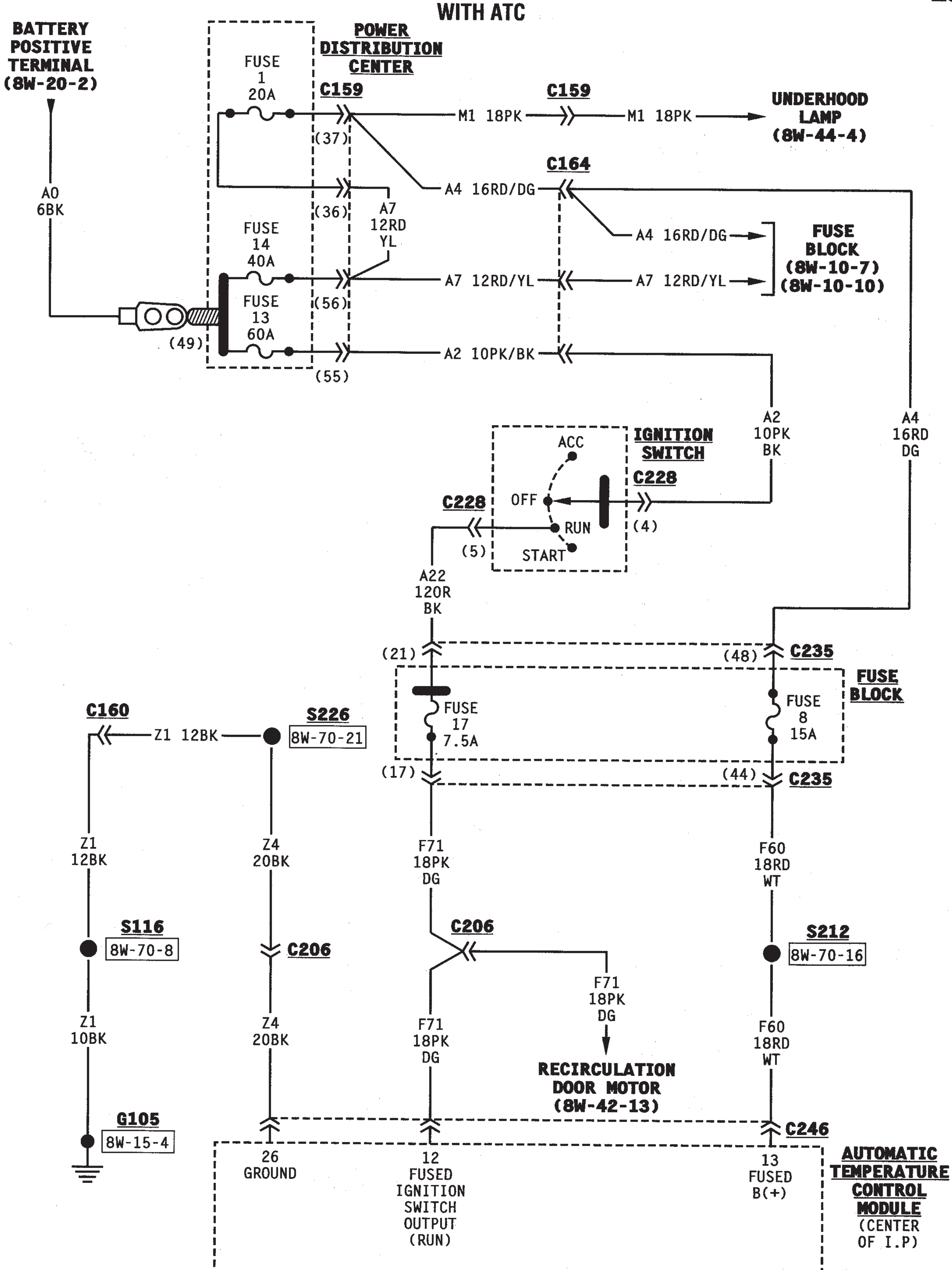


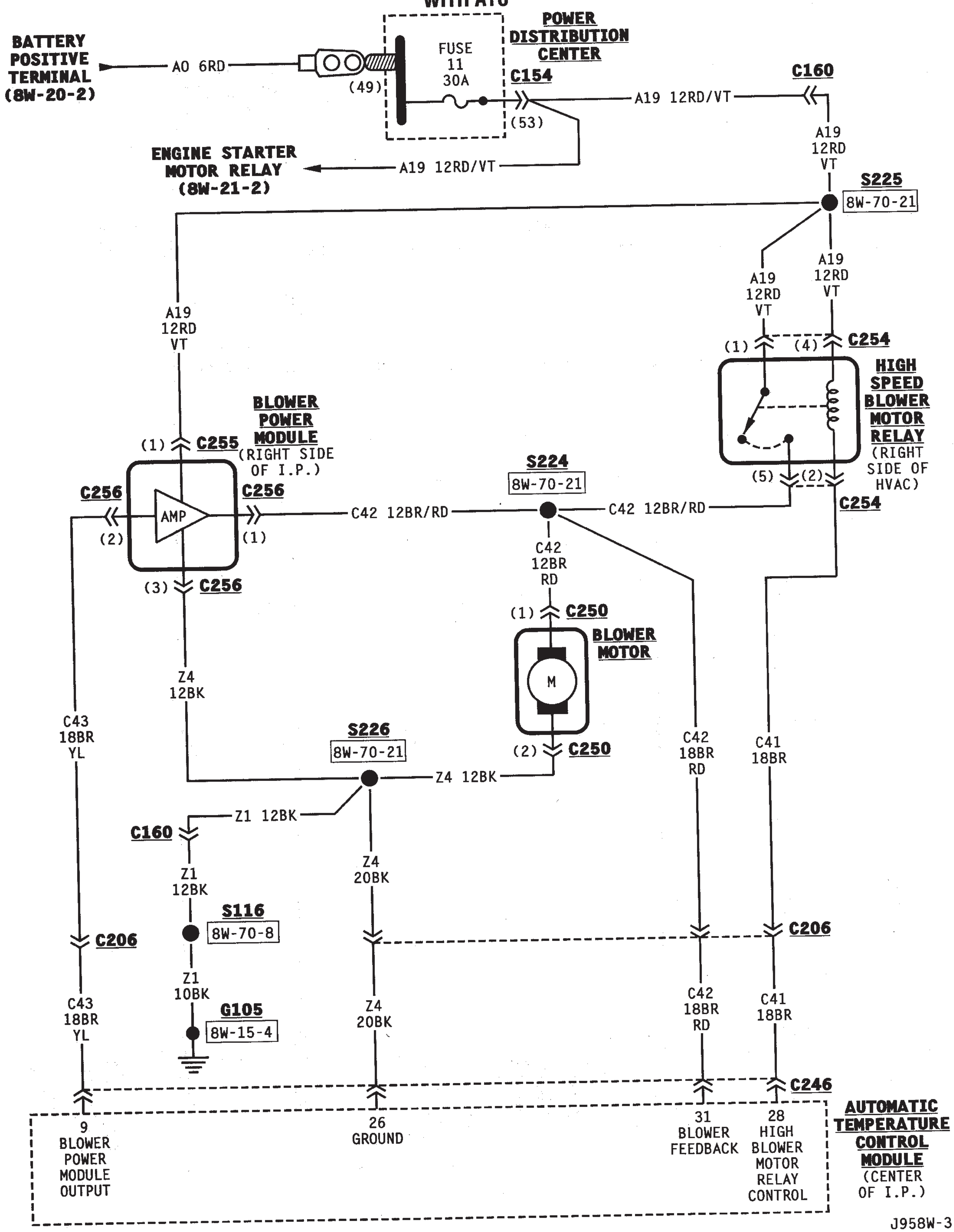
MANUAL A/C-HEATER



J958W-3

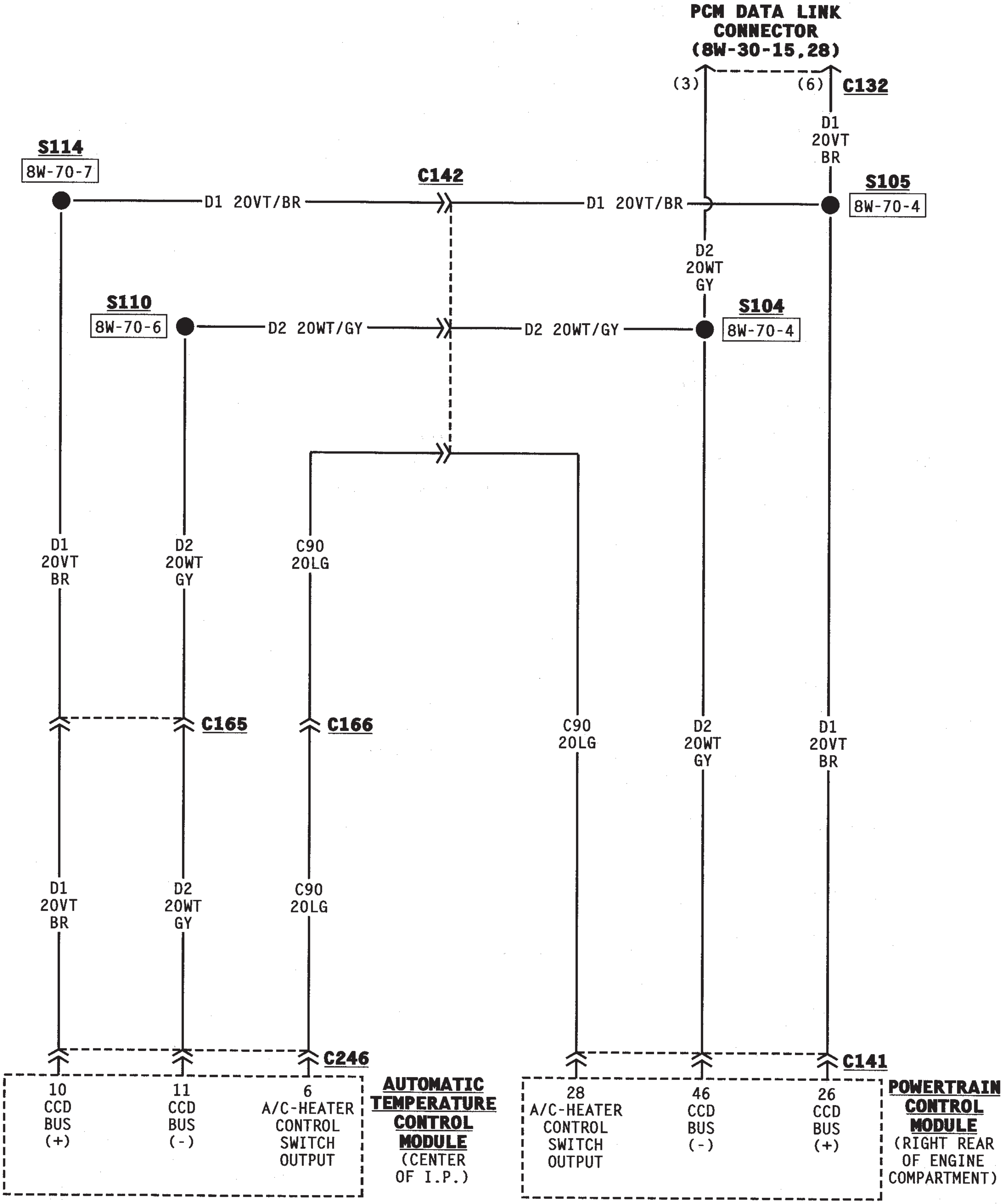

BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6BK
(49)
FUSE 1 20A
FUSE 14 40A
FUSE 13 60A
POWER DISTRIBUTION CENTER
C159
(37)
(36)
(56)
(55)
A7 12RD YL
M1 18PK
C159
M1 18PK
UNDERHOOD LAMP (8W-44-4)
C164
A4 16RD/DG
A4 16RD/DG
A7 12RD/YL
A7 12RD/YL
FUSE BLOCK (8W-10-7) (8W-10-10)
A2 10PK/BK
A2 10PK BK
A4 16RD DG
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(4)
C228
(5)
A22 12OR BK
(21)
(48)
C235
FUSE BLOCK
FUSE 17 7.5A
FUSE 8 15A
(17)
(44)
C235
C160
Z1 12BK
S226
8W-70-21
Z1 12BK
Z4 20BK
F71 18PK DG
F60 18RD WT
S116
8W-70-8
C206
C206
S212
8W-70-16
F71 18PK DG
Z1 10BK
Z4 20BK
F71 18PK DG
F60 18RD WT
RECIRCULATION DOOR MOTOR (8W-42-13)
G105
8W-15-4
C246
26 GROUND
12 FUSED IGNITION SWITCH OUTPUT (RUN)
13 FUSED B(+)
AUTOMATIC TEMPERATURE CONTROL MODULE (CENTER OF I.P)

J958W-3

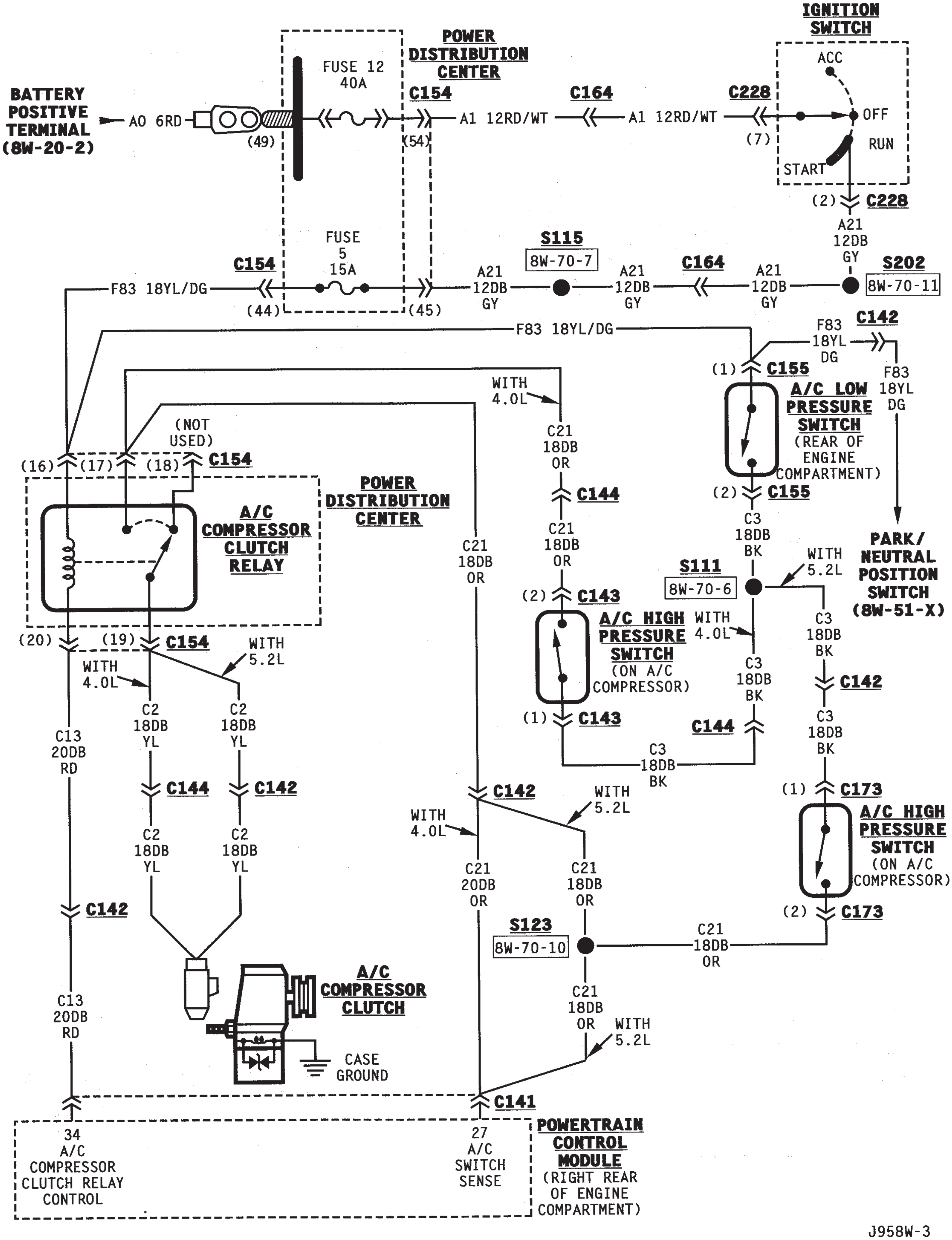


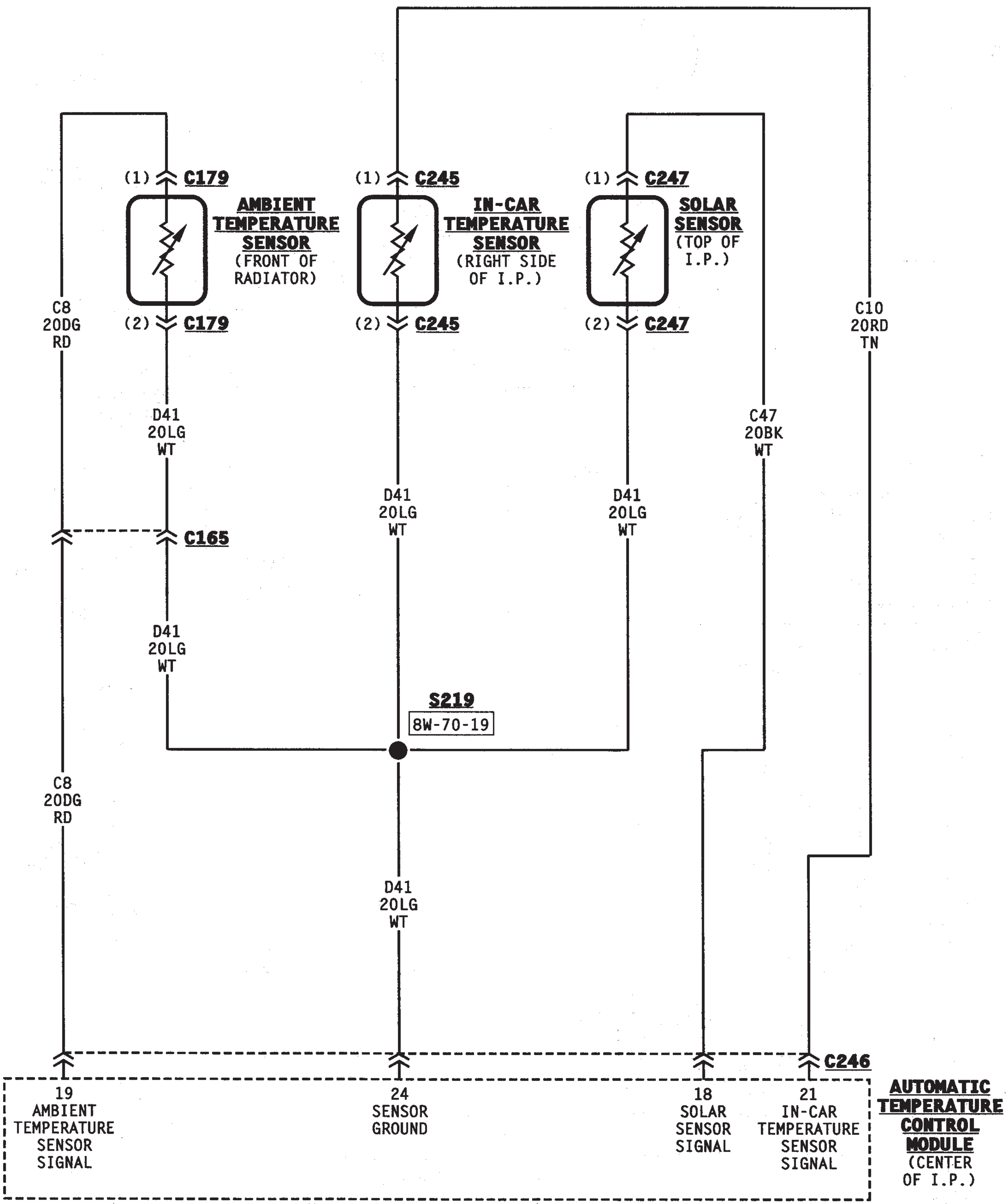
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 11 30A
POWER DISTRIBUTION CENTER
C154
(53)
A19 12RD/VT
C160
ENGINE STARTER MOTOR RELAY (8W-21-2)
S225
8W-70-21
A19 12RD VT
C254
(1)
(4)
HIGH SPEED BLOWER MOTOR RELAY (RIGHT SIDE OF HVAC)
(5)
(2)
BLOWER POWER MODULE (RIGHT SIDE OF I.P.)
C255
C256
AMP
(3)
S224
C42 12BR/RD
C42 12BR RD
C250
BLOWER MOTOR
M
Z4 12BK
S226
Z1 12BK
C160
C43 18BR YL
C42 18BR RD
C41 18BR
S116
8W-70-8
Z1 10BK
G105
8W-15-4
Z4 20BK
C206
C246
9 BLOWER POWER MODULE OUTPUT
26 GROUND
31 BLOWER FEEDBACK
28 HIGH BLOWER MOTOR RELAY CONTROL
AUTOMATIC TEMPERATURE CONTROL MODULE (CENTER OF I.P.)

J958W-3

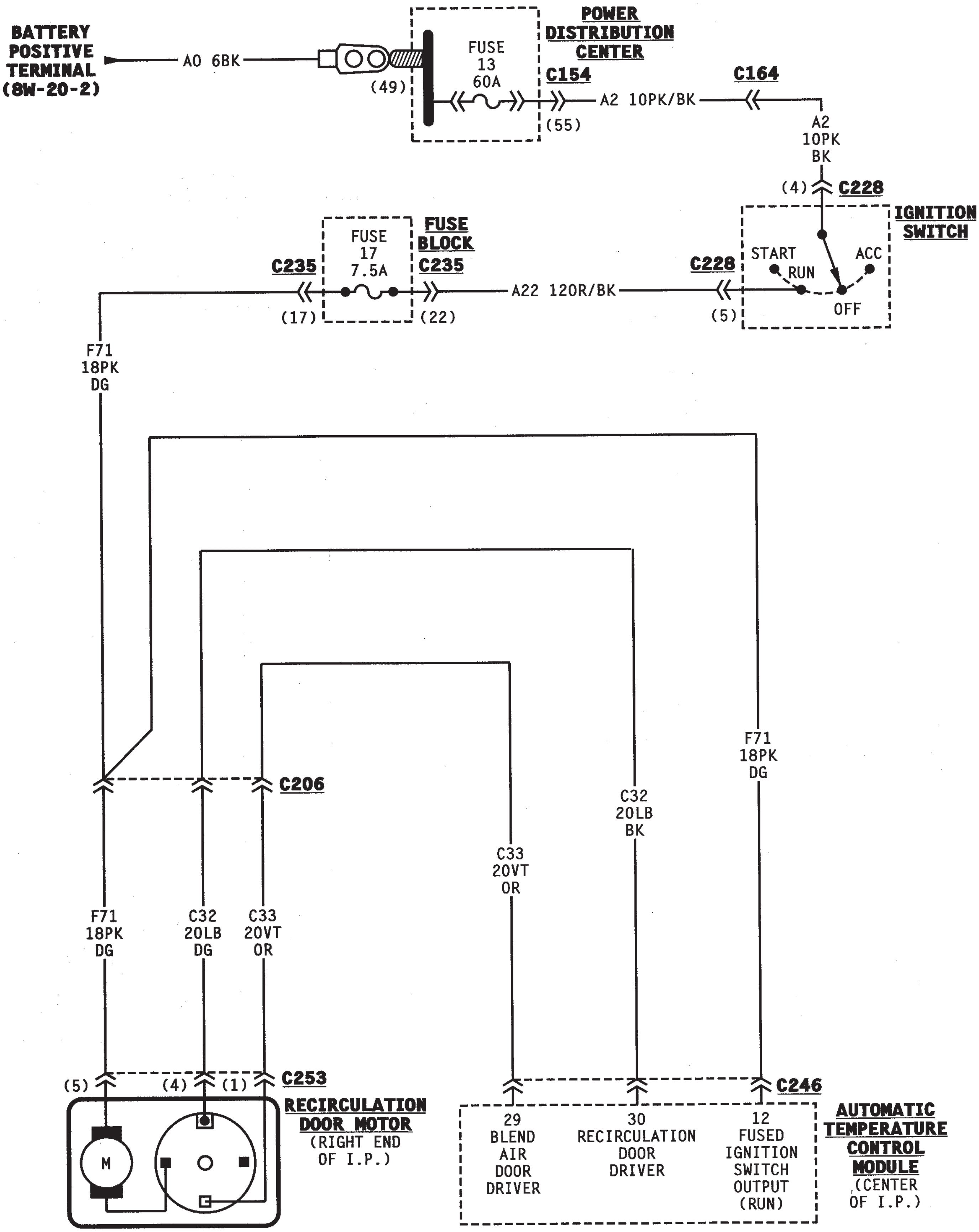

PCM DATA LINK CONNECTOR (8W-30-15,28)
(3)
(6)
C132
D1 20VT BR
S114
8W-70-7
D1 20VT/BR
C142
D1 20VT/BR
S105
8W-70-4
D2 20WT GY
S110
8W-70-6
D2 20WT/GY
D2 20WT/GY
S104
8W-70-4
D1 20VT BR
D2 20WT GY
C90 20LG
C165
C166
C90 20LG
D2 20WT GY
D1 20VT BR
D1 20VT BR
D2 20WT GY
C90 20LG
C246
10 CCD BUS (+)
11 CCD BUS (-)
6 A/C-HEATER CONTROL SWITCH OUTPUT
AUTOMATIC TEMPERATURE CONTROL MODULE
(CENTER OF I.P.)
C141
28 A/C-HEATER CONTROL SWITCH OUTPUT
46 CCD BUS (-)
26 CCD BUS (+)
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)

J958W-3

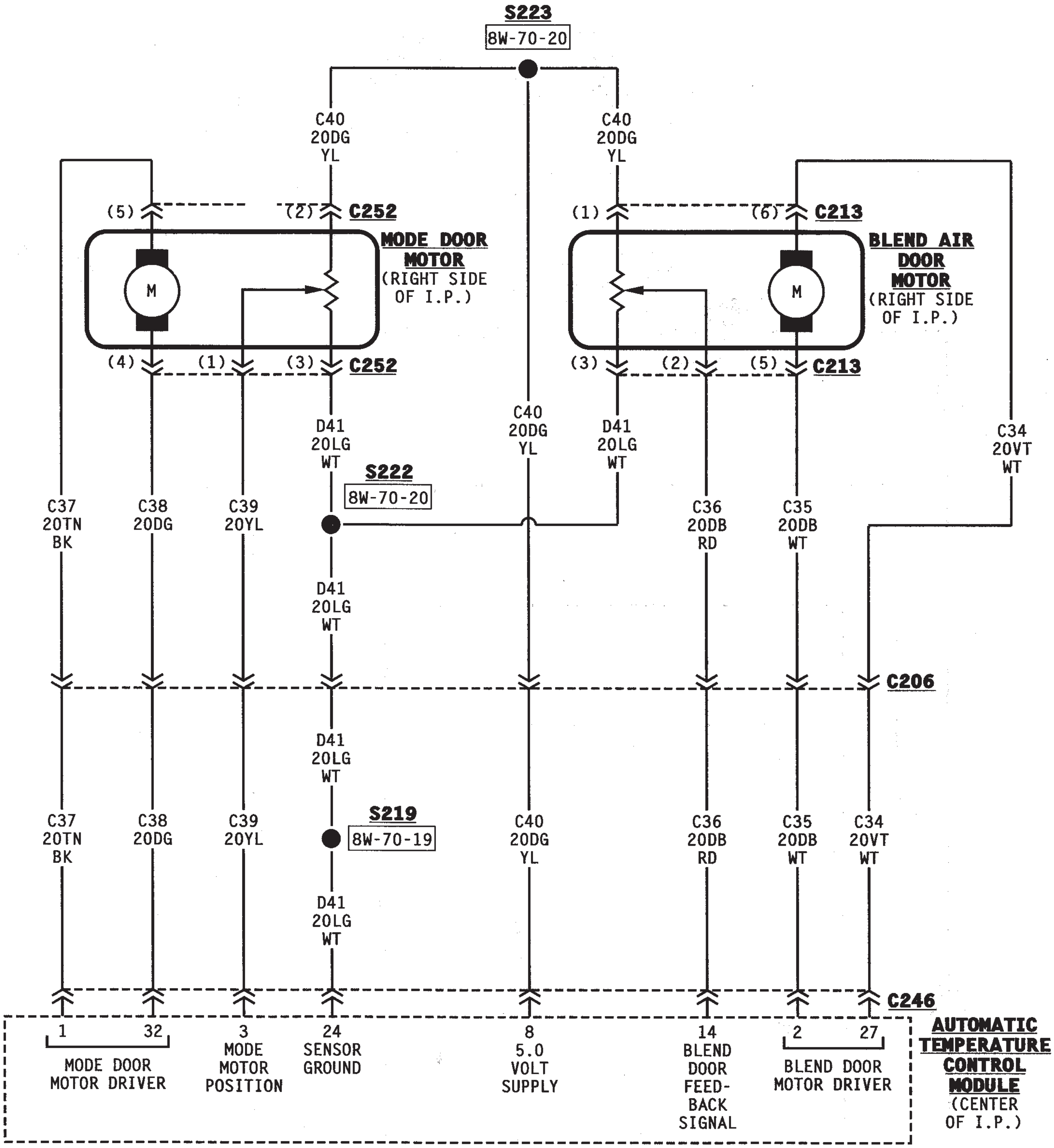

BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 12 40A
POWER DISTRIBUTION CENTER
C154
(54)
A1 12RD/WT
C164
A1 12RD/WT
C228
(7)
IGNITION SWITCH
ACC
OFF
RUN
START
(2)
C228
A21 12DB GY
S202
8W-70-11
FUSE 5 15A
C154
F83 18YL/DG
(44)
(45)
A21 12DB GY
S115
8W-70-7
A21 12DB GY
C164
A21 12DB GY
F83 18YL/DG
F83 18YL DG
C142
F83 18YL DG
(1)
C155
A/C LOW PRESSURE SWITCH
(REAR OF ENGINE COMPARTMENT)
(2)
C155
C3 18DB BK
PARK/ NEUTRAL POSITION SWITCH (8W-51-X)
WITH 4.0L
C21 18DB OR
(NOT USED)
(16)
(17)
(18)
C154
C144
C21 18DB OR
POWER DISTRIBUTION CENTER
A/C COMPRESSOR CLUTCH RELAY
C21 18DB OR
S111
8W-70-6
WITH 5.2L
(2)
C143
A/C HIGH PRESSURE SWITCH
(ON A/C COMPRESSOR)
WITH 4.0L
C3 18DB BK
C3 18DB BK
C142
(1)
C143
C144
C3 18DB BK
C3 18DB BK
C3 18DB BK
(20)
(19)
C154
WITH 5.2L
WITH 4.0L
C2 18DB YL
C2 18DB YL
C13 20DB RD
C144
C142
C142
WITH 5.2L
(1)
C173
WITH 4.0L
C2 18DB YL
C2 18DB YL
C21 20DB OR
C21 18DB OR
A/C HIGH PRESSURE SWITCH
(ON A/C COMPRESSOR)
C142
(2)
C173
S123
8W-70-10
C21 18DB OR
A/C COMPRESSOR CLUTCH
C13 20DB RD
C21 18DB OR
WITH 5.2L
CASE GROUND
C141
34 A/C COMPRESSOR CLUTCH RELAY CONTROL
27 A/C SWITCH SENSE
POWERTRAIN CONTROL MODULE
(RIGHT REAR OF ENGINE COMPARTMENT)
J958W-3

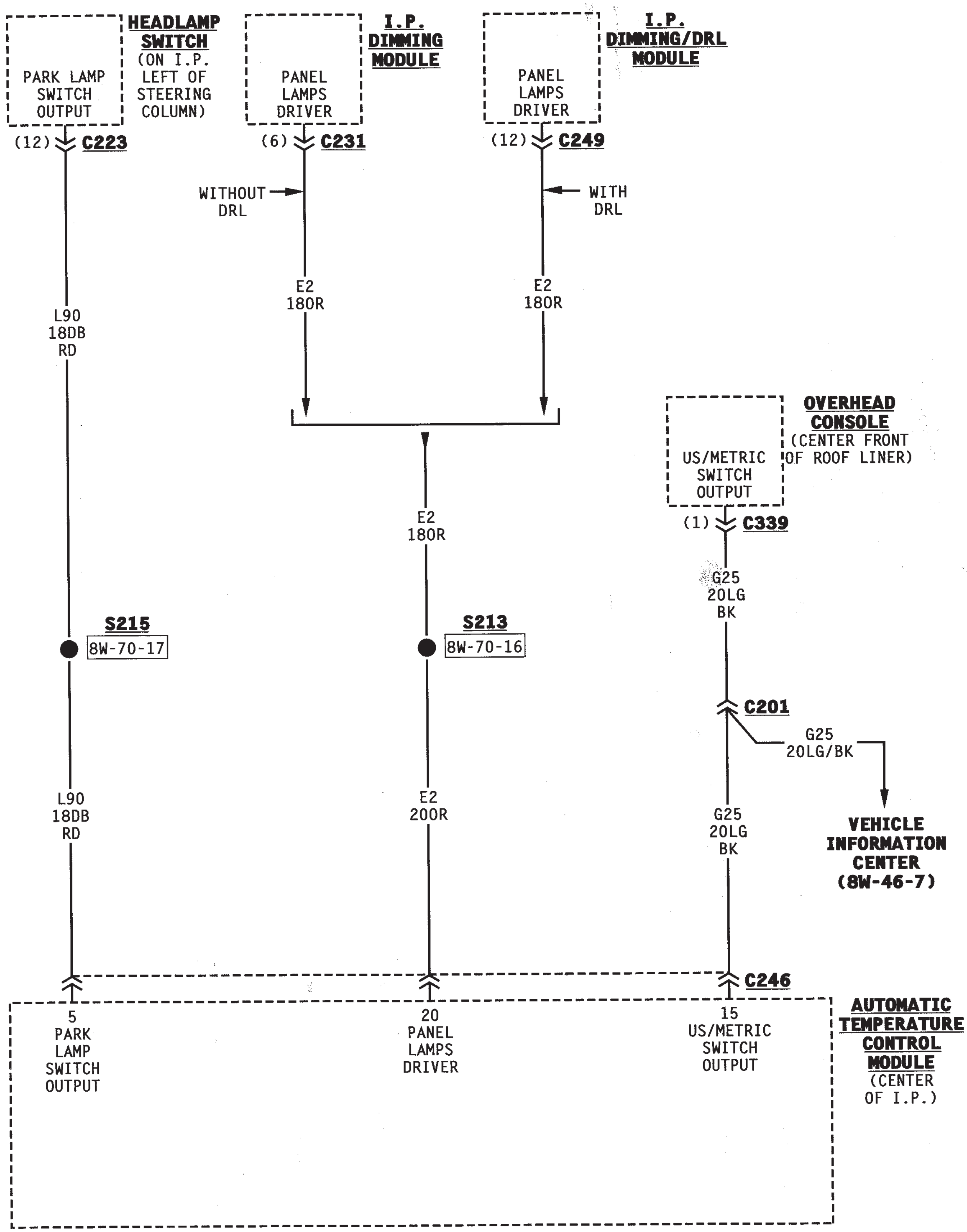

(1) C179
AMBIENT TEMPERATURE SENSOR
(FRONT OF RADIATOR)
(2) C179
(1) C245
IN-CAR TEMPERATURE SENSOR
(RIGHT SIDE OF I.P.)
(2) C245
(1) C247
SOLAR SENSOR
(TOP OF I.P.)
(2) C247
C8 20DG RD
D41 20LG WT
C165
C10 20RD TN
C47 20BK WT
S219
8W-70-19
C246
19 AMBIENT TEMPERATURE SENSOR SIGNAL
24 SENSOR GROUND
18 SOLAR SENSOR SIGNAL
21 IN-CAR TEMPERATURE SENSOR SIGNAL
AUTOMATIC TEMPERATURE CONTROL MODULE
(CENTER OF I.P.)

J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6BK
(49)
FUSE 13 60A
POWER DISTRIBUTION CENTER
C154
(55)
A2 10PK/BK
C164
A2 10PK BK
(4)
C228
IGNITION SWITCH
START
RUN
ACC
OFF
(5)
C228
A22 12OR/BK
FUSE 17 7.5A
FUSE BLOCK
C235
C235
(17)
(22)
F71 18PK DG
C206
F71 18PK DG
C32 20LB DG
C33 20VT OR
C33 20VT OR
C32 20LB BK
F71 18PK DG
(5)
(4)
(1)
C253
M
RECIRCULATION DOOR MOTOR
(RIGHT END OF I.P.)
C246
29 BLEND AIR DOOR DRIVER
30 RECIRCULATION DOOR DRIVER
12 FUSED IGNITION SWITCH OUTPUT (RUN)
AUTOMATIC TEMPERATURE CONTROL MODULE
(CENTER OF I.P.)

J958W-3


S223
8W-70-20
C40
20DG
YL
(5)
(2)
C252
(1)
(6)
C213
MODE DOOR
MOTOR
(RIGHT SIDE
OF I.P.)
BLEND AIR
DOOR
MOTOR
(RIGHT SIDE
OF I.P.)
M
(4)
(1)
(3)
C252
(3)
(2)
(5)
C213
D41
20LG
WT
S222
8W-70-20
C34
20VT
WT
C37
20TN
BK
C38
20DG
C39
20YL
C36
20DB
RD
C35
20DB
WT
C206
S219
8W-70-19
C246
1
32
MODE DOOR
MOTOR DRIVER
3
MODE
MOTOR
POSITION
24
SENSOR
GROUND
8
5.0
VOLT
SUPPLY
14
BLEND
DOOR
FEED-
BACK
SIGNAL
2
27
BLEND DOOR
MOTOR DRIVER
AUTOMATIC
TEMPERATURE
CONTROL
MODULE
(CENTER
OF I.P.)


HEADLAMP SWITCH
(ON I.P. LEFT OF STEERING COLUMN)
PARK LAMP SWITCH OUTPUT
(12) C223
I.P. DIMMING MODULE
PANEL LAMPS DRIVER
(6) C231
WITHOUT DRL
I.P. DIMMING/DRL MODULE
PANEL LAMPS DRIVER
(12) C249
WITH DRL
E2 18OR
E2 18OR
L90 18DB RD
E2 18OR
OVERHEAD CONSOLE
(CENTER FRONT OF ROOF LINER)
US/METRIC SWITCH OUTPUT
(1) C339
G25 20LG BK
S215
8W-70-17
S213
8W-70-16
C201
G25 20LG/BK
VEHICLE INFORMATION CENTER (8W-46-7)
L90 18DB RD
E2 20OR
G25 20LG BK
C246
5 PARK LAMP SWITCH OUTPUT
20 PANEL LAMPS DRIVER
15 US/METRIC SWITCH OUTPUT
AUTOMATIC TEMPERATURE CONTROL MODULE
(CENTER OF I.P.)

J958W-3

AIRBAG SYSTEM

AIRBAG CONTROL MODULE (ACM)

Three different circuits and fuses supply battery voltage to the Airbag Control Module (ACM), they are A14, F20 and G5. The A14 circuit is HOT at all times and protected by two fuses located in cavities 3 and 15 of the Power Distribution Center (PDC).

The F20 and G5 circuits are connected to separate bus bars internal to the fuse block. Different circuits from the PDC and the ignition switch supply battery voltage to the fuse block bus bars.

The F20 circuit supplies battery voltage to the ACM only when the ignition switch is in the RUN position. The G5 circuit powers the ACM when the ignition switch is in either the START or RUN position.

A bus bar internal to the ignition switch connects the A1 circuit from the Power Distribution Center (PDC) to the A21 circuit when the switch is in either the START or RUN position. The A21 circuit supplies battery voltage to the fuse block bus bar that feeds the G5 circuit. A 40 amp fuse in the PDC protects the A1 and A21 circuits. A 15 amp fuse in cavity 22 of the fuse block protects the G5 circuit.

When the ignition switch is in the RUN position, it connects the A2 circuit from the PDC to the A22 circuit. The A22 circuit supplies battery voltage to the fuse block bus bar that feeds the F20 circuit. A 60 amp fuse in cavity 13 of the PDC protects the A2 and A22 circuits. A 15 amp fuse in cavity 18 of the fuse block protects the F20 circuit.

The ACM has an external dedicated ground, circuit Z6.

AIRBAG IMPACT SENSORS

Two airbag impact sensors provide input to the airbag control module (ACM). Each sensor has two circuits that connect to the ACM.

From the left impact sensor, Circuit R47 connects to the ACM at cavity 4 of the 10-way connector. Circuit R49 connects to cavity 7 of the 10 way connector.

From the right impact sensor, Circuit R46 connects to the ACM at cavity 5 of the 10 way connector. Circuit R48 connects to cavity 6 of the 10 way connector.

AIRBAG SQUIB (AIRBAG IGNITER)

Two circuits, R43 and R45, connect the ACM to the driver's side Airbag squib (igniter) after passing through the clock spring connector. Circuit R43 from cavity 2 of the ACM 4-way connector connects to the squib. Circuit R45 from cavity 1 of the ACM 4-way connector connects to the squib.

AIRBAG WARNING LAMP

Illumination of the Airbag warning lamp is controlled by the Airbag Control Module (ACM). When the ACM detects a problem in the system it provides a ground for the R41 circuit. This causes the AIRBAG lamp in the instrument cluster to illuminate.

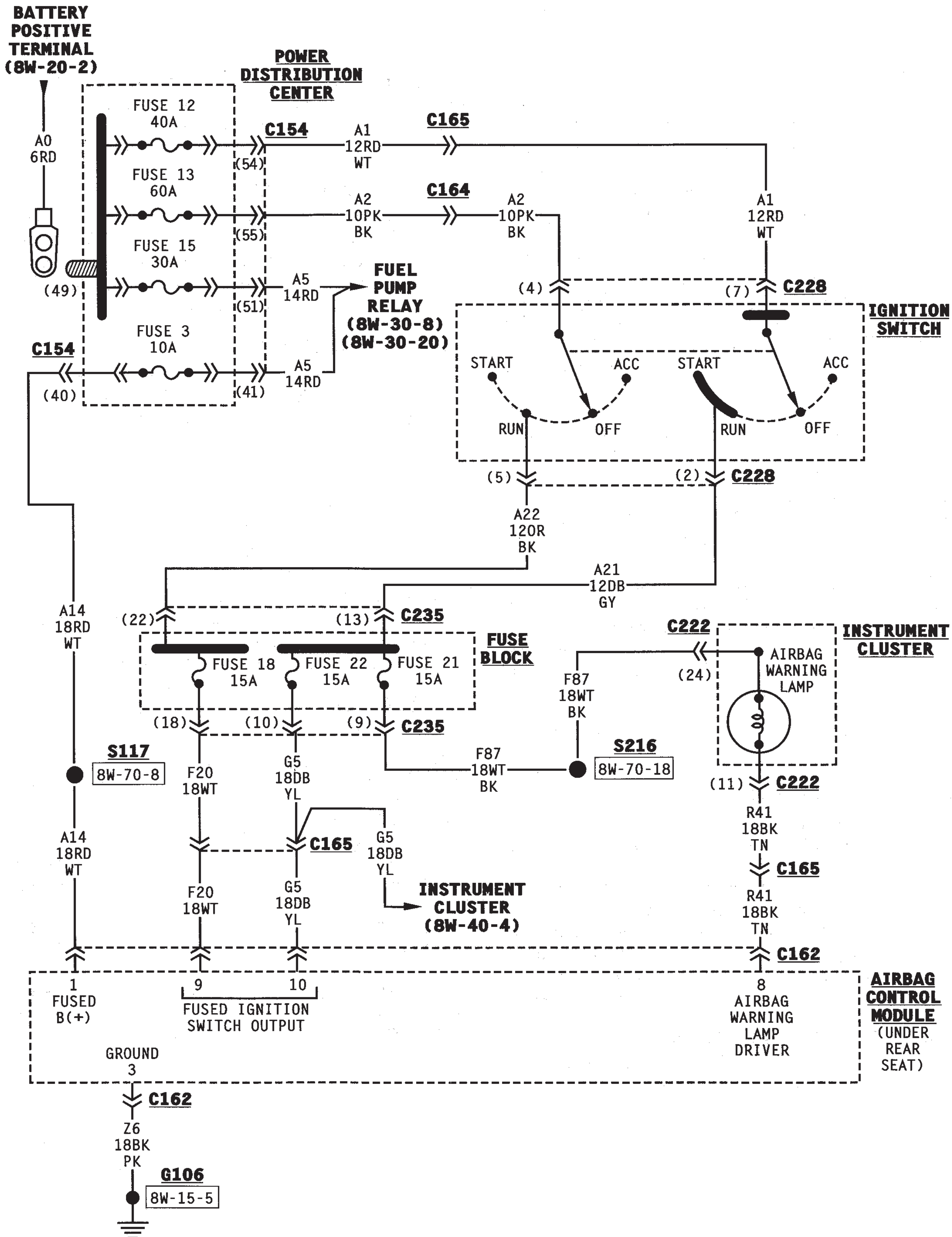
DATA LINK CONNECTOR

The airbag system used in this vehicle uses its own dedicated data link connector. This connector is located at the rear of the center console. Circuits D7, D8, F63, and Z6 connect from the Airbag Control Module (ACM) to the data link connector.

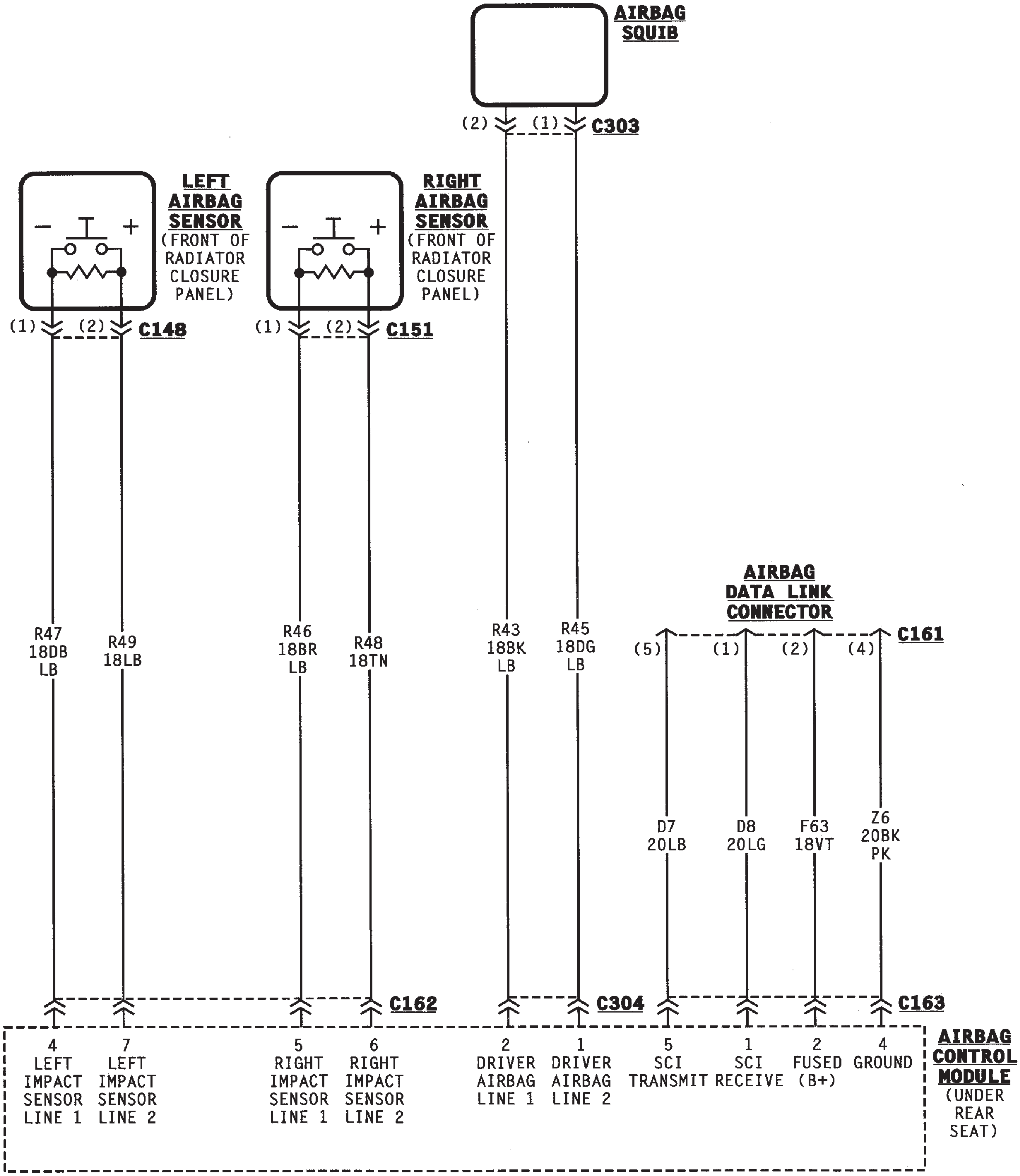
HELPFUL INFORMATION

• Check for blown fuses in the circuits that connect to the ignition switch and in those that connect to the ACM
• While the bus bars in the fuse block power the ACM, they also feed additional components on separate fuse-protected circuits
• The ACM has an external dedicated ground.

DIAGRAM INDEX


BATTERY
POSITIVE
TERMINAL
(8W-20-2)
POWER
DISTRIBUTION
CENTER
FUSE 12
40A
FUSE 13
60A
FUSE 15
30A
FUSE 3
10A
A0
6RD
(49)
C154
(54)
(55)
(51)
(40)
(41)
A1
12RD
WT
C165
C164
A2
10PK
BK
A5
14RD
FUEL
PUMP
RELAY
(8W-30-8)
(8W-30-20)
(4)
(7)
C228
IGNITION
SWITCH
START
ACC
RUN
OFF
(5)
(2)
A22
12OR
BK
A21
12DB
GY
A14
18RD
WT
(22)
(13)
C235
FUSE
BLOCK
FUSE 18
15A
FUSE 22
15A
FUSE 21
15A
(18)
(10)
(9)
C222
(24)
INSTRUMENT
CLUSTER
AIRBAG
WARNING
LAMP
F87
18WT
BK
S216
8W-70-18
S117
8W-70-8
F20
18WT
G5
18DB
YL
(11)
R41
18BK
TN
INSTRUMENT
CLUSTER
(8W-40-4)
C162
1
FUSED
B(+)
9
10
FUSED IGNITION
SWITCH OUTPUT
8
AIRBAG
WARNING
LAMP
DRIVER
AIRBAG
CONTROL
MODULE
(UNDER
REAR
SEAT)
GROUND
3
Z6
18BK
PK
G106
8W-15-5

J958W-3


AIRBAG SQUIB
(2) (1) C303
LEFT AIRBAG SENSOR (FRONT OF RADIATOR CLOSURE PANEL)
(1) (2) C148
RIGHT AIRBAG SENSOR (FRONT OF RADIATOR CLOSURE PANEL)
(1) (2) C151
R47 18DB LB
R49 18LB
R46 18BR LB
R48 18TN
R43 18BK LB
R45 18DG LB
AIRBAG DATA LINK CONNECTOR
(5) (1) (2) (4) C161
D7 20LB
D8 20LG
F63 18VT
Z6 20BK PK
C162
C304
C163
4 LEFT IMPACT SENSOR LINE 1
7 LEFT IMPACT SENSOR LINE 2
5 RIGHT IMPACT SENSOR LINE 1
6 RIGHT IMPACT SENSOR LINE 2
2 DRIVER AIRBAG LINE 1
1 DRIVER AIRBAG LINE 2
5 SCI TRANSMIT
1 SCI RECEIVE
2 FUSED (B+)
4 GROUND
AIRBAG CONTROL MODULE (UNDER REAR SEAT)

J958W-3

INTERIOR LIGHTING

INDEX

GENERAL INFORMATION

Circuit A4 from fuse 1 in the Power Distribution Center (PDC) powers circuit M1 through the Ignition Off Draw (IOD) fuse in cavity 5 of the fuse block. Circuit M1 supplies power to the interior lamps. A stand alone branch of circuit M1 connects directly to fuse 1 in the PDC and the underhood lamp.

Circuit M1 also connects to the coil side of the illuminated entry relay. The Remote Keyless Entry (RKE) module controls the illuminated entry relay.

Circuit E2 from the dimming module supplies power for the instrument panel illumination lamps.

DIMMING MODULE

Circuit 352 from fuse 24 in the fuse block powers the dimming module. Circuit L90 from the headlamp switch feeds circuit 352 through fuse 24 when the headlamp switch is in the PARK, LOW, or LOW/FOG position. Circuit 366 from fuse 12 in the fuse block supplies power to the headlamp switch for circuit L90. Circuit A6 from fuse 10 in the Power Distribution Center powers circuit 366 through fuse 12.

Circuit 52 from dimming switch connects to the dimming module. The dimming module determines the level of illumination selected from the input it receives on circuit 52.

The dimming module powers the illumination lamps on circuit E2. Circuit E2 splices to supply power to the following illumination lamps:
- Ash receiver lamp
- Cigar lighter lamp
- Headlamp switch lamps
- Radio lamp
- Instrument cluster general illumination lamps
- A/C-Heater control switch lamp
- Transmission range indicator lamp
- Transfer case range indicator lamp
- Heated rear window switch lamp
- Overdrive switch lamp
- Graphic display module illumination lamps
- Automatic temperature controls lamp
- Overhead console illumination lamp

Circuit Z1 provides ground for all of the illumination lamps except for the automatic temperature controls lamp and A/C-Heater switch lamp. Circuit Z4 provides ground for the automatic temperature controls lamp. The A/C-Heater switch lamp is case grounded.

Additionally, the headlamp switch lamps also ground when the courtesy lamp switch is closed. When closed, the courtesy lamp switch connects the headlamp switch lamps to circuit M2.

HELPFUL INFORMATION

- On vehicles built for sale in Canada, the dimming module is part of the Daytime Running Lamps (DRL) module.

INTERIOR LAMPS

Circuit A4 from fuse 1 in the Power Distribution Center (PDC) powers circuit M1 through the Ignition Off Draw (IOD) fuse in cavity 5 of the fuse block. Circuit M1 supplies power to the:
- Cargo lamp
- Dome/reading lamps
- Key-in lamp
- Left courtesy lamp
- Left door courtesy lamp
- Overhead console lamps
- Right courtesy lamp
- Right door courtesy lamp

Circuit M2 connects all of the above interior lamps to circuit Z1 through either one of the door jamb switches, liftgate switch, or liftgate glass ajar switch. With the vehicle not moving, when either the liftgate, liftgate glass or one of doors opens, these switches close connect circuits M2 and Z1. Circuit Z1 provides ground for the lamps.

If the vehicle is equipped with Remote Keyless Entry, the illuminated entry relay connects circuit M2 to ground on circuit M1.

Circuit Z1 also connects directly to the switches for the dome/reading lamps or if equipped, overhead console lamps.

GLOVE BOX LAMP

Circuit M1 from the Ignition Off Draw (IOD) fuse in cavity 5 of the fuse block powers the glove box lamp. A case grounded switch, in series after the lamp, closes when the glove box door is opened. The switch completes a path to ground on circuit Z1.

OVERHEAD CONSOLE LAMPS

Circuit A4 from fuse 1 in the Power Distribution Center (PDC) powers circuit F60 through fuse 8 in the fuse block. Circuit F60 supplies battery voltage to the left and right lamps.

Circuit Z2 connects directly to the switches for the left and right lamps. When one of the switches close, circuit Z1 provides ground for that lamp.

Also, circuit M2 connects to the left and right lamp in the overhead console. Circuit M2 connects the lamps to ground on circuit Z1 through either the liftgate switch, liftgate glass ajar switch, or one of the door jamb switches. With the vehicle not moving, when either the liftgate, liftgate glass or one of doors opens, these switches close connect circuits M2 and Z1. Circuit Z1 provides ground for the lamps.

REMOTE KEYLESS ENTRY

When the operator activates the Remote Keyless Entry (RKE) system, the RKE module grounds the coil side of the illuminated entry relay. Circuit M1 from the Ignition Off Draw (IOD) fuse in cavity 5 of the fuse block powers the coil side of the relay. Circuit M1 is HOT at all times.

When the RKE module grounds the relay, contacts inside the relay connect circuits M2 and Z1 providing ground for the following lamps:

- Cargo lamp
- Dome/reading lamps
- Key-in lamp
- Left courtesy lamp
- Left door courtesy lamp
- Overhead console lamps
- Right courtesy lamp
- Right door courtesy lamp

HELPFUL INFORMATION

- The RKE module also operates the power door lock relays. Refer to section 8W-61, Power Door Locks.

VANITY LAMPS

Circuit A4 feeds circuit M1 through the Ignition Off Draw (IOD) fuse in the cavity 5 of the fuse block. Circuit A4 originates at fuse 1 in the power distribution center (PDC). Circuits A4 and M1 are HOT at all times.

Circuit M1 supplies power to the vanity lamps. When the vanity lamps switch closes, it connects the lamps to ground on circuit Z1.

UNDERHOOD LAMP

A stand alone branch of circuit M1 connects directly to fuse 1 in the Power Distribution Center (PDC) and the underhood lamp. A mercury switch, in series after the lamp, connects the lamp to ground on circuit Z1. When the hood is raised, mercury inside the switch moves to a position where it connects circuit M1 to ground circuit Z1, illuminating the lamp.

DAY/NIGHT MIRROR

When the ignition switch is in the RUN position, it connects circuit A2 from fuse 13 in the Power Distribution Center (PDC) to circuit A22. Circuit A22 powers circuit F83 through fuse 19 in the fuse block. Circuit F83 feeds the day/night mirror. Circuit Z1 provides ground for the day/night mirror.

When the back-up lamps switch closes, circuit L10 provides a signal to the day/night mirror. The day night mirror turns Off when the vehicle is in reverse.

CHIME/BUZZER MODULE

The chime module sounds an audible warning tone. The tone sounds for seat belt warning and when the key is in the ignition switch while the drivers door is open. The tone also sounds when the ignition key is in the ON position while the drivers side seat belt is not buckled. Lastly, the tone sounds when the headlamps are ON when the ignition is OFF. Refer to Group 8U for system operation.

When the ignition switch is in the RUN position, circuit A2 from fuse 13 in the Power Distribution Center (PDC) connects to circuit A22. Circuit A22 powers circuit F83 through fuse 19 in the fuse block. Circuit F83 connects to the chime module.

Circuit A4 in the PDC powers circuit F60 through fuse 8 in the fuse block. Circuit F60 supplies battery voltage to the chime module. Circuits A4 and F60 are HOT at all times. Circuit Z1 provides ground for the chime module.

One branch of circuit G26 connects the chime module to the headlamp switch. Another branch of circuit G26 connects the chime module to the ignition key-in switch. Circuit G16 connects the key in switch to the headlamp switch and left front door jamb switch. When the parking lamps or headlamps are ON, the headlamp switch connects circuit G26 from the chime module to circuit G16.

If the headlamps are ON and the drivers door opens, ground for the chime module is through the headlamp switch on circuit G26. From the headlamp switch the ground path continues on circuit G16 through the drivers door jamb switch to ground on circuit Z1.

If the headlamps are OFF with the key in the ignition while the drivers side door is open, ground for the chime module is through the key-in switch on circuit G26. From the key-in, the ground path continues on circuit G16 through the drivers door jamb switch to ground on circuit Z1.

Circuit G13 from the chime module powers the seat belt warning lamp in the instrument cluster. Circuit Z1 at the instrument cluster provides ground for the lamp.

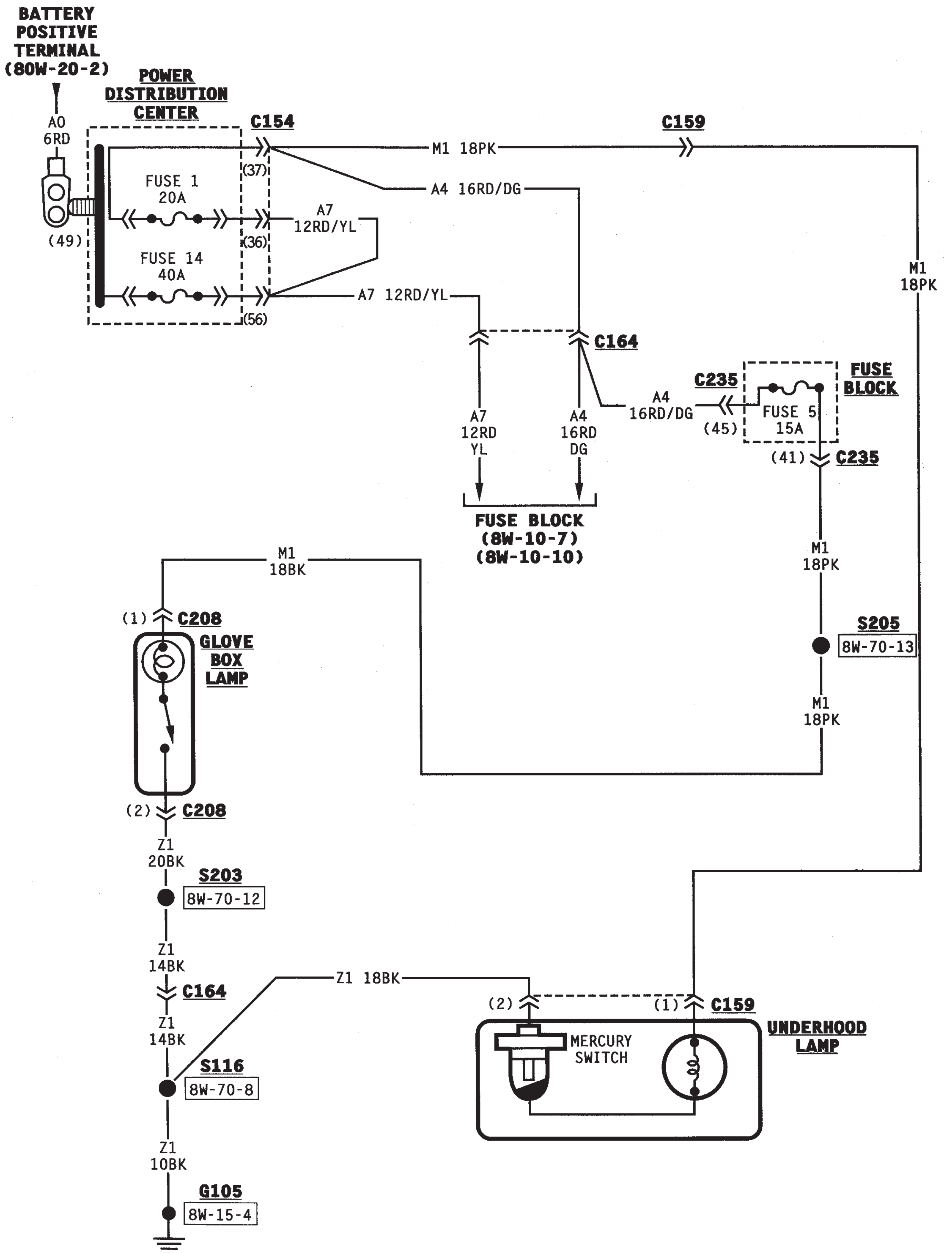
Circuit G10 from the chime module connects to the seat belt switch. When the seat belt switch closes a path to ground is completed on circuit Z1 and the tone sounds momentarily.

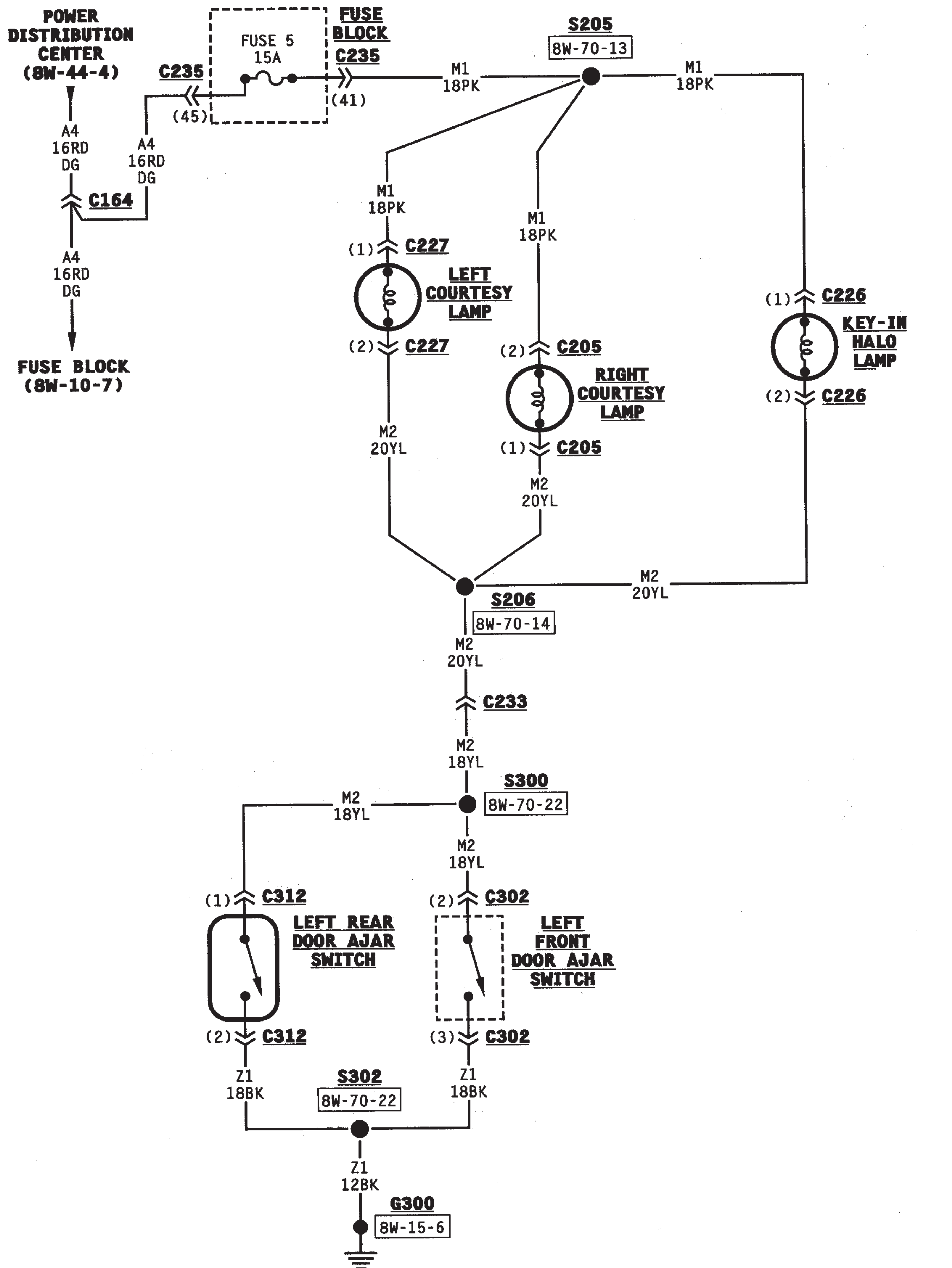
The chime module connects to the Vehicle Information Center (VIC) on circuit G81.

HELPFUL INFORMATION

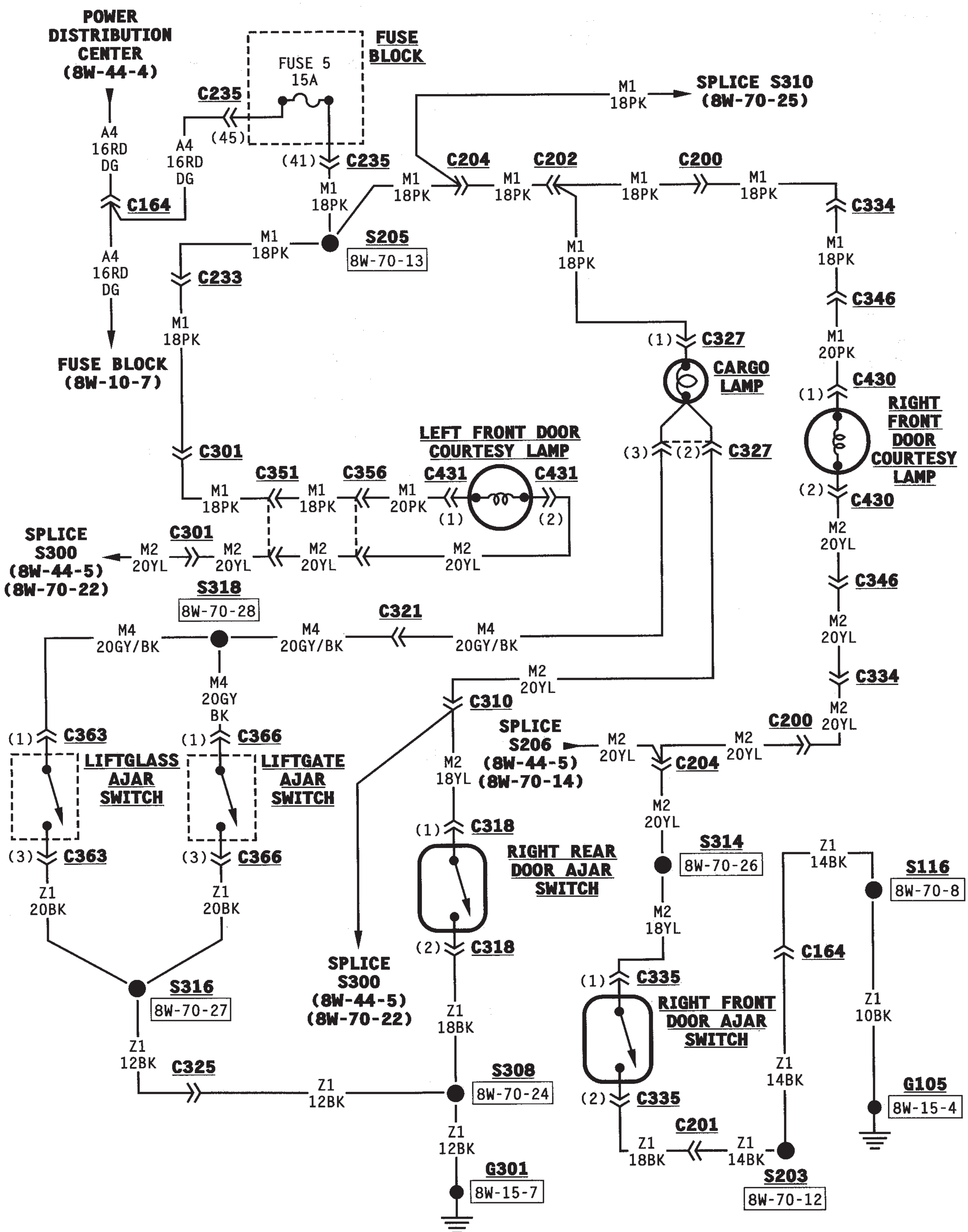
- Circuit F83 is double crimped at the chime module and branches to the dimming module.
- The chime module also controls the ground for the power door lock relay on circuit P57. The chime module prevents the doors from locking by not grounding the coil side of the power door lock relay.

DIAGRAM INDEX


BATTERY
POSITIVE
TERMINAL
(80W-20-2)
A0
6RD
(49)
POWER
DISTRIBUTION
CENTER
FUSE 1
20A
FUSE 14
40A
(37)
(36)
(56)
C154
M1 18PK
C159
A4 16RD/DG
A7
12RD/YL
A7 12RD/YL
M1
18PK
C164
C235
FUSE
BLOCK
A4
16RD/DG
(45)
FUSE 5
15A
(41)
C235
A7
12RD
YL
A4
16RD
DG
FUSE BLOCK
(8W-10-7)
(8W-10-10)
M1
18BK
M1
18PK
(1)
C208
GLOVE
BOX
LAMP
S205
8W-70-13
M1
18PK
(2)
C208
Z1
20BK
S203
8W-70-12
Z1
14BK
C164
Z1 18BK
Z1
14BK
S116
8W-70-8
(2)
(1)
C159
UNDERHOOD
LAMP
MERCURY
SWITCH
Z1
10BK
G105
8W-15-4

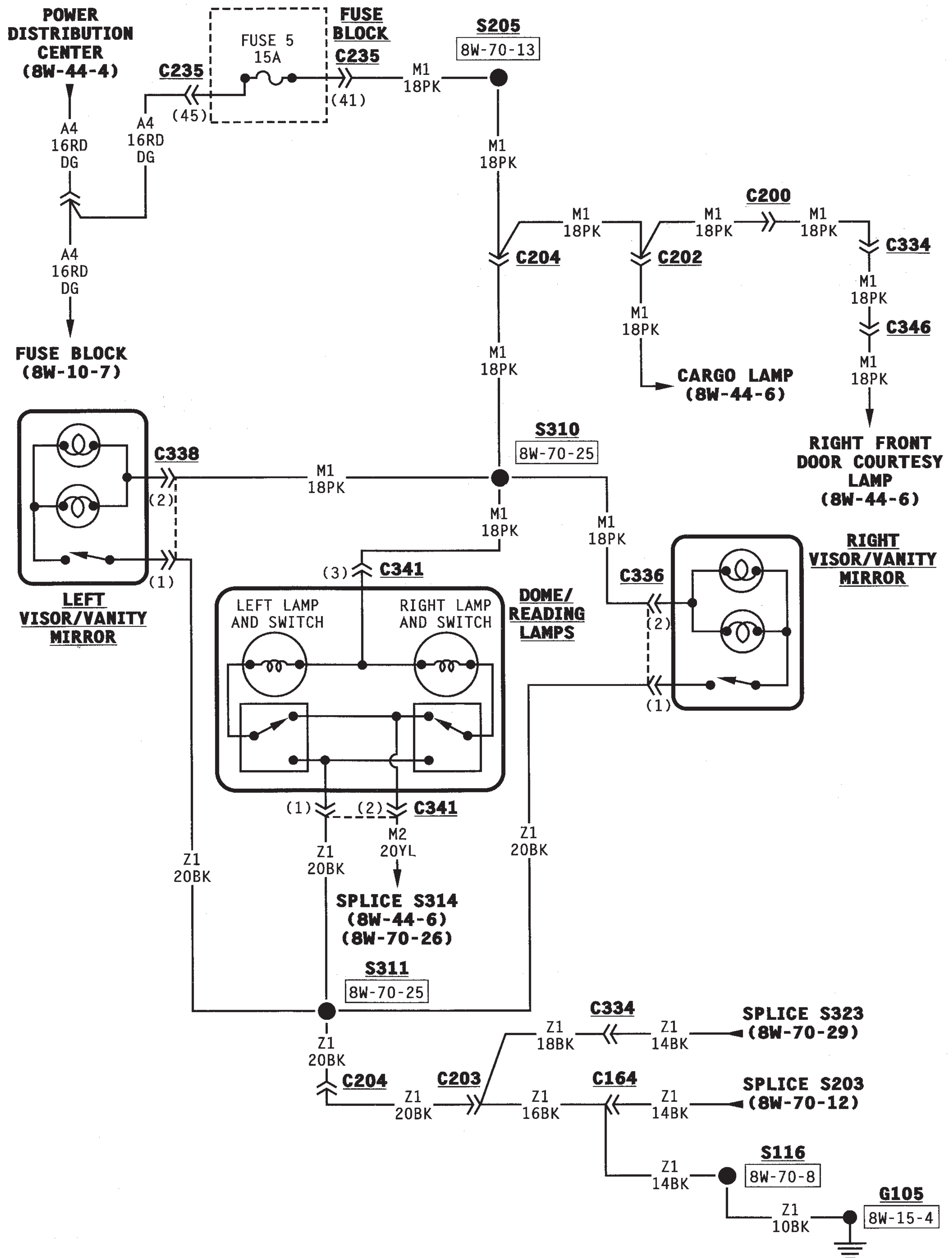

POWER DISTRIBUTION CENTER (8W-44-4)
A4 16RD DG
C164
A4 16RD DG
FUSE BLOCK (8W-10-7)
A4 16RD DG
C235
(45)
FUSE 5 15A
FUSE BLOCK
C235
(41)
M1 18PK
S205
8W-70-13
M1 18PK
M1 18PK
(1) C227
LEFT COURTESY LAMP
(2) C227
M2 20YL
M1 18PK
(2) C205
RIGHT COURTESY LAMP
(1) C205
M2 20YL
(1) C226
KEY-IN HALO LAMP
(2) C226
M2 20YL
S206
8W-70-14
M2 20YL
C233
M2 18YL
S300
8W-70-22
M2 18YL
M2 18YL
(1) C312
LEFT REAR DOOR AJAR SWITCH
(2) C312
(2) C302
LEFT FRONT DOOR AJAR SWITCH
(3) C302
Z1 18BK
S302
8W-70-22
Z1 18BK
Z1 12BK
G300
8W-15-6

J958W-3



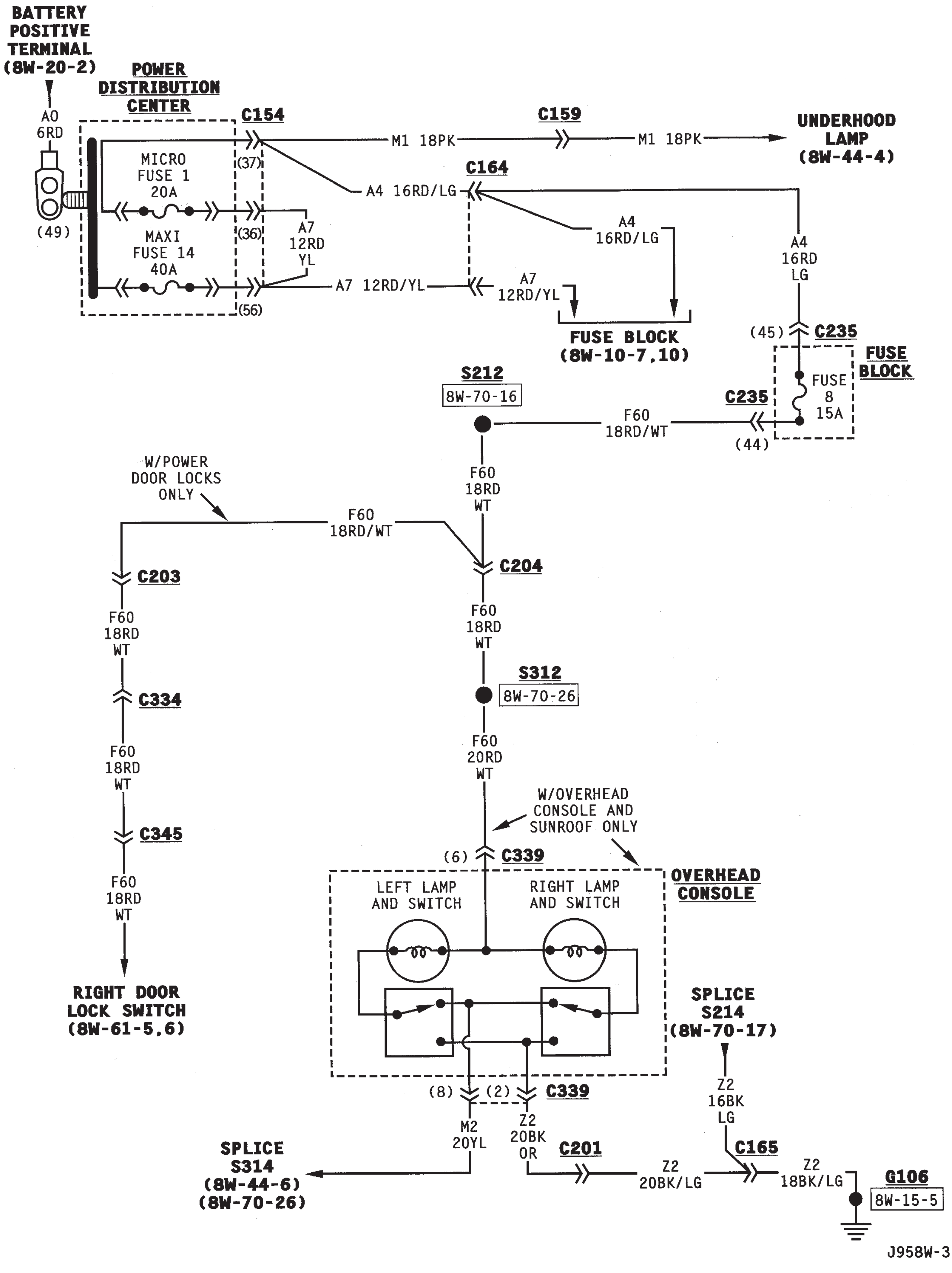
POWER DISTRIBUTION CENTER (8W-44-4)
FUSE BLOCK
FUSE 5 15A
C235
(45)
(41)
A4 16RD DG
C164
S205
8W-70-13
M1 18PK
C233
FUSE BLOCK (8W-10-7)
SPLICE S310 (8W-70-25)
C204
C202
C200
C334
C346
M1 20PK
C430
RIGHT FRONT DOOR COURTESY LAMP
C327
CARGO LAMP
LEFT FRONT DOOR COURTESY LAMP
C301
C351
C356
C431
SPLICE S300 (8W-44-5) (8W-70-22)
M2 20YL
S318
8W-70-28
C321
M4 20GY/BK
M4 20GY BK
C310
SPLICE S206 (8W-44-5) (8W-70-14)
C363
LIFTGLASS AJAR SWITCH
C366
LIFTGATE AJAR SWITCH
Z1 20BK
M2 18YL
C318
RIGHT REAR DOOR AJAR SWITCH
S314
8W-70-26
S116
8W-70-8
Z1 14BK
C164
C335
RIGHT FRONT DOOR AJAR SWITCH
S316
8W-70-27
Z1 12BK
C325
Z1 18BK
S308
8W-70-24
G301
8W-15-7
C201
S203
8W-70-12
Z1 10BK
G105
8W-15-4

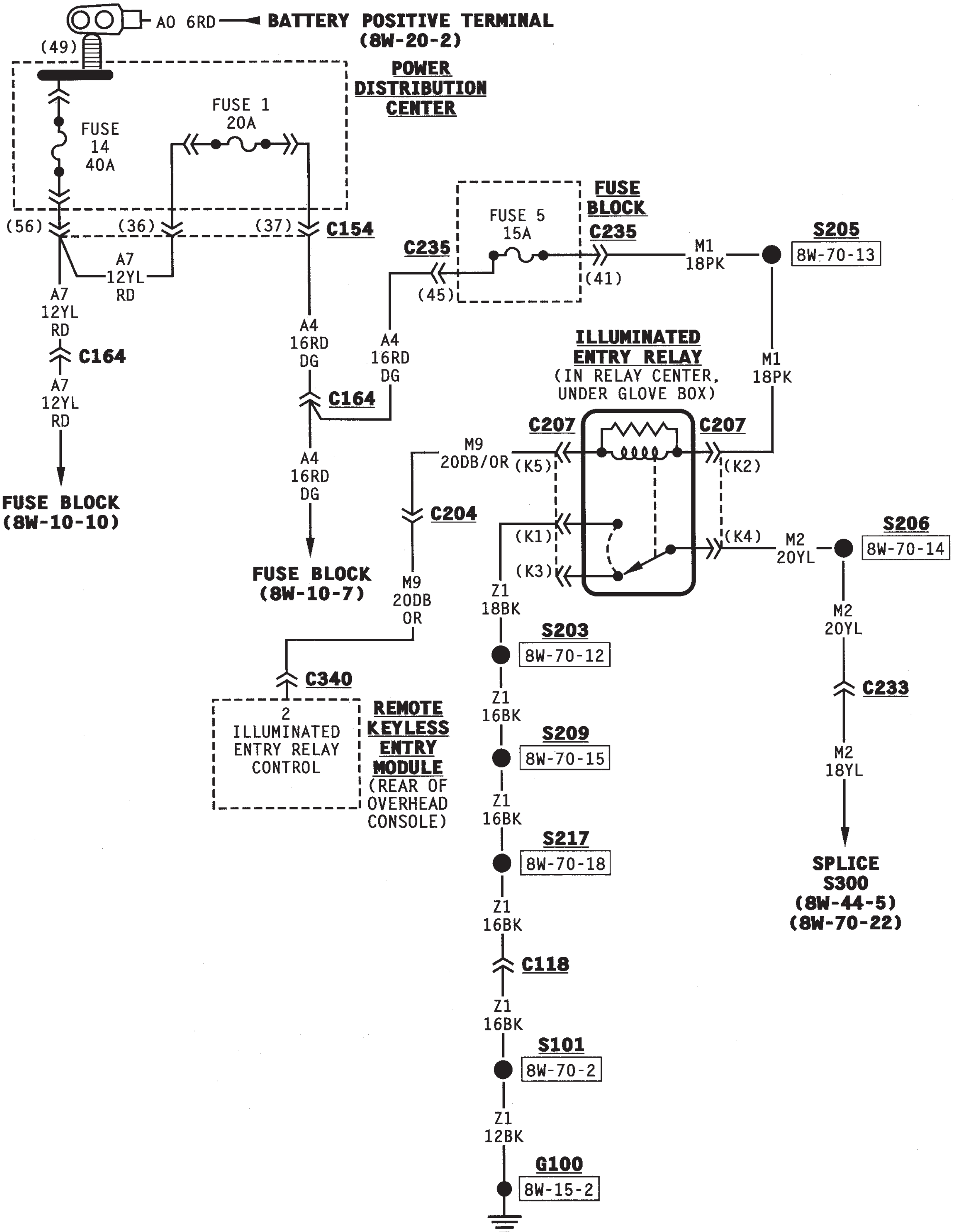
J958W-3



POWER DISTRIBUTION CENTER (8W-44-4)
C235
FUSE 5 15A
FUSE BLOCK
C235
(45)
(41)
M1 18PK
S205
8W-70-13
A4 16RD DG
A4 16RD DG
A4 16RD DG
FUSE BLOCK (8W-10-7)
M1 18PK
C200
M1 18PK
M1 18PK
M1 18PK
C204
C202
C334
M1 18PK
M1 18PK
C346
M1 18PK
M1 18PK
CARGO LAMP (8W-44-6)
S310
8W-70-25
RIGHT FRONT DOOR COURTESY LAMP (8W-44-6)
C338
(2)
(1)
LEFT VISOR/VANITY MIRROR
M1 18PK
M1 18PK
M1 18PK
(3)
C341
C336
RIGHT VISOR/VANITY MIRROR
LEFT LAMP AND SWITCH
RIGHT LAMP AND SWITCH
DOME/ READING LAMPS
(2)
(1)
(1)
(2)
C341
M2 20YL
Z1 20BK
Z1 20BK
Z1 20BK
SPLICE S314 (8W-44-6) (8W-70-26)
S311
8W-70-25
C334
Z1 18BK
Z1 14BK
SPLICE S323 (8W-70-29)
Z1 20BK
C204
C203
Z1 20BK
C164
Z1 16BK
Z1 14BK
SPLICE S203 (8W-70-12)
S116
Z1 14BK
8W-70-8
G105
Z1 10BK
8W-15-4

J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
POWER DISTRIBUTION CENTER
A0 6RD
(49)
MICRO FUSE 1 20A
MAXI FUSE 14 40A
C154
(37)
(36)
(56)
A7 12RD YL
M1 18PK
C159
M1 18PK
UNDERHOOD LAMP (8W-44-4)
A4 16RD/LG
C164
A4 16RD/LG
A4 16RD LG
A7 12RD/YL
A7 12RD/YL
FUSE BLOCK (8W-10-7,10)
(45)
C235
FUSE BLOCK
FUSE 8 15A
C235
(44)
S212
8W-70-16
F60 18RD/WT
F60 18RD WT
W/POWER DOOR LOCKS ONLY
F60 18RD/WT
C204
C203
F60 18RD WT
C334
F60 18RD WT
C345
F60 18RD WT
RIGHT DOOR LOCK SWITCH (8W-61-5,6)
F60 18RD WT
S312
8W-70-26
F60 20RD WT
W/OVERHEAD CONSOLE AND SUNROOF ONLY
(6)
C339
OVERHEAD CONSOLE
LEFT LAMP AND SWITCH
RIGHT LAMP AND SWITCH
SPLICE S214 (8W-70-17)
(8)
(2)
C339
M2 20YL
Z2 20BK OR
C201
Z2 16BK LG
C165
Z2 20BK/LG
Z2 18BK/LG
G106
8W-15-5
SPLICE S314 (8W-44-6) (8W-70-26)
J958W-3


A0 6RD
BATTERY POSITIVE TERMINAL
(8W-20-2)
(49)
POWER
DISTRIBUTION
CENTER
FUSE 1
20A
FUSE
14
40A
(56)
(36)
(37)
C154
A7
12YL
RD
C164
FUSE BLOCK
(8W-10-10)
A4
16RD
DG
FUSE BLOCK
(8W-10-7)
FUSE 5
15A
FUSE
BLOCK
C235
(45)
(41)
M1
18PK
S205
8W-70-13
ILLUMINATED
ENTRY RELAY
(IN RELAY CENTER,
UNDER GLOVE BOX)
C207
(K5)
(K2)
(K1)
(K3)
(K4)
M9
20DB/OR
C204
M9
20DB
OR
C340
2
ILLUMINATED
ENTRY RELAY
CONTROL
REMOTE
KEYLESS
ENTRY
MODULE
(REAR OF
OVERHEAD
CONSOLE)
M2
20YL
S206
8W-70-14
C233
M2
18YL
SPLICE
S300
(8W-44-5)
(8W-70-22)
Z1
18BK
S203
8W-70-12
Z1
16BK
S209
8W-70-15
S217
8W-70-18
C118
S101
8W-70-2
Z1
12BK
G100
8W-15-2

1995 Grand Cherokee
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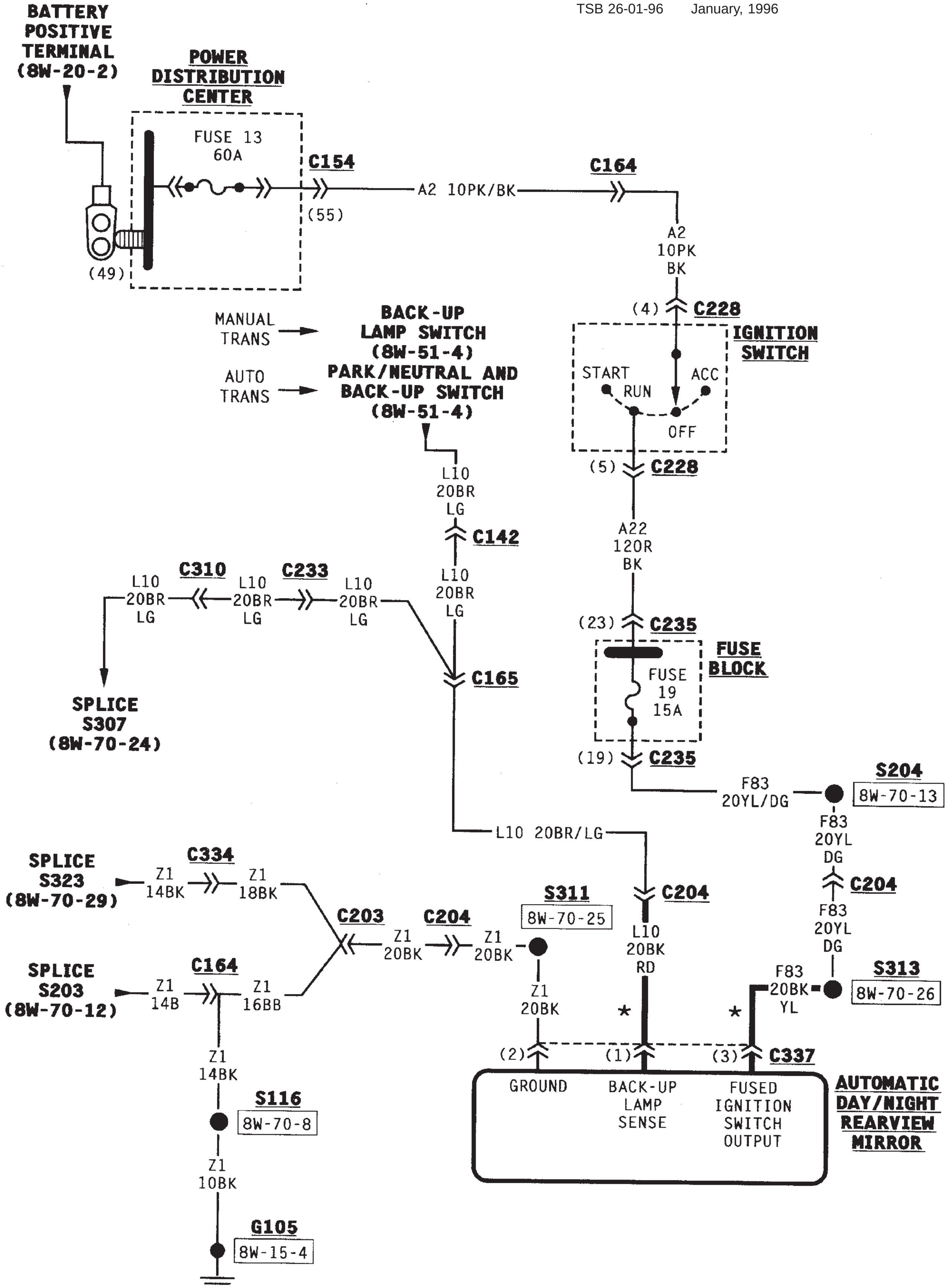

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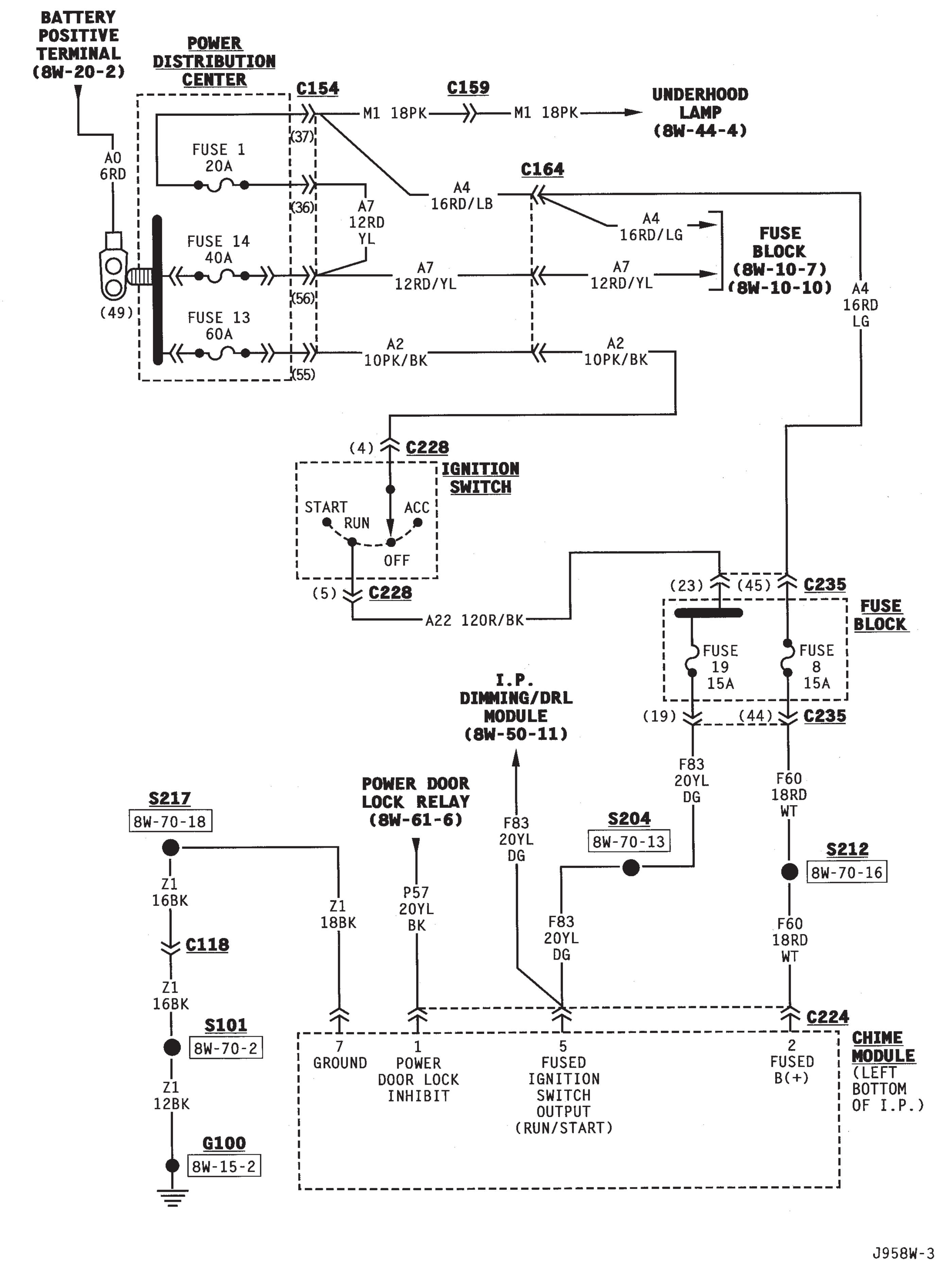
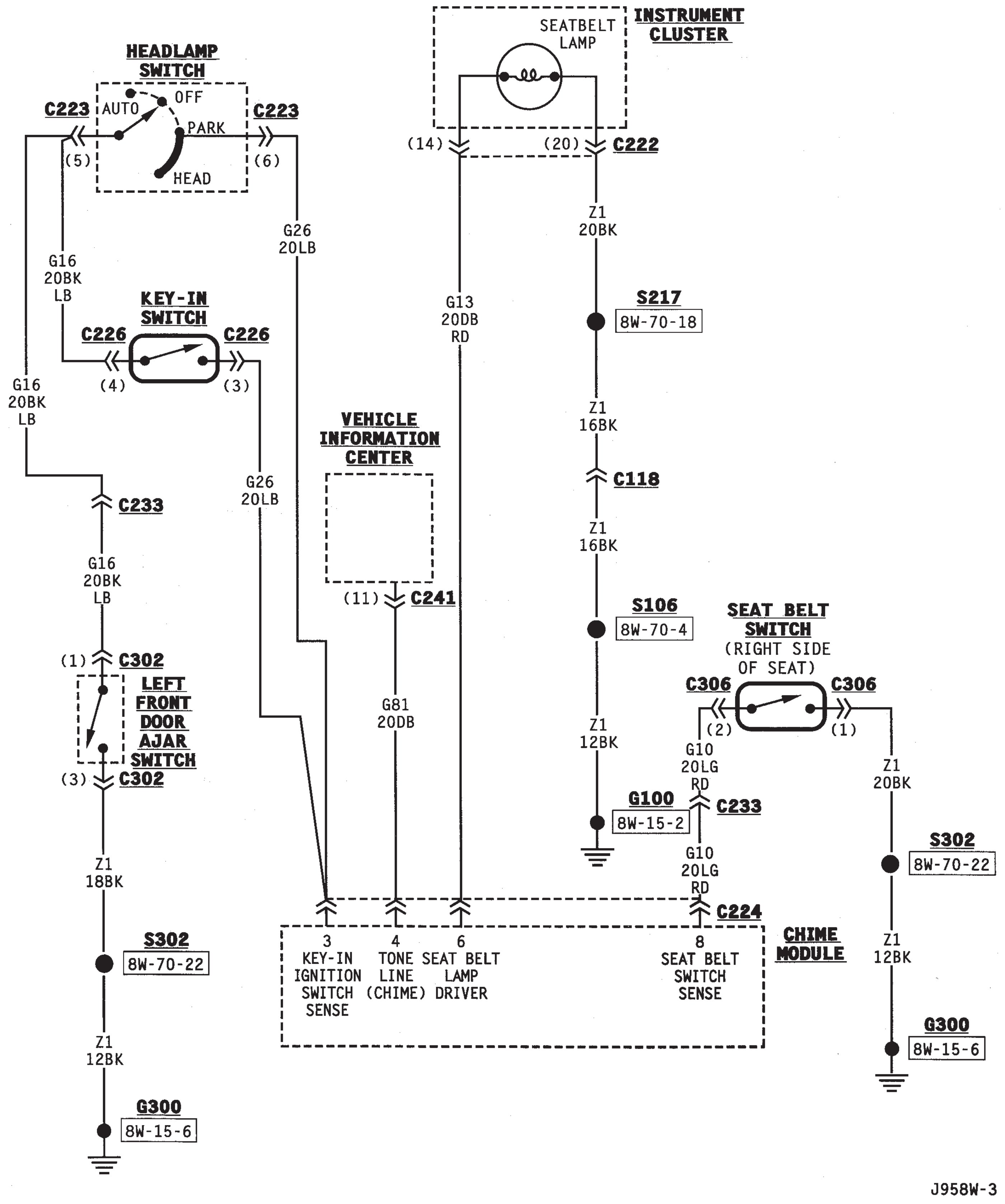
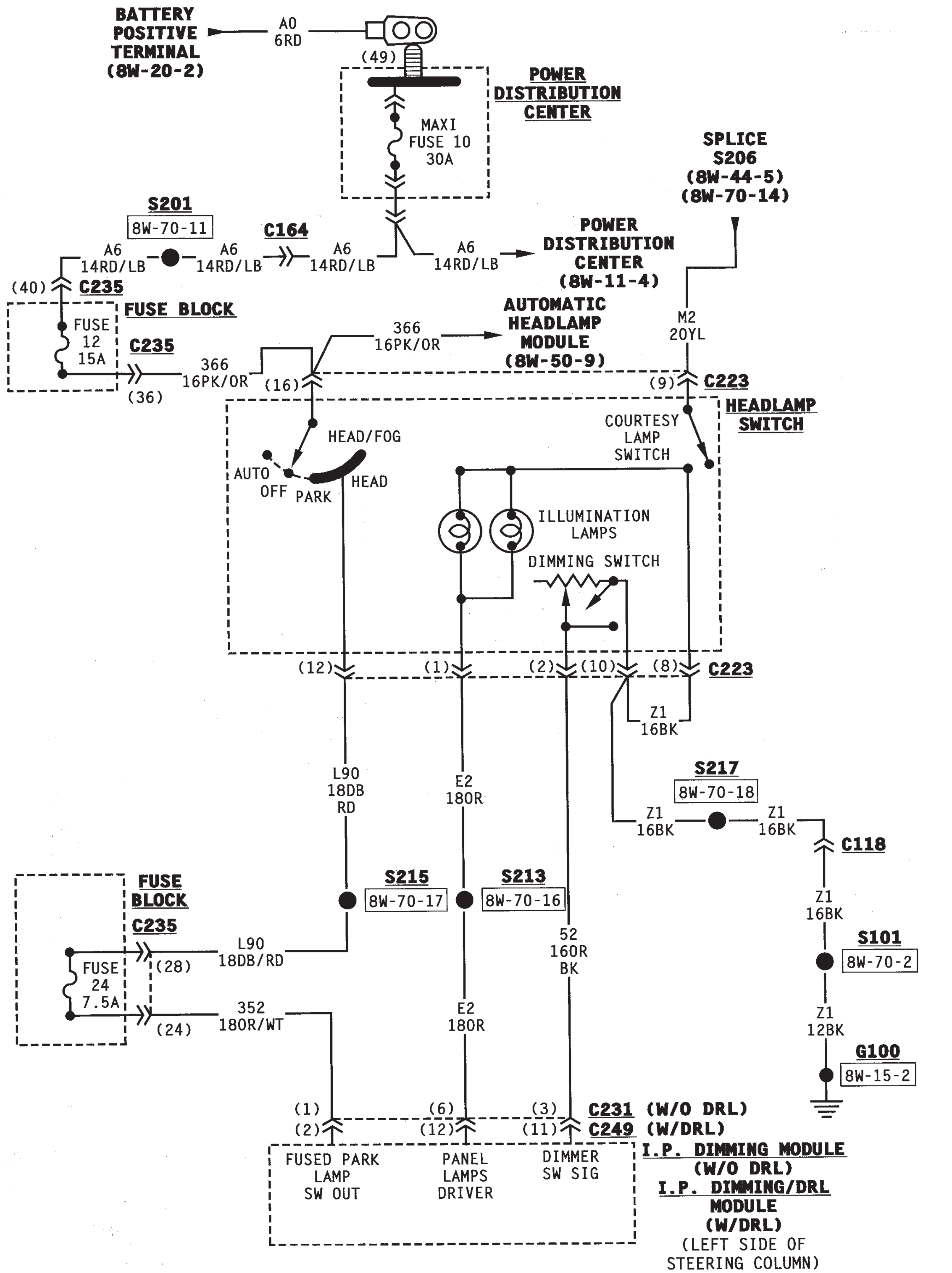

BATTERY POSITIVE TERMINAL (8W-20-2)
POWER DISTRIBUTION CENTER
C154
C159
M1 18PK
M1 18PK
UNDERHOOD LAMP (8W-44-4)
A0 6RD
FUSE 1 20A
(37)
(36)
A7 12RD YL
A4 16RD/LB
C164
A4 16RD/LG
FUSE BLOCK (8W-10-7) (8W-10-10)
FUSE 14 40A
A7 12RD/YL
A7 12RD/YL
A4 16RD LG
(49)
(56)
FUSE 13 60A
A2 10PK/BK
A2 10PK/BK
(55)
(4) C228
IGNITION SWITCH
START
RUN
ACC
OFF
(5) C228
A22 12OR/BK
(23)
(45) C235
FUSE BLOCK
FUSE 19 15A
FUSE 8 15A
(19)
(44) C235
I.P. DIMMING/DRL MODULE (8W-50-11)
F83 20YL DG
F60 18RD WT
POWER DOOR LOCK RELAY (8W-61-6)
S217
8W-70-18
F83 20YL DG
S204
8W-70-13
S212
8W-70-16
Z1 16BK
P57 20YL BK
Z1 18BK
F83 20YL DG
F60 18RD WT
C118
Z1 16BK
C224
S101
8W-70-2
7 GROUND
1 POWER DOOR LOCK INHIBIT
5 FUSED IGNITION SWITCH OUTPUT (RUN/START)
2 FUSED B(+)
CHIME MODULE (LEFT BOTTOM OF I.P.)
Z1 12BK
G100
8W-15-2
J958W-3


HEADLAMP SWITCH
AUTO
OFF
PARK
HEAD
C223
(5)
C223
(6)
INSTRUMENT CLUSTER
SEATBELT LAMP
(14)
(20)
C222
G26 20LB
G16 20BK LB
KEY-IN SWITCH
C226
(4)
C226
(3)
G13 20DB RD
Z1 20BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
G16 20BK LB
C233
G26 20LB
VEHICLE INFORMATION CENTER
(11)
C241
G16 20BK LB
S106
8W-70-4
SEAT BELT SWITCH
(RIGHT SIDE OF SEAT)
C306
(2)
C306
(1)
(1)
C302
LEFT FRONT DOOR AJAR SWITCH
(3)
C302
G81 20DB
Z1 12BK
G10 20LG RD
Z1 20BK
G100
8W-15-2
C233
G10 20LG RD
S302
8W-70-22
Z1 18BK
C224
3 KEY-IN IGNITION SWITCH SENSE
4 TONE LINE (CHIME)
6 SEAT BELT LAMP DRIVER
8 SEAT BELT SWITCH SENSE
CHIME MODULE
Z1 12BK
S302
8W-70-22
Z1 12BK
G300
8W-15-6
G300
8W-15-6
J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
MAXI FUSE 10 30A
SPLICE S206 (8W-44-5) (8W-70-14)
S201
8W-70-11
C164
A6 14RD/LB
POWER DISTRIBUTION CENTER (8W-11-4)
(40) C235
FUSE BLOCK
FUSE 12 15A
C235
366 16PK/OR
(36)
AUTOMATIC HEADLAMP MODULE (8W-50-9)
M2 20YL
(16)
(9) C223
HEADLAMP SWITCH
COURTESY LAMP SWITCH
HEAD/FOG
AUTO
OFF
PARK
HEAD
ILLUMINATION LAMPS
DIMMING SWITCH
(12) (1) (2) (10) (8) C223
Z1 16BK
L90 18DB RD
E2 18OR
S217
8W-70-18
C118
S215
8W-70-17
S213
8W-70-16
FUSE BLOCK
C235
FUSE 24 7.5A
(28)
L90 18DB/RD
52 16OR BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
(24)
352 18OR/WT
(1) (2)
(6) (12)
(3) (11)
C231 (W/O DRL)
C249 (W/DRL)
I.P. DIMMING MODULE (W/O DRL)
I.P. DIMMING/DRL MODULE (W/DRL)
(LEFT SIDE OF STEERING COLUMN)
FUSED PARK LAMP SW OUT
PANEL LAMPS DRIVER
DIMMER SW SIG

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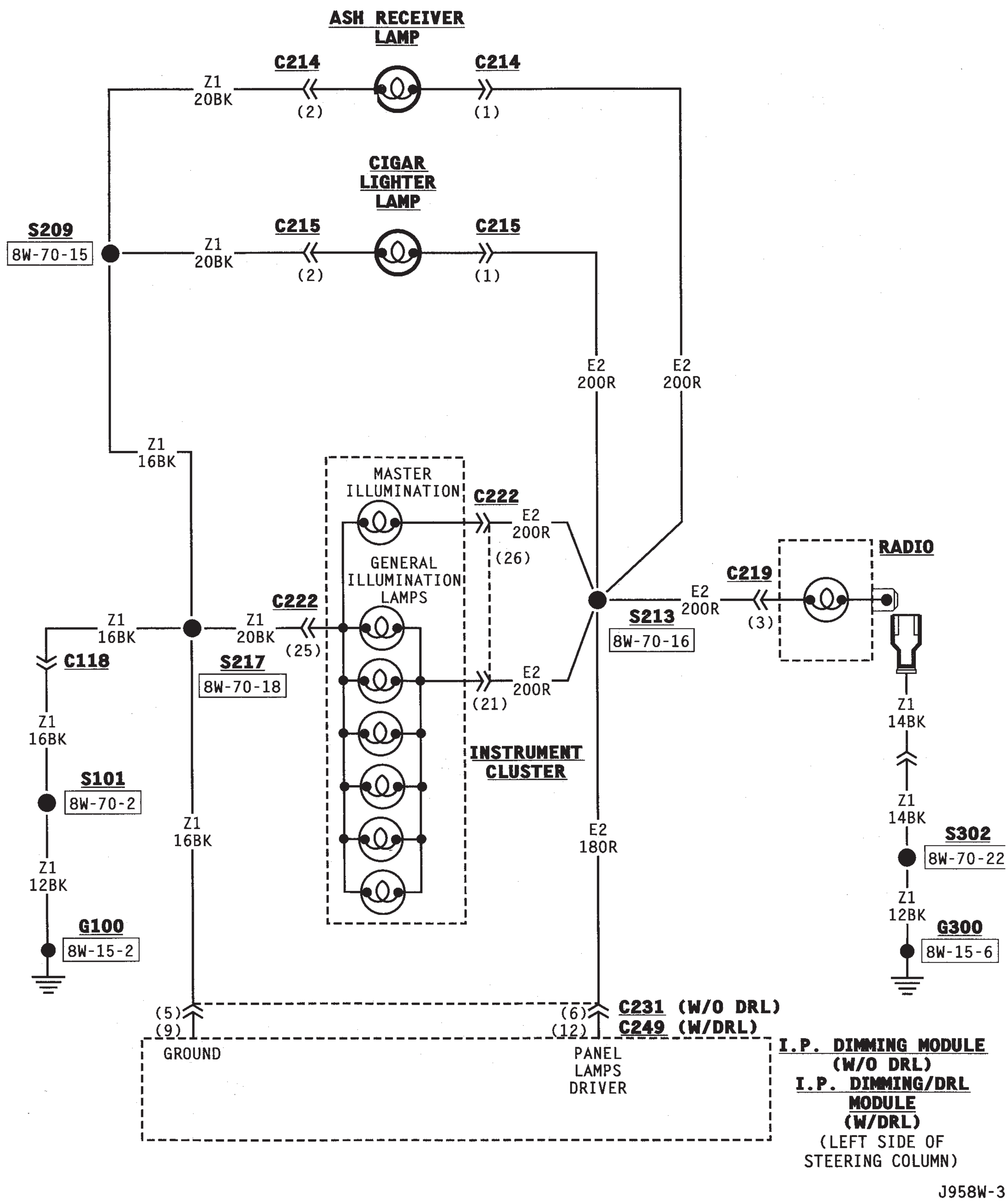
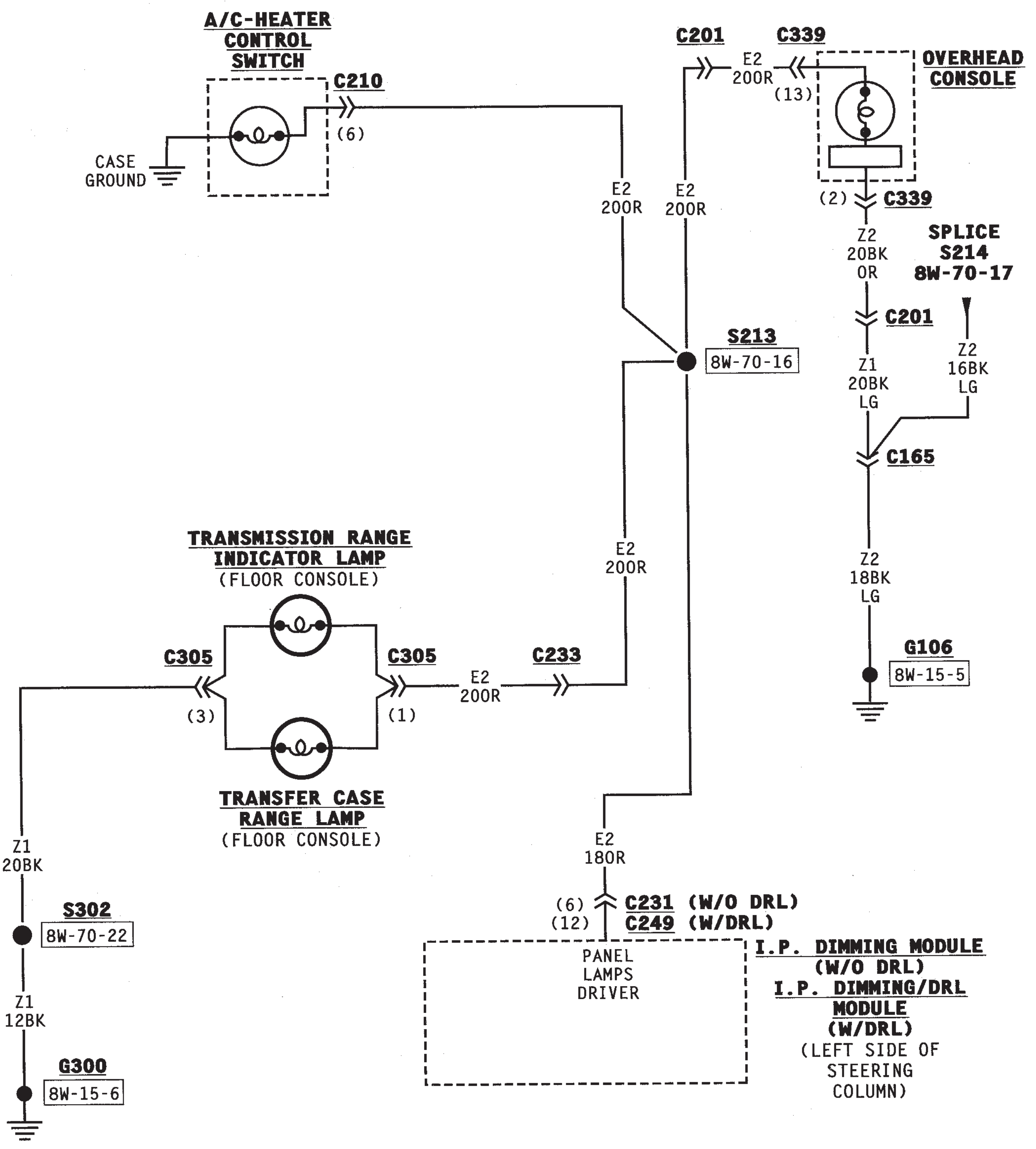

ASH RECEIVER LAMP
C214
C214
Z1 20BK
(2)
(1)
CIGAR LIGHTER LAMP
C215
C215
S209
8W-70-15
Z1 20BK
(2)
(1)
E2 200R
E2 200R
Z1 16BK
MASTER ILLUMINATION
C222
E2 200R
(26)
GENERAL ILLUMINATION LAMPS
RADIO
C219
C222
Z1 16BK
Z1 20BK
S213
E2 200R
(3)
8W-70-16
(25)
C118
S217
8W-70-18
E2 200R
(21)
Z1 16BK
Z1 14BK
INSTRUMENT CLUSTER
S101
8W-70-2
Z1 14BK
Z1 16BK
E2 180R
S302
8W-70-22
Z1 12BK
Z1 12BK
G100
8W-15-2
G300
8W-15-6
(5)
(9)
(6)
(12)
C231 (W/O DRL)
C249 (W/DRL)
GROUND
PANEL LAMPS DRIVER
I.P. DIMMING MODULE (W/O DRL)
I.P. DIMMING/DRL MODULE (W/DRL)
(LEFT SIDE OF STEERING COLUMN)
J958W-3


A/C-HEATER CONTROL SWITCH
C210
(6)
CASE GROUND
C201
C339
E2 200R
(13)
OVERHEAD CONSOLE
(2) C339
E2 200R
E2 200R
Z2 20BK OR
SPLICE S214 8W-70-17
C201
S213
8W-70-16
Z1 20BK LG
Z2 16BK LG
C165
TRANSMISSION RANGE INDICATOR LAMP
(FLOOR CONSOLE)
E2 200R
Z2 18BK LG
C305
C305
C233
G106
8W-15-5
E2 200R
(3)
(1)
TRANSFER CASE RANGE LAMP
(FLOOR CONSOLE)
Z1 20BK
E2 180R
S302
8W-70-22
(6) C231 (W/O DRL)
(12) C249 (W/DRL)
PANEL LAMPS DRIVER
I.P. DIMMING MODULE (W/O DRL)
I.P. DIMMING/DRL MODULE (W/DRL)
(LEFT SIDE OF STEERING COLUMN)
Z1 12BK
G300
8W-15-6

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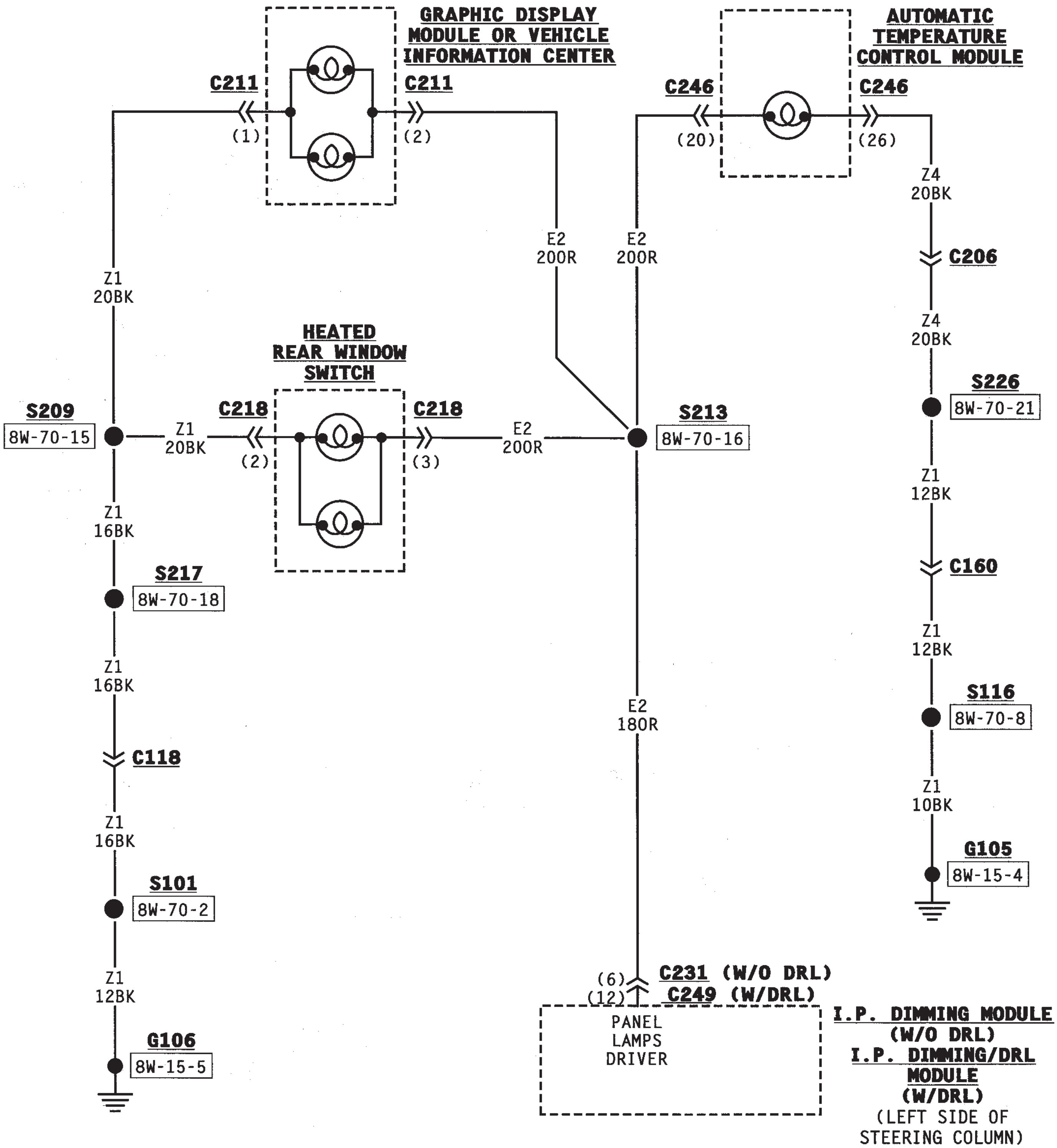
GRAPHIC DISPLAY MODULE OR VEHICLE INFORMATION CENTER
C211
(1)
C211
(2)
AUTOMATIC TEMPERATURE CONTROL MODULE
C246
(20)
C246
(26)
Z4 20BK
C206
Z4 20BK
S226
8W-70-21
Z1 12BK
C160
Z1 12BK
S116
8W-70-8
Z1 10BK
G105
8W-15-4
Z1 20BK
E2 20OR
E2 20OR
HEATED REAR WINDOW SWITCH
S209
8W-70-15
Z1 20BK
C218
(2)
C218
(3)
E2 20OR
S213
8W-70-16
Z1 16BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G106
8W-15-5
E2 18OR
(6)
(12)
C231 (W/O DRL)
C249 (W/DRL)
PANEL LAMPS DRIVER
I.P. DIMMING MODULE (W/O DRL)
I.P. DIMMING/DRL MODULE (W/DRL)
(LEFT SIDE OF STEERING COLUMN)

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MESSAGE CENTER

CONTENTS

GENERAL INFORMATION

This section of the wiring diagrams is divided into two sub-sections; Vehicle Information Center (VIC), and Graphic Display. When referring to the circuit descriptions or wiring diagrams, ensure that you use the correct sub-section.

VEHICLE INFORMATION CENTER

INDEX

GENERAL INFORMATION

Several fuses supply power to the Vehicle Information Center (VIC). Circuit A4 from fuse 1 in the Power Distribution Center (PDC) feeds circuit F60 through fuse 8 in the fuse block. Circuit F60 supplies battery voltage to the VIC. Circuits A4 and F60 are HOT at all times.

When the ignition switch is in the RUN position it connects circuit A2 from fuse 13 in the PDC to circuit A22. Circuit A22 feeds circuit F83 through fuse 19 in the fuse block. Circuit F83 supplies voltage to the VIC.

Circuit A6 from fuse 10 in the PDC powers circuit 366 through fuse 12 in the fuse block. Circuit 366 connects to the headlamp switch. When the headlamp switch is in the PARK, LOW or LOW/FOG position, it connects circuit 366 to circuit L90. Circuit L90 connects to the VIC. When the VIC senses voltage on circuit L90, it monitors circuit E2 from the interior lamps dimming switch to determine the selected display intensity.

Circuit L5 from the flasher relay connects to the VIC. Circuit L5 powers the turn signal switch circuitry in the multi-function switch.

The VIC receives the vehicle speed sensor signal on circuit G7. The input tells the VIC when the vehicle is moving.

Circuit G81 connects the VIC to the tone circuitry in the chime module.

Circuit Z1 provides ground for the VIC. Circuit Z1 connects to three cavities of the VIC.

US/METRIC DISPLAY

Circuit G25 connects the Vehicle Information Center (VIC) to the US/Metric switch in the overhead console. The switch allows the operator to select the display to appear in either metric or english units of measure.

HELPFUL INFORMATION

- The vehicle is equipped with a two-way connector located behind the VIC. The connector grounds two cavities of the VIC and causes the VIC to display only metric units of measure.
- Circuit G25 also connects to the Automatic Temperature Control (ATC) module (if equipped).

LAMP OUTAGE

Circuit G46 connects from the Lamp Outage Module (LOM) to the Vehicle Information Center (VIC). Circuit G46 supplies the rear lamp out signal to the VIC.

LOW WASHER FLUID WARNING

When the low washer fluid switch closes, it connects circuit G29 from the Vehicle Information Center VIC to ground on circuit Z1. The VIC displays the Low Washer Fluid warning when the switch closes.

LOW ENGINE COOLANT WARNING

When the coolant level switch closes, it connects circuit G18 from the Vehicle Information Center VIC to ground on circuit Z1. The VIC displays the Low Coolant Level warning when the switch closes.

DOOR AJAR DISPLAY

Each door has an ajar switch that connects to the Vehicle Information Center (VIC). When a door opens, the case grounded ajar switch closes and connects the VIC to ground. In response, the VIC displays which door is open.

LIFTGATE AJAR DISPLAY

The liftgate ajar switch and liftgate glass ajar switch connect to the Vehicle Information Center (VIC). When either the liftgate or liftgate glass opens, the ajar switch closes and connects the VIC to ground on circuit Z1. In response, the VIC displays that the lift gate is open.

TRANSFER CASE RANGE DISPLAY

When the transfer case is in either 4WD Low, Part Time 4WD, or Full Time it connects circuit G28 from the Vehicle Information Center (VIC) to ground on circuit Z1. In response, the VIC illuminates the 4WD display.

When the transfer case switch is in 4WD Low, it connects circuit G28 from the VIC to ground on circuit Z1. In addition to illuminating the 4WD display, the VIC also illuminates the LOW display.

When the transfer case switch is in Part Time 4WD position, it connects circuit 107 from the VIC to ground on circuit Z1. In addition to illuminating the 4WD display, the VIC also illuminates the PART TIME display.

When the transfer case switch is in Full Time 4WD position, it connects circuit 106 from the VIC to ground on circuit Z1. In addition to illuminating the 4WD display, the VIC also illuminates the FULL TIME display.

DIAGRAM INDEX

GRAPHIC DISPLAY MODULE

GENERAL INFORMATION

Several fuses supply power to the Graphic Display Module (GDM). When the ignition switch is in the RUN position it connects circuit A2 from fuse 13 in the PDC to circuit A22. Circuit A22 feeds circuit F83 through fuse 19 in the fuse block. Circuit F83 supplies voltage to the GDM.

Circuit A6 from fuse 10 in the PDC powers circuit 366 through fuse 12 in the fuse block. Circuit 366 connects to the headlamp switch. When the headlamp switch is in the PARK, LOW or LOW/FOG position, it connects circuit 366 to circuit L90. Circuit L90 connects to the GDM. When the GDM senses voltage on circuit L90, it monitors circuit E2 from the interior lamps dimming switch to determine the selected display intensity.

Circuit Z1 provides ground for the GDM. Circuit Z1 connects to three cavities of the GDM.

TRANSFER CASE RANGE DISPLAY

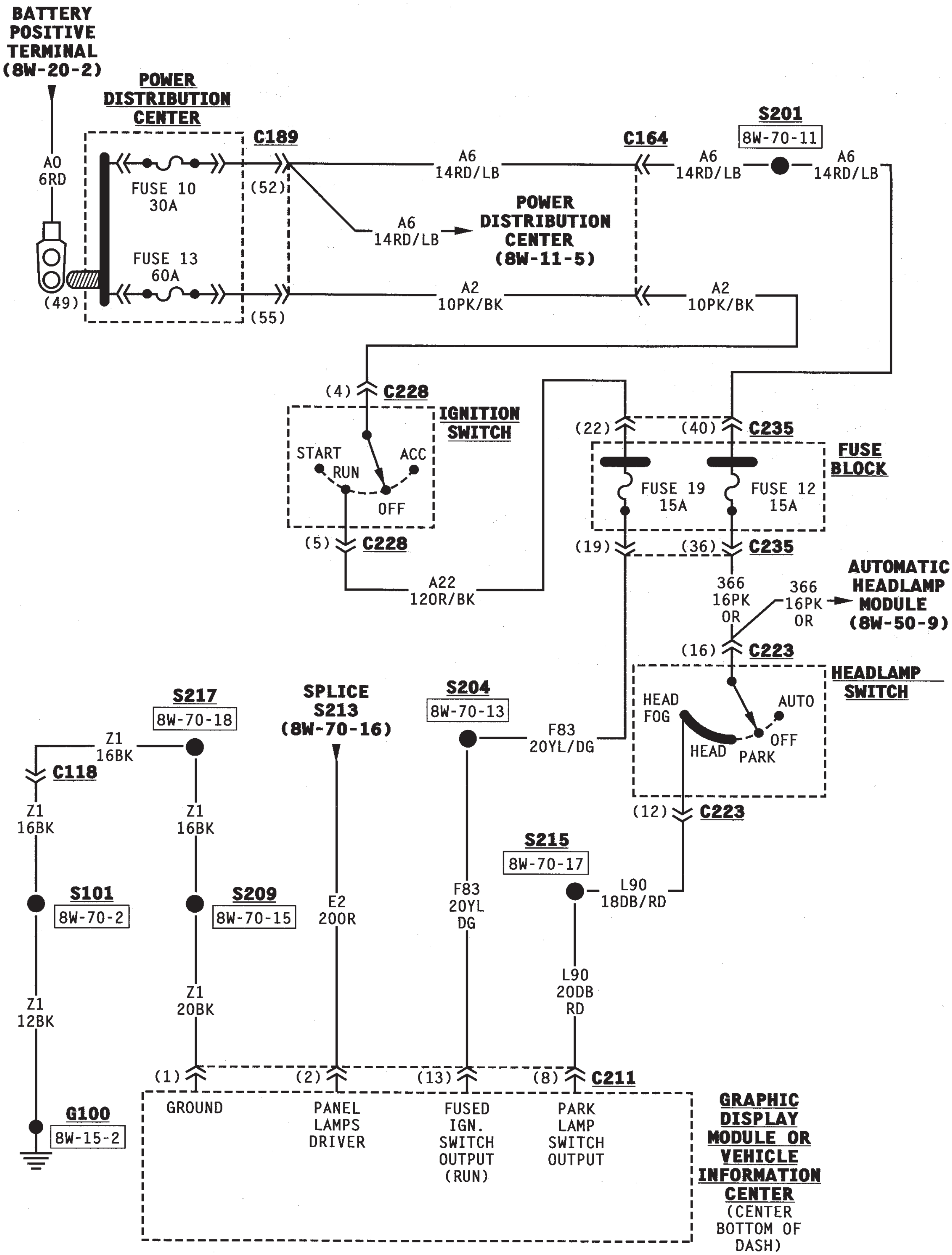
When the transfer case is in either 4WD Low, Part Time 4WD, or Full Time it connects circuit G28 from the Graphic Display Module (GDM) to ground on circuit Z1. In response, the GDM illuminates the 4WD display.

When the transfer case switch is in 4WD Low, it connects circuit G28 from the GDM to ground on circuit Z1. In addition to illuminating the 4WD display, the GDM also illuminates the LOW display.

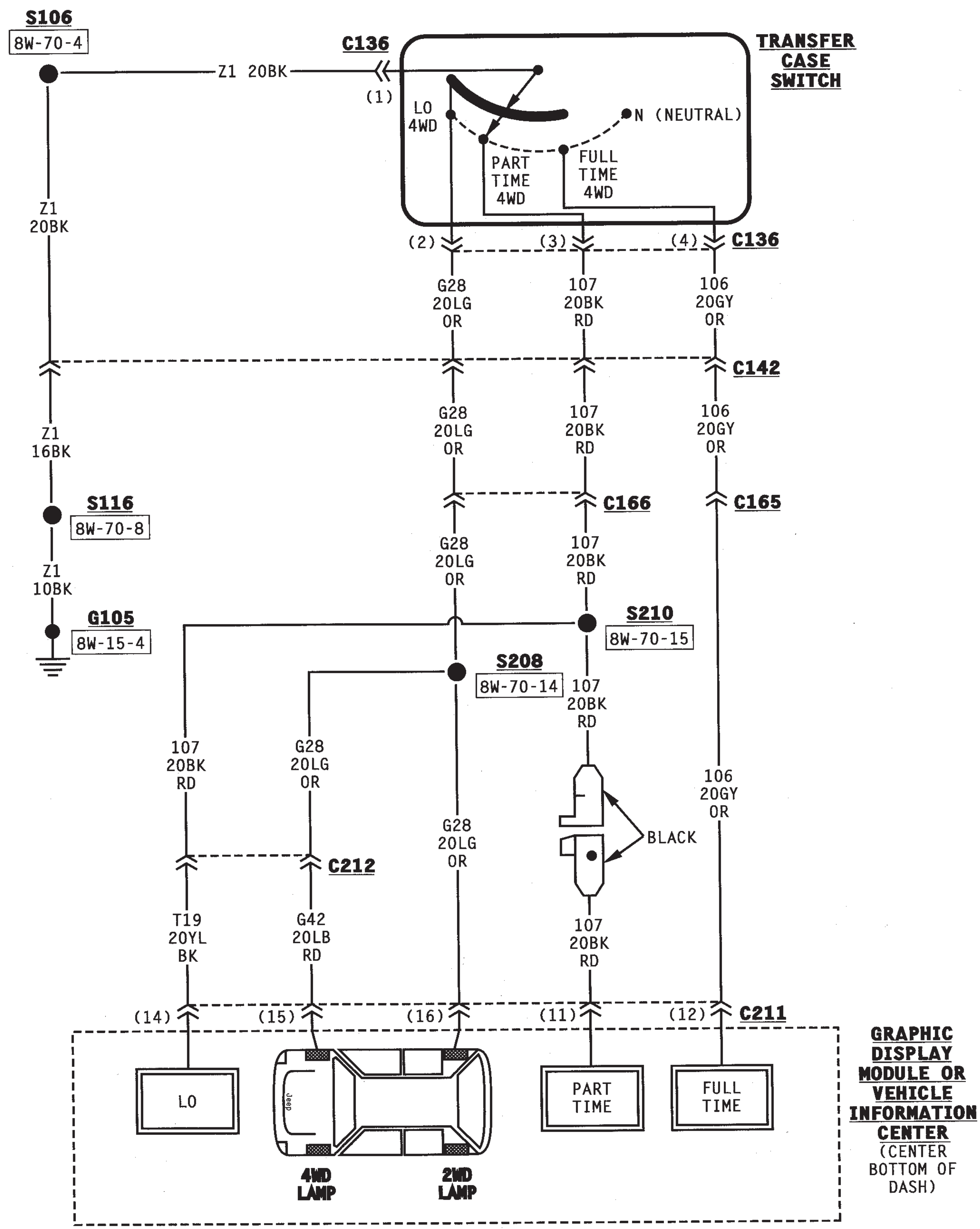
When the transfer case switch is in Part Time 4WD position, it connects circuit 107 from the GDM to ground on circuit Z1. In addition to illuminating the 4WD display, the GDM also illuminates the PART TIME display.

When the transfer case switch is in Full Time 4WD position, it connects circuit 106 from the GDM to ground on circuit Z1. In addition to illuminating the 4WD display, the GDM also illuminates the FULL TIME display.

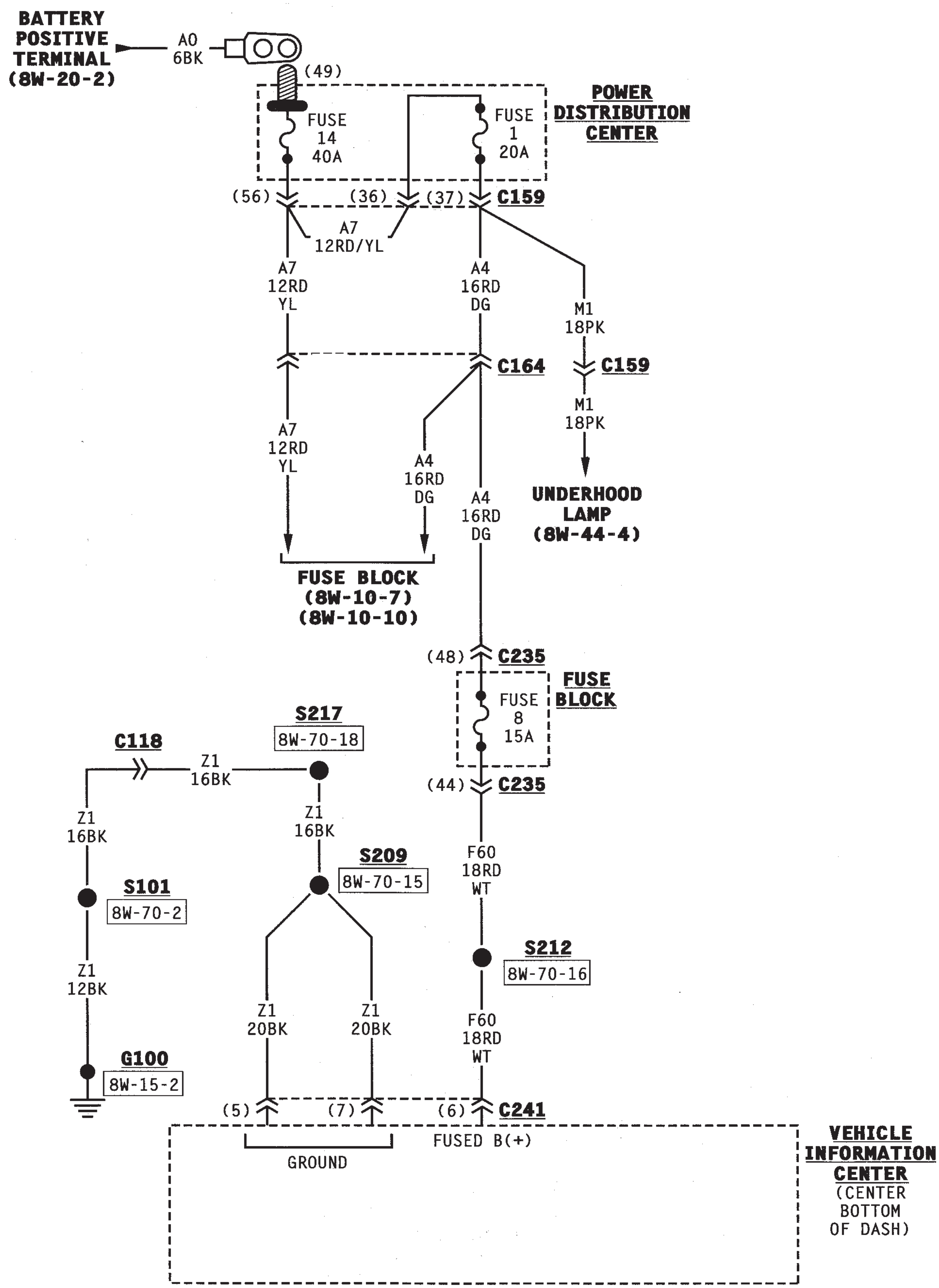
DIAGRAM INDEX


BATTERY
POSITIVE
TERMINAL
(8W-20-2)
POWER
DISTRIBUTION
CENTER
A0
6RD
FUSE 10
30A
FUSE 13
60A
(49)
C189
(52)
(55)
A6
14RD/LB
A6
14RD/LB
POWER
DISTRIBUTION
CENTER
(8W-11-5)
A2
10PK/BK
C164
A6
14RD/LB
A2
10PK/BK
S201
8W-70-11
A6
14RD/LB
(4)
C228
IGNITION
SWITCH
START
RUN
ACC
OFF
(5)
C228
A22
12OR/BK
(22)
(40)
C235
FUSE
BLOCK
FUSE 19
15A
FUSE 12
15A
(19)
(36)
C235
366
16PK
OR
366
16PK
OR
AUTOMATIC
HEADLAMP
MODULE
(8W-50-9)
(16)
C223
HEADLAMP
SWITCH
HEAD
FOG
AUTO
OFF
HEAD
PARK
(12)
C223
S217
8W-70-18
Z1
16BK
C118
Z1
16BK
Z1
16BK
SPLICE
S213
(8W-70-16)
S204
8W-70-13
F83
20YL/DG
S215
8W-70-17
L90
18DB/RD
S101
8W-70-2
S209
8W-70-15
E2
20OR
F83
20YL
DG
Z1
12BK
Z1
20BK
L90
20DB
RD
(1)
(2)
(13)
(8)
C211
GROUND
PANEL
LAMPS
DRIVER
FUSED
IGN.
SWITCH
OUTPUT
(RUN)
PARK
LAMP
SWITCH
OUTPUT
G100
8W-15-2
GRAPHIC
DISPLAY
MODULE OR
VEHICLE
INFORMATION
CENTER
(CENTER
BOTTOM OF
DASH)

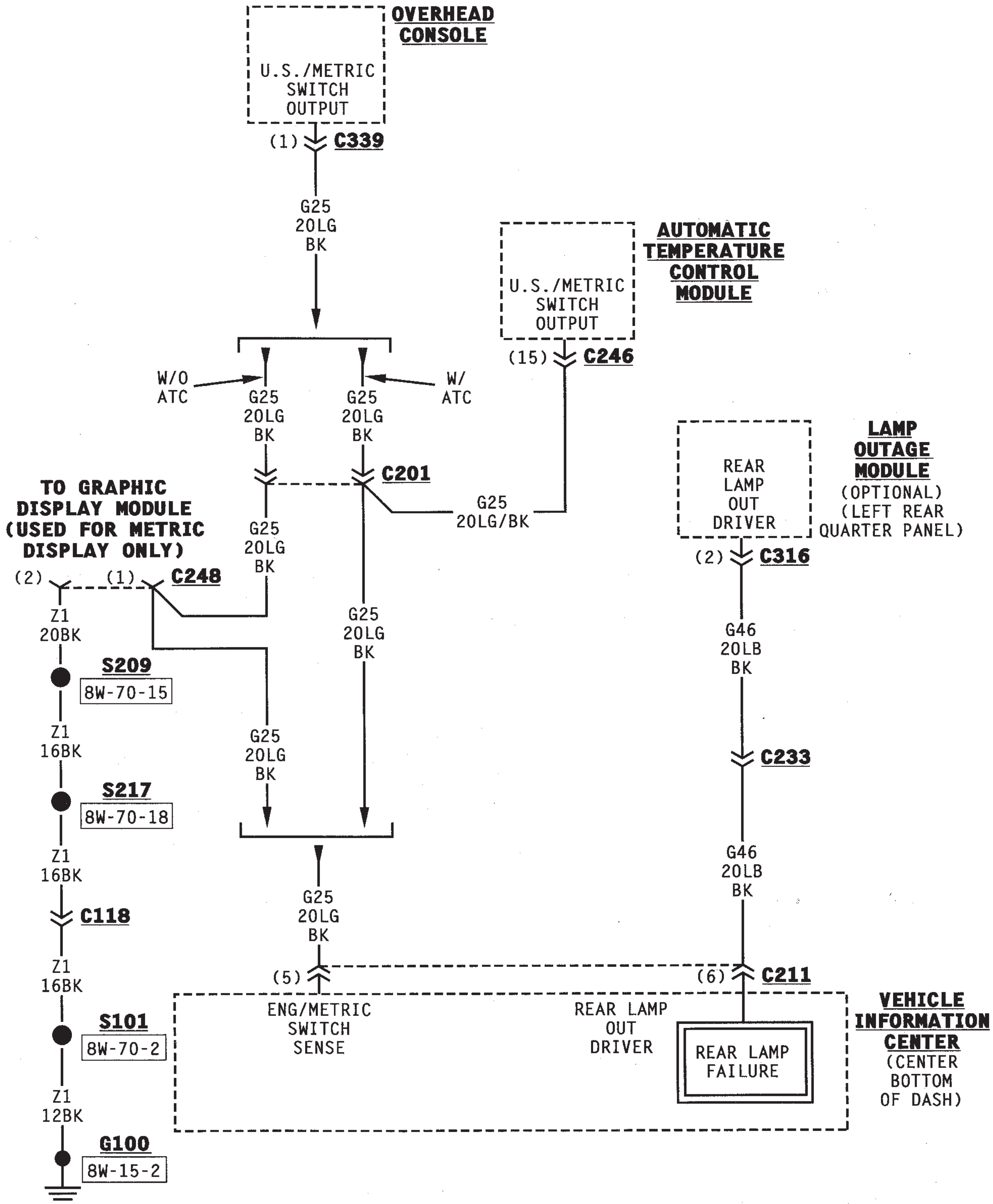
J958W-3

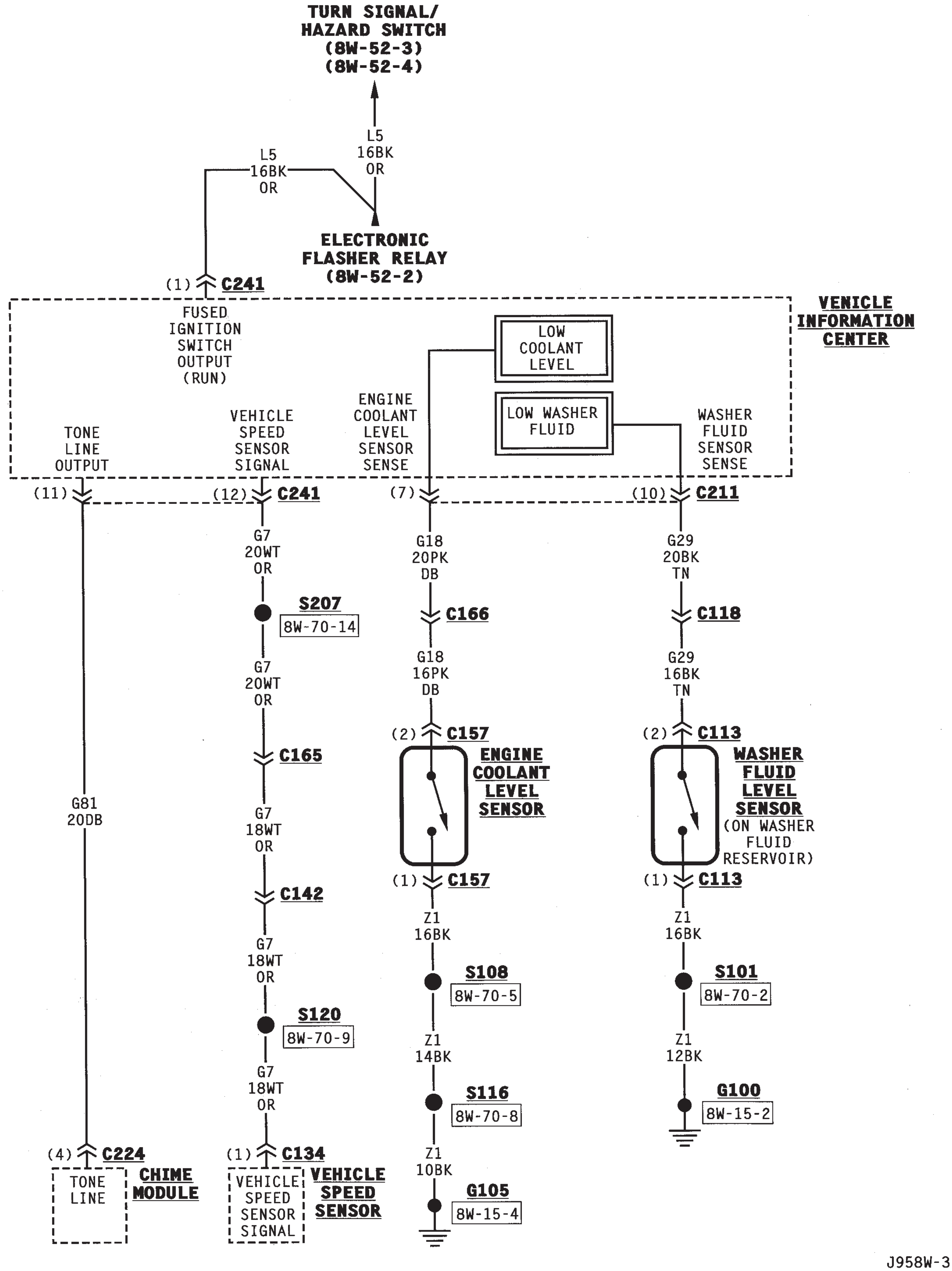

S106
8W-70-4
C136
Z1 20BK
(1)
TRANSFER CASE SWITCH
LO 4WD
N (NEUTRAL)
PART TIME 4WD
FULL TIME 4WD
(2)
(3)
(4)
C136
Z1 20BK
G28 20LG OR
107 20BK RD
106 20GY OR
C142
Z1 16BK
G28 20LG OR
107 20BK RD
106 20GY OR
S116
8W-70-8
C166
C165
Z1 10BK
G28 20LG OR
107 20BK RD
G105
8W-15-4
S210
8W-70-15
S208
8W-70-14
107 20BK RD
107 20BK RD
G28 20LG OR
G28 20LG OR
106 20GY OR
BLACK
C212
T19 20YL BK
G42 20LB RD
107 20BK RD
(14)
(15)
(16)
(11)
(12)
C211
LO
PART TIME
FULL TIME
4WD LAMP
2WD LAMP
GRAPHIC DISPLAY MODULE OR VEHICLE INFORMATION CENTER
(CENTER BOTTOM OF DASH)

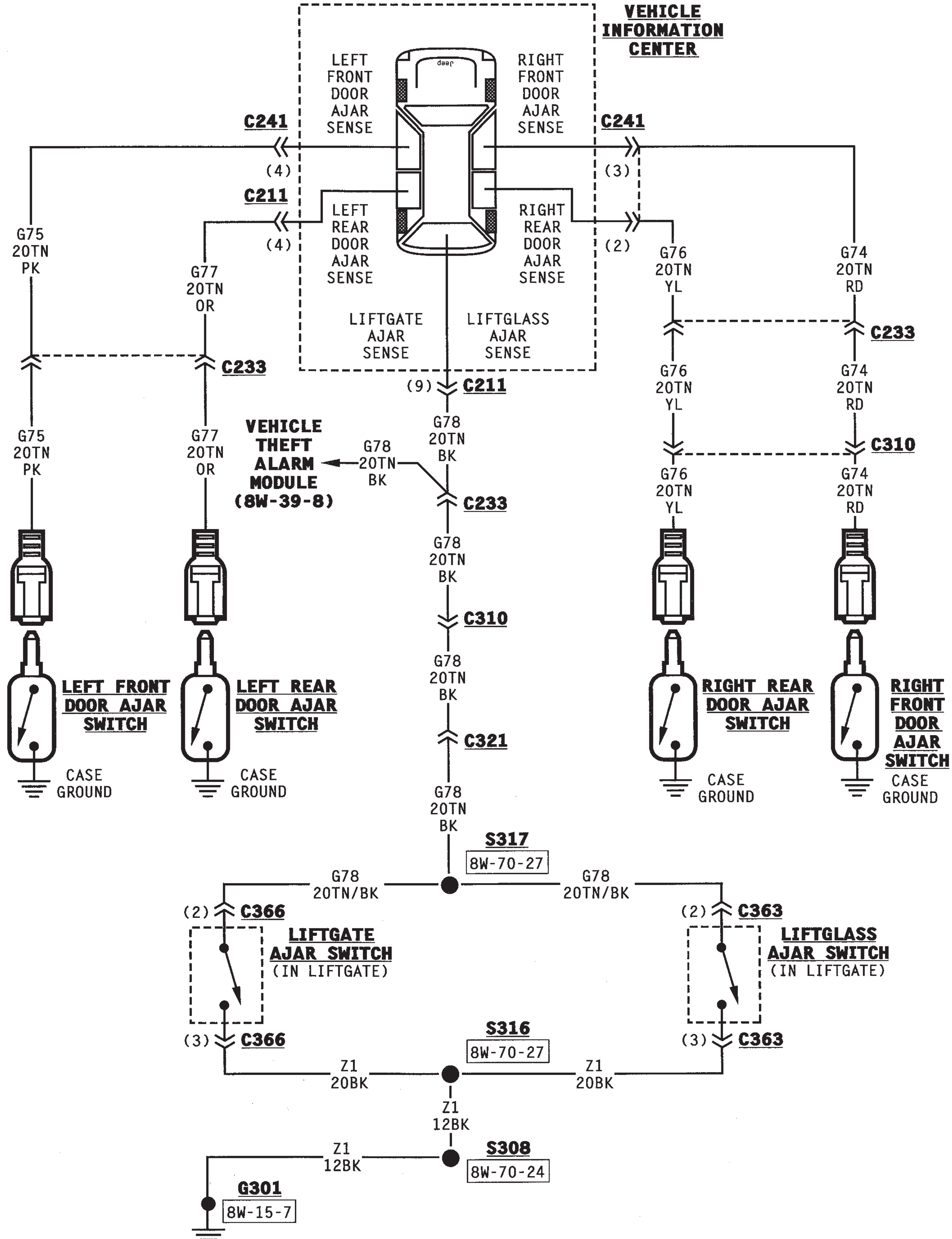
J958W-3


BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A0
6BK
(49)
FUSE
14
40A
FUSE
1
20A
POWER
DISTRIBUTION
CENTER
(56)
(36)
(37)
C159
A7
12RD/YL
A7
12RD
YL
A4
16RD
DG
M1
18PK
C164
C159
M1
18PK
A7
12RD
YL
A4
16RD
DG
A4
16RD
DG
UNDERHOOD
LAMP
(8W-44-4)
FUSE BLOCK
(8W-10-7)
(8W-10-10)
(48)
C235
FUSE
8
15A
FUSE
BLOCK
(44)
C235
S217
8W-70-18
C118
Z1
16BK
Z1
16BK
Z1
16BK
S209
8W-70-15
S101
8W-70-2
F60
18RD
WT
S212
8W-70-16
Z1
12BK
Z1
20BK
Z1
20BK
F60
18RD
WT
G100
8W-15-2
(5)
(7)
(6)
C241
FUSED B(+)
GROUND
VEHICLE
INFORMATION
CENTER
(CENTER
BOTTOM
OF DASH)

J958W-3


OVERHEAD CONSOLE
U.S./METRIC SWITCH OUTPUT
(1) C339
G25 20LG BK
W/O ATC
W/ ATC
G25 20LG BK
G25 20LG BK
C201
AUTOMATIC TEMPERATURE CONTROL MODULE
U.S./METRIC SWITCH OUTPUT
(15) C246
G25 20LG/BK
TO GRAPHIC DISPLAY MODULE (USED FOR METRIC DISPLAY ONLY)
(2) (1) C248
G25 20LG BK
Z1 20BK
S209
8W-70-15
Z1 16BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
G25 20LG BK
G25 20LG BK
G25 20LG BK
LAMP OUTAGE MODULE (OPTIONAL) (LEFT REAR QUARTER PANEL)
REAR LAMP OUT DRIVER
(2) C316
G46 20LB BK
C233
G46 20LB BK
(5)
(6) C211
ENG/METRIC SWITCH SENSE
REAR LAMP OUT DRIVER
REAR LAMP FAILURE
VEHICLE INFORMATION CENTER (CENTER BOTTOM OF DASH)


TURN SIGNAL/
HAZARD SWITCH
(8W-52-3)
(8W-52-4)
L5
16BK
OR
L5
16BK
OR
ELECTRONIC
FLASHER RELAY
(8W-52-2)
(1) C241
VENICLE
INFORMATION
CENTER
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
LOW
COOLANT
LEVEL
LOW WASHER
FLUID
TONE
LINE
OUTPUT
VEHICLE
SPEED
SENSOR
SIGNAL
ENGINE
COOLANT
LEVEL
SENSOR
SENSE
WASHER
FLUID
SENSOR
SENSE
(11)
(12) C241
(7)
(10) C211
G7
20WT
OR
G18
20PK
DB
G29
20BK
TN
S207
8W-70-14
C166
C118
G7
20WT
OR
G18
16PK
DB
G29
16BK
TN
(2) C157
(2) C113
C165
ENGINE
COOLANT
LEVEL
SENSOR
WASHER
FLUID
LEVEL
SENSOR
(ON WASHER
FLUID
RESERVOIR)
G81
20DB
G7
18WT
OR
(1) C157
(1) C113
C142
Z1
16BK
Z1
16BK
G7
18WT
OR
S108
8W-70-5
S101
8W-70-2
S120
8W-70-9
Z1
14BK
Z1
12BK
G7
18WT
OR
S116
8W-70-8
G100
8W-15-2
(4) C224
(1) C134
Z1
10BK
TONE
LINE
CHIME
MODULE
VEHICLE
SPEED
SENSOR
SIGNAL
VEHICLE
SPEED
SENSOR
G105
8W-15-4
J958W-3


VEHICLE INFORMATION CENTER
LEFT FRONT DOOR AJAR SENSE
RIGHT FRONT DOOR AJAR SENSE
LEFT REAR DOOR AJAR SENSE
RIGHT REAR DOOR AJAR SENSE
LIFTGATE AJAR SENSE
LIFTGLASS AJAR SENSE
C241
(4)
(3)
C211
(4)
(2)
(9)
G75 20TN PK
G77 20TN OR
G76 20TN YL
G74 20TN RD
C233
C310
C321
G78 20TN BK
VEHICLE THEFT ALARM MODULE (8W-39-8)
LEFT FRONT DOOR AJAR SWITCH
LEFT REAR DOOR AJAR SWITCH
RIGHT REAR DOOR AJAR SWITCH
RIGHT FRONT DOOR AJAR SWITCH
CASE GROUND
S317
8W-70-27
G78 20TN/BK
C366
C363
LIFTGATE AJAR SWITCH (IN LIFTGATE)
LIFTGLASS AJAR SWITCH (IN LIFTGATE)
S316
8W-70-27
Z1 20BK
Z1 12BK
S308
8W-70-24
G301
8W-15-7

J958W-3

AUDIO SYSTEMS

INDEX

RADIO OPERATION

There are two audio systems offered on this vehicle. The standard system uses four speakers and a standard antenna. The optional system has six speakers, power amplifier, and a power antenna.

Both systems are powered by circuit X12 from the 10 amp fuse located in cavity 10 of the fuse block. This fuse is HOT when the ignition switch is in the ACCESSORY or RUN position.

Power for the fuse is supplied on circuit A31 from the ignition switch. Power for the A31 circuit is supplied by circuit A1 from the Power Distribution Center (PDC). The A1 circuit is protected by a 40 amp fuse located in cavity 12 of the PDC.

The standard and optional radios use an external ground.

RADIO MEMORY

Both the standard and optional radios are connected to the Ignition-Off Draw (IOD) fuse located in the Power Distribution Center (PDC) cavity 1. The IOD fuse is a 20 amp and supplies power to fuse 5 and fuse 8 in the fuse block on circuit A4. From fuse 8, circuit F60 supplies power to the radio.

For additional information on the IOD fuse, refer to section 8W-10. The IOD fuse is removed during vehicle shipping to prevent excessive battery draw.

RADIO ILLUMINATION

When the parking lamps or the headlamps are ON, circuits E2 and L90 are used to power the radio illumination lamps. Circuit E2 is used for the dimmable lamps. Circuit L90 is the parking lamps feed.

SPEAKERS—STANDARD RADIO

The standard radio uses four speakers. Circuit X53 feeds the speaker in the left front door. Circuit X55 is the return from the speaker to the radio.

Circuit X54 feeds the right front door speaker. Circuit X56 is the return from the speaker to the radio.

From the radio, circuit X51 connects to circuit X52 at the jumper harness for the left rear door speaker. Circuit X51 and X52 feed the speaker. Circuit X58 from the speaker jumper harness connects to circuit X57. Circuit X57 is the return from the speaker to the radio.

Circuit X52 feeds the right rear door speaker. Circuit X58 is the return from the speaker to the radio. Circuits X52 and X58 continue through the jumper harness to the right rear door speaker.

POWER AMPLIFIER AND SPEAKERS

The power amplifier is used on the optional system only. It is connected between the radio and the speakers. Circuit F75 from fuse 4 in the fuse block supplies battery voltage to the radio amplifier. Circuit Z1 provides ground for the amplifier. Circuit X64 which connects to circuit X60 from the radio at the power antenna relay, supplies voltage to the amplifier.

From the radio, circuits X54 and X56 for the right front speaker and the tweeter in the right side of the instrument panel, connect to the power amplifier. Circuit X54 is the feed from the radio to the amplifier. Circuit X82 is the feed from the amplifier to the right tweeter and right front door speaker. Circuit X80 is the return from the tweeter and speaker to the amplifier and circuit X56 is the return from the amplifier to the radio. Circuits X80 and X82 from the amplifier connect to circuits X56 and X54 at the jumper harness for the right front door speaker.

For the left front door speaker and the tweeter in the left side of the instrument panel, circuits X53 and X55 from the radio connect to the power amplifier. Circuit X53 is the feed from the radio to the amplifier. Circuit X87 is the feed from the amplifier to the left tweeter and left front door speaker. Circuit X85 is the return from the tweeter and speaker to the amplifier and circuit X55 is the return from the amplifier to the radio. Circuits X87 and X85 from the amplifier connect to circuits X55 and X53 at the jumper harness for the left front door speaker.

Circuit X51, the feed for the left rear door speaker and circuit X57, the return for the speaker, connect from the radio to the power amplifier. At the jumper harness for the left rear door speaker, circuit X93 from the amplifier connects to circuit X52 and circuit X91 connects to circuit X58. Circuits X93 and X52 feed the speaker. The speaker return is on Circuit X58 and circuit X91.

Circuit X52, the feed for the right rear door speaker and circuit X58, the return for the speaker, connect from the radio to the power amplifier. At the jumper harness for the right door speaker, circuit X94 from the amplifier connects to circuit X52 and circuit X92 connects to circuit X58. Circuits X94 and X52 feed the speaker. The speaker return is on circuits X58 and X92.

POWER ANTENNA

The power antenna relay supplies voltage to the power antenna motor. A switch in the relay supplies voltage to the antenna motor to either raise or lower the antenna.

Circuit A7 from fuse 14 in the Power Distribution Center (PDC) supplies battery voltage to circuit A18 through fuse 1 in the fuse block. Circuit A18 supplies power to the switch inside the power antenna relay.

When the radio is OFF, the switch in the power antenna relay is in the DOWN position. In DOWN position, the switch connects circuit A18 to circuit X14. Circuit X14 supplies voltage to power antenna motor to lower the antenna. The ground path is from the motor to the relay on circuit X16, through the switch in the relay to ground on circuit Z1.

Circuit Z1 provides ground for the coil side of the power antenna relay. When the radio is turned ON, circuit X60 from the radio supplies power to the coil side of relay and the relay switches to the UP position. In the UP position, the switch connects circuit A18 to circuit X16. Circuit X16 supplies voltage to power antenna motor to raise the antenna. The ground path is from the motor to the relay on circuit X17, through the switch in the relay to ground on circuit Z1.

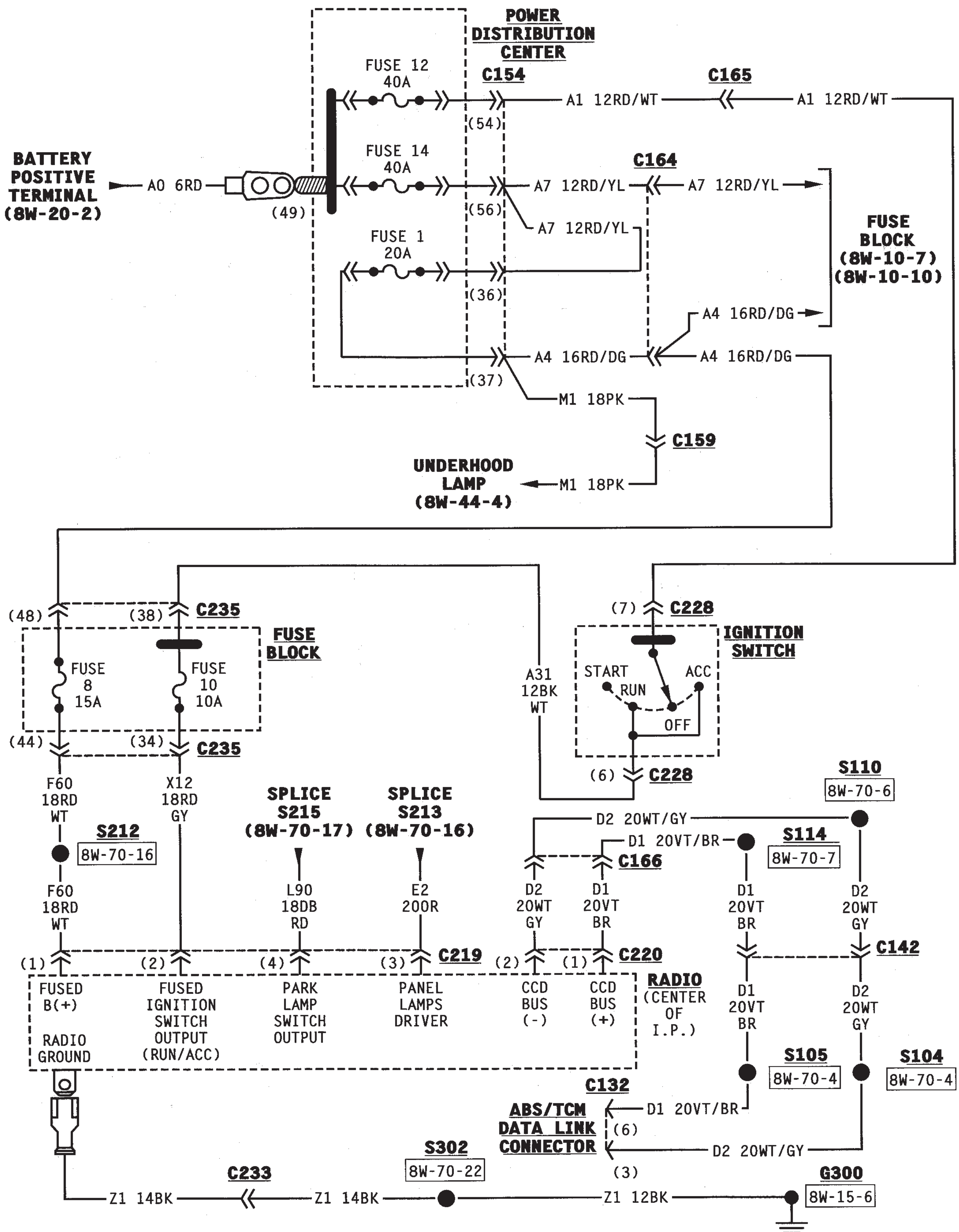
HELPFUL INFORMATION

At the power antenna relay, circuit X60 connects to circuit X64. Circuit X64 connects to the radio amplifier.

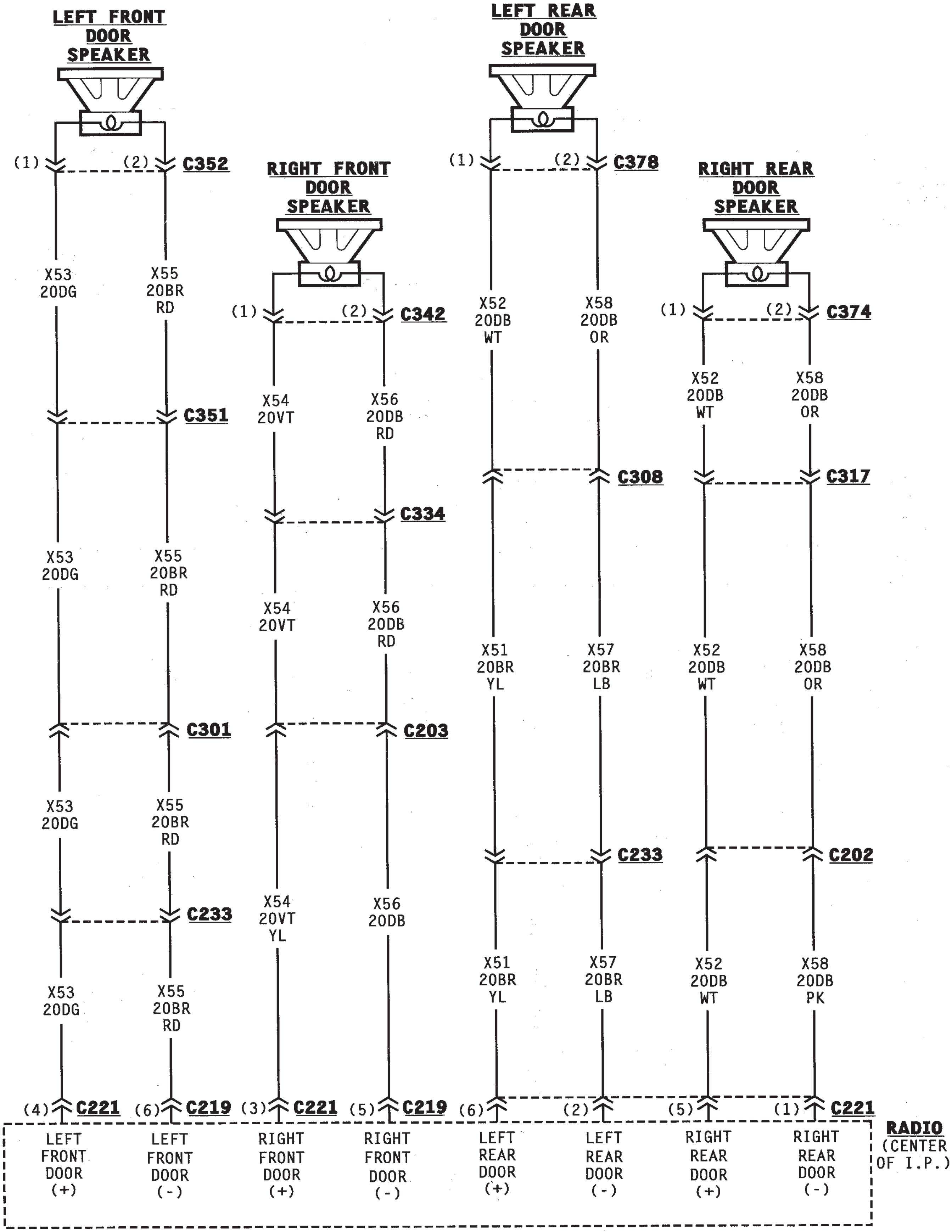
Although the radio is connected to the CCD bus, it does not transmit or receive data during this model year.

DIAGRAM INDEX

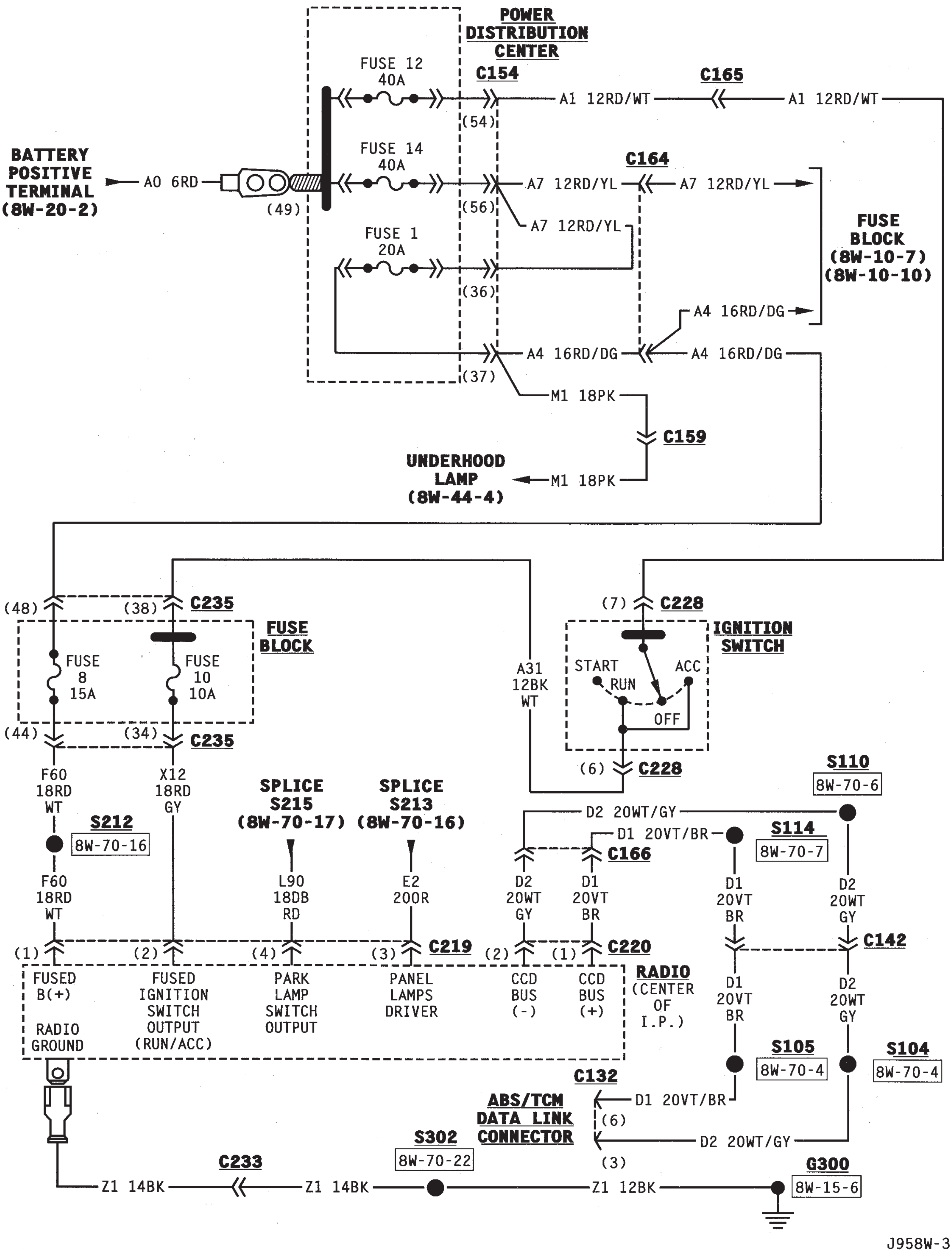
STANDARD RADIO



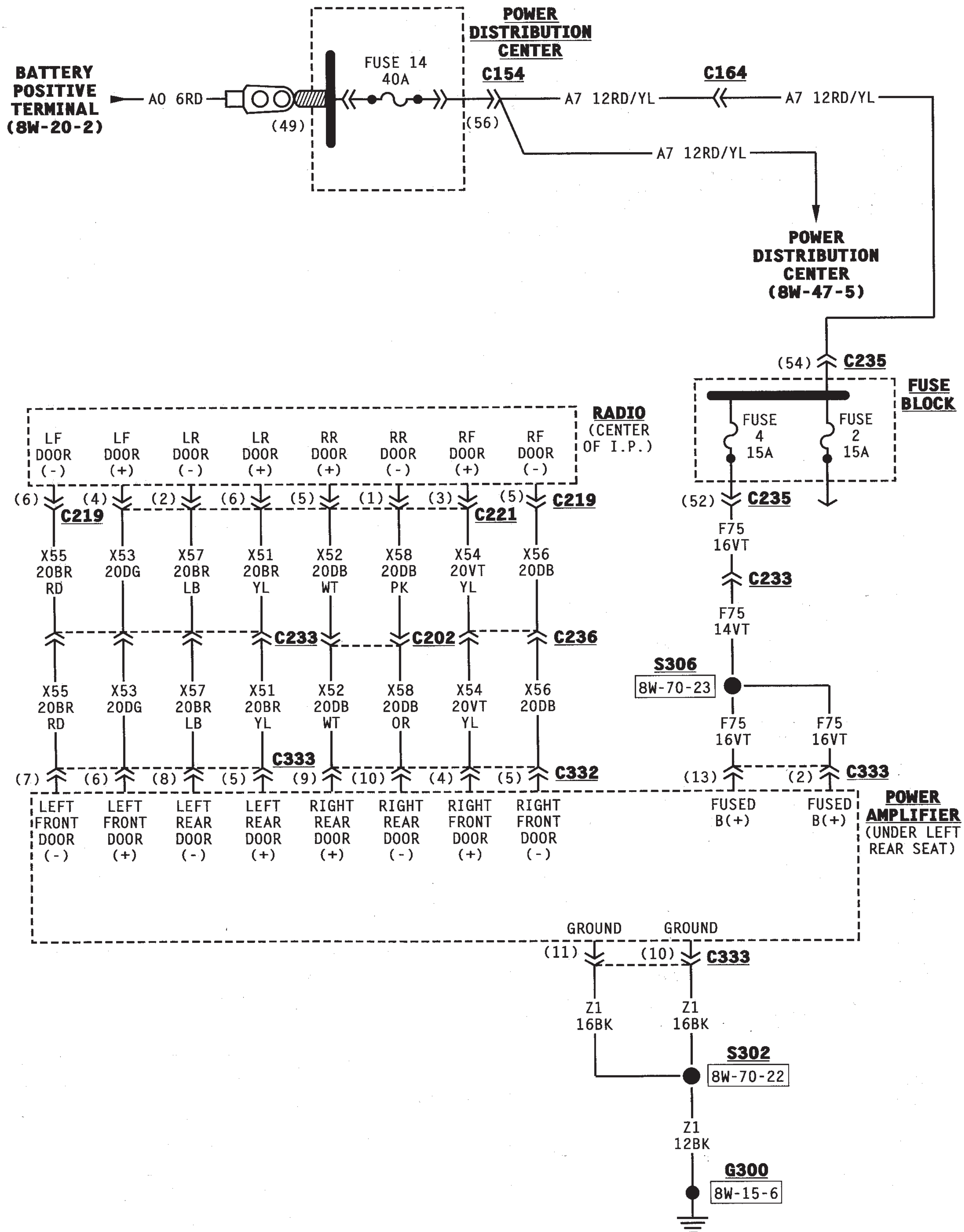
J958W-3


LEFT FRONT DOOR SPEAKER
LEFT REAR DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
(1)
(2)
C352
C378
C342
C374
C351
C308
C317
C334
C301
C203
C233
C202
C221
C219
X53 20DG
X55 20BR RD
X54 20VT
X56 20DB RD
X52 20DB WT
X58 20DB OR
X51 20BR YL
X57 20BR LB
X54 20VT YL
X56 20DB
X58 20DB PK
(4)
(6)
(3)
(5)
LEFT FRONT DOOR (+)
LEFT FRONT DOOR (-)
RIGHT FRONT DOOR (+)
RIGHT FRONT DOOR (-)
LEFT REAR DOOR (+)
LEFT REAR DOOR (-)
RIGHT REAR DOOR (+)
RIGHT REAR DOOR (-)
RADIO (CENTER OF I.P.)

J958W-3

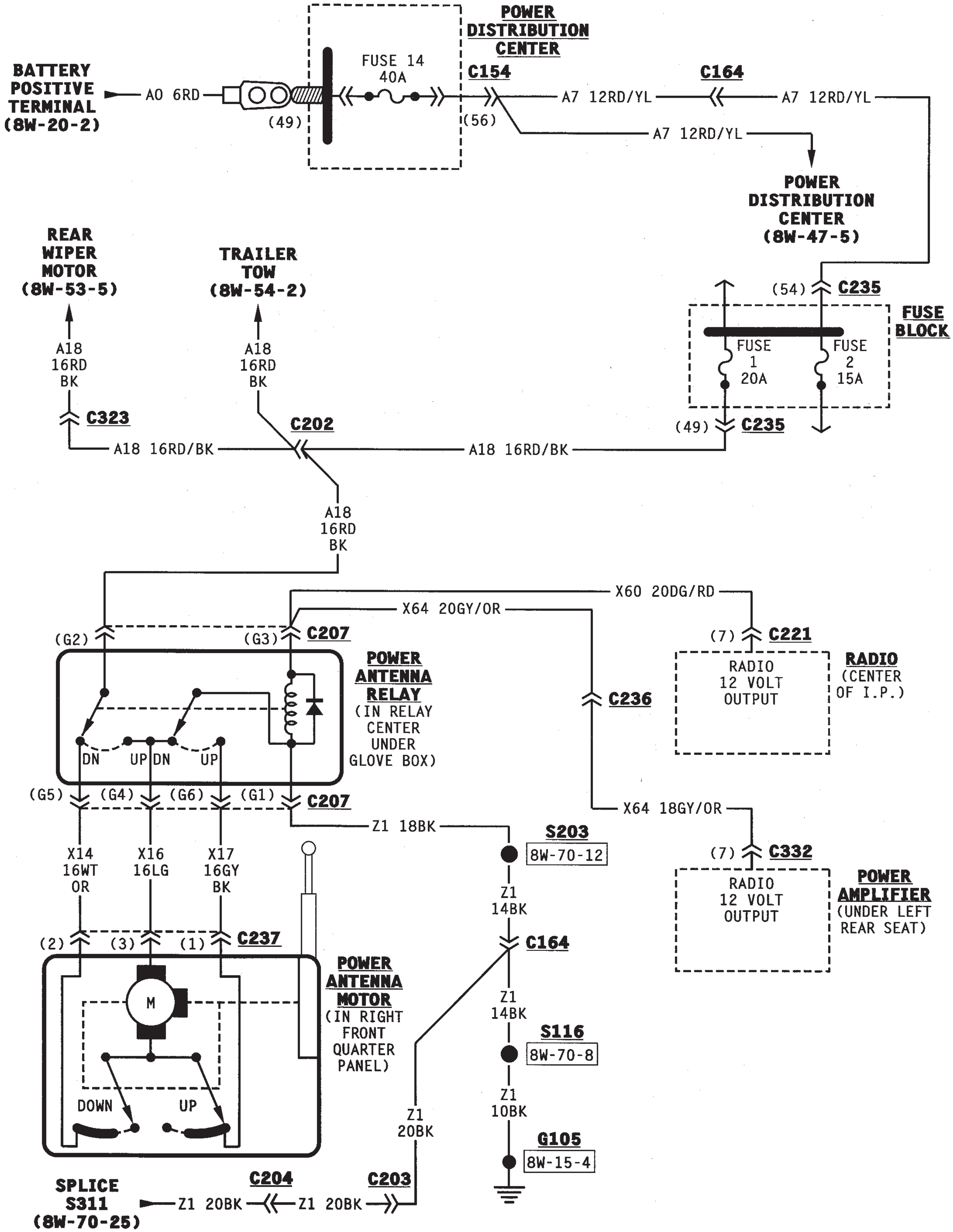

POWER DISTRIBUTION CENTER
FUSE 12 40A
FUSE 14 40A
FUSE 1 20A
C154
(54)
(56)
(36)
(37)
(49)
C165
A1 12RD/WT
A1 12RD/WT
C164
A7 12RD/YL
A7 12RD/YL
A7 12RD/YL
A4 16RD/DG
A4 16RD/DG
A4 16RD/DG
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
FUSE BLOCK (8W-10-7) (8W-10-10)
M1 18PK
C159
UNDERHOOD LAMP (8W-44-4)
M1 18PK
(48)
(38)
C235
FUSE BLOCK
FUSE 8 15A
FUSE 10 10A
(44)
(34)
C235
(7)
C228
IGNITION SWITCH
START
RUN
ACC
OFF
(6)
C228
A31 12BK WT
F60 18RD WT
X12 18RD GY
S212
8W-70-16
F60 18RD WT
SPLICE S215 (8W-70-17)
SPLICE S213 (8W-70-16)
L90 18DB RD
E2 20OR
D2 20WT/GY
D1 20VT/BR
C166
S110
8W-70-6
S114
8W-70-7
D2 20WT GY
D1 20VT BR
D1 20VT BR
D2 20WT GY
(1)
(2)
(4)
(3)
C219
(2)
(1)
C220
C142
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN/ACC)
PARK LAMP SWITCH OUTPUT
PANEL LAMPS DRIVER
CCD BUS (-)
CCD BUS (+)
RADIO (CENTER OF I.P.)
RADIO GROUND
D1 20VT BR
D2 20WT GY
S105
8W-70-4
S104
8W-70-4
C132
ABS/TCM DATA LINK CONNECTOR
D1 20VT/BR
(6)
D2 20WT/GY
(3)
S302
8W-70-22
C233
Z1 14BK
Z1 14BK
Z1 12BK
G300
8W-15-6
J958W-3

PREMIUM RADIO



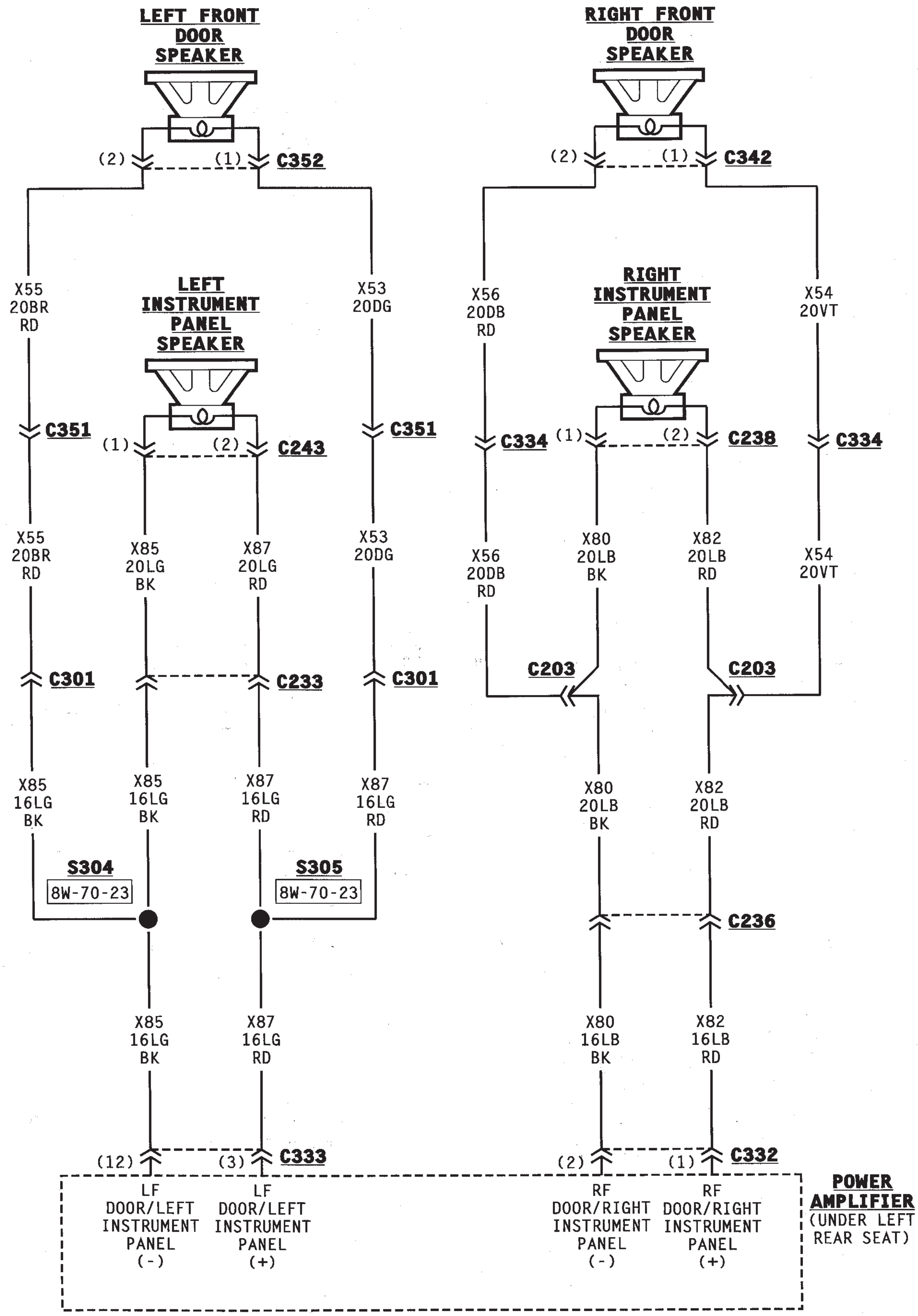
J958W-3

PREMIUM RADIO

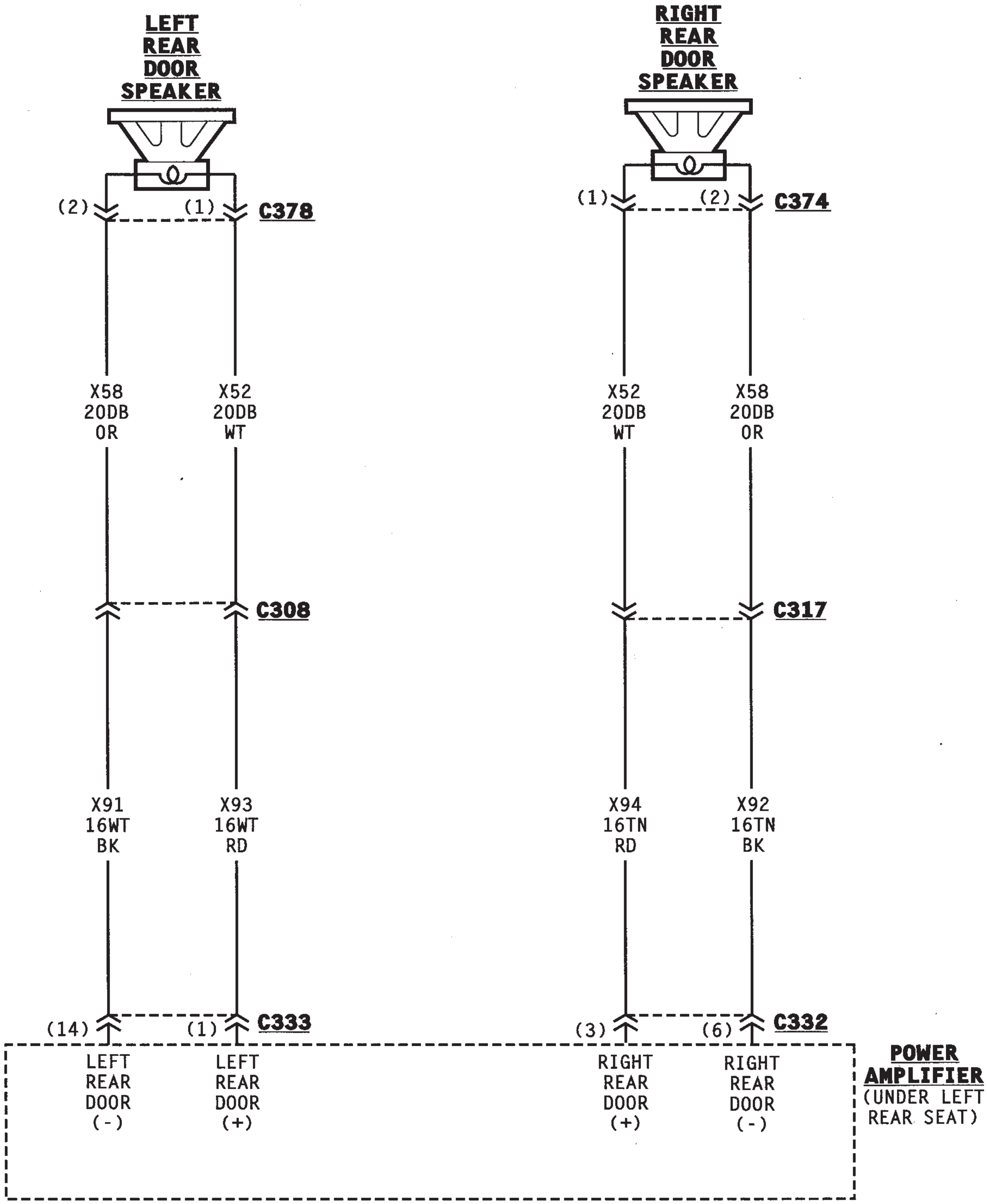


J958W-3

PREMIUM RADIO



J958W-3


LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
(2)
(1)
C378
(1)
(2)
C374
X58
20DB
OR
X52
20DB
WT
X52
20DB
WT
X58
20DB
OR
C308
C317
X91
16WT
BK
X93
16WT
RD
X94
16TN
RD
X92
16TN
BK
(14)
(1)
C333
(3)
(6)
C332
LEFT REAR DOOR (-)
LEFT REAR DOOR (+)
RIGHT REAR DOOR (+)
RIGHT REAR DOOR (-)
POWER AMPLIFIER
(UNDER LEFT REAR SEAT)

HEATED REAR WINDOW

HEATED REAR WINDOW

The heated rear window relay, located in the relay center under the glove box, supplies power to heated rear window grid. When the operator depresses the heated rear window switch, the contacts inside the switch momentarily close and circuit C80 connects the relay timer to ground on circuit Z1. This causes the relay to change state and complete a circuit to energize the coil side of the relay and start the relay timer. Circuit F83 from fuse 19, a 15 amp, in the fuse block supplies voltage to the coil and contact sides of the relay. Circuit Z1 provides ground for the relay.

When the heated rear window relay energizes, the contacts inside the relay close and connect circuit F83 to circuit C15. Fuse 19, a 15 amp, in the fuse block protects circuit F83.

Power for the relay is supplied on circuit F82. This circuit is protected by a 30 amp circuit breaker located in cavity 28 of the fuse block. Power for the circuit breaker is supplied on circuit A7 from the Power Distribution Center (PDC). The A7 circuit is protected by a 40 amp fuse located in cavity 14.

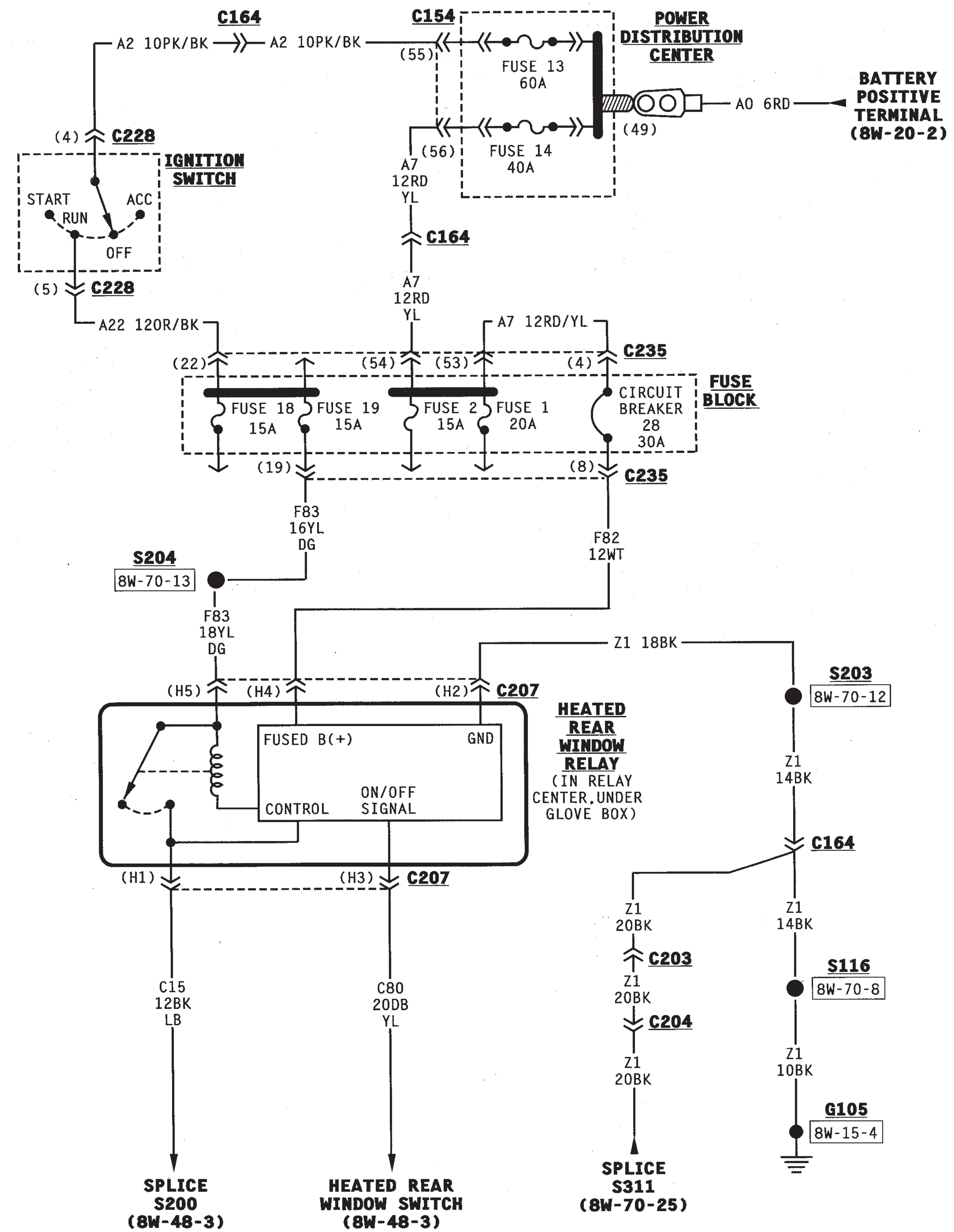
Circuit C15 is spliced in the instrument panel harness and supplies voltage from the closed contacts in the switch to the heated rear window grid, the heaters in the power mirrors, and the Light Emitting Diode (LED) in the switch.

Ground for the heated rear window grid is supplied on circuit Z1.

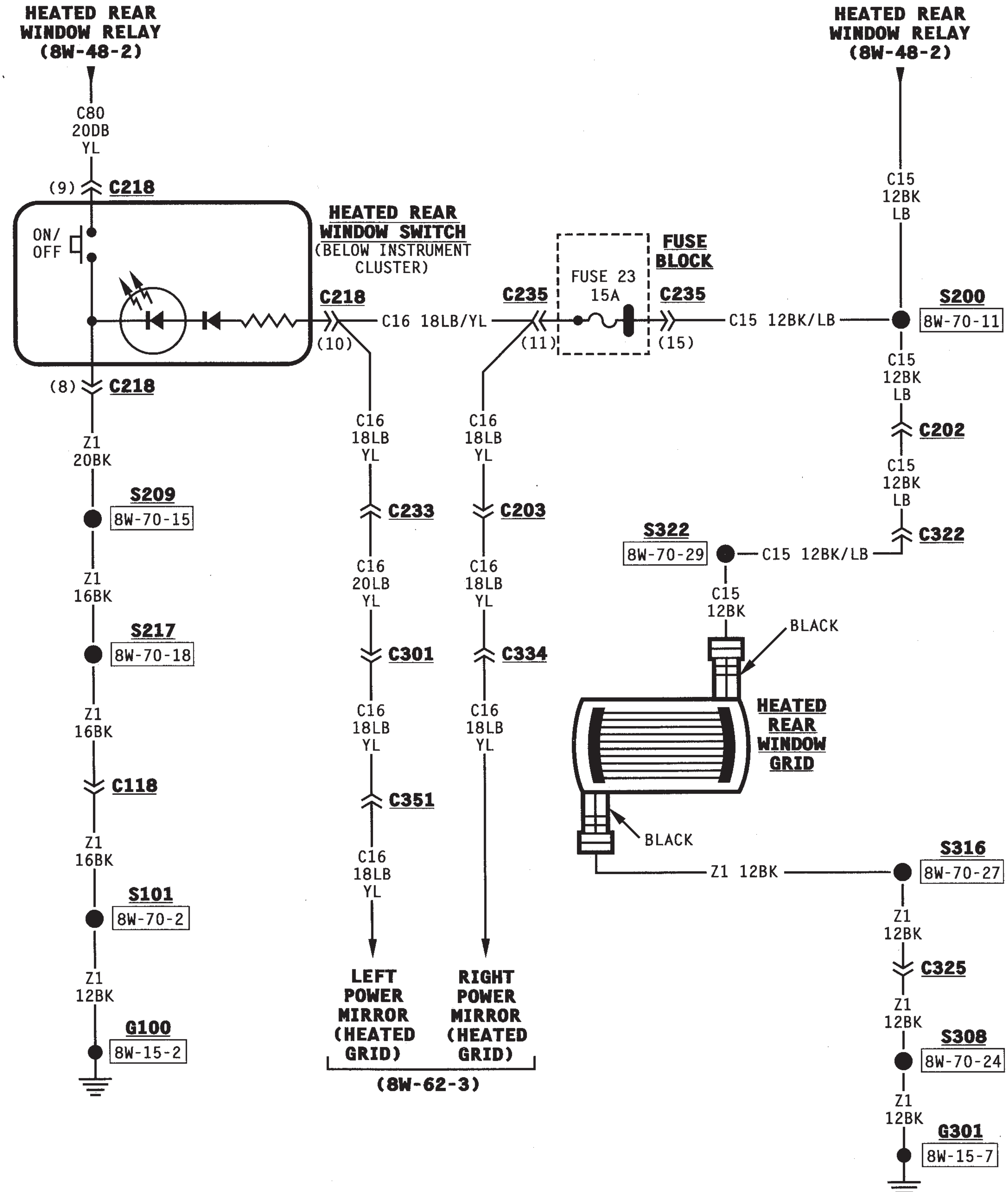
HELPFUL INFORMATION

- When the ignition switch is in the START or RUN positions, it connects circuit A2 from fuse 13, a 60 amp, in the PDC to circuit A22. Circuit A22 supplies battery voltage to the fuse block bus bar that powers circuit F83 through the fuse in cavity 19.
- Circuit A7 from PDC fuse 14, a 40 amp, supplies battery voltage to the fuse block bus bar that feeds the 30 amp circuit breaker in fuse cavity 28.
- Check for broken grid lines on the window.
- Check for a broken bus bar or disconnected leads at the rear window.

DIAGRAM INDEX


C164
A2 10PK/BK
A2 10PK/BK
C154
(55)
POWER DISTRIBUTION CENTER
FUSE 13 60A
FUSE 14 40A
(56)
(49)
A0 6RD
BATTERY POSITIVE TERMINAL (8W-20-2)
(4) C228
IGNITION SWITCH
START
RUN
ACC
OFF
(5) C228
A22 12OR/BK
A7 12RD YL
C164
A7 12RD YL
A7 12RD/YL
(22)
(54)
(53)
(4)
C235
FUSE 18 15A
FUSE 19 15A
FUSE 2 15A
FUSE 1 20A
CIRCUIT BREAKER 28 30A
FUSE BLOCK
(19)
(8)
C235
F83 16YL DG
F82 12WT
S204
8W-70-13
F83 18YL DG
Z1 18BK
(H5)
(H4)
(H2)
C207
S203
8W-70-12
FUSED B(+)
GND
CONTROL
ON/OFF SIGNAL
HEATED REAR WINDOW RELAY
(IN RELAY CENTER,UNDER GLOVE BOX)
Z1 14BK
C164
(H1)
(H3)
C207
Z1 20BK
Z1 14BK
C203
Z1 20BK
S116
8W-70-8
C204
Z1 20BK
Z1 10BK
G105
8W-15-4
C15 12BK LB
C80 20DB YL
SPLICE S200 (8W-48-3)
HEATED REAR WINDOW SWITCH (8W-48-3)
SPLICE S311 (8W-70-25)

J958W-3


HEATED REAR
WINDOW RELAY
(8W-48-2)
C80
20DB
YL
(9)
C218
ON/
OFF
HEATED REAR
WINDOW SWITCH
(BELOW INSTRUMENT
CLUSTER)
C218
(10)
C16 18LB/YL
C235
(11)
FUSE 23
15A
FUSE
BLOCK
C235
(15)
C15 12BK/LB
S200
8W-70-11
HEATED REAR
WINDOW RELAY
(8W-48-2)
C15
12BK
LB
(8)
C218
Z1
20BK
S209
8W-70-15
Z1
16BK
S217
8W-70-18
Z1
16BK
C118
Z1
16BK
S101
8W-70-2
Z1
12BK
G100
8W-15-2
C16
18LB
YL
C233
C16
20LB
YL
C301
C16
18LB
YL
C351
C16
18LB
YL
LEFT
POWER
MIRROR
(HEATED
GRID)
C16
18LB
YL
C203
C16
18LB
YL
C334
C16
18LB
YL
RIGHT
POWER
MIRROR
(HEATED
GRID)
(8W-62-3)
C15
12BK
LB
C202
C15
12BK
LB
C322
S322
8W-70-29
C15 12BK/LB
C15
12BK
BLACK
HEATED
REAR
WINDOW
GRID
BLACK
Z1 12BK
S316
8W-70-27
Z1
12BK
C325
Z1
12BK
S308
8W-70-24
Z1
12BK
G301
8W-15-7

OVERHEAD CONSOLE

INDEX

OVERHEAD CONSOLE

When the ignition switch is in the RUN position, it connects circuit A2 from fuse 13 in the Power Distribution Center (PDC) to circuit A22. Circuit A22 supplies power to circuit F83 through fuse 19 in the fuse block. Circuit F83 supplies power to the overhead console.

When the headlamps or parking lamps are ON, circuits L90 and E2 provide voltage to the overhead console for illumination. Voltage on circuit L90 informs the overhead console that the headlamps or parking lamps are ON. Circuit E2 from the dimming module (or dimming/DRL module on Canadian vehicles) powers the illumination lamps in the overhead console.

Circuit G44 from the fuel level sending unit sends the fuel level signal to the overhead console. Circuit Z2 provides ground for the overhead console and the fuel level sending unit.

US/METRIC SWITCH

If the vehicle is equipped with Automatic Temperature Control (ATC), circuit G25 from the US/Metric switch in the overhead console connects to the ATC module (Fig. 1). Circuit G25 also connects to the graphic display module or vehicle information center (if equipped).

If the vehicle is not equipped with ATC, circuit G25 connects to a connector that when connected, causes the overhead console to display metric units only. Refer to Group 8W-C, Overhead Console.

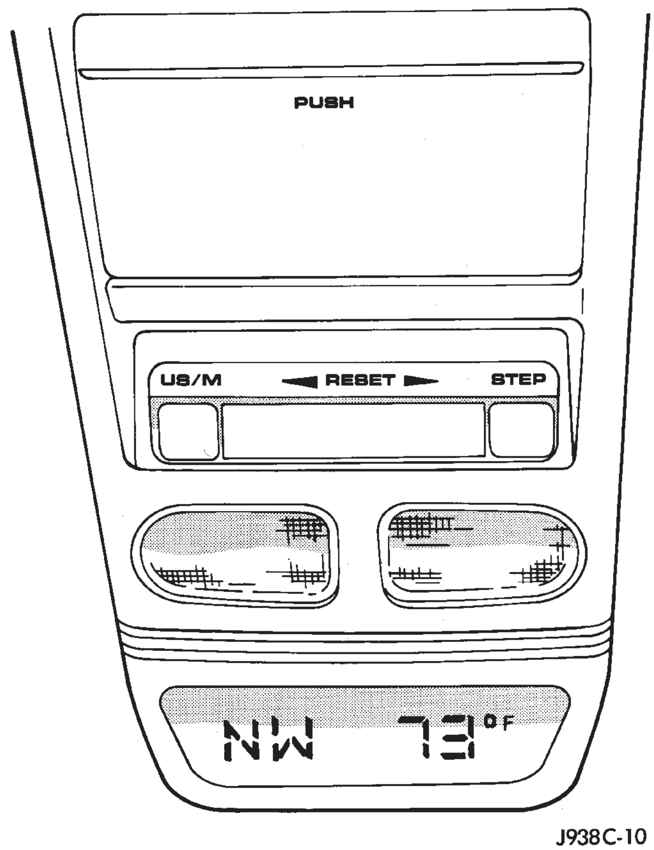


Fig. 1 U/S Metric Switch

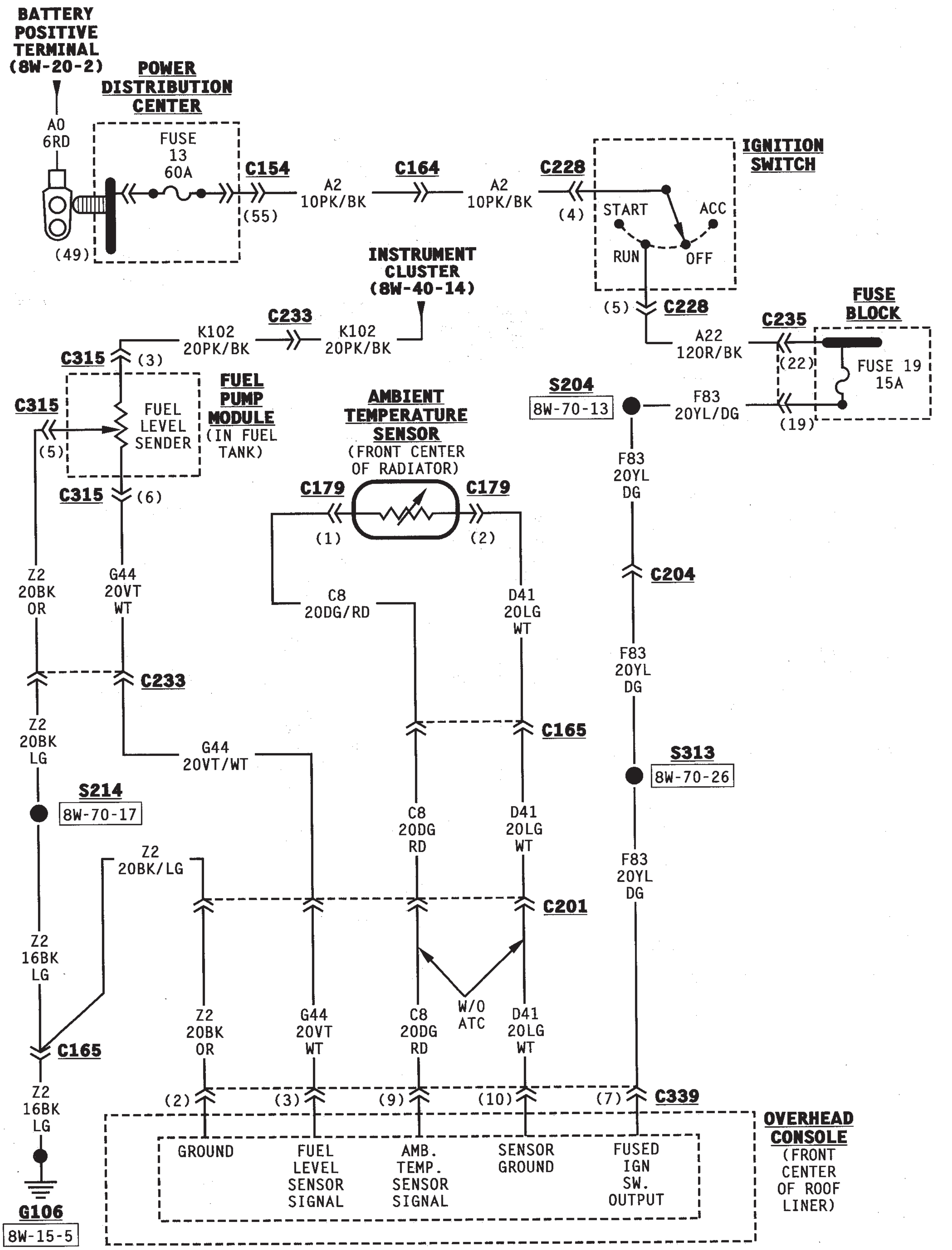
AMBIENT TEMPERATURE SENSOR

The ambient temperature sensor is a variable resistor. Circuit C8 supplies voltage from the overhead console to the sensor. Circuit D41 is the signal return from the sensor to the overhead console.

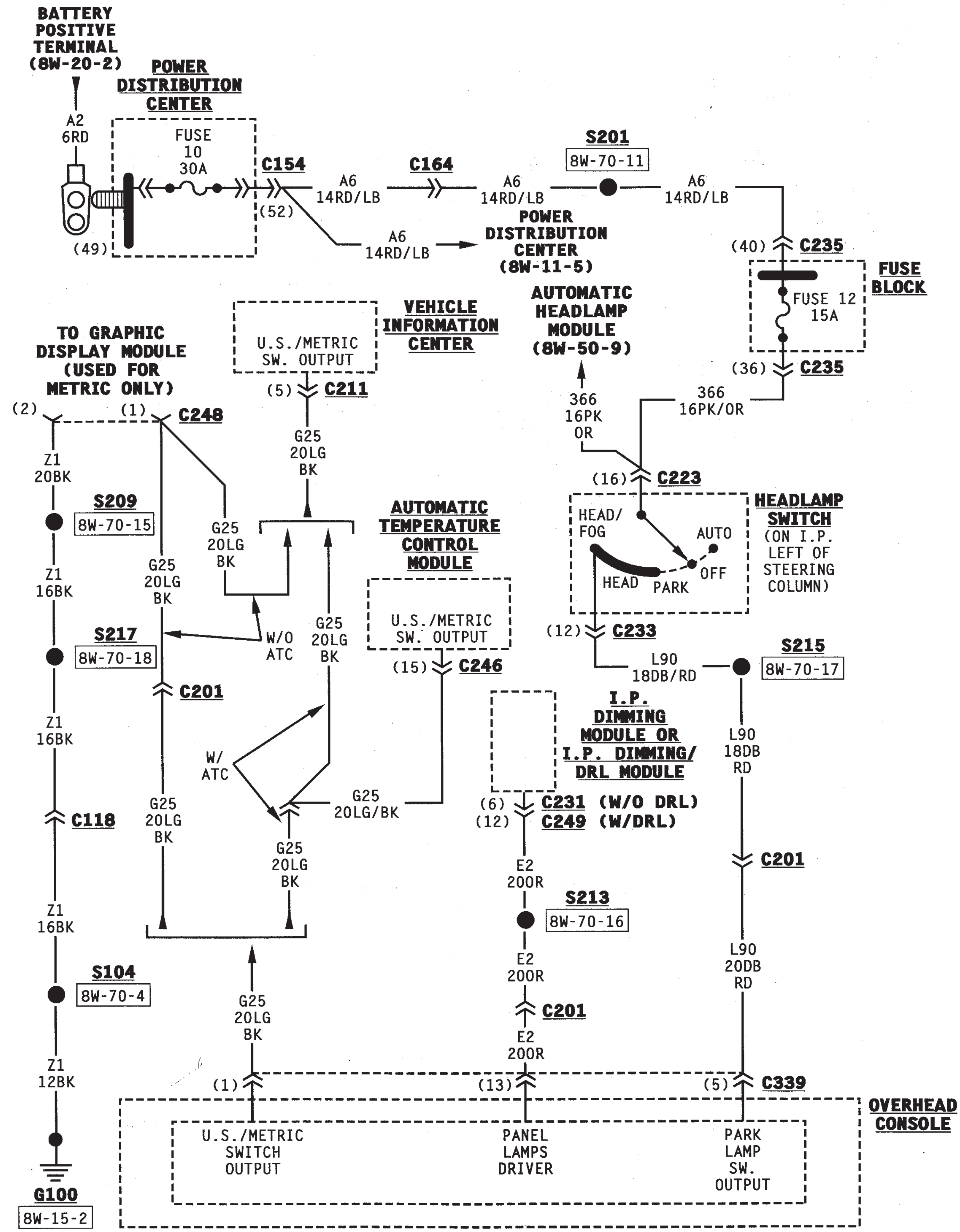
CCD BUS

The overhead console connects to the CCD bus on circuits D1 and D2. Circuits D1 and D2 are a twisted pair of wires.

DIAGRAM INDEX

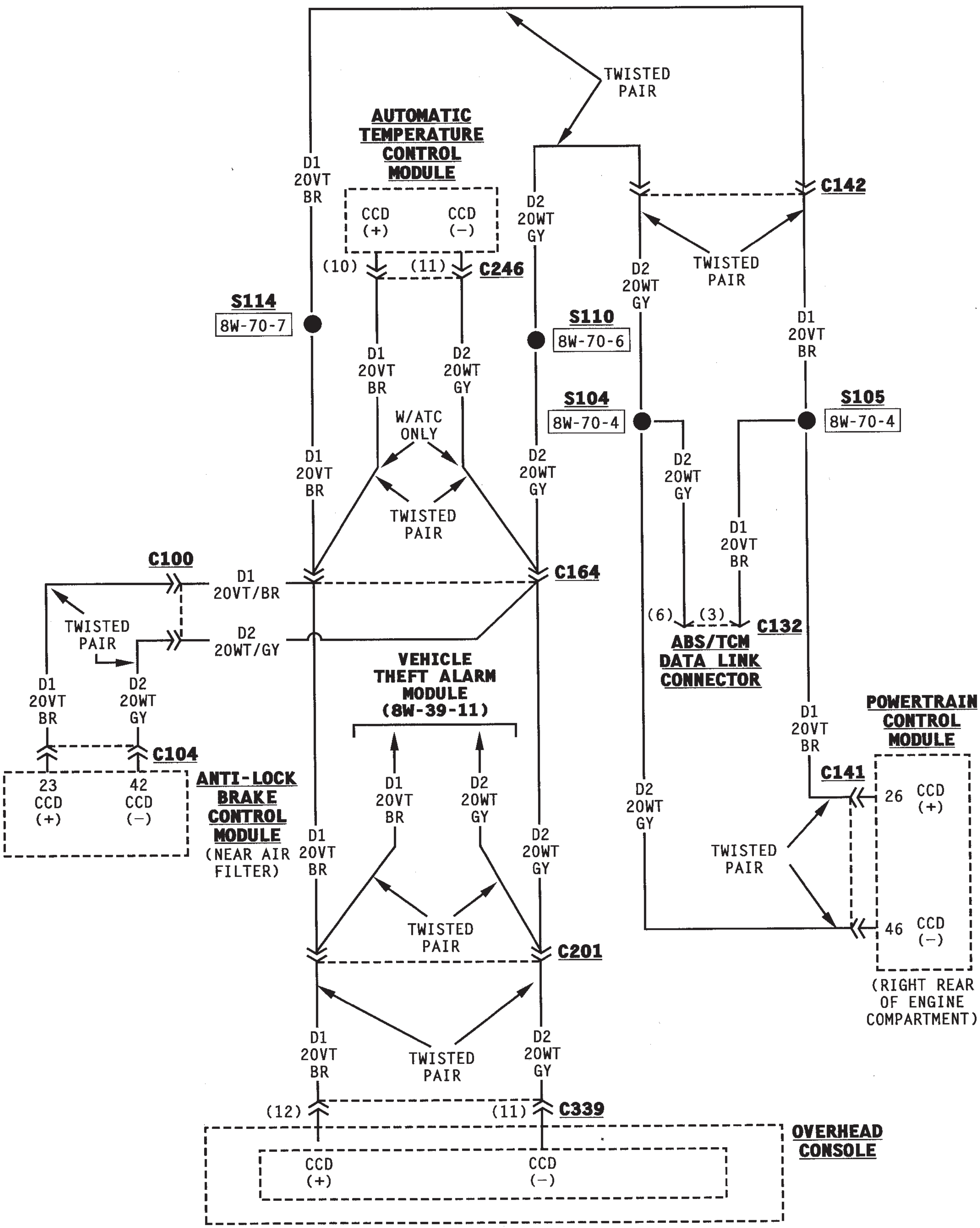

BATTERY POSITIVE TERMINAL (8W-20-2)
POWER DISTRIBUTION CENTER
A0 6RD
FUSE 13 60A
(49)
C154
(55)
A2 10PK/BK
C164
A2 10PK/BK
C228
(4)
IGNITION SWITCH
START
ACC
RUN
OFF
(5)
C228
A22 12OR/BK
C235
FUSE BLOCK
(22)
FUSE 19 15A
(19)
INSTRUMENT CLUSTER (8W-40-14)
C233
K102 20PK/BK
K102 20PK/BK
C315
(3)
C315
(5)
FUEL LEVEL SENDER
FUEL PUMP MODULE (IN FUEL TANK)
C315
(6)
S204
8W-70-13
F83 20YL/DG
F83 20YL DG
AMBIENT TEMPERATURE SENSOR (FRONT CENTER OF RADIATOR)
C179
C179
(1)
(2)
C204
Z2 20BK OR
G44 20VT WT
C8 20DG/RD
D41 20LG WT
F83 20YL DG
C233
C165
Z2 20BK LG
G44 20VT/WT
S313
8W-70-26
S214
8W-70-17
C8 20DG RD
D41 20LG WT
Z2 20BK/LG
F83 20YL DG
C201
Z2 16BK LG
W/O ATC
Z2 20BK OR
G44 20VT WT
C8 20DG RD
D41 20LG WT
C165
Z2 16BK LG
(2)
(3)
(9)
(10)
(7)
C339
OVERHEAD CONSOLE (FRONT CENTER OF ROOF LINER)
GROUND
FUEL LEVEL SENSOR SIGNAL
AMB. TEMP. SENSOR SIGNAL
SENSOR GROUND
FUSED IGN SW. OUTPUT
G106
8W-15-5

J958W-3



BATTERY POSITIVE TERMINAL (8W-20-2)
POWER DISTRIBUTION CENTER
A2 6RD
FUSE 10 30A
(49)
C154
(52)
A6 14RD/LB
C164
A6 14RD/LB
S201
8W-70-11
A6 14RD/LB
A6 14RD/LB
POWER DISTRIBUTION CENTER (8W-11-5)
(40) C235
FUSE BLOCK
FUSE 12 15A
(36) C235
AUTOMATIC HEADLAMP MODULE (8W-50-9)
366 16PK OR
366 16PK/OR
VEHICLE INFORMATION CENTER
U.S./METRIC SW. OUTPUT
(5) C211
TO GRAPHIC DISPLAY MODULE (USED FOR METRIC ONLY)
(2) (1) C248
G25 20LG BK
Z1 20BK
S209
8W-70-15
(16) C223
HEADLAMP SWITCH (ON I.P. LEFT OF STEERING COLUMN)
HEAD/ FOG
AUTO
OFF
HEAD PARK
AUTOMATIC TEMPERATURE CONTROL MODULE
U.S./METRIC SW. OUTPUT
(15) C246
Z1 16BK
G25 20LG BK
W/O ATC
S217
8W-70-18
(12) C233
L90 18DB/RD
S215
8W-70-17
C201
I.P. DIMMING MODULE OR I.P. DIMMING/ DRL MODULE
L90 18DB RD
Z1 16BK
W/ ATC
G25 20LG/BK
(6) C231 (W/O DRL)
(12) C249 (W/DRL)
C118
G25 20LG BK
E2 20OR
C201
S213
8W-70-16
Z1 16BK
S104
8W-70-4
E2 20OR
L90 20DB RD
C201
E2 20OR
Z1 12BK
(1)
(13)
(5) C339
OVERHEAD CONSOLE
U.S./METRIC SWITCH OUTPUT
PANEL LAMPS DRIVER
PARK LAMP SW. OUTPUT
G100
8W-15-2

J958W-3


TWISTED PAIR
AUTOMATIC TEMPERATURE CONTROL MODULE
CCD (+)
CCD (−)
(10)
(11)
C246
D1 20VT BR
D2 20WT GY
C142
S114
8W-70-7
S110
8W-70-6
S104
8W-70-4
S105
8W-70-4
W/ATC ONLY
C100
D1 20VT/BR
D2 20WT/GY
C164
(6)
(3)
C132
ABS/TCM DATA LINK CONNECTOR
VEHICLE THEFT ALARM MODULE (8W-39-11)
POWERTRAIN CONTROL MODULE
C141
26 CCD (+)
46 CCD (−)
(RIGHT REAR OF ENGINE COMPARTMENT)
C104
23 CCD (+)
42 CCD (−)
ANTI-LOCK BRAKE CONTROL MODULE
(NEAR AIR FILTER)
C201
(12)
C339
OVERHEAD CONSOLE

J958W-3

FRONT LIGHTING

INDEX

HEADLAMP SWITCH

The headlamp switch has five positions: AUTO, OFF, PARK, LOW, and LOW/FOG. The headlamp switch also has a position for the courtesy lamps and a cancelling switch connected to the instrument panel dimming module.

Circuit A6 from fuse 10 in the PDC connects to the headlamp switch. Circuit A6 also feeds circuit 366 through fuse 12 in the fuse block. Circuit 366 connects to the headlamp switch.

The headlamp switch has an internal circuit breaker that connects circuit A6 to circuit F34. Circuit F34 connects to the dimmer switch circuitry in the multi-function switch.

Circuit A7 from fuse 14 in the PDC feeds circuit L11 through fuse 7 in the fuse block. Circuit L11 connects to the dimmer switch circuitry in the multi-function switch, supplying power for the high beams.

When the courtesy lamp switch closes, the headlamp switch connects circuit M2 from the courtesy lamps to circuit Z1. Circuit Z1 provides ground to illuminate the courtesy lamps.

The cancelling switch in the headlamp switch connects circuit 52 from the instrument panel dimming module to ground on circuit Z1. The switch either connects circuit 52 directly to ground on circuit Z1 (cancelling switch closed) or through a resistor to ground on circuit Z1 (cancelling switch open).

Circuit E2 powers the illumination lamps in the headlamp switch. Circuit Z1 provides ground for the illumination lamps.

HEADLAMP SWITCH IN PARKING LAMP POSITION

When the PARK lamps are ON, the headlamp switch connects circuit 366 to circuit L90. From the headlamp switch, circuit L90 branches to power the optional lamp outage module, front parking lamps and rear tail lamps, side marker lamps, and rear license plate lamps. Circuit L90 also connects to the overhead console, fuse 24 in the fuse block, Vehicle Theft Alarm (VTA) module, HVAC module, and radio.

Circuit Z1 provides a ground for the parking lamps and side marker lamps. The Z1 circuit also provide ground for the headlamps.

Circuit L11 connects to the dimmer switch portion of the multi-function switch. Circuit L11 supplies power for the high beams on circuit L3 when the operator flashes the headlamps with the turn signal stalk of the multi-function switch.

HELPFUL INFORMATION

- Check fuse 10 in PDC.
- Check fuse 12 in the fuse block.

HEADLAMP SWITCH IN ON POSITION

When the headlamp switch is in the ON position, circuit A6 from fuse 10 in the Power Distribution Center (PDC) connects to circuit F34. Circuit F34 connects to the dimmer switch portion of the multi-function switch and feeds circuit L4. Circuit L4 powers the low beam of the headlamps. When the fog lamps are on, circuit L4 powers the lamp for the fog lamp switch. Circuit L4 connects to the instrument panel dimming module.

When the operator selects high beam operation with the turn signal stalk of the multi-function switch, circuit L11 connects to the L3 circuit. Circuit L3 powers high beam operation. Circuit L3 also connects to the instrument panel dimming module and Vehicle Theft Alarm (VTA) module.

HEADLAMP GROUND

Circuit Z1 provides ground for both the right and left headlamps. Circuit Z1 also supplies ground the turn signal lamps, and if equipped, the fog lamps.

HELPFUL INFORMATION

- Check fuses 10 and 14 in the PDC.
- Check fuse 7 in the fuse block.
- The headlamp switch has an internal circuit breaker.
- The auto headlamp module powers circuit F34 when the headlamp switch is in the AUTO position.
- Circuit L11 is double crimped at the multi-function switch. The L11 branch from the multi-function switch connects to the Vehicle Theft Alarm (VTA) module.
- Circuit 366 is double crimped at the headlamp switch. The circuit 366 branch from the headlamp switch connects to the auto headlamp module.

FOG LAMPS

The fog lamps are controlled by the headlamp switch and the fog lamp relay. The fog lamps operate only when the headlamp switch is in the LOW/FOG position. When the headlamps are in high-beam operation, the fog lamps will not operate.

Circuit F34 from the headlamp switch connects to the dimmer switch and feeds the low beams on circuit L4. When the low beams are on, circuit L4 from the dimmer switch feeds the coil side of the fog lamp relay. When the headlamp switch is in the LOW/FOG position, it connects circuit L35 from the coil side of the relay to circuit Z1. Circuit Z1 provides ground for the relay. When just the LOW beams are on, the headlamp switch does not ground the coil side of the fog lamp relay.

After the coil side of the relay energizes, the contacts in the relay close. When the relay contacts close, they connect circuit L34 from fuse 4 in the Power Distribution Center (PDC) to circuit L39. Circuit L39 powers the fog lamps. Circuit Z1 provides ground for the fog lamps.

FOG LAMP SWITCH ILLUMINATION

A Light Emitting Diode (LED) illuminates the fog lamp switch. Circuit L4 is double crimped at the fog lamp relay and supplies power to the LED through an additional diode and resistor in the headlamp switch. When the headlamp switch is in the LOW/FOG position, the switch connects the LED to circuit Z1. Circuit Z1 provide ground to illuminate the LED.

AUTO HEADLAMP MODULE

When the headlamp switch is in the AUTO position, the auto headlamp module powers the headlamps. A light sensor provides the input used by the module to determine if driving conditions warrant operating with the headlamps on.

Circuit A6 from fuse 10 in the Power Distribution Center (PDC) supplies battery voltage to circuit L26 through the circuit breaker in the headlamp switch. Circuit L26 powers the auto headlamp module. Circuits A6 and L26 are HOT at all times.

Circuit A6 also powers circuit 366 through fuse 12 in the fuse block. Circuit 366 is double crimped at the headlamp switch. The branch of circuit 366 from the headlamp switch connects to the auto headlamp module.

When the ignition switch is in the RUN position, it connects circuit A2 from fuse 13 in the PDC to circuit A22. Circuit A22 powers circuit F83 through fuse 19 in the fuse block. Circuit F83 connects to the auto headlamp module.

Circuit Z1 provides ground for the auto headlamp module. When the headlamp switch is in the AUTO position, it connects circuit L24 from the auto headlamp module to ground on circuit Z1. Circuit Z1 also connects directly to the auto headlamp module.

Circuit L109 from the auto headlamp powers the light sensor. Circuit L110 provides the input from the sensor to the auto headlamp module.

Circuit L90 from the headlamp switch powers the parking lamps and connects to the auto headlamp module.

When the headlamp switch is in the AUTO position, the auto headlamp module powers circuit F34. Circuit F34 connects to the dimmer switch. The dimmer switch connects circuit F34 to circuit L4. Circuit L4 powers the low beams of the headlamps.

HELPFUL INFORMATION

• The headlamp switch powers circuit F34 when the switch is in the LOW or LOW/FOG position.

DAYTIME RUNNING LAMPS MODULE

On Canadian models, the instrument panel dimming module and Daytime Running Lamps (DRL) module are the same. The Instrument Panel Dimming/DRL module operates the low beams of the headlamps when the ignition is in the RUN position.

In the RUN position, the ignition switch connects circuit A2 from fuse 13 in the Power Distribution Center (PDC) to circuit A22. Circuit A22 supplies power to circuit F83 through fuse 19 in the fuse block. Circuit F83 splices to the Instrument Panel Dimming/DRL module.

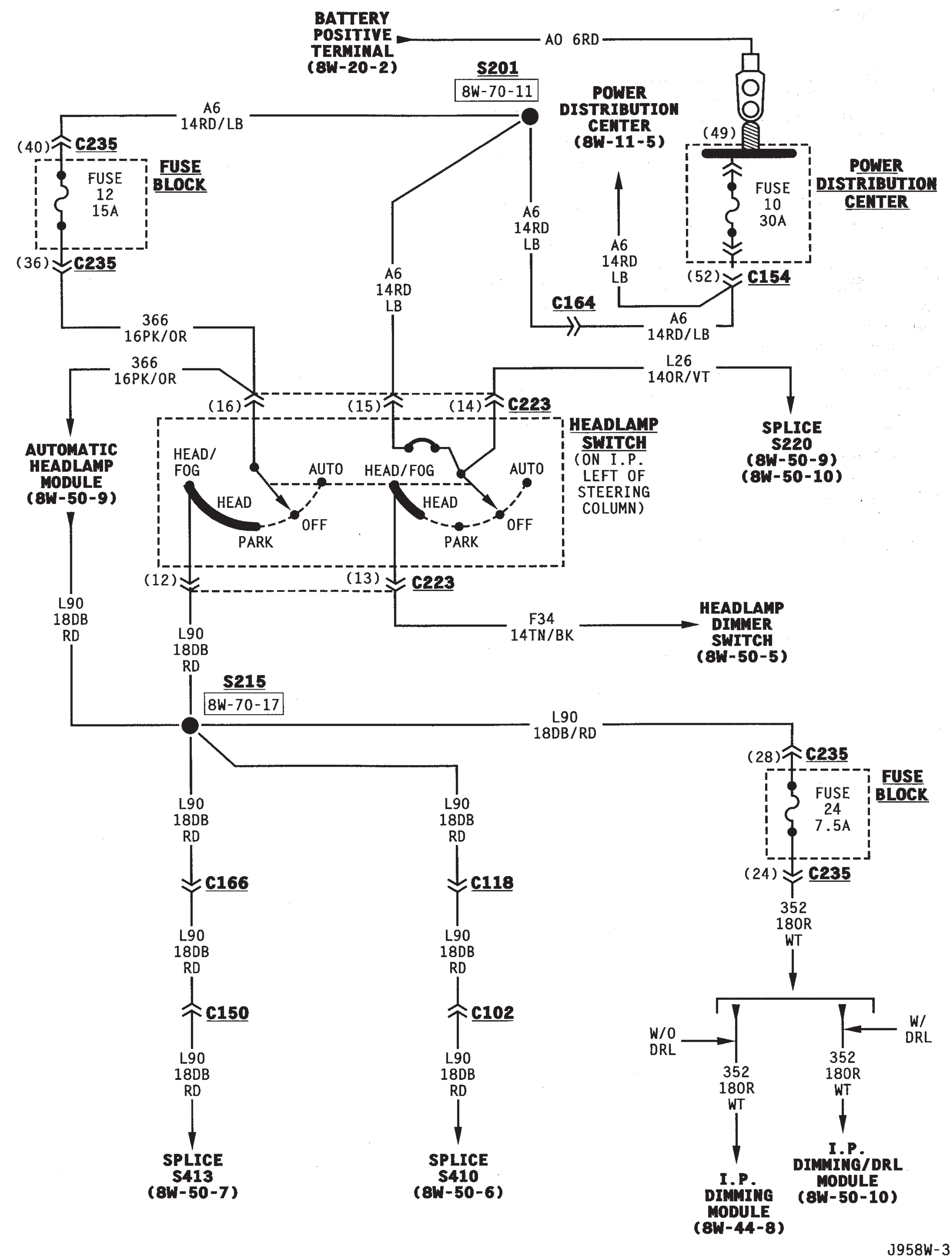
Circuit L26 from the headlamp switch also connects to the Instrument Panel Dimming/DRL module.

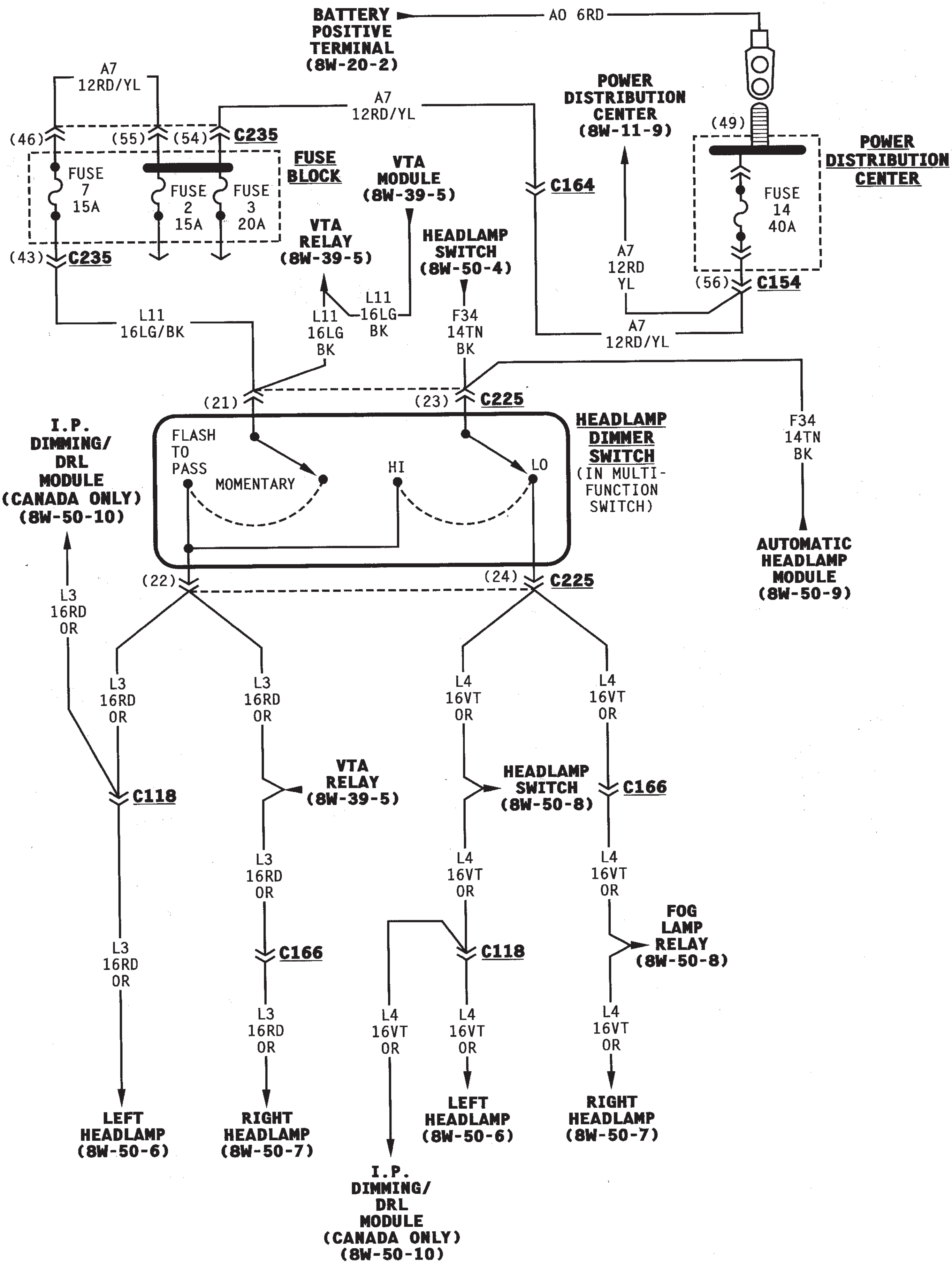
Circuit L4 powers the low beams of the left and right headlamps. When the headlamp switch is OFF, the Instrument Panel Dimming/DRL module powers the low beams on circuit L4. When the headlamps are ON, the dimmer switch in the multi-function switch powers the low beams on circuit L4.

Circuit L3 feeds the high beams of the headlamps. When the operator flashes the headlamps with the stalk of the multi-function switch, the DRL senses voltage on circuit L3. When it senses voltage on circuit L3, the Instrument Panel Dimming/DRL module stops supplying power to the low beams on circuit L4.

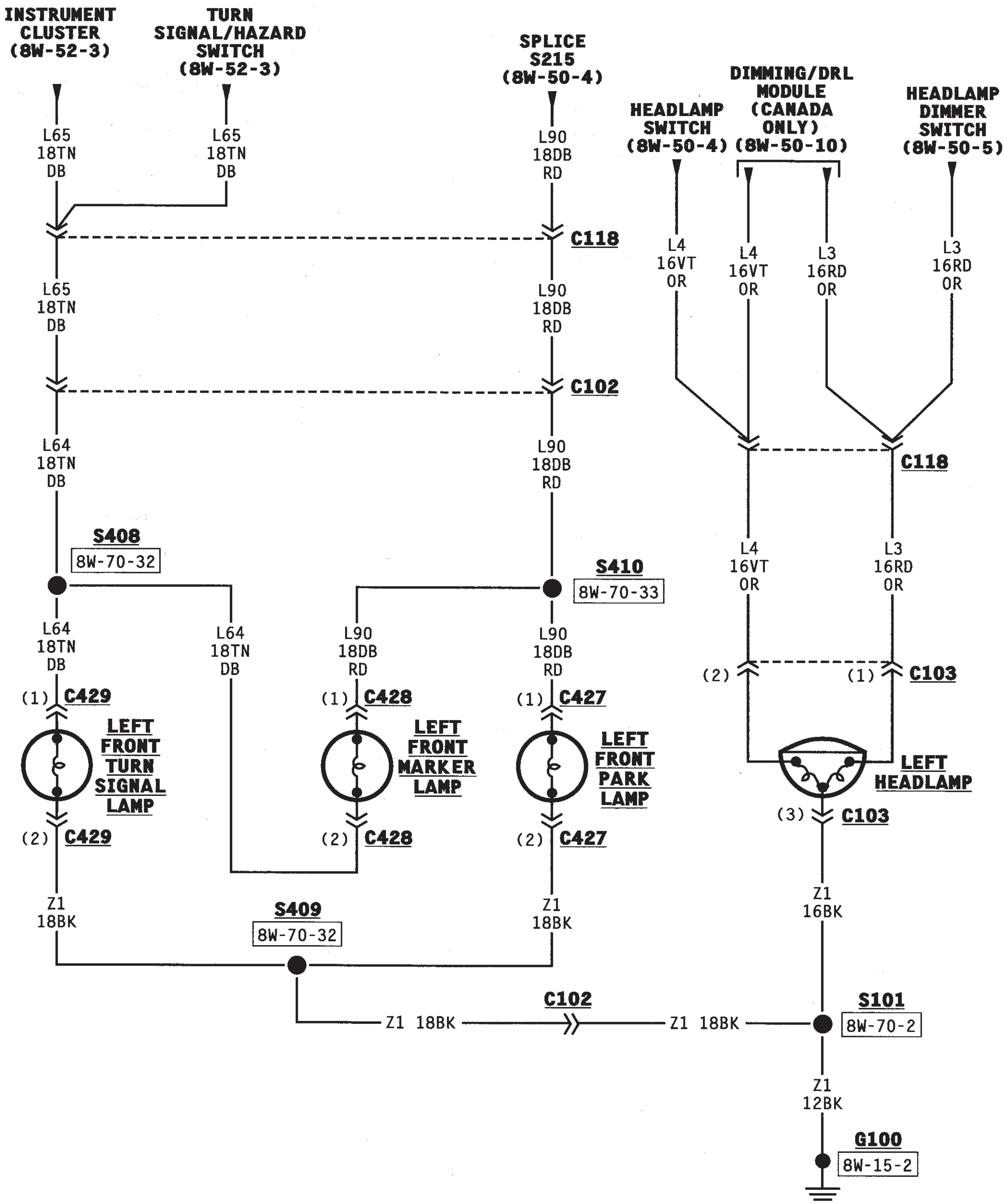
Circuit Z1 provides ground for the Instrument Panel Dimming/DRL module.

DIAGRAM INDEX

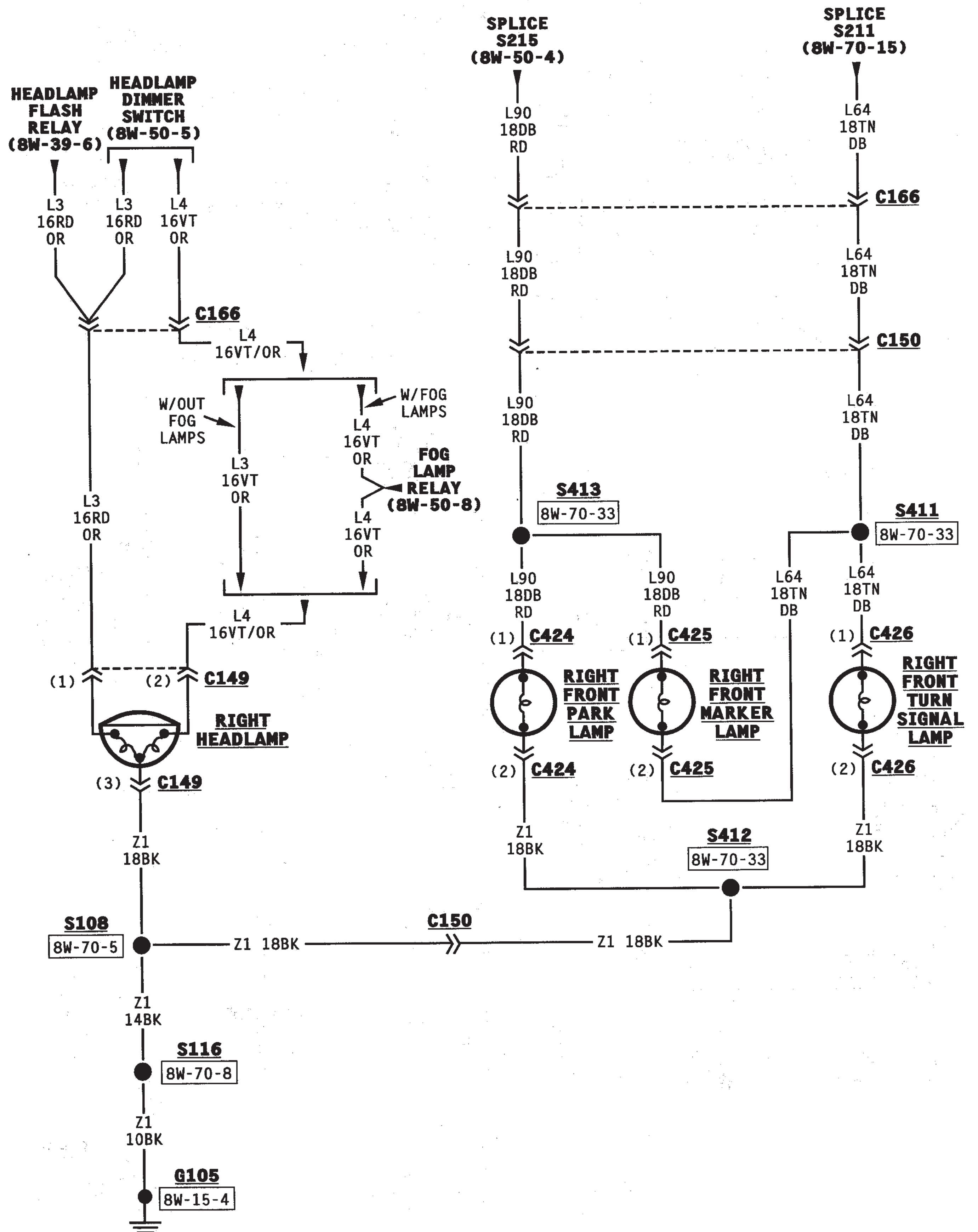

BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
S201
8W-70-11
A6 14RD/LB
POWER DISTRIBUTION CENTER (8W-11-5)
(49)
FUSE 10 30A
POWER DISTRIBUTION CENTER
(40) C235
FUSE 12 15A
FUSE BLOCK
(36) C235
A6 14RD LB
A6 14RD LB
A6 14RD LB
(52) C154
C164
A6 14RD/LB
366 16PK/OR
366 16PK/OR
L26 14OR/VT
(16) (15) (14) C223
HEADLAMP SWITCH (ON I.P. LEFT OF STEERING COLUMN)
SPLICE S220 (8W-50-9) (8W-50-10)
AUTOMATIC HEADLAMP MODULE (8W-50-9)
HEAD/ FOG
AUTO
HEAD/FOG
AUTO
HEAD
OFF
PARK
HEAD
OFF
PARK
(12) (13) C223
L90 18DB RD
L90 18DB RD
F34 14TN/BK
HEADLAMP DIMMER SWITCH (8W-50-5)
S215
8W-70-17
L90 18DB/RD
(28) C235
FUSE 24 7.5A
FUSE BLOCK
(24) C235
352 18OR WT
L90 18DB RD
L90 18DB RD
C166
C118
L90 18DB RD
L90 18DB RD
C150
C102
L90 18DB RD
L90 18DB RD
W/O DRL
W/ DRL
352 18OR WT
352 18OR WT
SPLICE S413 (8W-50-7)
SPLICE S410 (8W-50-6)
I.P. DIMMING MODULE (8W-44-8)
I.P. DIMMING/DRL MODULE (8W-50-10)
J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
A7 12RD/YL
POWER DISTRIBUTION CENTER (8W-11-9)
(49)
POWER DISTRIBUTION CENTER
FUSE 14 40A
(46) (55) (54) C235
FUSE 7 15A
FUSE 2 15A
FUSE 3 20A
FUSE BLOCK
(43) C235
VTA MODULE (8W-39-5)
C164
VTA RELAY (8W-39-5)
HEADLAMP SWITCH (8W-50-4)
A7 12RD YL
(56) C154
L11 16LG/BK
L11 16LG BK
F34 14TN BK
(21) (23) C225
HEADLAMP DIMMER SWITCH
(IN MULTI-FUNCTION SWITCH)
FLASH TO PASS
MOMENTARY
HI
LO
I.P. DIMMING/ DRL MODULE (CANADA ONLY) (8W-50-10)
AUTOMATIC HEADLAMP MODULE (8W-50-9)
(22) (24) C225
L3 16RD OR
L4 16VT OR
C118
VTA RELAY (8W-39-5)
HEADLAMP SWITCH (8W-50-8)
C166
FOG LAMP RELAY (8W-50-8)
LEFT HEADLAMP (8W-50-6)
RIGHT HEADLAMP (8W-50-7)
LEFT HEADLAMP (8W-50-6)
RIGHT HEADLAMP (8W-50-7)
I.P. DIMMING/ DRL MODULE (CANADA ONLY) (8W-50-10)

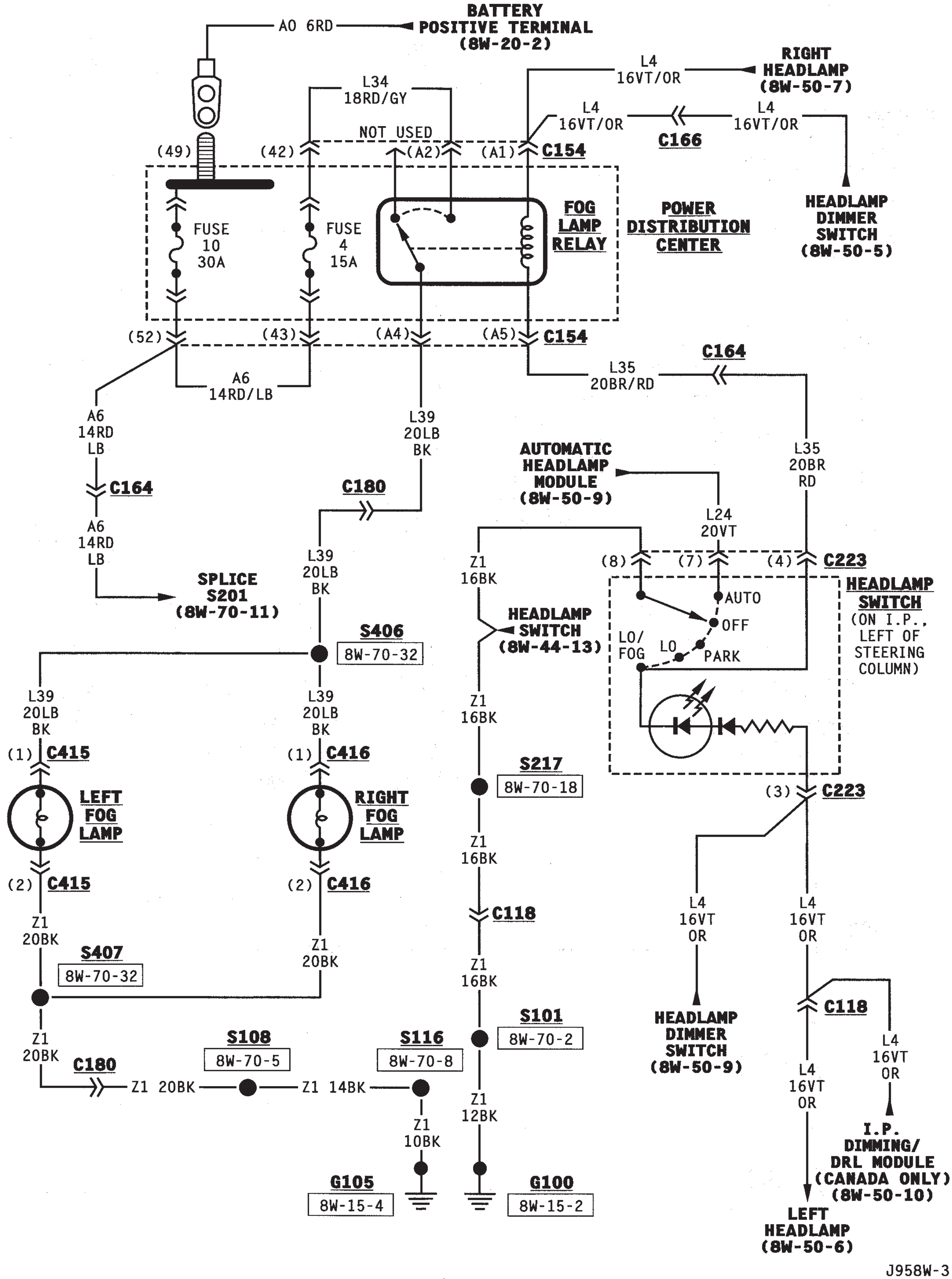
J958W-3

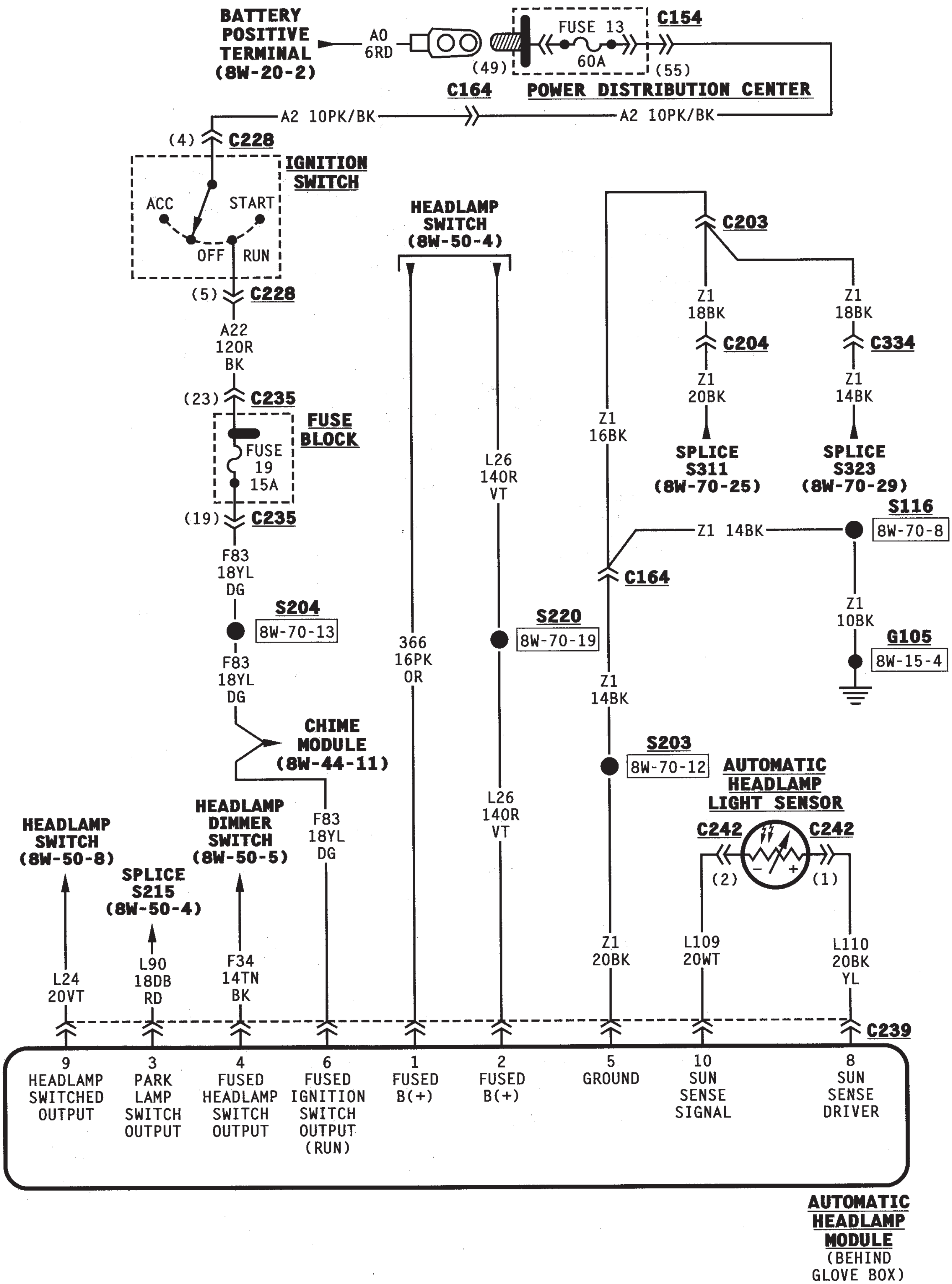

INSTRUMENT CLUSTER (8W-52-3)
TURN SIGNAL/HAZARD SWITCH (8W-52-3)
SPLICE S215 (8W-50-4)
HEADLAMP SWITCH (8W-50-4)
DIMMING/DRL MODULE (CANADA ONLY) (8W-50-10)
HEADLAMP DIMMER SWITCH (8W-50-5)
L65 18TN DB
L90 18DB RD
L4 16VT OR
L3 16RD OR
C118
C102
L64 18TN DB
S408
8W-70-32
S410
8W-70-33
C103
C429
C428
C427
LEFT FRONT TURN SIGNAL LAMP
LEFT FRONT MARKER LAMP
LEFT FRONT PARK LAMP
LEFT HEADLAMP
Z1 18BK
Z1 16BK
S409
8W-70-32
S101
8W-70-2
Z1 12BK
G100
8W-15-2

J958W-3

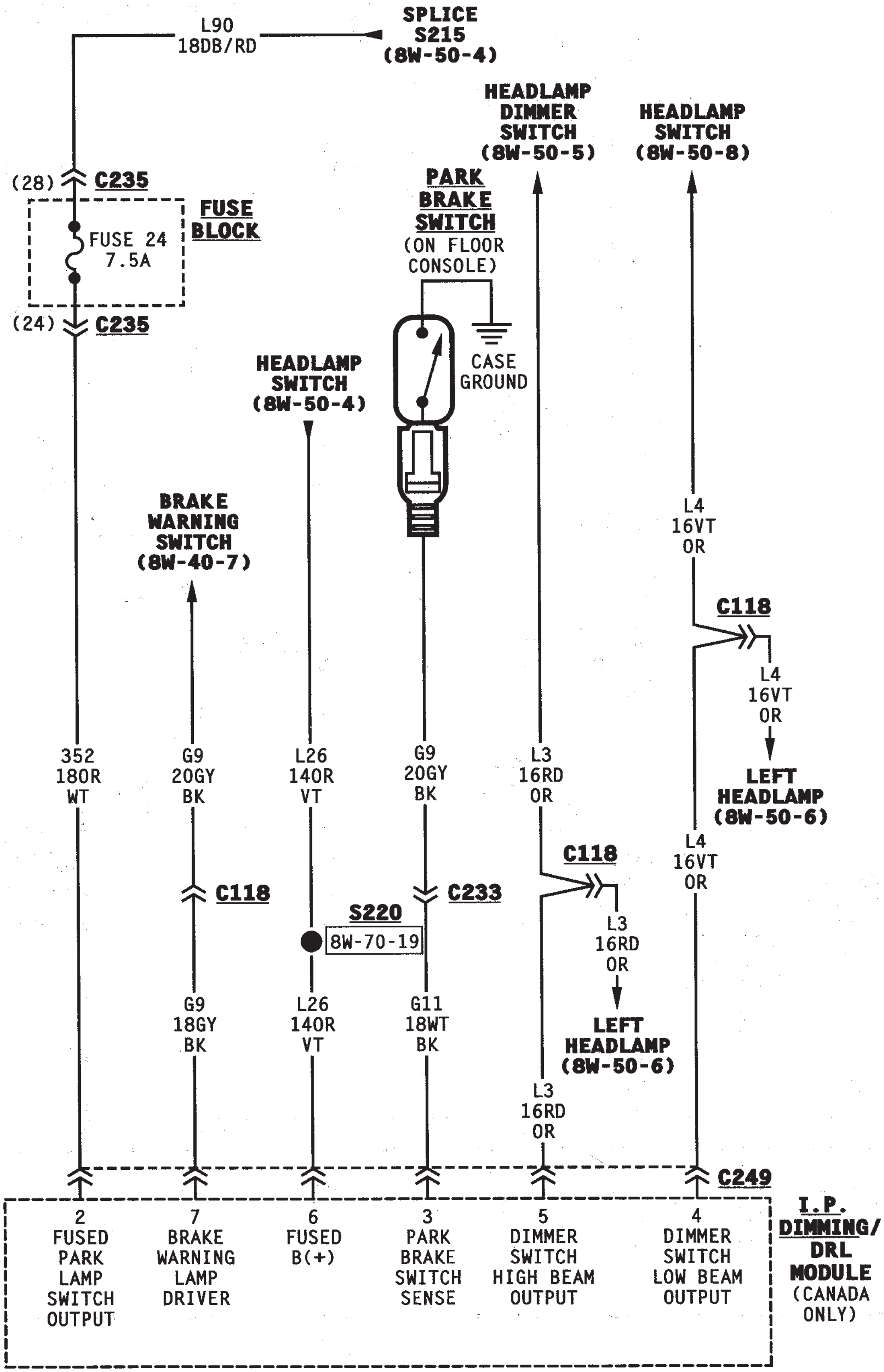

SPLICE
S215
(8W-50-4)
SPLICE
S211
(8W-70-15)
HEADLAMP FLASH RELAY (8W-39-6)
HEADLAMP DIMMER SWITCH (8W-50-5)
L3 16RD OR
L3 16RD OR
L4 16VT OR
L90 18DB RD
L64 18TN DB
C166
L4 16VT/OR
W/OUT FOG LAMPS
W/FOG LAMPS
L4 16VT OR
L3 16VT OR
FOG LAMP RELAY (8W-50-8)
C150
L3 16RD OR
S413
8W-70-33
S411
8W-70-33
L90 18DB RD
L64 18TN DB
L4 16VT/OR
(1) C424
(1) C425
(1) C426
(1) (2) C149
RIGHT FRONT PARK LAMP
RIGHT FRONT MARKER LAMP
RIGHT FRONT TURN SIGNAL LAMP
RIGHT HEADLAMP
(2) C424
(2) C425
(2) C426
(3) C149
Z1 18BK
S412
8W-70-33
S108
8W-70-5
Z1 18BK
C150
Z1 14BK
S116
8W-70-8
Z1 10BK
G105
8W-15-4

J958W-3

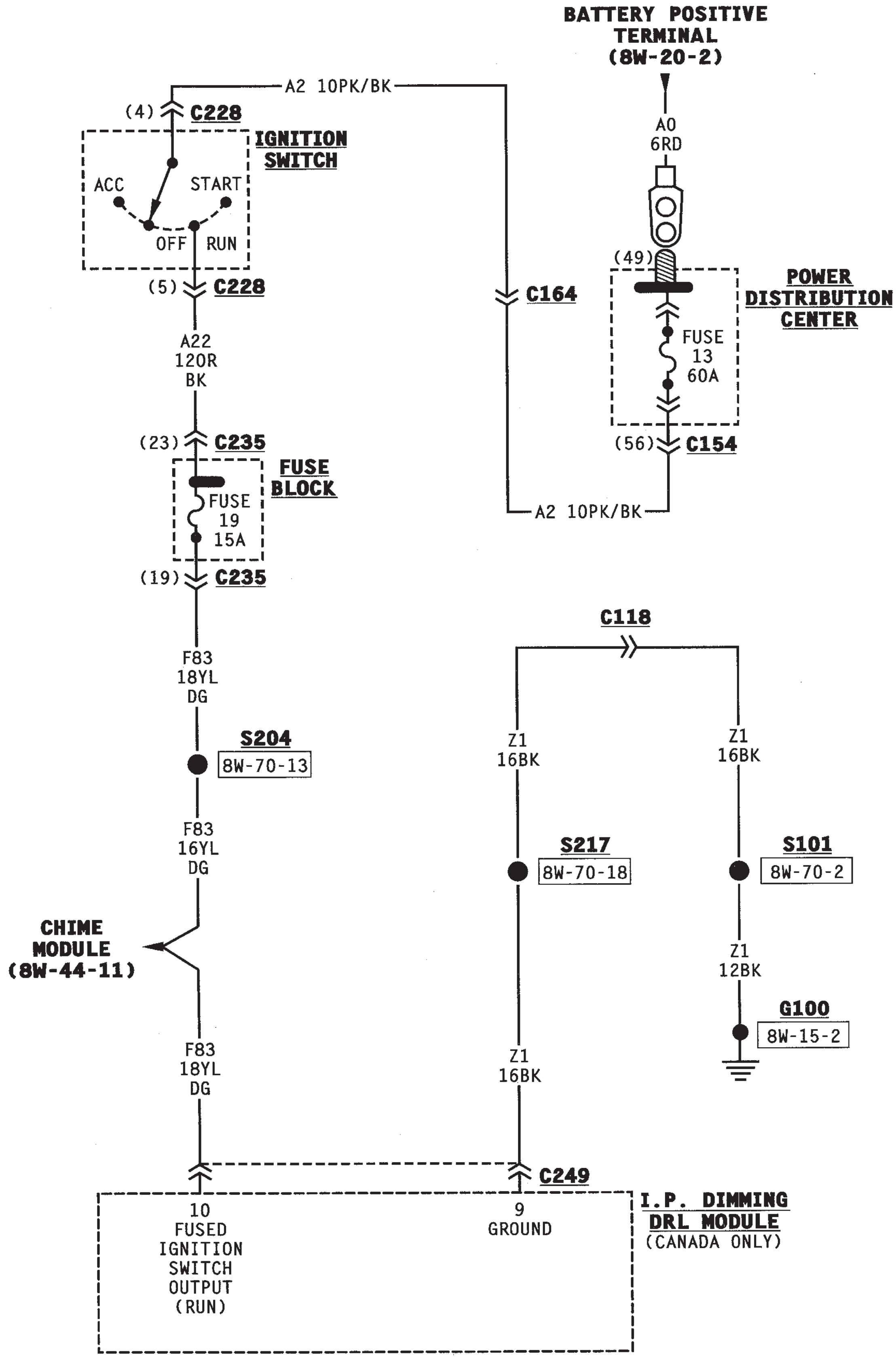

BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
L34 18RD/GY
NOT USED
L4 16VT/OR
RIGHT HEADLAMP (8W-50-7)
C166
HEADLAMP DIMMER SWITCH (8W-50-5)
(49) (42) (A2) (A1) C154
FUSE 10 30A
FUSE 4 15A
FOG LAMP RELAY
POWER DISTRIBUTION CENTER
(52) (43) (A4) (A5) C154
A6 14RD/LB
L35 20BR/RD
C164
A6 14RD LB
L39 20LB BK
C180
L35 20BR RD
AUTOMATIC HEADLAMP MODULE (8W-50-9)
L24 20VT
Z1 16BK
(8) (7) (4) C223
SPLICE S201 (8W-70-11)
HEADLAMP SWITCH (8W-44-13)
AUTO
OFF
LO/ FOG
LO
PARK
HEADLAMP SWITCH (ON I.P., LEFT OF STEERING COLUMN)
S406 8W-70-32
(1) C415
(1) C416
LEFT FOG LAMP
RIGHT FOG LAMP
(2) C415
(2) C416
S217 8W-70-18
(3) C223
Z1 20BK
S407 8W-70-32
C118
L4 16VT OR
HEADLAMP DIMMER SWITCH (8W-50-9)
S101 8W-70-2
S108 8W-70-5
S116 8W-70-8
Z1 20BK
Z1 14BK
Z1 10BK
Z1 12BK
I.P. DIMMING/ DRL MODULE (CANADA ONLY) (8W-50-10)
LEFT HEADLAMP (8W-50-6)
G105 8W-15-4
G100 8W-15-2
J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
FUSE 13 60A
C154
(49)
(55)
C164
POWER DISTRIBUTION CENTER
A2 10PK/BK
A2 10PK/BK
(4) C228
IGNITION SWITCH
ACC
START
OFF
RUN
(5) C228
A22 120R BK
(23) C235
FUSE BLOCK
FUSE 19 15A
(19) C235
F83 18YL DG
S204
8W-70-13
F83 18YL DG
CHIME MODULE (8W-44-11)
HEADLAMP SWITCH (8W-50-4)
366 16PK OR
L26 140R VT
S220
8W-70-19
L26 140R VT
C203
Z1 18BK
Z1 18BK
C204
C334
Z1 20BK
Z1 14BK
SPLICE S311 (8W-70-25)
SPLICE S323 (8W-70-29)
Z1 16BK
S116
Z1 14BK
8W-70-8
C164
Z1 10BK
G105
8W-15-4
Z1 14BK
S203
8W-70-12
AUTOMATIC HEADLAMP LIGHT SENSOR
C242
C242
(2)
(1)
HEADLAMP SWITCH (8W-50-8)
SPLICE S215 (8W-50-4)
HEADLAMP DIMMER SWITCH (8W-50-5)
F83 18YL DG
L24 20VT
L90 18DB RD
F34 14TN BK
Z1 20BK
L109 20WT
L110 20BK YL
C239
9 HEADLAMP SWITCHED OUTPUT
3 PARK LAMP SWITCH OUTPUT
4 FUSED HEADLAMP SWITCH OUTPUT
6 FUSED IGNITION SWITCH OUTPUT (RUN)
1 FUSED B(+)
2 FUSED B(+)
5 GROUND
10 SUN SENSE SIGNAL
8 SUN SENSE DRIVER
AUTOMATIC HEADLAMP MODULE (BEHIND GLOVE BOX)

J958W-3


L90
18DB/RD
SPLICE
S215
(8W-50-4)
HEADLAMP
DIMMER
SWITCH
(8W-50-5)
HEADLAMP
SWITCH
(8W-50-8)
(28)
C235
FUSE
BLOCK
FUSE 24
7.5A
(24)
C235
PARK
BRAKE
SWITCH
(ON FLOOR
CONSOLE)
CASE
GROUND
HEADLAMP
SWITCH
(8W-50-4)
BRAKE
WARNING
SWITCH
(8W-40-7)
L4
16VT
OR
C118
L4
16VT
OR
LEFT
HEADLAMP
(8W-50-6)
352
18OR
WT
G9
20GY
BK
L26
14OR
VT
G9
20GY
BK
L3
16RD
OR
C118
L4
16VT
OR
C118
S220
C233
8W-70-19
L3
16RD
OR
LEFT
HEADLAMP
(8W-50-6)
G9
18GY
BK
L26
14OR
VT
G11
18WT
BK
L3
16RD
OR
C249
2
FUSED
PARK
LAMP
SWITCH
OUTPUT
7
BRAKE
WARNING
LAMP
DRIVER
6
FUSED
B(+)
3
PARK
BRAKE
SWITCH
SENSE
5
DIMMER
SWITCH
HIGH BEAM
OUTPUT
4
DIMMER
SWITCH
LOW BEAM
OUTPUT
I.P.
DIMMING/
DRL
MODULE
(CANADA
ONLY)

J958W-3


BATTERY POSITIVE
TERMINAL
(8W-20-2)
A0
6RD
(49)
POWER
DISTRIBUTION
CENTER
FUSE
13
60A
(56)
C154
A2 10PK/BK
C164
A2 10PK/BK
(4)
C228
IGNITION
SWITCH
ACC
START
OFF
RUN
(5)
C228
A22
12OR
BK
(23)
C235
FUSE
BLOCK
FUSE
19
15A
(19)
C235
F83
18YL
DG
S204
8W-70-13
F83
16YL
DG
CHIME
MODULE
(8W-44-11)
F83
18YL
DG
C118
Z1
16BK
Z1
16BK
S217
8W-70-18
S101
8W-70-2
Z1
12BK
G100
8W-15-2
Z1
16BK
C249
10
FUSED
IGNITION
SWITCH
OUTPUT
(RUN)
9
GROUND
I.P. DIMMING
DRL MODULE
(CANADA ONLY)

J958W-3

REAR LIGHTING

TAIL LAMPS, REAR LICENSE PLATE LAMPS AND SIDE MARKER LAMPS

The headlamp switch has five positions: AUTO, OFF, PARK, LOW, and LOW/FOG. The headlamp switch also has a position for the courtesy lamps and a cancelling switch connected to the instrument panel dimming module.

Circuit A6 from fuse 10 in the PDC connects to the headlamp switch. Circuit A6 also feeds circuit 366 through fuse 12 in the fuse block. Circuit 366 connects to the headlamp switch.

When the headlamp switch is in the PARK or LOW position, the switch connects circuit 366 to circuit L90. From the headlamp switch, circuit L90 branches to power the front parking lamps, side marker lamps, and rear tail lamps, and license plate lamps.

Circuit Z1 provides a ground for the parking lamps, tail lamps, and rear license plate lamps.

HELPFUL INFORMATION

- If the vehicle is equipped with factory installed trailer tow, circuit L90 connects to the trailer tow harness.
- Check fuse 10 in PDC.
- Check fuse 12 in the fuse block.

STOP LAMPS AND CHMSL LAMPS

Circuit A7 from fuse 14 in the Power Distribution Center (PDC) supplies voltage to circuit L16 through fuse 2 in the fuse block. Circuit L16 connects to the stop lamp switch.

When the operator depresses the brake pedal, the stop lamp switch closes and connects circuit L16 to circuit L50. Circuit L50 connects to the stop lamps and Center High Mounted Stop Lamps (CHMSL). Circuit Z1 provides a ground for the stop lamps and CHMSL lamps.

HELPFUL INFORMATION

- Check fuses 4 and 15 in the PDC.
- Check for continuity across the stop lamp switch when it is closed.
- If the vehicle is equipped with the Lamp Outage Module (LOM), circuit L50 connects to the LOM. From the LOM, circuits L87, L73 and L74 continue to the stop lamps and CHMSL.

BACK-UP LAMPS

In the RUN position, the ignition switch connects circuit A1 from fuse 12 in the Power Distribution Center (PDC) to circuit A21. Circuit A21 feeds a bus bar in the PDC that powers circuit F83 through fuse 5.

Circuit F83 supplies power to the back-up lamp switch. On automatic transmission equipped vehicles, the back-up lamp switch is part of an assembly that includes the PARK/NEUTRAL position switch. When the operator puts the transmission in REVERSE, the back-up lamp switch connects circuit F83 to circuit L10. Circuit L10 feeds the back-up lamps. Circuit Z1 provides ground for the back-up lamps.

HELPFUL INFORMATION

- Check fuses 5 and 12 in the PDC.
- Check for continuity across the back-up lamp switch when it is closed.

LAMP OUTAGE MODULE (LOM)

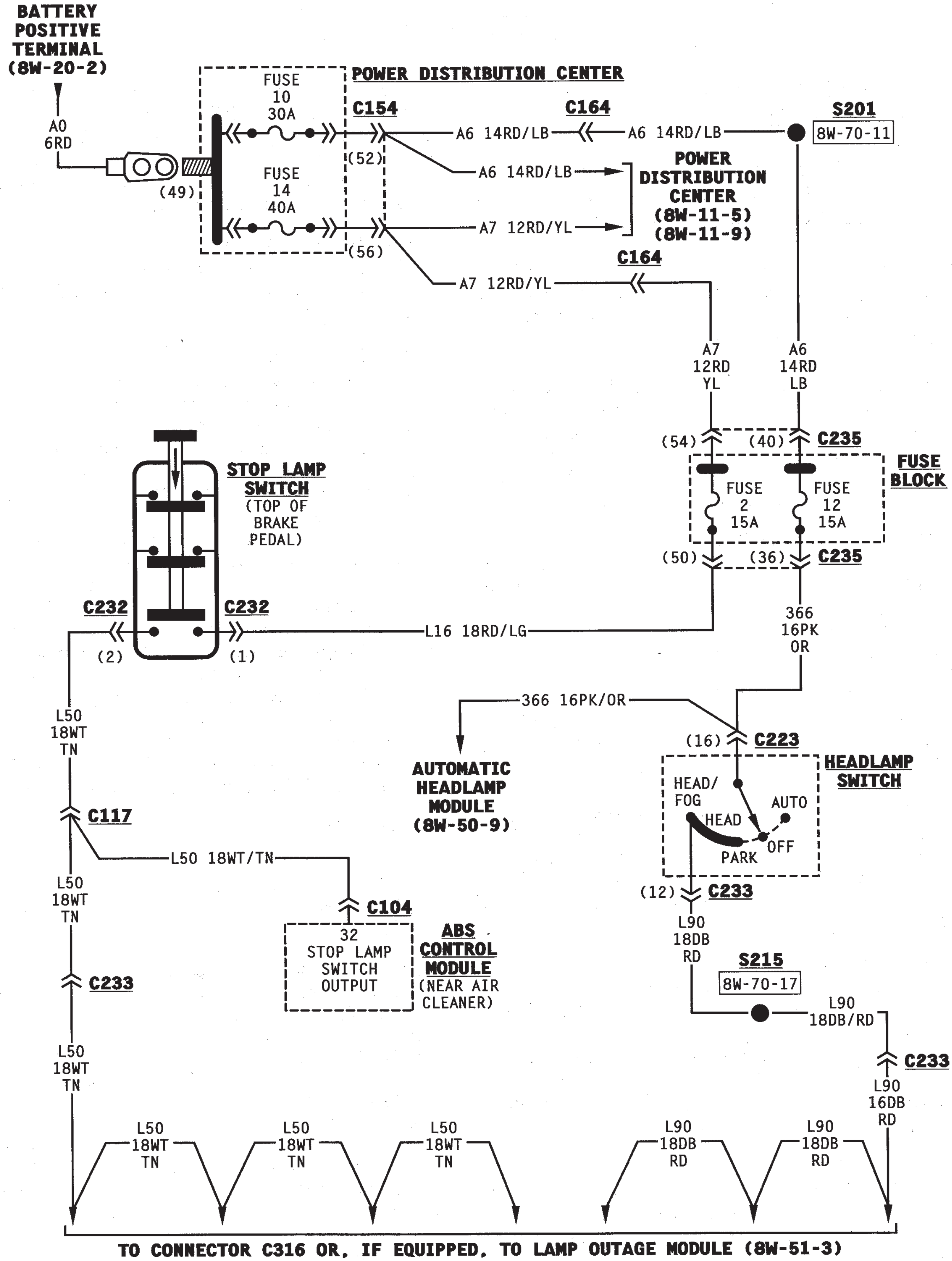
The Lamp Outage Module (LOM) determines if a rear lighting lamp is not operating. When the ignition switch is in the START or RUN position, circuit A1 from fuse 12 in the Power Distribution Center (PDC) connects to circuit A22. Circuit A21 feeds circuit F87 through fuse 22 in the fuse block. Circuit F87 feeds the LOM.

Circuit G46 from the LOM connects to the Vehicle Information Center (VIC). When the LOM senses a inoperative lamp, the VIC displays the data to the vehicle operator.

Circuit L90 which feeds the tail lamps and side marker lamps, connects to the LOM. From the LOM, circuit L90 continues to the license plate lamps. Circuits L21 and L22 from the LOM power the tail lamps and side marker lamps.

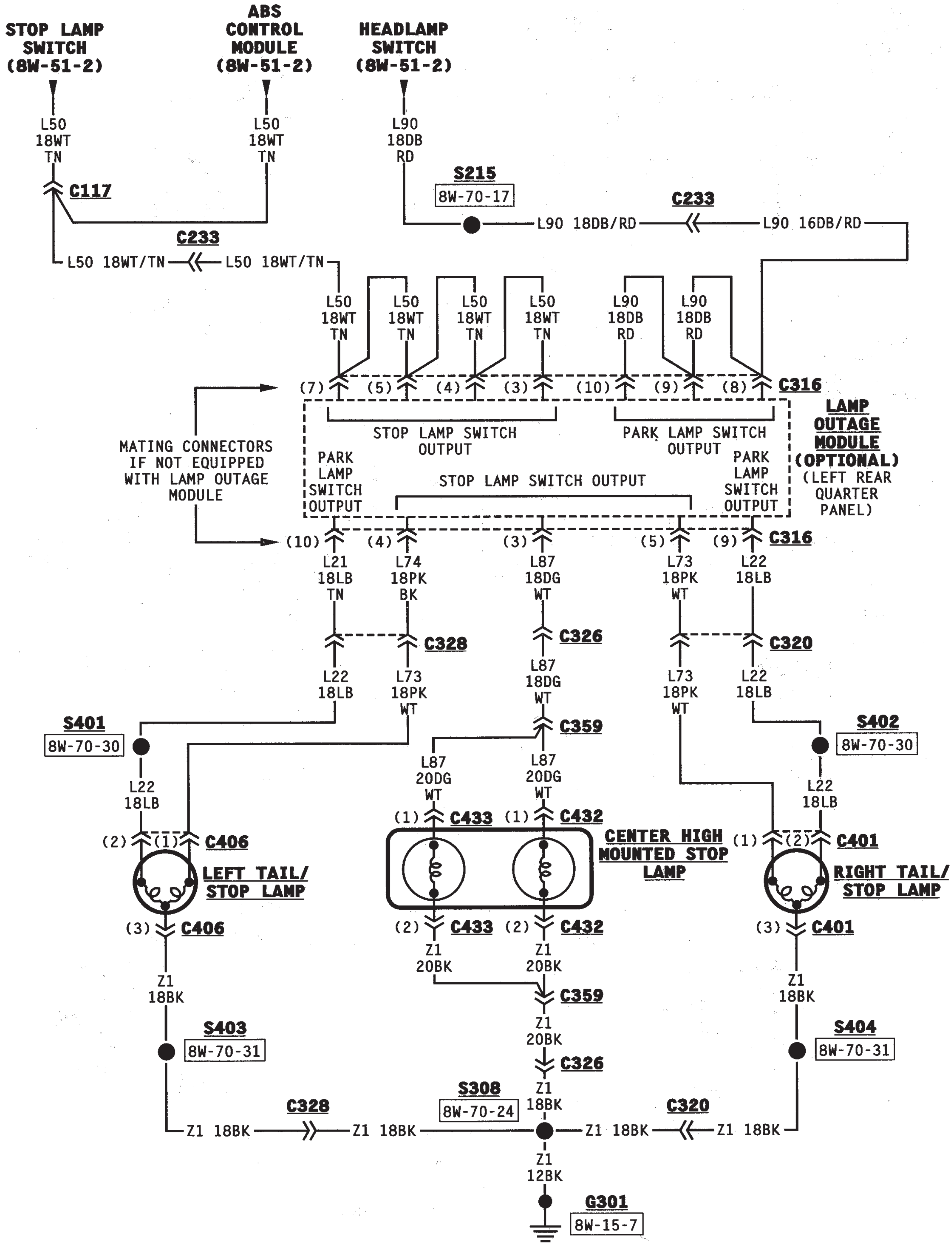
Circuit L50 from the stop lamp switch connects to the LOM. From the LOM, circuit L74 powers the left stop lamp and circuit L73 powers the right stop lamp.

DIAGRAM INDEX

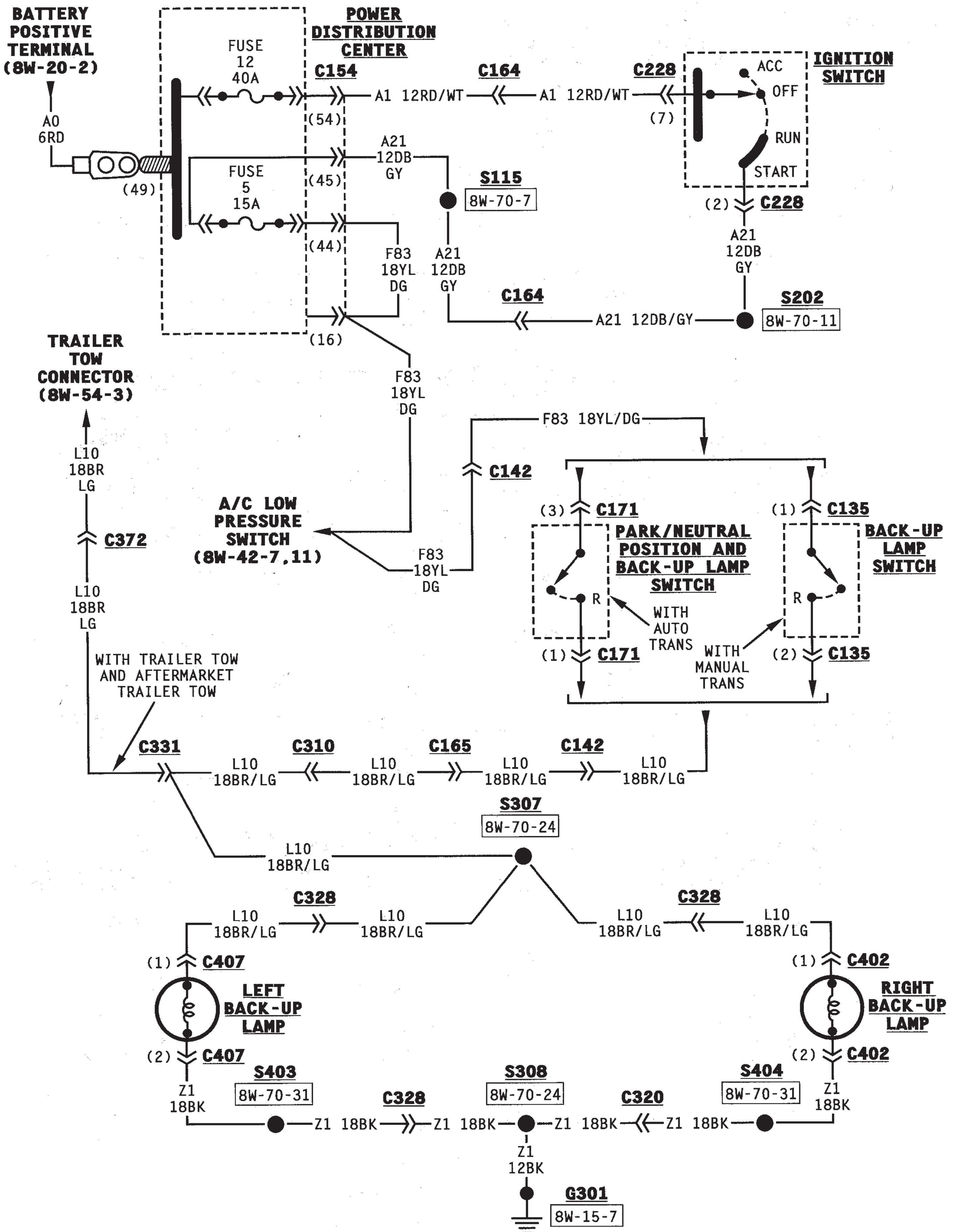


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 10 30A
FUSE 14 40A
POWER DISTRIBUTION CENTER
C154
(52)
(56)
A6 14RD/LB
C164
A6 14RD/LB
S201
8W-70-11
A6 14RD/LB
A7 12RD/YL
POWER DISTRIBUTION CENTER (8W-11-5) (8W-11-9)
C164
A7 12RD/YL
A7 12RD YL
A6 14RD LB
(54)
(40)
C235
FUSE BLOCK
FUSE 2 15A
FUSE 12 15A
(50)
(36)
C235
STOP LAMP SWITCH
(TOP OF BRAKE PEDAL)
C232
C232
(2)
(1)
L16 18RD/LG
366 16PK OR
366 16PK/OR
AUTOMATIC HEADLAMP MODULE (8W-50-9)
(16)
C223
HEADLAMP SWITCH
HEAD/ FOG
HEAD
AUTO
OFF
PARK
(12)
C233
L90 18DB RD
S215
8W-70-17
L90 18DB/RD
C233
L90 16DB RD
L50 18WT TN
C117
L50 18WT/TN
C104
L50 18WT TN
32 STOP LAMP SWITCH OUTPUT
ABS CONTROL MODULE
(NEAR AIR CLEANER)
C233
L50 18WT TN
L50 18WT TN
L50 18WT TN
L50 18WT TN
L90 18DB RD
L90 18DB RD
TO CONNECTOR C316 OR, IF EQUIPPED, TO LAMP OUTAGE MODULE (8W-51-3)

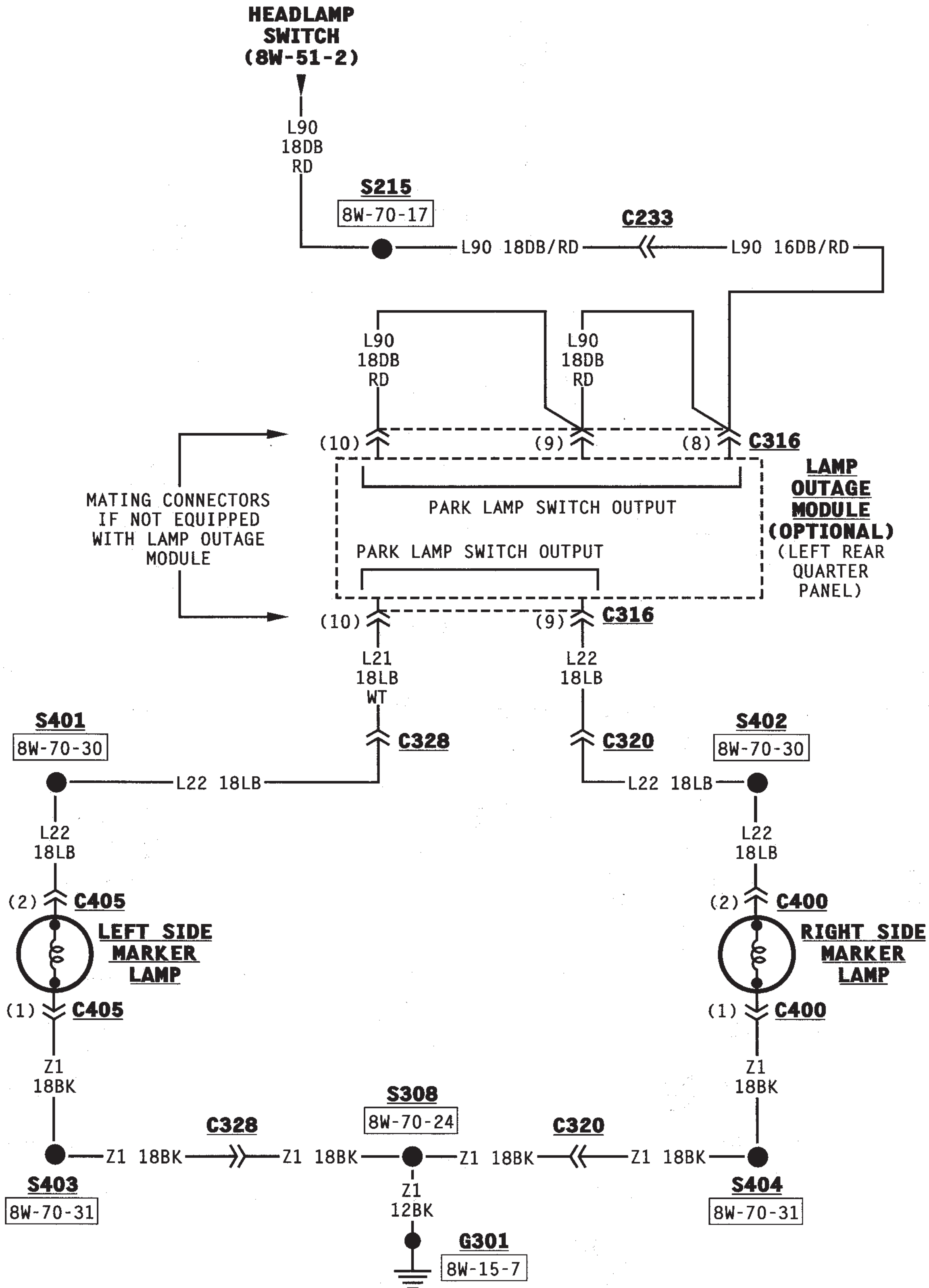
J958W-3

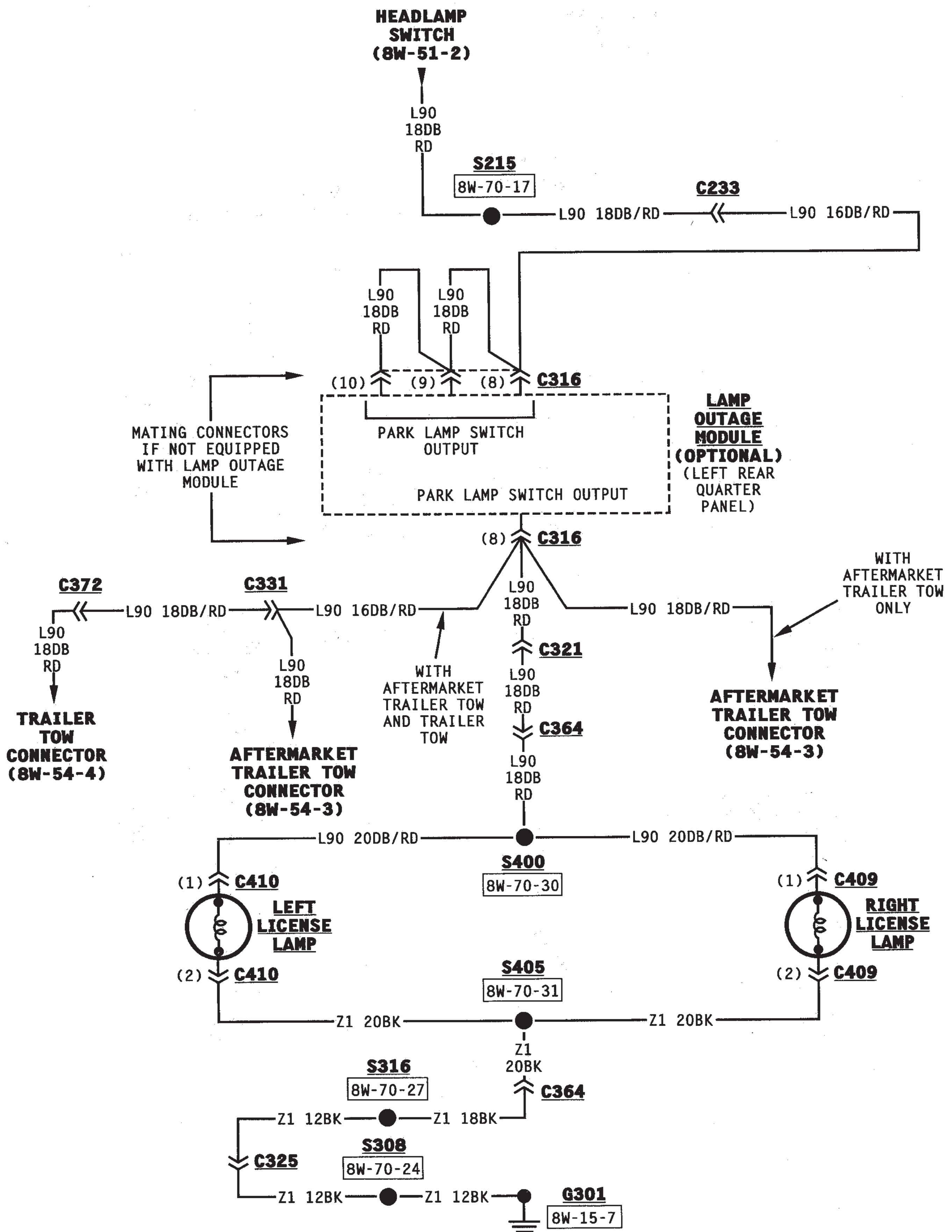

STOP LAMP SWITCH (8W-51-2)
ABS CONTROL MODULE (8W-51-2)
HEADLAMP SWITCH (8W-51-2)
L50 18WT TN
L90 18DB RD
C117
S215
8W-70-17
C233
L90 18DB/RD
L90 16DB/RD
L50 18WT/TN
(7) (5) (4) (3) (10) (9) (8) C316
LAMP OUTAGE MODULE (OPTIONAL) (LEFT REAR QUARTER PANEL)
STOP LAMP SWITCH OUTPUT
PARK LAMP SWITCH OUTPUT
MATING CONNECTORS IF NOT EQUIPPED WITH LAMP OUTAGE MODULE
(10) (4) (3) (5) (9) C316
L21 18LB TN
L74 18PK BK
L87 18DG WT
L73 18PK WT
L22 18LB
C328
C326
C320
C359
S401
8W-70-30
S402
L87 20DG WT
(1) C433
(1) C432
(2) (1) C406
LEFT TAIL/ STOP LAMP
CENTER HIGH MOUNTED STOP LAMP
(1) (2) C401
RIGHT TAIL/ STOP LAMP
(3) C406
(2) C433
(2) C432
(3) C401
Z1 18BK
Z1 20BK
S403
8W-70-31
S404
S308
8W-70-24
Z1 12BK
G301
8W-15-7

J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 12 40A
FUSE 5 15A
C154
(54)
(45)
(44)
(16)
A1 12RD/WT
C164
A1 12RD/WT
C228
(7)
IGNITION SWITCH
ACC
OFF
RUN
START
(2) C228
A21 12DB GY
S115
8W-70-7
F83 18YL DG
A21 12DB GY
C164
A21 12DB/GY
S202
8W-70-11
TRAILER TOW CONNECTOR (8W-54-3)
L10 18BR LG
C372
L10 18BR LG
F83 18YL DG
A/C LOW PRESSURE SWITCH (8W-42-7,11)
F83 18YL DG
C142
F83 18YL/DG
(3) C171
PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH
R
WITH AUTO TRANS
(1) C171
(1) C135
BACK-UP LAMP SWITCH
R
WITH MANUAL TRANS
(2) C135
WITH TRAILER TOW AND AFTERMARKET TRAILER TOW
C331
L10 18BR/LG
C310
L10 18BR/LG
C165
L10 18BR/LG
C142
L10 18BR/LG
S307
8W-70-24
L10 18BR/LG
C328
L10 18BR/LG
L10 18BR/LG
C328
L10 18BR/LG
L10 18BR/LG
(1) C407
LEFT BACK-UP LAMP
(2) C407
Z1 18BK
(1) C402
RIGHT BACK-UP LAMP
(2) C402
Z1 18BK
S403
8W-70-31
C328
S308
8W-70-24
C320
S404
8W-70-31
Z1 18BK
Z1 18BK
Z1 18BK
Z1 18BK
Z1 12BK
G301
8W-15-7

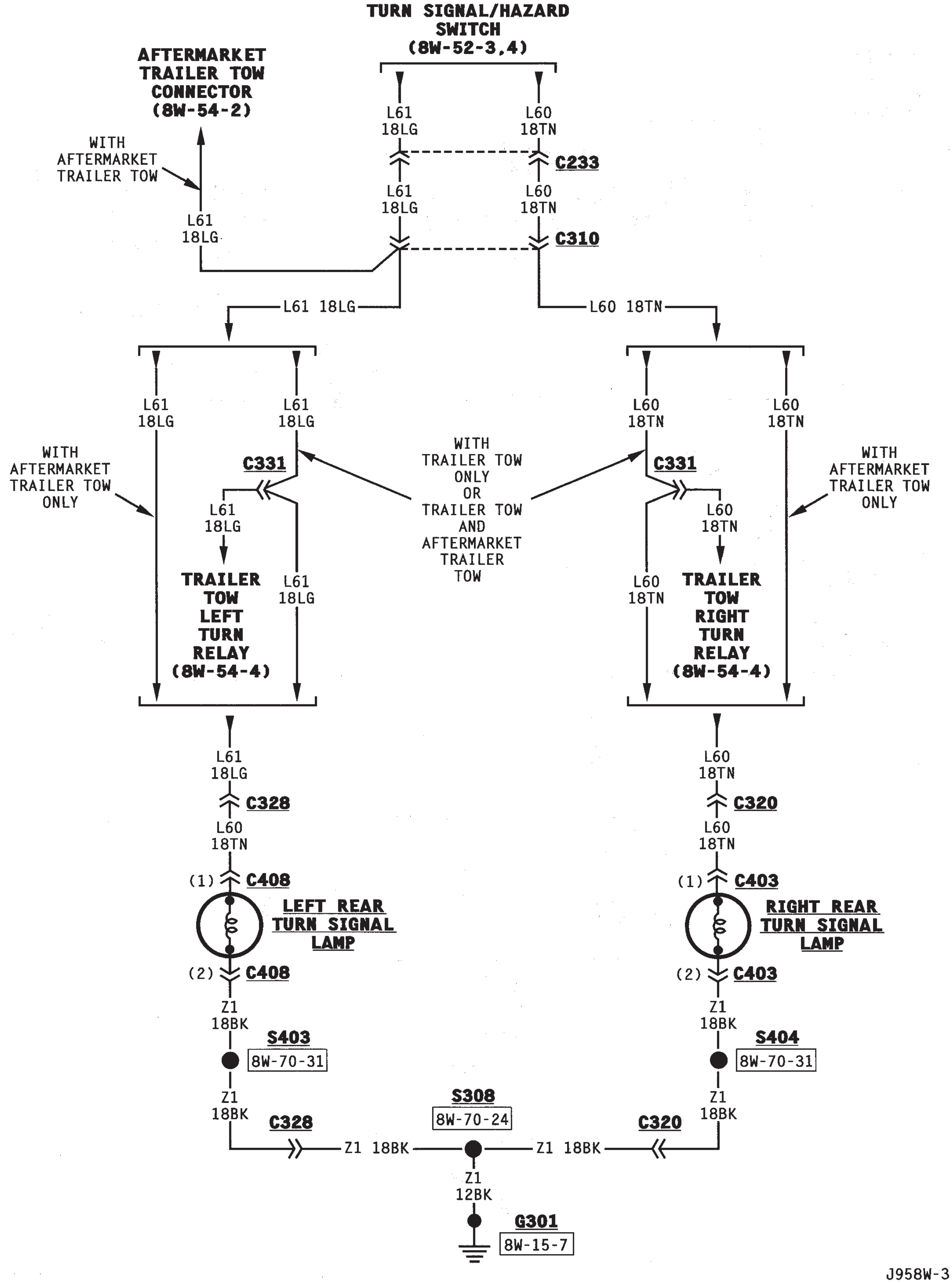
J958W-3

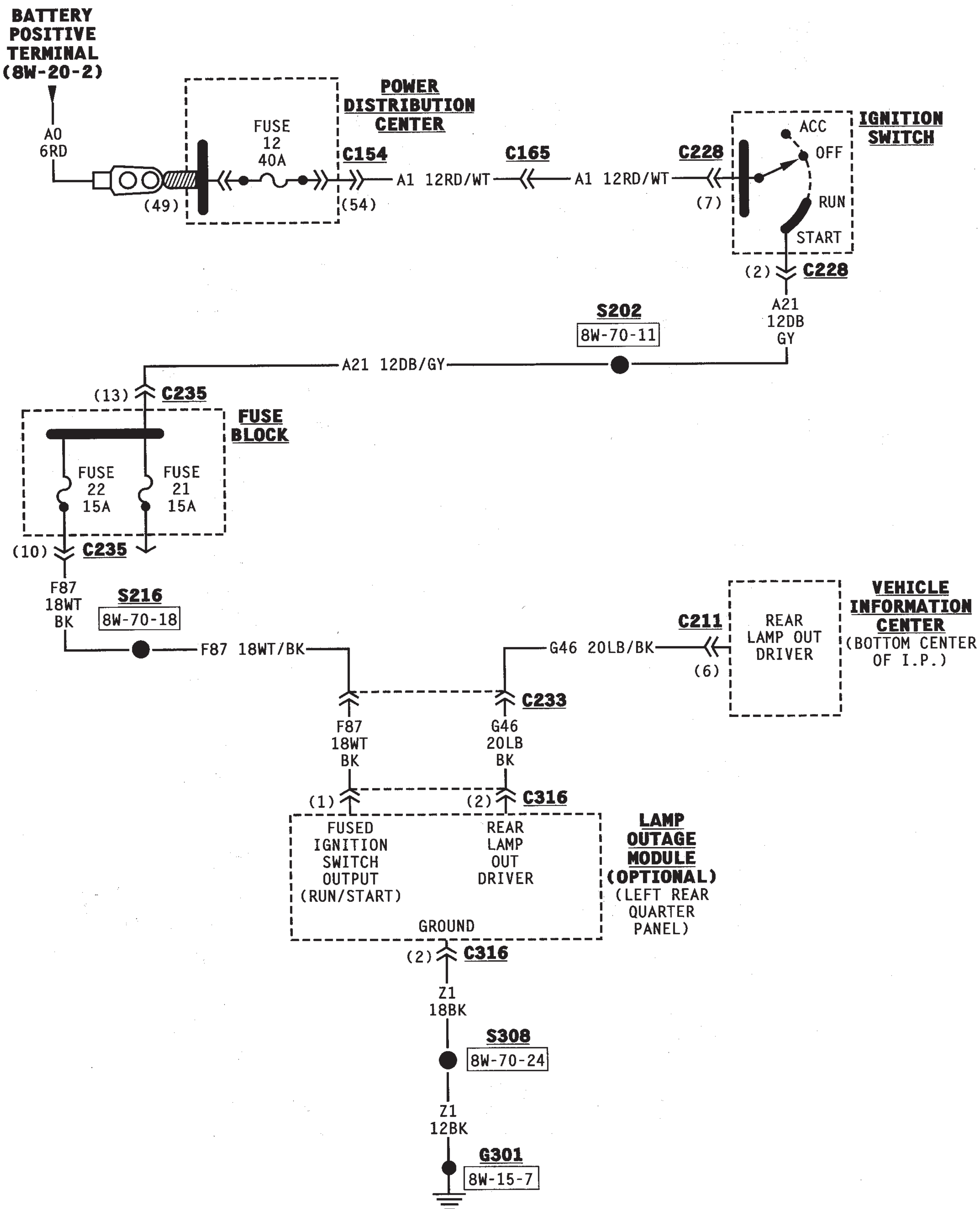

HEADLAMP SWITCH (8W-51-2)
L90 18DB RD
S215
8W-70-17
L90 18DB/RD
C233
L90 16DB/RD
L90 18DB RD
L90 18DB RD
(10)
(9)
(8)
C316
LAMP OUTAGE MODULE (OPTIONAL)
(LEFT REAR QUARTER PANEL)
MATING CONNECTORS IF NOT EQUIPPED WITH LAMP OUTAGE MODULE
PARK LAMP SWITCH OUTPUT
PARK LAMP SWITCH OUTPUT
(10)
(9)
C316
L21 18LB WT
L22 18LB
S401
8W-70-30
C328
C320
S402
8W-70-30
L22 18LB
L22 18LB
L22 18LB
L22 18LB
(2)
C405
LEFT SIDE MARKER LAMP
(1)
C405
(2)
C400
RIGHT SIDE MARKER LAMP
(1)
C400
Z1 18BK
Z1 18BK
S308
8W-70-24
C328
C320
Z1 18BK
Z1 18BK
Z1 18BK
Z1 18BK
S403
8W-70-31
S404
8W-70-31
Z1 12BK
G301
8W-15-7



HEADLAMP SWITCH (8W-51-2)
L90 18DB RD
S215
8W-70-17
L90 18DB/RD
C233
L90 16DB/RD
L90 18DB RD
L90 18DB RD
(10)
(9)
(8)
C316
MATING CONNECTORS IF NOT EQUIPPED WITH LAMP OUTAGE MODULE
PARK LAMP SWITCH OUTPUT
PARK LAMP SWITCH OUTPUT
LAMP OUTAGE MODULE (OPTIONAL) (LEFT REAR QUARTER PANEL)
(8)
C316
C372
L90 18DB/RD
C331
L90 16DB/RD
L90 18DB RD
L90 18DB/RD
WITH AFTERMARKET TRAILER TOW ONLY
L90 18DB RD
TRAILER TOW CONNECTOR (8W-54-4)
L90 18DB RD
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-3)
WITH AFTERMARKET TRAILER TOW AND TRAILER TOW
C321
L90 18DB RD
C364
L90 18DB RD
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-3)
L90 20DB/RD
L90 20DB/RD
S400
8W-70-30
(1)
C410
LEFT LICENSE LAMP
(2)
C410
(1)
C409
RIGHT LICENSE LAMP
(2)
C409
S405
8W-70-31
Z1 20BK
Z1 20BK
Z1 20BK
C364
S316
8W-70-27
Z1 12BK
Z1 18BK
C325
S308
8W-70-24
Z1 12BK
Z1 12BK
G301
8W-15-7

J958W-3


TURN SIGNAL/HAZARD SWITCH (8W-52-3,4)
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-2)
WITH AFTERMARKET TRAILER TOW
L61 18LG
L60 18TN
C233
C310
L61 18LG
L60 18TN
WITH AFTERMARKET TRAILER TOW ONLY
C331
WITH TRAILER TOW ONLY OR TRAILER TOW AND AFTERMARKET TRAILER TOW
TRAILER TOW LEFT TURN RELAY (8W-54-4)
TRAILER TOW RIGHT TURN RELAY (8W-54-4)
C328
C320
(1) C408
(1) C403
LEFT REAR TURN SIGNAL LAMP
RIGHT REAR TURN SIGNAL LAMP
(2) C408
(2) C403
Z1 18BK
S403 8W-70-31
S404 8W-70-31
S308 8W-70-24
Z1 12BK
G301 8W-15-7
J958W-3


BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A0
6RD
(49)
POWER
DISTRIBUTION
CENTER
FUSE
12
40A
C154
(54)
A1 12RD/WT
C165
A1 12RD/WT
C228
(7)
ACC
OFF
RUN
START
IGNITION
SWITCH
(2)
C228
A21
12DB
GY
S202
8W-70-11
A21 12DB/GY
(13)
C235
FUSE
BLOCK
FUSE
22
15A
FUSE
21
15A
(10)
C235
F87
18WT
BK
S216
8W-70-18
F87 18WT/BK
G46 20LB/BK
C211
(6)
REAR
LAMP OUT
DRIVER
VEHICLE
INFORMATION
CENTER
(BOTTOM CENTER
OF I.P.)
C233
F87
18WT
BK
G46
20LB
BK
(1)
(2)
C316
FUSED
IGNITION
SWITCH
OUTPUT
(RUN/START)
REAR
LAMP
OUT
DRIVER
GROUND
LAMP
OUTAGE
MODULE
(OPTIONAL)
(LEFT REAR
QUARTER
PANEL)
(2)
C316
Z1
18BK
S308
8W-70-24
Z1
12BK
G301
8W-15-7

J958W-3

TURN SIGNALS

ELECTRONIC FLASHER RELAY

The electronic flasher relay supplies battery voltage to the turn signal/hazard switch circuitry in the multi-function switch. When the ignition switch is OFF, the hazard flashers will operate but the turn signals will not.

In the ACCESSORY or RUN position, the ignition switch connects circuit A2 from fuse 13 in the Power Distribution Center (PDC) to circuit A22. Circuit A22 feeds circuit L6 through fuse 16 in the fuse block.

Circuit L6 supplies power to the flasher relay. Circut Z1 provides ground for the relay.

Circuit L12 from the flasher relay connects to the multi-function switch to supply power to the hazard flasher circuits. The multi-function switch connects to the rear turn signal lamps on circuits L60 and L61 and the front turn signal lamps on circuits L64 and L65.

TURN SIGNALS

When the operator selects the right turn signal, the multi-function switch connects circuit L5 from the flasher relay to circuits L60 and L64. Circuit L64 feeds the right front turn signal lamp; circuit L60 feeds the right rear turn signal lamp. Circuit L64 also splices to power the right turn signal indicator lamp in the instrument cluster.

When the operator selects the left turn signal, the multi-function switch connects circuit L5 from the flasher relay to circuits L61 and L65. Circuit L61 feeds the left rear turn signal lamp; circuit L65 feeds the left front turn signal lamp. Circuit L65 also splices to power the left turn signal indicator lamp on the instrument cluster.

Circuit Z1 provides ground for the turn signal lamps.

HELPFUL INFORMATION

- The turn signal lamps are the same lamps used for the hazard flasher.
- Check fuse 13 in the PDC and fuse 16 in the fuse block if the turn signals do not operate.

HAZARD FLASHERS

When the operator selects the hazard flashers, the multi-function switch circuit L12 from the flasher relay circuits L60, L61, L64 and L65.

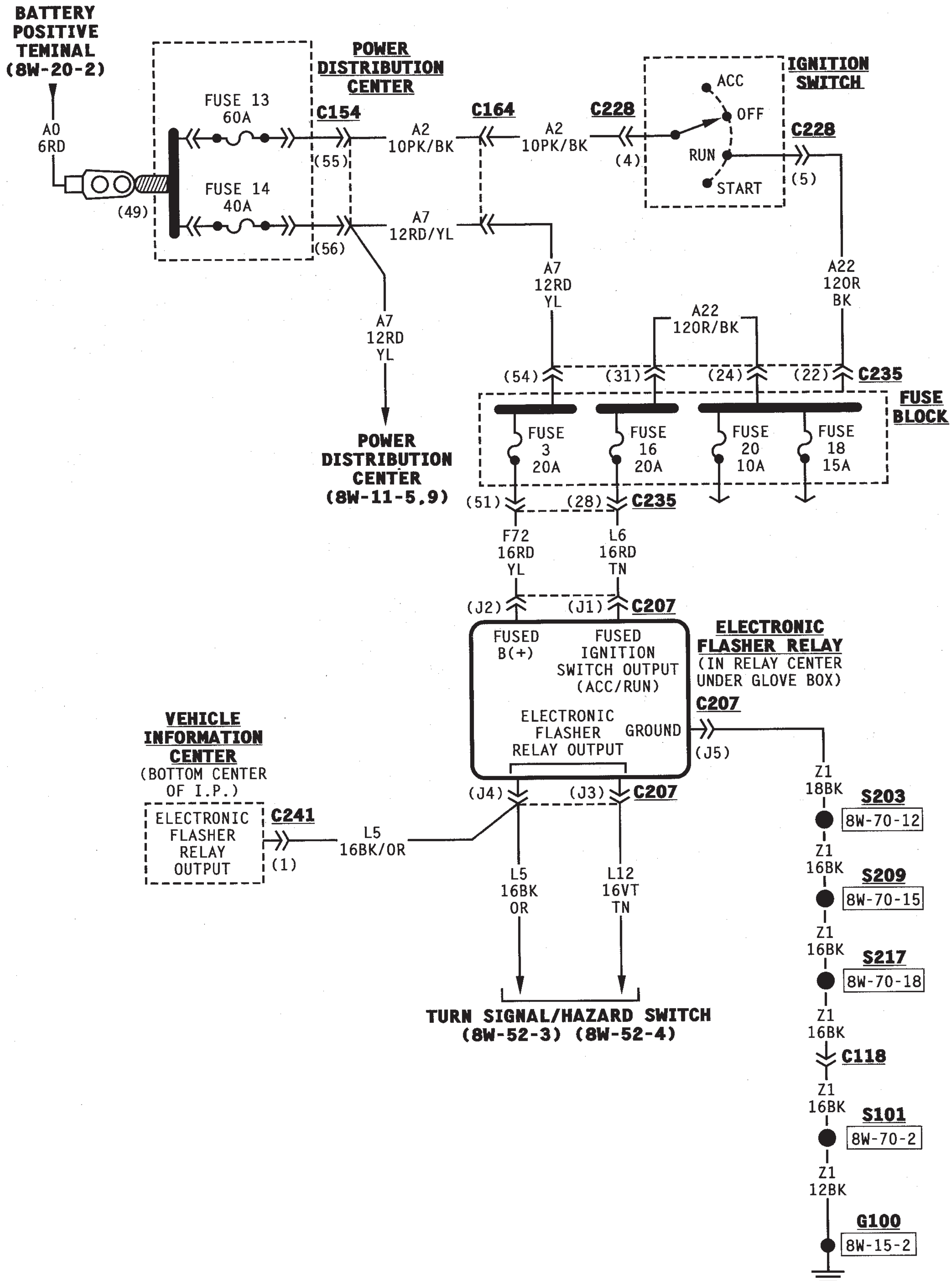
Circuit L61 feeds the left rear turn signal lamp. Circuit L60 feeds the right rear turn signal lamp. Circuit L65 feeds the left front turn signal lamp and the instrument cluster indicator lamp. Circuit L64 feeds the right front turn signal lamp and the instrument cluster indicator lamp.

Circuit Z1 provides ground for the hazard flasher lamps.

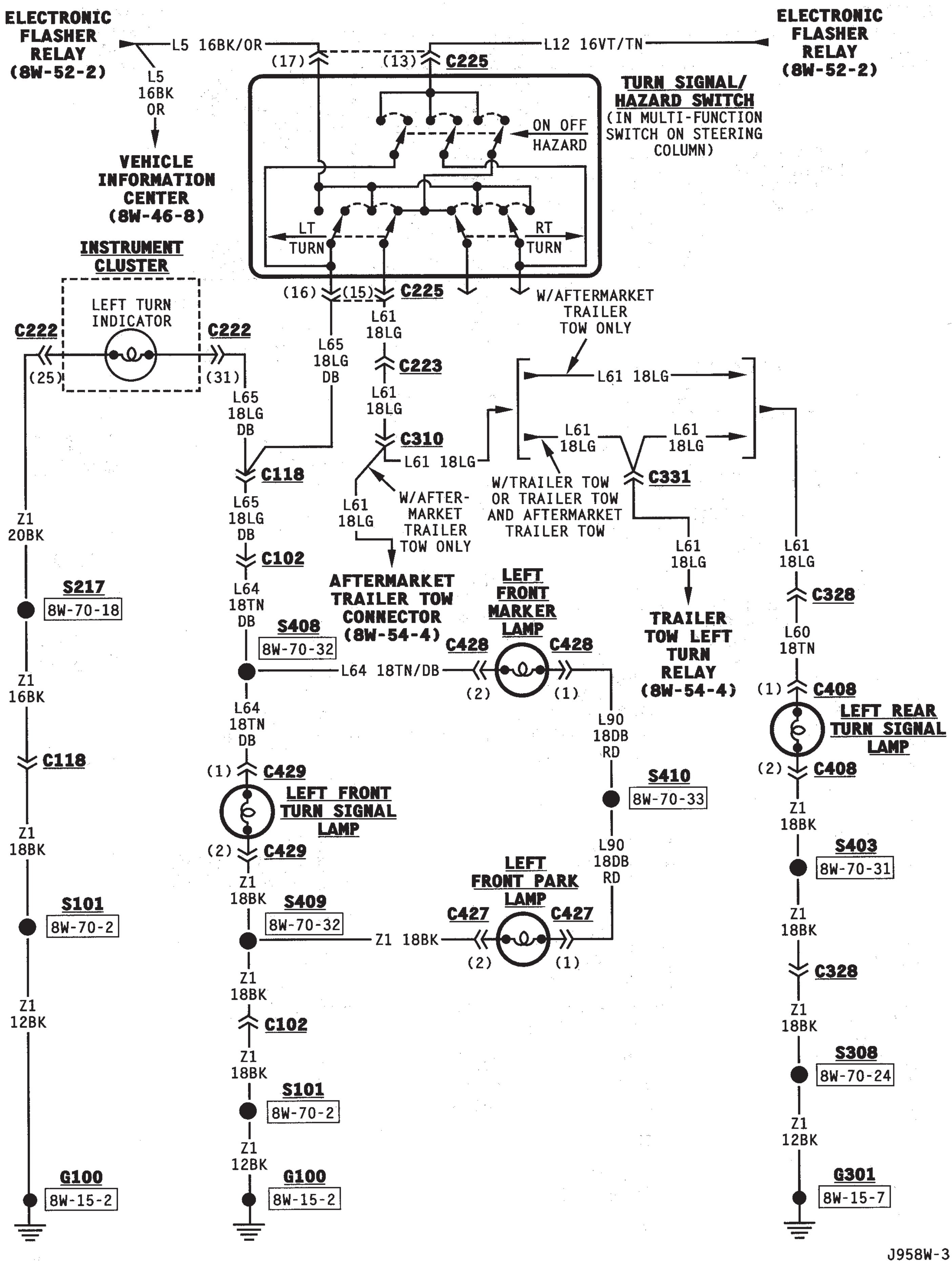
HELPFUL INFORMATION THE HAZARD

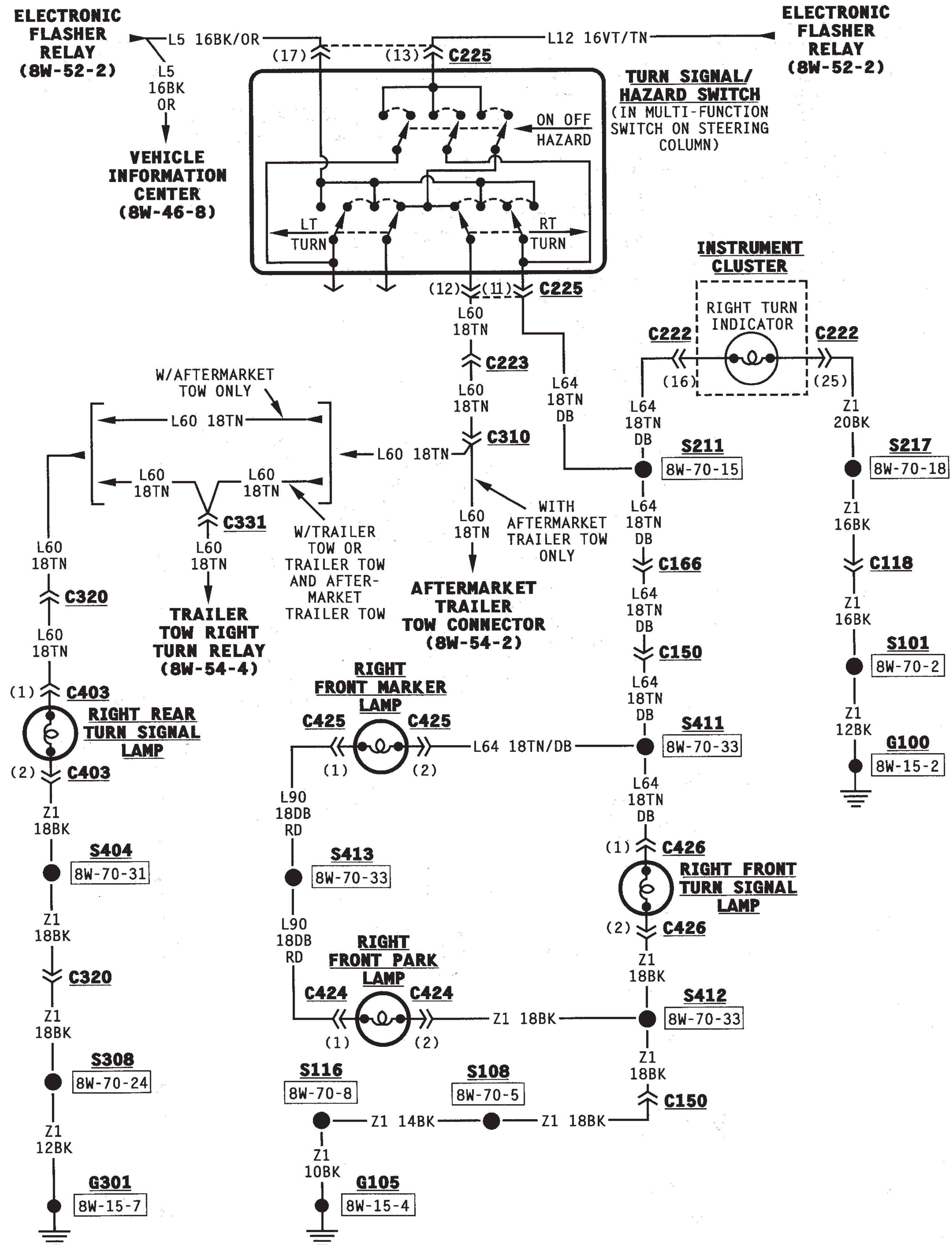
Flasher lamps are the same lamps used for the turn signals.

DIAGRAM INDEX


BATTERY POSITIVE TEMINAL (8W-20-2)
A0 6RD
(49)
FUSE 13 60A
FUSE 14 40A
POWER DISTRIBUTION CENTER
C154
(55)
(56)
A2 10PK/BK
C164
A2 10PK/BK
C228
(4)
A7 12RD/YL
A7 12RD YL
A7 12RD YL
POWER DISTRIBUTION CENTER (8W-11-5,9)
IGNITION SWITCH
ACC
OFF
RUN
START
C228
(5)
A22 12OR BK
A22 12OR/BK
(54)
(31)
(24)
(22)
C235
FUSE BLOCK
FUSE 3 20A
FUSE 16 20A
FUSE 20 10A
FUSE 18 15A
(51)
(28)
C235
F72 16RD YL
L6 16RD TN
(J2)
(J1)
C207
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (ACC/RUN)
ELECTRONIC FLASHER RELAY OUTPUT
GROUND
ELECTRONIC FLASHER RELAY
(IN RELAY CENTER UNDER GLOVE BOX)
C207
(J5)
(J4)
(J3)
C207
VEHICLE INFORMATION CENTER
(BOTTOM CENTER OF I.P.)
ELECTRONIC FLASHER RELAY OUTPUT
C241
(1)
L5 16BK/OR
L5 16BK OR
L12 16VT TN
TURN SIGNAL/HAZARD SWITCH (8W-52-3) (8W-52-4)
Z1 18BK
S203
8W-70-12
Z1 16BK
S209
8W-70-15
Z1 16BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2

J958W-3


ELECTRONIC FLASHER RELAY (8W-52-2)
L5 16BK/OR
L5 16BK OR
VEHICLE INFORMATION CENTER (8W-46-8)
L12 16VT/TN
ELECTRONIC FLASHER RELAY (8W-52-2)
(17)
(13)
C225
TURN SIGNAL/ HAZARD SWITCH
(IN MULTI-FUNCTION SWITCH ON STEERING COLUMN)
ON OFF
HAZARD
LT TURN
RT TURN
(16)
(15)
C225
W/AFTERMARKET TRAILER TOW ONLY
INSTRUMENT CLUSTER
LEFT TURN INDICATOR
C222
C222
(25)
(31)
L65 18LG DB
L61 18LG
C223
L61 18LG
C310
L61 18LG
W/AFTER-MARKET TRAILER TOW ONLY
L61 18LG
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-4)
L61 18LG
L61 18LG
L61 18LG
W/TRAILER TOW OR TRAILER TOW AND AFTERMARKET TRAILER TOW
C331
L61 18LG
TRAILER TOW LEFT TURN RELAY (8W-54-4)
L61 18LG
C328
L60 18TN
(1) C408
LEFT REAR TURN SIGNAL LAMP
(2) C408
Z1 18BK
S403 8W-70-31
Z1 18BK
C328
Z1 18BK
S308 8W-70-24
Z1 12BK
G301 8W-15-7
L65 18LG DB
C118
L65 18LG DB
C102
L64 18TN DB
S408 8W-70-32
L64 18TN/DB
LEFT FRONT MARKER LAMP
C428
C428
(2)
(1)
L90 18DB RD
S410 8W-70-33
L90 18DB RD
LEFT FRONT PARK LAMP
C427
C427
(2)
(1)
Z1 18BK
L64 18TN DB
(1) C429
LEFT FRONT TURN SIGNAL LAMP
(2) C429
Z1 18BK
S409 8W-70-32
Z1 18BK
C102
Z1 18BK
S101 8W-70-2
Z1 12BK
G100 8W-15-2
Z1 20BK
S217 8W-70-18
Z1 16BK
C118
Z1 18BK
S101 8W-70-2
Z1 12BK
G100 8W-15-2
J958W-3


ELECTRONIC FLASHER RELAY (8W-52-2)
L5 16BK/OR
L5 16BK OR
VEHICLE INFORMATION CENTER (8W-46-8)
(17)
(13)
C225
L12 16VT/TN
ELECTRONIC FLASHER RELAY (8W-52-2)
TURN SIGNAL/ HAZARD SWITCH (IN MULTI-FUNCTION SWITCH ON STEERING COLUMN)
ON OFF HAZARD
LT TURN
RT TURN
(12)
(11)
C225
L60 18TN
C223
L60 18TN
C310
L64 18TN DB
INSTRUMENT CLUSTER
RIGHT TURN INDICATOR
C222
C222
(16)
(25)
L64 18TN DB
Z1 20BK
S211
8W-70-15
S217
8W-70-18
W/AFTERMARKET TOW ONLY
L60 18TN
L60 18TN
L60 18TN
L60 18TN
C331
W/TRAILER TOW OR TRAILER TOW AND AFTER-MARKET TRAILER TOW
L60 18TN
WITH AFTERMARKET TRAILER TOW ONLY
L64 18TN DB
Z1 16BK
C166
C118
L60 18TN
C320
L60 18TN
TRAILER TOW RIGHT TURN RELAY (8W-54-4)
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-2)
L64 18TN DB
C150
Z1 16BK
S101
8W-70-2
L60 18TN
L64 18TN DB
Z1 12BK
(1)
C403
RIGHT REAR TURN SIGNAL LAMP
(2)
C403
RIGHT FRONT MARKER LAMP
C425
C425
(1)
(2)
L64 18TN/DB
S411
8W-70-33
G100
8W-15-2
Z1 18BK
L90 18DB RD
L64 18TN DB
S404
8W-70-31
S413
8W-70-33
(1)
C426
RIGHT FRONT TURN SIGNAL LAMP
(2)
C426
Z1 18BK
L90 18DB RD
C320
RIGHT FRONT PARK LAMP
C424
C424
(1)
(2)
Z1 18BK
Z1 18BK
Z1 18BK
S412
8W-70-33
S308
8W-70-24
Z1 18BK
C150
S116
8W-70-8
S108
8W-70-5
Z1 14BK
Z1 18BK
Z1 12BK
Z1 10BK
G301
8W-15-7
G105
8W-15-4

J958W-3

WIPERS

INDEX

INTERMITTENT WIPERS

The intermittent wiper system is standard equipment on this vehicle. Power for the system is supplied on circuit F86 from the 10 amp circuit breaker in cavity 27 of the fuse block. Circuit F86 splices to the intermittent wiper module and the wiper switch.

Power for the circuit breaker is supplied on circuit A31 from the ignition switch. This circuit is HOT in the ACCESSORY and RUN positions only. Power for the A31 circuit is supplied on circuit A1 from the Power Distribution Center (PDC). This circuit is HOT at all times and protected by a 40 amp fuse located in cavity 12.

Ground for the wiper system is provided on circuit Z1.

When the operator moves the wiper switch to the LOW position, battery voltage passes through the switch to circuit V3. Circuit V3 feeds the wiper motor low speed brushes through the intermittent wiper module. If the operator selects wiper HIGH speed operation, the wiper switch passes current to circuit V4. Circuit V4 feeds the wiper motor high speed brushes through the intermittent wiper module.

The DELAY portion of the wiper switch contains a variable resistor. The variable resistor connects to the intermittent wiper module through the wiper switch harness. The amount of delay selected by the operator determines the voltage drop through the resistor and the voltage level received by the intermittent wiper module on circuit V50.

After the intermittent wiper control module determines the amount of delay selected, it cycles the wipers by periodically energizing circuit V3. Circuit V3 powers the wiper motor low speed brushes.

As the windshield wiper motor turns, the park switch, internal to the motor, moves from its DOWN position to the UP position. When the wiper switch is turned OFF, the F86 circuit prevents the wipers from stopping in any position but park.

The windshield washer uses a pump motor located inside the windshield washer fluid reservoir. When the washer switch is pressed, power is supplied through the wiper switch to the pump motor on circuit V11. Circuit Z1 provides ground for the pump motor.

HELPFUL INFORMATION

- Check the 40 amp fuse in cavity F12 of the PDC
- Check the 10 amp circuit breaker in cavity 27 of the fuse block

REAR WIPER/WASHER

The optional rear wiper and washer system uses a switch assembly located in the right switch pod. Power for the switch pod is supplied by circuit V23 from the fuse box. This circuit is protected by a 20 amp fuse located in cavity 9.

Power for fuse 9 is supplied on circuit A31 from the ignition switch. This circuit is HOT in the ACCESSORY and RUN positions only. Power for the A31 circuit is supplied on circuit A1 from the Power Distribution Center (PDC) fuse 12.

Power for the rear wiper motor and the control module located internal to the motor assembly is provided by the A18 circuit from the fuse block fuse 1. This fuse is HOT at all times. Power for the fuse is supplied on the A7 circuit from the PDC. This circuit is protected by a 40 amp fuse located in cavity 14.

When the operator selects the ON position, power is supplied through the switch to circuit V13. The V13 circuit connects from the switch to the rear wiper control module.

The module processes this signal and supplies power to the wiper motor. Ground for the wiper motor is supplied on circuit Z1.

When the switch is placed in the DELAY position, power is supplied from the switch to the motor control on circuit V24. The module processes this signal and connects the motor to voltage. The amount of DELAY is controlled by the position of the rear wiper switch.

When the WASH switch is activated, power is passed through the switch to circuit V20. This circuit is double crimped at the switch. One branch of the circuit connects to the rear wiper control module. The other branch connects to the rear washer pump motor.

An additional input to the wiper control module is supplied on circuit G78. This circuit is connected to the liftgate ajar switch, and is used to signal to the control when the liftgate is ajar.

When the liftgate is ajar the wiper control module will not allow the rear wiper or washer to operate.

HELPFUL INFORMATION

- Check the 40 amp fuse located in cavity 12 of the PDC
- Check the 20 amp fuse located in cavity 9 of the fuse block
- Check the operation of the liftgate ajar switch

WASHER FLUID LEVEL SENSOR

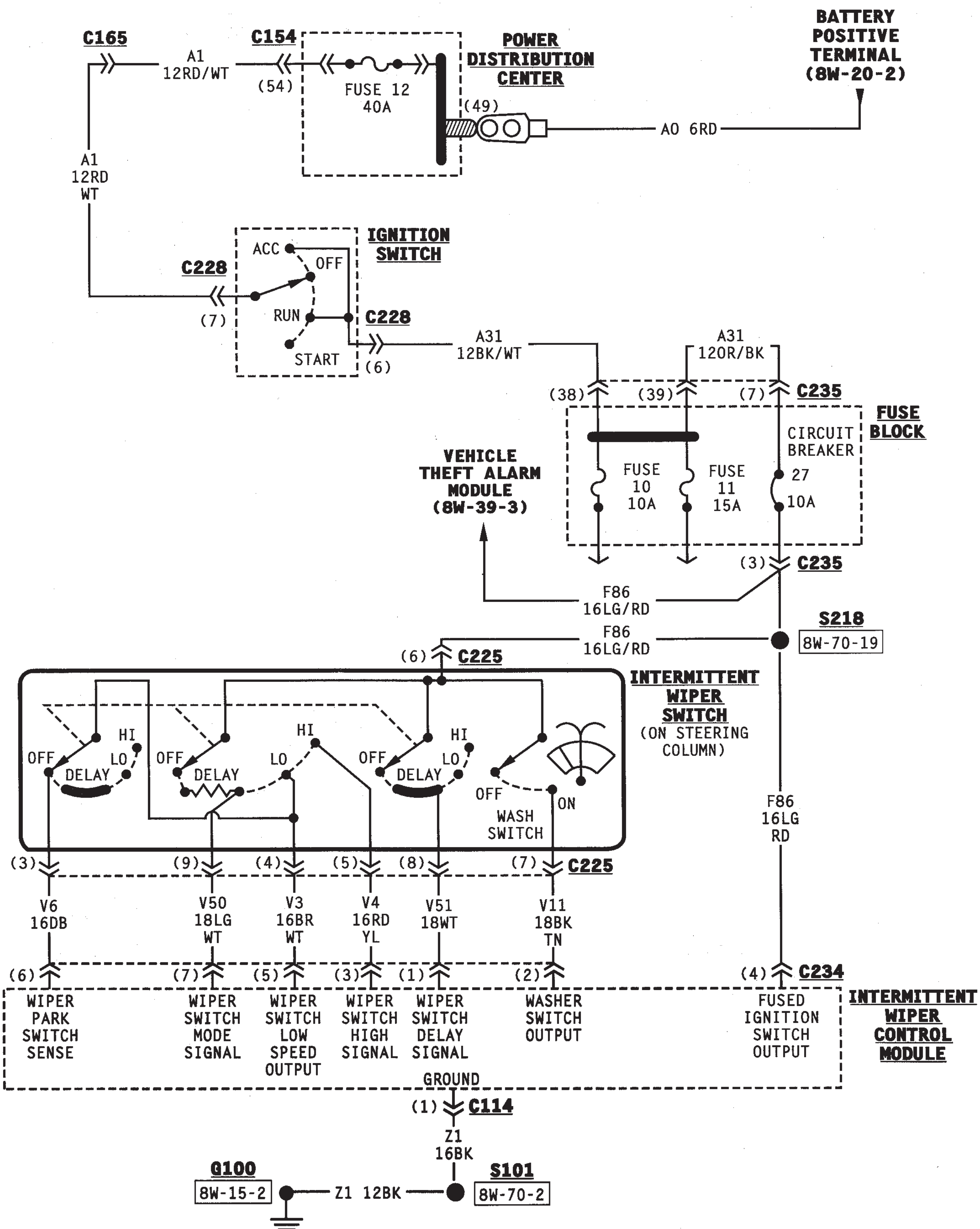
Vehicles equipped with the optional Vehicle Information Center (VIC) have a washer fluid level sensor located in the washer fluid reservoir. Power for the sensor is supplied from the VIC on circuit G29.

When the fluid in the reservoir reaches a calibrated level the contacts in the sensor close connecting the G29 circuit to ground on circuit Z1.

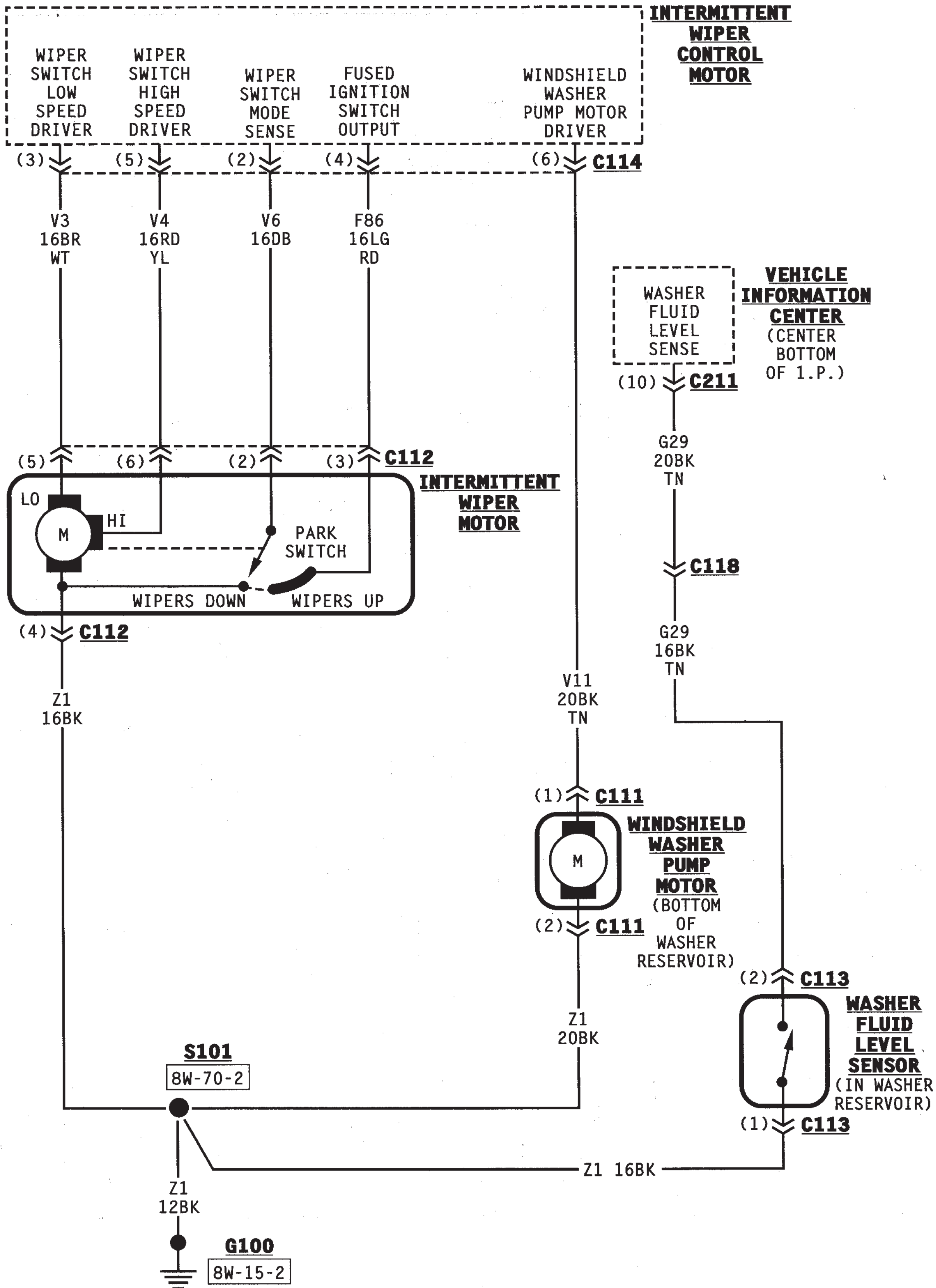
HELPFUL INFORMATION

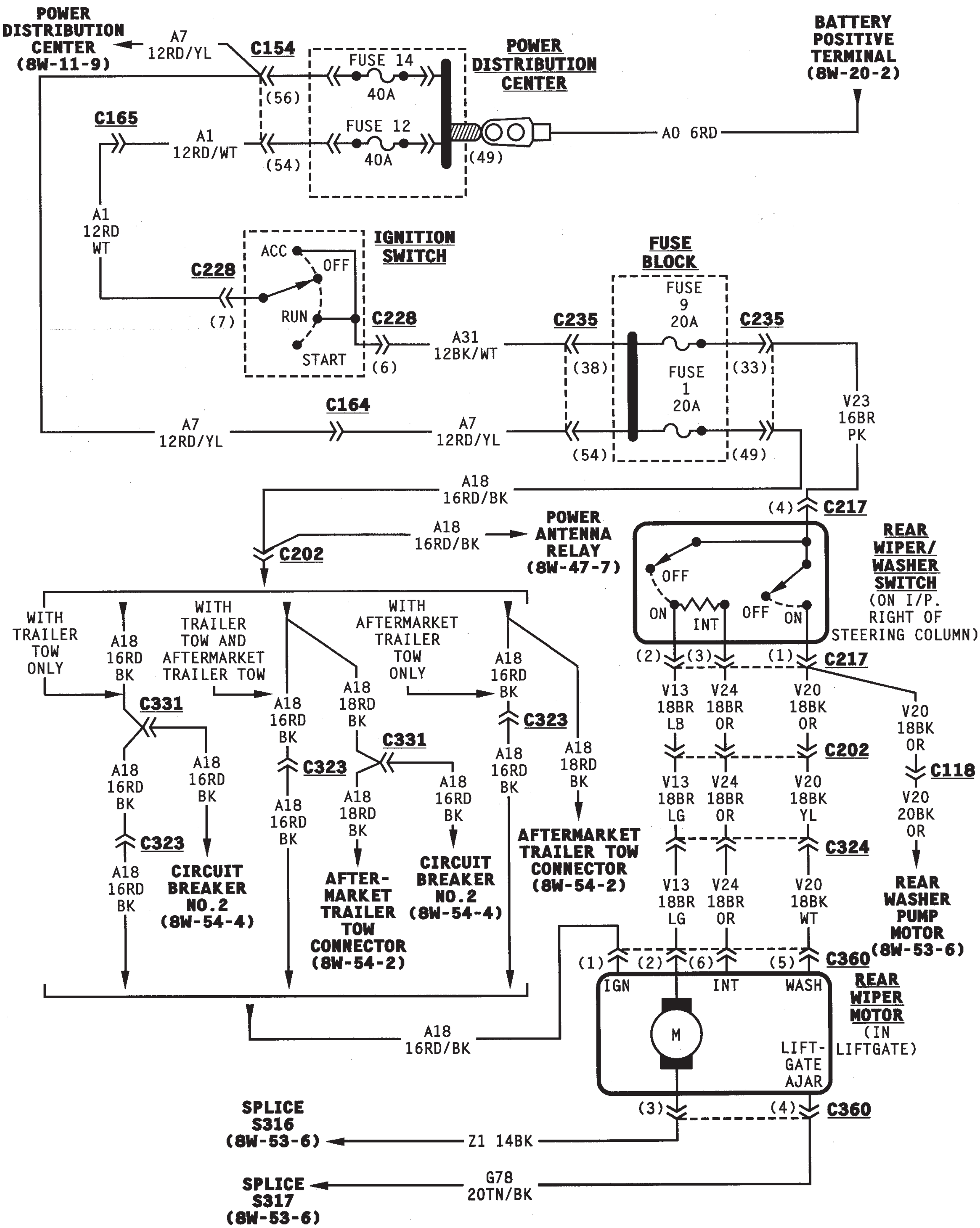
- Check the continuity of the switch

DIAGRAM INDEX

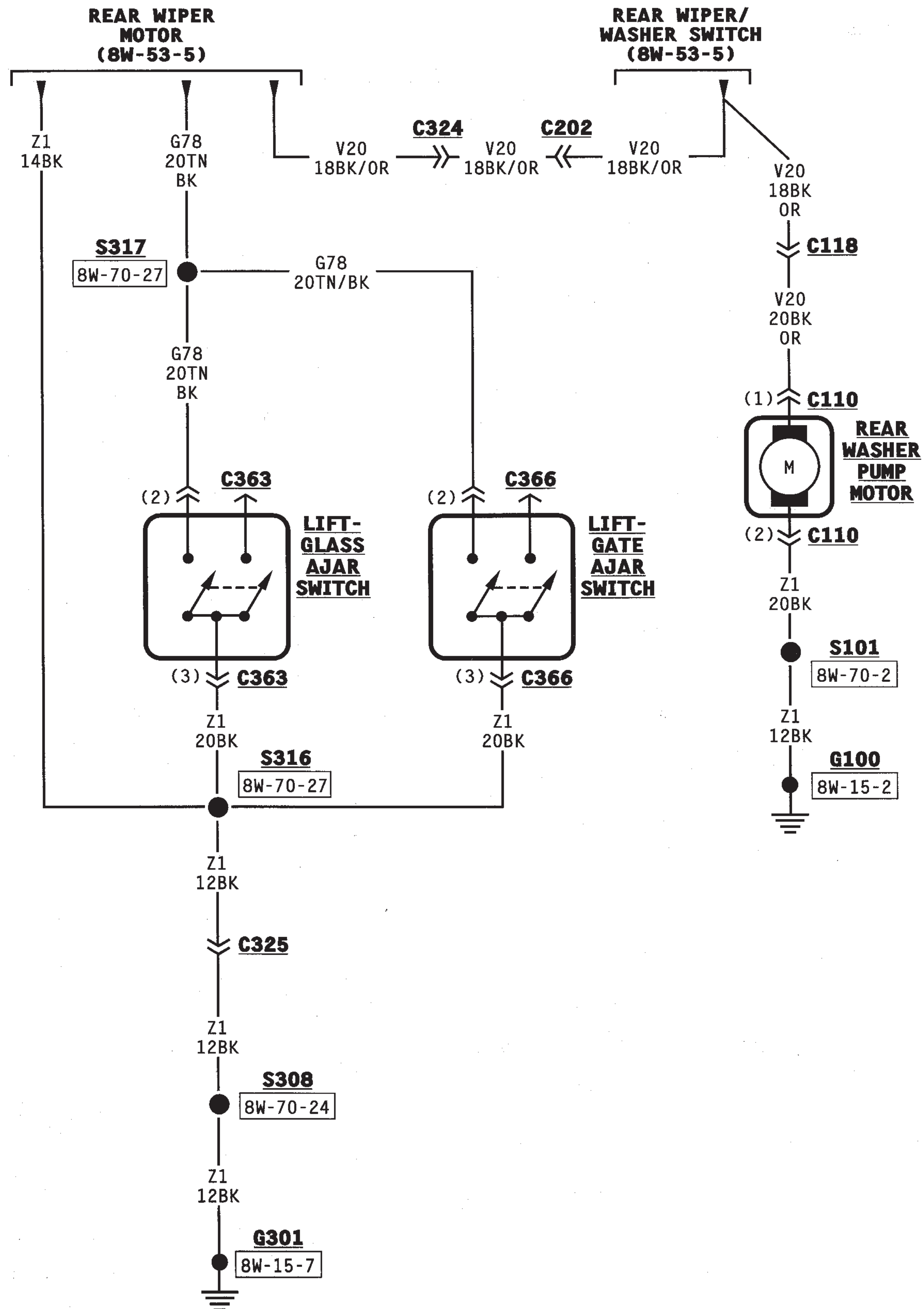

C165
A1
12RD/WT
C154
(54)
FUSE 12
40A
POWER
DISTRIBUTION
CENTER
(49)
A0 6RD
BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A1
12RD
WT
IGNITION
SWITCH
ACC
OFF
C228
(7)
RUN
START
C228
(6)
A31
12BK/WT
A31
12OR/BK
(38)
(39)
(7)
C235
FUSE
BLOCK
CIRCUIT
BREAKER
27
10A
FUSE
10
10A
FUSE
11
15A
VEHICLE
THEFT ALARM
MODULE
(8W-39-3)
(3)
C235
F86
16LG/RD
F86
16LG/RD
S218
8W-70-19
(6)
C225
INTERMITTENT
WIPER
SWITCH
(ON STEERING
COLUMN)
OFF
HI
LO
DELAY
OFF
DELAY
LO
HI
OFF
HI
LO
DELAY
OFF
ON
WASH
SWITCH
F86
16LG
RD
(3)
(9)
(4)
(5)
(8)
(7)
C225
V6
16DB
V50
18LG
WT
V3
16BR
WT
V4
16RD
YL
V51
18WT
V11
18BK
TN
(6)
(7)
(5)
(3)
(1)
(2)
(4)
C234
WIPER
PARK
SWITCH
SENSE
WIPER
SWITCH
MODE
SIGNAL
WIPER
SWITCH
LOW
SPEED
OUTPUT
WIPER
SWITCH
HIGH
SIGNAL
WIPER
SWITCH
DELAY
SIGNAL
WASHER
SWITCH
OUTPUT
FUSED
IGNITION
SWITCH
OUTPUT
INTERMITTENT
WIPER
CONTROL
MODULE
GROUND
(1)
C114
Z1
16BK
G100
8W-15-2
Z1 12BK
S101
8W-70-2

J958W-3


INTERMITTENT WIPER CONTROL MOTOR
WIPER SWITCH LOW SPEED DRIVER
WIPER SWITCH HIGH SPEED DRIVER
WIPER SWITCH MODE SENSE
FUSED IGNITION SWITCH OUTPUT
WINDSHIELD WASHER PUMP MOTOR DRIVER
(3)
(5)
(2)
(4)
(6)
C114
V3 16BR WT
V4 16RD YL
V6 16DB
F86 16LG RD
WASHER FLUID LEVEL SENSE
VEHICLE INFORMATION CENTER (CENTER BOTTOM OF I.P.)
(10)
C211
G29 20BK TN
C118
G29 16BK TN
(5)
(6)
(2)
(3)
C112
INTERMITTENT WIPER MOTOR
LO
HI
M
PARK SWITCH
WIPERS DOWN
WIPERS UP
(4)
C112
Z1 16BK
V11 20BK TN
(1)
C111
WINDSHIELD WASHER PUMP MOTOR (BOTTOM OF WASHER RESERVOIR)
M
(2)
C111
Z1 20BK
(2)
C113
WASHER FLUID LEVEL SENSOR (IN WASHER RESERVOIR)
(1)
C113
S101
8W-70-2
Z1 16BK
Z1 12BK
G100
8W-15-2


POWER DISTRIBUTION CENTER (8W-11-9)
A7 12RD/YL
C154
FUSE 14 40A
(56)
POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
C165
A1 12RD/WT
FUSE 12 40A
(54)
(49)
A0 6RD
A1 12RD WT
IGNITION SWITCH
ACC
OFF
C228
(7)
RUN
START
C228
(6)
A31 12BK/WT
FUSE BLOCK
C235
FUSE 9 20A
C235
(38)
(33)
FUSE 1 20A
C164
A7 12RD/YL
A7 12RD/YL
(54)
(49)
V23 16BR PK
A18 16RD/BK
(4) C217
A18 16RD/BK
POWER ANTENNA RELAY (8W-47-7)
C202
REAR WIPER/ WASHER SWITCH (ON I/P. RIGHT OF STEERING COLUMN)
OFF
ON
INT
OFF
ON
WITH TRAILER TOW ONLY
WITH TRAILER TOW AND AFTERMARKET TRAILER TOW
WITH AFTERMARKET TRAILER TOW ONLY
A18 16RD BK
A18 18RD BK
A18 16RD BK
(2) (3) (1) C217
V13 18BR LB
V24 18BR OR
V20 18BK OR
V20 18BK OR
C331
A18 16RD BK
C323
C331
C202
C118
A18 16RD BK
A18 16RD BK
A18 16RD BK
A18 18RD BK
V13 18BR LG
V24 18BR OR
V20 18BK YL
V20 20BK OR
C323
A18 16RD BK
A18 18RD BK
A18 16RD BK
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-2)
C324
REAR WASHER PUMP MOTOR (8W-53-6)
A18 16RD BK
CIRCUIT BREAKER NO.2 (8W-54-4)
AFTER-MARKET TRAILER TOW CONNECTOR (8W-54-2)
CIRCUIT BREAKER NO.2 (8W-54-4)
V13 18BR LG
V24 18BR OR
V20 18BK WT
(1) (2) (6) (5) C360
IGN
INT
WASH
M
REAR WIPER MOTOR (IN LIFTGATE)
LIFT-GATE AJAR
A18 16RD/BK
(3) (4) C360
SPLICE S316 (8W-53-6)
Z1 14BK
SPLICE S317 (8W-53-6)
G78 20TN/BK

J958W-3


REAR WIPER MOTOR (8W-53-5)
REAR WIPER/ WASHER SWITCH (8W-53-5)
Z1 14BK
G78 20TN BK
V20 18BK/OR
C324
V20 18BK/OR
C202
V20 18BK/OR
V20 18BK OR
C118
V20 20BK OR
(1) C110
REAR WASHER PUMP MOTOR
M
(2) C110
Z1 20BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
S317
8W-70-27
G78 20TN/BK
G78 20TN BK
(2) C363
LIFT-GLASS AJAR SWITCH
(3) C363
(2) C366
LIFT-GATE AJAR SWITCH
(3) C366
Z1 20BK
Z1 20BK
S316
8W-70-27
Z1 12BK
C325
Z1 12BK
S308
8W-70-24
Z1 12BK
G301
8W-15-7

TRAILER TOW

TRAILER TOW

The factory installed trailer tow system in this vehicle uses three relays and a circuit breaker along with the trailer tow wiring connector located below the rear bumper.

Battery voltage for the trailer tow circuit breaker and the stop lamp relay is supplied on circuit A18. This circuit is HOT at all times and protected by a 20 amp fuse in cavity 1 of the fuse block. Power for the fuse is supplied on circuit A7 from the Power Distribution Center (PDC). The A7 circuit is protected by a 40 amp fuse in cavity 12 of the PDC.

The trailer tow circuit breaker is a 10 amp and located in the right rear quarter panel.

STOP LAMP RELAY

Power for the coil side of the stop lamp relay is supplied by circuit L50. This circuit connects to the stop lamps. Ground for the coil side is supplied on circuit Z1.

When the operator depresses the brake pedal, voltage flows through the coil of the relay to ground causing the contacts in the relay to close connecting circuits A18 and 95.

Circuit 95 connects to the left and right turn signal relays. Voltage flows through the closed contacts in the relays to the trailer tow connector.

RIGHT TURN RELAY

Power for the coil side of the right turn relay is supplied by circuit L60. This circuit connects to the right side turn signal lamps. Ground for the coil side of the relay is supplied on circuit Z1.

When the operator turns the right turn signal ON, power flows through the coil in the relay to ground causing the contacts in the relay to switch from the normally CLOSED position to connect circuits 94 and L60.

Circuit 94 is the feed for the contact side of the relay. Circuit L60 connects from the relay to the trailer tow connector.

Circuit 94 is fed power through the normally CLOSED side of the stop lamp relay and circuit A18. The A18 circuit is HOT at all times and protected by a 10 amp circuit breaker located in the right rear quarter panel.

LEFT TURN RELAY

Power for the coil side of the left turn relay is supplied by circuit L61. This circuit connects to the left side turn signal lamps. Ground for the coil side of the relay is supplied on circuit Z1.

When the operator turns the left turn signal ON, power flows through the coil in the relay to ground causing the contacts in the relay to switch from the normally CLOSED position to connect circuits 94 and L61.

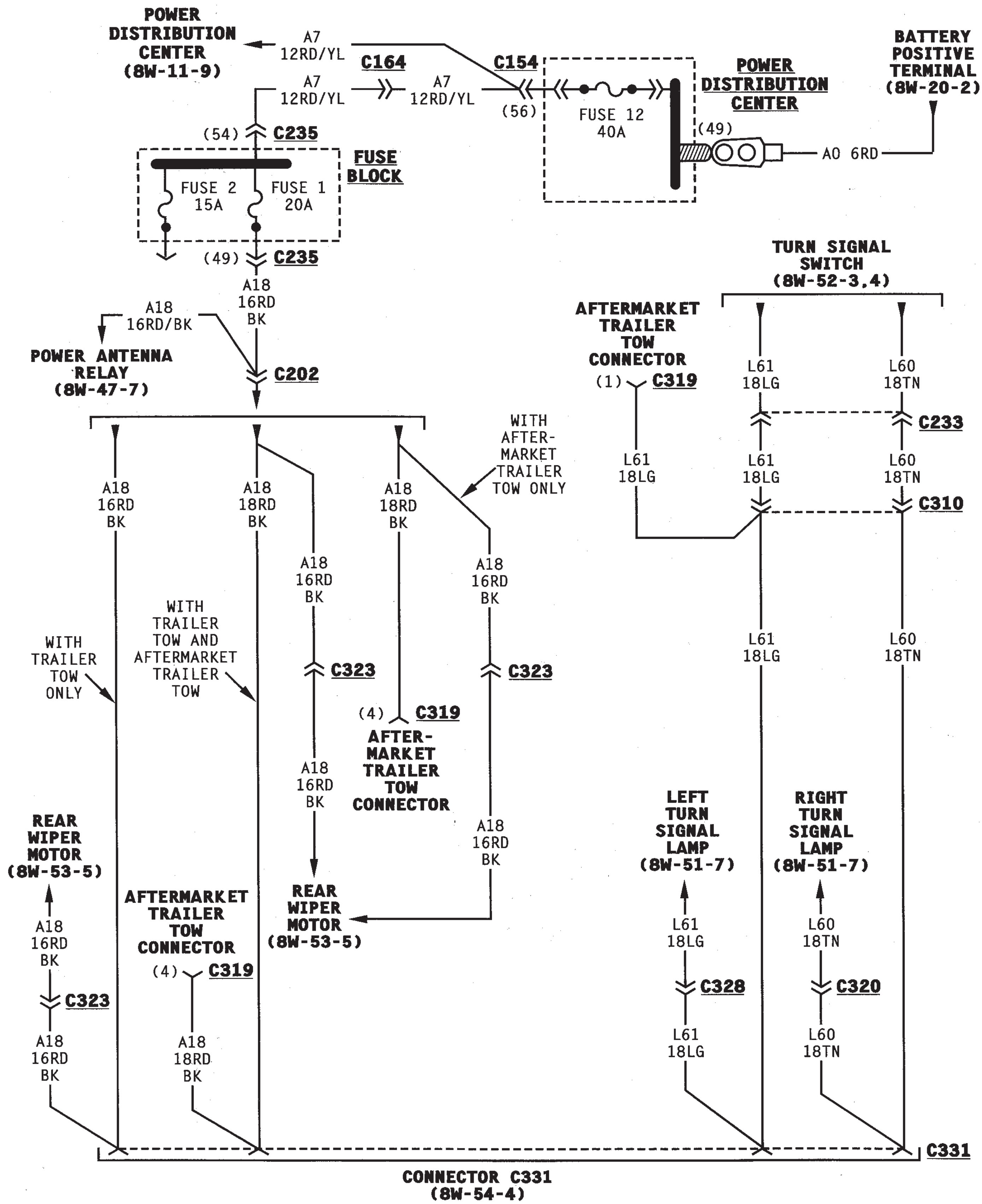
Circuit 94 is the feed for the contact side of the relay. Circuit L61 connects from the relay to the trailer tow connector.

Circuit 94 is fed power through the normally CLOSED side of the stop lamp relay and circuit A18. The A18 circuit is HOT at all times and protected by a 10 amp circuit breaker located in the right rear quarter panel.

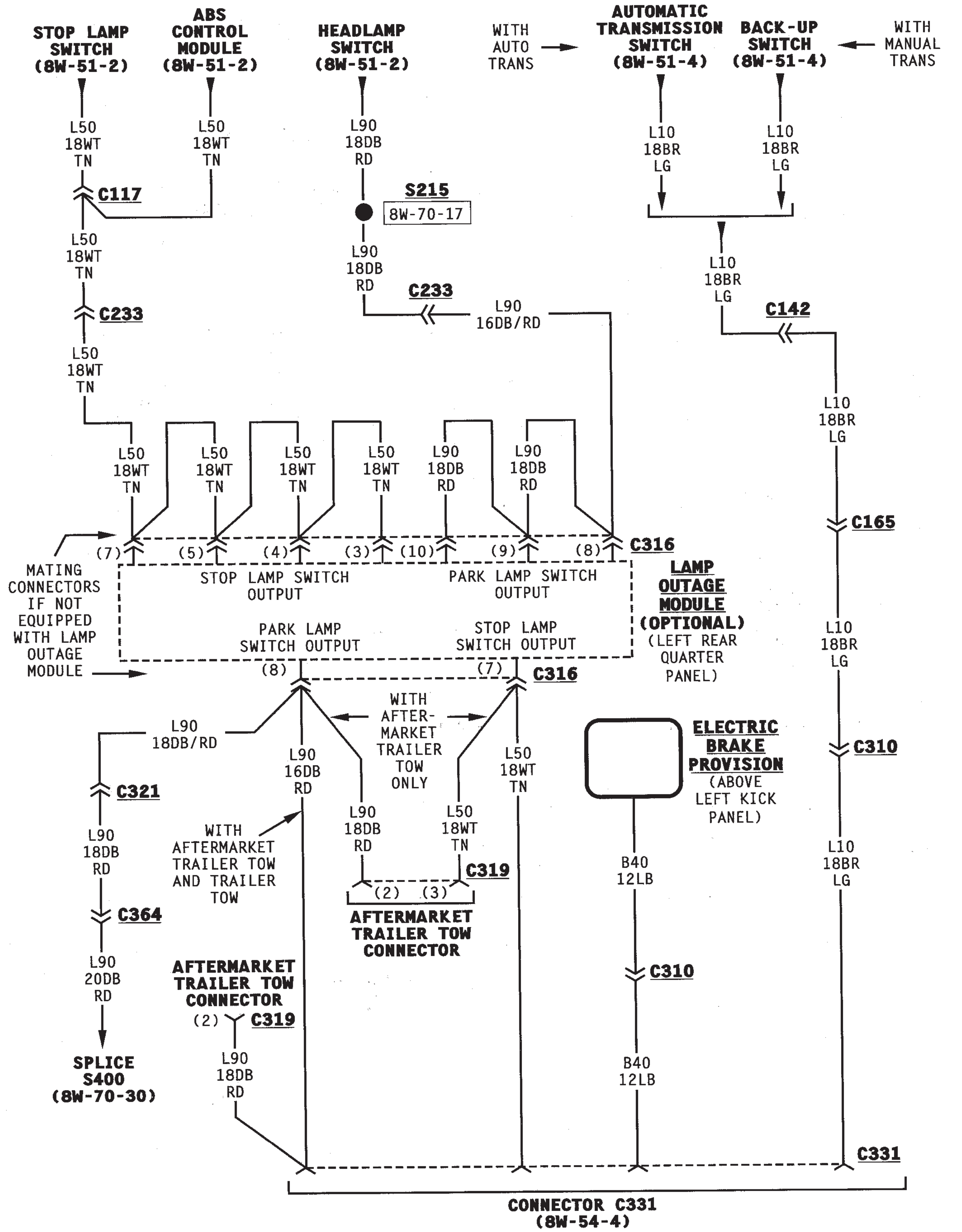
HELPFUL INFORMATION

- Check the 40 amp fuse located in cavity 12 of the PDC
- Check the 20 amp fuse located in cavity 1 of the fuse block
- Check the In-Line circuit breaker

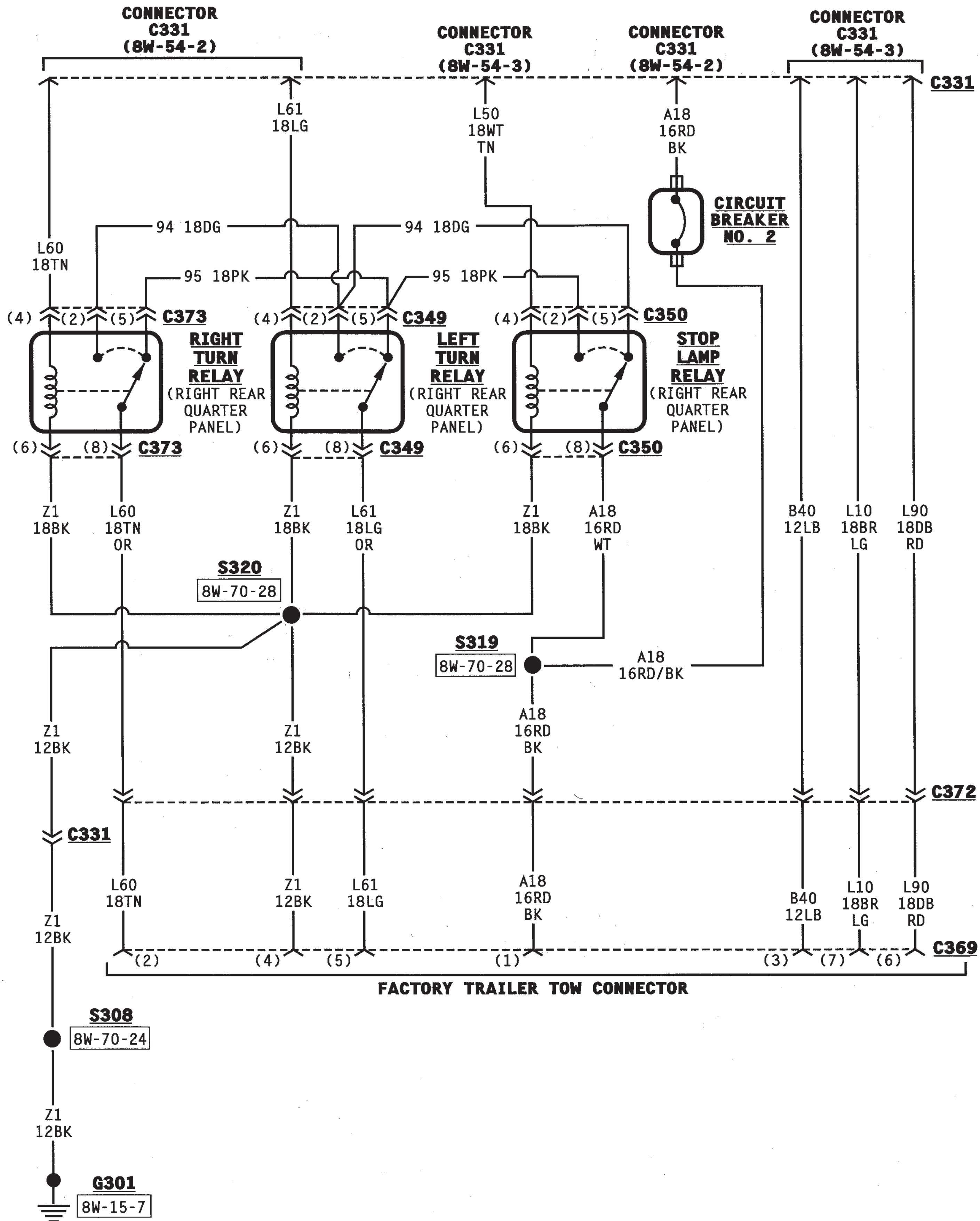
DIAGRAM INDEX


POWER DISTRIBUTION CENTER (8W-11-9)
A7 12RD/YL
C164
A7 12RD/YL
A7 12RD/YL
C154
(56)
FUSE 12 40A
POWER DISTRIBUTION CENTER
BATTERY POSITIVE TERMINAL (8W-20-2)
(49)
A0 6RD
(54) C235
FUSE BLOCK
FUSE 2 15A
FUSE 1 20A
(49) C235
A18 16RD BK
A18 16RD/BK
POWER ANTENNA RELAY (8W-47-7)
C202
A18 16RD BK
A18 18RD BK
A18 18RD BK
WITH AFTER-MARKET TRAILER TOW ONLY
A18 16RD BK
A18 16RD BK
WITH TRAILER TOW ONLY
WITH TRAILER TOW AND AFTERMARKET TRAILER TOW
C323
C323
(4) C319
AFTER-MARKET TRAILER TOW CONNECTOR
A18 16RD BK
A18 16RD BK
REAR WIPER MOTOR (8W-53-5)
REAR WIPER MOTOR (8W-53-5)
A18 16RD BK
C323
A18 16RD BK
AFTERMARKET TRAILER TOW CONNECTOR
(4) C319
A18 18RD BK
TURN SIGNAL SWITCH (8W-52-3,4)
AFTERMARKET TRAILER TOW CONNECTOR
(1) C319
L61 18LG
L60 18TN
C233
L61 18LG
L61 18LG
L60 18TN
C310
L61 18LG
L60 18TN
LEFT TURN SIGNAL LAMP (8W-51-7)
RIGHT TURN SIGNAL LAMP (8W-51-7)
L61 18LG
C328
L61 18LG
L60 18TN
C320
L60 18TN
C331
CONNECTOR C331 (8W-54-4)

J958W-3


STOP LAMP SWITCH (8W-51-2)
ABS CONTROL MODULE (8W-51-2)
HEADLAMP SWITCH (8W-51-2)
WITH AUTO TRANS
AUTOMATIC TRANSMISSION SWITCH (8W-51-4)
BACK-UP SWITCH (8W-51-4)
WITH MANUAL TRANS
L50 18WT TN
L90 18DB RD
L10 18BR LG
C117
S215
8W-70-17
C233
L90 16DB/RD
C142
C165
MATING CONNECTORS IF NOT EQUIPPED WITH LAMP OUTAGE MODULE
(7) (5) (4) (3) (10) (9) (8)
C316
STOP LAMP SWITCH OUTPUT
PARK LAMP SWITCH OUTPUT
PARK LAMP SWITCH OUTPUT
STOP LAMP SWITCH OUTPUT
LAMP OUTAGE MODULE (OPTIONAL) (LEFT REAR QUARTER PANEL)
(8) (7)
WITH AFTER-MARKET TRAILER TOW ONLY
L90 18DB/RD
L90 16DB RD
L50 18WT TN
C321
WITH AFTERMARKET TRAILER TOW AND TRAILER TOW
C319
(2) (3)
AFTERMARKET TRAILER TOW CONNECTOR
ELECTRIC BRAKE PROVISION (ABOVE LEFT KICK PANEL)
B40 12LB
C310
C364
L90 20DB RD
SPLICE S400 (8W-70-30)
AFTERMARKET TRAILER TOW CONNECTOR
(2) C319
C331
CONNECTOR C331 (8W-54-4)

J958W-3



CONNECTOR C331 (8W-54-2)
CONNECTOR C331 (8W-54-3)
CONNECTOR C331 (8W-54-2)
CONNECTOR C331 (8W-54-3)
C331
L61 18LG
L50 18WT TN
A18 16RD BK
CIRCUIT BREAKER NO. 2
L60 18TN
94 18DG
94 18DG
95 18PK
95 18PK
(4) (2) (5) C373
(4) (2) (5) C349
(4) (2) (5) C350
RIGHT TURN RELAY (RIGHT REAR QUARTER PANEL)
LEFT TURN RELAY (RIGHT REAR QUARTER PANEL)
STOP LAMP RELAY (RIGHT REAR QUARTER PANEL)
(6) (8) C373
(6) (8) C349
(6) (8) C350
Z1 18BK
L60 18TN OR
Z1 18BK
L61 18LG OR
Z1 18BK
A18 16RD WT
B40 12LB
L10 18BR LG
L90 18DB RD
S320
8W-70-28
S319
8W-70-28
A18 16RD/BK
Z1 12BK
Z1 12BK
A18 16RD BK
C372
C331
L60 18TN
Z1 12BK
L61 18LG
A18 16RD BK
B40 12LB
L10 18BR LG
L90 18DB RD
Z1 12BK
(2) (4) (5) (1) (3) (7) (6)
C369
FACTORY TRAILER TOW CONNECTOR
S308
8W-70-24
Z1 12BK
G301
8W-15-7

J958W-3

POWER WINDOWS

INDEX

POWER WINDOWS

The power window system is powered by a 30 amp circuit breaker located in the fuse block cavity 26.

The circuit breaker receives its feed from the ignition switch on the A22 circuit. This circuit breaker is HOT when the ignition switch is in the RUN position only.

Circuit F81 is the feed circuit from the circuit breaker to the power window switch. This circuit is the feed for the entire system. The ground path for the power windows is on the Z1 circuit.

A LOCK-OUT feature is provided on the driver's door window switch. When this feature is engaged the other windows in the system will not operate.

LEFT FRONT WINDOW OPERATION

When the operator selects window DOWN operation, power is supplied on the F81 circuit through the switch to circuit Q21. Circuit Q21 goes from the switch to the power window motor. Ground for the motor is supplied on the Q11 circuit back to the switch. A bus bar, internal to the switch, connects the Q11 circuit to the Z1 circuit.

For window UP operation the circuits are reversed. Circuit Q11 is the feed, and circuit Q21 is the ground.

RIGHT FRONT WINDOW OPERATION

When the DRIVER selects window DOWN operation, power is supplied on the F81 circuit through the switch to circuit Q26. Circuit Q26 goes from the drivers door switch to the right front door switch. Power is passed through this switch to circuit Q22. The Q22 circuit then goes to the right front window motor.

Ground for the window motor is supplied on the Q12 circuit back to the right door switch. Circuity internal to the switch then passes the ground to circuit Q16. Circuit Q16 goes from the right front door switch to the master switch. A bus bar, internal to the switch, connects the Q16 circuit to the Z1 circuit.

For window UP operation the circuits are reversed. Circuits Q16 and Q12 are the feeds, and circuits Q22 and Q26 are the grounds.

If the switch is being operated from the PASSENGER'S front door, and the operator is requesting window DOWN operation, power is supplied on the Q1 circuit from the driver's master switch circuit through the passengers switch to the Q22 circuit.

Ground for the motor is supplied on the Q12 circuit through the switch and back to the master switch on circuit Q16. A bus bar, internal to the switch, connects the Q16 circuit to the Z1 circuit.

For window UP operation, the circuits are reversed. Circuit Q12 is the power and circuit Q22 is the ground.

LEFT REAR WINDOW

When the DRIVER selects window DOWN operation, power is supplied on the F81 circuit through the switch to circuit Q27.

Circuit Q27 goes from the drivers door switch to the left rear door connector. At the connector the Q27 circuit switches to circuit Q28. Power is passed through this switch to circuit Q22. The Q22 circuit then goes to the left rear window motor.

Ground for the window motor is supplied on the Q12 circuit back to the left rear door switch. Circuity internal to the switch then passes the ground to circuit Q18. Circuit Q18 goes from the left rear door switch to the left rear door connector. At the connector the circuit changes to Q17. Circuit Q17 goes to the master switch. A bus bar, internal to the switch, connects the Q17 circuit to the Z1 circuit.

For window UP operation the circuits are reversed. Circuits Q12, Q17, and Q18 are the feeds, and circuits Q22, Q27, and Q28 are the grounds.

If the switch is being operated from the LEFT REAR door, and the operator is requesting window DOWN operation, power is supplied on the Q1 circuit from the driver's master switch circuit through the switch to the Q22 circuit.

Ground for the motor is supplied on the Q12 circuit through the switch and to circuit Q18. Circuit Q18 connects from the left rear door switch to the left rear door connector. At the connector the Q18 circuit is changes to circuit Q17.

Circuit Q17 connects from the left rear door connector to the master window switch. A bus bar, internal to the switch, connects the Q17 circuit to the Z1 circuit.

For window UP operation, the circuits are reversed. Circuit Q12 is the power and circuits Q22, Q28, and Q27 are the grounds.

RIGHT REAR WINDOW

When the DRIVER selects window DOWN operation, power is supplied on the F81 circuit through the switch to circuit Q28.

Circuit Q28 goes from the drivers door switch to the right rear door switch. Power is passed through this switch to circuit Q22. The Q22 circuit then goes to the right rear window motor.

Ground for the window motor is supplied on the Q12 circuit back to the right rear door switch. Circuity internal to the switch then passes the ground to circuit Q18. Circuit Q18 goes from the right rear door switch to the master switch. A bus bar, internal to the switch, connects the Q18 circuit to the Z1 circuit.

For window UP operation the circuits are reversed. Circuits Q18 and Q12 are the feeds, and circuits Q22 and Q28 are the grounds.

If the switch is being operated from the RIGHT REAR door, and the operator is requesting window DOWN operation, power is supplied on the Q1 circuit from the driver's master switch circuit through the switch to the Q22 circuit.

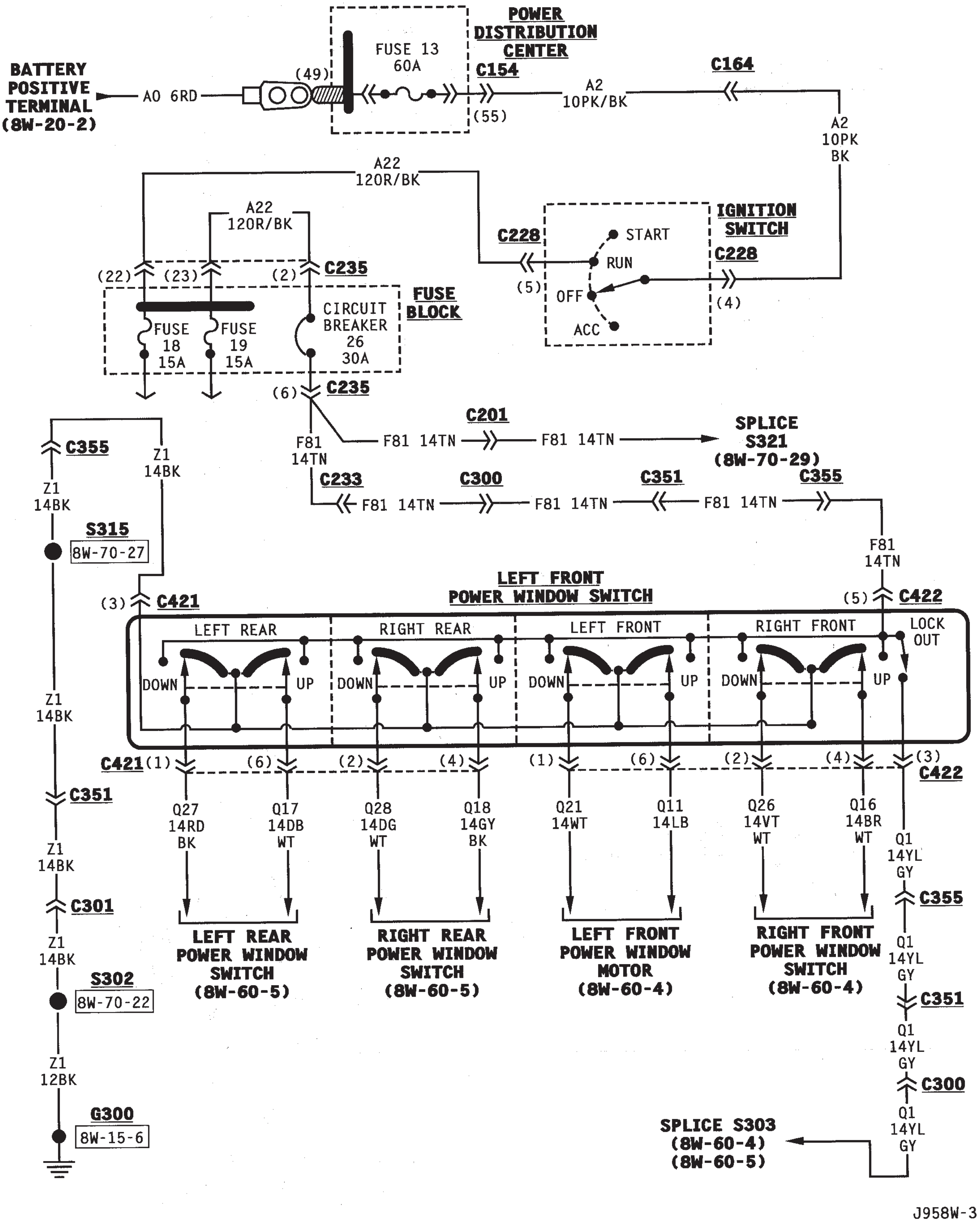
Ground for the motor is supplied on the Q12 circuit through the switch and back to the master switch on circuit Q18. A bus bar, internal to the switch, connects the Q18 circuit to the Z1 circuit.

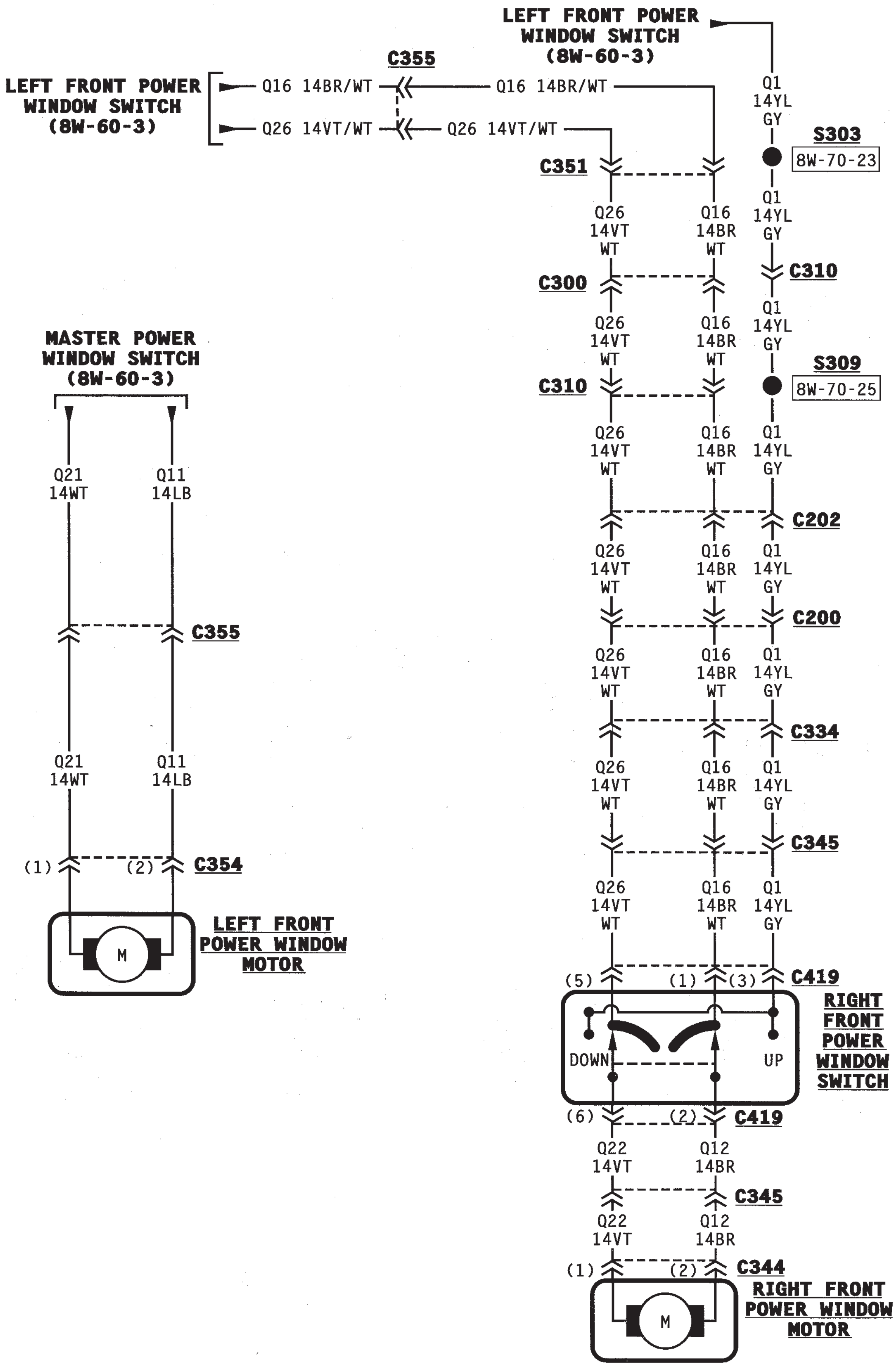
For window UP operation, the circuits are reversed. Circuit Q12 is the power and circuits Q22 and Q28 are the ground.

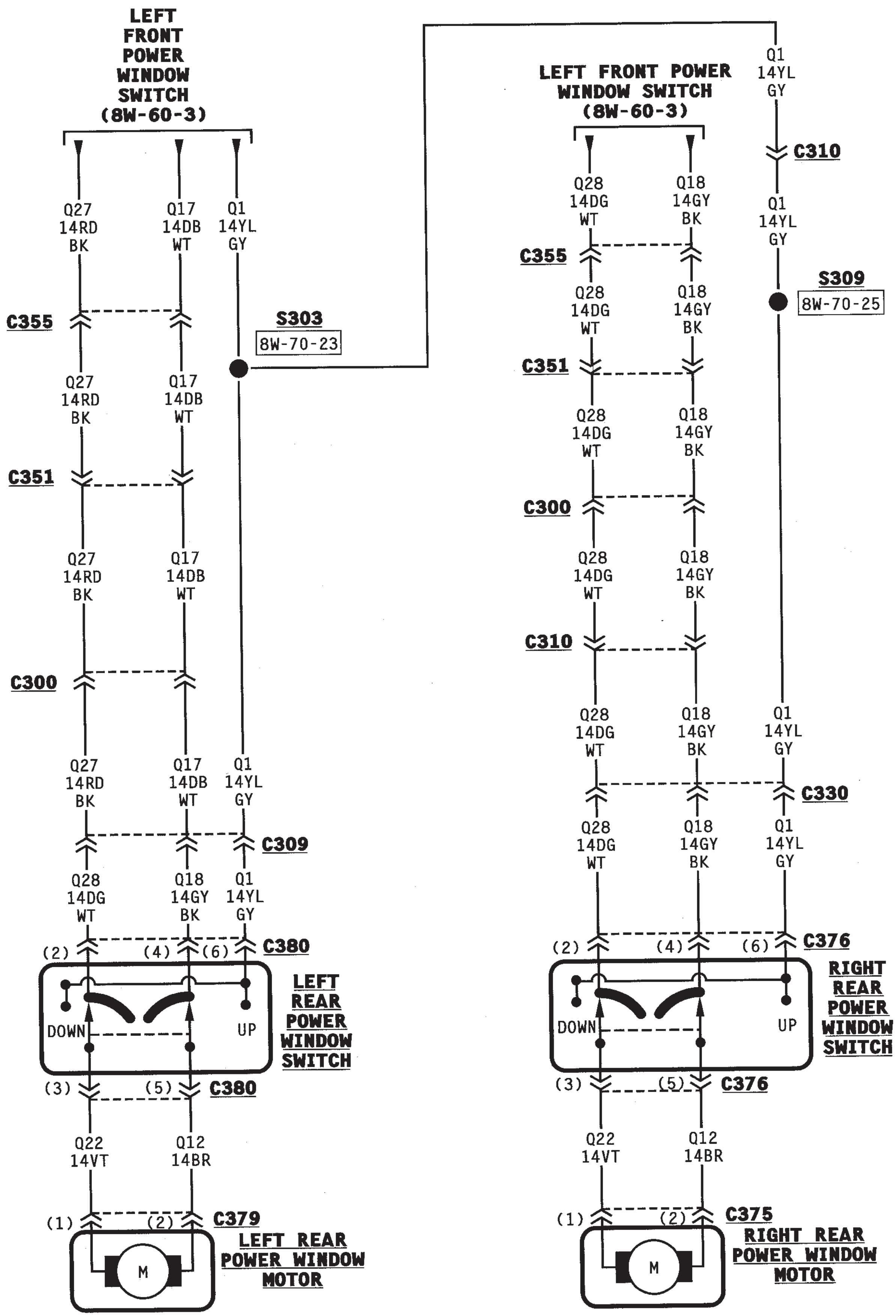
HELPFUL INFORMATION

- Check the 30 amp circuit breaker located in cavity 26 of the fuse block
- Check the 60 amp fuse located in cavity 13 of the PDC
- Refer to the appropriate group of the Service Manual for additional test procedures

DIAGRAM INDEX


POWER DISTRIBUTION CENTER
FUSE 13 60A
C154
(49)
(55)
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
A2 10PK/BK
C164
A2 10PK BK
A22 12OR/BK
IGNITION SWITCH
C228
START
RUN
OFF
ACC
(5)
(4)
C235
(22)
(23)
(2)
FUSE BLOCK
FUSE 18 15A
FUSE 19 15A
CIRCUIT BREAKER 26 30A
(6)
C201
F81 14TN
SPLICE S321 (8W-70-29)
C233
C300
C351
C355
Z1 14BK
S315
8W-70-27
(3)
C421
LEFT FRONT POWER WINDOW SWITCH
(5)
C422
LEFT REAR
RIGHT REAR
LEFT FRONT
RIGHT FRONT
LOCK OUT
DOWN
UP
C421(1)
(6)
(2)
(4)
(1)
(3)
Q27 14RD BK
Q17 14DB WT
Q28 14DG WT
Q18 14GY BK
Q21 14WT
Q11 14LB
Q26 14VT WT
Q16 14BR WT
Q1 14YL GY
LEFT REAR POWER WINDOW SWITCH (8W-60-5)
RIGHT REAR POWER WINDOW SWITCH (8W-60-5)
LEFT FRONT POWER WINDOW MOTOR (8W-60-4)
RIGHT FRONT POWER WINDOW SWITCH (8W-60-4)
C301
S302
8W-70-22
Z1 12BK
G300
8W-15-6
SPLICE S303 (8W-60-4) (8W-60-5)
J958W-3


LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
C355
LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
Q16 14BR/WT
Q26 14VT/WT
Q1 14YL GY
S303
8W-70-23
C351
Q26 14VT WT
Q16 14BR WT
C300
C310
S309
8W-70-25
C202
C200
C334
C345
MASTER POWER WINDOW SWITCH (8W-60-3)
Q21 14WT
Q11 14LB
C355
C354
(1)
(2)
M
LEFT FRONT POWER WINDOW MOTOR
C419
(5)
(1)
(3)
DOWN
UP
RIGHT FRONT POWER WINDOW SWITCH
(6)
(2)
Q22 14VT
Q12 14BR
C345
C344
RIGHT FRONT POWER WINDOW MOTOR


LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
Q27 14RD BK
Q17 14DB WT
Q1 14YL GY
C355
S303
8W-70-23
C351
C300
C309
Q28 14DG WT
Q18 14GY BK
C380
(2)
(4)
(6)
LEFT REAR POWER WINDOW SWITCH
DOWN
UP
(3)
(5)
Q22 14VT
Q12 14BR
C379
(1)
LEFT REAR POWER WINDOW MOTOR
M
LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
C310
S309
8W-70-25
C330
C376
RIGHT REAR POWER WINDOW SWITCH
C375
RIGHT REAR POWER WINDOW MOTOR

POWER DOOR LOCKS

POWER DOOR LOCKS

Two relays provide power for the power door lock motors and the liftgate lock motor. The Unlock relay provides power for the unlock circuits while the Lock relay powers the lock circuits. Either the power door lock switches or the remote keyless entry module operate the Unlock and Lock relays.

If the vehicle is equipped with the Vehicle Theft Alarm (VTA) system, the VTA module also operates the Unlock and Lock relays.

LOCK RELAY

Circuit F60 from fuse 8 in the fuse block supplies battery voltage to the door lock switches. When either power door lock switch is put in the LOCK position, the switch connects circuit F60 to circuit P35. If the operator uses Remote Keyless Entry (RKE), the RKE module powers circuit P35. If the Vehicle Theft Alarm (VTA) activates, the VTA module powers circuit P35. In either case, circuit P35 supplies power to the coil side of the lock relay, causing the relay contacts to close. The chime module controls ground for the coil side of the relay on circuit P57.

When the lock relay contacts close, they connect battery voltage from circuit F35 to circuit P2. Circuit P2 then supplies battery voltage to the power door lock motors to LOCK the doors and the liftgate lock.

When the power doors LOCK, ground for the motors is on circuit P34 through the normally closed contacts in the door unlock relay to ground on circuit Z1.

UNLOCK RELAY

Circuit F60 from fuse 8 in the fuse block supplies battery voltage to the door lock switches. When either power door lock switch is put in the UNLOCK position, the switch connects circuit F60 to circuit P36. If the operator uses Remote Keyless Entry (RKE), the RKE module powers circuit P36. If the Vehicle Theft Alarm (VTA) activates, the VTA module powers circuit P36. In either case, circuit P36 supplies power to the coil side of the unlock relay, causing the relay contacts to close. Circuit Z1 provides ground for the coil side of the unlock relay.

When the unlock relay contacts close, they connect battery voltage from circuit F35 to circuit P34. Circuit P34 then supplies battery voltage to the power door lock motors to UNLOCK the doors and the liftgate lock.

When the power doors UNLOCK, ground for the motors is on circuit P2 through the normally closed contacts in the door lock relay to ground on circuit Z1.

REMOTE KEYLESS ENTRY (RKE) MODULE

Circuit F60 from fuse 8 in the fuse block supplies power to the Remote Keyless Entry (RKE) module. Circuit F60 is HOT at all times.

When the ignition switch is in the RUN position, circuit F83 from fuse 19 in the fuse block supplies power to the RKE module. Circuit Z1 provides ground for the RKE module.

Circuit G71 from the left and right front door key switches connects to the RKE module. Circuit G71 also branches to the Vehicle Theft Alarm (VTA) module.

The RKE module UNLOCKS the doors by energizing the unlock relay on circuit P36. Refer to Unlock Relay.

The module LOCKS the doors by energizing the lock relay on circuit P35. Refer to Lock Relay.

Circuit G49 from the Keyless entry module connects the RKE module to the VTA module.

LIFTGLASS RELEASE SOLENOID

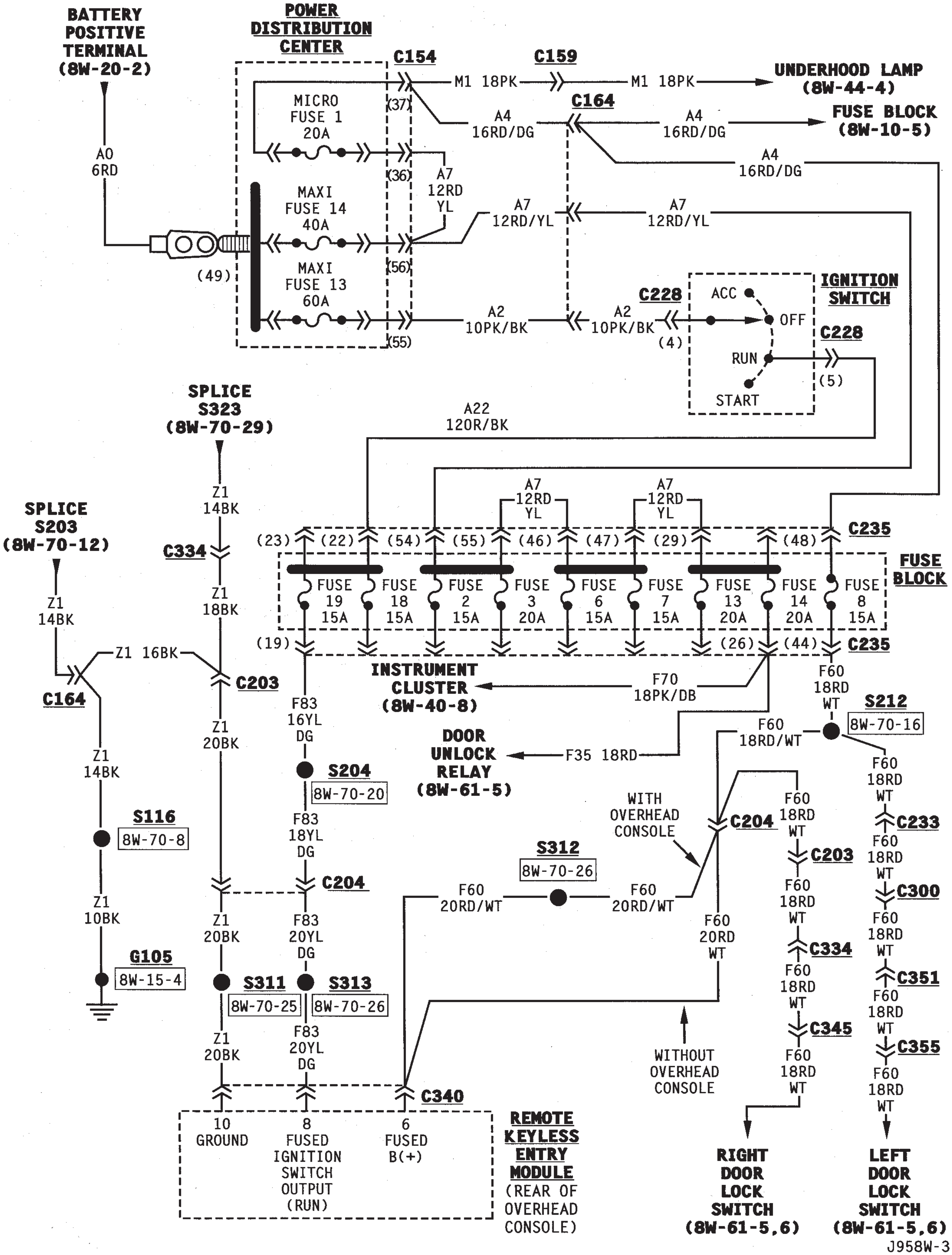
Circuit F60 from fuse 8 in the fuse block supplies power to the liftgate limit switch. When the switch closes, it supplies battery voltage to the liftglass push button on circuit P101.

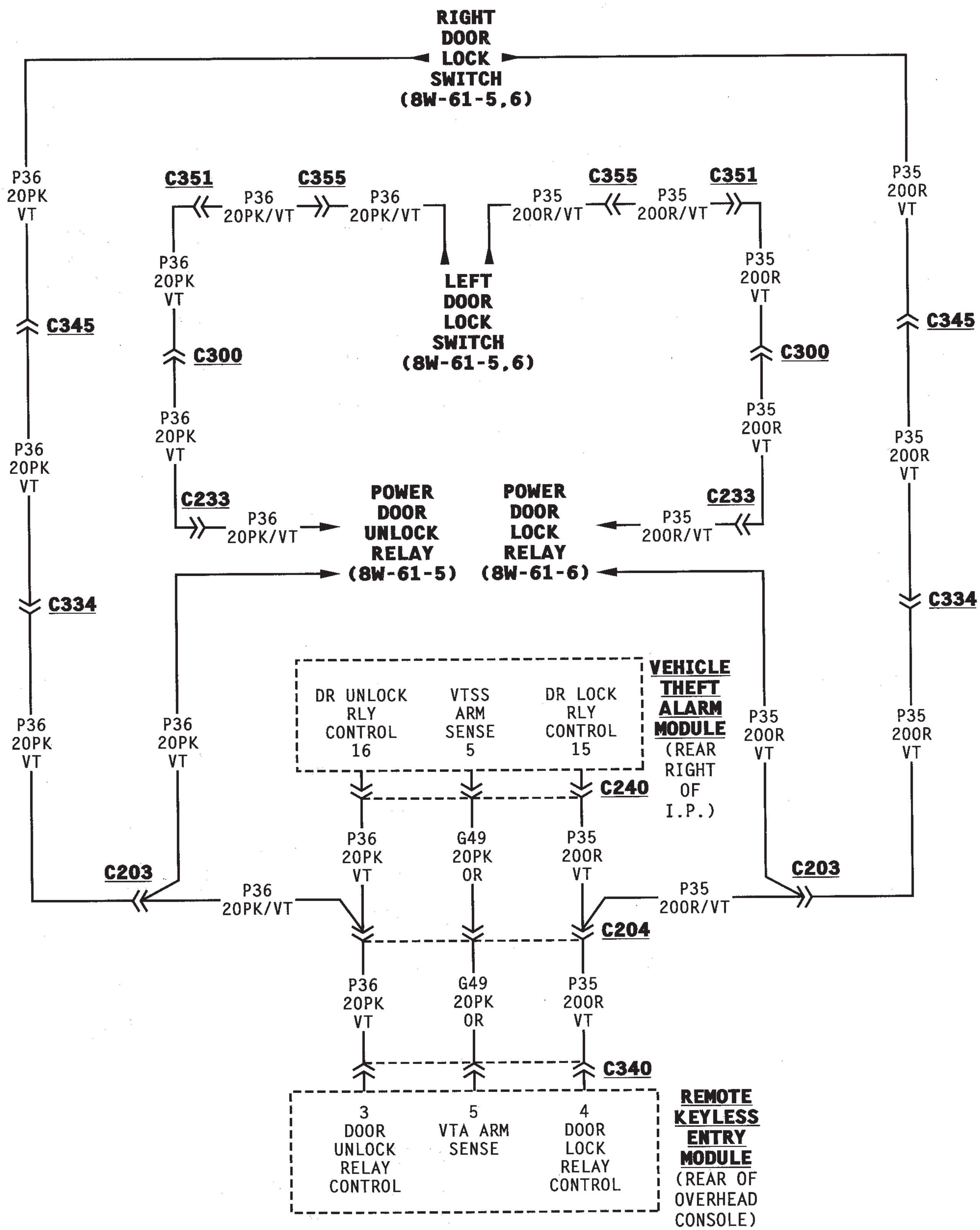
When voltage in present on circuit P101 and the operator presses the liftglass push button switch, the switch powers the liftglass solenoid on circuit P100. Circuit Z1 provides ground for the solenoid.

HELPFUL INFORMATION

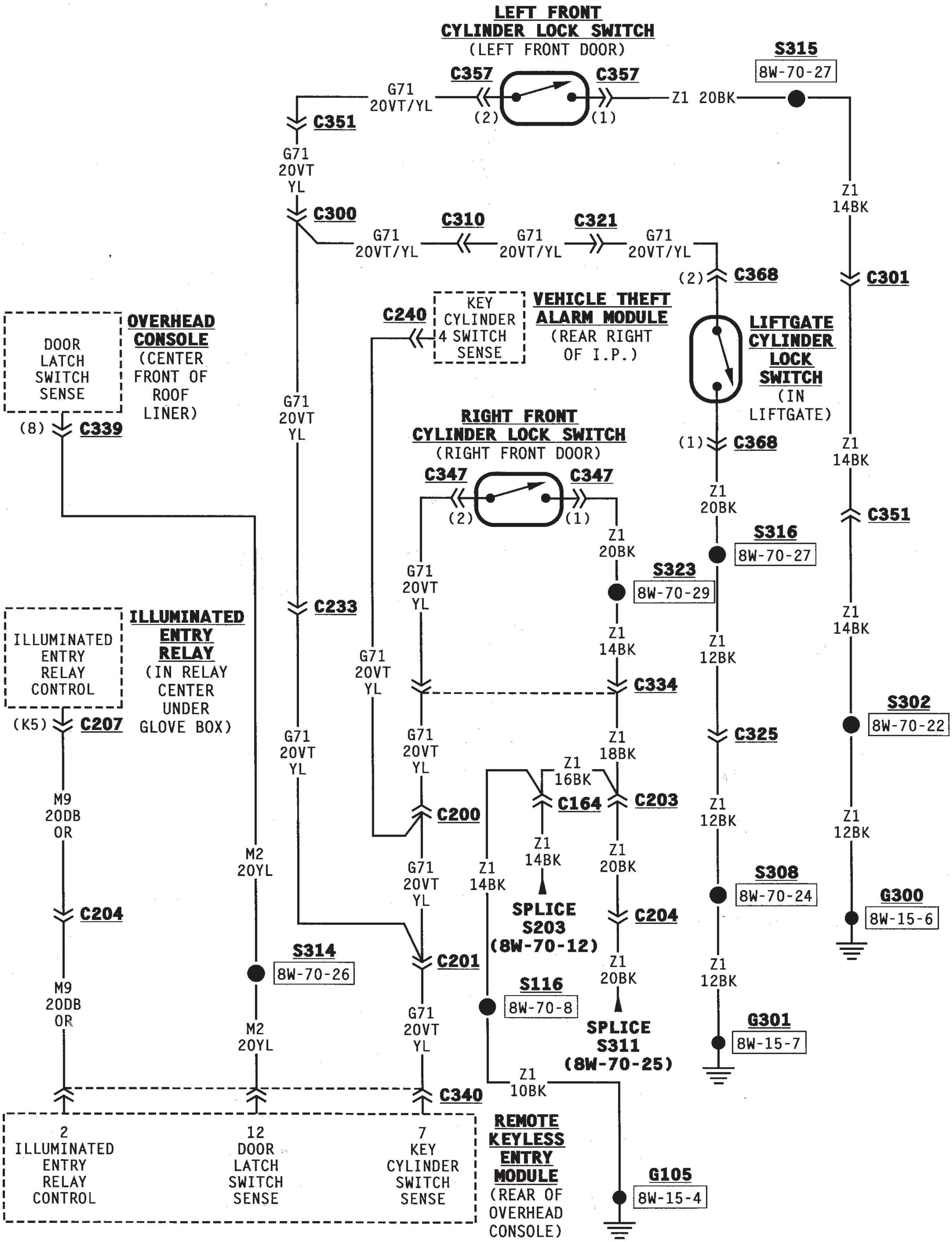
- When the ignition switch is in RUN position, it connects circuit A2 from fuse 13 in the PDC to circuit A22. Circuit A22 connects to the fuse block and powers circuit F83 through the fuse in cavity 19.
- Circuit A7 from fuse 14 in the PDC feeds circuit F35 through fuse 14 in the fuse block.
- Circuit A4 from fuse 1 in the PDC powers circuit F60 through fuse 8 in the fuse block.

DIAGRAM INDEX


BATTERY POSITIVE TERMINAL (8W-20-2)
POWER DISTRIBUTION CENTER
C154
C159
M1 18PK
UNDERHOOD LAMP (8W-44-4)
C164
A4 16RD/DG
FUSE BLOCK (8W-10-5)
MICRO FUSE 1 20A
MAXI FUSE 14 40A
MAXI FUSE 13 60A
A0 6RD
(49)
(37)
(36)
(56)
(55)
A7 12RD YL
A7 12RD/YL
A2 10PK/BK
C228
IGNITION SWITCH
ACC
OFF
RUN
START
(4)
(5)
A22 12OR/BK
SPLICE S323 (8W-70-29)
SPLICE S203 (8W-70-12)
Z1 14BK
C334
Z1 18BK
Z1 16BK
C203
C164
Z1 20BK
Z1 10BK
S116
8W-70-8
G105
8W-15-4
C235
FUSE BLOCK
FUSE 19 15A
FUSE 18 15A
FUSE 2 15A
FUSE 3 20A
FUSE 6 15A
FUSE 7 15A
FUSE 13 20A
FUSE 14 20A
FUSE 8 15A
(23) (22) (54) (55) (46) (47) (29) (48)
(19) (26) (44)
INSTRUMENT CLUSTER (8W-40-8)
F70 18PK/DB
F83 16YL DG
S204
8W-70-20
F83 18YL DG
DOOR UNLOCK RELAY (8W-61-5)
F35 18RD
F60 18RD WT
S212
8W-70-16
F60 18RD/WT
WITH OVERHEAD CONSOLE
C204
C233
C300
S312
8W-70-26
F60 20RD/WT
F60 20RD WT
C334
C351
C345
C355
F83 20YL DG
S311
8W-70-25
S313
8W-70-26
WITHOUT OVERHEAD CONSOLE
C340
10 GROUND
8 FUSED IGNITION SWITCH OUTPUT (RUN)
6 FUSED B(+)
REMOTE KEYLESS ENTRY MODULE (REAR OF OVERHEAD CONSOLE)
RIGHT DOOR LOCK SWITCH (8W-61-5,6)
LEFT DOOR LOCK SWITCH (8W-61-5,6)
J958W-3

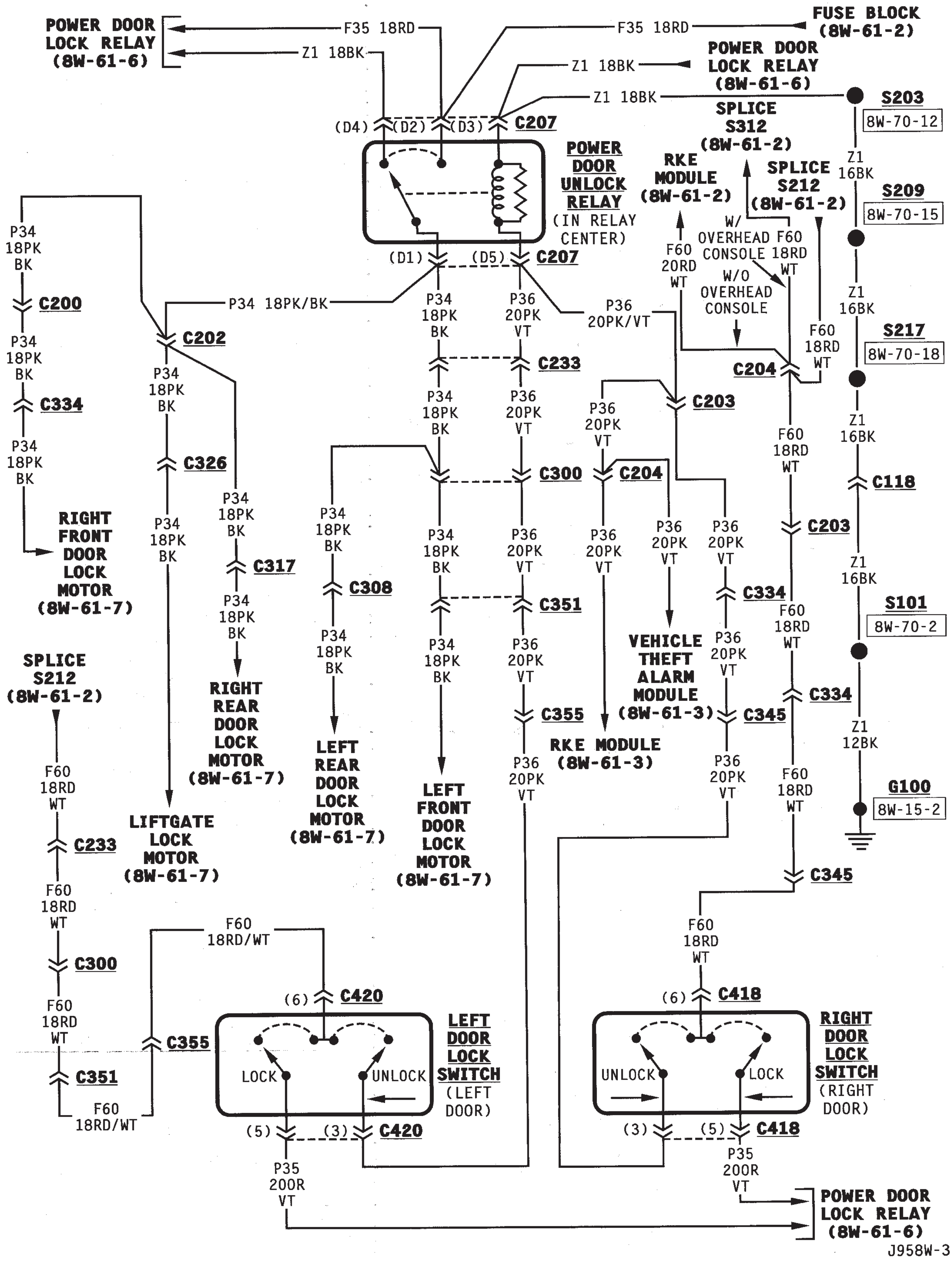

RIGHT DOOR LOCK SWITCH (8W-61-5,6)
P36 20PK VT
C351
P36 20PK/VT
C355
P36 20PK/VT
P35 200R/VT
C355
P35 200R/VT
C351
P35 200R VT
P36 20PK VT
LEFT DOOR LOCK SWITCH (8W-61-5,6)
P35 200R VT
C345
C300
C300
C345
P36 20PK VT
P36 20PK VT
P35 200R VT
P35 200R VT
C233
P36 20PK/VT
POWER DOOR UNLOCK RELAY (8W-61-5)
POWER DOOR LOCK RELAY (8W-61-6)
C233
P35 200R/VT
C334
C334
DR UNLOCK RLY CONTROL 16
VTSS ARM SENSE 5
DR LOCK RLY CONTROL 15
VEHICLE THEFT ALARM MODULE (REAR RIGHT OF I.P.)
P36 20PK VT
P36 20PK VT
P35 200R VT
P35 200R VT
C240
P36 20PK VT
G49 20PK OR
P35 200R VT
C203
P36 20PK/VT
P35 200R/VT
C203
C204
P36 20PK VT
G49 20PK OR
P35 200R VT
C340
3 DOOR UNLOCK RELAY CONTROL
5 VTA ARM SENSE
4 DOOR LOCK RELAY CONTROL
REMOTE KEYLESS ENTRY MODULE (REAR OF OVERHEAD CONSOLE)

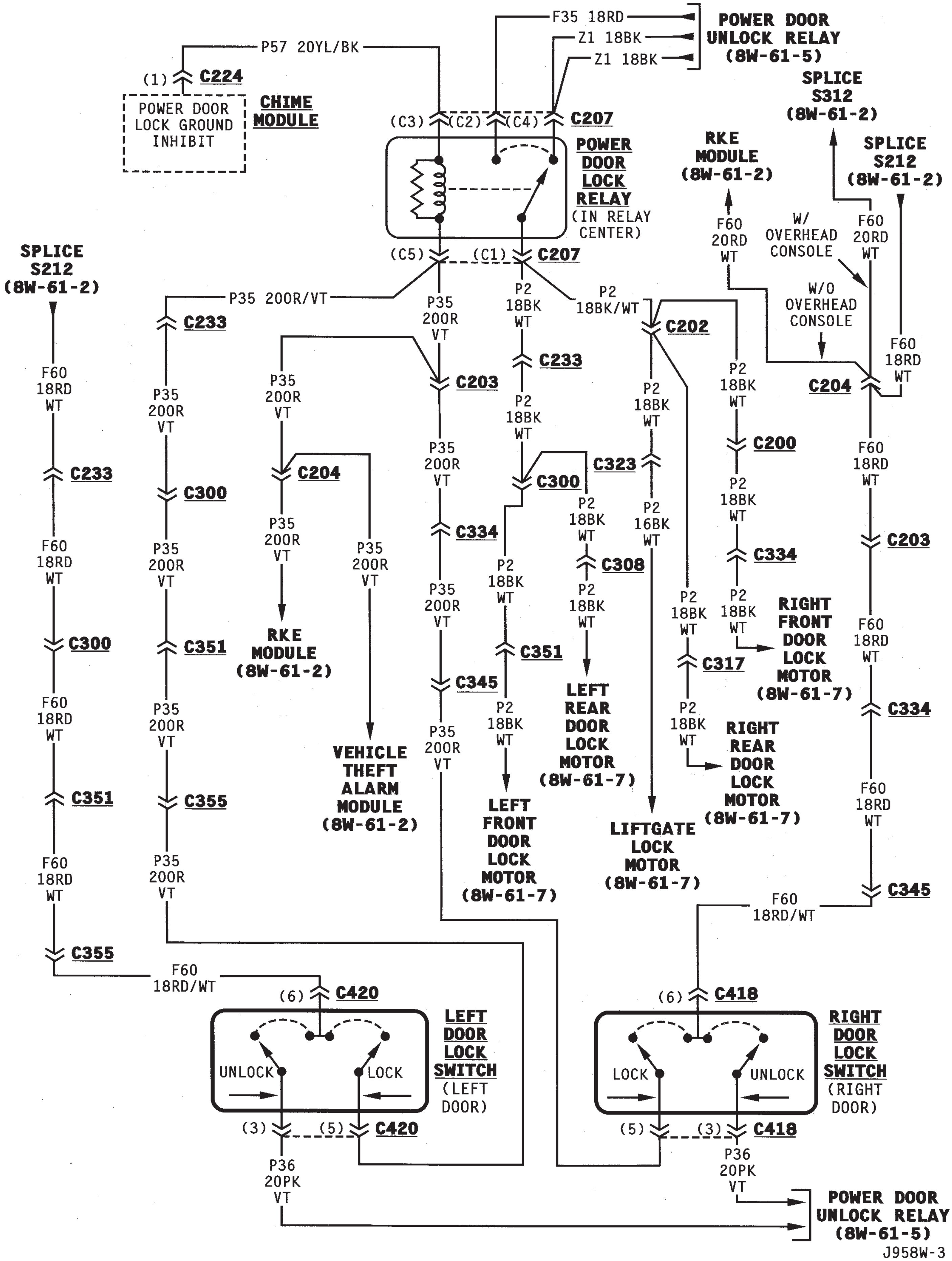
J958W-3



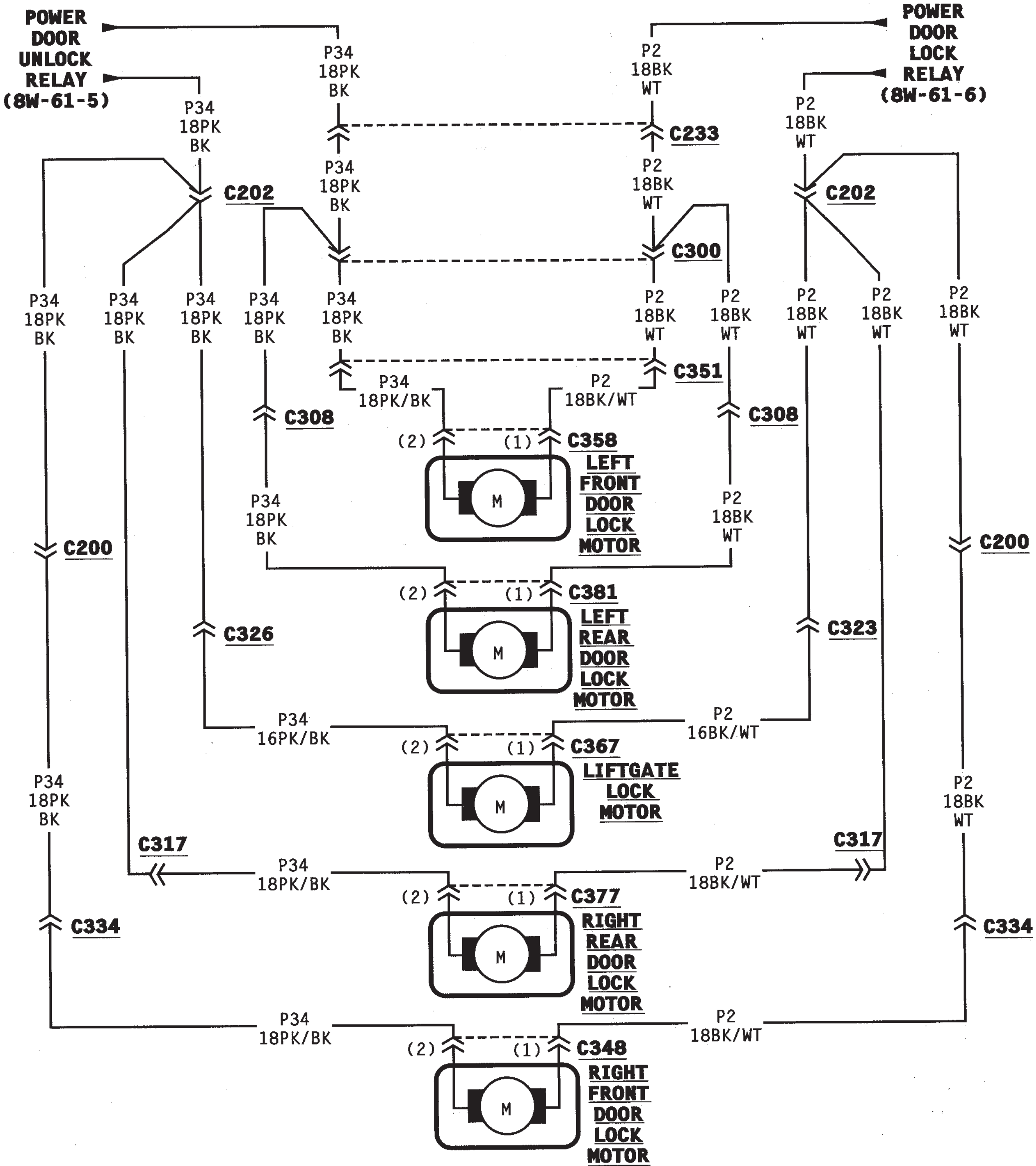
LEFT FRONT
CYLINDER LOCK SWITCH
(LEFT FRONT DOOR)
C357
C357
G71
20VT/YL
(2)
(1)
Z1 20BK
S315
8W-70-27
C351
G71
20VT
YL
C300
C310
C321
G71
20VT/YL
G71
20VT/YL
G71
20VT/YL
Z1
14BK
(2)
C368
C301
KEY
CYLINDER
4 SWITCH
SENSE
VEHICLE THEFT
ALARM MODULE
(REAR RIGHT
OF I.P.)
C240
DOOR
LATCH
SWITCH
SENSE
OVERHEAD
CONSOLE
(CENTER
FRONT OF
ROOF
LINER)
LIFTGATE
CYLINDER
LOCK
SWITCH
(IN
LIFTGATE)
G71
20VT
YL
(8)
C339
RIGHT FRONT
CYLINDER LOCK SWITCH
(RIGHT FRONT DOOR)
(1)
C368
Z1
14BK
C347
C347
(2)
(1)
Z1
20BK
C351
Z1
20BK
S316
8W-70-27
G71
20VT
YL
S323
8W-70-29
C233
Z1
14BK
Z1
12BK
Z1
14BK
ILLUMINATED
ENTRY
RELAY
CONTROL
ILLUMINATED
ENTRY
RELAY
(IN RELAY
CENTER
UNDER
GLOVE BOX)
G71
20VT
YL
C334
(K5)
C207
G71
20VT
YL
G71
20VT
YL
Z1
18BK
C325
S302
8W-70-22
Z1
16BK
M9
20DB
OR
C200
C164
C203
Z1
12BK
Z1
12BK
M2
20YL
G71
20VT
YL
Z1
14BK
Z1
14BK
Z1
20BK
S308
8W-70-24
G300
8W-15-6
C204
SPLICE
S203
(8W-70-12)
C204
S314
8W-70-26
C201
Z1
20BK
Z1
12BK
M9
20DB
OR
S116
8W-70-8
G301
8W-15-7
M2
20YL
G71
20VT
YL
SPLICE
S311
(8W-70-25)
Z1
10BK
C340
2
ILLUMINATED
ENTRY
RELAY
CONTROL
12
DOOR
LATCH
SWITCH
SENSE
7
KEY
CYLINDER
SWITCH
SENSE
REMOTE
KEYLESS
ENTRY
MODULE
(REAR OF
OVERHEAD
CONSOLE)
G105
8W-15-4

J958W-3

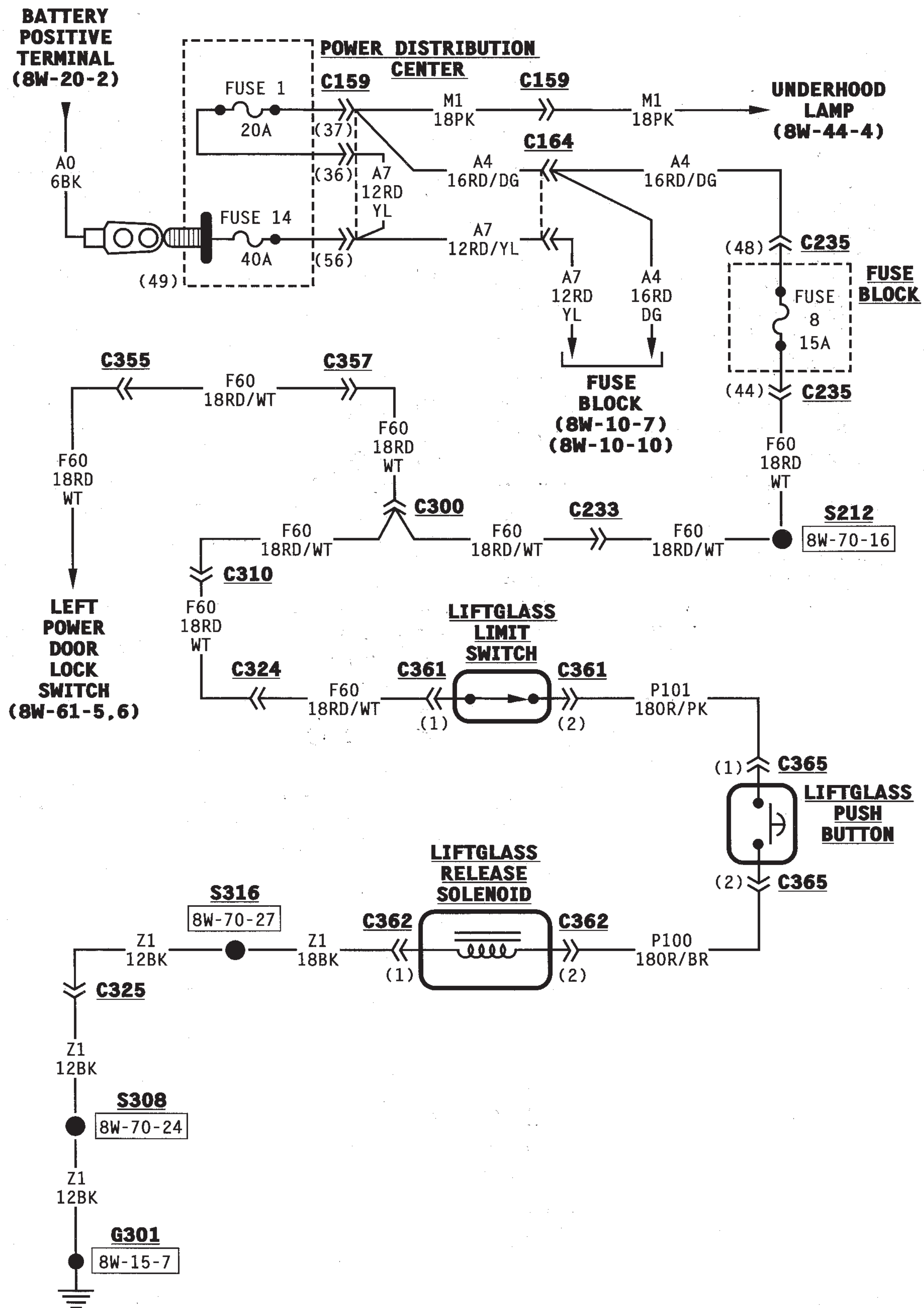

POWER DOOR LOCK RELAY (8W-61-6)
F35 18RD
Z1 18BK
F35 18RD
FUSE BLOCK (8W-61-2)
Z1 18BK
POWER DOOR LOCK RELAY (8W-61-6)
Z1 18BK
S203
8W-70-12
SPLICE S312 (8W-61-2)
(D4) (D2) (D3) C207
POWER DOOR UNLOCK RELAY (IN RELAY CENTER)
RKE MODULE (8W-61-2)
SPLICE S212 (8W-61-2)
Z1 16BK
S209
8W-70-15
W/ OVERHEAD CONSOLE
F60 18RD WT
F60 20RD WT
W/O OVERHEAD CONSOLE
(D1) (D5) C207
P34 18PK BK
C200
P34 18PK/BK
C202
P34 18PK BK
P36 20PK VT
P36 20PK/VT
Z1 16BK
F60 18RD WT
S217
8W-70-18
C233
C204
C334
C203
P36 20PK VT
C326
C300
C204
C118
C203
RIGHT FRONT DOOR LOCK MOTOR (8W-61-7)
C317
C308
C351
C334
C334
S101
8W-70-2
SPLICE S212 (8W-61-2)
VEHICLE THEFT ALARM MODULE (8W-61-3)
C355
C345
Z1 12BK
RIGHT REAR DOOR LOCK MOTOR (8W-61-7)
LEFT REAR DOOR LOCK MOTOR (8W-61-7)
RKE MODULE (8W-61-3)
G100
8W-15-2
LIFTGATE LOCK MOTOR (8W-61-7)
LEFT FRONT DOOR LOCK MOTOR (8W-61-7)
C233
C345
C300
F60 18RD/WT
F60 18RD WT
(6) C420
(6) C418
C355
LEFT DOOR LOCK SWITCH (LEFT DOOR)
LOCK
UNLOCK
RIGHT DOOR LOCK SWITCH (RIGHT DOOR)
UNLOCK
LOCK
C351
F60 18RD/WT
(5) (3) C420
(3) (5) C418
P35 20OR VT
POWER DOOR LOCK RELAY (8W-61-6)
J958W-3



POWER DOOR UNLOCK RELAY (8W-61-5)
F35 18RD
Z1 18BK
Z1 18BK
P57 20YL/BK
(1) C224
POWER DOOR LOCK GROUND INHIBIT
CHIME MODULE
(C3) (C2) (C4) C207
POWER DOOR LOCK RELAY (IN RELAY CENTER)
(C5) (C1) C207
SPLICE S312 (8W-61-2)
SPLICE S212 (8W-61-2)
RKE MODULE (8W-61-2)
F60 20RD WT
W/ OVERHEAD CONSOLE
W/O OVERHEAD CONSOLE
F60 18RD WT
C204
SPLICE S212 (8W-61-2)
P35 20OR/VT
P35 20OR VT
P2 18BK WT
P2 18BK/WT
C202
C233
C203
C200
C300
C323
C204
P2 16BK WT
C308
C334
C351
C355
C345
C317
C420
C418
F60 18RD/WT
RKE MODULE (8W-61-2)
VEHICLE THEFT ALARM MODULE (8W-61-2)
LEFT FRONT DOOR LOCK MOTOR (8W-61-7)
LEFT REAR DOOR LOCK MOTOR (8W-61-7)
LIFTGATE LOCK MOTOR (8W-61-7)
RIGHT REAR DOOR LOCK MOTOR (8W-61-7)
RIGHT FRONT DOOR LOCK MOTOR (8W-61-7)
(6) C420
LEFT DOOR LOCK SWITCH (LEFT DOOR)
UNLOCK
LOCK
(3) (5) C420
(6) C418
RIGHT DOOR LOCK SWITCH (RIGHT DOOR)
(5) (3) C418
P36 20PK VT
POWER DOOR UNLOCK RELAY (8W-61-5)
J958W-3


POWER DOOR UNLOCK RELAY (8W-61-5)
POWER DOOR LOCK RELAY (8W-61-6)
P34 18PK BK
P2 18BK WT
C233
C202
C300
C351
P34 18PK/BK
P2 18BK/WT
C308
C358
LEFT FRONT DOOR LOCK MOTOR
C200
C381
LEFT REAR DOOR LOCK MOTOR
C326
C323
P34 16PK/BK
P2 16BK/WT
C367
LIFTGATE LOCK MOTOR
C317
C377
RIGHT REAR DOOR LOCK MOTOR
C334
C348
RIGHT FRONT DOOR LOCK MOTOR
(1)
(2)
M

J958W-3



BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A0
6BK
(49)
POWER DISTRIBUTION
CENTER
FUSE 1
20A
FUSE 14
40A
C159
(37)
(36)
(56)
M1
18PK
C159
M1
18PK
UNDERHOOD
LAMP
(8W-44-4)
A7
12RD
YL
A4
16RD/DG
C164
A4
16RD/DG
A7
12RD/YL
A7
12RD
YL
A4
16RD
DG
FUSE
BLOCK
(8W-10-7)
(8W-10-10)
(48)
C235
FUSE
BLOCK
FUSE
8
15A
(44)
C235
F60
18RD
WT
C355
F60
18RD/WT
C357
F60
18RD
WT
F60
18RD
WT
LEFT
POWER
DOOR
LOCK
SWITCH
(8W-61-5,6)
C300
F60
18RD/WT
F60
18RD/WT
C233
F60
18RD/WT
S212
8W-70-16
C310
F60
18RD
WT
LIFTGLASS
LIMIT
SWITCH
C324
F60
18RD/WT
C361
(1)
C361
(2)
P101
18OR/PK
(1)
C365
LIFTGLASS
PUSH
BUTTON
(2)
C365
LIFTGLASS
RELEASE
SOLENOID
S316
8W-70-27
Z1
12BK
Z1
18BK
C362
(1)
C362
(2)
P100
18OR/BR
C325
Z1
12BK
S308
8W-70-24
Z1
12BK
G301
8W-15-7

J958W-3

POWER MIRRORS

POWER MIRRORS

A single switch operates both the left and right power mirrors. Each mirror has two motors; a LEFT/RIGHT motor and a UP/DOWN motor. The motors switch polarity to allow mirror adjustment.

Circuit A4 from fuse 1 in the Power Distribution Center (PDC) supplies battery voltage to fuse 8 in the fuse block. Fuse 8 powers the power mirror switch on circuit F60.

Circuit Z1 connects to the power mirror switch and supplies ground for the power mirror system.

RIGHT POWER MIRROR OPERATION

In the right position, the power mirror switch supplies power to the right mirror LEFT/RIGHT motor on circuit P79 when a rightward adjustment is made. Circuit P77 provides the ground path the for rightward adjustments.

When the operator makes leftward adjustment, polarity reverses. For leftward adjustments, the switch supplies battery voltage to the right mirror LEFT/RIGHT motor on circuit P77. Circuit P79 supplies ground for leftward adjustments.

During upward adjustments, the switch supplies voltage to the right mirror UP/DOWN motor on circuit P79. Circuit P78 supplies ground during upward adjustments.

For downward adjustments, the polarity is reversed, the switch powers the right mirror UP/DOWN motor on circuit P78. Circuit P79 supplies the ground path.

LEFT POWER MIRROR OPERATION

In the left position, the power mirror switch supplies power to the left mirror LEFT/RIGHT motor on circuit P79 when a rightward adjustment is made. Circuit P75 provides the ground path the for rightward adjustments.

When the operator makes leftward adjustment, polarity reverses. For leftward adjustments, the switch supplies battery voltage to the left mirror LEFT/RIGHT motor on circuit P75. Circuit P79 supplies ground for leftward adjustments.

During upward adjustments, the switch supplies voltage to the left mirror UP/DOWN motor on circuit P79. Circuit P64 supplies ground during upward adjustments.

For downward adjustments, the polarity is reversed, the switch powers the left mirror UP/DOWN motor on circuit P64. Circuit P79 supplies the ground path.

HELPFUL INFORMATION

- Check the 20 amp fuse in cavity F1 of the PDC
- Check the 15 amp fuse in cavity 8 of the fuse block
- Move the switch to its various positions and listen for the motors to click or try to move. Some movement or clicking indicates a poor connection or a mechanical problem with a mirror.

HEATER ELEMENTS

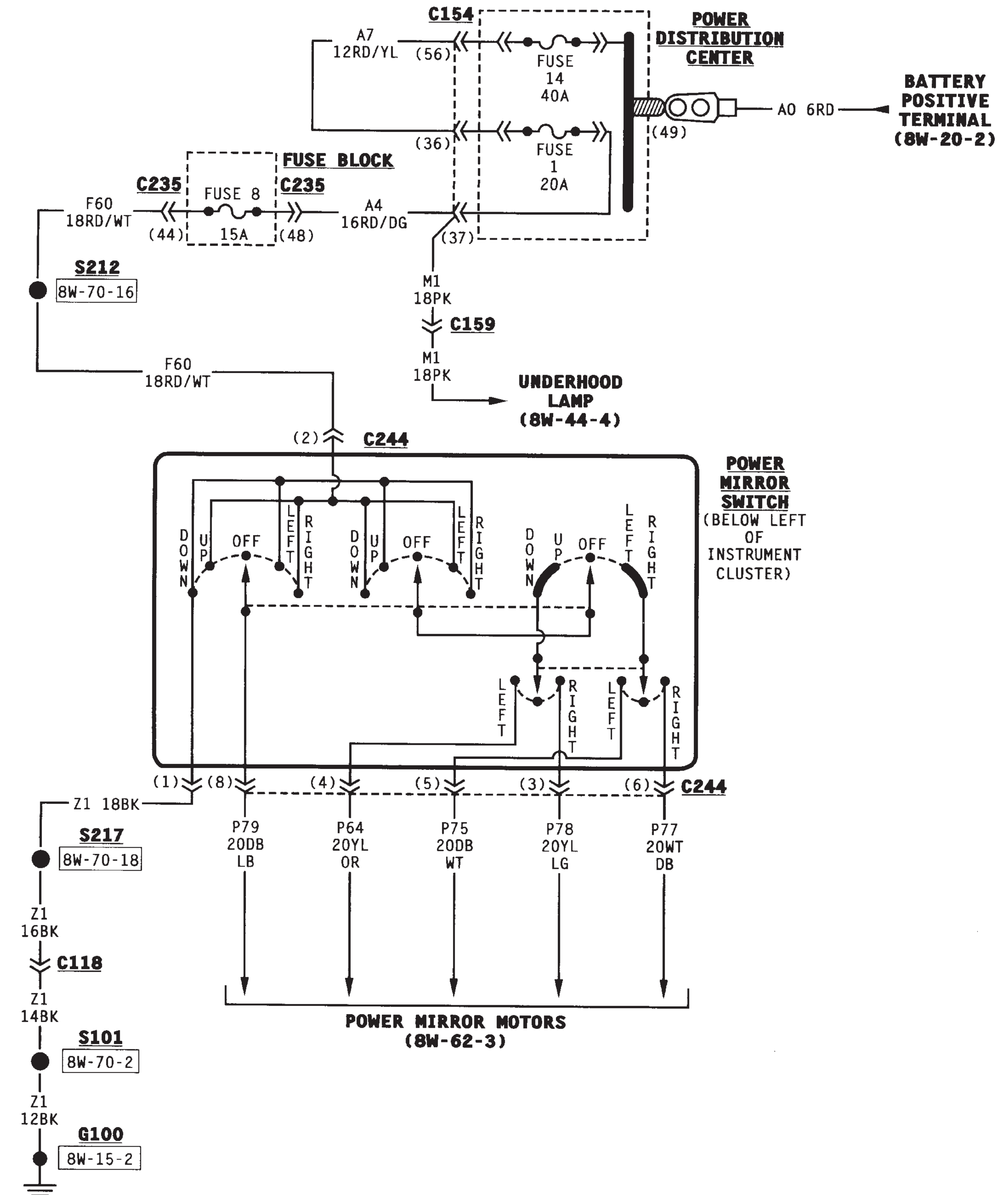
The heated rear window relay powers the heater elements in power mirrors. When the relay energizes, it connects circuit F83 from fuse 19 in the fuse block to circuit C15.

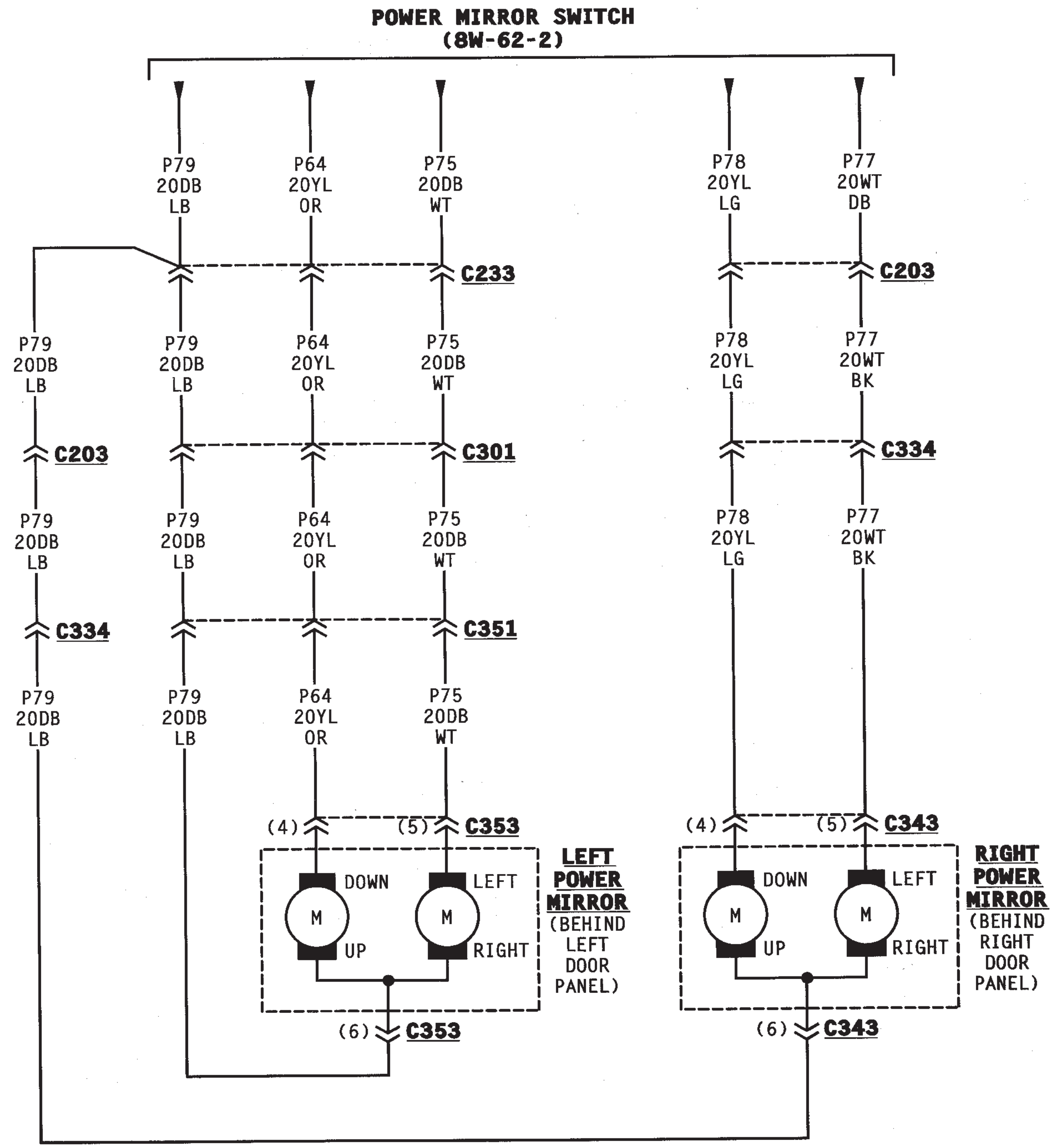
Circuit C15 powers circuit C16 through fuse 23 in the fuse block. Circuit C16 powers the heater elements in the power mirrors. Circuit Z1 provides ground for the power mirror heater elements.

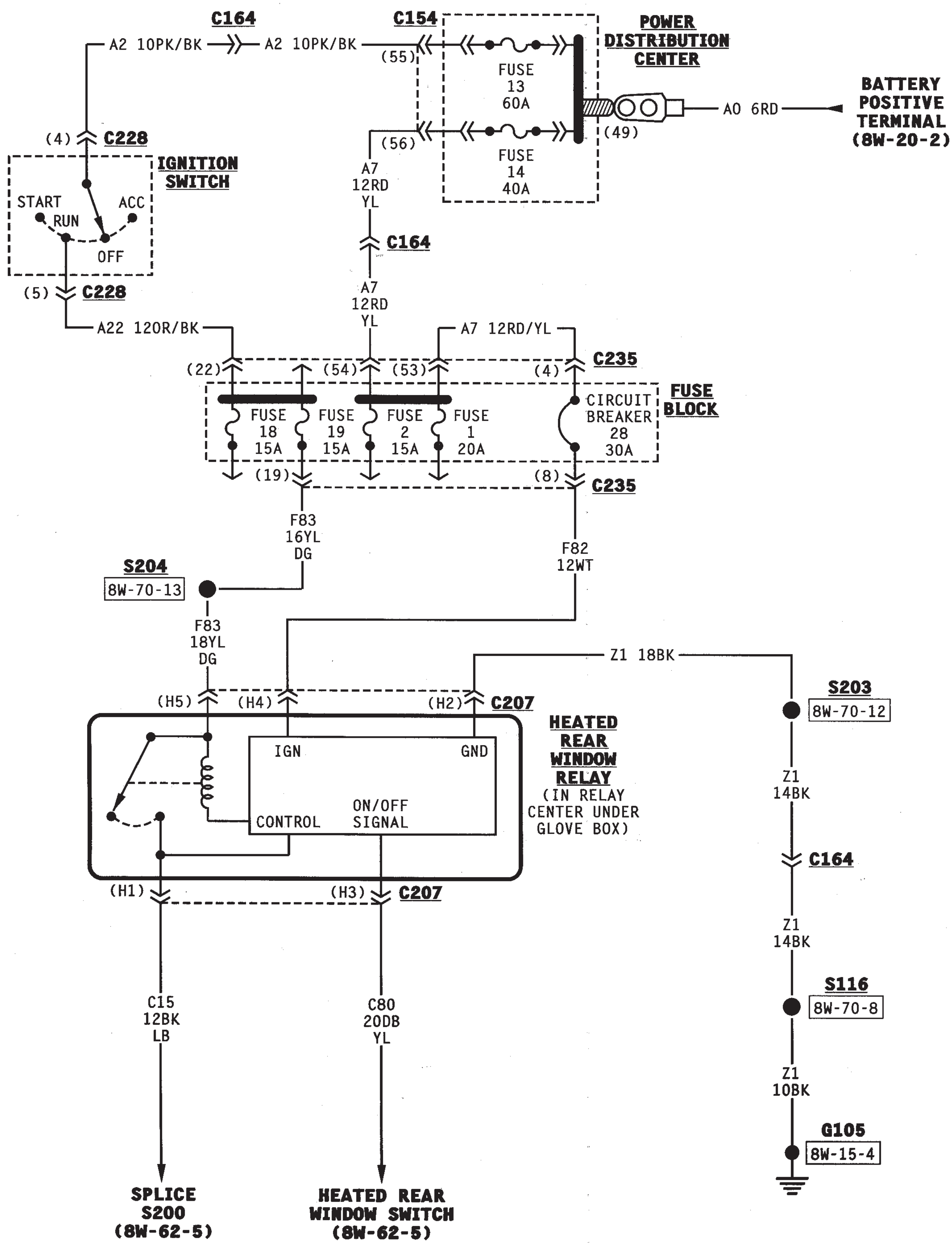
HELPFUL INFORMATION

- Circuit A2 from fuse 13 in the Power Distribution Center (PDC) connects to circuit A22 when the ignition switch is in the RUN position. Circuit A22 powers F83 through fuse 19 in the fuse block.

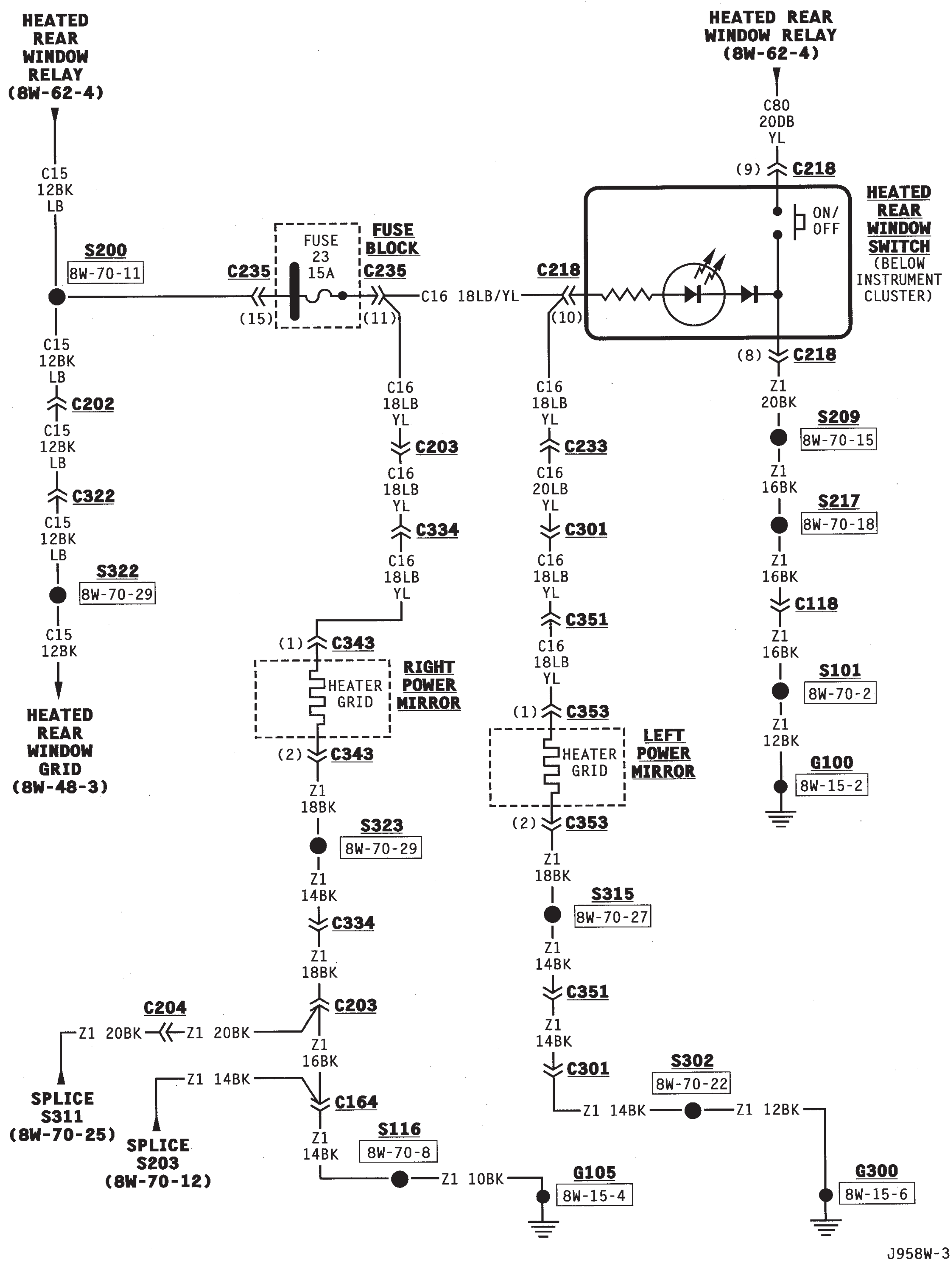
DIAGRAM INDEX


C154
POWER DISTRIBUTION CENTER
A7 12RD/YL
(56)
FUSE 14 40A
BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
(36)
FUSE 1 20A
FUSE BLOCK
C235
C235
FUSE 8 15A
F60 18RD/WT
(44)
(48)
A4 16RD/DG
(37)
S212
8W-70-16
M1 18PK
C159
M1 18PK
UNDERHOOD LAMP (8W-44-4)
F60 18RD/WT
(2)
C244
POWER MIRROR SWITCH (BELOW LEFT OF INSTRUMENT CLUSTER)
DOWN
UP
OFF
LEFT
RIGHT
(1)
(8)
(4)
(5)
(3)
(6)
C244
Z1 18BK
S217
8W-70-18
P79 20DB LB
P64 20YL OR
P75 20DB WT
P78 20YL LG
P77 20WT DB
Z1 16BK
C118
Z1 14BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
POWER MIRROR MOTORS (8W-62-3)


POWER MIRROR SWITCH
(8W-62-2)
P79
20DB
LB
P64
20YL
OR
P75
20DB
WT
P78
20YL
LG
P77
20WT
DB
C233
C203
P77
20WT
BK
C203
C301
C334
C334
C351
(4)
(5)
C353
(4)
(5)
C343
DOWN
LEFT
M
UP
RIGHT
LEFT POWER MIRROR
(BEHIND LEFT DOOR PANEL)
RIGHT POWER MIRROR
(BEHIND RIGHT DOOR PANEL)
(6)
C353
(6)
C343


C164
A2 10PK/BK
A2 10PK/BK
C154
(55)
POWER
DISTRIBUTION
CENTER
FUSE
13
60A
BATTERY
POSITIVE
TERMINAL
(8W-20-2)
A0 6RD
(49)
(56)
FUSE
14
40A
A7
12RD
YL
(4)
C228
IGNITION
SWITCH
START
RUN
ACC
OFF
C164
(5)
C228
A7
12RD
YL
A22 12OR/BK
A7 12RD/YL
(22)
(54)
(53)
(4)
C235
FUSE
BLOCK
FUSE
18
15A
FUSE
19
15A
FUSE
2
15A
FUSE
1
20A
CIRCUIT
BREAKER
28
30A
(19)
(8)
C235
F83
16YL
DG
F82
12WT
S204
8W-70-13
F83
18YL
DG
Z1 18BK
(H5)
(H4)
(H2)
C207
S203
8W-70-12
IGN
GND
HEATED
REAR
WINDOW
RELAY
(IN RELAY
CENTER UNDER
GLOVE BOX)
Z1
14BK
CONTROL
ON/OFF
SIGNAL
C164
(H1)
(H3)
C207
Z1
14BK
S116
8W-70-8
C15
12BK
LB
C80
20DB
YL
Z1
10BK
G105
8W-15-4
SPLICE
S200
(8W-62-5)
HEATED REAR
WINDOW SWITCH
(8W-62-5)

J958W-3


HEATED REAR WINDOW RELAY (8W-62-4)
C15 12BK LB
S200
8W-70-11
C15 12BK LB
C202
C15 12BK LB
C322
C15 12BK LB
S322
8W-70-29
C15 12BK
HEATED REAR WINDOW GRID (8W-48-3)
C235
(15)
FUSE 23 15A
FUSE BLOCK
C235
(11)
C16 18LB/YL
C218
(10)
C16 18LB YL
C203
C16 18LB YL
C334
C16 18LB YL
(1)
C343
HEATER GRID
RIGHT POWER MIRROR
(2)
C343
Z1 18BK
S323
8W-70-29
Z1 14BK
C334
Z1 18BK
C203
C204
Z1 20BK
Z1 20BK
SPLICE S311 (8W-70-25)
Z1 16BK
Z1 14BK
SPLICE S203 (8W-70-12)
C164
Z1 14BK
S116
8W-70-8
Z1 10BK
G105
8W-15-4
C16 18LB YL
C233
C16 20LB YL
C301
C16 18LB YL
C351
C16 18LB YL
(1)
C353
HEATER GRID
LEFT POWER MIRROR
(2)
C353
Z1 18BK
S315
8W-70-27
Z1 14BK
C351
Z1 14BK
C301
Z1 14BK
S302
8W-70-22
Z1 12BK
G300
8W-15-6
HEATED REAR WINDOW RELAY (8W-62-4)
C80 20DB YL
(9)
C218
ON/ OFF
HEATED REAR WINDOW SWITCH (BELOW INSTRUMENT CLUSTER)
(8)
C218
Z1 20BK
S209
8W-70-15
Z1 16BK
S217
8W-70-18
Z1 16BK
C118
Z1 16BK
S101
8W-70-2
Z1 12BK
G100
8W-15-2
J958W-3

POWER SEAT

INDEX

GENERAL INFORMATION

The power seat system is protected by a 30 amp circuit breaker located in cavity 25 of the fuse block. This circuit breaker is HOT at all times and feeds circuit F35. Circuit A7 is the power supply for the circuit breaker.

The A7 circuit originates in the Power Distribution Center (PDC) and is protected by a 40 amp fuse located in cavity 14.

Circuit F35 is the feed for the switches and the seat motors from the circuit breaker. A BUS bar internal to the switches feeds all the contacts. Grounding for the seats is provided on circuit Z1.

The motors located under the seat are protected by a circuit breaker wired in with the motors. Each motor has its own circuit breaker.

DRIVER'S SEAT

When the operator selects the FRONT VERTICAL UP function power is passed on the F35 circuit through the closed contacts in the switch to the P19 circuit. The P19 circuit connects to the motor. Ground is provided on the P21 circuit back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For FRONT VERTICAL DOWN function the circuits are reversed. P21 is the feed and P19 is the ground.

When the operator selects the SEAT FORWARD function power is passed on the F35 circuit through the closed contacts in the switch to the P15 circuit. The P15 circuit connects to the motor. Ground is provided on the P17 circuit back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For SEAT REARWARD function the circuits are reversed. P17 is the feed and P15 is the ground.

When the operator selects the REAR VERTICAL UP function power is passed on the F35 circuit through the closed contacts in the switch to the P11 circuit. The P11 circuit connects to the motor. Ground is provided on the P13 circuit back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For REAR VERTICAL DOWN function the circuits are reversed. P13 is the feed and P11 is the ground.

When the operator selects the SEAT UP function power is passed on the F35 circuit through the closed contacts in the switch to the P11 and P19 circuits. The P11 circuit connects to the rear UP/DOWN motor, and P19 connects to the front UP/DOWN motor. Ground is provided on the P13 and P21 circuits back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For SEAT DOWN function the circuits are reversed. P13 and P21 circuits are the feeds and P11 and P19 are the grounds.

PASSENGER'S SEAT

When the operator selects the FRONT VERTICAL UP function power is passed on the F35 circuit through the closed contacts in the switch to the P18 circuit. The P18 circuit connects to the motor. Ground is provided on the P20 circuit back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For FRONT VERTICAL DOWN function the circuits are reversed. P20 is the feed and P18 is the ground.

When the operator selects the SEAT FORWARD function power is passed on the F35 circuit through the closed contacts in the switch to the P14 circuit. The P14 circuit connects to the motor. Ground is provided on the P16 circuit back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For SEAT REARWARD function the circuits are reversed. P16 is the feed and P14 is the ground.

When the operator selects the REAR VERTICAL UP function power is passed on the F35 circuit through the closed contacts in the switch to the P10 circuit. The P10 circuit connects to the motor. Ground is provided on the P12 circuit back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For REAR VERTICAL DOWN function the circuits are reversed. P12 is the feed and P10 is the ground.

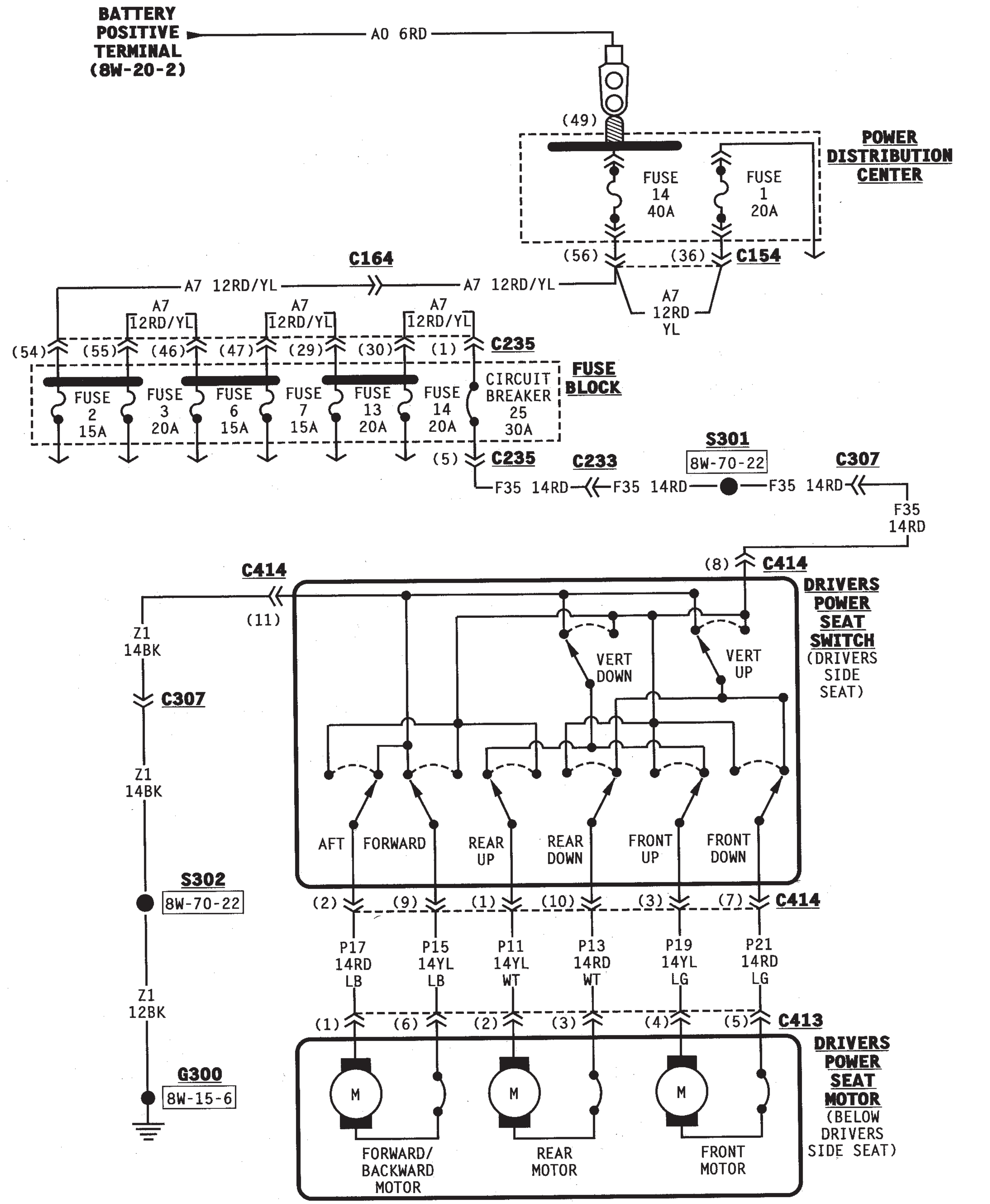
When the operator selects the SEAT UP function power is passed on the F35 circuit through the closed contacts in the switch to the P10 and P18 circuits. The P10 circuit connects to the rear UP/DOWN motor, and P18 connects to the front UP/DOWN motor. Ground is provided on the P12 and P20 circuits back to the switch. A ground BUS bar internal to the switch then connects to the Z1 circuit.

For SEAT DOWN function the circuits are reversed. P12 and P20 circuits are the feeds and P10 and P18 are the grounds.

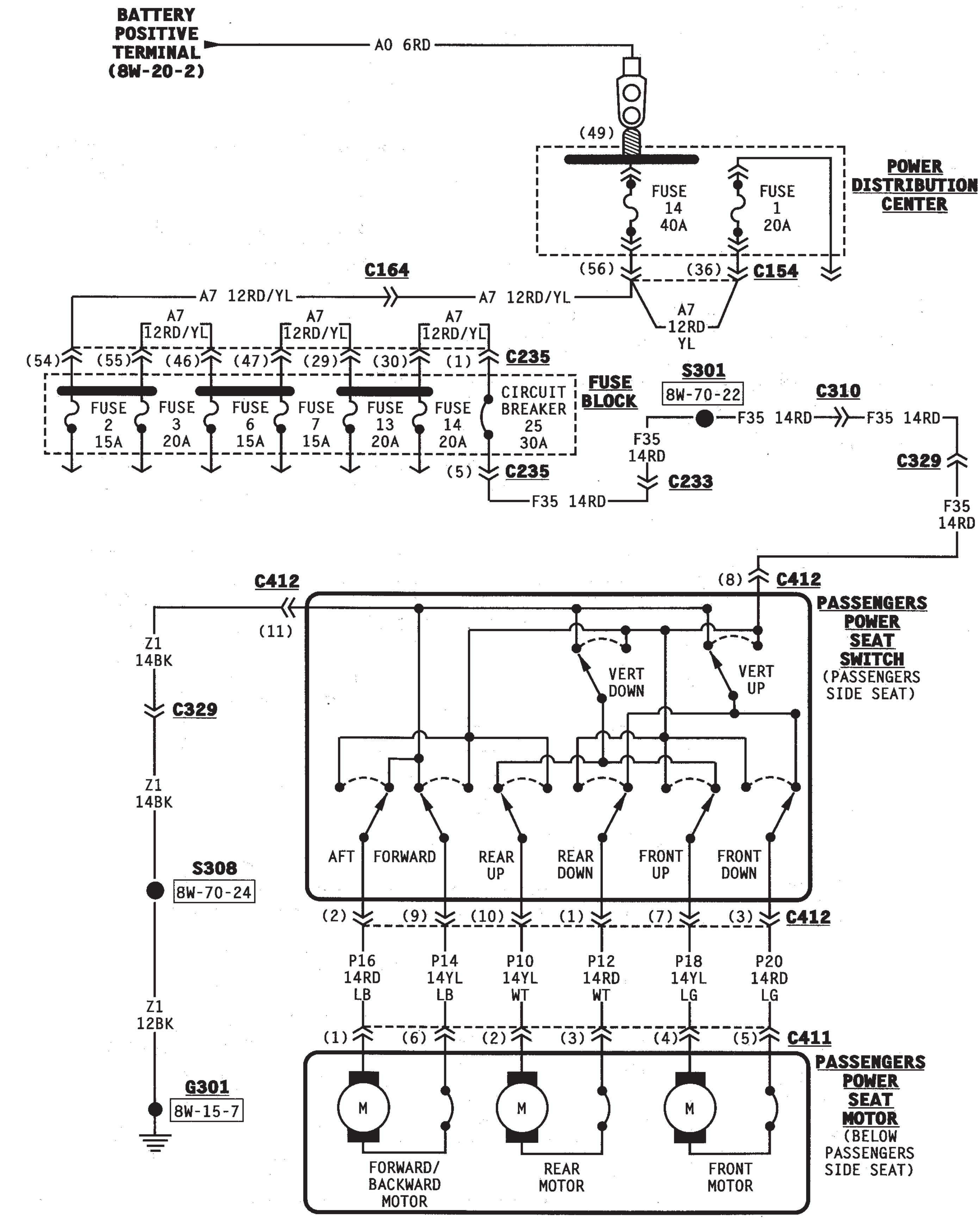
HELPFUL INFORMATION

• Check the 25 amp circuit breaker in located in cavity 25 of the fuse block
• Check the 40 amp fuse located in cavity 14 of the PDC

DIAGRAM INDEX


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
POWER DISTRIBUTION CENTER
FUSE 14 40A
FUSE 1 20A
(56)
(36)
C154
C164
A7 12RD/YL
A7 12RD YL
(54) (55) (46) (47) (29) (30) (1)
C235
FUSE 2 15A
FUSE 3 20A
FUSE 6 15A
FUSE 7 15A
FUSE 13 20A
FUSE 14 20A
CIRCUIT BREAKER 25 30A
FUSE BLOCK
(5)
C235
C233
S301
8W-70-22
C307
F35 14RD
(8)
C414
(11)
Z1 14BK
C307
DRIVERS POWER SEAT SWITCH (DRIVERS SIDE SEAT)
VERT DOWN
VERT UP
AFT
FORWARD
REAR UP
REAR DOWN
FRONT UP
FRONT DOWN
(2) (9) (1) (10) (3) (7)
S302
8W-70-22
Z1 12BK
G300
8W-15-6
P17 14RD LB
P15 14YL LB
P11 14YL WT
P13 14RD WT
P19 14YL LG
P21 14RD LG
(1) (6) (2) (3) (4) (5)
C413
DRIVERS POWER SEAT MOTOR (BELOW DRIVERS SIDE SEAT)
M
FORWARD/ BACKWARD MOTOR
REAR MOTOR
FRONT MOTOR

J958W-3


BATTERY POSITIVE TERMINAL (8W-20-2)
A0 6RD
(49)
FUSE 14 40A
FUSE 1 20A
POWER DISTRIBUTION CENTER
(56)
(36)
C154
C164
A7 12RD/YL
A7 12RD/YL
A7 12RD YL
A7 12RD/YL
A7 12RD/YL
A7 12RD/YL
(54) (55) (46) (47) (29) (30) (1)
C235
FUSE 2 15A
FUSE 3 20A
FUSE 6 15A
FUSE 7 15A
FUSE 13 20A
FUSE 14 20A
CIRCUIT BREAKER 25 30A
FUSE BLOCK
(5)
C235
F35 14RD
S301
8W-70-22
F35 14RD
C310
F35 14RD
F35 14RD
C233
C329
F35 14RD
(8)
C412
C412
(11)
Z1 14BK
C329
Z1 14BK
S308
8W-70-24
Z1 12BK
G301
8W-15-7
PASSENGERS POWER SEAT SWITCH
(PASSENGERS SIDE SEAT)
VERT DOWN
VERT UP
AFT
FORWARD
REAR UP
REAR DOWN
FRONT UP
FRONT DOWN
(2) (9) (10) (1) (7) (3)
C412
P16 14RD LB
P14 14YL LB
P10 14YL WT
P12 14RD WT
P18 14YL LG
P20 14RD LG
(1) (6) (2) (3) (4) (5)
C411
M
M
M
FORWARD/ BACKWARD MOTOR
REAR MOTOR
FRONT MOTOR
PASSENGERS POWER SEAT MOTOR
(BELOW PASSENGERS SIDE SEAT)

J958W-3

POWER SUNROOF

POWER SUNROOF

The optional power sunroof is supplied power on circuit F81. This circuit is HOT in the RUN position only and protected by a 30 amp circuit breaker located in cavity 26 of the fuse block. Power for the circuit breaker is supplied on circuit A22 from the ignition switch. Power for the A22 circuit is supplied by circuit A2. This circuit is protected by a 60 amp fuse located in cavity 13 of the Power Distribution Center (PDC).

Circuit F81 is spliced in the sunroof wiring harness and supplies voltage to the sunroof switch, and the sunroof control module.

Ground for the sunroof system is provided on circuit Z1.

When the operator selects the OPEN function, voltage is provided on the F81 circuit through the closed contacts in the switch to circuit Q41. Circuit Q41 connects between the switch and the control module.

The control module then activates the motor and moves the sunroof to the desired position. A position sensor is used to prevent the sunroof from being moved to far in any one direction. When the sensor detects the roof is at the end of its travel it sends a signal to the control module and voltage is shut off to the motor.

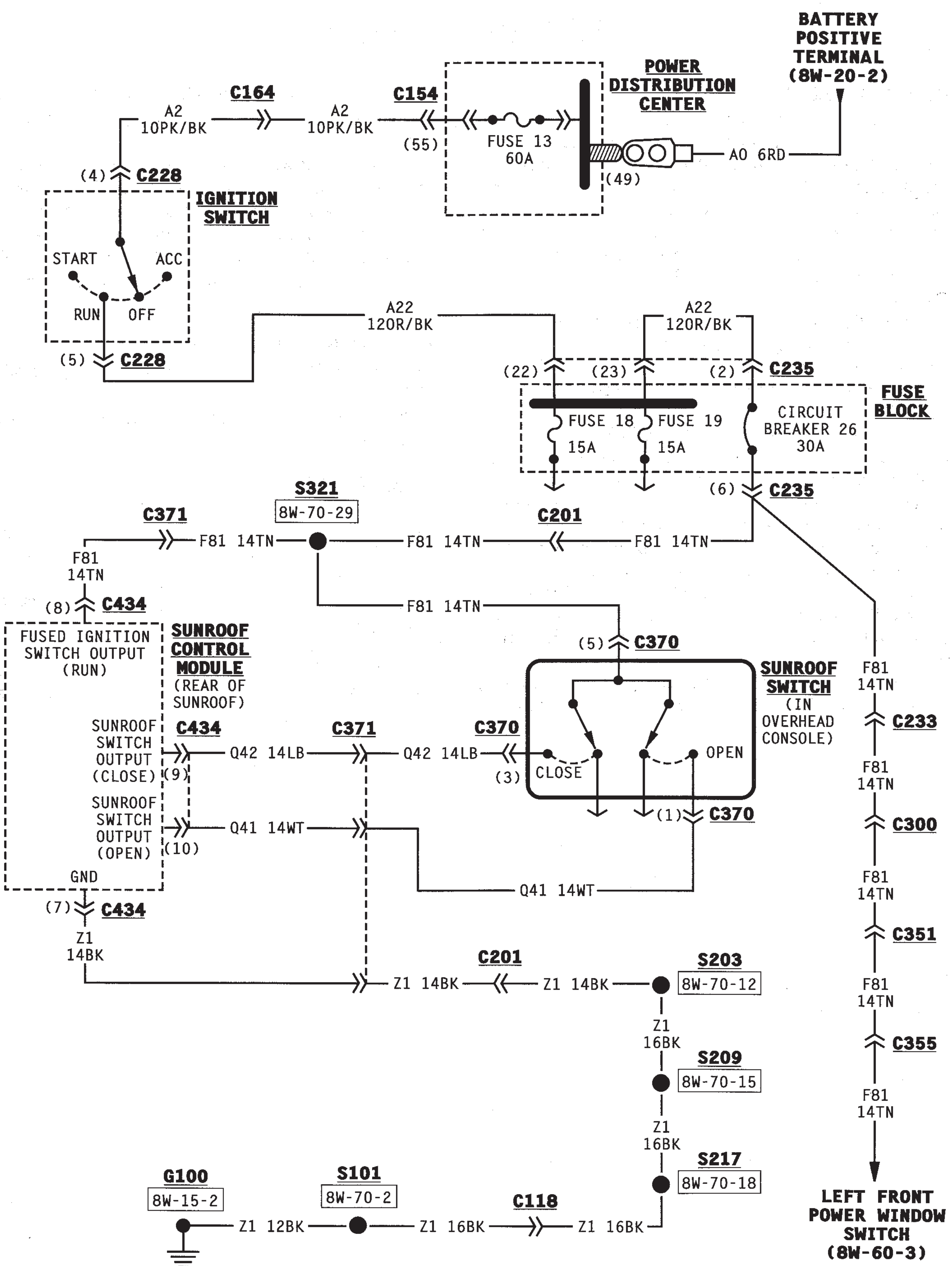
When the operator selects the CLOSE function, voltage is provided on the F81 circuit through the closed contacts in the switch to circuit Q42. Circuit Q42 connects between the switch and the control module.

The control module then activates the motor and moves the sunroof to the desired position. A position sensor is used to prevent the sunroof from being moved to far in any one direction. When the sensor detects the roof is at the end of its travel it sends a signal to the control module and voltage is shut off to the motor.

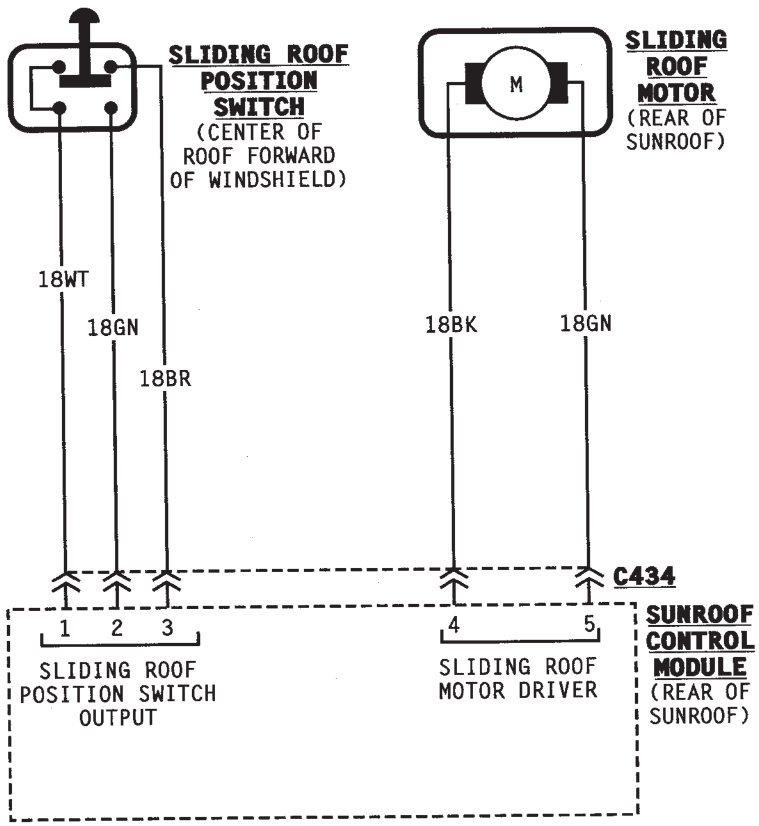
HELPFUL INFORMATION

- Check the 60 amp fuse located in cavity 13 of the PDC
- Check the 30 amp circuit breaker located in cavity 26 of the fuse block

DIAGRAM INDEX


BATTERY POSITIVE TERMINAL (8W-20-2)
POWER DISTRIBUTION CENTER
C164
C154
A2 10PK/BK
A2 10PK/BK
(55)
FUSE 13 60A
(49)
A0 6RD
(4) C228
IGNITION SWITCH
START
ACC
RUN
OFF
(5) C228
A22 120R/BK
A22 120R/BK
(22)
(23)
(2) C235
FUSE BLOCK
FUSE 18 15A
FUSE 19 15A
CIRCUIT BREAKER 26 30A
(6) C235
S321
8W-70-29
C371
C201
F81 14TN
F81 14TN
F81 14TN
F81 14TN
F81 14TN
(8) C434
FUSED IGNITION SWITCH OUTPUT (RUN)
SUNROOF CONTROL MODULE
(REAR OF SUNROOF)
(5) C370
SUNROOF SWITCH
(IN OVERHEAD CONSOLE)
F81 14TN
C233
SUNROOF SWITCH OUTPUT (CLOSE)
SUNROOF SWITCH OUTPUT (OPEN)
C434
C371
C370
Q42 14LB
Q42 14LB
(9)
(3)
CLOSE
OPEN
(1) C370
Q41 14WT
(10)
Q41 14WT
GND
(7) C434
Z1 14BK
F81 14TN
C300
F81 14TN
C351
C201
Z1 14BK
Z1 14BK
S203
8W-70-12
F81 14TN
C355
Z1 16BK
S209
8W-70-15
F81 14TN
Z1 16BK
S217
8W-70-18
G100
8W-15-2
S101
8W-70-2
C118
Z1 12BK
Z1 16BK
Z1 16BK
LEFT FRONT POWER WINDOW SWITCH (8W-60-3)

J958W-3


SLIDING ROOF POSITION SWITCH
(CENTER OF ROOF FORWARD OF WINDSHIELD)
SLIDING ROOF MOTOR
(REAR OF SUNROOF)
M
18WT
18GN
18BR
18BK
18GN
C434
1
2
3
4
5
SLIDING ROOF POSITION SWITCH OUTPUT
SLIDING ROOF MOTOR DRIVER
SUNROOF CONTROL MODULE
(REAR OF SUNROOF)

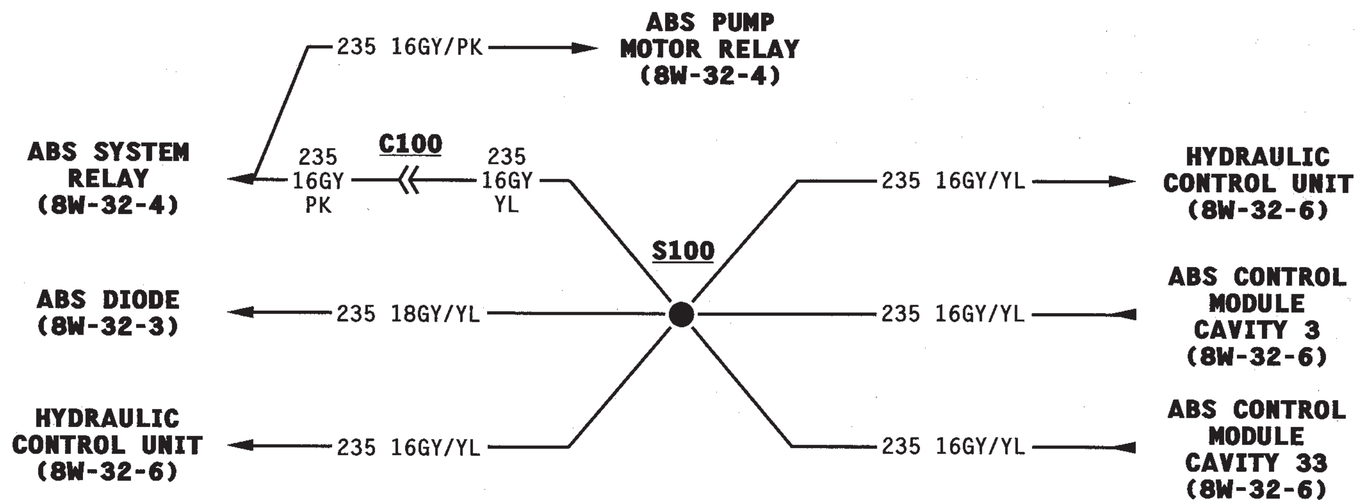
J958W-3

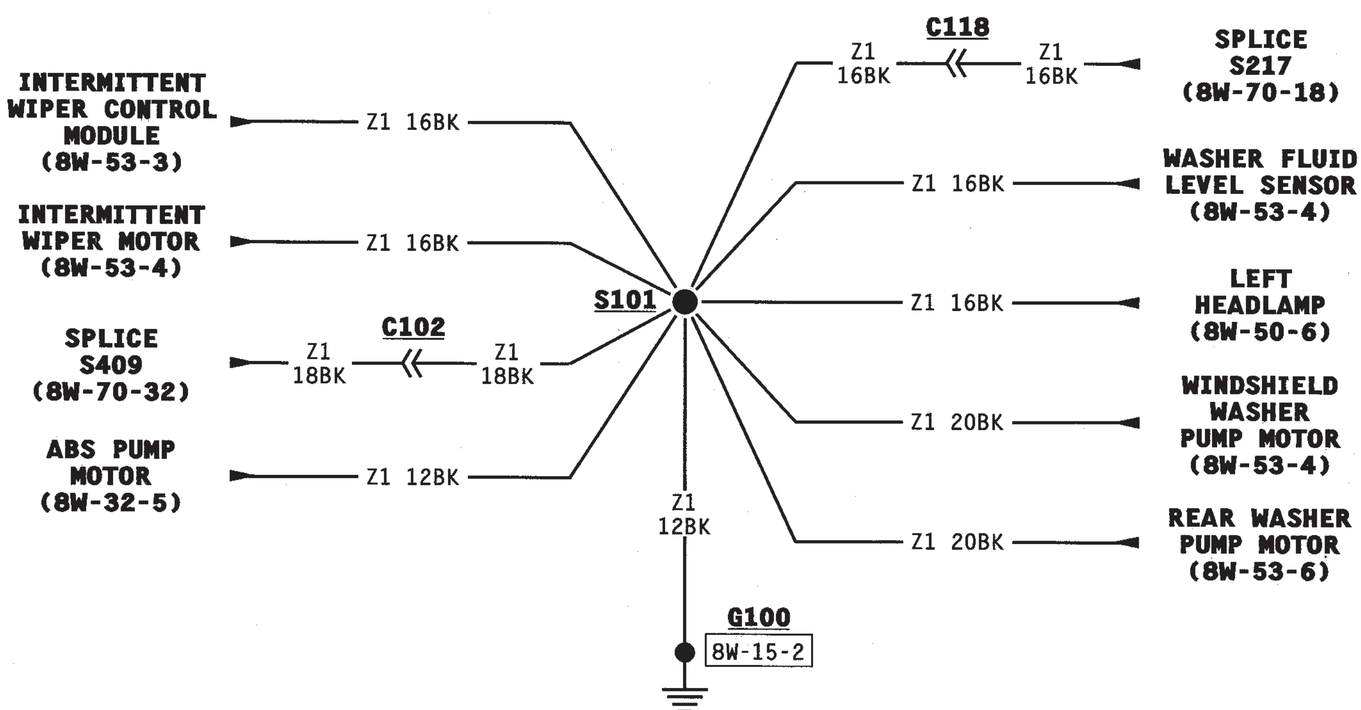
SPLICE INFORMATION

GENERAL INFORMATION

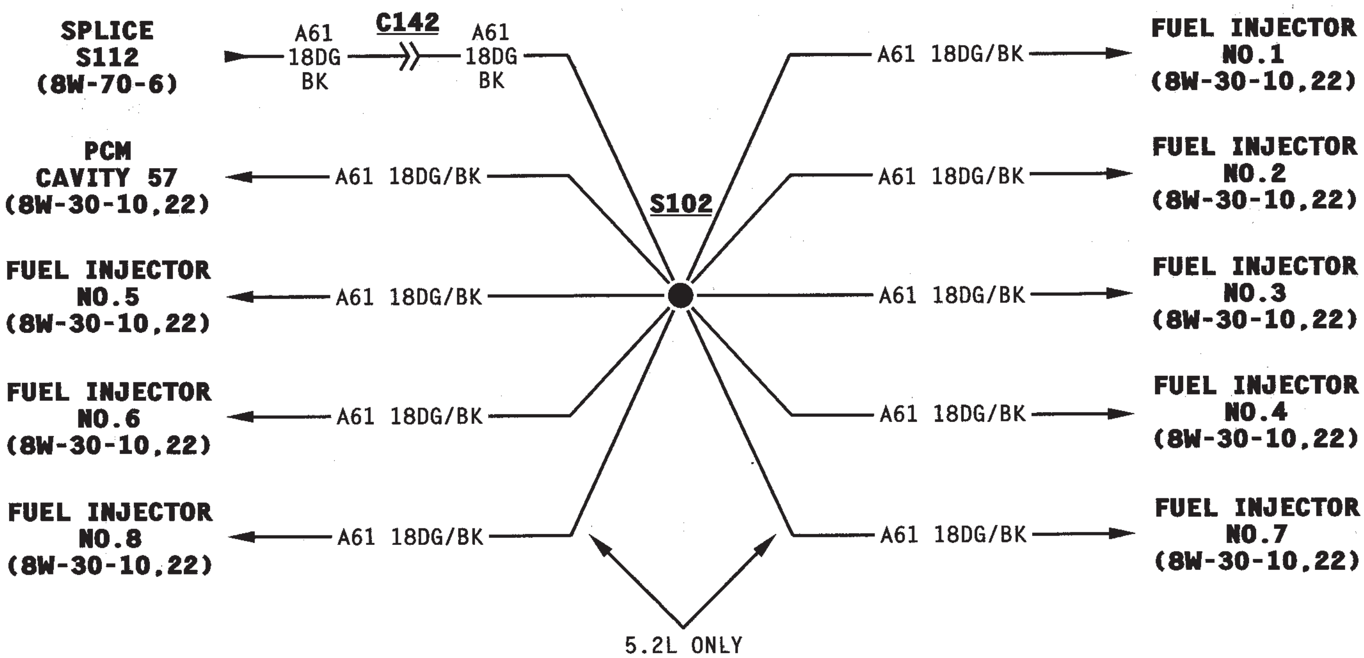
This section identifies all splices in the wiring diagrams. It also shows the splices in their entirety. All circuits that are part of the splices are shown, and the systems they affect are referenced. For viewing the location of each splice in the vehicle, refer to Section 8W-95.

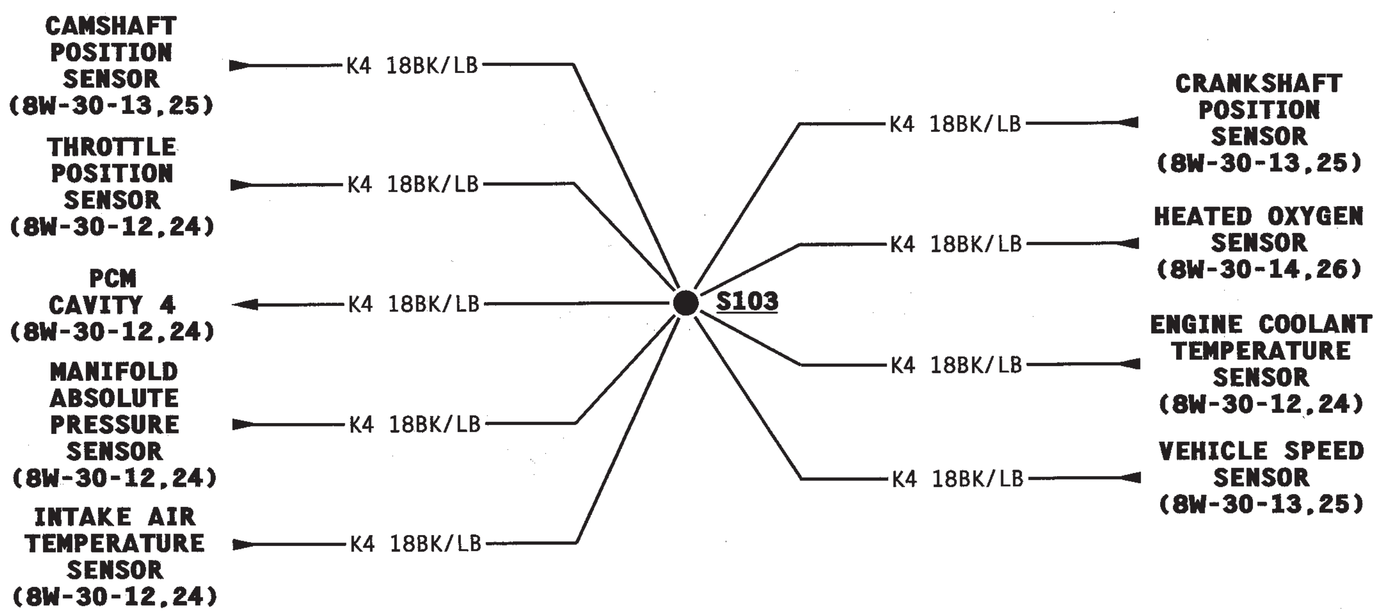
SPLICE INDEX


235 16GY/PK
ABS PUMP MOTOR RELAY (8W-32-4)
ABS SYSTEM RELAY (8W-32-4)
235 16GY PK
C100
235 16GY YL
S100
235 16GY/YL
HYDRAULIC CONTROL UNIT (8W-32-6)
ABS DIODE (8W-32-3)
235 18GY/YL
235 16GY/YL
ABS CONTROL MODULE CAVITY 3 (8W-32-6)
HYDRAULIC CONTROL UNIT (8W-32-6)
235 16GY/YL
235 16GY/YL
ABS CONTROL MODULE CAVITY 33 (8W-32-6)

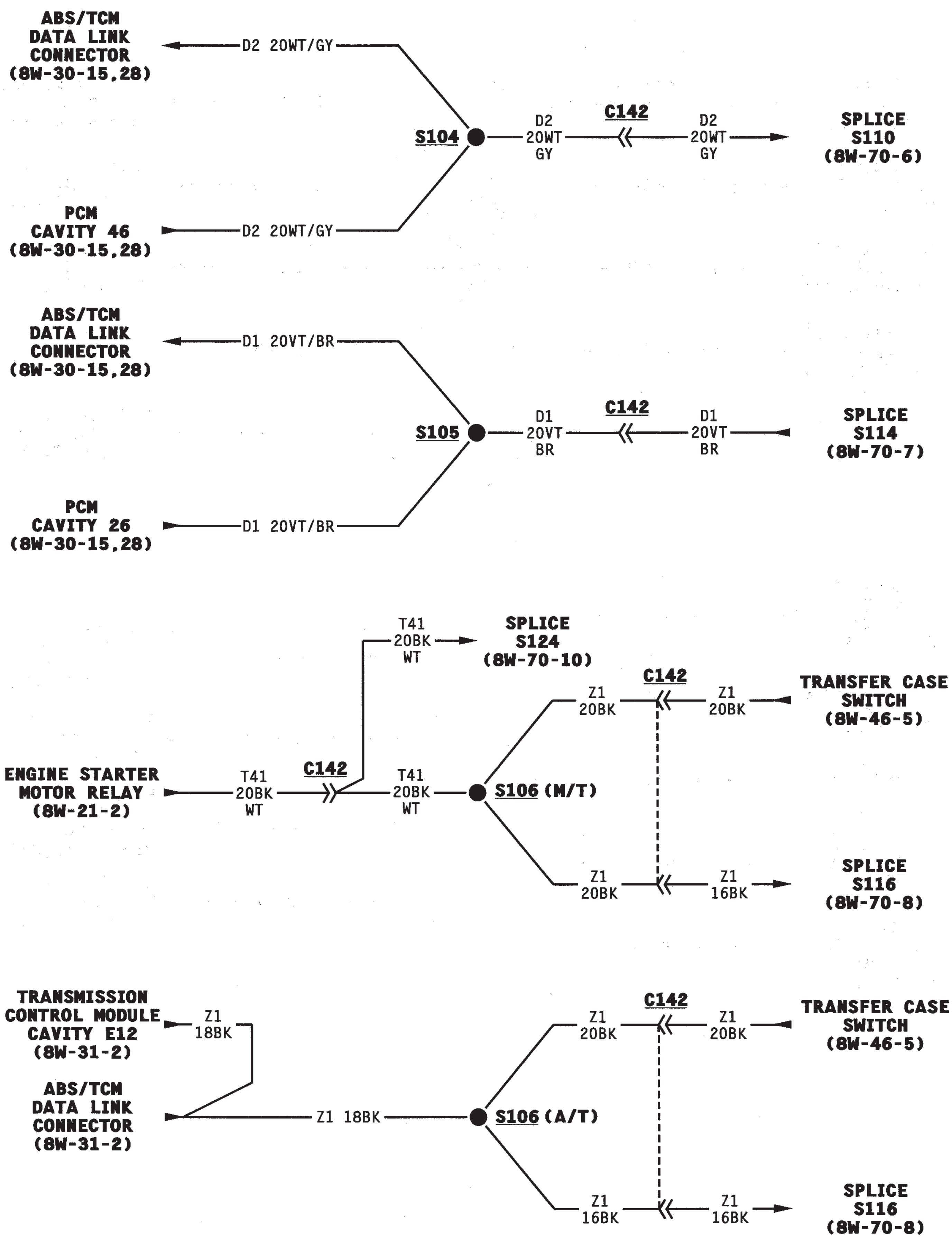

C118
Z1 16BK
Z1 16BK
SPLICE S217 (8W-70-18)
INTERMITTENT WIPER CONTROL MODULE (8W-53-3)
Z1 16BK
Z1 16BK
WASHER FLUID LEVEL SENSOR (8W-53-4)
INTERMITTENT WIPER MOTOR (8W-53-4)
Z1 16BK
S101
Z1 16BK
LEFT HEADLAMP (8W-50-6)
SPLICE S409 (8W-70-32)
Z1 18BK
C102
Z1 18BK
Z1 20BK
WINDSHIELD WASHER PUMP MOTOR (8W-53-4)
ABS PUMP MOTOR (8W-32-5)
Z1 12BK
Z1 12BK
Z1 20BK
REAR WASHER PUMP MOTOR (8W-53-6)
G100
8W-15-2

J958W-3

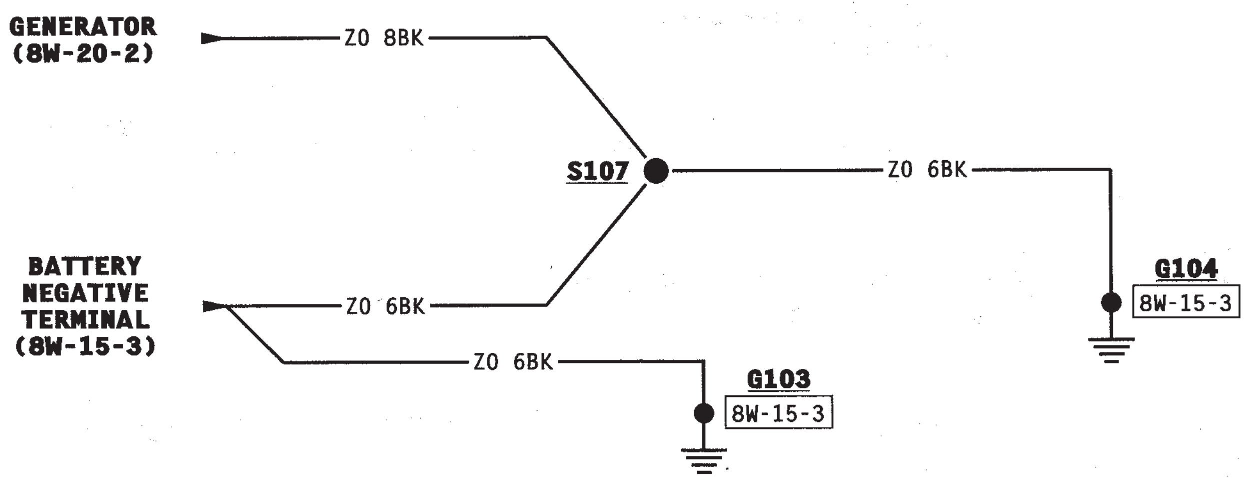

SPLICE
S112
(8W-70-6)
A61
18DG
BK
C142
A61
18DG
BK
PCM
CAVITY 57
(8W-30-10,22)
A61 18DG/BK
FUEL INJECTOR
NO.5
(8W-30-10,22)
FUEL INJECTOR
NO.6
(8W-30-10,22)
FUEL INJECTOR
NO.8
(8W-30-10,22)
S102
FUEL INJECTOR
NO.1
(8W-30-10,22)
FUEL INJECTOR
NO.2
(8W-30-10,22)
FUEL INJECTOR
NO.3
(8W-30-10,22)
FUEL INJECTOR
NO.4
(8W-30-10,22)
FUEL INJECTOR
NO.7
(8W-30-10,22)
5.2L ONLY

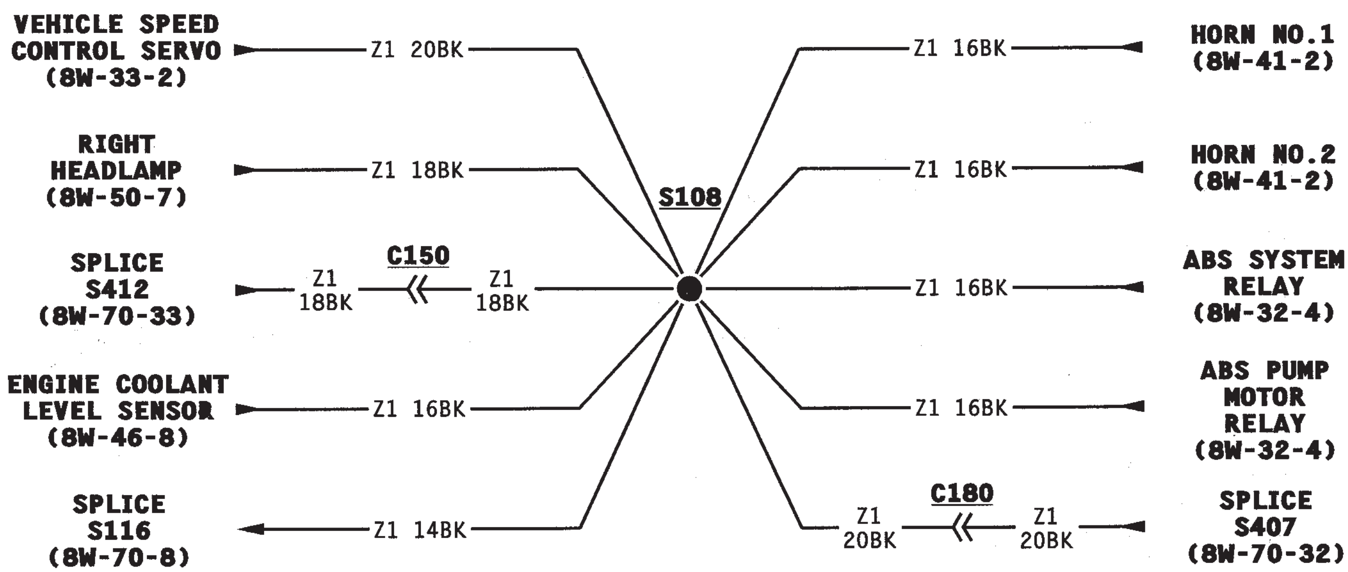

CAMSHAFT
POSITION
SENSOR
(8W-30-13,25)
THROTTLE
POSITION
SENSOR
(8W-30-12,24)
PCM
CAVITY 4
(8W-30-12,24)
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
(8W-30-12,24)
INTAKE AIR
TEMPERATURE
SENSOR
(8W-30-12,24)
K4 18BK/LB
S103
CRANKSHAFT
POSITION
SENSOR
(8W-30-13,25)
HEATED OXYGEN
SENSOR
(8W-30-14,26)
ENGINE COOLANT
TEMPERATURE
SENSOR
(8W-30-12,24)
VEHICLE SPEED
SENSOR
(8W-30-13,25)

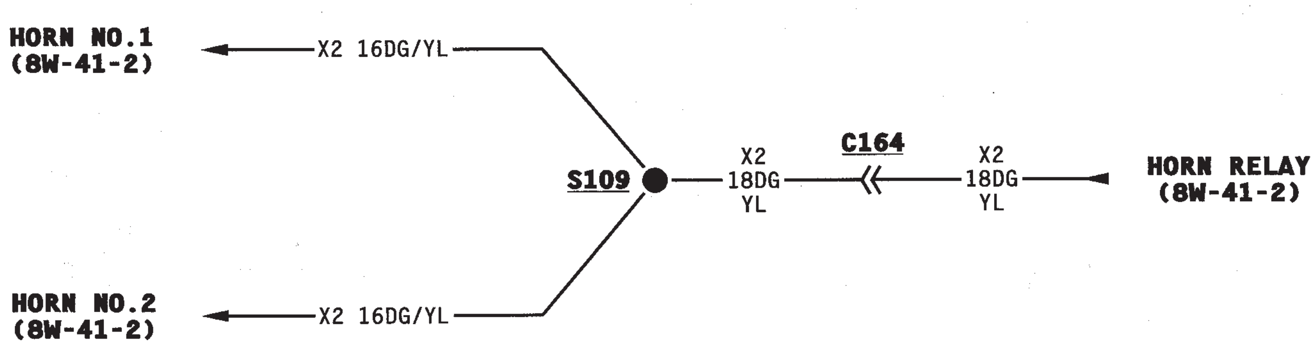
J958W-3


ABS/TCM DATA LINK CONNECTOR (8W-30-15,28)
D2 20WT/GY
S104
D2 20WT GY
C142
D2 20WT GY
SPLICE S110 (8W-70-6)
PCM CAVITY 46 (8W-30-15,28)
D2 20WT/GY
ABS/TCM DATA LINK CONNECTOR (8W-30-15,28)
D1 20VT/BR
S105
D1 20VT BR
C142
D1 20VT BR
SPLICE S114 (8W-70-7)
PCM CAVITY 26 (8W-30-15,28)
D1 20VT/BR
T41 20BK WT
SPLICE S124 (8W-70-10)
C142
Z1 20BK
Z1 20BK
TRANSFER CASE SWITCH (8W-46-5)
ENGINE STARTER MOTOR RELAY (8W-21-2)
T41 20BK WT
C142
T41 20BK WT
S106 (M/T)
Z1 20BK
Z1 16BK
SPLICE S116 (8W-70-8)
TRANSMISSION CONTROL MODULE CAVITY E12 (8W-31-2)
Z1 18BK
C142
Z1 20BK
Z1 20BK
TRANSFER CASE SWITCH (8W-46-5)
ABS/TCM DATA LINK CONNECTOR (8W-31-2)
Z1 18BK
S106 (A/T)
Z1 16BK
Z1 16BK
SPLICE S116 (8W-70-8)

J958W-3


GENERATOR
(8W-20-2)
Z0 8BK
S107
Z0 6BK
G104
8W-15-3
BATTERY
NEGATIVE
TERMINAL
(8W-15-3)
Z0 6BK
Z0 6BK
G103
8W-15-3


VEHICLE SPEED
CONTROL SERVO
(8W-33-2)
Z1 20BK
RIGHT
HEADLAMP
(8W-50-7)
Z1 18BK
SPLICE
S412
(8W-70-33)
Z1
18BK
C150
Z1
18BK
ENGINE COOLANT
LEVEL SENSOR
(8W-46-8)
Z1 16BK
SPLICE
S116
(8W-70-8)
Z1 14BK
S108
Z1 16BK
HORN NO.1
(8W-41-2)
Z1 16BK
HORN NO.2
(8W-41-2)
Z1 16BK
ABS SYSTEM
RELAY
(8W-32-4)
Z1 16BK
ABS PUMP
MOTOR
RELAY
(8W-32-4)
Z1
20BK
C180
Z1
20BK
SPLICE
S407
(8W-70-32)


HORN NO.1
(8W-41-2)
X2 16DG/YL
S109
X2
18DG
YL
C164
X2
18DG
YL
HORN RELAY
(8W-41-2)
HORN NO.2
(8W-41-2)
X2 16DG/YL

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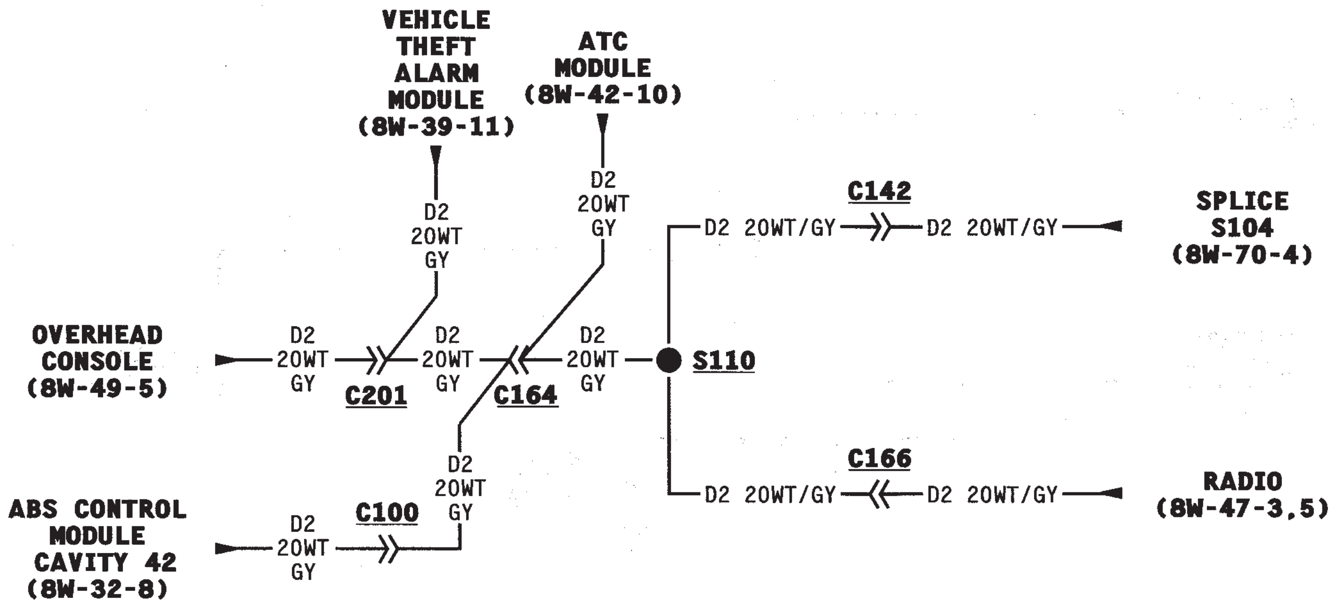
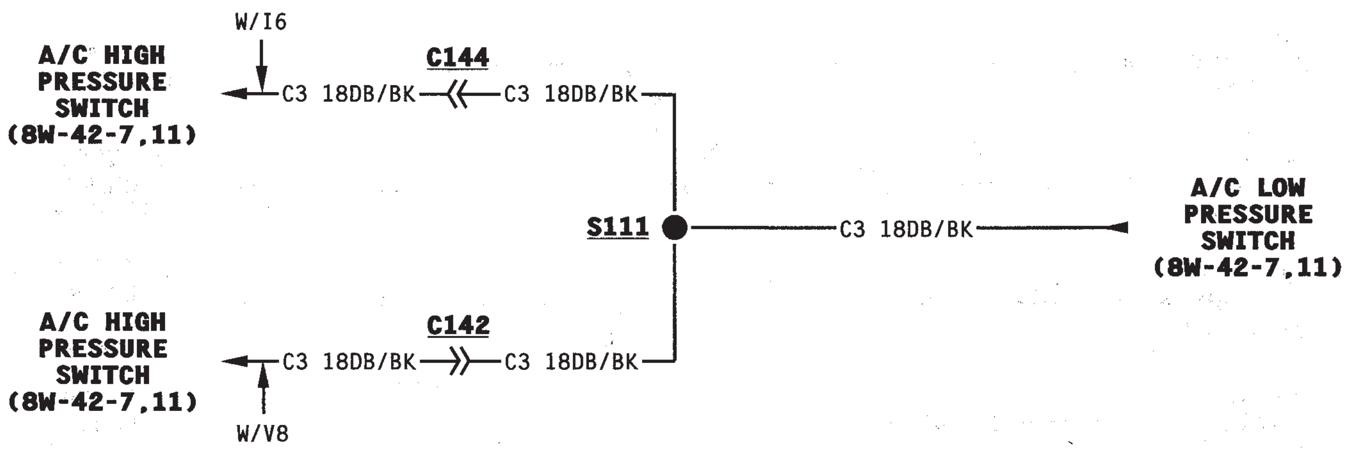
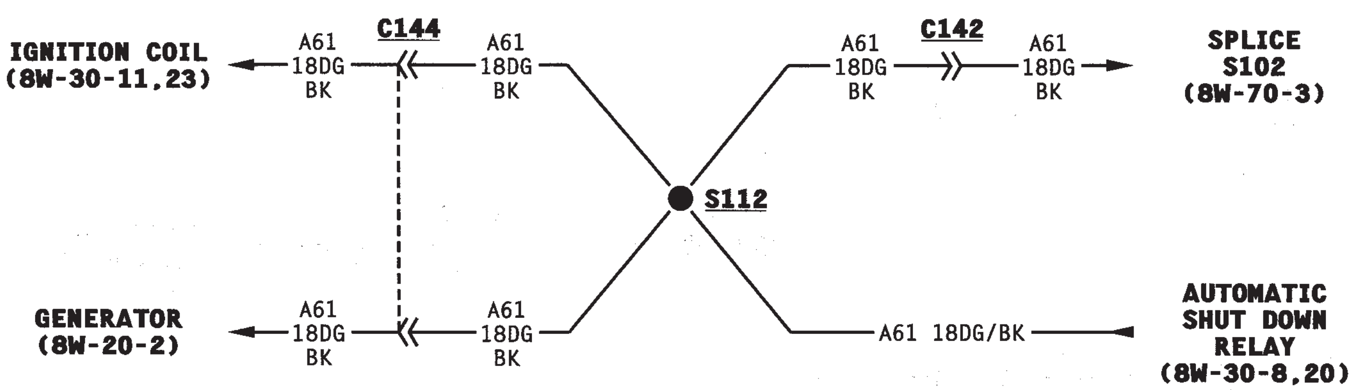

VEHICLE THEFT ALARM MODULE (8W-39-11)
ATC MODULE (8W-42-10)
D2 20WT GY
D2 20WT GY
C142
D2 20WT/GY
D2 20WT/GY
SPLICE S104 (8W-70-4)
OVERHEAD CONSOLE (8W-49-5)
D2 20WT GY
C201
D2 20WT GY
C164
D2 20WT GY
S110
D2 20WT GY
C166
D2 20WT/GY
D2 20WT/GY
RADIO (8W-47-3,5)
ABS CONTROL MODULE CAVITY 42 (8W-32-8)
C100
D2 20WT GY


W/I6
A/C HIGH PRESSURE SWITCH (8W-42-7,11)
C144
C3 18DB/BK
C3 18DB/BK
S111
C3 18DB/BK
A/C LOW PRESSURE SWITCH (8W-42-7,11)
A/C HIGH PRESSURE SWITCH (8W-42-7,11)
C142
C3 18DB/BK
C3 18DB/BK
W/V8


IGNITION COIL (8W-30-11,23)
A61 18DG BK
C144
A61 18DG BK
A61 18DG BK
C142
A61 18DG BK
SPLICE S102 (8W-70-3)
S112
GENERATOR (8W-20-2)
A61 18DG BK
A61 18DG BK
A61 18DG/BK
AUTOMATIC SHUT DOWN RELAY (8W-30-8,20)

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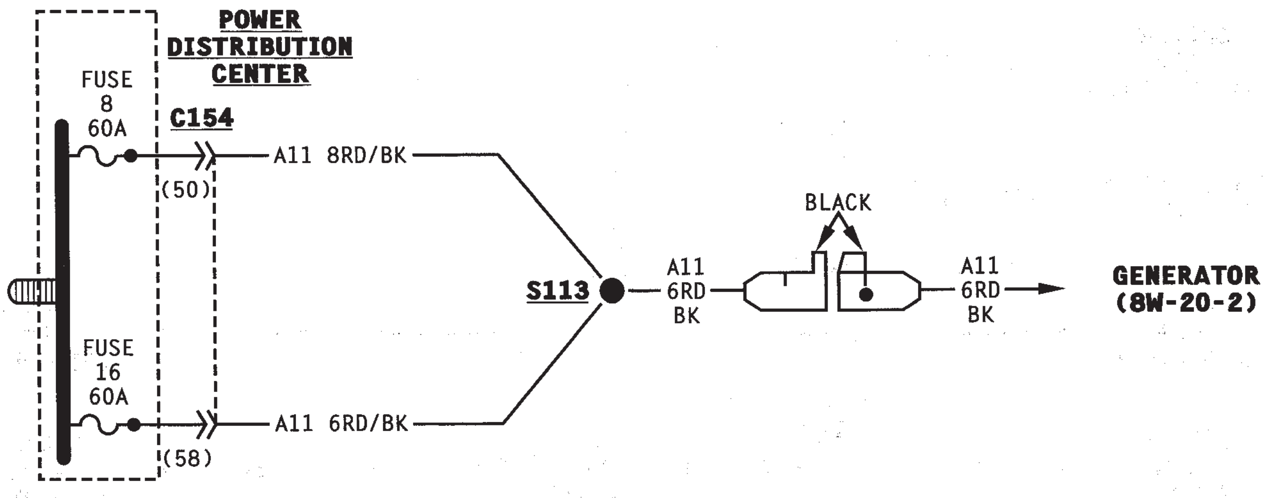
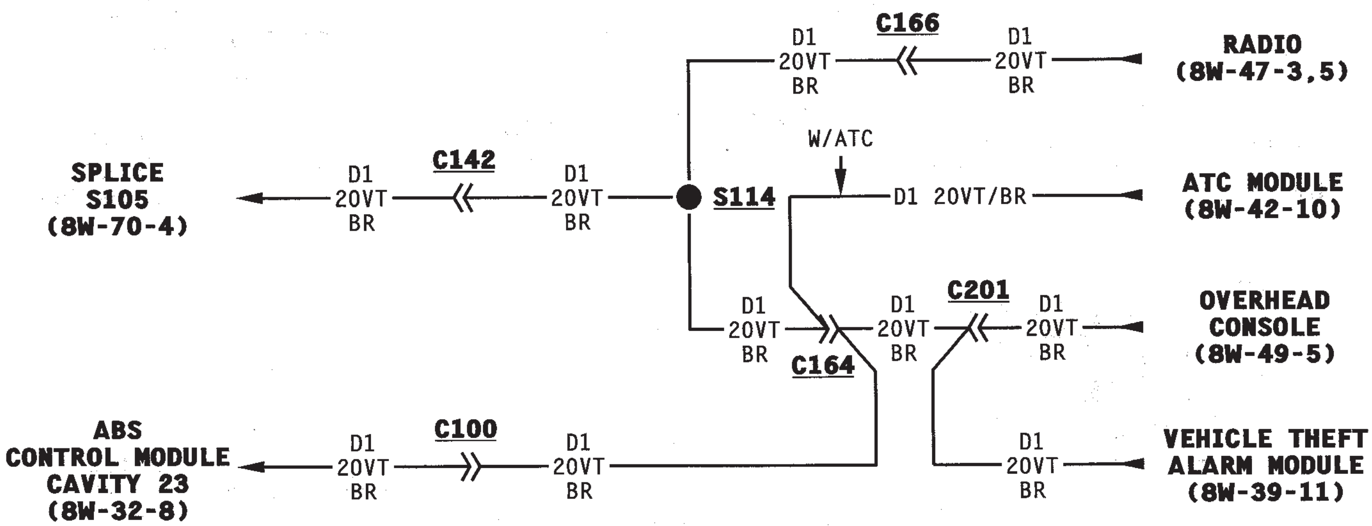
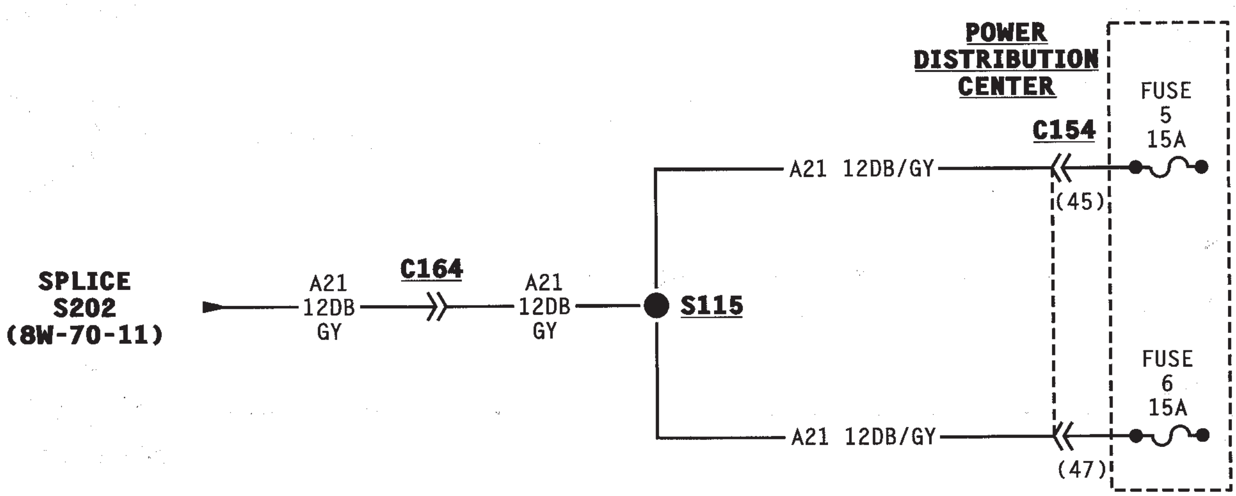

POWER DISTRIBUTION CENTER
FUSE 8 60A
C154
(50)
A11 8RD/BK
FUSE 16 60A
(58)
A11 6RD/BK
S113
A11 6RD BK
BLACK
A11 6RD BK
GENERATOR (8W-20-2)


C166
D1 20VT BR
D1 20VT BR
RADIO (8W-47-3,5)
SPLICE S105 (8W-70-4)
C142
D1 20VT BR
D1 20VT BR
S114
W/ATC
D1 20VT/BR
ATC MODULE (8W-42-10)
D1 20VT BR
C164
D1 20VT BR
C201
D1 20VT BR
OVERHEAD CONSOLE (8W-49-5)
ABS CONTROL MODULE CAVITY 23 (8W-32-8)
C100
D1 20VT BR
D1 20VT BR
D1 20VT BR
VEHICLE THEFT ALARM MODULE (8W-39-11)


POWER DISTRIBUTION CENTER
C154
FUSE 5 15A
A21 12DB/GY
(45)
SPLICE S202 (8W-70-11)
C164
A21 12DB GY
A21 12DB GY
S115
FUSE 6 15A
A21 12DB/GY
(47)

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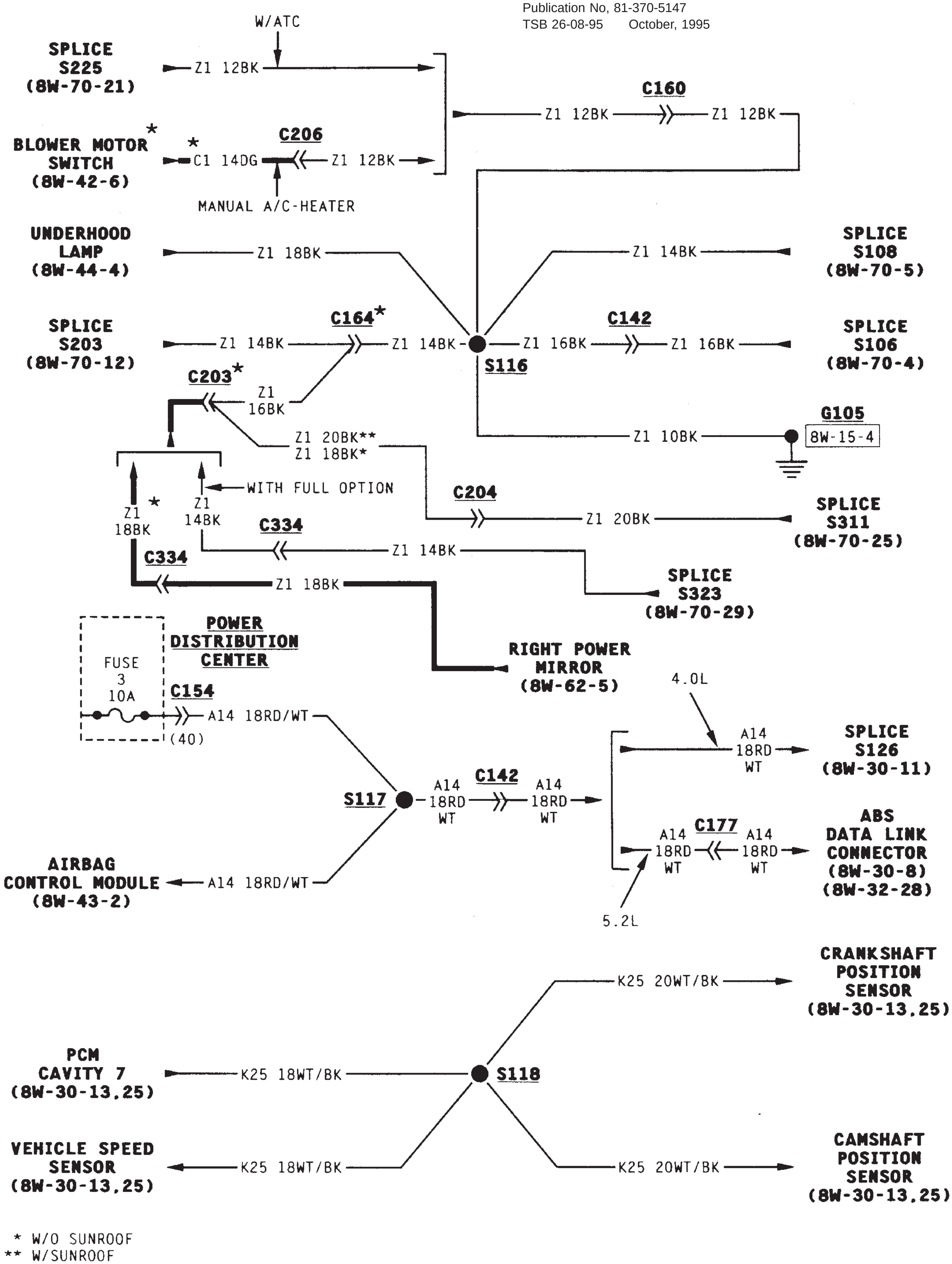

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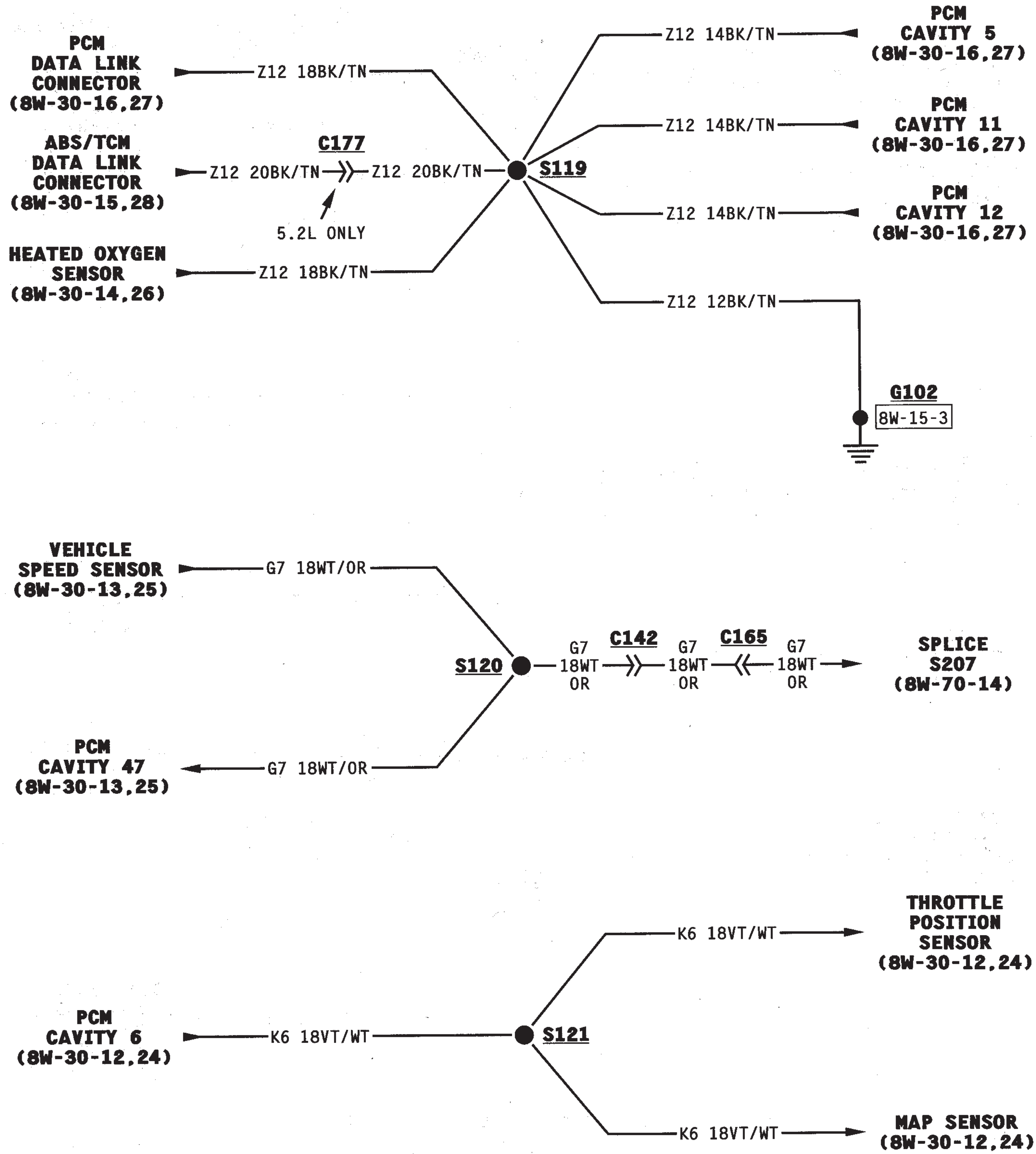
PCM
DATA LINK
CONNECTOR
(8W-30-16,27)
Z12 18BK/TN
ABS/TCM
DATA LINK
CONNECTOR
(8W-30-15,28)
Z12 20BK/TN
C177
Z12 20BK/TN
5.2L ONLY
HEATED OXYGEN
SENSOR
(8W-30-14,26)
Z12 18BK/TN
S119
Z12 14BK/TN
PCM
CAVITY 5
(8W-30-16,27)
Z12 14BK/TN
PCM
CAVITY 11
(8W-30-16,27)
Z12 14BK/TN
PCM
CAVITY 12
(8W-30-16,27)
Z12 12BK/TN
G102
8W-15-3
VEHICLE
SPEED SENSOR
(8W-30-13,25)
G7 18WT/OR
S120
G7 18WT OR
C142
G7 18WT OR
C165
G7 18WT OR
SPLICE
S207
(8W-70-14)
PCM
CAVITY 47
(8W-30-13,25)
G7 18WT/OR
THROTTLE
POSITION
SENSOR
(8W-30-12,24)
K6 18VT/WT
PCM
CAVITY 6
(8W-30-12,24)
K6 18VT/WT
S121
K6 18VT/WT
MAP SENSOR
(8W-30-12,24)

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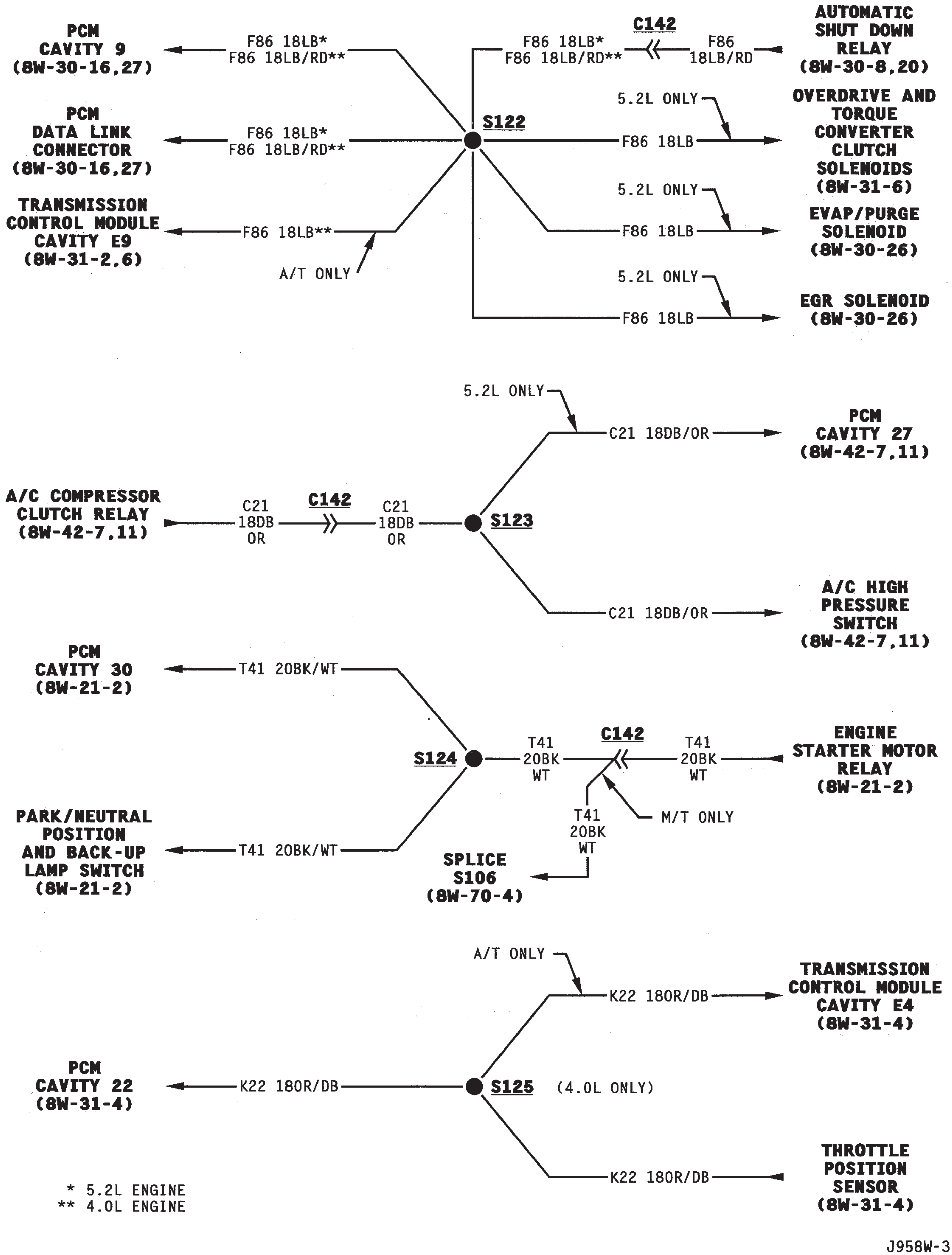
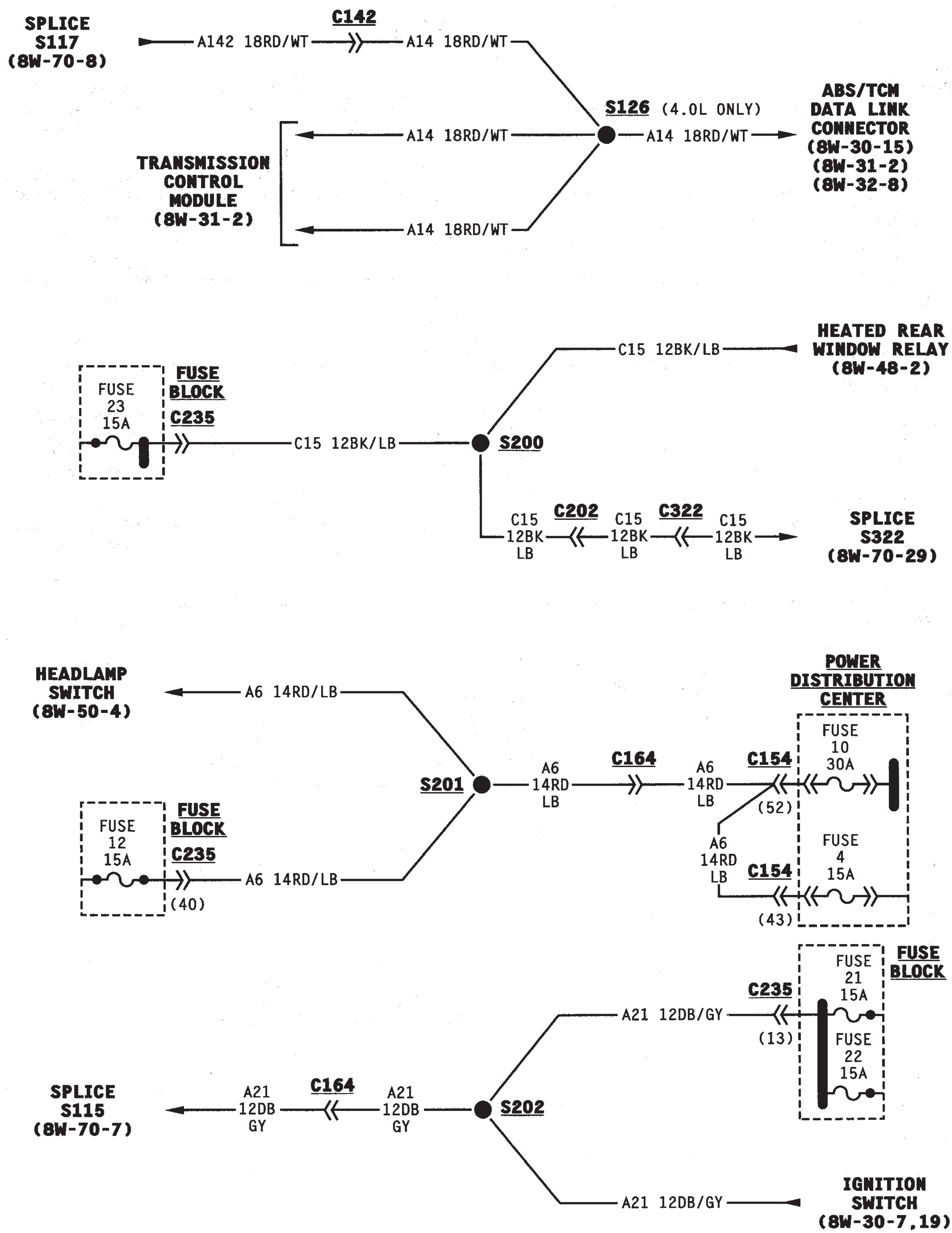

PCM CAVITY 9 (8W-30-16,27)
F86 18LB*
F86 18LB/RD**
C142
F86 18LB*
F86 18LB/RD**
F86 18LB/RD
AUTOMATIC SHUT DOWN RELAY (8W-30-8,20)
PCM DATA LINK CONNECTOR (8W-30-16,27)
F86 18LB*
F86 18LB/RD**
S122
5.2L ONLY
F86 18LB
OVERDRIVE AND TORQUE CONVERTER CLUTCH SOLENOIDS (8W-31-6)
TRANSMISSION CONTROL MODULE CAVITY E9 (8W-31-2,6)
F86 18LB**
A/T ONLY
5.2L ONLY
F86 18LB
EVAP/PURGE SOLENOID (8W-30-26)
5.2L ONLY
F86 18LB
EGR SOLENOID (8W-30-26)
5.2L ONLY
C21 18DB/OR
PCM CAVITY 27 (8W-42-7,11)
A/C COMPRESSOR CLUTCH RELAY (8W-42-7,11)
C21 18DB OR
C142
C21 18DB OR
S123
C21 18DB/OR
A/C HIGH PRESSURE SWITCH (8W-42-7,11)
PCM CAVITY 30 (8W-21-2)
T41 20BK/WT
S124
T41 20BK WT
C142
T41 20BK WT
ENGINE STARTER MOTOR RELAY (8W-21-2)
M/T ONLY
T41 20BK WT
PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH (8W-21-2)
T41 20BK/WT
SPLICE S106 (8W-70-4)
A/T ONLY
K22 18OR/DB
TRANSMISSION CONTROL MODULE CAVITY E4 (8W-31-4)
PCM CAVITY 22 (8W-31-4)
K22 18OR/DB
S125 (4.0L ONLY)
K22 18OR/DB
THROTTLE POSITION SENSOR (8W-31-4)
* 5.2L ENGINE
** 4.0L ENGINE
J958W-3


SPLICE
S117
(8W-70-8)
A142 18RD/WT
C142
A14 18RD/WT
S126 (4.0L ONLY)
A14 18RD/WT
ABS/TCM
DATA LINK
CONNECTOR
(8W-30-15)
(8W-31-2)
(8W-32-8)
TRANSMISSION
CONTROL
MODULE
(8W-31-2)
A14 18RD/WT
A14 18RD/WT
HEATED REAR
WINDOW RELAY
(8W-48-2)
C15 12BK/LB
FUSE
23
15A
FUSE
BLOCK
C235
C15 12BK/LB
S200
C15
12BK
LB
C202
C15
12BK
LB
C322
C15
12BK
LB
SPLICE
S322
(8W-70-29)
HEADLAMP
SWITCH
(8W-50-4)
A6 14RD/LB
POWER
DISTRIBUTION
CENTER
S201
A6
14RD
LB
C164
A6
14RD
LB
C154
FUSE
10
30A
(52)
FUSE
12
15A
FUSE
BLOCK
C235
A6 14RD/LB
(40)
A6
14RD
LB
C154
FUSE
4
15A
(43)
FUSE
BLOCK
FUSE
21
15A
C235
A21 12DB/GY
(13)
FUSE
22
15A
SPLICE
S115
(8W-70-7)
A21
12DB
GY
C164
A21
12DB
GY
S202
A21 12DB/GY
IGNITION
SWITCH
(8W-30-7,19)

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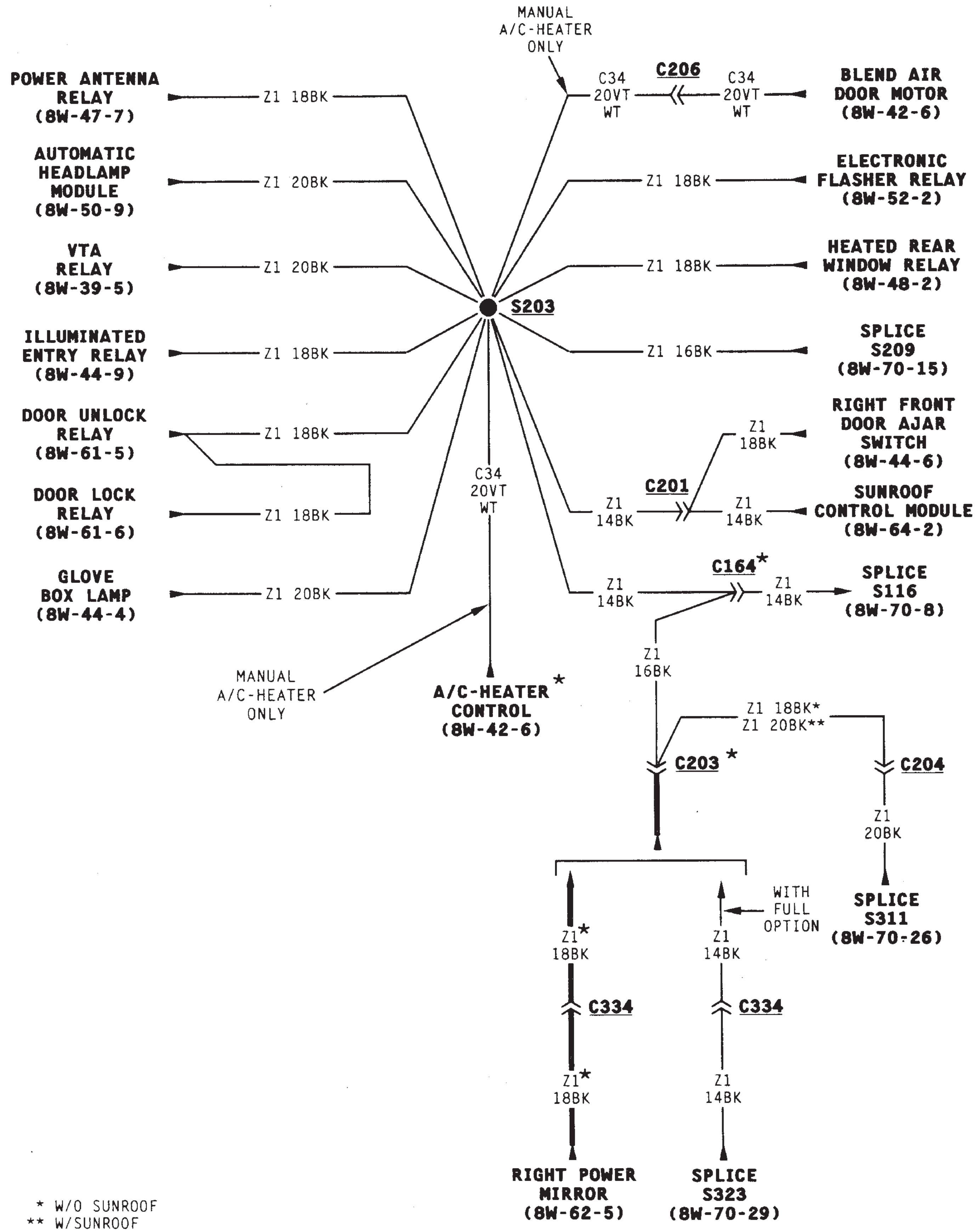

* W/O SUNROOF
** W/SUNROOF

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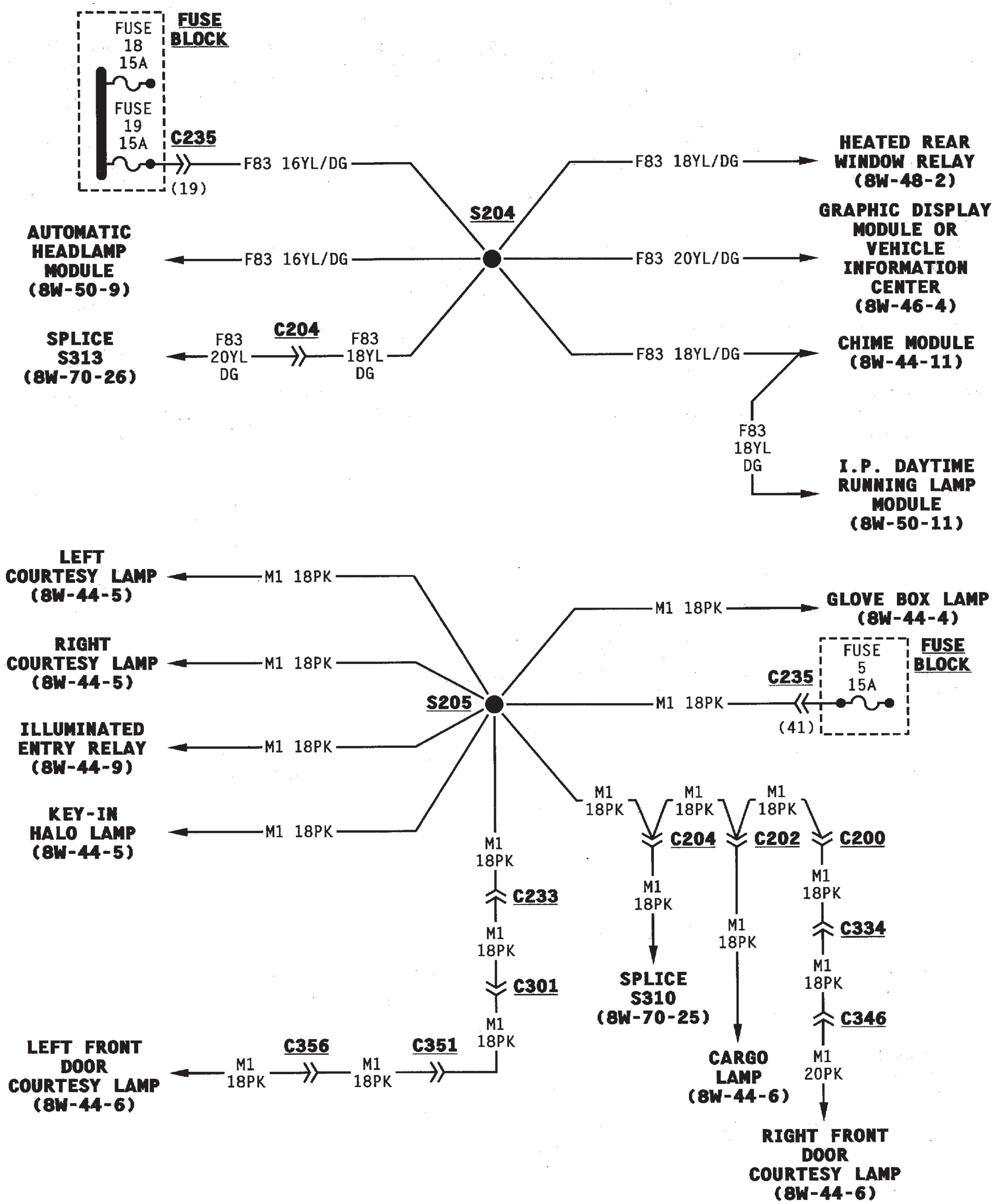
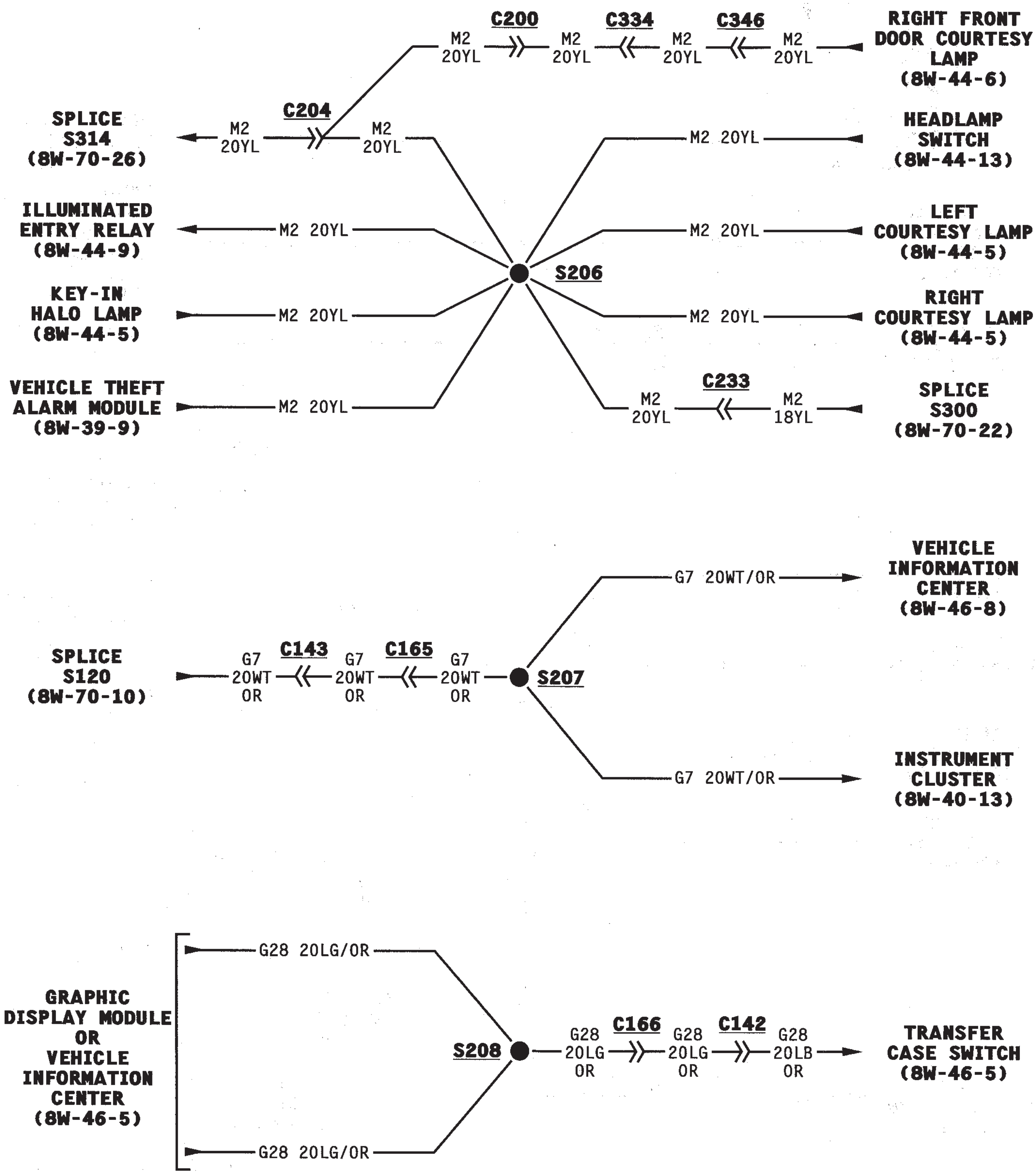

FUSE
BLOCK
FUSE
18
15A
FUSE
19
15A
C235
(19)
F83 16YL/DG
F83 18YL/DG
HEATED REAR
WINDOW RELAY
(8W-48-2)
S204
AUTOMATIC
HEADLAMP
MODULE
(8W-50-9)
F83 16YL/DG
F83 20YL/DG
GRAPHIC DISPLAY
MODULE OR
VEHICLE
INFORMATION
CENTER
(8W-46-4)
SPLICE
S313
(8W-70-26)
F83
20YL
DG
C204
F83
18YL
DG
F83 18YL/DG
CHIME MODULE
(8W-44-11)
F83
18YL
DG
I.P. DAYTIME
RUNNING LAMP
MODULE
(8W-50-11)
LEFT
COURTESY LAMP
(8W-44-5)
M1 18PK
M1 18PK
GLOVE BOX LAMP
(8W-44-4)
RIGHT
COURTESY LAMP
(8W-44-5)
M1 18PK
FUSE
5
15A
FUSE
BLOCK
C235
S205
M1 18PK
(41)
ILLUMINATED
ENTRY RELAY
(8W-44-9)
M1 18PK
KEY-IN
HALO LAMP
(8W-44-5)
M1 18PK
M1
18PK
M1
18PK
M1
18PK
M1
18PK
C204
C202
C200
C233
M1
18PK
M1
18PK
M1
18PK
C334
C301
M1
18PK
M1
18PK
SPLICE
S310
(8W-70-25)
C346
LEFT FRONT
DOOR
COURTESY LAMP
(8W-44-6)
C356
C351
M1
18PK
M1
18PK
M1
18PK
CARGO
LAMP
(8W-44-6)
M1
20PK
RIGHT FRONT
DOOR
COURTESY LAMP
(8W-44-6)

J958W-3


C200
C334
C346
M2 20YL
RIGHT FRONT DOOR COURTESY LAMP (8W-44-6)
SPLICE S314 (8W-70-26)
C204
HEADLAMP SWITCH (8W-44-13)
ILLUMINATED ENTRY RELAY (8W-44-9)
LEFT COURTESY LAMP (8W-44-5)
S206
KEY-IN HALO LAMP (8W-44-5)
RIGHT COURTESY LAMP (8W-44-5)
VEHICLE THEFT ALARM MODULE (8W-39-9)
C233
M2 18YL
SPLICE S300 (8W-70-22)
VEHICLE INFORMATION CENTER (8W-46-8)
G7 20WT/OR
SPLICE S120 (8W-70-10)
C143
C165
G7 20WT OR
S207
INSTRUMENT CLUSTER (8W-40-13)
G28 20LG/OR
GRAPHIC DISPLAY MODULE OR VEHICLE INFORMATION CENTER (8W-46-5)
S208
C166
C142
G28 20LG OR
G28 20LB OR
TRANSFER CASE SWITCH (8W-46-5)

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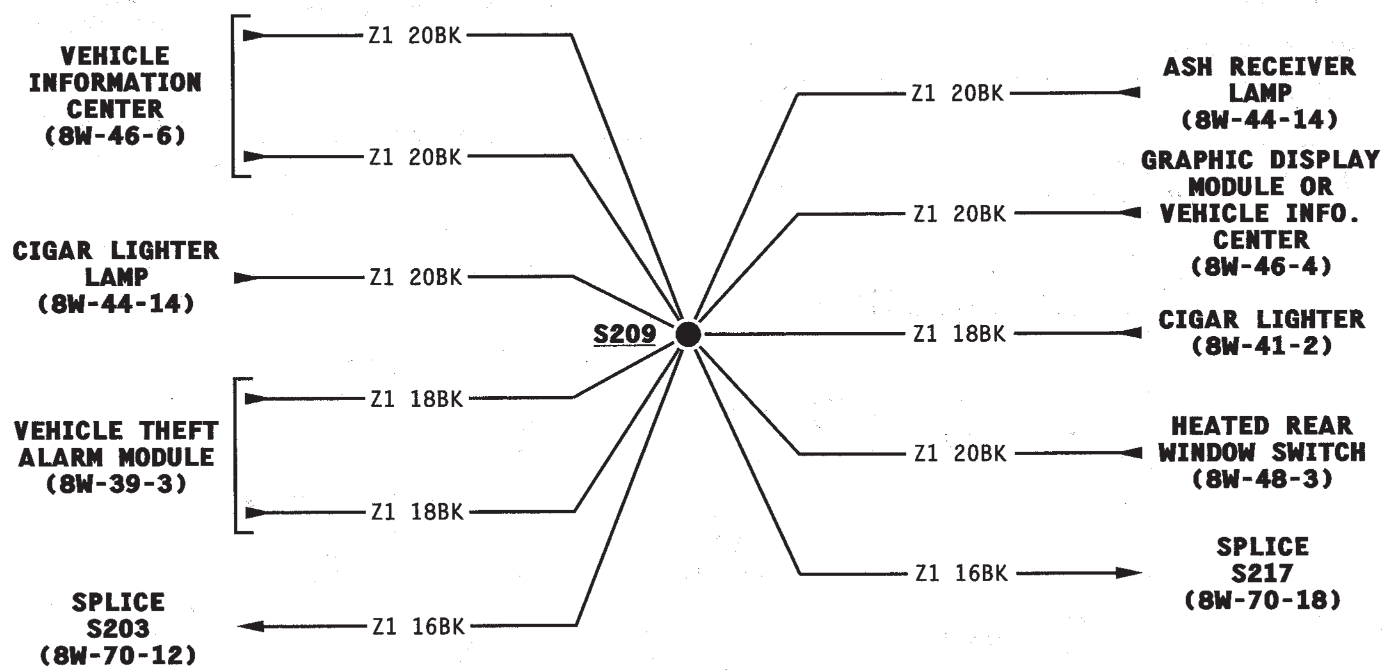
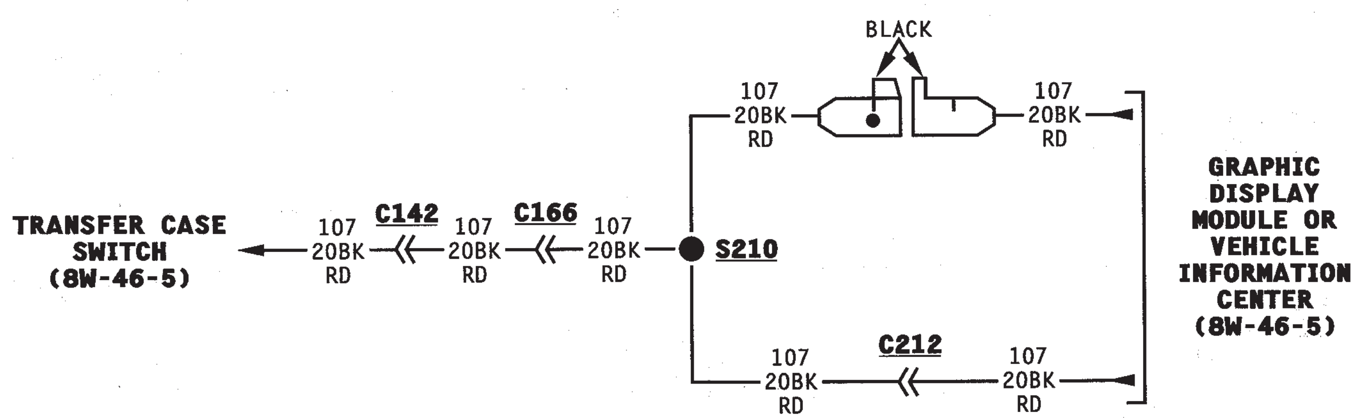
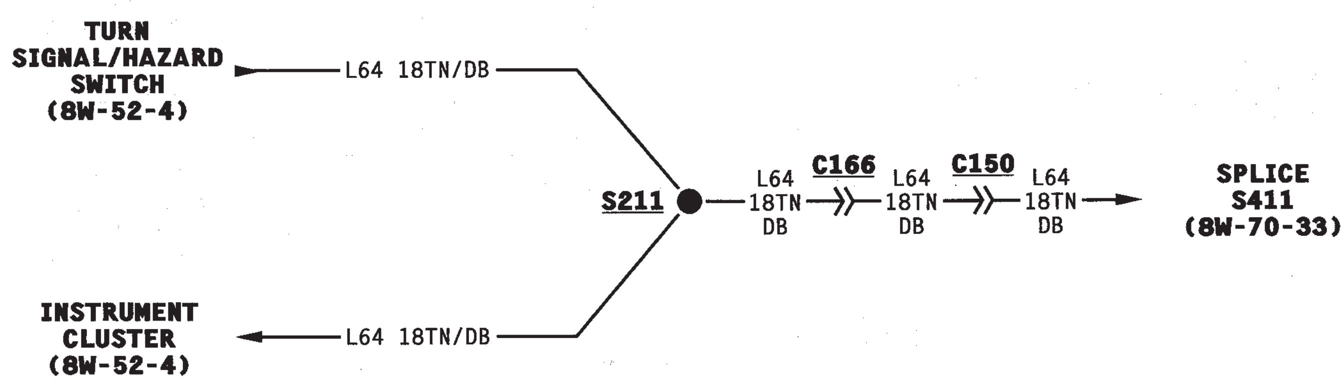

VEHICLE INFORMATION CENTER (8W-46-6)
Z1 20BK
Z1 20BK
CIGAR LIGHTER LAMP (8W-44-14)
Z1 20BK
VEHICLE THEFT ALARM MODULE (8W-39-3)
Z1 18BK
Z1 18BK
SPLICE S203 (8W-70-12)
Z1 16BK
S209
Z1 20BK
ASH RECEIVER LAMP (8W-44-14)
Z1 20BK
GRAPHIC DISPLAY MODULE OR VEHICLE INFO. CENTER (8W-46-4)
Z1 18BK
CIGAR LIGHTER (8W-41-2)
Z1 20BK
HEATED REAR WINDOW SWITCH (8W-48-3)
Z1 16BK
SPLICE S217 (8W-70-18)


BLACK
107 20BK RD
107 20BK RD
TRANSFER CASE SWITCH (8W-46-5)
107 20BK RD
C142
107 20BK RD
C166
107 20BK RD
S210
107 20BK RD
C212
107 20BK RD
GRAPHIC DISPLAY MODULE OR VEHICLE INFORMATION CENTER (8W-46-5)


TURN SIGNAL/HAZARD SWITCH (8W-52-4)
L64 18TN/DB
S211
L64 18TN DB
C166
L64 18TN DB
C150
L64 18TN DB
SPLICE S411 (8W-70-33)
INSTRUMENT CLUSTER (8W-52-4)
L64 18TN/DB

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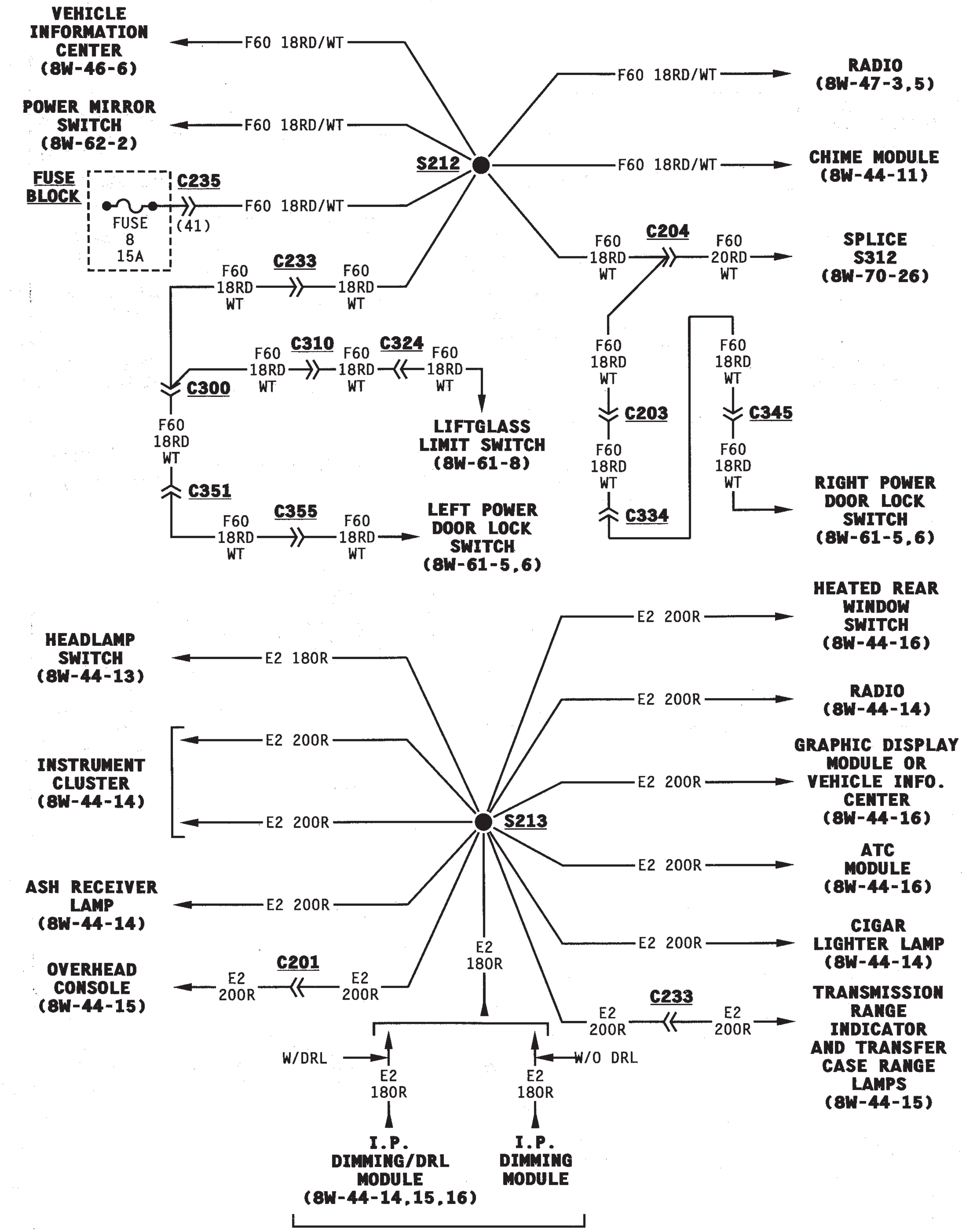
VEHICLE INFORMATION CENTER (8W-46-6)
F60 18RD/WT
POWER MIRROR SWITCH (8W-62-2)
FUSE BLOCK
FUSE 8 15A
C235
(41)
S212
RADIO (8W-47-3,5)
CHIME MODULE (8W-44-11)
C204
F60 18RD WT
F60 20RD WT
SPLICE S312 (8W-70-26)
C233
C310
C324
C300
LIFTGLASS LIMIT SWITCH (8W-61-8)
C351
C355
LEFT POWER DOOR LOCK SWITCH (8W-61-5,6)
C203
C345
C334
RIGHT POWER DOOR LOCK SWITCH (8W-61-5,6)
HEATED REAR WINDOW SWITCH (8W-44-16)
E2 20OR
HEADLAMP SWITCH (8W-44-13)
E2 18OR
RADIO (8W-44-14)
INSTRUMENT CLUSTER (8W-44-14)
GRAPHIC DISPLAY MODULE OR VEHICLE INFO. CENTER (8W-44-16)
S213
ATC MODULE (8W-44-16)
ASH RECEIVER LAMP (8W-44-14)
CIGAR LIGHTER LAMP (8W-44-14)
C201
OVERHEAD CONSOLE (8W-44-15)
C233
TRANSMISSION RANGE INDICATOR AND TRANSFER CASE RANGE LAMPS (8W-44-15)
W/DRL
W/O DRL
I.P. DIMMING/DRL MODULE (8W-44-14,15,16)
I.P. DIMMING MODULE

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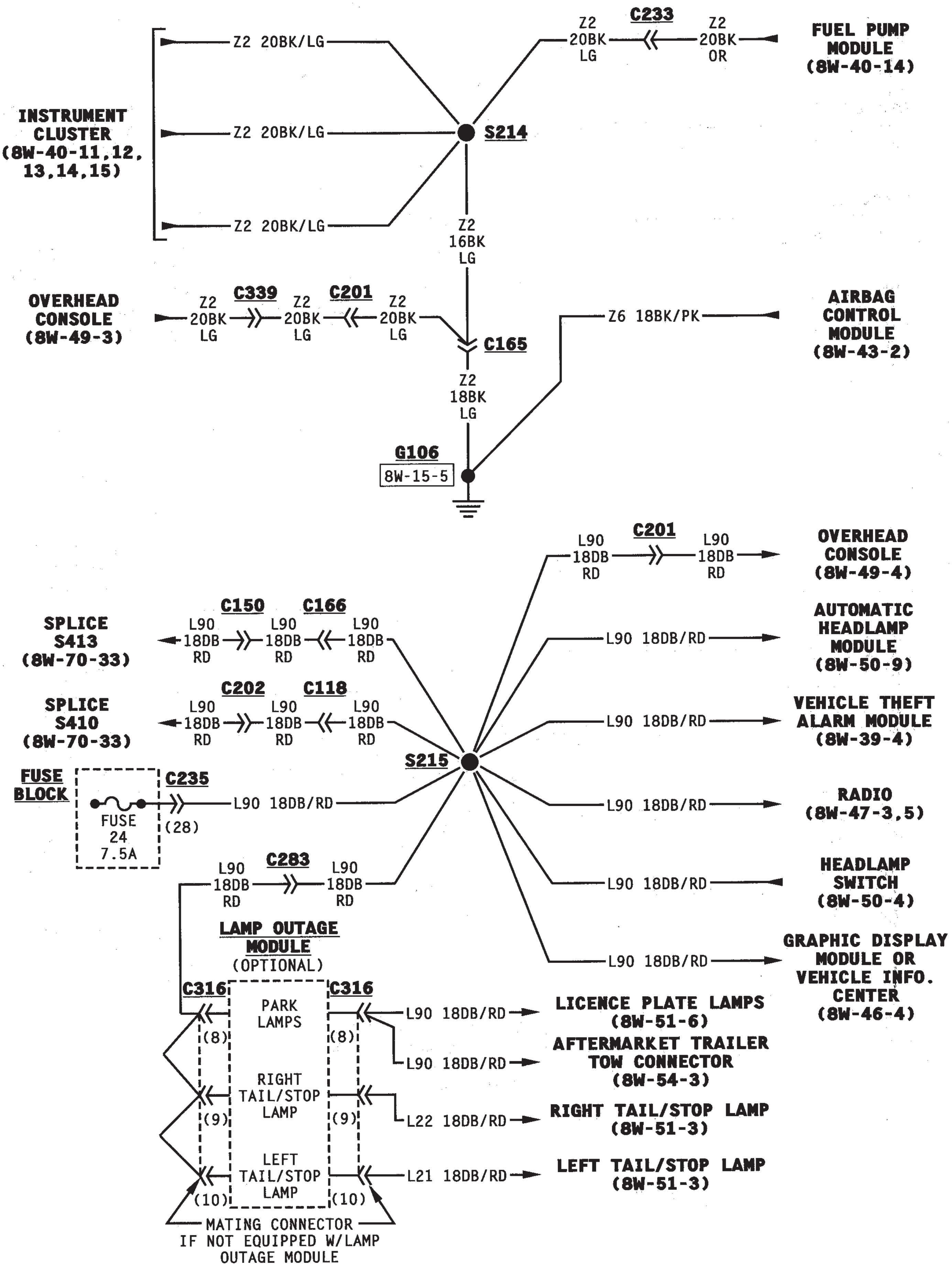
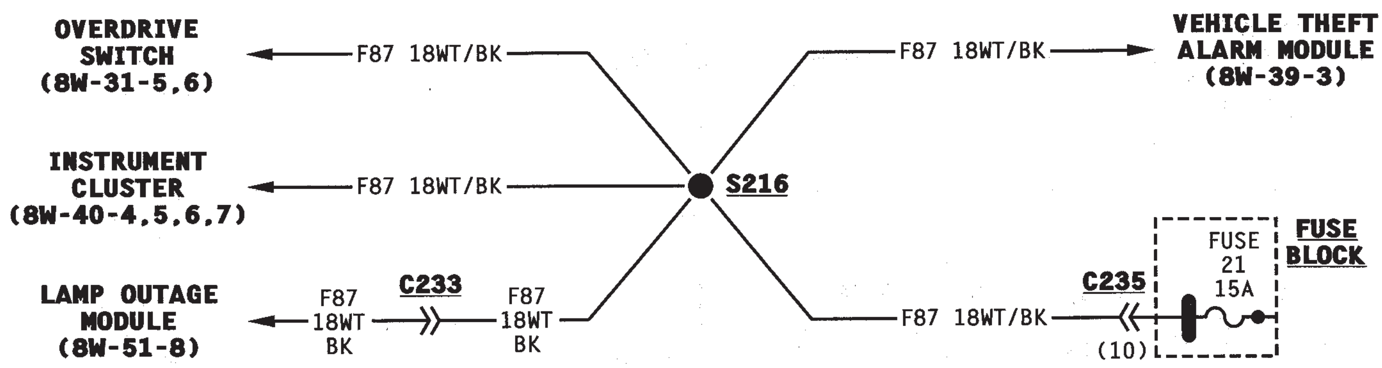
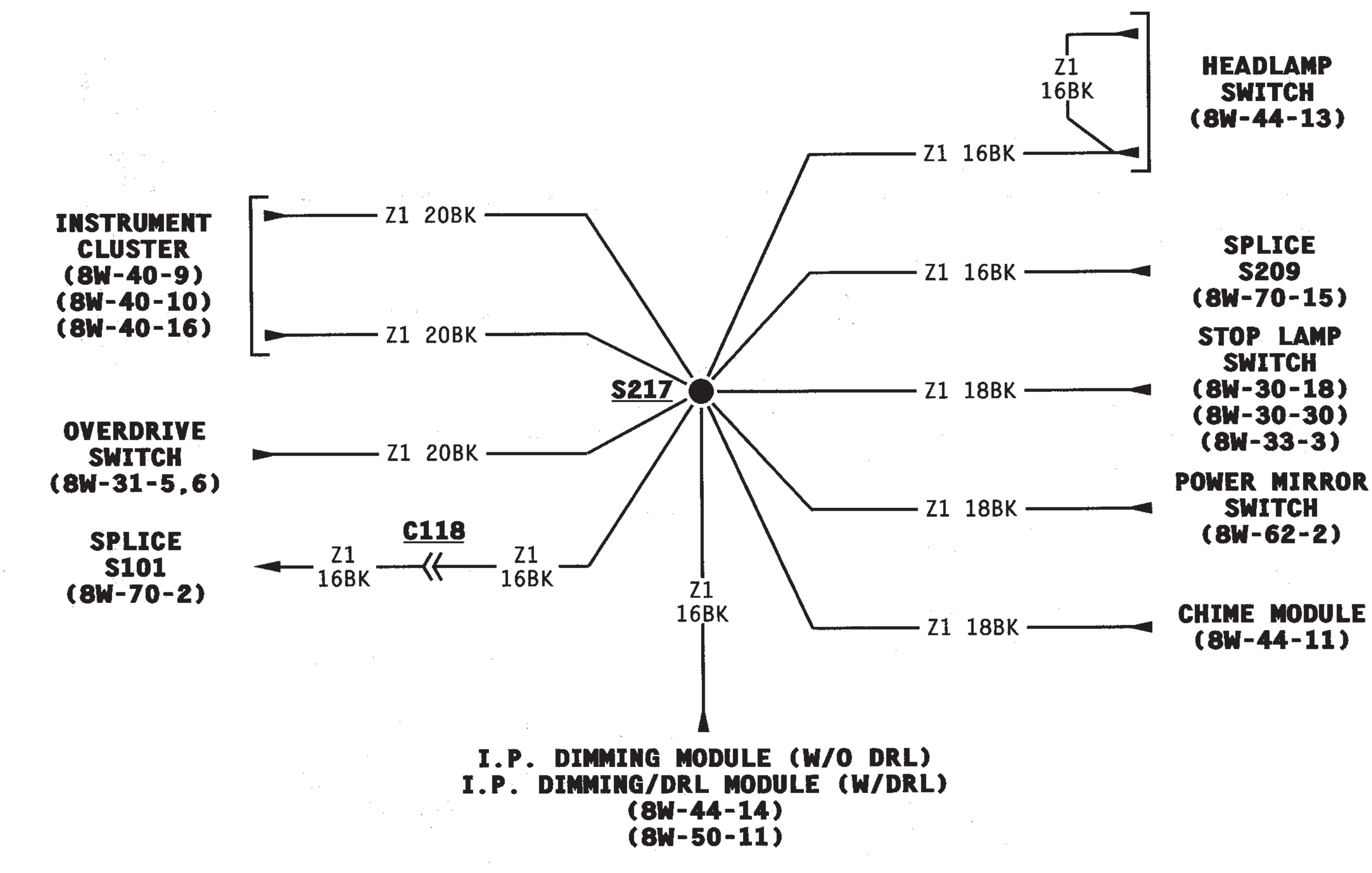
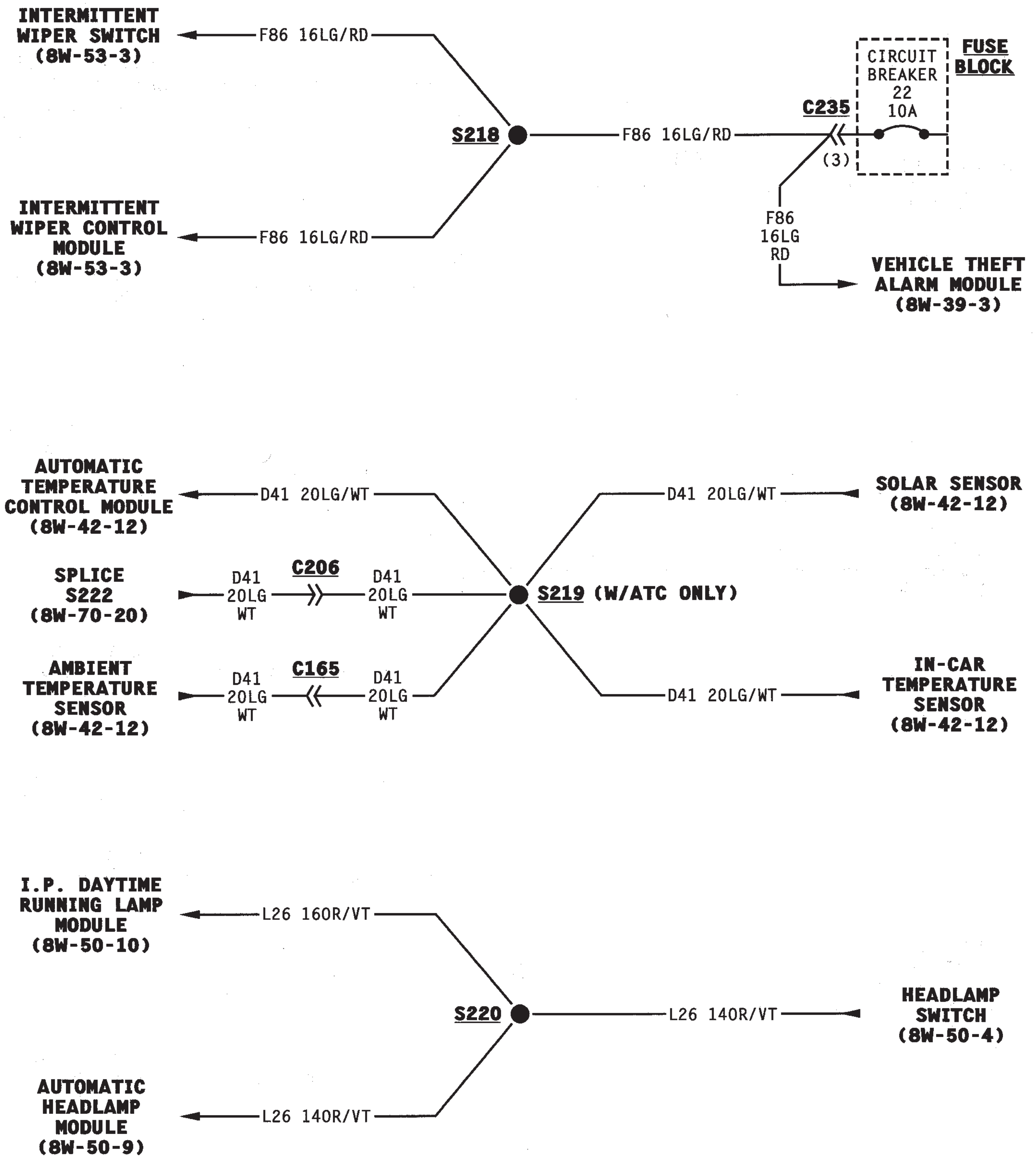

INSTRUMENT CLUSTER (8W-40-11,12, 13,14,15)
Z2 20BK/LG
Z2 20BK/LG
Z2 20BK/LG
S214
Z2 20BK LG
C233
Z2 20BK OR
FUEL PUMP MODULE (8W-40-14)
Z2 16BK LG
OVERHEAD CONSOLE (8W-49-3)
Z2 20BK LG
C339
Z2 20BK LG
C201
Z2 20BK LG
C165
Z6 18BK/PK
AIRBAG CONTROL MODULE (8W-43-2)
Z2 18BK LG
G106
8W-15-5
L90 18DB RD
C201
L90 18DB RD
OVERHEAD CONSOLE (8W-49-4)
SPLICE S413 (8W-70-33)
C150
C166
L90 18DB RD
L90 18DB/RD
AUTOMATIC HEADLAMP MODULE (8W-50-9)
SPLICE S410 (8W-70-33)
C202
C118
L90 18DB RD
VEHICLE THEFT ALARM MODULE (8W-39-4)
S215
FUSE BLOCK
FUSE 24 7.5A
C235
(28)
L90 18DB/RD
RADIO (8W-47-3,5)
L90 18DB RD
C283
L90 18DB RD
HEADLAMP SWITCH (8W-50-4)
LAMP OUTAGE MODULE (OPTIONAL)
GRAPHIC DISPLAY MODULE OR VEHICLE INFO. CENTER (8W-46-4)
C316
C316
PARK LAMPS
(8)
(8)
L90 18DB/RD
LICENCE PLATE LAMPS (8W-51-6)
L90 18DB/RD
AFTERMARKET TRAILER TOW CONNECTOR (8W-54-3)
RIGHT TAIL/STOP LAMP
(9)
(9)
L22 18DB/RD
RIGHT TAIL/STOP LAMP (8W-51-3)
LEFT TAIL/STOP LAMP
(10)
(10)
L21 18DB/RD
LEFT TAIL/STOP LAMP (8W-51-3)
MATING CONNECTOR IF NOT EQUIPPED W/LAMP OUTAGE MODULE
J958W-3


OVERDRIVE SWITCH (8W-31-5,6)
F87 18WT/BK
INSTRUMENT CLUSTER (8W-40-4,5,6,7)
F87 18WT/BK
LAMP OUTAGE MODULE (8W-51-8)
F87 18WT BK
C233
F87 18WT BK
S216
VEHICLE THEFT ALARM MODULE (8W-39-3)
F87 18WT/BK
F87 18WT/BK
C235
(10)
FUSE 21 15A
FUSE BLOCK


HEADLAMP SWITCH (8W-44-13)
Z1 16BK
Z1 16BK
INSTRUMENT CLUSTER (8W-40-9) (8W-40-10) (8W-40-16)
Z1 20BK
Z1 20BK
SPLICE S209 (8W-70-15)
Z1 16BK
S217
STOP LAMP SWITCH (8W-30-18) (8W-30-30) (8W-33-3)
Z1 18BK
OVERDRIVE SWITCH (8W-31-5,6)
Z1 20BK
POWER MIRROR SWITCH (8W-62-2)
Z1 18BK
SPLICE S101 (8W-70-2)
Z1 16BK
C118
Z1 16BK
Z1 16BK
CHIME MODULE (8W-44-11)
Z1 18BK
I.P. DIMMING MODULE (W/O DRL)
I.P. DIMMING/DRL MODULE (W/DRL)
(8W-44-14)
(8W-50-11)

J958W-3



INTERMITTENT WIPER SWITCH (8W-53-3)
F86 16LG/RD
FUSE BLOCK
CIRCUIT BREAKER 22 10A
C235
S218
F86 16LG/RD
(3)
INTERMITTENT WIPER CONTROL MODULE (8W-53-3)
F86 16LG/RD
F86 16LG RD
VEHICLE THEFT ALARM MODULE (8W-39-3)
AUTOMATIC TEMPERATURE CONTROL MODULE (8W-42-12)
D41 20LG/WT
D41 20LG/WT
SOLAR SENSOR (8W-42-12)
SPLICE S222 (8W-70-20)
D41 20LG WT
C206
D41 20LG WT
S219 (W/ATC ONLY)
AMBIENT TEMPERATURE SENSOR (8W-42-12)
D41 20LG WT
C165
D41 20LG WT
D41 20LG/WT
IN-CAR TEMPERATURE SENSOR (8W-42-12)
I.P. DAYTIME RUNNING LAMP MODULE (8W-50-10)
L26 16OR/VT
S220
L26 14OR/VT
HEADLAMP SWITCH (8W-50-4)
AUTOMATIC HEADLAMP MODULE (8W-50-9)
L26 14OR/VT

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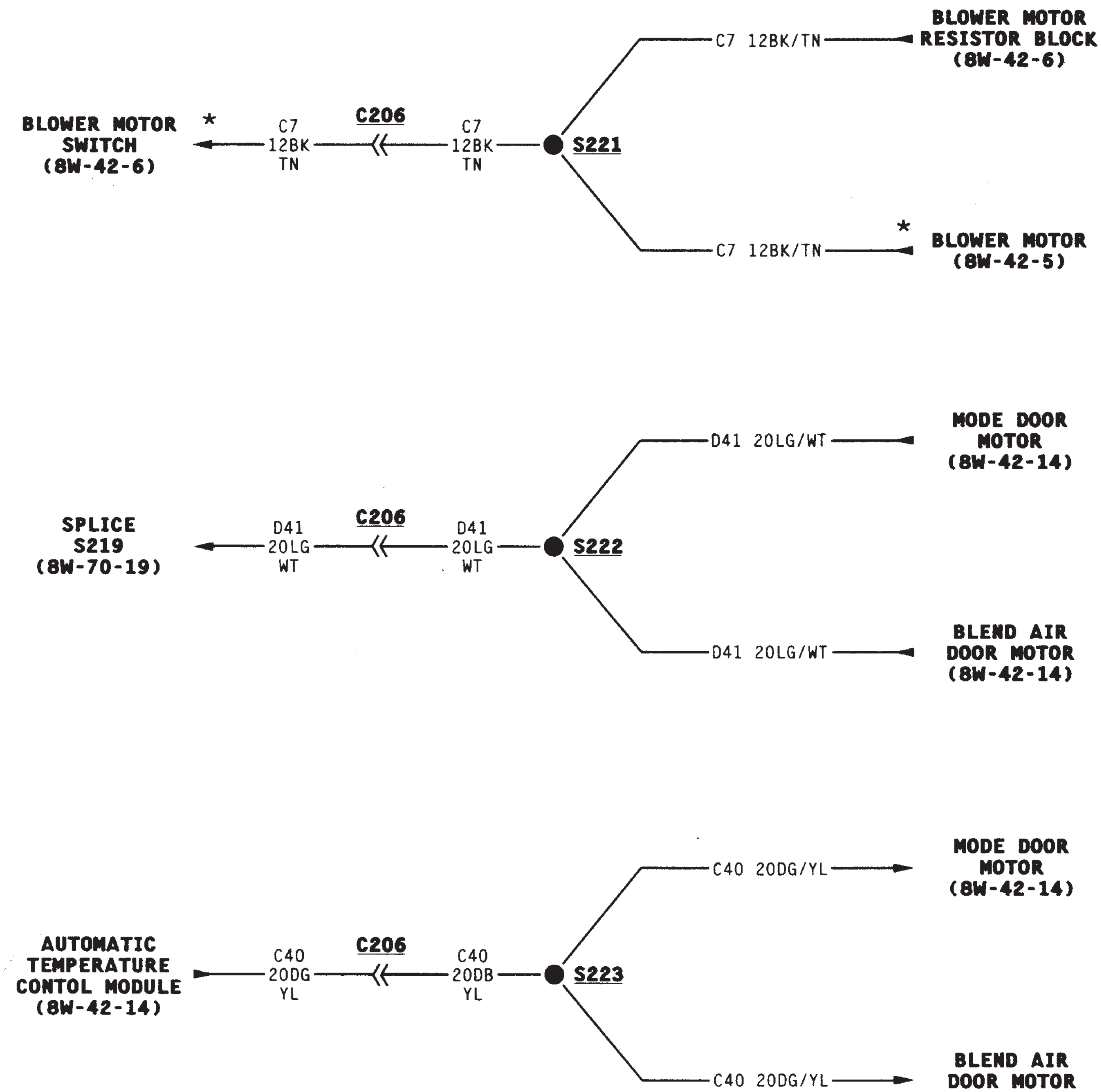
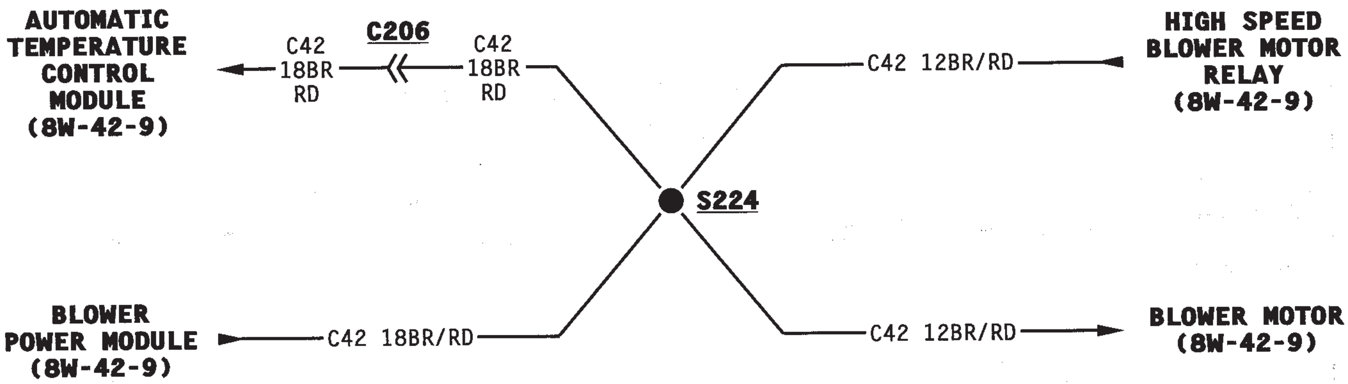
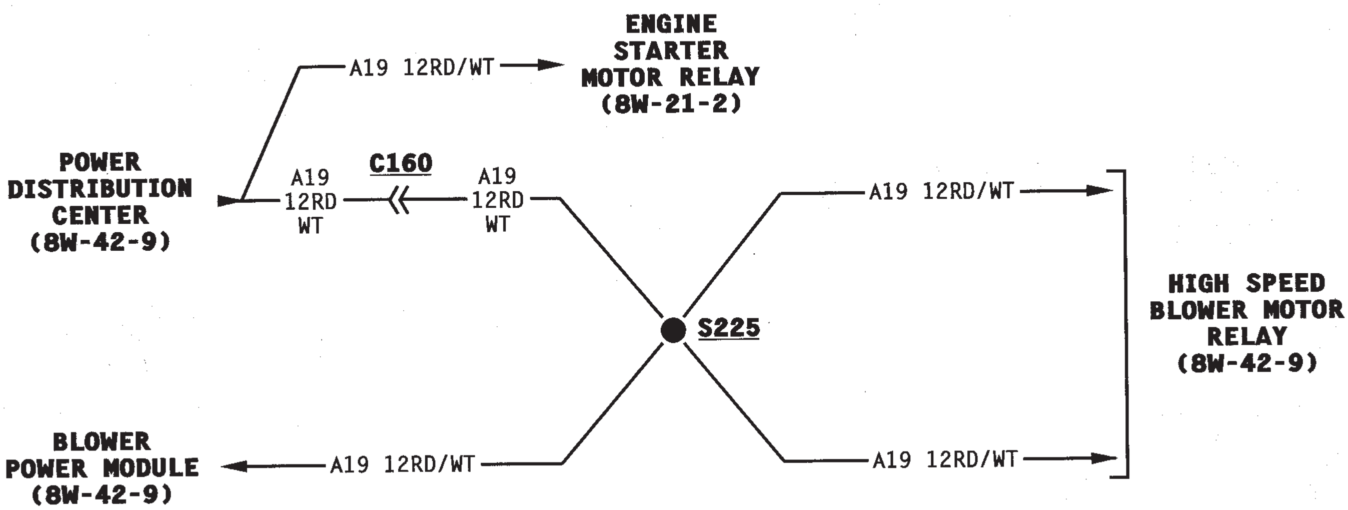
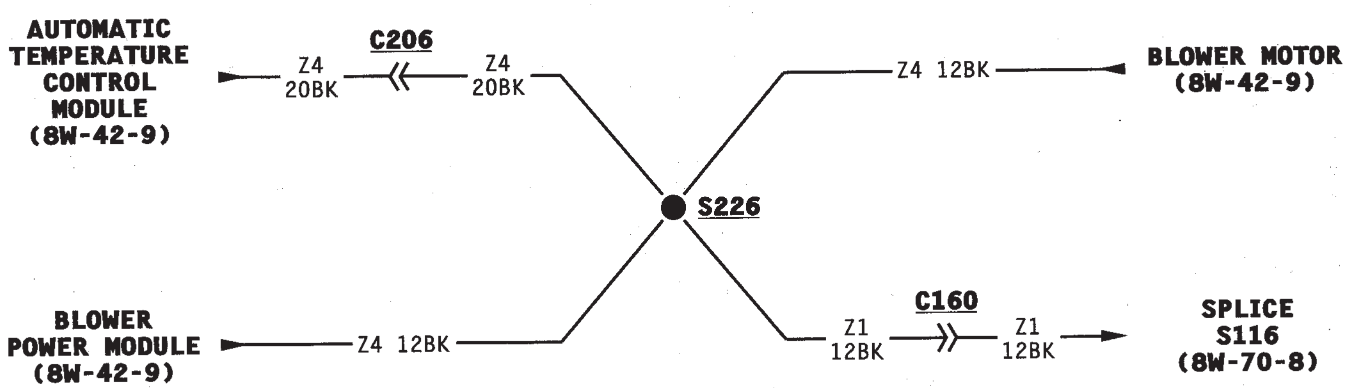
TSB 26-08-95 October, 1995



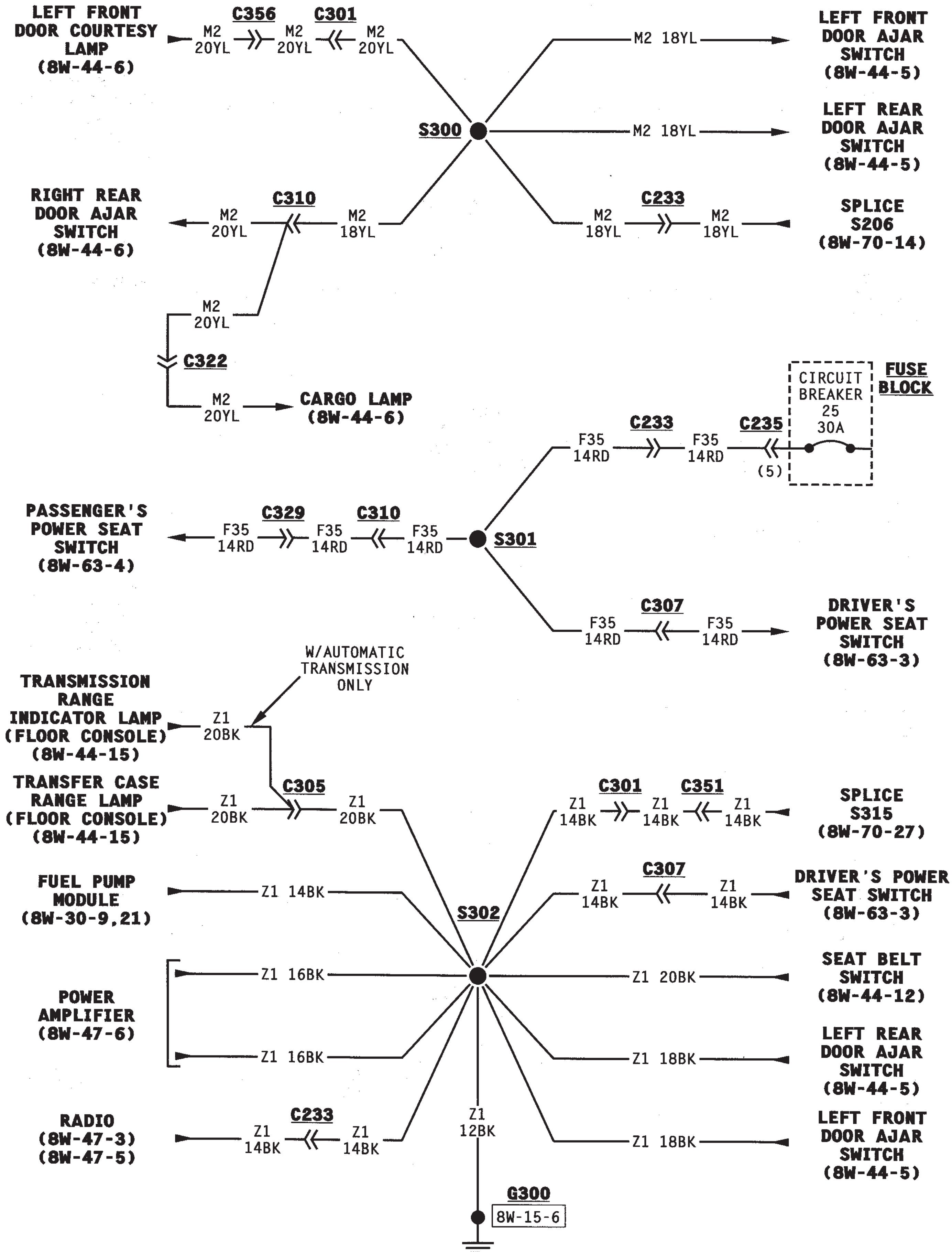
J958W-3


AUTOMATIC
TEMPERATURE
CONTROL
MODULE
(8W-42-9)
C42
18BR
RD
C206
C42
18BR
RD
C42 12BR/RD
HIGH SPEED
BLOWER MOTOR
RELAY
(8W-42-9)
S224
BLOWER
POWER MODULE
(8W-42-9)
C42 18BR/RD
C42 12BR/RD
BLOWER MOTOR
(8W-42-9)

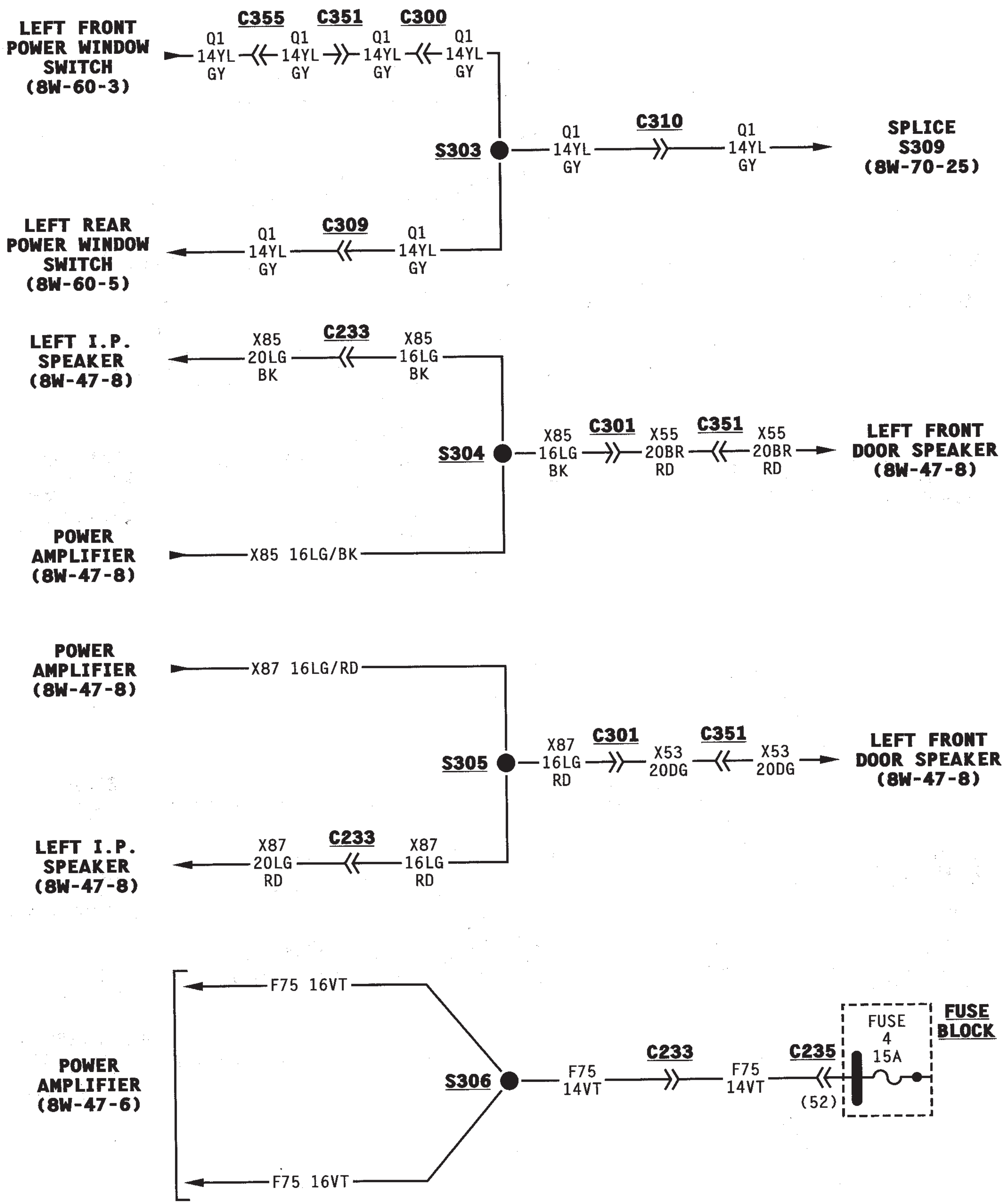

A19 12RD/WT
ENGINE
STARTER
MOTOR RELAY
(8W-21-2)
POWER
DISTRIBUTION
CENTER
(8W-42-9)
A19
12RD
WT
C160
A19
12RD
WT
A19 12RD/WT
S225
HIGH SPEED
BLOWER MOTOR
RELAY
(8W-42-9)
BLOWER
POWER MODULE
(8W-42-9)
A19 12RD/WT
A19 12RD/WT

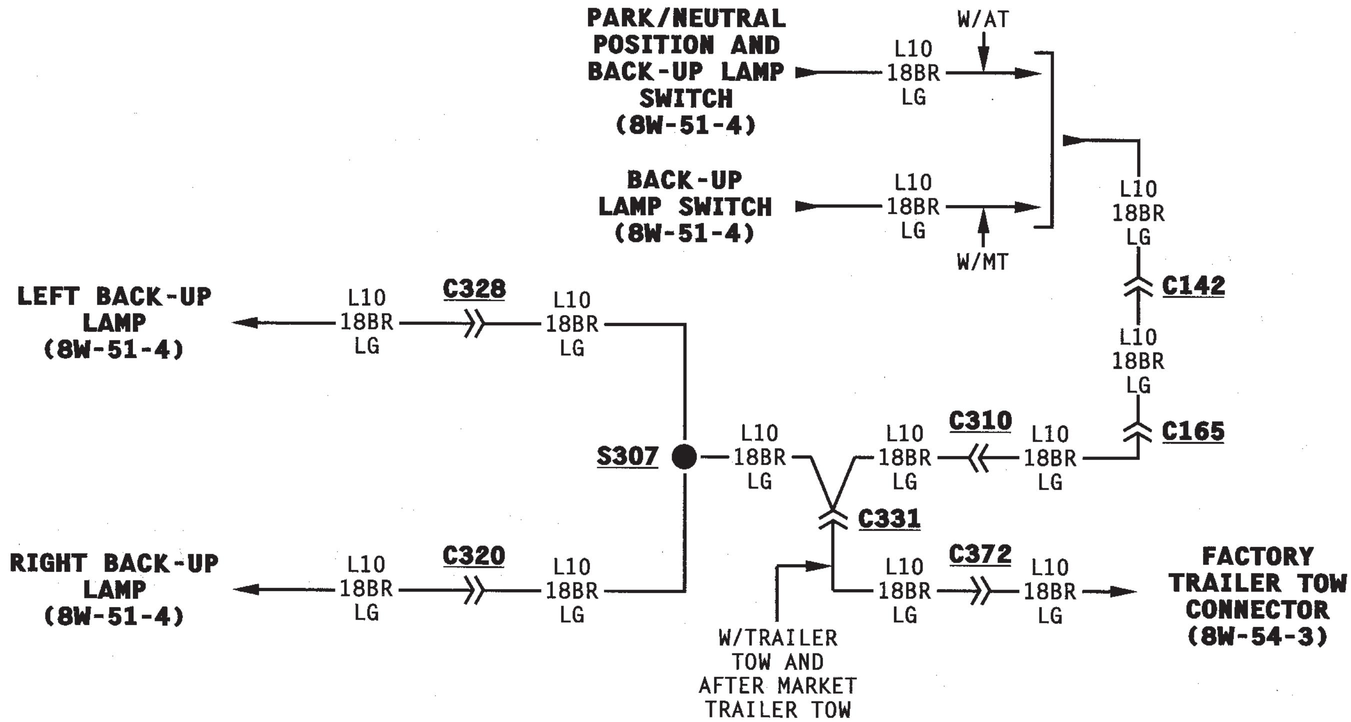

AUTOMATIC
TEMPERATURE
CONTROL
MODULE
(8W-42-9)
Z4
20BK
C206
Z4
20BK
Z4 12BK
BLOWER MOTOR
(8W-42-9)
S226
BLOWER
POWER MODULE
(8W-42-9)
Z4 12BK
Z1
12BK
C160
Z1
12BK
SPLICE
S116
(8W-70-8)

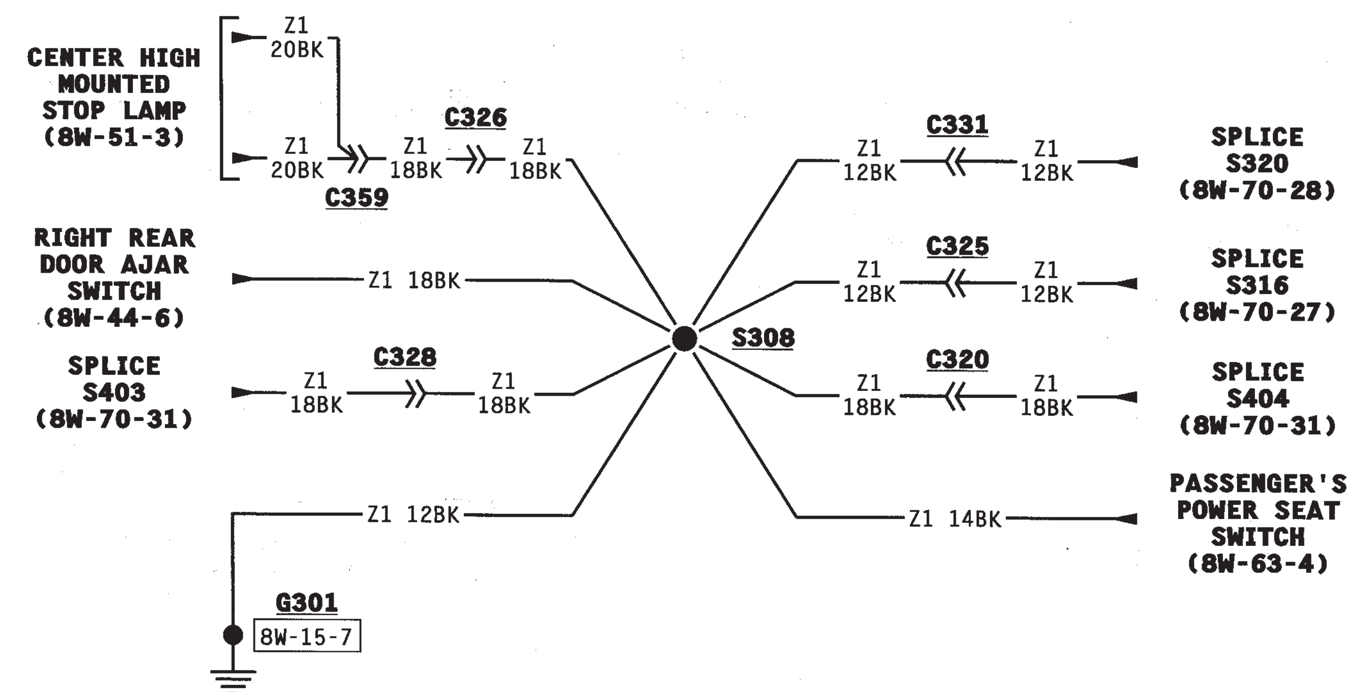
J958W-3


LEFT FRONT DOOR COURTESY LAMP (8W-44-6)
C356
C301
M2 20YL
M2 18YL
LEFT FRONT DOOR AJAR SWITCH (8W-44-5)
S300
LEFT REAR DOOR AJAR SWITCH (8W-44-5)
RIGHT REAR DOOR AJAR SWITCH (8W-44-6)
C310
C233
SPLICE S206 (8W-70-14)
C322
CARGO LAMP (8W-44-6)
CIRCUIT BREAKER 25 30A
FUSE BLOCK
C235
(5)
F35 14RD
PASSENGER'S POWER SEAT SWITCH (8W-63-4)
C329
S301
C307
DRIVER'S POWER SEAT SWITCH (8W-63-3)
W/AUTOMATIC TRANSMISSION ONLY
TRANSMISSION RANGE INDICATOR LAMP (FLOOR CONSOLE) (8W-44-15)
Z1 20BK
TRANSFER CASE RANGE LAMP (FLOOR CONSOLE) (8W-44-15)
C305
C351
Z1 14BK
SPLICE S315 (8W-70-27)
FUEL PUMP MODULE (8W-30-9,21)
S302
DRIVER'S POWER SEAT SWITCH (8W-63-3)
Z1 16BK
POWER AMPLIFIER (8W-47-6)
SEAT BELT SWITCH (8W-44-12)
Z1 18BK
LEFT REAR DOOR AJAR SWITCH (8W-44-5)
RADIO (8W-47-3) (8W-47-5)
Z1 12BK
LEFT FRONT DOOR AJAR SWITCH (8W-44-5)
G300
8W-15-6

J958W-3


LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
C355
C351
C300
Q1 14YL GY
S303
Q1 14YL GY
C310
Q1 14YL GY
SPLICE S309 (8W-70-25)
LEFT REAR POWER WINDOW SWITCH (8W-60-5)
C309
LEFT I.P. SPEAKER (8W-47-8)
X85 20LG BK
C233
X85 16LG BK
S304
X85 16LG BK
C301
X55 20BR RD
C351
LEFT FRONT DOOR SPEAKER (8W-47-8)
POWER AMPLIFIER (8W-47-8)
X85 16LG/BK
X87 16LG/RD
S305
X87 16LG RD
X53 20DG
X87 20LG RD
POWER AMPLIFIER (8W-47-6)
F75 16VT
S306
F75 14VT
C235
(52)
FUSE 4 15A
FUSE BLOCK


PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH (8W-51-4)
W/AT
L10 18BR LG
BACK-UP LAMP SWITCH (8W-51-4)
L10 18BR LG
W/MT
L10 18BR LG
C142
L10 18BR LG
C165
LEFT BACK-UP LAMP (8W-51-4)
L10 18BR LG
C328
L10 18BR LG
S307
L10 18BR LG
L10 18BR LG
C310
L10 18BR LG
C331
RIGHT BACK-UP LAMP (8W-51-4)
L10 18BR LG
C320
L10 18BR LG
L10 18BR LG
C372
L10 18BR LG
FACTORY TRAILER TOW CONNECTOR (8W-54-3)
W/TRAILER TOW AND AFTER MARKET TRAILER TOW


CENTER HIGH MOUNTED STOP LAMP (8W-51-3)
Z1 20BK
Z1 20BK
C359
Z1 18BK
C326
Z1 18BK
RIGHT REAR DOOR AJAR SWITCH (8W-44-6)
Z1 18BK
SPLICE S403 (8W-70-31)
Z1 18BK
C328
Z1 18BK
Z1 12BK
G301
8W-15-7
S308
Z1 12BK
C331
Z1 12BK
SPLICE S320 (8W-70-28)
Z1 12BK
C325
Z1 12BK
SPLICE S316 (8W-70-27)
Z1 18BK
C320
Z1 18BK
SPLICE S404 (8W-70-31)
Z1 14BK
PASSENGER'S POWER SEAT SWITCH (8W-63-4)

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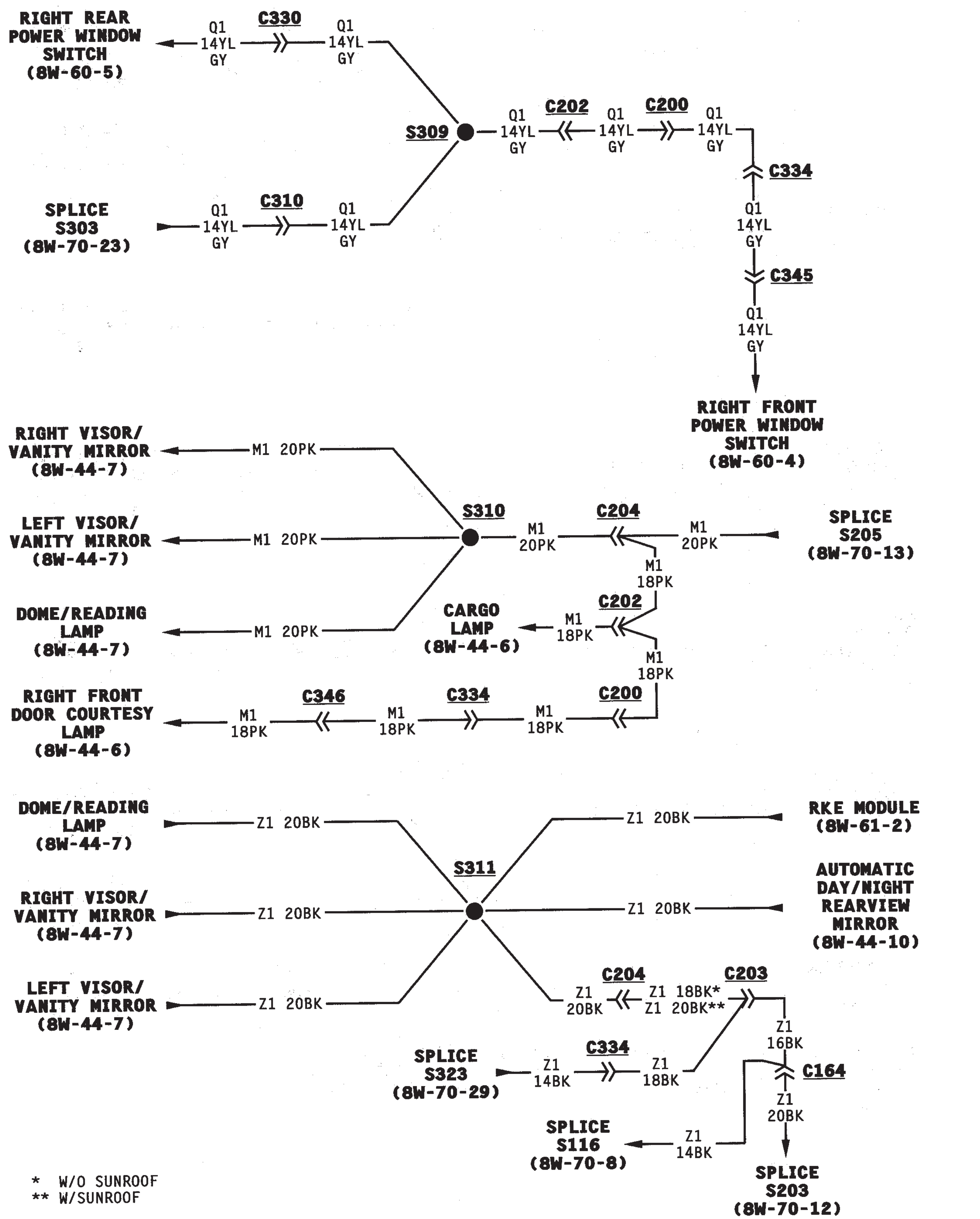

* W/O SUNROOF
** W/SUNROOF

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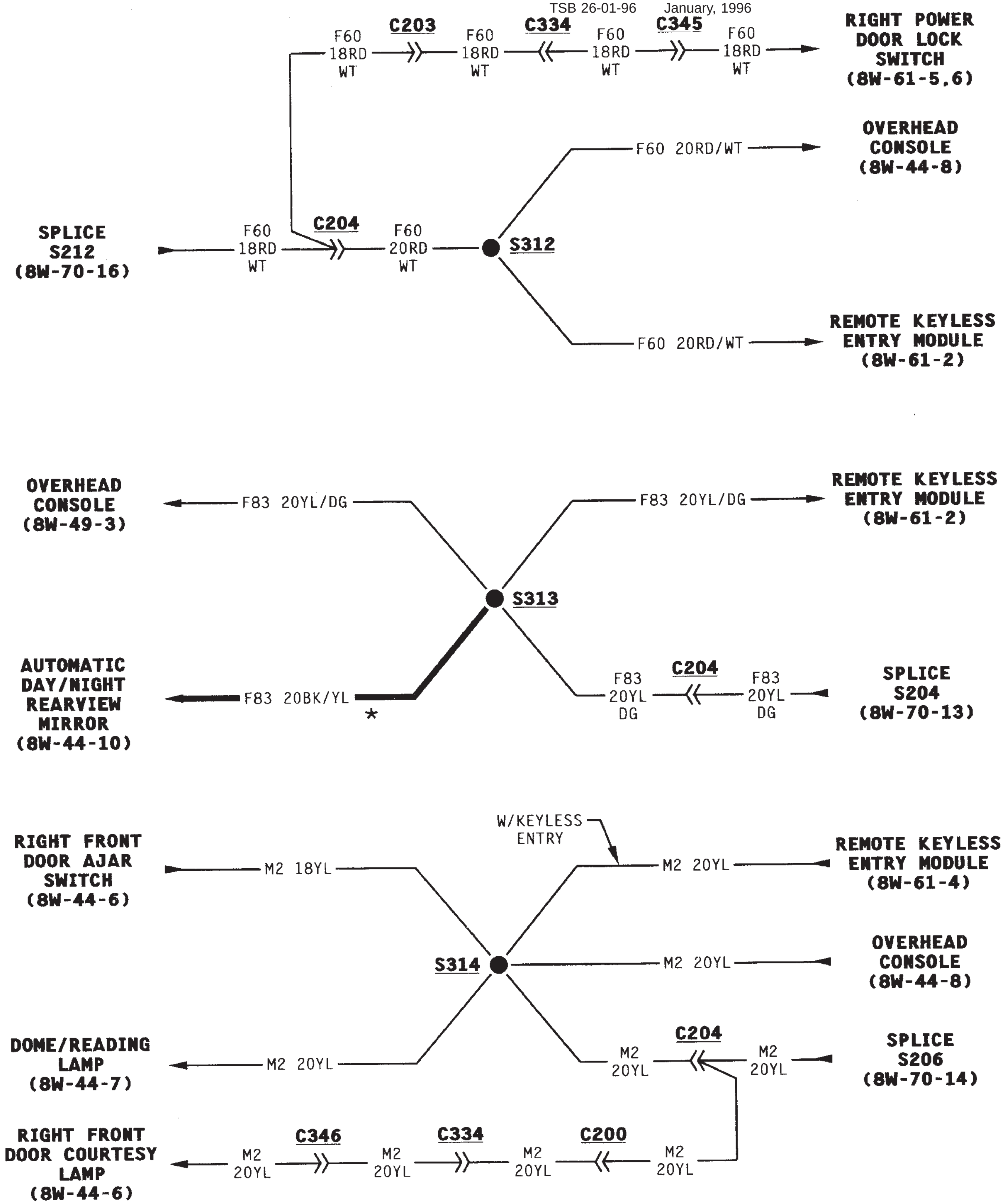
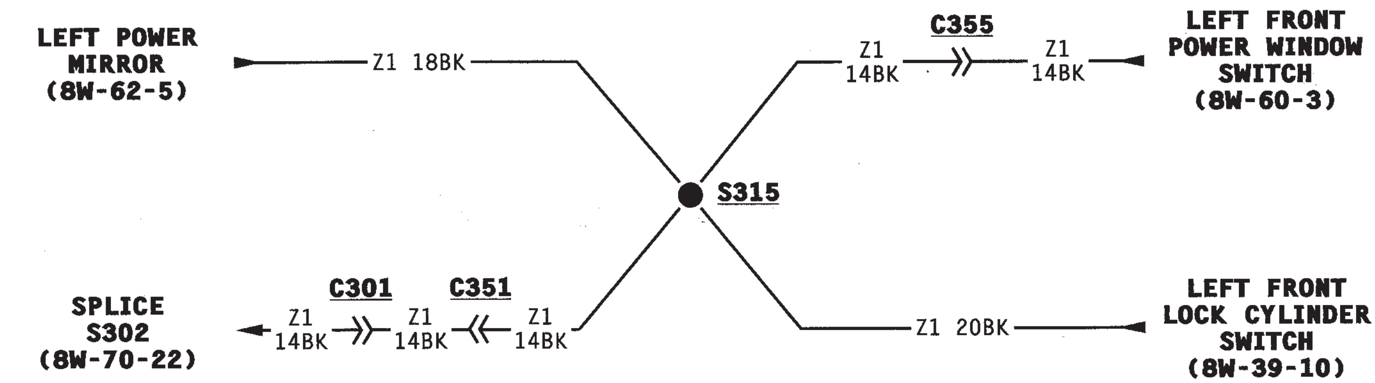
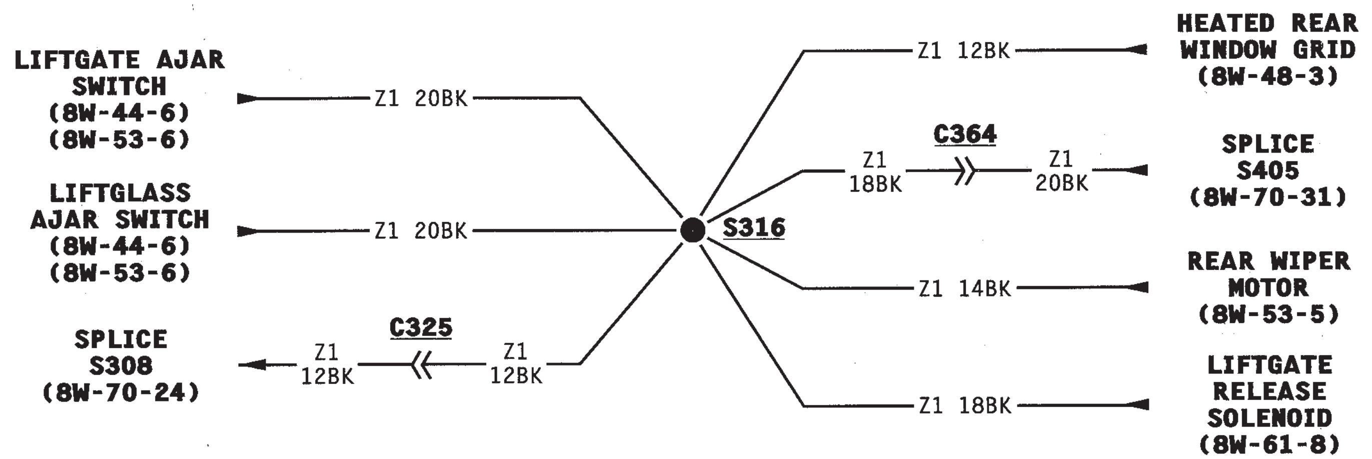
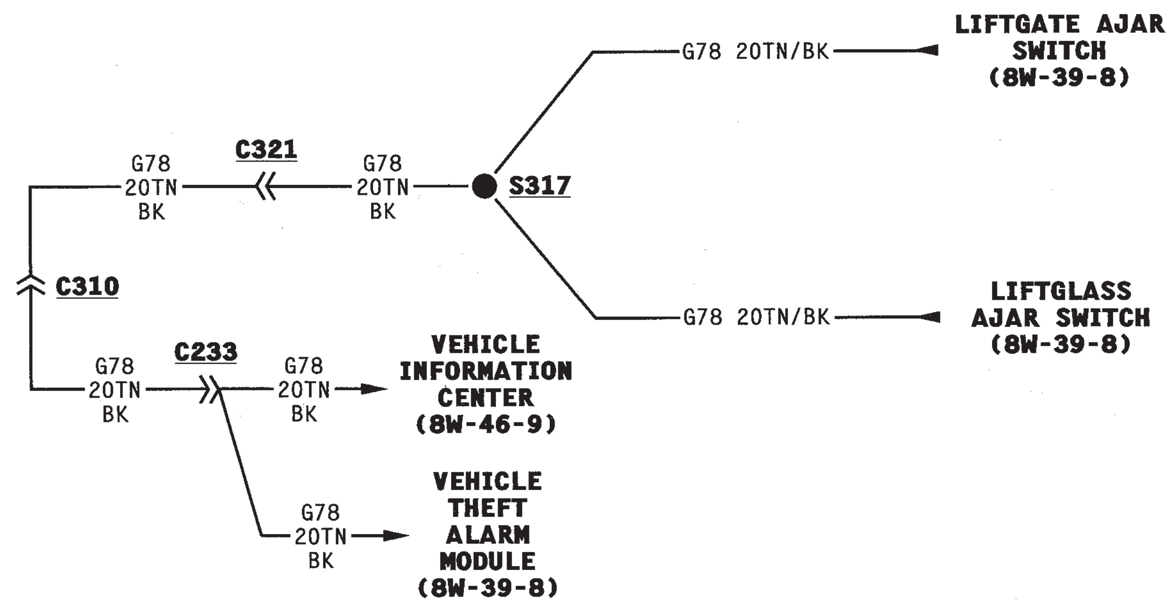
TSB 26-01-96 January, 1996



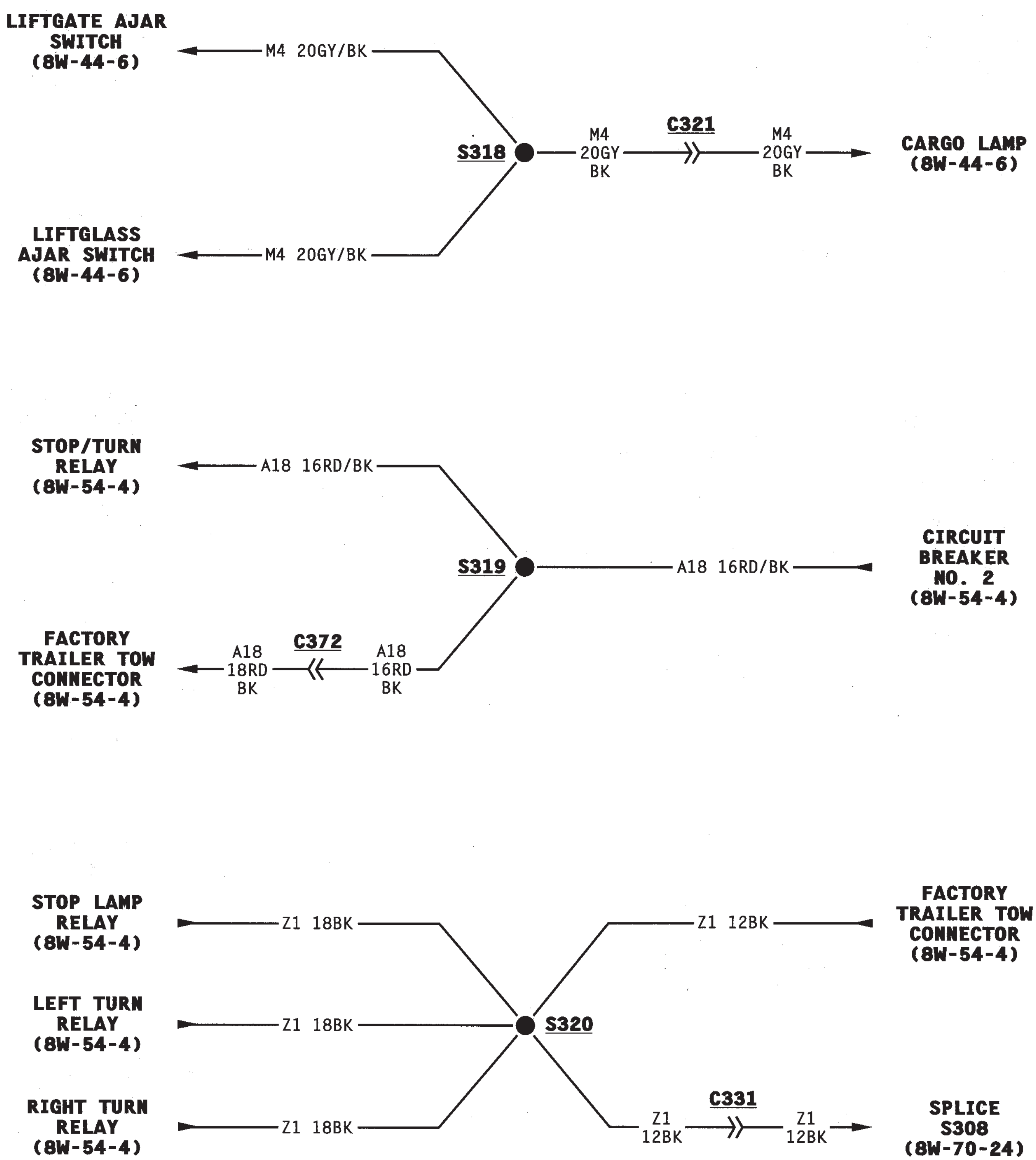
J958W-3


LEFT POWER MIRROR (8W-62-5)
Z1 18BK
C355
Z1 14BK
Z1 14BK
LEFT FRONT POWER WINDOW SWITCH (8W-60-3)
S315
C301
C351
SPLICE S302 (8W-70-22)
Z1 14BK
Z1 14BK
Z1 14BK
Z1 20BK
LEFT FRONT LOCK CYLINDER SWITCH (8W-39-10)

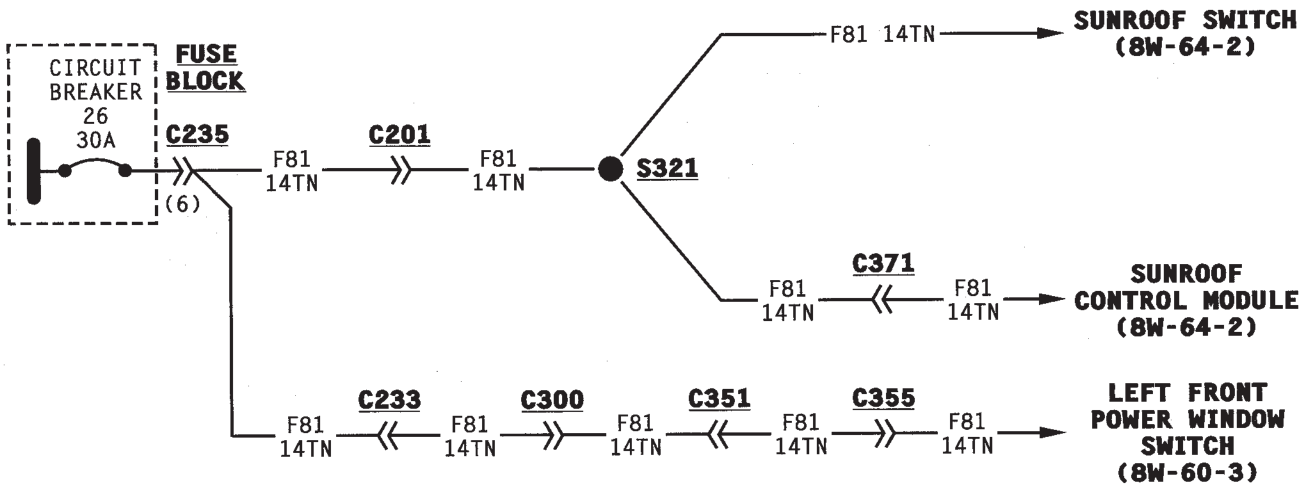

HEATED REAR WINDOW GRID (8W-48-3)
Z1 12BK
LIFTGATE AJAR SWITCH (8W-44-6) (8W-53-6)
Z1 20BK
C364
Z1 18BK
Z1 20BK
SPLICE S405 (8W-70-31)
LIFTGLASS AJAR SWITCH (8W-44-6) (8W-53-6)
Z1 20BK
S316
REAR WIPER MOTOR (8W-53-5)
Z1 14BK
C325
SPLICE S308 (8W-70-24)
Z1 12BK
Z1 12BK
LIFTGATE RELEASE SOLENOID (8W-61-8)
Z1 18BK


LIFTGATE AJAR SWITCH (8W-39-8)
G78 20TN/BK
C321
G78 20TN BK
G78 20TN BK
S317
C310
G78 20TN/BK
LIFTGLASS AJAR SWITCH (8W-39-8)
G78 20TN BK
C233
G78 20TN BK
VEHICLE INFORMATION CENTER (8W-46-9)
G78 20TN BK
VEHICLE THEFT ALARM MODULE (8W-39-8)

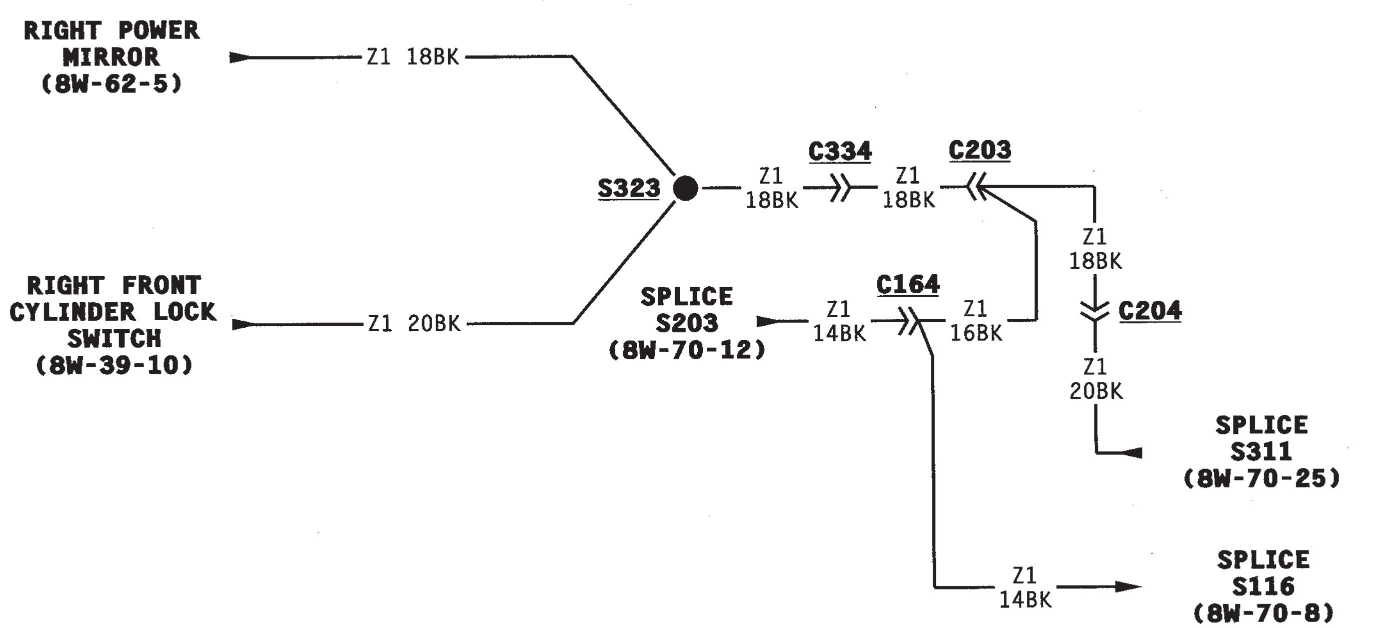
J958W-3


LIFTGATE AJAR SWITCH (8W-44-6)
M4 20GY/BK
S318
M4 20GY BK
C321
M4 20GY BK
CARGO LAMP (8W-44-6)
LIFTGLASS AJAR SWITCH (8W-44-6)
M4 20GY/BK
STOP/TURN RELAY (8W-54-4)
A18 16RD/BK
S319
A18 16RD/BK
CIRCUIT BREAKER NO. 2 (8W-54-4)
FACTORY TRAILER TOW CONNECTOR (8W-54-4)
A18 18RD BK
C372
A18 16RD BK
STOP LAMP RELAY (8W-54-4)
Z1 18BK
LEFT TURN RELAY (8W-54-4)
Z1 18BK
RIGHT TURN RELAY (8W-54-4)
Z1 18BK
S320
Z1 12BK
FACTORY TRAILER TOW CONNECTOR (8W-54-4)
Z1 12BK
C331
Z1 12BK
SPLICE S308 (8W-70-24)

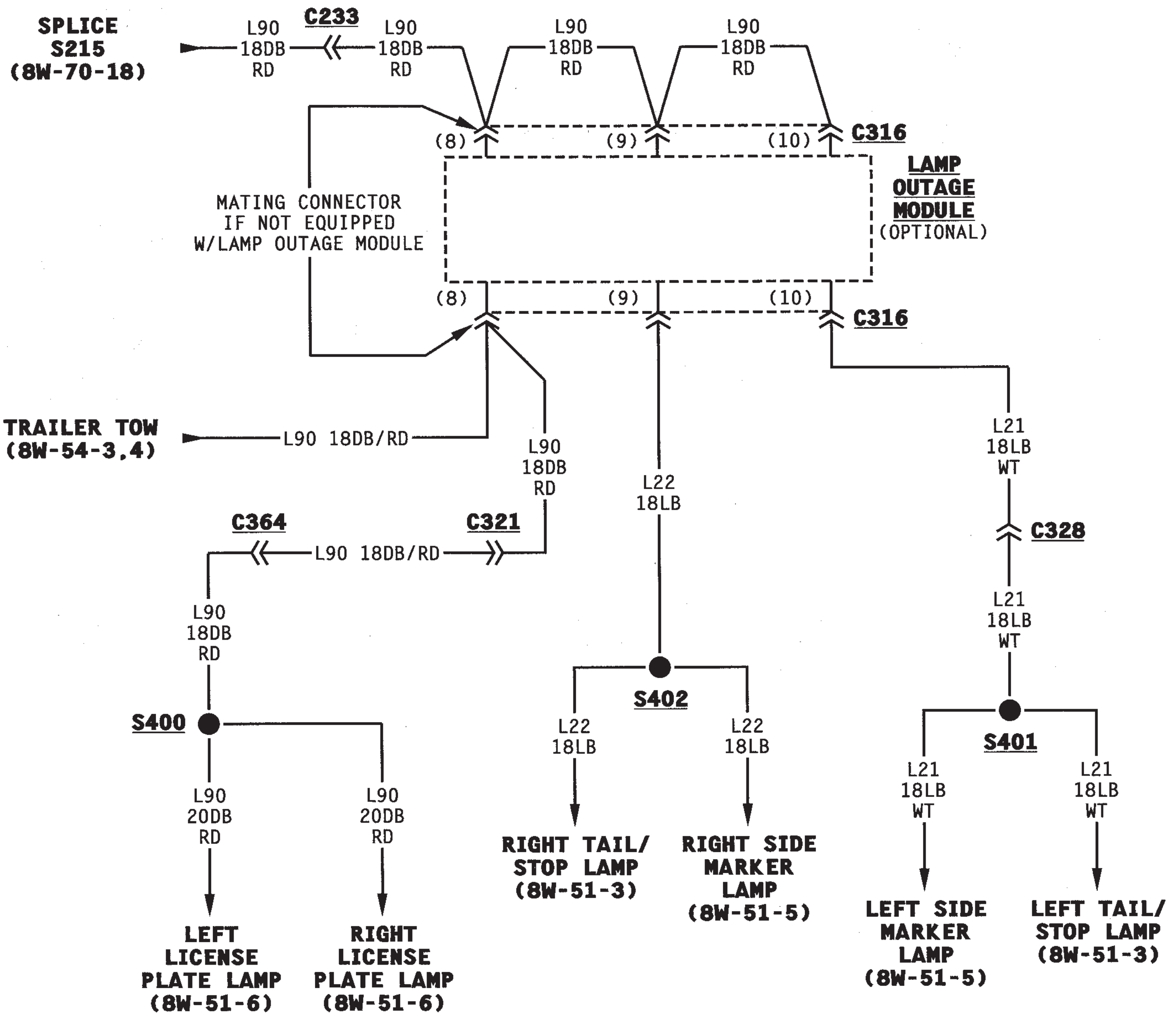
J958W-3


CIRCUIT
BREAKER
26
30A
FUSE
BLOCK
C235
(6)
F81
14TN
C201
F81
14TN
S321
F81 14TN
SUNROOF SWITCH
(8W-64-2)
F81
14TN
C371
F81
14TN
SUNROOF
CONTROL MODULE
(8W-64-2)
F81
14TN
C233
F81
14TN
C300
F81
14TN
C351
F81
14TN
C355
F81
14TN
LEFT FRONT
POWER WINDOW
SWITCH
(8W-60-3)


SPLICE
S200
(8W-70-11)
C15
12BK
LB
C202
C15
12BK
LB
C322
C15
12BK
LB
S322
C15 12BK
HEATED REAR
WINDOW GRID
(8W-48-3)


RIGHT POWER
MIRROR
(8W-62-5)
Z1 18BK
RIGHT FRONT
CYLINDER LOCK
SWITCH
(8W-39-10)
Z1 20BK
S323
Z1
18BK
C334
Z1
18BK
C203
Z1
18BK
C204
Z1
20BK
SPLICE
S311
(8W-70-25)
SPLICE
S203
(8W-70-12)
Z1
14BK
C164
Z1
16BK
Z1
14BK
SPLICE
S116
(8W-70-8)

J958W-3


SPLICE S215 (8W-70-18)
L90 18DB RD
C233
L90 18DB RD
L90 18DB RD
L90 18DB RD
(8)
(9)
(10)
C316
MATING CONNECTOR IF NOT EQUIPPED W/LAMP OUTAGE MODULE
LAMP OUTAGE MODULE (OPTIONAL)
(8)
(9)
(10)
C316
TRAILER TOW (8W-54-3,4)
L90 18DB/RD
L90 18DB RD
L22 18LB
L21 18LB WT
C364
C321
L90 18DB/RD
C328
L90 18DB RD
L21 18LB WT
S400
S402
S401
L22 18LB
L22 18LB
L21 18LB WT
L21 18LB WT
L90 20DB RD
L90 20DB RD
RIGHT TAIL/ STOP LAMP (8W-51-3)
RIGHT SIDE MARKER LAMP (8W-51-5)
LEFT SIDE MARKER LAMP (8W-51-5)
LEFT TAIL/ STOP LAMP (8W-51-3)
LEFT LICENSE PLATE LAMP (8W-51-6)
RIGHT LICENSE PLATE LAMP (8W-51-6)

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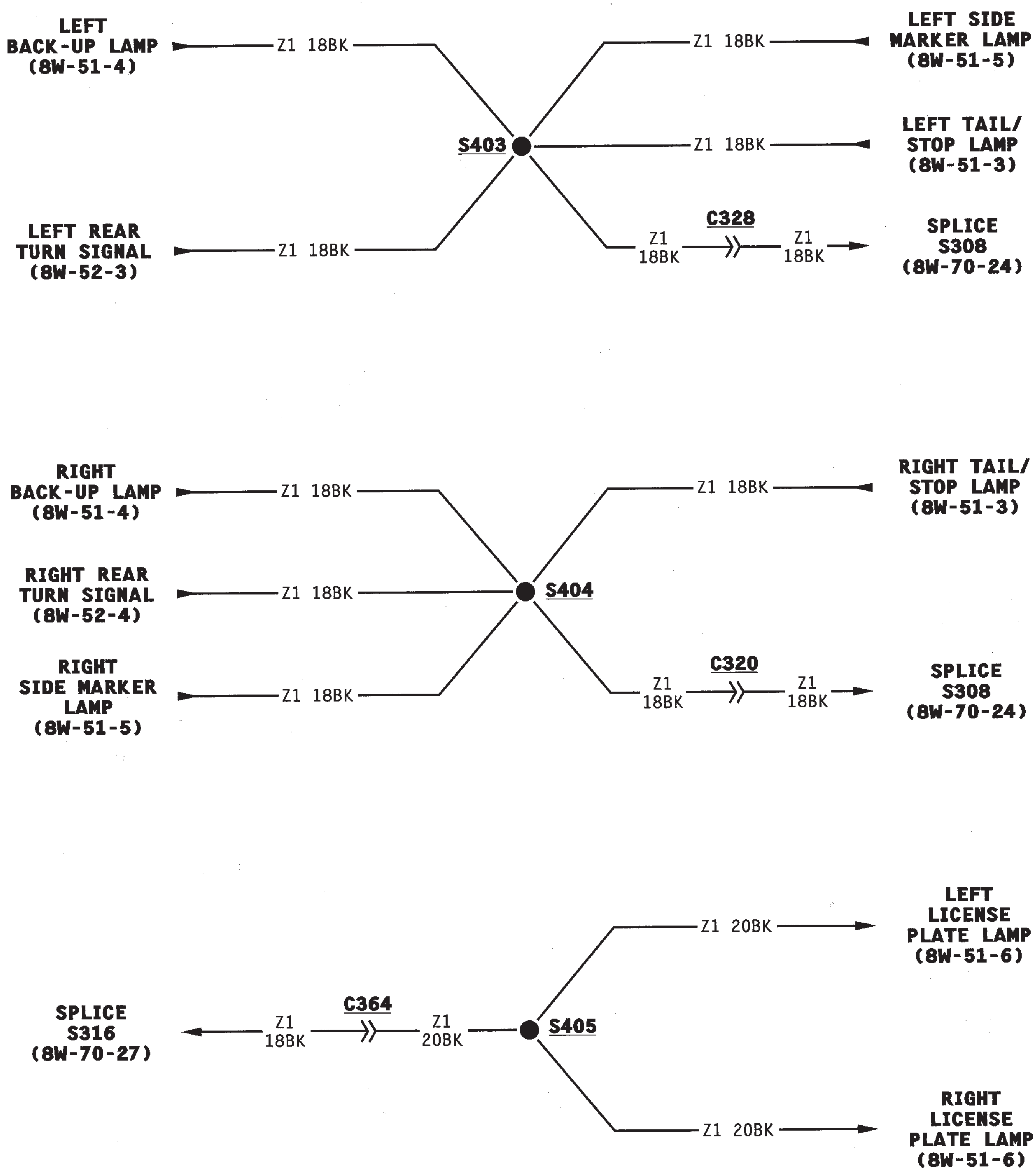
LEFT BACK-UP LAMP (8W-51-4)
Z1 18BK
LEFT SIDE MARKER LAMP (8W-51-5)
Z1 18BK
S403
LEFT TAIL/ STOP LAMP (8W-51-3)
Z1 18BK
LEFT REAR TURN SIGNAL (8W-52-3)
Z1 18BK
C328
Z1 18BK
Z1 18BK
SPLICE S308 (8W-70-24)
RIGHT BACK-UP LAMP (8W-51-4)
Z1 18BK
RIGHT TAIL/ STOP LAMP (8W-51-3)
Z1 18BK
RIGHT REAR TURN SIGNAL (8W-52-4)
Z1 18BK
S404
RIGHT SIDE MARKER LAMP (8W-51-5)
Z1 18BK
C320
Z1 18BK
Z1 18BK
SPLICE S308 (8W-70-24)
LEFT LICENSE PLATE LAMP (8W-51-6)
Z1 20BK
SPLICE S316 (8W-70-27)
C364
Z1 18BK
Z1 20BK
S405
RIGHT LICENSE PLATE LAMP (8W-51-6)
Z1 20BK

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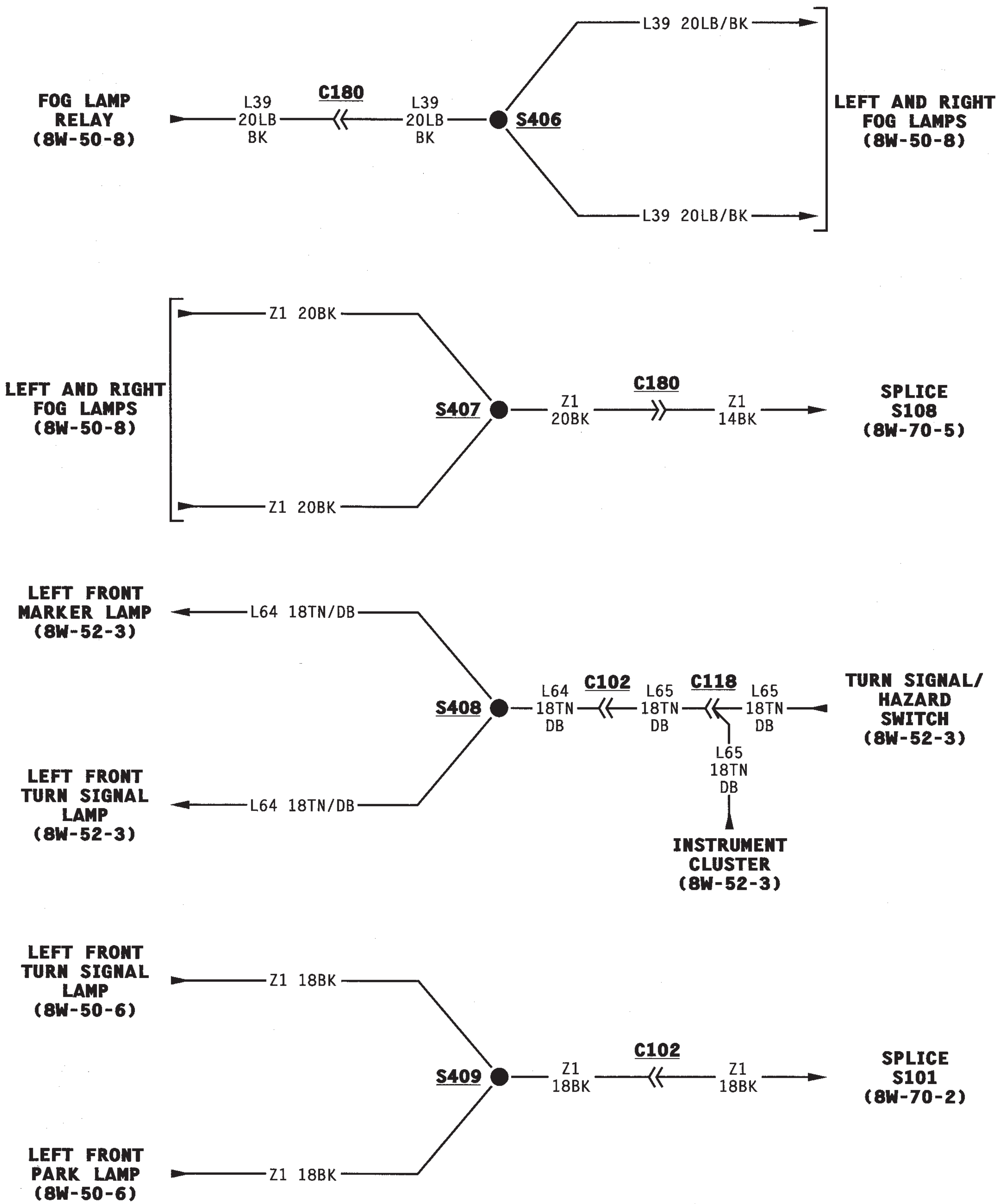
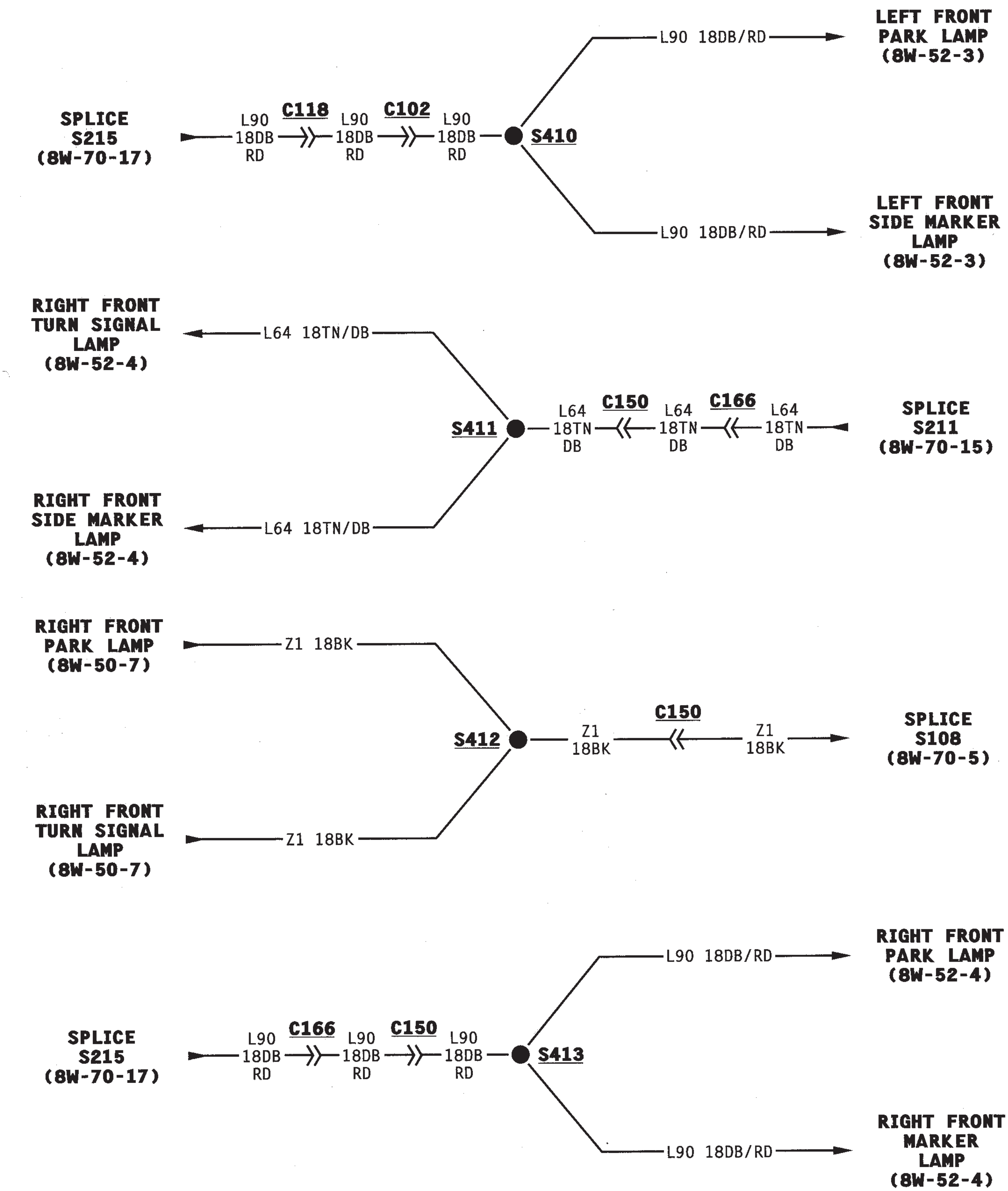

FOG LAMP RELAY (8W-50-8)
L39 20LB BK
C180
L39 20LB BK
S406
L39 20LB/BK
L39 20LB/BK
LEFT AND RIGHT FOG LAMPS (8W-50-8)
LEFT AND RIGHT FOG LAMPS (8W-50-8)
Z1 20BK
Z1 20BK
S407
Z1 20BK
C180
Z1 14BK
SPLICE S108 (8W-70-5)
LEFT FRONT MARKER LAMP (8W-52-3)
L64 18TN/DB
LEFT FRONT TURN SIGNAL LAMP (8W-52-3)
L64 18TN/DB
S408
L64 18TN DB
C102
L65 18TN DB
C118
L65 18TN DB
TURN SIGNAL/ HAZARD SWITCH (8W-52-3)
L65 18TN DB
INSTRUMENT CLUSTER (8W-52-3)
LEFT FRONT TURN SIGNAL LAMP (8W-50-6)
Z1 18BK
LEFT FRONT PARK LAMP (8W-50-6)
Z1 18BK
S409
Z1 18BK
C102
Z1 18BK
SPLICE S101 (8W-70-2)

J958W-3


LEFT FRONT PARK LAMP (8W-52-3)
L90 18DB/RD
SPLICE S215 (8W-70-17)
L90 18DB RD
C118
L90 18DB RD
C102
L90 18DB RD
S410
L90 18DB/RD
LEFT FRONT SIDE MARKER LAMP (8W-52-3)
RIGHT FRONT TURN SIGNAL LAMP (8W-52-4)
L64 18TN/DB
S411
L64 18TN DB
C150
L64 18TN DB
C166
L64 18TN DB
SPLICE S211 (8W-70-15)
RIGHT FRONT SIDE MARKER LAMP (8W-52-4)
L64 18TN/DB
RIGHT FRONT PARK LAMP (8W-50-7)
Z1 18BK
S412
Z1 18BK
C150
Z1 18BK
SPLICE S108 (8W-70-5)
RIGHT FRONT TURN SIGNAL LAMP (8W-50-7)
Z1 18BK
RIGHT FRONT PARK LAMP (8W-52-4)
L90 18DB/RD
SPLICE S215 (8W-70-17)
L90 18DB RD
C166
L90 18DB RD
C150
L90 18DB RD
S413
L90 18DB/RD
RIGHT FRONT MARKER LAMP (8W-52-4)

J958W-3

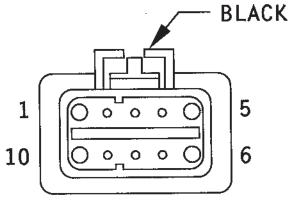
CONNECTOR PIN OUTS

GENERAL INFORMATION

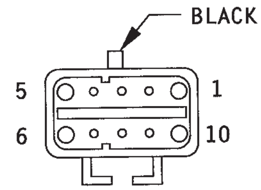
The pages referenced in this section show the connector, the circuits in the connector, and the pin that circuit occupies. Individual connector numbers are referenced on diagram pages throughout Group 8W.

CONNECTOR LOCATIONS

C100

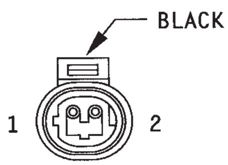


CAV	CIRCUIT
1	–
2	B116 20GY
3	B6 20WT/DB
4	B7 20WT
5	B120 12BR/WT
6	235 16 GY/YL
7	207 18PK/DB
8	D1 20VT/BR
9	D2 20WT/GY
10	236 20LG/YL

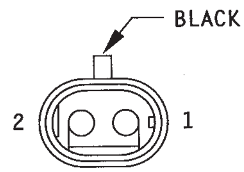


CAV	CIRCUIT
1	–
2	B116 20GY
3	B6 20WT/DB
4	B7 20WT
5	B120 12BR/WT
6	235 16GY/YL
7	207 18PK
8	D1 20VT/BR
9	D2 20WT/GY
10	236 20LG/YL

C101

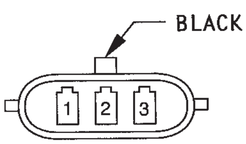


CAV	CIRCUIT
1	F86 18LB/RD
2	K52 18PK/BK

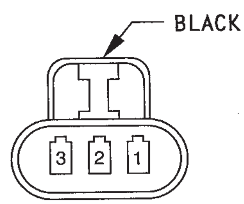


CAV	CIRCUIT
1	A21 18DB
2	K52 18PK/BK

C102

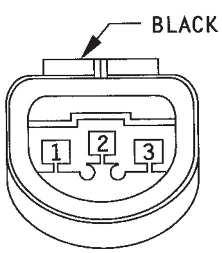


CAV	CIRCUIT
1	L65 18LG/DB
2	L90 18DB/RD
3	Z1 18PK/BK



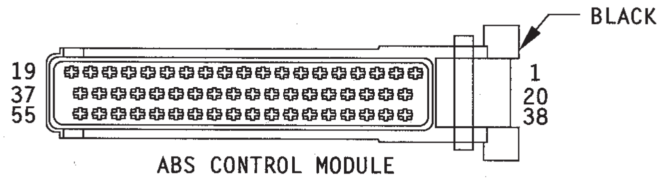
CAV	CIRCUIT
1	L65 18LG/DB
2	L90 18DB/RD
3	Z1 18PK/BK

C103



LEFT HEADLAMP

CAV	CIRCUIT	FUNCTION
1	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
2	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT
3	Z1 16BK	GROUND

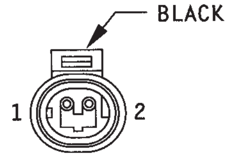


ABS CONTROL MODULE

C104

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	B243 18DG/BK	ABS LEFT FRONT DUMP VALVE CONTROL
3	235 16GY/YL	ABS SYSTEM RELAY OUTPUT
4	–	–
5	–	–
6	–	–
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–
15	B116 20GY	PUMP MOTOR RELAY CONTROL
16	B210 20RD/BK	PEDAL TRAVEL SENSOR GROUND
17	–	–
18	–	–
19	Z1 16BK	GROUND
20	B245 18WT/LG	LEFT FRONT ISOLATION VALVE CONTROL
21	B248 18DG/WT	RIGHT FRONT DUMP VALVE CONTROL
22	–	–
23	D1 20VT/BR	CCD BUS (+)
24	–	–
25	B41 20YL/VT	ACCELERATION SWITCH #1 SENSE
26	B43 20PK/OR	ACCELERATION SWITCH SENSOR GROUND
27	B2 20YL	RIGHT REAR WHEEL SPEED SENSOR (+)
28	B3 20LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
29	B6 20WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
30	B8 20RD	LEFT FRONT WHEEL SPEED SENSOR (+)
31	B219 20DB	PUMP/MOTOR SPEED SENSOR (-)
32	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
33	235 16GY/YL	ABS SYSTEM RELAY OUTPUT
34	207 18PK	ABS SYSTEM RELAY CONTROL
35	–	–
36	B254 18DG/OR	REAR DUMP VALVE CONTROL
37	–	–
38	B249 18WT/OR	RIGHT FRONT ISOLATION VALVE CONTROL
39	–	–
40	–	–
41	B210 20RD/BK	PEDAL TRAVEL SENSOR GROUND
42	D2 20WT/GY	CCD BUS (-)
43	B42 20TN/WT	ACCELERATION SWITCH #2 SENSE
44	–	–
45	B1 20YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
46	B4 20LG	LEFT REAR WHEEL SPEED SENSOR (+)
47	B7 20WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
48	B9 20RD	LEFT FRONT WHEEL SPEED SENSOR (-)
49	B220 20TN	PUMP/MOTOR SPEED SENSOR (+)
50	–	–
51	–	–
52	205 18VT/WT	ABS WARNING LAMP DRIVER
53	236 20LG/YL	FUSED IGNITION SWITCH OUTPUT
54	B251 18WT/RD	REAR ISOLATION VALVE CONTROL
55	–	–

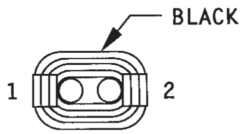
J958W-3



EVAP/PURGE SOLENOID
(4.0L ENGINE ONLY)

C105

CAV	CIRCUIT	FUNCTION
1	A21 18DB	IGNITION SWITCH OUTPUT (RUN/START)
2	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL

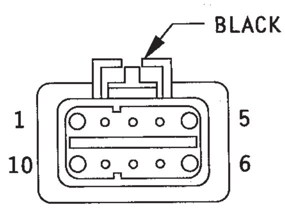


BRAKE WARNING
SWITCH

C106

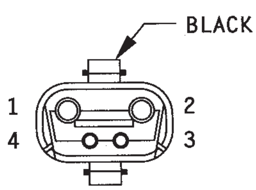
CAV	CIRCUIT	FUNCTION
1	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
2	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER

C107



HYDRAULIC
CONTROL UNIT

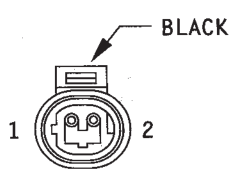
CAV	CIRCUIT	FUNCTION
1	–	–
2	B245 18WT/LG	LEFT FRONT INLET VALVE CONTROL
3	B249 18WT/OR	RIGHT FRONT ISOLATION VALVE CONTROL
4	B251 18WT/RD	REAR INLET VALVE CONTROL
5	235 16GY/YL	ABS SYSTEM RELAY OUTPUT
6	–	–
7	B254 18DG/OR	REAR DUMP VALVE CONTROL
8	B248 18DG/WT	RIGHT FRONT DUMP VALVE CONTROL
9	B243 18DG/BK	LEFT FRONT DUMP VALVE CONTROL
10	235 16GY/YL	ABS SYSTEM RELAY OUTPUT



ABS PUMP MOTOR

C108

CAV	CIRCUIT	FUNCTION
1	B120 12BR/WT	ABS SYSTEM RELAY OUTPUT
2	Z1 12BK	GROUND
3	B220 20TN	PUMP/MOTOR SPEED SENSOR (+)
4	B219 20DB	PUMP/MOTOR SPEED SENSOR (-)

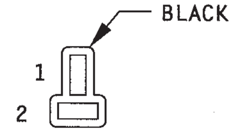


LEFT FRONT
WHEEL SPEED SENSOR

C109

CAV	CIRCUIT	FUNCTION
1	B9 20RD	LEFT FRONT WHEEL SPEED SENSOR (+)
2	B8 20RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)

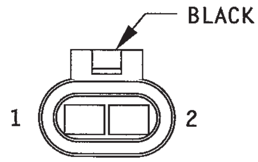
J958W-3



REAR WASHER
PUMP MOTOR

C110

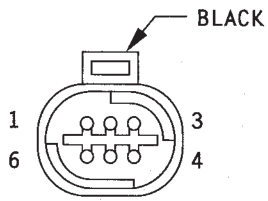
CAV	CIRCUIT	FUNCTION
1	V20 20BK/OR	REAR WASHER SWITCH OUTPUT
2	Z1 20BK	GROUND



WINDSHIELD WASHER
PUMP MOTOR

C111

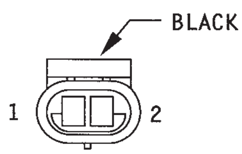
CAV	CIRCUIT	FUNCTION
1	V11 20BK/TN	WINDSHIELD WASHER PUMP MOTOR DRIVER
2	Z1 20BK	GROUND



WINDSHIELD
WIPER MOTOR

C112

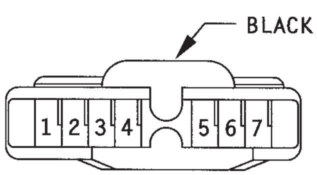
CAV	CIRCUIT	FUNCTION
1	–	–
2	V6 16DB	WIPER SWITCH MODE SENSE
3	F86 16LG/RD	FUSED IGNITION SWITCH OUTPUT
4	Z1 16BK	GROUND
5	V3 16BR/WT	WIPER SWITCH LOW SPEED DRIVER
6	V4 16RD/YL	WIPER SWITCH HIGH SPEED DRIVER



LOW WASHER
FLUID LEVEL
SENSOR

C113

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	G29 16BK/TN	WASHER FLUID LEVEL SENSOR



INTERMITTENT WIPER
CONTROL MODULE

C114

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	V6 16DB	WIPER SWITCH MODE SENSE
3	V3 16BR/WT	WIPER SWITCH LOW SPEED DRIVER
4	F86 16LG/RD	FUSED IGNITION SWITCH OUTPUT
5	V4 16RD/YL	WIPER SWITCH HIGH SPEED DRIVER
6	V11 20BK/TN	WINDSHIELD WASHER PUMP MOTOR DRIVER
7	–	–

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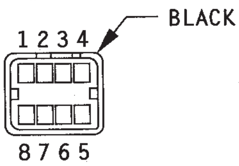
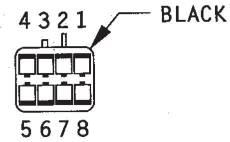
C115

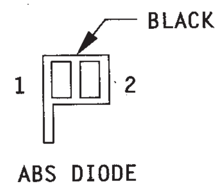


CAV	CIRCUIT
1	B4 20LG
2	B3 20LG/DB
3	B2 20YL
4	B1 20YL/DB
5	B41 20YL/VT
6	B42 20TN/WT
7	B43 20PK/OR
8	–



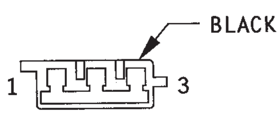
CAV	CIRCUIT
1	B4 20LG
2	B3 20LG/DB
3	B2 20YL
4	B1 20YL/DB
5	B41 20YL/VT
6	B42 20TN/WT
7	B23 20PK/OR
8	–

C116

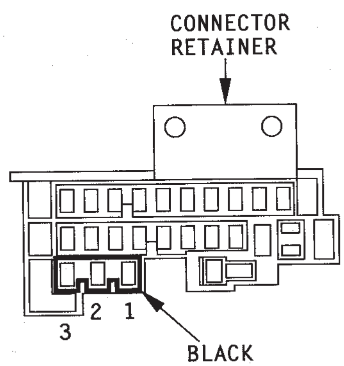


CAV	CIRCUIT	FUNCTION
1	235 18GY/YL	ABS SYSTEM RELAY OUTPUT
2	205 18VT/WT	ABS WARNING LAMP DRIVER

C117

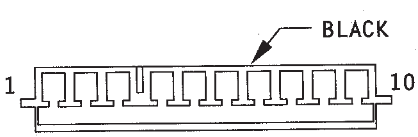


CAV	CIRCUIT
1	–
2	236 20LG/YL
	236 20LG/YL
3	L50 18WT/TN

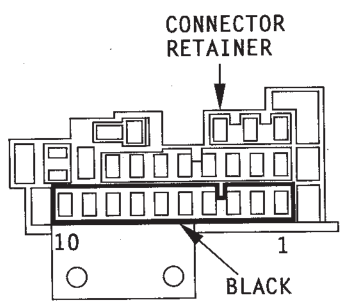


CAV	CIRCUIT
1	–
2	236 20LG/YL
3	L50 18WT/TN
	L50 18WT/TN

C118



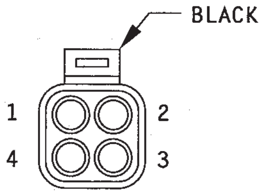
CAV	CIRCUIT
1	G9 20GY/BK
2	Z1 16BK
3	L3 16RD/OR
4	L4 16VT/OR
5	L65 18LG/DB
6	L90 18DB/RD
7	G9 20GY/BK
8	V20 16BK/OR
9	G29 16BK/TN
10	205 18VT/WT
	205 18VT/WT



CAV	CIRCUIT
1	G9 20GY/BK
	G9 20GY/BK
2	Z1 16BK
3	L3 16RD/OR
4	L4 16VT/OR
5	L65 18LG/DB
	L65 18LG/DB
6	L90 18DB/RD
7	G9 18GY/BK*
7	G9 20GY/BK**
8	V20 18BK/OR
9	G29 20BK/TN
10	205 20VT/WT

* WITH DRL
** WITHOUT DRL

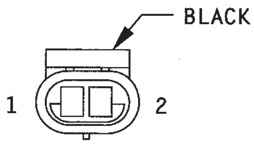
J958W-3



HEATED OXYGEN SENSOR

C119

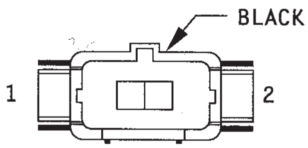
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K41 18BK/OR	OXYGEN SENSOR SIGNAL
3	Z12 18BK/TN	GROUND
4	A64 14OR/DB	FUEL PUMP RELAY OUTPUT



ENGINE COOLANT TEMPERATURE SENSOR (I6 ONLY)

C120

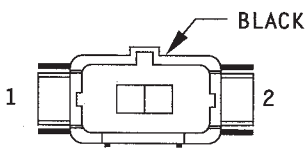
CAV	CIRCUIT	FUNCTION
1	K2 16TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
2	K4 16BK/TN	SENSOR GROUND



FUEL INJECTOR NO.1

C121

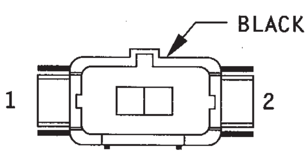
CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K11 18WT/DB	INJECTOR #1 DRIVER



FUEL INJECTOR NO.2

C122

CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K12 18TN	INJECTOR #2 DRIVER

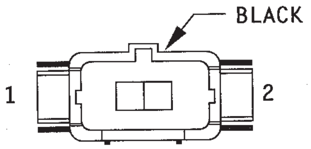


FUEL INJECTOR NO.3

C123

CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K13 18YL/WT	INJECTOR #3 DRIVER

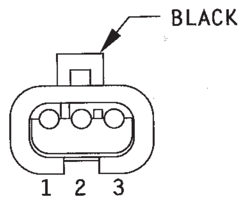
J958W-3



FUEL INJECTOR
NO.4

C124

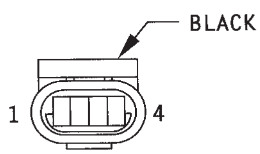
CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K14 18LB/BR	INJECTOR #4 DRIVER



THROTTLE
POSITION SENSOR

C125

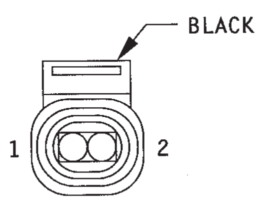
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K6 18VT/WT	5.0 VOLT SUPPLY



IDLE AIR
CONTROL MOTOR

C126

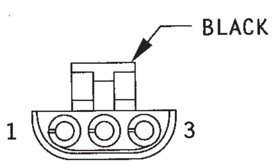
CAV	CIRCUIT	FUNCTION
1	K60 16YL/BK	IDLE AIR CONTROL MOTOR #4 DRIVER
2	K59 16VT/BK	IDLE AIR CONTROL MOTOR #3 DRIVER
3	K40 16BR/WT	IDLE AIR CONTROL MOTOR #2 DRIVER
4	K39 16GY/RD	IDLE AIR CONTROL MOTOR #1 DRIVER



INTAKE AIR
TEMPERATURE SENSOR

C127

CAV	CIRCUIT	FUNCTION
1	K21 20BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND

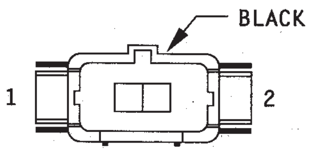


MANIFOLD ABSOLUTE
PRESSURE SENSOR
(I6 ONLY)

C128 (I6 ONLY)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K70 18RD/WT	MAP SENSOR SIGNAL
3	K6 18VT/WT	5.0 VOLT SUPPLY

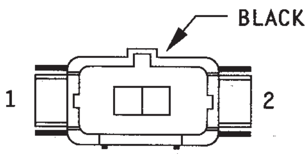
J958W-3



FUEL INJECTOR
NO.5

C129

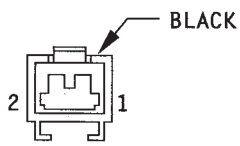
CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K38 18GY	INJECTOR #5 DRIVER



FUEL INJECTOR
NO.6

C130

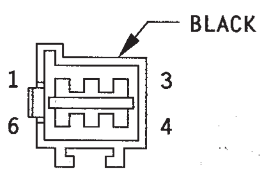
CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K58 18BR/YL	INJECTOR #6 DRIVER



ROLLS TEST CONNECTOR
(IN-PLANT USE ONLY)

C131

CAV	CIRCUIT	FUNCTION
1	D83 20BK/YL	SCI RECEIVE
2	D84 20BK	SCI TRANSMIT



ABS/TCM DATA
LINK CONNECTOR
(4.0L ONLY)
ABS DATA LINK
CONNECTOR
(5.2L ONLY)

C132

CAV	CIRCUIT	FUNCTION
1	D82 20BK/YL**	TRANSMISSION DIAGNOSTIC RECEIVE
2	A14 18RD/WT	FUSED B (+)
3	D2 20WT/GY	CCD BUS (-)
4	Z12 20BK/TN*	GROUND
4	Z1 18BK**	GROUND
	Z1 18BK**	GROUND
5	D5 20PK/BK**	TRANSMISSION DIAGNOSTIC TRANSMIT
6	D1 20VT/BR	CCD BUS (+)

* MANUAL TRANSMISSION
** AUTOMATIC TRANSMISSION

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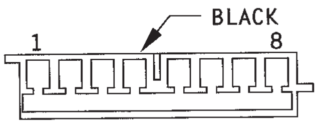
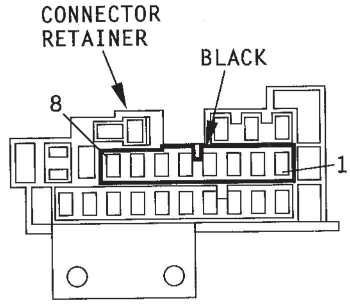
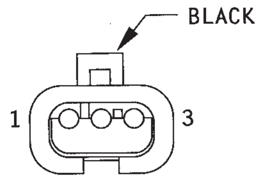
C133



CAV	CIRCUIT
1	K54 20OR/BK*
2	V31 20BR/RD
3	V32 20YL/RD
4	–
5	G21 20GY/LB
5	G21 20GY/LB**
6	G6 20GY/WT
7	G20 18VT/YL
8	G3 20BK/PK



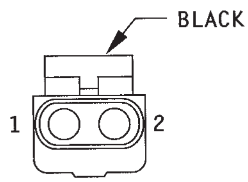
CAV	CIRCUIT
1	K54 20OR/BK
2	V31 20BR/RD
3	V32 20YL/RD
3	V32 20YL/RD
4	–
5	G21 20GY/LB
6	G6 20GY/WT
7	G20 20VT/YL
8	G3 20BK/PK



VEHICLE SPEED SENSOR

C134

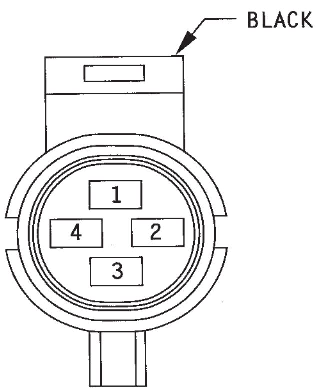
CAV	CIRCUIT	FUNCTION
1	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K25 18WT/BK	8.0 VOLT SUPPLY



BACK-UP LAMP SWITCH (M/T ONLY)

C135 (M/T ONLY)

CAV	CIRCUIT	FUNCTION
1	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN/START)
2	L10 18BR/LG	BACK-UP LAMP SWITCH OUTPUT



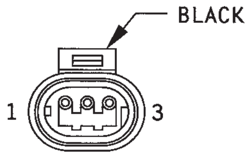
TRANSFER CASE SWITCH

C136

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G28 20LG/OR	2-WHEEL DRIVE LAMP/LOW RANGE
3	107 20BK/RD	PART TIME LAMP
4	106 20GY/OR	4-WHEEL DRIVE FULL TIME

* MANUAL TRANSMISSION
** AUTOMATIC TRANSMISSION

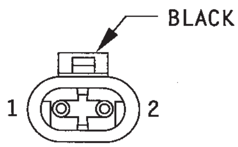
J958W-3



CRANKSHAFT
POSITION SENSOR

C137

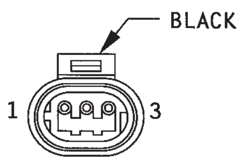
CAV	CIRCUIT	FUNCTION
1	K27 20RD/LG	CRANKSHAFT POSITION SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K25 20WT/BK	8.0 VOLT SUPPLY



OIL PRESSURE
SENSOR

C138

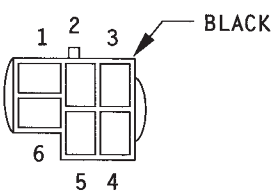
CAV	CIRCUIT	FUNCTION
1	–	–
2	G6 20GY/WT	OIL PRESSURE SENSOR SIGNAL



CAMSHAFT
POSITION SENSOR

C139

CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CAMSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K25 20WT/BK	8.0 VOLT SUPPLY



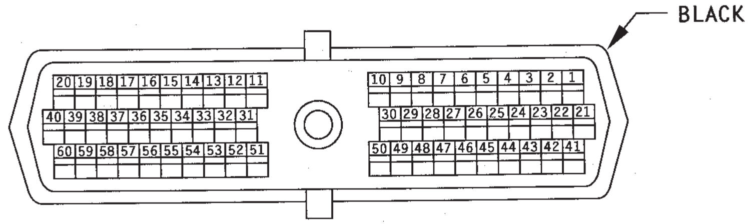
PCM DATA LINK
CONNECTOR

C140

CAV	CIRCUIT	FUNCTION
1	–	–
2	D83 20BK/YL	SCI RECEIVE
	D83 20BK/YL	SCI RECEIVE
3	–	–
4	F86 16LB/RD*	FUSED IGNITION SWITCH OUTPUT (RUN/START)
	F86 16LB/RD*	FUSED IGNITION SWITCH OUTPUT (RUN/START)
4	F86 16LB/RD**	FUSED IGNITION SWITCH OUTPUT (RUN/START)
5	D84 20BK	SCI TRANSMIT
	D84 20BK	SCI TRANSMIT
6	Z12 18BK/TN	GROUND

* MANUAL TRANSMISSION
** AUTOMATIC TRANSMISSION

J958W-3



POWERTRAIN CONTROL MODULE

C141

CAV	CIRCUIT	FUNCTION
1	K70 18RD/WT	MAP SENSOR SIGNAL
2	K2 16TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
3	A5 16RD	FUSED B(+) (I6 ONLY)
3	A5 14RD	FUSED B(+) (V8 ONLY)
4	K4 18BK/LB	SENSOR GROUND
5	Z12 14BK/TN	GROUND
6	K6 18VT/WT	5.0 VOLT SUPPLY (FROM PCM)
7	K25 20WT/BK	8.0 VOLT SUPPLY (FROM PCM)
8	–	–
9	F86 16LB	FUSED IGNITION SWITCH OUTPUT (RUN/START) (V8)
9	F86 16LB/RD	FUSED IGNITION SWITCH OUTPUT (RUN/START) (I6)
10	T9 20OR/BK	OVERDRIVE PRESSURE SWITCH SENSE (V8 ONLY)
11	Z12 14BK/TN	GROUND
12	Z12 14BK/TN	GROUND
13	K14 18LB/BR	INJECTOR #4 DRIVER
14	K13 18YL/WT	INJECTOR #3 DRIVER
15	K12 18TN	INJECTOR #2 DRIVER
16	K11 18WT/DB	INJECTOR #1 DRIVER
17	K17 18DB/WT	INJECTOR #7 DRIVER
18	K18 18DB/YL	INJECTOR #8 DRIVER
19	K19 18GY/WT	IGNITION COIL DRIVER
20	K20 18DG	GENERATOR FIELD DRIVER
21	K21 20BK/RD	INTAKE AIR TEMPERATURE SIGNAL
22	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
23	–	–
24	K27 20RD/LG	CRANKSHAFT POSITION SENSOR SIGNAL
25	D84 20BK	SCI TRANSMIT
26	D1 20VT/BR	CCD BUS (+)
27	C21 18DB/OR	A/C SWITCH SENSE (V8)
27	C21 20DB/OR	A/C SWITCH SENSE (I6)
28	C90 20LG	A/C-HEATER CONTROL SWITCH OUTPUT
29	L53 20BR	STOP LAMP SWITCH SENSE
30	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
31	–	–
32	G3 20BK/PK	MALFUNCTION INDICATOR LAMP DRIVER
33	V36 20TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
34	C13 20DB/RD	A/C COMPRESSOR CLUTCH RELAY CONTROL
35	K35 20GY/YL	EGR SOLENOID CONTROL (V8 ONLY)
36	–	–
37	G68 20PK/OR	OVERDRIVE OFF LAMP DRIVER (V8 ONLY)
38	K38 18GY	INJECTOR #5 DRIVER
39	K60 16YL/BK	IDLE AIR CONTROL #4 DRIVER
40	K40 16BR/WT	IDLE AIR CONTROL #2 DRIVER

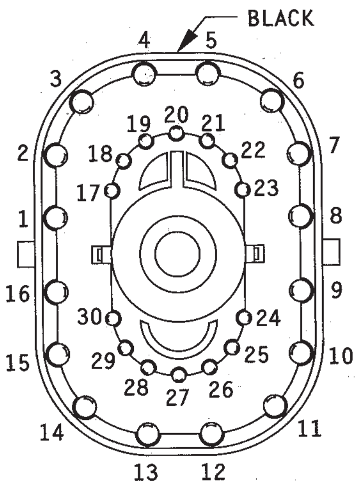
J958W-3

C141 CONTINUED

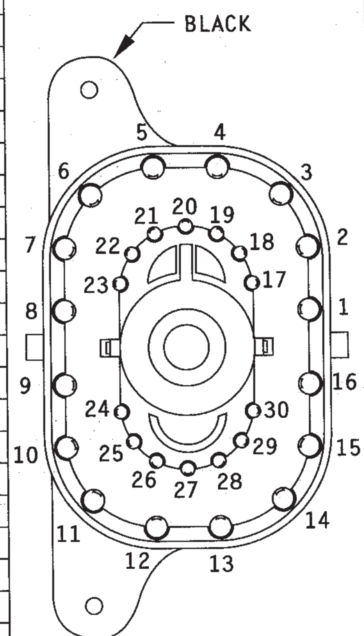
CAV	CIRCUIT	FUNCTION
41	K41 18BK/OR	OXYGEN SENSOR SIGNAL
42	–	–
43	G21 20GY/LB	TACHOMETER SIGNAL
44	K24 18GY/BK	CAMSHAFT POSITION SENSOR SIGNAL
45	D83 20BK/YL	SCI RECEIVE
46	D2 20WT/GY	CCD BUS (-)
47	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
48	V31 20BR/RD	SPEED CONTROL/SET SWITCH SENSE
49	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
50	V33 20WT/LG	SPEED CONTROL RESUME SWITCH SENSE
51	K81 20PK	ASD RELAY AND FUEL PUMP RELAY CONTROL
52	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
53	V35 20LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
54	K54 20OR/BK	UP-SHIFT LAMP DRIVER (I6 MANUAL TRANS.)
54	T6 20VT/YL	TRANSMISSION OVERDRIVE SWITCH SENSE (V8)
55	T60 18BR/LG	OVERDRIVE SOLENOID CONTROL (V8 ONLY)
56	–	–
57	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
58	K58 18BR/YL	INJECTOR #6 DRIVER
59	K39 16GY/RD	IDLE AIR CONTROL MOTOR #1 DRIVER
60	K59 16VT/BK	IDLE AIR CONTROL MOTOR #3 DRIVER

J958W-3

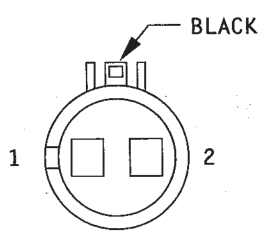
C142



CAV	CIRCUIT
1	–
2	L10 18BR/LG
3	K20 18DG
4	K19 18GY/WT
5	F86 16LB/RD**
5	F86 16LB*
6	A14 18RD/WT
7	K52 18PK/BK
8	–
9	–
10	–
11	C21 20DB/OR
12	F83 18YL/DG
13	A61 18DG/BK
14	A5 16RD
15	Z1 16BK
16	A64 14OR/DB
17	107 20BK/RD
18	106 20GY/OR
19	D1 20VT/BR
20	D2 20WT/GY
21	V36 20TN/RD
22	V35 20LG/RD
23	L53 20BR
24	K81 20PK
25	C90 20LG
26	T41 20BK/WT
27	G28 20LG/OR
28	C13 20DB/RD
29	V33 20WT/LG
30	G7 20WT/OR



CAV	CIRCUIT
1	C2 18DB/YL
2	L10 18BR/LG
3	K20 18DG
4	K19 18GY
5	F86 16LB/RD
6	A14 18RD/WT
7	K52 18PK/BK
8	C3 18DB/BK
9	–
10	–
11	C21 18DB/OR
12	F83 18YL/DG
13	A61 18DG/BK
14	A5 16RD
15	Z1 16BK
16	A64 14OR/DB
17	107 20BK/RD
18	106 20GY/YL
19	D1 20VT/BR
20	D2 20WT/GY
21	V36 20TN/RD
22	V35 20LG/RD
23	L53 20BR
24	K81 20PK
25	C90 20LG
26	T41 20BK/WT
27	G28 20LG/OR
28	C13 20DB/RD
29	V33 20WT/LG
30	G7 18WT/OR



A/C HIGH
PRESSURE SWITCH
(I6 ONLY)

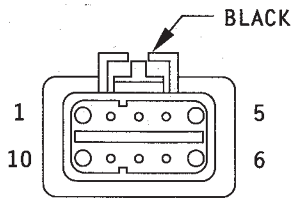
C143 (I6 ONLY)

CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK	A/C HIGH PRESSURE SWITCH FEED
2	C21 18DB/OR	A/C SWITCH SENSE

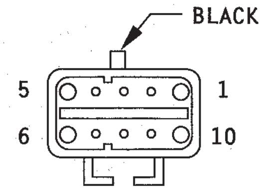
* WITH V8
** WITH I6

J958W-3

C144

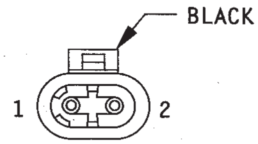


CAV	CIRCUIT
1	C2 18DB/BK
2	K20 18DG
3	A61 18DG/BK
4	A61 18DG/BK
5	–
6	K19 18GY
7	–
8	C21 18DB/OR
9	C3 18DB/BK
10	T40 14BR



CAV	CIRCUIT
1	C2 18DB/YL
2	K20 18DG
3	A61 18DG/BK
4	A61 18DG/BK
5	–
6	K19 18GY/WT
7	–
8	C21 18DB/OR
9	C3 18DB/BK
10	T40 14LG/BK

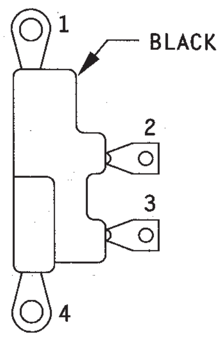
C145



IGNITION COIL

CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K19 18GY	IGNITION COIL DRIVER

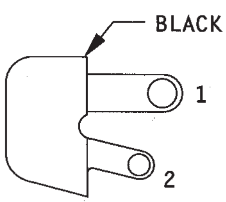
C146



GENERATOR

CAV	CIRCUIT	FUNCTION
1	Z0 8BK	GROUND
2	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K20 18DG	GENERATOR FIELD DRIVER
4	–	–

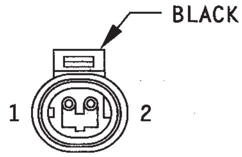
C147



ENGINE STARTER MOTOR

CAV	CIRCUIT	FUNCTION
1	A0 6RD	B(+)
2	T40 14LG/BK	ENGINE STARTER MOTOR RELAY OUTPUT

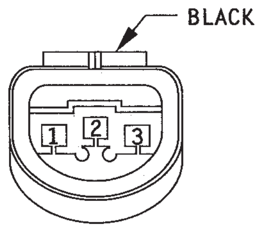
J958W-3



LEFT AIRBAG
SENSOR

C148

CAV	CIRCUIT	FUNCTION
1	R47 18DB/LB	LEFT IMPACT SENSOR LINE 1
2	R49 18LB	LEFT IMPACT SENSOR LINE 2

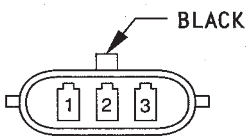


RIGHT HEADLAMP

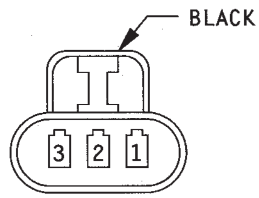
C149

CAV	CIRCUIT	FUNCTION
1	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
2	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT
3	Z1 18BK	GROUND

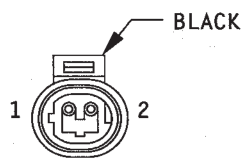
C150



CAV	CIRCUIT
1	L64 18TN/DB
2	L90 18DB/RD
3	Z1 18BK



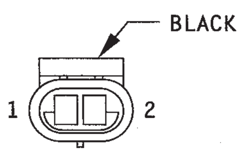
CAV	CIRCUIT
1	L64 18TN/DB
2	L90 18DB/RD
3	Z1 18BK



RIGHT AIRBAG
SENSOR

C151

CAV	CIRCUIT	FUNCTION
1	R46 18BR/LB	RIGHT IMPACT SENSOR LINE 1
2	R48 18TN	RIGHT IMPACT SENSOR LINE 2

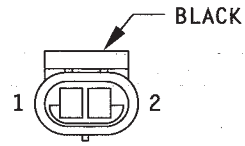


HORN NO.1

C152

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	X2 16DG/YL	HORN RELAY OUTPUT

J958W-3



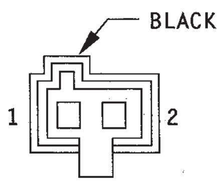
HORN NO.2

C153

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	X2 16DG/YL	HORN RELAY OUTPUT

C154

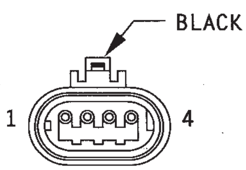
POWER DISTRIBUTION CENTER
(SEE 8W-11-2)



A/C LOW PRESSURE
SWITCH

C155

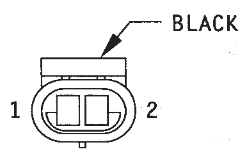
CAV	CIRCUIT	FUNCTION
1	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN/START)
	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN/START)
2	C3 18DB/BK	A/C PRESSURE SWITCH OUTPUT



VEHICLE SPEED
CONTROL SERVO

C156

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	V30 20DB/LG	STOP LAMP SWITCH OUTPUT
3	V35 20LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
4	V36 20TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL



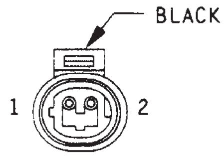
ENGINE COOLANT
LEVEL SENSOR

C157

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	G18 16PK/DB	ENGINE COOLANT LEVEL SENSOR SENSE

J958W-3

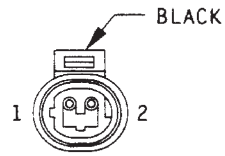
1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-08-95 October, 1995



RIGHT FRONT
WHEEL SPEED
SENSOR

C158

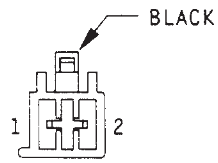
CAV	CIRCUIT	FUNCTION
1	B7 20WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
2	B6 20WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)



UNDERHOOD LAMP

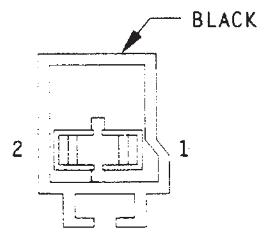
C159

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	M1 18PK	FUSED B(+)



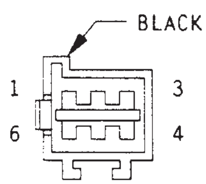
C160

CAV	CIRCUIT
1	Z1 12BK
2	A19 12RD/VT



CAV	CIRCUIT
1	Z1 12BK
2	*A19 12RD

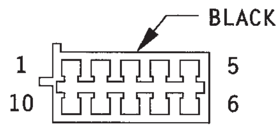
C161



AIRBAG DATA
LINK CONNECTOR

CAV	CIRCUIT	FUNCTION
1	D8 20LG	SCI RECEIVE
2	F63 18VT	FUSED B(+)
3	–	–
4	Z6 20BK/PK	GROUND
5	D7 20LB	SCI TRANSMIT
6	–	–

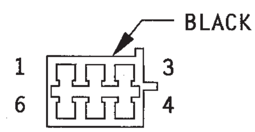
C162



AIRBAG CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	A14 18RD/WT	FUSED B(+)
2	–	–
3	Z6 18BK/PK	GROUND
4	R47 18DB/LB	LEFT IMPACT SENSOR LINE 1
5	R46 18BR/LB	RIGHT IMPACT SENSOR LINE 2
6	R48 18TN	RIGHT IMPACT SENSOR LINE 2
7	R49 18LB	LEFT IMPACT SENSOR LINE 2
8	R41 18BK/TN	AIRBAG WARNING LAMP DRIVER
9	F20 18WT	FUSED IGNITION SWITCH OUTPUT (RUN)
10	G5 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN/START)

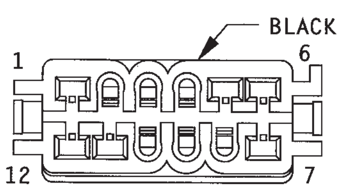
C163



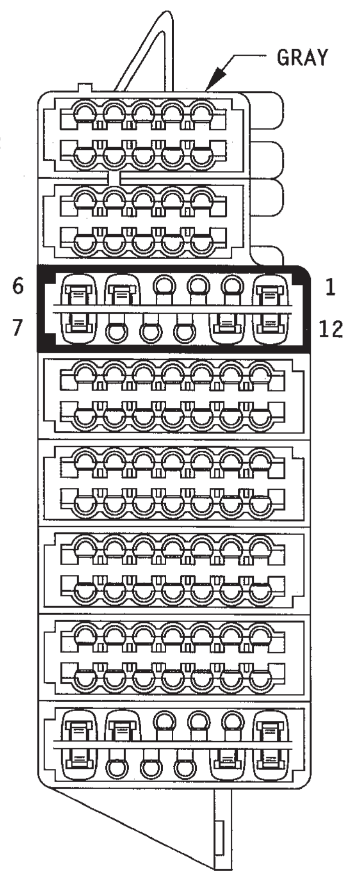
AIRBAG CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	D8 20LG	SCI RECEIVE
2	F63 18VT	FUSED B(+)
3	–	–
4	Z6 20BK/PK	GROUND
5	D7 20LB	SCI TRANSMIT
6	–	–

C164

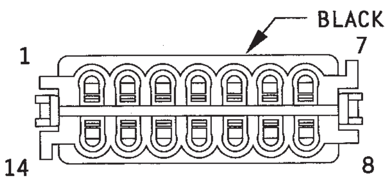


CAV	CIRCUIT
1	A2 10PK/BK
2	–
3	D1 20VT/BR
4	D2 20WT/GY
5	A7 12RD/YL
6	A6 14RD/LB
7	Z1 14BK
8	V33 20WT/LG
9	L35 20BR/RD
10	X2 18DG/YL
11	A4 16RD/DG
12	A21 12DB/GY

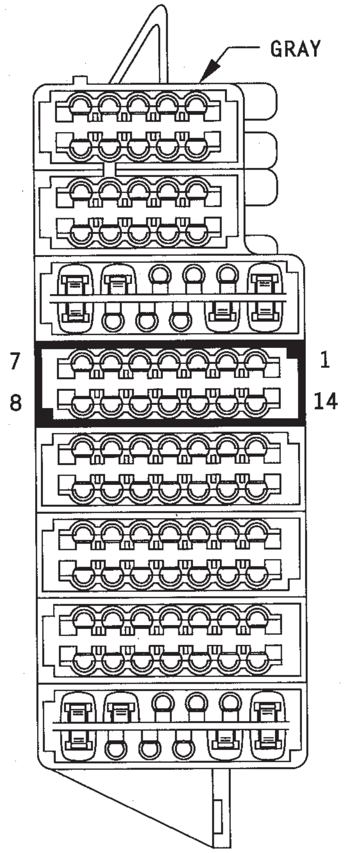


CAV	CIRCUIT
1	A2 10PK/BK
2	–
3	D1 20VT/BR
4	D2 20WT/GY
5	A7 12RD/YL
6	A6 14RD/LB
7	Z1 16BK
7	Z1 14BK
8	V33 20WT/LG
9	L35 20BR/RD
10	X2 18DG/YL
11	A4 16RD/DG
11	A4 16RD/DG
12	A21 12DB/GY

C165

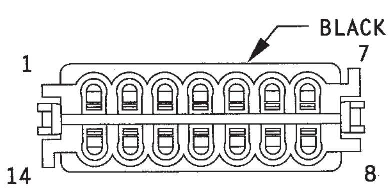


CAV	CIRCUIT
1	A64 140R/DB
2	F20 18WT
3	G5 18DB/YL
4	A41 16YL/BK
5	L53 20BR
6	106 20GY/YL
7	Z2 18BK/LG
8	A1 12RD/WT
9	L10 18BR/LG
10	–
11	C8 20DG/RD
12	D41 20LG/WT
13	G7 20WT/OR
14	R41 18BK/TN

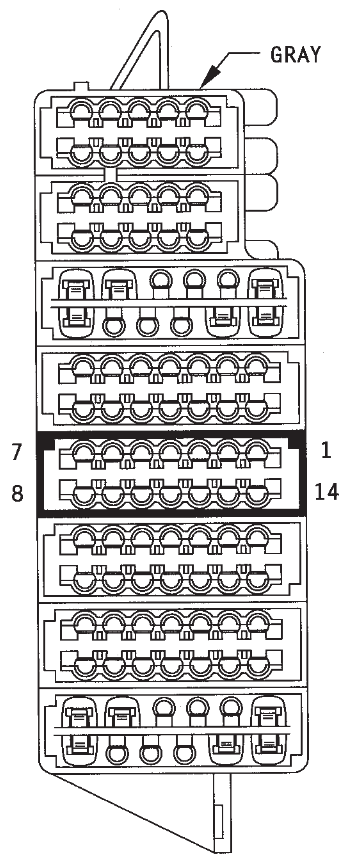


CAV	CIRCUIT
1	A64 140R/DB
2	F20 18WT
3	G5 18DB/YL
3	G5 18DB/YL
4	A41 16YL
5	L53 20BR
6	106 20GY/OR
7	Z2 18BK/LG
7	Z2 20BK/LG
8	A1 12RD/WT
9	L10 18BR/LG
	L10 18BR/LG
10	–
11	C8 20DG/RD
12	D41 20LG/WT
13	G7 20WT/OR
14	R41 18BK/TN

C166



CAV	CIRCUIT
1	G70 20BR/TN
2	D1 20VT/BR
3	G18 16BK/DB
4	L4 16VT/OR
5	L3 16RD/OR
6	L64 18TN/DB
7	L90 18DB/RD
8	V30 20DB/LG
9	–
10	C90 20LG
11	G28 20LG/OR
12	–
13	107 20BK/RD
14	D2 20WT/GY



CAV	CIRCUIT
1	G70 20BR/TN
2	D1 20VT/BR
3	G18 20PK/DB
4	L4 16VT/OR
5	L3 16RD/OR
5	G34 16RD/GY
6	L64 18TN/DB
7	L90 18DB/RD
8	V30 20DB/LG
9	–
10	C90 20LG
11	G28 20LG/OR
12	–
13	107 20BK/RD
14	D2 20WT/BK

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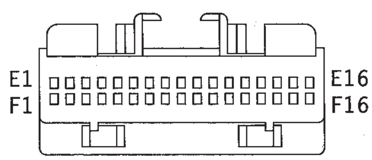
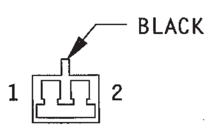
C167

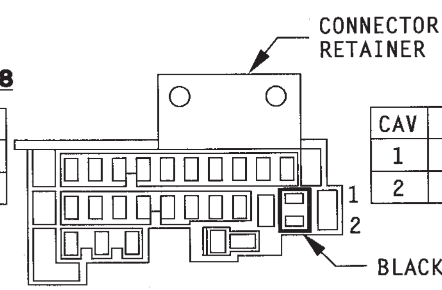


CAV	CIRCUIT	FUNCTION
E1	–	–
E2	–	–
E3	T25 18LG	GOVERNOR PRESSURE SIGNAL
E4	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
E5	T9 20OR/BK	OVERDRIVE PRESSURE SWITCH
E6	G21 20GY/LB	TACHOMETER SIGNAL
E7	T14 18LG/WT	SHAFT SPEED SENSOR (+)
E8	A14 18RD/WT	FUSED B(+)
E9	F86 18LB/RD	FUSED IGNITION SWITCH OUTPUT (RUN/START)
E10	T33 18RD/YL	5.0 VOLT SUPPLY
E11	T35 18TN/OR	SENSOR GROUND
E12	Z1 18BK	GROUND
E13	G68 20PK/OR	OVERDRIVE OFF LAMP DRIVER
E14	T22 18DG/LB	TORQUE CONVERTER CLUTCH RELAY OUTPUT
E15	T60 18BR/YL	OVERDRIVE SOLENOID CONTROL
E16	T59 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
F1	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
F2	D5 20PK/BK	TRANSMISSION DIAGNOSTIC (TRANSMIT)
F3	D82 20BK/YL	TRANSMISSION DIAGNOSTIC (RECEIVE)
F4	K4 18BK/LB	SENSOR GROUND
F6	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
F7	T13 18DB/BK	OUTPUT SHAFT SPEED SENSOR SIGNAL (-)
F8	A14 18RD/WT	FUSED B(+)
F9	–	–
F10	–	–
F11	–	–
F12	Z1 18BK	GROUND
F13	–	–
F14	–	–
F15	–	–
F16	T20 18LB/BR	LOW REVERSE SOLENOID CONTROL

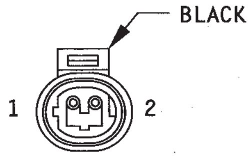
C168



CAV	CIRCUIT
1	G68 20PK/OR
2	T9 20OR/BK



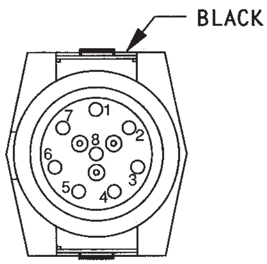
CAV	CIRCUIT
1	G68 20BR/YL
2	T9 20OR



OUTPUT SHAFT SPEED SENSOR

C169

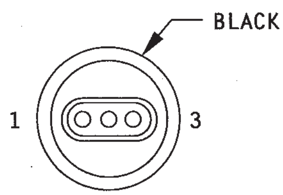
CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	OUTPUT SHAFT SPEED SENSOR SIGNAL (+)
2	T13 18DB/BK	OUTPUT SHAFT SPEED SENSOR SIGNAL (-)



TRANSMISSION SOLENOID ASSEMBLY

C170

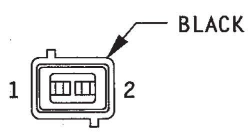
CAV	CIRCUIT	FUNCTION
1	T20 18LB/BR	LOW REVERSE SOLENOID CONTROL
2	T33 18RD/YL	5.0 VOLT SUPPLY
3	T35 18TN/OR	SENSOR GROUND
4	T25 18LG	GOVERNOR PRESSURE SIGNAL
5	T59 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
6	T60 18BR/YL	OVERDRIVE SOLENOID CONTROL
7	T22 18DG/LB	TORQUE CONVERTER CLUTCH RELAY OUTPUT
8	T54 18VT	TRANSMISSION TEMPERATURE SIGNAL



PARK/NEUTRAL POSITION AND BACK-UP LAMP SWITCH (A/T ONLY)

C171 (A/T ONLY)

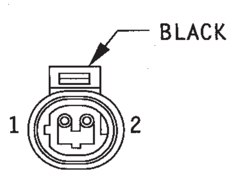
CAV	CIRCUIT	FUNCTION
1	L10 18BR/LG	BACK-UP LAMP SWITCH OUTPUT
2	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
3	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN/START)



ENGINE COOLANT TEMPERATURE SENSOR (V8 ONLY)

C172 (V8 ONLY)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



A/C HIGH PRESSURE SWITCH (V8 ONLY)

C173 (V8 ONLY)

CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK	A/C LOW PRESSURE SWITCH OUTPUT
2	C21 18DB/OR	A/C HIGH PRESSURE SWITCH OUTPUT

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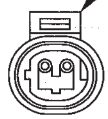
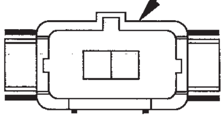


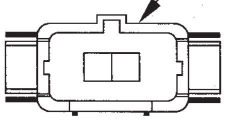
C174

CAV	CIRCUIT	FUNCTION
1	F86 18LB	FUSED IGNITION SWITCH OUTPUT (RUN/START)
2	K52 18PK/BK	EVAP/PURGE SOLENOID SIGNAL



C175

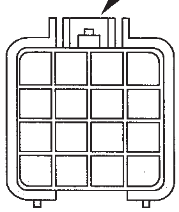
CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K17 18DB/WT	INJECTOR #7 DRIVER



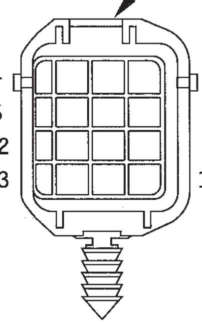
C176

CAV	CIRCUIT	FUNCTION
1	A61 18DG/BK	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K18 18DB/YL	INJECTOR #8 DRIVER

C177



CAV	CIRCUIT
1	Z12 20BK/TN
2	D1 20VT/BR
3	D2 20WT/GY
4	A14 16RD/WT
5	V31 20BR/RD
6	V32 20YL/RD
7	–
8	G21 20GY/LB
9	G68 20PK/OR
10	G3 20BK/PK
11	G20 18VT/YL
12	G6 20GY/WT
13	T9 20OR/BK
14	–
15	D83 20BK/YL
16	D84 20BK



CAV	CIRCUIT
1	Z12 20BK/TN
2	D1 20VT/BR
3	D2 20WT/GY
4	A14 18RD/WT
5	V31 20BR/RD
6	V32 20YL/RD
7	–
8	G21 20GY/LB
9	G68 20PK/OR
10	G3 20BK/PK
11	G20 20VT/YL
12	G6 20GY/WT
13	T9 20OR/BK
14	–
15	D83 20BK/YL
16	D84 20BK

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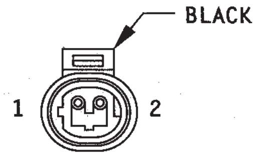
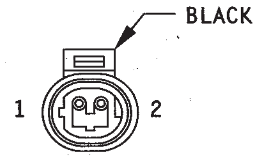


EGR
SOLENOID

C178

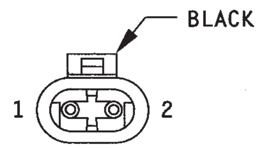
CAV	CIRCUIT	FUNCTION
1	F86 18LB	FUSED IGNITION SWITCH OUTPUT (RUN/START)
2	K35 20GY/YL	EGR SOLENOID CONTROL



AMBIENT
TEMPERATURE SENSOR

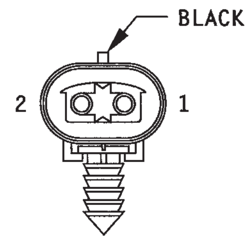
C179

CAV	CIRCUIT	FUNCTION
1	C8 20DG/RD	AMBIENT TEMPERATURE SENSOR SIGNAL
2	D41 20LG/WT	SENSOR GROUND

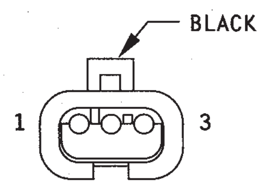


C180

CAV	CIRCUIT
1	Z1 20BK
2	L39 20LB/BK



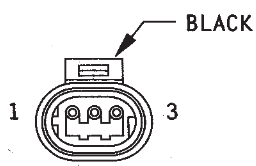
CAV	CIRCUIT
1	L39 20LB/BK
2	Z1 20BK



MANIFOLD ABSOLUTE
PRESSURE SENSOR (V8 ONLY)

C181 (V8 ONLY)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K70 18RD/WT	MAP SENSOR SIGNAL
3	K6 18VT/WT	5.0 VOLT SUPPLY



TRANSMISSION OVERDRIVE
AND TORQUE CONVERTER
CLUTCH SOLENOID (V8 ONLY)

C182 (V8 ONLY)

CAV	CIRCUIT	FUNCTION
1	T60 18BR/LG	OVERDRIVE SOLENOID CONTROL
2	F86 18LB	FUSED IGNITION SWITCH OUTPUT (RUN/START)
3	T6 20VT/YL	TRANSMISSION OVERDRIVE SWITCH SENSE

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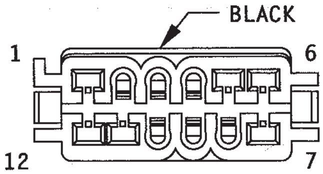
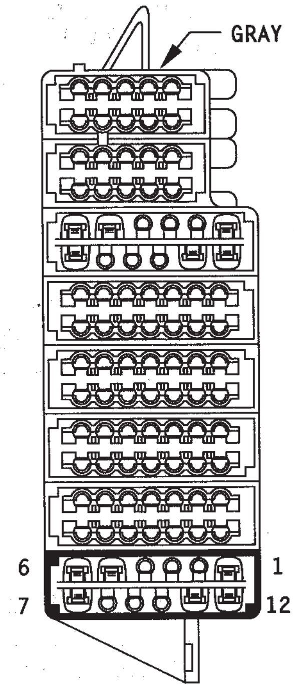
C200

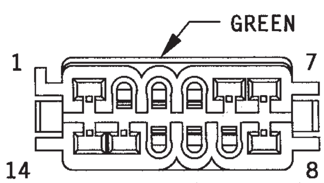


CAV	CIRCUIT
1	Q16 14BR/WT
2	P2 18BK/WT
3	P34 18PK/BK
4	M1 18PK
5	Q26 14VT/WT
6	Q1 14YL/GY
7	–
8	–
9	–
10	G71 20VT/YL
11	M2 20YL
12	–

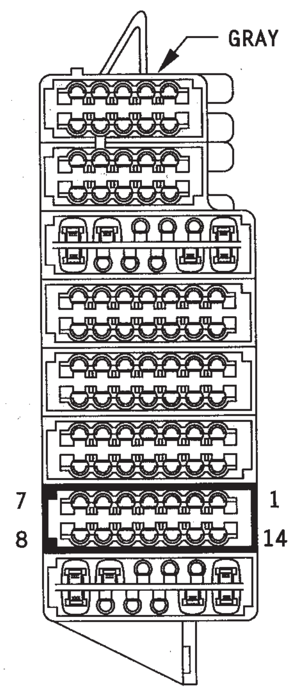


CAV	CIRCUIT
1	Q16 12BR/WT
2	P2 18BK/WT
3	P34 18PK/BK
4	M1 18PK
5	Q26 12VT/WT
6	Q1 12YL/GY
7	–
8	–
9	–
10	G71 20VT/YL
10	G71 20VT/YL
11	M2 20YL
12	–

C201



CAV	CIRCUIT
1	G25 20LG/BK
2	F81 14TN
3	Z2 20BK/OR
4	Z1 18BK
4	Z1 14BK
5	G44 20VT/WT
6	E2 20OR
7	L90 20DB/RD
8	–
9	–
10	G71 20VT/YL
11	C8 20DG/RD
12	D41 20LG/WT
13	D2 20WT/BK
14	D1 20VT/BR



CAV	CIRCUIT
1	G25 20LG/BK
	G25 20LG/BK
2	F81 14TN
3	Z2 20BK/LG
4	Z1 14BK
5	G44 20VT/TN
6	E2 20OR
7	L90 18DB/RD
8	–
9	–
10	G71 20VT/YL
10	G71 20VT/YL
11	C8 20DG/RD
12	D41 20LG/WT
13	D2 20WT/GY
	D2 20WT/GY
14	D1 20VT/BR
	D1 20VT/BR

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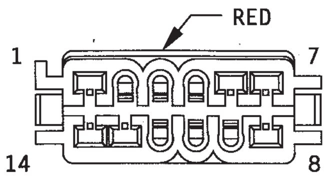
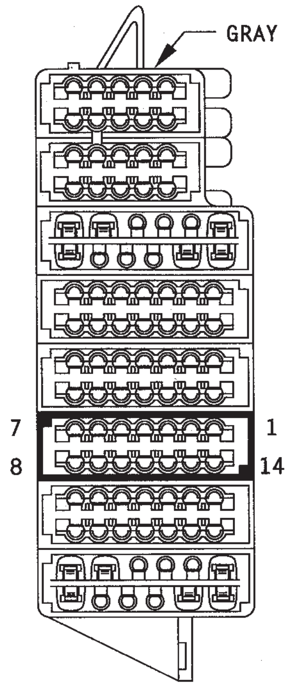
C202

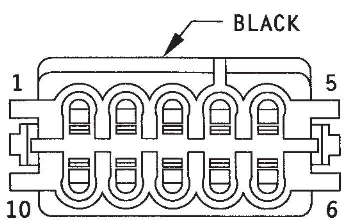


CAV	CIRCUIT
1	Q16 14BR/WT
2	Q26 14VT/WT
3	Q1 14YL/GY
4	M1 20PK
5	X52 20DB/WT
6	X58 20DB/OR
7	C15 12BK/LB
8	A18 18RD/BK
8	A18 16RD/BK
9	P34 18PK/BK
	P34 18PK/BK
10	P2 18BK/WT
10	P2 18BK/WT
11	V13 18BR/LG
12	V24 18BR/OR
13	–
14	V20 16BK/YL

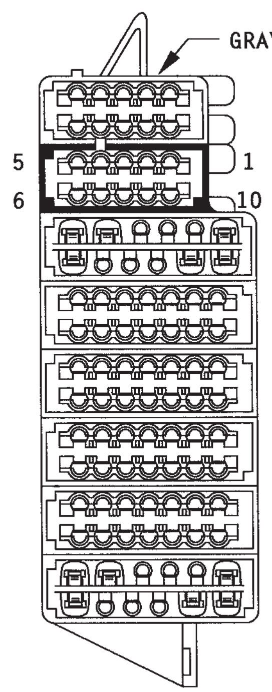


CAV	CIRCUIT
1	Q16 12BR/WT
2	Q26 12VT/WT
3	Q1 12YL/GY
4	M1 18PK
	M1 18PK
5	X52 20DB/WT
6	X58 20DB/PK
7	C15 12BK/LB
8	A18 16RD/BK
	A18 16RD/BK
9	P34 18PK/BK
	P34 18PK/BK
10	P2 18BK/WT
	P2 18BK/WT
11	V13 18BR/LB
12	V24 18BR/OR
13	–
14	V20 18BK/OR

C203



CAV	CIRCUIT
1	P78 20YL/LG
2	P77 20WT/BK
3	P79 20DB/LB
4	C16 18LB/YL
5	X56 20DB/RD
6	Z1 18BK
7	F60 18RD/WT
8	P36 20PK/VT
9	P35 20OR/VT
10	X54 20VT



CAV	CIRCUIT
1	P78 20YL/LG
2	P77 20WT/DB
3	P79 20DB/LB
4	C16 18LB/YL
5	X80 20LB/BK**
	X80 20LB/BK**
5	X56 20DB*
6	Z1 20BK
	Z1 16BK
7	F60 18RD/WT
8	P36 20PK/VT
	P36 20PK/VT
9	P35 20OR/VT
	P35 20OR/VT
10	X82 20LB/RD*
	X82 20LB/RD*
10	X54 20VT/YL**

* WITH PREMIUM SOUND
** WITHOUT PREMIUM SOUND

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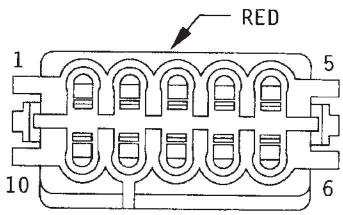
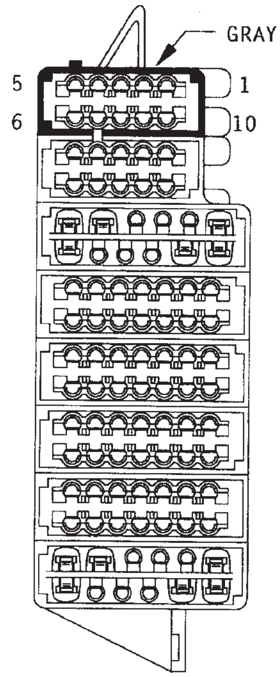
1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-01-96 January, 1996

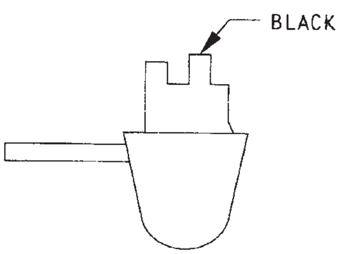
C204



CAV	CIRCUIT
1	M1 20PK
2	Z1 20BK*
	Z1 18BK**
	Z1 18BK**
3	M2 20YL
4	F60 20RD/WT
5	M9 20DB/OR
6	F83 20YL/DG
7	*L10 20BK/RD
8	G49 20PK/OR
9	P36 20PK/VT
10	P35 20OR/VT



CAV	CIRCUIT
1	M1 18PK
1	M1 18PK
2	Z1 20BK
3	M2 20YL
3	M2 20YL
4	F60 18RD/WT
	F60 18RD/WT
5	M9 20DB/OR
6	F83 18YL/DG
7	L10 20BR/LG
8	G49 20PK/OR
9	P36 20PK/VT
	P36 20PK/VT
10	P35 20OR/VT
	P35 20OR/VT



RIGHT COURTESY LAMP

C205

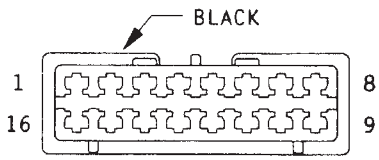
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	M2 20YL	DOOR LATCH SWITCH SENSE

* WITHOUT SUNROOF
** WITH SUNROOF

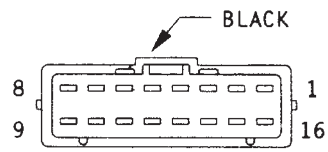
J958W-3

1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-08-95 October, 1995

C206 (WITHOUT AUTOMATIC TEMPERATURE CONTROL)

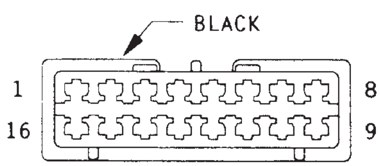


CAV	CIRCUIT
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	C1 14DG
9	C34 20VT/WT
10	F71 18PK/DG
	F71 18PK/DG
11	C36 20DB/RD
12	C4 14TN
13	C5 14LG
14	C6 14LB
15	C7 12BK/TN
16	-

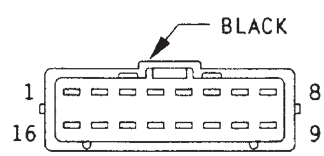


CAV	CIRCUIT
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	★Z1 12BK
9	C34 20VT/WT
10	F71 18PK/DG
11	C36 20DB/RD
12	C4 14TN
13	C5 14LG
14	C6 14LB
15	C7 12BK/TN
16	-

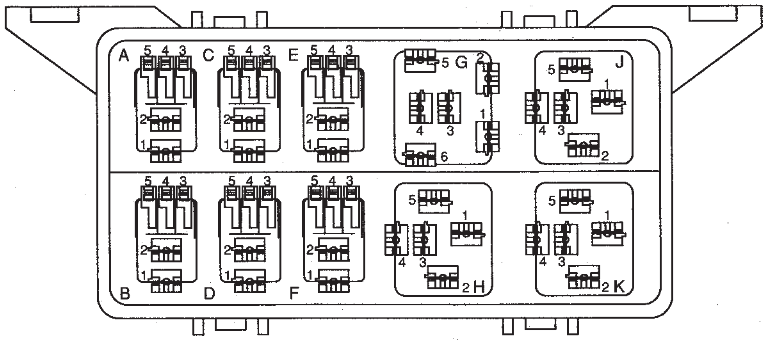
C206 (WITH AUTOMATIC TEMPERATURE CONTROL)



CAV	CIRCUIT
1	★C39 20YL
2	★C37 20TN/BK
3	★C35 20DB/WT
4	★C36 20DB/RD
5	★C34 20VT/WT
6	★F71 18PK/DG
	★F71 18PK/DG
7	★C33 20VT/OR
8	★C32 20LB/BK
9	★C38 20DG
10	★C40 20DG/YL
11	★C41 18BR
12	★C42 18BR/RD
13	★C43 18BR/YL
14	★Z4 20BK
15	★ -
16	★D41 20LG/WT



CAV	CIRCUIT
1	★C39 20YL
2	★C37 20TN/BK
3	★C35 20DB/WT
4	★C36 20DB/RD
5	★C34 20VT/WT
6	★F71 18PK/DG
7	★C33 20VT/OR
8	★C32 20LB/DG
9	★C38 20DG
10	★C40 20DG/YL
11	★C41 18BR
12	★C42 18BR/RD
13	★C43 18BR/YL
14	★Z4 20BK
15	★ -
16	★D41 20LG/WT



RELAY CENTER

C207

VEHICLE THEFT ALARM RELAY (A)

CAV	CIRCUIT	FUNCTION
A1	L11 16LG/BK	FLASH OUTPUT
	L11 16LG/BK	FLASH OUTPUT
A2	L3 16RD/OR	VTA RELAY OUTPUT
	L3 16RD/OR	VTA RELAY OUTPUT
A3	Z1 20BK	GROUND
A4	–	–
A5	G79 20TN/PK	VTA RELAY CONTROL

HORN RELAY (B)

CAV	CIRCUIT	FUNCTION
B1	F62 16BK/RD	FUSED B(+)
	F62 16BK/RD	FUSED B(+)
B2	X2 18DG/YL	HORN RELAY OUTPUT
B3	F62 16BK/RD	FUSED B(+)
B4	–	–
B5	X4 20GY/OR	HORN SWITCH
	X4 20GY/OR	HORN SWITCH

DOOR LOCK RELAY (C)

CAV	CIRCUIT	FUNCTION
C1	P2 18BK/WT	DOOR LOCK RELAY OUTPUT
	P2 18BK/WT	DOOR LOCK RELAY OUTPUT
C2	F35 18RD	FUSED B(+)
C3	P57 20YL/BK	POWER DOOR LOCK INHIBIT
C4	Z1 18BK	GROUND
	Z1 18BK	GROUND
C5	P35 20OR/VT	DOOR LOCK RELAY CONTROL
	P35 20OR/VT	DOOR LOCK RELAY CONTROL

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C207 CONTINUED

DOOR UNLOCK RELAY (D)

CAV	CIRCUIT	FUNCTION
D1	P34 18PK/BK	DOOR UNLOCK RELAY OUTPUT
	P34 18PK/BK	DOOR UNLOCK RELAY OUTPUT
D2	F35 18RD	FUSED B(+)
	F35 18RD	FUSED B(+)
D3	Z1 18BK	GROUND
	Z1 18BK	GROUND
D4	Z1 18BK	GROUND
D5	P36 20PK/VT	DOOR UNLOCK RELAY CONTROL
	P36 20PK/VT	DOOR UNLOCK RELAY CONTROL

(E)

CAV	CIRCUIT	FUNCTION
E1	–	–
E2	–	–
E3	–	–
E4	–	–
E5	–	–

(F)

CAV	CIRCUIT	FUNCTION
F1	–	–
F2	–	–
F3	–	–
F4	–	–
F5	–	–

POWER ANTENNA RELAY (G)

CAV	CIRCUIT	FUNCTION
G1	Z1 18BK	GROUND
G2	A18 16RD/BK	FUSED B(+)
G3	X64 20DG/RD	RADIO 12 VOLT OUTPUT
	X60 20GY/OR	RADIO 12 VOLT OUTPUT
G4	X16 16LG	POWER ANTENNA MOTOR DRIVER
G5	X14 16WT/OR	POWER ANTENNA DOWN CONTROL
G6	X17 16GY/BK	POWER ANTENNA UP CONTROL

C207 CONTINUED

HEATED REAR WINDOW RELAY (H)

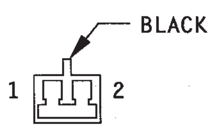
CAV	CIRCUIT	FUNCTION
H1	C15 12BK/LB	HEATED REAR WINDOW RELAY OUTPUT
H2	Z1 18BK	GROUND
H3	C80 20DB/YL	HEATED REAR WINDOW SWITCH OUTPUT
H4	F82 12WT	FUSED B(+)
H5	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN)

ELECTRONIC FLASHER RELAY (J)

CAV	CIRCUIT	FUNCTION
J1	L6 16RD/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
J2	F72 16RD/YL	FUSED B(+)
J3	L12 16VT/TN	ELECTRONIC FLASHER RELAY OUTPUT
J4	L5 16BK/OR	ELECTRONIC FLASHER RELAY OUTPUT
	L5 16BK/OR	ELECTRONIC FLASHER RELAY OUTPUT
J5	Z1 18BK	GROUND

ILLUMINATED ENTRY RELAY (K)

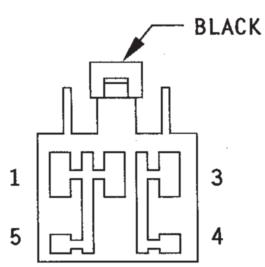
CAV	CIRCUIT	FUNCTION
K1	Z1 18BK	GROUND
K2	M1 18PK	FUSED B(+)
K3	–	–
K4	M2 20YL	DOOR LATCH SWITCH SENSE
K5	M9 20DB/OR	ILLUMINATED ENTRY RELAY CONTROL



GLOVE BOX LAMP

C208

CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	Z1 20BK	GROUND



BLOWER MOTOR SWITCH

C209

CAV	CIRCUIT	FUNCTION
1	C1 14DG	FUSED B(+)
2	C6 14LB	M2 BLOWER MOTOR DRIVER
3	C7 12BK/TN	HIGH BLOWER MOTOR DRIVER
4	C4 14TN	LOW BLOWER MOTOR DRIVER
5	C5 14LG	M1 BLOWER MOTOR DRIVER

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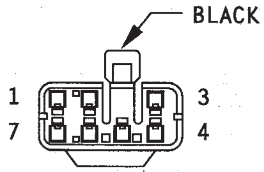
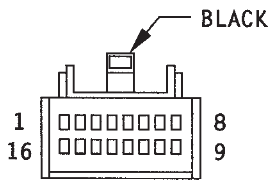
C210



A/C-HEATER
CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	–	–
2	C34 20VT/WT	GROUND
3	F71 18PK/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
4	C90 20LG	A/C-HEATER CONTROL SWITCH OUTPUT
5	–	–
6	E2 20OR	FUSED PANEL LAMPS DRIVER
7	C36 20DB/RD	BLEND DOOR FEEDBACK SIGNAL

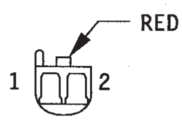
C211



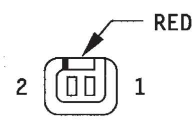
VEHICLE INFORMATION
CENTER (WITH GRAPHIC
DISPLAY MODULE)

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	E2 20OR	PANEL LAMPS DRIVER
3	–	–
4	G77 20TN/OR	LEFT REAR DOOR AJAR SWITCH SENSE
5	G25 20LG/BK	US/METRIC SWITCH OUTPUT
6	G46 20LB/BK	REAR LAMP OUT DRIVER
7	G18 20PK/DB	ENGINE COOLANT LEVEL SENSOR SENSE
8	L90 20DB/RD	PARK LAMP SWITCH OUTPUT
9	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
10	G29 20BK/TN	WASHER FLUID SWITCH SENSE
11	107 20BK/RD	4-WHEEL DRIVE PART TIME
12	106 20GY/OR	FULL TIME 4-WHEEL DRIVE
13	F83 20YL/DG	FUSED IGNITION SWITCH OUTPUT
14	T19 20YL/BK	2-OR 4-WHEEL DRIVE SOLENOID CONTROL
15	G42 20LB/RD	ALL TIME FRONT WHEELS
16	G28 20LG/OR	2-WHEEL DRIVE OR REAR WHEELS IN ALL TIME

C212



CAV	CIRCUIT
1	G28 20LG/OR
2	107 20BK/RD



CAV	CIRCUIT
1	G42 20LB/RD
2	T19 20YL/BK

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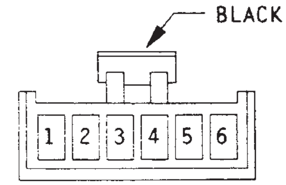
1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-08-95 October, 1995

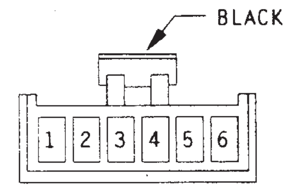
C213 (MANUAL A/C-HEATER)



BLEND AIR DOOR MOTOR (MANUAL A/C-HEATER)

CAV	CIRCUIT	FUNCTION
1	★F71 18PK/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
2	★ –	–
3	★C36 20DB/RD	BLEND DOOR FEEDBACK SIGNAL
4	★C34 20VT/WT	COMMON DOOR DRIVER
5	–	–
6	–	–

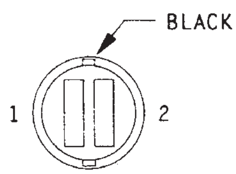
C213 (WITH ATC)



BLEND AIR DOOR MOTOR (WITH ATC)

CAV	CIRCUIT	FUNCTION
1	C40 20DG/YL	5 VOLT SUPPLY (FROM ATC MODULE)
2	C36 20DB/RD	BLEND DOOR FEEDBACK SIGNAL
3	D41 20LG/WT	SENSOR GROUND
4	–	–
5	C35 20DB/WT	BLEND DOOR MOTOR DRIVER
6	C34 20VT/WT	BLEND DOOR MOTOR DRIVER

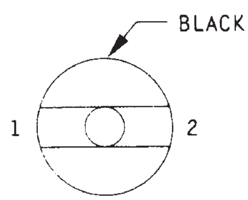
C214



ASH RECEIVER LAMP

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	Z1 20BK	GROUND

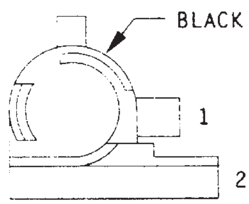
C215



CIGAR LIGHTER LAMP

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	Z1 20BK	GROUND

C216



CIGAR LIGHTER

CAV	CIRCUIT	FUNCTION
1	F30 18RD/DB	FUSED B(+)
2	Z1 18BK	GROUND

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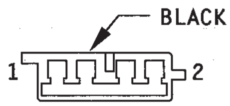
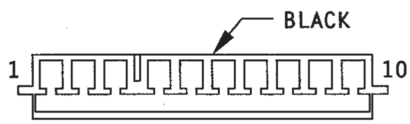
C217



REAR WIPER/WASHER SWITCH

CAV	CIRCUIT	FUNCTION
1	V20 18BK/OR	REAR WASHER SWITCH OUTPUT
	V20 18BK/OR	REAR WASHER SWITCH OUTPUT
2	V13 18BR/LB	REAR WIPER SWITCH OUTPUT (INT)
3	V24 18BR/OR	REAR WIPER SWITCH OUTPUT (INT)
4	V23 16BR/PK	FUSED IGNITION SWITCH OUTPUT (ACC/RUN)

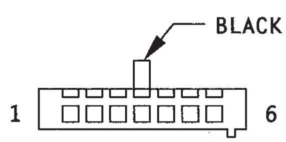
C218



HEATED REAR WINDOW/
OVERDRIVE SWITCH

CAV	CIRCUIT	FUNCTION
1	–	–
2	Z1 20BK	GROUND
3	E2 200R	PANEL LAMPS DRIVER
4	Z1 20BK	GROUND
5	T9 200R	OVERDRIVE OFF SWITCH SENSE
6	G68 20BR/YL	OVERDRIVE OFF LAMP DRIVER
7	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT
8	Z1 20BK	GROUND
9	C80 20DB/YL	HEATED REAR WINDOW SWITCH OUTPUT
10	C16 18LB/YL	FUSED HEATED REAR WINDOW RELAY OUTPUT
	C16 18LB/YL	FUSED HEATED REAR WINDOW RELAY OUTPUT

C219



RADIO

CAV	CIRCUIT	FUNCTION
1	F60 18RD/WT	FUSED B(+)
2	X12 18RD/GY	FUSED IGNITION SWITCH OUTPUT (ACC/RUN)
3	E2 200R	PANEL LAMPS DRIVER
4	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
5	X56 20DB	RIGHT FRONT DOOR (-)
6	X55 20BR/RD	LEFT FRONT DOOR (-)

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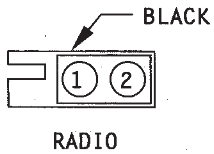
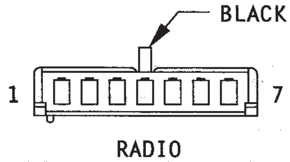


C220

CAV	CIRCUIT	FUNCTION
1	D1 20VT/BR	CCD BUS (+)
2	D2 20WT/GY	CCD BUS (-)



C221

CAV	CIRCUIT	FUNCTION
1	X58 20DB/PK	RIGHT REAR DOOR (-)
2	X57 20BR/LB	LEFT REAR DOOR (-)
3	X54 20VT/YL	RIGHT FRONT DOOR (+)
4	X53 20DG	LEFT FRONT DOOR (+)
5	X52 20DB/WT	RIGHT REAR DOOR (+)
6	X51 20BR/YL	LEFT REAR DOOR (-)
7	X60 20DG/RD	RADIO 12 VOLT OUTPUT

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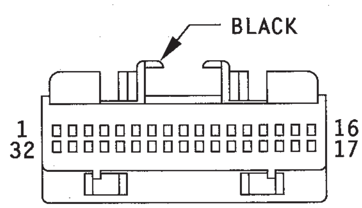
C222

CAV	CIRCUIT	FUNCTION
1	–	–
2	–	–
3	205 20VT/WT	ABS WARNING LAMP DRIVER
4	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
5	G3 20BK/PK	MALFUNCTION INDICATOR LAMP DRIVER
6	–	–
7	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
8	K54 20OR/BK	UP-SHIFT INDICATOR LAMP DRIVER (MAN. TRANS. ONLY)
9	G6 20GY/WT	OIL PRESSURE SENSOR SENSE
10	Z2 20BK/LG	GROUND
11	R41 18BK/TN	AIRBAG WARNING LAMP DRIVER
12	G5 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN/START)
13	G34 16RD/GY	HIGH BEAM INDICATOR DRIVER
14	G13 20DB/RD	SEAT BELT WARNING LAMP DRIVER
15	–	–
16	L64 18TN/DB	RIGHT TURN SIGNAL INDICATOR LAMP DRIVER
17	G69 20BK/OR	VTA INDICATOR LAMP DRIVER
18	F70 18PK/DB	FUSED B(+)
19	–	–
20	Z1 20BK	GROUND
21	E2 20OR	FUSED PANEL LAMPS DRIVER
22	G20 20VT/YL	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
23	Z2 20BK/LG	GROUND
24	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT (RUN/START)
25	Z1 20BK	GROUND
26	E2 20OR	FUSED PANEL LAMPS DRIVER
27	K102 20PK/BK	FUEL LEVEL SENSOR SIGNAL
28	G21 20GY/LB	TACHOMETER SIGNAL
29	G5 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN/START)
30	Z2 20BK/LG	GROUND
31	L65 18LG/DB	LEFT TURN SIGNAL INDICATOR LAMP DRIVER
32	–	–



INSTRUMENT CLUSTER

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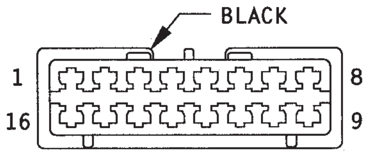
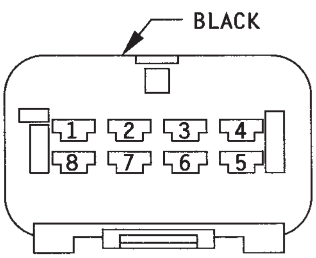


C223

CAV	CIRCUIT	FUNCTION
1	E2 18OR	PANEL LAMPS DRIVER
2	52 16OR/BK	DIMMER SWITCH SIGNAL
3	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT
	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT
4	L35 20BR/RD	FOG LAMP SWITCH SENSE
5	G16 20BK/LB	LEFT FRONT DOOR AJAR SWITCH SENSE
	G16 20BK/LB	LEFT FRONT DOOR AJAR SWITCH SENSE
6	G26 20LB	KEY-IN IGNITION SWITCH SENSE
7	L24 20VT	AUTOMATIC HEADLAMP SWITCH OUTPUT
8	Z1 16BK	GROUND
9	M2 20YL	COURTESY LAMP DRIVER
10	Z1 16BK	GROUND
	Z1 16BK	GROUND
11	–	–
12	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
13	F34 14TN/BK	FUSED B(+)
14	L26 14OR/VT	FUSED B(+)
15	A6 14RD/LB	FUSED B(+)
16	366 16PK/OR	FUSED B(+)
	366 16PK/OR	FUSED B(+)



C224

CAV	CIRCUIT	FUNCTION
1	P57 20YL/BK	POWER DOOR LOCK INHIBIT
2	F60 18RD/WT	FUSED B(+)
3	G26 20LB	KEY-IN IGNITION SWITCH SENSE
	G26 20LB	KEY-IN IGNITION SWITCH SENSE
4	G81 20DB	TONE LINE (CHIME)
5	F83 20YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN/START)
	F83 20YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN/START)
6	G13 20DB/RD	SEAT BELT LAMP DRIVER
7	Z1 18BK	GROUND
8	G10 20LG/RD	SEAT BELT SWITCH SENSE

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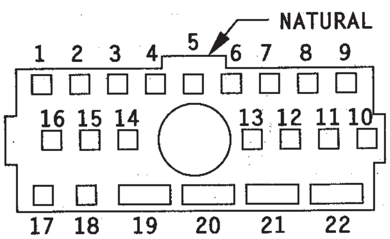
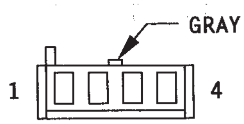


MULTI-FUNCTION SWITCH

C225

CAV	CIRCUIT	FUNCTION
1	–	–
2	–	–
3	V6 16DB	WIPER PARK SWITCH SENSE
4	V3 16BR/WT	WIPER SWITCH LOW SPEED OUTPUT
5	V4 16RD/YL	WIPER SWITCH HIGH SPEED OUTPUT
6	F86 16LG/RD	FUSED IGNITION SWITCH OUTPUT (ACC/RUN)
7	V11 18BK/TN	WINDSHIELD WASH SIGNAL OUTPUT
8	V51 18WT	WIPER SWITCH DELAY SIGNAL
9	V50 18LG/WT	WIPER SWITCH MODE SIGNAL
10	–	–
11	L64 18TN/DB	TURN SIGNAL SWITCH OUTPUT (RIGHT)
12	L60 18TN	TURN SIGNAL SWITCH OUTPUT (RIGHT)
13	L12 16VT/TN	ELECTRONIC FLASHER RELAY OUTPUT
14	–	–
15	L61 18LG	TURN SIGNAL SWITCH OUTPUT (LEFT)
16	L65 18LG/DB	TURN SIGNAL SWITCH OUTPUT (LEFT)
17	L5 16BK/OR	ELECTRONIC FLASHER RELAY OUTPUT
18	–	–
19	–	–
20	–	–
21	L11 16LG/BK	FLASH OUTPUT
	L11 16LG/BK	FLASH OUTPUT
22	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
23	F34 14TN/BK	FUSED B(+)
	F34 14TN/BK	FUSED B(+)
24	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT
	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT



KEY-IN SWITCH/
KEY-IN HALO LAMP

C226

CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	M2 20YL	DOOR LATCH SWITCH SENSE
3	G26 20LB	KEY-IN IGNITION SWITCH SENSE
4	G16 20BK/LB	LEFT FRONT DOOR AJAR SWITCH SENSE

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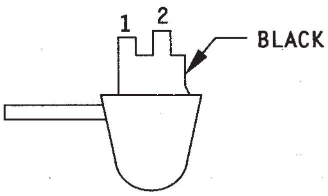
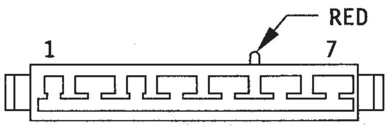


LEFT COURTESY LAMP

C227

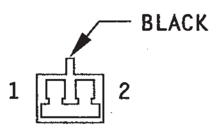
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	M2 20YL	DOOR LATCH SWITCH SENSE



IGNITION SWITCH

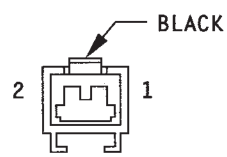
C228

CAV	CIRCUIT	FUNCTION
1	A41 16YL/DB	IGNITION SWITCH OUTPUT (START)
2	A21 12DB/GY	IGNITION SWITCH OUTPUT (RUN/START)
3	G9 20GY/BK	RED BRAKE WARNING LAMP DRIVER
4	A2 10PK/BK	FUSED B(+)
5	A22 12OR/BK	IGNITION SWITCH OUTPUT (RUN)
6	A31 12BK/WT	IGNITION SWITCH OUTPUT (ACC/RUN)
7	A1 12RD/WT	FUSED B(+)

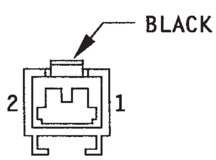


C229 (WITH AUTOMATIC TRANSMISSION)

CAV	CIRCUIT
1	A41 16YL/DB
2	A41 16YL



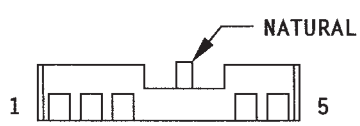
CAV	CIRCUIT
1	A41 16YL
2	A41 16YL



CLUTCH PEDAL POSITION SWITCH (MANUAL TRANSMISSION)

C229 (WITH MANUAL TRANSMISSION)

CAV	CIRCUIT	FUNCTION
1	A41 16YL/DB	CLUTCH PEDAL POSITION SWITCH SENSE
2	A41 16YL	CLUTCH PEDAL POSITION SWITCH SENSE

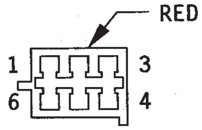


VEHICLE SPEED CONTROL AND HORN SWITCH

C230

CAV	CIRCUIT	FUNCTION
1	X4 20GY/OR	HORN SWITCH OUTPUT
2	V33 20WT/LG	SPEED CONTROL RESUME SWITCH SENSE
3	V34 20WT/RD	FUSED IGNITION SWITCH OUTPUT
4	V31 20BR/RD	SPEED CONTROL COAST/SET SWITCH SENSE
5	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE

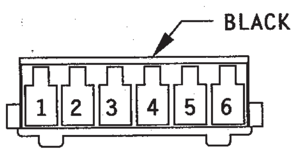
J958W-3



I.P. DIMMING MODULE
(W/O DRL)

C231 (W/O DRL)

CAV	CIRCUIT	FUNCTION
1	352 18OR/WT	FUSED PARK LAMP SWITCH OUTPUT
2	–	–
3	52 16OR/BK	DIMMER SWITCH SIGNAL
4	–	–
5	Z1 16BK	GROUND
6	E2 18OR	FUSED PANEL LAMPS DRIVER



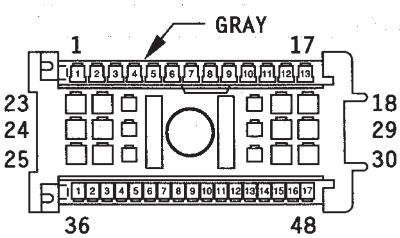
STOP LAMP SWITCH

C232

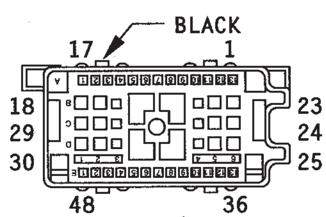
CAV	CIRCUIT	FUNCTION
1	L16 18RD/LG	FUSED B(+)
2	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
3	V30 20DB/LG	SPEED CONTROL BRAKE SWITCH OUTPUT
4	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
5	Z1 18BK	GROUND
6	L53 20BR	STOP LAMP SWITCH SENSE

J958W-3

C233



CAV	CIRCUIT
1	C16 18LB/YL
2	M2 20YL
3	–
4	G71 20VT/YL
5	G44 20VT/TN
6	X85 20LG/BK
7	K102 20PK/BK
8	G16 20BK/LB
9	X87 20LG/RD
10	L50 18WT/TN
11	F60 18RD/WT
12	P35 20OR/VT
13	M1 18PK
14	X57 20BR/LB
15	X55 20BR/RD
16	X51 20BR/YL
17	X53 20DG
18	P2 18BK/WT
19	P34 18PK/BK
20	Z2 20BK/LG
21	G46 20LB/BK
22	A64 14OR/DB
23	F81 14TN
24	L10 18BR/LG
25	F35 14RD
26	P36 20PK/VT
27	–
28	–
29	–
30	G10 20LG/RD
31	L90 18DB/RD
32	–
33	G78 20TN/BK
33	G78 20TN/BK
34	F75 16VT
35	Z1 14BK
36	–
37	G87 18WT/BK
38	G9 20GY/BK*
	G9 20GY/BK*
38	G11 18WT/BK**
39	E2 20OR
40	P79 20DB/LB
40	P79 20DB/LB
41	P75 20DB/WT
42	P64 20OR/YL
43	L60 18TN
44	L61 18LG
45	G76 20TN/YL
46	G77 20TN/OR
47	–
48	G75 20TN/PK



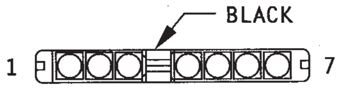
CAV	CIRCUIT
1	C16 20LB/YL
2	M2 18YL
3	–
4	G71 18VT/YL
5	G44 20VT/WT
6	X85 16LG/BK
7	K102 20PK/BK
8	G16 20BK/LB
9	X87 20LG/RD
10	L50 18WT/TN
11	F60 18RD/WT
12	P35 20OR/VT
13	M1 18PK
14	X57 20BR/LB
15	X55 20BR/RD
16	X51 20BR/YL
17	X53 20DG
18	P2 18BK/WT
19	P34 18PK/BK
20	Z2 20BK/OR
21	G46 20LB/BK
22	A64 14OR/BK
23	F81 14TN
24	L10 18BR/LG
25	F35 14RD
26	P36 20PK/VT
27	–
28	–
29	–
30	G10 20LG/RD
31	L90 16DB/RD
32	–
33	G78 20TN/BK
34	F75 14VT
35	Z1 14BK
36	L36 18LG/BK
37	F87 18WT/BK
38	G9 20GY/BK
39	E2 20OR
40	P79 20DB/LB
41	P75 20DB/WT
42	P64 20YL/OR
43	L60 18TN
44	L61 18LG
45	G76 20TN/YL
46	G77 20TN/OR
47	G74 20TN/RD
48	G75 20TN/PK

* WITHOUT DRL

** WITH DRL

J958W-3

C234



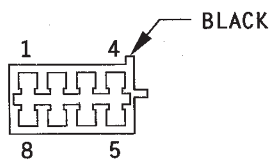
INTERMITTENT WIPER CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	V51 18WT	WIPER SWITCH DELAY SIGNAL
2	V11 18BK/TN	WASHER SWITCH OUTPUT
3	V4 16RD/YL	WIPER SWITCH HIGH SPEED OUTPUT
4	F86 16LG/RD	FUSED IGNITION SWITCH OUTPUT
5	V3 16BR/WT	WIPER SWITCH LOW SPEED OUTPUT
6	V6 16DB	WIPER PARK SWITCH SENSE
7	V50 18LG/WT	WIPER SWITCH MODE SIGNAL

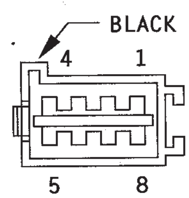
C235

FUSE BLOCK
(SEE 8W-10-2)

C236

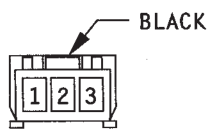


CAV	CIRCUIT
1	–
2	–
3	–
4	X64 20GY/OR
5	X80 20LB/BK
6	X82 20LB/RD
7	X54 20VT/YL
8	X56 20DB



CAV	CIRCUIT
1	–
2	–
3	–
4	X64 18GY/OR
5	X80 16LB/BK
6	X82 16LB/RD
7	X54 20VT/YL
8	X56 20DB

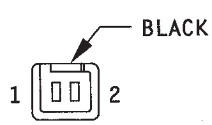
C237



POWER ANTENNA MOTOR

CAV	CIRCUIT	FUNCTION
1	X17 16GY/BK	POWER ANTENNA UP CONTROL
2	X14 16WT/OR	POWER ANTENNA DOWN CONTROL
3	X16 16LG	POWER ANTENNA DRIVER

C238



RIGHT I.P. SPEAKER (TWEETER)

CAV	CIRCUIT	FUNCTION
1	X80 20LB/BK	AMPLIFIED RIGHT DOOR (-)
2	X82 20LB/RD	AMPLIFIED RIGHT DOOR (+)

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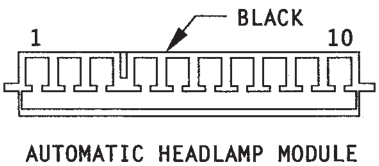
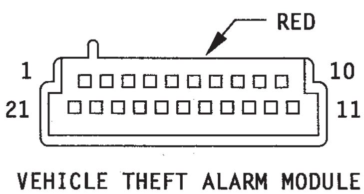


C239

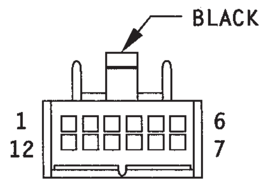
CAV	CIRCUIT	FUNCTION
1	366 16PK/OR	PARK LAMP FEED
2	L26 14OR/VT	HEADLAMP OFF SWITCH TO TWILIGHT
3	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
4	F34 14TN/BK	FUSED HEADLAMP SWITCH OUTPUT
5	Z1 20BK	GROUND
6	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
7	–	–
8	L110 20BK/YL	AUTOMATIC HEADLAMP LIGHT SENSOR DRIVER
9	L24 20VT	HEADLAMP SWITCH OUTPUT
10	L109 20WT	AUTOMATIC HEADLAMP LIGHT SENSOR SIGNAL



C240

CAV	CIRCUIT	FUNCTION
1	D2 20WT/GY	CCD BUS(-)
2	D1 20VT/BR	CCD BUS(+)
3	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT
4	G71 20VT/YL	KEY CYLINDER SWITCH SENSE
5	G49 20PK/OR	VTA ARM SENSE
6	X4 20GY/OR	HORN RELAY CONTROL
7	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
8	M2 20YL	DOOR LATCH SWITCH SENSE
9	X3 18BK/TN	FUSED B(+)
10	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
11	L11 16LG/BK	FLASH OUTPUT
12	F86 16LG/RD	FUSED IGNITION SWITCH OUTPUT (ACC)
13	Z1 18BK	GROUND
14	–	–
15	P35 20OR/VT	DOOR LOCK RELAY CONTROL
16	P36 20PK/VT	DOOR UNLOCK RELAY CONTROL
17	G69 20BK/OR	VTA INDICATOR LAMP DRIVER
18	G79 20TN/PK	VTA RELAY CONTROL
19	–	–
20	G70 20BR/TN	HOOD AJAR SWITCH SENSE
21	Z1 18BK	GROUND

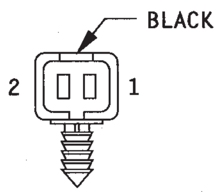
J958W-3



VEHICLE INFORMATION CENTER

C241

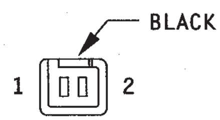
CAV	CIRCUIT	FUNCTION
1	L5 16BK/OR	ELECTRONIC FLASHER RELAY OUTPUT
2	G76 20TN/YL	SIDE REAR DOOR AJAR SWITCH SENSE
3	G74 20TN/RD	RIGHT FRONT DOOR AJAR SWITCH SENSE
4	G75 20TN/PK	LEFT FRONT DOOR AJAR SWITCH SENSE
5	Z1 20BK	GROUND
6	F60 18RD/WT	FUSED B(+)
7	Z1 20BK	GROUND
8	–	–
9	–	–
10	–	–
11	G81 20DB	TONE LINE (CHIME)
12	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL



AUTOMATIC HEADLAMP LIGHT SENSOR

C242

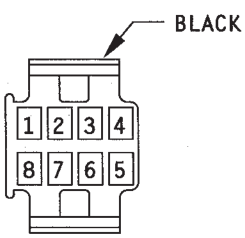
CAV	CIRCUIT	FUNCTION
1	L110 20BK/YL	AUTOMATIC HEADLAMP LIGHT SENSOR DRIVER
2	L109 20WT	AUTOMATIC HEADLAMP LIGHT SENSOR SIGNAL



LEFT I.P. SPEAKER (TWEETER)

C243

CAV	CIRCUIT	FUNCTION
1	X85 20LG/BK	AMPLIFIED LEFT DOOR (-)
2	X87 20LG/RD	AMPLIFIED LEFT DOOR (+)



POWER MIRROR SWITCH

C244

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	F60 18RD/WT	FUSED B(+)
3	P78 20YL/LG	RIGHT MIRROR MOTOR UP/DOWN CONTROL
4	P64 20YL/OR	LEFT MIRROR MOTOR UP/DOWN CONTROL
5	P75 20DB/WT	LEFT MIRROR MOTOR LEFT/RIGHT CONTROL
6	P77 20WT/DB	RIGHT MIRROR MOTOR LEFT/RIGHT CONTROL
7	–	–
8	P79 20DB/LB	MIRROR MOTOR CONTROL

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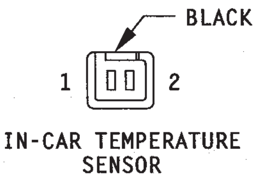
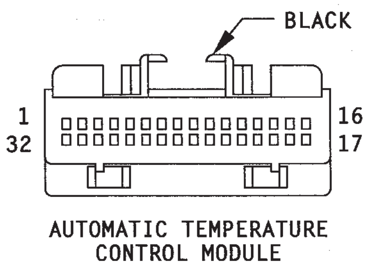


C245

CAV	CIRCUIT	FUNCTION
1	C10 20RD/TN	IN-CAR TEMPERATURE SENSOR SIGNAL
2	D41 20LG/WT	SENSOR GROUND



C246

CAV	CIRCUIT	FUNCTION
1	C37 20TN/BK	MODE DOOR MOTOR DRIVER
2	C35 20DB/WT	BLEND DOOR MOTOR DRIVER
3	C39 20YL	MODE DOOR FEEDBACK SIGNAL
4	–	–
5	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
6	C90 20LG	A/C-HEATER CONTROL SWITCH OUTPUT
7	–	–
8	C40 20DG/YL	5.0 VOLT SUPPLY
9	C43 18BR/YL	BLOWER POWER MODULE OUTPUT
10	D1 20VT/BR	CCD BUS(+)
11	D2 20WT/GY	CCD BUS(-)
12	F71 18PK/DG	FUSED IGNITION SWITCH OUTPUT
13	F60 18RD/WT	FUSED B(+)
14	C36 20DB/RD	BLEND DOOR FEEDBACK SIGNAL
15	G25 20LG/BK	US/METRIC SWITCH OUTPUT
16	–	–
17	–	–
18	C47 20BK/WT	SOLAR SENSOR SIGNAL
19	C8 20DG/RD	AMBIENT TEMPERATURE SENSOR SIGNAL
20	E2 20OR	PANEL LAMPS DRIVER
21	C10 20RD/TN	IN-CAR TEMPERATURE SENSOR SIGNAL
22	–	–
23	–	–
24	D41 20LG/WT	SENSOR GROUND
25	–	–
26	Z4 20BK	GROUND
27	C34 20VT/WT	BLEND DOOR MOTOR DRIVER
28	C41 18BR	HIGH BLOWER MOTOR RELAY CONTROL
29	C33 20VT/OR	BLEND AIR DOOR DRIVER
30	C32 20LB/BK	RECIRCULATION DOOR DRIVER
31	C42 18BR/RD	BLOWER FEEDBACK
32	C38 20DG	MODE DOOR MOTOR DRIVER

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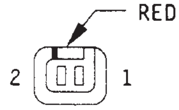
1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-08-95 October, 1995

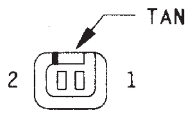
C247



SOLAR SENSOR

CAV	CIRCUIT	FUNCTION
1	C47 20BK/WT	SUN SENSOR SIGNAL
2	D41 20LG/WT	SENSOR GROUND

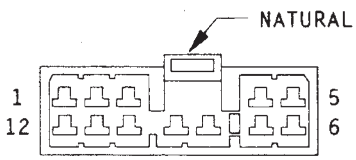
C248



TO GRAPHIC DISPLAY MODULE
(IN-PLANT USE ONLY-METRIC)

CAV	CIRCUIT	FUNCTION
1	G25 20LG/BK	US/METRIC SWITCH OUTPUT
	G25 20LG/BK	US/METRIC SWITCH OUTPUT
2	Z1 20BK	GROUND

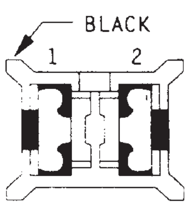
C249 (W/DRL)



I.P.DIMMING/DAYTIME
RUNNING LAMP MODULE
(W/DRL)

CAV	CIRCUIT	FUNCTION
1	–	–
2	352 18OR/WT	FUSED PARK LAMP SWITCH OUTPUT
3	G11 18WT/BK	PARK BRAKE SWITCH SENSE
4	L4 16VT/OR	DIMMER SWITCH LOW BEAM OUTPUT
5	L3 16RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
6	L26 16OR/VT	FUSED B(+)
7	G9 18GY/BK	RED BRAKE WARNING LAMP DRIVER
8	G34 16RD/GY	HIGH BEAM INDICATOR DRIVER
9	Z1 16BK	GROUND
10	F83 18YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
11	52 16OR/BK	DIMMER SWITCH SIGNAL
12	E2 18OR	FUSED PANEL LAMPS DRIVER

C250 (W/MANUAL A/C-HEATER)

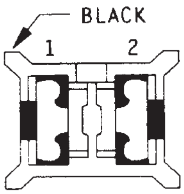


BLOWER MOTOR
(W/MANUAL A/C-HEATER)

CAV	CIRCUIT	FUNCTION
1	C7 12BK/TN	BLOWER MOTOR DRIVER
2	*A19 12RD	GROUND

J958W-3

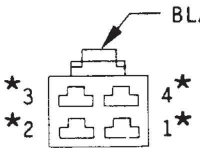
1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-08-95 October, 1995



BLOWER MOTOR
(WITH ATC)

C250 (WITH ATC)

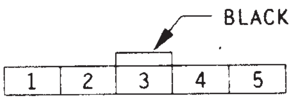
CAV	CIRCUIT	FUNCTION
1	*C42 12RD	BLOWER MOTOR DRIVER
2	Z4 12BK	GROUND



BLOWER MOTOR
RESISTOR BLOCK
(W/MANUAL A/C-HEATER)

C251 (W/MANUAL A/C-HEATER)

CAV	CIRCUIT	FUNCTION
1	C4 14TN	LO BLOWER MOTOR DRIVER
2	C6 14LB	M2 BLOWER MOTOR DRIVER
3	C7 12BK/TN	HI BLOWER MOTOR DRIVER
4	C5 14LG	M1 BLOWER MOTOR DRIVER

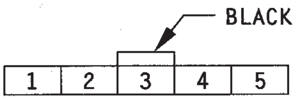


MODE DOOR
MOTOR

C252

CAV	CIRCUIT	FUNCTION
1	C39 20YL	MODE DOOR FEEDBACK SIGNAL
2	C40 20DG/YL	5 VOLT SUPPLY (FROM ATC MODULE)
3	D41 20LG/WT	SENSOR GROUND
4	C38 20DG	MODE DOOR MOTOR DRIVER
5	C37 20TN/BK	MODE DOOR MOTOR DRIVER

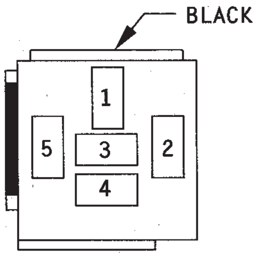
J958W-3



RECIRCULATION DOOR MOTOR

C253

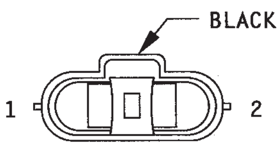
CAV	CIRCUIT	FUNCTION
1	C33 20VT/OR	BLEND AIR DOOR DRIVER
2	–	–
3	–	–
4	C32 20LB/DG	RECIRCULATION DOOR DRIVER
5	F71 18PK/DG	FUSED IGNITION SWITCH OUTPUT (RUN)



HIGH SPEED BLOWER MOTOR RELAY

C254

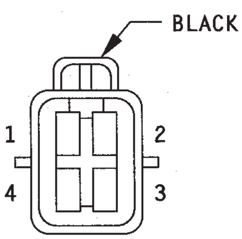
CAV	CIRCUIT	FUNCTION
1	A19 12RD/VT	FUSED B(+)
2	C41 18BR	HIGH BLOWER MOTOR RELAY CONTROL
3	–	–
4	A19 12RD/VT	FUSED B(+)
5	C42 18BR/RD	BLOWER MOTOR DRIVER
6	–	–



BLOWER POWER MODULE

C255

CAV	CIRCUIT	FUNCTION
1	A19 12RD/VT	FUSED B(+)
2	–	–



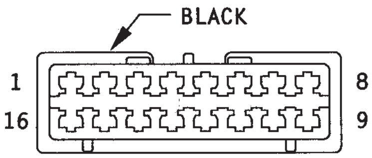
BLOWER POWER MODULE

C256

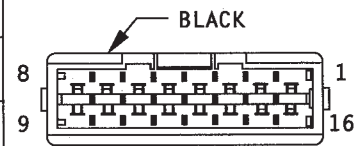
CAV	CIRCUIT	FUNCTION
1	C42 18BR/RD	BLOWER MOTOR DRIVER
2	C43 18BR/YL	BLOWER POWER MODULE OUTPUT
3	Z4 12BK	GROUND
4	–	–

J958W-3

C300

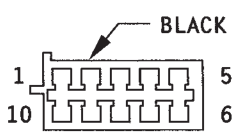


CAV	CIRCUIT
1	–
2	–
3	G71 20VT/YL
4	P36 20PK/VT
5	P35 20OR/VT
6	F60 18RD/WT
7	P34 18PK/BK
8	P2 18BK/WT
9	Q16 14BR/WT
10	Q26 14VT/WT
11	F81 14TN
12	Q18 14GY/BK
13	Q17 14DB/WT
14	Q28 14DG/WT
15	Q27 14RD/BK
16	Q1 14YL/GY

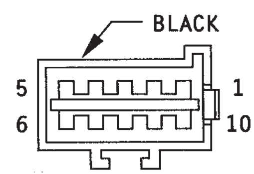


CAV	CIRCUIT
1	–
2	–
3	G71 18VT/YL
3	G71 20VT/YL
4	P36 20PK/VT
5	P35 20OR/VT
6	F60 18RD/WT
6	F60 18RD/WT
7	P34 18PK/BK
7	P34 18PK/BK
8	P2 18BK/WT
8	P2 18BK/WT
9	Q16 14BR/WT
10	Q26 14VT/WT
11	F81 14TN
12	Q18 14GY/BK
13	Q17 14DB/WT
14	Q28 14DG/WT
15	Q27 14RD/BK
16	Q1 14YL/GY

C301



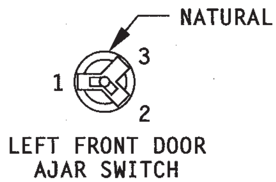
CAV	CIRCUIT
1	X53 20DG
2	X55 20BR/RD
3	C16 20LB/YL
4	P64 20YL/OR
5	P75 20DB/WT
6	–
7	P79 20DB/LB
8	M2 18YL
9	M1 18PK
10	Z1 14BK



CAV	CIRCUIT
1	X53 20DG*
1	X87 16LG/RD**
2	X55 20BR/RD*
2	X85 16LG/BK**
3	C16 20LB/YL
4	P64 20YL/OR
5	P75 20DB/WT
6	–
7	P79 20DB/LB
8	M2 18YL
9	M1 18PK
10	Z1 14BK

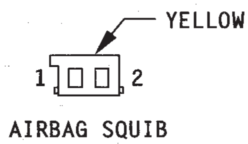
* W/STANDARD RADIO
** W/PREMIUM RADIO

J958W-3



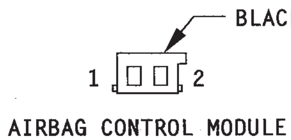
C302

CAV	CIRCUIT	FUNCTION
1	G16 20BK/LB	LEFT FRONT DOOR AJAR SWITCH SENSE
2	M2 18YL	DOOR LATCH SWITCH SENSE
3	Z1 18BK	GROUND



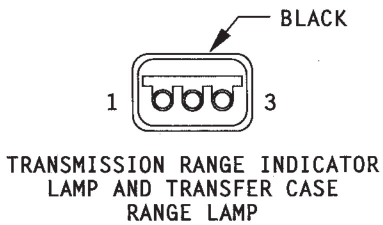
C303

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER AIRBAG LINE 2
2	R43 18BK/LB	DRIVER AIRBAG LINE 1



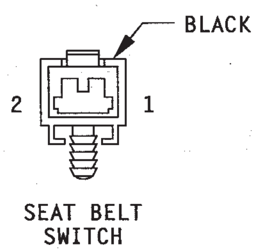
C304

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER AIRBAG LINE 2
2	R43 18BK/LB	DRIVER AIRBAG LINE 1



C305

CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	–	–
3	Z1 20BK	GROUND

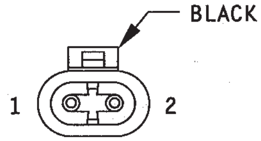


C306

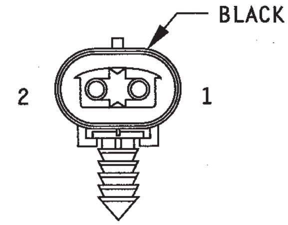
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G10 20LG/RD	SEAT BELT SWITCH SENSE

J958W-3

C307

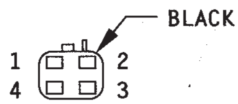


CAV	CIRCUIT
1	Z1 14BK
2	F35 14RD

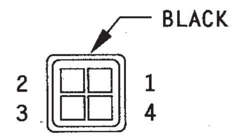


CAV	CIRCUIT
1	Z1 14BK
2	P35 14RD

C308

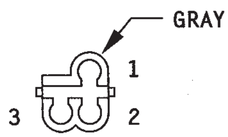


CAV	CIRCUIT
1	P2 18BK/WT
2	X57 20BR/LB*
2	X91 16WT/BK**
3	X51 20BR/YL*
4	P34 18PK/BK

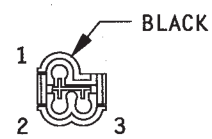


CAV	CIRCUIT
1	P2 18BK/WT
2	X57 20DB/OR
3	X51 20DB/WT
4	P34 18PK/BK

C309



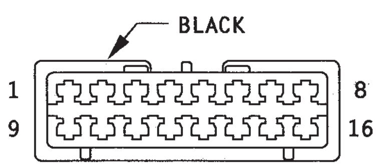
CAV	CIRCUIT
1	Q17 14DB/WT
2	Q27 14RD/BK
3	Q1 14YL/GY

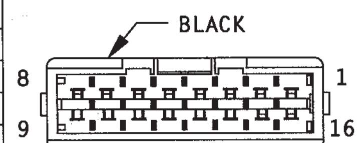


CAV	CIRCUIT
1	Q18 14GY/BK
2	Q28 14DG/WT
3	Q1 14YL/GY

C310

CAV	CIRCUIT
1	L60 18TN
2	L61 18LG
	L61 18LG
3	L10 18BR/LG
4	F35 14RD
5	F60 18RD/WT
6	Q16 14BR/WT
7	M2 18YL
	M2 20YL
8	B40 12LB
9	G71 20VT/YL
10	Q26 14VT/WT
11	Q18 14GY/BK
12	Q28 14DG/WT
13	Q1 14YL/GY
14	G74 20TN/RD
15	G76 20TN/YL
16	G78 20TN/BK

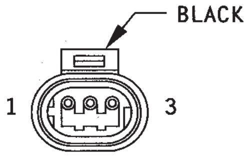




CAV	CIRCUIT
1	L60 18TN
2	L61 18LG
3	L10 18BR/LG
4	F35 14RD
5	F60 18RD/WT
6	Q16 14BR/WT
7	M2 18YL
8	B40 12LB
9	G71 20VT/YL
10	Q26 14VT/WT
11	Q18 14GY/BK
12	Q28 14DG/WT
13	Q1 14YL/GY
14	G74 20TN/RD
15	G76 20TN/YL
16	G78 20TN/BK

* W/STANDARD RADIO
** W/PREMIUM RADIO

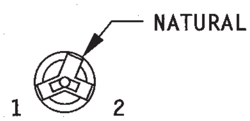
J958W-3



ACCELERATION SWITCH

C311

CAV	CIRCUIT	FUNCTION
1	B42 20TN/WT	ACCELERATION SWITCH #2 SENSE
2	B41 20YL/VT	ACCELERATION SWITCH #1 SENSE
3	B43 20PK/OR	ACCELERATION SWITCH SENSOR GROUND

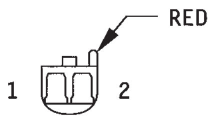


LEFT REAR DOOR
AJAR SWITCH

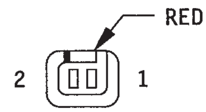
C312

CAV	CIRCUIT	FUNCTION
1	M2 18YL	DOOR LATCH SWITCH SENSE
2	Z1 18BK	GROUND

C313

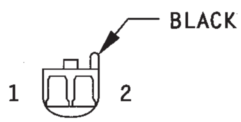


CAV	CIRCUIT
1	B1 20YL/DB
2	B2 20YL

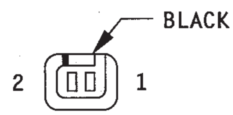


CAV	CIRCUIT
1	B1 20YL/DB
2	B2 20YL

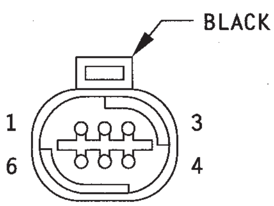
C314



CAV	CIRCUIT
1	B3 20LG/DB
2	B4 20LG



CAV	CIRCUIT
1	B3 20LG/DB
2	B4 20LG



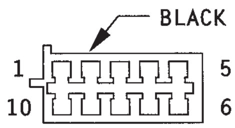
FUEL PUMP
MODULE

C315

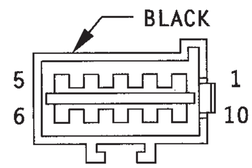
CAV	CIRCUIT	FUNCTION
1	–	–
2	Z2 20BK/OR	GROUND
3	K102 20PK/BK	FUEL LEVEL SENSOR SIGNAL
4	A64 14OR/BK	FUEL PUMP RELAY OUTPUT
5	Z1 14BK	GROUND
6	G44 20VT/WT	FUEL LEVEL SENSOR SIGNAL

J958W-3

C316 (WITHOUT LAMP OUTAGE MODULE)

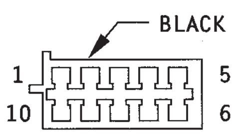


CAV	CIRCUIT
1	F87 18WT/BK
2	G46 20LB/BK
3	L50 18WT/TN
4	L50 18WT/TN
	L50 18WT/TN
5	L50 18WT/TN
	L50 18WT/TN
6	L36 18LG/BK
7	L50 18WT/TN
	L50 18WT/TN
8	L90 16DB/RD
	L90 18DB/RD
9	L90 18DB/RD
	L90 18DB/RD
10	L90 18DB/RD



CAV	CIRCUIT
1	–
2	Z1 18BK
3	L87 18DG/WT
4	L74 18PK/BK
5	L73 18PK/WT
6	L36 18LG/BK
7	L50 18WT/TN
	L50 18WT/TN
8	L90 16DB/RD*
	L90 18DB/RD**
	L90 18DB/RD
9	L22 18LB
10	L21 18LB/WT

C316
(WITH LAMP OUTAGE MODULE – 1 OF 2 CONNECTORS)



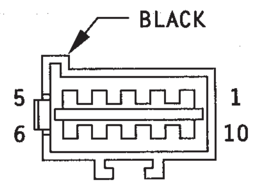
LAMP OUTAGE MODULE

CAV	CIRCUIT	FUNCTION
1	F87 18WT/BK	FUSED IGNITION SWITCH OUTPUT (RUN/START)
2	G46 20LB/BK	REAR LAMP OUT DRIVER
3	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
4	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
5	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
6	L36 18LG/BK	NOT USED
7	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
8	L90 16DB/RD	PARK LAMP SWITCH OUTPUT
	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
9	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
10	L90 18DB/RD	PARK LAMP SWITCH OUTPUT

* W/TRAILER TOW
** W/O TRAILER TOW

J958W-3

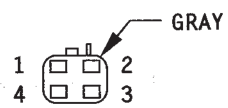
C316
(WITH LAMP OUTAGE MODULE — 2 OF 2 CONNECTORS)



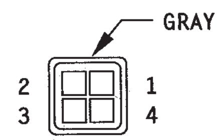
LAMP OUTAGE MODULE

CAV	CIRCUIT	FUNCTION
1	–	–
2	Z1 18BK	GROUND
3	L87 18DG/WT	STOP LAMP SWITCH OUTPUT
4	L74 18PK/BK	STOP LAMP SWITCH OUTPUT
5	L73 18PK/WT	STOP LAMP SWITCH OUTPUT
6	L36 18LG/BK	NOT USED
7	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
8	L90 16DB/RD*	PARK LAMP SWITCH OUTPUT
	L90 18DB/RD**	PARK LAMP SWITCH OUTPUT
	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
9	L22 18LB	PARK LAMP SWITCH OUTPUT
10	L21 18LB/WT	PARK LAMP SWITCH OUTPUT

C317

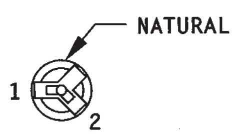


CAV	CIRCUIT
1	P2 18BK/WT
2	X58 20DB/OR‡
2	X92 16TN/BK‡‡
3	X52 20DB/WT‡
3	X94 16TN/RD‡‡
4	P34 18PK/BK



CAV	CIRCUIT
1	P2 18BK/WT
2	X58 20DB/OR
3	X52 20DB/WT
4	P34 18PK/BK

C318



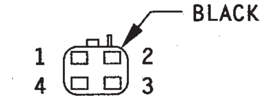
RIGHT REAR DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	M2 18YL	DOOR LATCH SWITCH SENSE
2	Z1 18BK	GROUND

* W/TRAILER TOW
** W/AFTERMARKET TRAILER TOW
‡ W/STANDARD SOUND
‡‡ W/PREMIUM SOUND

J958W-3

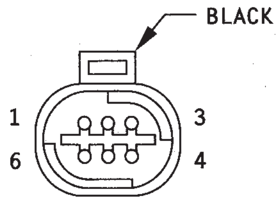
C319



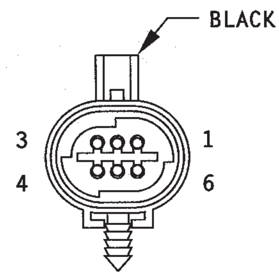
AFTERMARKET TRAILER TOW CONNECTOR

CAV	CIRCUIT	FUNCTION
1	L61 18LG	LEFT TURN SIGNAL
2	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
3	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
4	A18 18RD/BK	FUSED B(+)

C320

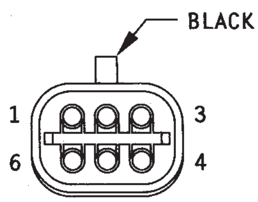


CAV	CIRCUIT
1	L73 18PK/WT
2	L22 18LB
3	L10 18BR/LG
4	–
5	L60 18TN
6	Z1 18BK

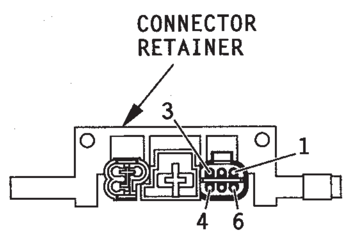


CAV	CIRCUIT
1	L73 18PK/WT
2	L22 18LB
3	L10 18BR/LG
4	–
5	L60 18TN
6	Z1 18BK

C321

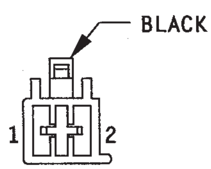


CAV	CIRCUIT
1	L90 18DB/RD
2	–
3	G78 20TN/BK
4	–
5	M4 20GY/BK
6	G71 20VT/YL

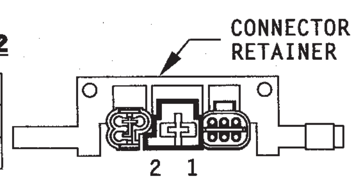


CAV	CIRCUIT
1	L90 18DB/RD
2	–
3	G78 20TN/BK
4	–
5	M4 20GY/BK
6	G71 20VT/YL

C322



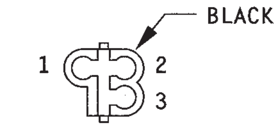
CAV	CIRCUIT
1	C15 12BK/LB
2	–



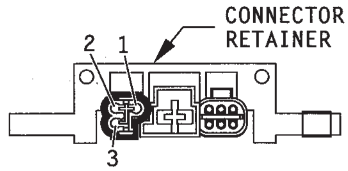
CAV	CIRCUIT
1	C15 12LB/BK
2	–

J958W-3

C323

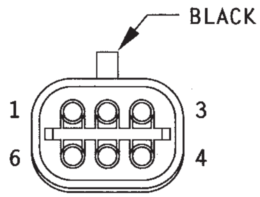


CAV	CIRCUIT
1	–
2	A18 16RD/BK
3	P2 18BK/WT

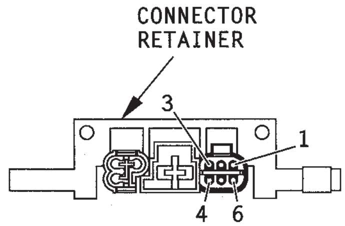


CAV	CIRCUIT
1	–
2	A18 16RD/BK
3	P2 18BK/WT

C324

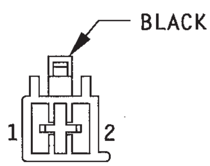


CAV	CIRCUIT
1	V20 16BK/YL
2	–
3	V24 18BR/OR
4	V13 18BR/LG
5	–
6	F60 18RD/WT

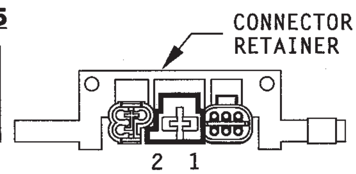


CAV	CIRCUIT
1	V20 18BK/WT
2	–
3	V24 18BR/OR
4	V13 18BR/LG
5	–
6	F60 18RD/WT

C325

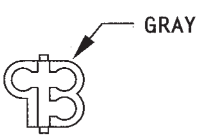


CAV	CIRCUIT
1	Z1 12BK
2	–

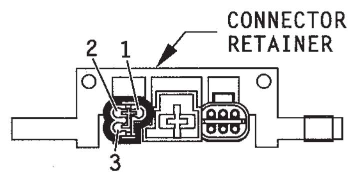


CAV	CIRCUIT
1	Z1 12BK
2	–

C326

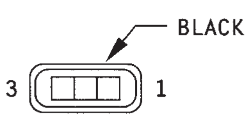


CAV	CIRCUIT
1	L87 18DG/WT
2	Z1 18BK
3	P34 18PK/BK



CAV	CIRCUIT
1	L87 18DG/WT
2	Z1 20BK
3	P34 16PK/BK

C327

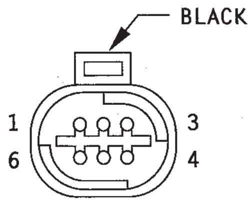


CARGO LAMP

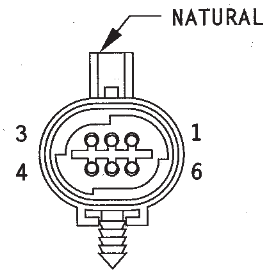
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	M2 20YL	DOOR LATCH SWITCH SENSE
3	M4 20GY/BK	LIFTGATE/LIFTGLASS AJAR SWITCH SENSE

J958W-3

C328

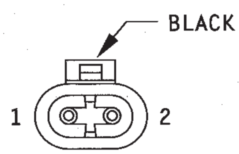


CAV	CIRCUIT
1	L73 18PK/WT
2	L22 18LB
3	L10 18BR/LG
4	–
5	L60 18TN
6	Z1 18BK

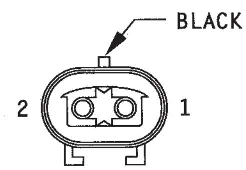


CAV	CIRCUIT
1	L74 18PK/BK
2	L21 18LB/WT
3	L10 18BR/LG
4	L36 18LG/BK
5	L61 18LG
6	Z1 18BK

C329

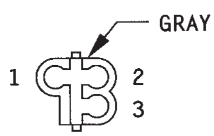


CAV	CIRCUIT
1	Z1 14BK
2	F35 14RD

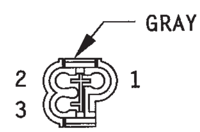


CAV	CIRCUIT
1	Z1 14BK
2	F35 14RD

C330

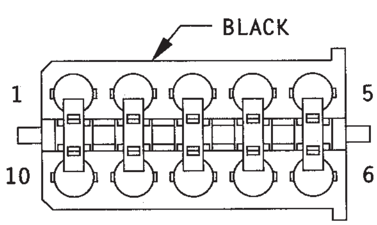


CAV	CIRCUIT
1	Q18 14GY/BK
2	Q28 14DG/WT
3	Q1 14YL/GY

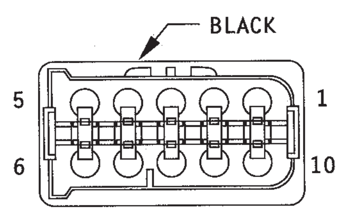


CAV	CIRCUIT
1	Q18 14GY/BK
2	Q28 14DG/WT
3	Q1 14YL/GY

C331



CAV	CIRCUIT
1	L50 18WT/TN
2	L90 16DB/RD
	L90 18DB/RD
3	L10 18BR/LG
	L10 18BR/LG
4	L61 18LG
	L61 18LG
5	L60 18TN
	L60 18TN
6	–
7	–
8	Z1 12BK
9	B40 12LB
10	A18 18RD/BK



CAV	CIRCUIT
1	L50 18WT/TN
2	L90 18DB/RD
3	L10 18BR/LG
4	L61 18LG
5	L60 18TN
6	–
7	–
8	Z1 12BK
9	B40 12LB
10	A18 16RD/BK
	A18 18RD/BK

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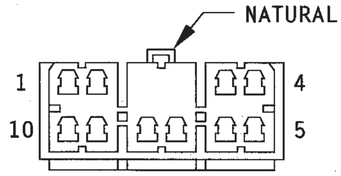
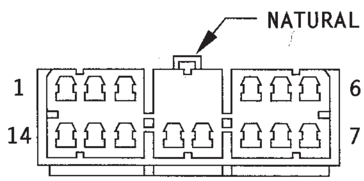
C332



POWER AMPLIFIER

CAV	CIRCUIT	FUNCTION
1	X82 16LB/RD	RIGHT FRONT DOOR (+)
2	X80 16LB/BK	RIGHT FRONT DOOR (-)
3	X94 16TN/RD	RIGHT REAR DOOR (+)
4	X54 20VT/YL	RIGHT FRONT DOOR (+)
5	X56 20DB	RIGHT FRONT DOOR (-)
6	X92 16TN/BK	RIGHT REAR DOOR (-)
7	X64 18GY/OR	ENABLE SIGNAL TO AMPLIFIER
8	–	–
9	X52 20DB/WT	RIGHT REAR DOOR (+)
10	X58 20DB/OR	RIGHT REAR DOOR (-)

C333

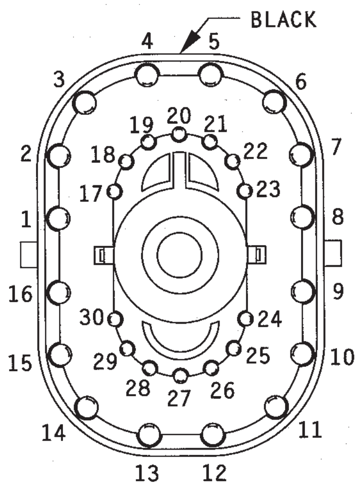


POWER AMPLIFIER

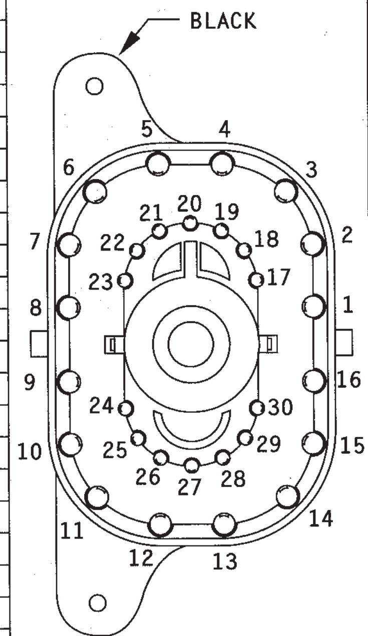
CAV	CIRCUIT	FUNCTION
1	X93 16WT/RD	LEFT REAR DOOR (+)
2	F75 16VT	FUSED B(+)
3	X87 16LG/RD	LEFT FRONT DOOR/I.P. (+)
4	–	–
5	X51 20BR/YL	LEFT REAR DOOR (+)
6	X53 20DG	LEFT FRONT DOOR (+)
7	X55 20BR/RD	LEFT FRONT DOOR (-)
8	X57 20BR/LB	LEFT REAR DOOR (-)
9	–	–
10	Z1 16BK	GROUND
11	Z1 16BK	GROUND
12	X85 16LG/BK	LEFT FRONT DOOR/I.P. (-)
13	F75 16VT	FUSED B(+)
14	X91 16WT/BK	LEFT REAR DOOR (-)

J958W-3

C334

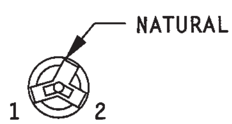


CAV	CIRCUIT
1	C16 18LB/YL
2	–
3	–
4	–
5	–
6	Q26 14VT/WT
7	Q16 14BR/WT
8	–
9	–
10	–
11	P34 18PK/BK
12	P2 18BK/WT
13	Z1 18BK
14	M1 18PK
15	Q1 14YL/GY
16	–
17	–
18	P78 20YL/LG
19	M2 20YL
20	P36 20PK/VT
21	P35 20OR/VT
22	F60 18RD/WT
23	–
24	–
25	X56 20DB/RD
26	X54 20VT
27	–
28	P79 20DB/LB
29	P77 20WT/BK
30	G71 20VT/YL



CAV	CIRCUIT
1	C16 18LB/YL
2	–
3	–
4	–
5	–
6	Q26 14VT/WT
7	Q16 14BR/WT
8	–
9	–
10	–
11	P34 18PK/BK
12	P2 18BK/WT
13	Z1 18BK*
14	M1 18PK
15	Q1 14YL
16	–
17	–
18	P78 20YL/LG
19	M2 20YL
20	P36 20PK/VT
21	P35 20OR/VT
22	F60 18RD/WT
23	–
24	–
25	X56 20DB/RD
26	X54 20VT
27	–
28	P79 20DB/LB
29	P77 20WT/BK
30	G71 20VT/YL

C335



RIGHT FRONT DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	M2 18YL	DOOR LATCH SWITCH SENSE
2	Z1 18BK	GROUND

* 14BK WITH COURTESY LAMPS AND VTA

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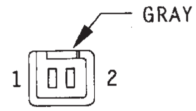
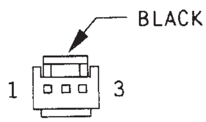
1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-01-96 January, 1996



RIGHT VISOR/
VANITY MIRROR

C336

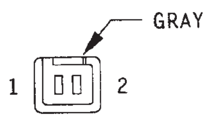
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M1 18PK	FUSED B(+)



AUTOMATIC DAY/
NIGHT REARVIEW MIRROR

C337

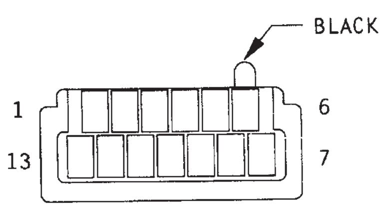
CAV	CIRCUIT	FUNCTION
1	★L10 20BK/RD	BACK-UP LAMP SWITCH SENSE
2	Z1 20BK	GROUND
3	★F83 20BK/YL	FUSED IGNITION FUSED OUTPUT (RUN/START)



LEFT VISOR/
VANITY MIRROR

C338

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M1 18PK	FUSED B(+)

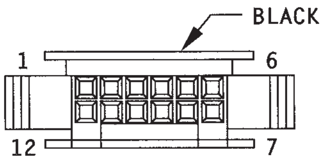


OVERHEAD CONSOLE

C339

CAV	CIRCUIT	FUNCTION
1	G25 20LG/BK	US/METRIC SWITCH OUTPUT
2	Z2 20BK/OR	GROUND
3	G44 20VT/WT	FUEL LEVEL SENSOR SIGNAL
4	–	–
5	L90 20DB/RD	PARK LAMP SWITCH OUTPUT
6	F60 20RD/WT	FUSED B(+)
7	F83 20YL/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
8	M2 20YL	DOOR LATCH SWITCH SENSE
9	C8 20DG/RD	AMBIENT TEMPERATURE SENSOR SIGNAL
10	D41 20LG/WT	SENSOR GROUND
11	D2 20WT/GY	CCD(-)
12	D1 20VT/BR	CCD(+)
13	E2 20OR	PANEL LAMPS DRIVER

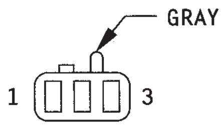
J958W-3



REMOTE KEYLESS ENTRY MODULE

C340

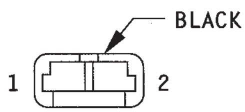
CAV	CIRCUIT	FUNCTION
1	–	–
2	M9 20DB/OR	ILLUMINATED ENTRY RELAY CONTROL
3	P36 20PK/VT	DOOR UNLOCK RELAY CONTROL
4	P35 20OR/VT	DOOR LOCK RELAY CONTROL
5	G49 20PK/OR	VTA ARM SENSE
6	F60 20RD/WT	FUSED B(+)
7	G71 20VT/YL	KEY CYLINDER SWITCH SENSE
8	F83 20YL/DG	FUSED IGNITION SWITCH OUTPUT
9	–	–
10	Z1 20BK	GROUND
11	–	–
12	M2 20YL	DOOR LATCH SWITCH SENSE



DOME/READING LAMP

C341

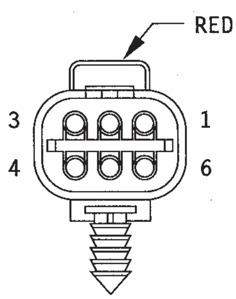
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M2 20YL	COURTESY LAMP DRIVER
3	M1 18PK	FUSED B(+)



RIGHT FRONT DOOR SPEAKER (STANDARD)

C342

CAV	CIRCUIT	FUNCTION
1	X54 20VT	RIGHT FRONT DOOR (+)
2	X56 20DB/RD	RIGHT FRONT DOOR (-)

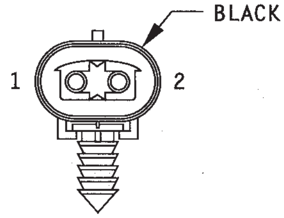


RIGHT POWER MIRROR

C343

CAV	CIRCUIT	FUNCTION
1	C16 18LB/YL	HEATED REAR WINDOW RELAY OUTPUT
2	Z1 18BK	GROUND
3	–	–
4	P78 20YL/LG	MIRROR UP/DOWN CONTROL
5	P77 20WT/BK	MIRROR LEFT/RIGHT CONTROL
6	P79 20DB/LB	MIRROR MOTOR CONTROL

J958W-3

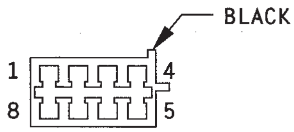


RIGHT FRONT POWER
WINDOW MOTOR

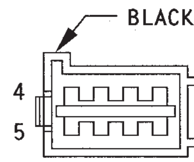
C344

CAV	CIRCUIT	FUNCTION
1	Q22 14VT	RIGHT FRONT WINDOW DOWN CONTROL
2	Q12 14BR	RIGHT FRONT WINDOW UP CONTROL

C345

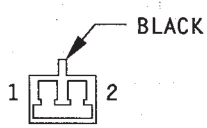


CAV	CIRCUIT
1	P36 20PK/VT
2	F60 18RD/WT
3	P35 20OR/VT
4	Q1 14YL/GY
5	Q26 14VT/WT
6	Q22 14BR/WT
7	Q16 14BR/WT
8	Q12 14BR



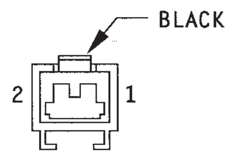
CAV	CIRCUIT
1	P36 20PK/VT
2	F60 18RD/WT
3	P35 20OR/VT
4	Q1 14YL/GY
5	Q26 14VT/WT
6	Q22 14VT
7	Q16 14BR/WT
8	Q12 14BR

C346

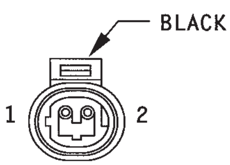


CAV	CIRC
1	M1 18PK
2	M2 20YL

ZJ



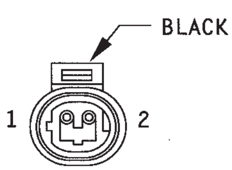
CAV	CIRCUIT
1	M1 20PK
2	M2 20YL



RIGHT FRONT CYLINDER
LOCK SWITCH

C347

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G71 20VT/YL	KEY CYLINDER SWITCH SENSE



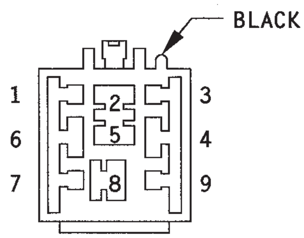
RIGHT FRONT DOOR
LOCK MOTOR

C348

CAV	CIRCUIT	FUNCTION
1	P2 18BK/WT	DOOR LOCK RELAY OUTPUT
2	P34 18PK/BK	DOOR UNLOCK RELAY OUTPUT

J958W-3

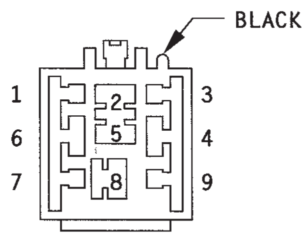
C349



LEFT TURN RELAY

CAV	CIRCUIT	FUNCTION
1	–	–
2	94 18DG	AFTERMARKET TRAILER TOW RELAY OUTPUTS
	94 18DG	AFTERMARKET TRAILER TOW RELAY OUTPUTS
3	–	–
4	L61 18LG	TURN SIGNAL SWITCH OUTPUT (LEFT)
5	95 18PK	AFTERMARKET TRAILER TOW RELAY OUTPUTS
	95 18PK	AFTERMARKET TRAILER TOW RELAY OUTPUTS
6	Z1 18BK	GROUND
7	–	–
8	L61 18LG/OR	LEFT TURN RELAY OUTPUT
9	–	–

C350

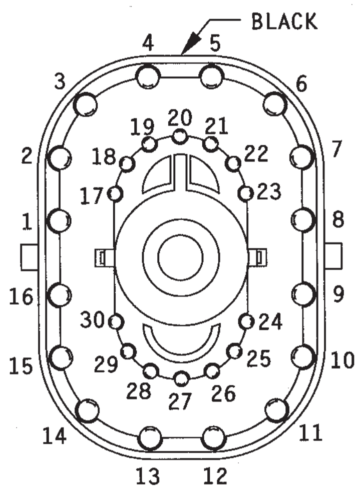


STOP LAMP RELAY

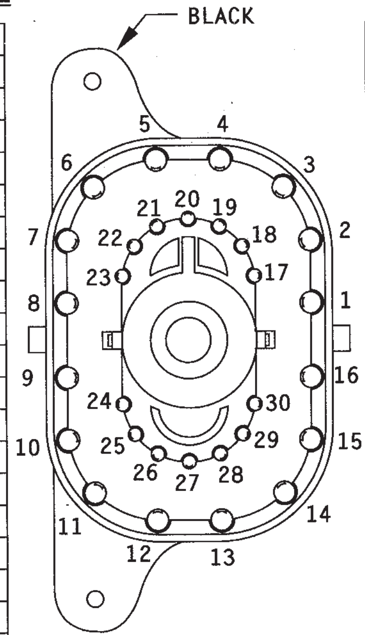
CAV	CIRCUIT	FUNCTION
1	–	–
2	95 18PK	AFTERMARKET TRAILER TOW RELAY OUTPUTS
3	–	–
4	L50 18WT/TN	STOP LAMP SWITCH OUTPUT
5	94 18DG	AFTERMARKET TRAILER TOW RELAY OUTPUTS
6	Z1 18BK	GROUND
7	–	–
8	A18 16RD/WT	FUSED B(+)
9	–	–

J958W-3

C351

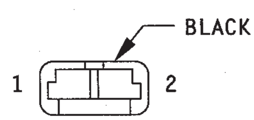


CAV	CIRCUIT
1	C16 18LB/YL
2	Q28 14DG/WT
3	Q17 14DB/WT
4	Q18 14GY/BK
5	F81 14TN
6	Q26 14VT/WT
7	Q16 14BR/WT
8	–
9	–
10	–
11	P34 18PK/BK
12	P2 18BK/WT
13	Z1 18BK
14	M1 18PK
15	Q1 14YL/GY
16	Q27 14RD/BK
17	–
18	P64 20YL/OR
19	M2 18YL
20	P36 20PK/VT
21	P35 20OR/VT
22	F60 18RD/WT
23	–
24	–
25	X55 20BR/RD
26	X53 20DG
27	–
28	P79 20DB/LB
29	P75 20DB/WT
30	G71 20VT/YL



CAV	CIRCUIT
1	C16 18LB/YL
2	Q28 14DG/WT
3	Q17 14DB/WT
4	Q18 14GY/BK
5	F81 14TN
6	Q26 14VT/WT
7	Q16 14BR/WT
8	–
9	–
10	–
11	P34 18PK/BK
12	P2 18BK/WT
13	Z1 18BK*
14	M1 18PK
15	Q1 14YL/GY
16	Q27 14RD/BK
17	–
18	P64 20YL/OR
19	M2 20YL
20	P36 20PK/VT
21	P35 20OR/VT
22	F60 18RD/WT
23	–
24	–
25	X55 20BR/RD
26	X53 20DG
27	–
28	P79 20DB/LB
29	P75 20DB/WT
30	G71 20VT/YL

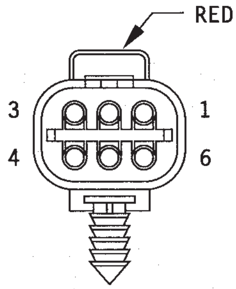
C352



LEFT FRONT DOOR SPEAKER (STANDARD)

CAV	CIRCUIT	FUNCTION
1	X53 20DG	LEFT FRONT DOOR (+)
2	X55 20BR/RD	LEFT FRONT DOOR (-)

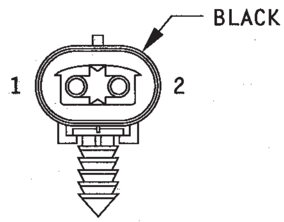
* 14BK WITH COURTESY LAMPS AND VTA



LEFT POWER
MIRROR

C353

CAV	CIRCUIT	FUNCTION
1	C16 18LB/YL	HEATED REAR WINDOW RELAY OUTPUT
2	Z1 18BK	GROUND
3	–	–
4	P64 20YL/OR	MIRROR UP/DOWN CONTROL
5	P75 20DB/WT	MIRROR LEFT/RIGHT CONTROL
6	P79 20DB/LB	MIRROR MOTOR CONTROL

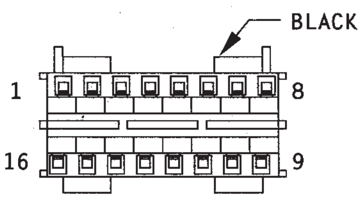


LEFT FRONT POWER
WINDOW MOTOR

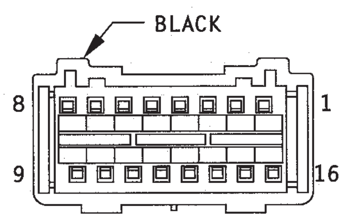
C354

CAV	CIRCUIT	FUNCTION
1	Q21 14WT	LEFT FRONT WINDOW DOWN CONTROL
2	Q11 14LB	LEFT FRONT WINDOW UP CONTROL

C355



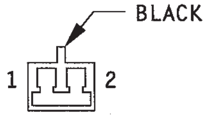
CAV	CIRCUIT
1	Q18 14GY/BK
2	Q17 14DB/WT
3	Q27 14RD/BK
4	Q28 14DG/WT
5	Z1 14BK
6	P35 20OR/VT
7	F60 18RD/WT
8	P36 20PK/VT
9	–
10	–
11	Q16 14BR/WT
12	F81 14TN
13	Q11 14LB
14	Q21 14WT
15	Q26 14VT/WT
16	Q1 14YL/GY



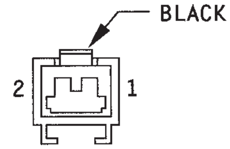
CAV	CIRCUIT
1	Q18 14GY/BK
2	Q17 14DB/WT
3	Q27 14RD/BK
4	Q28 14DG/WT
5	Z1 14BK
6	P35 20OR/VT
7	F60 18RD/WT
8	P36 20PK/VT
9	–
10	–
11	Q16 14BR/WT
12	F81 14TN
13	Q11 14LB
14	Q21 14WT
15	Q26 14VT/WT
16	Q1 14YL/GY

J958W-3

C356

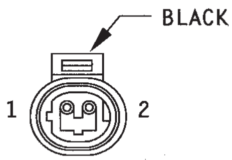


CAV	CIRCUIT
1	M1 18PK
2	M2 20YL



CAV	CIRCUIT
1	M1 20PK
2	M2 20YL

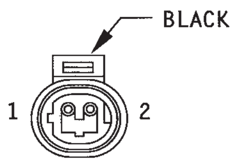
C357



LEFT FRONT
CYLINDER LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G71 20VT/YL	KEY CYLINDER SWITCH SENSE

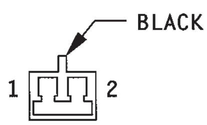
C358



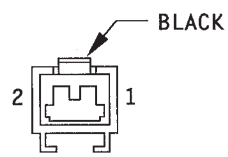
LEFT FRONT DOOR
LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P2 18BK/WT	DOOR LOCK RELAY OUTPUT
2	P34 18PK/BK	DOOR UNLOCK RELAY OUTPUT

C359

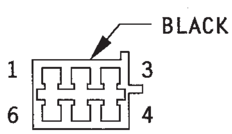


CAV	CIRCUIT
1	L87 18DG/WT
2	Z1 20BK



CAV	CIRCUIT
1	L87 20DG/WT
	L87 20DG/WT
2	Z1 20BK
	Z1 20BK

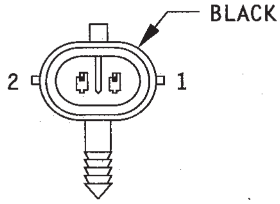
C360



REAR WIPER
MOTOR

CAV	CIRCUIT	FUNCTION
1	A18 16RD/BK	FUSED IGNITION SWITCH OUTPUT (ACC/RUN)
2	V13 18BR/LG	REAR WIPER SWITCH OUTPUT
3	Z1 14BK	GROUND
4	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
5	V20 18BK/WT	REAR WASHER SWITCH OUTPUT
6	V24 18BR/OR	REAR WIPER SWITCH OUTPUT (INT)

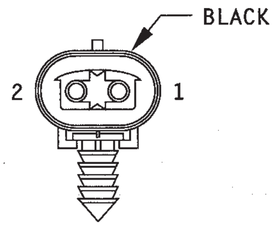
J958W-3



LIFTGLASS LIMIT SWITCH

C361

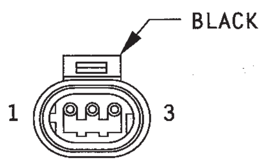
CAV	CIRCUIT	FUNCTION
1	F60 18RD/WT	FUSED B(+)
2	P101 18OR/PK	LIFTGLASS LIMIT SWITCH OUTPUT



LIFTGLASS RELEASE SOLENOID

C362

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	P100 18OR/BR	LIFTGLASS PUSH BUTTON OUTPUT

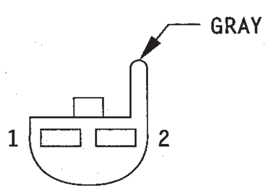


LIFTGLASS AJAR SWITCH

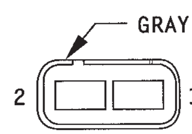
C363

CAV	CIRCUIT	FUNCTION
1	M4 20GY/BK	LIFTGLASS AJAR SWITCH SENSE
2	G78 20TN/BK	LIFTGLASS AJAR SWITCH SENSE
3	Z1 20BK	GROUND

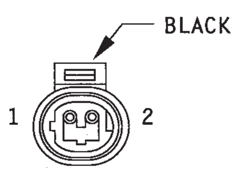
C364



CAV	CIRCUIT
1	L90 18DB/RD
2	Z1 18BK



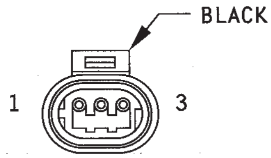
CAV	CIRCUIT
1	L90 20DB/RD
2	Z1 20BK



LIFTGLASS PUSH BUTTON

C365

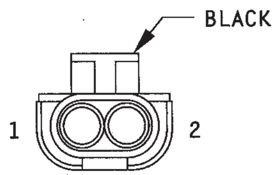
CAV	CIRCUIT	FUNCTION
1	P101 18OR/PK	LIFTGLASS LIMIT SWITCH OUTPUT
2	P100 18OR/BR	LIFTGLASS PUSH BUTTON OUTPUT



LIFTGATE AJAR SWITCH

C366

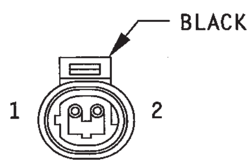
CAV	CIRCUIT	FUNCTION
1	M4 20GY/BK	LIFTGATE TO CARGO LAMP
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
3	Z1 20BK	GROUND



LIFTGATE LOCK MOTOR

C367

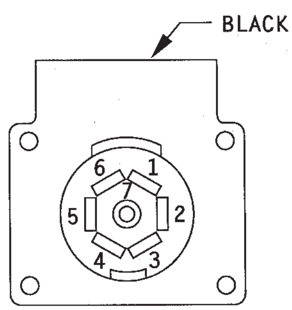
CAV	CIRCUIT	FUNCTION
1	P2 16BK/WT	DOOR LOCK RELAY OUTPUT
2	P34 16PK/BK	DOOR UNLOCK RELAY OUTPUT



LIFTGATE
CYLINDER LOCK SWITCH

C368

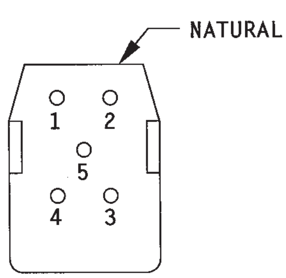
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G71 20VT/YL	KEY CYLINDER SWITCH SENSE



FACTORY TRAILER
TOW CONNECTOR

C369

CAV	CIRCUIT	FUNCTION
1	A18 18RD/BK	FUSED B(+)
2	L60 18TN	RIGHT TURN RELAY OUTPUT
3	B40 12LB	ELECTRONIC BRAKE PROVISION OUTPUT
4	Z1 12BK	GROUND
5	L61 18LG	LEFT TURN RELAY OUTPUT
6	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
7	L10 18BR/LG	BACK-UP LAMP SWITCH SENSE



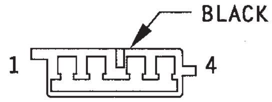
SUNROOF SWITCH

C370

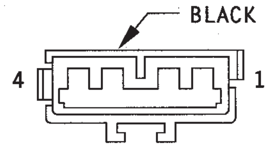
CAV	CIRCUIT	FUNCTION
1	Q41 14WT	SUNROOF SWITCH OUTPUT (OPEN)
2	–	–
3	Q42 14LB	SUNROOF SWITCH OUTPUT (CLOSE)
4	–	–
5	F81 14TN	FUSED B(+)

J958W-3

C371

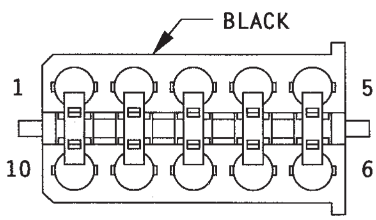


CAV	CIRCUIT
1	F81 14TN
2	Q42 14LB
3	Q41 14WT
4	Z1 14BK

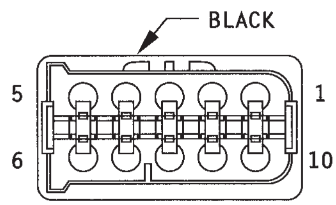


CAV	CIRCUIT
1	F81 14TN
2	Q42 14LB
3	Q41 14WT
4	Z1 14BK

C372

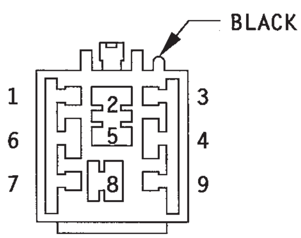


CAV	CIRCUIT
1	L60 18TN
2	L61 18LG
3	L10 18BR/LG
4	L90 18DB/RD
5	–
6	A18 18RD/BK
7	–
8	B40 12LB
9	Z1 12BK
10	–



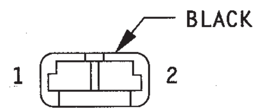
CAV	CIRCUIT
1	L60 18TN/OR
2	L61 18LG/OR
3	L10 18BR/LG
4	L90 18DB/RD
5	–
6	A18 16RD/WT
7	–
8	B40 12LB
9	Z1 12BK
10	–

C373



RIGHT TURN RELAY

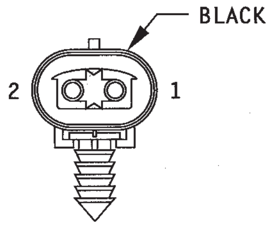
CAV	CIRCUIT	FUNCTION
1	–	–
2	94 18DG	AFTERMARKET TRAILER TOW RELAY OUTPUTS
3	–	–
4	L60 18TN	TURN SIGNAL SWITCH OUTPUT (RIGHT)
5	95 18PK	AFTERMARKET TRAILER TOW RELAY OUTPUTS
6	Z1 18BK	GROUND
7	–	–
8	L60 18TN/OR	RIGHT TURN RELAY OUTPUT
9	–	–



RIGHT REAR
DOOR SPEAKER

C374

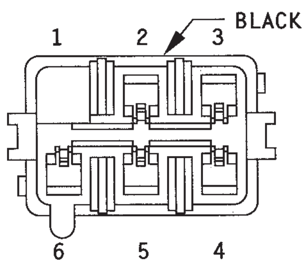
CAV	CIRCUIT	FUNCTION
1	X52 20DB/WT	RIGHT REAR DOOR (+)
2	X58 20DB/OR	RIGHT REAR DOOR (-)



RIGHT REAR POWER
WINDOW MOTOR

C375

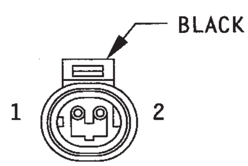
CAV	CIRCUIT	FUNCTION
1	Q22 14VT	RIGHT REAR WINDOW DOWN CONTROL
2	Q12 14BR	RIGHT REAR WINDOW UP CONTROL



RIGHT REAR POWER
WINDOW SWITCH

C376

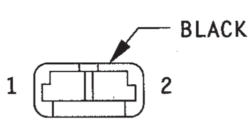
CAV	CIRCUIT	FUNCTION
1	–	–
2	Q28 14DG/WT	RIGHT REAR WINDOW DOWN CONTROL
3	Q22 14VT	RIGHT REAR WINDOW DOWN CONTROL
4	Q18 14GY/BK	RIGHT REAR WINDOW UP CONTROL
5	Q12 14BR	RIGHT REAR WINDOW UP CONTROL
6	Q1 14YL/GY	LEFT FRONT POWER WINDOW SWITCH OUTPUT



RIGHT REAR DOOR
LOCK MOTOR

C377

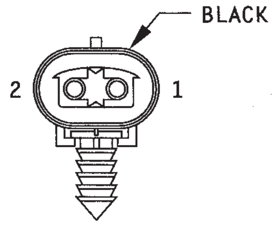
CAV	CIRCUIT	FUNCTION
1	P2 18BK/WT	DOOR LOCK RELAY OUTPUT
2	P34 18PK/BK	DOOR UNLOCK RELAY OUTPUT



LEFT REAR
DOOR SPEAKER

C378

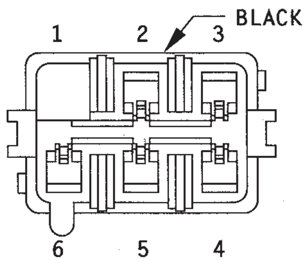
CAV	CIRCUIT	FUNCTION
1	X52 20DB/WT	LEFT REAR DOOR (+)
2	X58 20DB/OR	LEFT REAR DOOR (-)



LEFT REAR POWER
WINDOW MOTOR

C379

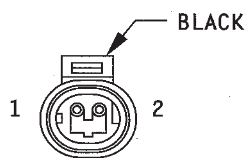
CAV	CIRCUIT	FUNCTION
1	Q22 14VT	LEFT REAR WINDOW DOWN CONTROL
2	Q12 14BR	LEFT REAR WINDOW UP CONTROL



LEFT REAR POWER
WINDOW SWITCH

C380

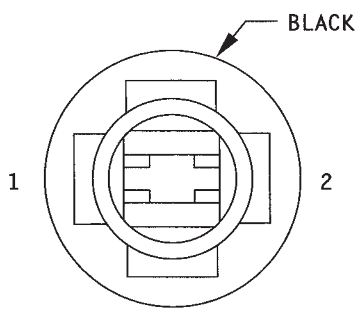
CAV	CIRCUIT	FUNCTION
1	–	–
2	Q28 14DG/WT	LEFT REAR WINDOW DOWN CONTROL
3	Q22 14VT	LEFT REAR WINDOW DOWN CONTROL
4	Q18 14GY/BK	LEFT REAR WINDOW UP CONTROL
5	Q12 14BR	LEFT REAR WINDOW UP CONTROL
6	Q1 14YL/GY	LEFT FRONT POWER WINDOW SWITCH OUTPUT



LEFT REAR DOOR
LOCK MOTOR

C381

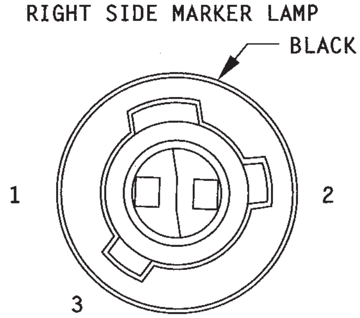
CAV	CIRCUIT	FUNCTION
1	P2 18BK/WT	DOOR LOCK RELAY OUTPUT
2	P34 18PK/BK	DOOR UNLOCK RELAY OUTPUT



RIGHT SIDE MARKER LAMP

C400

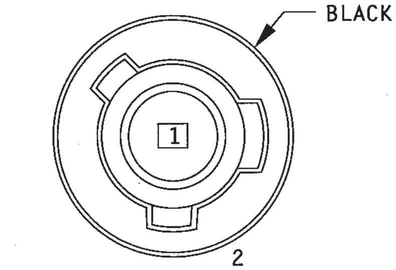
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L22 18LB	PARK LAMP SWITCH OUTPUT



RIGHT TAIL/STOP LAMP

C401

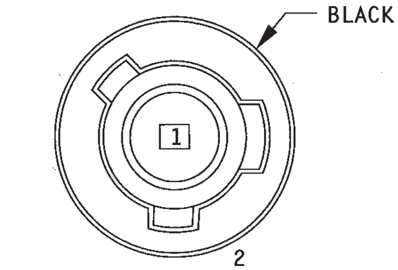
CAV	CIRCUIT	FUNCTION
1	L73 18PK/WT	STOP LAMP SWITCH OUTPUT
2	L22 18LB	PARK LAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



RIGHT BACK-UP LAMP

C402

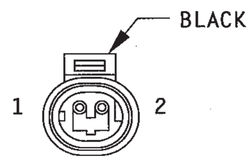
CAV	CIRCUIT	FUNCTION
1	L10 18BR/LG	BACK-UP LAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



RIGHT REAR TURN SIGNAL LAMP

C403

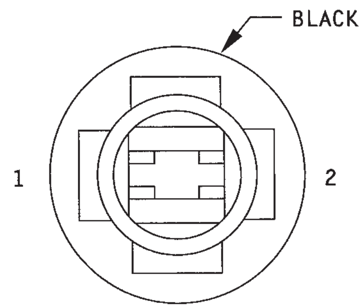
CAV	CIRCUIT	FUNCTION
1	L60 18TN	TURN SIGNAL SWITCH OUTPUT
2	Z1 18BK	GROUND



LEFT REAR WHEEL SPEED SENSOR

C404

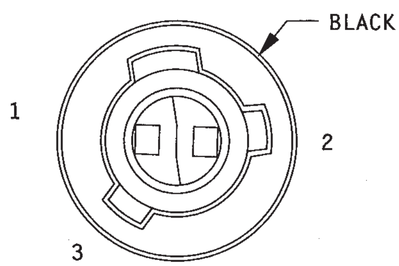
CAV	CIRCUIT	FUNCTION
1	B4 20LG	LEFT REAR WHEEL SPEED SENSOR (+)
2	B3 20LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)



LEFT SIDE MARKER LAMP

C405

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L22 18LB	PARK LAMP SWITCH OUTPUT

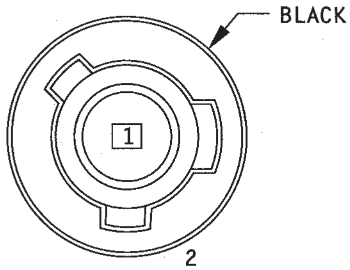


LEFT TAIL/STOP LAMP

C406

CAV	CIRCUIT	FUNCTION
1	L73 18PK/WT	STOP LAMP SWITCH OUTPUT
2	L22 18LB	PARK LAMP SWITCH OUTPUT
3	Z1 18BK	GROUND

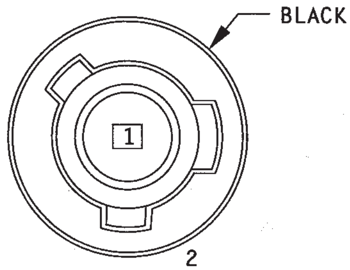
J958W-3



LEFT BACK-UP LAMP

C407

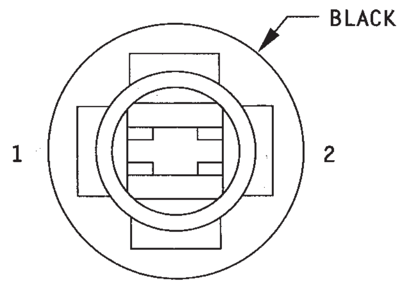
CAV	CIRCUIT	FUNCTION
1	L10 18BR/LG	BACK-UP LAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



LEFT REAR TURN SIGNAL LAMP

C408

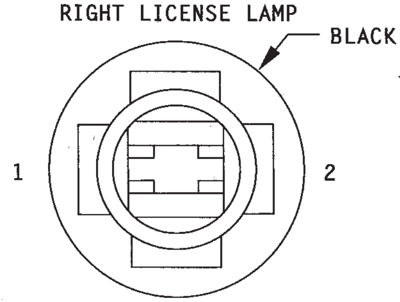
CAV	CIRCUIT	FUNCTION
1	L60 18TN	TURN SIGNAL SWITCH OUTPUT
2	Z1 18BK	GROUND



RIGHT LICENSE LAMP

C409

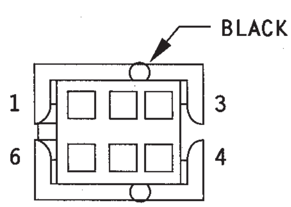
CAV	CIRCUIT	FUNCTION
1	L90 20DB/RD	PARK LAMP SWITCH OUTPUT
2	Z1 20BK	GROUND



LEFT LICENSE LAMP

C410

CAV	CIRCUIT	FUNCTION
1	L90 20DB/RD	PARK LAMP SWITCH OUTPUT
2	Z1 20BK	GROUND



RIGHT POWER SEAT MOTORS

C411

CAV	CIRCUIT	FUNCTION
1	P16 14RD/LB	RIGHT POWER SEAT HORZ RWD
2	P10 14YL/WT	RIGHT POWER SEAT REAR UP
3	P12 14RD/WT	RIGHT POWER SEAT REAR DOWN
4	P18 14YL/LG	RIGHT POWER SEAT FRONT UP
5	P20 14RD/LG	RIGHT POWER SEAT FRONT DOWN
6	P14 14YL/LB	RIGHT POWER SEAT HORZ FWD

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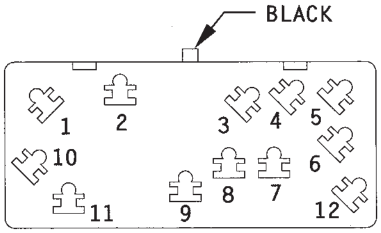
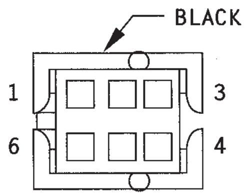
C412



PASSENGER'S POWER SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	P12 14RD/WT	RIGHT POWER SEAT REAR DOWN
2	P16 14RD/LB	RIGHT POWER SEAT HORZ RWD
3	P20 14RD/LG	RIGHT POWER SEAT FRONT DOWN
4	–	–
5	–	–
6	–	–
7	P18 14YL/LG	RIGHT POWER SEAT FRONT UP
8	F35 14RD	FUSED B(+)
9	P14 14YL/LB	RIGHT POWER SEAT HORZ FWD
10	P10 14YL/WT	RIGHT POWER SEAT REAR UP
11	Z1 14BK	GROUND
12	–	–

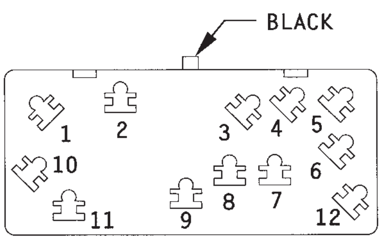
C413



LEFT POWER SEAT MOTORS

CAV	CIRCUIT	FUNCTION
1	P17 14RD/LB	LEFT POWER SEAT HORZ RWD
2	P11 14YL/WT	LEFT POWER SEAT REAR UP
3	P13 14RD/WT	LEFT POWER SEAT REAR DOWN
4	P19 14YL/LG	LEFT POWER SEAT FRONT UP
5	P21 14RD/LG	LEFT POWER SEAT FRONT DOWN
6	P15 14YL/LB	LEFT POWER SEAT HORZ FWD

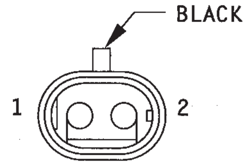
C414



DRIVER'S POWER SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	P11 14YL/WT	LEFT POWER SEAT REAR UP
2	P17 14RD/LB	LEFT POWER SEAT HORZ RWD
3	P19 14YL/LG	LEFT POWER SEAT FRONT UP
4	–	–
5	–	–
6	–	–
7	P21 14RD/LG	RIGHT POWER SEAT FRONT DOWN
8	F35 14RD	FUSED B(+)
9	P15 14YL/LB	LEFT POWER SEAT HORZ FWD
10	P13 14RD/WT	LEFT POWER SEAT REAR DOWN
11	Z1 14BK	GROUND
12	–	–

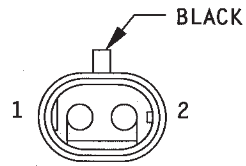
J958W-3



LEFT FOG LAMP

C415

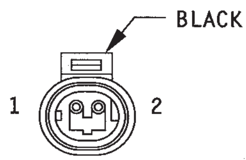
CAV	CIRCUIT	FUNCTION
1	L39 20LB/BK	FOG LAMPS SWITCH OUTPUT
2	Z1 20BK	GROUND



RIGHT FOG LAMP

C416

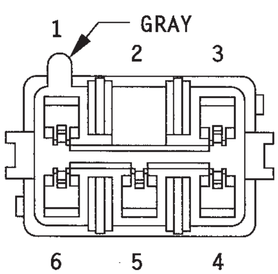
CAV	CIRCUIT	FUNCTION
1	L39 20LB/BK	FOG LAMPS SWITCH OUTPUT
2	Z1 20BK	GROUND



UNDERHOOD LAMP

C417

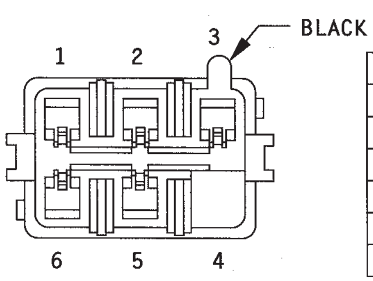
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	Z1 18BK	GROUND



RIGHT POWER DOOR
LOCK SWITCH

C418

CAV	CIRCUIT	FUNCTION
1	–	–
2	–	–
3	P36 20PK/VT	DOOR UNLOCK RELAY CONTROL
4	–	–
5	P35 20OR/VT	DOOR LOCK RELAY CONTROL
6	F60 18RD/WT	FUSED B(+)



RIGHT FRONT POWER
WINDOW SWITCH

C419

CAV	CIRCUIT	FUNCTION
1	Q16 14BR/WT	RIGHT FRONT WINDOW UP CONTROL
2	Q12 14BR	RIGHT FRONT WINDOW UP CONTROL
3	Q1 14YL/GY	LEFT FRONT POWER WINDOW SWITCH OUTPUT
4	–	–
5	Q26 14VT/WT	RIGHT FRONT WINDOW DOWN CONTROL
6	Q22 14VT	RIGHT FRONT WINDOW DOWN CONTROL

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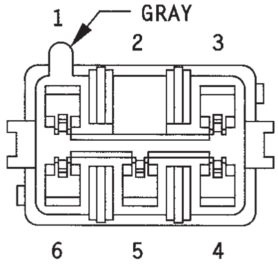
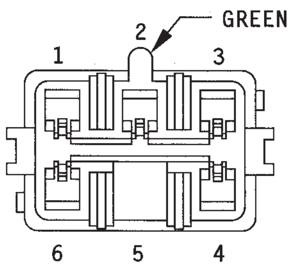


LEFT POWER DOOR LOCK SWITCH

C420

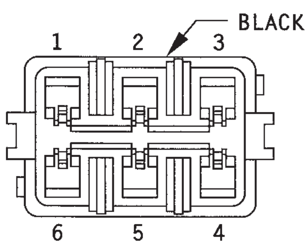
CAV	CIRCUIT	FUNCTION
1	–	–
2	–	–
3	P36 20PK/VT	DOOR UNLOCK RELAY CONTROL
4	–	–
5	P35 20OR/VT	DOOR LOCK RELAY CONTROL
6	F60 18RD/WT	FUSED B(+)



LEFT FRONT POWER WINDOW SWITCH

C421

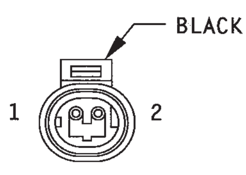
CAV	CIRCUIT	FUNCTION
1	Q27 14RD/BK	LEFT REAR WINDOW DOWN CONTROL
2	Q28 14DG/WT	RIGHT REAR WINDOW DOWN CONTROL
3	Z1 14BK	GROUND
4	Q18 14GY/BK	RIGHT REAR MOTOR UP CONTROL
5	–	–
6	Q17 14DB/WT	LEFT REAR WINDOW UP CONTROL



LEFT FRONT POWER WINDOW SWITCH

C422

CAV	CIRCUIT	FUNCTION
1	Q21 14WT	LEFT FRONT WINDOW DOWN CONTROL
2	Q26 14VT/WT	RIGHT FRONT WINDOW DOWN CONTROL
3	Q1 14YL/GY	LEFT FRONT POWER WINDOW SWITCH OUTPUT
4	Q16 14BR/WT	RIGHT FRONT WINDOW UP CONTROL
5	F81 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
6	Q11 14LB	LEFT FRONT WINDOW UP CONTROL



RIGHT REAR WHEEL SPEED SENSOR

C423

CAV	CIRCUIT	FUNCTION
1	B1 20YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 20YL	RIGHT REAR WHEEL SPEED SENSOR (+)

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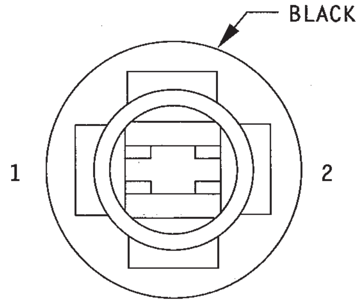
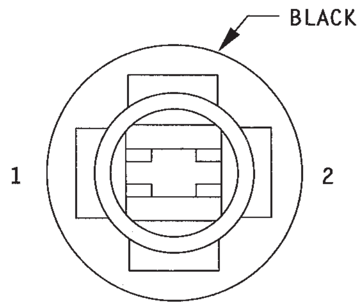


RIGHT FRONT PARK LAMP

C424

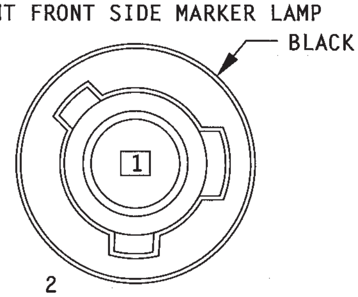
CAV	CIRCUIT	FUNCTION
1	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



RIGHT FRONT SIDE MARKER LAMP

C425

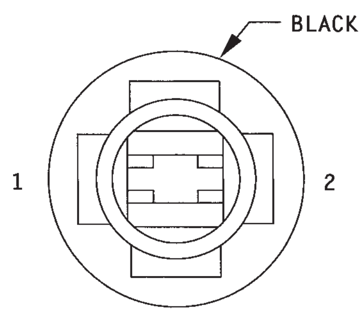
CAV	CIRCUIT	FUNCTION
1	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
2	L64 18TN/DB	TURN SIGNAL SWITCH OUTPUT



RIGHT FRONT TURN
SIGNAL LAMP

C426

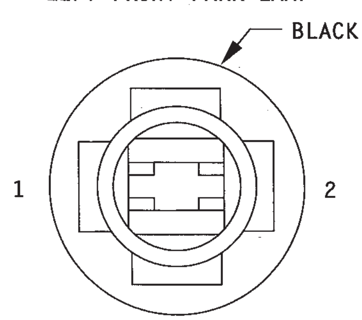
CAV	CIRCUIT	FUNCTION
1	L64 18TN/DB	TURN SIGNAL SWITCH OUTPUT
2	Z1 18BK	GROUND



LEFT FRONT PARK LAMP

C427

CAV	CIRCUIT	FUNCTION
1	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



LEFT FRONT SIDE MARKER LAMP

C428

CAV	CIRCUIT	FUNCTION
1	L90 18DB/RD	PARK LAMP SWITCH OUTPUT
2	L64 18TN/DB	TURN SIGNAL SWITCH OUTPUT

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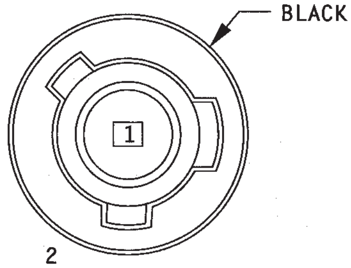
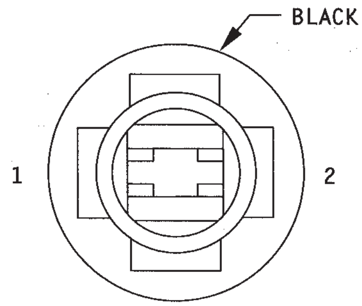


LEFT FRONT TURN SIGNAL LAMP

C429

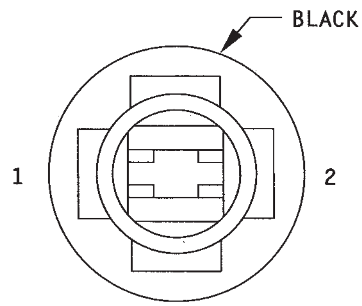
CAV	CIRCUIT	FUNCTION
1	L64 18TN/DB	TURN SIGNAL SWITCH OUTPUT
2	Z1 18BK	GROUND



RIGHT FRONT DOOR COURTESY LAMP

C430

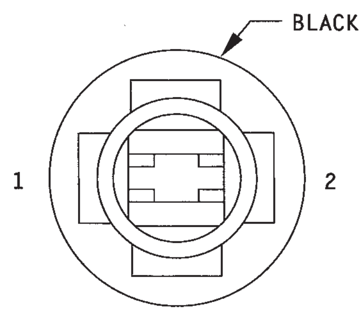
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	M2 20YL	COURTESY LAMPS DRIVER



LEFT FRONT DOOR COURTESY LAMP

C431

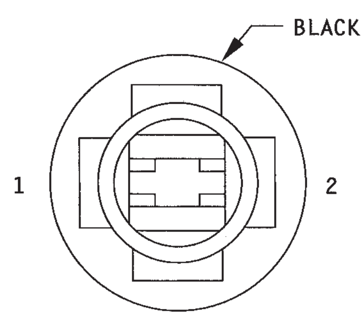
CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	M2 20YL	COURTESY LAMPS DRIVER



CENTER HIGH MOUNTED STOP LAMP

C432

CAV	CIRCUIT	FUNCTION
1	L87 20DG/WT	STOP LAMP SWITCH OUTPUT
2	Z1 20BK	GROUND



CENTER HIGH MOUNTED STOP LAMP

C433

CAV	CIRCUIT	FUNCTION
1	L87 20DG/WT	STOP LAMP SWITCH OUTPUT
2	Z1 20BK	GROUND

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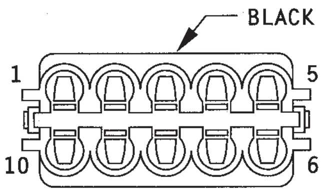
C434



SUNROOF CONTROL MODULE

CAV	CIRCUIT	FUNCTION
1	18WT	SLIDING ROOF POSITION SWITCH OUTPUT
2	18GN	SLIDING ROOF POSITION SWITCH OUTPUT
3	18BR	SLIDING ROOF POSITION SWITCH OUTPUT
4	18BK	SLIDING ROOF MOTOR DRIVER
5	18GN	SLIDING ROOF MOTOR DRIVER
6	–	–
7	Z1 14BK	GROUND
8	F81 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
9	Q42 14LB	SUNROOF SWITCH OUTPUT (CLOSE)
10	Q41 14WT	SUNROOF SWITCH OUTPUT (OPEN)

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CONNECTOR LOCATIONS

GENERAL INFORMATION

This section provides illustrations identifying component and connector locations in the vehicle. A connector index is provided. Use the wiring diagrams in each section for connector number identification. Refer to the index for the proper figure number.

CONNECTOR LOCATIONS

Connector #	Color	Location	Fig.
C100	BK	Below Left Headlamp Opening	2
C101	BK	Below Left Headlamp Opening	2
C102	BK	Left Fender Side Shield	
C103	BK	Behind Headlamp	1
C104	BK	Left Fender Side Shield	2
C105	BK	Left Fender Side Shield	
C106	BK	On Brake Booster	
C107	BK	Below Brake Master Cylinder	2
C108	BK	Below Brake Master Cylinder	2
C109	BK	Rear of Washer Fluid Reservoir	2
C110	BK	Bottom of Washer Fluid Reservoir	2
C111	BK	Bottom of Washer Fluid Reservoir	2
C112	BK	Center of Dash Panel	2
C113	BK	Top of Washer Fluid Reservoir	2
C114	BK	Left Kick Panel	9
C115	BK	Left Kick Panel	9
C116	BK	Left Kick Panel	9
C117	BK	Left Side of I.P.	
C118	BK	Left Side of I.P.	
C119	BK	Below Power Steering Pump (4.0L)	4
C119	BK	In Exhaust Down Pipe (5.2L)	
C120	BK	On Thermostat Housing	4
C121	BK	Injector #1 (4.0L)	4
C121	BK	Injector #1 (5.2L)	5
C122	BK	Injector #2 (4.0L)	4
C122	BK	Injector #2 (5.2L)	5
C123	BK	Injector #3 (4.0L)	4
C123	BK	Injector #3 (5.2L)	5
C124	BK	Injector #4 (4.0L)	4
C124	BK	Injector #4 (5.2L)	5
C125	BK	On Throttle Body (4.0L)	4
C125	BK	On Throttle Body (5.2L)	5
C126	BK	On Throttle Body (4.0L)	4
C126	BK	On Throttle Body (5.2L)	5
C127	BK	Rear of Intake Manifold (4.0L)	4
C127	BK	Front Right of Intake Manifold (5.2L)	5
C128	BK	Center of Dash Panel (4.0L Engine)	3
C129	BK	Injector #5 (4.0L)	4
C129	BK	Injector #5 (5.2L)	5
C130	BK	Injector #6 (4.0L)	4
C130	BK	Injector #6 (5.2L)	5
C131	BK	Bottom Left of I.P.	
C132	BK	Bottom Left of I.P	
C133	BK	Left Side of I.P.	
C134	BK	Rear of Transmission (2WD) Rear of Transfer Case (4WD)	6
C135	BK	Right Side of Transmission	6
C136	BK	Left Side of Transmission	6
C137	BK	Rear of Intake Manifold (4.0L)	4
C137	BK	Below Distributor (5.2L)	4
C138	BK	Near Distributor (4.0L)	4
C138	BK	Near Distributor (5.2L)	5
C139	BK	At Distributor (4.0L)	4
C139	BK	At Distributor (5.2L)	5
C140	BK	Right Side of Dash Panel	3
C141	BK	Right Rear of Dash Panel	3
C142	BK	Right Side of Dash Panel	3
C143	BK	On A/C Compressor	4
C144	BK	Right Fender Side Shield, Below PDC	
C145	BK	Right Side of Engine Block (4.0L)	4
C145	BK	Right Front of Engine (5.2L)	5
C146	BK	Rear of Generator (4.0L)	4
C146	BK	Rear of Generator (5.2L)	5
C147	BK	At Starter Motor	4
C148	BK	Bottom Left of Radiator Closure Panel	3
C149	BK	Behind Headlamp	1
C150	BK	Behind Lens	
C151	BK	Bottom Right of Radiator Closure Panel	3
C152	BK	Bottom Right of Radiator Closure Panel	3
C153	BK	Bottom Right of Radiator Closure Panel	3
C154	BK	Below Power Distribution Center (PDC)	3
C155	BK	Right Fender Side Shield	3
C156	BK	Right Fender Side Shield	3
C157	BK	Right Fender Side Shield	3
C158	BK	Right Side of Dash Panel	3
C159	BK	Right Side of Dash Panel	20
C160	BK	Lower Right of I.P., Near HVAC	10
C161	BK	Under Floor Console	11
C162	BK	Under Floor Console	11
C163	BK	Under Floor Console	11
C164	BK	Lower Right of I.P.	
C165	BK	Lower Right of I.P.	
C166	BK	Lower Right of I.P.	
C167	BK	Left Side of I.P., Above Brake Pedal	9
C168	BK	Left Side of I.P.	
C169	BK	Left Side of Transmission	
C170	BK	Left Side of Transmission	6
C171	BK	Left Side of Transmission	6
C172	BK	Rear of Generator	5
C173	BK	Top of Intake Manifold	5
C174	BK	Left Fender Side Shield	2

Connector #	Color	Location	Fig.
C175	BK	Injector #7	5
C176	BK	Injector #8	5
C177	BK	Center Rear of Engine Compartment	
C178	BK	Right Rear of Engine	5
C179	BK	Center of Grille Opening	1
C180	BK	Right Side of Grille Opening	1
C181	BK	On Throttle Body	5
C182	BK	Left Side of Transmission	6
C200	BK	Lower Right of I.P.	18
C201	GR	Lower Right of I.P.	18
C202	RD	Lower Right of I.P.	18
C203	BK	Lower Right of I.P.	18
C204	BK	Lower Right of I.P.	18
C205	BK	Right Bottom of I.P.	7
C206	BK	Lower Right of I.P., Near HVAC	10
C207	BK	In Glove Box	7
C208	BK	In Glove Box	8
C209	BK	Center of I.P.	8
C210	BK	Center of I.P.	7
C211	BK	Center of I.P.	7
C212	RD	Center of I.P.	7
C213	BK	At HVAC Housing	
C214	BK	Center of I.P.	8
C215	BK	Center of I.P.	8
C216	BK	Center of I.P.	8
C217	BK	Rear of Switch	
C218	BK	Rear of Switch	
C219	BK	Center of I.P.	7
C220	BK	Center of I.P.	7
C221	BK	Center of I.P.	7
C222	BK	Rear of Cluster	7
C223	BK	Left Side of I.P.	7
C224	BK	Bottom Left of I.P.	7
C225	NAT	Left Front of Steering Column	12
C226	GY	Right Front of Steering Column	12
C227	BK	Bottom Left of I.P.	7
C228	RD	Right Front of I.P.	12
C229	BK	Left Side of I.P.	8
C230	NAT	Front Bottom of Steering Column	12
C231	RD	Left Bottom of I.P.	7
C232	BK	Top of Brake Pedal	9
C233	GY	Left Side of I.P.	
C234	BK	Left Side of I.P.	
C235	BK	Left Side of I.P.	8
C236	BK	Bottom Right of I.P.	10
C237	BK	Right Inner Fender	
C238	BK	Right Side of I.P	7
C239	BK	Below Glove Box	8
C240	RD	Below Glove box	8
C241	BK	Center of I.P.	7
C242	BK	Top Center of I.P.	7
C243	BK	Left Side of I.P.	7
C244	BK	Left Side of I.P.	7
C245	BK	Center of I.P.	8
C246	BK	Left Side of HVAC Housing	
C247	RD	Center of I.P.	7
C248	TN	Center Bottom of I.P.	

Connector #	Color	Location	Fig.
C249	NAT	Left Bottom of I.P.	7
C250	BK	On HVAC Housing	
C251	BK	On HVAC Housing	
C252	BK	On HVAC Housing	
C253	BK	On HVAC Housing	
C254	BK	On HVAC Housing	
C255	BK	On HVAC Housing	
C256	BK	On HVAC Housing	
C300	BK	Near Left Kick Panel	18
C301	BK	Near Left Kick Panel	18
C302	NAT	In Door Opening	18
C303	YL	Left Side of I.P.	12
C304	BK	Under Floor Console	11
C305	BK	Under Floor Console	11
C306	BK	Under Floor Console	11
C307	BK	Under Left Front Seat	22
C308	BK	In Left B Pillar	17
C309	GY	In Left B Pillar	17
C310	BK	Under Left Rear Seat	15
C311	BK	Under Left Rear Seat	15
C312	NAT	In Left B Pillar	17
C313	RD	Under Left Rear Seat	15
C314	BK	Under Left Rear Seat	15
C315	BK	Along Left Frame Rail, Near Rear Wheel Well	15
C316	BK	Left Rear of Vehicle, Near Liftgate Opening	15
C317	GY	In Right B Pillar	17
C318	NAT	In Right B Pillar	17
C319	BK	Right Rear Quarter Panel	19
C320	BK	Left Rear of Vehicle, Near Liftgate Opening	15
C321	BK	Top of Liftgate, Left of CHMSL	21
C322	BK	Top of Liftgate, Left of CHMSL	21
C323	BK	Top of Liftgate, Left of CHMSL	21
C324	BK	Top of Liftgate, Right of CHMSL	21
C325	BK	Top of Liftgate, Right of CHMSL	21
C326	GY	Top of Liftgate, Right of CHMSL	21
C327	BK	Behind Lamp	16
C328	BK	Left Rear of Vehicle, Near Liftgate Opening	15
C329	BK	Under Right Front Seat	22
C330	GY	In Left B Pillar	
C331	BK	Right Rear Quarter Panel	19
C332	NAT	Under Left Rear Seat	15
C333	NAT	Under Left Rear Seat	15
C334	BK	In Right Front Door	18
C335	NAT	In Door Opening	18
C336	GY	At Right Visor Vanity Mirror	13
C337	BK	Rear of Day/Night Mirror	13
C338	GY	At Left Visor Vanity Mirror	13
C339	BK	Behind Overhead Console	13
C340	BK	Behind Overhead Console	13
C341	GY	Behind Lamp	14
C342	BK	In Right Front Door	18
C343	RD	In Right Front Door	18
C344	BK	In Right Front Door	18
C345	BK	In Right Front Door	18

Connector #	Color	Location	Fig.
C346	BK	In Right Front Door	18
C347	BK	In Right Front Door	
C348	BK	In Right Front Door	18
C349	BK	Right Rear Quarter Panel	19
C350	BK	Right Rear Quarter Panel	19
C351	BK	In Left Front Door	18
C352	BK	In Left Front Door	18
C353	RD	In Left Front Door	18
C354	BK	In Left Front Door	18
C355	BK	In Left Front Door	18
C356	BK	In Left Front Door	18
C357	BK	In Left Front Door	18
C358	BK	In Left Front Door	18
C359	BK	Top Center of Liftgate	21
C360	BK	Center of Liftgate	21
C361	BK	In Liftgate	
C362	BK	Bottom Center of Liftgate	21
C363	BK	Bottom Left of Liftgate	21
C364	GY	Center of Liftgate	21
C365	BK	Center of Liftgate	21
C366	BK	Bottom Center of Liftgate	21
C367	BK	Bottom Center of Liftgate	
C368	BK	Bottom Left of Liftgate	21
C369	BK	On Trailer Hitch	19
C370	NAT	Behind Overhead Console	14
C371	BK	Rear of Sunroof	14
C372	BK	Right Rear Quarter Panel	19
C373	BK	Right Rear Quarter Panel	19
C374	BK	In Right Rear Door	17
C375	BK	In Right Rear Door	17
C376	BK	In Right Rear Door	
C377	BK	In Right Rear Door	
C378	BK	In Left Rear Door	17
C379	BK	In Left Rear Door	17
C380	BK	In Left Rear Door	
C381	BK	In Left Rear Door	
C400	BK	At Lamp	
C401	BK	At Lamp	
C402	BK	At Lamp	
C403	BK	At Lamp	
C404	BK	Left Rear Frame Rail	
C405	BK	At Lamp	
C406	BK	At Lamp	
C407	BK	At Lamp	
C408	BK	At Lamp	
C409	BK	In Liftgate	20
C410	BK	In Liftgate	20
C411	BK	Under Right Front Seat	22
C412	BK	At Switch	
C413	BK	Under right Front Seat	22
C414	BK	At Switch	
C415	BK	Rear of Fog Lamp	1
C416	BK	Rear of Fog Lamp	1
C417	BK	At Underhood Lamp	20
C418	GY	In Right Front Door	18
C419	BK	In Right Front Door	18
C420	GY	In Left Front Door	18
C421	GN	In Left Front Door	18
C422	BK	In Left Front Door	18
C423	BK	Right Rear Frame Rail	
C424	BK	At Lamp	
C425	BK	At Lamp	
C426	BK	At Lamp	
C427	BK	At Lamp	
C428	BK	At Lamp	
C428	BK	At Lamp	
C429	BK	At Lamp	
C430	BK	At Lamp	
C431	BK	At Lamp	
C432	BK	At Lamp	
C433	BK	At Lamp	
G100		Left Fender Side Shield	2
G101		Left Fender Side Shield	2
G102		Below Coil (4.0L)	4
G102		On Bracket Near Coil (5.2L)	5
G103		Right Fender Side Shield, Near Battery	3
G104		Below Coil (4.0L)	4
G104		On Bracket Near Coil (5.2L)	5
G105		Right Fender Side Shield, Near Battery	3
G106		Right Fender Side Shield, Near Battery	3
G300		On Floor Pan, Behind left Rear Seat	15
G301		Right Rear Quarter Panel	16

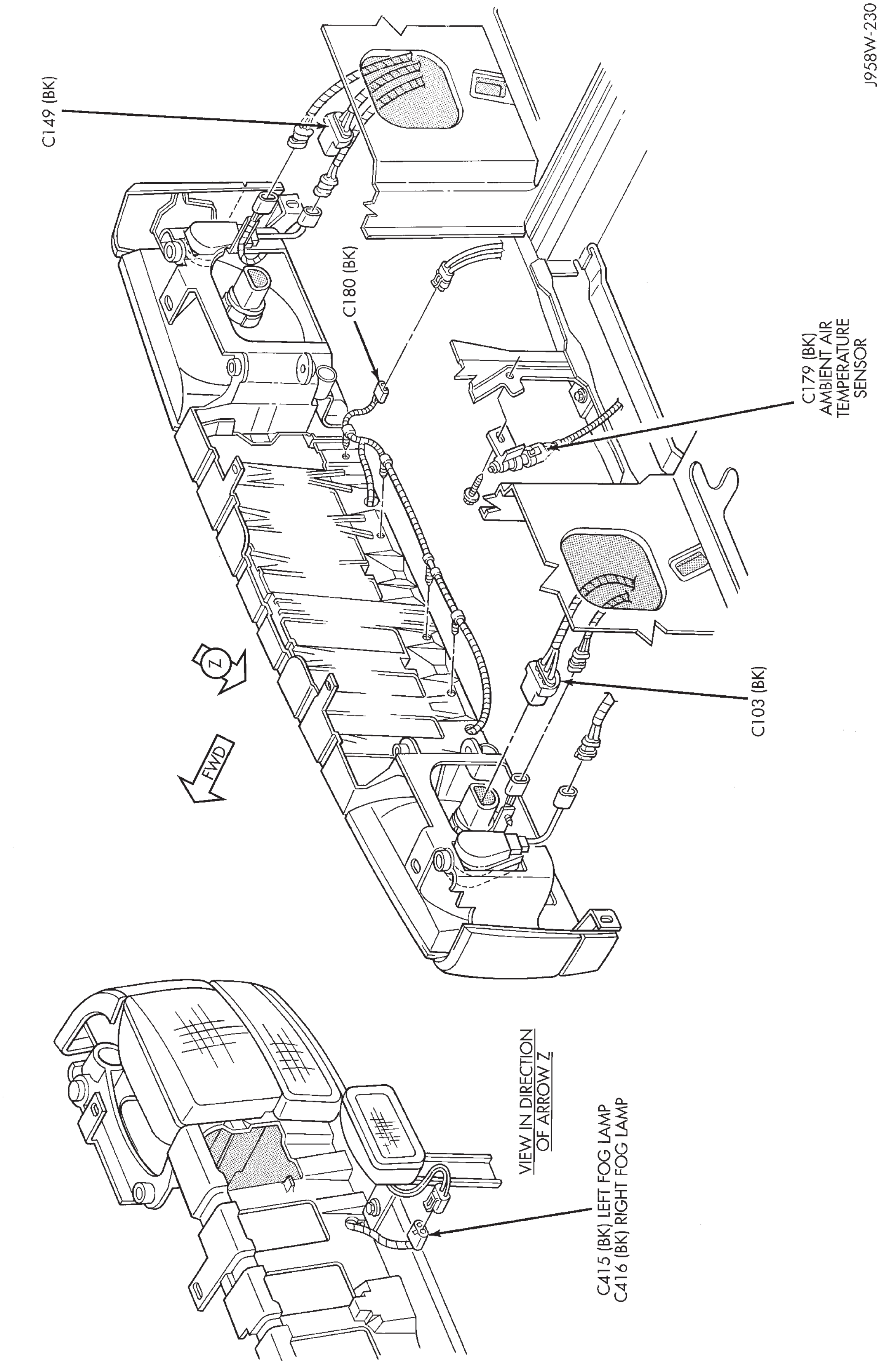

Fig. 1 Front End Lighting Wiring Connectors

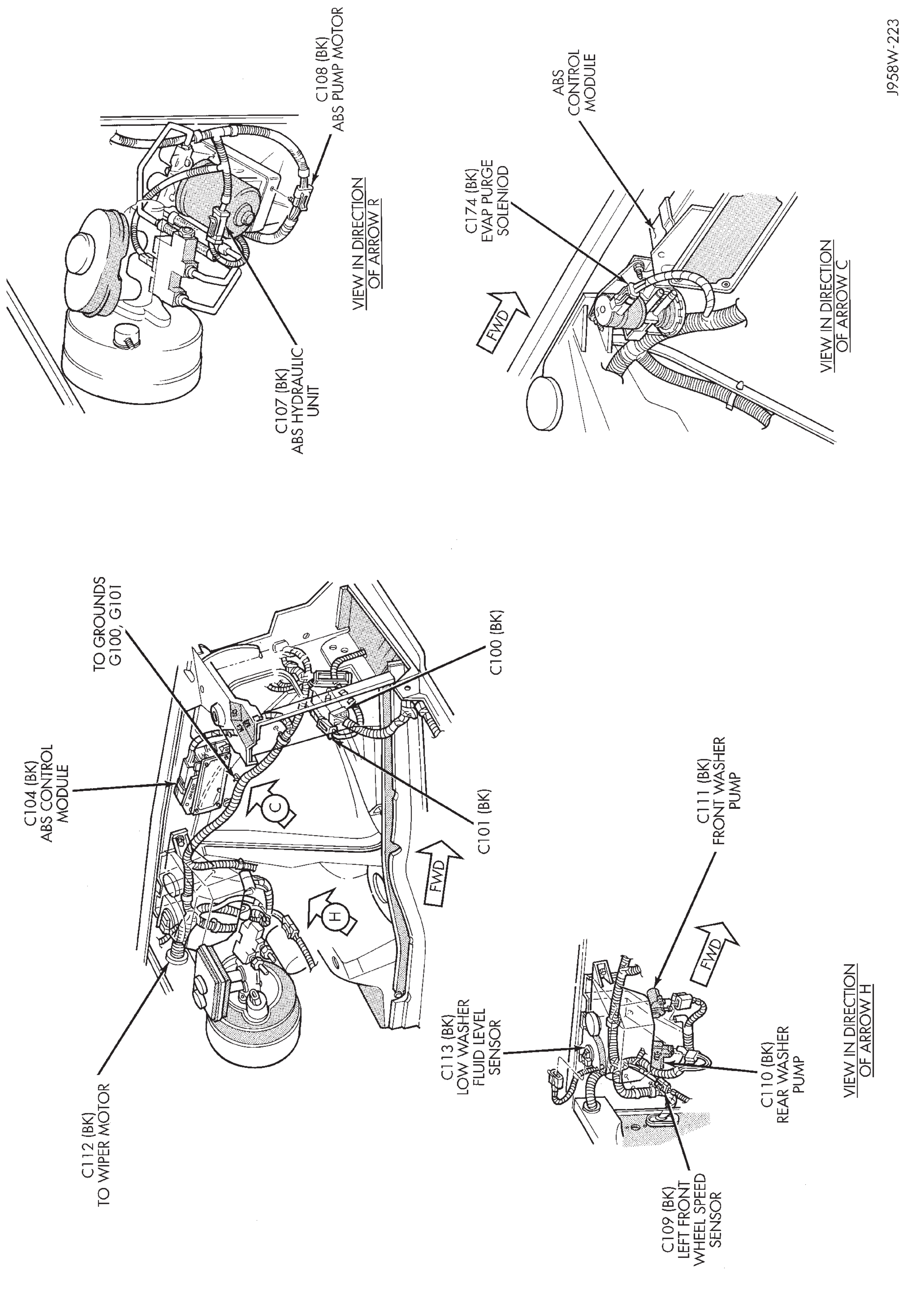

Fig. 2 Engine Compartment Wiring Connectors—Left Side

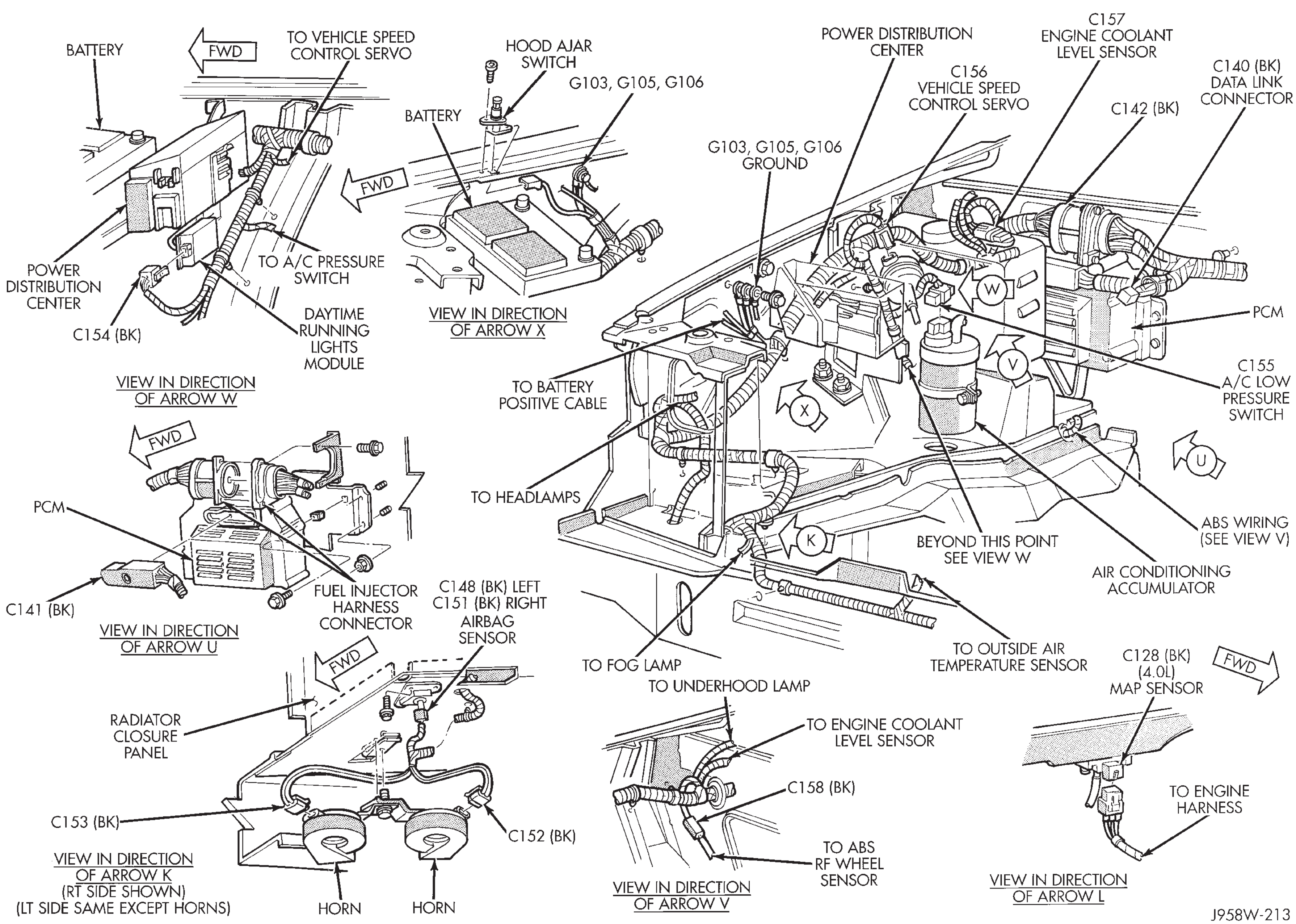

Fig. 3 Engine Compartment Wiring Connectors—Right Side

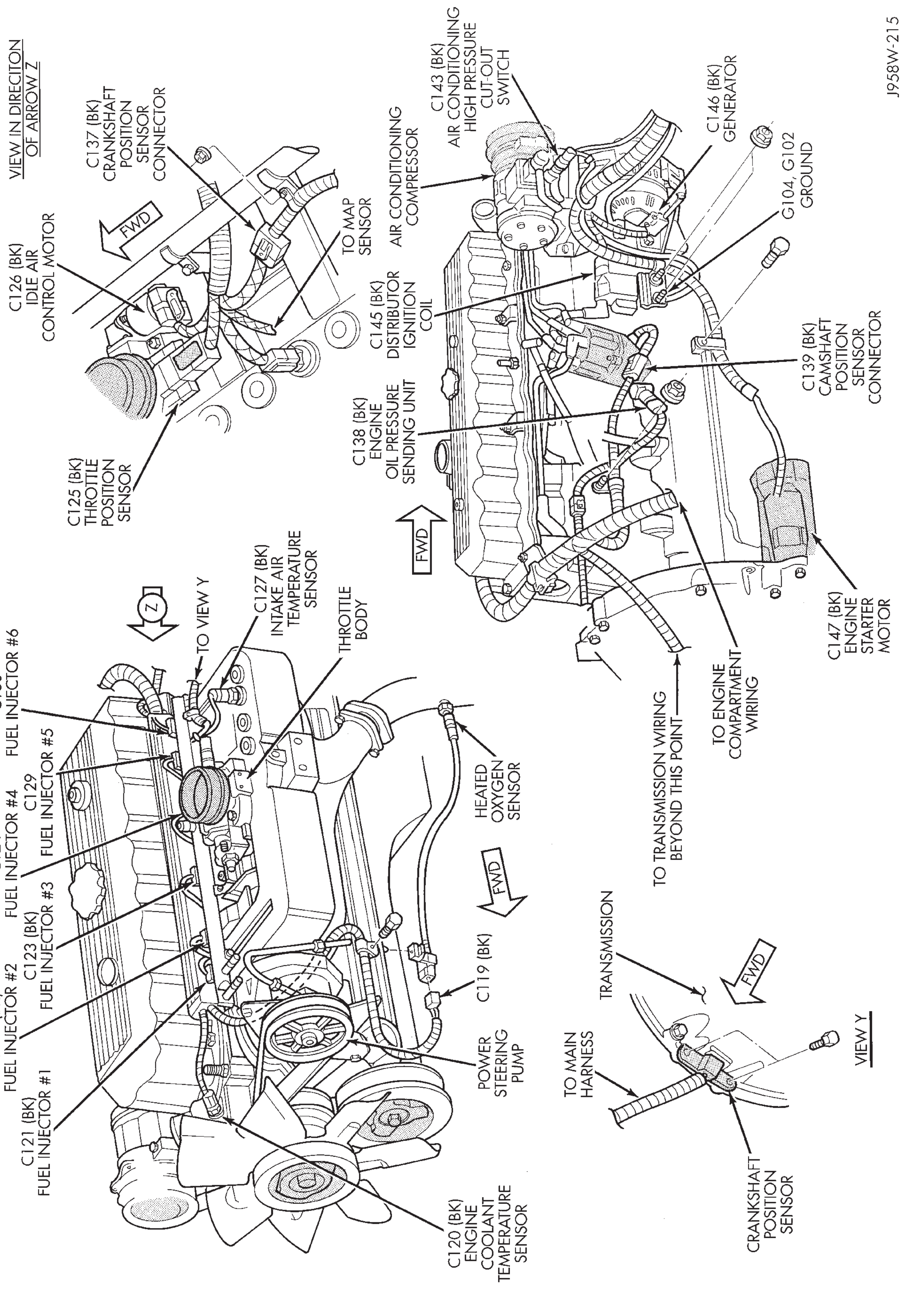

Fig. 4 Engine Wiring Connectors—4.0L

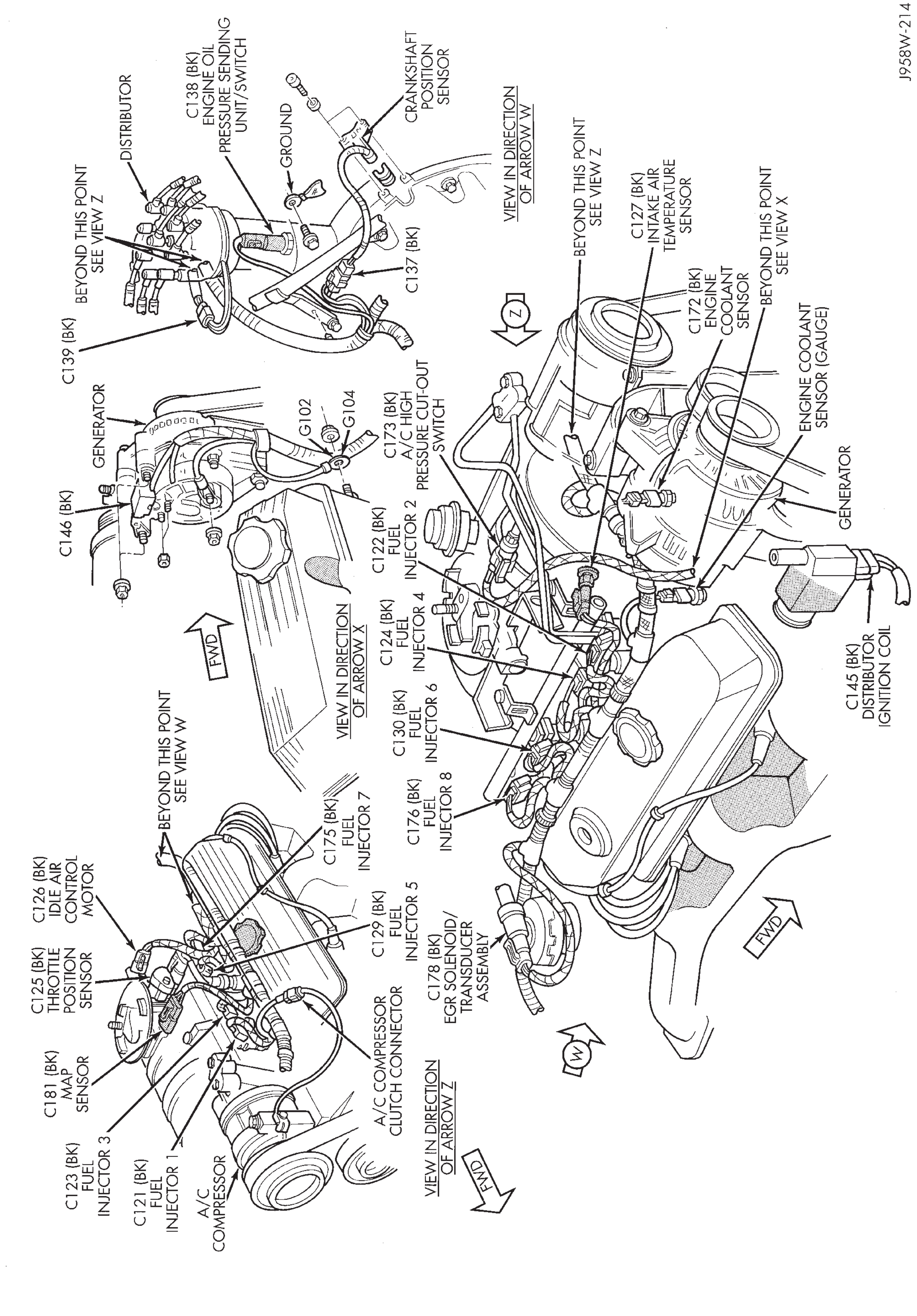

Fig. 5 Engine Wiring Connectors—5.2L

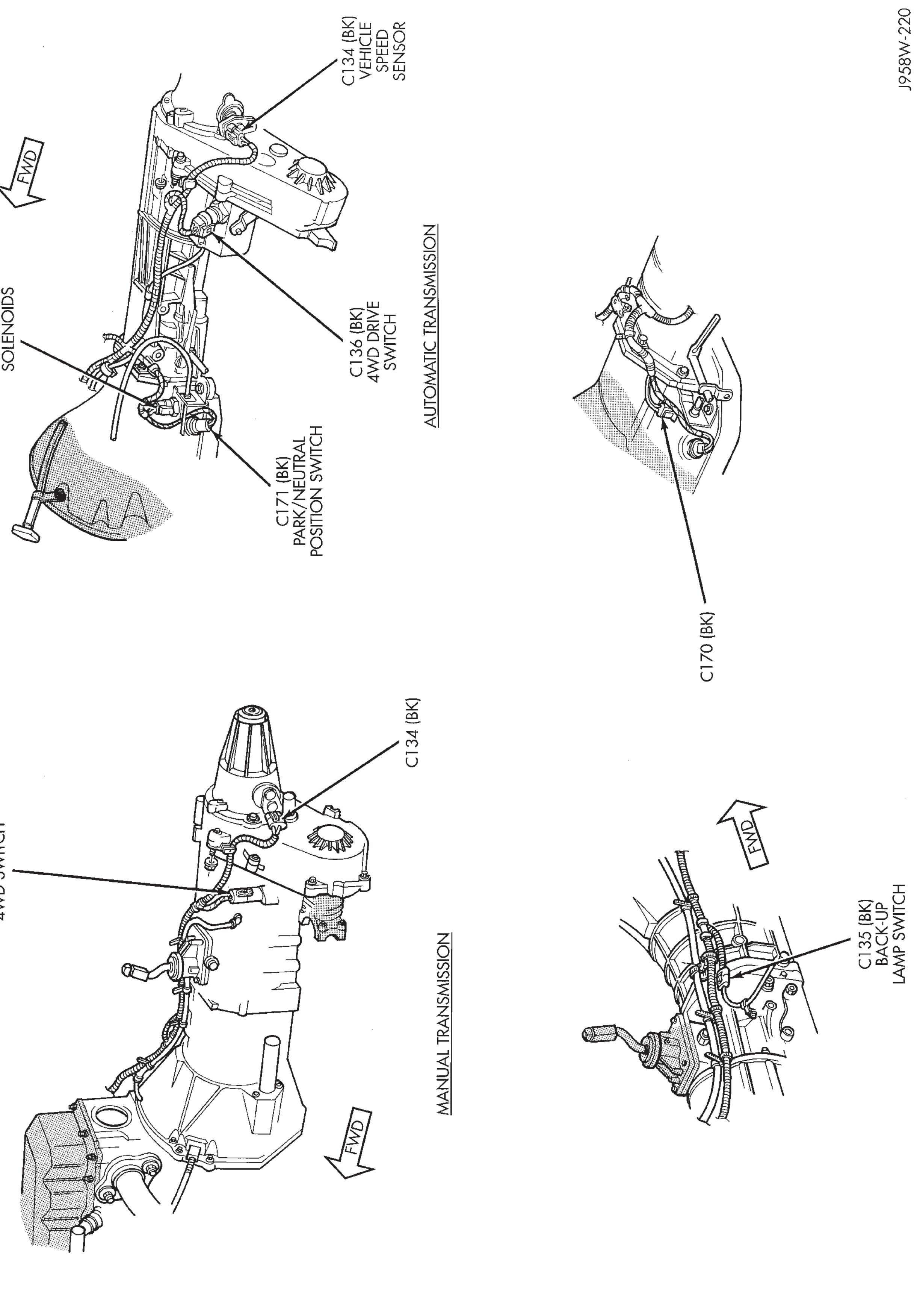

Fig. 6 Transmission Wiring Connectors

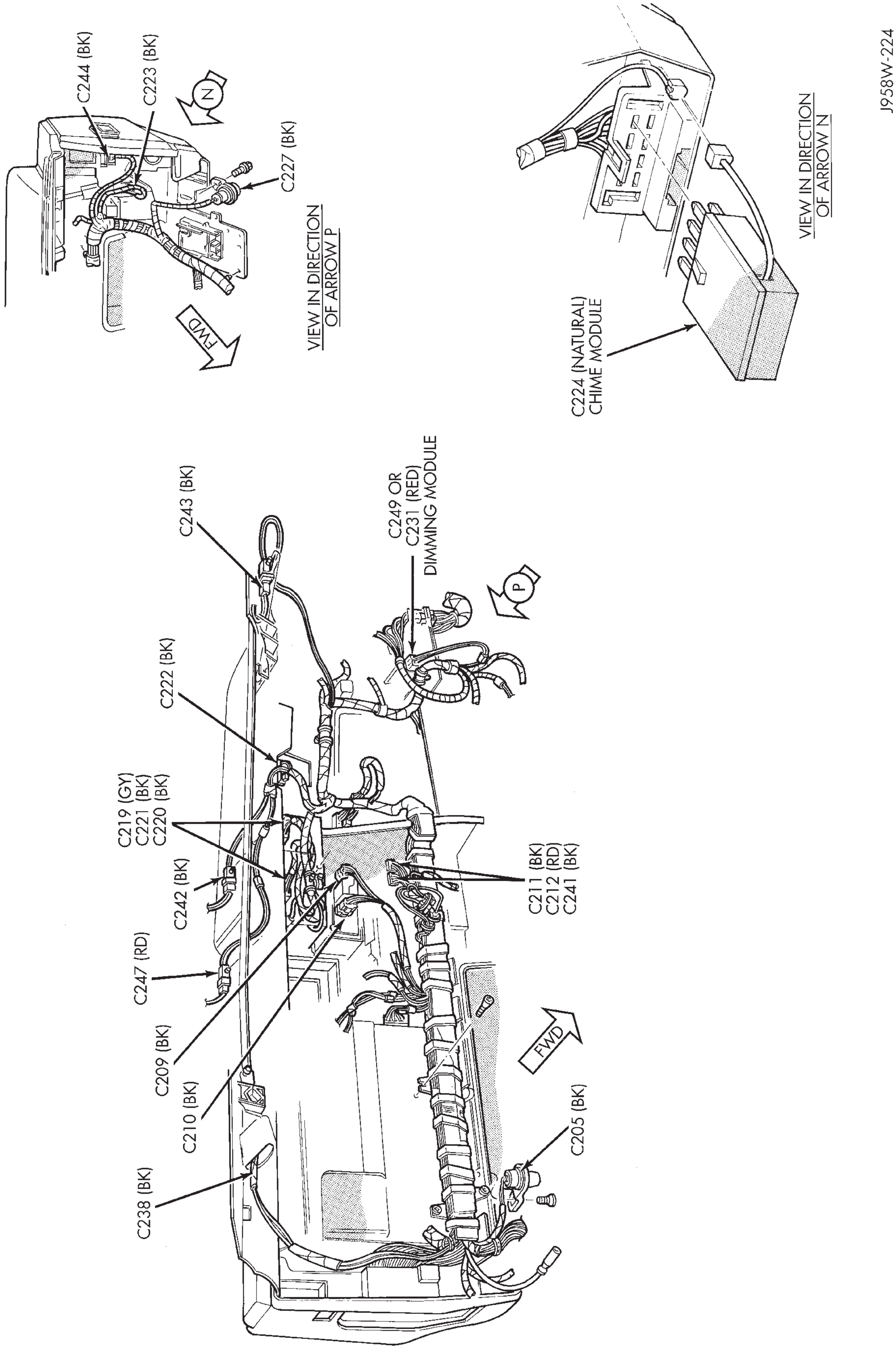

Fig. 7 Instrument Panel Wiring Connectors

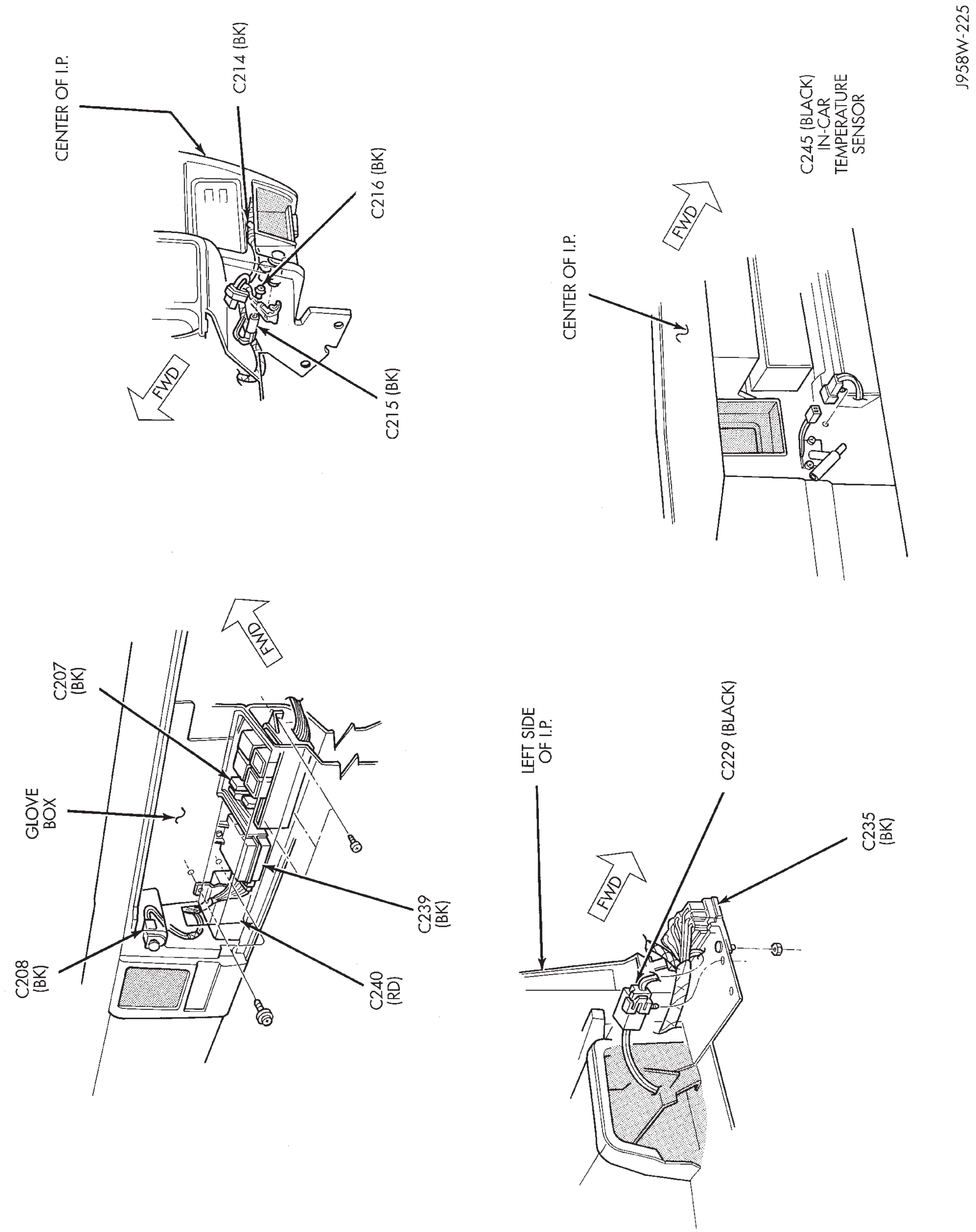

Fig. 8 Instrument Panel Wiring Connectors

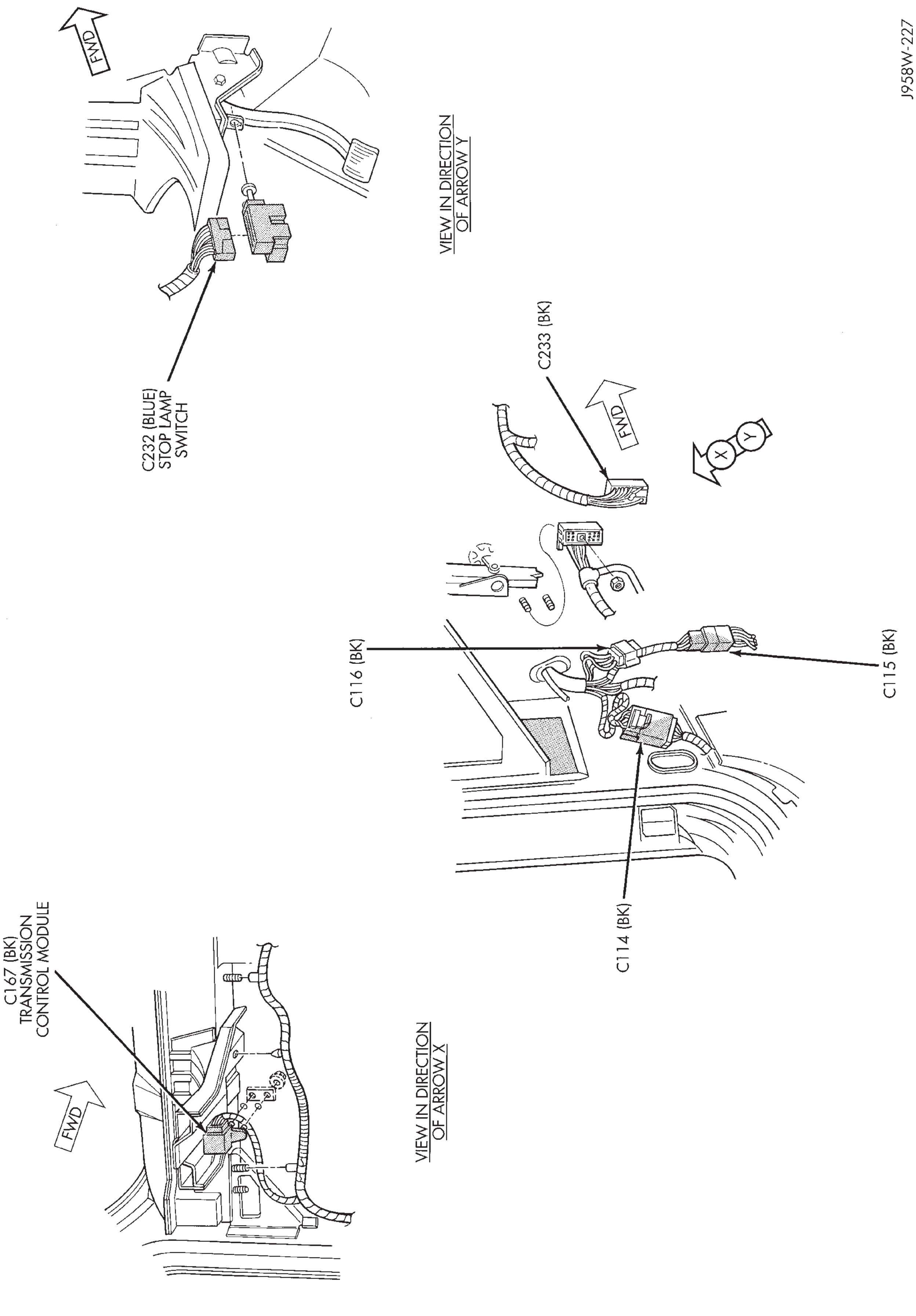

Fig. 9 Instrument Panel Wiring Connectors

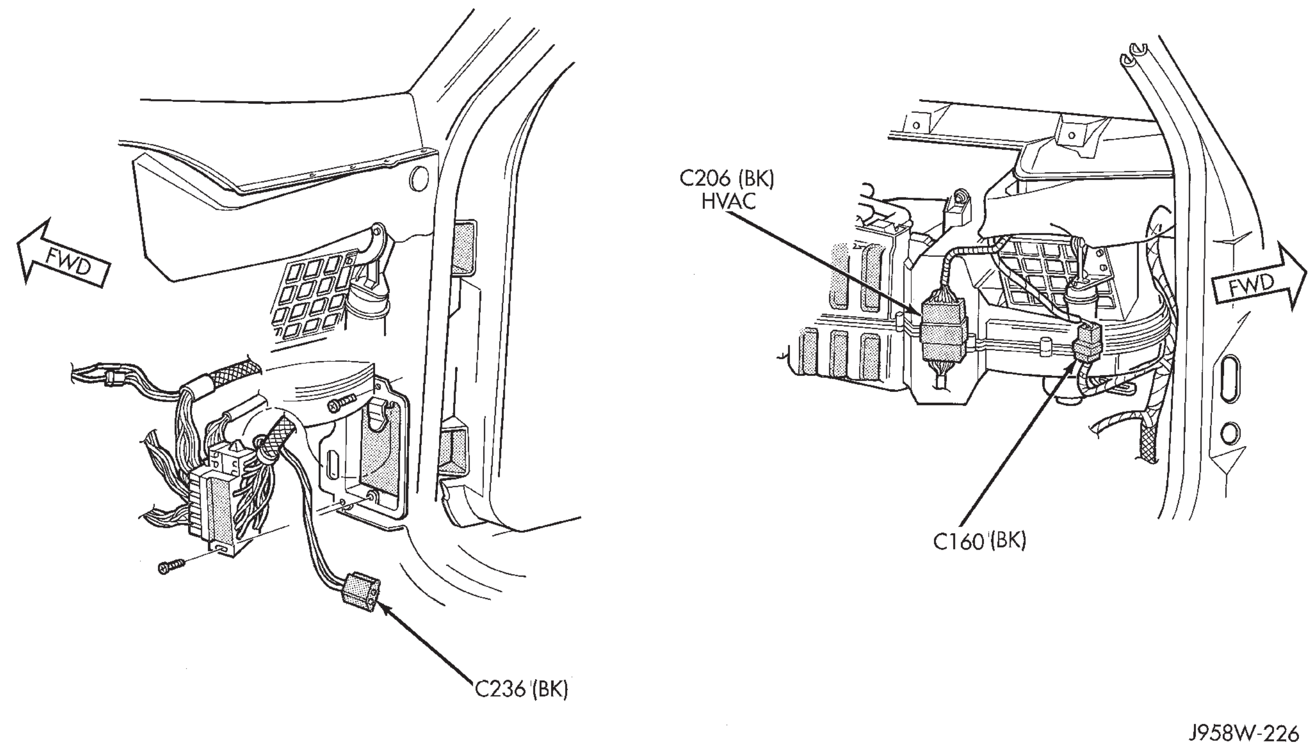

Fig. 10 HVAC Housing

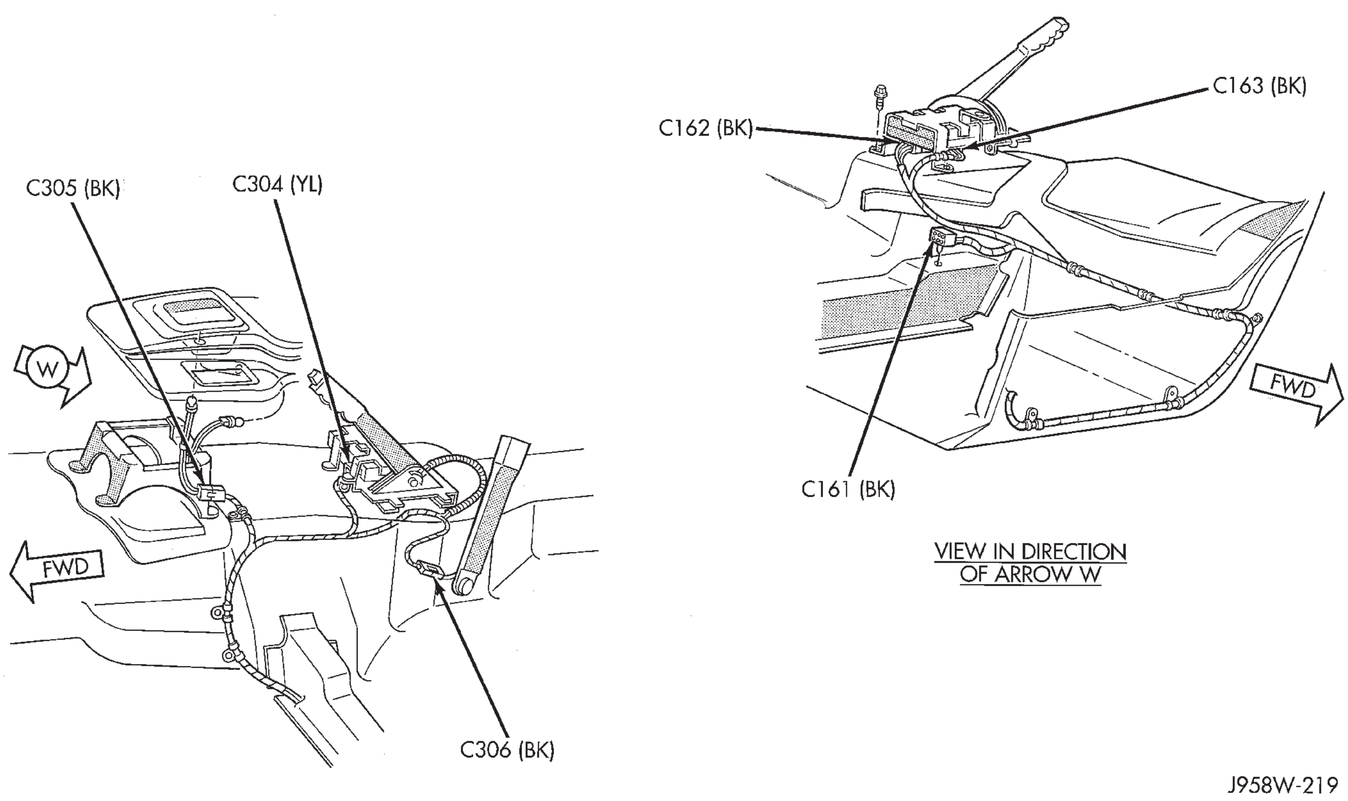

Fig. 11 Floor Console

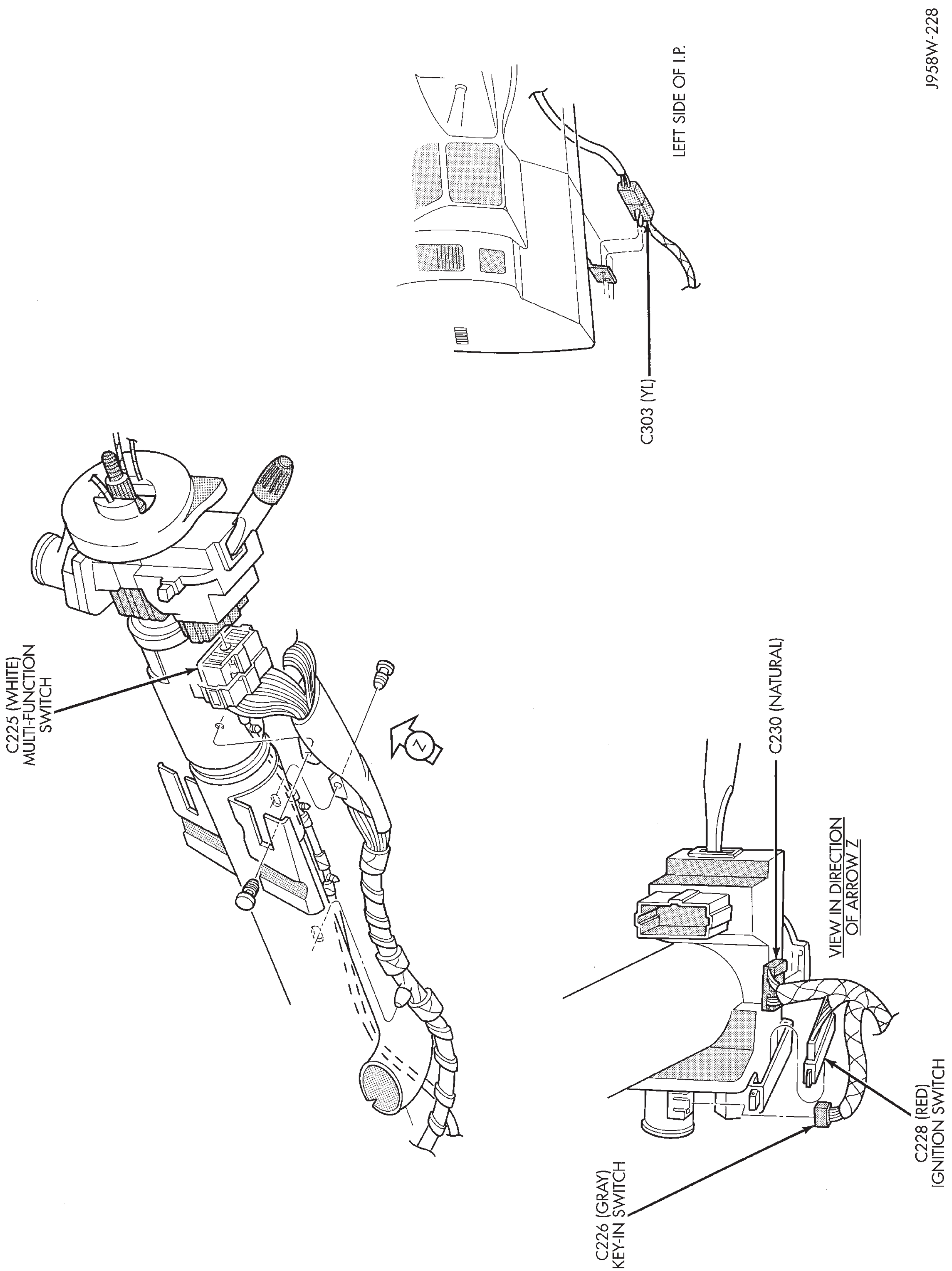

Fig. 12 Steering Column Wiring Connectors

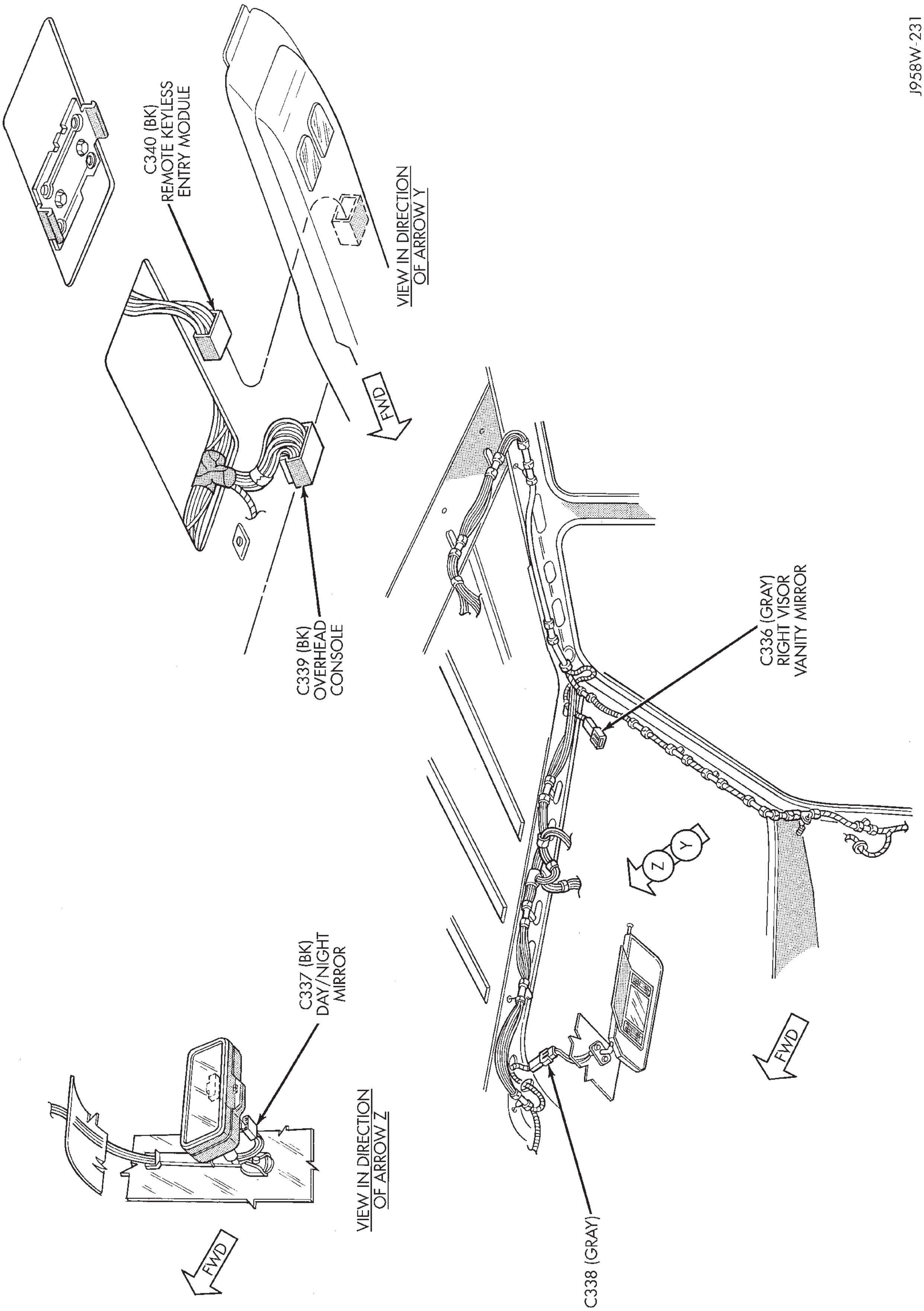

Fig. 13 Visor Vanity Mirrors

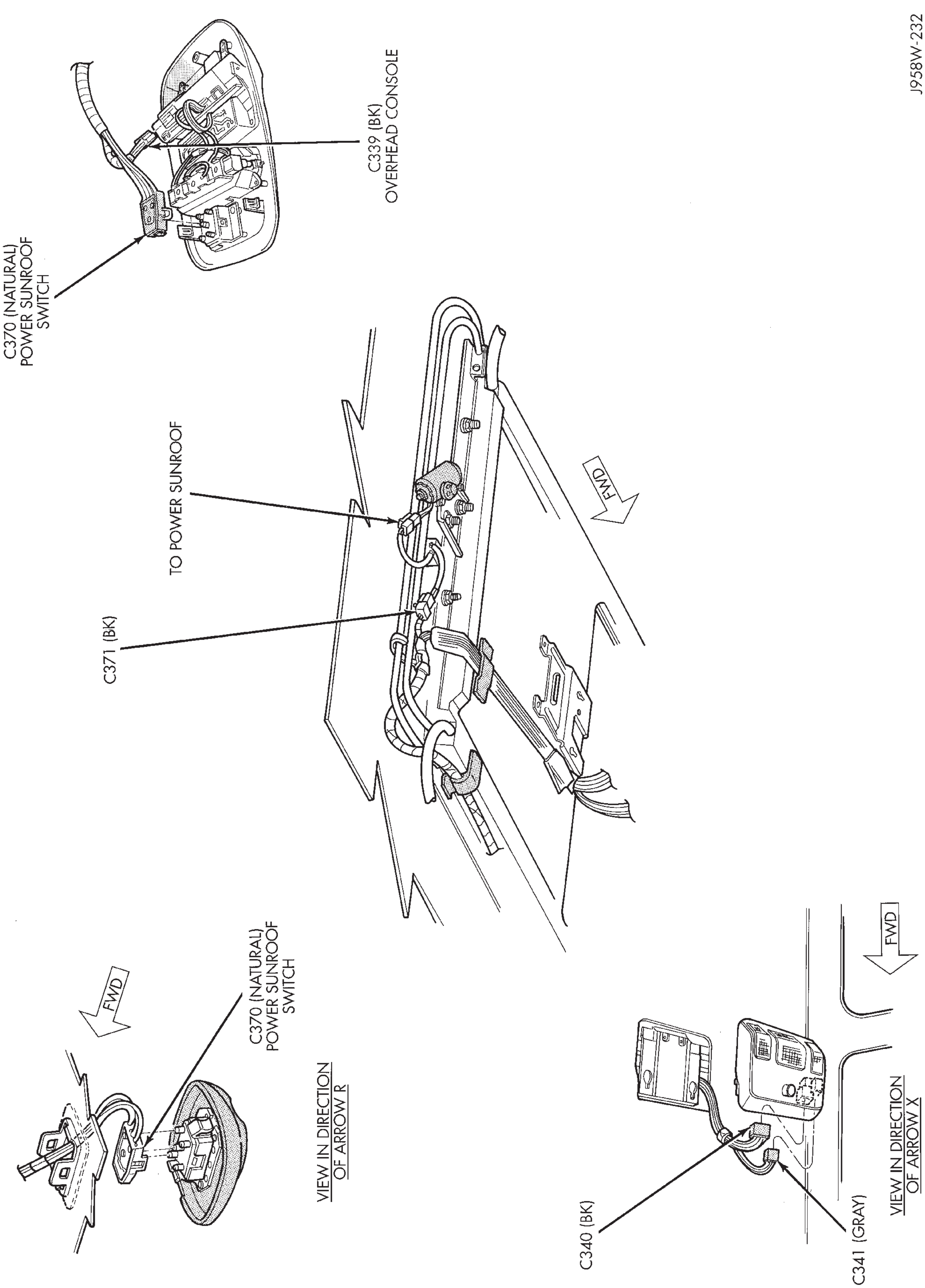

Fig. 14 Overhead Console Wiring Connectors

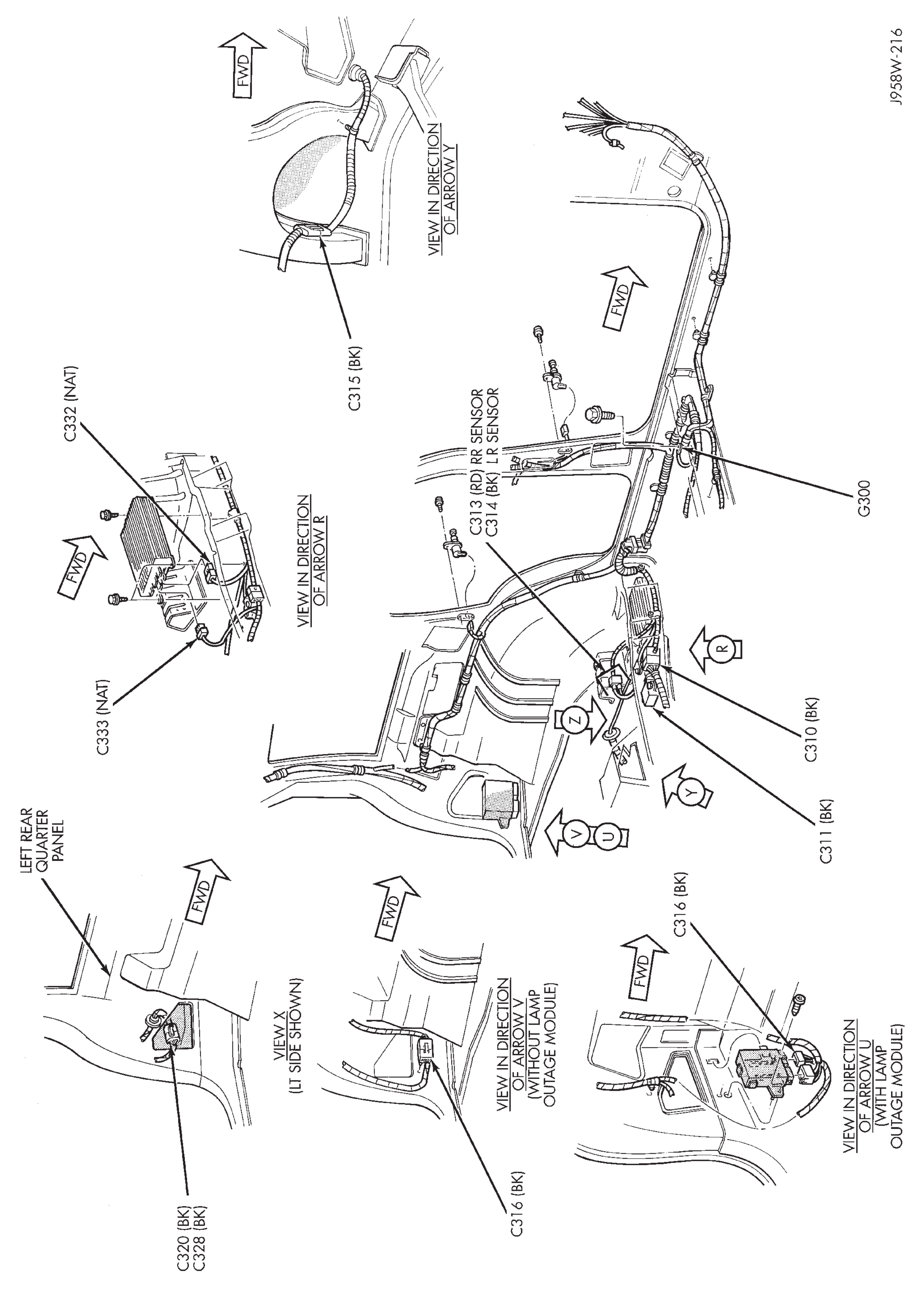

Fig. 15 Left Body Wiring Connectors

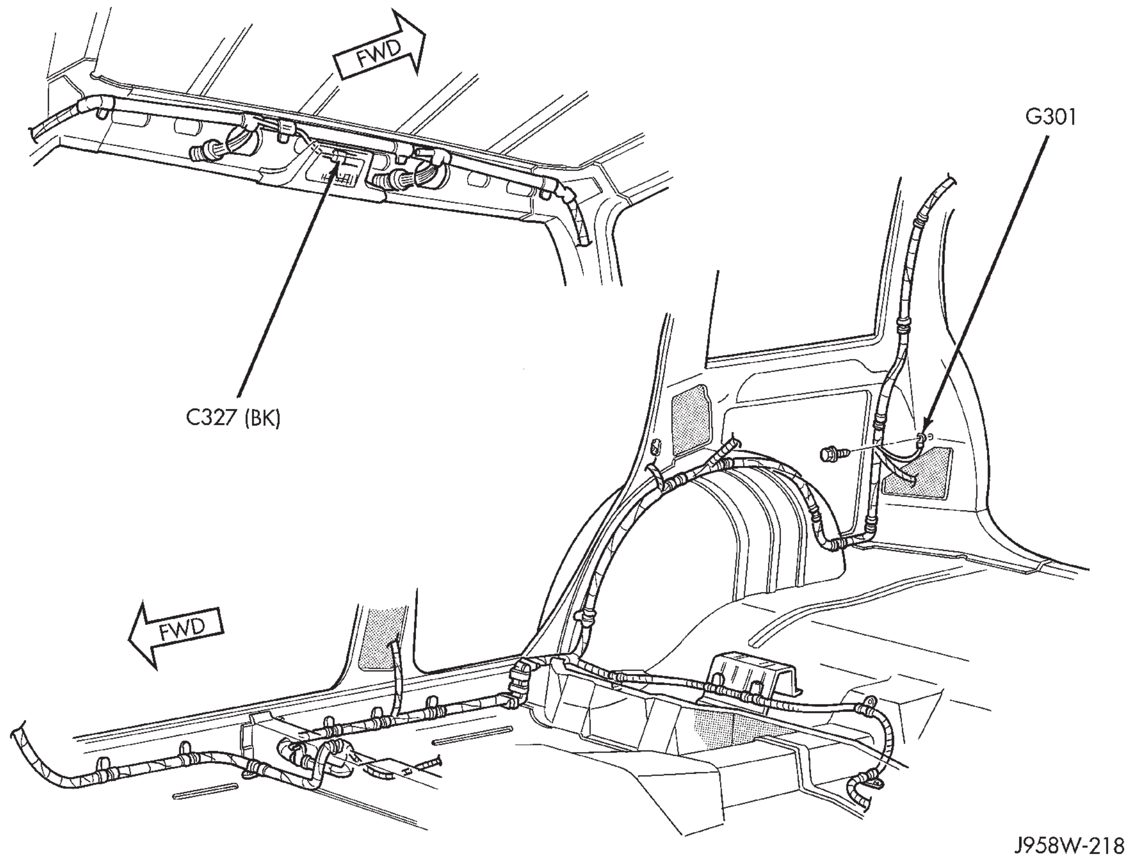

Fig. 16 Right Body Wiring Connectors

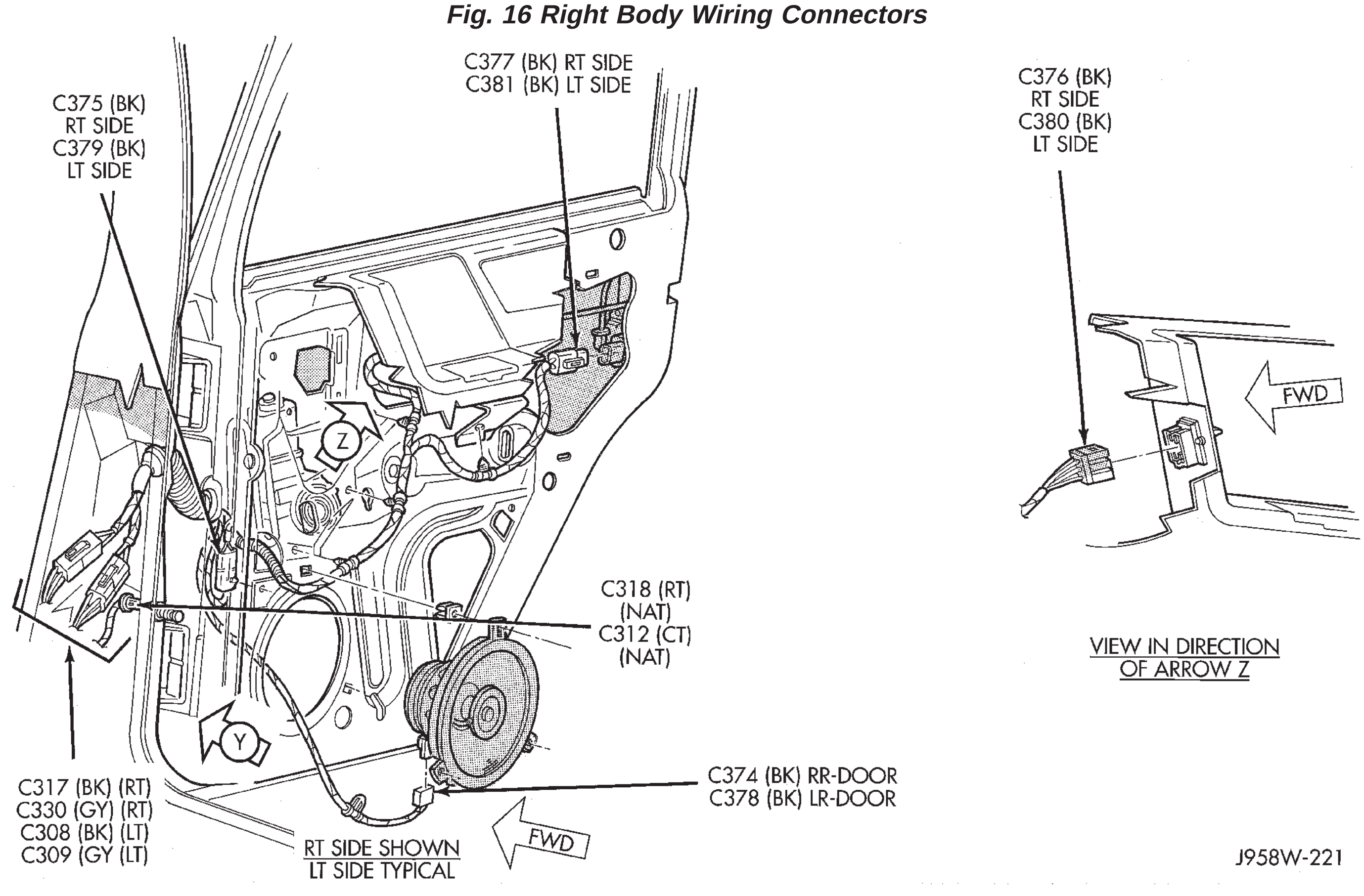

Fig. 17 Rear Door Wiring Connectors

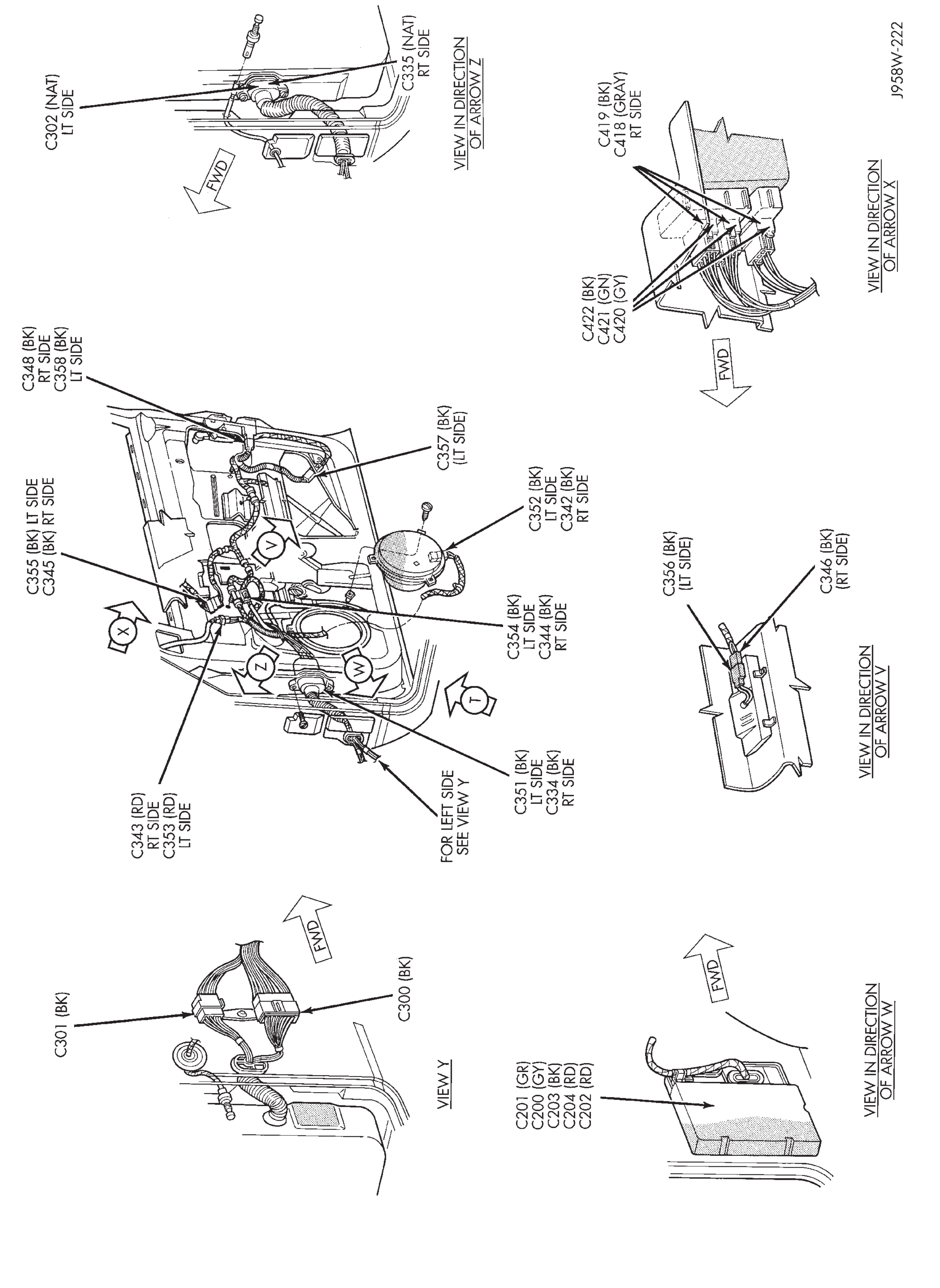

Fig. 18 Front Door Wiring Connectors

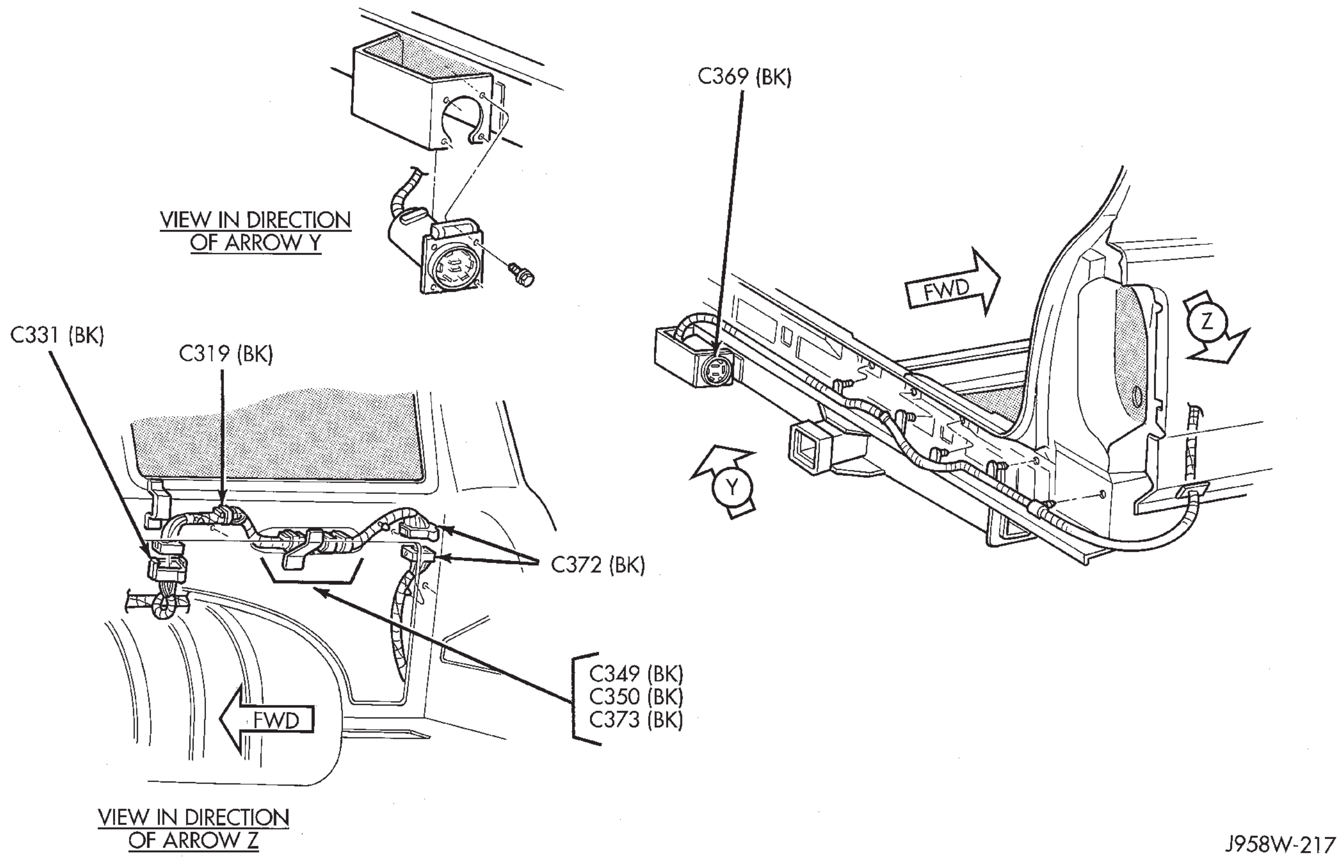

Fig. 19 Trailer Tow Harness Wiring Connections

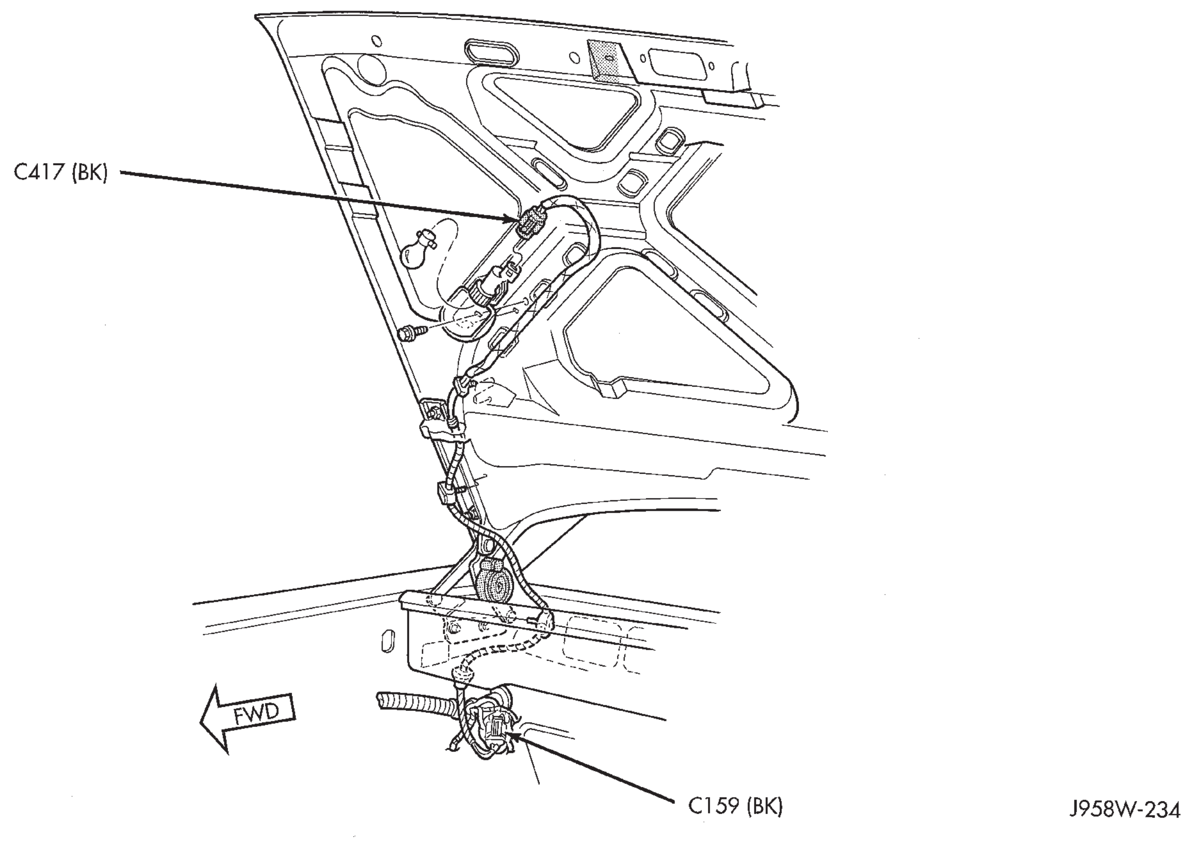

Fig. 20 Underhood Lamp

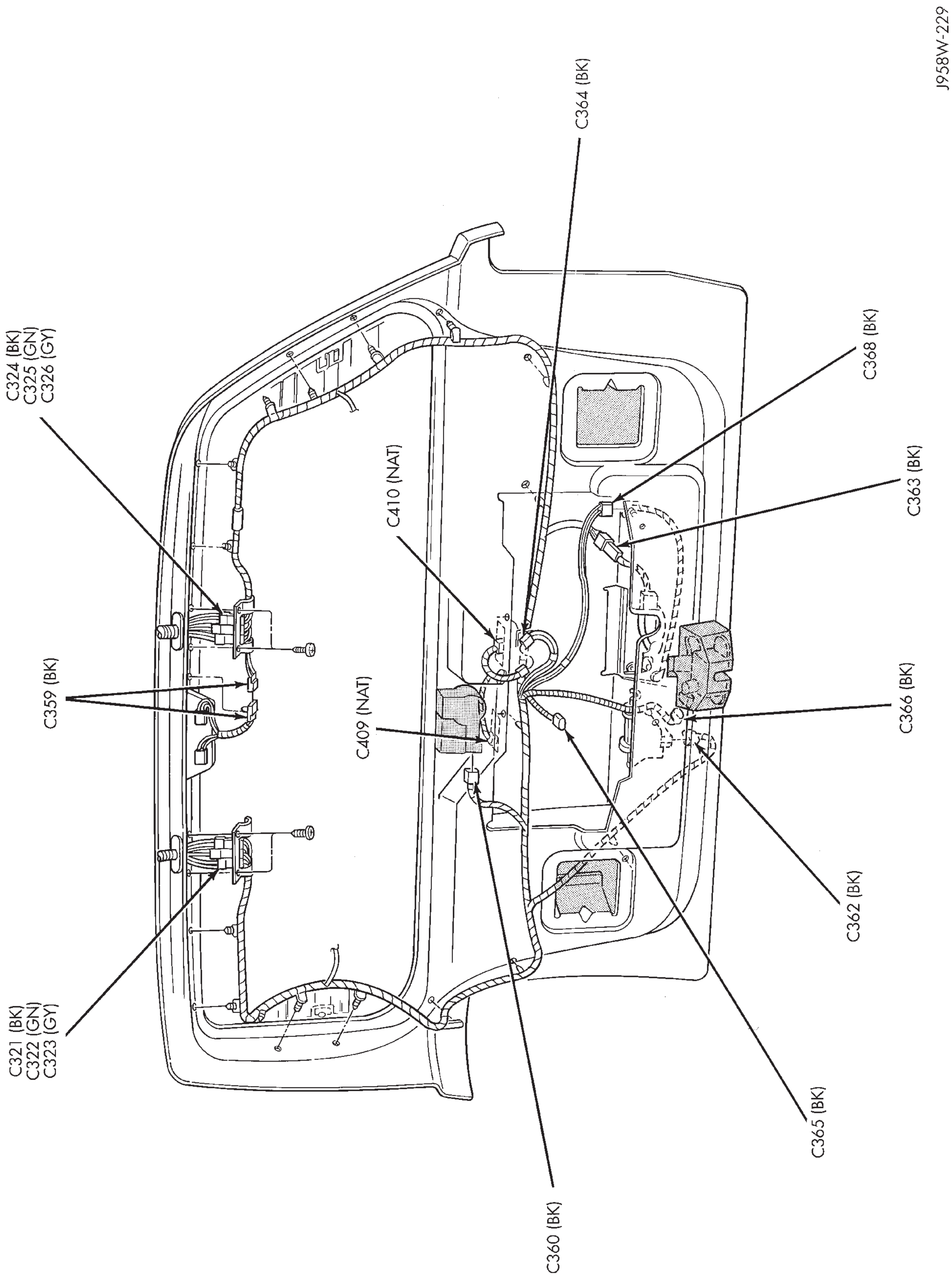

Fig. 21 Liftgate Wiring Connectors

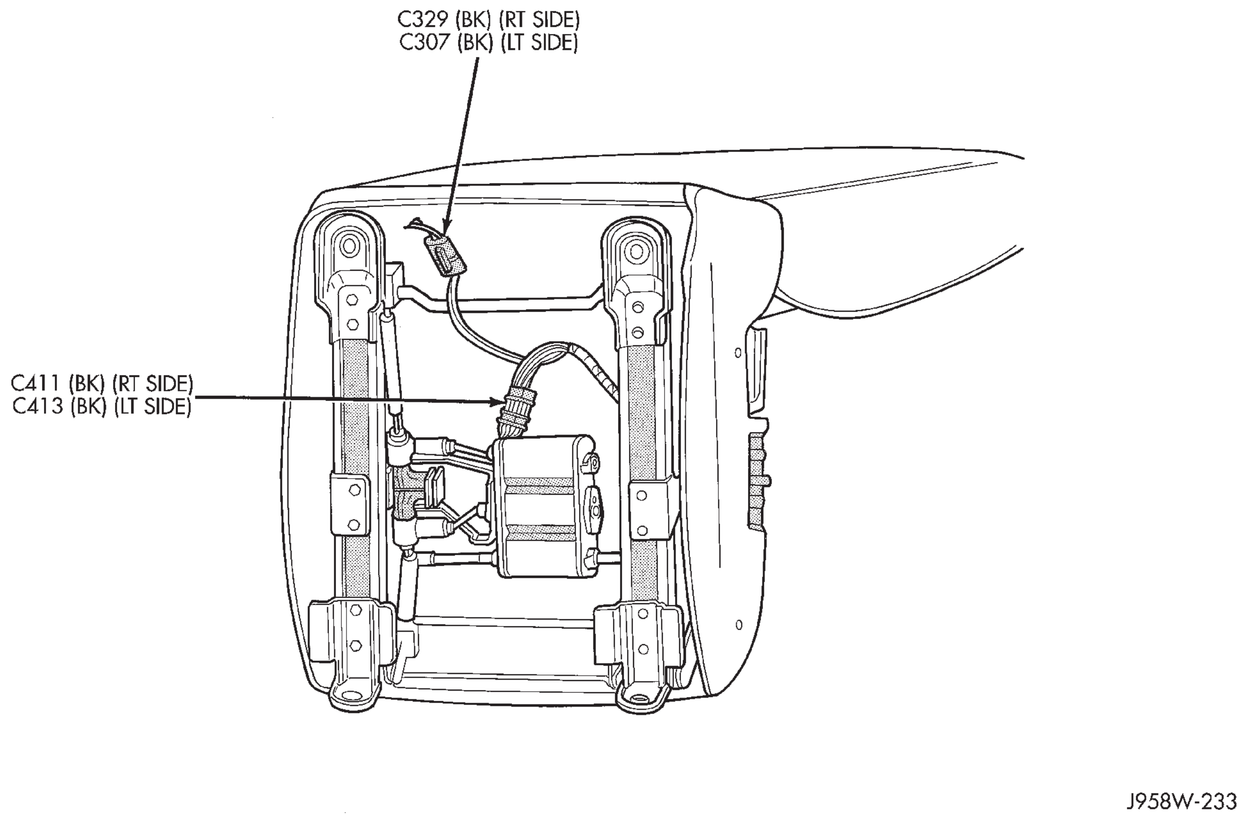

Fig. 22 Power Seat Wiring Connectors

SPLICE LOCATIONS

SPLICE LOCATIONS

Splice Number	Locations	Fig.
S100	In T/O for ABS Control Module	1
S101	Before T/O for Washer Pump Motor	1
S102	Before Grommet to I.P. (4.0L)	2
S102	Between T/O for Injectors No. 6 and No. 4 (5.2L)	3
S103	Rear of Engine (4.0L)	2
S103	Before T/O for Injector No. 3	3
S104	Rear of Engine (4.0L)	2
S104	After T/O for PCM	3
S105	After T/O for PCM (4.0L)	2
S105	After T/O for PCM (5.2L)	3
S106	After T/O for PCM	1
S107	Between T/O for A/C High Pressure Switch and Engine Harness	1
S108	Before T/O's for Grounds G105 and G106	1
S109	Before T/O's for Grounds G105 and G106	1
S110	Before T/O's for PDC	1
S111	In T/O's for Generator Connectors	1
S112	In T/O's for Generator Connectors	1
S113	In T/O's for Generator Connectors	1
S114	After T/O for PDC	1
S115	Before T/O for Underhood Lamp	1
S116	Before T/O for Underhood Lamp	1
S117	After T/O for Underhood Lamp	1
S118	Before Crankshaft Position Sensor T/O (4.0L)	2
S118	Before T/O for Oxygen Sensor (5.2L)	3
S119	In T/O for PCM Connector	1
S120	In T/O for PCM Connector	1
S121	Before T/O to TPS and MAP (4.0L)	2
S121	Before T/O's for Injectors No. 7 and No. 5	3
S122	After T/O for PCM	2
S122	After T/O for PCM	3
S123	Near T/O for Crankshaft Position Sensor	3
S124	Before Branch to Crankshaft Position Sensor T/O (4.OL)	2
S124	Before T/O for Heated Oxygen Sensor (5.2L)	3
S125	Between T/O's for Injectors No. 5 and No. 6	2
S126	After Grommet, Near T/O for ABS Data Link Connector	5
S200	Right Side of I.P.	6
S201	Right Side of I.P.	6
S202	Right Side of I.P.	6
S203	Right Side of I.P.	6
S204	Right Side of I.P.	6
S205	Right Side of I.P., Before Glove Box Lamp T/O	6
S206	Right Side of I.P., Before Glove Box Lamp T/O	6
S207	After T/O for Glove Box Lamp	6
S208	In Branch to Vehicle Information Center (VIC)	6
S209	Before Vehicle Information Center (VIC) T/O's	6
S210	In Branch to Vehicle Information Center (VIC)	6
S211	Center of I.P., After Cigar Lighter Lamp T/O	6
S212	Center of I.P.	6
S213	Before Rear Wiper Switch T/O	6
S214	After Radio T/O's	6
S215	After Radio T/O's	6
S216	After Radio T/O's	6
S217	Before T/O for Left I.P. Speaker	6
S218	After T/O for Left Courtesy Lamp	6
S219	Right Side of I.P., Before Glove Box Lamp T/O	6
S220	In T/O for Power Mirror Switch	6
S221	In HVAC Harness	7
S222	In HVAC Harness	7
S223	In HVAC Harness	7
S224	In HVAC Harness	7
S225	In HVAC Harness	7
S226	In HVAC Harness	7
S300	After Left Front Door T/O's	9
S301	Before Floor Console Illumination Lamp T/O	9
S302	After Floor Console Illumintiaon Lamp T/O	9
S303	After Floor Console Illumination Lamp T/O	9
S304	After T/O's for Left Front Door	9
S305	After T/O's for Left Front Door	9
S306	In T/O for Right Body Connector	9
S307	After T/O for Right Tail Lamp Harness	10
S308	Between Right Tail Lamp Harness T/O and Liftgate T/O	10
S309	Before Power Seat T/O	10
S310	In T/O for Left Vanity Visor Mirror	8
S311	In T/O for Left Vanity Visor Mirror	8
S312	After Day/Night Mirror T/O	8
S313	In T/O for Left Lighted Visor Mirror	8
S314	Before T/O for Right Front Door Jamb Switch	8
S315	Before Power Mirror T/O	11
S316	After Heated Rear Window T/O	13
S317	Between Liftgate Ajar Switch T/O and Rear Wiper Motor T/O	13
S318	Between Liftgate Ajar Switch T/O and Rear Wiper Motor T/O	13
S319	Before Stop Lamp Relay T/O and Left Turn Signal Relay T/O	12
S320	Between Stop Lamp Relay T/O and Body Harness Connector T/O	12
S321	After T/O for Day/Night Mirror	8
S322	Before Right Liftgate Connector	13
S323	Before T/O for Power Mirror	11
S400	Between Liftgate Connector and License Plate Lamp T/o's	13
S401	Between Body Connector and Grommet	14
S402	Between Body Connector and Grommet	14
S403	Between Body Connector and Grommet	14
S404	Between Body Connector and Grommet	14
S405	Between Liftgate Harness Connector and License Plate Lamp T/O's	13

Splice Number	Locations	Fig.
S406	Center of Grille Opening	4
S407	Center of Grille Opening	4
S408	Near Left Headlamp Connector	4
S409	Near Left Headlamp Connector	4
S410	Near Left Headlamp Connector	4
S411	Near Right Headlamp Connector	4
S412	Near Right Headlamp Connector	4
S413	Near Right Headlamp Connector	4

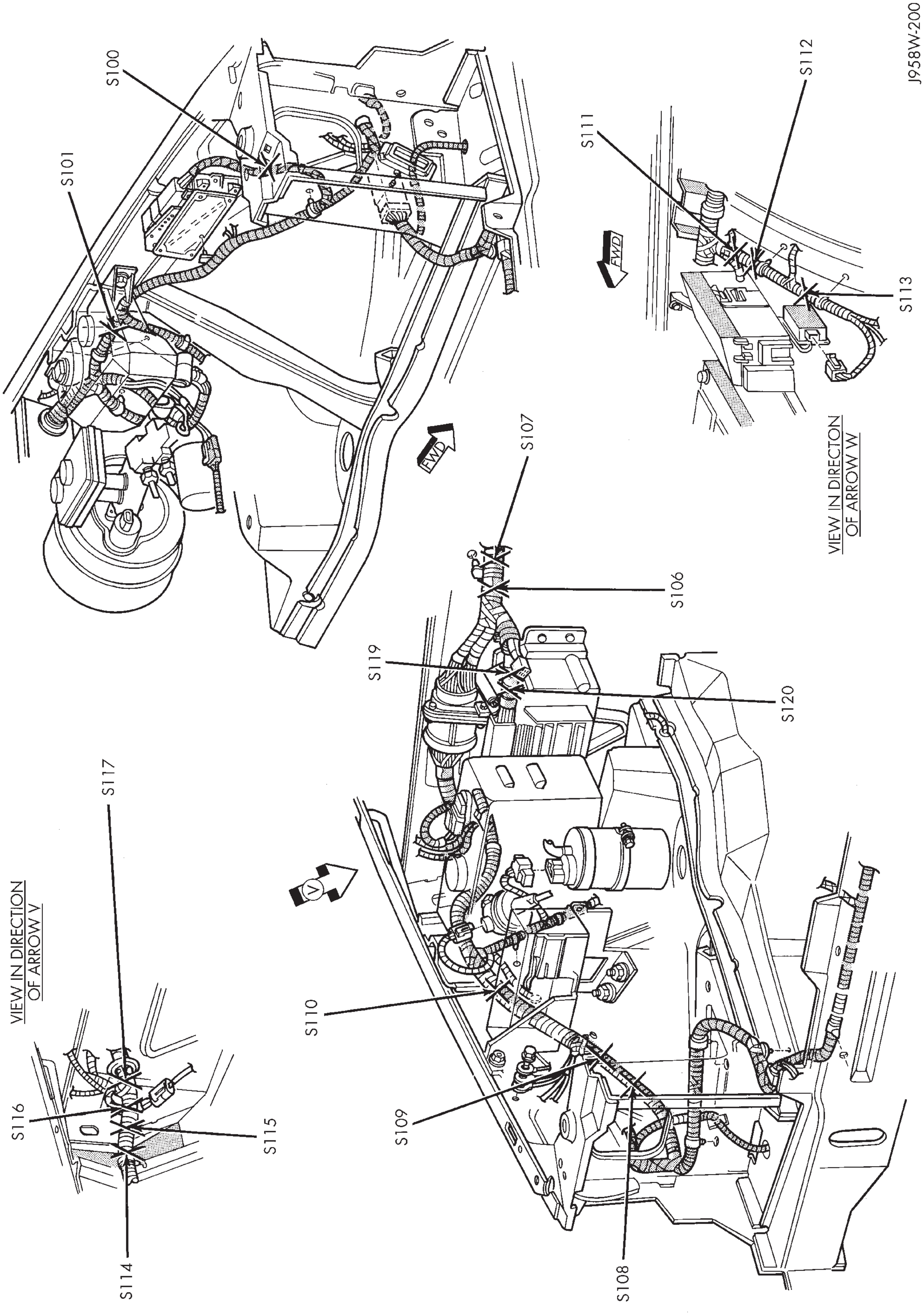

Fig. 1 Engine Compartment Splices

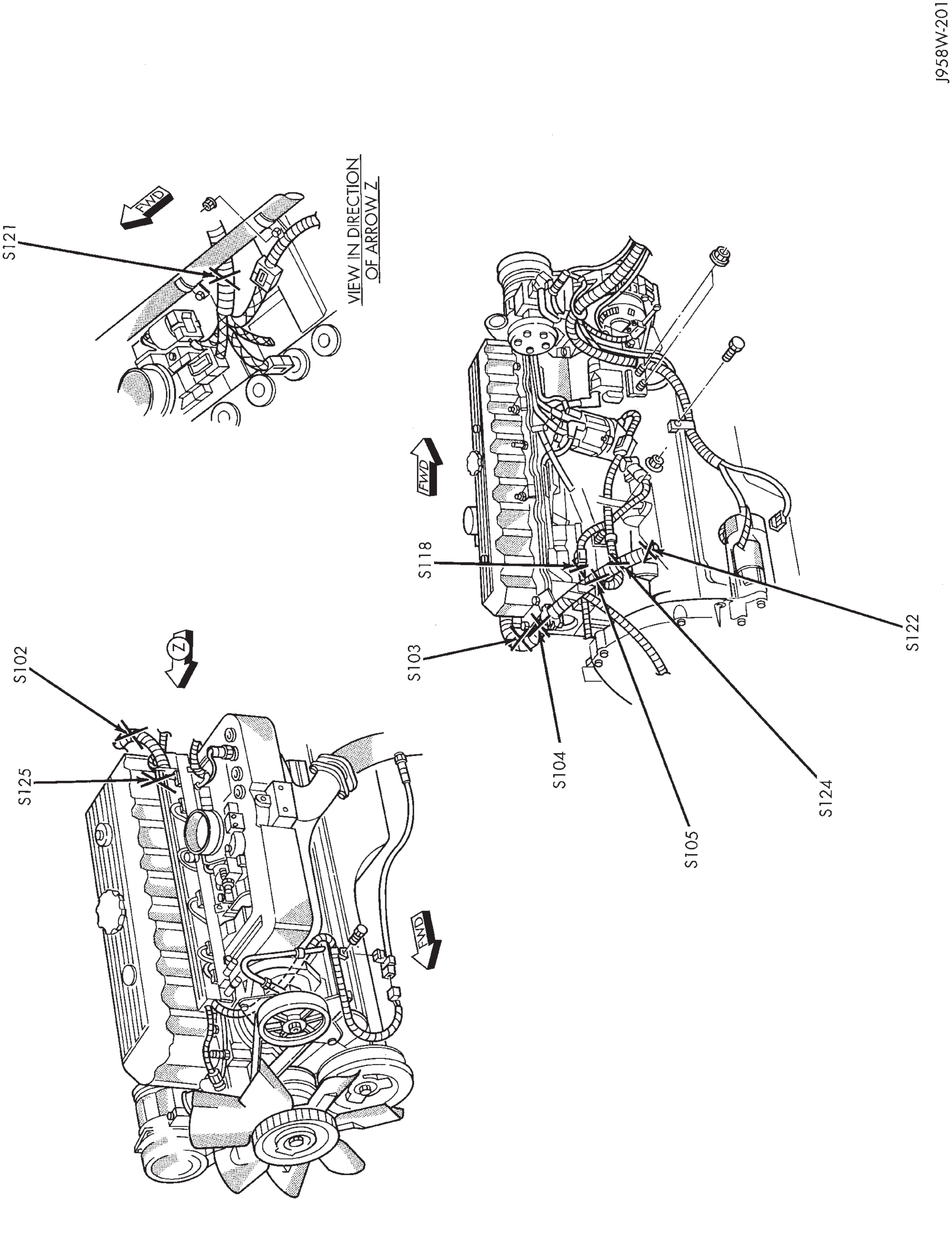

Fig. 2 Engine Splices— 4.0L Engine

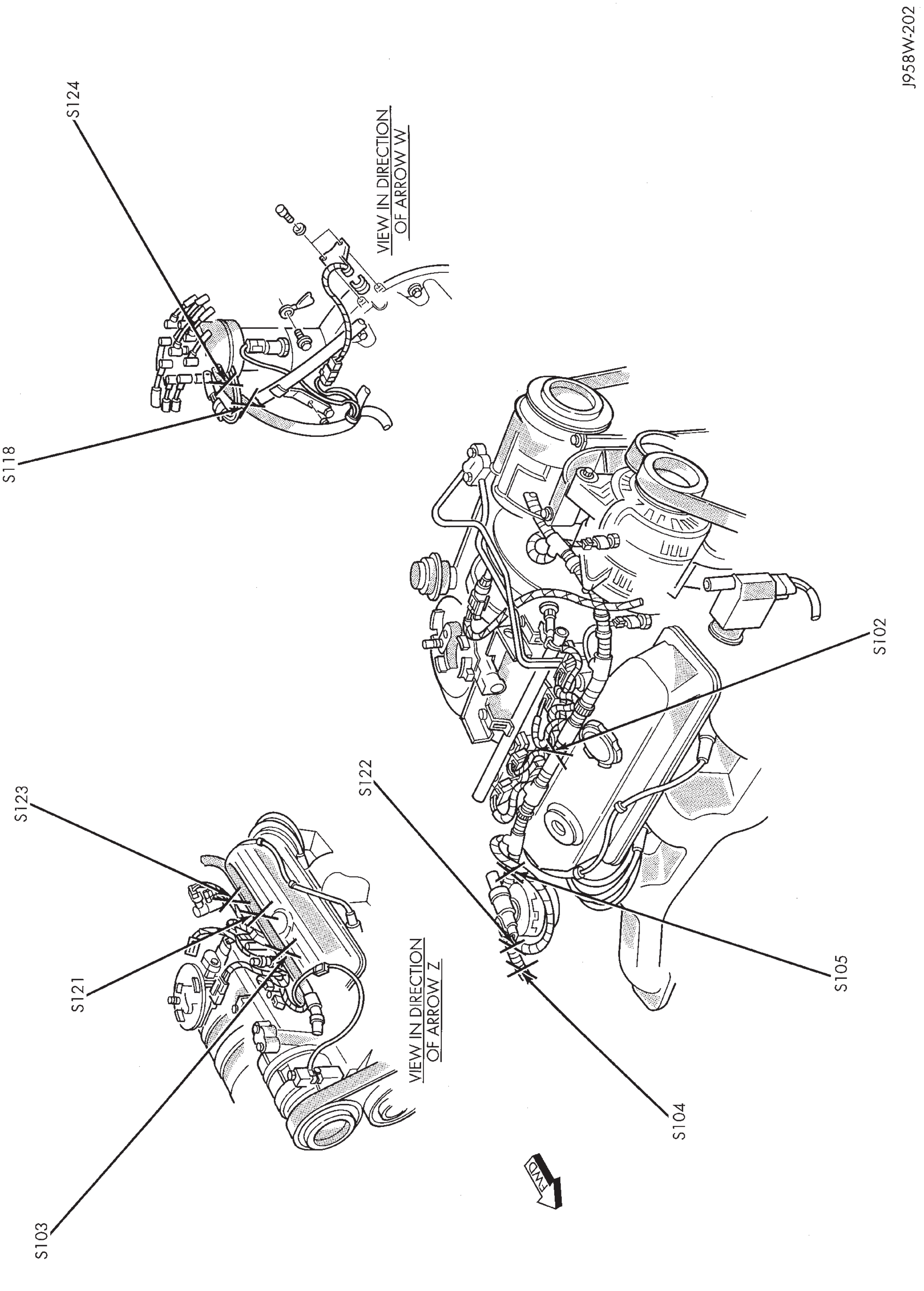

Fig. 3 Engine Splices—5.2L Engine

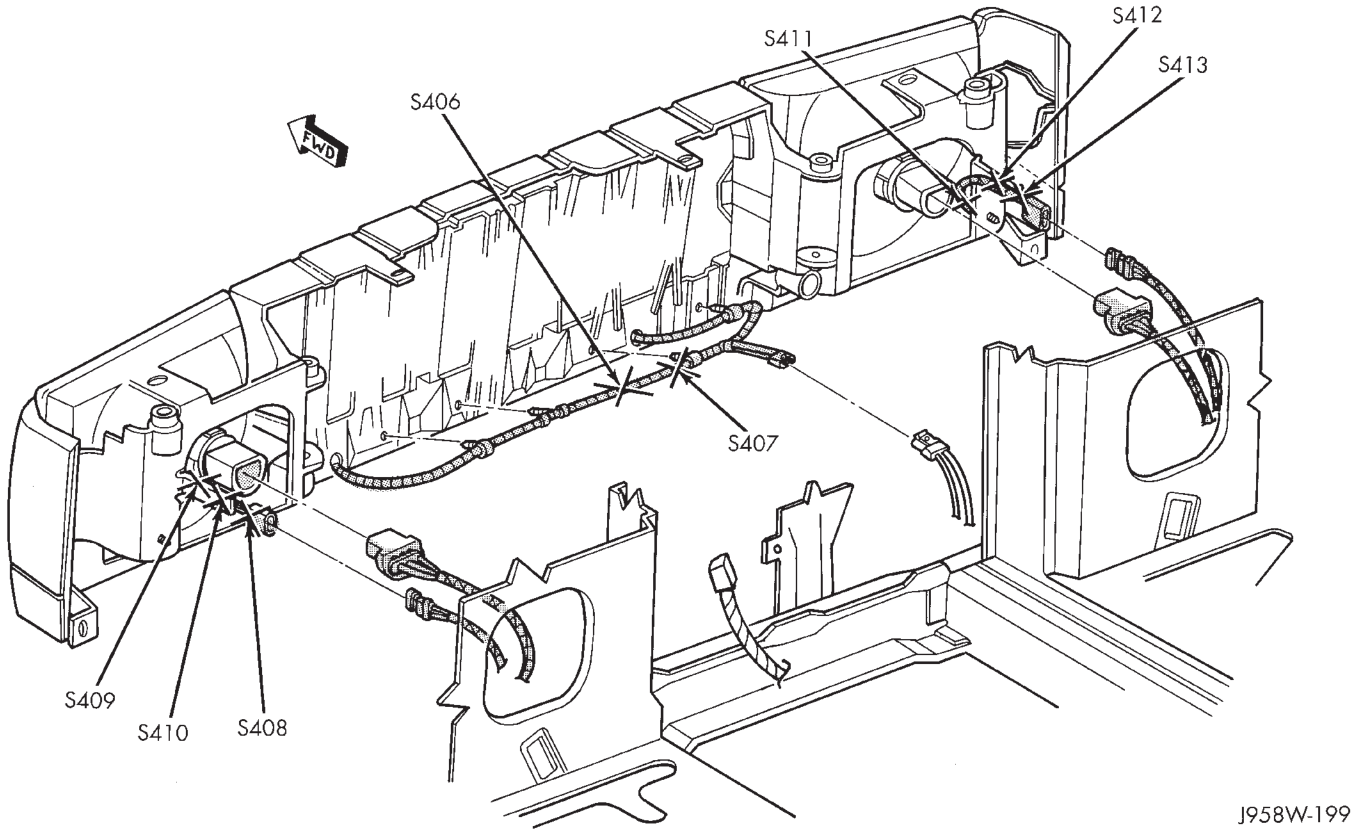

Fig. 4 Front End Lighting Splices

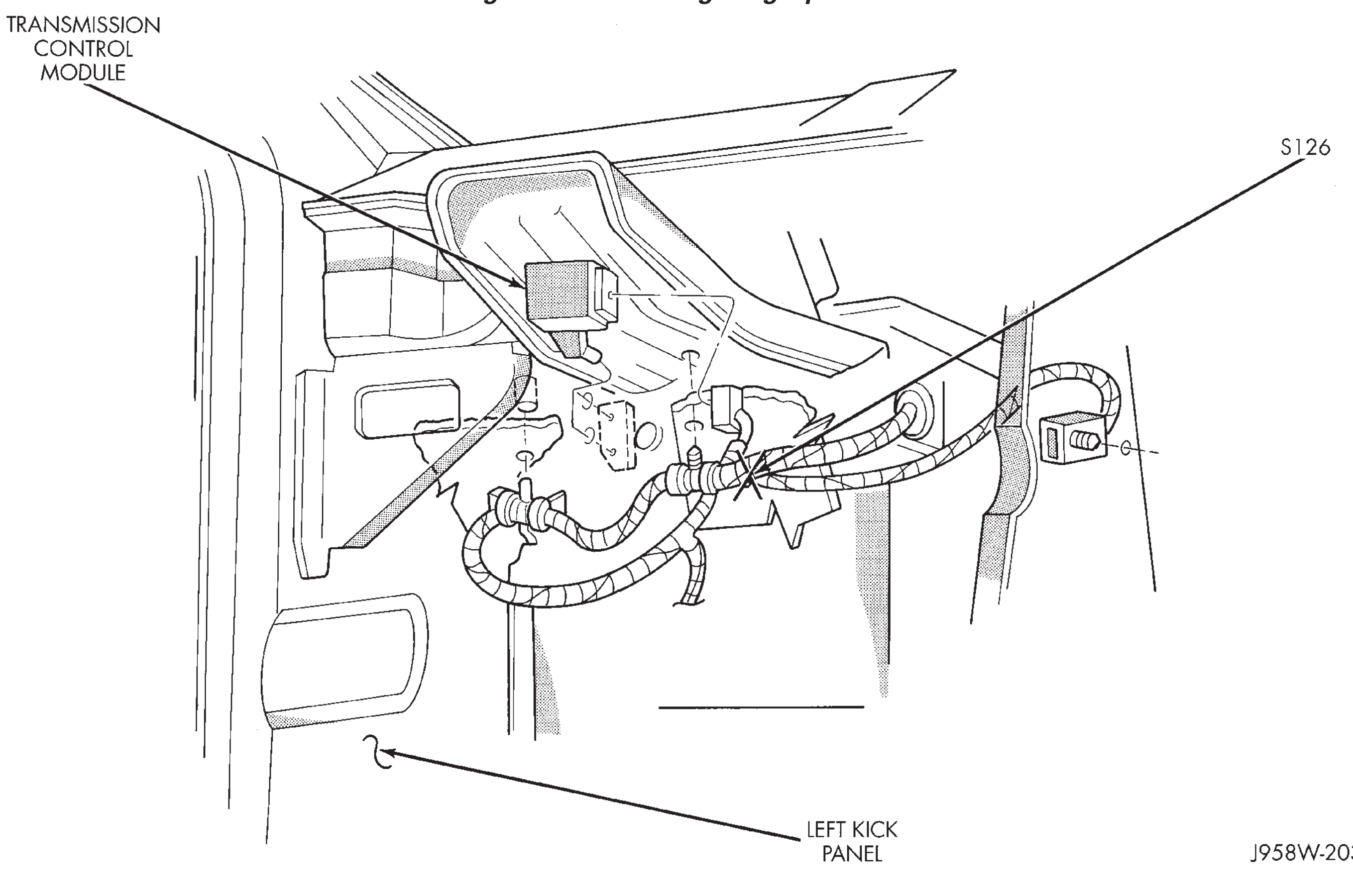

Fig. 5 Transmission Control Module

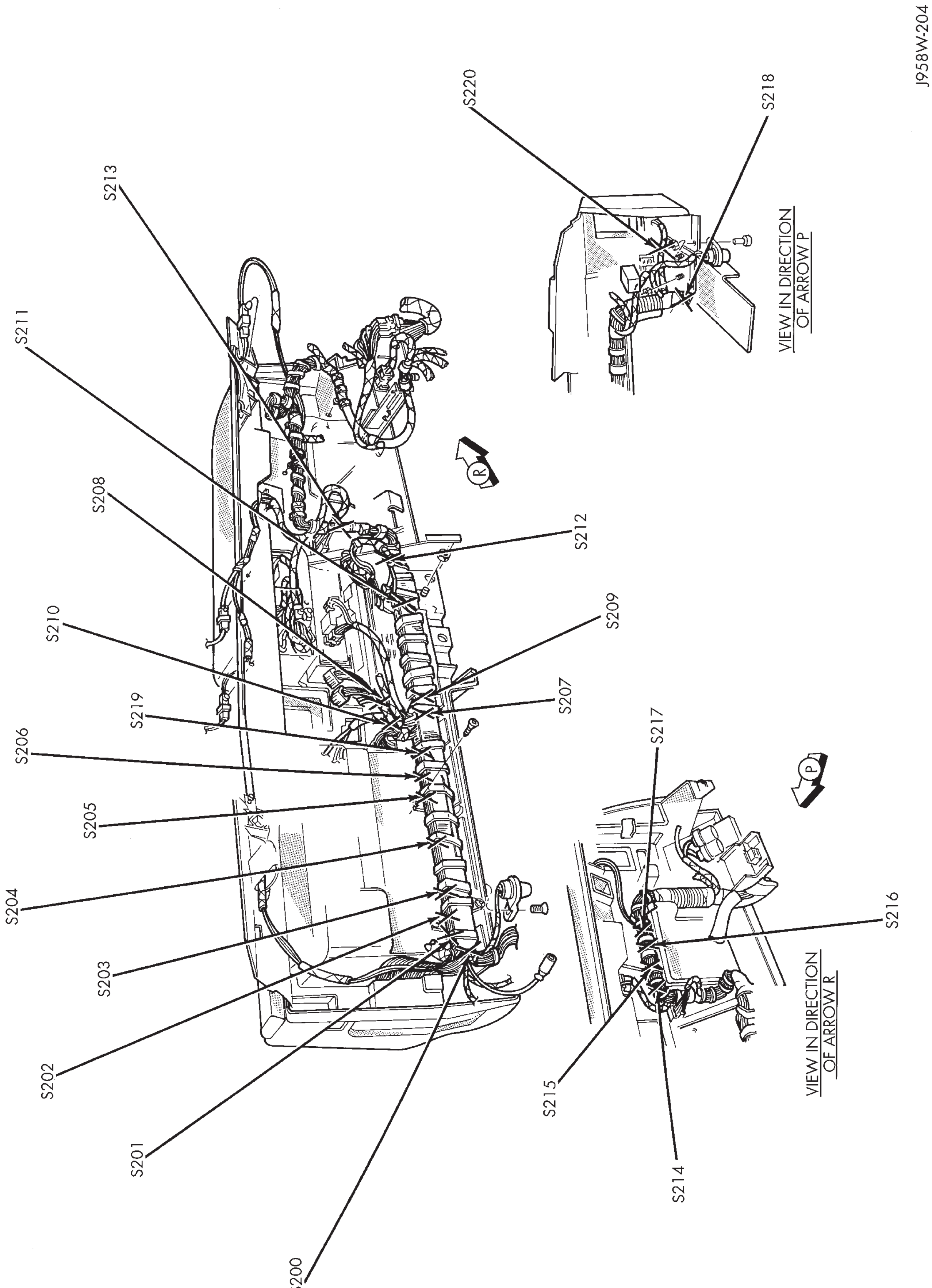

Fig. 6 Instrument Panel Wiring Splices

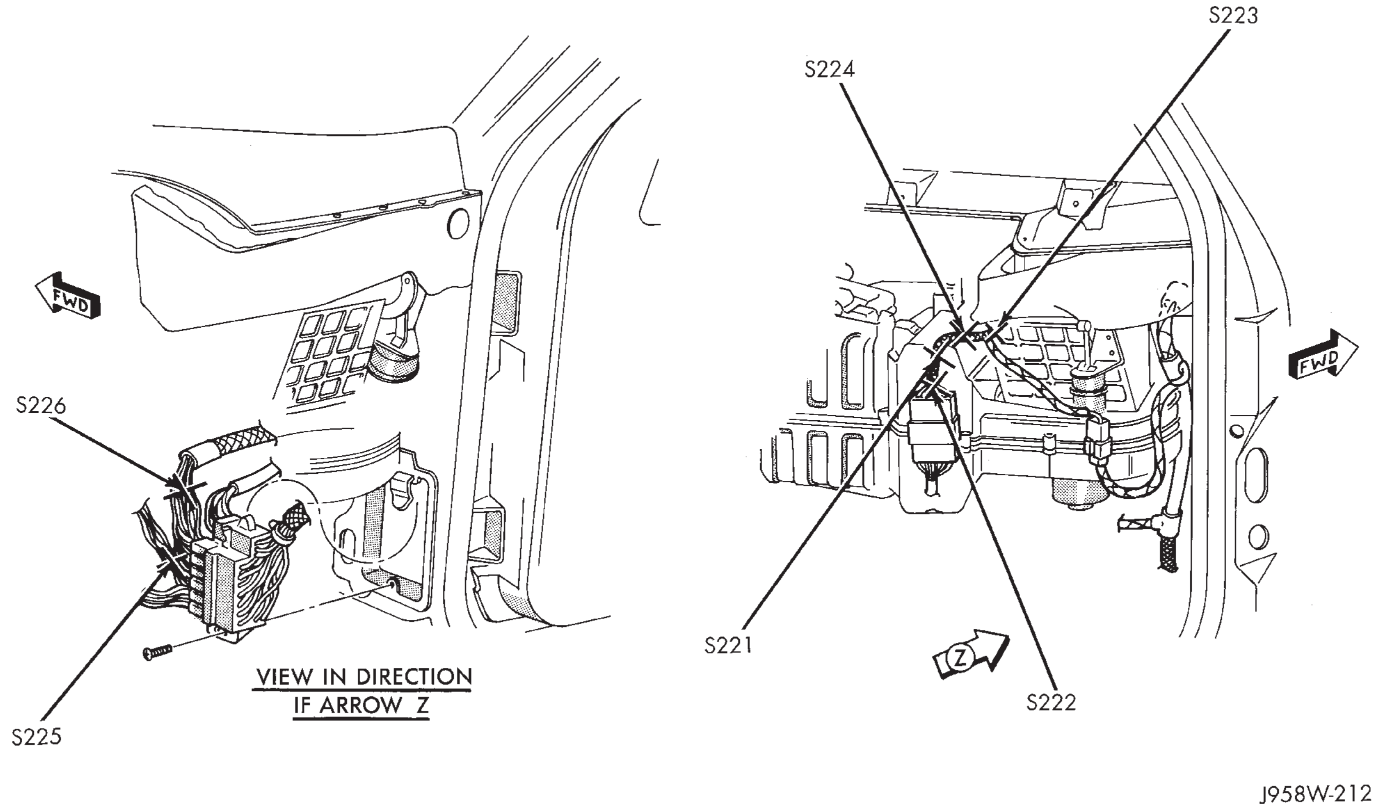

Fig. 7 HVAC Harness Splices

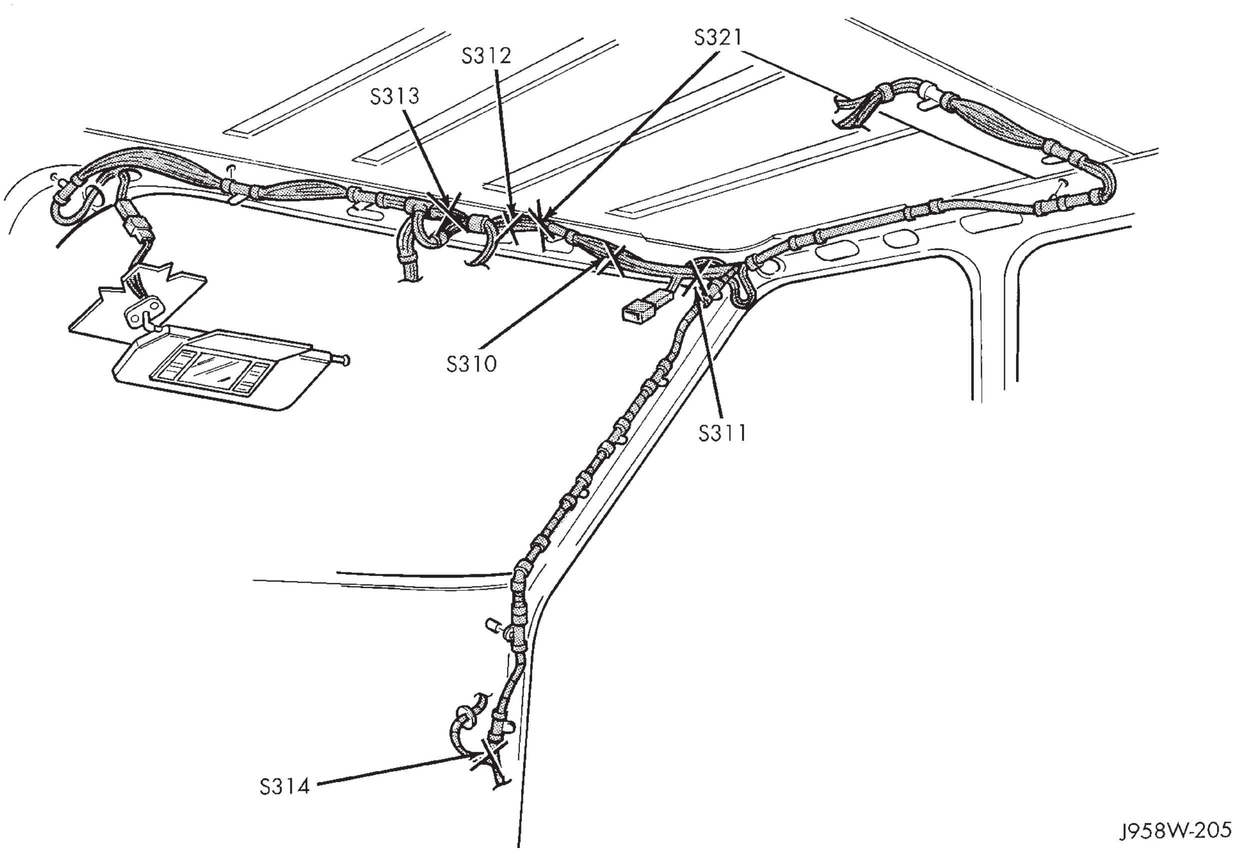

Fig. 8 Roof Splices

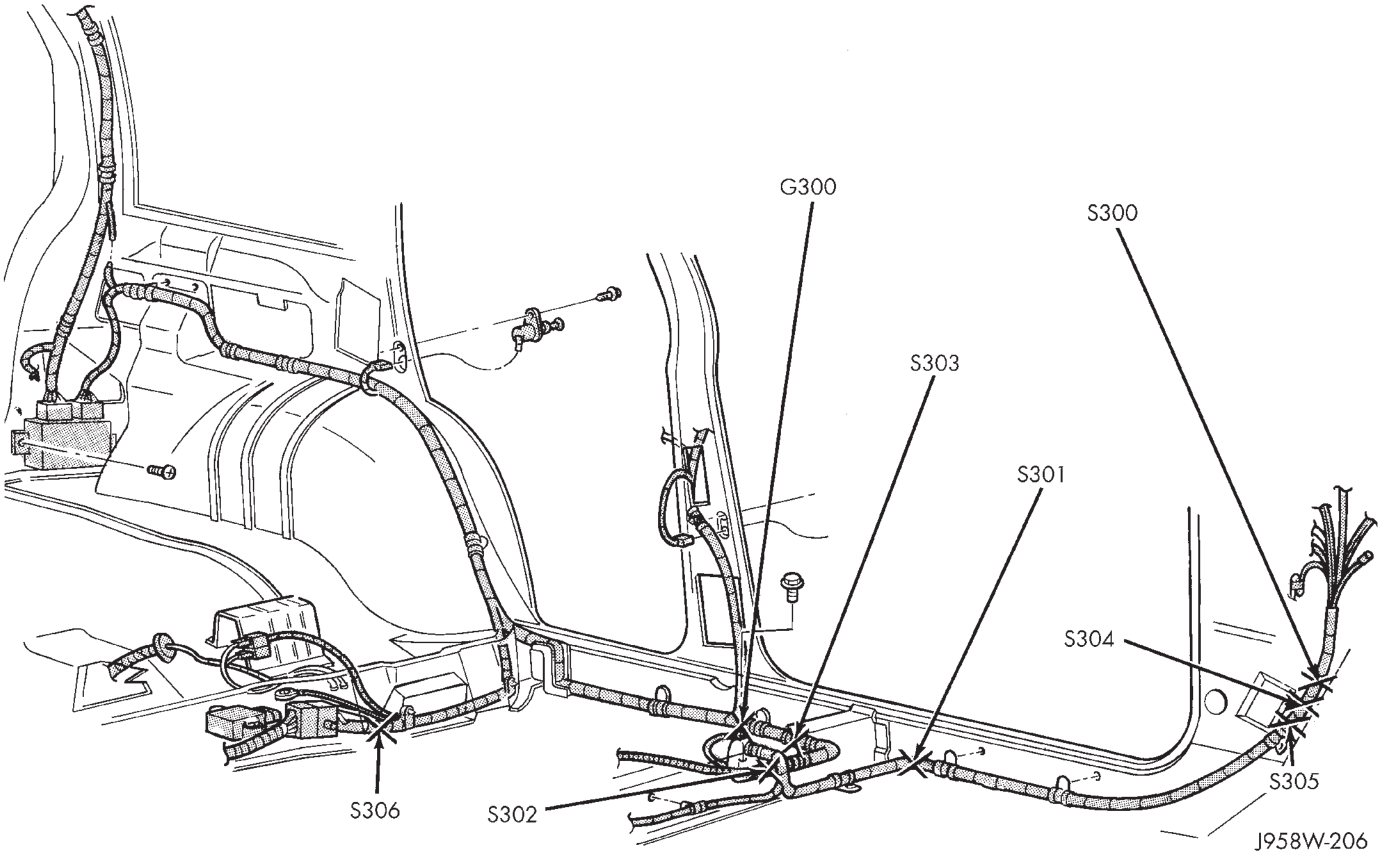

Fig. 9 Left Body Splices

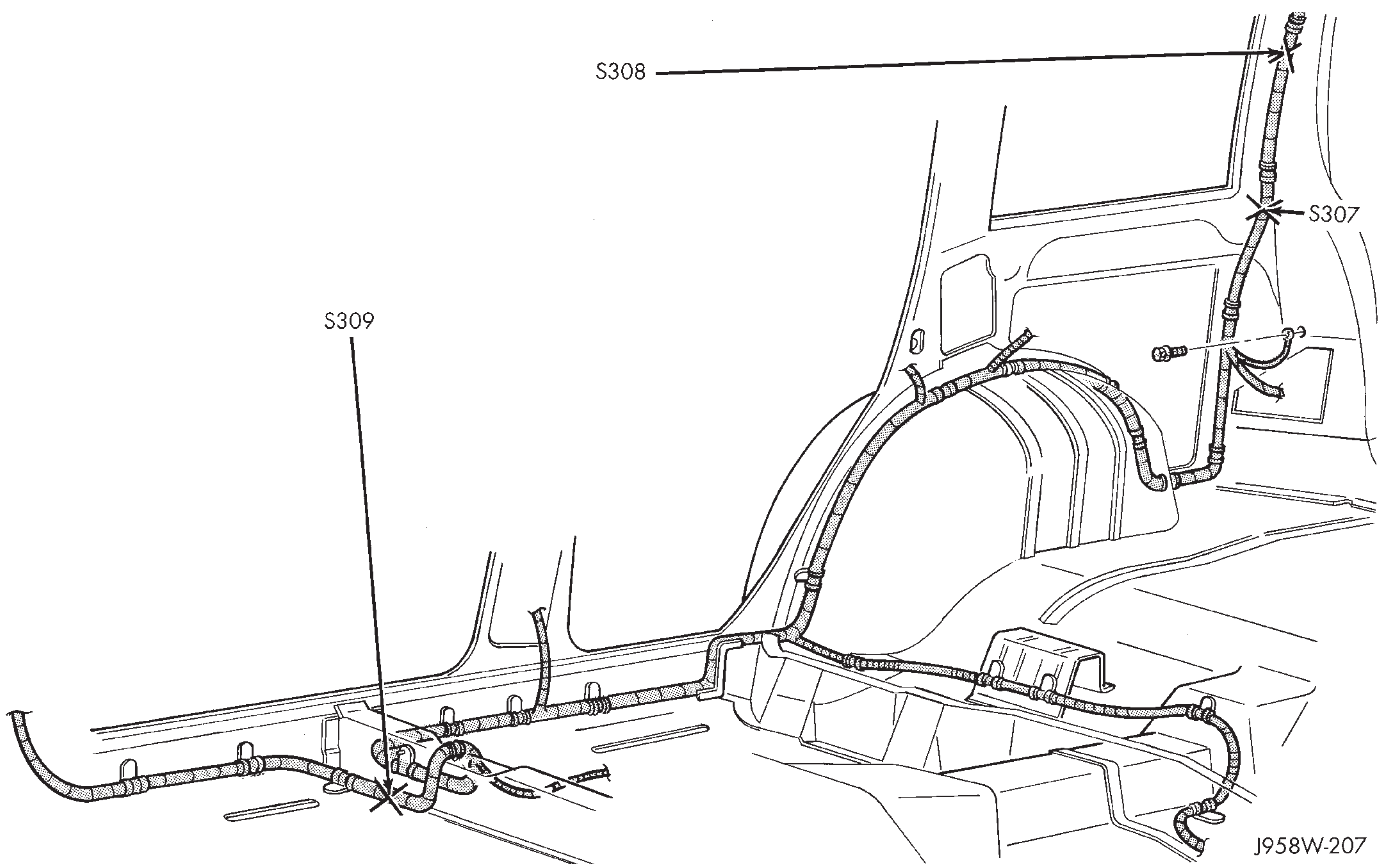

Fig. 10 Right Body Splices

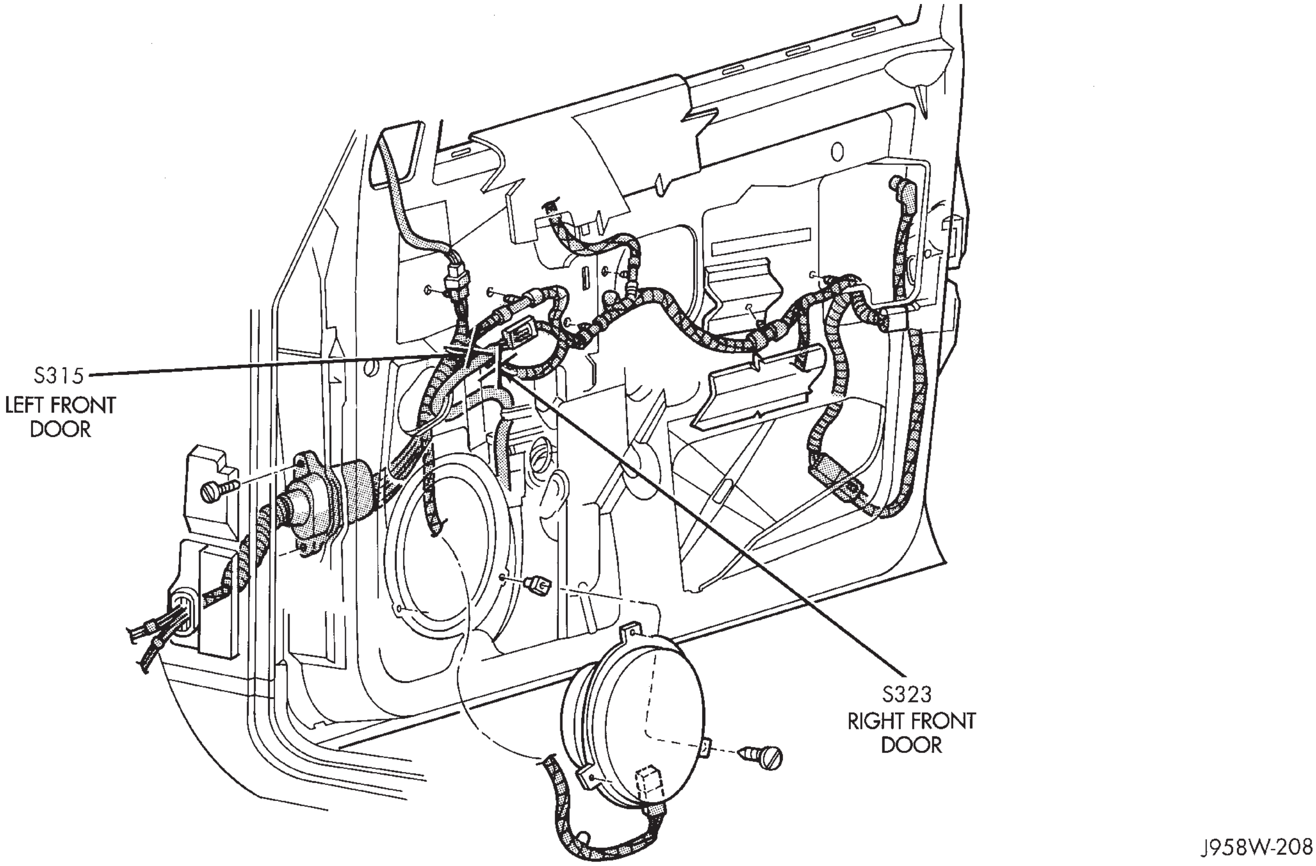

Fig. 11 Door Splices

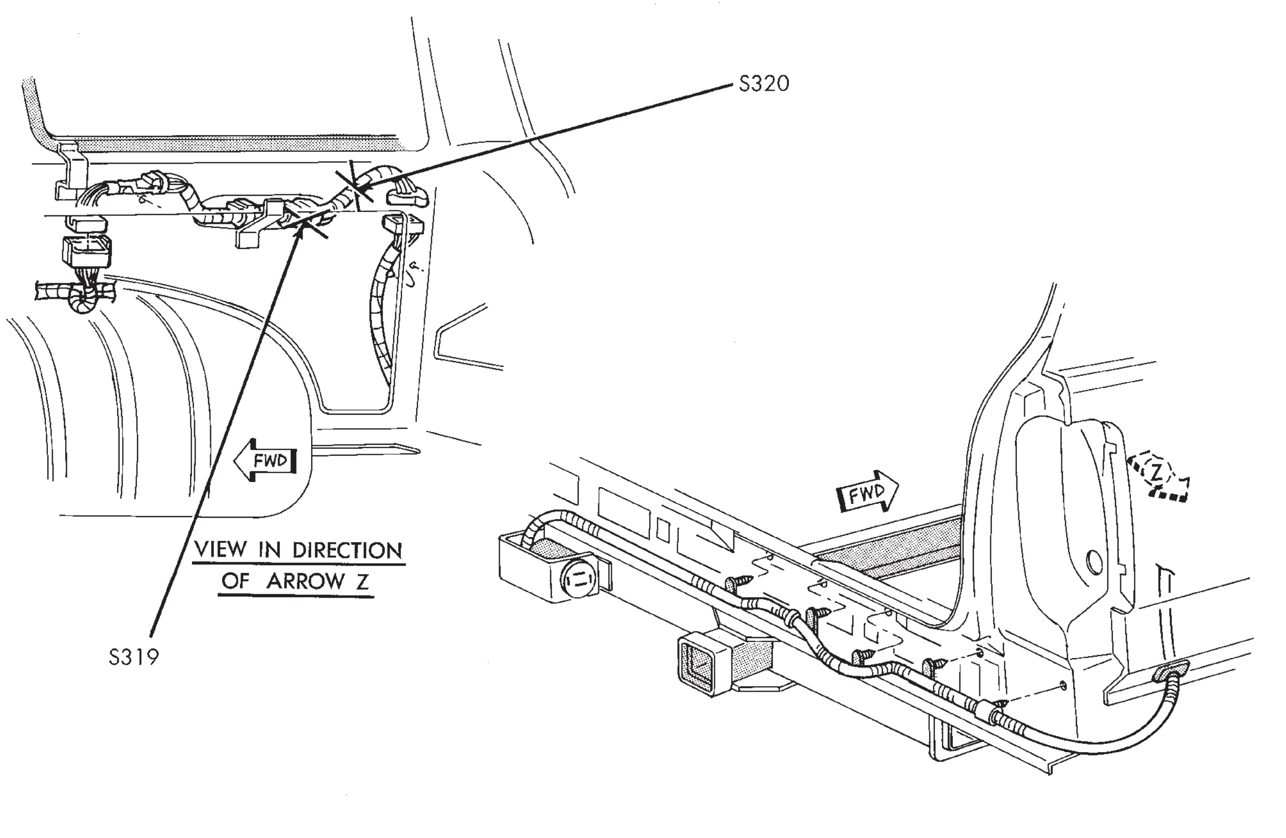

Fig. 12 Trailer Tow Harness Splices

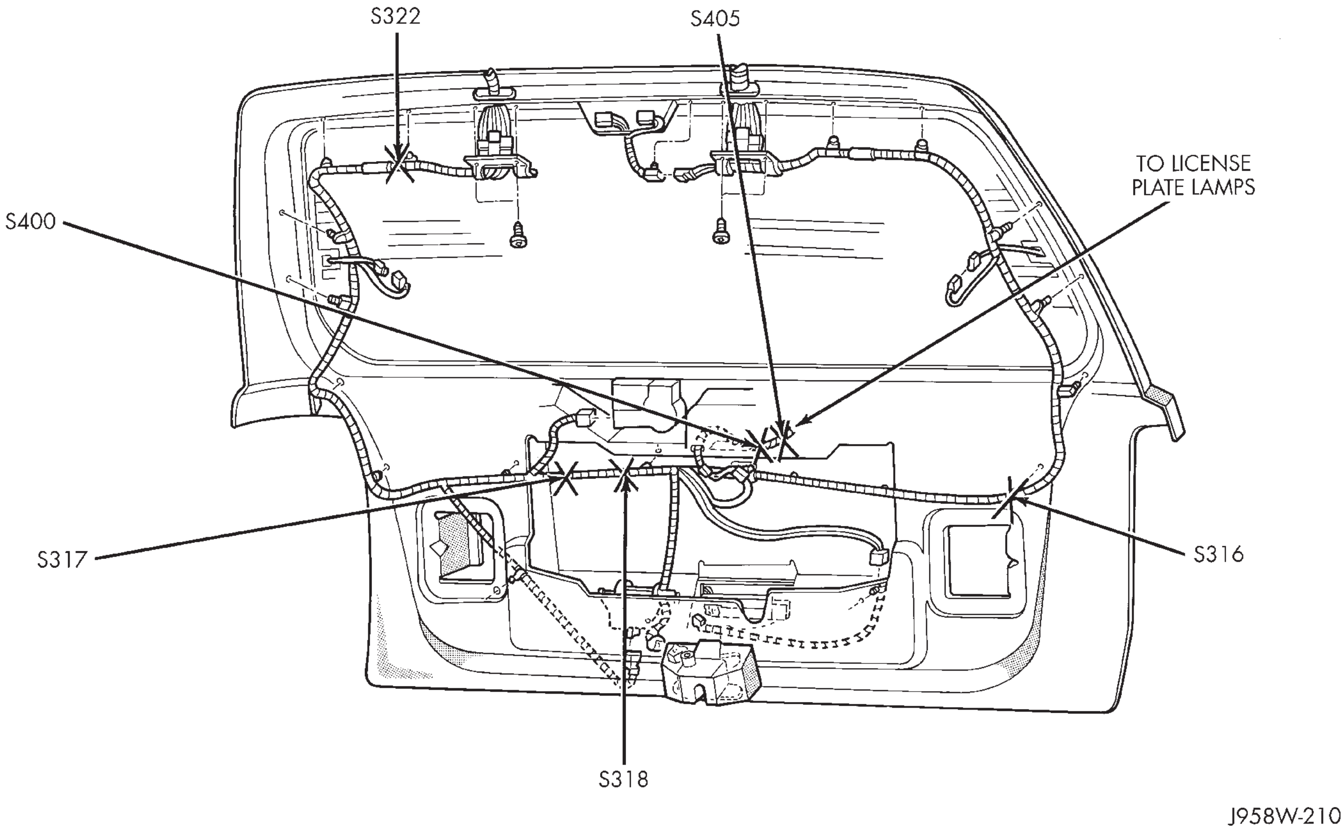

Fig. 13 Liftgate Splices

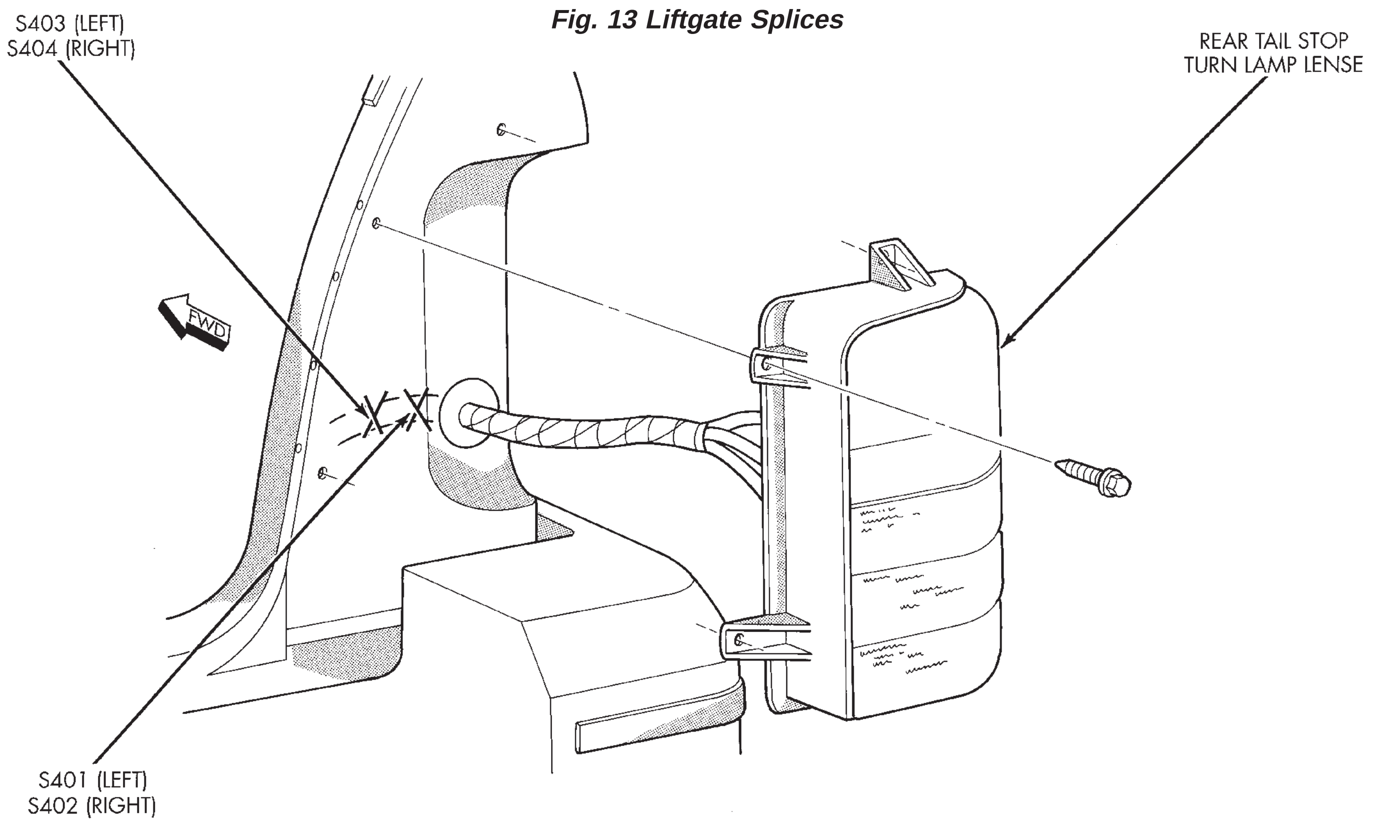

Fig. 14 Tail Lamp Harness Splices

ENGINES

CONTENTS

STANDARD SERVICE PROCEDURES

INDEX

FORM-IN-PLACE GASKETS

There are several places where form-in-place gaskets are used on the engine. **DO NOT use form-in-place gasket material unless specified.** Care must be taken when applying form-in-place gaskets. 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 area (Mopar® Silicone Rubber Adhesive Sealant and Mopar® Gasket Maker). Each have different properties and cannot be used interchangeably.

MOPAR® SILICONE RUBBER ADHESIVE SEALANT

Mopar® Silicone Rubber Adhesive Sealant, normally black in color, is available in 3 ounce tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of a year and will not properly cure if over aged. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker, normally red in color, is available in 6 cc tubes. This anaerobic type gasket material cures in the absence of air when squeezed between smooth machined metallic surfaces. It will not cure if left in the uncovered tube. DO NOT use on flexible metal flanges.

SURFACE PREPARATION

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.

Scrape or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Make sure the old gasket material is removed from blind attaching holes.

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

Mopar® Silicone Rubber Adhesive Sealant should be applied in a continuous bead approximately 3 mm (0.12 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3 or 6 mm (1/8 or 1/4 inch) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

Mopar® Gasket Maker should be applied sparingly to one gasket surface. The sealant diameter should be 1.00 mm (0.04 inch) or less. 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.

ENGINE PERFORMANCE

To provide best vehicle performance and lowest vehicle emissions, it is most important that the tune-up be done accurately. Use the specifications listed on the Vehicle Emission Control Information label found on the engine compartment hood.

(1) Test battery specific gravity. Add water, if necessary. Clean and tighten battery connections.

(2) Test cranking amperage draw (refer to Group 8B, Battery/Starter Service for the proper procedures).

(3) Tighten the intake manifold bolts (refer to Group 11, Exhaust System and Intake Manifold for the proper specifications).

(4) Perform cylinder compression test:

(a) Check engine oil level and add oil, if necessary.

(b) Drive the vehicle until engine reaches normal operating temperature.

(c) Select a route free from traffic and other forms of congestion, observe all traffic laws and briskly accelerate through the gears several times. The higher engine speed may help clean out valve seat deposits which can prevent accurate compression readings.

CAUTION: DO NOT overspeed the engine.

(d) 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.

(e) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire.

(f) Be sure throttle blades are fully open during the compression check.

(g) Insert compression gage adaptor into the No.1 spark plug hole. Crank engine until maximum pressure is reached on gauge. Record this pressure as No.1 cylinder pressure.

(h) Repeat Step 4 g for all remaining cylinders.

(i) Compression should not be less than 689 kPa (100 psi) and not vary more than 172 kPa (25 psi) from cylinder to cylinder.

(j) If cylinder(s) have abnormally low compression pressures, repeat steps 4a through 4h.

(k) If the same cylinder(s) repeat an abnormally low reading, it could indicate the existence of a problem in the cylinder.

The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should NOT be disassembled to determine the cause of low compression unless some malfunction is present.

(5) Clean or replace spark plugs as necessary. Adjust gap (refer to Group 8D, Ignition System for gap adjustment and torque).

(6) Test resistance of spark plug cables (refer to Group 8D, Ignition System).

(7) Inspect the primary wire. Test coil output voltage, primary and secondary resistance. Replace parts as necessary (refer to Group 8D, Ignition System and make necessary adjustment).

(8) Set ignition timing to specifications (refer to Specification Label on engine compartment hood).

(9) Perform a combustion analysis.

(10) Test fuel pump for pressure (refer to Group 14, Fuel System for the proper specifications).

(11) Inspect air filter element (refer to Group 0, Lubrication and Maintenance for the proper procedure).

(12) Inspect crankcase ventilation system (refer to Group 0, Lubrication and Maintenance for the proper procedure).

(13) For emission controls refer to Group 25, Emission Controls System for service procedures.

(14) Inspect and adjust accessory belt drives (refer to Group 7, Cooling System for the proper adjustments).

(15) Road test vehicle as a final test.

HONING CYLINDER BORES

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing 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.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). 20-60 strokes, depending on the bore condition, will be sufficient to

provide a satisfactory surface. Using honing oil C-3501-3880 or a light honing oil available from major oil distributors.

CAUTION: 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 crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings (Fig. 1).

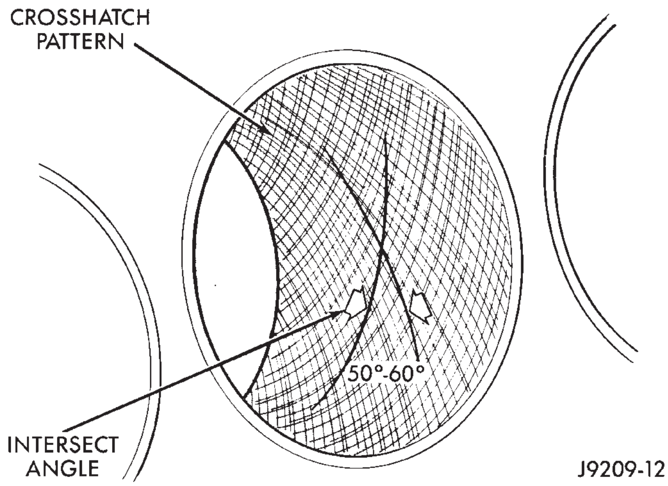

Fig. 1 Cylinder Bore Crosshatch Pattern

(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

MEASURING WITH PLASTIGAGE

CRANKSHAFT MAIN BEARING CLEARANCE

Engine crankshaft bearing clearances can be determined by use of Plastigage, or equivalent. The following is the recommended procedures for the use of Plastigage:

(1) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(2) 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:

METHOD - 1 (PREFERRED)—Shim the bearings adjacent to the bearing to be checked. This will remove the clearance between upper bearing shell and the crankshaft. Place a minimum of 0.254 mm (0.010 inch) shim between the bearing shell and the adjacent bearing cap. Tighten the bolts to 18 N·m (13 ft. lbs.) torque.

- **CHECK NO.1 BEARING:** Shim No.2 main bearing.
- **CHECK NO.2 BEARING:** Shim No.1 and No.3 main bearing.
- **CHECK NO.3 BEARING:** Shim No.2 and No.4 main bearing.
- **CHECK NO.4 BEARING:** Shim No.3 and No.5 main bearing.
- **CHECK NO.5 BEARING:** Shim No.4 main bearing (5.2L). Shim No.4 and No.6 main bearing (4.0L).
- **CHECK NO.6 BEARING:** Shim No.5 and No.7 main bearing (4.0L).
- **CHECK NO.7 BEARING:** Shim No.6 main bearing (4.0L).

Remove all shims before assembling engine.

METHOD - 2 (ALTERNATIVE)—The weight of the crankshaft is supported by a jack under the counterweight adjacent to the bearing being checked.

(3) Place a piece of Plastigage across the entire width of the bearing cap shell (Fig. 2). Position the Plastigage approximately 6.35 mm (1/4 inch) off center and away from the oil holes. In addition, suspect areas can be checked by placing the Plastigage in that area. Tighten the bearing cap bolts of the bearing being checked to 108 N·m (80 ft. lbs.) torque (4.0L Engine). Tighten the bearing cap bolts of the bearing being checked to 115 N·m (85 ft. lbs.) torque (5.2L Engine). **DO NOT rotate the crankshaft or the Plastigage may be smeared, giving inaccurate results.**

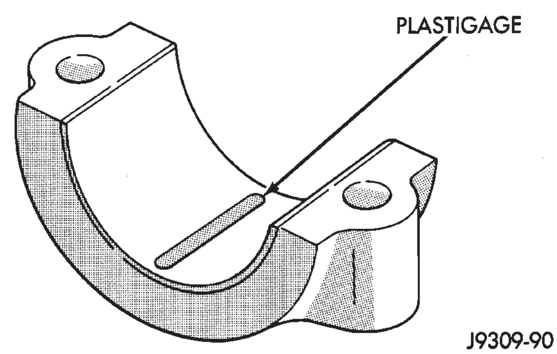

Fig. 2 Placement of Plastigage in Bearing Shell

(4) Remove the bearing cap and compare the width of the flattened Plastigage with the scale provided on the package (Fig. 3). Plastigage generally comes in 2 scales (one scale is in inches and the other is a metric scale). Locate the band closest to the same width. This band shows the amount of clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken (refer to Engine Specifications).

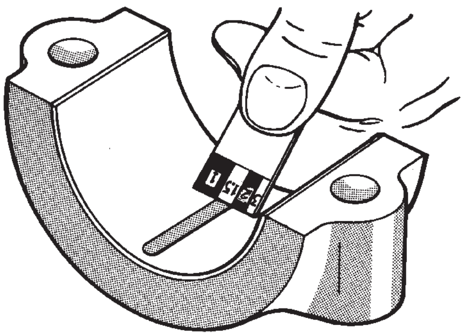

Fig. 3 Clearance Measurement

(5) Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (0.001-0.003 inch) range is usually the most appropriate for checking engine bearing clearances.

CONNECTING ROD BEARING CLEARANCE

Engine connecting rod bearing clearances can be determined by use of Plastigage, or equivalent. The following is the recommended procedures for the use of Plastigage:

(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 cap shell (Fig. 2). Position the Plastigage approximately 6.35 mm (1/4 inch) off center and away from the oil holes. In addition, suspect areas can be checked by placing the Plastigage in the suspect area.

(3) The crankshaft must be turned until the connecting rod to be checked starts moving toward the top of the engine. Only then should the rod cap with Plastigage in place be assembled. Tighten the 4.0L rod cap nut to 45 N·m (33 ft. lbs.) torque. Tighten the 5.2L rod cap nut to 61 N·m (45 ft. lbs.) torque. **DO NOT rotate the crankshaft or the Plastigage may be smeared, giving inaccurate results.**

(4) Remove the bearing cap and compare the width of the flattened Plastigage with the scale provided on the package (Fig. 3). Plastigage generally comes in 2 scales (one scale is in inches and the other is a metric scale). Locate the band closest to the same width. This band shows the amount of clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken (refer to Engine Specifications).

(5) Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (0.001-0.003 inch) range is usually the most appropriate for checking engine bearing clearances.

REPAIR DAMAGED OR WORN THREADS

Damaged or worn 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.
• 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 center line.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

SERVICE ENGINE ASSEMBLY (SHORT BLOCK)— 4.0L ENGINE

A service replacement engine assembly (short block) may be installed whenever the original cylinder block is defective or damaged beyond repair. It consists of the cylinder block, crankshaft, piston and rod assemblies. If needed, the camshaft must be procured separately and installed before the engine is installed in the vehicle.

A short block is identified with the letter S stamped on the same machined surface where the build date code is stamped for complete engine assemblies.

Installation includes the transfer of components from the defective or damaged original engine. Follow the appropriate procedures for cleaning, inspection and torque tightening.

HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Preform the Fuel Pressure Release Procedure (refer to Group 14, Fuel System).

(2) Disconnect the negative cable from the battery.

(3) Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the plugs from the engine.

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (coolant, fuel, oil, etc.).

(7) Make sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs. Tighten the 4.0L engine spark plugs to 37 N·m (27 ft. lbs.) torque. Tighten the 5.2L engine spark plugs to 41 N·m (30 ft. lbs.) torque.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the drain plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil (refer to Group 0, Lubrication and Maintenance).

(15) Connect the negative cable to the battery.

(16) Start the engine and check for any leaks.

ENGINE DIAGNOSIS

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine tune-ups.

These malfunctions may be classified as either performance (engine idles rough and stalls) or mechanical (a strange noise).

Refer to the Service Diagnosis—Performance chart and the Service Diagnosis—Mechanical chart for possible causes and corrections of malfunctions. Refer to Group 14, Fuel System for the fuel system diagnosis.

GENERAL INFORMATION

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- 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 at the suspected leak area.

(3) If a change in RPM'S, 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) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs.

(3) Secure the throttle in the wide-open position.

(4) Disconnect the ignition coil.

(5) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(6) Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

Refer to Engine Specifications for the correct engine compression pressures.

ENGINE CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A leaking engine cylinder head gasket usually results in loss of power, loss of coolant and engine misfiring.

An engine cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- An engine cylinder head gasket leaking between adjacent cylinders is indicated by a loss of power or engine misfire.
- An engine cylinder head gasket leaking between a cylinder and an adjacent water jacket is indicated by coolant foaming or overheating and loss of coolant.

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders; follow the procedures outlined in Cylinder Compression Pressure Test. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

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.

Remove the radiator cap.

Start the engine and allow it to warm up until the engine thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

If bubbles are not visible, install a radiator pressure tester and pressurize the coolant system.

If a cylinder is leaking combustion pressure into the water jacket, the tester pointer will pulsate with every combustion stroke of the cylinder.

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.

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 and 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.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to the Cylinder Combustion Pressure Leakage Test Diagnosis chart.

INSPECTION (ENGINE OIL LEAKS IN GENERAL)

Begin with a through 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 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 24km (15 miles), and repeat step (3).

If the oil leak source is not positively identified at this time, proceed with the air leak detection test method as follows:

(1) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(2) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(3) 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.

(4) 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.

(5) 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 step 7.

(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:

(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, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Group 9, Engines for proper repair procedures of 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. Refer to the service Diagnosis—Mechanical, under the Oil Leak row for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, Refer to Group 9, Engines—Crankshaft Rear Oil Seals, for proper replacement procedures.

ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292. Start engine and record pressure. Refer to Oil Pressure in Engine Specifications for the proper pressures.

SERVICE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT START	1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Moisture on ignition wires and distributor cap. 5. Faulty ignition cables. 6. Faulty coil or control unit. 7. Incorrect spark plug gap. 8. Incorrect ignition timing. 9. Dirt or water in fuel system. 10. Faulty fuel pump, relay or wiring.	1. Test battery specific gravity. Charge or replace as necessary. 2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals. 3. Refer to Group 8A, Battery/Starter/Charging System Diagnostics. 4. Wipe wires and cap clean and dry. 5. Replace any cracked or shorted cables. 6. Test and replace, if necessary (refer to Group 8D, Ignition System). 7. Set gap (refer to Group 8D, Ignition System). 8. Refer to Group 8D, Ignition System. 9. Clean system and replace fuel filter. 10. Refer to Group 14, Fuel System.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set too low. 2. Idle mixture too lean or too rich. 3. Leak in intake manifold. 4. Worn or burned distributor rotor. 5. Incorrect ignition wiring. 6. Faulty coil. 7. EGR valve leaking. 8. Incorrect cam timing.	1. Refer to Group 14, Fuel System. 2. Refer to Group 14, Fuel System. 3. Inspect intake manifold gasket and vacuum hoses. Replace, if necessary (refer to Group 11, Exhaust System & Intake Manifold). 4. Install new distributor rotor. 5. Install correct wiring. 6. Test and replace, if necessary (refer to Group 8D, Ignition System). 7. Test and replace, if necessary (refer to Group 25, Emissions Control System). 8. Refer to Timing Belt Service.
ENGINE LOSS OF POWER	1. Incorrect ignition timing. 2. Worn or burned distributor rotor. 3. Worn distributor shaft. 4. Dirty or incorrectly gapped spark plugs. 5. Dirt or water in fuel system. 6. Faulty fuel pump. 7. Incorrect valve timing. 8. Blown cylinder head gasket. 9. Low compression. 10. Burned, warped or pitted valves. 11. Plugged or restricted exhaust system. 12. Faulty ignition cables. 13. Faulty coil. 14. Incorrect cam timing.	1. Refer to Group 8D, Ignition System. 2. Install new distributor rotor. 3. Remove and repair distributor (refer to Group 8D, Ignition System). 4. Clean plugs and set gap (refer to Group 8D, Ignition System). 5. Clean system and replace fuel filter. 6. Install new fuel pump. 7. Correct valve timing. 8. Install new cylinder head gasket. 9. Test compression of each cylinder. 10. Install new valves. 11. Install new parts, as necessary. 12. Replace any cracked or shorted cables. 13. Test and replace, as necessary (refer to Group 8D, Ignition System). 14. Refer to Timing Belt Service.
ENGINE MISSES ON ACCELERATION	1. Dirty or gap set too wide in spark plug. 2. Incorrect ignition timing. 3. Dirt in fuel system. 4. Burned, warped or pitted valves. 5. Faulty coil. 6. Incorrect cam timing.	1. Clean spark plugs and set gap (refer to Group 8D, Ignition System). 2. Refer to Group 8D, Ignition System. 3. Clean fuel system. 4. Install new valves. 5. Test and replace, if necessary, (refer to Group 8D, Ignition System). 6. Refer to Timing Belt Service.
ENGINE MISSES AT HIGH SPEED	1. Dirty or gap set too wide in spark plug. 2. Worn distributor shaft. 3. Worn or burned distributor rotor. 4. Faulty coil. 5. Incorrect ignition timing. 6. Dirty injector in throttle body. 7. Dirt or water in fuel system. 8. Incorrect cam timing.	1. Clean spark plugs and set gap (refer to Group 8D, Ignition System). 2. Remove and repair distributor (refer to Group 8D, Ignition System). 3. Install new distributor rotor. 4. Test and replace, as necessary (refer to Group 8D, Ignition System). 5. Refer to Group 8D, Ignition System. 6. Clean injector. 7. Clean system and replace fuel filter. 8. Refer to Timing Belt Service.

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SERVICE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check for correct oil level (refer to Group 0, Lubrication and Maintenance.
	2. Thin or diluted oil.	2. Change oil (refer to Group 0, Lubrication and Maintenance).
	3. Low oil pressure.	3. Check engine oil level.
	4. Dirt in tappets/lash adjusters.	4. Clean hydraulic tappets/hydraulic lash adjusters.
	5. Bent push rods.	5. Install new push rods.
	6. Worn rocker arms.	6. Inspect oil supply to rocker arms.
	7. Worn tappets/lash adjusters.	7. Install new hydraulic tappets/ hydraulic lash adjusters.
	8. Worn valve guides.	8. Ream and install new valves with oversize stems.
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level (refer to Group 0, Lubrication and Maintenance).
	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 journals.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level (refer to Group 0, Lubrication and Maintenance).
	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 No. 3 main bearing for wear on flanges.
	6. Crankshaft journal out-of-round, worn.	6. Grind journals or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque.

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SERVICE DIAGNOSIS—LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings. (a) Misaligned, deteriorated or torn. (b) Loose fastener, broken or porous metal part.	1. (a) Replace the part. (b) Tighten, repair or replace the part.
	2. Crankshaft Rear Seal (a) Misinstalled, inverted or torn lip (b) Torn, cut or shaved seal back bead.	2. (a) Replace the seal. (b) Replace the seal.
	3. Crankshaft Seal Flange. Scratched, nicked or grooved.	3. Replace or polish if necessary.
	4. Cylinder block to Cap Mating Surface. (a) Inadequate Loctite sealant. (b) Oil hole burr.	4. (a) Apply sealant per sealant per service manual. (b) Carefully stone or chamfer hole.
	5. Oil Pan to Rear Main Cap Sealant (Slots 3.9 - 5.2 only). (a) Inadequate or mislocated sealant. (b) Torn, cut or misinstalled oil pan. (c) Cracked or damaged oil pan flange.	5. (a) Apply sealant per service manual procedures. (b) Replace the gasket. (c) Replace the oil pan.
	6. Chain Case Cover Seal. (a) Misinstalled, cocked or misaligned. (b) Torn, cut or damaged seal lips. (c) Scratched or damaged seal casing or cover bore. (d) Scratched or damaged vibration damper hub.	6. (a) Replace per service manual procedures. (b) Replace the seal. (c) Replace the seal. (d) Minor damage can be polished out; otherwise replace the part.
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 check 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. Excessive bearing clearance.	7. Measure bearings for correct clearance.
	8. Oil pump relief valve stuck.	8. Remove valve and inspect, clean and install.
	9. Oil pump suction tube loose, bent or cracked.	9. Remove oil pan and install new tube, if necessary.
	10. Oil pump cover warped or cracked.	10. Install new oil pump.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn, scuffed or broken rings.	1. Hone cylinder bores and install new rings.
	2. Carbon in oil ring slot.	2. Install new rings.
	3. Rings fitted too tightly in grooves.	3. Remove the rings. Check grooves. If grooves are not proper width, replace piston.
	4. Worn valve guides.	4. Ream guides and replace valves with oversize valves and seals.
	5. Leaking intake gasket (3.9L & 5.2L engines).	5. Replace gasket and tighten intake manifold to proper torque.
	6. Leaking valve guide seals (3.9L & 5.2L engines).	6. Replace seals.
	7. Dislodged valve guide seals (3.9L & 5.2L engines).	7. Seat valve guide seals or replace, as needed.

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4.0L ENGINE SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

The 4.0 Liter (242 CID) six-cylinder engine is an In-line, lightweight, overhead valve engine (Fig. 1).

Engine Type	In-line 6 Cylinder
Bore and Stroke	98.4 x 87.4 mm (3.88 x 3.44 in.)
Displacement	4.0L (242 cu. in.)
Compression Ratio	8.7:1
Torque	305 N•m (225 ft. lbs.) @ 4,000 RPM
Firing Order	1-5-3-6-2-4
Lubrication	Pressure Feed - Full Flow Filtration
Engine Oil Capacity	5.7L (6.0 Qts.) with Filter
Cooling System	Liquid Cooled - Forced Circulation
Cooling Capacity	11.4L (12.0 Qts.)
Cylinder Block	Cast Iron
Crankshaft	Cast Nodular Iron
Cylinder Head	Cast Iron
Camshaft	Cast Iron
Pistons	Aluminum Alloy (with Strut)
Piston Combustion Cavity	Double Quench
Connecting Rods	Cast Iron

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Fig. 1 Engine Description

This engine is designed for unleaded fuel.

The engine cylinder head has dual quench-type combustion chambers that create turbulence and fast burning of the air/fuel mixture. This results in good fuel economy.

The cylinders are numbered 1 through 6 from front to rear. The firing order is 1-5-3-6-2-4 (Fig. 2).

The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within seven main bearings. The camshaft rotates within four bearings.

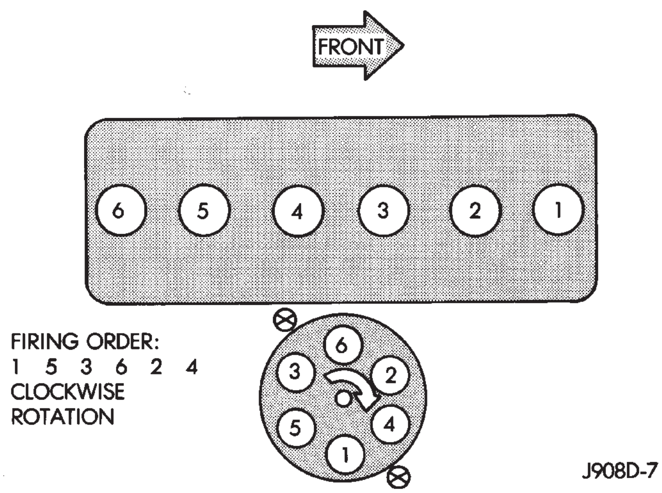

Fig. 2 Engine Firing Order

BUILD DATE CODE

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No.2 and No.3 cylinders (Fig. 3).

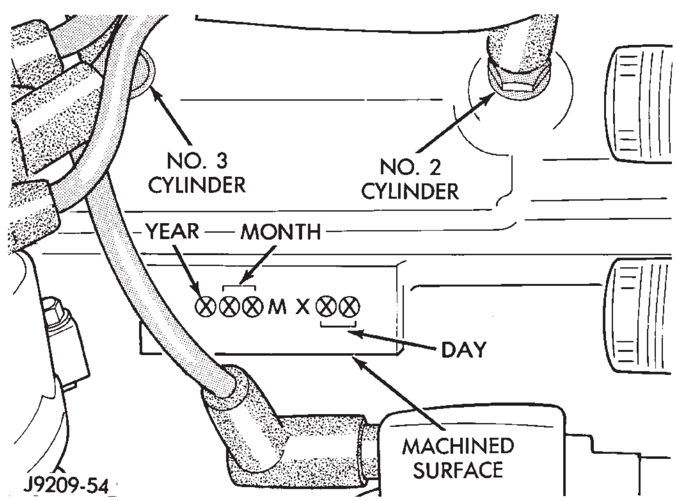

Fig. 3 Build Date Code Location

The digits of the code identify:

(1) 1st Digit—The year (4 = 1994).
(2) 2nd & 3rd Digits—The month (01 - 12).
(3) 4th & 5th Digits—The engine type/fuel system/compression ratio (MX = A 4.0 Liter (242 CID) 8.8:1 compression ratio engine with a multi-point fuel injection system).
(4) 6th & 7th Digits—The day of engine build (01 - 31).

FOR EXAMPLE: Code * 401MX12 * Identifies a 4.0 Liter (242 CID) engine with a multi-point fuel injection system, 8.7:1 compression ratio and built on January 12, 1994.

OVERSIZE AND UNDERSIZE COMPONENT CODES

Some engines may be built with oversize or undersize components such as:
- Oversize cylinder bores.
- Oversize camshaft bearing bores.
- Undersize crankshaft main bearing journals.
- Undersize connecting rod journals.

These engines are identified by a letter code (Fig. 4) stamped on a boss between the ignition coil and the distributor (Fig. 5).

CODE	COMPONENT	UNDERSIZE
P	One or more connecting rod bearing journals	0.254 mm (0.010 in)
M	All crankshaft main bearing journals	0.254 mm (0.010 in)
PM	All crankshaft main bearing journals and one or more connecting rod journals	0.254 mm (0.010 in)

CODE	COMPONENT	OVERSIZE
B	All cylinder bores	0.254 mm (0.010 in)
C	All camshaft bearing bores	0.254 mm (0.010 in)

J8909-54

Fig. 4 Oversize and Undersize Component Codes

ENGINE MOUNTS—FRONT

The front mounts support the engine at each side. These insulators are made of resilient rubber.

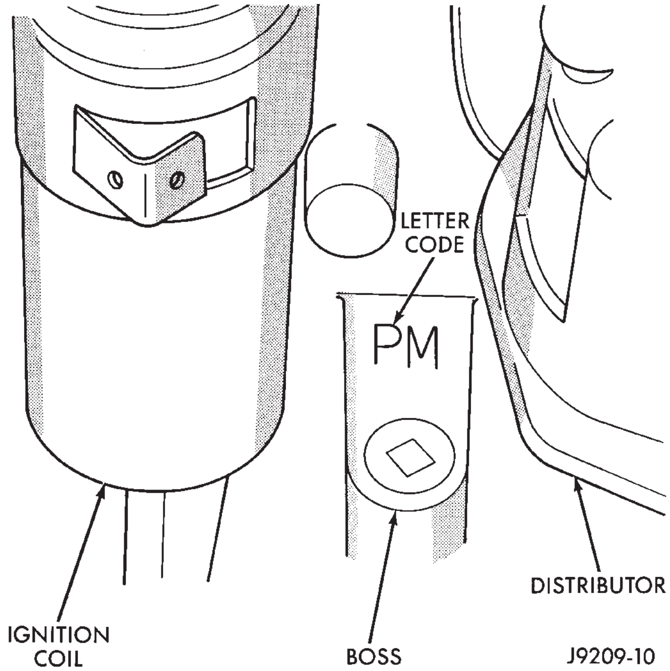

Fig. 5 Oversize and Undersize Component Code Location

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Support the engine.
(3) Raise the vehicle.
(4) Remove the insulator assembly-to-lower front sill bolts (Fig. 6 or 7).
(5) Raise the engine slightly.
(6) Remove the thru-bolt nut and thru-bolt (Fig. 6 or 7). Remove the insulator.

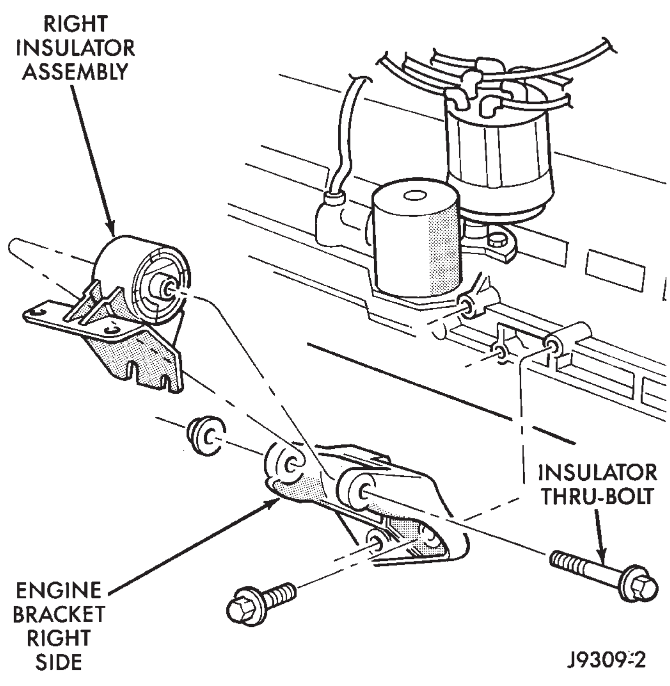

Fig. 6 Front Engine Mount—Right Side

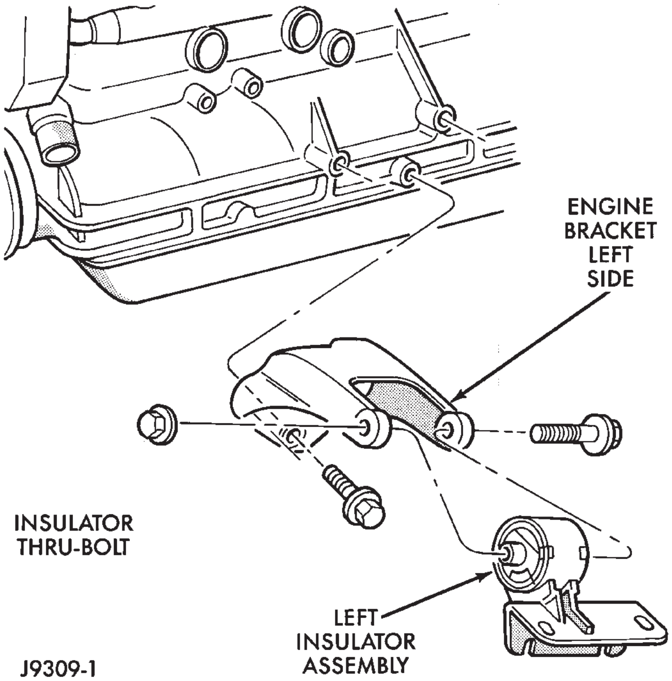

Fig. 7 Front Engine Mount—Left Side

(7) If required, remove the engine bracket from the block (Fig. 6 or 7).

INSTALLATION

(1) If removed, install the engine bracket to the block (Fig. 6 or 7). Tighten the bolts to 61 N·m (45 ft. lbs.) torque.

(2) Install the insulator assembly to the lower front sill. Tighten the bolts to 65 N·m (48 ft. lbs.) torque.

(3) With the engine insulator assembly and engine bracket in position, install the thru-bolt and nut (Fig. 6 or 7). Tighten the thru-bolt nut to 121 N·m (89 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Remove the engine support.

(6) Connect the negative cable to the battery.

ENGINE MOUNT—REAR

A resilient rubber cushion bracket assembly supports the transmission at the rear. This bracket is attached to the crossmember (Fig. 8).

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle and support the transmission.

(3) Remove the nuts holding the clevis bracket to the crossmember (Fig. 8).

(4) Raise the transmission SLIGHTLY.

(5) Remove the thru-bolt and nut (Fig. 8). Remove the rear mount bracket clevis.

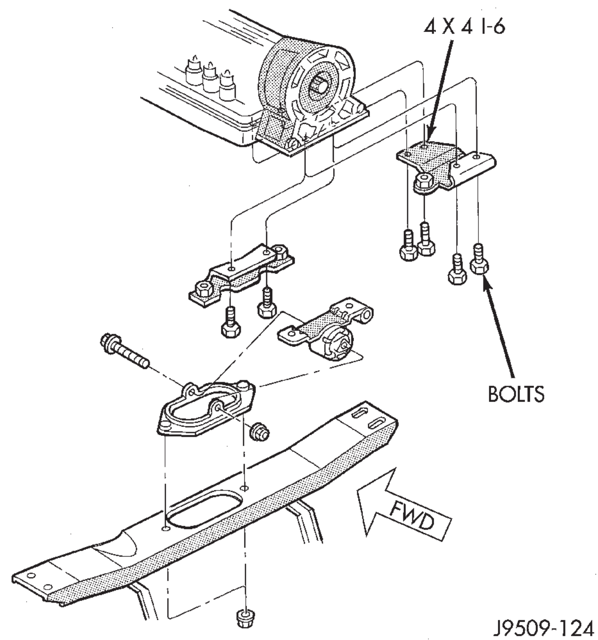

Fig. 8 Engine Mount—Rear

(6) Remove the bolts holding the rear mount bracket to the transmission (Fig. 8). Remove the bracket from the exhaust pipe hanger. Remove the bracket.

INSTALLATION

(1) Position the rear mount bracket onto the exhaust hanger. Position the rear mount bracket assembly onto the transmission and install the bolts (Fig. 8). Tighten the bolts to the proper torque:

• MANUAL TRANSMISSION—Tighten to 46 N·m (34 ft. lbs.) torque.

• AUTOMATIC TRANSMISSION—Tighten to 75 N·m (55 ft. lbs.) torque.

(2) Install the thru-bolt into the rear mount bracket and clevis (Fig. 8). Finger tighten the nut at this time.

(3) Lower the transmission until the clevis bracket studs are in position on the crossmember (Fig. 8). Install the clevis bracket stud nuts. Tighten the nuts to 41 N·m (30 ft. lbs) torque.

(4) Tighten the thru-bolt nut to 121 N·m (89 ft. lbs.) torque.

(5) Remove the transmission support.

(6) Lower the vehicle.

(7) Connect the negative cable to the battery.

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect the battery cables. Remove the battery.

(2) Mark the hinge locations on the hood panel for alignment reference during installation. Remove the engine compartment lamp. Remove the hood.

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. USE CARE TO PREVENT SCALDING BY HOT COOLANT. CAREFULLY RELEASE THE PRESSURE BEFORE REMOVING THE RADIATOR DRAIN COCK AND CAP.

(3) Remove the radiator drain cock and radiator cap to drain the coolant. DO NOT waste usable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(4) Remove the upper radiator hose and coolant recovery hose (Fig. 9).

(5) Remove the lower radiator hose.

(6) Remove upper radiator support retaining bolts and remove radiator support.

(7) Remove the fan assembly from the water pump.

(8) Remove the fan shroud (Fig. 9).

(9) Disconnect the transmission fluid cooler tubing (automatic transmission).

(10) **Vehicles with Air Conditioning:**

(a) Discharge the A/C system (refer to Group 24, Heating and Air Conditioning).

(b) Remove the service valves and cap the compressor ports.

(11) Remove the radiator or radiator/condenser (if equipped with A/C).

(12) Disconnect the heater hoses at the engine thermostat housing and water pump (Fig. 9).

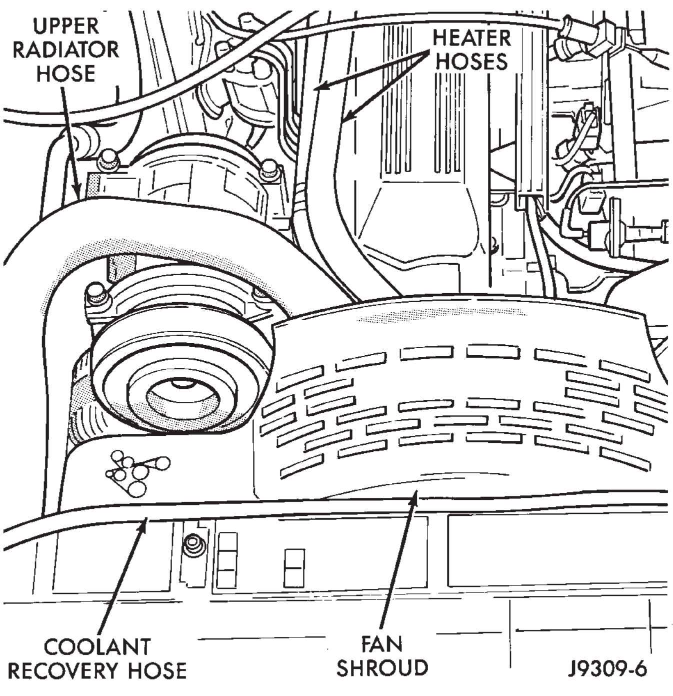

Fig. 9 Upper Radiator Hose, Coolant Recovery Hose, Fan Shroud & Heater hoses

(13) Disconnect the throttle linkages (Fig. 10).

(14) Disconnect the vehicle speed control cable (if equipped)—(Fig. 10).

(15) Disconnect the line pressure cable (if equipped with automatic transmission).

(16) Disconnect injection system wire harness connector at each injector. Mark the wires for proper installation.

(17) Disconnect the distributor electrical connection and the oil pressure switch connector.

(18) Disconnect the quick-connect fuel lines at the fuel rail and return line by squeezing the two retaining tabs against the fuel tube (Fig. 10). Pull the fuel tube and retainer from the quick-connect fitting (refer to Group 14, Fuel System for the proper procedure).

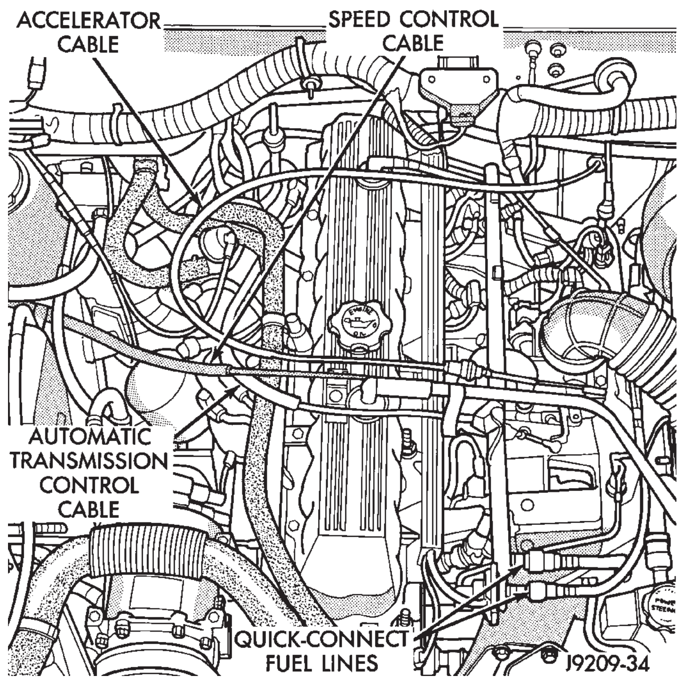

Fig. 10 Accelerator Cable, Vehicle Speed Control Cable, Automatic Transmission Control Cable & Quick-Connect Fuel Lines

(19) Remove the fuel line bracket from the intake manifold.

(20) Remove the air cleaner assembly (Fig. 11).

(21) Remove the power brake vacuum check valve from the booster, if equipped.

(22) **Vehicles with Power Steering (Fig. 11):**

(a) Disconnect the hoses from the fittings at the steering gear.

(b) Drain the pump reservoir.

(c) Cap the fittings on the hoses and steering gear to prevent foreign objects from entering the system.

(23) Identify, tag and disconnect all necessary wire connectors and vacuum hoses.

(24) Raise and support the vehicle.

(25) Disconnect the wires from the engine starter motor solenoid.

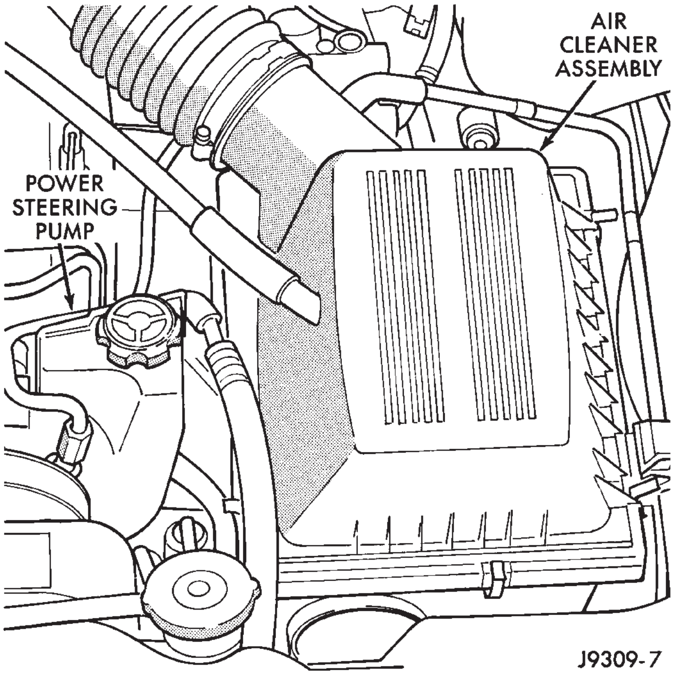

Fig. 11 Air Cleaner Assembly & Power Steering Pump

(26) Remove the engine starter motor.

(27) Disconnect the oxygen sensor from the exhaust pipe.

(28) Disconnect the exhaust pipe from the manifold.

(29) Disconnect the vehicle speed sensor wire connection.

(30) Remove the exhaust pipe support.

(31) Remove the engine flywheel/converter housing access cover.

(32) **Vehicles with Automatic Transmission:**

(a) Mark the converter and drive plate location.

(b) Remove the converter-to-drive plate bolts.

(33) Remove the upper engine flywheel/converter housing bolts and loosen the bottom bolts.

(34) Remove the engine mount cushion-to-engine compartment bracket bolts.

(35) Lower the vehicle.

(36) Attach a lifting device to the engine.

(37) Raise the engine off the front supports.

(38) Place a support or floor jack under the converter (or engine flywheel) housing.

(39) Remove the remaining converter (or engine flywheel) housing bolts.

(40) Lift the engine out of the engine compartment.

INSTALLATION

CAUTION: When installing the engine into a vehicle equipped with an automatic transmission, be careful not to damage the trigger wheel on the engine flywheel.

(1) Attach a lifting device to the engine and lower the engine into the engine compartment. For easier installation, it may be necessary to remove the engine mount bracket as an aid in alignment of the engine to the transmission.

(2) **Vehicles with Manual Transmission:**

(a) Insert the transmission shaft into the clutch spline.

(b) Align the engine flywheel housing with the engine.

(c) Install and tighten the engine flywheel housing lower bolts finger tight.

(3) **Vehicles with Automatic Transmission:**

(a) Align the transmission torque converter housing with the engine.

(b) Loosely install the converter housing lower bolts and install the next higher bolt and nut on each side.

(c) Tighten all 4 bolts finger tight.

(4) Install the engine mount brackets (if removed).

(5) Lower the engine and engine mount brackets onto the engine compartment cushions. Install the bolts and finger tighten the nuts.

(6) Remove the engine lifting device.

(7) Raise and support the vehicle.

(8) Install the remaining engine flywheel/converter housing bolts. Tighten all bolts to 38 N·m (28 ft. lbs.) torque.

(9) **Vehicles with Automatic Transmission:**

(a) Install the converter-to-drive plate bolts.

(b) Ensure the installation reference marks are aligned.

(10) Install the engine flywheel/converter housing access cover.

(11) Install the exhaust pipe support and tighten the screw.

(12) Tighten the engine mount-to-bracket bolts.

(13) Connect the vehicle speed sensor wire connections and tighten the screws.

(14) Connect the exhaust pipe to the manifold.

(15) Install the engine starter motor and connect the cable.

(16) Connect the wires to the engine starter motor solenoid.

(17) Lower the vehicle.

(18) Connect all the vacuum hoses and wire connectors identified during engine removal.

(19) **Vehicles equipped with Power Steering:**

(a) Remove the protective caps

(b) Connect the hoses to the fittings at the steering gear. Tighten the nut to 52 N·m (38 ft. lbs.) torque.

(c) Fill the pump reservoir with fluid.

(20) Install the power brake vacuum check valve from the booster, if equipped.

(21) Connect the fuel inlet and return hoses at the fuel rail. Verify that the quick-connect fitting assembly fits securely over the fuel lines by giving the fuel lines a firm tug.

(22) Install the fuel line bracket to the intake manifold.

(23) Connect the distributor electrical connector and oil pressure switch connector.

(24) Connect the injection system wires to the injectors.

(25) Connect the line pressure cable (if equipped with automatic transmission).

(26) Connect the vehicle speed control cable, if equipped.

(27) Connect the throttle cable linkages.

(28) Connect the heater hoses at the engine thermostat housing and water pump.

(29) Install the fan assembly to the water pump.

(30) Place the fan shroud in position over the fan.

(31) Install the radiator or radiator/condenser (if equipped with A/C).

(32) Connect the service valves to the A/C compressor ports, if equipped with A/C.

(33) Charge the air conditioner system (refer to Group 24, Heating and Air Conditioning).

(34) Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped.

(35) Install the fan shroud to the radiator or radiator/condenser (if equipped with A/C).

(36) Install upper radiator support.

(37) Connect the upper radiator hose and tighten the clamp.

(38) Connect the lower radiator hose and tighten the clamp.

(39) Fill the cooling system with reusable coolant or new coolant (refer to Group 7, Cooling System).

(40) Align the hood to the scribe marks. Install the hood.

(41) Connect the vacuum harness connector.

(a) Firmly push the connectors together ensuring that the retaining tabs are engaged.

(b) Insert the vacuum connector assembly into the retaining bracket on the intake manifold.

(42) Install the air cleaner assembly.

(43) Install the battery and connect the battery cable.

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 FAN. DO NOT WEAR LOOSE CLOTHING.

(44) Start the engine, inspect for leaks and correct the fluid levels, as necessary.

ENGINE CYLINDER HEAD COVER

A cured gasket is part of the engine cylinder head cover.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect the Crankcase Ventilation (CCV) vacuum hose from engine cylinder head cover (Fig. 1).

(3) Disconnect the fresh air inlet hose from the engine cylinder head cover (Fig. 1).

(4) Remove the engine cylinder head cover mounting bolts.

(5) Remove the engine cylinder head cover.

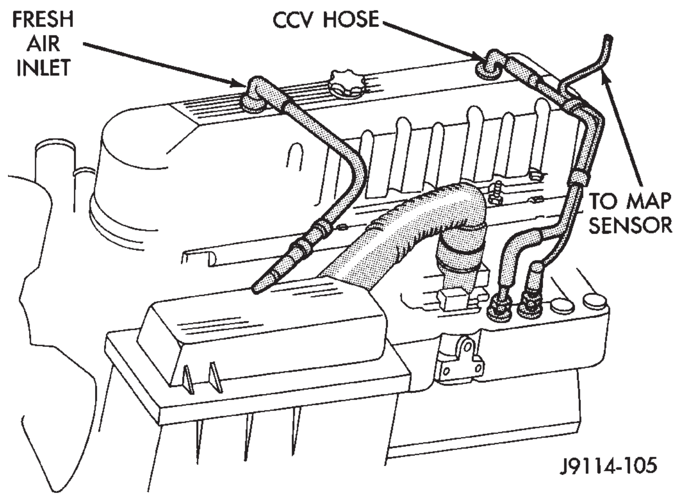

Fig. 1 Engine Cylinder Head Cover

CLEANING

Remove any original sealer from the cover sealing surface of the engine cylinder head and clean the surface using a fabric cleaner.

Remove all residue from the sealing surface using a clean, dry cloth.

INSPECTION

Inspect the engine cylinder head cover for cracks. Replace the cover, if cracked.

The original dark grey gasket material should NOT be removed. If sections of the gasket material are missing or are compressed, replace the engine cylinder head cover. However, sections with minor damage such as small cracks, cuts or chips may be repaired with a hand held applicator. The new material must be smoothed over to maintain gasket height. Allow the gasket material to cure prior to engine cylinder head cover installation.

INSTALLATION

(1) If a replacement cover is installed, transfer the CCV valve grommet and oil filler cap from the original cover to the replacement cover.

(2) Install engine cylinder head cover. Tighten the mounting bolts to 10 N·m (85 in. lbs.) torque.

(3) Connect the CCV hoses (Fig. 1).
(4) Connect negative cable to battery.

VALVE COMPONENT REPLACE—CYLINDER HEAD NOT REMOVED

ROCKER ARMS AND PUSH RODS

This procedure can be done with the engine in or out of the vehicle.

REMOVAL

(1) Remove the engine cylinder head cover.
(2) Remove the capscrews at each bridge and pivot assembly (Fig. 2). Alternately loosen the capscrews one turn at a time to avoid damaging the bridges.
(3) Check for rocker arm bridges which are causing misalignment of the rocker arm to valve tip area.
(4) Remove the bridges, pivots and corresponding pairs of rocker arms (Fig. 2). Place them on a bench in the same order as removed.
(5) Remove the push rods and place them on a bench in the same order as removed.

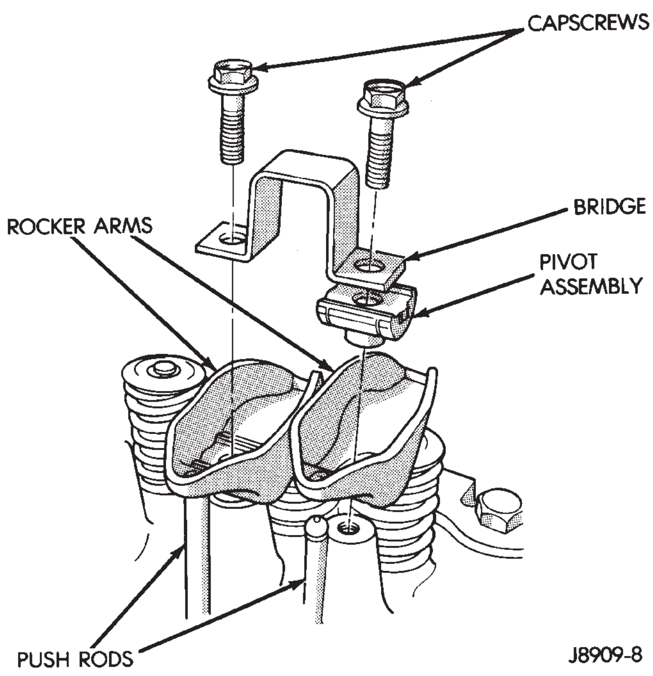

Fig. 2 Rocker Arm Assembly

CLEANING

Clean all the components with cleaning solvent.
Use compressed air to blow out the oil passages in the rocker arms and push rods.

INSPECTION

Inspect the pivot surface area of each rocker arm. Replace any that are scuffed, pitted, cracked or excessively worn.
Inspect the valve stem tip contact surface of each rocker arm and replace any rocker arm that is deeply pitted.
Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn because of lack of oil, replace it and inspect the corresponding hydraulic tappet for excessive wear.
Inspect the push rods for straightness by rolling them on a flat surface or by shining a light between the push rod and the flat surface.
A wear pattern along the length of the push rod is not normal. Inspect the engine cylinder head for obstruction if this condition exists.

INSTALLATION

(1) Lubricate the ball ends of the push rods with Mopar® Engine Oil Supplement, or equivalent and install push rods in their original locations. Ensure that the bottom end of each push rod is centered in the tappet plunger cap seat.
(2) Using Mopar® Engine Oil Supplement, or equivalent, lubricate the area of the rocker arm that the pivot contacts. Install rocker arms, pivots and bridge above each cylinder in their original position.
(3) Loosely install the capscrews through each bridge.
(4) At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.
(5) Install the engine cylinder head cover.

VALVE STEM SEAL AND SPRING REPLACEMENT

This procedure can be done with the engine cylinder head installed on the block.

REMOVAL

Each valve spring is held in place by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.
(1) Remove the engine cylinder head cover.
(2) Remove capscrews, bridge and pivot assemblies and rocker arms for access to each valve spring to be removed.
(3) Remove push rods. Retain the push rods, bridges, pivots and rocker arms in the same order and position as removed.
(4) Inspect the springs and retainer for cracks and possible signs of weakening.
(5) Remove the spark plug(s) adjacent to the cylinder(s) below the valve springs to be removed.
(6) Install a 14 mm (1/2 inch) (thread size) air hose adaptor in the spark plug hole. An adaptor can be constructed by welding an air hose connection to the body of a spark plug with the porcelain removed.
(7) Connect an air hose to the adapter and apply air pressure slowly. Maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats. For vehicles equipped with an air conditioner, use a flexible air adaptor when servicing the No.1 cylinder.

(8) Tap the retainer or tip with a rawhide hammer to loosen the lock from the retainer. Use Valve Spring Compressor Tool MD-998772A to compress the spring and remove the locks (Fig. 3).

(9) Remove valve spring and retainer (Fig. 3).

(10) Remove valve stem oil seals (Fig. 3). Note the valve seals are different for intake and exhaust valves. The top of each seal is marked either INT (Intake) or EXH (Exhaust). DO NOT mix the seals.

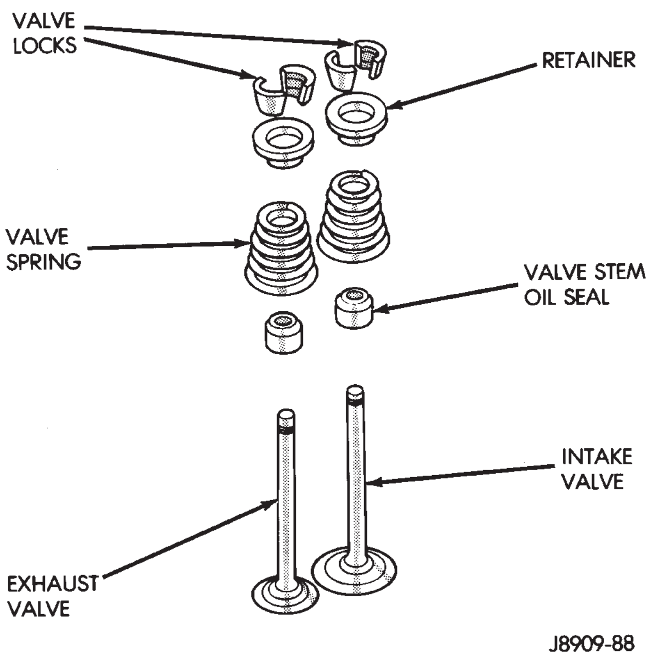

Fig. 3 Valve and Valve Components

INSPECTION

Inspect the valve stems, especially the grooves. An Arkansas smooth stone should be used to remove nicks and high spots.

INSTALLATION

CAUTION: Install oil seals carefully to prevent damage from the sharp edges of the valve spring lock grove.

(1) Lightly push the valve seal over the valve stem and valve guide boss. Be sure the seal is completely seated on the valve guide boss.

(2) Install valve spring and retainer.

(3) Compress the valve spring with Valve Spring Compressor Tool MD-988772A and insert the valve locks. Release the spring tension and remove the tool. Tap the spring from side-to-side to ensure that the spring is seated properly on the engine cylinder head.

(4) Disconnect the air hose. Remove the adaptor from the spark plug hole and install the spark plug.

(5) Repeat the procedures for each remaining valve spring to be removed.

(6) Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

(7) Install the rocker arms, pivots and bridge at their original location.

(8) Tighten the bridge capscrews alternately, one at a time, to avoid damaging the bridge. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(9) Install the engine cylinder head cover.

HYDRAULIC TAPPETS

Retain all the components in the same order as removed.

REMOVAL

(1) Remove the engine cylinder head cover.

(2) Remove the bridge and pivot assemblies and rocker arms by removing the capscrews at each bridge. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

(3) Remove the push rods.

(4) Remove the intake and engine exhaust manifolds (refer to Group 11, Exhaust System and Intake Manifold for the proper procedure).

(5) Remove the engine cylinder head and gasket.

(6) Remove the tappets through the push rod openings in the cylinder block with Hydraulic Valve Tappet Removal/Installation Tool C-4129-A (Fig. 4).

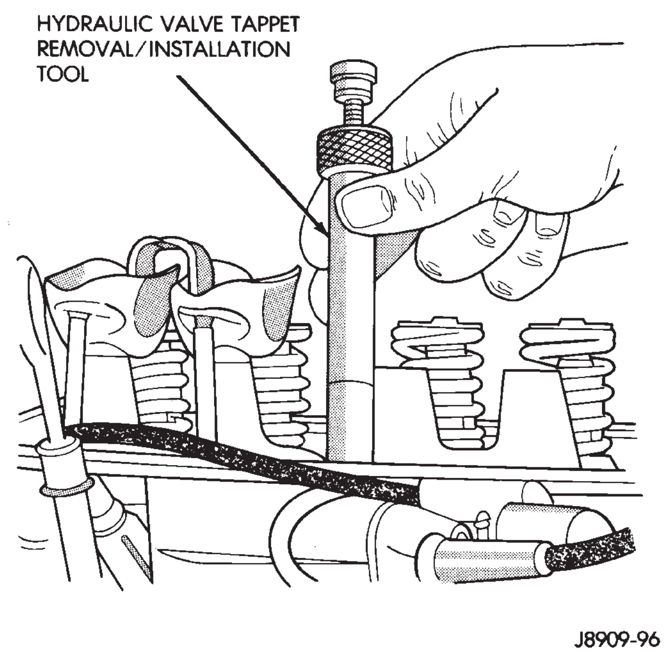

Fig. 4 Hydraulic Valve Tappet Removal/Installation Tool C-4129-A

CLEANING

Clean each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

INSPECTION

Inspect for indications of scuffing on the side and base of each tappet body.

Inspect each tappet base for concave wear with a straightedge positioned across the base. If the base is concave, the corresponding lobe on the camshaft is also worn. Replace the camshaft and defective tappets.

LEAK-DOWN TEST

After cleaning and inspection, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation (Fig. 5).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Leak-Down Tester 7980.

(1) Place a 7.925-7.950 mm (0.312-0.313 inch) diameter ball bearing on the plunger cap of the tappet.

(2) Lift the ram and position the tappet (with the ball bearing) inside the tester cup.

(3) Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. DO NOT tighten the hex nut on the ram.

(4) Fill the tester cup with hydraulic valve tappet test oil until the tappet is completely submerged.

(5) Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

(6) Adjust the nose of the ram to align the pointer with the SET mark on the scale of the tester and tighten the hex nut.

(7) Slowly swing the weighted arm onto the push rod.

(8) Rotate the cup by turning the handle at the base of the tester clockwise one revolution every 2 seconds.

(9) Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark. A normally functioning tappet will require 20-110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.

INSTALLATION

It is not necessary to charge the tappets with engine oil. They will charge themselves within a very short period of engine operation.

(1) Dip each tappet in Mopar® Engine Oil Supplement, or equivalent.

(2) Use Hydraulic Valve Tappet Removal/Installation Tool C-4129-A to install each tappet in the same bore from where it was originally removed.

(3) Install the exhaust and intake manifolds (refer to Group 11, Exhaust System and Intake Manifold for the proper procedure).

(4) Install the engine cylinder head and gasket.

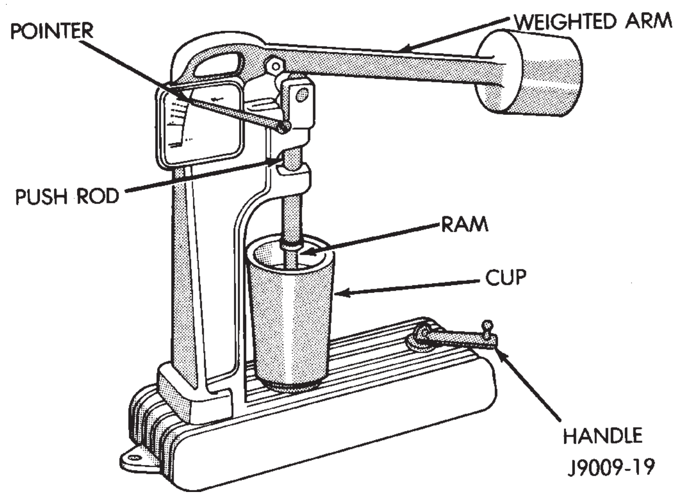

Fig. 5 Leak-Down Tester 7980

(5) Install the push rods in their original locations.

(6) Install the rocker arms and bridge and pivot assemblies at their original locations. Loosely install the capscrews at each bridge.

(7) Tighten the capscrews alternately, one turn at a time, to avoid damaging the bridges. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(8) Pour the remaining Mopar® Engine Oil Supplement, or equivalent over the entire valve actuating assembly. The Mopar® Engine Oil Supplement, or equivalent must remain with the engine oil for at least 1 609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

(9) Install the engine cylinder head cover.

ENGINE CYLINDER HEAD

This procedure can be done with the engine in or out of the vehicle.

REMOVAL

(1) Disconnect negative cable from battery.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAIN COCK WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(2) Drain the coolant and disconnect the hoses at the engine thermostat housing. DO NOT waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

(3) Remove the air cleaner assembly.

(4) Remove the engine cylinder head cover.

(5) Remove the capscrews, bridge and pivot assemblies and rocker arms (Fig. 2).

(6) Remove the push rods (Fig. 2). **Retain the push rods, bridges, pivots and rocker arms in the same order as removed.**

(7) Loosen the serpentine drive belt at the power steering pump, if equipped or at the idler pulley (refer to Group 7, Cooling System for the proper procedure).

(8) If equipped with air conditioning, perform the following:

(a) Remove the bolts from the A/C compressor mounting bracket and set the compressor aside.

(b) Remove the air conditioner compressor bracket bolts from the engine cylinder head.

(c) Loosen the thru-bolt at the bottom of the bracket.

(9) If equipped, disconnect the power steering pump bracket. Set the pump and bracket aside. DO NOT disconnect the hoses.

(10) Perform the Fuel System Pressure Release procedure (refer to Group 14, Fuel System). Remove the fuel lines and vacuum advance hose.

(11) Remove the intake and engine exhaust manifolds from the engine cylinder head (refer to Group 11, Exhaust System and Intake Manifold for the proper procedures).

(12) Disconnect the ignition wires and remove the spark plugs.

(13) Disconnect the temperature sending unit wire connector.

(14) Remove the ignition coil and bracket assembly.

(15) Remove the engine cylinder head bolts. Bolt No.14 cannot be removed until the head is moved forward. Pull bolt No.14 out as far as it will go and then suspend the bolt in this position (tape around the bolt).

(16) Remove the engine cylinder head and gasket (Fig. 6).

(17) If this was the first time the bolts were removed, put a paint dab on the top of the bolt. If the bolts have a paint dab on the top of the bolt or it isn't known if they were used before, discard the bolts.

(18) Stuff clean lint free shop towels into the cylinder bores.

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and engine exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

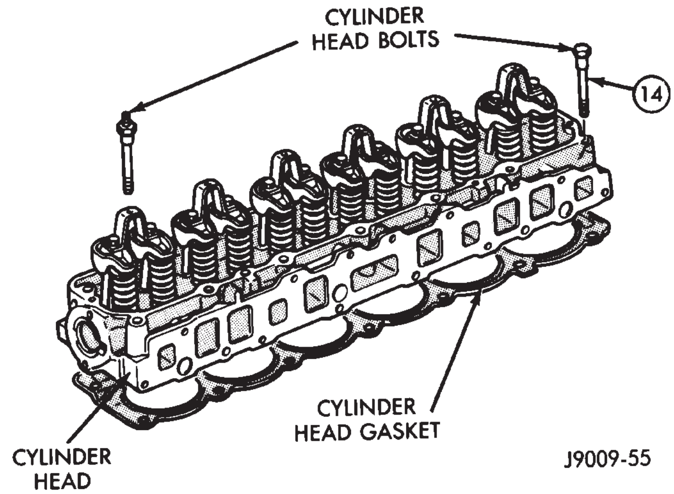

Fig. 6 Engine Cylinder Head Assembly

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

INSTALLATION

The engine cylinder head gasket is a composition gasket. The gasket is to be installed DRY. **DO NOT use a gasket sealing compound on the gasket.**

If the engine cylinder head is to be replaced and the original valves used, measure the valve stem diameter. Only standard size valves can be used with a service replacement engine cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems. Remove all carbon buildup and reface the valves.

(1) Remove the shop towels from the cylinder bores. Coat the bores with clean engine oil.

(2) Position the engine cylinder head gasket (with the numbers facing up) onto the cylinder block.

CAUTION: Engine cylinder head bolts should be reused only once. Replace the head bolts if they were used before or if they have a paint dab on the top of the bolt.

(3) With bolt No.14 held in place (tape around bolt), install the engine cylinder head. Remove the tape from bolt No.14.

(4) Coat the threads of stud bolt No.11 with Loctite 592 sealant, or equivalent.

(5) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 7):

(a) Tighten all bolts in sequence (1 through 14) to 30 N·m (22 ft. lbs.) torque.

(b) Tighten all bolts in sequence (1 through 14) to 61 N·m (45 ft. lbs.) torque.

(c) Check all bolts to verify they are set to 61 N·m (45 ft. lbs.) torque.

(d) Tighten bolts (in sequence):

• Bolts 1 through 10 to 149 N·m (110 ft. lbs.) torque.
• Bolt 11 to 136 N·m (100 ft. lbs.) torque.
• Bolts 12 through 14 to 149 N·m (110 ft. lbs.) torque.

CAUTION: During the final tightening sequence, bolt No.11 will be tightened to a lower torque than the rest of the bolts. DO NOT overtighten bolt No.11.

(e) Check all bolts in sequence to verify the correct torque.

(f) If not already done, clean and mark each bolt with a dab of paint after tightening. Should you encounter bolts which were painted in an earlier service operation, replace them.

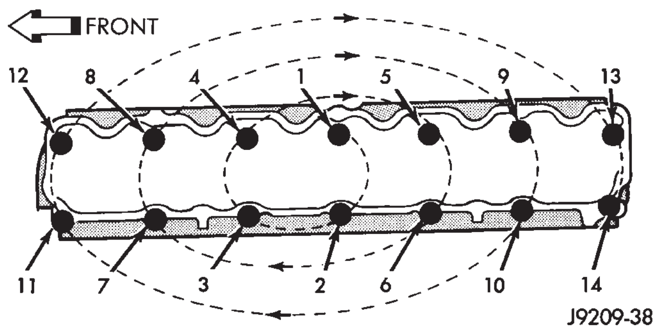

Fig. 7 Engine Cylinder Head Bolt Tightening Sequence

(6) Install the ignition coil and bracket assembly.

(7) Connect the temperature sending unit wire connector.

(8) Install the spark plugs and tighten to 37 N·m (27 ft. lbs.) torque. Connect the ignition wires.

(9) Install the intake and engine exhaust manifolds (refer to Group 11, Exhaust System and Intake Manifold for the proper procedures).

(10) Install the fuel lines and the vacuum advance hose.

(11) If equipped, attach the power steering pump and bracket.

(12) Install the push rods, rocker arms, pivots and bridges in the order they were removed.

(13) Install the engine cylinder head cover.

(14) Attach the air conditioner compressor mounting bracket to the engine cylinder head and block. Tighten the bolts to 40 N·m (30 ft. lbs.) torque.

(15) Attach the air conditioning compressor to the bracket. Tighten the bolts to 27 N·m (20 ft. lbs.) torque.

CAUTION: The serpentine drive belt must be routed correctly. Incorrect routing can cause the water pump to turn in the opposite direction causing the engine to overheat.

(16) Install the serpentine drive belt and correctly tension the belt (refer to Group 7, Cooling System for the proper procedure).

(17) Install the air cleaner and ducting.

(18) Install the engine cylinder head cover.

(19) Connect the hoses to the engine thermostat housing and fill the cooling system to the specified level (refer to Group 7, Cooling Systems for the proper procedure).

(20) The automatic transmission throttle linkage and cable must be adjusted after completing the engine cylinder head installation (refer to Group 21, Transmissions for the proper procedures).

(21) Install the temperature sending unit and connect the wire connector.

(22) Connect the fuel pipe and vacuum advance hose.

(23) Connect negative cable to battery.

(24) Connect the upper radiator hose and heater hose at the engine thermostat housing.

(25) Fill the cooling system. Check for leaks.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH THE FAN. DO NOT PUT HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(26) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the engine thermostat opens. Add coolant, if required.

VALVES AND VALVE SPRINGS

This procedure is done with the engine cylinder head removed from the block.

REMOVAL

(1) Remove the engine cylinder head from the cylinder block.

(2) Use Valve Spring Compressor Tool MD-998772A and compress each valve spring.

(3) Remove the valve locks, retainers, springs and valve stem oil seals. Discard the oil seals.

(4) Use an Arkansas smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.

(5) Remove the valves, and place them in a rack in the same order as removed.

VALVE CLEANING

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

Clean all grime and gasket material from the engine cylinder head machined gasket surface.

INSPECTION

Inspect for cracks in the combustion chambers and valve ports.

Inspect for cracks on the exhaust seat.

Inspect for cracks in the gasket surface at each coolant passage.

Inspect valves for burned, cracked or warped heads.

Inspect for scuffed or bent valve stems.

Replace valves displaying any damage.

VALVE REFACING

(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 0.787 mm (0.031 inch) must remain (Fig. 8). If the margin is less than 0.787 mm (0.031 inch), the valve must be replaced.

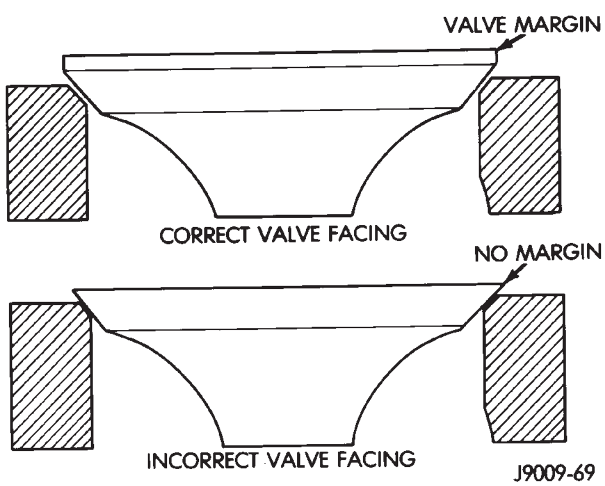

Fig. 8 Valve Facing Margin

VALVE SEAT REFACING

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

(2) Use tapered stones to obtain the specified seat width when required.

(3) Control valve seat runout to a maximum of 0.0635 mm (0.0025 in.)—(Fig. 9).

VALVE STEM OIL SEAL REPLACEMENT

Valve stem oil seals are installed on each valve stem to prevent rocker arm lubricating oil from entering the combustion chamber through the valve guide bores. One seal is marked INT (intake valve) and the other is marked EXH (exhaust valve).

Replace the oil seals whenever valve service is performed or if the seals have deteriorated.

VALVE GUIDES

The valve guides are an integral part of the engine cylinder head and are not replaceable.

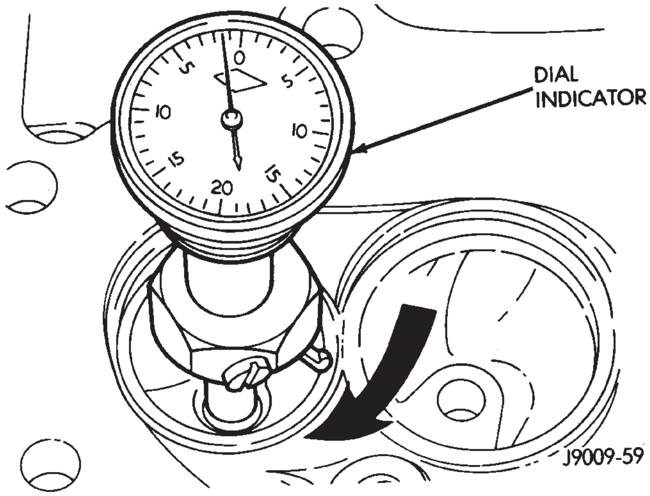

Fig. 9 Measurement of Valve Seat Runout

When the valve stem guide clearance is excessive, the valve guide bores must be reamed oversize. Service valves with oversize stems are available in 0.076 mm (0.003 inch) and 0.381 mm (0.015 inch) increments.

Corresponding oversize valve stem seals are also available and must be used with valves having 0.381 mm (0.015 inch) oversize stems, 0.076mm (.003in.) oversize stems do not require oversize seals.

If the valve guides are reamed oversize, the valve seats must be ground to ensure that the valve seat is concentric to the valve guide.

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

Valve stem-to-guide clearance may be measured by either of the following two methods.

PREFERRED METHOD:

(1) Remove the valve from the head.

(2) Clean the valve stem guide bore with solvent and a bristle brush.

(3) Insert a telescoping gauge into the valve stem guide bore approximately 9.525 mm (.375 inch) from the valve spring side of the head (Fig. 10).

(4) Remove and measure telescoping gauge with a micrometer.

(5) Repeat the measurement with contacts lengthwise to engine cylinder head.

(6) Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0635 mm (0.0025 in.), ream the guide bore to accommodate an oversize valve stem.

(7) Compare the measured valve guide bore diameter with specifications (7.95-7.97 mm or 0.313-0.314 inch). If the measurement differs from specification by more than 0.076 mm (0.003 inch), ream the guide bore to accommodate an oversize valve stem.

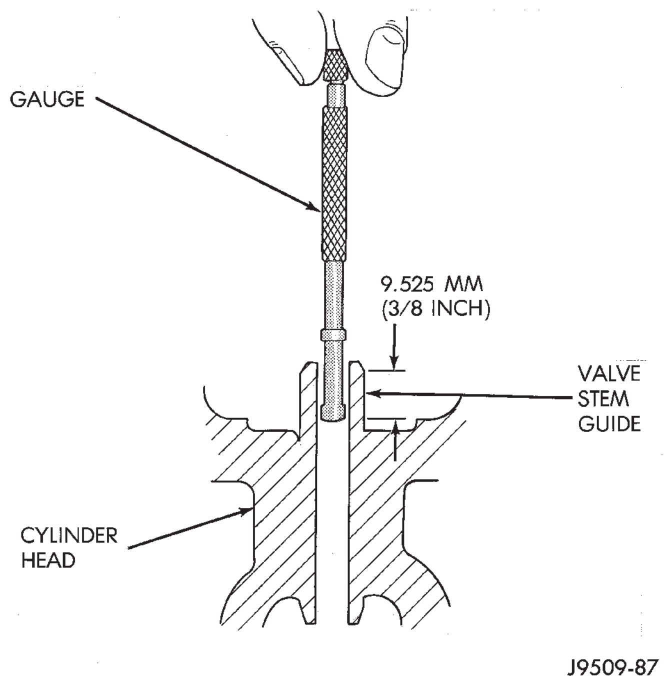

Fig. 10 Measurement of Valve Guide Bore Diameter

ALTERNATIVE METHOD:

(1) Use a dial indicator to measure the lateral movement of the valve stem (stem-to-guide clearance). This must be done with the valve installed in its guide and just off the valve seat (Fig. 11).

(2) Correct clearance is 0.025-0.0762 mm (0.001-0.003 inch). If indicated movement exceeds the specification ream the valve guide to accommodate an oversize valve stem.

Valve seats must be ground after reaming the valve guides to ensure that the valve seat is concentric to the valve guide.

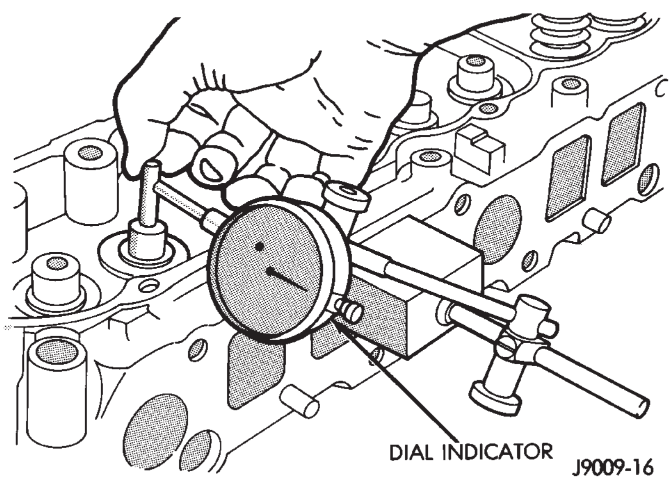

Fig. 11 Measurement of Lateral Movement of Valve Stem

VALVE SPRING TENSION TEST

Use Universal Valve Spring Tester and a torque wrench to test each valve spring for the specified tension value (Fig. 12).

Replace valve springs that are not within specifications.

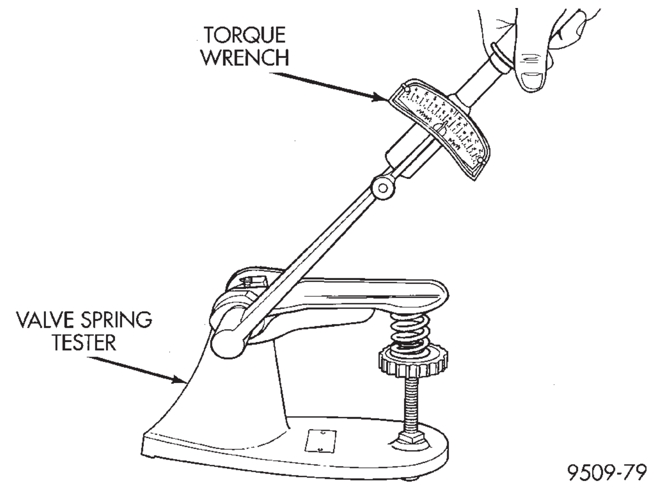

Fig. 12 Valve Spring Tester

INSTALLATION

(1) Thoroughly clean the valve stems and the valve guide bores.

(2) Lightly lubricate the stem.

(3) Install the valve in the original valve guide bore.

(4) Install the replacement valve stem oil seals on the valve stems. If the 0.381 mm (0.015 inch) oversize valve stems are used, oversize oil seals are required.

(5) Position the valve spring and retainer on the engine cylinder head and compress the valve spring with Valve Spring Compressor Tool MD-998772A.

(6) Install the valve locks and release the tool.

(7) Tap the valve spring from side to side with a hammer to ensure that the spring is properly seated at the engine cylinder head. Also tap the top of the retainer to seat the valve locks.

(8) Install the engine cylinder head.

VALVE TIMING

Disconnect the spark plug wires and remove the spark plugs.

Remove the engine cylinder head cover.

Remove the capscrews, bridge and pivot assembly, and rocker arms from above the No.1 cylinder.

Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.

Rotate the crankshaft until the No.6 piston is at top dead center (TDC) on the compression stroke.

Rotate the crankshaft counterclockwise (viewed from the front of the engine) 90°.

Install a dial indicator on the end of the No.1 cylinder intake valve push rod. Use rubber tubing to secure the indicator stem on the push rod.

Set the dial indicator pointer at zero.

Rotate the crankshaft clockwise (viewed from the front of the engine) until the dial indicator pointer indicates 0.305 mm (0.012 inch) travel distance (lift).

The timing notch index on the vibration damper should be aligned with the TDC mark on the timing degree scale.

If the timing notch is more than 13 mm (1/2 inch) away from the TDC mark in either direction, the valve timing is incorrect.

If the valve timing is incorrect, the cause may be a broken camshaft pin. It is not necessary to replace the camshaft because of pin failure. A spring pin is available for service replacement.

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt and fan shroud.

(3) Remove the vibration damper retaining bolt and washer.

(4) Use Vibration Damper Removal Tool 8068 to remove the damper from the crankshaft (Fig. 1).

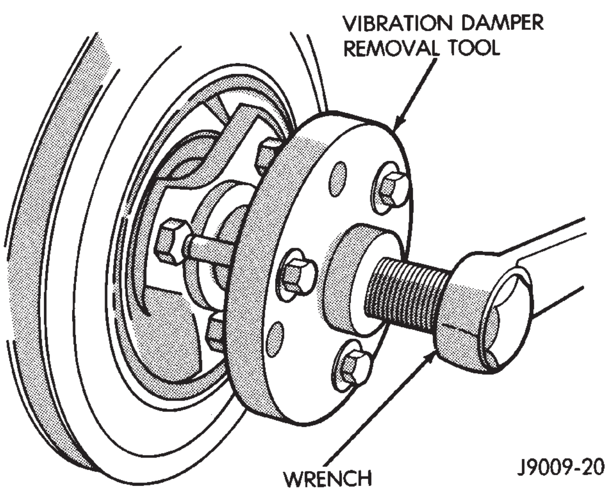

Fig. 1 Vibration Damper Removal Tool 8068

INSTALLATION

(1) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in position, align the keyway of the vibration damper hub with the crankshaft key and tap the damper onto the crankshaft.

(2) Install the vibration damper retaining bolt and washer.

(3) Tighten the damper retaining bolt to 108 N·m (80 ft. lbs.) torque.

(4) Install the serpentine drive belt and tighten to the specified tension (refer to Group 7, Cooling Systems for the proper specifications and procedures).

(5) Connect negative cable to battery.

TIMING CASE COVER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the vibration damper (Fig. 2).

(3) Remove the fan and hub assembly and remove the fan shroud.

(4) Remove the accessory drive brackets that are attached to the timing case cover.

(5) Remove the A/C compressor (if equipped) and generator bracket assembly from the engine cylinder head and move to one side.

(6) Remove the oil pan-to-timing case cover bolts and timing case cover-to-cylinder block bolts.

(7) Remove the timing case cover and gasket from the engine. Make sure the tension spring and thrust pin do not fall out of the preload bolt.

(8) Pry the crankshaft oil seal from the front of the timing case cover (Fig. 2).

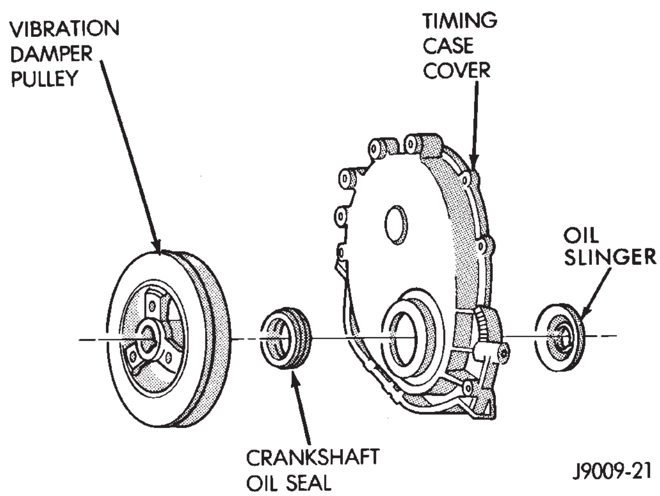

Fig. 2 Timing Case Cover Components

CLEANING

Clean the timing case cover, oil pan and cylinder block gasket surfaces.

INSTALLATION

(1) Install a new crankshaft oil seal in the timing case cover. The open end of the seal should be toward the inside of the cover. Support the cover at the seal area while installing the seal. Force it into position with Seal Installation Tool 6139.

(2) Position the gasket on the cylinder block.

(3) Position the timing case cover on the oil pan gasket and the cylinder block. Make sure the tension spring and thrust pin are in place in the camshaft preload bolt.

(4) Insert Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening in the cover (Fig. 3).

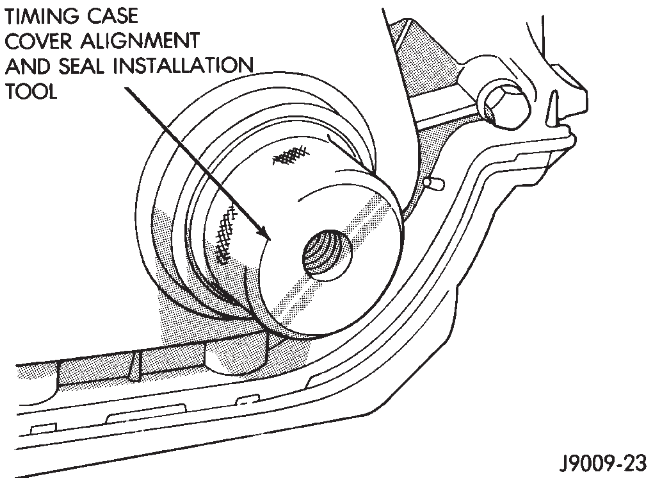

Fig. 3 Timing Case Cover Alignment and Seal Installation Tool 6139

(5) Install the timing case cover-to-cylinder block and the oil pan-to-timing case cover bolts.

(6) Tighten the 1/4 inch front cover-to-block bolts to 7 N·m (60 in. lbs.) torque. Tighten the 5/16 inch front cover-to-block bolts to 22 N·m (192 in. lbs.) torque. Tighten the oil pan-to-cover 1/4 inch bolts to 14 N·m (120 in. lbs.) torque. Tighten the oil pan-to-cover 5/16 inch bolts to 18 N·m (156 in. lbs.) torque.

(7) Remove the cover alignment tool.

(8) Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(9) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt to 108 N·m (80 ft. lbs.) torque.

(10) Install the A/C compressor (if equipped) and generator bracket assembly.

(11) Install the engine fan and hub assembly and shroud.

(12) Install the serpentine drive belt and tighten to obtain the specified tension.

(13) Connect negative cable to battery.

TIMING CASE COVER OIL SEAL REPLACEMENT

This procedure is done with the timing case cover installed.

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt.

(3) Remove the vibration damper.

(4) Remove the radiator shroud.

(5) Carefully remove the oil seal. Make sure seal bore is clean.

(6) Position the replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool 6139 with seal open end facing inward. Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal. Lightly coat the crankshaft with engine oil.

(7) Position the tool and seal over the end of the crankshaft and insert a draw screw tool into Seal Installation Tool 6139 (Fig. 4). Tighten the nut against the tool until it contacts the cover.

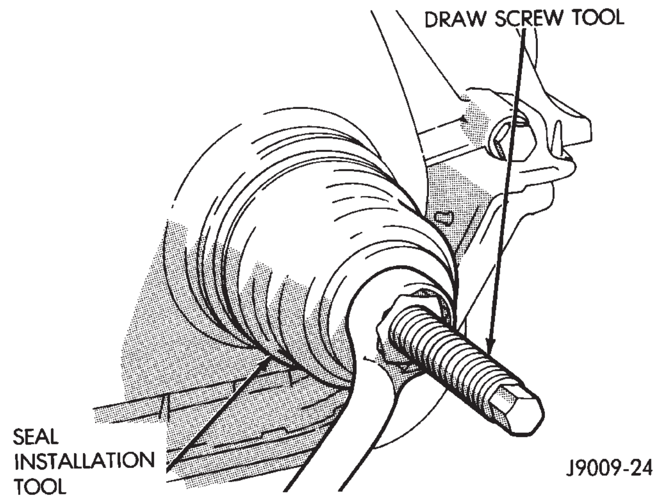

Fig. 4 Timing Case Cover Oil Seal Installation

(8) Remove the tools. Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(9) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt to 108 N·m (80 ft. lbs.) torque.

(10) Install the serpentine belt and tighten to the specified tension (refer to Group 7, Cooling Systems for the proper specifications and procedures).

(11) Install the radiator shroud.

(12) Connect negative cable to battery.

TIMING CHAIN AND SPROCKETS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the fan and shroud.

(3) Remove the serpentine drive belt.

(4) Remove the crankshaft vibration damper.

(5) Remove the timing case cover.

(6) Rotate crankshaft until the 0 timing mark is closest to and on the center line with camshaft sprocket timing mark (Fig. 5).

(7) Remove the oil slinger from the crankshaft.

(8) Remove the tension spring and thrust pin from the preload bolt (Fig. 6). Remove the camshaft sprocket retaining preload bolt and washer.

(9) Remove the crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

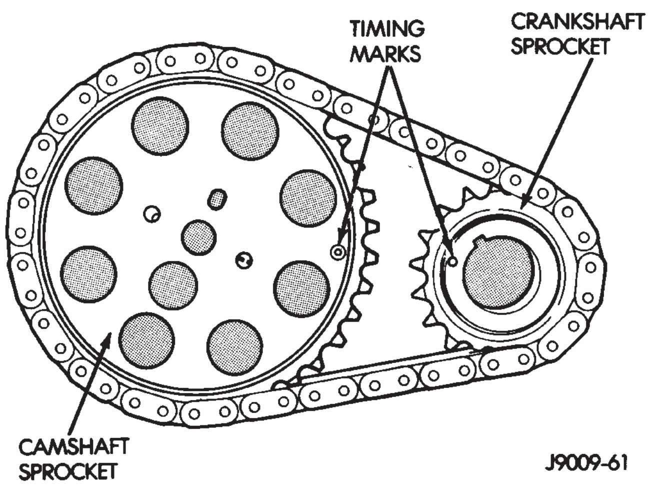

Fig. 5 Crankshaft/Camshaft Alignment—Typical

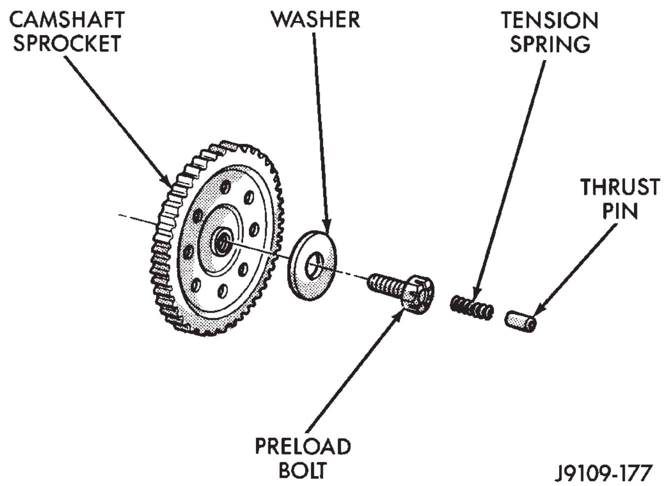

Fig. 6 Camshaft Sprocket Preload Bolt

Installation of the timing chain with the timing marks on the crankshaft and camshaft sprockets properly aligned ensures correct valve timing. A worn or stretched timing chain will adversely affect valve timing. If the timing chain deflects more than 12.7 mm (1/2 inch) replace it. The correct timing chain has 48 pins. A chain with more than 48 pins will cause excessive slack.

INSTALLATION

Assemble the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned (Fig. 5).

(1) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in the keyway on the crankshaft, install the assembly on the crankshaft and camshaft.

(2) Install the camshaft sprocket retaining preload bolt and washer (Fig. 6). Tighten the preload bolt to 108 N·m (80 ft. lbs.) torque.

(3) To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark as shown in Fig. 7. Count the number of chain pins between the timing marks of both sprockets. There must be 15 pins.

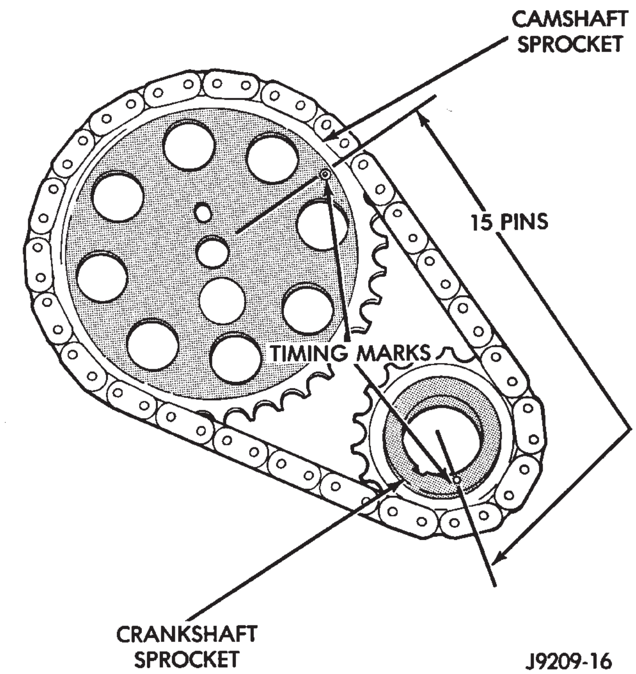

Fig. 7 Verify Sprocket/Chain Installation—Typical

(4) Install the crankshaft oil slinger.

(5) Replace the oil seal in the timing case cover.

(6) Lubricate the tension spring, thrust pin and pin bore in the preload bolt with Mopar® Engine Oil Supplement, or equivalent. Install the spring and thrust pin in the preload bolt head (Fig. 6).

(7) Install the timing case cover and gasket.

(8) With the key installed in the crankshaft keyway, install the vibration damper, washer and bolt. Lubricate and tighten the bolt to 108 N·m (80 ft. lbs.) torque.

(9) Install the serpentine drive belt and tighten to the specified tension (refer to Group 7, Cooling System for the proper procedure).

(10) Install the fan and hub (or Tempatrol fan) assembly. Install the shroud.

(11) Connect negative cable to battery.

CAMSHAFT

REMOVAL

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. RELEASE THE PRESSURE BEFORE REMOVING THE DRAIN COCK, CAP AND DRAIN PLUGS.

(1) Disconnect negative cable from battery.

(2) Drain the cooling system. DO NOT waste reusable coolant. If the solution is clean, drain it into a clean container for reuse.

(3) Remove the radiator or radiator/condenser, if equipped with A/C (refer to Group 7, Cooling System for the proper procedure).

(4) Remove the air conditioner condenser and receiver/drier assembly as a charged unit, if equipped (refer to Group 24, Heating and Air Conditioning).

(5) Remove the distributor cap and mark the position of the rotor.

(6) Remove the distributor and ignition wires.

(7) Remove the engine cylinder head cover.

(8) Remove the rocker arms, bridges and pivots.

(9) Remove the push rods.

(10) Remove the engine cylinder head and gasket.

(11) Remove the hydraulic valve tappets from the engine cylinder head.

(12) Remove the vibration damper.

(13) Remove the timing case cover.

(14) Remove the timing chain and sprockets.

(15) Remove the front bumper and grille, as required.

(16) Remove the camshaft (Fig. 8).

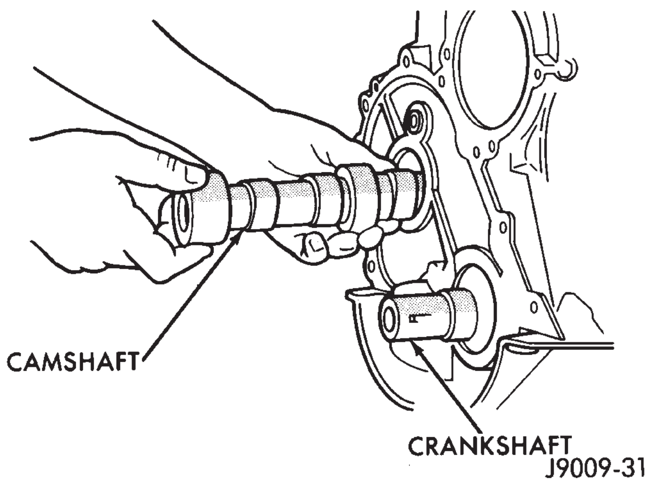

Fig. 8 Camshaft

INSPECTION

Inspect the cam lobes for wear.

Inspect the bearing journals for uneven wear pattern or finish.

Inspect the bearings for wear.

Inspect the distributor drive gear for wear.

If the camshaft appears to have been rubbing against the timing case cover, examine the oil pressure relief holes in the rear cam journal. The oil pressure relief holes must be free of debris.

INSTALLATION

(1) Lubricate the camshaft with Mopar® Engine Oil Supplement, or equivalent.

(2) Carefully install the camshaft to prevent damage to the camshaft bearings (Fig. 8).

(3) Install the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned.

(4) Install the camshaft sprocket retaining preload bolt. Tighten the bolt to 108 N·m (80 ft. lbs.) torque.

(5) Lubricate the tension spring, the thrust pin and the pin bore in the preload bolt with Mopar® Engine Oil Supplement, or equivalent. Install the spring and thrust pin in the preload bolt head.

(6) Install the timing case cover with a replacement oil seal (Fig. 9). Refer to Timing Case Cover Installation.

(7) Install the vibration damper (Fig. 9).

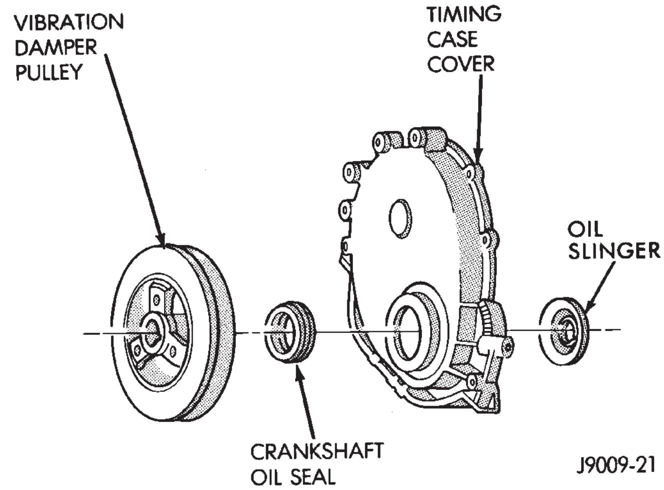

Fig. 9 Timing Case Cover Components

(8) Install the hydraulic valve tappets.

(9) Install the engine cylinder head.

(10) Install the push rods.

(11) Install the rocker arms and pivot and bridge assemblies. Tighten each of the capscrews for each bridge alternately, one turn at a time, to avoid damaging the bridge.

(12) Install the engine cylinder head cover.

(13) Install the serpentine drive belt and tighten to the specified tension (refer to Group 7, Cooling System for the proper procedure).

(14) Rotate the crankshaft until the No.1 piston is at the TDC position on the compression stroke.

(15) Install the distributor, cap and ignition wires. Install the distributor so that the rotor is aligned with the mark made during removal. The rotor should be aligned with the No.1 cylinder spark plug terminal on the cap when the distributor housing is fully seated on the cylinder block.

During installation, lubricate the hydraulic valve tappets and all valve components with Mopar® Engine Oil Supplement, or equivalent. The Mopar® Engine Oil Supplement, or equivalent must remain with the engine oil for at least 1 609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

(16) Install the A/C condenser and receiver/drier assembly, if equipped (refer to Group 24, Heating and Air Conditioning).

CAUTION: Both service valves must be opened before the air conditioning system is operated.

(17) Install the radiator, connect the hoses and fill the cooling system to the specified level (refer to Group 7, Cooling System for the proper procedure).
(18) Check the ignition timing and adjust as necessary.
(19) Install the grille and bumper, if removed.
(20) Connect negative cable to battery.

CAMSHAFT PIN REPLACEMENT

REMOVAL

WARNING: DO NOT LOOSEN THE RADIATOR DRAIN COCK WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Disconnect negative cable from battery.
(2) Drain the radiator. DO NOT waste reusable coolant. Drain the coolant into a clean container.
(3) Remove the fan and shroud.
(4) Disconnect the radiator overflow tube, radiator hoses, automatic transmission fluid cooler pipes (if equipped).
(5) Remove the radiator.
(6) If equipped with air conditioning:

CAUTION: DO NOT loosen or disconnect any air conditioner system fittings. Move the condenser and receiver/drier aside as a complete assembly.

(a) Remove the A/C compressor serpentine drive belt idler pulley.
(b) Disconnect and remove the generator.
(c) Remove the A/C condenser attaching bolts and move the condenser and receiver/drier assembly up and out of the way.

(7) Remove the serpentine drive belt.
(8) Remove the crankshaft vibration damper.
(9) Remove the timing case cover. Clean the gasket material from the cover.
(10) Remove the thrust pin and tension spring from the preload bolt head.
(11) Rotate crankshaft until the crankshaft sprocket timing mark is closest to and on the center line with the camshaft sprocket timing mark (Fig. 10).
(12) Remove the camshaft sprocket preload retaining bolt and washer.
(13) Remove the crankshaft oil slinger.
(14) Remove the sprockets and chain as an assembly.

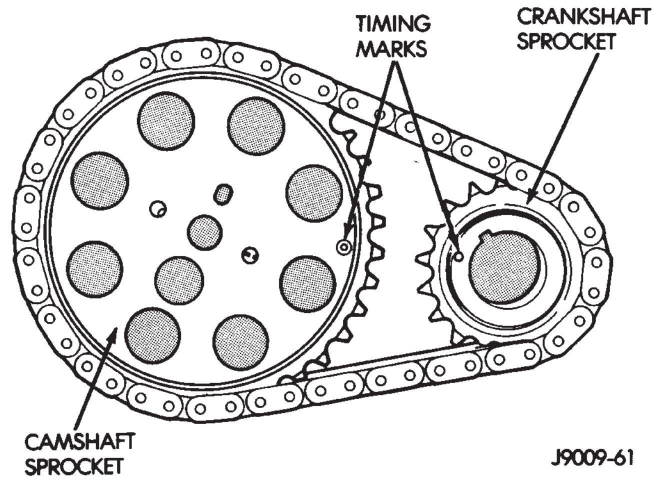

Fig. 10 Timing Chain Alignment—Typical

CAUTION: The following procedural step must be accomplished to prevent the camshaft from damaging the rear camshaft plug during pin installation.

(15) Inspect the damaged camshaft pin.
(16) If the pin is a spring-type pin, remove the broken pin by inserting a self-tapping screw into the pin and carefully pulling the pin from the camshaft.
(17) If the pin is a dowel-type pin, center-punch it. Ensure the exact center is located when center-punching the pin.

CAUTION: Cover the opened oil pan area to prevent metal chips from entering the pan.

(18) Drill into the pin center with a 4 mm (5/32 inch) drill bit.
(19) Insert a self-tapping screw into the drilled pin and carefully pull the pin from the camshaft.

CAMSHAFT BEARINGS

The camshaft rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed. The camshaft bearing bores and bearing diameters are not the same size. They are stepped down in 0.254 mm (0.010 inch) increments from the front bearing (largest) to the rear bearing (smallest). This permits easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated.

It is not advisable to attempt to replace camshaft bearings unless special removal and installation tools are available.

Camshaft end play is maintained by the load placed on the camshaft by the sprocket preload bolt tension spring and thrust pin.

INSTALLATION

(1) Clean the camshaft pin hole.
(2) Compress the center of the replacement spring pin with vise grips.

(3) Carefully drive the pin into the camshaft pin hole until it is seated.

(4) Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks aligned (Fig. 10).

(5) To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark as shown in Fig. 11. Count the number of chain pins between the timing marks of both sprockets. There must be 15 pins.

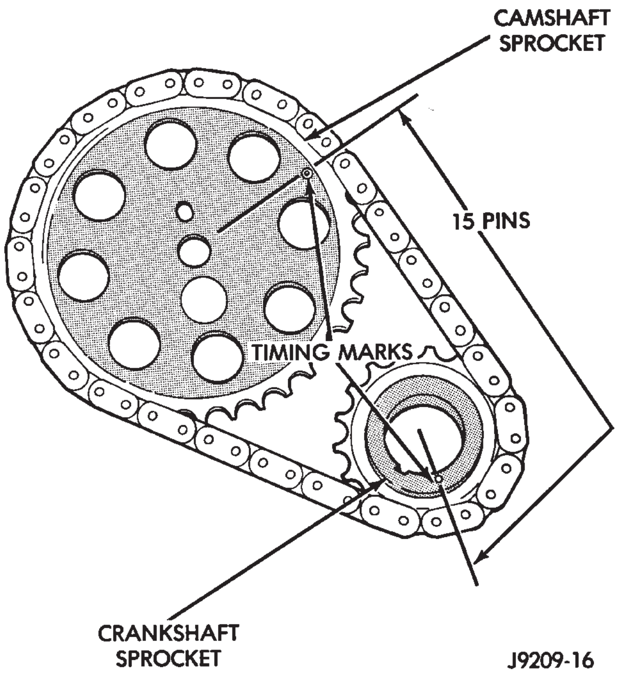

Fig. 11 Verify Crankshaft/Camshaft Installation—Typical

(6) Install the crankshaft oil slinger.

(7) Tighten the camshaft sprocket preload bolt to 108 N·m (80 ft. lbs.) torque.

(8) Check the valve timing.

(9) Lubricate the tension spring, the thrust pin and the pin bore in the preload bolt with Mopar® Engine Oil Supplement, or equivalent. Install the spring and thrust pin in the preload bolt head.

(10) Coat both sides of the replacement timing case cover gasket with gasket sealer. Apply a 3 mm (1/8 inch) bead of Mopar® Silicone Rubber Adhesive Sealant, or equivalent to the joint formed at the oil pan and cylinder block.

(11) Position the timing case cover on the oil pan gasket and the cylinder block.

(12) Place Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening in the cover (Fig. 12).

(13) Install the timing case cover-to-cylinder block bolts. Install the oil pan-to-timing case cover bolts.

(14) Tighten the 1/4 inch cover-to-block bolts to 7 N·m (60 in. lbs.) torque. Tighten the 5/16 inch front cover-to-block bolts to 22 N·m (192 in. lbs.) torque.

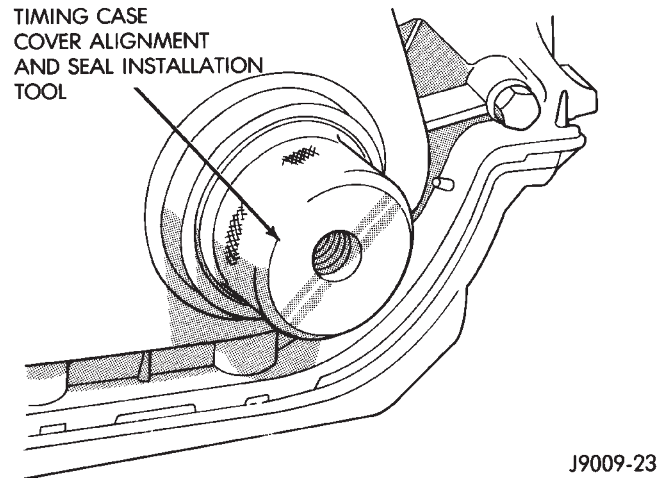

Fig. 12 Timing Case Cover Alignment and Seal Installation Tool 6139

Tighten the oil pan-to-cover 1/4 inch bolts to 14 N·m (120 in. lbs.) torque. Tighten the oil pan-to-cover 5/16 inch bolts to 18 N·m (156 in. lbs.) torque.

(15) Remove the cover alignment tool and install a replacement oil seal into the cover.

(16) Install the vibration damper on the crankshaft.

(17) Lubricate and tighten the damper bolt to 108 N·m (80 ft. lbs.) torque.

(18) If equipped with air conditioning:

(a) Install the A/C compressor serpentine drive belt idler pulley.

(b) Install the generator.

(c) Install the A/C condenser and receiver/drier assembly.

(19) Install the serpentine drive belt on the pulleys and tighten (refer to Group 7, Cooling System for the specifications and procedures).

(20) Install the radiator. Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped. Fill the cooling system.

(21) Install the fan and shroud.

(22) Connect negative cable to battery.

OIL PAN

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise the vehicle.

(3) Remove the oil pan drain plug and drain the engine oil.

(4) Disconnect the exhaust pipe at the engine exhaust manifold.

(5) Disconnect the exhaust hanger at the catalytic converter and lower the pipe.

(6) Remove the starter motor.

(7) Remove the engine flywheel/transmission torque converter housing access cover.

(8) If equipped with an oil level sensor, disconnect the sensor.

(9) Position a jack stand directly under the engine vibration damper.

(10) Place a piece of wood (2 x 2) between the jack stand and the engine vibration damper.

(11) Remove the engine mount thru-bolts.

(12) Using the jack stand, raise the engine until adequate clearance is obtained to remove the oil pan.

(13) Remove the oil pan bolts. Carefully slide the oil pan and gasket to the rear. If equipped with an oil level sensor, take care not to damage the sensor.

CLEANING

Clean the block and pan gasket surfaces.

INSTALLATION

(1) Fabricate 4 alignment dowels from 1/4 x 1 1/2 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 1).

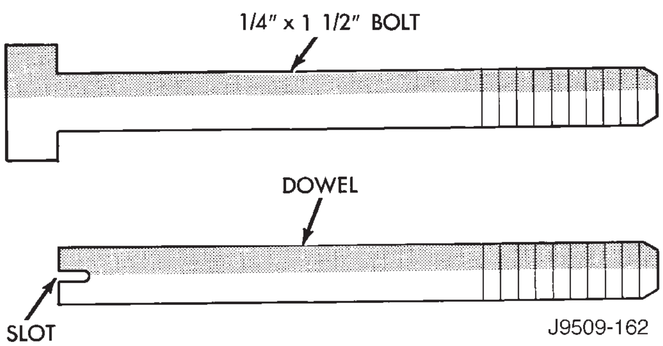

Fig. 1 Fabrication of Alignment Dowels

(2) Install two dowels in the timing case cover. Install the other two dowels in the cylinder block (Fig. 2).

(3) Slide the one-piece gasket over the dowels and onto the block and timing case cover.

(4) Position the oil pan over the dowels and onto the gasket. If equipped with an oil level sensor, take care not to damage the sensor.

(5) Install the 1/4 inch oil pan bolts. Tighten these bolts to 14 N·m (120 in. lbs.) torque. Install the 5/16 inch oil pan bolts (Fig. 3). Tighten these bolts to 18 N·m (156 in. lbs.) torque.

(6) Remove the dowels. Install the remaining 1/4 inch oil pan bolts. Tighten these bolts to 14 N·m (120 in. lbs.) torque.

(7) Lower the engine until it is properly located on the engine mounts.

(8) Install the thru-bolts and tighten the nuts.

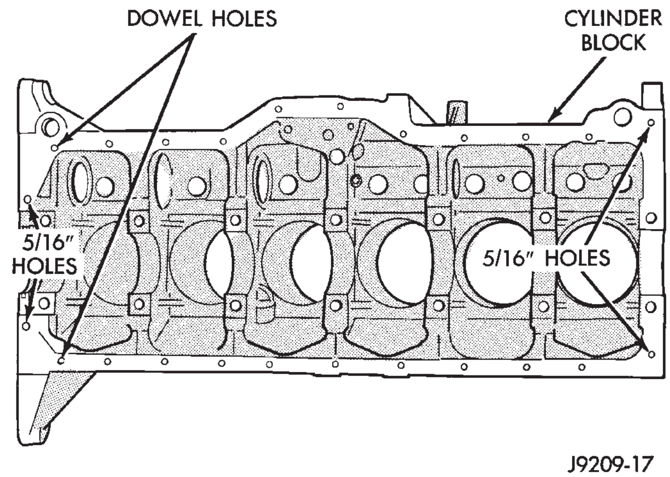

Fig. 2 Position of Dowels in Cylinder Block

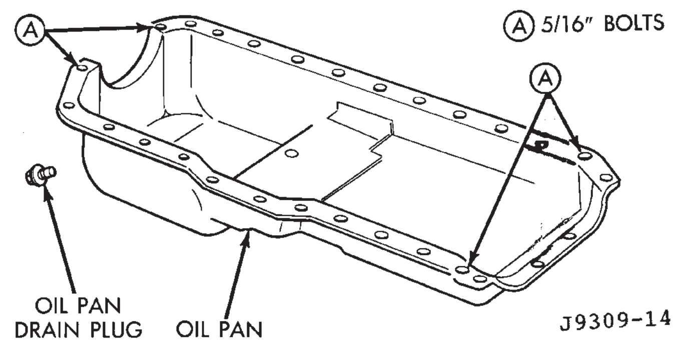

Fig. 3 Position of 5/16 inch Oil Pan Bolts

(9) Lower the jack stand and remove the piece of wood.

(10) If equipped with an oil level sensor, connect the sensor.

(11) Install the engine flywheel/transmission torque converter housing access cover.

(12) Install the engine starter motor.

(13) Connect the exhaust pipe to the hanger and to the engine exhaust manifold.

(14) Install the oil pan drain plug (Fig. 3). Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(15) Lower the vehicle.

(16) Connect negative cable to battery.

(17) Fill the oil pan with engine oil to the specified level.

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 FAN. DO NOT WEAR LOOSE CLOTHING.

(18) Start the engine and inspect for leaks.

LUBRICATION SYSTEM

A gear—type positive displacement pump is mounted at the underside of the block opposite the No. 4 main bearing. The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery which extends the entire length of the block.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals (except number 4 main bearing journal) to the connecting rod journals. Each connecting rod bearing cap has a small squirt hole, oil passes through the squirt hole and is thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

The hydraulic valve tappets receive oil directly from the main oil gallery. Oil is provided to the camshaft bearing through galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the number one main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components, then passes down through the push rod guide holes in the cylinder head past the valve tappet area, and returns to the oil pan.

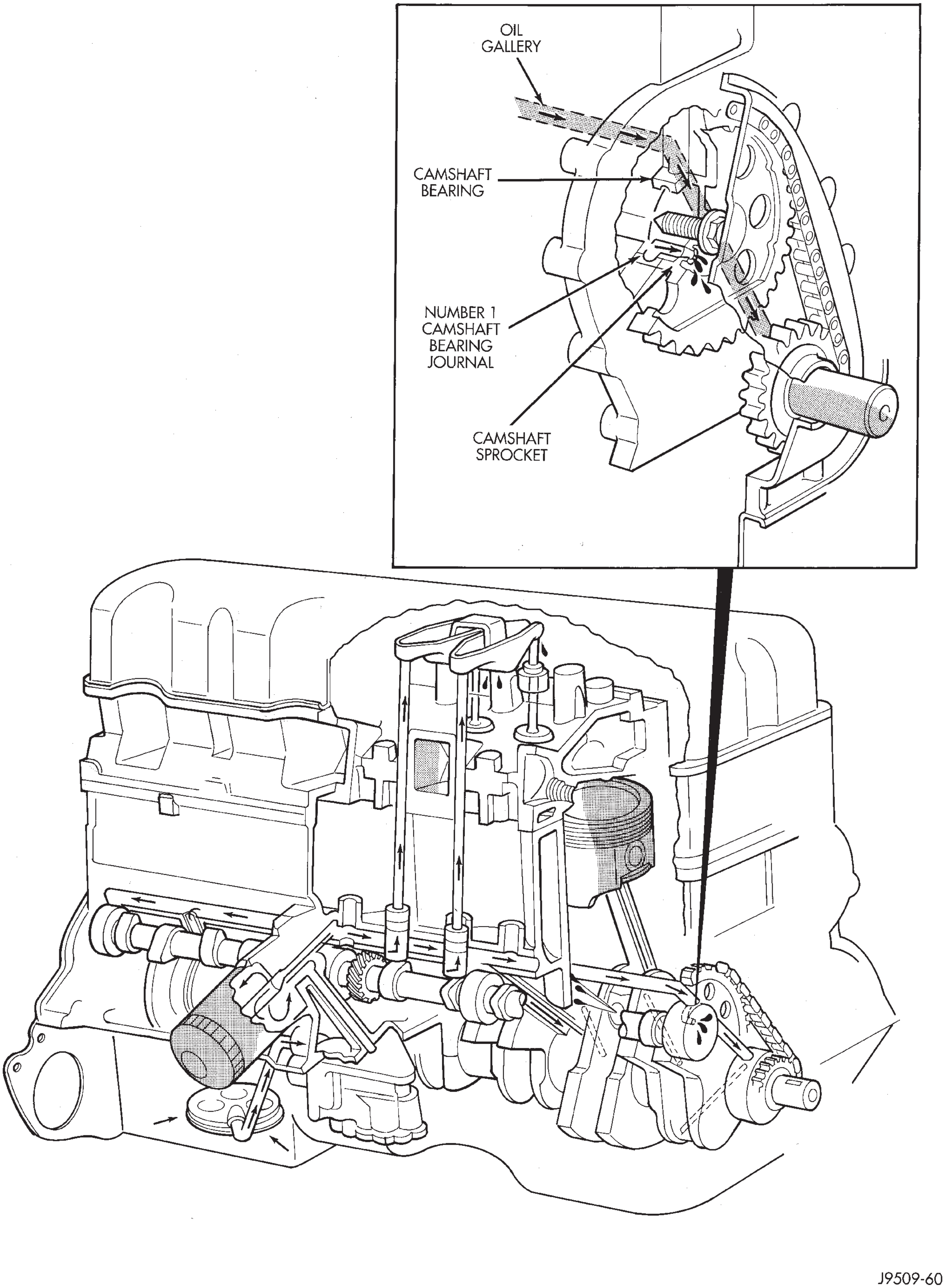

Fig. 4 Oil Lubrication System

OIL PUMP

A gear-type oil pump is mounted at the underside of the cylinder block opposite the No.4 main bearing.

The pump incorporates a nonadjustable pressure relief valve to limit maximum pressure to 517 kPa (75 psi). In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

Oil pump removal or replacement will not affect the distributor timing because the distributor drive gear remains in mesh with the camshaft gear.

OIL PUMP PRESSURE

The MINIMUM oil pump pressure is 89.6 kPa (13 psi) at 600 RPM. The MAXIMUM oil pump pressure is 255-517 kPa (37-75 psi) at 1,600 RPM or more.

REMOVAL

(1) Drain the engine oil.

(2) Remove the oil pan.

(3) Remove the pump-to-cylinder block attaching bolts. Remove the pump assembly with gasket (Fig. 5).

CAUTION: If the oil pump is not to be serviced, DO NOT disturb position of oil inlet tube and strainer assembly in pump body. If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

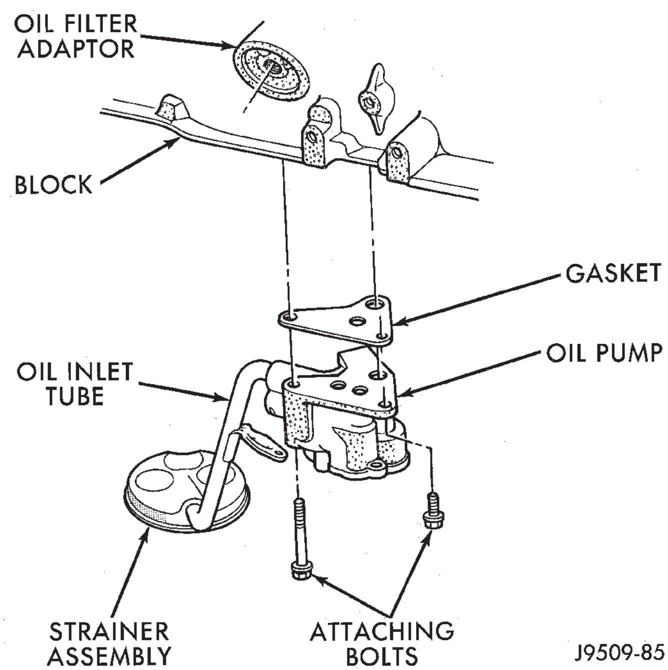

Fig. 5 Oil Pump Assembly

INSTALLATION

(1) Install the oil pump on the cylinder block using a replacement gasket. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(2) Install the oil pan.

(3) Fill the oil pan with oil to the specified level.

PISTONS AND CONNECTING RODS

REMOVAL

(1) Remove the engine cylinder head cover.

(2) Remove the rocker arms, bridges and pivots.

(3) Remove the push rods.

(4) Remove the engine cylinder head.

(5) Position the pistons one at a time near the bottom of the stroke. Use a ridge reamer to remove the ridge from the top end of the cylinder walls. Use a protective cloth to collect the cuttings.

(6) Raise the vehicle.

(7) Drain the engine oil.

(8) Remove the oil pan and gasket.

(9) Remove the connecting rod bearing caps and inserts. Mark the caps and rods with the cylinder bore location. The connecting rods and caps are stamped with a two letter combination (Fig. 1).

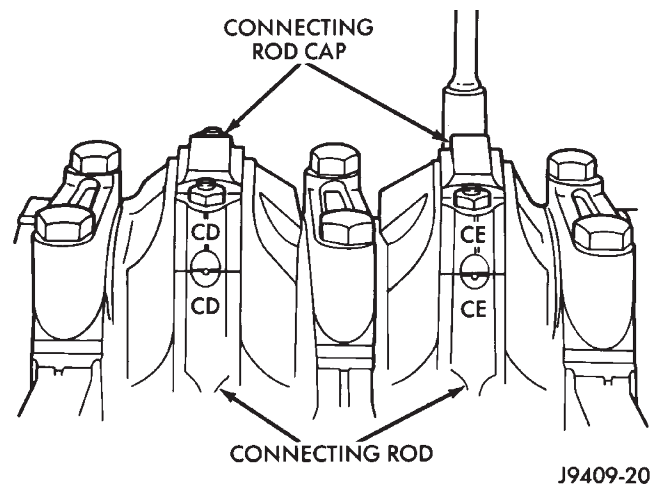

Fig. 1 Stamped Connecting Rods and Caps

(10) Lower the vehicle until it is about 2 feet from the floor.

CAUTION: Ensure that the connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose, slipped over the rod bolts will provide protection during removal.

(11) Have an assistant push the piston/connecting rod assemblies up and through the top of the cylinder bores (Fig. 2).

INSPECTION—CONNECTING ROD

CONNECTING ROD BEARINGS

Inspect the connecting rod bearings for scoring and bent alignment tabs (Figs. 3 and 4). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 5). Replace any bearing that shows abnormal wear.

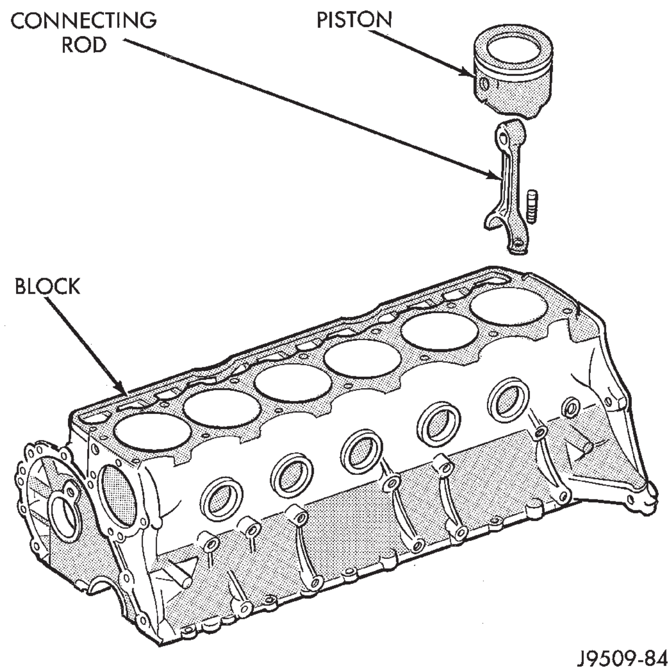

Fig. 2 Removal of Connecting Rod and Piston Assembly

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

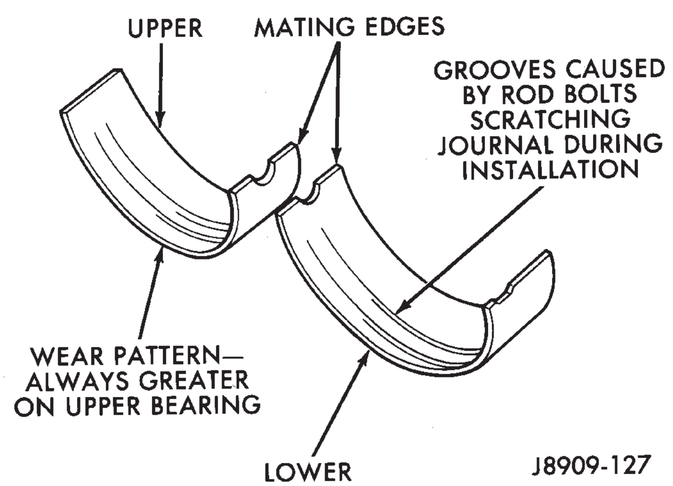

Fig. 3 Connecting Rod Bearing Inspection

CONNECTING RODS

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

BEARING-TO-JOURNAL CLEARANCE

(1) Wipe the oil from the connecting rod journal.

(2) Use short rubber hose sections over rod bolts during installation.

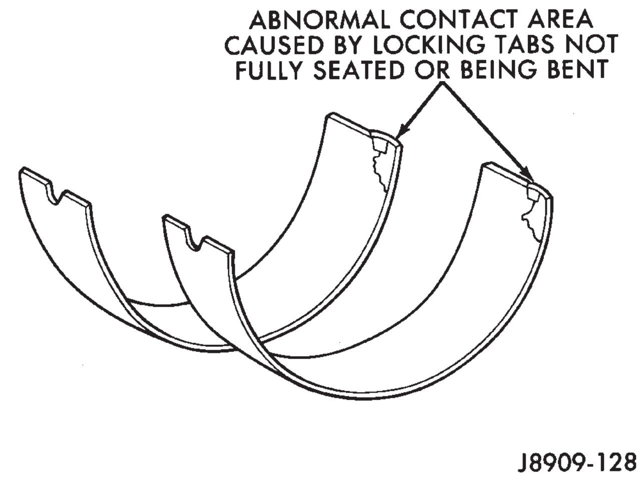

Fig. 4 Locking Tab Inspection

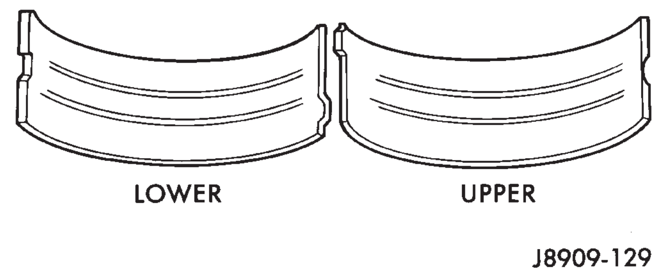

Fig. 5 Scoring Caused by Insufficient Lubrication or by Damaged Crankshaft Pin Journal

(3) Lubricate the upper bearing insert and install in connecting rod.

(4) Use piston ring compressor to install the rod and piston assemblies. The oil squirt holes in the rods must face the camshaft. The arrow on the piston crown should point to the front of the engine (Fig. 6). Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

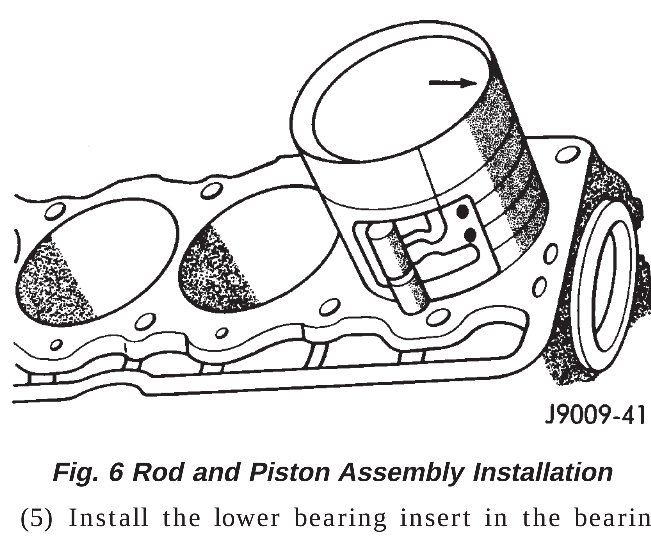

Fig. 6 Rod and Piston Assembly Installation

(5) Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the cen-

ter of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

(6) Install bearing cap and connecting rod on the journal and tighten nuts to 45 N·m (33 ft. lbs.) torque. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

(7) Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (Fig. 7). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**

(8) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

(9) If bearing-to-journal clearance exceeds the specification, install a pair of 0.0254 mm (0.001 inch) undersize bearing inserts. All the odd size inserts must be on the bottom. The sizes of the service replacement bearing inserts are stamped on the backs of the inserts. Measure the clearance as described in the previous steps.

(10) The clearance is measured with a pair of 0.0254 mm (0.001 inch) undersize bearing inserts installed. This will determine if two 0.0254 mm (0.001 inch) undersize inserts or another combination is needed to provide the correct clearance (refer to Connecting Rod Bearing Fitting Chart).

FOR EXAMPLE: If the initial clearance was 0.0762 mm (0.003 inch), 0.025 mm (0.001 inch) undersize inserts would reduce the clearance by 0.025 mm (0.001 inch). The clearance would be 0.002 inch and within specification. A 0.051 mm (0.002 inch) undersize insert would reduce the initial clearance an additional 0.013 mm (0.0005 inch). The clearance would then be 0.038 mm (0.0015 inch).

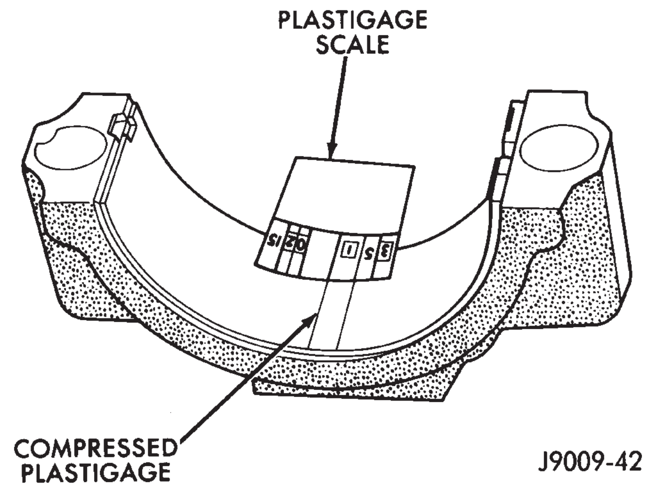

Fig. 7 Measuring Bearing Clearance with Plastigage

(11) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(12) Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 45 N·m (33 ft. lbs.) torque.

SIDE CLEARANCE MEASUREMENT

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to En-

CONNECTING ROD BEARING FITTING CHART

Crankshaft Journal		Corresponding Connecting Rod Bearing Insert	
Color Code	Diameter	Upper Insert Size	Lower Insert Size
Yellow	53.2257-53.2079 mm (2.0955-2.0948 in.)	Yellow - Standard	Yellow - Standard
Orange	53.2079-53.1901 mm (2.0948-2.0941 in.) 0.0178 mm (0.0007 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	53.1901-53.1724 mm (2.0941-2.0934 in.) 0.0356 mm (0.0014 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Red	52.9717-52.9539 mm (2.0855-2.0848 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

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gine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

PISTON FITTING

BORE GAGE METHOD

(1) To correctly select the proper size piston, a cylinder bore gauge, Special Tool 6879 or equivalent, capable of reading in .0001″ INCREMENTS with gauge ring Special Tool 6884 is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Set the bore gauge, Special Tool 6879 or equivalent, to the gauge ring, Special Tool 6884, and zero gauge.

(3) Remove gauge from ring and check cylinder as shown in (Fig. 8) bore and record reading.

(4) Measure the inside diameter of the cylinder bore at a point 58.725 mm (2-5/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point B and then take an additional bore reading 90 degrees to that at point A.

(5) Recheck bore gauge, Special Tool 6879 or equivalent, in gauge ring, Special Tool 6884, bore gauge should read zero. If gauge does not read zero, reset gauge and start over with procedure.

The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. **The coated piston connecting rod assembly can be used to service previous built engines and MUST be replaced as complete sets.** Tin coated pistons should not be used as replacements for the new coated pistons.

The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY.**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in .0001″ increments is required.

Piston installation into the cylinder bore require slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

PISTON PIN

Piston pins are press-fitted into the connecting rods and require no locking device. The piston, piston pin and connecting rod are replaced as an assembly.

PISTON RING FITTING

(1) Carefully clean the carbon from all ring grooves. Oil drain openings in the oil ring groove and pin boss must be clear. DO NOT remove metal from the grooves or lands. This will change ring-to-groove clearances and will damage the ring-to-land seating.

(2) Be sure the piston ring grooves are free of nicks and burrs.

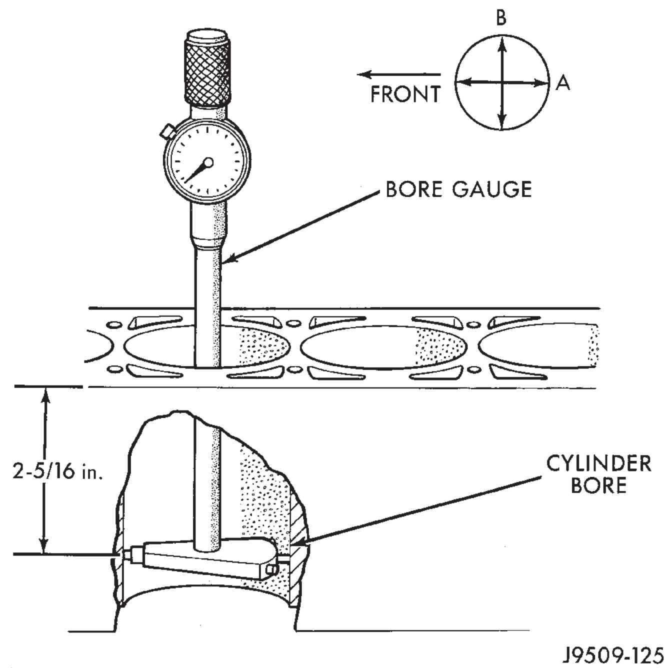

Fig. 8 Bore Gauge

CYLINDER BORE SIZE	PISTON LETTER SIZE
3.8759 to 3.8763	B
3.8763 to 3.8767	C
3.8767 to 3.8771	D

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Fig. 9 Piston Size Chart

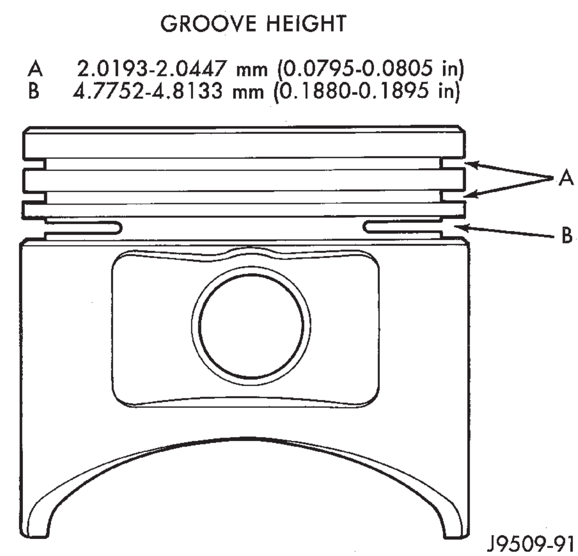

Fig. 10 Piston Dimensions

(3) Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring (Fig. 11). Rotate the ring in the groove. It must move freely around circumference of the groove.

	Millimeters	Inches
No. 1 Compression	0.025-0.081 (0.043 Preferred)	0.001-0.0032 (0.0017 Preferred)
No. 2 Compression	0.025-0.081 (0.043 Preferred)	0.001-0.0032 (0.0017 Preferred)
Oil Control	0.025-0.241 (0.08 Preferred)	0.001-0.0095 (0.003 Preferred)

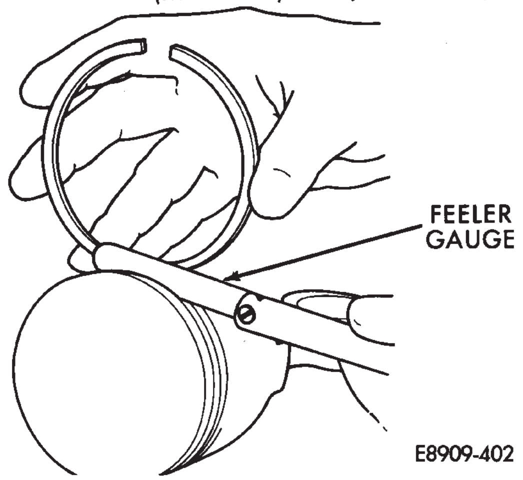

Fig. 11 Ring Side Clearance Measurement

(4) Place ring in the cylinder bore and push down with inverted piston to position near lower end of the ring travel. Measure ring gap with a feeler gauge fitting snugly between ring ends (Fig. 12). The correct compression ring end gap is 0.25-0.51 mm (0.010-0.020 inch). The correct oil control ring end gap is 0.381-1.397 mm (0.015-0.055 inch).

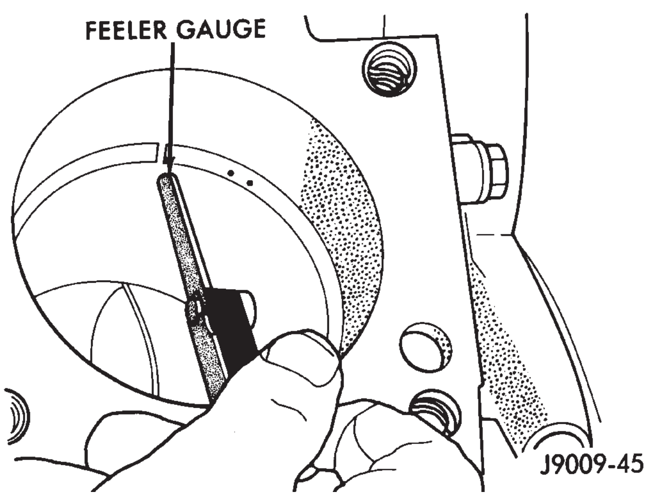

Fig. 12 Ring Gap Measurement

(5) Install the oil control rings according to instructions in the package. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

(6) The two compression rings are different and cannot be interchanged. The top ring (Fig. 13) is a moly ring (the scraping edge is gray in color). The second ring (Fig. 14) is a black cast iron ring (the scraping edge is black in color when new). The compression rings may also be identified by 1 or 2 dots on the top surface of the ring (Figs. 13 and 14).

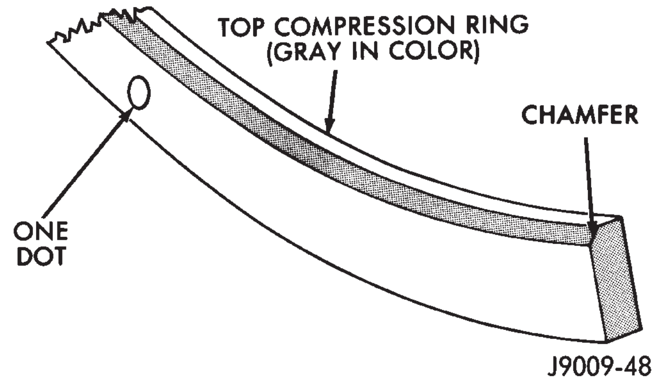

Fig. 13 Top Compression Ring Identification

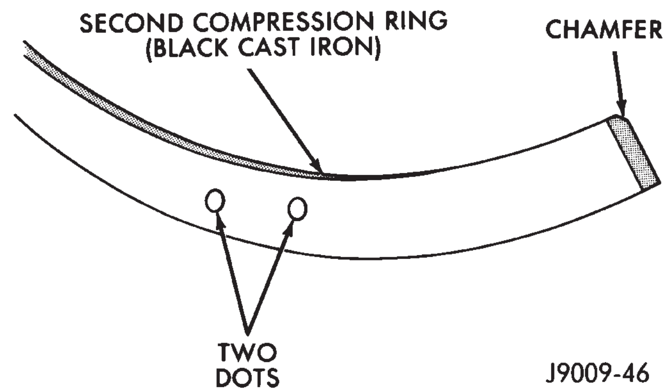

Fig. 14 Second Compression Ring Identification

(7) The second compression ring (black cast iron) has a chamfer on the BOTTOM of the inside edge (Fig. 15). This ring may also have 2 dots located on the top surface.

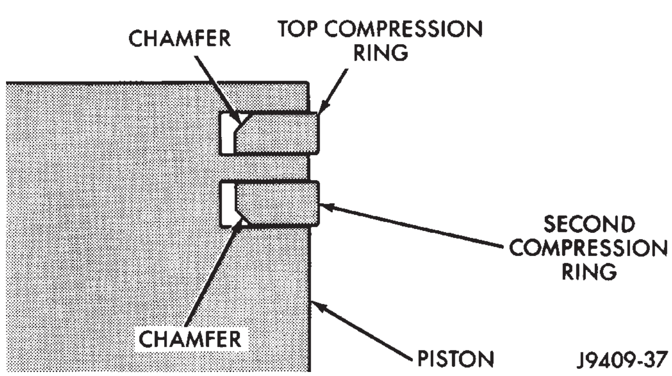

Fig. 15 Compression Ring Chamfer Location

(8) Using a ring installer, install the second compression ring with the chamfer facing down (Fig. 15). The 2 dots will be facing up.

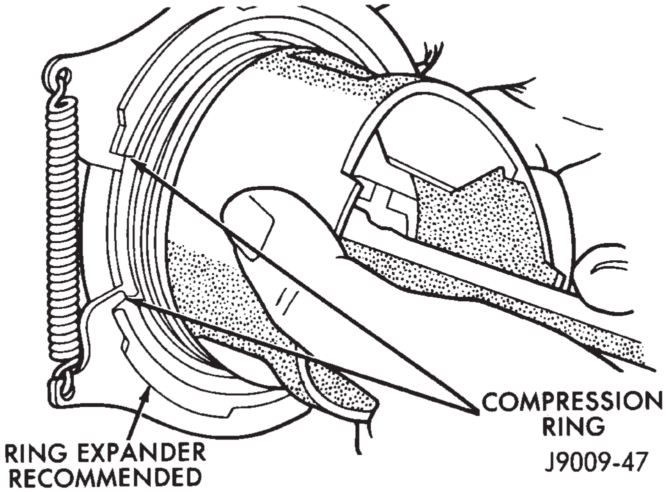

Fig. 16 Compression Ring Installation

(9) The top compression ring (the scraping edge is gray in color) has a chamfer on the TOP of the inside edge (Fig. 15). This ring may also have 1 dot located on the top surface.

(10) Using a ring installer, install the top ring with the chamfer facing up (Fig. 15). The dot will be facing up.

(11) Position the ring end gaps on the piston (Fig. 17):

- Oil spacer—Gap on center line of piston pin bore.
- Oil rails—Gap 180° apart on center line of piston skirt.
- No.2 Compression ring—Gap 180° from top oil rail gap.
- No.1 Compression ring—Gap 180° from No.2 compression ring gap.

CLEANING

Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean lint-free cloth.

INSTALLATION

(1) Install the piston rings on the pistons if removed.

(2) Lubricate the piston and rings with clean engine oil.

CAUTION: Ensure that connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during installation.

(3) Use a piston ring compressor to install the connecting rod and piston assemblies through the top of the cylinder bores (Fig. 18).

(4) Ensure the arrow on the piston top points to the front of the engine (Fig. 18).

(5) Raise the vehicle.

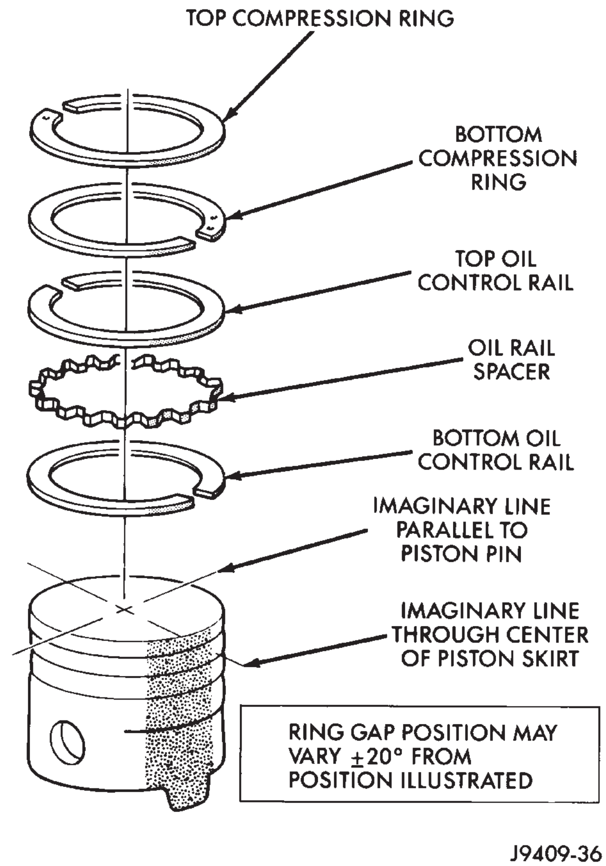

Fig. 17 Ring Gap Position

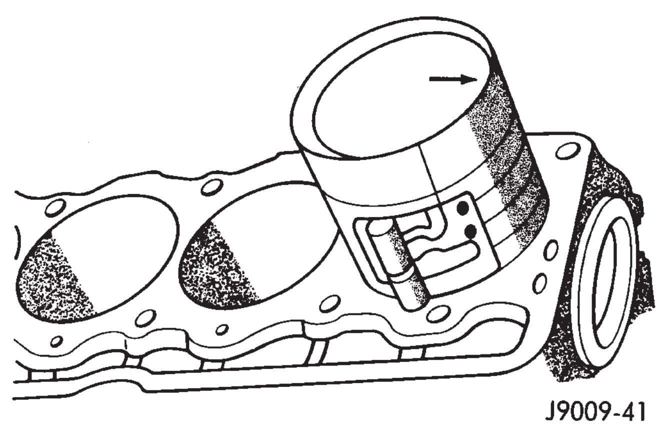

Fig. 18 Rod and Piston Assembly Installation

Each bearing insert is fitted to its respective journal to obtain the specified clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the Connecting Rod Bearing Fitting Chart. The color code appears on the edge of the bearing insert. The size is not stamped on inserts used for production of engines.

The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flange (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the Connecting Rod Bearing Fitting Chart.

When required, upper and lower bearing inserts of different sizes may be used as a pair (refer to Connecting Rod Bearing Fitting Chart). A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce clearance 0.013 mm (0.0005 inch).

CAUTION: DO NOT intermix bearing caps. Each connecting rod and bearing cap are stamped with the cylinder number. The stamp is located on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

(6) Install the connecting rod bearing caps and inserts in the same positions as removed.

CAUTION: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

(7) Install the oil pan and gaskets as outlined in the installation procedure.
(8) Lower the vehicle.
(9) Install the engine cylinder head, push rods, rocker arms, bridges, pivots and engine cylinder head cover.
(10) Fill the crankcase with engine oil.

CRANKSHAFT MAIN BEARINGS

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove the spark plugs.
(3) Raise the vehicle.
(4) Remove the oil pan and oil pump.
(5) Remove only one main bearing cap and lower insert at a time (Fig. 1).
(6) Remove the lower insert from the bearing cap.
(7) Remove the upper insert by LOOSENING (DO NOT REMOVE) all of the other bearing caps. Now insert a small cotter pin tool in the crankshaft journal oil hole. Bend the cotter pin as illustrated to fabricate the tool (Fig. 2). With the cotter pin tool in place, rotate the crankshaft so that the upper bearing insert will rotate in the direction of its locking tab. Because there is no hole in the No.3 main journal, use a tongue depressor or similar soft-faced tool to remove the bearing insert (Fig. 2). After moving the insert approximately 25 mm (1 inch), it can be removed by applying pressure under the tab.
(8) Using the same procedure described above, remove the remaining bearing inserts one at a time for inspection.

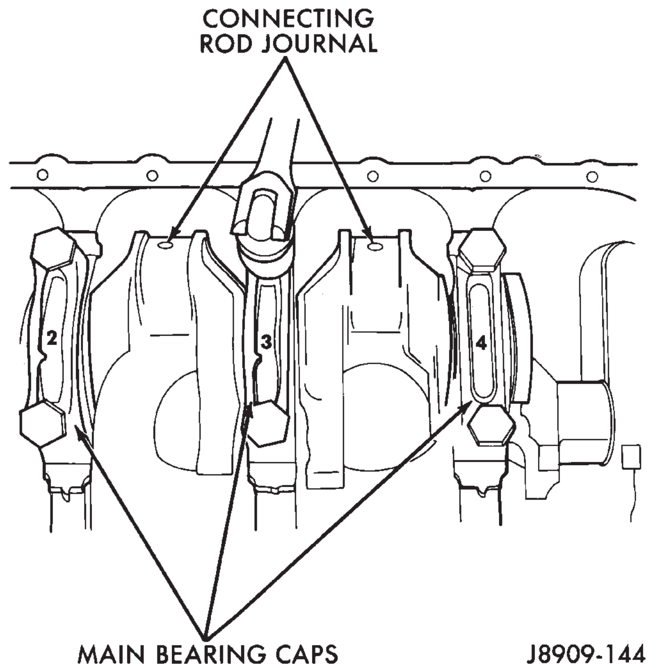

Fig. 1 Removing Main Bearing Caps and Lower Inserts

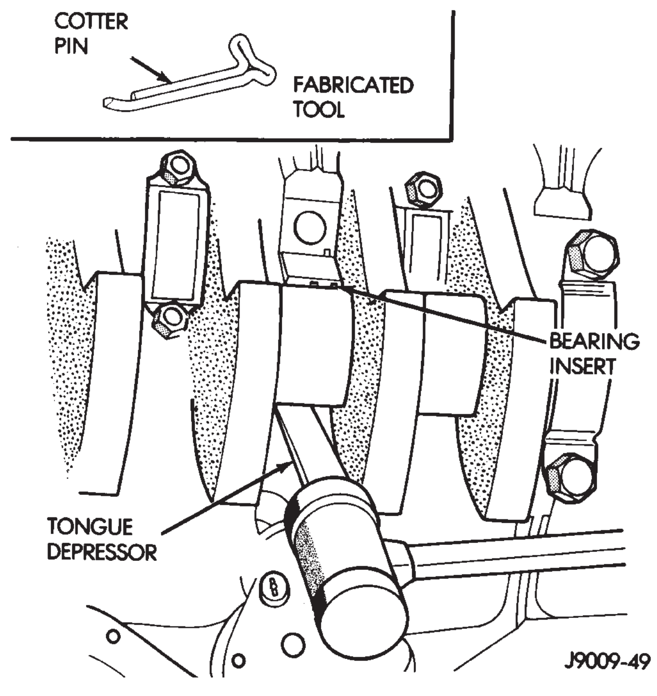

Fig. 2 Removing Upper Inserts

INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated (Fig. 3).

If any of the crankshaft journals are scored, remove the engine for crankshaft repair.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

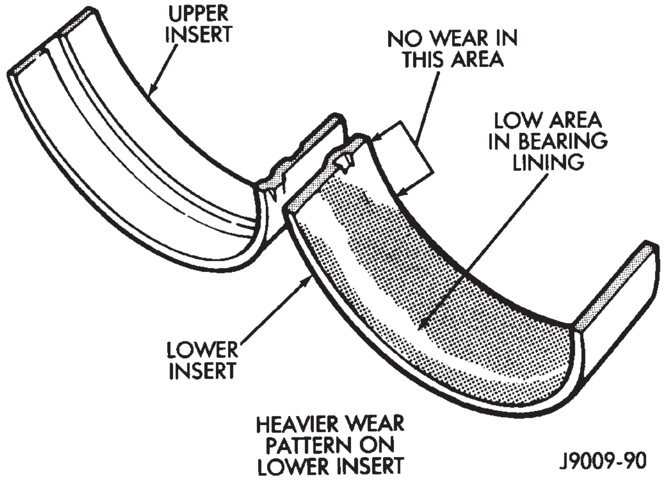

Fig. 3 Main Bearing Wear Patterns

Replace all damaged or worn bearing inserts.

FITTING—CRANKSHAFT INSTALLED

The main bearing caps, numbered (front to rear) from 1 through 7 have an arrow to indicate the forward position. The upper main bearing inserts are grooved to provide oil channels while the lower inserts are smooth.

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance. In production, the select fit is obtained by using various-sized color-coded bearing insert pairs as listed in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert. **The size is not stamped on bearing inserts used for engine production.**

The main bearing journal size (diameter) is identified by a color-coded paint mark on the adjacent cheek. The rear main journal, is identified by a color-coded paint mark on the crankshaft rear flange.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce the clearance by 0.013 mm (0.0005 inch). **Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 inch) difference in size (Fig. 4).**

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.025 mm (0.001 in.) Undersize	0.051 mm (0.002 in.) Undersize

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Fig. 4 Bearing Insert Pairs

When replacing inserts, the odd size inserts must be either all on the top (in cylinder block) or all on the bottom (in main bearing cap).

Once the bearings have been properly fitted, proceed to Crankshaft Main Bearing—Installation.

BEARING-TO-JOURNAL CLEARANCE—CRANKSHAFT INSTALLED

When using Plastigage, check only one bearing clearance at a time.

Install the grooved main bearings into the cylinder block and the non-grooved bearings into the bearing caps.

Install the crankshaft into the upper bearings dry.

Place a strip of Plastigage across full width of the crankshaft journal to be checked.

Install the bearing cap and tighten the bolts to 108 N·m (80 ft. lbs.) torque.

DO NOT rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate reading. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

Remove the bearing cap. Determine the amount of clearance by measuring the width of the compressed Plastigage with the scale on the Plastigage envelope (Fig. 5). Refer to Engine Specifications for the proper clearance.

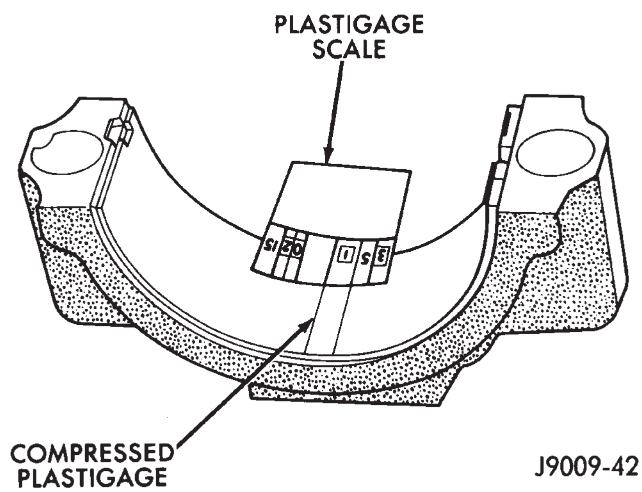

Fig. 5 Measuring Bearing Clearance with Plastigage

Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

If the specified clearance is indicated and there are no abnormal wear patterns, replacement of the bearing inserts is not necessary. Remove the Plastigage from the crankshaft journal and bearing insert. Proceed to Crankshaft Main Bearing—Installation.

If the clearance exceeds specification, install a pair of 0.025 mm (0.001 inch) undersize bearing inserts and measure the clearance as described in the previous steps.

The clearance indicated with the 0.025 mm (0.001 inch) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance.

FOR EXAMPLE: If the clearance was 0.0762 mm (0.003 inch) originally, a pair of 0.0254 mm (0.001 inch) undersize inserts would reduce the clearance by 0.0254 mm (0.001 inch). The clearance would then be 0.0508 mm (0.002 inch) and within the specification. A 0.051 mm (0.002 inch) undersize bearing insert and a 0.0254 mm (0.001 inch) undersize insert would reduce the original clearance an additional 0.0127 mm (0.0005 inch). The clearance would then be 0.0381 mm (0.0015 inch).

CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair.

FOR EXAMPLE: DO NOT use a standard size upper insert and a 0.051 mm (0.002 inch) undersize lower insert.

If the clearance exceeds specification using a pair of 0.051 mm (0.002 inch) undersize bearing inserts, measure crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

Replace the crankshaft or grind to accept the appropriate undersize bearing inserts if:

- Journal diameters 1 through 6 are less than 63.4517 mm (2.4981 inches).
- Journal 7 diameter is less than 63.4365 mm (2.4975 inches).

Once the proper clearances have been obtained, proceed to Crankshaft Main Bearing—Installation.

MAIN BEARING JOURNAL DIAMETER—CRANKSHAFT REMOVED

Remove the crankshaft from the cylinder block (refer to Cylinder Block - Disassemble).

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper and out of round is 0.013 mm (0.0005 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block (refer to Cylinder Block - Assemble and Crankshaft Main Bearings - Installation).

INSTALLATION

(1) Lubricate the bearing surface of each insert with engine oil.

(2) Loosen all the main bearing caps. Install the main bearing upper inserts.

(3) Install the lower bearing inserts into the main bearing caps.

(4) Install the main bearing cap(s) and lower insert(s).

(5) Tighten the bolts of caps 1, 2, 4, 5, 6, and 7 to 54 N·m (40 ft. lbs.) torque. Now tighten these bolts to 95 N·m (70 ft. lbs.) torque. Finally, tighten these bolts to 108 N·m (80 ft. lbs.) torque.

(6) Push the crankshaft forward and backward. Load the crankshaft front or rear and tighten cap bolt No.3 to 54 N·m (40 ft. lbs.) torque. Then tighten to 95 N·m (70 ft. lbs.) torque and finally tighten to 108 N·m (80 ft. lbs.) torque.

(7) Rotate the crankshaft after tightening each main bearing cap to ensure the crankshaft rotates freely.

(8) Check crankshaft end play. Crankshaft end play is controlled by the thrust bearing which is flange and installed at the No.2 main bearing position.

(a) Attach a magnetic base dial indicator to the cylinder block at either the front or rear of the engine.

(b) Position the dial indicator rod so that it is parallel to the center line of the crankshaft.

(c) Pry the crankshaft forward, position the dial indicator to zero.

(d) Pry the crankshaft forward and backward. Note the dial indicator readings. End play is the difference between the high and low measurements (Fig. 6). Correct end play is 0.038-0.165 mm (0.0015-0.0065 inch). The desired specifications are 0.051-0.064 mm (0.002-0.0025 inch).

(e) If end play is not within specification, inspect crankshaft thrust faces for wear. If no wear is apparent, replace the thrust bearing and measure end play. If end play is still not within specification, replace the crankshaft.

If the crankshaft was removed, install the crankshaft into the cylinder block (refer to Cylinder Block - Assemble).

(9) Install the oil pan.

(10) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(11) Lower the vehicle.

(12) Install the spark plugs. Tighten the plugs to 37 N·m (27 ft. lbs.) torque.

(13) Fill the oil pan with engine oil to the full mark on the dipstick level.

(14) Connect negative cable to battery.

REAR MAIN OIL SEALS

The crankshaft rear main bearing oil seal consists of two half pieces of viton with a single lip that ef-

MAIN BEARING FITTING CHART

Crankshaft Journals #1 - #6		Corresponding Crankshaft Bearing Insert	
Color Code	Diameter	Upper Insert Size	Lower Insert Size
Yellow	63.5025-63.4898 mm (2.5001-2.4996 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4898-63.4771 mm (2.4996-2.4991 in.) 0.0127 mm (0.0005 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Yellow - Standard
Blue	63.4771-63.4644 mm (2.4991-2.4986 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4644-63.4517 mm (2.4986-2.4981 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2485-63.2358 mm (2.4901-2.4896 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

Crankshaft Journals #7 Only		Corresponding Crankshaft Bearing Insert	
Color Code	Diameter	Upper Insert Size	Lower Insert Size
Yellow	63.4873-63.4746 mm (2.4995-2.4990 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4746-63.4619 mm (2.4990-2.4985 in.) 0.0127 mm (0.0005 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Yellow - Standard
Blue	63.4619-63.4492 mm (2.4985-2.4980 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4492-63.4365 mm (2.4980-2.4975 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2333-63.2206 mm (2.4895-2.4890 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

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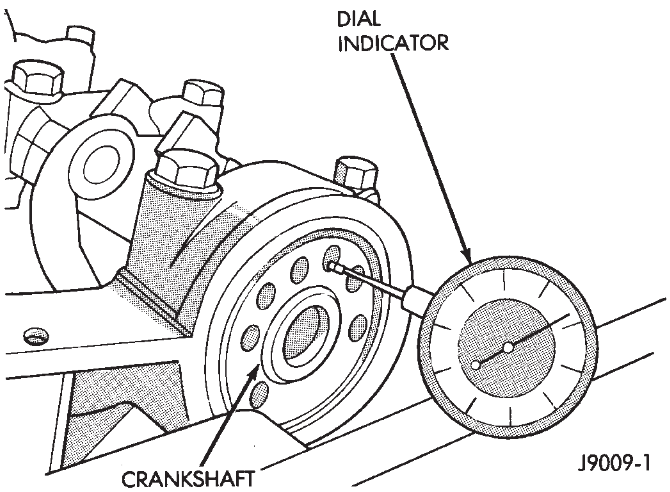

Fig. 6 Crankshaft End Play Measurement

fectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

REMOVAL

(1) Remove the engine flywheel or converter drive plate.
(2) Remove the oil pan.
(3) Remove the rear main bearing cap (No.7).
(4) Push the upper seal out of the groove. Ensure that the crankshaft and seal groove are not damaged.
(5) Remove the lower half of the seal from the bearing cap.

INSTALLATION

(1) Wipe the seal surface area of the crankshaft until it is clean.
(2) Apply a thin coat of engine oil.
(3) Coat the lip of the seal with engine oil.
(4) Carefully position the upper seal into the groove in the cylinder block. The lip of the seal faces toward the front of the engine.
(5) Place the lower half of the seal into bearing cap No.7 (Fig. 7).
(6) Coat the outer curved surface of the lower seal with soap and the lip of the seal with engine oil (Fig. 7).
(7) Position the lower seal into the bearing cap recess and seat it firmly. Be sure the seal is flush with the cylinder block pan rail.
(8) Apply Loctite 518, or equivalent on the rear bearing cap (Fig. 8). The bead should be 3 mm (0.125 in) thick. DO NOT apply Loctite 518, or equivalent to the lip of the seal.
(9) Install the rear main bearing cap. DO NOT strike the cap more than twice for proper engagement.
(10) Tighten all main bearing bolts to 108 N·m (80 ft. lbs.) torque.
(11) Install the oil pan gasket and oil pan.

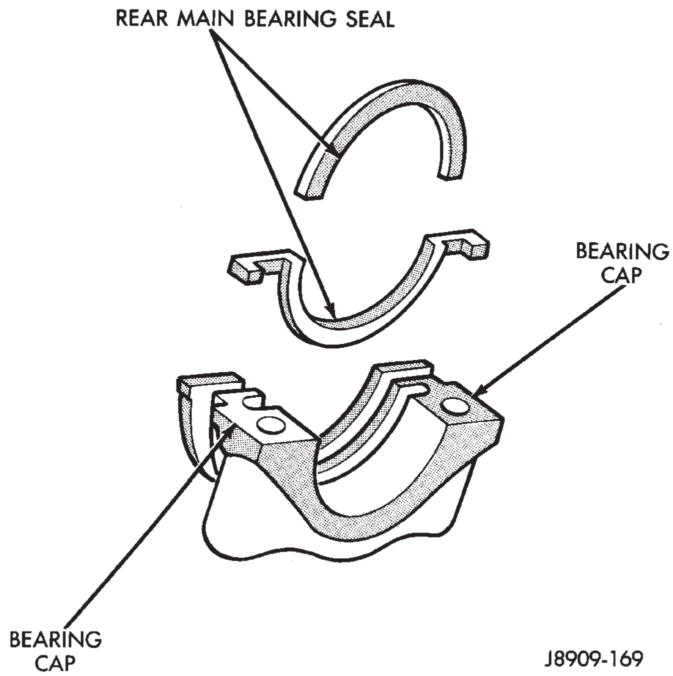

Fig. 7 Rear Main Bearing Oil Seal

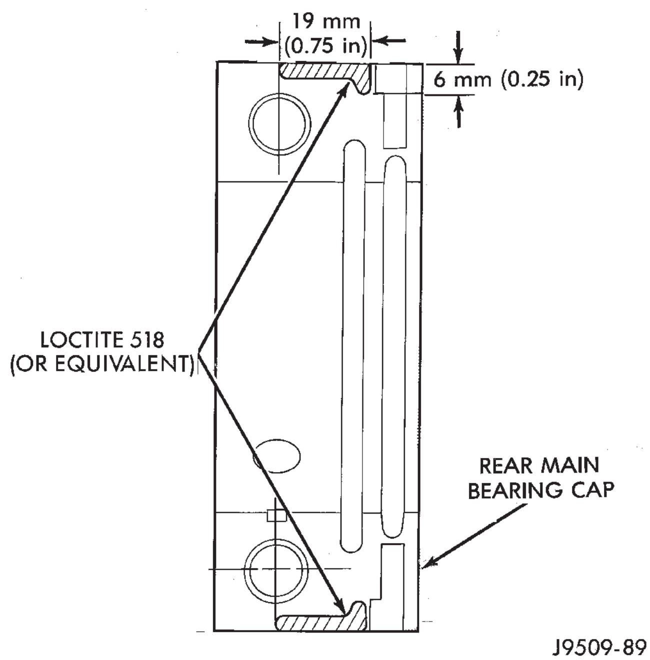

Fig. 8 Location of Loctite 518 (or equivalent)

(12) Install the engine flywheel or converter drive plate.

CYLINDER BLOCK

Remove the Engine Assembly from the vehicle.

DISASSEMBLY

Refer to the applicable sections for detailed instructions.
(1) Drain the engine oil. Remove and discard the oil filter.

(2) Remove the water pump from the cylinder block.

(3) Remove the vibration damper.

(4) Remove the timing case cover and lay the cover upside down.

(5) Position a drift punch into the slot in the back of the cover and tap the old seal out.

(6) Remove the oil slinger from crankshaft.

(7) Remove the camshaft retaining bolt and remove the sprockets and chain as an assembly.

(8) Remove the camshaft.

(9) Remove the oil pan and gasket.

(10) Remove the front and rear oil galley plugs.

(11) Remove the oil pump.

(12) Remove the connecting rods and the pistons. Remove the connecting rod and piston assemblies through the top of the cylinder bores.

(13) Remove the crankshaft.

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole, the filter bypass hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 41 N·m (30 ft. lbs.) torque.

INSPECTION—CYLINDER BORE

(1) Use a bore gauge to measure each cylinder bore diameter (Fig. 9). If a bore gauge is not available, use an inside micrometer.

(2) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the bottom of the bore.

(3) Determine taper by subtracting the smaller diameter from the larger diameter.

(4) Rotate measuring device 120° and repeat steps above. Finally, rotate the device another 120° and repeat measurements.

(5) Determine out-of-roundness by comparing the difference between each 120° measurement.

(6) If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out-of-round condition exceeds these maximum limits, the cylinder must be bored and then honed to accept an oversize piston. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

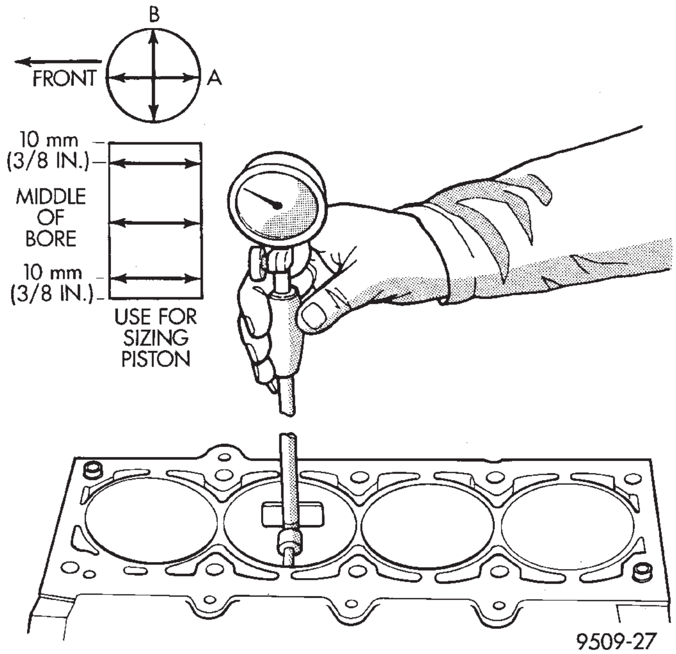

Fig. 9 Cylinder Bore Measurement

HONING—CYLINDER BORE

The honing operation should be closely coordinated with the fitting of pistons and rings. This will ensure specified clearances are maintained.

Refer to Standard Service Procedures in the beginning of this Group for the proper honing of cylinder bores.

ASSEMBLY

Refer to the applicable sections for detailed instructions.

(1) Install the crankshaft.

(2) Install the connecting rods and the pistons through the top of the cylinder bores.

(3) Install the oil pump.

(4) Install the oil pan and gasket.

(5) Install the camshaft.

(6) Install the sprockets and chain as an assembly.

(7) Install the oil slinger from the crankshaft.

(8) Install the timing case cover seal.

(9) Install the timing case cover.

(10) Install the vibration damper.

(11) Install the water pump. Tighten the mounting bolts to 31 N·m (270 in. lbs.) torque.

(12) Lubricate the oil filter seal with clean engine oil. Tighten oil filter to 18 N·m (13 ft. lbs.) torque.

(13) Install the engine into the vehicle.

(14) Fill the engine with clean lubrication oil (refer to Group 0, Lubrication and Maintenance).

(15) Fill the cooling system (refer to Group 7, Cooling System for the proper procedures).

ENGINE SPECIFICATIONS

Camshaft

Hydraulic Tappet Clearance	Zero Lash
Bearing Clearance	0.025 - 0.076 mm (0.001 - 0.003 in)
Bearing Journal Diameter	
No.1	51.54 - 51.56 mm (2.029 - 2.030 in)
No.2	51.28 - 51.31 mm (2.019 - 2.020 in)
No.3	51.03 - 51.05 mm (2.009 - 2.010 in)
No.4	50.78 - 50.80 mm (1.999 - 2.000 in)
Base Circle Runout	0.03 mm - max. (0.001 in - max.)
Camshaft Lobe Lift	6.43 mm (0.253 in)
Valve Lift	10.29 mm (0.405 in)
Intake Valve Timing	
Opens	15°BTDC
Closes	75°ABDC
Exhaust Valve Timing	
Opens	59°BBDC
Closes	31°ATDC
Valve Overlap	46°
Intake Duration	270°
Exhaust Duration	270°

Crankshaft

End Play	0.038 - 0.165 mm (0.0015 - 0.0065 in)
Main Bearing Journal Diameter	
No.1-6	63.489 - 63.502 mm (2.4996 - 2.5001 in)
No.7	**63.449 - 63.487 mm (2.4980 - 2.4995 in)**
Main Bearing Journal Width	
No.1	27.58 - 27.89 mm (1.086 - 1.098 in)
No.3	32.28 - 32.33 mm (1.271 - 1.273 in)
No.2-4-5-6-7	30.02 - 30.18 mm (1.182 - 1.188 in)
Main Bearing Clearance	0.03 - 0.06 mm (0.001 - 0.0025 in)
Preferred	0.051 mm (0.002 in)
Connecting Rod Journal Dia.	53.17 - 53.23 mm (2.0934 - 2.0955 in)
Connecting Rod Journal Width	27.18 - 27.33 mm (1.070 - 1.076 in)
Out-of-Round (Max. All Journals)	0.013 mm (0.0005 in)
Taper (Max. - All Journals)	0.013 mm (0.0005 in)

Cylinder Block

Deck Height	240.03 - 240.18 mm (9.450 - 9.456 in)
Deck Clearance (Below Block)	0.546 mm (0.0215 in)
Cylinder Bore Diameter	
Standard	98.45 - 98.48 mm (3.8759 - 3.8775 in)
Taper (Max.)	0.025 mm (0.001 in)
Out-of-Round	0.025 mm (0.001 in)
Tappet Bore Diameter	23.000 - 23.025 mm (0.9055 - 0.9065 in)
Flatness	0.03 mm per 25 mm (0.001 in per 1 in) 0.05 mm per 152 mm (0.002 in per 6 in) 0.20 mm - max. for total length (0.008 in - max. for total length)
Main Bearing Bore Dia.	68.3514 - 68.3768 mm (2.691 - 2.692 in)

Connecting Rods

Total Weight (Less Bearing)	657 - 665 grams (23.17 - 23.45 oz)
Length (Center-to-Center)	155.52 - 155.62 mm (6.123 - 6.127 in)
Piston Pin Bore Diameter	23.59 - 23.62 mm (0.9288 - 0.9298 in)
Bore (Less Bearings)	56.08 - 56.09 mm (2.2080 - 2.2085 in)
Bearing Clearance	0.025 - 0.076 mm (0.001 - 0.003 in)
Preferred	0.044 - 0.050 mm (0.0015 - 0.0020 in)
Side Clearance	0.25 - 0.48 mm (0.010 - 0.019 in)
Twist (Max.)	0.001 mm per mm (0.001 in per in)
Bend (Max.)	0.0005 mm per mm (0.0005 in per in)

Cylinder Compression Pressure

Ratio	8.7:1
Pressure Range	827 - 1 034 kPa (120 - 150 psi)
Max. Variation Between Cylinders	206 kPa (30 psi)

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SPECIFICATIONS

ENGINE SPECIFICATIONS—CONT.

Cylinder Head

Combustion Chamber ....55.22 - 58.22 cc
(3.37 - 3.55 cu. in.)
Valve Guide I.D. (Integral)..7.9 mm
(0.312 in)
Valve Stem-to-Guide Clearance ....0.025 - 0.076 mm
(0.001 - 0.003 in)
Intake Valve Seat Angle..44.5°
Exhaust Valve Seat Angle ....44.5°
Valve Seat Width ....1.02 - 1.52 mm
(0.040 - 0.060 in)
Valve Seat Runout ....0.064 mm
(0.0025 in)
Flatness ....0.03 mm per 25 mm
(0.001 in per 1 in)
0.05 mm per 152 mm
(0.002 in per 6 in)
0.20 mm - max. for total length
(0.008 in - max. for total length)

Rocker Arms, Push Rods & Tappets

Rocker Arm Ratio 1.6:1
Push Rod Length ....244.856 - 245.364 mm
(9.640 - 9.660 in)
Push Rod Diameter.......................................7.92 - 8.00 mm
(0.312 - 0.315 in)
Hydraulic Tappet Diameter ....22.962 - 22.974 mm
(0.904 - 0.9045 in)
Tappet-to-Bore Clearance..........................0.025 - 0.063 mm
(0.001 - 0.0025 in)

Valves

Length (Tip-to-Gauge Dimension Line)
Intake..122.479 - 122.860 mm
(4.822 - 4.837 in)
Exhaust ....122.860 - 123.241 mm
(4.837 - 4.852 in)
Valve Stem Diameter................................7.899 - 7.925 mm
(0.311 - 0.312 in)
Stem-to-Guide Clearance ....0.025 - 0.076 mm
(0.001 - 0.003 in)
Valve Head Diameter
Intake..48.387 - 48.641 mm
(1.905 - 1.915 in)
Exhaust ....37.973 - 38.227 mm
(1.495 - 1.505 in)
Valve Face Angle
Intake ....45°
Exhaust..45°
Tip Refinishing (Max. Allowable).............................0.25 mm
(0.010 in)

Valve Springs

Free Length (Approx.) ....49.962 mm
(1.967 in)
Spring Tension
Valve Closed ....360 - 396 N @ 41.656 mm
(81 - 89 lbf @ 1.640 in)
Valve Open............................845 - 934 N @ 30.886 mm
(190 - 210 lbf @ 1.216 in)
Inside Diameter ....24.08 - 24.59 mm
(0.948 - 0.968 in)

Pistons

Weight (Less Pin) ....563 - 567 grams
(19.86 - 20.00 oz)
Piston Pin Bore (Centerline-to-Piston Top).....40.61 - 40.72 mm
1.599 - 1.603 in)
Piston-to-Bore Clearance ....0.033 - 0.053 mm
(0.0013 - 0.0021 in)
Preferred........ 0.033 - 0.038 mm
(0.0013 - 0.0015 in)
Piston Ring Gap Clearance
Compression Rings ....0.25 - 0.51 mm
(0.010 - 0.020 in)
Oil Control Steel Rails ....0.25 - 0.64 mm
(0.010 - 0.025 in)
Piston Ring Side Clearance
Compression Rings ....0.025 - 0.081 mm
(0.001 - 0.0032 in)
Preferred...................0.025 mm
(0.001 in)
Oil Control Ring ....0.025 - 0.241 mm
(0.001 - 0.0095 in)
Preferred.....................0.08 mm
(0.003 in)
Piston Ring Groove Height
Compression Rings ....2.019 - 2.045 mm
(0.0795 - 0.0805 in)
Oil Control Ring ....4.78 - 4.80 mm
(0.1880 - 0.1895 in)
Piston Ring Groove Diameter
Compression Rings ....88.30 - 88.55 mm
(3.476 - 3.486 in)
Oil Control Ring ....90.35 - 90.60 mm
(3.557 - 3.566 in)
Piston Pin Bore Diameter....................... 23.647 - 23.655 mm
(0.9310 - 0.9313 in)
Piston Pin Diameter. .... 23.637 - 23.640 mm
(0.9306 - 0.9307 in)
Piston-to-Pin Clearance..............0.0076 - 0.0178 mm - Loose
(0.0003 - 0.0007 in - Loose)
Preferred . . . . .0.013 mm
(0.0005 in)
Piston-to-Pin Connecting Rod (Press Fit)........................8.9 kN
(2000 lb.f)

J9409-32

ENGINE SPECIFICATIONS—CONT.

Oil Pump

Gear-to-Body Clearance (Radial) ....0.051 - 0.102 mm (0.002 - 0.004 in)
Preferred...............0.051 mm (0.002 in)

Gear End Clearance
Plastigage...0.051 - 0.152 mm (0.002 - 0.006 in)
Preferred...............0.051 mm (0.002 in)
Feeler Gauge....................................0.1016 - 0.2032 mm (0.004 - 0.008 in)
Preferred.............0.1778 mm (0.007 in)

Oil Pressure

At Idle Speed (600 rpm) ....89.6 kPa (13 psi)
At 1600 rpm & higher. ....255 - 517 kPa (37 - 75 psi)
Oil Pressure Relief. ....517 kPa (75 psi)

J9409-33

TORQUE SPECIFICATIONS

Description	Torque
A/C Compressor Bracket-to-Engine Bolts	34 N•m (25 ft. lbs.)
A/C Compressor Mounting Bolts	27 N•m (20 ft. lbs.)
A/C Low Pressure Service Valve Nut	38 N•m (28 ft. lbs.)
Block Heater Nut	1.8 N•m (16 in. lbs.)
Camshaft Sprocket Bolt	108 N•m (80 ft. lbs.)
Connecting Rod Nuts	45 N•m (33 ft. lbs.)
Cylinder Block Drain Plugs	41 N•m (30 ft. lbs.)
Cylinder Head Bolts	
(#1–10 & #12–14)	149 N•m (110 ft. lbs.)
(#11)	135 N•m (100 ft. lbs.)
Cylinder Head Cover Bolts	13 N•m (115 in. lbs.)
Engine Mounts—Front	
Engine Support Bracket	
Bolts (XJ)	61 N•m (45 ft. lbs.)
Bolts (YJ)	62 N•m (46 ft. lbs.)
Support Cushion	
Bolts/Nuts (XJ)	41 N•m (30 ft. lbs.)
Bolts/Nuts (YJ)	52 N•m (38 ft. lbs.)
Support Cushion Bracket—(XJ)	
Bolts	54 N•m (40 ft. lbs.)
Stud Nuts	41 N•m (30 ft. lbs.)
Support Cushion Thru-Bolt	
XJ Vehicles	65 N•m (48 ft. lbs.)
YJ Vehicles	69 N•m (51 ft. lbs.)
Engine Mount—Rear	
Crossmember-to-Sill Bolts (XJ-Automatic)	41 N•m (30 ft. lbs.)
Insulator Stud Assembly Nut	41 N•m (30 ft. lbs.)
Skid Plate/Support Cushion Stud Nuts (YJ)	54 N•m (40 ft. lbs.)
Skid Plate-to-Sill Bolts (YJ)	88 N•m (65 ft. lbs.)
Support Cushion/Crossmember Nuts (XJ)	22 N•m (192 in. lbs.)
Support Cushion/Support Bracket Nuts (XJ Manual)	75 N•m (55 ft. lbs.)
Support Cushion/Torque Arm Bracket Nuts (YJ)	54 N•m (40 ft. lbs.)
Torque Arm Bracket Bolts (YJ-Automatic)	54 N•m (40 ft. lbs.)
Engine Mount—Rear (Cont.)	
Torque Arm Bracket/Support Cushion Bolts (YJ-Manual)	54 N•m (40 ft. lbs.)
Transmission Support Adaptor Bracket Bolts (XJ 2WD Auto)	75 N•m (55 ft. lbs.)
Transmission Support Bracket Bolts (XJ-Manual)	46 N•m (34 ft. lbs.)
Transmission Support Bracket/Support Cushion Bolts (XJ Automatic)	75 N•m (55 ft. lbs.)
Exhaust Manifold/Pipe Nuts	27 N•m (20 ft. lbs.)
Flywheel/Converter Housing Bolts	38 N•m (28 ft. lbs.)
Flywheel/Crankshaft Bolts	143 N•m (105 ft. lbs.)
Front Cover-to-Block Bolts (1/4-20)	7 N•m (60 in. lbs.)
Front Cover-to-Block Bolts (5/16-18)	22 N•m (192 in. lbs.)
Fuel Pump Bolts	22 N•m (16 ft. lbs.)
Generator Adjusting Bolt	24 N•m (18 ft. lbs.)
Generator Pivot Bolt/Nut	38 N•m (28 ft. lbs.)
Main Bearing Bolts	108 N•m (80 ft. lbs.)
Oil Filter	18 N•m (13 ft. lbs.)
Oil Filter Adaptor Bolts	102 N•m (75 ft. lbs.)
Oil Galley Plug	41 N•m (30 ft. lbs.)
Oil Pan Bolts (1/4-20)	14 N•m (120 in. lbs.)
(5/16-18)	18 N•m (156 in. lbs.)
Oil Pan Drain Plug	34 N•m (25 ft. lbs.)
Oil Pump Attaching Bolts	
Short Bolts	14 N•m (10 ft. lbs.)
Long Bolts	23 N•m (17 ft. lbs.)
Oil Pump Cover Bolts	8 N•m (70 in. lbs.)
Power Steering Pump Pressure Hose Nut	52 N•m (38 ft. lbs.)
Rocker Arm Assembly-to-Cylinder Head Capscrews	28 N•m (21 ft. lbs.)
Spark Plugs	37 N•m (27 ft. lbs.)
Starting Motor Mounting Bolts	45 N•m (33 ft. lbs.)
Thermostat Housing	18 N•m (156 in. lbs.)
Vibration Damper Bolts	108 N•m (80 ft. lbs.)
Water Pump/Block Bolts	31 N•m (270 in. lbs.)

J9509-82

5.2L ENGINE SERVICE PROCEDURES

INDEX

GENERAL INFORMATION

The 5.2 Liter (318 CID) eight-cylinder engine is a V-Type lightweight, single cam, overhead valve engine with hydraulic roller tappets (Fig. 1).

Engine Type	90° V-8 OHV
Bore and Stroke	99.3 × 84.0 mm (3.91 × 3.31 in.)
Displacement	5.2L (318 cu. in.)
Compression Ratio	9.1:1
Torque	386 N·m (285 ft. lbs.) @ 3,600 rpm
Firing Order	1-8-4-3-6-5-7-2
Lubrication	Pressure Feed — Full Flow Filtration
Engine Oil Capacity	4.7L (5.0 qts) w/filter
Cooling System	Liquid Cooled — Forced Circulation
Cooling Capacity	15.6L (16.5 qts)
Cylinder Block	Cast Iron
Crankshaft	Nodular Iron
Cylinder Head	Cast Iron
Combustion Chambers	Wedge-High Swirl Valve Shrouding
Camshaft	Nodular Cast Iron
Pistons	Aluminum Alloy w/Strut
Connectiong Rods	Forged Steel

J9309-16

Fig. 1 Engine Description

This engine is designed for unleaded fuel.

Engine lubrication system consists of a rotor type oil pump and a full flow oil filter.

The cylinders are numbered from front to rear; 1, 3, 5, 7 on the left bank and 2, 4, 6, 8 on the right bank. The firing order is 1-8-4-3-6-5-7-2 (Fig. 2).

The engine serial number is stamped into a machined pad located on the left, front corner of the cylinder block. When component part replacement is necessary, use the engine type and serial number for reference (Fig. 3).

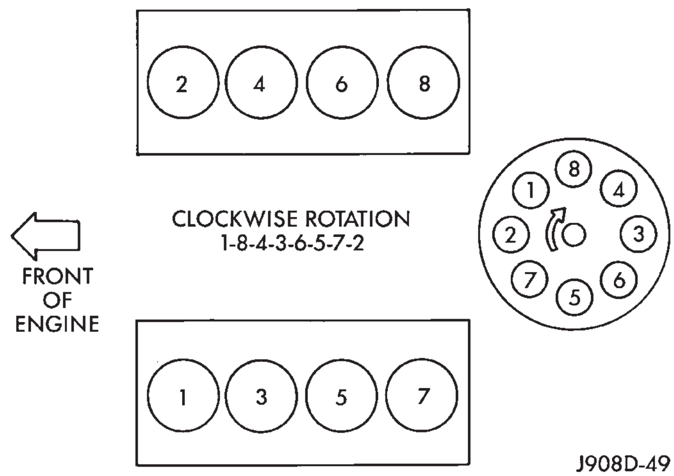


Fig. 2 Firing Order

X M 5.2L T XXXX XXXXXXXX

X = Last Digit of Model Year
M = Plant - M Mound Road
S Saltillo
T Trenton
K Toluca
5.2L = Engine Displacement
T = Usage - T Truck
XXXX = Month/Day
XXXXXXXX = Serial Code - Last 8 Digits of VIN No.

J9209-73

Fig. 3 Engine Identification Number

ENGINE MOUNTS—FRONT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Position fan to assure clearance for radiator top tank and hose.

CAUTION: DO NOT lift the engine by the intake manifold.

(3) Install engine lifting fixture.

(4) Raise vehicle on hoist.

(5) Remove the engine support insulator thru-bolts and nuts (Figs. 4 and 5).

(6) Raise engine SLIGHTLY. Remove the engine support insulator bolts. Remove the engine support insulator assembly.

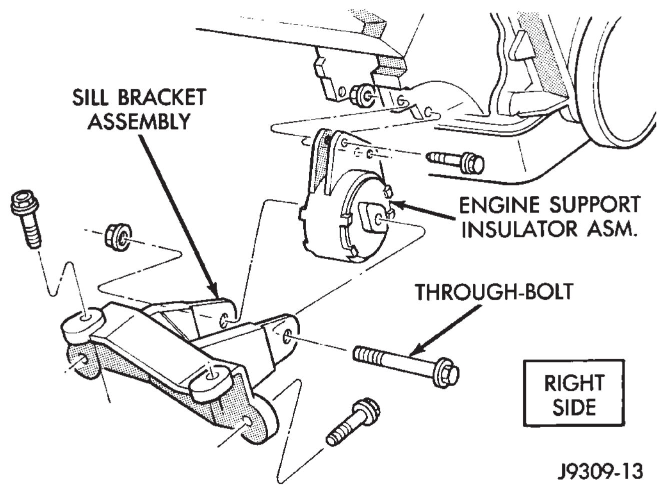


Fig. 4 Front Engine Mount—Right Side

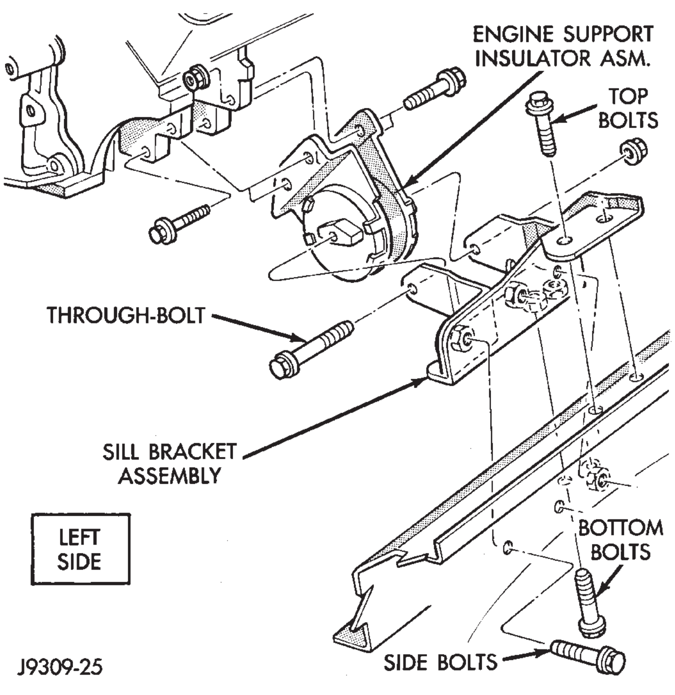


Fig. 5 Front Engine Mount—Left Side

(7) If required, remove the sill bracket assembly.

INSTALLATION

(1) If the sill bracket assembly was removed, install the bracket to the sill assembly.

(a) RIGHT SIDE—Install the sill bracket assembly onto the sill assembly (Fig. 4). Install and tighten the bolts to 65 N·m (48 ft. lbs.) torque.

(b) LEFT SIDE—Install the sill bracket assembly onto the sill assembly (Fig. 5). Install and tighten the 2 top bolts to 65 N·m (48 ft. lbs.) torque. Install and tighten the 2 side bolts to 95 N·m (70 ft. lbs.) torque. Install and tighten the 2 bottom bolts to 121 N·m (89 ft. lbs.) torque.

(2) With the engine raised SLIGHTLY, position engine support insulator assembly onto the engine block (Figs. 4 and 5). Install bolts and tighten to 88 N·m (65 ft. lbs.) torque.

(3) Lower engine with lifting fixture while aligning engine support insulator assembly into sill bracket assembly.

(4) Install the thru-bolt and nut. Tighten the RIGHT SIDE nut to 65 N·m (48 ft. lbs.) torque. Tighten the LEFT SIDE nut to 121 N·m (89 ft. lbs.) torque.

(5) Lower the vehicle.

(6) Remove lifting fixture.

(7) Connect the negative cable to the battery.

ENGINE MOUNTS—REAR

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle on a hoist.

(3) Support the transmission with a jack.

(4) Remove engine mount bracket thru-bolt (Fig. 6).

(5) Raise the transmission and engine SLIGHTLY.

(6) Remove stud nuts attaching engine mount clevis bracket to crossmember (Fig. 6). Remove bracket.

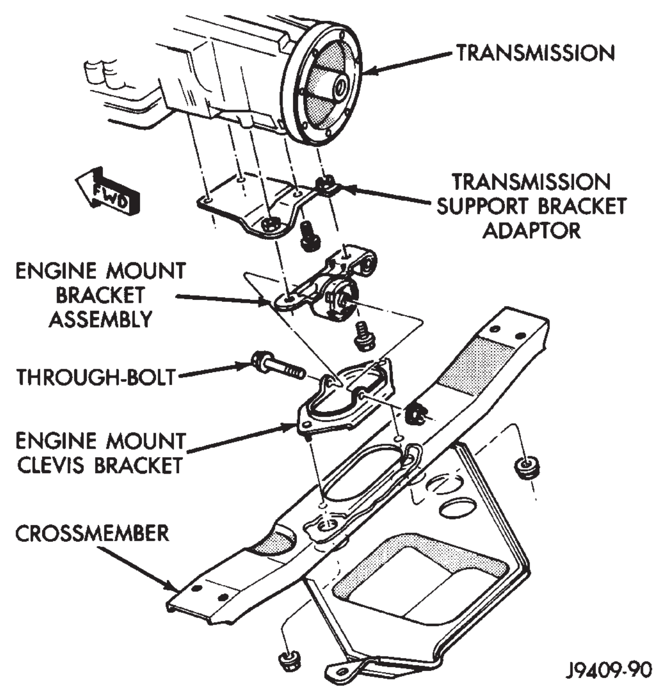


Fig. 6 Engine Rear Support Assembly

(7) Remove the engine mount bracket assembly from the adaptor (Fig. 6).

(8) If required, remove the transmission support bracket adaptor.

INSTALLATION

(1) If the transmission support bracket adaptor was removed, position the adaptor to the transmission (Fig. 6). Tighten the bolts to 60 N·m (44 ft. lbs.) torque.

(2) Install the engine mount clevis bracket onto crossmember. Tighten the stud nuts to 41 N·m (30 ft. lbs) torque.

(3) Install the engine mount bracket assembly to the adaptor. Install the bolts and tighten to 75 N·m (55 ft. lbs.) torque.

(4) Lower the transmission and engine while aligning the engine mount bracket assembly to the engine mount clevis bracket.

(5) Install thru-bolt and tighten the nut to 65 N·m (48 ft. lbs.) torque.

(6) Remove transmission jack.

(7) Lower the vehicle.

(8) Connect the negative cable to the battery.

ENGINE ASSEMBLY

REMOVAL

(1) Scribe hood hinge outlines on hood and remove the hood.

(2) Remove the battery.

(3) Drain cooling system.

(4) Remove the air cleaner and tube.

(5) Set fan shroud aside.

(6) Remove radiator and heater hoses. Remove the radiator (refer to Group 7, Cooling System).

(7) Remove the vacuum lines.

(8) Remove the distributor cap and wiring.

(9) Disconnect the accelerator linkage.

(10) Perform the Fuel System Pressure Release procedure (refer to Group 14, Fuel System).

(11) Remove throttle body.

(12) Remove the starter wires.

(13) Remove the oil pressure wire.

(14) Discharge the air conditioning system, if equipped (refer to Group 24, Heating and Air Conditioning for service procedures).

(15) Remove air conditioning hoses.

(16) Disconnect the power steering hoses, if equipped.

(17) Remove starter motor (refer to Group 8B, Battery/Starter Service).

(18) Remove the generator (refer to Group 8C, Generator Service).

(19) Raise and support the vehicle on a hoist.

(20) Disconnect exhaust pipe at manifold.

(21) Support automatic transmission with a transmission stand. This will assure that the torque converter will remain in proper position in the transmission housing.

(22) Remove bell housing bolts and inspection plate. Attach C-clamp on front bottom of transmission torque converter housing to prevent torque converter from coming out.

(23) Remove torque converter drive plate bolts from torque converter drive plate. Mark converter and drive plate to aid in assembly.

(24) Disconnect the engine from the torque converter drive plate.

CAUTION: DO NOT lift the engine by the intake manifold.

(25) Install an engine lifting fixture.

(26) Remove the engine front mount thru-bolts.

(27) Lower the vehicle.

(28) Remove engine from engine compartment.

(29) Install on engine repair stand.

INSTALLATION

(1) Remove engine from the repair stand and position in the engine compartment.

(2) Install engine support fixture.

(3) Raise and support the vehicle on a hoist.

(4) Position the torque converter and drive plate. Install torque converter drive plate bolts. Tighten the bolts to 31 N·m (270 in. lbs.) torque.

(5) Install the engine front mount thru-bolts.

(6) Install bell housing bolts. Tighten the bolts to 41 N·m (30 ft. lbs.) torque.

(7) Remove C-clamp and install inspection plate.

(8) Remove stand from transmission.

(9) Install exhaust pipe to manifold.

(10) Lower the vehicle.

(11) Remove engine lifting fixture.

(12) Install the generator (refer to Group 8C, Generator Service).

(13) Install starter motor (refer to Group 8B, Battery/Starter Service).

(14) Install power steering hoses, if equipped.

(15) Install air conditioning hoses.

(16) Charge the air conditioner, if equipped (refer to Group 24, Heater and Air Conditioning for service procedures).

(17) Using a new gasket, install throttle body. Tighten the throttle body bolts to 23 N·m (200 in. lbs.) torque.

(18) Connect the accelerator linkage.

(19) Connect the starter wires.

(20) Connect the oil pressure wire.

(21) Install the distributor cap and wiring.

(22) Install vacuum lines.

(23) Install radiator, radiator hoses and heater hoses (refer to Group 7, Cooling System).

(24) Install fan shroud in position.
(25) Install the battery
(26) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).
(27) Install the air cleaner.
(28) Warm engine and adjust.
(29) Install hood and line up.
(30) Road test vehicle.

CYLINDER HEAD COVER

A steel backed silicon gasket is used with the cylinder head cover (Fig. 1). This gasket can be used again.

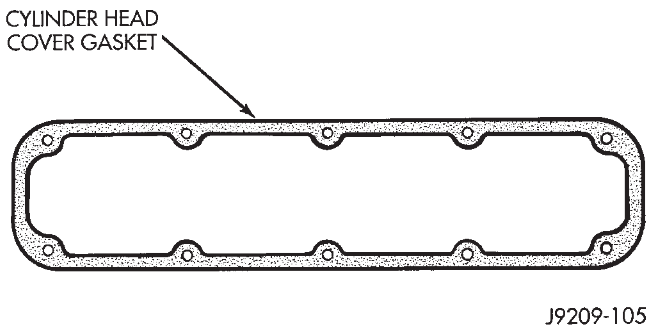


Fig. 1 Cylinder Head Cover Gasket

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Disconnect closed ventilation system and evaporation control system from cylinder head cover.
(3) On the left cover, remove the coolant tube bracket.
(4) Remove the ignition wires from the holders.
(5) Remove cylinder head cover and gasket. The gasket may be used again.

CLEANING

Clean cylinder head cover gasket surface.
Clean head rail, if necessary.

INSPECTION

Inspect cover for distortion and straighten, if necessary.
Check the gasket for use in head cover installation. If damaged, use a new gasket.

INSTALLATION

(1) The cylinder head cover gasket can be used again. Install the gasket onto the head rail.
(2) Position the cylinder head cover onto the gasket. On the left cover, install the coolant tube bracket (refer to Group 7, Cooling System). Tighten the bolts to 11 N·m (95 in. lbs.) torque.
(3) Install the ignition wires onto the holders.
(4) Install closed crankcase ventilation system and evaporation control system.
(5) Connect the negative cable to the battery.

VALVE COMPONENTS REPLACE—CYLINDER HEAD NOT REMOVED

ROCKER ARMS AND PUSH RODS

REMOVAL

(1) Disconnect spark plug wires by pulling on the boot straight out in line with plug.
(2) Remove cylinder head cover and gasket.
(3) Remove the rocker arm bolts and pivots (Fig. 2). Place them on a bench in the same order as removed.
(4) Remove the push rods and place them on a bench in the same order as removed.

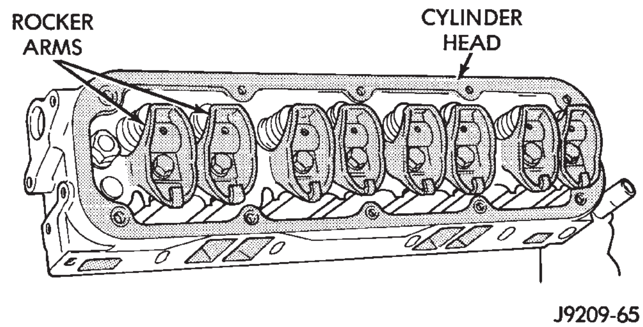


Fig. 2 Rocker Arms

INSTALLATION

(1) Rotate the crankshaft until the V8 mark lines up with the TDC mark on the timing chain case cover (located 17.5° ATDC from the No.1 firing mark).
(2) Install the push rods in the same order as removed.
(3) Install rocker arm and pivot assemblies in the same order as removed. Tighten the rocker arm bolts to 28 N·m (21 ft. lbs.) torque.

CAUTION: DO NOT rotate or crank the engine during or immediately after rocker arm installation. Allow the hydraulic roller tappets adequate time to bleed down (about 5 minutes).

(4) Install cylinder head cover.
(5) Connect spark plug wires.

VALVE STEM SEAL AND SPRING REPLACEMENT

This procedure is done with the cylinder head installed.
(1) Set engine basic timing to TDC and remove Air Cleaner.
(2) Remove cylinder head covers and spark plugs.
(3) Remove coil wire from distributor and secure to good ground to prevent engine from starting.
(4) Using suitable socket and flex handle at crankshaft retaining bolt, turn engine so the No.1 piston is at Top Dead Center on the compression stroke.
(5) Remove rocker arms.

(6) With air hose attached to an adapter installed in No.1 spark plug hole, apply 620-689 kPa (90-100 psi) air pressure.

(7) Using Valve Spring Compressor Tool MD-988772A, compress valve spring and remove retainer valve locks and valve spring.

(8) Install seals on the exhaust valve stem and position down against valve guides.

(9) The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as a guide. DO NOT force seal against top of guide. When installing the valve retainer locks, compress the spring only enough to install the locks.

(10) Follow the same procedure on the remaining 7 cylinders using the firing sequence 1-8-4-3-6-5-7-2. Make sure piston in cylinder is at TDC on the valve spring that is being removed.

(11) Remove adapter from the No.1 spark plug hole.

(12) Install rocker arms.

(13) Install covers and coil wire to distributor.

(14) Install air cleaner.

(15) Road test vehicle.

CYLINDER HEADS

The alloy cast iron cylinder heads (Fig. 3) are held in place by 10 bolts. The spark plugs are located in the peak of the wedge between the valves.

The 5.2L cylinder head is identified by the foundry mark NH.

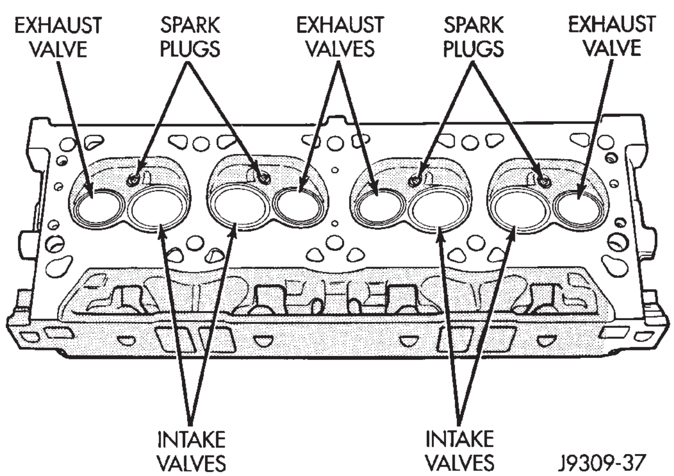


Fig. 3 Cylinder Head Assembly

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Drain cooling system (refer to Group 7, Cooling System for the proper procedures).

(3) Remove the generator.

(4) Remove closed crankcase ventilation system.

(5) Disconnect the evaporation control system.

(6) Remove the air cleaner.

(7) Perform the Fuel System Pressure Release procedure (refer to Group 14, Fuel System). Disconnect the fuel lines.

(8) Disconnect accelerator linkage and if so equipped, the speed control and transmission kickdown cables.

(9) Remove the return spring.

(10) Remove distributor cap and wires.

(11) Disconnect the coil wires.

(12) Disconnect heat indicator sending unit wire.

(13) Disconnect heater hoses and bypass hose.

(14) Remove cylinder head covers and gaskets.

(15) Remove intake manifold and throttle body as an assembly. Discard the flange side gaskets and the front and rear cross-over gaskets.

(16) Remove exhaust manifolds.

(17) Remove rocker arm assemblies and push rods. Identify to ensure installation in original locations.

(18) Remove the head bolts from each cylinder head and remove cylinder heads. Discard the cylinder head gasket.

(19) Remove spark plugs.

CLEANING

Clean all surfaces of cylinder block and cylinder heads.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

INSPECTION

Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out-of-flatness exceeds 0.00075 mm (0.00075 inch/inch) times the span length in inches in any direction, either replace head or lightly machine the head surface.

FOR EXAMPLE: A 305 mm (12 inch) span is 0.102 mm (0.004 inch) out-of-flat. The allowable out-of-flat is 305 X 0.00075 (12 X 0.00075) equals 0.23 mm (0.009 inch). This amount of out-of-flat is acceptable.

The cylinder head surface finish should be 1.78-3.00 microns (70-125 microinches).

Inspect push rods. Replace worn or bent rods.

INSTALLATION

(1) Position the new cylinder head gaskets onto the cylinder block.

(2) Position the cylinder heads onto head gaskets and cylinder block.

(3) Starting at top center, tighten all cylinder head bolts, in sequence, to 68 N·m (50 ft. lbs.) torque (Fig. 4). Repeat procedure, tighten all cylinder head bolts to 143 N·m (105 ft. lbs.) torque. Repeat procedure to confirm that all bolts are at 143 N·m (105 ft. lbs.) torque.

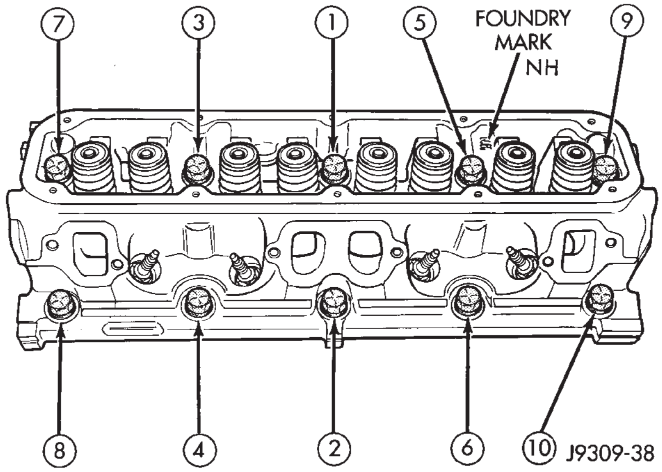


Fig. 4 Cylinder Head Bolt Tightening Sequence

CAUTION: When tightening the rocker arm bolts, make sure the piston in that cylinder is NOT at TDC. Contact between the valves and piston could occur.

(4) Install push rods and rocker arm assemblies in their original position. Tighten the bolts to 28 N·m (21 ft. lbs.) torque.

(5) Install the intake manifold and throttle body assembly (refer to Group 11, Exhaust System and Intake Manifold).

(6) Install exhaust manifolds. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

(7) Adjust spark plugs to specifications (refer to Group 8D, Ignition System). Install the plugs and tighten to 41 N·m (30 ft. lbs.) torque.

(8) Install coil wires.

(9) Connect heat indicator sending unit wire.

(10) Connect the heater hoses and bypass hose.

(11) Install distributor cap and wires.

(12) Hook up the return spring.

(13) Connect the accelerator linkage and if so equipped, the speed control and transmission kickdown cables.

(14) Install the fuel lines.

(15) Install the generator and drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque. Tighten the adjusting strap bolt to 23 N·m (200 in. lbs.) torque. Refer to Group 7, Cooling System for adjusting the belt tension.

(16) Install the intake manifold-to-generator bracket support rod. Tighten the bolts.

(17) Place the cylinder head cover gaskets in position and install cylinder head covers. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(18) Install closed crankcase ventilation system.

(19) Connect the evaporation control system.

(20) Install the air cleaner.

(21) Fill cooling system (refer to Group 7, Cooling System for proper procedure).

(22) Connect the negative cable to the battery.

VALVES AND VALVE SPRINGS

The valves are arranged in-line and inclined 18°. The rocker pivot support and the valve guides are cast integral with the heads.

This procedure requires the removal of the cylinder head.

REMOVAL

(1) Remove the cylinder head.

(2) Compress valve springs using Valve Spring Compressor Tool MD-998772A.

(3) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

(4) Before removing valves, remove any burrs from valve stem lock grooves to prevent damage to the valve guides. Identify valves to ensure installation in original location.

VALVE CLEANING

Clean valves thoroughly. Discard burned, warped and cracked valves.

Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

VALVE INSPECTION

Measure valve stems for wear. If wear exceeds 0.051 mm (0.002 inch), replace the valve.

VALVE GUIDES

Measure valve stem guide clearance as follows:

(a) Install Valve Guide Sleeve Tool C-3973 over valve stem and install valve (Fig. 5). The special sleeve places the valve at the correct height for checking with a dial indicator.

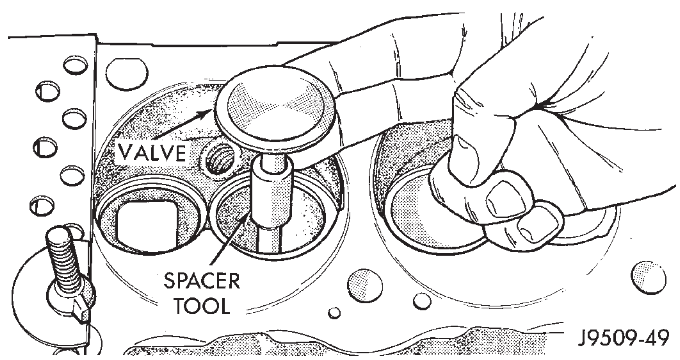


Fig. 5 Positioning Valve with Tool C-3973

(b) Attach Dial Indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured (Fig. 6).

(c) Move valve to and from the indicator. The total dial indicator reading should not exceed 0.432 mm (0.017 inch). Ream the guides for valves with oversize stems if dial indicator reading is excessive or if the stems are scuffed or scored.

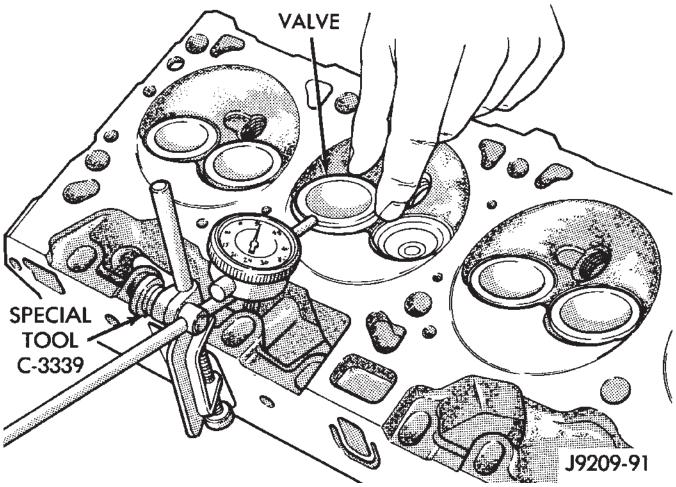


Fig. 6 Measuring Valve Guide Wear

Service valves with oversize stems are available (Fig. 7):

Reamer O/S	Valve Guide Size
0.076 mm (0.003 in.)	8.026 – 8.052 mm (0.316 – 0.317 in.)
0.381 mm (0.015 in.)	8.331 – 8.357 mm (0.328 – 0.329 in.)

J9309-30

Fig. 7 Reamer Sizes

Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Ream the valve guides from standard to 0.381 mm (0.015 inch). Use a 2 step procedure so the valve guides are reamed true in relation to the valve seat:**

- Step 1—Ream to 0.0763 mm (0.003 inch).
- Step 2—Ream to 0.381 mm (0.015 inch).

REFACING VALVES—VALVE SEATS

The intake and exhaust valves have a 43-1/4° to 43-3/4° face angle and a 44-1/4° to 44-3/4° seat angle (Fig. 8).

VALVES

Inspect the remaining margin after the valves are refaced (Fig. 9). Valves with less than 1.190 mm (0.047 inch) margin should be discarded.

VALVE SEATS

CAUTION: DO NOT un-shroud valves during valve seat refacing (Fig. 10).

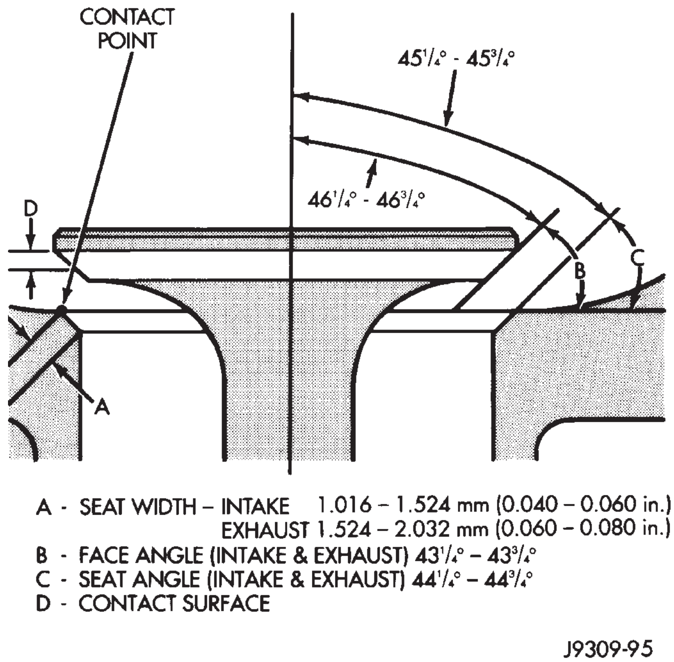


Fig. 8 Valve Face and Seat Angles

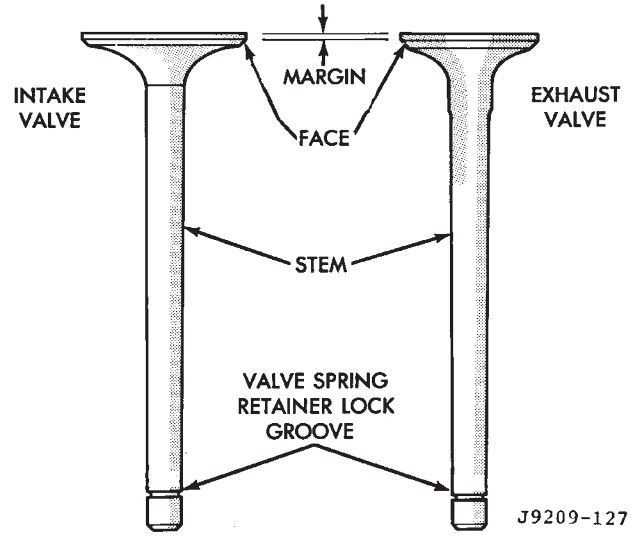


Fig. 9 Intake and Exhaust Valves

(1) 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.

(2) Measure the concentricity of valve seat using a dial indicator. Total runout should not exceed 0.051 mm (0.002 inch) total indicator reading.

(3) 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 the top edge of valve face, lower valve seat with a 15°

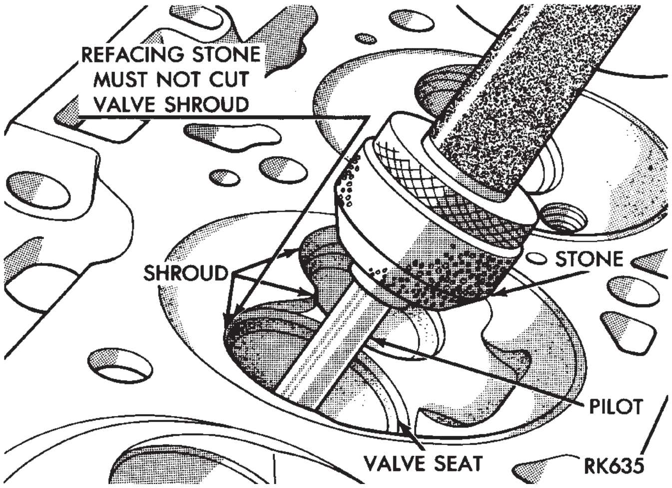


Fig. 10 Refacing Valve Seats

stone. If the blue is transferred to bottom edge of valve face raise valve seat with a 60° stone.

(4) When seat is properly positioned the width of intake seats should be 1.016-1.524 mm (0.040-0.060 inch). The width of the exhaust seats should be 1.524-2.032 mm (0.060-0.080 inch).

VALVE SPRING INSPECTION

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. As an example the compression length of the spring to be tested is 1-5/16 inch. Turn table of Universal Valve Spring Tester Tool (Fig. 11) until surface is in line with the 1-5/16 inch mark on the threaded stud. Be sure the zero mark is to the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by 2. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to specifications to obtain specified height and allowable tensions. Discard the springs that do not meet specifications.

INSTALLATION

(1) Coat valve stems with lubrication oil and insert them in cylinder head.

(2) If valves or seats are reground, check valve stem height. If valve is too long, replace cylinder head.

(3) Install new seals on all valve guides. Install valve springs and valve retainers.

(4) Compress valve springs with Valve Spring Compressor Tool MD-998772A, install locks and release tool. If valves and/or seats are ground, measure the installed height of springs. Make sure the measurement is taken from bottom of spring seat in cylinder head to the bottom surface of spring retainer. If spacers are installed, measure from the top of spacer.

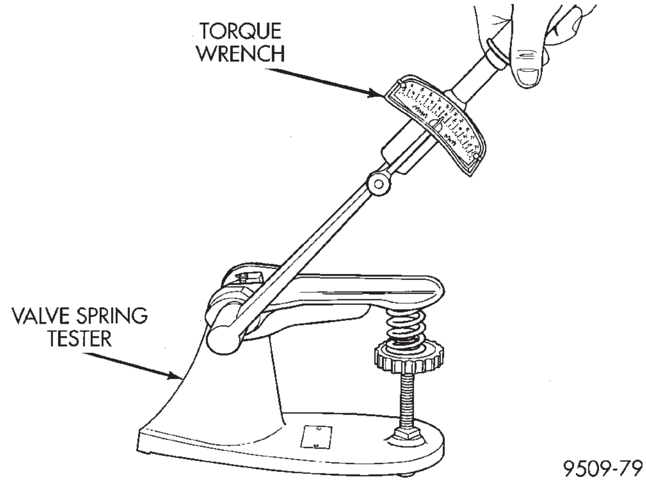


Fig. 11 Testing Valve Spring for Compressed Length

If height is greater than 42.86 mm (1-11/16 inches), install a 1.587 mm (1/16 inch) spacer in head counterbore. This should bring spring height back to normal 41.27 to 42.86 mm (1-5/8 to 1-11/16 inch).

HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check the oil pressure. If vehicle has no oil pressure gauge, install a reliable gauge at the pressure sending unit. The pressure should be between 207-552 kPa (30-80 psi) at 3,000 RPM.

Check the oil level after the engine reaches normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick.

The oil level in the pan should never be above the FULL mark or below the ADD OIL mark on dipstick. Either of these 2 conditions could be responsible for noisy tappets.

OIL LEVEL

HIGH

If oil level is above the FULL mark, it is possible for the connecting rods to dip into the oil. With the engine running this condition could create foam in the oil pan. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

LOW

Low oil level may allow oil pump to take in air. When air is fed to the tappets, they lose length which allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than 1 tappet will be noisy. When oil level and leaks have been corrected, operate the engine at fast idle. Run engine for a sufficient time to allow all of the air inside the tappets to be bled out.

TAPPET NOISE DIAGNOSIS

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger or by the plunger partially sticking in the tappet body cylinder. The tappet should be replaced. A heavy click is caused by a tappet check valve not seating or by foreign particles becoming wedged between the plunger and the tappet body. This will cause the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

The valve train generates a noise very much like a light tappet noise during normal operation. Care must be taken to ensure that tappets are making the noise. In general, if more than one tappet seems to be noisy, its probably not the tappets.

REMOVAL

(1) Remove the air cleaner.

(2) Remove cylinder head cover, rocker assembly and push rods. Identify push rods to ensure installation in original location.

(3) Remove intake manifold, yoke retainer and aligning yokes.

(4) Slide Hydraulic Tappet Remover/Installer Tool C-4129-A through opening in cylinder head and seat tool firmly in the head of tappet.

(5) Pull tappet out of bore with a twisting motion. If all tappets are to be removed, identify tappets to ensure installation in original
location.

(6) If the tappet or bore in cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize. Replace with oversize tappet.

CAUTION: The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body. It is advisable to work on one tappet at a time to avoid mixing of parts. Mixed parts are not compatible. DO NOT disassemble a tappet on a dirty work bench.

DISASSEMBLE

(1) Pry out plunger retainer spring clip (Fig. 12).

(2) Clean varnish deposits from inside of tappet body above plunger cap.

(3) Invert tappet body and remove plunger cap, plunger, check valve, check valve spring, check valve retainer and plunger spring (Fig. 12). Check valve could be flat or ball.

ASSEMBLE

(1) Clean all tappet parts in a solvent that will remove all varnish and carbon.

(2) Replace tappets that are unfit for further service with new assemblies.

(3) If plunger shows signs of scoring or wear, install a new tappet assembly. If valve is pitted, or valve seat on end of plunger is prevented from seating, install a new tappet assembly.

(4) Assemble tappets (Fig. 12).

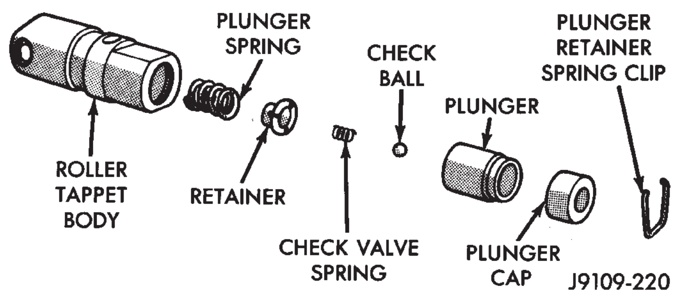


Fig. 12 Hydraulic Tappet Assembly

INSTALLATION

(1) Lubricate tappets.

(2) Install tappets and push rods in their original positions. Ensure that the oil feed hole in the side of the tappet body faces up (away from the crankshaft).

(3) Install aligning yokes with ARROW toward camshaft.

(4) Install yoke retainer. Tighten the bolts to 23 N·m (200 in. lbs.) torque. Install intake manifold.

(5) Install push rods in original positions.

(6) Install rocker arm.

(7) Install cylinder head cover.

(8) Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

VALVE TIMING

(1) Turn crankshaft until the No.6 exhaust valve is

closing and No.6 intake valve is opening.

(2) Insert a 6.350 mm (1/4 inch) spacer between rocker arm pad and stem tip of No.1 intake valve. Allow spring load to bleed tappet down giving in effect a solid tappet.

(3) Install a dial indicator so plunger contacts valve spring retainer as nearly perpendicular as possible. Zero the indicator.

(4) Rotate the crankshaft clockwise (normal running direction) until the valve has lifted 0.254 mm (0.010 inch). The timing of the crankshaft should now read from 10° before top dead center to 2° after top dead center. Remove spacer.

CAUTION: DO NOT turn crankshaft any further clockwise as valve spring might bottom and result in serious damage.

(5) If reading is not within specified limits:

(a) Check sprocket index marks.

(b) Inspect timing chain for wear.

(c) Check accuracy of DC mark on timing indicator.

VIBRATION DAMPER

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove fan shroud retainer bolts and set shroud back over engine.

(3) Remove the cooling system fan.

(4) Remove the serpentine belt (refer to Group 7, Cooling System).

(5) Remove the vibration damper pulley.

(6) Remove vibration damper bolt and washer from end of crankshaft.

(7) Install bar and screw from Puller Tool Set C-3688. Install 2 bolts with washers through the puller tool and into the vibration damper (Fig. 1).

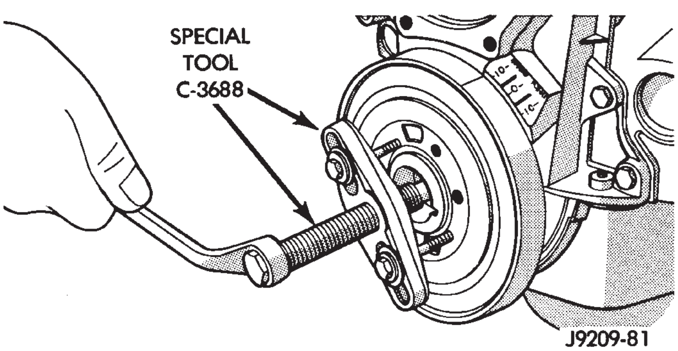


Fig. 1 Vibration Damper Assembly

(8) Pull vibration damper off of the crankshaft.

INSTALLATION

(1) Position the vibration damper onto the crankshaft.

(2) Place installing tool, part of Puller Tool Set C-3688 in position and press the vibration damper onto the crankshaft (Fig. 2).

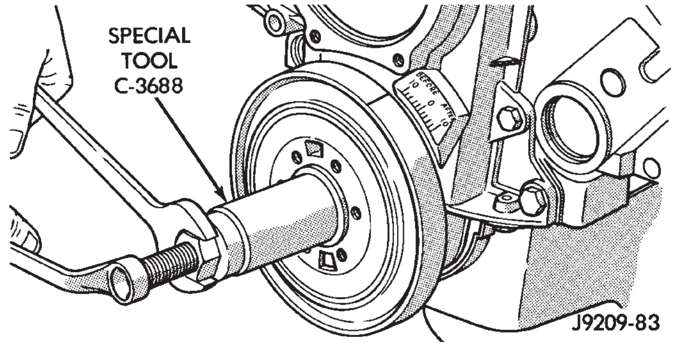


Fig. 2 Installing Vibration Damper

(3) Install the crankshaft bolt and washer. Tighten the bolt to 183 N·m (135 ft. lbs.) torque.

(4) Install the crankshaft pulley. Tighten the pulley bolts to 23 N·m (200 in. lbs.) torque.

(5) Install the serpentine belt (refer to Group 7, Cooling System).

(6) Install the cooling system fan. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(7) Position the fan shroud and install the bolts. Tighten the retainer bolts to 11 N·m (95 in. lbs.) torque.

(8) Connect the negative cable to the battery.

TIMING CHAIN COVER

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Drain cooling system (refer to Group 7, Cooling System).

(3) Remove the serpentine belt (refer to Group 7, Cooling System).

(4) Remove water pump (refer to Group 7, Cooling System).

(5) Remove power steering pump (refer to Group 19, Steering).

(6) Remove vibration damper.

(7) Loosen oil pan bolts and remove the front bolt at each side.

(8) Remove the cover bolts.

(9) Remove chain case cover and gasket using extreme caution to avoid damaging oil pan gasket.

(10) Place a suitable tool behind the lips of the oil seal to pry the oil seal outward. Be careful not to damage the crankshaft seal surface of cover (Fig. 3).

TIMING CHAIN STRETCH

(1) Place a scale next to the timing chain so that any movement of the chain may be measured.

(2) Place a torque wrench and socket over camshaft sprocket attaching bolt. Apply torque in the direction of crankshaft rotation to take up slack; 41

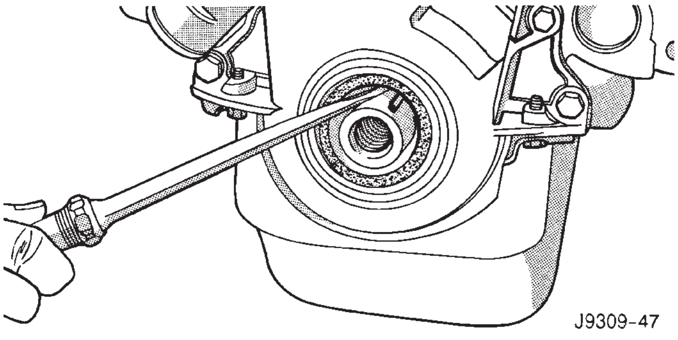


Fig. 3 Removal of Front Crankshaft Oil Seal

N·m (30 ft. lbs.) torque with cylinder head installed or 20 N·m (15 ft. lbs.) torque with cylinder head removed. With a torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block the crankshaft to prevent rotation.

(3) Hold a scale with dimensional reading even with the edge of a chain link. With cylinder heads installed, apply 14 N·m (30 ft. lbs.) torque in the reverse direction. With the cylinder heads removed, apply 20 N·m (15 ft. lbs.) torque in the reverse direction. Note the amount of chain movement (Fig. 4).

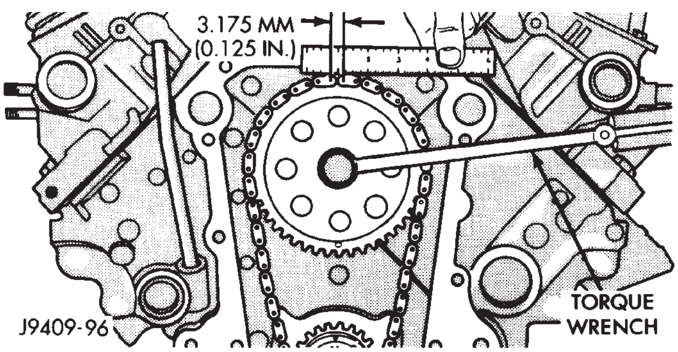


Fig. 4 Measuring Timing Chain Wear and Stretch

(4) Install a new timing chain, if its movement exceeds 3.175 mm (1/8 inch).

(5) If chain is not satisfactory, remove camshaft sprocket attaching bolt and remove timing chain with crankshaft and camshaft sprockets.

(6) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(7) Place timing chain around both sprockets.

(8) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(9) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(10) Slide both sprockets evenly over their respective shafts and use a straightedge to check alignment of timing marks (Fig. 5).

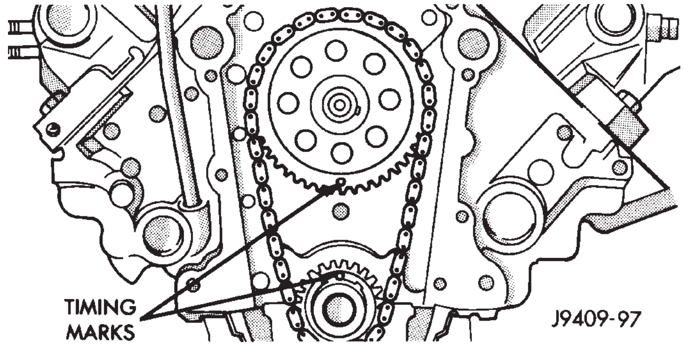


Fig. 5 Alignment of Timing Marks

(11) Install the camshaft bolt. Tighten the bolt to 68 N·m (50 ft. lbs.) torque.

(12) Check camshaft end play. The end play should be 0.051-0.152 mm (0.002-0.006 inch) with a new thrust plate and up to 0.254 mm (0.010 inch) with a used thrust plate. If not within these limits install a new thrust plate.

CLEANING

Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs.

The water pump mounting surface must be cleaned.

INSTALLATION

(1) Using a new cover gasket, carefully install chain case cover to avoid damaging oil pan gasket. Use a small amount of Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at the joint between timing chain cover gasket and the oil pan gasket. Finger tighten the timing chain cover bolts at this time.

(2) Place the smaller diameter of the oil seal over Front Oil Seal Installation Tool 6635 (Fig. 6). Seat the oil seal in the groove of the tool.

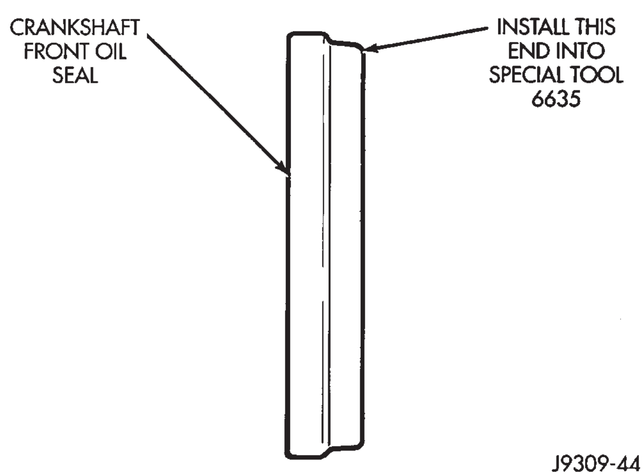


Fig. 6 Placing Oil Seal on Installation Tool 6635

(3) Position the seal and tool onto the crankshaft (Fig. 7).

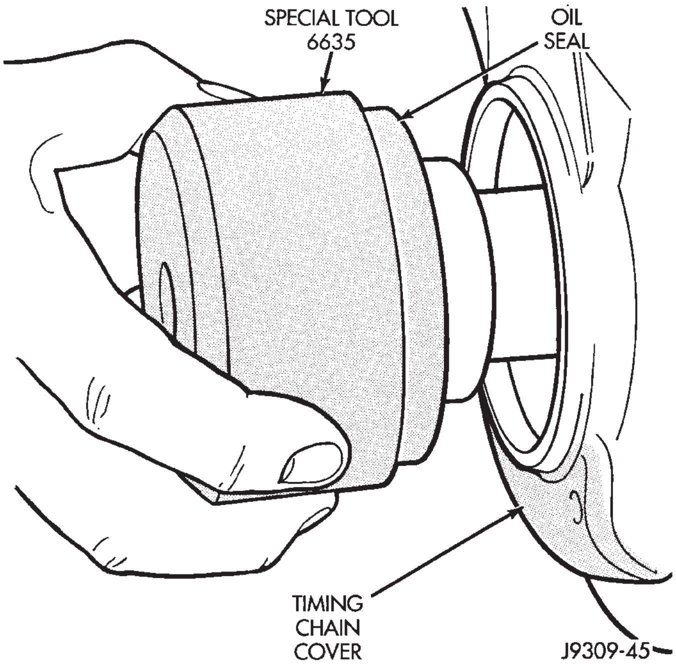


Fig. 7 Position Tool and Seal onto Crankshaft

(4) Tighten the 4 lower chain case cover bolts to 13N·m (10 ft.lbs.) to prevent the cover from tipping during seal installation.

(5) Using the vibration damper bolt, tighten the bolt to draw the seal into position on the crankshaft (Fig. 8).

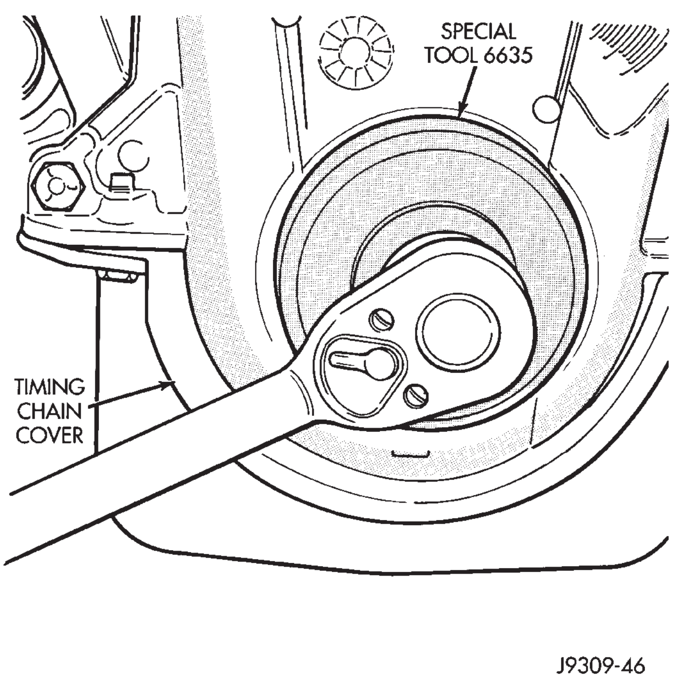


Fig. 8 Installing Oil Seal

(6) Loosen the 4 bolts tightened in step 4 to allow realignment of front cover assembly.

(7) Tighten chain case cover bolts to 41 N·m (30 ft. lbs.) torque. Tighten oil pan bolts to 24 N·m (215 in. lbs.) torque.

(8) Remove the vibration damper bolt and seal installation tool.

(9) Install vibration damper.

(10) Install water pump and housing assembly using new gaskets (refer to Group 7, Cooling System). Tighten bolts to 41 N·m (30 ft. lbs.) torque.

(11) Install power steering pump (refer to Group 19, Steering).

(12) Install the serpentine belt (refer to Group 7, Cooling System).

(13) Install the cooling system fan. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(14) Position the fan shroud and install the bolts. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(15) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).

(16) Connect the negative cable to the battery.

FRONT CRANKSHAFT OIL SEAL REPLACEMENT

The oil seal can be replaced without removing the timing chain cover provided the cover is not misaligned.

(1) Disconnect the negative cable from the battery.

(2) Remove vibration damper.

(3) If front seal is suspected of leaking, check front oil seal alignment to crankshaft. The seal installation/alignment tool 6635, should fit with minimum interference. If tool does not fit, the cover must be removed and installed properly.

(4) Place a suitable tool behind the lips of the oil seal to pry the oil seal outward. Be careful not to damage the crankshaft bore surface of cover.

(5) Place the smaller diameter of the oil seal over Front Oil Seal Installation Tool 6635 (Fig. 6). Seat the oil seal in the groove of the tool.

(6) Position the seal and tool onto the crankshaft (Fig. 7).

(7) Using the vibration damper bolt, tighten the bolt to draw the seal into position on the crankshaft (Fig. 8).

(8) Remove the vibration damper bolt and seal installation tool.

(9) Install the vibration damper.

(10) Connect the negative cable to the battery.

CAMSHAFT

The camshaft has an integral oil pump and distributor drive gear (Fig. 9).

REMOVAL

(1) Remove intake manifold.

(2) Remove cylinder head covers.

(3) Remove timing case cover and timing chain.

(4) Remove rocker arms.

(5) Remove push rods and tappets. Identify each part so it can be installed in its original location.

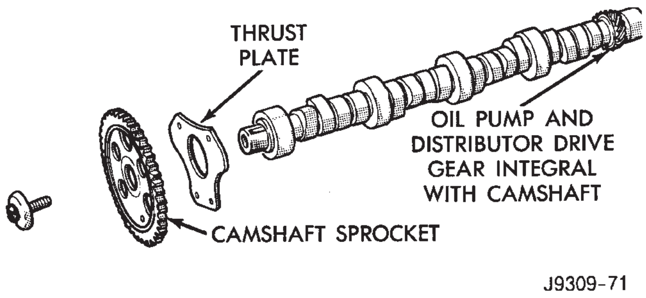


Fig. 9 Camshaft and Sprocket Assembly

(6) Remove distributor and lift out the oil pump and distributor drive shaft.

(7) Remove camshaft thrust plate; note location of oil tab (Fig. 10).

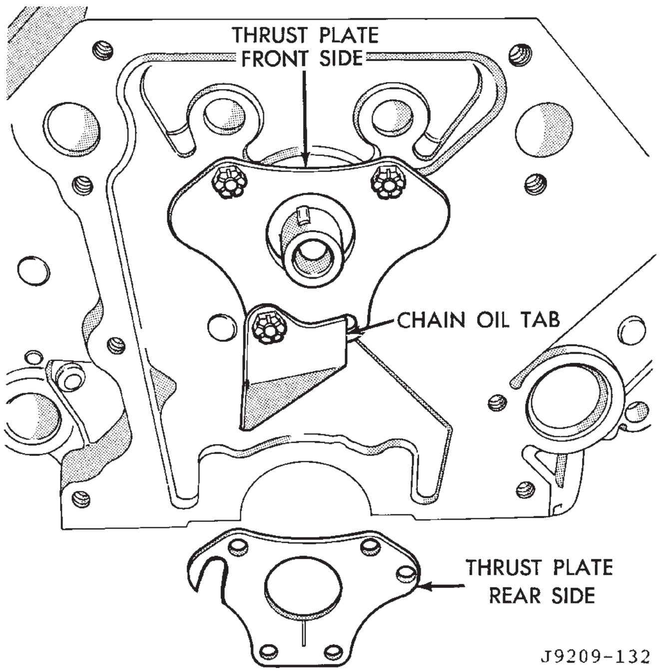


Fig. 10 Timing Chain Oil Tab Installation

(8) Install a long bolt into front of camshaft to facilitate removal of the camshaft. Remove camshaft, being careful not to damage cam bearings with the cam lobes.

REMOVAL—BEARING

This procedure requires that the engine is removed from the vehicle.

(1) With engine completely disassembled, drive out rear cam bearing core hole plug.

(2) Install proper size adapters and horseshoe washers (part of Camshaft Bearing Remover/Installer Tool C-3132-A) at back of each bearing shell. Drive out bearing shells (Fig. 11).

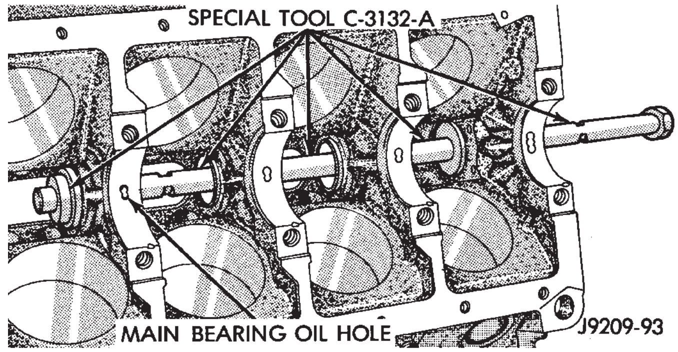


Fig. 11 Camshaft Bearings Removal and Installation with Tool C-3132-A

INSTALLATION—BEARING

(1) Install new camshaft bearings with Camshaft Bearing Remover/Installer Tool C-3132-A by sliding the new camshaft bearing shell over proper adapter.

(2) Position rear bearing in the tool. Install horseshoe lock and by reversing removal procedure, carefully drive bearing shell into place.

(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main bearing. If the camshaft bearing shell oil holes are not in exact alignment, remove and install them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

INSTALLATION

(1) Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft to within 51 mm (2 inches) of its final position in cylinder block.

Whenever an engine has been rebuilt, a new camshaft and/or new tappets installed, add 1 pint of Mopar® Crankcase Conditioner, or equivalent. The oil mixture should be left in engine for a minimum of 805 km (500 miles). Drain at the next normal oil change.

(2) Install Camshaft Gear Installer Tool C-3509 with tongue back of distributor drive gear (Fig. 12).

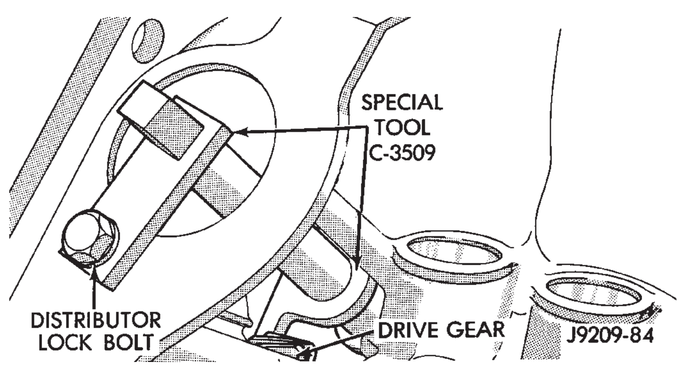


Fig. 12 Camshaft Holding Tool C-3509 (Installed Position)

(3) Hold tool in position with a distributor lockplate bolt. This tool will restrict camshaft from being

pushed in too far and prevent knocking out the welch plug in rear of cylinder block. **Tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.**

(4) Install camshaft thrust plate and chain oil tab. **Make sure tang enters lower right hole in thrust plate.** Tighten bolts to 24 N·m (210 in. lbs.) torque. Top edge of tab should be flat against thrust plate in order to catch oil for chain lubrication.

(5) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(6) Place timing chain around both sprockets.

(7) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(8) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(9) Slide both sprockets evenly over their respective shafts and use a straightedge to check alignment of timing marks (Fig. 13).

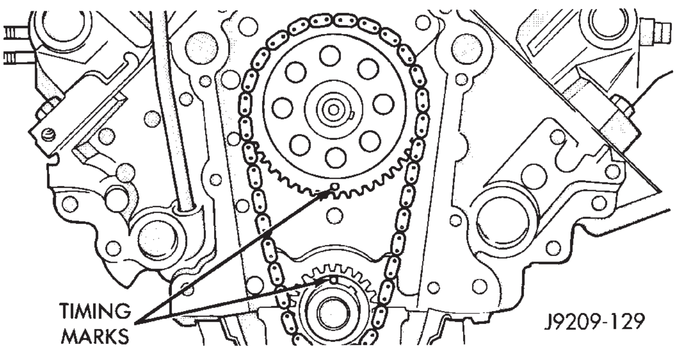


Fig. 13 Alignment of Timing Marks

(10) Install the camshaft bolt/cup washer. Tighten bolt to 68 N·m (50 ft. lbs.) torque.

(11) Measure camshaft end play. Refer to Specifications for proper clearance. If not within limits install a new thrust plate.

(12) Each tappet reused must be installed in the same position from which it was removed. **When camshaft is replaced, all of the tappets must be replaced.**

DISTRIBUTOR BUSHING

DISTRIBUTOR REMOVAL

Refer to Group 8D, Ignition Systems for the proper procedure.

REMOVAL—DRIVE SHAFT BUSHING

(1) Remove the intake manifold (refer to Group 11, Exhaust System and Intake Manifold).

(2) Insert Distributor Drive Shaft Bushing Puller Tool C-3052 into old bushing and thread down until a tight fit is obtained (Fig. 14).

(3) Hold puller screw and tighten puller nut until bushing is removed.

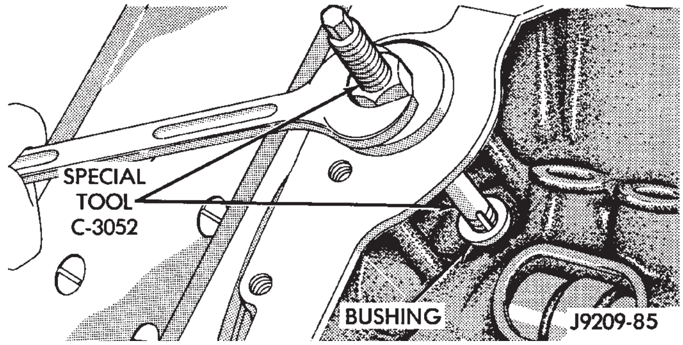


Fig. 14 Distributor Driveshaft Bushing Removal

INSTALLATION—DRIVE SHAFT BUSHING

(1) Slide new bushing over burnishing end of Distributor Drive Shaft Bushing Driver/Burnisher Tool C-3053. Insert the tool and bushing into the bore.

(2) Drive bushing and tool into position, using a hammer (Fig. 15).

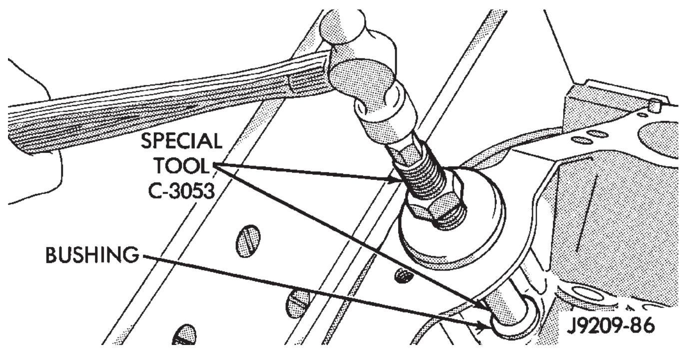


Fig. 15 Distributor Driveshaft Bushing Installation

(3) As the burnisher is pulled through the bushing, the bushing is expanded tight in the block and burnished to correct size (Fig. 16). **DO NOT ream this bushing.**

CAUTION: This procedure MUST be followed when installing a new bushing or seizure to shaft may occur.

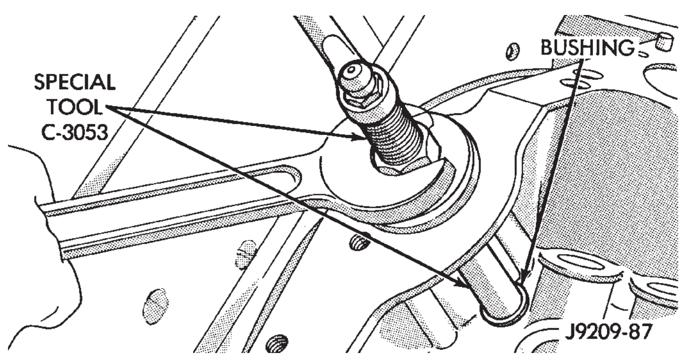


Fig. 16 Burnishing Distributor Driveshaft Bushing

(4) Install the intake manifold (refer to Group 11, Exhaust System and Intake Manifold).

DISTRIBUTOR INSTALLATION

Refer to the Component Removal/Installation section of Group 8D, Ignition Systems for the proper procedure. See Distributor. After the distributor has been installed, its rotational position must be set using the **SET SYNC** mode of the DRB scan tool. Refer to Checking Distributor Position following the Distributor Installation section in Group 8D, Ignition system. **Do not attempt to adjust ignition timing by rotating the distributor. It has no effect on ignition timing. Adjusting distributor position will effect fuel synchronization only.**

Before installing the distributor, the oil pump drive shaft must be aligned to number one cylinder.

(1) Rotate crankshaft until No.1 cylinder is at top dead center on the firing stroke.

(2) When in this position, the timing mark on vibration damper should be under 0 on the timing indicator.

(3) Install the shaft so that after the gear spirals into place, it will index with the oil pump shaft. The slot on top of oil pump shaft should be aligned towards left front intake manifold attaching bolt hole (Fig. 17).

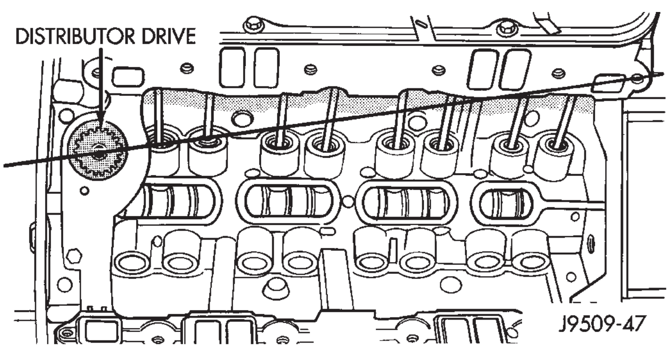


Fig. 17 Position of Oil Pump Shaft Slot

OIL PAN

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle.

(3) Remove the oil pan drain plug and drain the engine oil.

(4) Remove the oil filter.

(5) Remove the starter (refer to Group 8B, Battery/Starter/Generator Service).

(6) If equipped with an oil level sensor, disconnect the sensor.

(7) Position the cooler lines out of the way.

(8) Disconnect the oxygen sensor.

(9) Remove exhaust pipe.

(10) Remove the oil pan bolts. Carefully slide the oil pan and gasket to the rear. If equipped with an oil level sensor, take care not to damage the sensor.

CLEANING

Clean the block and pan gasket surfaces.

Trim or remove excess sealant film in the rear main cap oil pan gasket groove. **DO NOT remove the sealant inside the rear main cap slots.**

If present, trim excess sealant from inside the engine.

Clean oil pan in solvent and wipe dry with a clean cloth.

Clean oil screen and pipe thoroughly in clean solvent. Inspect condition of screen.

INSPECTION

Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.

Inspect oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

INSTALLATION

(1) Fabricate 4 alignment dowels from 5/16 x 1 1/2 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 1).

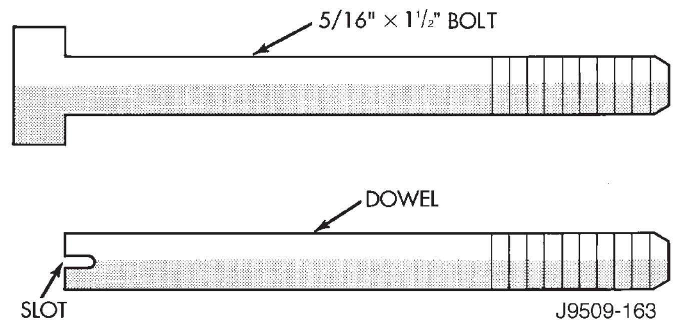


Fig. 1 Fabrication of Alignment Dowels

(2) Install the dowels in the cylinder block (Fig. 2).

(3) Apply small amount of Mopar® Silicone Rubber Adhesive Sealant, or equivalent in the corner of the cap and the cylinder block.

(4) Slide the one-piece gasket over the dowels and onto the block.

(5) Position the oil pan over the dowels and onto the gasket. If equipped with an oil level sensor, take care not to damage the sensor.

(6) Install the oil pan bolts. Tighten the bolts to 24 N·m (215 in. lbs.) torque.

(7) Remove the dowels. Install the remaining oil pan bolts. Tighten these bolts to 24 N·m (215 in. lbs.) torque.

(8) Install the drain plug. Tighten drain plug to 34 N·m (25 ft. lbs.) torque.

(9) Install exhaust pipe.

(10) Connect the oxygen sensor.

(11) Install the oil filter.

(12) If equipped with an oil level sensor, connect the sensor.

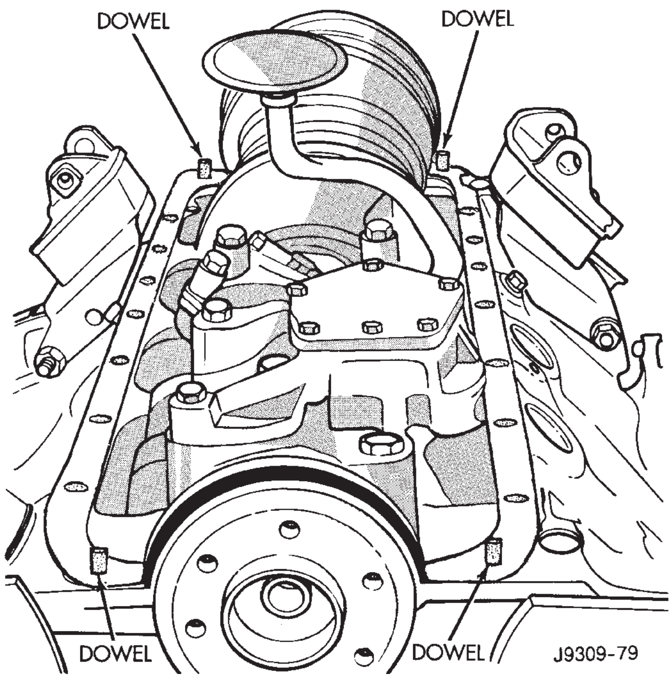


Fig. 2 Position of Dowels in Cylinder Block

(13) Install the starter (refer to Group 8B, Battery/Starter/Generator Service).

(14) Move the cooler lines back into position.

(15) Lower vehicle.

(16) Connect the negative cable to the battery.

(17) Fill the oil pan with engine oil to the specified level.

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 FAN. DO NOT WEAR LOOSE CLOTHING.

(18) Start the engine and inspect for leaks.

LUBRICATION SYSTEM

A gear—type positive displacement pump is mounted at the underside of the rear main bearing cap. The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery which extends the entire length on the right side of the block. The oil then goes down to the No. 1 main bearing, back up to the left side of the block and into the oil gallery on the left side of the engine.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals to the connecting rod journals. Each connecting rod bearing has half a hole in it, oil passes through the hole when the rods rotate and the hole lines up, oil is then thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

The hydraulic valve tappets receive oil directly from the main oil gallery. The camshaft bearings receive oil from the main bearing galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the number one main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components. The oil then passes down through the push rod guide holes, and the oil drain back passages in the cylinder head past the valve tappet area, and returns to the oil pan.

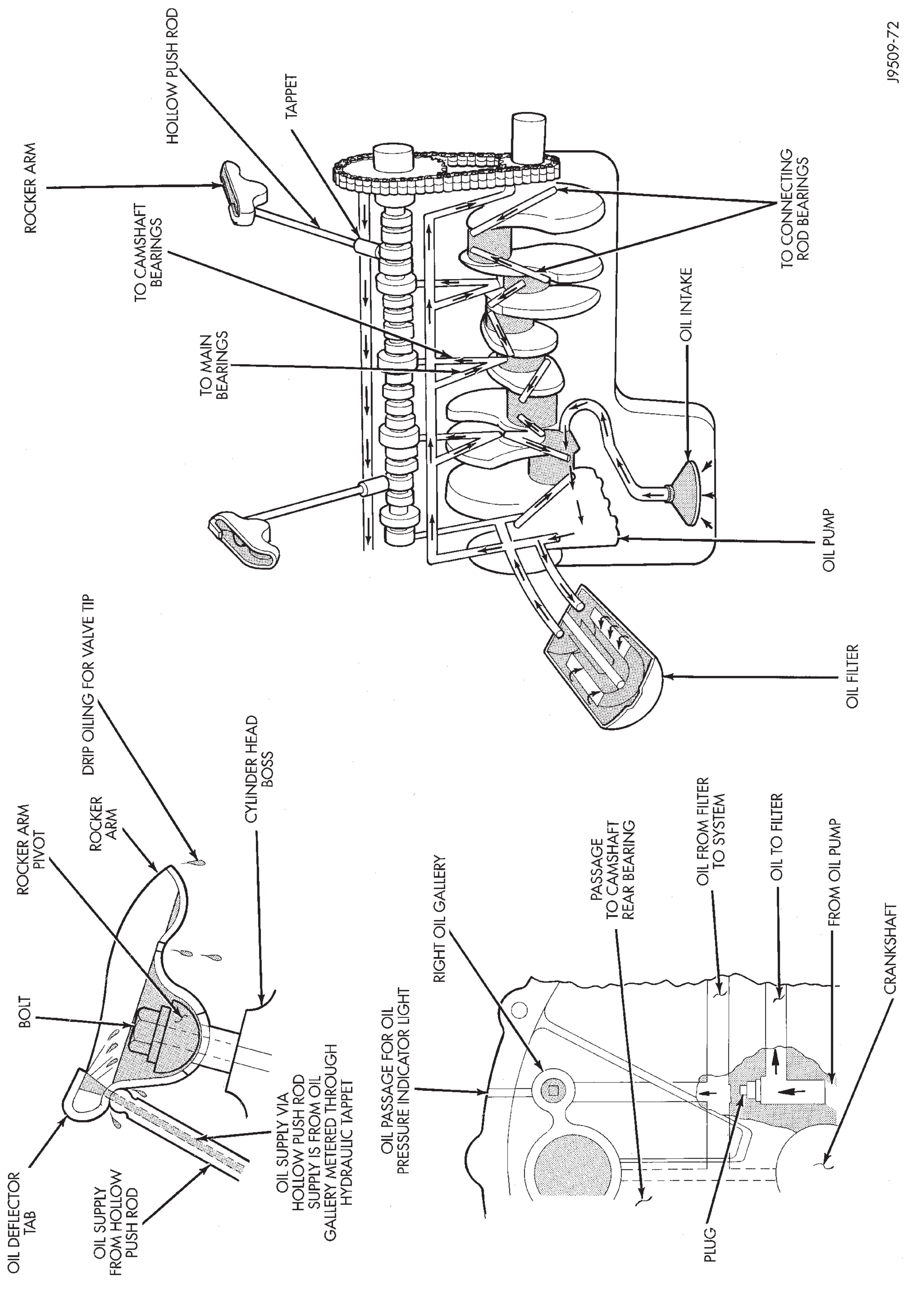


Fig. 3 Oil Lubrication System

OIL PUMP

OIL PUMP PRESSURE

The MINIMUM oil pump pressure is 41.4 kPa (6 psi) at curb idle. The MAXIMUM oil pump pressure is 207-552 kPa (30-80 psi) at 3000 RPM or more.

CAUTION: If oil pressure is ZERO at curb idle, DO NOT run engine at 3000 RPM.

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from rear main bearing cap.

DISASSEMBLE

(1) Remove the relief valve as follows:

(a) Remove cotter pin. Drill a 3.175 mm (1/8 inch) hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.

(b) Clamp screw into a vise and while supporting oil pump, remove cap by tapping pump body using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 4).

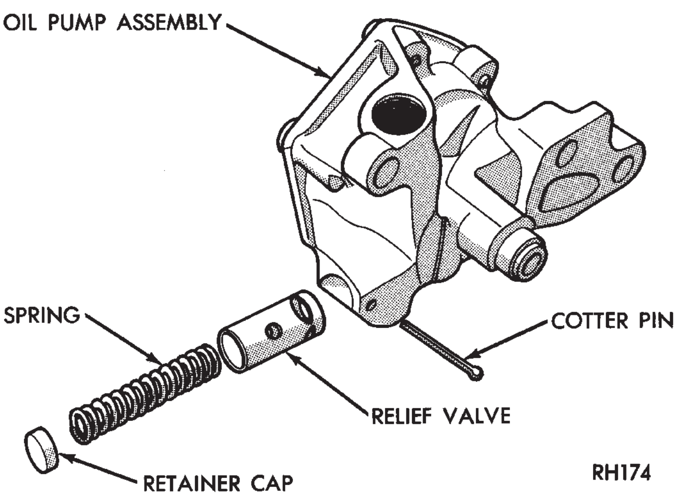


Fig. 4 Oil Pressure Relief Valve

(2) Remove oil pump cover (Fig. 5).

(3) Remove pump outer rotor and inner rotor with shaft (Fig. 5).

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

INSPECTION

Mating surface of the oil pump cover should be smooth. Replace pump assembly if cover is scratched or grooved.

Lay a straightedge across the pump cover surface (Fig. 6). If a 0.038 mm (0.0015 inch) feeler gauge can be inserted between cover and straightedge, pump assembly should be replaced.

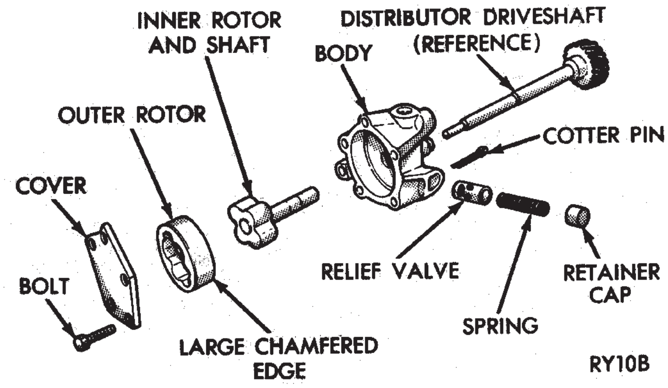


Fig. 5 Oil Pump

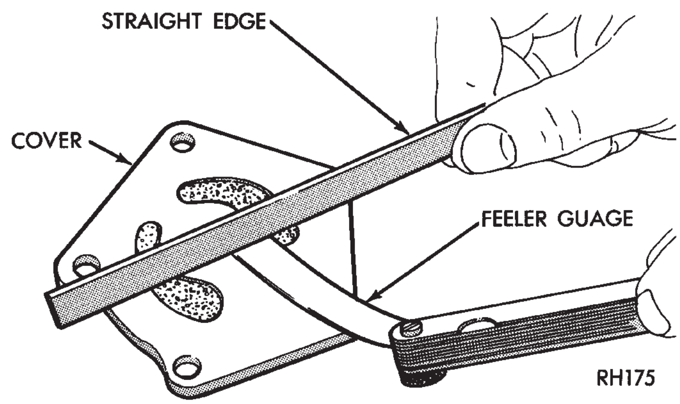


Fig. 6 Checking Oil Pump Cover Flatness

Measure thickness and diameter of outer rotor. If outer rotor thickness measures 20.9 mm (0.825 inch) or less or if the diameter is 62.7 mm (2.469 inches) or less, replace outer rotor (Fig. 7).

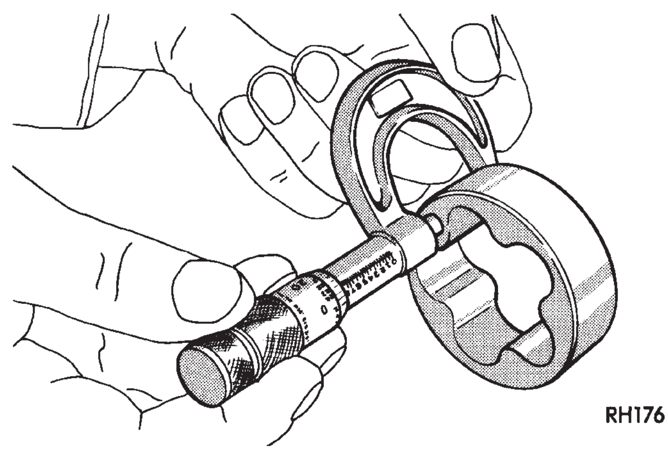


Fig. 7 Measuring Outer Rotor Thickness

If inner rotor measures 20.9 mm (0.825 inch) or less, replace inner rotor and shaft assembly (Fig. 8).

Slide outer rotor into pump body. Press rotor to the side with your fingers and measure clearance between rotor and pump body (Fig. 9). If clearance is 0.356 mm (0.014 inch) or more, replace oil pump assembly.

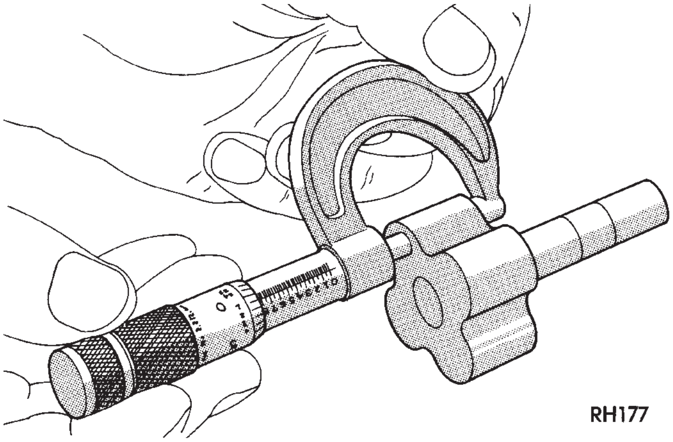


Fig. 8 Measuring Inner Rotor Thickness

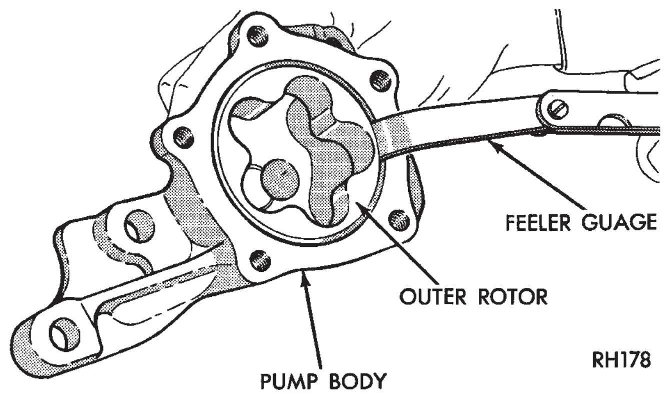


Fig. 9 Measuring Outer Rotor Clearance in Housing

Install inner rotor and shaft into pump body. If clearance between inner and outer rotors is 0.203 mm (0.008 inch) or more, replace shaft and both rotors (Fig. 10).

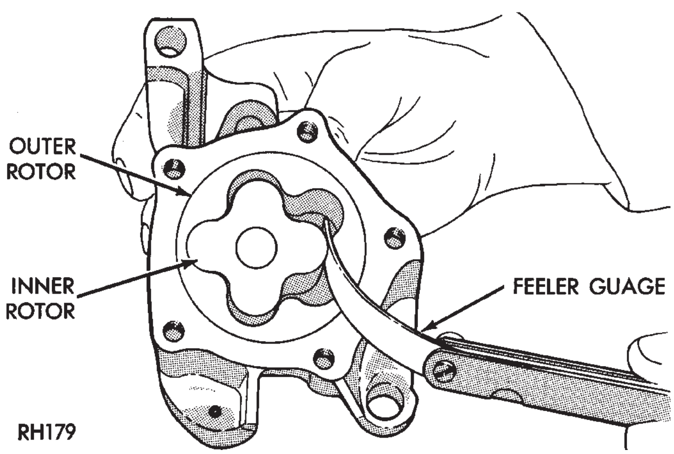


Fig. 10 Measuring Clearance Between Rotors

Place a straightedge across the face of the pump, between bolt holes. If a feeler gauge of 0.102 mm (0.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 11).

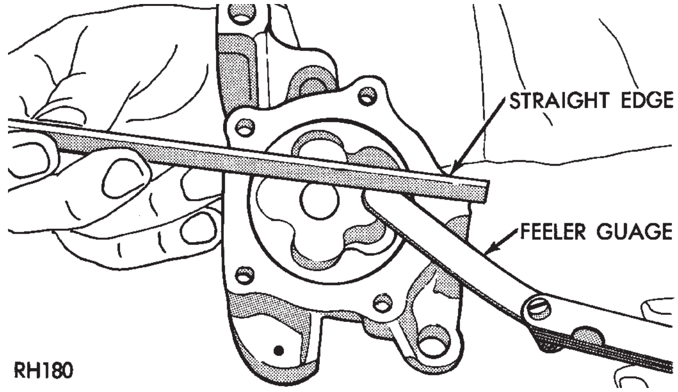


Fig. 11 Measuring Clearance Over Rotors

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.

The relief valve spring has a free length of approximately 49.5 mm (1.95 inches). The spring should test between 19.5 and 20.5 pounds when compressed to 34 mm (1-11/32 inches). Replace spring that fails to meet these specifications (Fig. 12).

If oil pressure was low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

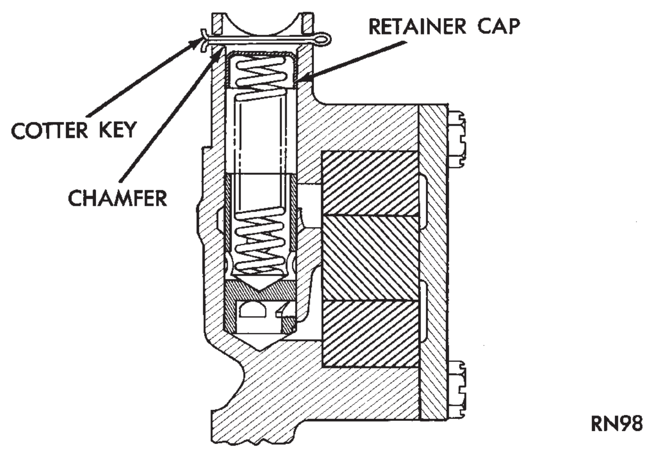


Fig. 12 Proper Installation of Retainer Cap

ASSEMBLE

(1) Install pump rotors and shaft, using new parts as required.

(2) Position the oil pump cover onto the pump body. Tighten cover bolts to 11 N·m (95 in. lbs.) torque.

(3) Install the relief valve and spring. Insert the cotter pin.

(4) Tap on a new retainer cap.

(5) Prime oil pump before installation by filling rotor cavity with engine oil.

INSTALLATION

(1) Install oil pump. During installation slowly rotate pump body to ensure driveshaft-to-pump rotor shaft engagement.

(2) Hold the oil pump base flush against mating surface on No.4 main bearing cap. Finger tighten pump attaching bolts. Tighten attaching bolts to 41 N·m (30 ft. lbs.) torque.

(3) Install the oil pan.

PISTON AND CONNECTING ROD ASSEMBLY

The pistons are elliptically turned so that the diameter at the pin boss is less than its diameter across the thrust face. This allows for expansion under normal operating conditions. Under operating temperatures, expansion forces the pin bosses away from each other, causing the piston to assume a more nearly round shape.

All pistons are machined to the same weight, regardless of size, to maintain piston balance.

The piston pin rotates in the piston only and is retained by the press interference fit of the piston pin in the connecting rod.

REMOVAL

(1) Remove the engine from the vehicle.

(2) Remove the cylinder head.

(3) Remove the oil pan.

(4) 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.

(5) Be sure the connecting rod and connecting rod cap are identified with the cylinder number. Remove connecting rod cap. Install connecting rod bolt guide set on connecting rod bolts.

(6) Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies, rotate crankshaft so that the connecting rod is centered in cylinder bore and at BDC. **Be careful not to nick crankshaft journals.**

(7) After removal, install bearing cap on the mating rod.

INSPECTION

Check the crankshaft connecting rod journal for excessive wear, taper and scoring.

Check the cylinder block bore for out-of-round, taper, scoring and scuffing.

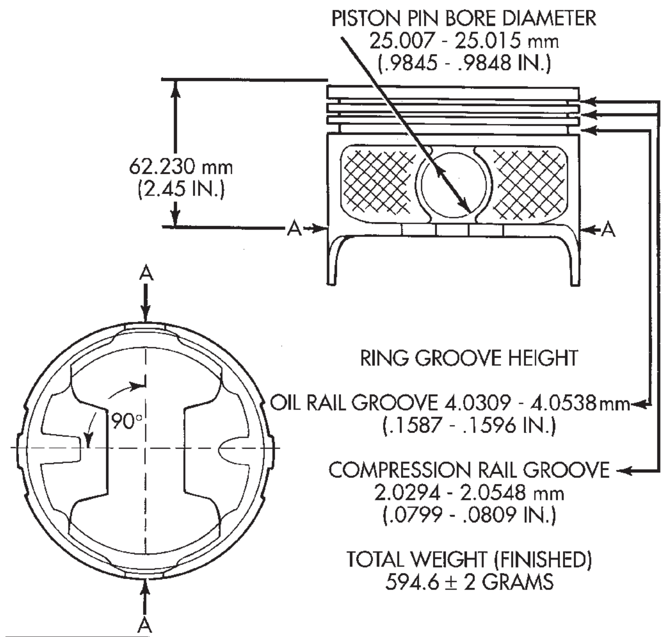
Check the pistons for taper and elliptical shape before they are fitted into the cylinder bore (Fig. 1).

FITTING PISTONS

Piston and cylinder wall must be clean and dry. Specified clearance between the piston and the cylinder wall is 0.013-0.038 mm (0.0005-0.0015 inch).

Piston diameter should be measured at the top of skirt, 90° to piston pin axis. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line.

Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).



PISTON SIZE	A DIA = PISTON DIAMETER		BORE DIAMETER	
	MIN. mm (IN.)	MAX. mm (IN.)	MIN. mm (IN.)	MAX. mm (IN.)
A	99.280 (3.9087)	99.294 (3.9092)	99.306 (3.9097)	99.319 (3.9102)
B	99.294 (3.9092)	99.306 (3.9097)	99.319 (3.9102)	99.332 (3.9107)
C	99.306 (3.9097)	99.319 (3.9102)	99.332 (3.9107)	99.344 (3.9112)
D	99.319 (3.9102)	99.332 (3.9107)	99.344 (3.9112)	99.357 (3.9117)
E	99.332 (3.9107)	99.344 (3.9112)	99.357 (3.9117)	99.370 (3.9122)

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Fig. 1 Piston Measurements

FITTING RINGS

(1) Measurement of end gaps:

(a) Measure piston ring gap 2 inches from bottom of cylinder bore. An inverted piston can be used to push the rings down to ensure positioning rings squarely in the cylinder bore before measuring.

(b) Insert feeler gauge in the gap. The top compression ring gap should be between 0.254-0.508 mm (0.010-0.020 inch). The second compression ring gap should be between 0.508-0.762 mm (0.020-0.030 inch). The oil ring gap should be 0.254-1.270 mm (0.010-0.050 inch).

(c) Rings with insufficient end gap may be filed to the correct dimension. Rings with excess gaps should not be used.

(2) Install rings and confirm ring side clearance:

(a) Install oil rings being careful not to nick or scratch the piston.

(b) Install the compression rings using Installation Tool C-4184. The top compression may be installed with either side up. The second compression ring must be installed with the identification mark face up (toward top of piston) and the chamfer should face down. An identification mark on the ring is a drill point, a stamped letter O, an oval depression or the word TOP.

(c) Measure side clearance between piston ring and ring land (Fig. 2). Clearance should be 0.038-0.076 mm (0.0015-0.0030 inch) for the compression rings. The steel rail oil ring should be free in groove, but should not exceed 0.203 mm (0.0080 inch) side clearance.

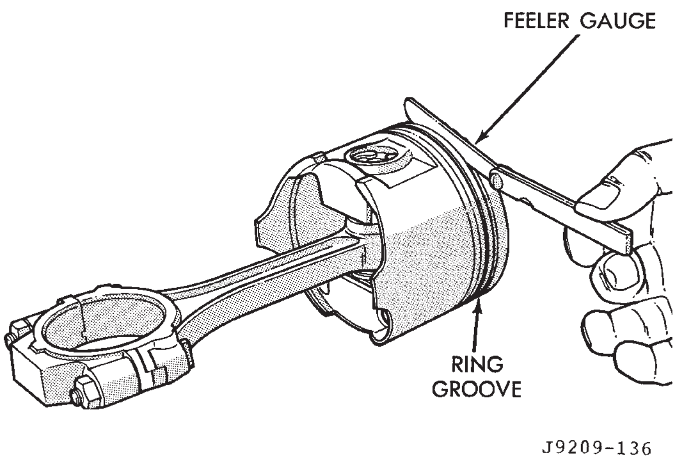

Fig. 2 Measuring Piston Ring Side Clearance

(d) Pistons with insufficient or excessive side clearance should be replaced.

(3) Arrange ring gaps 90° apart as shown in Fig. 3.

CONNECTING ROD BEARINGS

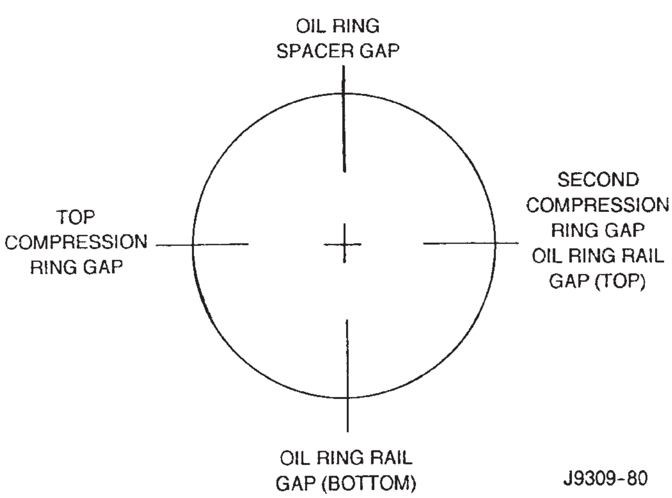

Fig. 3 Proper Ring Installation

Fit all rods on a bank until completed. DO NOT alternate from one bank to another, because connecting rods and pistons are not interchangeable from one bank to another.

The bearing caps are not interchangeable and should be marked at removal to ensure correct assembly.

Each bearing cap has a small V-groove across the parting face. When installing the lower bearing shell, make certain that the V-groove in the shell is in line with the V-groove in the cap. This provides lubrication of the cylinder wall in the opposite bank.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

Limits of taper or out-of-round on any crankshaft journals should be held to 0.025 mm (0.001 inch). Bearings are available in 0.025 mm (0.001 inch), 0.051 mm (0.002 inch), 0.076 mm (0.003 inch), 0.254 mm (0.010 inch) and 0.305 mm (0.012 inch) undersize. **Install the bearings in pairs. DO NOT use a new bearing half with an old bearing half. DO NOT file the rods or bearing caps.**

INSTALLATION

(1) 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 properly (Fig. 3).

(3) Immerse the piston head and rings in clean engine oil. Slide Piston Ring Compressor Tool C-385 over the piston and tighten with the special wrench (part of Tool C-385). **Be sure position of rings does not change during this operation.**

(4) Install connecting rod bolt protectors on rod bolts, the long protector should be installed on the numbered side of the connecting rod.

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Be sure connecting rod and cylinder bore number are the same. Insert rod and piston 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 crankshaft journal.

(7) The notch or groove on top of piston must be pointing toward front of engine. The larger chamfer of the connecting rod bore must be installed toward crankshaft journal fillet.

(8) Install rod caps. Be sure connecting rod, connecting rod cap and cylinder bore number are the same. Install nuts on cleaned and oiled rod bolts and tighten nuts to 61 N·m (45 ft. lbs.) torque.

(9) Install the oil pan.

(10) Install the cylinder head.

(11) Install the engine into the vehicle.

CRANKSHAFT

A crankshaft which has undersize journals will be stamped with 1/4 inch letters on the milled flat on the No.8 crankshaft counterweight (Fig. 4).

FOR EXAMPLE: R2 stamped on the No.6 crankshaft counterweight indicates that the No.2 rod journal is 0.025 mm (0.001 in) undersize. M4 indicates that the No.4 main journal is 0.025 mm (0.001 in) undersize. R3 M2 indicates that the No.3 rod journal and the No.2 main journal are 0.025 mm (0.001 in) undersize.

Undersize Journal	Identification Stamp
0.025 mm (0.001 in.) (Rod)	R1-R2-R3 or R4
0.025 mm (0.001 in.) (Main)	M1-M2-M3-M4 or M5

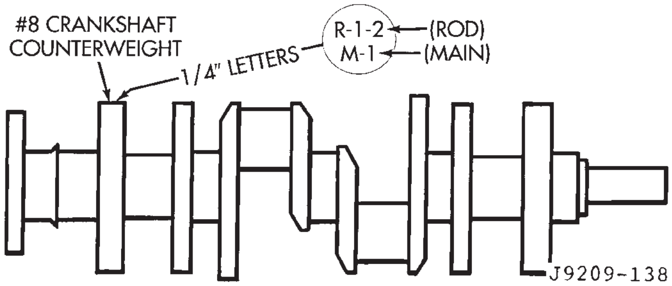

Fig. 4 Location of Crankshaft Identification

When a crankshaft is replaced, all main and connecting rod bearings should be replaced with new bearings. Therefore, selective fitting of the bearings is not required when a crankshaft and bearings are replaced.

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Identify bearing caps before removal. Remove bearing caps and bearings one at a time.

(4) Lift the crankshaft out of the block.

(5) Remove and discard the crankshaft rear oil seals.

(6) Remove and discard the front crankshaft oil seal.

INSPECTION OF JOURNALS

The crankshaft connecting rod and main journals should be checked for excessive wear, taper and scoring. The maximum taper or out-of-round on any crankshaft journal is 0.025 mm (0.001 inch).

Journal grinding should not exceed 0.305 mm (0.012 inch) under the standard journal diameter. DO NOT grind thrust faces of No.3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all oil passages.

CAUTION: After any journal grind, it is important that the final paper or cloth polish be in the same direction as the engine rotates.

Clean Loctite 515 residue and sealant from the cylinder block and rear cap mating surface. Do this before applying the Loctite drop and the installation of rear cap.

INSTALLATION

(1) Lightly oil the new upper seal lips with engine oil.

(2) Install the new upper rear bearing oil seal with the white paint facing towards the rear of the engine.

(3) Position the crankshaft into the cylinder block.

(4) Lightly oil the new lower seal lips with engine oil.

(5) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(6) Apply 5 mm (0.20 in) drop of Loctite 515, or equivalent, on each side of the rear main bearing cap (Fig. 5). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

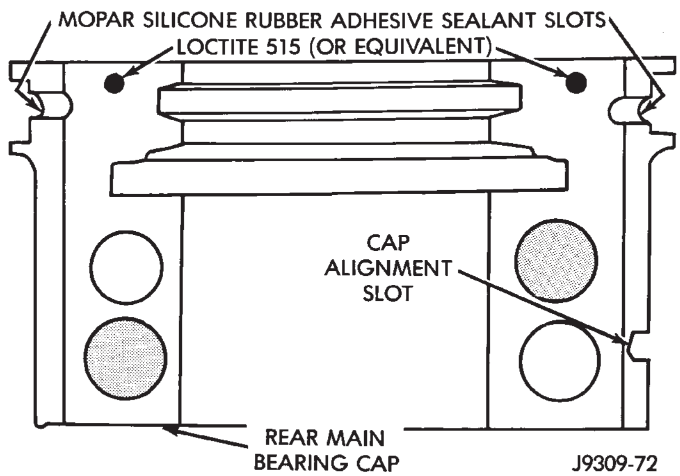

Fig. 5 Sealant Application to Bearing Cap

(7) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(8) Clean and oil all cap bolts. Install all main bearing caps. Install all cap bolts and alternately tighten to 115 N·m (85 ft. lbs.) torque.

(9) Install oil pump.

(10) Install the timing chain cover.

(11) Install the vibration damper.

(12) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 6). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(13) Install new front crankshaft oil seal.

(14) Immediately install the oil pan.

CRANKSHAFT MAIN BEARINGS

Bearing caps are not interchangeable and should be marked at removal to ensure correct assembly.

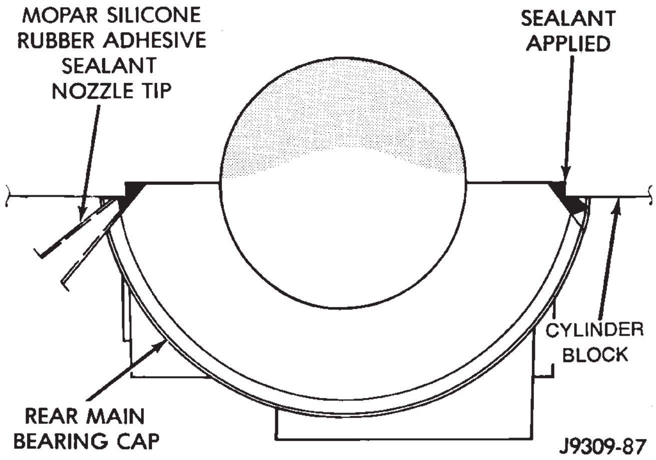

Fig. 6 Apply Sealant to Bearing Cap to Block Joint

Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of No.2 and 4 are interchangeable.

Upper and lower No.3 bearing halves are flanged to carry the crankshaft thrust loads. They are NOT interchangeable with any other bearing halves in the engine (Fig. 7). Bearing shells are available in standard and the following undersizes: 0.25 mm (0.001 inch), 0.051 mm (0.002 inch), 0.076 mm (0.003 inch), 0.254 mm (0.010 inch) and 0.305 mm (0.012 inch). Never install an undersize bearing that will reduce clearance below specifications.

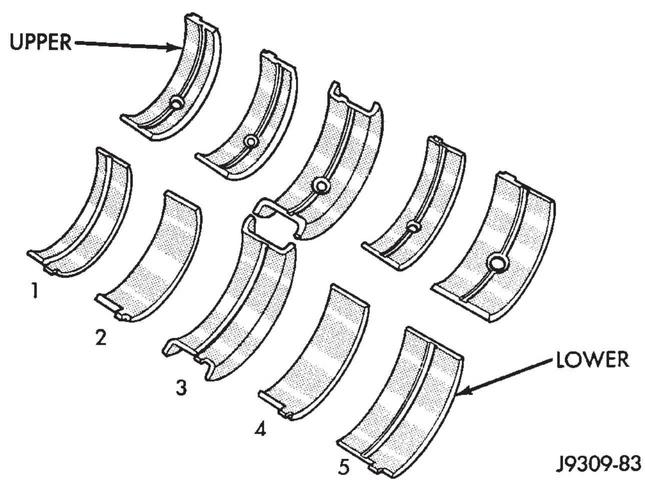

Fig. 7 Main Bearing Identification

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Identify bearing caps before removal. Remove bearing caps one at a time.

(4) Remove upper half of bearing by inserting Crankshaft Main Bearing Remover/Installer Tool C-3059 into the oil hole of crankshaft (Fig. 8).

(5) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

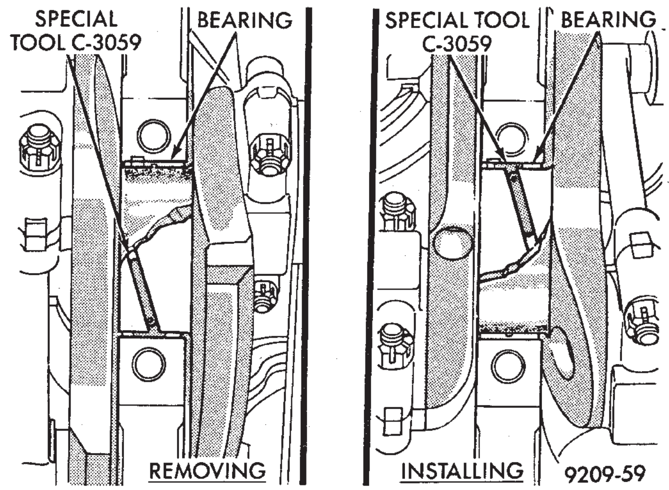

Fig. 8 Upper Main Bearing Removal and Installation with Tool C-3059

INSTALLATION

Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened. All bearing capbolts removed during service procedures are to be cleaned and oiled before installation.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Crankshaft Main Bearing Remover/Installer Tool C-3059 into oil hole of crankshaft (Fig. 8).

(2) Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Tool C-3059.

(3) Install the bearing caps. Clean and oil the bolts. Tighten the capbolts to 115 N·m (85 ft. lbs.) torque.

(4) Install the oil pump.

(5) Install the oil pan.

CRANKSHAFT REAR OIL SEALS

The service seal is a 2 piece, viton seal. The upper seal half can be installed with crankshaft removed from engine or with crankshaft installed. When a new upper seal is installed, install a new lower seal. The lower seal half can only be installed with the rear main bearing cap removed.

UPPER SEAL REPLACEMENT—CRANKSHAFT REMOVED

(1) Remove the crankshaft.

(2) Clean the cylinder block rear cap mating surface. Make sure the seal groove is free of debris. Check for burr at the oil hole on the cylinder block mating surface to rear cap.

(3) Lightly oil the new upper seal lips with engine oil.

(4) Install the new upper rear bearing oil seal with the white paint facing towards the rear of the engine.

(5) Position the crankshaft into the cylinder block.

(6) Lightly oil the new lower seal lips with engine oil.

(7) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(8) Apply 5 mm (0.20 in) drop of Loctite 515, or equivalent, on each side of the rear main bearing cap (Fig. 5). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

(9) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(10) Clean and oil all cap bolts. Install all main bearing caps. Install all cap bolts and alternately tighten to 115 N·m (85 ft. lbs.) torque.

(11) Install oil pump.

(12) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 6). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(13) Install new front crankshaft oil seal.

(14) Immediately install the oil pan.

UPPER SEAL REPLACEMENT—CRANKSHAFT INSTALLED

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the rear main bearing cap. Remove and discard the old lower oil seal.

(4) Carefully remove and discard the old upper oil seal.

(5) Clean the cylinder block mating surfaces before oil seal installation.

Check for burr at the oil hole on the cylinder block mating surface to rear cap.

(6) Lightly oil the new upper seal lips with engine oil. To allow ease of installation of the seal, loosen at least the 2 main bearing caps forward of the rear bearing cap.

(7) Rotate the new upper seal into the cylinder block being careful not to shave or cut the outer surface of the seal. To assure proper installation, use the installation tool provided with the kit. Install the new seal with the white paint facing towards the rear of the engine.

(8) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(9) Apply 5 mm (0.20 in) drop of Loctite 515, or equivalent, on each side of the rear main bearing cap (Fig. 5). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application. Be sure the white paint faces toward the rear of the engine.

(10) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(11) Install the rear main bearing cap with cleaned and oiled cap bolts. Alternately tighten ALL cap bolts to 115 N·m (85 ft. lbs.) torque.

(12) Install oil pump.

(13) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 6). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(14) Immediately install the oil pan.

LOWER SEAL REPLACEMENT

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the rear main bearing cap and discard the old lower seal.

(4) Clean the rear main cap mating surfaces including the oil pan gasket groove.

(5) Carefully install a new upper seal (refer to Upper Seal Replacement - Crankshaft Installed procedure above).

(6) Lightly oil the new lower seal lips with engine oil.

(7) Install a new lower seal in bearing cap with the white paint facing the rear of engine.

(8) Apply 5 mm (0.20 in) drop of Loctite 515, or equivalent, on each side of the rear main bearing cap (Fig. 5). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

(9) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(10) Install the rear main bearing cap with cleaned and oiled cap bolts. Alternately tighten the cap bolts to 115 N·m (85 ft. lbs.) torque.

(11) Install oil pump.

(12) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 6). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(13) Immediately install the oil pan.

CYLINDER BLOCK

Remove the engine assembly from the vehicle.

DISASSEMBLE

(1) Remove the cylinder head.

(2) Remove the oil pan.

(3) Remove the piston/connecting rod assembly.

CLEANING

Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

INSPECTION

Examine block for cracks or fractures.

The cylinder walls should be checked for out-of-round and taper with Cylinder Bore Indicator Tool 6879. The cylinder block should be bored and honed with new pistons and rings fitted if:

• The cylinder bores show more than 0.127 mm (0.005 inch) out-of-round.

• The cylinder bores show a taper of more than 0.254 mm (0.010 inch).

• The cylinder walls are badly scuffed or scored.

Boring and honing operation should be closely co-ordinated with the fitting of pistons and rings so specified clearances may be maintained.

Refer to Standard Service Procedures in the beginning of this Group for the proper honing of cylinder bores.

OIL LINE PLUG

The oil line plug is located in the vertical passage at the rear of the block between the Oil-To-Filter and Oil-From-Filter passages (Fig. 9). Improper installation or plug missing could cause erratic, low or no oil pressure.

(1) Remove oil pressure sending unit from back of block.

(2) Insert a 3.175 mm (1/8 inch) finish wire or equivalent into passage.

(3) Plug should be 190.0 to 195.2 mm (7-1/2 to 7-11/16 inches) from machined surface of block (Fig. 9). If plug is too high, use a suitable flat dowel to position properly.

(4) If plug is to low, remove oil pan and rear main bearing cap. Use suitable flat dowel to position properly. Coat outside diameter of new plug with Mopar® (Stud and Bearing Mount Adhesive), or equivalent. Plug should be 54.0 to 57.7 mm (2-1/8 to 2-5/16 inches) from bottom of the block.

(5) Assemble engine and check oil pressure.

ENGINE CORE, OIL AND CAMSHAFT PLUGS

Engine core plugs have been pressed into the oil galleries behind the camshaft thrust plate (Fig. 10). This will reduce internal leakage and help maintain higher oil pressure at idle.

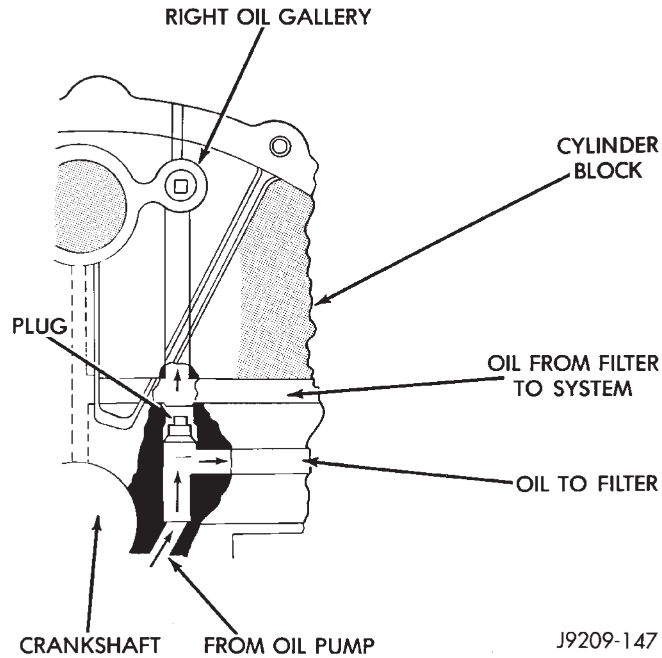

Fig. 9 Oil Line Plug

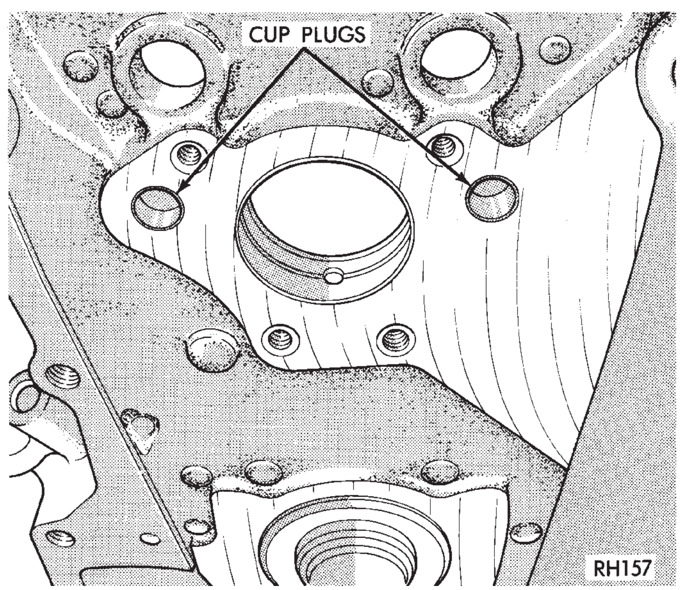

Fig. 10 Location of Cup Plugs in Oil Galleries

REMOVAL

(1) Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 11).

(2) With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 11).

CLEANING

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer.

Make certain the new plug is cleaned of all oil or grease.

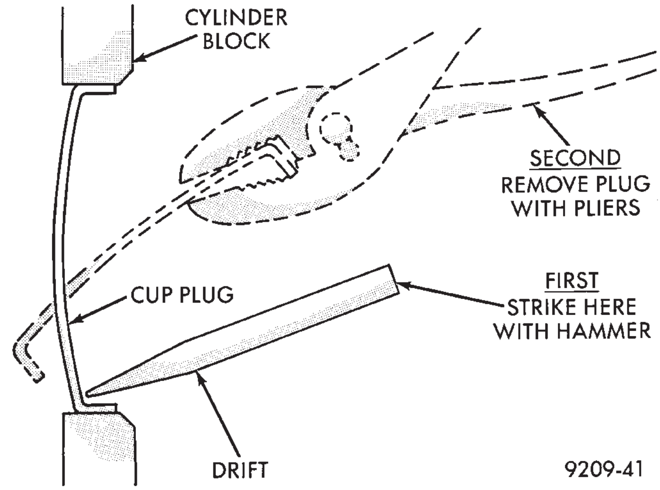

Fig. 11 Core Hole Plug Removal

INSTALLATION

(1) Coat edges of plug and core hole with Mopar® Gasket Maker, or equivalent.

CAUTION: DO NOT drive cup plug into the casting as restricted coolant flow can result and cause serious engine problems.

(2) Using proper plug driver, drive cup plug into hole. The sharp edge of the plug should be at least 0.50 mm (0.020 inch) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be filled and the vehicle placed in service immediately.

ASSEMBLE

(1) Install the piston/connecting rod assembly.
(2) Install the oil pan.
(3) Install the cylinder head.
(4) Install the engine into the vehicle.

SPECIFICATIONS—5.2L ENGINE

ENGINE SPECIFICATIONS

Camshaft	
Bearing Diameter	
No. 1	50.800-50.825 mm (2.000-2.001 in)
No. 2	50.394-50.419 mm (1.984-1.985 in)
No. 3	50.013-50.038 mm (1.969-1.970 in)
No. 4	49.606-49.632 mm (1.953-1.954 in)
No. 5	39.688-39.713 mm (1.5625-1.5635 in)
Diametrical Clearance	0.0254-0.0762 mm (0.001-0.003 in)
Max. Allowable	0.127 mm (0.005 in)
End Play	0.051-0.254 mm (0.002-0.010 in)
Bearing Journal Diameter	
No. 1	50.749-50.775 mm (1.998-1.999 in)
No. 2	50.343-50.368 mm (1.982-1.983 in)
No. 3	49.962-49.987 mm (1.967-1.968 in)
No. 4	49.555-49.581 mm (1.951-1.952 in)
No. 5	39.637-39.662 mm (1.5605-1.5615 in)
Connecting Rods	
Bearing Clearance	0.013-0.056 mm (0.0005-0.0022 in)
Max. Allowable	0.08 mm (0.003 in)
Piston Pin Bore Diameter	24.966-24.978 mm (0.9829-0.9834 in)
Side Clearance (Two Rods)	0.152-0.356 mm (0.006-0.014 in)
Total Weight (Less Bearing)	726 grams (25.61 oz)
Crankshaft	
Connect Rod Journal	
Diameter	53.950-53.975 mm (2.124-2.125 in)
Out-of-Round (Max.)	0.0254 mm (0.001 in)
Taper (Max.)	0.0254 mm (0.001 in)
Diametrical Clearance	
No. 1	0.013-0.038 mm (0.0005-0.0015 in)
Nos. 2, 3, 4 and 5	0.013-0.051 mm (0.005-0.0020 in)
Max. Allowable (Nos. 2, 3, 4 & 5)	0.064 mm (0.0025 in)
End Play	0.051-0.178 mm (0.002-0.007 in)
Max. Allowable	0.254 mm (0.010 in)
Main Bearing Journals	
Diameter	63.487-63.513 mm (2.4995-2.5005 in)
Out-of-Round (Max.)	0.0254 mm (0.001 in)
Taper (Max.)	0.0254 mm (0.001 in)
Cylinder Block	
Cylinder Bore	
Diameter	99.314-99.365 mm (3.910-3.912 in)
Out-of-Round (Max.)	0.127 mm (0.005 in)
Taper (Max.)	0.254 mm (0.010 in)
Oversize (Max.)	1.016 mm (0.040 in)
Distributor Lower Drive Shaft	
Bushing (Press Fit in Block)	0.0127-0.3556 mm (0.0005-0.0140 in)
Shaft-to-Bushing Clearance	0.0178-0.0686 mm (0.0007-0.0027 in)
Tappet Bore Diameter	22.99-23.01 mm (0.9051-0.9059 in)
Cylinder Head	
Compression Pressure	689 kPa (100 psi)
Gasket Thickness (Compressed)	1.2065 mm (0.0475 in)
Valve Seat	
Angle	44.25° - 44.75°
Runout (Max.)	0.0762 mm (0.003 in)
Width (Finish) – Intake	1.016-1.524 mm (0.040-0.060 in)
Width (Finish) – Exhaust	1.524-2.032 mm (0.060-0.080 in)
Hydraulic Tappets	
Body Diameter	22.949-22.962 mm (0.9035-0.9040 in)
Clearance in Block	0.0279-0.0610 mm (0.0011-0.0024 in)
Dry Lash	1.524-5.334 mm (0.060-0.210 in)
Push Rod Length	175.64–176.15 mm (6.915–6.935 in)

J9509-66

ENGINE SPECIFICATIONS—CONT.

Oil Pump

Clearance Over Rotors (Max.)	0.1016 mm (0.004 in)
Cover Out-of-Flat (Max.)	0.0381 mm (0.0015 in)
Inner Rotor Thickness (Min.)	20.955 mm (0.825 in)
Outer Rotor	
Clearance (Max.)	0.3556 mm (0.014 in)
Diameter (Min.)	62.7126 mm (2.469 in)
Thickness (Min.)	20.955 mm (0.825 in)
Tip Clearance Between Rotors (Max)	0.2032 mm (0.008 in)

Oil Pressure

At Curb Idle Speed (Minimum)*	41.4 kPa (6 psi)
At 3000 rpm	207-552 kPa (30-80 psi)
Oil Pressure Switch	
Actuating Pressure (Min.)	34.5-48.3 kPa (5-7 psi)

*CAUTION: If pressure is ZERO at curb idle, DO NOT run engine at 3,000 rpm.

Oil Filter

Bypass Valve Setting	62-103 kPa (9-15 psi)

Pistons

Clearance at Top of Skirt	0.0127-0.0381 mm (0.0005-0.0015 in)
Land Clearance (Diametrical)	0.635-1.016 mm (0.025-0.040 in)
Piston Length	86.360 mm (3.40 in)
Piston Ring Groove Depth	
Nos. 1 and 2	4.572-4.826 mm (0.180-0.190 in)
No. 3	3.810-4.064 mm (0.150-0.160 in)
Weight	592.6-596.6 grams (20.90-21.04 oz)

Piston Pins

Clearance	
In Piston	0.00635-0.01905 mm (0.00025-0.00075 in)
In Rod (Interference)	0.0178-0.0356 mm (0.0007-0.0014 in)
Diameter	24.996-25.001 mm (0.9841-0.9843 in)
End Play	NONE
Length	75.946-76.454 mm (2.990-3.010 in)

Piston Rings

Ring Gap	
Compression Rings	0.254-0.508 mm (0.010-0.020 in)
Oil Control (Steel Rails)	0.254-1.270 mm (0.010-0.050 in)
Ring Side Clearance	
Compression Rings	0.038-0.076 mm (0.0015-0.0030 in)
Oil Ring (Steel Rails)	0.06-0.21 mm (0.002-0.008 in)
Ring Width	
Compression Rings	1.971-1.989 mm (0.0776-0.0783 in)
Oil Ring (Steel Rails)	3.848-3.975 mm (0.1515-0.1565 in)

Valves

Face Angle	43.25°-43.75°
Head Diameter	
Intake	48.666 mm (1.916 in)
Exhaust	41.250 mm (1.624 in)
Length (Overall)	
Intake	124.28-125.92 mm (4.893-4.918 in)
Exhaust	124.64-125.27 mm (4.907-4.932 in)
Lift (Zero Lash)	10.973 mm (0.432 in)
Stem Diameter	7.899-7.925 mm (0.311-0.312 in)
Stem-to-Guide Clearance	0.0254-0.0762 mm (0.001-0.003 in)
Max. Allowable (Rocking Method)	0.4318 mm (0.017 in)
Guide Bore Diameter (Std)	7.950-7.976 mm (0.313-0.314 in)

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ENGINE SPECIFICATIONS—CONT.

Valve Springs

Free Length (Approx.)	49.962 mm (1.967 in)
Spring Tension (Valve Closed)	@ 41.66 mm = 378 N (@ 1.64 in = 85 lbs)
Spring Tension (Valve Open)	@ 30.89 mm = 890 N (@ 1.212 in = 200 lbs)
Number of Coils	6.8
Installed Height (Spring Seat to Retainer)	41.66 mm (1.64 in)
Wire Diameter	4.50 mm (0.177 in)

Valve Timing

Exhaust Valve	
Closes (ATC)	21°
Opens (BBC)	60°
Duration	264°
Intake Valve	
Closes (ABC)	61°
Opens (BTC)	10°
Duration	250°
Valve Overlap	31°

J9409-99

OVERSIZE AND UNDERSIZE ENGINE COMPONENT MARKINGS

CONDITION	IDENTIFICATION	LOCATION OF IDENTIFICATION
CRANKSHAFT JOURNALS (UNDERSIZE) 0.0254 mm (0.001 in.)	R or M M-2-3 etc. (indicating no. 2 and 3 main bearing journal) and/or R-1-4 etc. (indicating no. 1 and 4 connecting rod journal)	Milled flat on no. 8 crankshaft counterweight.
HYDRAULIC TAPPETS (OVERSIZE) 0.2032 mm (0.008 in.)	♦	Diamond-shaped stamp top pad – front of engine and flat ground on outside surface of each O/S tappet bore.
VALVE STEMS (OVERSIZE) 0.127 mm (0.005 in.)	X	Milled pad adjacent to two tapped holes (3/8 in.) on each end of cylinder head.

J9309-82

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Adjusting Strap Bolt	23 N·m (200 in. lbs.)
Bell Housing Bolts	41 N·m (30 ft. lbs.)
Camshaft Bolt	68 N·m (50 ft. lbs.)
Camshaft Thrust Plate Bolts	24 N·m (210 in. lbs.)
Chain Case Cover Bolts	41 N·m (30 ft. lbs.)
Connecting Rod Cap Bolts	61 N·m (45 ft. lbs.)
Crankshaft Main Bearing Cap Bolts	115 N·m (85 ft. lbs.)
Cylinder Head Bolts	
1st Step	68 N·m (50 ft. lbs.)
2nd Step	143 N·m (105 ft. lbs.)
Cylinder Head Collar Studs	13 N·m (115 in. lbs.)
Cylinder Head Cover Bolts	11 N·m (95 in. lbs.)
Exhaust Manifold Bolts	27 N·m (20 ft. lbs.)
Exhaust Manifold Nuts	20 N·m (15 ft. lbs.)
Front Left Sill Bracket	
Top Bolts	65 N·m (48 ft. lbs.)
Side Nuts	95 N·m (70 ft. lbs.)
Side and Bottom Bolts	121 N·m (89 ft. lbs.)
Front Right Sill Bracket Bolts	65 N·m (48 ft. lbs.)
Front Left Through-Bolt Nuts	121 N·m (89 ft. lbs.)
Front Right Through-Bolt Nuts	65 N·m (48 ft. lbs.)
Front Support Insulator Bolts	88 N·m (65 ft. lbs.)
Generator Mounting Bolt	41 N·m (30 ft. lbs.)

DESCRIPTION	TORQUE
Intake Manifold Bolts	Refer to Procedure in Service Manual
Oil Pan Bolts	24 N·m (215 in. lbs.)
Oil Pan Drain Plug	34 N·m (25 ft. lbs.)
Oil Pump Attaching Bolts	41 N·m (30 ft. lbs.)
Oil Pump Cover Bolts	11 N·m (95 in. lbs.)
Rear Mount Bracket Through-Bolt Nut	65 N·m (48 ft. lbs.)
Rear Mount Bracket Assembly Bolts	75 N·m (55 ft. lbs.)
Rear Mount Clevis Bracket-to-Crossmember Stud-Nuts	41 N·m (30 ft. lbs.)
Rocker Arm Bolts	28 N·m (21 ft. lbs.)
Spark Plugs	41 N·m (30 ft. lbs.)
Starter Mounting Bolts	68 N·m (50 ft. lbs.)
Throttle Body Bolts	23 N·m (200 in. lbs.)
Torque Converter Drive Plate Bolts	31 N·m (270 in. lbs.)
Transmission Support Bracket Adaptor Bolts	60 N·m (44 ft. lbs.)
Transmission-to-Clutch Bolts	68 N·m (50 ft. lbs.)
Vibration Damper Retainer Bolt	183 N·m (135 ft. lbs.)
Water Pump-to-Chain Case Cover Bolt	41 N·m (30 ft. lbs.)

J9409-81

EXHAUST SYSTEM AND INTAKE MANIFOLD

CONTENTS

EXHAUST SYSTEM

GENERAL INFORMATION

The basic exhaust system consists of exhaust manifold(s), exhaust pipe with oxygen sensor, catalytic converter, heat shield(s), muffler and tailpipe (Fig. 1 or 2).

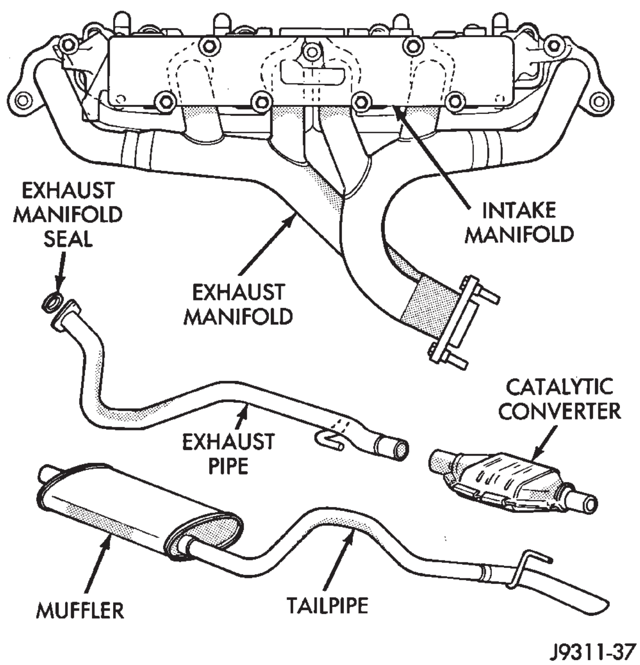

Fig. 1 Exhaust System—4.0L Engine

The exhaust system uses a single muffler with a single monolithic-type catalytic converter.

The 4.0L engines use a seal between the exhaust manifold and exhaust pipe to assure a tight seal and strain free connections.

The 5.2L exhaust manifolds are equipped with ball flange outlets to assure a tight seal and strain free connections.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it may amplify objectionable noises originating from the engine or body.

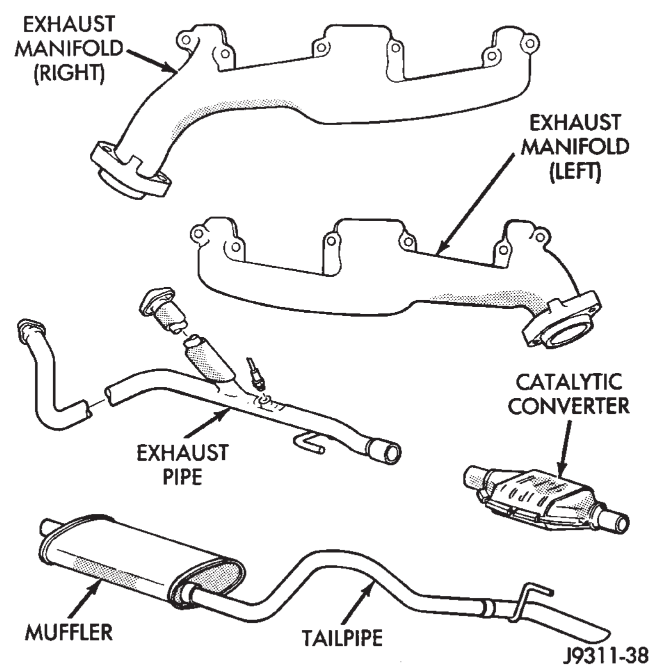

Fig. 2 Exhaust System—5.2L Engine

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or their equivalent). This will assure proper alignment and provide acceptable exhaust noise levels.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

CATALYTIC CONVERTER

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

Unleaded gasoline must be used to avoid contaminating the catalyst core.

HEAT SHIELDS

Heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter (Fig. 3 or 4). The catalytic converter releases additional heat into the exhaust system. Under severe operating conditions, the temperature increases in the area of the converter. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency.

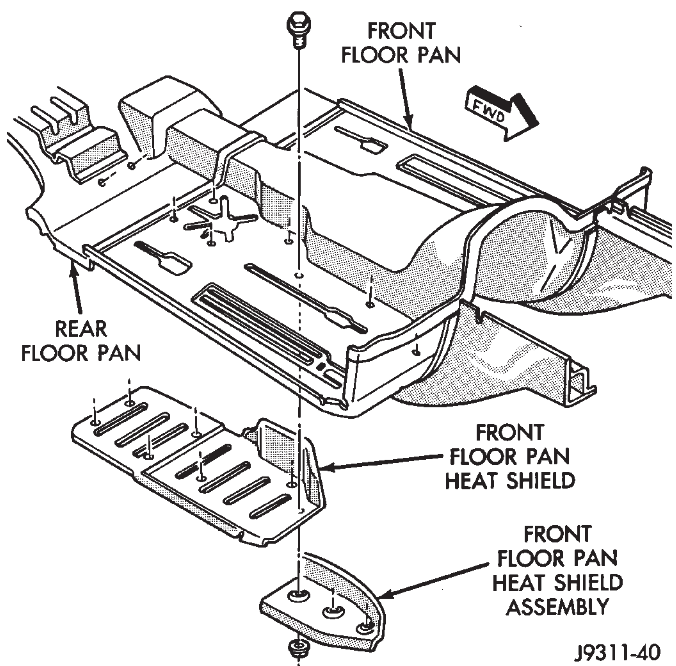

Fig. 3 Front Floor Pan Heat Shield

DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

DO NOT allow the engine to operate at fast idle for extended periods (over 5 minutes). This condition may result in excessive temperatures in the exhaust system and on the floor pan.

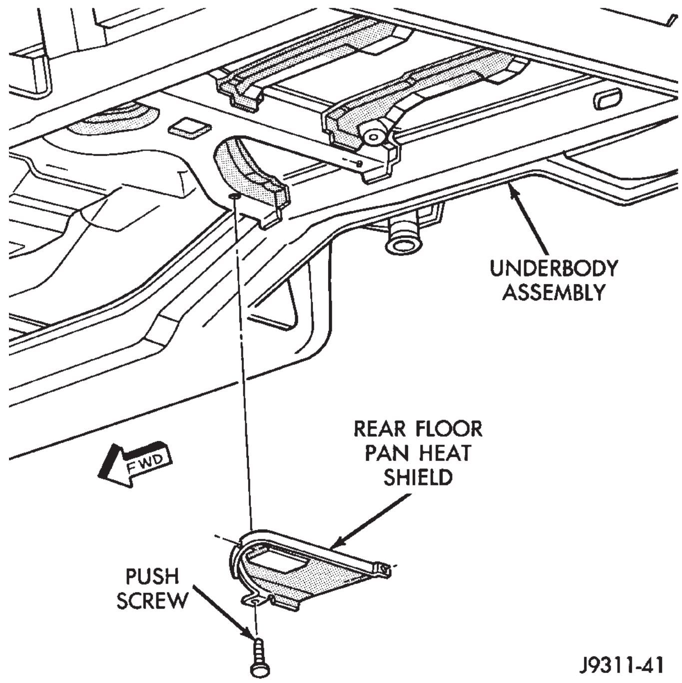

Fig. 4 Rear Floor Pan Heat Shield

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 piped from the exhaust manifold to the intake manifold through an EGR tube. Refer to Group 25, Emission Control Systems for complete description, diagnosis and service procedures of the exhaust gas recirculation system and components.

EXHAUST SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE	1. Leaks at pipe joints.	1. Tighten clamps at leaking joints.
	2. Burned or blown-out muffler.	2. Replace muffler assembly. Check exhaust system.
	3. Burned or rusted-out exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten connection attaching nuts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head stud nuts or bolts.
	7. Restriction in muffler or tail pipe.	7. Remove restriction, if possible. Replace muffler or tail pipe, as necessary.
LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten clamps at leaking joints.
	2. Damaged or improperly installed gaskets.	2. Replace gaskets, as necessary.

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SERVICE PROCEDURES

INDEX

EXHAUST PIPE

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the oxygen sensor from the exhaust pipe (Fig. 1 or 2).

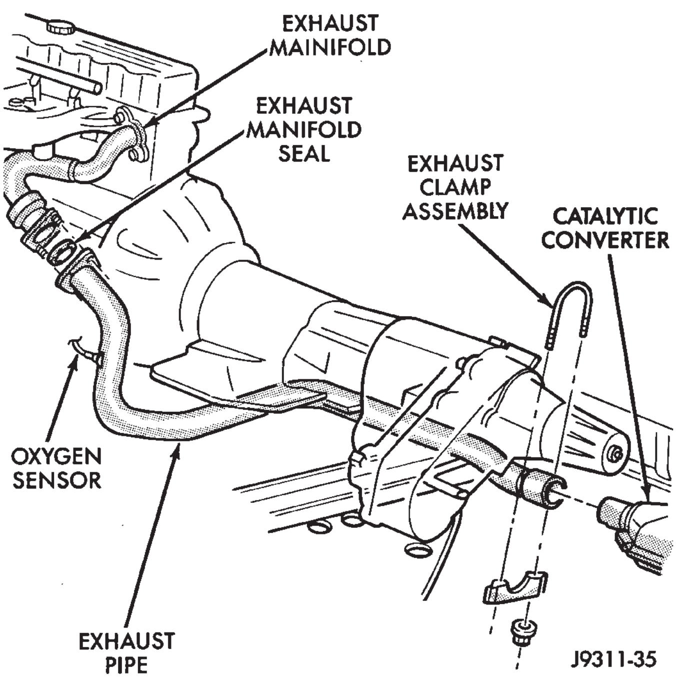

Fig. 1 Exhaust Pipe—4.0L Engine

(4) Disconnect the exhaust pipe from the engine exhaust manifold. On 4.0L engines, discard the exhaust manifold seal (Fig. 1).

(5) Remove the exhaust clamp and nuts from the exhaust pipe and catalytic converter connection (Fig. 1 or 2). Disconnect the exhaust pipe from the catalytic converter. If needed:

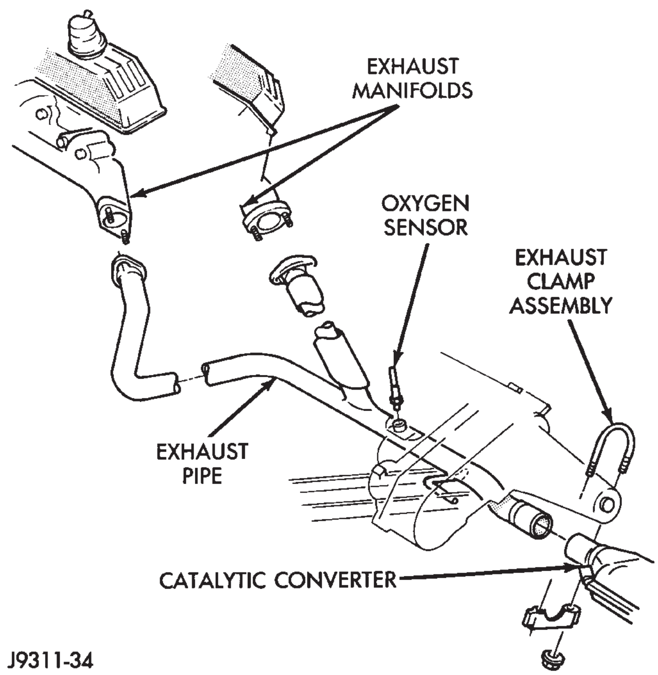

Fig. 2 Exhaust Pipe—5.2L Engine

(a) Heat the exhaust pipe and catalytic converter connection with an torch until the metal becomes cherry red.

(b) While the metal is still cherry red, twist the exhaust pipe back and forth to separate it from the catalytic converter.

(6) Disconnect the exhaust pipe hanger from the rear mount bracket insulator (Fig. 3).

(7) Remove the exhaust pipe.

INSTALLATION

(1) Position the exhaust pipe onto the catalytic converter.

(2) Connect the exhaust pipe hanger to the rear mount bracket insulator.

(3) On 4.0L engines, install a new seal between the exhaust pipe and the engine exhaust manifold (Fig. 1). Connect the exhaust pipe to the engine exhaust manifold. Tighten the nuts to 31 N·m (23 ft. lbs.) torque.

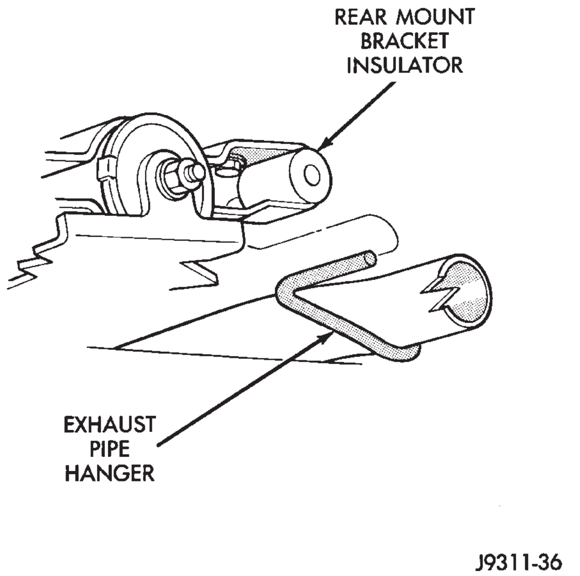

Fig. 3 Rear Mount Bracket Insulator

(4) Position the exhaust clamp assembly over the exhaust pipe/catalytic converter connection (Fig. 1 or 2). Tighten the nuts to 68 N·m (50 ft. lbs.) torque.

(5) Coat the oxygen sensor with anti-seize compound. Install the sensor and tighten the nut to 48 N·m (35 ft. lbs.) torque.

(6) Lower the vehicle.

(7) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

(8) After initial start-up, check the engine exhaust manifold to exhaust pipe nuts for proper torque.

CATALYTIC CONVERTER

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the clamp and nuts from the catalytic converter and exhaust pipe connection (Fig. 4).

(4) Remove the clamp and nuts from the catalytic converter and muffler connection (Fig. 4).

(5) Heat the exhaust pipe, catalytic converter and muffler connections with an torch until the metal becomes cherry red.

(6) While the metal is still cherry red, twist the catalytic converter back and forth to separate it from the exhaust pipe and the muffler.

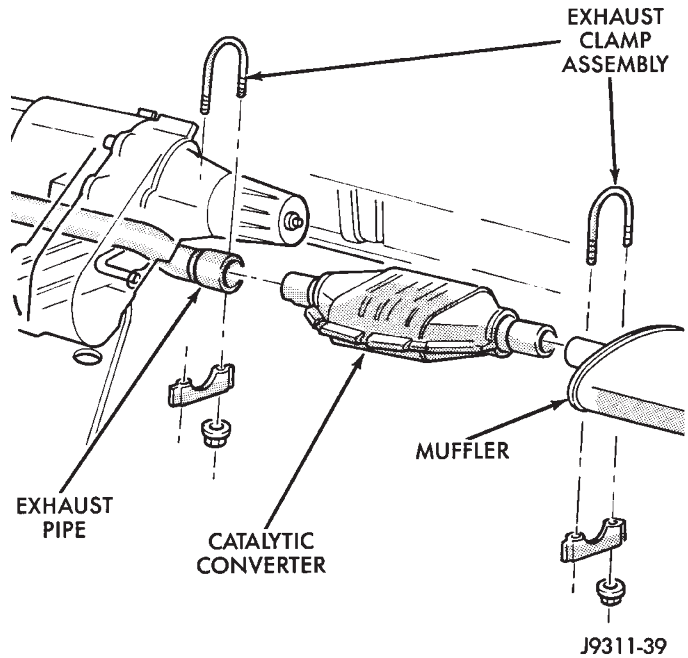

Fig. 4 Exhaust Pipe-to-Catalytic Converter-to-Muffler Connection

INSTALLATION

(1) Position the exhaust clamp assembly over the exhaust pipe/catalytic converter connection (Fig. 4). Tighten the nuts to 68 N·m (50 ft. lbs.) torque.

(2) Install the muffler onto the catalytic converter until the alignment tab is inserted into the alignment slot.

(3) Install the exhaust clamp assembly at the muffler and catalytic converter connection (Fig. 4). Tighten the clamp nuts to 68 N·m (50 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

MUFFLER AND TAILPIPE

All original equipment exhaust systems are manufactured with the tailpipe welded to the muffler. Service replacement mufflers and tailpipes are either clamped together or welded together.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with heat valve lubricant. Allow 5 minutes for penetration.

(3) Remove the exhaust clamp and nuts from the catalytic converter and muffler connection (Fig. 4).

(4) Heat the catalytic converter-to-muffler connection with an torch until the metal becomes cherry red.

(5) While the metal is still cherry red, remove the tailpipe/muffler assembly from the catalytic converter.

(6) Remove the tailpipe from the tailpipe hanger (Fig. 5).

(7) Remove the tailpipe/muffler assembly.

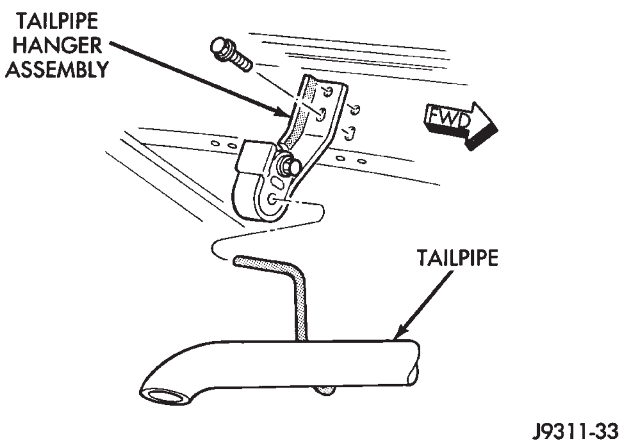

Fig. 5 Tailpipe Hanger

INSTALLATION

(1) If the tailpipe hanger assembly was removed, install the hanger to the frame. Tighten the bolts to 22 N·m (192 in. lbs.) torque.

(2) Position the tailpipe and muffler onto the tailpipe hanger (Fig. 5).

(3) Install the muffler onto the catalytic converter. Make sure that the tailpipe has sufficient clearance from the floor pan. Install the exhaust clamp assembly and tighten the nuts to 68 N·m (50 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

EXHAUST MANIFOLD—4.0L ENGINE

The intake and engine exhaust manifold must be removed and installed together. The manifolds use a common gasket at the cylinder head.

Refer to Intake Manifold in this section for the proper removal and installation procedures.

INTAKE MANIFOLD—4.0L ENGINE

The intake and engine exhaust manifold must be removed and installed together. The manifolds use a common gasket at the cylinder head.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove air cleaner inlet hose from throttle plate assembly.

(3) Remove the air cleaner assembly.

(4) Remove the throttle cable, vehicle speed control cable (if equipped) and the transmission line pressure cable.

(5) Disconnect all electrical connectors on the intake manifold.

(6) Disconnect and remove the fuel system supply and return lines from the fuel rail assembly (refer to Group 14, Fuel System).

(7) Loosen the accessory drive belt (refer to Group 7, Cooling System). Loosen the tensioner.

(8) Remove the power steering pump and bracket from the intake manifold and set aside.

(9) Remove the fuel rail and injectors (refer to Group 14, Fuel System).

(10) Raise the vehicle.

(11) Disconnect the exhaust pipe from the engine exhaust manifold. Discard the seal.

(12) Lower the vehicle.

(13) Remove the intake manifold and engine exhaust manifold.

CLEANING

Clean the mating surfaces of the cylinder head and the manifold if the original manifold is to be installed.

INSTALLATION

If the manifold is being replaced, ensure all the fitting, etc. are transferred to the replacement manifold.

(1) Install a new engine exhaust/intake manifold gasket over the alignment dowels on the cylinder head.

(2) Position the engine exhaust manifold to the cylinder head. Install fastener No.3 and finger tighten at this time (Fig. 6).

(3) Install intake manifold on the cylinder head dowels.

(4) Install washers and fasteners Nos.1, 2, 4, 5, 8, 9, 10 and 11 (Fig. 6).

(5) Install washers and fasteners Nos.6 and 7 (Fig. 6).

(6) Tighten the fasteners in sequence and to the specified torque (Fig. 6).

- Fasteners Nos.1 through 5—Tighten to 33 N·m (24 ft. lbs.) torque.
- Fasteners Nos.6 and 7—Tighten to 31 N·m (23 ft. lbs.) torque.
- Fasteners Nos.8 through 11—Tighten to 33 N·m (24 ft. lbs.) torque.

(7) Install the fuel rail and injectors (refer to Group 14, Fuel System).

(8) Install the power steering pump and bracket to the intake manifold. Tighten the belt to specification (refer to Group 7, Cooling System for the proper procedures).

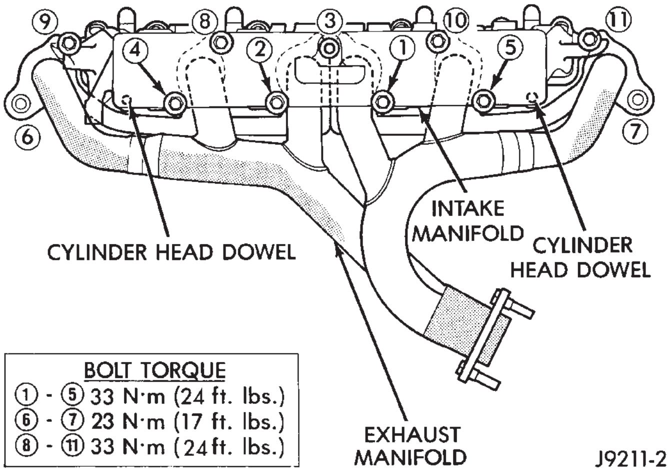

Fig. 6 Engine Exhaust/Intake Manifold

(9) Install the fuel system supply and return lines to the fuel rail assembly. **Before connecting the fuel system lines to the fuel rail replace the O-rings in the quick-connect fuel line couplings. Refer to Group 14, Fuel System for the proper procedure.**

(10) Connect all electrical connections on the intake manifold.

(11) Connect the vacuum connector on the intake manifold and install it in the bracket.

(12) Install throttle cable, vehicle speed control cable (if equipped).

(13) Install the transmission line pressure cable (if equipped). Refer to Group 21, Transmission for the adjustment procedures.

(14) Install air cleaner assembly.

(15) Connect air inlet hose to the throttle plate assembly.

(16) Raise the vehicle on a side mounted hoist.

(17) Use a new engine exhaust manifold seal. Connect the exhaust pipe to the engine exhaust manifold.

(18) Lower the vehicle.

(19) Connect the negative cable to the battery.

(20) Start the engine and check for leaks.

INTAKE MANIFOLD—5.2L ENGINE

The aluminum intake manifold is a single plane design with equal length runners. The manifold is sealed by flange side gaskets with front and rear cross-over gaskets. The intake manifold has internal EGR.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Drain the cooling system (refer to Group 7, Cooling System for the proper procedures).

(3) Remove the generator (refer to Group 8B Battery/Starting/Charging Systems).

(4) Remove the air cleaner.

(5) Remove the fuel lines and fuel rail (refer to Group 14, Fuel System).

(6) Disconnect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(7) Remove the return spring.

(8) Remove the distributor cap and wires.

(9) Disconnect the coil wires.

(10) Disconnect the heat indicator sending unit wire.

(11) Disconnect the heater hoses and bypass hose.

(12) Remove the closed crankcase ventilation and evaporation control systems.

(13) Remove the A/C compressor bolts and set the compressor on the fan shroud.

(14) Remove the support bracket from the intake manifold and the mounting bracket.

(15) Remove intake manifold bolts.

(16) Lift the intake manifold and throttle body out of the engine compartment as an assembly.

(17) Remove and discard the flange side gaskets and the front and rear cross-over gaskets.

(18) Remove the throttle body bolts and lift the throttle body off the intake manifold (Fig. 7). Discard the throttle body gasket.

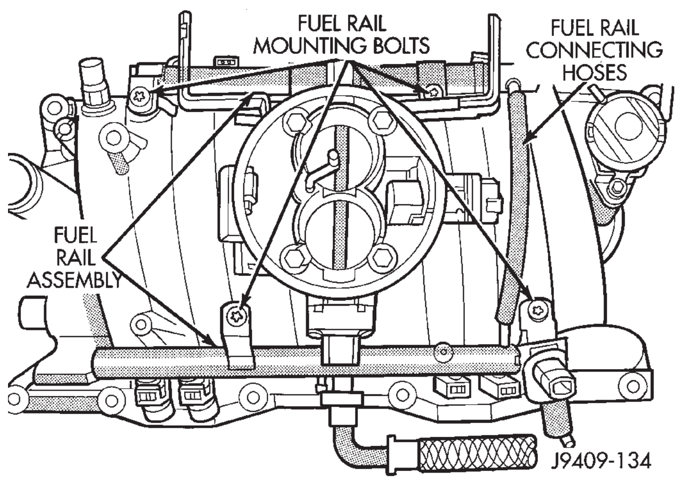

Fig. 7 Throttle Body Assembly

(19) Remove the plenum pan as follows:

(a) Turn the intake manifold upside down. Support the manifold.

(b) Remove the bolts and lift the pan off the manifold. Discard the gasket.

CLEANING

Clean manifold in solvent and blow dry with compressed air.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

The plenum pan rail must be clean and dry (free of all foreign material).

INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straightedge.

INSTALLATION

(1) Install the plenum pan, if removed, as follows:

(a) Turn the intake manifold upside down. Support the manifold.

(b) Place a new plenum pan gasket onto the seal rail of the intake manifold. Position the pan over the gasket. Align all the gasket and pan holes with the intake manifold.

(c) Hand start all bolts.

(d) Tighten the bolts, in sequence (Fig. 8), as follows:

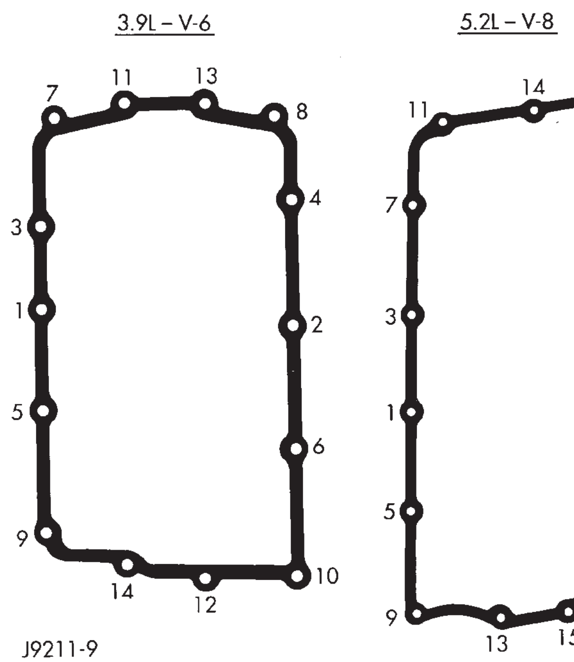

Fig. 8 Plenum Pan Bolt Tightening Sequence

• Step 1—Tighten bolts to 2.7 N·m (24 in. lbs.) torque.
• Step 2—Tighten bolts to 5.4 N·m (48 in. lbs.) torque.
• Step 3—Tighten bolts to 9.5 N·m (84 in. lbs.) torque.
• Step 4—Check that all bolts are tighten to 9.5 N·m (84 in. lbs.) torque.

(2) Using a new gasket, install the throttle body onto the intake manifold. Tighten the bolts to 23 N·m (200 in. lbs.) torque.

(3) Place the 4 plastic locator dowels into the holes in the block Fig. 9).

(4) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, to the four corner joints. An excessive amount of sealant is not required to ensure a leak proof seal. However, an excessive amount of sealant may reduce the effectiveness of the flange gasket. The sealant should be slightly higher than the cross-over gaskets, approx. 5 mm (0.2 in).

(5) Install the front and rear cross-over gaskets onto the dowels (Fig. 9).

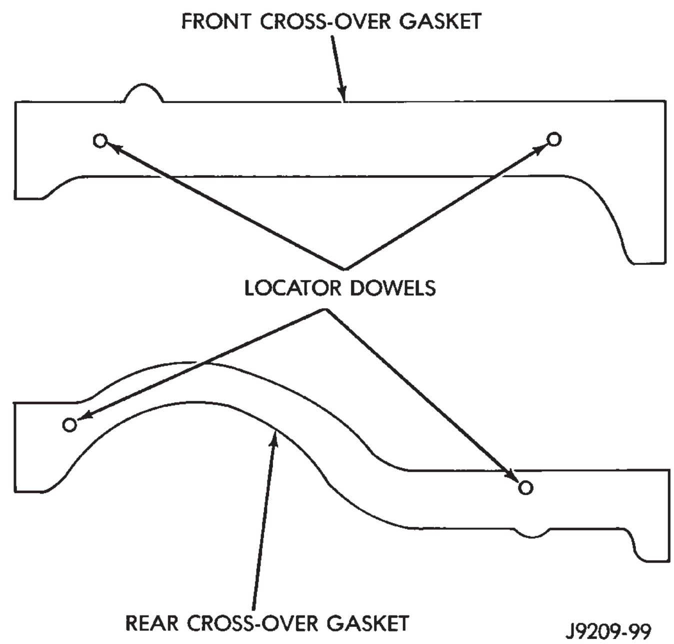

Fig. 9 Cross-Over Gaskets and Locator Dowels

(6) Install the flange gaskets. Ensure that the vertical port alignment tab is resting on the deck face of the block. Also the horizontal alignment tabs must be in position with the mating cylinder head gasket tabs (Fig. 10). The words MANIFOLD SIDE should be visible on the center of each flange gasket.

(7) Carefully lower intake manifold into position on the cylinder block and cylinder heads. Use the alignment dowels in the cross-over gaskets to position the intake manifold. After intake manifold is in place, inspect to make sure seals are in place.

(8) The following torque sequence duplicates the expected results of the automated assembly system (Fig. 11).

• Step 1—Tighten bolts 1 through 4, in sequence, to 8 N·m (72 in. lbs.) torque. Tighten in alternating steps 1.4 N·m (12 in. lbs.) torque at a time.
• Step 2—Tighten bolts 5 through 12, in sequence, to 8 N·m (72 in. lbs.) torque.
• Step 3—Check that all bolts are tighten to 8 N·m (72 in. lbs.) torque.
• Step 4—Tighten all bolts, in sequence, to 16 N·m (12 ft. lbs.) torque.
• Step 5—Check that all bolts are tighten to 16 N·m (12 ft. lbs.) torque.

(9) Install closed crankcase ventilation and evaporation control systems.

(10) Install the coil wires.

(11) Connect the heat indicator sending unit wire.

(12) Connect the heater hoses and bypass hose.

(13) Install distributor cap and wires.

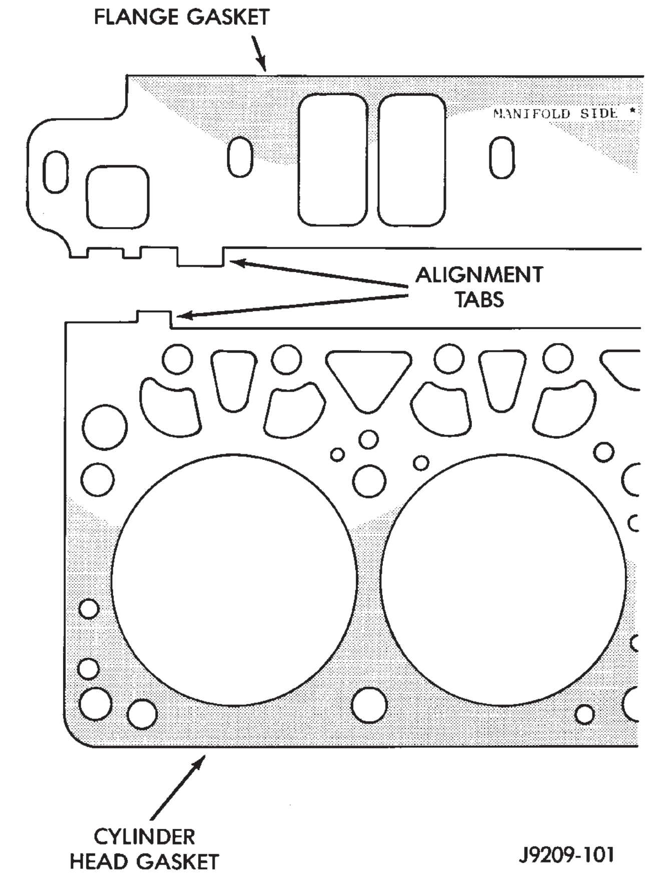

Fig. 10 Intake Manifold Flange Gasket Alignment

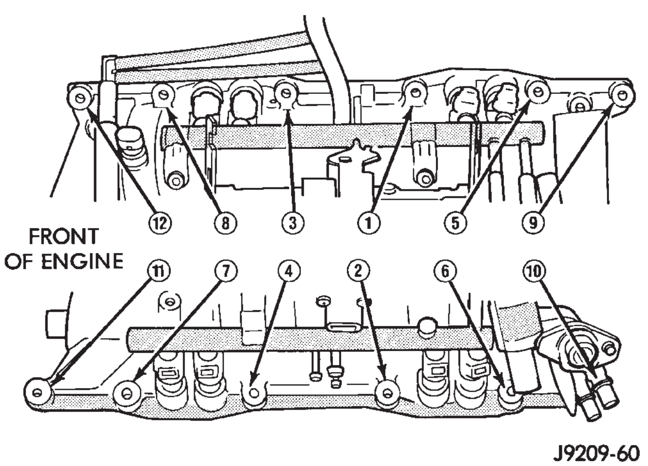

Fig. 11 Intake Manifold Bolt Tightening Sequence

(14) Hook up the return spring.

(15) Connect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(16) Install the fuel lines and fuel rail (refer to Group 14, Fuel System).

(17) Install the support bracket to the intake manifold and the mounting bracket.

(18) Install the generator and drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque. Tighten the adjusting strap bolt to 23 N·m (200 in. lbs.) torque. Refer to Group 7, Cooling System for the proper adjusting of belt tension.

(19) Install the A/C compressor on the mounting bracket (refer to Group 24, Heating and Air Conditioning).

(20) Install the air cleaner.

(21) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).

(22) Connect the negative cable to the battery.

EXHAUST MANIFOLD—5.2L ENGINE

Exhaust manifolds are LOG type with balanced flow.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove the exhaust manifold heat shields (Fig. 12).

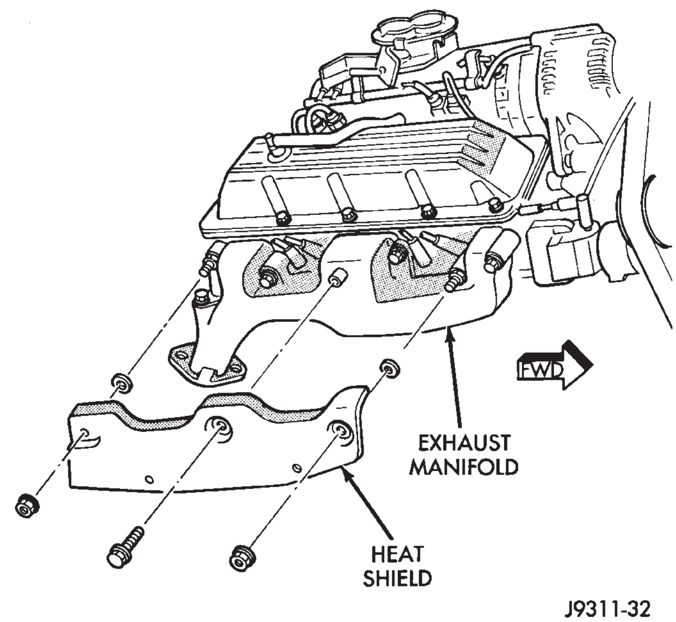

Fig. 12 Exhaust Manifold Heat Shields (Left Shield Shown)

(3) Remove the ERG tube (refer to Group 25, Emission Control Systems).

(4) Raise the vehicle.

(5) Remove the bolts and nuts attaching the exhaust pipe to the exhaust manifold.

(6) Lower the vehicle.

(7) Remove bolts, nuts and washers attaching manifold to cylinder head.

(8) Remove manifold from the cylinder head.

CLEANING

Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air. Inspect manifold for cracks.

INSPECTION

Inspect mating surfaces of manifold for flatness with a straight edge. Seal surfaces must be flat within 0.1 mm (0.004 inch) overall.

INSTALLATION

CAUTION: If the studs came out with the nuts when removing the exhaust manifold, install new studs.

(1) Position the exhaust manifolds on the two studs located on the cylinder head. Install conical washers and nuts on these studs (Fig. 13).

(2) Install new bolt and washer assemblies in the remaining holes (Fig. 13). Start at the center arm and work outward. Tighten the bolts and nuts to 27 N·m (20 ft. lbs.) torque.

(3) Raise the vehicle.

(4) Assemble the exhaust pipe to the exhaust manifold and secure with bolts, nuts and washers. Tighten these nuts to 31 N·m (23 ft. lbs.) torque.

(5) Lower the vehicle.

(6) Install the EGR tube (refer to Group 25, Emission Control Systems).

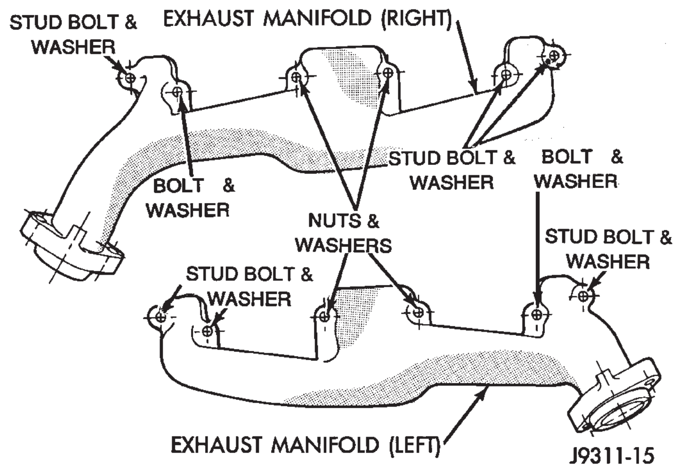

Fig. 13 Exhaust Manifold

CAUTION: The exhaust manifold heat shields MUST be installed to protect the underhood components.

(7) Install the exhaust manifold heat shields. Tighten the nuts to 27 N·m (20 ft. lbs.) torque.

(8) Connect the negative cable to the battery.

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Adjusting Strap Bolt	23 N·m (200 in. lbs.)
Catalytic Converter-to-Exhaust Pipe Clamp Nuts	68 N·m (50 ft. lbs.)
Exhaust Pipe-to-Manifold Nuts	31 N·m (23 ft. lbs.)
Exhaust/Intake Manifold Nut/ Bolts #1-5 & #8-11 (4.0L)	33 N·m (24 ft. lbs.)
Exhaust Manifold Heat Shield Nuts (5.2L)	27 N·m (20 ft. lbs.)
Exhaust Manifold Nuts #6 & 7 (4.0L Engine)	31 N·m (23 ft. lbs.)
Exhaust Manifold Nuts/Bolts (5.2L Engine)	27 N·m (20 ft. lbs.)
Floor Pan Heat Shield Bolts/Nuts	5 N·m (45 in. lbs.)
Generator Mounting Bolts	41 N·m (30 ft. lbs.)
Intake Manifold Bolts (5.2L)	Refer to Procedure in Service Manual
Muffler-to-Catalytic Converter Clamp Nuts	68 N·m (50 ft. lbs.)
Oxygen Sensor	48 N·m (35 ft. lbs.)
Plenum Pan Bolts (5.2L)	Refer to Procedure in Service Manual
Rear Tailpipe Hanger Assembly	22 N·m (192 in. lbs.)
Throttle Body (5.2L)	23 N·m (200 in. lbs.)

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FRAME AND BUMPERS

CONTENTS

FRAME

GENERAL INFORMATION

Jeep Grand Cherokee vehicles do not have a conventional frame (Fig. 1). They are constructed as a unitized body and frame. Jeep unibodies are constructed from special high-strength steel and coated metals. This process reduces weight and provides strength to withstand the forces applied against structural members. The structural members provide a unibody that has great structural strength.

A vehicle is designed within a three dimensional grid partitioned into 100 mm (3.92 in.) cubes. The lines that make the grid run in three planes defined as X, Y and Z (Fig 1.). The X-plane extends from the front to the rear of the vehicle. The Y-plane extends from 50 mm (2.00 in.) below the frame rails upward (Datum). The Z-plane extends from the center line (C/L) of the vehicle outward. The Zero point of the grid is located 50 mm (2.00 in.) below the front Principle Location Points (PLPs) at the center line of the vehicle. Most Z-plane dimensions are symmetrical to the center line.

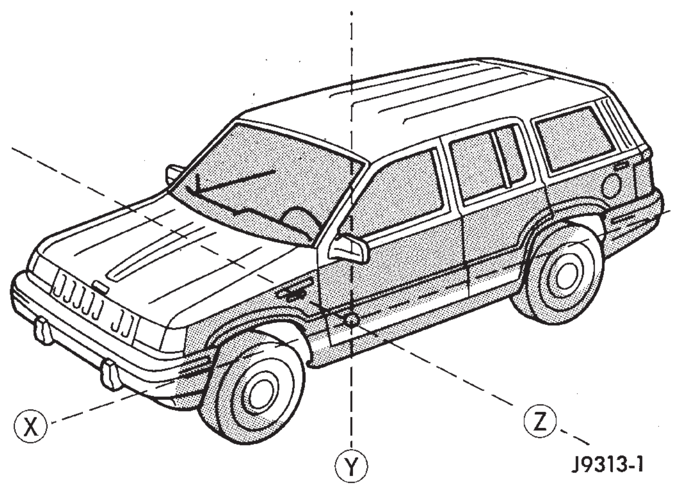


Fig. 1 Grand Cherokee

COLLISION DAMAGE

DAMAGE DIAGNOSIS

A unibody reacts differently to impact than a vehicle with a conventional frame. While damage at the point of impact is noticed, the extent of hidden damage must be diagnosed to expose it.

With unibody construction, there are five logical areas to examine to expose damage.

- (1) Damage at immediate point of impact—primary damage.
- (2) Other body damage—secondary damage.
- (3) Damage to exterior trim and other attached components.
- (4) Damage to mechanical components.
- (5) Interior trim and accessory damage.

DAMAGE REPAIR

A logical approach to damage repair must be used. Usually, the repairs are done in the reverse order of consequence.

Also, when there is damage to a unibody, the critical alignment points must be returned to the manufacturer's specifications (Figs. 2 and 3). This entails:

- Accurate measurement.
- Repetitive measurement.
- Re-check of measurements.

Collision damage repair can be done right the first time:

- If the fundamental steps for damage repair are correctly followed.
- If the basic structural details of unibody construction are correctly considered.

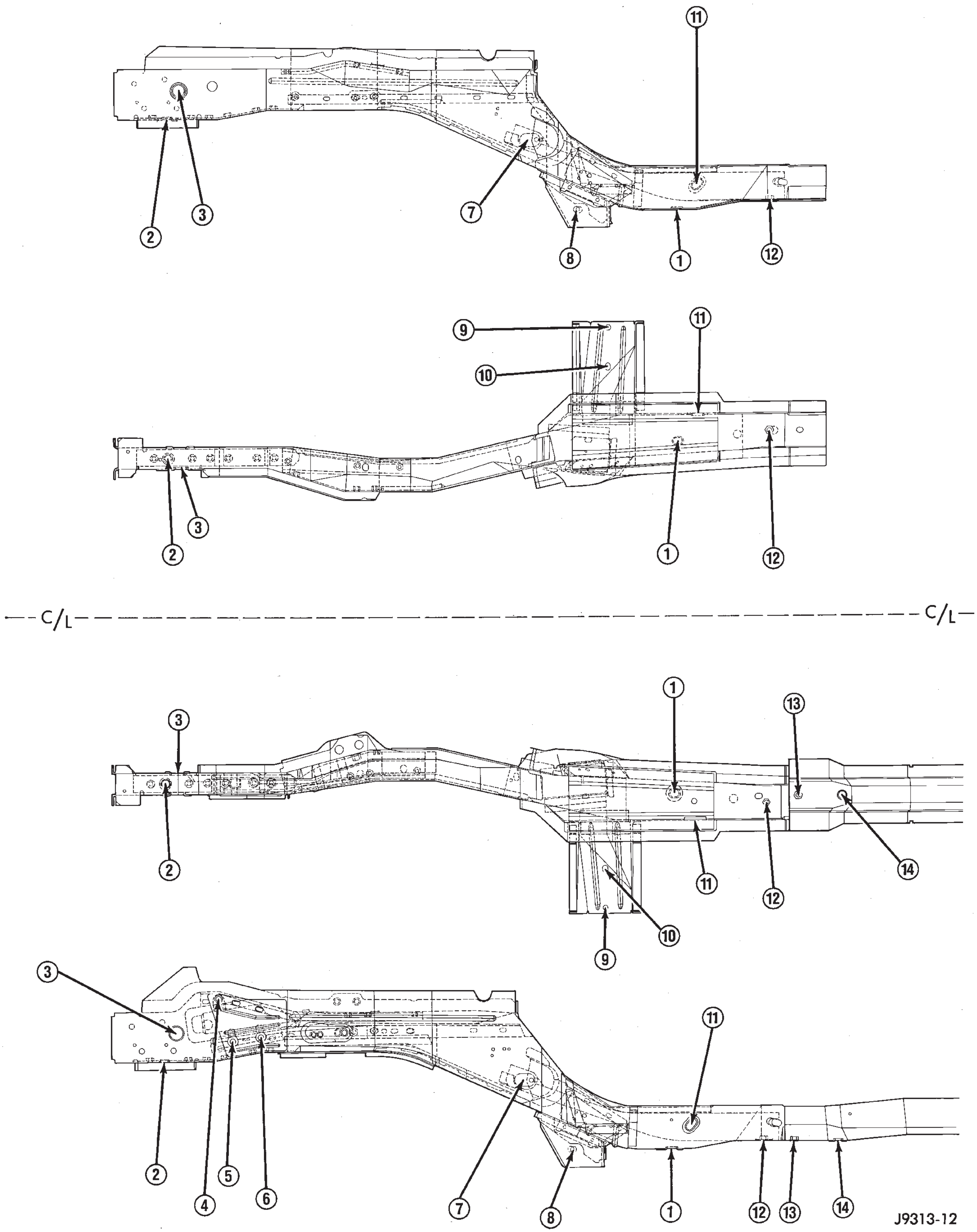


Fig. 2 Frame Dimension Locations—Front

Location	X from ZERO	Y from DATUM	Z from C/L ♦
1	0	50 mm (2.00 in.)	420 mm (16.8 in.)
2	-1280 mm (-51.2 in.)	280 mm (11.2 in.)	385 mm (15.4 in.)
3	-1250 mm (-50.0 in.)	350 mm (14.0 in.)	413 mm (16.5 in.)
4	-1144 mm (-45.8 in.)	434 mm (17.4 in.)	N/A
5	-1107 mm (-44.3 in.)	326 mm (13.0 in.)	N/A
6	-1037 mm (-41.5 in.)	337 mm (13.5 in.)	N/A
7	- 370 mm (-14.8 in.)	222 mm (8.9 in.)	N/A
8	- 249 mm (- 9.9 in.)	49 mm (1.9 in.)	N/A
9	- 190 mm (- 7.6 in.)	110 mm (4.4 in.)	706 mm (28.2 in.)
10	- 190 mm (- 7.6 in.)	110 mm (4.4 in.)	606 mm (24.2 in.)
11	50 mm (2.0 in.)	108 mm (4.3 in.)	489 mm (19.6 in.)
12	232 mm (9.3 in.)	70 mm (2.8 in.)	444 mm (17.8 in.)
13	308 mm (12.3 in.)	70 mm (2.8 in.)	444 mm (17.8 in.)
14	420 mm (16.8 in.)	70 mm (2.8 in.)	444 mm (17.8 in.)
15	900 mm (36.0 in.)	84 mm (3.4 in.)	444 mm (17.8 in.)
16	1128 mm (45.1 in.)	129 mm (5.1 in.)	N/A
17	1350 mm (54.0 in.)	82 mm (3.3 in.)	444 mm (17.8 in.)
18	1505 mm (60.2 in.)	50 mm (2.0 in.)	444 mm (17.8 in.)
19	1635 mm (65.4 in.)	189 mm (7.6 in.)	N/A
20	1933 mm (77.3 in.)	280 mm (11.2 in.)	518 mm (20.7 in.)
21	2064 mm (82.6 in.)	230 mm (9.2 in.)	444 mm (17.8 in.)
22	2272 mm (90.9 in.)	340 mm (13.6 in.)	570 mm (22.8 in.)
23	2314 mm (92.6 in.)	267 mm (10.7 in.)	464 mm (18.6 in.)
24	2463 mm (98.5 in.)	295 mm (11.8 in.)	495 mm (19.8 in.)
25	2515 mm (100.6 in.)	267 mm (10.7 in.)	464 mm (18.6 in.)
26	2710 mm (108.4 in.)	N/A	170 mm (6.8 in.)

N/A = Not Applicable
C/L = Center Line
* = Measure to C/L of rail.
Locations 1, 2, 3, 14, 15, and 25 are Principal Location Points (PLP).

Zero = Point of X, Y and Z origin.
Datum = 50 mm below frame rails.
♦ = Measures symmetrical to C/L

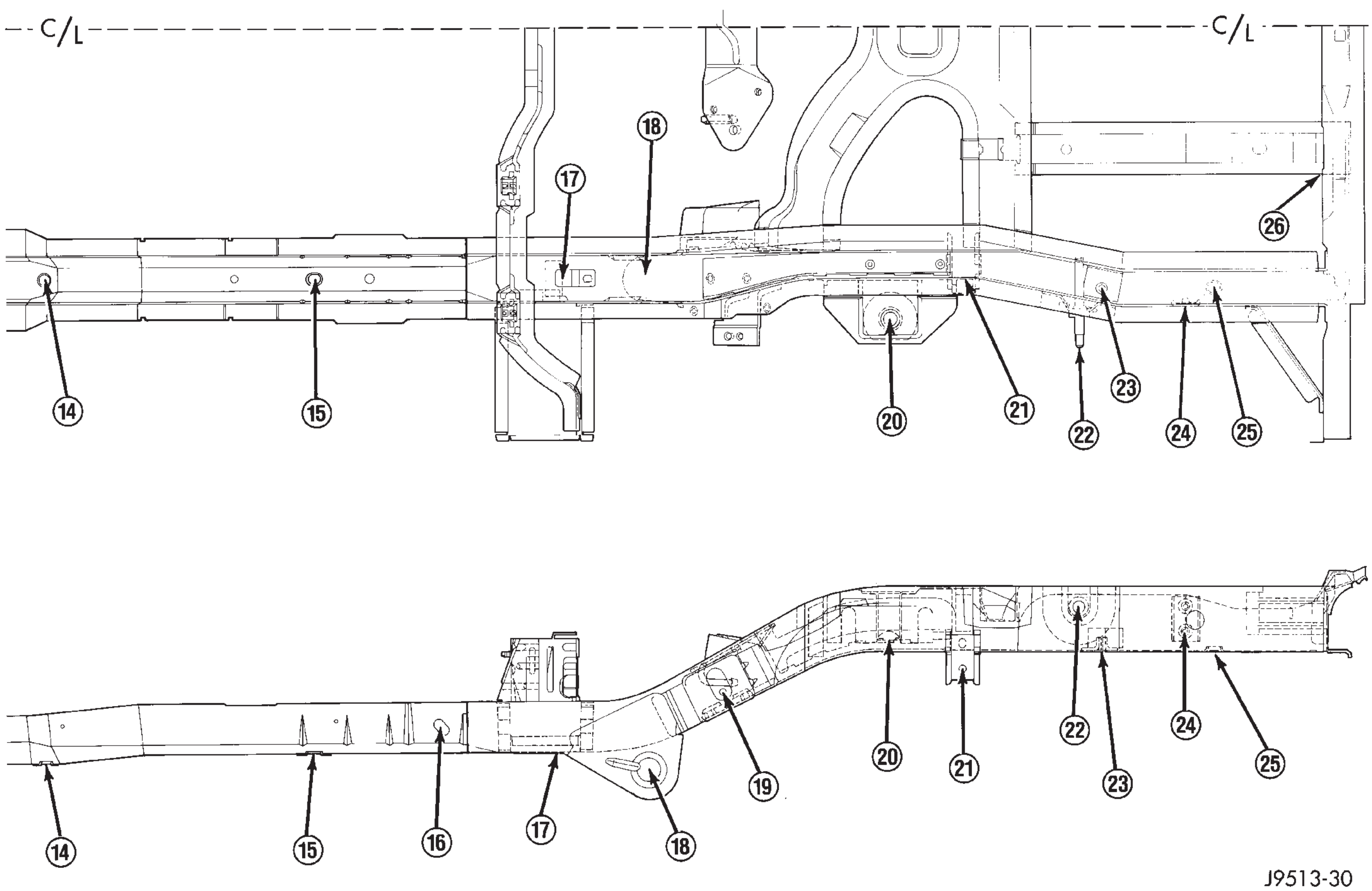


Fig. 3 Frame Dimension Locations—Rear

BUMPERS

INDEX

FRONT BUMPER/FASCIA

GENERAL INFORMATION

The Grand Cherokee front bumper is actually a bumper fascia incorporated with a lower welded crossmember. The lower crossmember is a fixed welded structure. To replace the crossmember a frame machine should be used to correctly align the crossmember to the unibody.

REMOVAL

(1) Remove grille screws at grille opening reinforcement (GOR) (Fig. 1).

(2) Unsnap lower clips at grille. Remove grille from (GOR).

(3) Remove turn signals, side markers and headlamps. Refer to Group 8L, Lamps for service information.

(4) Remove the retainers at the front fascia (Fig. 2).

(5) Remove the plastic rivets at each front wheel well (Fig. 3).

(6) Slide the fascia off of the retainer pegs at the side of the fender attach brackets. Using a small screwdriver, pull up on locating tangs under turn signal mounting location.

(7) Remove the fascia from the vehicle (Fig. 2).

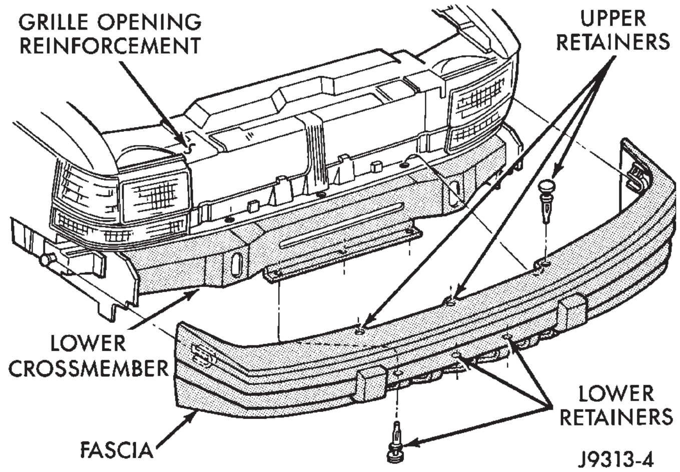


Fig. 2 Lower Fascia Removal

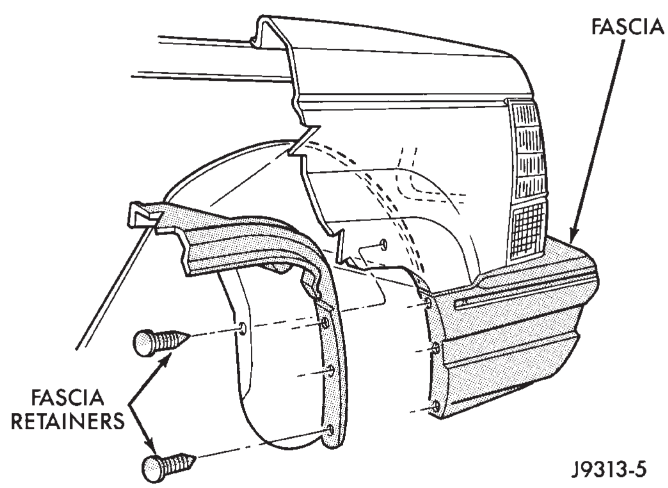


Fig. 3 Wheel Well Retainers

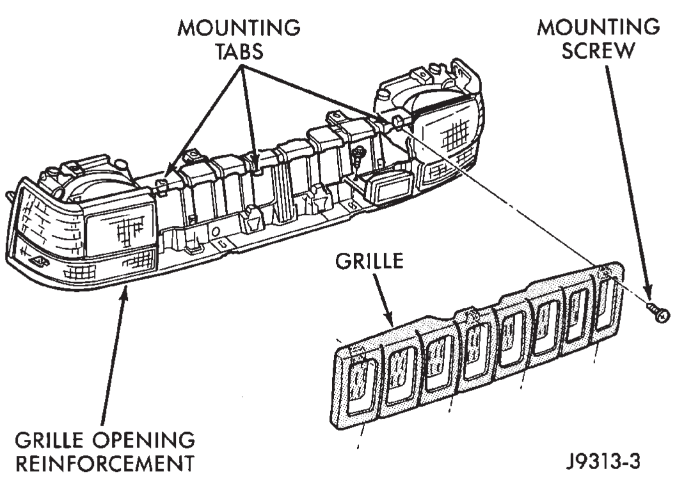


Fig. 1 Grille Removal

Reverse removal procedure for installation.

FRONT TOW HOOKS

REMOVAL

(1) Remove the nuts and bolts that attach the tow hooks to the lower crossmember (Fig. 4).

(2) Remove the tow hooks from the lower crossmember (Fig. 4).

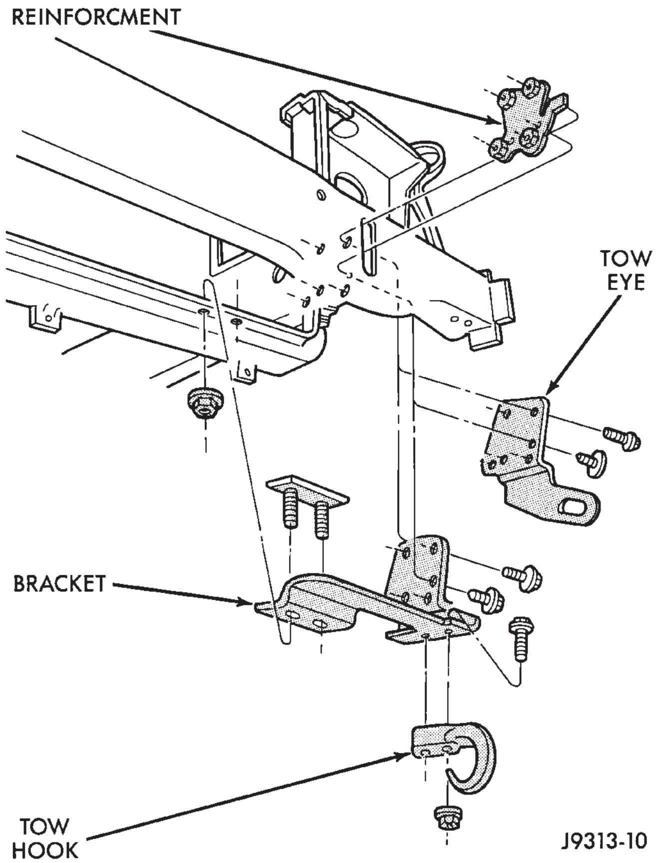


Fig. 4 Tow Hook Removal

INSTALLATION

(1) Position the tow hooks at the lower crossmember. Install the bolts and nuts that attach tow hooks (Fig. 4). Tighten the retaining nuts to 100 N·m (74 ft-lbs) torque.

REAR BUMPER

REMOVAL

(1) For vehicles equipped with a trailer hitch, remove the hitch before removing the bumper. If necessary, refer to the removal procedure within Group 23, Body Components.

(2) Raise and support the rear of the vehicle.

(3) Support the bumper.

(4) Remove push-in retainers at each side rear wheel well.

(5) Remove the bolts that attach the bumper support brackets to the rear rails (Fig. 5).

(6) Slide the bumper beam/fascia off of the retainer pegs on the side of the lower quarter panel.

(7) Remove the beam/fascia from the vehicle.

(8) Remove the bumper support brackets from the bumper (Fig. 6).

(9) Remove the upper scuff pad from the bumper fascia by squeezing fasteners and pushing through slots.(Fig. 6).

(10) Remove the lower retainers from the bumper fascia (Fig. 6).

(11) Remove the bumper fascia from the bumper.

INSTALLATION

(1) Install brackets onto bumper beam.

(2) Install beam/brackets onto vehicle rails finger-tight (Fig. 6).

(3) Install fascia onto bumper assembly (Fig. 6).

(4) Check gaps and fit. Adjust as necessary. Tighten bolts to 56 N·m (41 ft-lbs).

(5) Install scuff pad (Fig. 6).

(6) If removed, install the trailer hitch. If necessary, refer to the installation procedure within Group 23, Body Components.

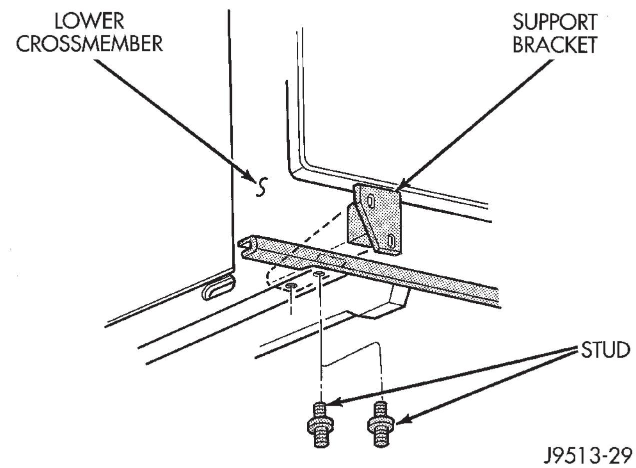


Fig. 5 Bumper Support Bracket

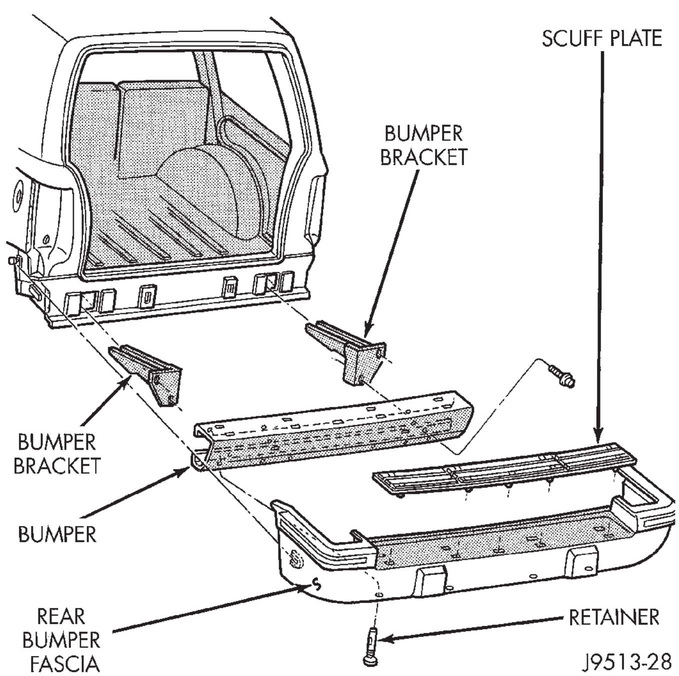


Fig. 6 Bumper Removal

REAR BUMPER FASCIA

REMOVAL

(1) For vehicles equipped with a trailer hitch, remove the hitch before removing the bumper fascia. If necessary, refer to the removal procedure within Group 23, Body Components.

(2) Raise and support the rear of the vehicle.

(3) Remove the upper scuff pad from fascia (Fig. 6).

(4) Remove the lower retainers from fascia (Fig. 6).

(5) Remove the push-in retainers located at the rear wheel well on each side.

(6) Remove the fascia from the bumper.

For installation, reverse removal procedure.

REAR TOW HOOK

REMOVAL

(1) Remove the nuts and bolts that attach the tow hook to the lower crossmember (Fig. 7).

(2) Remove the tow hook from the lower crossmember (Fig. 7).

INSTALLATION

(1) Position the tow hook at the lower crossmember. Install the bolts and nuts that attach tow hook (Fig. 7). Tighten the retaining nuts to 100 N·m (74 ft-lbs) torque.

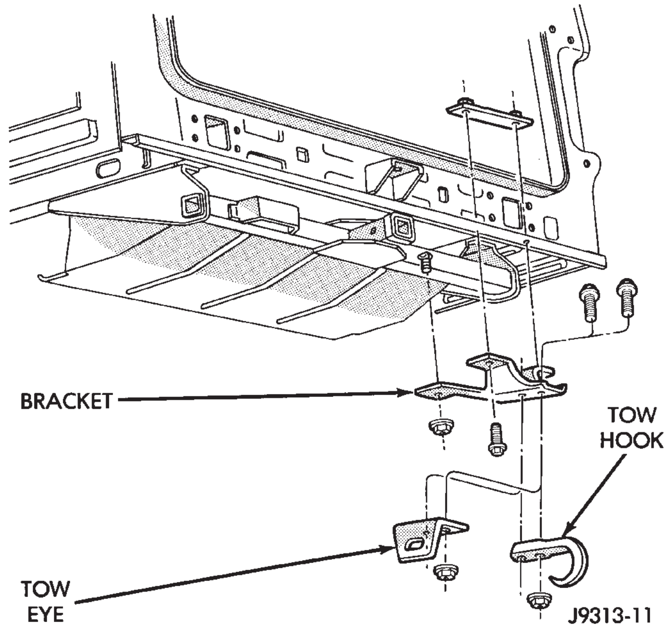


Fig. 7 Tow Hook Removal

FUEL SYSTEM

CONTENTS

GENERAL INFORMATION

Throughout this group, references are made to particular vehicle models by alphabetical designation or by the particular vehicle nameplate. A chart showing a breakdown of the alphabetical designations is included in the Introduction section at the beginning of this manual.

The **Fuel System** consists of: the fuel tank, an electric (fuel tank mounted) fuel pump, a fuel pressure regulator, fuel filter, sensors, switches and powertrain control module (PCM). It also consists of fuel tubes/lines/hoses, vacuum hoses, throttle body, fuel rail and fuel injectors.

The **Fuel Delivery System** consists of: the electric fuel pump, a frame mounted fuel filter, fuel tubes/lines/hoses, fuel rail, fuel injectors and fuel pressure regulator.

A **Fuel Return System** is used on all models with either a 4.0L or 5.2L engine. A separate fuel return line from the engine to the tank is no longer used on any 4.0L or 5.2L engine. Excess fuel is returned through the fuel pump module and back into the fuel tank through the fuel pressure regulator. The fuel pressure regulator is located in the fuel tank within the fuel pump module.

The **Fuel Tank Assembly** consists of: the fuel tank, filler tube, fuel gauge sending unit/electric fuel pump module, a fuel pressure regulator mounted to the fuel pump module, a pressure relief/rollover valve and a pressure-vacuum filler cap.

Also to be considered part of the fuel system is the **Evaporation Control System.** This is designed to reduce the emission of fuel vapors into the atmosphere. The description and function of the Evaporative Control System is found in Group 25, Emission Control Systems.

FUEL USAGE STATEMENT

Your vehicle was designed to meet all emission regulations and provide excellent fuel economy using high quality unleaded gasoline. Only use unleaded gasolines having a minimum posted octane of 87.

If your vehicle develops occasional light spark knock (ping) at low engine speeds, this is not harmful. However, **continued heavy knock at high speeds can cause damage and should be reported to your dealer immediately.** Engine damage as a result of heavy knock operation may not be covered by the new vehicle warranty.

In addition to using unleaded gasoline with the proper octane rating, **those that contain detergents, corrosion and stability additives are recommended.** Using gasolines that have these additives will help improve fuel economy, reduce emissions and maintain vehicle performance.

Poor quality gasoline can cause problems such as hard starting, stalling and stumble. If you experience these problems, use another brand of gasoline before considering service for the vehicle.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with materials that contain oxygen such as alcohol, MTBE and ETBE. The type and amount of oxygenate used in the blend is important. The following are generally used in gasoline blends:

ETHANOL

Ethanol (Ethyl or Grain Alcohol) properly blended, is used as a mixture of 10 percent ethanol and 90 percent gasoline. **Gasoline with ethanol may be used in your vehicle.**

METHANOL

CAUTION: DO NOT USE GASOLINES CONTAINING METHANOL. Use of methanol/gasoline blends may result in starting and driveability problems. In addition, damage may be done to critical fuel system components.

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.

Problems that are the result of using methanol/gasoline blends are not the responsibility of Chrysler Corporation. They may not be covered by the vehicle warranty.

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.

CLEAN AIR GASOLINE

Many gasolines are now being blended that contribute to cleaner air, especially in those areas of the country where air pollution levels are high. These new blends provide a cleaner burning fuel and some are referred to as **Reformulated Gasoline.**

In areas of the country where carbon monoxide levels are high, gasolines are being treated with oxygenated materials such as MTBE, ETBE and ethanol.

Chrysler Corporation supports these efforts toward cleaner air and recommends that you use these gasolines as they become available.

FUEL DELIVERY SYSTEM

INDEX

FUEL PUMP MODULE

The fuel pump module is installed in the top of the fuel tank (Fig. 1). The fuel pressure regulator is a part of the fuel pump module assembly and is no longer mounted to the fuel rail on either engine. The fuel pump module contains the following components:

- Electric fuel pump
- Fuel pressure regulator
- Fuel pump reservoir
- In-tank fuel filter
- Fuel gauge sending unit
- Fuel supply line (tube) connection

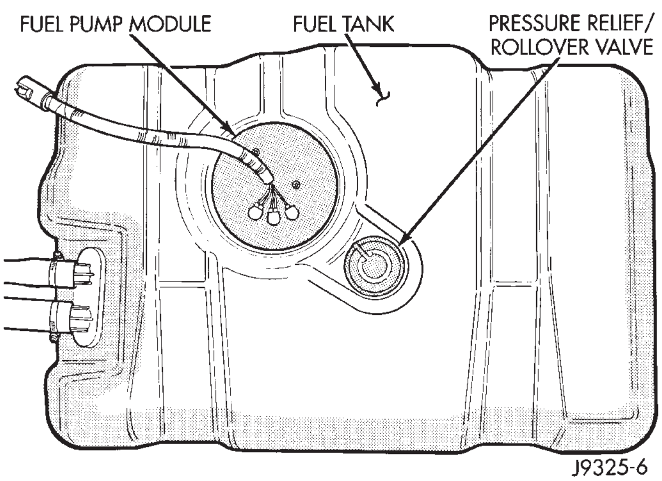


Fig. 1 Fuel Pump Module Location

The fuel pump used on all models is driven by a permanent magnet 12 volt electric motor that is immersed in the fuel tank. The electrical pump is integral with the fuel sender unit. The pump/sender assembly is installed inside the fuel tank.

The fuel pump has a check valve at the outlet end that consists of a ball held against a seat by force applied from a spring. When the pump is operating, fuel pressure overcomes spring pressure and forces the ball off its seat, allowing fuel to flow. When the pump is not operating, spring pressure forces the ball back against the seat preventing fuel backflow through the pump.

The fuel pump module is not serviceable. If the electric fuel pump or the fuel pressure regulator needs replacement, the complete fuel pump module must be replaced.

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. BEFORE SERVICING THE FUEL PUMP MODULE, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

(1) Drain and remove the fuel tank. Refer to Fuel Tank removal and installation in the Fuel Tank section of this group.

(2) The fuel pump module locknut is threaded onto the fuel tank. Remove the fuel pump module locknut (Fig. 2). The fuel pump module will spring up from the fuel tank after the locknut has been removed.

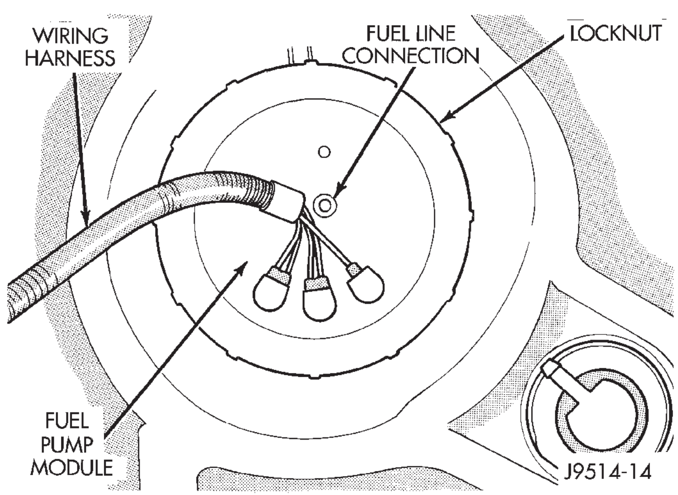


Fig. 2 Top View of Fuel Pump Module—Typical

(3) Remove module from fuel tank.

INSTALLATION

CAUTION: Whenever the fuel pump module is serviced, the rubber gasket must be replaced.

(1) Clean the fuel tank at the module opening.

(2) Using a new gasket on the fuel tank (Fig. 3), position fuel pump module into opening in fuel tank. Refer to figure 2 for rotational position.

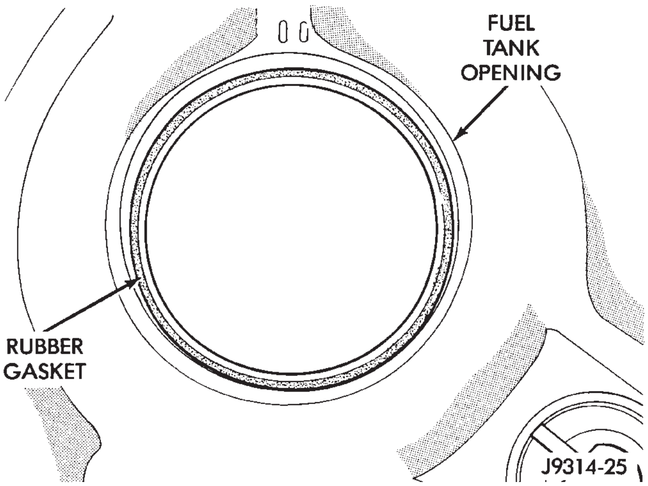


Fig. 3 Rubber Gasket

(3) Tighten locknut.

(4) Install fuel tank. Refer to Fuel Tank Installation in this group.

FUEL PUMP REPLACEMENT

The electric fuel pump is not serviceable. If the fuel pump needs replacement, the complete fuel pump module must be replaced. Refer to the previous procedure.

FUEL GAUGE SENDING UNIT REPLACEMENT

The fuel gauge sending unit is not serviceable. If the unit needs replacement, the complete fuel pump module must be replaced.

FUEL PRESSURE REGULATOR

ALL ENGINES

A fuel pressure regulator is used with all engines. It is mounted inside of the fuel pump module (Fig. 4) and is suspended in fuel.

The vacuum assisted fuel pressure regulator located on the fuel rail is no longer used on the 4.0L or 5.2L engine.

Fuel Pressure Regulator Operation: The pressure regulator is a mechanical device that is not controlled by engine vacuum or by the powertrain control module (PCM).

The regulator is calibrated to maintain a constant pressure at the fuel pump module outlet fitting of 269-283 kPa (39-41 psi). System operating pressure at the fuel injectors, as measured at the fuel rail test port is 255-283 kPa (39 psi ± 2 psi). The regulator contains a diaphragm, calibrated springs and a fuel return valve.

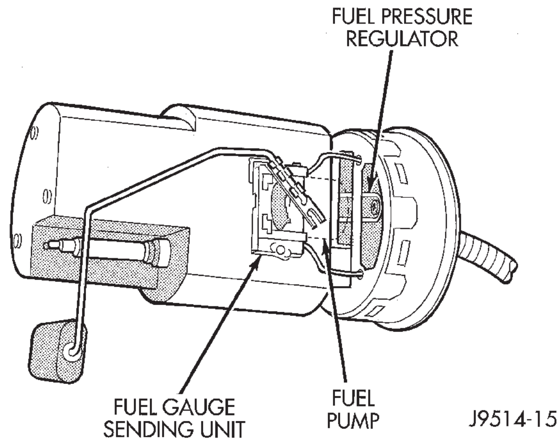


Fig. 4 Fuel Pressure Regulator Location

Fuel is supplied to the regulator by the electric fuel pump. The fuel pump also contains a check valve to maintain some fuel pressure at the fuel injectors when the engine is not operating. This will help to start the engine.

If fuel pressure at the pressure regulator exceeds 269-283 kPa (39-41 psi), an internal diaphragm closes and excess fuel pressure is routed back into the fuel tank through the pressure regulator. A separate fuel return line to the engine is no longer used with any 4.0L or 5.2L engine.

REMOVAL/INSTALLATION

The fuel pressure regulator is not serviced separately. If the pressure regulator needs replacement, the fuel pump module must be replaced. Refer to Fuel Pump Module Removal/Installation for procedures.

FUEL PUMP ELECTRICAL CONTROL

The powertrain control module (PCM) computer energizes the fuel pump through the fuel pump relay. Battery voltage is applied to the relay from the ignition switch. The coil in the relay is energized when a ground is provided by the PCM. The relay is located in the power distribution center (PDC) next to the battery (Fig. 5). For location of relay within the PDC, refer to label under PDC cover.

Also refer to either of the MFI System—Component Description/System Operation sections of this group. See Automatic Shutdown (ASD) Relay—PCM Output.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING ANY FUEL SUPPLY SYSTEM COMPONENT.

(1) Disconnect negative battery cable.

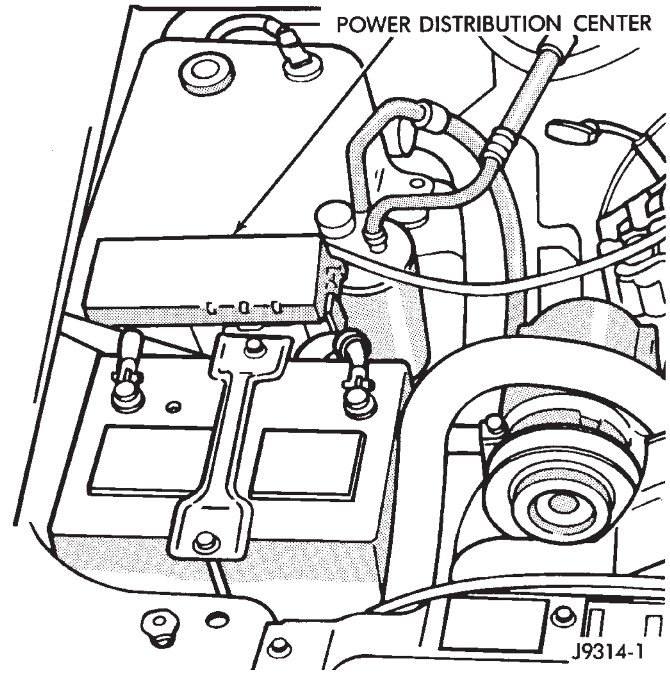


Fig. 5 Power Distribution Center

(2) Remove fuel tank filler neck cap to release fuel tank pressure.

WARNING: DO NOT ALLOW FUEL TO SPILL ONTO THE ENGINE INTAKE OR EXHAUST MANIFOLDS. PLACE SHOP TOWELS UNDER AND AROUND THE PRESSURE PORT TO ABSORB FUEL WHEN THE PRESSURE IS RELEASED FROM THE FUEL RAIL.

WARNING: WEAR PROPER EYE PROTECTION WHEN RELEASING FUEL SYSTEM PRESSURE.

(3) Remove protective cap from pressure test port on the fuel rail (Figs. 6 or 7).

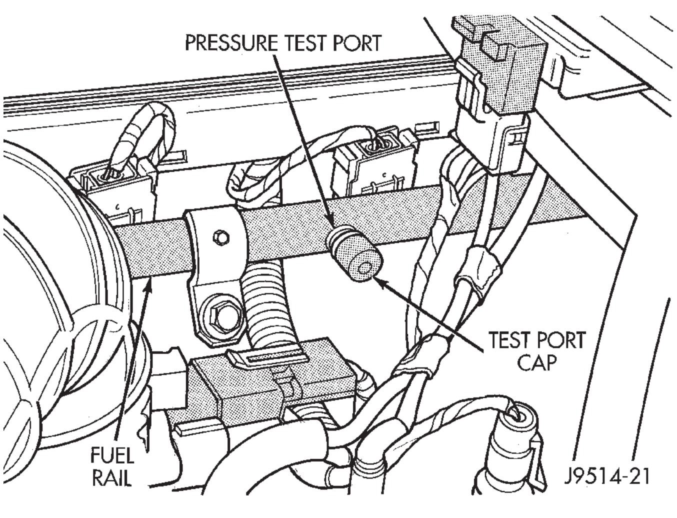


Fig. 6 Pressure Test Port Location—4.0L Engine

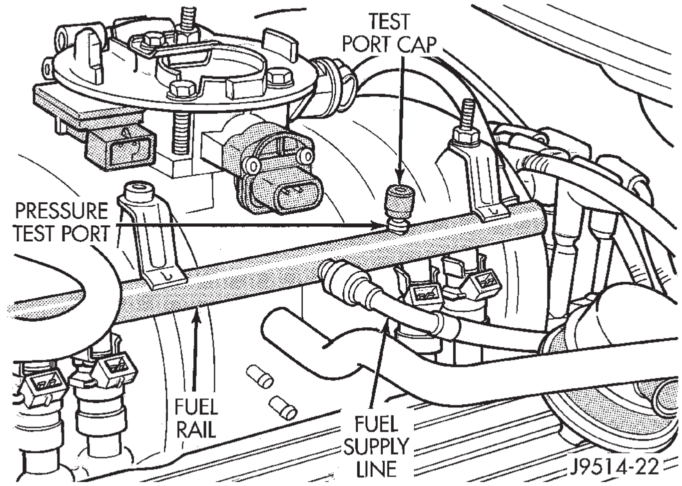


Fig. 7 Pressure Test Port Location—5.2L Engine

(4) Obtain the fuel pressure gauge/hose assembly from fuel pressure gauge tool set 5069. Remove the gauge from the hose.

(5) Place one end of hose (gauge end) into an approved gasoline container.

(6) Place a shop towel under the test port.

(7) To release fuel pressure, screw the other end of hose onto the fuel pressure test port.

(8) After fuel pressure has been released, remove the hose from the test port.

(9) Install protective cap to fuel test port.

FUEL SYSTEM PRESSURE TEST

The vacuum assisted fuel pressure regulator located on the fuel rail is no longer used on the 4.0L or 5.2L engine.

Fuel systems on the 4.0L and 5.2L engines are equipped with a fuel tank module mounted, fuel pressure regulator (Fig. 4). The fuel pressure regulator is a mechanical device that is not controlled by the powertrain control module (PCM) or by engine vacuum.

With engine at idle speed, system fuel pressure should be 255-283 kPa (39 psi ± 2 psi).

(1) Remove the protective cap at the fuel rail (Figs. 6 or 7). Connect the 0-414 kPa (0-60 psi) fuel pressure gauge (from Gauge Set 5069) to test port pressure fitting on fuel rail (Fig. 8).

(2) Note pressure gauge reading. Fuel pressure should be 255-283 kPa (39 psi ± 2 psi) at idle.

(3) If pressure is at O psi, connect DRB scan tool and refer to operating instructions in the appropriate Powertrain Diagnostics Procedures service manual.

If operating pressure is above 41 psi, the electric fuel pump is OK, but the fuel pressure regulator if defective. Replace fuel pump module assembly.

FUEL PUMP CAPACITY TEST

Before performing this test, verify fuel pump pressure by performing the previous tests.

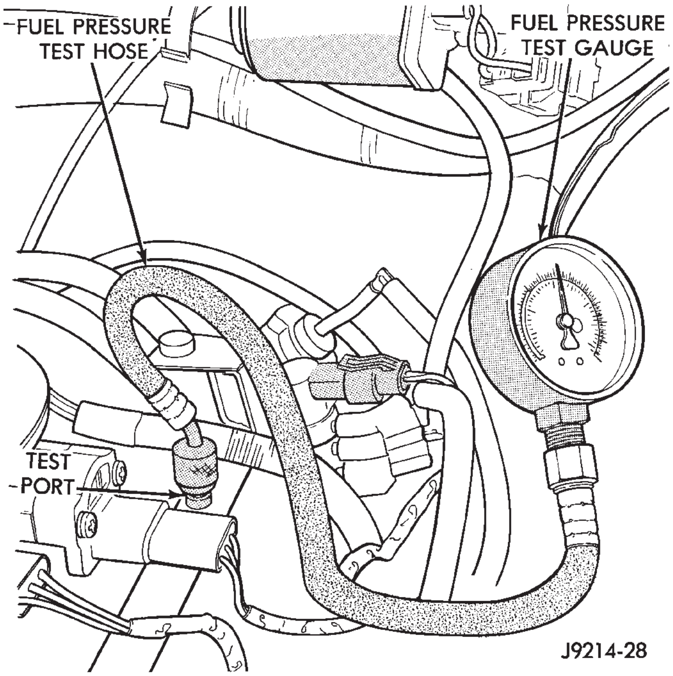


Fig. 8 Typical Fuel Pressure Test Connection

(1) Release the fuel system pressure from fuel system. Refer to the previous Fuel System Pressure Release Procedure in this group.

(2) Disconnect the fuel supply line at the fuel rail. Refer to Fuel Tubes/Lines/Hoses and Clamps in this section of the group for procedures.

(3) Connect Fuel Line Pressure Test Adapter Tool number 6631 (3/8 in.) into the disconnected fuel supply line. Insert the other end of tool 6631 into an approved gasoline container.

(4) To activate the fuel pump and pressurize the system, obtain the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures service manual for DRB operation.

(5) A good fuel pump will deliver at least 1 liter of fuel per minute.

FUEL PRESSURE LEAK DOWN TEST

ENGINE OFF

Abnormally long periods of cranking to restart a hot engine that has been shut down for a short period of time may be caused by:

- Fuel pressure bleeding past a fuel injector(s).
- Fuel pressure bleeding past the check valve in the fuel pump module.

(1) Disconnect the fuel inlet line at fuel rail. Refer to Fuel Tubes/Lines/Hoses and Clamps in this section of the group for procedures.

(2) Connect Fuel Line Pressure Test Adapter Tool number 6539 (5/16 in.), or Adapter Tool number 6631 (3/8 in.) between the disconnected fuel line and fuel rail (Fig. 9).

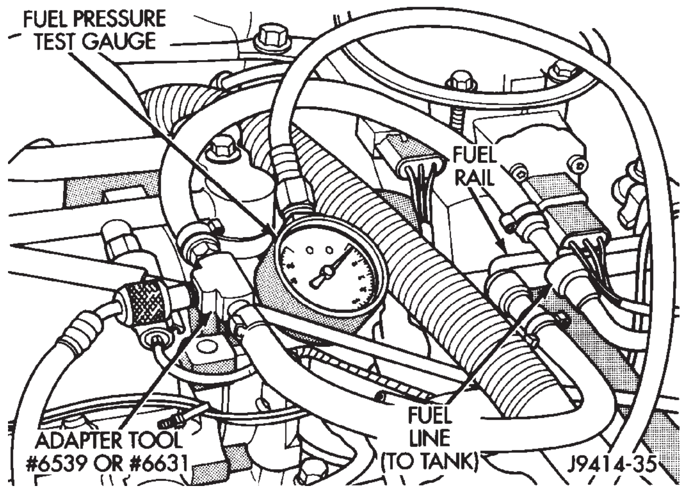


Fig. 9 Connecting Adapter Tool—Typical

(3) Connect the 0-414 kPa (0-60 psi) fuel pressure test gauge (from Gauge Set 5069) to the test port on either tool 6631 or 6539. **The fittings on both tools must be in good condition and free from any small leaks before performing the proceeding test.**

(4) Start engine and bring to normal operating temperature.

(5) Observe test gauge. Normal operating pressure at the fuel rail test port should be 255-283 kPa (39 psi ± 2 psi).

(6) Shut engine off.

(7) Pressure should not fall below 24 psi for five minutes.

(8) If pressure falls below 24 psi, it must determined if a fuel injector, the fuel module mounted fuel pressure regulator or a fuel tube/line is leaking.

(9) Again, start engine and bring to normal operating temperature.

(10) Shut engine off.

(11) **Checking for fuel injector leakage:** Clamp off the rubber hose portion of either tool 6539 or 6631 between the disconnected fuel tube (line) and test port inlet. If pressure now holds at or above 24 psi, a fuel injector or the fuel rail is leaking.

Checking for fuel pump module or fuel tube leakage: Clamp off the rubber hose portion of either tool 6539 or 6631 between the fuel rail and test port inlet. If pressure now holds at or above 24 psi, a leak can be found at a fuel tube/line. If no leaks are found at fuel tubes or lines, replace the fuel pump module.

MECHANICAL MALFUNCTIONS

Mechanical malfunctions are more difficult to diagnose with this system. The powertrain control module (PCM) has been programmed to compensate for some mechanical malfunctions such as incorrect cam timing, vacuum leaks, etc. If engine performance problems are encountered and diagnostic trouble codes are not displayed, the problem may be mechanical rather than electronic.

FUEL FILTER

The fuel filter protects the fuel injectors from dirt, water and other foreign matter. The filter is located under the vehicle near the front of fuel tank (Fig. 10). Replace fuel filter at intervals specified in the Lubrication and Maintenance Schedule chart found in Group 0, Lubrication and Maintenance.

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING THE FUEL FILTER.

(1) Disconnect negative battery cable. Remove fuel filler cap.
(2) Release fuel system pressure. Refer to the previous Fuel System Pressure Release Procedure in this section.
(3) Raise and support vehicle.
(4) Place shop towels under fuel filter.
(5) Disconnect fuel lines at filter. Refer to Quick-Connect Fittings in this group for procedures.

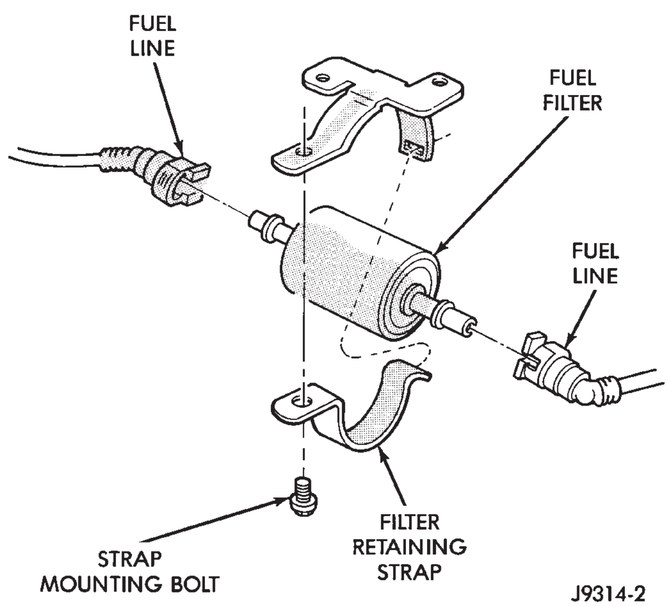


Fig. 10 Fuel Filter

(6) Remove retaining strap mounting bolt (Fig. 10).
(7) Remove filter retaining strap (Fig. 10).
(8) Remove filter from mounting bracket.

INSTALLATION

CAUTION: The ends of the fuel filter are marked for correct installation. Install filter with the end marked IN towards fuel tank and the end marked OUT towards engine.

(1) Place fuel filter in retaining strap with the marked ends in the correct position.
(2) Install retaining strap bolt. Tighten to 7 N·m (66 in. lbs.) torque.
(3) Install fuel lines to filter. Refer to Fuel Tubes/Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings in this group for procedures.
(4) Lower vehicle.
(5) Connect negative battery cable.
(6) Start engine and check for leaks.

FUEL TUBES/LINES/HOSES AND CLAMPS

Also refer to the proceeding section on 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.

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 1 N·m (15 in. lbs.) torque.

QUICK-CONNECT FITTINGS

Also refer to the previous Fuel Tubes/Lines/Hoses and Clamps section.

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.

SINGLE-TAB TYPE

This type of fitting is equipped with a single pull tab (Fig. 11). The tab is removable. After the tab is removed, the quick-connect fitting can be separated from the fuel system component.

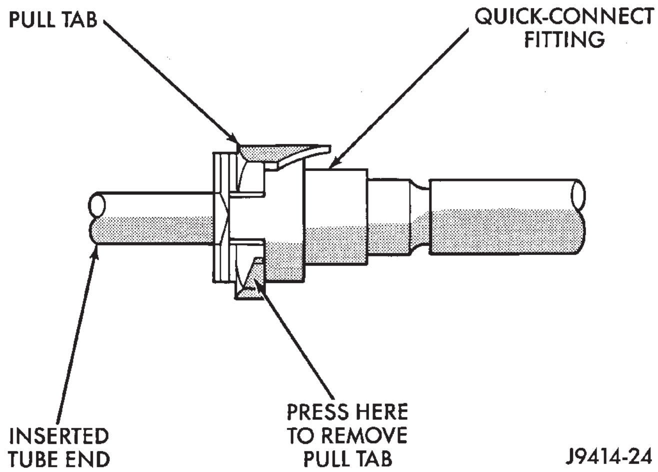


Fig. 11 Single-Tab Type Fitting

CAUTION: The interior components (o-rings, spacers) of this type of quick-connect fitting are not serviced separately, but new pull tabs are available. 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) Disconnect negative battery cable from battery.

(2) Perform the fuel pressure release procedure. Refer to the Fuel System Pressure Release Procedure in this section.

(3) Clean the fitting of any foreign material before disassembly.

(4) Press the release tab on the side of fitting to release pull tab (Fig. 11).

CAUTION: If this release tab is not pressed prior to releasing the pull tab, the pull tab will be damaged.

(5) While pressing the release tab on the side of the fitting, use a screwdriver to pry up the pull tab (Fig. 12).

(6) Raise the pull tab until it separates from the quick-connect fitting (Fig. 13). Discard the old pull tab.

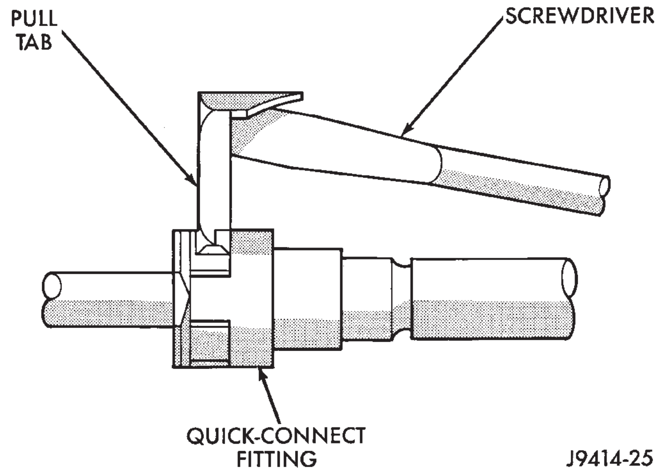


Fig. 12 Disconnecting Single-Tab Type Fitting

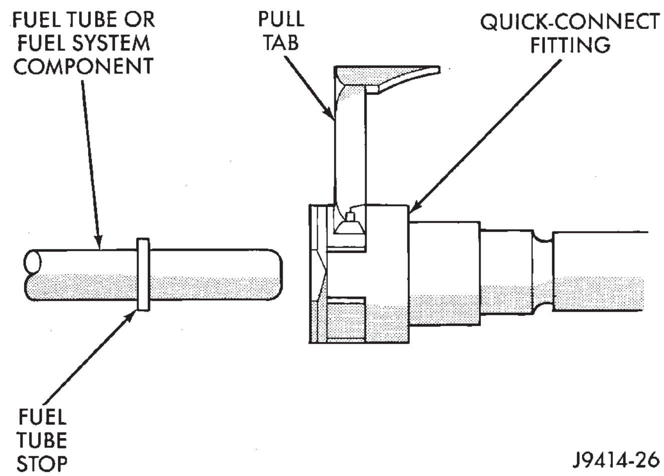


Fig. 13 Removing Pull Tab

(7) Disconnect the quick-connect fitting from the fuel system component being serviced.

(8) Inspect the quick-connect fitting body and fuel system component for damage. Replace as necessary.

(9) Prior to connecting the quick-connect fitting to component being serviced, check condition of fitting and component. Clean the parts with a lint-free cloth. Lubricate them with clean engine oil.

(10) Insert the quick-connect fitting into the fuel tube or fuel system component until the built-on stop on the fuel tube or component rests against back of fitting.

(11) Obtain a new pull tab. Push the new tab down until it locks into place in the quick-connect fitting.

(12) Verify a locked condition by firmly pulling on fuel tube and fitting.

(13) Connect negative cable to battery.

(14) Start engine and check for leaks.

TWO-TAB TYPE FITTING

This type of fitting is equipped with tabs located on both sides of the fitting (Fig. 14). These tabs are supplied for disconnecting the quick-connect fitting from component being serviced.

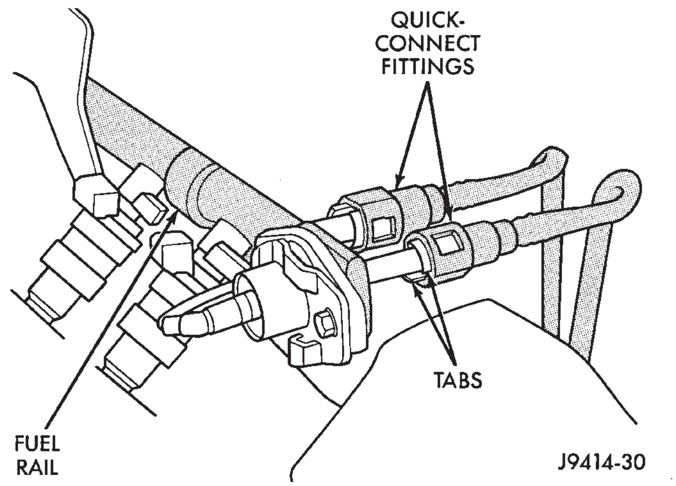


Fig. 14 Typical Two-Tab Type Quick-Connect Fitting

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.

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) Disconnect negative battery cable from the battery.

(2) Perform the fuel pressure release procedure. Refer to the Fuel System Pressure Release Procedure in this section.

(3) Clean the fitting of any foreign material before disassembly.

(4) To disconnect the quick-connect fitting, squeeze the plastic retainer tabs against the sides of the quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer. Pull the fitting from the fuel system component being serviced. The plastic retainer will remain on the component being serviced after fitting is disconnected. The o-rings and spacer will remain in the quick-connect fitting connector body.

(5) Inspect the 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 the quick-connect fitting to component being serviced, check condition of fitting and component. Clean the parts with a lint-free cloth. Lubricate them with clean engine oil.

(7) Insert the quick-connect fitting to the component being serviced and into the 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.

(9) Connect negative cable to battery.

(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. 15) usually black in color.

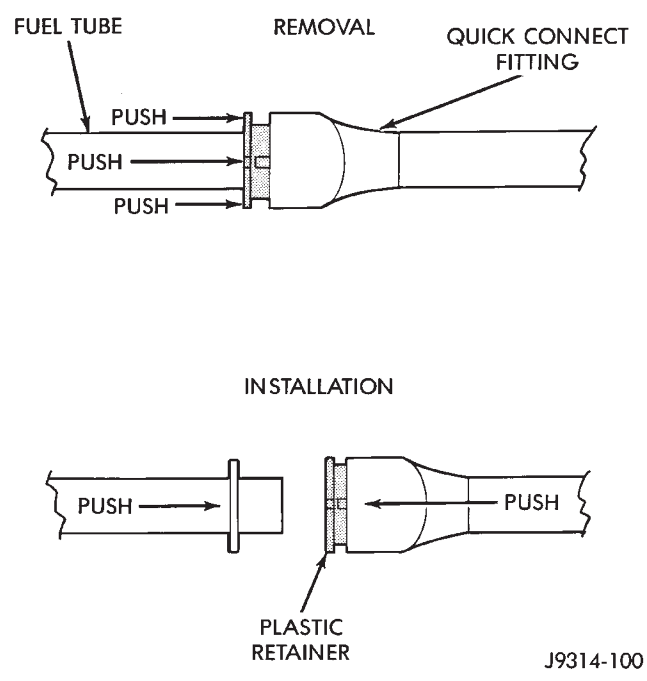


Fig. 15 Plastic Retainer Ring Type Fitting

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) Disconnect negative battery cable from the battery.

(2) Perform the fuel pressure release procedure. Refer to the Fuel System Pressure Release Procedure in this section.

(3) Clean the fitting of any foreign material before disassembly.

(4) To release the fuel system component from the quick-connect fitting, firmly push the fitting towards the component being serviced while firmly pushing the plastic retainer ring into the fitting (Fig. 15). With the plastic ring depressed, pull the fitting from the component. **The plastic retainer ring must be pressed squarely into the fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on the shoulder of the plastic retainer ring to aid in disconnection.**

After disconnection, the plastic retainer ring will remain with the quick-connect fitting connector body.

(5) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

(6) Prior to connecting the quick-connect fitting to component being serviced, check condition of fitting and component. Clean the parts with a lint-free cloth. Lubricate them with clean engine oil.

(7) Insert the quick-connect fitting into the component being serviced until a click is felt.

(8) Verify a locked condition by firmly pulling on fuel tube and fitting.

(9) Connect negative battery cable to battery.

(10) Start engine and check for leaks.

FUEL LINE WITH LATCH CLIP

DISCONNECTION/CONNECTION AT FUEL RAIL

A latch clip is used to secure the fuel line to the fuel rail on the 5.2L V-8 engine (Fig. 16). A special tool will be necessary to separate the fuel line from the fuel rail after the latch clip is removed.

(1) Disconnect the negative battery cable from battery.

(2) Perform the fuel pressure release procedure. Refer to the Fuel System Pressure Release Procedure in this section.

(3) Clean the fitting of any foreign material before disassembly.

(4) Pry up on the latch clip with a screwdriver (Fig. 17).

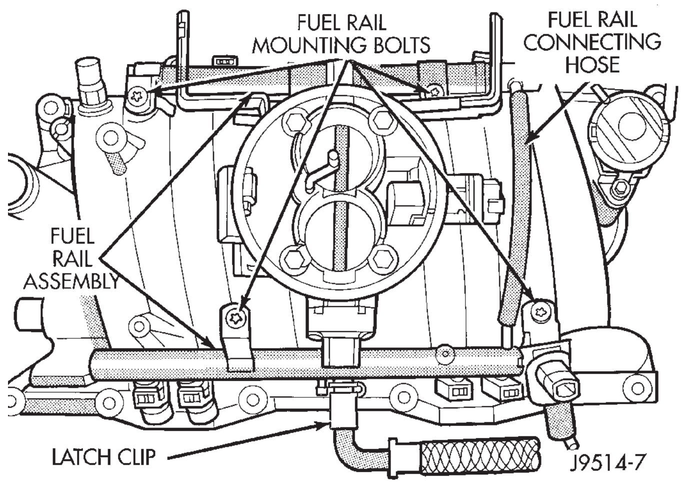


Fig. 16 Latch Clip Location—Typical

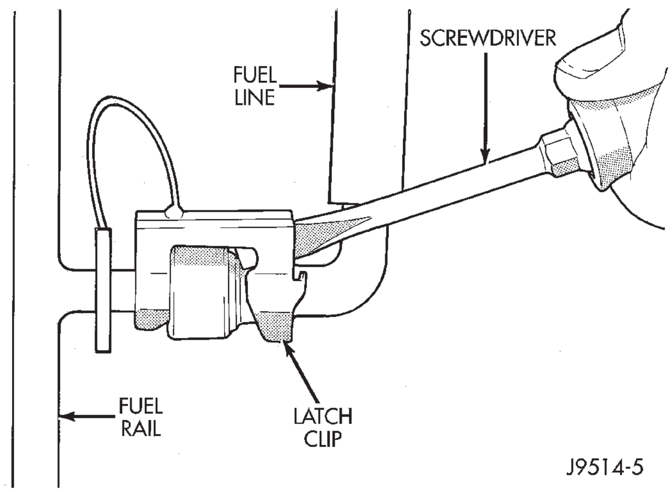


Fig. 17 Latch Clip Removal—Typical

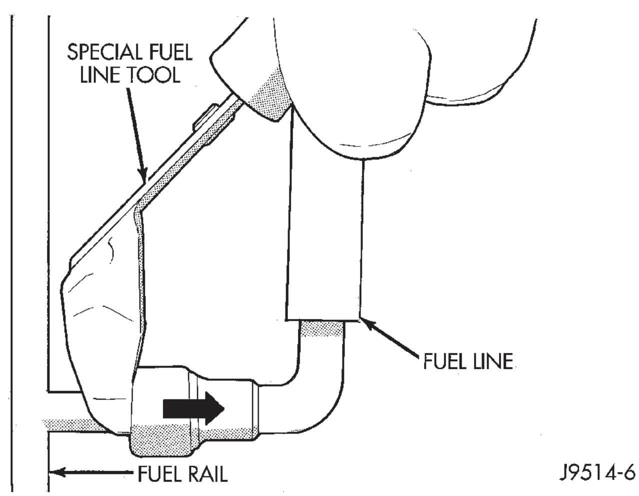


Fig. 18 Fuel Line Disconnection—Typical

(5) Slide the latch clip toward the fuel rail while lifting with the screwdriver.

(6) Remove the latch clip from fuel rail.

(7) Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into the fuel line (Fig. 18). Use this tool to release the locking fingers in the end of the line.

(8) With the special tool still inserted, pull the fuel line from the fuel rail.

After disconnection, the locking fingers will remain within the quick-connect fitting at the end of the fuel line.

(9) Inspect fuel line fitting, locking fingers and fuel rail fitting for damage. Replace as necessary.

(10) Prior to connecting the fuel line to the fuel rail, check condition of both fittings. Clean the parts with a lint-free cloth. Lubricate them with clean engine oil.

(11) Insert the fuel line onto the fuel rail until a click is felt.

(12) Verify a locked condition by firmly pulling on fuel line and fitting (15-30 lbs.).

(13) Install latch clip (snaps into position). **If the latch clip will not fit, this indicates the fuel line is not properly installed to the fuel rail. Recheck the fuel line connection.**

(14) Connect negative battery cable to battery.

(15) Start engine and check for leaks.

FUEL TANKS

INDEX

GENERAL INFORMATION

These vehicles 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 a pressure relief/rollover valve mounted in the top of the fuel pump module.

An evaporative control system prevents raw fuel vapor from escaping into the atmosphere. Fuel vapors from the fuel tank are collected in the EVAP canister. When the engine is operating, the vapors are drawn into the intake manifold to be used in combustion. Refer to Group 25, Emission Control System for more information.

Inspect all hose/tube connections for completeness. Be sure that leaks are not present. Replace any hose that is cracked, scuffed, swelled, has rubbed against other vehicle components or shows any other sign of wear that could lead to failure. If it is necessary to replace a hose, only hose marked EFM/EFI may be used.

When installing hoses, be sure that they are routed away from contact with other vehicle components.

The hose clamps used on fuel injected vehicles are of a special rolled edge construction to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used on this system. Other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

NO-LEAD FUEL TANK FILLER TUBE

These vehicles are designed to operate using Unleaded fuels. The diameter of the opening in the fuel tank filler neck is sized to only accept unleaded fuel nozzles. Gasoline station pumps for unleaded and leaded fuels have different size nozzles. Leaded fuel nozzles are larger in diameter than unleaded nozzles. The fuel tank filler neck opening is also equipped with a deflector, which the smaller unleaded nozzle pushes back upon entering the filler neck. The deflector will prevent the larger diameter leaded fuel nozzles from entering the filler neck and will deflect fuel away from the filler neck. This happens if filling of the tank with leaded fuel is attempted.

A label is attached to the instrument panel under the fuel gauge that reads UNLEADED FUEL ONLY as a reminder to the driver. A similar label is located near the fuel tank filler.

FUEL TANK FILLER TUBE CAP

The loss of any fuel or vapor out of the filler neck is prevented by the use of a safety filler cap. This will release only under pressure of 10.9 to 13.45 kPa (1.58 to 1.95 psi). The vacuum release is between .97 and 2.0 kPa (.14 and .29 psi). This cap must be replaced by a similar unit if replacement is necessary.

CAUTION: Remove fuel tank filler tube cap prior to removing or repairing fuel lines to relieve fuel tank pressure.

HEAT SHIELDS

The sheet metal heat shields may have to be removed when servicing the fuel tank, fuel lines or vapor vent line. The heat shields must be installed to protect the lines and tank from the heat of the exhaust system. Refer to Group 11, Exhaust System and Intake Manifold for proper installation.

FUEL TANK CAPACITIES

Refer to the Specifications section at the end of the Fuel System Group.

FUEL TANK

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL TANK.

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Release fuel system pressure. Refer to the Fuel System Pressure Release Procedure in the Fuel Delivery section of this group.

(3) Raise and support vehicle.

(4) Remove the fuel tank filler hose and vent hose retaining clamps (Fig. 1). Remove both tubes at fuel filler tube (Fig. 1).

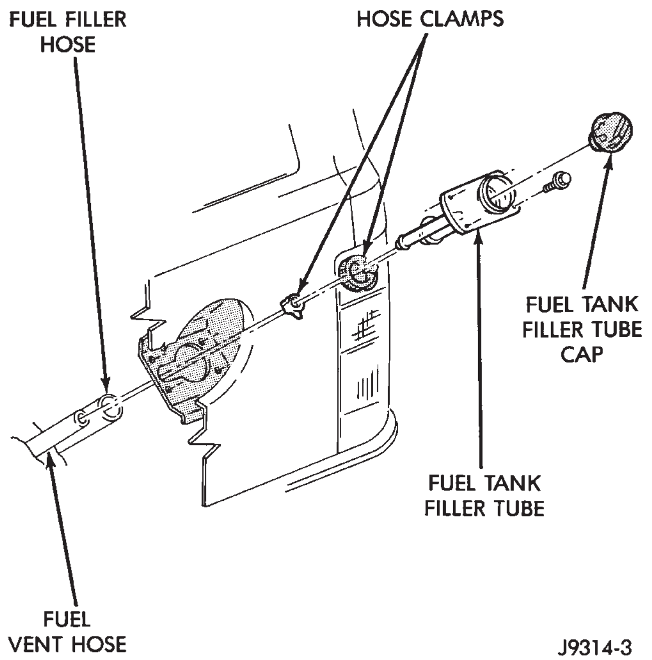


Fig. 1 Fuel Filler Tube and Hoses

(5) Remove the rear tow hooks (if equipped).

(6) Remove the fuel tank skid plate mounting nuts/bolts and remove skid plate (Fig. 2) (if equipped).

(7) Remove the optional trailer hitch (if equipped).

(8) Remove the exhaust tailpipe heat shield mounting bolts and remove shield.

CAUTION: To protect the fuel tank from exhaust heat, this shield must reinstalled after tank installation.

(9) Place a hydraulic jack to bottom of fuel tank.

WARNING: PLACE A SHOP TOWEL AROUND FUEL LINES TO CATCH ANY EXCESS FUEL.

(10) Disconnect fuel supply line at inlet side of fuel filter. Disconnect fuel vent line near front of tank. Refer to Fuel Tubes/Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings for procedures.

(11) Disconnect fuel pump module electrical connector near front of tank.

CAUTION: The right (passenger side) of the fuel tank must be lowered first to gain access to the two fuel filler hose clamps located on the left side of tank (Fig. 2).

(12) Remove the two fuel tank strap nuts (Fig. 2). Position both tank support straps away from tank.

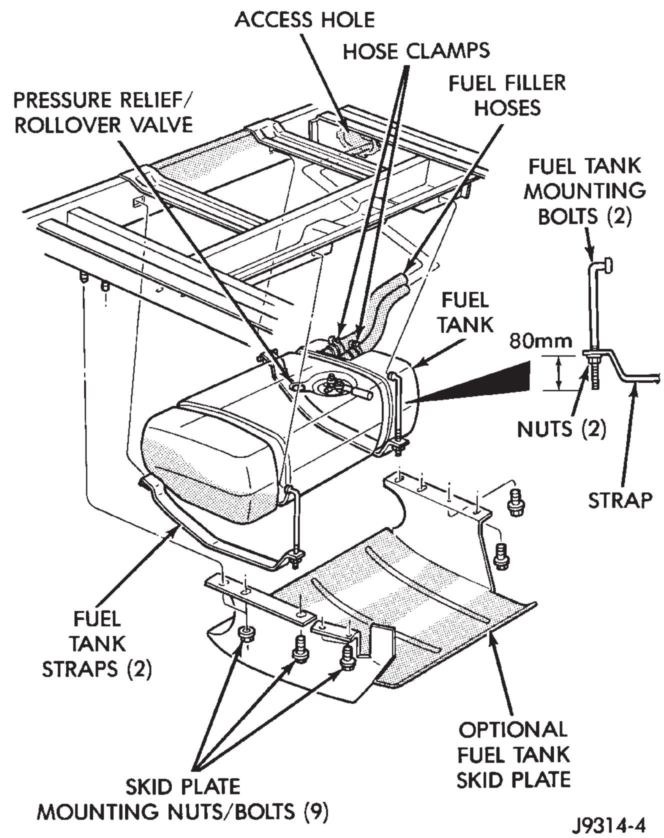


Fig. 2 Fuel Tank Mounting

(13) Carefully lower right side of tank while feeding fuel hoses through access hole in body (Fig. 2) until fuel tank filler hose clamps can be removed.

(14) Before removing fuel filler hoses (Fig. 2) from tank, mark their rotational position in relation to tank. Remove both hose clamps and hoses at tank (Fig. 2). Insert the drain hose (from an approved gasoline draining station) into either of the hose openings. Drain tank until empty.

(15) Continue lowering tank and remove from vehicle.

(16) If tank is to be replaced, disconnect fuel tank pressure relief/rollover valve (Fig. 2) from tank. For valve removal, refer to Fuel Tank Pressure Relief/ Rollover Valve in this section. Remove fuel pump module from tank. Refer to Fuel Pump Module Removal/Installation in the Fuel Delivery section of this group.

INSTALLATION

(1) Install fuel pump module and pressure relief/ rollover valve to tank (if removed).

(2) Connect the fuel filter-to-fuel pump module supply line to the fuel pump module. Refer to Fuel Tubes/Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings for procedures.

(3) Install fuel filler hoses and hose clamps (Fig. 2) to tank noting their previously marked position.

(4) Position fuel tank to hydraulic jack.

(5) Raise tank into position while guiding the fuel filler hoses into and through the access hole (Fig. 2) in body.

(6) Continue raising tank until positioned to body.

(7) Attach two fuel tank mounting straps and mounting nuts.

CAUTION: The two mounting nuts must be tightened until 80 mm (3.149 in.) is attained between the end of the mounting bolt and bottom of strap. See insert (Fig. 2). Do not over tighten nuts.

(8) Connect pump module electrical connector.

(9) Install exhaust tailpipe heat shield.

(10) Connect the fuel filter-to-fuel pump module supply line to the fuel filter. Refer to Fuel Tubes/ Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings for procedures.

(11) Install the fuel tank skid plate (Fig. 2) and trailer hitch (if equipped).

(12) Install the rear tow hooks (if equipped).

(13) Install the fuel tank filler hose and vent hose to tank necks. Tighten both retaining clamps (Fig. 1).

(14) Lower vehicle and connect battery cable to battery.

FUEL PUMP—REMOVAL/INSTALLATION

The electric fuel pump is not serviceable. If it needs replacement, the complete fuel pump module must be replaced. Refer to Fuel Pump Module in the Fuel Delivery System section of this group.

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit is not serviceable. If it needs replacement, the complete fuel pump module must be replaced. Refer to Fuel Pump Module in the Fuel Delivery System section of this group.

FUEL TANK PRESSURE RELIEF/ROLLOVER VALVE

The fuel tank is equipped with a pressure relief/ rollover valve (Fig. 3). The dual function valve will relieve fuel tank pressure and prevent fuel flow through the fuel tank vent tubes in the event of accidental vehicle rollover.

The valve consists of a plunger, spring and orifice/ guide plate (Fig. 4). The valve is normally open allowing fuel vapor to vent to the EVAP canister. Here it is stored until it can be consumed by the engine (under controlled conditions). The plunger seats in the guide plate at the orifice preventing liquid fuel from reaching the EVAP canister. This is done if bottom of plunger is contacted by fuel sloshing in tank when vehicle is cornering.

In the event of accidental vehicle rollover, the valve is inverted. In this position the plunger is forced against the guide plate and raw fuel is prevented from flowing through the valve orifice into the fuel tank vent tube.

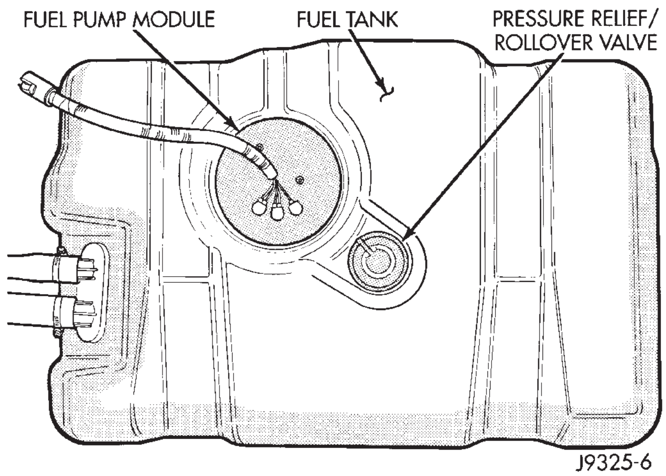


Fig. 3 Pressure Relief/Rollover Valve Location

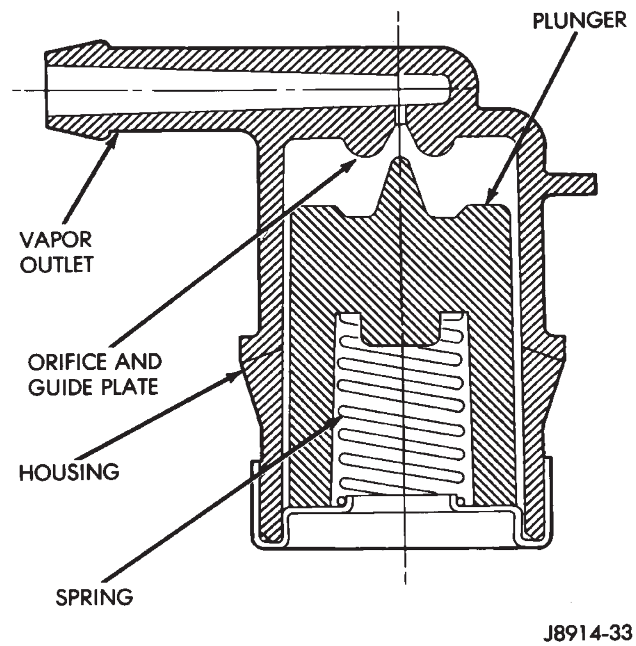


Fig. 4 Pressure Relief/Rollover Valve Operation

REMOVAL

(1) Disconnect negative battery cable.

(2) Drain and remove the fuel tank. Refer to Fuel Tank removal and installation in the Fuel Tank section of this group.

(3) The valve is seated in a grommet. Remove by prying one side upward and then roll the grommet out of tank.

INSTALLATION

(1) Start one side of grommet into opening in fuel tank. Using finger pressure only, press valve/grommet into place.

(2) Install fuel tank. Refer to Fuel Tank Installation.

(3) Fill fuel tank. Install fuel tank filler cap.

(4) Connect negative battery cable.

(5) Start vehicle and check for leaks.

ACCELERATOR PEDAL AND THROTTLE CABLE

GENERAL INFORMATION

The accelerator pedal is connected to the throttle body linkage by the throttle cable. The cable is protected by a plastic sheathing and is connected to the throttle body linkage by a ball socket (4.0L engine) or pin (5.2L engine). It is connected to the accelerator pedal arm by a plastic retainer (clip) (Fig. 1). This retainer (clip) snaps into the top of the accelerator pedal arm. Retainer tabs (built into the cable sheathing) (Fig. 1) fasten the cable to the dash panel.

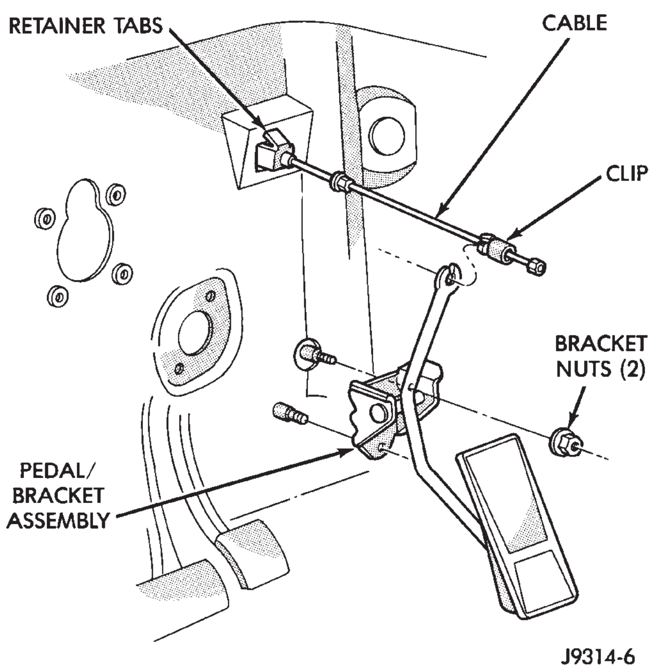


Fig. 1 Accelerator Pedal Mounting—Typical

Dual throttle return springs (attached to the throttle shaft) are used to close the throttle.

CAUTION: Never attempt to remove or alter these springs.

ACCELERATOR PEDAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

REMOVAL

(1) From inside the vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 1). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove accelerator pedal bracket nuts. Remove accelerator pedal assembly (Fig. 1).

INSTALLATION

(1) Place accelerator pedal assembly over studs protruding from floor pan. Tighten mounting nuts to 10 N·m (92 in. lbs.) torque.

(2) Slide throttle cable into opening in top of pedal arm. Push plastic cable retainer (clip) into pedal arm opening until it snaps into place.

(3) Before starting engine, operate accelerator pedal to check for any binding.

THROTTLE CABLE

REMOVAL

(1) From inside the vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 1). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove the cable core wire at pedal arm.

(3) From inside the vehicle, pinch both sides of the cable housing retainer tabs (Fig. 1) at the dash panel. Remove cable housing from dash panel and pull into the engine compartment.

(4) 4.0L Engine: Remove cable from clip on engine valve cover (Fig. 2) and clip at dash panel.

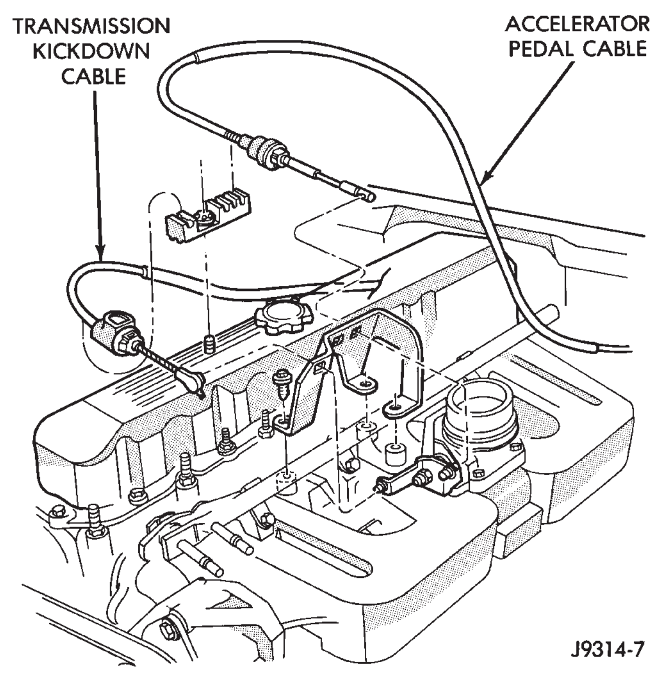


Fig. 2 Throttle Cable—4.0L Engine

(5) Remove the throttle cable ball end socket at throttle body linkage (Figs. 2 or 3) (snaps off).

(6) 4.0L Engine: Remove throttle cable from throttle body mounting bracket by compressing retainer tabs and pushing cable through hole in bracket. Remove throttle cable from vehicle.

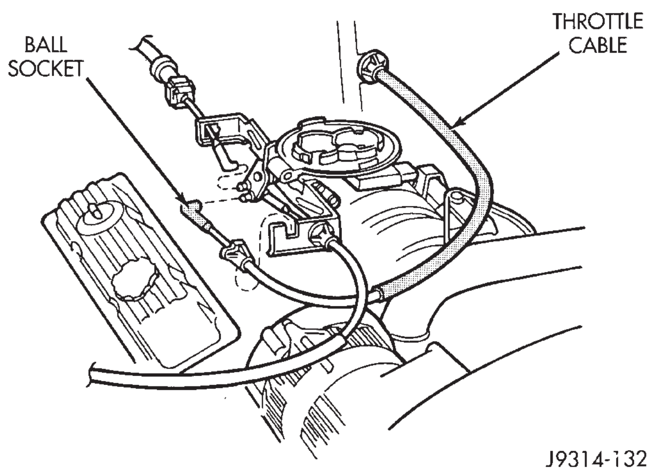


Fig. 3 Throttle Cable—5.2L V-8 Engine

(7) 5.2L Engine: Remove cable housing at throttle body mounting bracket by pressing forward on release tab with a small screwdriver (Fig. 4). **To prevent cable housing breakage, press on the tab only enough to release the cable from the bracket.** Lift the cable housing straight up from bracket while pressing on release tab. Remove throttle cable from vehicle.

INSTALLATION

(1) 4.0L Engine: Slide throttle cable through hole in throttle body bracket until retainer tabs lock into bracket. Connect cable ball end to throttle body linkage ball (snaps on).

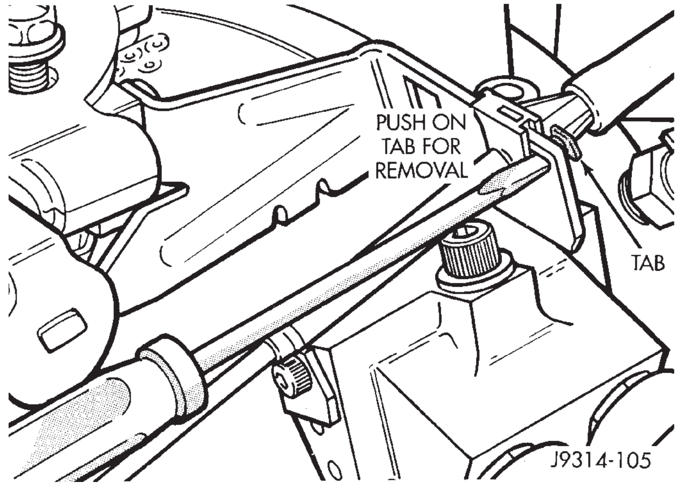


Fig. 4 Cable Release Tab—5.2L Engines—Typical

(2) 5.2L Engine: Connect cable ball end to throttle body linkage ball (snaps on). Connect cable to throttle body bracket (push down and lock).

(3) 4.0L Engine: Snap cable into clip on engine valve cover and clip at dash panel.

(4) Push other end of cable through opening in dash panel until retaining tabs lock into panel.

(5) From inside drivers compartment, slide throttle cable core wire into opening in top of pedal arm. Push cable retainer (clip) into pedal arm opening until it snaps in place.

(6) Before starting engine, operate accelerator pedal to check for any binding.

MULTI-PORT FUEL INJECTION (MFI)—4.0L 6 CYL. ENGINE—COMPONENT DESCRIPTION/SYSTEM OPERATION

INDEX

GENERAL INFORMATION

All 4.0L engines are equipped with sequential Multi-Port Fuel Injection (MFI). The MFI system provides precise air/fuel ratios for all driving conditions.

The powertrain control module (PCM) operates the fuel system. The PCM was formerly referred to as the SBEC or engine controller. The PCM is a pre-programmed, dual microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

Powertrain Control Module (PCM) Inputs represent the instantaneous engine operating conditions. Air-fuel mixture and ignition timing calibrations for various driving and atmospheric conditions are pre-programmed into the PCM. The PCM monitors and analyzes various inputs. It then computes engine fuel and ignition timing requirements based on these inputs. Fuel delivery control and ignition timing will then be adjusted accordingly.

Other inputs to the PCM are provided by the brake light switch, air conditioning select switch and the speed control switches. All inputs to the PCM are converted into signals.

Electrically operated fuel injectors spray fuel in precise metered amounts into the intake port directly above the intake valve. The injectors are fired in a specific sequence by the PCM. The PCM maintains an air/fuel ratio of 14.7 to 1 by constantly adjusting injector pulse width. Injector pulse width is the length of time that the injector opens and sprays fuel into the chamber. The PCM adjusts injector pulse width by opening and closing the ground path to the injector.

Manifold absolute pressure (air density) and engine rpm (speed) are the primary inputs that determine fuel injector pulse width. The PCM also monitors other inputs when adjusting air-fuel ratio.

Inputs That Effect Fuel Injector Pulse Width:
- Exhaust gas oxygen content
- Engine coolant temperature
- Manifold absolute pressure (MAP)
- Engine speed
- Throttle position
- Battery voltage
- Air conditioning selection
- Transmission gear selection (automatic transmissions only)
- Speed control

The powertrain control module (PCM) adjusts ignition timing by controlling ignition coil operation. The ignition coil receives battery voltage when the ignition key is in the run or starter position. The PCM provides a ground for the ignition coil. The coil discharges when the PCM supplies a ground. By switching the ground path on and off, the PCM regulates ignition timing.

The sensors and switches that provide inputs to the powertrain control module (PCM) comprise the Engine Control System. It is also comprised of the PCM Outputs (engine control devices that the are operated by the PCM).

SYSTEM DIAGNOSIS

The powertrain control module (PCM) tests many of its own input and output circuits. If a Diagnostic Trouble Code (DTC) is found in a major system, this information is stored in the PCM memory. Refer to On-Board Diagnostics in the MFI System—4.0L Engine—General Diagnosis section of this group for DTC information.

POWERTRAIN CONTROL MODULE (PCM)

The powertrain control module (PCM) (Fig. 1) operates the fuel system. The PCM was formerly referred to as the SBEC or engine controller. The PCM is a pre-programmed, dual microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

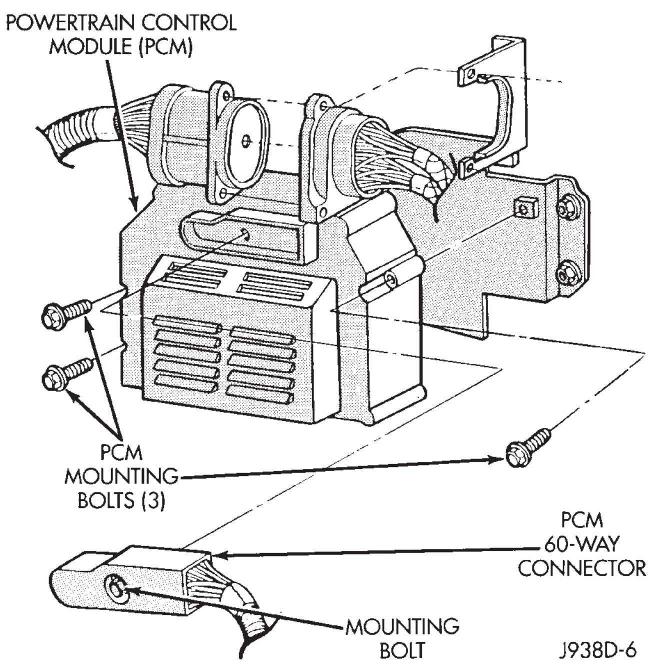


Fig. 1 Powertrain Control Module (PCM)

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as powertrain control module (PCM) outputs. The sensors and switches that provide inputs to the PCM are considered powertrain control module (PCM) inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

Powertrain Control Module (PCM) Inputs:

- Generator output
- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Intake manifold air temperature sensor
- Battery voltage
- Brake switch
- Engine coolant temperature sensor
- Crankshaft position sensor
- Ignition circuit sense (ignition switch in run position)
- Manifold absolute pressure sensor
- Overdrive/override switch
- Oxygen sensor
- Park/neutral switch (auto. trans. only)
- SCI receive (DRB scan tool connection)
- Speed control resume switch
- Speed control set switch
- Speed control on/off switch
- Camshaft position sensor signal
- Throttle position sensor
- Vehicle speed sensor
- Sensor return
- Power ground
- Signal ground

Powertrain Control Module (PCM) Outputs:

- A/C clutch relay
- Idle air control (IAC) motor
- Auto shutdown (ASD) relay
- Generator field
- Malfunction indicator lamp (Check engine lamp)
- Fuel injectors
- Fuel pump relay
- Ignition coil
- SCI transmit (DRB scan tool connection)
- Shift indicator lamp (manual transmission only)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (on instrument panel, if equipped)

The powertrain control module (PCM) contains a voltage convertor. This converts battery voltage to a regulated 8.0 volts. It is used to power the crankshaft position sensor, camshaft position sensor and vehicle speed sensor. The PCM also provides a five (5) volt supply for the manifold absolute pressure (MAP) sensor and throttle position sensor (TPS).

AIR CONDITIONING (A/C) CONTROLS—PCM INPUT

The A/C control system information applies to factory installed air conditioning units.

A/C SELECT SIGNAL: When the A/C switch is in the ON position and the A/C low-pressure switch is closed, an input signal is sent to the powertrain control module (PCM). The signal informs the PCM that A/C has been selected. The PCM then adjusts idle speed to a pre-programmed rpm through the idle air control (IAC) motor to compensate for increased engine load.

A/C REQUEST SIGNAL: Once A/C has been selected, the powertrain control module (PCM) receives the A/C request signal from the evaporator switch. The input indicates that the evaporator temperature is in the proper range for A/C application. The PCM uses this input to cycle the A/C compressor clutch through the A/C relay. It will also determine the correct engine idle speed through the idle air control (IAC) motor position.

If the A/C low-pressure switch opens (indicating a low refrigerant level), the PCM will not receive an A/C select signal. The PCM will then remove the ground from the A/C relay. This will deactivate the A/C compressor clutch.

If the evaporator switch opens, indicating that evaporator is not in proper temperature range, the PCM will not receive the A/C request signal. The PCM will then remove the ground from the A/C relay, deactivating the A/C compressor clutch.

AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The ASD relay is located in the power distribution center (PDC) in the engine compartment. It is used to connect the oxygen sensor heater element, ignition coil, generator field winding and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the powertrain control module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

BATTERY VOLTAGE—PCM INPUT

The battery voltage input provides power to the powertrain control module (PCM). It also informs the PCM what voltage level is supplied to the ignition coil and fuel injectors.

If battery voltage is low, the PCM will increase injector pulse width (period of time that the injector is energized). This is done to compensate for the reduced flow through the injector caused by the lowered voltage.

BRAKE SWITCH—PCM INPUT

When the brake light switch is activated, the powertrain control module (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 (IAC) motor. The brake switch input is also used to operate the speed control system.

CAMSHAFT POSITION SENSOR—PCM INPUT

A sync signal is provided by the camshaft position sensor located in the distributor (Fig. 2). The sync signal from this sensor works in conjunction with the crankshaft position sensor to provide the powertrain control module (PCM) with inputs. This is done to establish and maintain correct injector firing order.

Refer to Camshaft Position Sensor in Group 8D, Ignition System for more information.

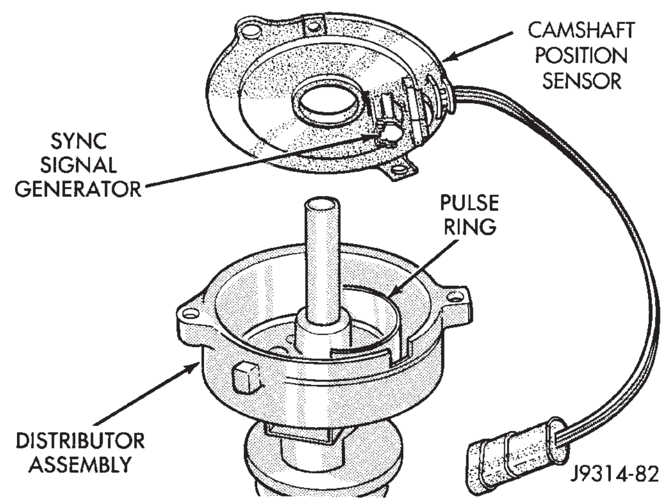


Fig. 2 Camshaft Position Sensor—Typical

DATA LINK CONNECTOR—PCM INPUT

The data link connector (diagnostic scan tool connector) links the DRB scan tool with the powertrain control module (PCM). The data link connector is located in the engine compartment (Fig. 3). For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

The data link connector uses two different pins on the PCM. One is for Data Link Transmit and the other is for Data Link Receive.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT

The intake manifold air temperature sensor is installed in the intake manifold with the sensor ele-

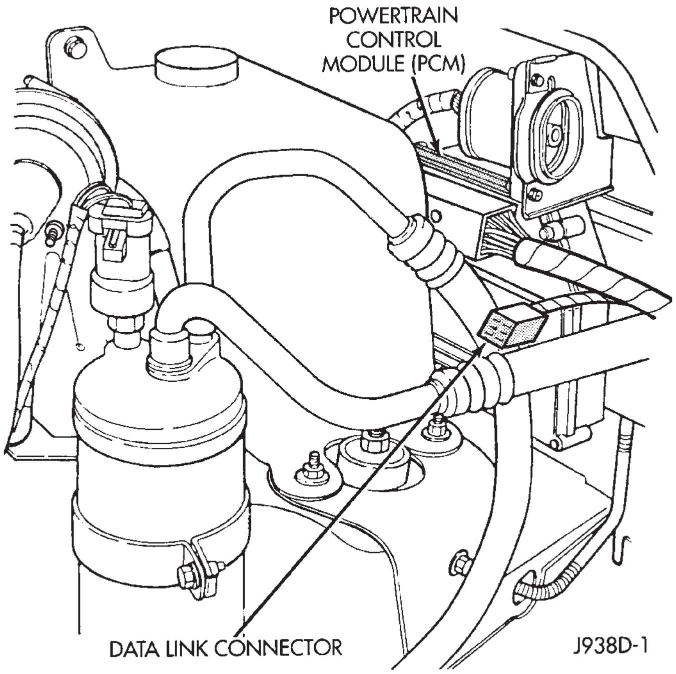


Fig. 3 Data Link Connector Location—Typical

ment extending into the air stream (Fig. 4). The sensor provides an input voltage to the powertrain control module (PCM) indicating intake manifold air temperature. The input is used along with inputs from other sensors to determine injector pulse width. As the temperature of the air-fuel stream in the manifold varies, the sensor resistance changes. This results in a different input voltage to the PCM.

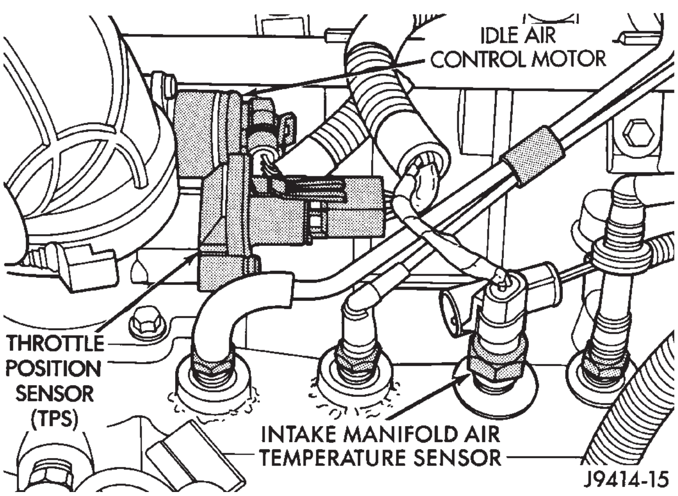


Fig. 4 Air Temperature Sensor

CRANKSHAFT POSITION SENSOR—PCM INPUT

This sensor is a hall effect device that detects notches in the flywheel (manual transmission), or flexplate (automatic transmission).

This sensor is used to indicate to the powertrain control module (PCM) that a spark and or fuel injection event is to be required. The output from this sensor, in conjunction with the camshaft position sensor signal, is used to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

The sensor is bolted to the transmission housing near the rear of the cylinder head (Figs. 5 or 6).

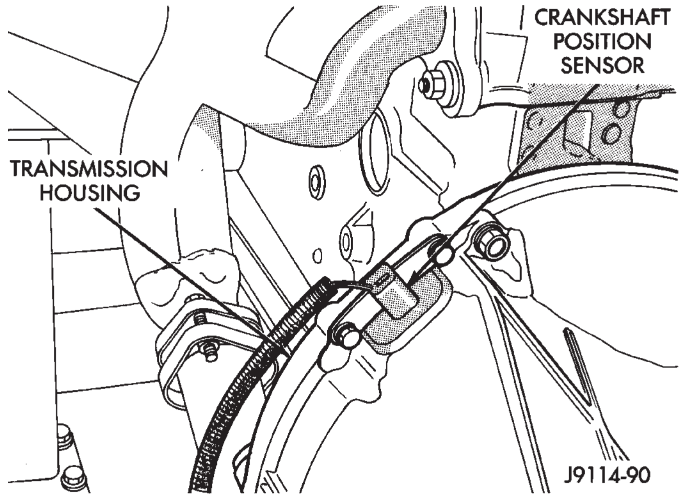


Fig. 5 Crankshaft Position Sensor—4.0L Engine With Man. Trans.

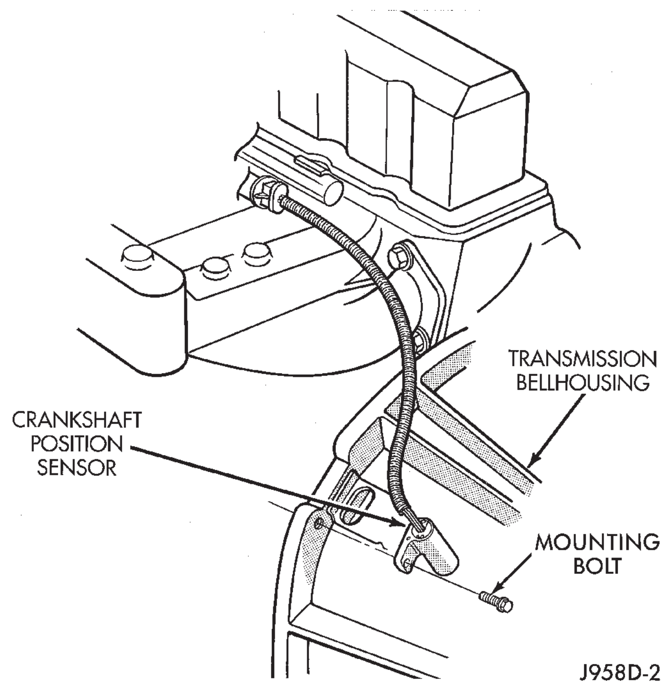


Fig. 6 Crankshaft Position Sensor—4.0L Engine With Auto. Trans.

Refer to Group 8D, Ignition System for more crankshaft position sensor information.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The engine coolant temperature sensor is installed in the thermostat housing (Fig. 7) and protrudes into the water jacket. The sensor provides an input voltage to the powertrain control module (PCM) relating engine coolant temperature. The PCM uses this input along with inputs from other sensors to determine injector pulse width and ignition timing. As coolant temperature varies, the coolant temperature sensor's resistance changes. The change in resistance results in a different input voltage to the PCM.

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

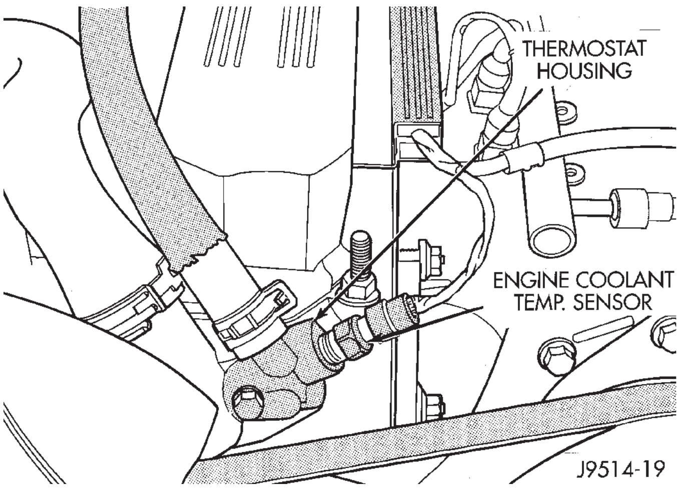


Fig. 7 Coolant Temperature Sensor

IGNITION CIRCUIT SENSE—PCM INPUT

The ignition circuit sense input tells the powertrain control module (PCM) the ignition switch has energized the ignition circuit. Refer to the wiring diagrams for circuit information.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

The MAP sensor reacts to absolute pressure in the intake manifold. It provides an input voltage to the powertrain control module (PCM). As engine load changes, manifold pressure varies. The change in manifold pressure causes MAP sensor voltage to change. The change in MAP sensor voltage results in a different input voltage to the PCM. The input voltage level supplies the PCM with information about ambient barometric pressure during engine start-up (cranking) and engine load while the engine is running. The PCM uses this input along with inputs from other sensors to adjust air-fuel mixture.

The MAP sensor is mounted on the dash panel (Fig. 8). The sensor is connected to the throttle body with a vacuum hose and to the PCM electrically.

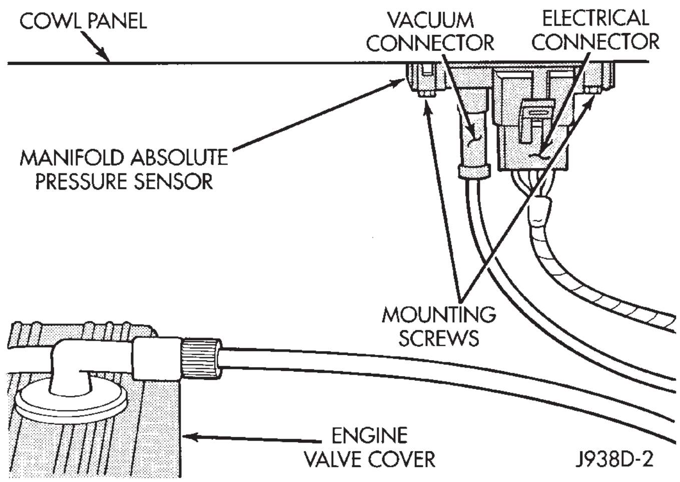


Fig. 8 Manifold Absolute Pressure (MAP) Sensor

OXYGEN (O2S) SENSOR—PCM INPUT

The O2S sensor is located in the exhaust down pipe (Fig. 9). It provides an input voltage to the powertrain control module (PCM) relating the oxygen content of the exhaust gas. The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

The O2S sensor produces voltages from 0 to 1 volt. This voltage will depend 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 a low voltage. When there is a lesser amount present (rich air-fuel mixture) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner.

In Closed Loop operation, the powertrain control module (PCM) monitors the O2S sensor input (along with other inputs). It then adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2S sensor input and adjusts injector pulse width to a preprogrammed value (based on other sensor inputs).

PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the transmission housing and provides an input to the powertrain control module (PCM). This will indicate that the automatic transmission is in Park, Neutral or a drive gear selection. This input is used to determine idle speed (varying with gear selection), fuel injector pulse width, ignition timing advance and vehicle speed control operation. Refer to Group 21, Transmissions, for testing, replacement and adjustment information.

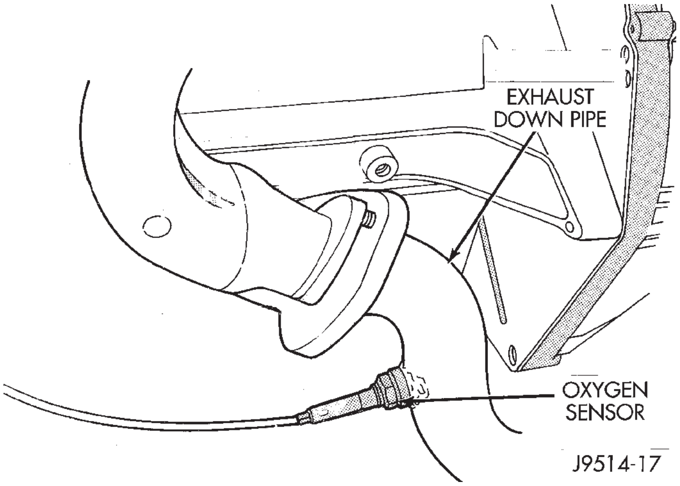


Fig. 9 Heated Oxygen Sensor Location

POWER GROUND

The power ground is used to control ground circuits for the following powertrain control module (PCM) loads:

- Generator Field Winding
- 8 volt (PCM) power supply
- Fuel Injectors
- Ignition Coil

SCI RECEIVE—PCM INPUT

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.

SPEED CONTROL—PCM INPUT

The speed control system provides three separate inputs to the powertrain control module (PCM); On/Off, Set and Resume. The On/Off input informs the PCM that the speed control system has been activated. The Set input informs the PCM that a fixed vehicle speed has been selected. The Resume input indicates to the PCM that the previous fixed speed is requested.

The speed control operating range is from 50 km/h to 142 km/h (35 to 85 mph). Inputs that effect speed control operation are:

- Brake switch position
- Park/neutral switch
- Vehicle speed sensor
- Throttle position sensor

Refer to Group 8H for further speed control information.

SENSOR RETURN—PCM INPUT

Sensor Return provides a low noise ground reference for all system sensors.

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The throttle position sensor (TPS) is mounted on the throttle body (Fig. 10). The TPS is a variable resistor that provides the powertrain control module (PCM) with an input signal (voltage) that represents throttle blade position. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the resistance of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from 1 volt at minimum throttle opening (idle), to 4 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

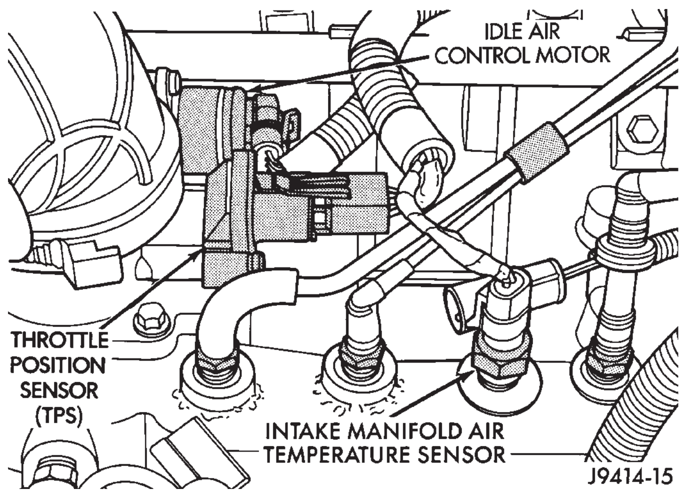


Fig. 10 Throttle Position Sensor and IAC Motor

VEHICLE SPEED SENSOR—PCM INPUT

The speed sensor (Fig. 11) is located in the extension housing of the transmission (2WD) or on the transfer case extension housing (4WD). The sensor input is used by the powertrain control module (PCM) to determine vehicle speed and distance traveled.

The 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. 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 deceleration conditions, the PCM adjusts the idle air control (IAC) motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

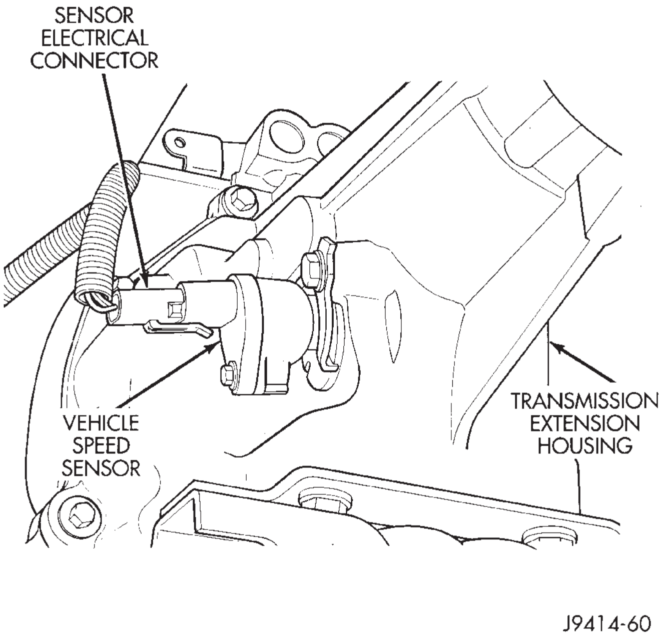


Fig. 11 Vehicle Speed Sensor—Typical

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

The powertrain control module (PCM) activates the A/C compressor through the A/C clutch relay. The PCM regulates A/C compressor operation by switching the ground circuit for the A/C clutch relay on and off. The relay is located in the power distribution center (PDC) (Fig. 12). For the location of the relay within the PDC, refer to label under PDC cover.

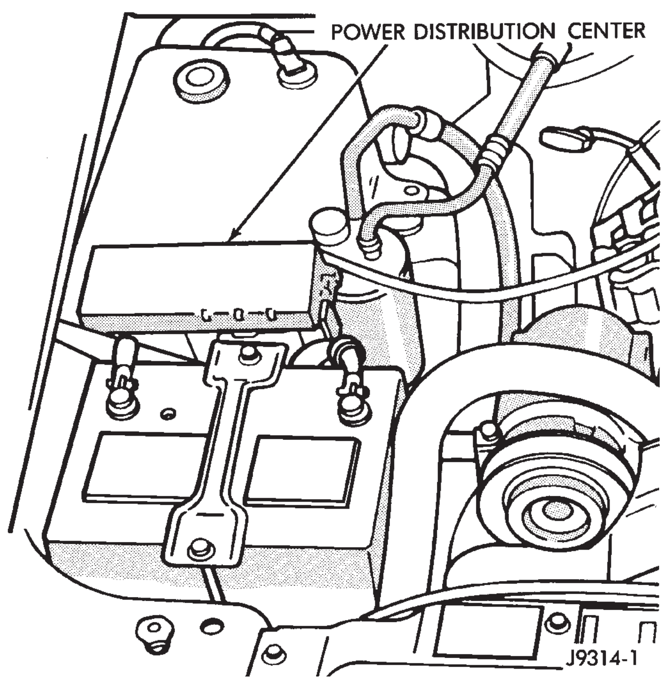


Fig. 12 Power Distribution Center (PDC)

When the PCM receives a request for A/C from the A/C evaporator switch, it will adjust idle air control (IAC) motor position. This is done to increase idle speed. The PCM will then activate the A/C clutch through the A/C clutch relay. The PCM then adjusts the idle air control (IAC) stepper motor position to compensate for increased engine load from the A/C compressor.

By switching the ground path for the relay on and off, the PCM is able to cycle the A/C compressor clutch. This is based on changes in engine operating conditions. If, during A/C operation, the PCM senses low idle speeds or a wide open throttle condition, it will de-energize the relay. This prevents A/C clutch engagement. The relay will remain de-energized until the idle speed increases or the wide open throttle condition exceeds 15 seconds, or no longer exists. The PCM will also de-energize the relay if engine coolant temperature exceeds 125°C (257°F).

IDLE AIR CONTROL (IAC) MOTOR—PCM OUTPUT

The IAC motor is mounted on the throttle body (Fig. 10) and is controlled by the powertrain control module (PCM).

The throttle body has an air control passage that provides air for the engine at idle (the throttle plate is closed). The IAC motor pintle protrudes into the air control passage and regulates air flow through it. Based on various sensor inputs, the powertrain control module (PCM) adjusts engine idle speed by moving the IAC motor pintle in and out of the air control passage. The IAC motor is positioned when the ignition key is turned to the On position.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

AUTO SHUTDOWN (ASD) RELAY—PCM OUTPUT

The ASD relay is located in the power distribution center (PDC) (Fig. 12). For the location of this relay within the PDC, refer to label under PDC cover.

The ASD supplies battery voltage to the fuel pump, fuel injector, ignition coil, generator field winding and oxygen (O2S) sensor heating element. The ground circuit for the coil in the ASD relay is controlled by the powertrain control module (PCM). The PCM operates the relay by switching the ground circuit on and off.

The fuel pump relay is controlled by the PCM through same circuit that the ASD relay is controlled.

DUTY CYCLE EVAP PURGE SOLENOID—PCM OUTPUT

4.0L ENGINE—CALIFORNIA EMISSION PACKAGE ONLY

The duty cycle EVAP purge solenoid is located in the engine compartment near the windshield washer reservoir tank (Fig. 13).

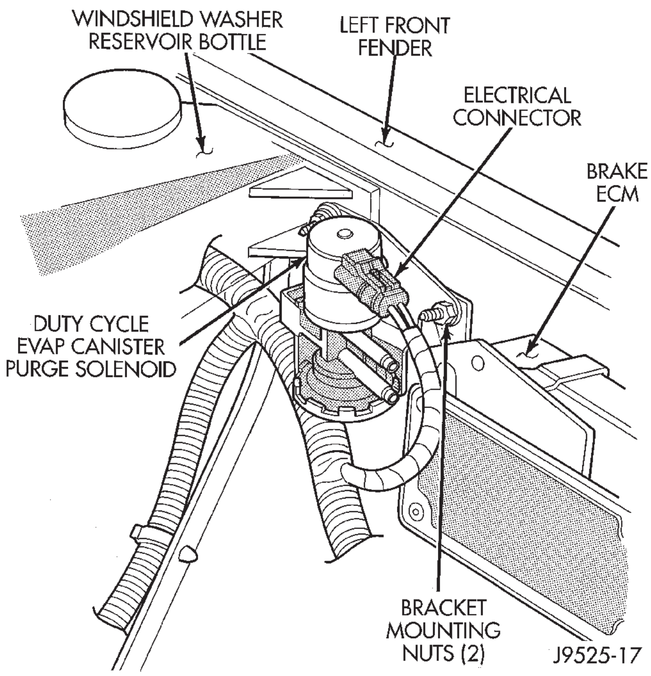


Fig. 13 Purge Solenoid—4.0L Engine—California Emission Package

The duty cycle EVAP purge solenoid regulates the rate of vapor flow from the EVAP canister to the intake manifold. The powertrain control module 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 engine enters closed loop operation after it reaches a specified temperature and the programmed time delay ends. During closed loop operation, the PCM energizes and de-energizes the solenoid 5 to 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time the solenoid is energized.

Refer to Group 25, Emission Control System for additional information.

GENERATOR FIELD—PCM OUTPUT

The powertrain control module (PCM) regulates the charging system voltage within a range of 12.9 to 15.0 volts. Refer to Group 8A for charging system information.

GENERATOR LAMP—PCM OUTPUT

If the powertrain control module (PCM) senses a low charging condition in the charging system, it will illuminate the generator lamp on the instrument panel. For example, during low idle with all accessories turned on, the lamp may momentarily go on. Once the PCM corrects idle speed to a higher rpm, the lamp will go out. Refer to Group 8A for charging system information.

DATA LINK CONNECTOR—PCM OUTPUT

Refer to the previous paragraphs on Data Link Connector—PCM Input for information.

FUEL INJECTORS—PCM OUTPUT

Six fuel injectors are attached to the fuel rail (Fig. 14).

The nozzle ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

The injectors are energized individually in a sequential order by the powertrain control module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

During start up, battery voltage is supplied to the injectors through the ASD relay. When the engine is operating, voltage is supplied by the charging system. The PCM determines injector pulse width based on various inputs.

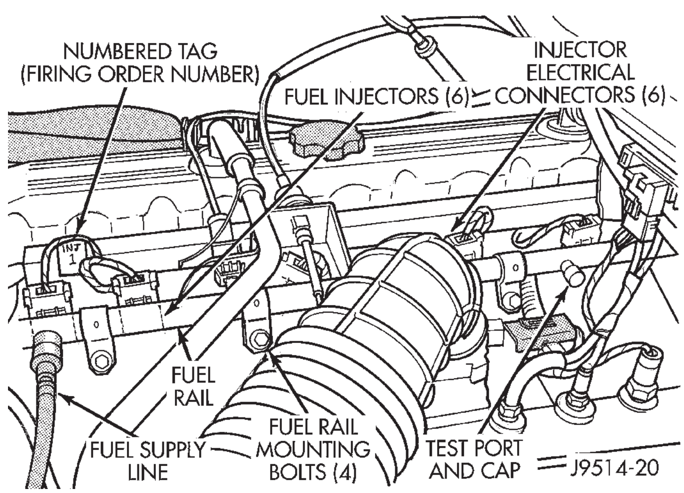


Fig. 14 Fuel Injectors—Typical

MALFUNCTION INDICATOR LAMP—PCM OUTPUT

The malfunction indicator lamp illuminates each time the ignition key is turned on. It will stay on for approximately three seconds as a bulb test. The lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 15).

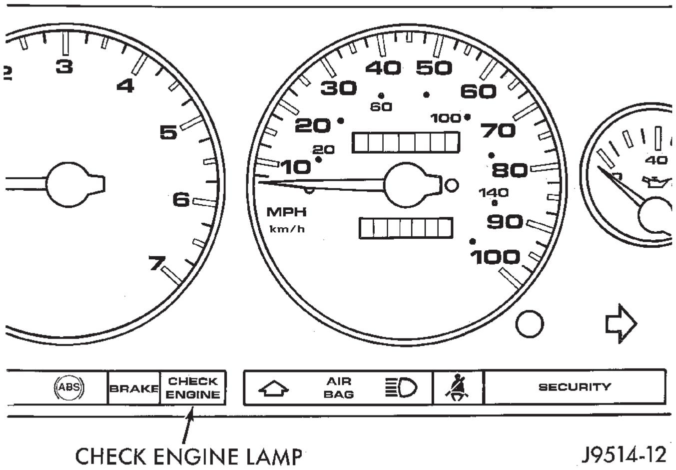


Fig. 15 Check Engine Lamp Location

If the powertrain control module (PCM) receives an incorrect signal, or no signal from certain sensors or emission related systems, the lamp is turned on. This is a warning that the PCM has recorded a system or sensor malfunction. In some cases, when a problem is declared, the PCM will go into a limp-in mode. This is an attempt to keep the system operating. It signals an immediate need for service.

The lamp can also be used to display a Diagnostic Trouble Code (DTC). Cycle the ignition switch On-Off-On-Off-On within three seconds and any codes stored in the PCM memory will be displayed. This is done in a series of flashes representing digits. Refer to On-Board Diagnostics in the General Diagnosis section of this group for more information.

IGNITION COIL—PCM OUTPUT

System voltage is supplied to the ignition coil positive terminal. The powertrain control module (PCM) operates the ignition coil. **Base (initial) ignition timing is not adjustable.** The PCM adjusts ignition timing to meet changing engine operating conditions.

The ignition coil is located near the distributor (Fig. 16).

SCI TRANSMIT—PCM OUTPUT

SCI Transmit is the serial data communication transmit circuit for the DRB scan tool. The powertrain control module (PCM) transmits data to the DRB through the SCI Transmit circuit.

SHIFT INDICATOR—PCM OUTPUT

Vehicles equipped with manual transmissions have an Up-Shift indicator lamp. The lamp is controlled by the powertrain control module (PCM). The lamp illuminates on the instrument panel to indicate when the driver should shift to the next highest gear for best fuel economy. The PCM will turn the lamp OFF

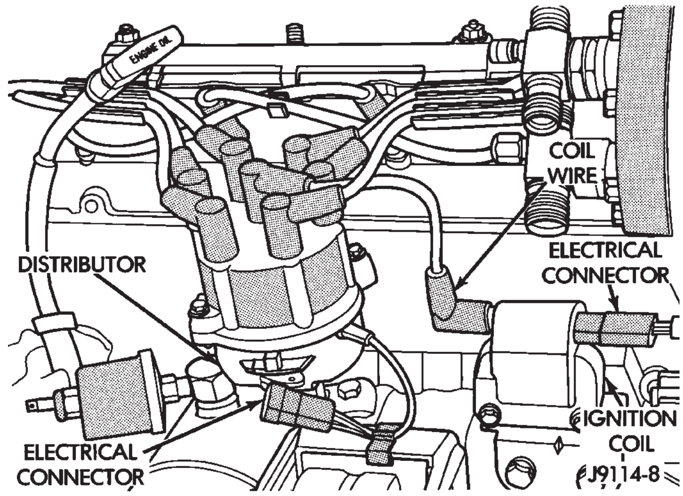


Fig. 16 Ignition Coil—Typical

after 3 to 5 seconds if the shift of gears is not performed. The up-shift lamp will remain off until vehicle stops accelerating and is brought back to range of up-shift lamp operation. This will also happen if vehicle is shifted into fifth gear.

The indicator lamp is normally illuminated when the ignition switch is turned on and it is turned off when the engine is started up. With the engine running, the lamp is turned on/off depending upon engine speed and load.

SPEED CONTROL—PCM OUTPUT

Speed control operation is regulated by the powertrain control module (PCM). The PCM controls the vacuum to the throttle actuator through the speed control vacuum and vent solenoids. Refer to Group 8H for Speed Control information.

TACHOMETER—PCM OUTPUT

The powertrain control module (PCM) supplies engine rpm values to the instrument cluster tachometer. Refer to Group 8E for tachometer information.

OPEN LOOP/CLOSED LOOP MODES OF OPERATION

As input signals to the powertrain control module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate 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.

MODES

- Open Loop
- Closed Loop

During Open Loop modes, the powertrain control module (PCM) receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensor is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensor input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:
• Ignition switch ON
• Engine start-up (crank)
• Engine warm-up
• Idle
• Cruise
• Acceleration
• Deceleration
• Wide open throttle (WOT)
• Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:
• The powertrain control module (PCM) pre-positions the idle air control (IAC) motor.
• The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
• The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
• Intake manifold air temperature sensor input is monitored
• Throttle position sensor (TPS) is monitored
• The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
• The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
• The O2S sensor heater element is energized through the fuel pump relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.
• The up-shift indicator lamp is illuminated (manual transmission only).

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The powertrain control module (PCM) receives inputs from:
• Battery voltage
• Engine coolant temperature sensor
• Crankshaft position sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Starter motor relay
• Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the powertrain control module (PCM) receives inputs from:
• Battery voltage
• Crankshaft position sensor
• Engine coolant temperature sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal (in the distributor)
• Park/neutral switch (gear indicator signal—auto. trans. only)
• Air conditioning select signal (if equipped)
• Air conditioning request signal (if equipped)

Based on these inputs the following occurs:
• Voltage is applied to the fuel injectors with the powertrain control module (PCM). The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
• The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.
• The PCM operates the A/C compressor clutch through the clutch relay. This is done if A/C has been selected by the vehicle operator and requested by the A/C thermostat.
• If the vehicle has a manual transmission, the up-shift lamp is operated by the PCM.

• When the engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the powertrain control module (PCM) receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensor

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the powertrain control module (PCM). The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the powertrain control module (PCM) receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen (O2S) sensor

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

ACCELERATION MODE

This is an Open Loop mode. The powertrain control module (PCM) recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the powertrain control module (PCM) receives the following inputs.

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply battery voltage to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

The PCM opens the ground circuit to the A/C clutch relay to disengage the A/C compressor clutch. This is done until the vehicle is no longer under deceleration (if the A/C system is operating).

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the powertrain control module (PCM) receives the following inputs.

• Battery voltage
• Crankshaft position sensor
• Engine coolant temperature sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal (in the distributor)

During wide open throttle conditions, the following occurs:

• Voltage is applied to the fuel injectors with the powertrain control module (PCM). The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
• The PCM adjusts ignition timing by turning the ground path to the coil on and off.
• The PCM opens the ground circuit to the A/C clutch relay to disengage the A/C compressor clutch. This will be done for approximately 15 seconds if the air conditioning system is operating.

If the vehicle has a manual transmission, the upshift lamp is operated by the PCM.

IGNITION SWITCH OFF MODE

When ignition switch is turned to the OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

THROTTLE BODY

Filtered air from the air cleaner enters the intake manifold through the throttle body (Fig. 17). Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors. The throttle body is mounted on the intake manifold. It contains an air control passage controlled by an idle air control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

The throttle position sensor (TPS) and idle air control (IAC) motor are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle arm.

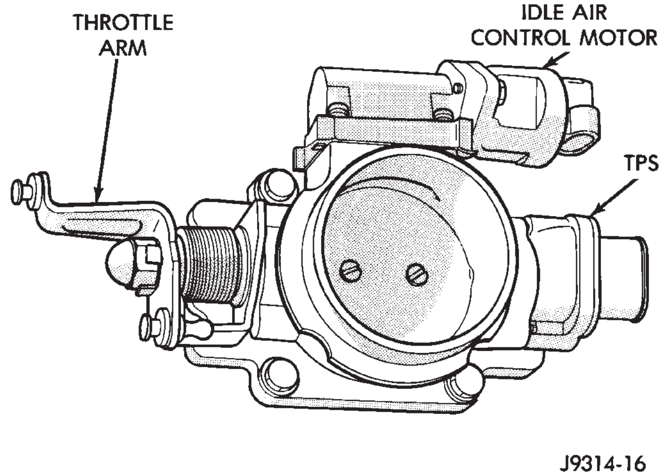


Fig. 17 Throttle Body—Typical

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

FUEL RAIL

The fuel rail supplies fuel to the injectors and is mounted to the intake manifold (Fig. 18). The fuel pressure regulator is no longer attached to the fuel rail. It is now part of the fuel pump module. The fuel pressure test port is integral with the rail and the rail is not repairable.

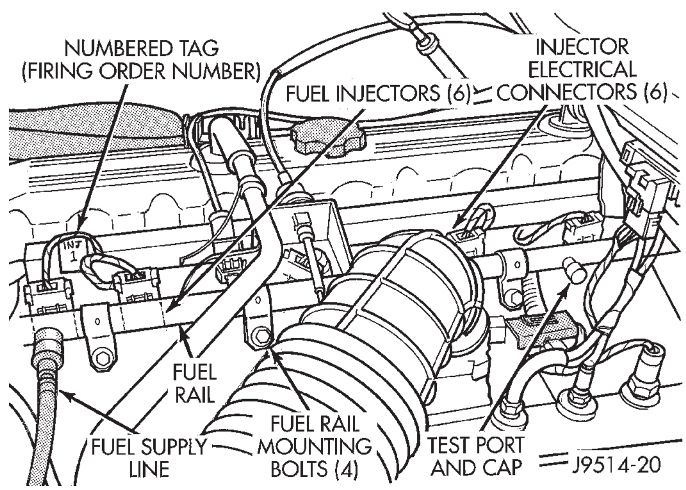


Fig. 18 Fuel Rail—Typical

FUEL PRESSURE REGULATOR

The fuel pressure regulator is no longer attached to the fuel rail. Refer to the Fuel Delivery section of this group for information.

MULTI-PORT FUEL INJECTION (MFI)—4.0L 6 CYL. ENGINE—GENERAL DIAGNOSIS

INDEX

GENERAL INFORMATION

All 4.0L engines are equipped with sequential Multi-Port Fuel Injection (MFI). The MFI system provides precise air/fuel ratios for all driving conditions.

VISUAL INSPECTION

A visual inspection for loose, disconnected, or incorrectly routed wires and hoses should be made. This should be done before attempting to diagnose or service the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Verify that the 60-way connector is fully inserted into the connector of the powertrain control module (PCM) (Fig. 1). Verify that the connector mounting bolt is tightened to 4 N·m (35 in. lbs.) torque.

(2) Inspect the battery cable connections. Be sure that they are clean and tight.

(3) Inspect fuel pump relay, air conditioning compressor clutch relay (if equipped) and ASD relay. These are located in the power distribution center (Fig. 2). Inspect starter motor relay connections. Inspect relays for signs of physical damage and corrosion.

(4) Inspect ignition coil connections. Look for bent or spread pins in the connector. Verify that coil secondary cable is firmly connected to coil (Fig. 3).

(5) Verify that distributor cap is correctly attached to distributor. Be sure that spark plug cables are firmly connected to the distributor cap and the spark plugs are in their correct firing order. Be sure that coil cable is firmly connected to distributor cap and coil. Be sure that camshaft position sensor wire connector (from in the distributor) is firmly connected to main harness connector (Fig. 4). Inspect spark plug condition. Refer to Group 8D, Ignition System. Connect vehicle to an oscilloscope and inspect spark events for fouled or damaged spark plugs or cables.

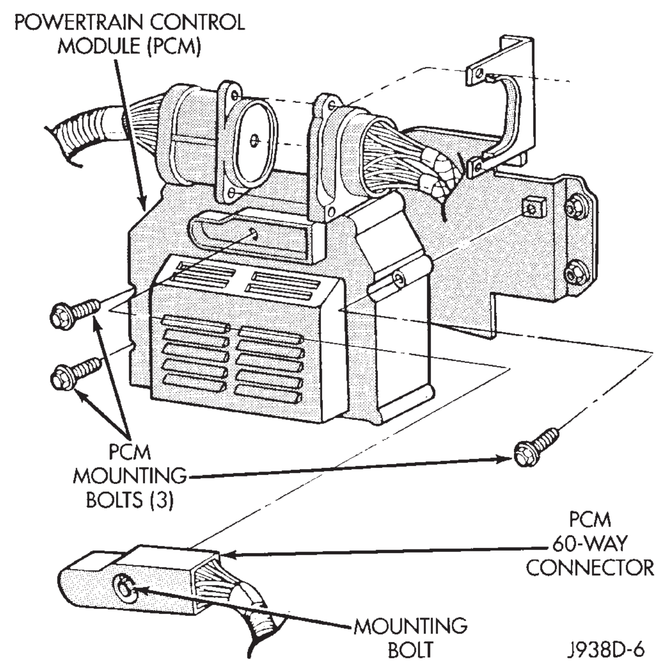


Fig. 1 Powertrain Control Module (PCM) Connector

(6) Verify that generator output wire, generator connector and ground wire are firmly connected to the generator (Fig. 5).

(7) Inspect the system ground connections. Refer to Group 8, Wiring Diagrams for ground locations. Be sure bolts are tight and ground terminals are clean. The powertrain control module (PCM) is grounded directly, and plugged individually, to the negative battery cable with a small jumper harness.

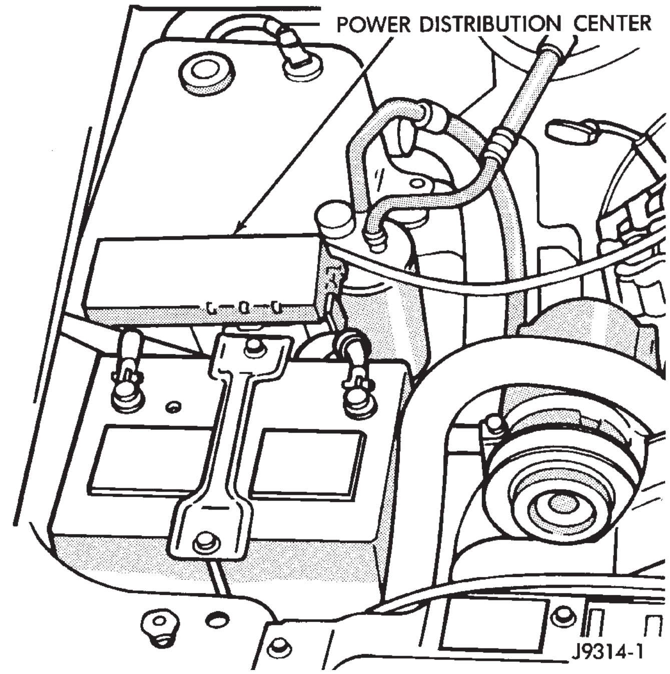


Fig. 2 Power Distribution Center

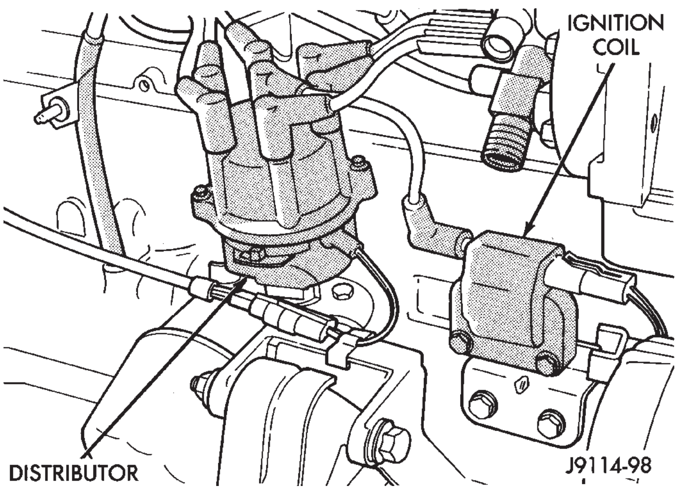


Fig. 3 Ignition Coil—Typical

(8) Verify that crankcase ventilation (CCV) fresh air hose is firmly connected to cylinder head and air cleaner covers. Refer to Group 25, Emission Control System for information.

(9) Inspect fuel line/tube quick-connect fitting-to-fuel rail connection (Fig. 6). For procedures, refer to Fuel Tubes/Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings in this group.

(10) Verify that hose connections to all ports of vacuum fittings on intake manifold are tight and not leaking.

(11) Inspect accelerator cable, transmission throttle cable (if equipped) and cruise control cable connections (if equipped). Check their connections to the throttle arm of throttle body for any binding or restrictions (Fig. 7).

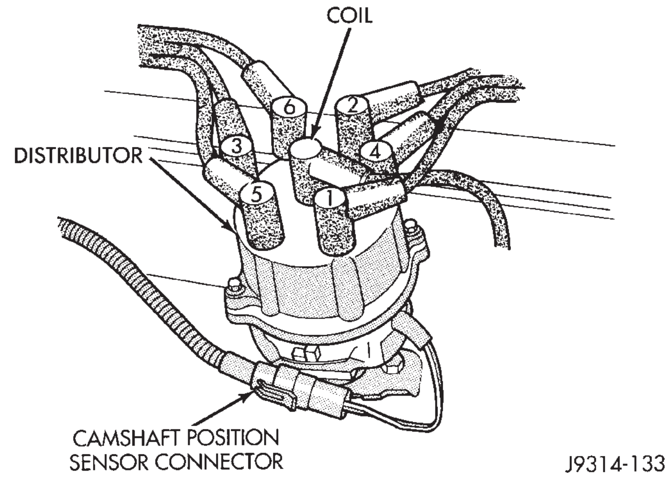


Fig. 4 Cap, Plug Cables and Sensor Connector—Typical

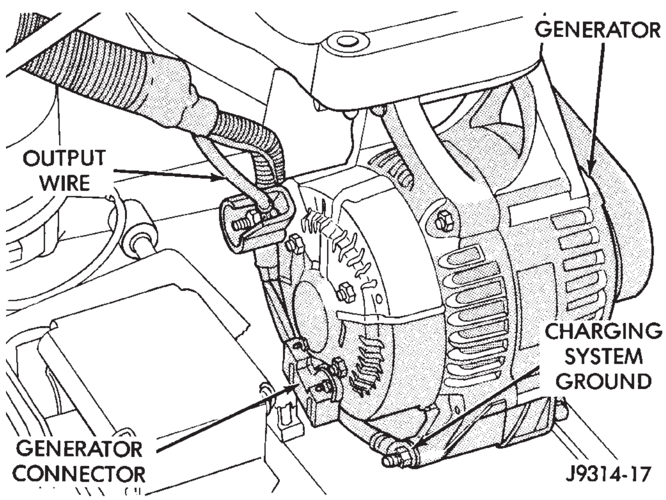


Fig. 5 Generator Connector and Output Wire Connections—Typical

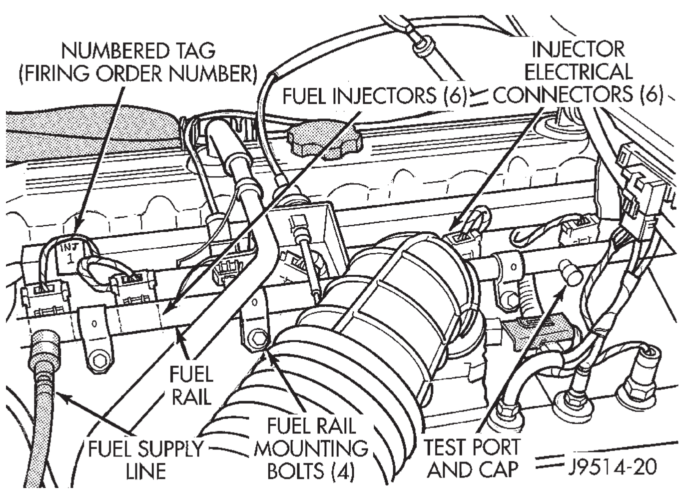


Fig. 6 Fuel Supply Line—Typical

(12) Verify that brake vacuum booster hose is firmly connected to fitting on intake manifold. Also check connection to brake vacuum booster.

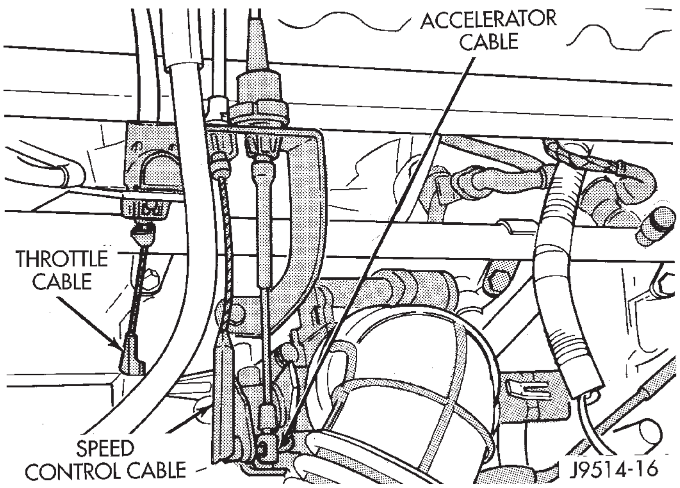


Fig. 7 Accelerator Cable, Throttle Cable and Speed Control Cable

(13) Inspect the air cleaner inlet and air cleaner element for restrictions.

(14) Inspect radiator grille area, radiator fins and air conditioning condenser for restrictions.

(15) Verify that intake manifold air temperature sensor wire connector is firmly connected to harness connector (Fig. 8).

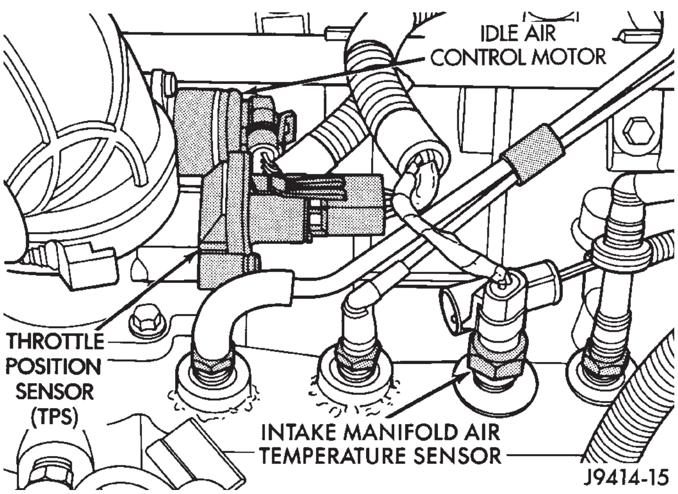


Fig. 8 Sensor Connectors

(16) Verify that MAP sensor electrical connector is firmly connected to MAP sensor (Fig. 9). Verify that vacuum hose is firmly connected to MAP sensor and to the intake manifold.

(17) Verify that fuel injector wire harness connectors are firmly connected to the fuel injectors in the correct firing order. Each harness connector is tagged with the number of its corresponding fuel injector (Fig. 10).

(18) Verify that harness connectors are firmly connected to idle air control motor and throttle position sensor.

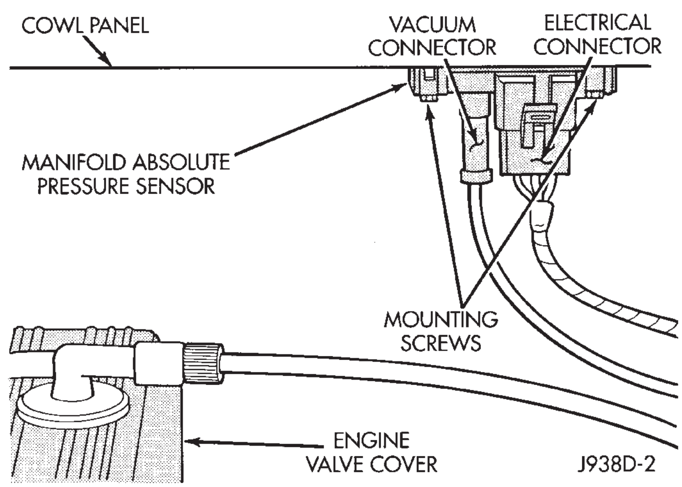


Fig. 9 Manifold Absolute Pressure (MAP) Sensor

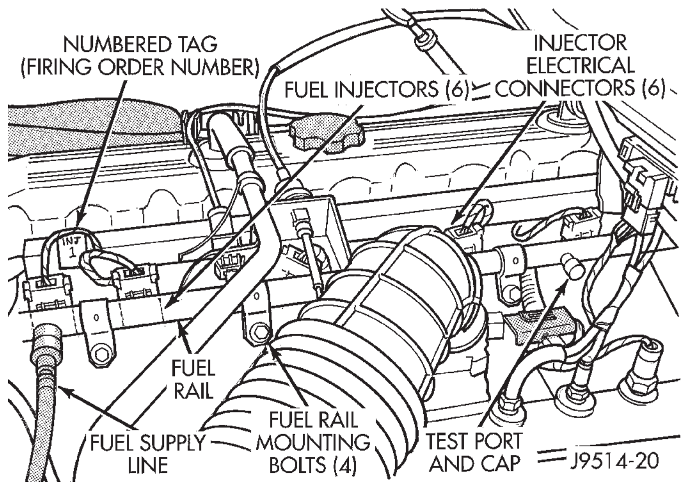


Fig. 10 Fuel Injector Wire Harness—Typical

(19) Verify that wire harness connector is firmly connected to the engine coolant temperature sensor (Fig. 11).

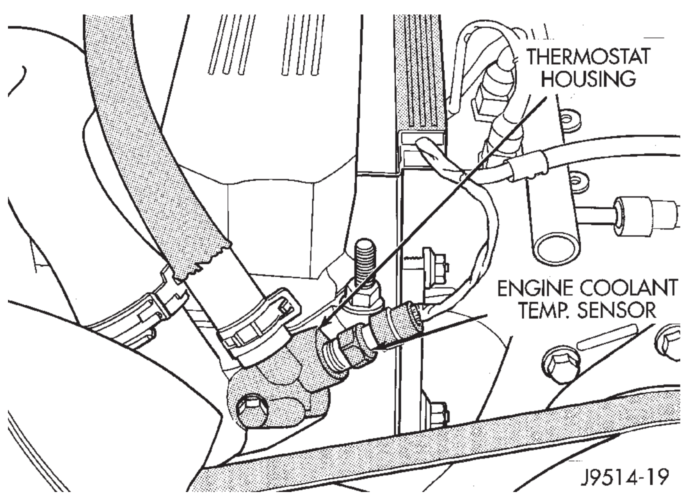


Fig. 11 Engine Coolant Temperature Sensor—Typical

(20) Verify that oxygen sensor wire connector is firmly connected to the sensor. Inspect sensor and connector for damage (Fig. 12).

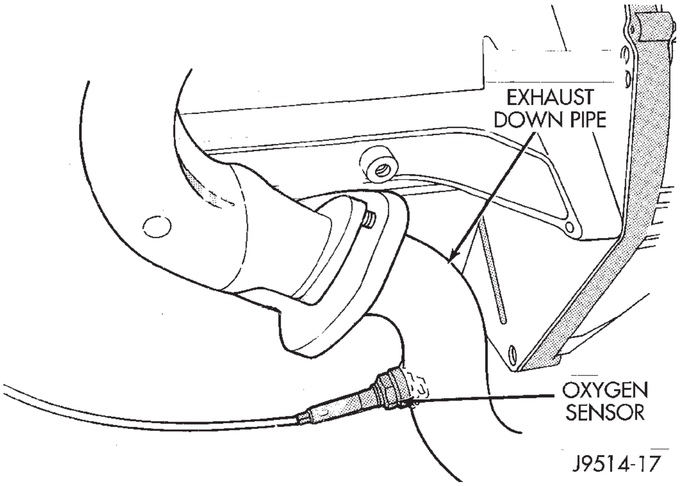


Fig. 12 Oxygen Sensor Location—Typical

(21) Raise and support the vehicle.

(22) Inspect for pinched or leaking fuel lines/tubes. Inspect for pinched cracked or leaking fuel lines. Refer to Fuel Tubes/Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings in this group.

(23) Inspect for exhaust system restrictions such as pinched exhaust pipes, collapsed muffler or plugged catalytic convertor.

(24) If equipped with automatic transmission, verify that electrical harness is firmly connected to neutral safety switch. Refer to the Automatic Transmission section of Group 21.

(25) Verify that the harness connector is firmly connected to the vehicle speed sensor (Fig. 13).

(26) Verify that fuel pump/gauge sender unit wire connector (located near front of fuel tank) is firmly connected to harness connector.

(27) Inspect fuel lines at front of fuel tank for cracks or leaks. Refer to Fuel Tubes/Lines/Hoses and Clamps in this group. Also refer to Quick-Connect Fittings in this group.

(28) Inspect transmission torque convertor housing (automatic transmission) or clutch housing (manual transmission) for damage to timing ring on drive plate/flywheel.

(29) Verify that battery cable and solenoid feed wire connections to the starter solenoid are tight and clean. Inspect for chaffed wires or wires rubbing up against other components (Fig. 14).

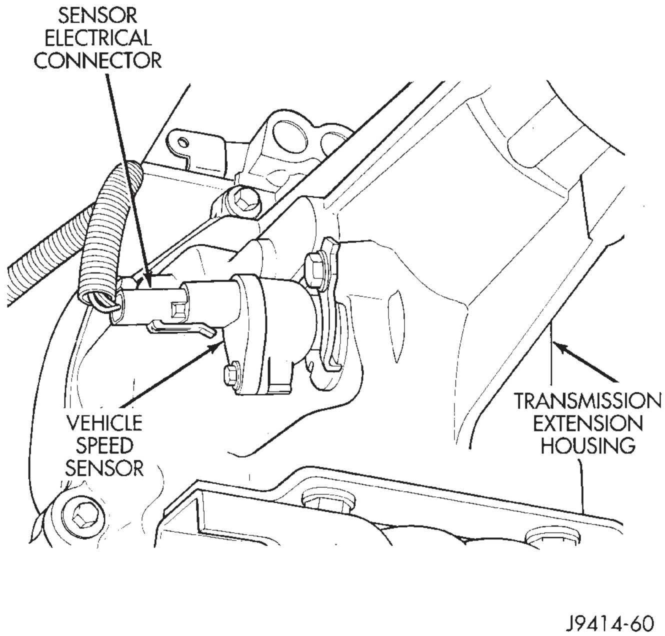


Fig. 13 Vehicle Speed Sensor—Typical

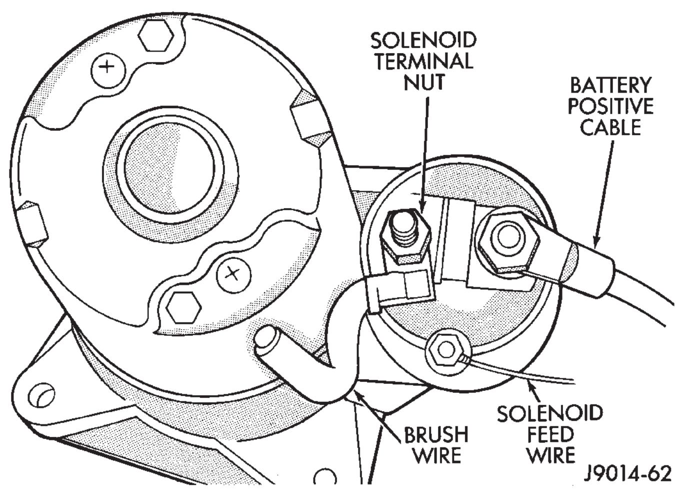


Fig. 14 Starter Solenoid Connection—Typical

POWERTRAIN CONTROL MODULE (PCM) 60-WAY CONNECTOR

For PCM 60-way connector wiring schematics, refer to Group 8W, Wiring Diagrams.

PCM SYSTEM SCHEMATICS

A powertrain control system schematic for the fuel injected 4.0L 6-cylinder engine is shown in figure 15.

The schematic is displayed as a quick reference only. It is not intended to be all-inclusive. Refer to the Wiring Diagrams section for detailed information.

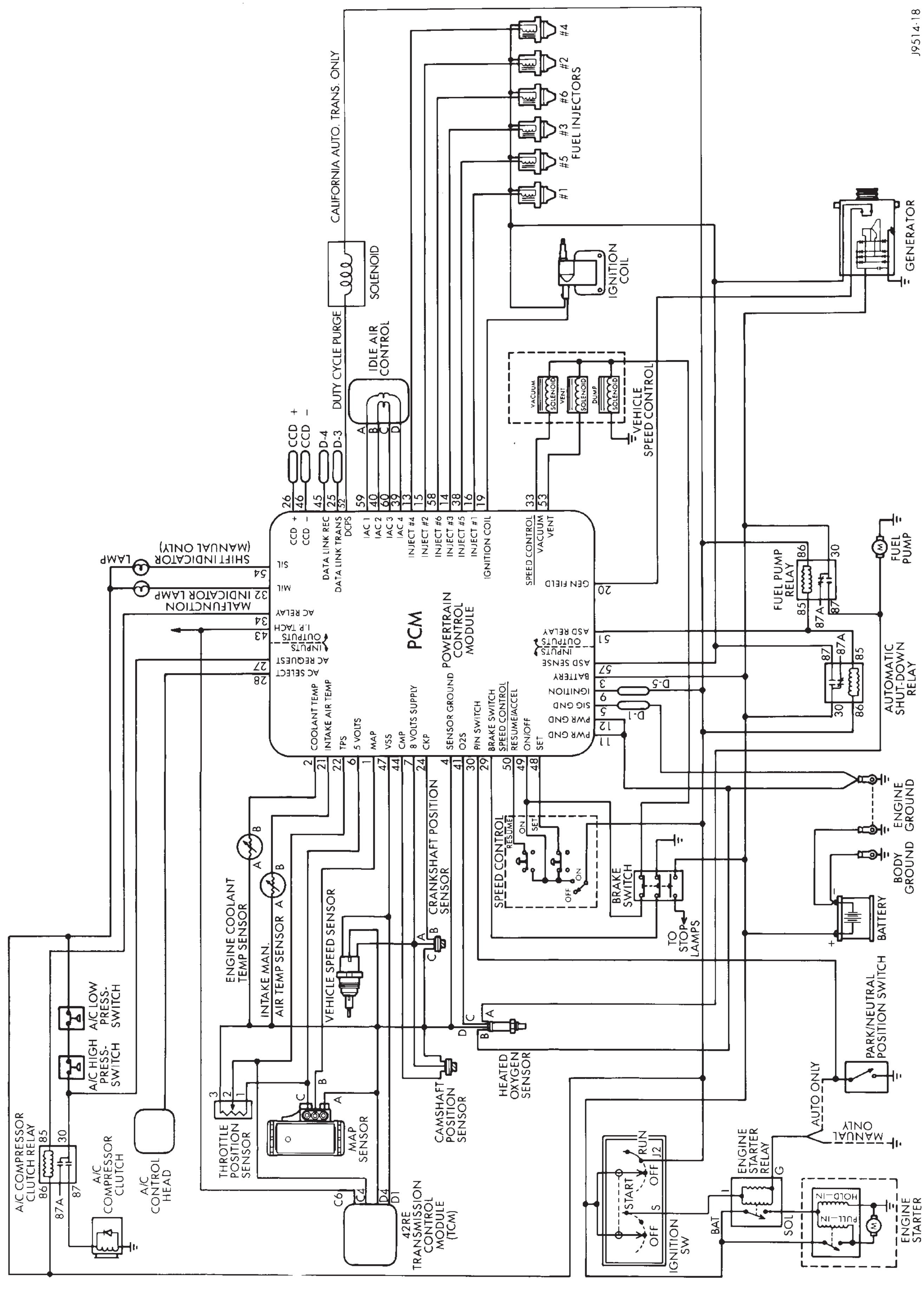


Fig. 15 PCM System Schematic—4.0L 6-Cylinder Engine

AUTOMATIC SHUTDOWN (ASD) RELAY TESTING

To perform a complete test of the ASD relay and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the relay only, refer to Relays—Operation/Testing in this section of the group.

CAMSHAFT POSITION SENSOR TEST

Refer to Group 8D, Ignition Systems, for Camshaft Position Sensor testing.

ENGINE COOLANT TEMPERATURE SENSOR TEST

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:

Disconnect wire harness connector from engine coolant temperature sensor (Fig. 16).

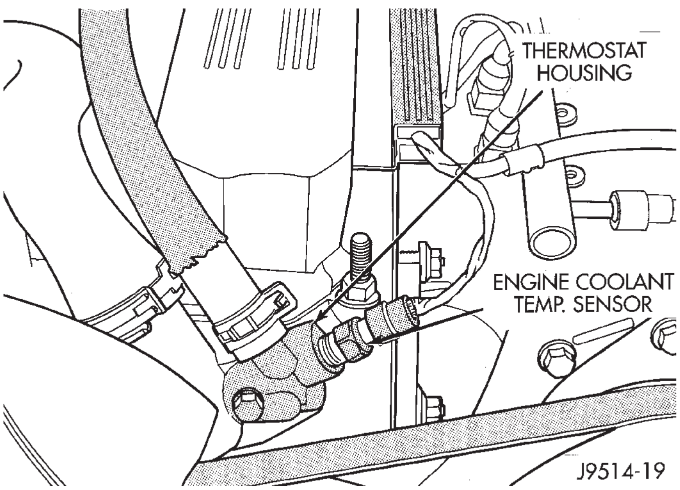


Fig. 16 Coolant Temperature Sensor—Typical

Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter. The resistance should be less than 1000 ohms with the engine at its correct operating temperature. Refer to the Coolant Temperature Sensor/Manifold Air Temperature Sensor resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

Test continuity of the wire harness. Do this between the powertrain control module (PCM) wire harness connector terminal/pin-2 and the sensor connector terminal. Also test continuity of wire harness terminal/pin-4 to the sensor connector terminal. Repair the wire harness if an open circuit is indicated.

FUEL PUMP RELAY TESTING

For testing this relay, refer to Relays—Operation/Testing in this section of the group.

SENSOR RESISTANCE (OHMS)—COOLANT TEMPERATURE SENSOR/MANIFOLD AIR TEMPERATURE

TEMPERATURE		RESISTANCE (OHMS)	
C	F	MIN	MAX
−40	−40	291,490	381,710
−20	−4	85,850	108,390
−10	14	49,250	61,430
0	32	29,330	35,990
10	50	17,990	21,810
20	68	11,370	13,610
25	77	9,120	10,880
30	86	7,370	8,750
40	104	4,900	5,750
50	122	3,330	3,880
60	140	2,310	2,670
70	158	1,630	1,870
80	176	1,170	1,340
90	194	860	970
100	212	640	720
110	230	480	540
120	248	370	410

J928D-4

INTAKE MANIFOLD AIR TEMPERATURE SENSOR TEST

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:

Disconnect the wire harness connector from the intake manifold air temperature sensor (Fig. 17).

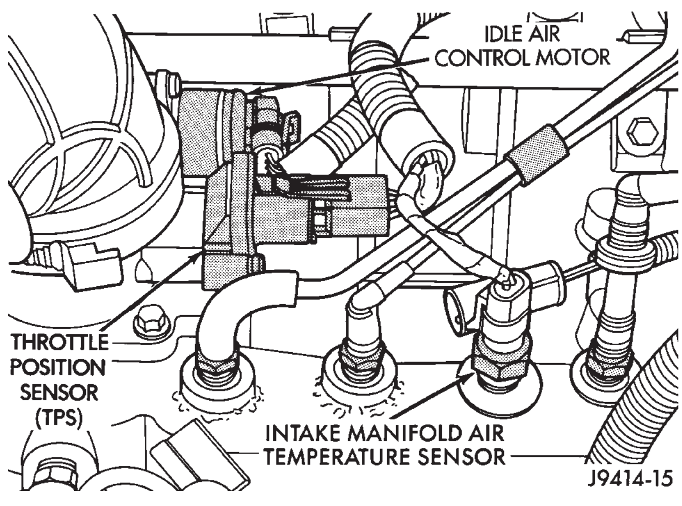


Fig. 17 Air Temperature Sensor

Test the resistance of the sensor with an input impedance (digital) volt-ohmmeter. The resistance should be less than 4000 ohms with the engine at operating temperature. The longer the engine idles, the warmer the intake manifold temperature will become. Refer to the Coolant Temperature Sensor/Manifold Air Temperature Sensor resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness. Do this between the powertrain control module (PCM) wire harness connector terminal/pin-21 and the sensor connector terminal. Also test terminal/pin-4 to the sensor connector terminal. Repair the wire harness as necessary if the resistance is greater than 1 ohm.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

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:

Inspect the MAP sensor vacuum hose connections at the throttle body and sensor. Repair as necessary.

CAUTION: When testing, do not remove the electrical connector from MAP sensor (Fig. 18). Be sure that the MAP sensor harness wires are not damaged by the test meter probes.

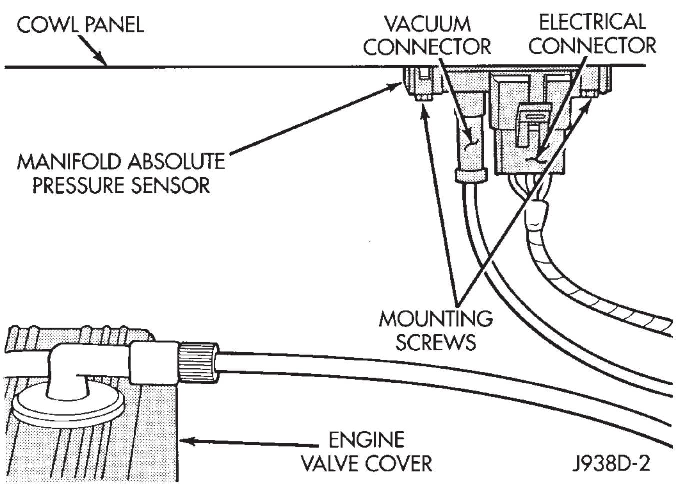


Fig. 18 MAP Sensor Location

Test the MAP sensor output voltage at the MAP sensor connector between terminals-A and B (as marked on the sensor body) (Fig. 19). With the ignition switch ON and the engine OFF, output voltage should be 4-to-5 volts. The voltage should drop to 1.5-to-2.1 volts with a neutral-hot idle speed condition.

Test MAP sensor supply voltage at sensor connector between terminals-A and C (Fig. 19) with the ignition ON and engine OFF. The voltage should be approximately 5 volts (±0.5V). Five volts (±0.5V) should also be at terminal/pin-6 of the PCM wire harness connector. Repair or replace the wire harness as necessary.

Test the MAP sensor ground circuit at sensor connector terminal-A (Fig. 19) and PCM connector terminal/pin-4. Repair the wire harness if necessary.

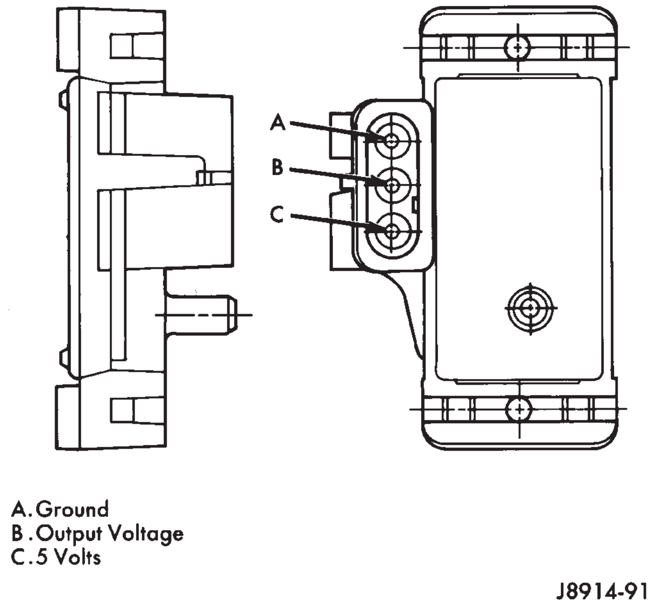


Fig. 19 MAP Sensor Connector Terminals—Typical

Test the MAP sensor ground circuit at the PCM connector between terminal/pin-4 and terminal/pin-11 with an ohmmeter. If the ohmmeter indicates an open circuit, inspect for a defective sensor ground connection. Refer to Group 8W, Wiring for location of engine grounds. If the ground connection is good, replace the PCM. If terminal-4 has a short circuit to 12 volts, correct this condition before replacing the PCM.

CRANKSHAFT POSITION SENSOR TEST

Refer to Group 8D, Ignition Systems for test procedures.

THROTTLE POSITION SENSOR (TPS) TEST

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:

The throttle position sensor (TPS) can be tested with a digital voltmeter. The center terminal of the TPS is the output terminal (Fig. 20).

With the ignition key in the ON position, backprobe the TPS connector. Check the TPS output voltage at the center terminal wire of the connector. Check this at idle (throttle plate closed) and at wide open throttle (WOT). At idle, TPS output voltage should must be greater than 200 millivolts. At wide open throttle, TPS output voltage must be less than 4.8 volts. The output voltage should increase gradually as the throttle plate is slowly opened from idle to WOT.

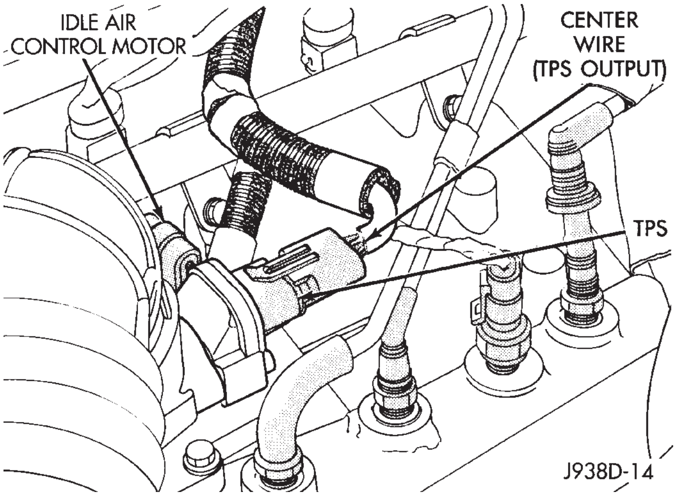


Fig. 20 Throttle Position Sensor (TPS) Testing—Typical

VEHICLE SPEED SENSOR TEST

To perform a complete test of the sensor and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual.

OXYGEN SENSOR (O2S) HEATING ELEMENT TEST

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:

With the sensor at room temperature 25 degrees C (77 degrees F), disconnect the O2S sensor connector (Fig. 21). Connect the ohmmeter test leads across the white wire terminals of the sensor connector. Resistance should be between 5 and 7 ohms. Replace the sensor if the ohmmeter displays an infinity (open) reading.

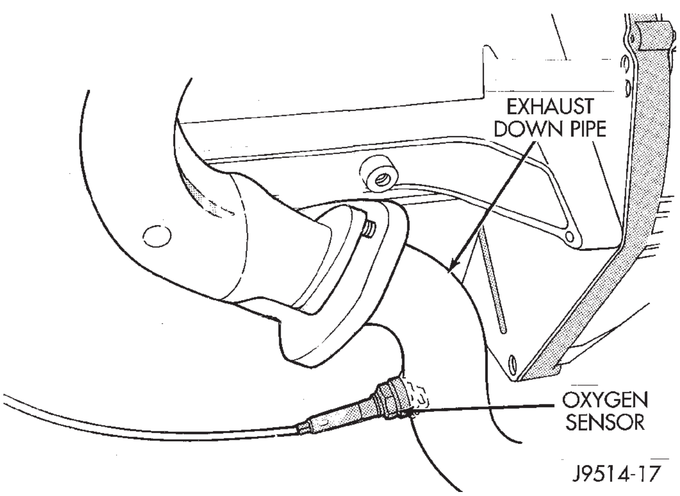


Fig. 21 Oxygen Sensor—Typical

IDLE AIR CONTROL MOTOR TEST

To perform a complete test of the idle air control motor and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the control motor only, refer to the following:

Idle air control motor operation can be tested using special exerciser tool number 7558 (Fig. 22).

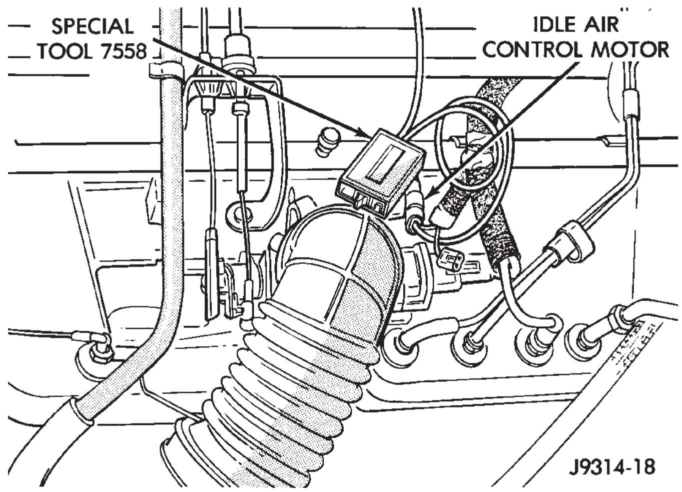


Fig. 22 Idle Air Control Motor Testing

CAUTION: Proper safety precautions must be taken when testing the idle air control motor:

- Set the parking brake and block the drive wheels
- Route all tester cables away from the cooling fans, drive belt, pulleys and exhaust components
- Provide proper ventilation while operating the engine
- Always return the engine idle speed to normal before disconnecting the exerciser tool

(1) With the ignition OFF, disconnect the idle air control motor wire connector at throttle body (Fig. 22).

(2) Plug the exerciser tool number 7558 harness connector into the idle air control motor.

(3) Connect the red clip of exerciser tool 7558 to battery positive terminal. Connect the black clip to negative battery terminal. The red lamp on the exerciser tool will flash when the tool is properly connected.

(4) Start engine.

When the switch on the tool is in the HIGH or LOW position, the lamp on the tool will flash. This indicates that voltage pulses are being sent to the idle air control stepper motor.

(5) Move the switch to the HIGH position. The engine speed should increase. Move the switch to the LOW position. The engine speed should decrease.

(a) If the engine speed changes while using the exerciser tool, the idle air control motor is functioning properly. Disconnect the exerciser tool and connect the idle air control motor wire connector to the stepper motor.

(b) If the engine speed does not change, turn the ignition OFF and proceed to step (6). Do not disconnect exerciser tool from the idle air control motor.

(6) Remove the idle air control motor from the throttle body. Do not remove idle speed motor housing from throttle body.

CAUTION: When checking idle air control motor operation with the motor removed from the throttle body, do not extend the pintle (Fig. 23) more than 6.35 mm (.250 in). If the pintle is extended more than this amount, it may separate from the idle air control motor. The idle air control motor must be replaced if the pintle separates from the motor.

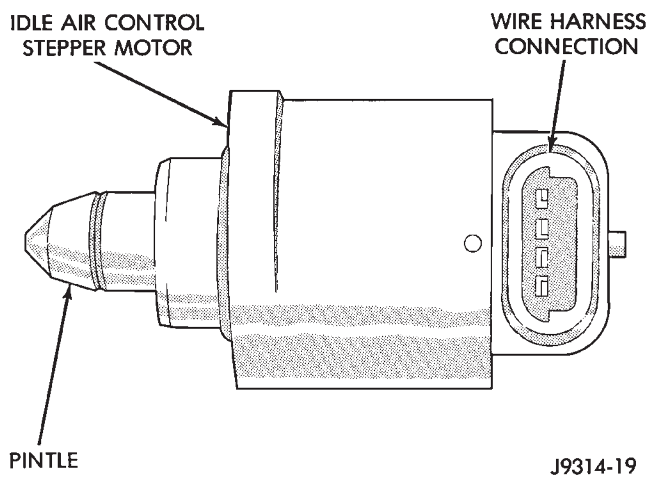


Fig. 23 Idle Air Control Motor Pintle

(7) With the ignition OFF, cycle the exerciser tool switch between the HIGH and LOW positions. Observe the pintle. The pintle should move in-and-out of the motor.

(a) If the pintle does not move, replace the idle air control motor. Start the engine and test the replacement motor operation as described in step (5).

(b) If the pintle operates properly, check the idle air control motor bore in the throttle body bore for blockage and clean as necessary. Reinstall the idle air control motor and retest. If blockage is not found, refer to the DRB scan tool and the appropriate Powertrain Diagnostics Procedures service manual.

RELAYS—OPERATION/TESTING

OPERATION

The following operations/tests apply to these relays only: Automatic shutdown (ASD) and fuel pump. For operations/tests on all other relays, refer to the appropriate section of this service manual.

The relay terminal numbers from (Fig. 24) can be found on the bottom of the relay:

- Terminal number 30 is connected to battery voltage and can be switched or B+ (hot) at all times.
- Terminal number 87A is connected (a circuit is formed) to terminal 30 in the de-energized (normally OFF) position.
- Terminal number 87 is connected (a circuit is formed) to terminal 30 in the energized (ON) position. Terminal number 87 then supplies battery voltage to the component being operated.
- Terminal number 86 is connected to a switched (+) power source.
- Terminal number 85 is grounded by the powertrain control module (PCM).

TESTING

(1) Remove relay before testing.

(2) Using an ohmmeter, perform a resistance test between terminals 85 and 86. Resistance value (ohms) should be 75 ±5 ohms for resistor equipped relays.

(3) Connect the ohmmeter between terminals number 87A and 30. Continuity should be present at this time.

(4) Connect the ohmmeter between terminals number 87 and 30. Continuity should not be present at this time.

(5) Use a set of jumper wires (16 gauge or smaller). Connect one jumper wire between terminal number 85 (on the relay) to the ground side (-) of a 12 Volt power source.

(6) Attach the other jumper wire to the positive side (+) of a 12V power source. Do not connect the jumper wire to relay at this time.

CAUTION: Do not allow the ohmmeter to contact terminals 85 or 86 during these tests. Damage to ohmmeter may result.

(7) Attach the other jumper wire (12V +) to terminal number 86. This will activate the relay. Continuity should now be present between terminals number 87 and 30. Continuity should not be present between terminals number 87A and 30.

(8) Disconnect jumper wires from relay and 12 Volt power source.

If continuity or resistance tests did not pass, replace relay. If tests passed, refer to Group 8W, Wiring Diagrams for additional circuit information. Also refer to the Powertrain Diagnostic Procedures manual for operation of the DRB scan tool.

STARTER MOTOR RELAY TEST

Refer to Group 8A, Battery/Starting/Charging System Diagnostics, for starter motor relay testing.

FUEL INJECTOR TEST

To perform a complete test of the fuel injectors and their circuitry, refer to DRB scan tool and appropri-

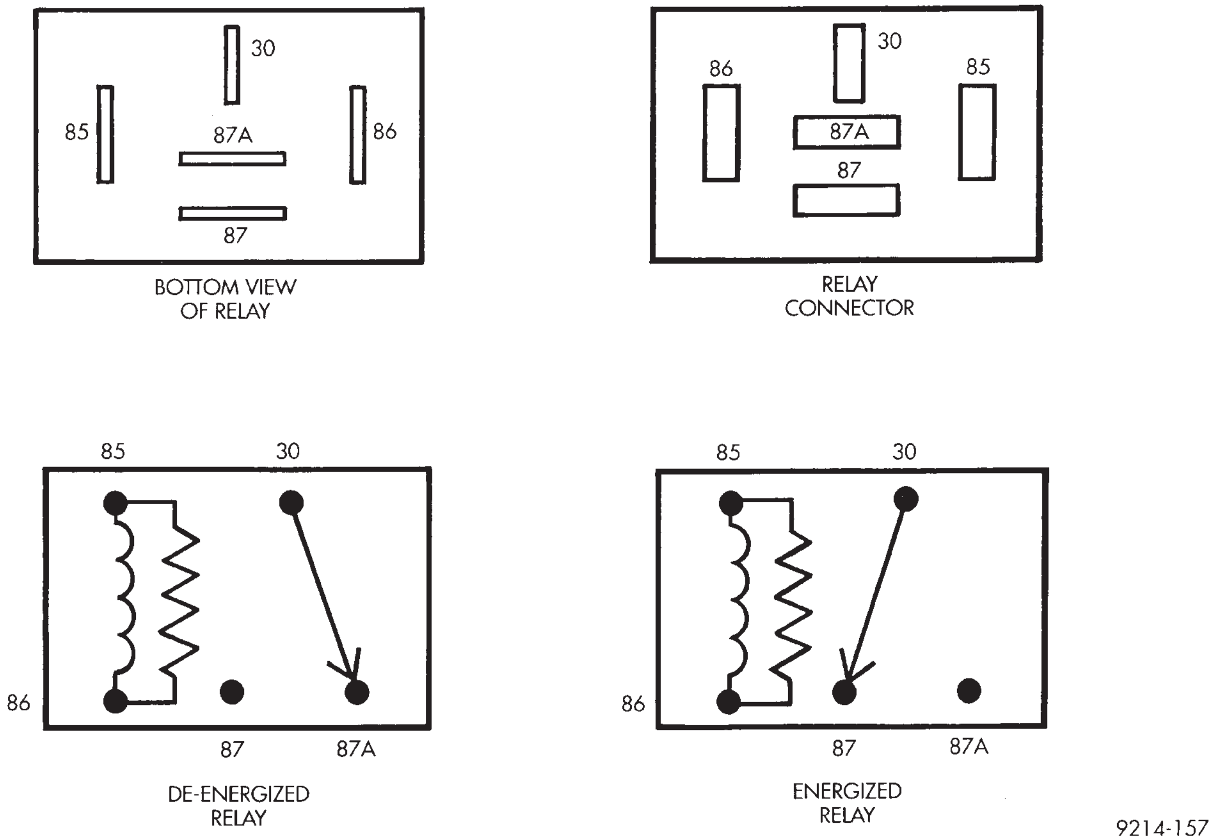


Fig. 24 Relay Terminals

ate Powertrain Diagnostics Procedures manual. To test the injector only, refer to the following:

Disconnect the injector wire connector from the injector. Place an ohmmeter on the injector terminals. Resistance reading should be approximately 14.5 ohms ±1.2 ohms at 20°C (68°F). Proceed to following Injector Diagnosis chart. **When performing the following tests from the chart, do not leave electrical current applied to the injector for longer than five seconds. Damage to injector coil or internal injector seals could result.**

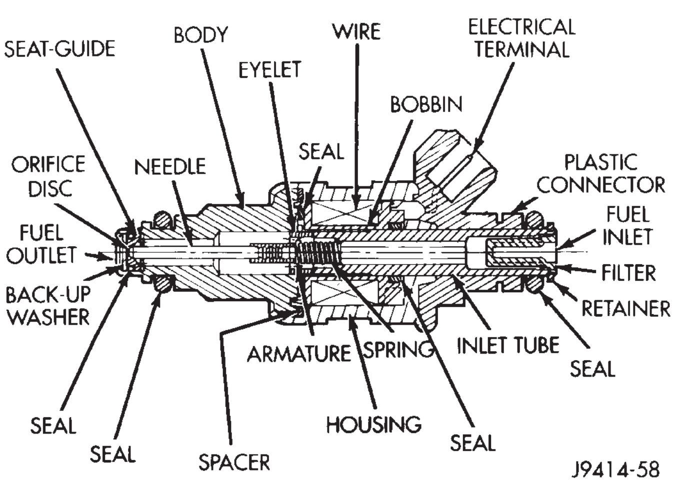


Fig. 25 Fuel Injector Internal Components—Typical

FUEL SYSTEM PRESSURE TEST

Refer to the Fuel Delivery System section of this group.

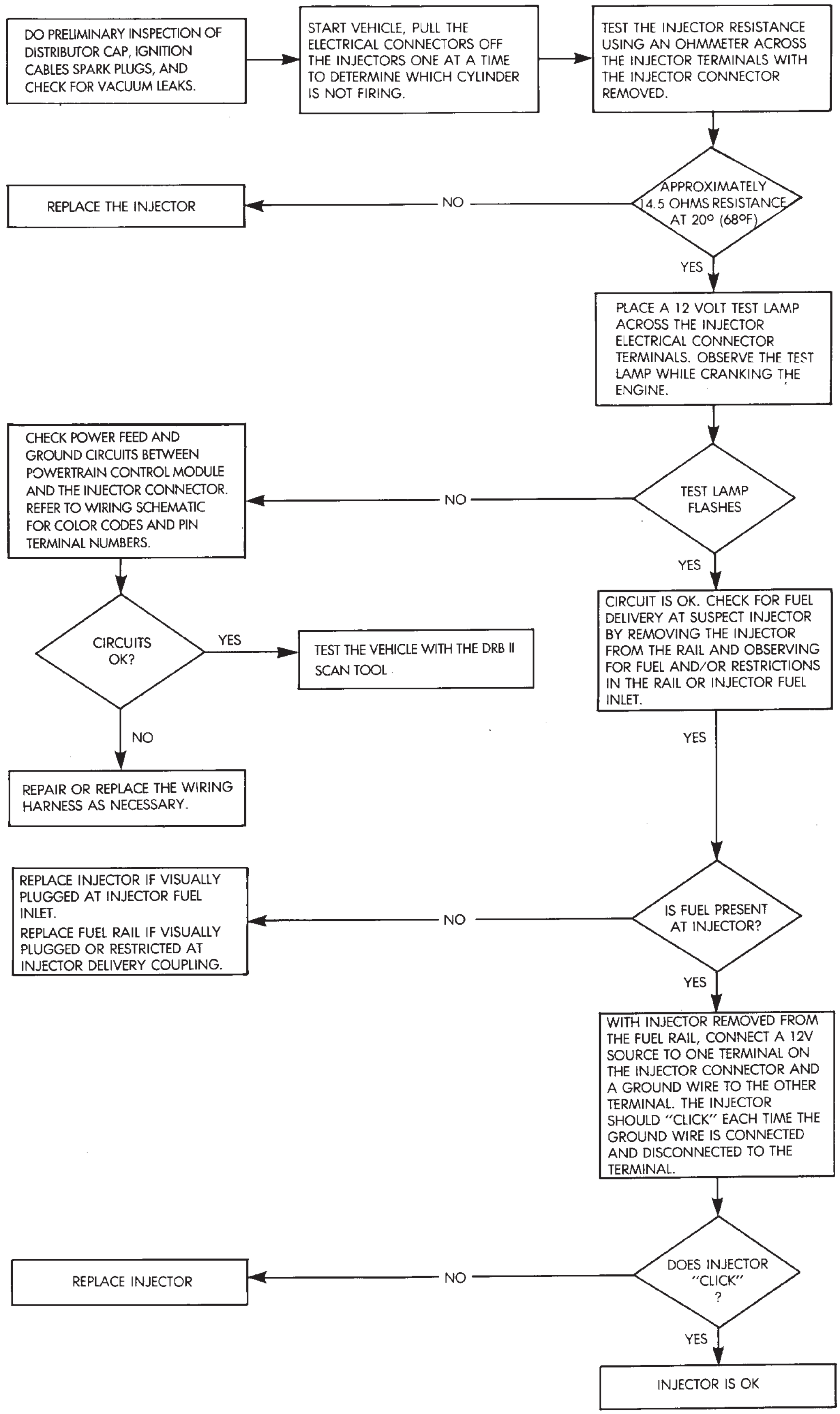
ON-BOARD DIAGNOSTICS (OBD)

The powertrain control module (PCM) has been programmed to monitor many different circuits of the fuel injection system. If a problem is sensed in a monitored circuit often enough to indicate an actual problem, a Diagnostic Trouble Code (DTC) is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. If the problem is repaired or ceases to exist, the PCM cancels the DTC after 51 engine starts.

Certain criteria must be met for a diagnostic trouble code (DTC) to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine temperature and/or input voltage to the PCM.

It is possible that a DTC for a monitored circuit may not be entered into memory even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. Example: assume that one of the criteria for the MAP sensor circuit is that the engine must be operating between 750 and 2000 rpm to be monitored for a DTC. If the MAP sensor output circuit shorts to ground when the engine rpm is above 2400 rpm, a 0 volt input will be seen by the PCM. A DTC will not

INJECTOR DIAGNOSIS—VEHICLE RUNS ROUGH AND/OR HAS A MISS



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be entered into memory because the condition does not occur within the specified rpm range.

A DTC indicates that the powertrain control module (PCM) has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

There are several operating conditions that the PCM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non-Monitored Circuits in this section.

MONITORED CIRCUITS

The powertrain control module (PCM) can detect certain problems in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if sensor output (which is the input to PCM) is within proper range. It also determines if the circuit is open or shorted.

Output Device Current Flow - The PCM senses whether the output devices are hooked up.

If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground (-), or shorted to (+) voltage.

Oxygen Sensor - The PCM can determine if the oxygen sensor is switching between rich and lean. This is, once the system has entered Closed Loop. Refer to Open Loop/Closed Loop Modes Of Operation in the Component Description/System Operation section for an explanation of Closed (or Open) Loop operation.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A Diagnostic Trouble Code (DTC) may not be displayed for these conditions.

Fuel Pressure: Fuel pressure is controlled by the fuel pressure regulator. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply line. However, these could result in a rich or lean condition causing an oxygen sensor DTC to be stored in the PCM.

Secondary Ignition Circuit: The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open circuited spark plug cables.

Engine Timing: The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket or crankshaft sprocket. The PCM also cannot detect an incorrectly indexed distributor. However, these could result in a rich or lean condition causing an oxygen sensor DTC to be stored in the PCM.

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.

Fuel Injector Malfunctions: The PCM cannot determine if the fuel injector is clogged, or the wrong injector is installed. However, these could result in a rich or lean condition causing an oxygen sensor DTC to be stored in the PCM.

Excessive Oil Consumption: Although the PCM monitors exhaust stream oxygen content through oxygen sensor (closed loop), it cannot determine excessive oil consumption.

Throttle Body Air Flow: The PCM cannot detect a clogged or restricted air cleaner inlet or air cleaner element.

Evaporative System: The PCM will not detect a restricted, plugged or loaded EVAP canister.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM. However, a vacuum leak at the MAP sensor will be monitored and a diagnostic trouble code (DTC) will be generated by the PCM.

Powertrain Control Module (PCM) System Ground: The PCM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

Powertrain Control Module (PCM) Connector Engagement: The PCM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The powertrain control module (PCM) compares input signal voltages from each input device. It will establish high and low limits that are programmed into it for that device. If the input voltage is not within specifications and other Diagnostic Trouble Code (DTC) criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the PCM when it senses a high or low input voltage from the control system device in question.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored Diagnostic Trouble Code (DTC) can be displayed by cycling the ignition key On-Off-On-Off-On within three seconds and observing the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 26).

They can also be displayed through the use of the Diagnostic Readout Box (DRB scan tool). The DRB connects to the data link connector in the vehicle (Fig. 27). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.

EXAMPLES:

• If the lamp (Fig. 26) flashes 1 time, pauses and flashes 2 more times, a flashing Diagnostic Trouble

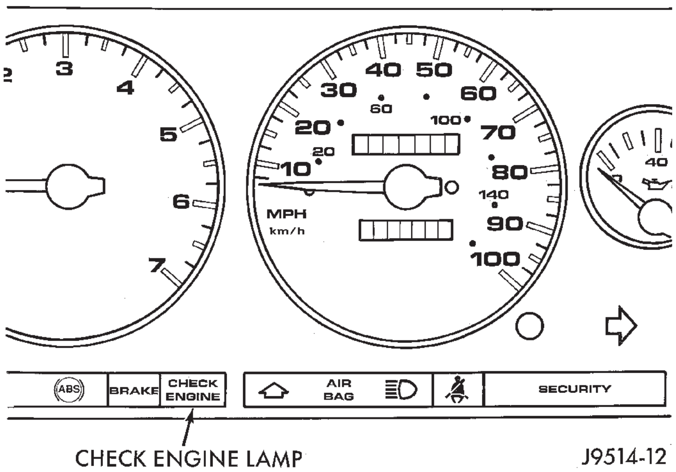

Fig. 26 Check Engine Lamp Location

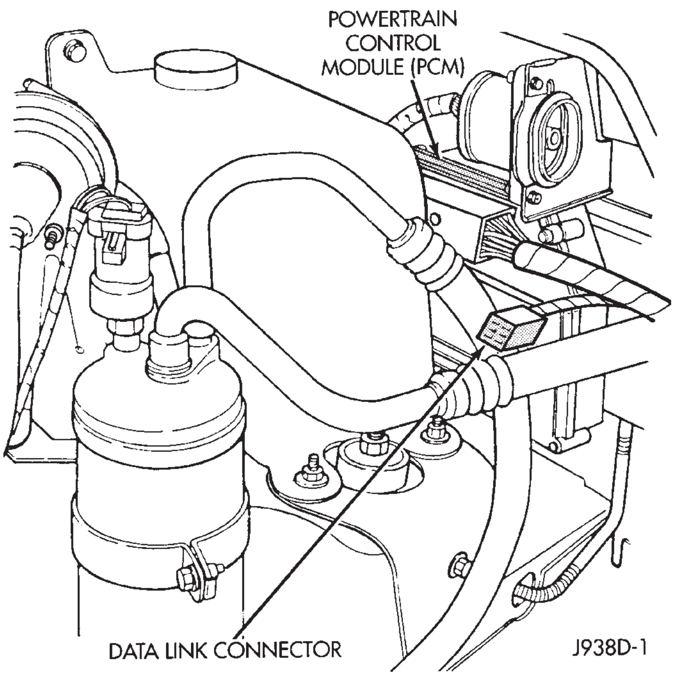

Fig. 27 Data Link Connector Location—Typical

Code (DTC) number 12 is indicated. If this code is observed, it is indicating that the battery has been disconnected within the last 50 key-on cycles. It could also indicate that battery voltage has been disconnected to the PCM. In either case, other DTC's may have been erased.

- If the lamp flashes 3 times, pauses and flashes 1 more time, a Diagnostic Trouble Code (DTC) number 31 is indicated.
- If the lamp flashes 1 time, pauses and flashes 4 more times, a Diagnostic Trouble Code (DTC) number 14 is indicated.

After any stored DTC information has been observed, the display will end with a flashing DTC number 55. This will indicate the end of all stored information.

Refer to the Diagnostic Trouble Code (DTC) charts for DTC identification.

If the problem is repaired or ceases to exist, the powertrain control module (PCM) cancels the DTC after 51 engine starts.

Diagnostic Trouble Codes indicate the results of a failure, but never identify the failed component directly.

The circuits of the data link connector are shown in (Fig. 28).

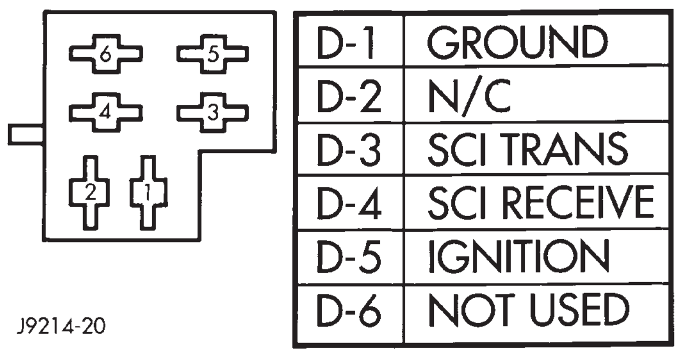

Fig. 28 Data Link Connector Schematic

ERASING TROUBLE CODES

Use the DRB scan tool to erase a Diagnostic Trouble Code (DTC). Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

DIAGNOSTIC TROUBLE CODE (DTC)

On the following pages, a list of diagnostic trouble codes is provided for the 4.0L 6-cylinder engine. A DTC indicates that the powertrain control module (PCM) has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
11*	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**	No Change in MAP From Start to Run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14**	MAP Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
	or	
	MAP Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
15**	No Vehicle Speed Sensor Signal	No vehicle distance (speed) sensor signal detected during road load conditions.
17*	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O2S Stays at Center	Neither rich or lean condition detected from the oxygen sensor input.
	or	
	O2S Shorted to Voltage	Oxygen sensor input voltage maintained above the normal operating range.
22**	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above maximum acceptable voltage.
	or	
	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below minimum acceptable voltage.
23**	Intake Air Temp Sensor Voltage Low	Intake manifold air temperature sensor input below the minimum acceptable voltage.
	or	
	Intake Air Temp Sensor Voltage High	Intake manifold air temperature sensor input above the maximum acceptable voltage.
24**	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
	or	
	Throttle Position Sensor Voltage Low	Throttle position sensor input below the minimum acceptable voltage.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS—CONTINEUD

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
25**	Idle Air Control Motor Circuits	A shorted condition detected in one or more of the idle air control motor circuits.
27*	Injector #1 Control Circuit	Injector #1 output driver does not respond properly to the control signal.
	or	
	Injector #2 Control Circuit	Injector #2 output driver does not respond properly to the control signal.
	or	
	Injector #3 Control Circuit	Injector #3 output driver does not respond properly to the control signal.
	or	
	Injector #4 Control Circuit	Injector #4 output driver does not respond properly to the control signal.
	or	
	Injector #5 Control Circuit	Injector #5 output driver does not respond properly to the control signal.
	or	
	Injector #6 Control Circuit	Injector #6 output driver does not respond properly to the control signal.
31**	EVAP Solenoid Circuit	An open or shorted condition detected in the EVAP solenoid circuit. This code is used for the 4.0L engine when equipped with the California Emission Package only.
33*	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay circuit.
34*	Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
	or	
	Speed Control Switch Always Low	Speed Control switch input below the minimum acceptable voltage.
	or	
	Speed Control Switch Always High	Speed Control switch input above the maximum acceptable voltage.
41**	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS—CONTINEUD

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
42*	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
44*	Battery Temp Sensor Volts out of Limit	An open or shorted condition exists in the engine coolant temperature sensor circuit or a problem exists in the PCM's battery temperature voltage circuit.
46**	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
47**	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.
51**	O2S Signal Stays Below Center (Lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**	O2S Signal Stays Above Center (Rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53*	Internal PCM Failure	PCM Internal fault condition detected.
	or	
	PCM Failure SPI (Serial Peripheral Interface) Communications	PCM Internal fault condition detected.
54*	No Cam Sync Signal at PCM	No fuel sync (camshaft signal) detected during engine cranking.
55*	Display not shown on DRB scan tool	Completion of diagnostic trouble code display on the Malfunction Indicator Lamp (Check Engine Lamp).
62*	PCM Failure SRI miles not stored	Unsuccessful attempt to update SRI (service reminder indicator) miles in the PCM EEPROM.
63*	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the PCM.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

MULTI-PORT FUEL INJECTION (MFI)—4.0L 6 CYL. ENGINE—COMPONENT REMOVAL/INSTALLATION

INDEX

AIR CLEANER HOUSING

REMOVAL

(1) Unlock clean air hose clamp (Fig. 1) at air cleaner cover. To unlock the clamp, attach adjustable pliers to clamp and rotate pliers as shown in figure 2. Remove clean air hose at cover.

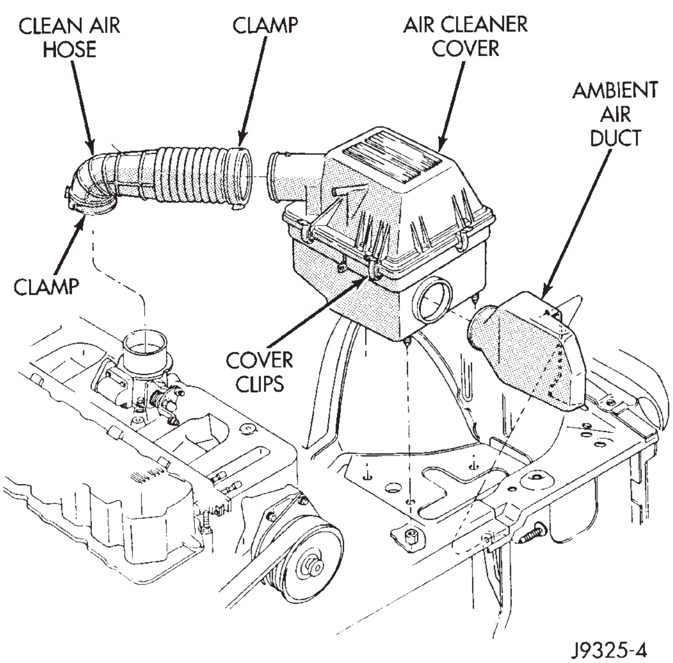

Fig. 1 Air Cleaner—4.0L 6-Cylinder Engine—Typical

(2) Remove crankcase breather/filter hose at air cleaner cover.

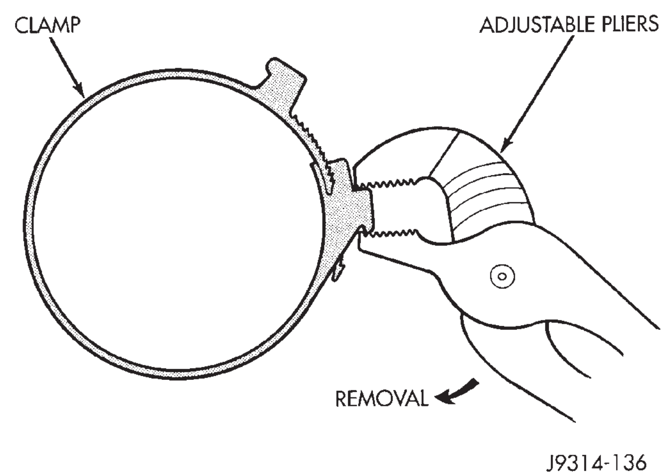

Fig. 2 Clamp Removal

(3) From under vehicle, remove three housing nuts (Fig. 1).

(4) Release the air cleaner housing from the ambient air duct and remove housing from vehicle.

INSTALLATION

(1) Position air cleaner housing to body and ambient air duct (Fig. 1).

(2) Install three nuts and tighten to 10 N·m (93 in. lbs.) torque.

(3) Install crankcase breather/filter hose to cover.

(4) Install clamp to cover. Compress the clamp snugly with adjustable pliers as shown in figure 3.

AIR CLEANER ELEMENT

REMOVAL/INSTALLATION

(1) Pry back the six clips retaining the air cleaner cover to the air cleaner housing (Fig. 4).

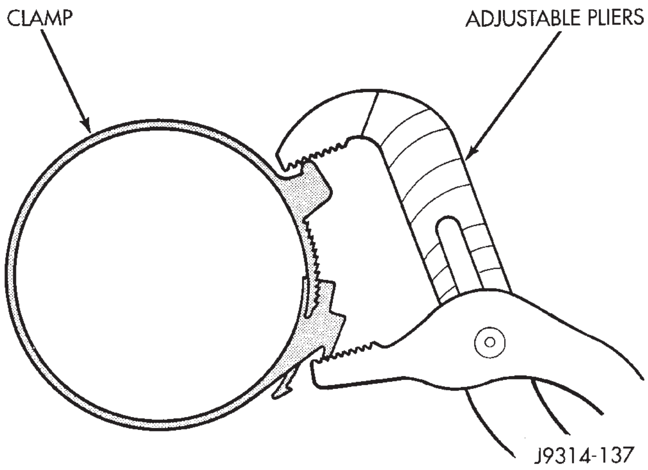

Fig. 3 Clamp Installation

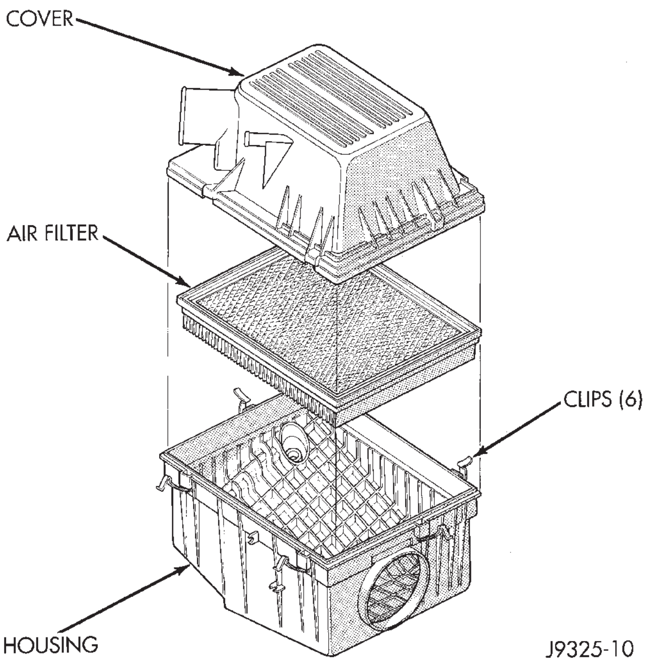

Fig. 4 Typical Air Cleaner Element Removal/Installation

(2) Lift the cover up and position to the side.

(3) Remove air cleaner element.

(4) Clean the inside of air cleaner housing before installing new element.

(5) Reverse the preceding operation for installation. Be sure the air cleaner cover is properly seated to air cleaner housing.

ACCELERATOR PEDAL AND THROTTLE CABLE

Refer to the Accelerator Pedal and Throttle Cable section of this group for removal/installation procedures.

AIR CONDITIONING (A/C) CLUTCH RELAY

The A/C clutch relay is located in the power distribution center (PDC) (Fig. 5). For location of this relay within the PDC, refer to label attached to bottom of PDC cover.

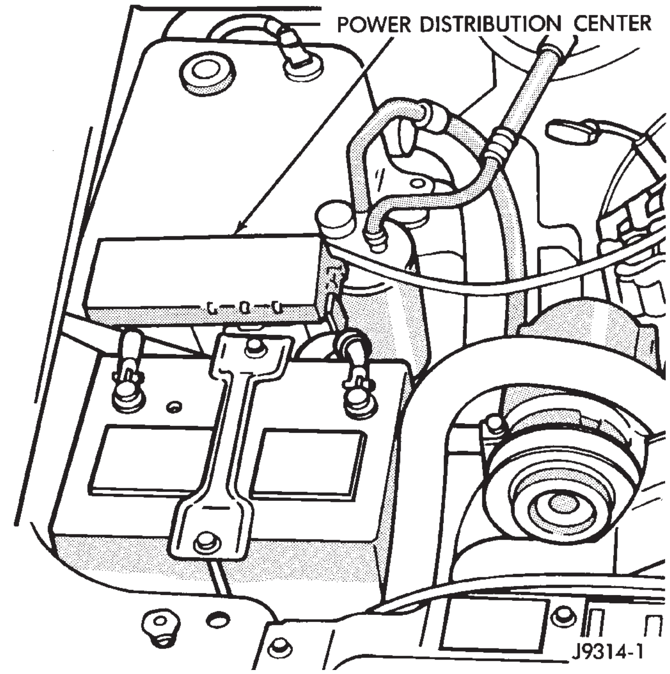

Fig. 5 Power Distribution Center (PDC)

AUTOMATIC SHUTDOWN (ASD) RELAY

The ASD relay is located in the power distribution center (Fig. 5) (PDC). For location of this relay within the PDC, refer to label attached to bottom of PDC cover.

BRAKE SWITCH

Refer to Group 5, Brakes for removal/installation procedures.

CAMSHAFT POSITION SENSOR

For removal/installation procedures, refer to Group 8D, Ignition System. See Camshaft Position Sensor.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR

The intake manifold air temperature sensor is installed into the intake manifold plenum (Fig. 6).

REMOVAL

(1) Disconnect the electrical connector from the sensor.

(2) Remove the sensor from the intake manifold.

INSTALLATION

(1) Install the sensor into the intake manifold. Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect the electrical connector to the sensor.

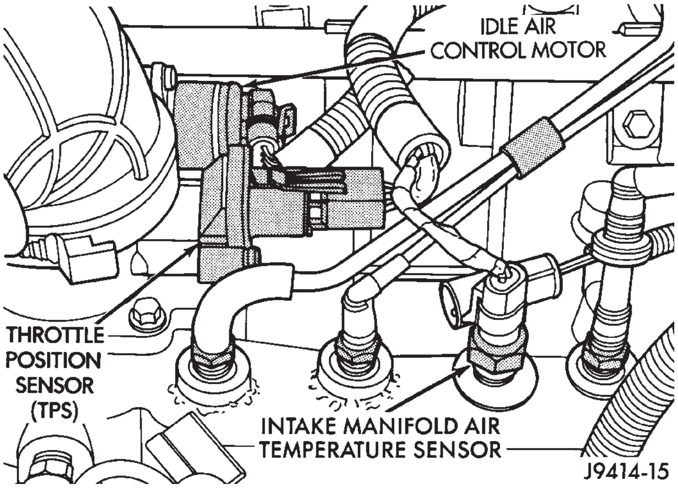

Fig. 6 Sensor Location

CRANKSHAFT POSITION SENSOR

Refer to Group 8D, Ignition Systems for procedures.

ENGINE COOLANT TEMPERATURE SENSOR

The coolant temperature sensor is installed in the thermostat housing (Fig. 7).

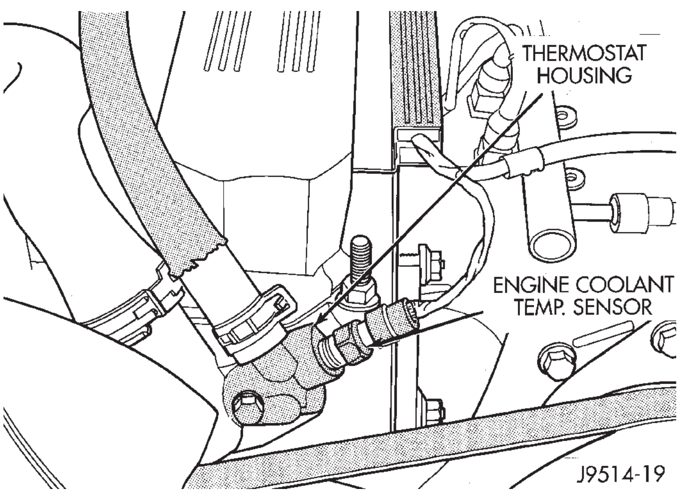

Fig. 7 Engine Coolant Temperature Sensor—Typical

REMOVAL

(1) Drain cooling system until the coolant level is below the cylinder head. Observe the **WARNINGS** in Group 7, Cooling.

(2) Disconnect the coolant temperature sensor wire connector.

(3) Remove the sensor from the thermostat housing (Fig. 7).

INSTALLATION

(1) Install coolant temperature sensor into the cylinder block. Tighten to 28 N·m (21 ft. lbs.) torque.

(2) Connect the wire connector.

(3) Fill the cooling system.

FUEL FILTER

Refer to the Fuel Delivery System section of this group for removal/installation procedures.

FUEL INJECTOR

REMOVAL

(1) Remove the fuel rail. Refer to Fuel Rail Removal in this section.

(2) Remove the clip(s) that retain the fuel injector(s) to the fuel rail (Figs. 8 or 9).

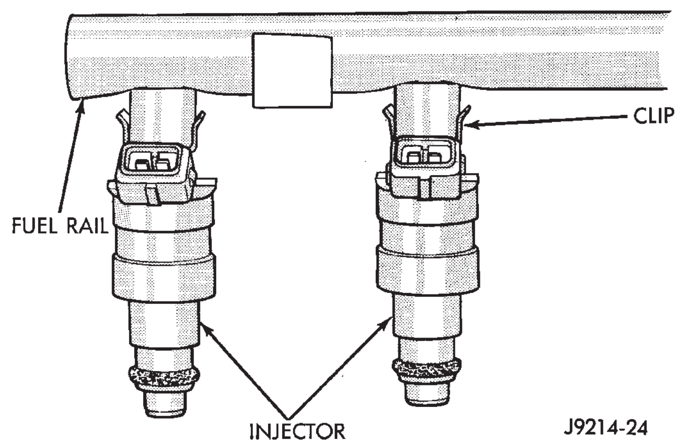

Fig. 8 Injector Mounting

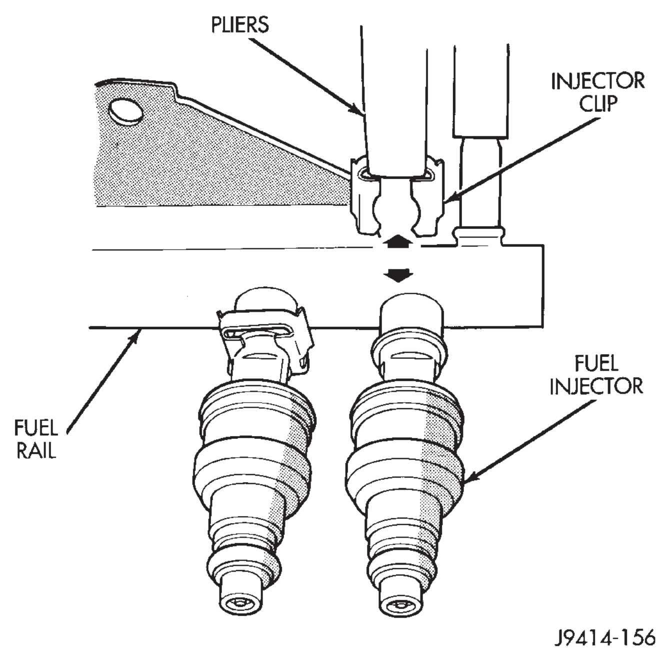

Fig. 9 Injector Retaining Clips

INSTALLATION

(1) Install the fuel injector(s) into the fuel rail assembly and install retaining clip(s).

(2) Install fuel rail. Refer to Fuel Rail Installation in this section.

(3) Start engine and check for fuel leaks.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is part of the fuel pump module and is not serviced separately. If it needs replacement, the fuel pump module assembly must be replaced. Refer to the Fuel Delivery section of this group for procedures.

FUEL PUMP MODULE

Refer to the Fuel Delivery System section of this group for removal/installation procedures.

FUEL PUMP RELAY

The fuel pump relay is located in the power distribution center (PDC) (Fig. 10). For location of this relay within the PDC, refer to label attached to bottom of PDC cover.

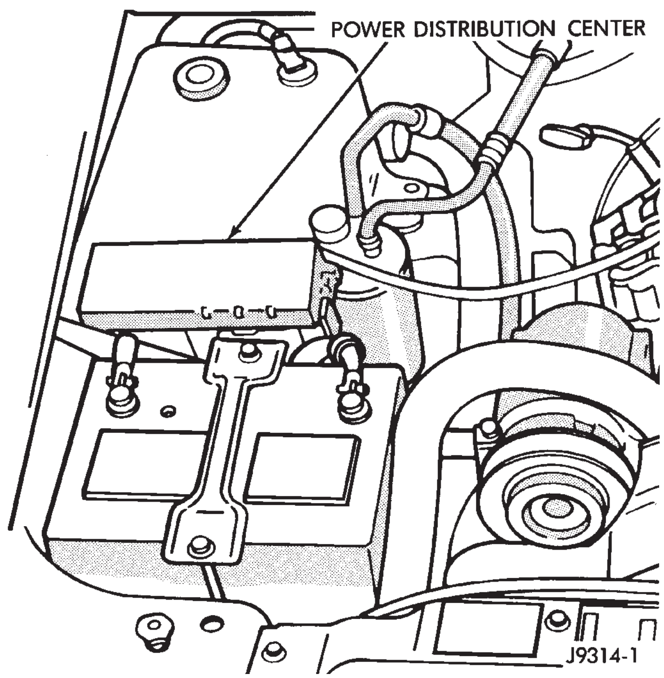

Fig. 10 Power Distribution Center (PDC)

FUEL RAIL ASSEMBLY

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING THE FUEL RAIL.

(1) Remove fuel tank filler tube cap.

(2) Disconnect the negative battery cable from battery.

(3) Perform the Fuel System Pressure Release Procedure as described in the Fuel Delivery System section of this group.

(4) Remove and numerically attach a tag (if fuel injector is not already tagged), the injector harness connectors. Do this at each injector (Fig. 11).

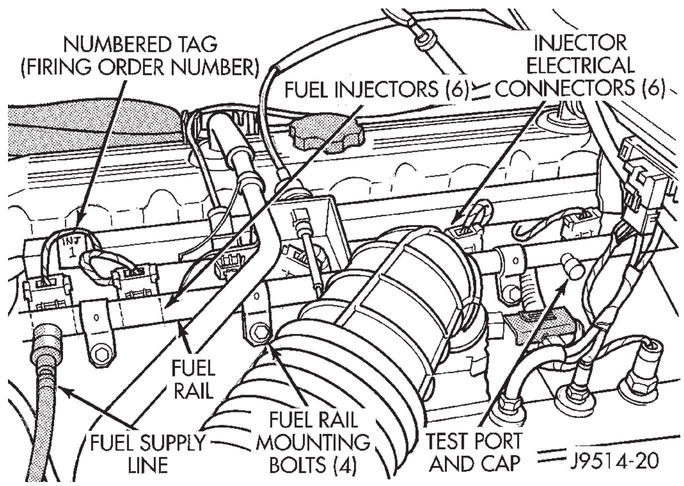

Fig. 11 Fuel Injector Harness—Typical

(5) Disconnect fuel supply line from fuel rail (Fig. 11). Refer to Fuel Tubes/Lines/Hoses and Clamps, or Quick-Connect Fittings. These can both be found in the Fuel Delivery section of this group.

(6) Remove fuel rail mounting bolts.

On models with automatic transmissions, it may be necessary to remove automatic transmission throttle line pressure cable and bracket. This will aid in fuel rail assembly removal.

(7) Remove fuel rail by gently rocking until all the fuel injectors are out of the intake manifold.

INSTALLATION

(1) Position tips of all fuel injectors into the corresponding injector bore in the intake manifold. Seat injectors into manifold.

(2) Tighten fuel rail mounting bolts to 27 N·m (20 ft. lbs.) torque.

(3) Connect injector harness connectors to appropriate (tagged) injector.

(4) Connect fuel supply line to fuel rail. Refer to Fuel Tubes/Lines/Hoses and Clamps, or Quick-Connect Fittings. These can both be found in the Fuel Delivery section of this group.

(5) Install protective cap to pressure test port fitting.

(6) Install fuel tank cap.

(7) Connect negative battery cable to battery.

(8) Start engine and check for fuel leaks.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE OFF. BEFORE SERVICING THE FUEL PUMP, FUEL LINES, FUEL FILTER OR FUEL INJECTOR, THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

Refer to the Fuel Delivery System section of this group. See Fuel System Pressure Release procedure.

FUEL TANKS

Refer to the Fuel Tank section of this group for removal/installation procedures.

FUEL TANK PRESSURE RELIEF/ROLLOVER VALVE

Refer to the Fuel Tank section of this group for removal/installation procedures.

FUEL TUBES/LINES/HOSES AND CLAMPS

Refer to Fuel Tubes/Lines/Hoses and Clamps in the Fuel Delivery System section of this group for removal/installation procedures. Also refer to Quick-Connect Fittings in the Fuel Delivery section of this group.

IDLE AIR CONTROL (IAC) MOTOR

The idle air control motor is mounted to the throttle body adjacent to the throttle position sensor (Fig. 12).

REMOVAL

(1) Disconnect the electrical connector from the idle air control motor.

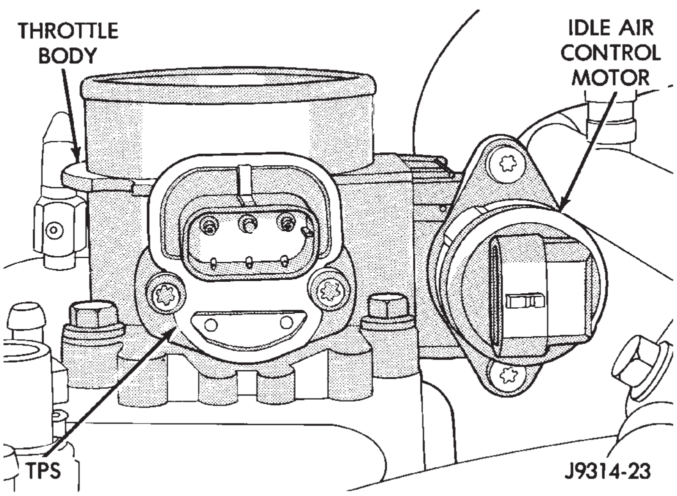

Fig. 12 Idle Air Control Motor—Removal/Installation

(2) Remove idle air control motor torx head mounting bolts.
(3) Remove idle air control motor.

INSTALLATION

(1) Install idle air control motor into throttle body and tighten retaining bolts.
(2) Connect electrical connector to idle air control motor.

IGNITION COIL

Refer to Group 8D, Ignition Systems for removal/installation procedures.

INTAKE MANIFOLD

Refer to Group 11, Exhaust System and Intake Manifold for removal/installation procedures.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The MAP sensor is located on the dash panel near the rear of the engine cylinder head cover (Fig. 13).

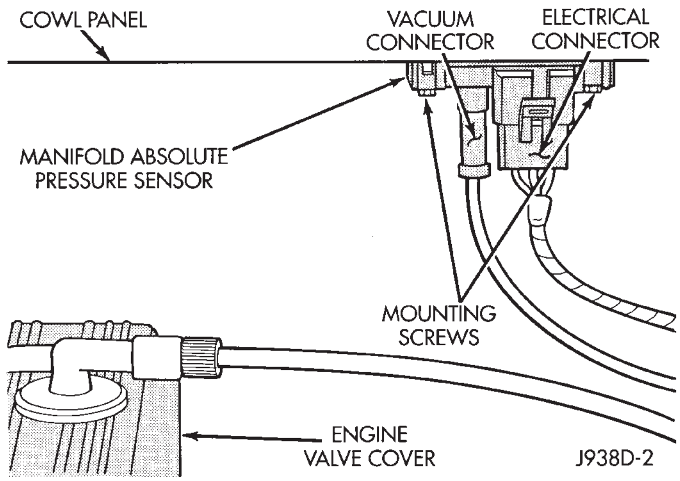

Fig. 13 MAP Sensor

REMOVAL

(1) Disconnect the MAP sensor electrical connector (Fig. 13).
(2) Disconnect the MAP sensor vacuum supply hose (Fig. 13).
(3) Remove the MAP sensor mounting bolts and remove MAP sensor.

INSTALLATION

(1) Install MAP sensor to dash panel and secure with mounting bolts.
(2) Install the MAP sensor vacuum supply hose.
(3) Connect the MAP sensor electrical connector.

OXYGEN (O2S) SENSOR

The O2S sensor is installed in the exhaust down pipe just below the exhaust manifold flange (Fig. 14).

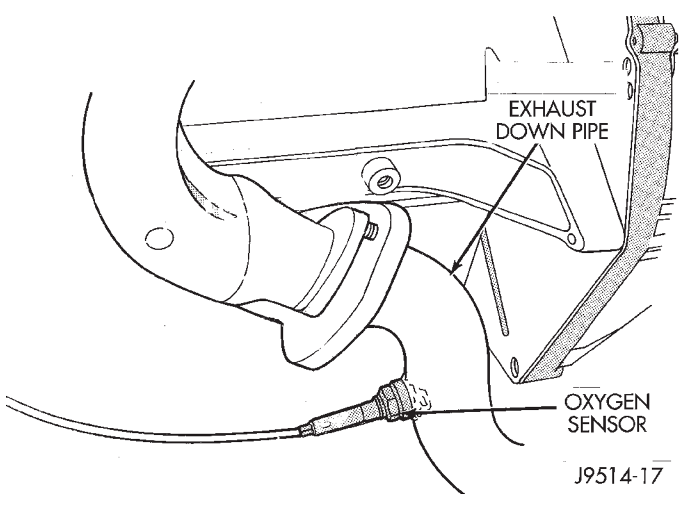

Fig. 14 Oxygen Sensor—Typical

REMOVAL

WARNING: THE EXHAUST MANIFOLD BECOMES VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support the vehicle.
(2) The sensors electrical connector clip is pushed over an oil pan mounting stud. Pull the connector clip from the mounting stud.
(3) Separate the electrical connectors.
(4) Remove the O2S sensor from the exhaust manifold. Snap-On oxygen sensor wrench (number YA 8875) may be used for removal and installation.

INSTALLATION

Threads of new factory oxygen sensors are coated with anti-seize compound to aid in removal.
(1) Install the O2S sensor into the exhaust manifold and tighten to 30 N·m (22 ft. lbs.) torque.
(2) Connect the O2S sensor wire connector to the main harness.
(3) Push the sensor clip on firmly at the oil pan stud.
(4) Lower the vehicle.

PARK/NEUTRAL SWITCH

Refer to Group 21, Transmissions for park/neutral switch service.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is located on the cowl panel in the right/rear side of the engine compartment (Fig. 15).

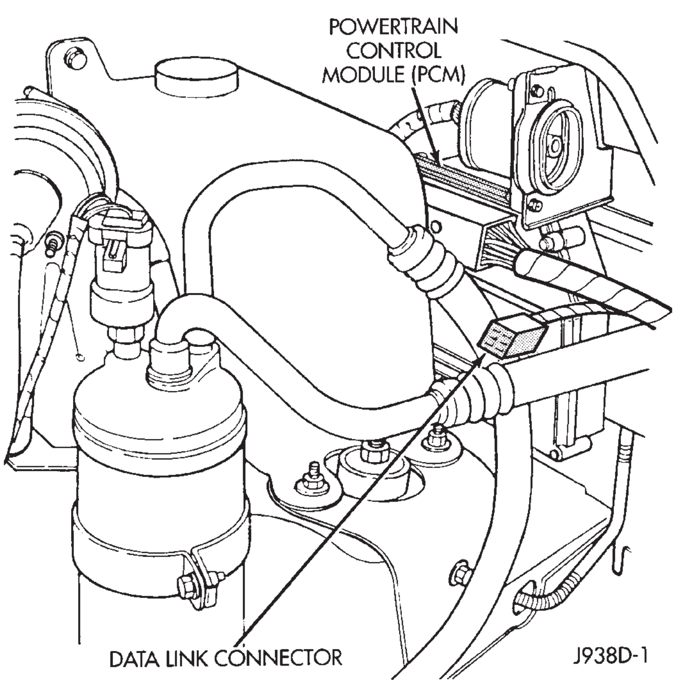

Fig. 15 Powertrain Control Module (PCM) Location

REMOVAL

(1) Disconnect the negative battery cable at the battery.
(2) Remove the coolant reserve/overflow tank (one bolt and two nuts) (Fig. 16)

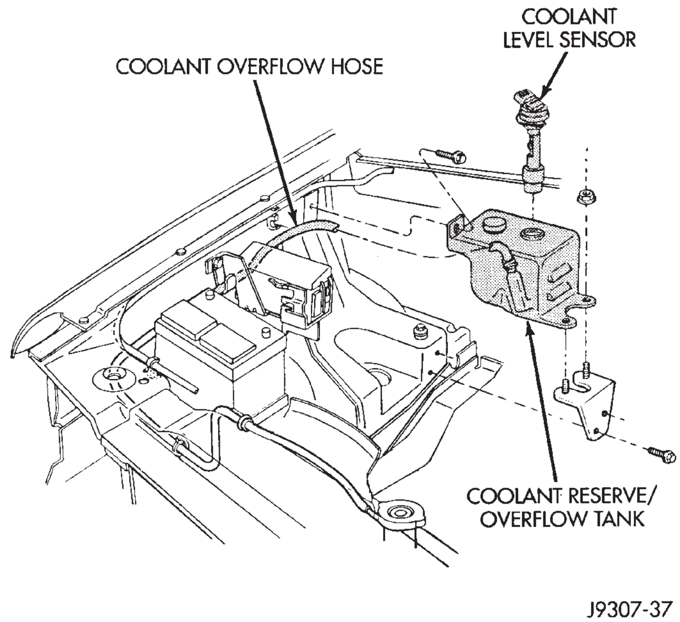

Fig. 16 Coolant Reserve/Overflow Tank Mounting

(3) Loosen the 60-Way connector mounting bolt (Fig. 17).
(4) Remove the electrical connector by pulling straight back.

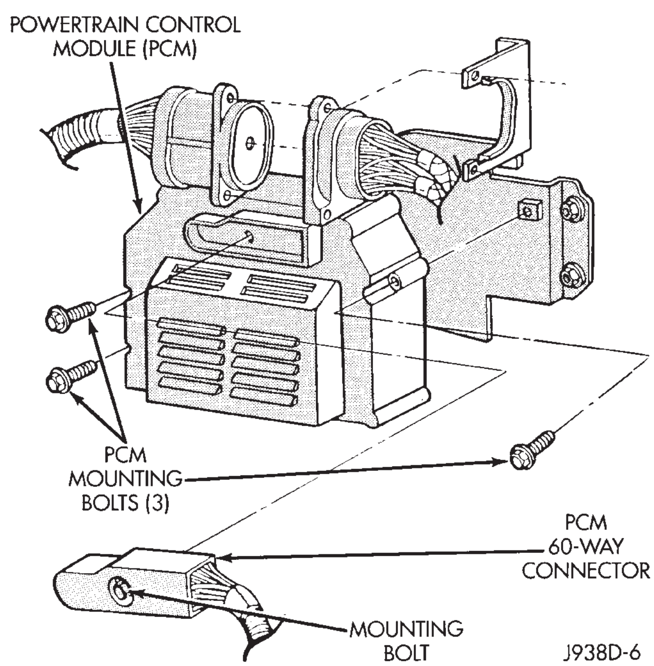

Fig. 17 Powertrain Control Module (PCM) Mounting

(5) Remove the three PCM mounting bolts (Fig. 17).
(6) Remove PCM.

INSTALLATION

(1) Check the pins in 60-way electrical connector for damage. Repair as necessary.

(2) Install PCM. Tighten three mounting bolts to 1 N·m (9 in. lbs.) torque.

(3) Engage 60-way connector into PCM. Tighten connector mounting bolt to 4 N·m (35 in. lbs.) torque.

(4) Install coolant reserve/overflow tank.

(5) Connect negative cable to battery.

QUICK-CONNECT FITTINGS

Refer to the Fuel Delivery System section of this group for removal/installation procedures.

THROTTLE BODY

REMOVAL

(1) Disconnect the negative battery cable.

(2) Disconnect air cleaner hose from throttle body.

(3) Disconnect idle air control motor and throttle position sensor wire connectors.

(4) Disconnect accelerator cable, throttle cable (automatic transmission) and speed control cable (if equipped) from throttle arm (Fig. 18).

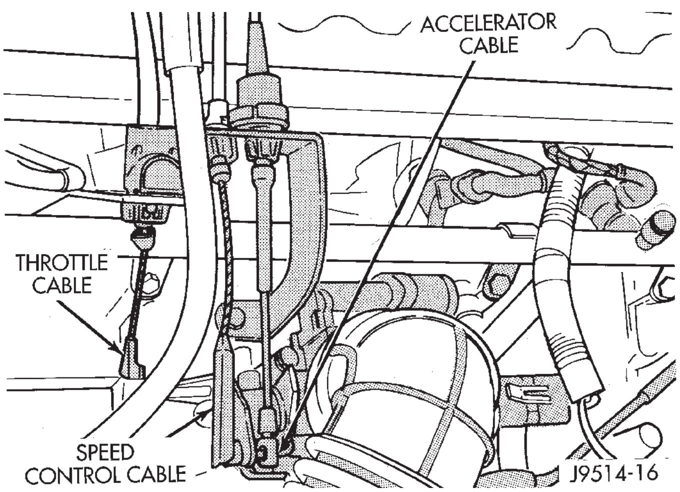

Fig. 18 Accelerator, Throttle and Speed Control Cables

(5) Remove throttle body mounting bolts, throttle body and gasket. Discard old gasket (Fig. 19).

INSTALLATION

(1) Install throttle body and new gasket. Tighten throttle body mounting bolts to 12 N·m (9 ft. lbs.) torque.

(2) Connect idle air control motor and throttle position sensor wire connectors.

(3) Connect throttle linkage to throttle arm.

CAUTION: When the automatic transmission throttle cable is connected, it MUST be adjusted.

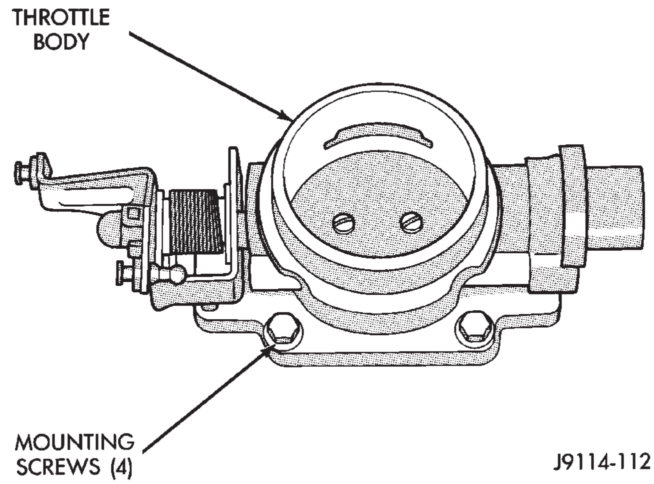

Fig. 19 Throttle Body—Removal/Installation

(4) If equipped with an automatic transmission, connect and adjust the transmission line pressure cable. Refer to Group 21, Transmissions for adjustment procedure.

(5) Install air cleaner hose to throttle body.

(6) Connect negative battery cable to battery.

THROTTLE POSITION SENSOR (TPS)

REMOVAL

(1) Disconnect TPS electrical connector.

(2) Remove TPS mounting bolts.

(3) Remove TPS.

INSTALLATION

The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 20). The TPS must be installed so that it can be rotated a few degrees. If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs. The TPS will be under slight tension when rotated.

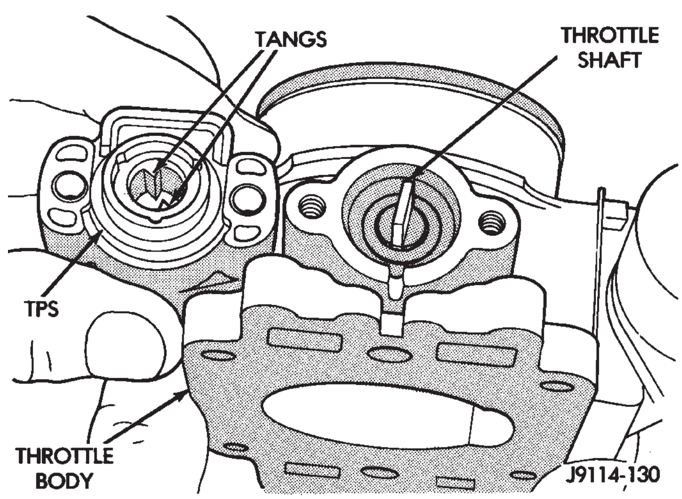

Fig. 20 Throttle Position Sensor—Installation

(1) Install the TPS and retaining bolts.

(2) Connect TPS electrical connector to TPS.

(3) Manually operate the throttle (by hand) to check for any TPS binding before starting the engine.

VEHICLE SPEED SENSOR

The vehicle speed sensor (Fig. 21) is located on the extension housing of the transmission on 2WD models. It is located on the transfer case on 4WD models.

REMOVAL

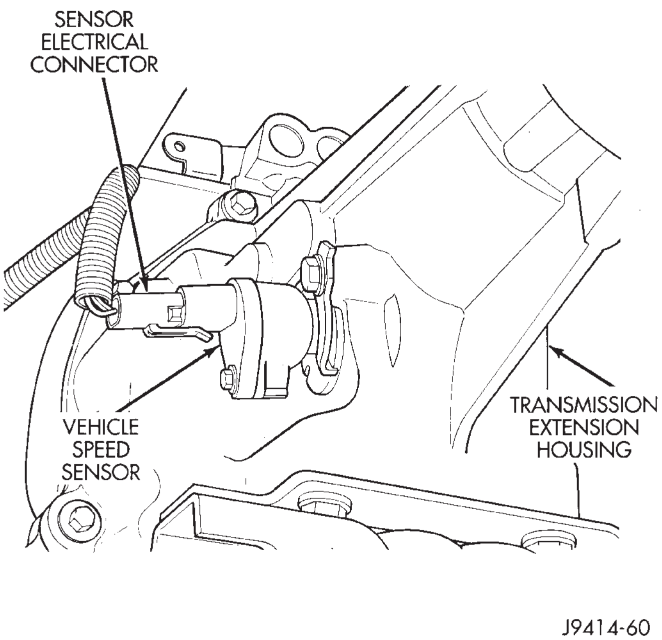

Fig. 21 Vehicle Speed Sensor Location—Typical

(1) Raise and support vehicle.

(2) Clean the area around the sensor before removal.

(3) Disconnect the electrical connector from the sensor.

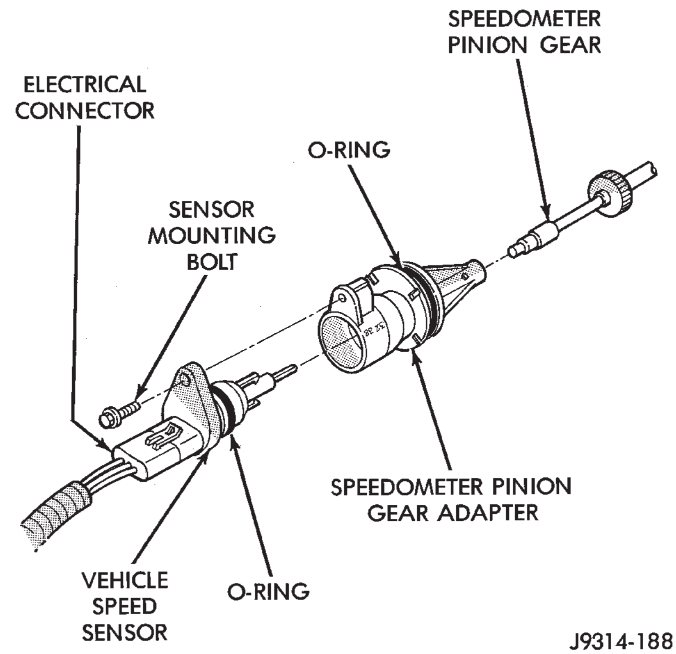

Fig. 22 Sensor Removal/Installation—Typical

(4) Remove the sensor mounting nut (Fig. 22).

(5) Pull the sensor from the speedometer pinion gear adapter for removal.

INSTALLATION

(1) Install new sensor into speedometer gear adapter.

(2) Install and tighten sensor mounting bolt. **To prevent damage to sensor or speedometer adapter, be sure the sensor is mounted flush to the adapter before tightening.**

(3) Connect electrical connector to sensor.

MULTI-PORT FUEL INJECTION (MFI)—5.2L V-8 ENGINE—COMPONENT DESCRIPTION/SYSTEM OPERATION

INDEX

GENERAL INFORMATION

All 5.2L V-8 engines are equipped with sequential Multi-Port Fuel Injection (MFI). The MFI system provides precise air/fuel ratios for all driving conditions.

The powertrain control module (PCM) operates the fuel system. The PCM was formerly referred to as the SBEC or engine controller. The PCM is a pre-programmed, dual microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

Powertrain Control Module (PCM) Inputs represent the instantaneous engine operating conditions. Air-fuel mixture and ignition timing calibrations for various driving and atmospheric conditions are pre-programmed into the PCM. The PCM monitors and analyzes various inputs. It then computes engine fuel and ignition timing requirements based on these inputs. Fuel delivery control and ignition timing will then be adjusted accordingly.

Other inputs to the PCM are provided by the brake light switch, air conditioning select switch and the speed control switches. All inputs to the PCM are converted into signals.

Electrically operated fuel injectors spray fuel in precise metered amounts into the intake port directly above the intake valve. The injectors are fired in a specific sequence by the PCM. The PCM maintains an air/fuel ratio of 14.7 to 1 by constantly adjusting injector pulse width. Injector pulse width is the length of time that the injector opens and sprays fuel into the chamber. The PCM adjusts injector pulse width by opening and closing the ground path to the injector.

Manifold absolute pressure (air density) and engine rpm (speed) are the primary inputs that determine fuel injector pulse width. The PCM also monitors other inputs when adjusting air-fuel ratio.

Inputs That Effect Fuel Injector Pulse Width:

- Exhaust gas oxygen content
- Engine coolant temperature
- Manifold absolute pressure (MAP)
- Engine speed
- Throttle position
- Battery voltage
- Air conditioning selection
- Transmission gear selection (automatic transmissions only)
- Speed control

The powertrain control module (PCM) adjusts ignition timing by controlling ignition coil operation. The ignition coil receives battery voltage when the ignition key is in the run or starter position. The PCM provides a ground for the ignition coil. The coil discharges when the PCM supplies a ground. By switching the ground path on and off, the PCM regulates ignition timing.

The sensors and switches that provide inputs to the powertrain control module (PCM) comprise the Engine Control System. It is also comprised of the PCM Outputs (engine control devices that the are operated by the PCM).

SYSTEM DIAGNOSIS

The powertrain control module (PCM) tests many of its own input and output circuits. If a Diagnostic Trouble Code (DTC) is found in a major system, this information is stored in the PCM memory. Refer to On-Board Diagnostics in the Multi-Port Fuel Injection—General Diagnosis—5.2L Engine section of this group for DTC information.

POWERTRAIN CONTROL MODULE (PCM)

The powertrain control module (PCM) (Fig. 1) operates the fuel system. The PCM was formerly referred to as the SBEC or engine controller. The PCM is a pre-programmed, dual microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

Powertrain Control Module (PCM) Inputs:

- Generator output
- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Intake manifold air temperature sensor
- Battery voltage

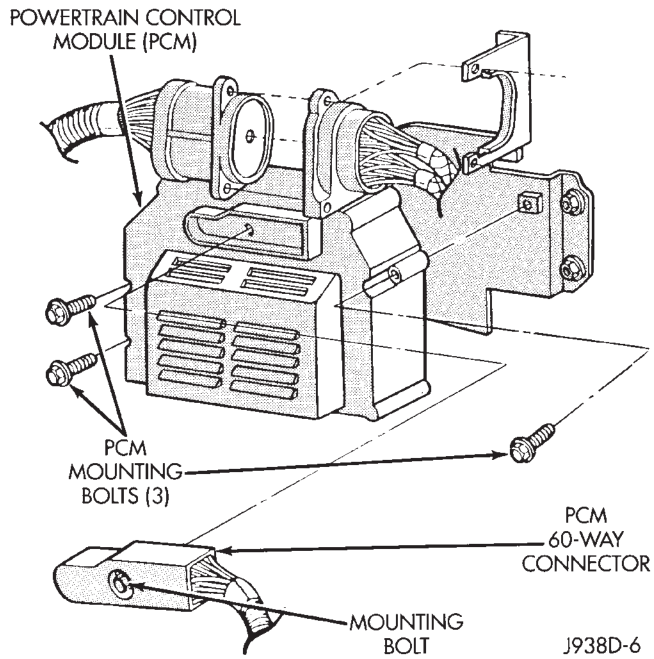

Fig. 1 Powertrain Control Module (PCM) Location

- Brake switch
- Engine coolant temperature sensor
- Crankshaft position sensor
- Ignition circuit sense (ignition switch in run position)
- Manifold absolute pressure sensor
- Overdrive/override switch
- Oxygen sensor
- Park/neutral switch (auto. trans. only)
- SCI receive (DRB scan tool connection)
- Speed control resume switch
- Speed control set switch
- Speed control on/off switch
- Camshaft position sensor signal
- Throttle position sensor
- Vehicle speed sensor
- Sensor return
- Power ground
- Signal ground

Powertrain Control Module (PCM) Outputs:

- A/C clutch relay
- Idle air control (IAC) motor
- Auto shutdown (ASD) relay
- Generator field
- Malfunction indicator lamp (Check engine lamp)
- EGR valve control solenoid
- Fuel injectors
- Fuel pump relay
- Ignition coil
- EVAP canister purge solenoid
- SCI transmit (DRB scan tool connection)
- Shift indicator lamp (manual transmission only)
- Speed control vacuum solenoid
- Speed control vent solenoid

• Tachometer (on instrument panel, if equipped)

The powertrain control module (PCM) contains a voltage convertor. This converts battery voltage to a regulated 8.0 volts. It is used to power the crankshaft position sensor, camshaft position sensor and vehicle speed sensor. The PCM also provides a five (5) volt supply for the manifold absolute pressure (MAP) sensor and throttle position sensor (TPS).

AIR CONDITIONING (A/C) CONTROLS—PCM INPUT

The A/C control system information applies to factory installed air conditioning units.

A/C SELECT SIGNAL: When the A/C switch is in the ON position and the A/C low-pressure switch is closed, an input signal is sent to the powertrain control module (PCM). The signal informs the PCM that the A/C has been selected. The PCM then adjusts idle speed to a pre-programmed rpm through the idle air control (IAC) motor to compensate for increased engine load.

A/C REQUEST SIGNAL: Once A/C has been selected, the powertrain control module (PCM) receives the A/C request signal from the evaporator switch. The input indicates that the evaporator temperature is in the proper range for A/C application. The PCM uses this input to cycle the A/C compressor clutch through the A/C relay. It will also determine the correct engine idle speed through the idle air control (IAC) motor position.

If the A/C low-pressure switch opens, indicating a low refrigerant level, the PCM will not receive an A/C select signal. The PCM will then remove the ground from the A/C relay. This will deactivate the A/C compressor clutch.

If the evaporator switch opens, (indicating that evaporator is not in proper temperature range), the PCM will not receive the A/C request signal. The PCM will then remove the ground from the A/C relay, deactivating the A/C compressor clutch.

AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The ASD relay is located in the power distribution center (PDC) in the engine compartment. It is used to connect the oxygen sensor heater element, ignition coil, generator field winding and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the powertrain control module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

BATTERY VOLTAGE—PCM INPUT

The battery voltage input provides power to the powertrain control module (PCM). It also informs the PCM what voltage level is supplied to the ignition coil and fuel injectors.

If battery voltage is low, the PCM will increase injector pulse width (period of time that the injector is energized). This is done to compensate for the reduced flow through the injector caused by the lowered voltage.

BRAKE SWITCH—PCM INPUT

When the brake light switch is activated, the powertrain control module (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 (IAC) motor. The brake switch input is also used to operate the speed control system.

CAMSHAFT POSITION SENSOR—PCM INPUT

A sync signal is provided by the camshaft position sensor located in the distributor (Fig. 2). The sync signal from this sensor works in conjunction with the crankshaft position sensor to provide the powertrain control module (PCM) with inputs. This is done to establish and maintain correct injector firing order.

Refer to Camshaft Position Sensor in Group 8D, Ignition System for more information.

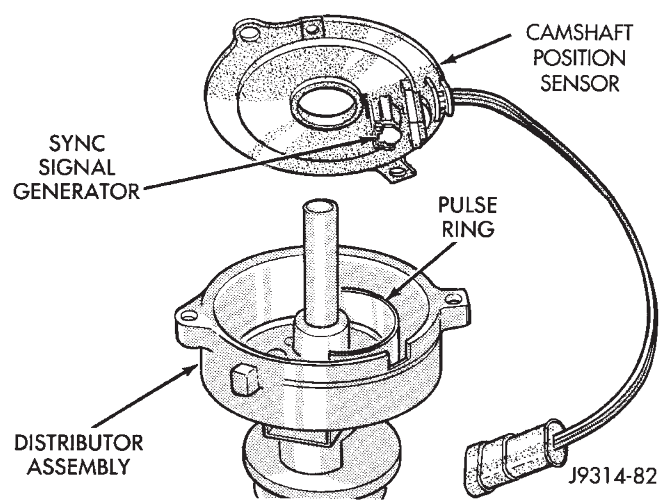

Fig. 2 Camshaft Position Sensor

DATA LINK CONNECTOR—PCM INPUT

The data link connector (diagnostic scan tool connector) links the DRB scan tool with the powertrain control module (PCM). The data link connector is located in the engine compartment (Fig. 3). For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

The data link connector uses two different pins on the PCM. One is for Data Link Transmit and the other is for Data Link Receive.

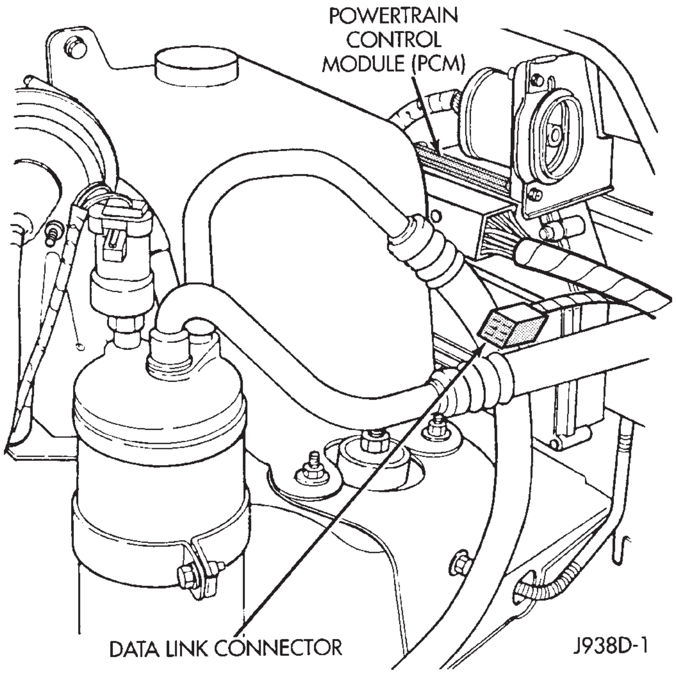

Fig. 3 Data Link Connector Location—Typical

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT

The intake manifold air temperature sensor is installed in the intake manifold with the sensor element extending into the air stream (Fig. 4). The sensor provides an input voltage to the powertrain control module (PCM) indicating intake manifold air temperature. The input is used along with inputs from other sensors to determine injector pulse width. As the temperature of the air-fuel stream in the manifold varies, the sensor resistance changes. This results in a different input voltage to the PCM.

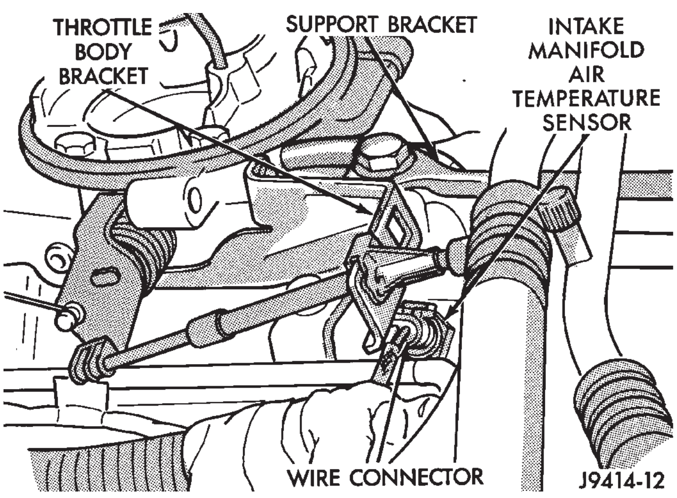

Fig. 4 Air Temperature Sensor—Typical

CRANKSHAFT POSITION SENSOR—PCM INPUT

This sensor is a hall effect device that detects notches in the flywheel (manual transmission), or flexplate (automatic transmission).

This sensor is used to indicate to the powertrain control module (PCM) that a spark and or fuel injection event is to be required. The output from this sensor, in conjunction with the camshaft position sensor signal, is used to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

The sensor is bolted to the cylinder block near the rear of the right cylinder head (Fig. 5).

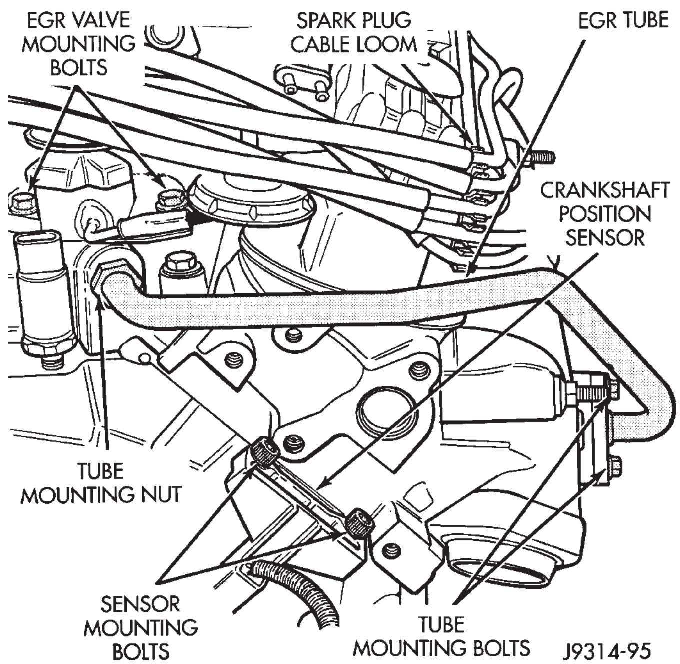

Fig. 5 Crankshaft Position Sensor

Refer to Group 8D, Ignition System for more crankshaft position sensor information.

The engine will not operate if the PCM does not receive a crankshaft position sensor input.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

The engine coolant temperature sensor is installed next to the thermostat housing (Fig. 6) and protrudes into the water jacket. The sensor provides an input voltage to the powertrain control module (PCM) relating coolant temperature. The PCM uses this input along with inputs from other sensors to determine injector pulse width and ignition timing. As coolant temperature varies, the coolant temperature sensor's resistance changes. The change in resistance results in a different input voltage to the PCM.

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

IGNITION CIRCUIT SENSE—PCM INPUT

The ignition circuit sense input tells the powertrain control module (PCM) the ignition switch has ener-

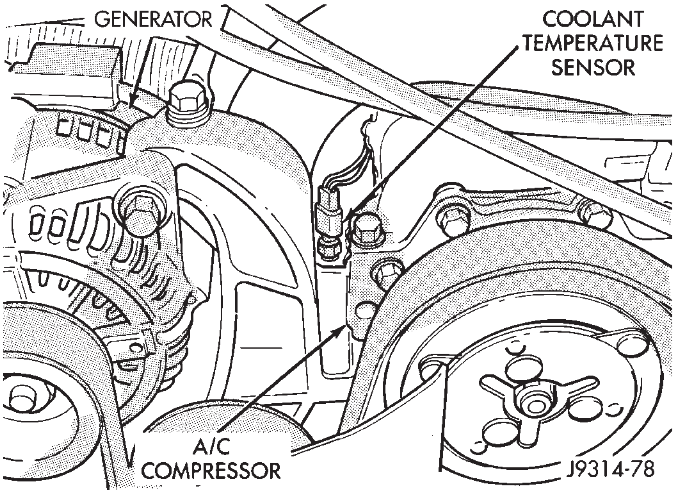

Fig. 6 Coolant Temperature Sensor—Typical

gized the ignition circuit. Refer to the wiring diagrams for circuit information.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

The MAP sensor reacts to absolute pressure in the intake manifold. It provides an input voltage to the powertrain control module (PCM). As engine load changes, manifold pressure varies. The change in manifold pressure causes MAP sensor voltage to change. The change in MAP sensor voltage results in a different input voltage to the PCM. The input voltage level supplies the PCM with information about ambient barometric pressure during engine start-up (cranking) and engine load while the engine is running. The PCM uses this input along with inputs from other sensors to adjust air-fuel mixture.

The MAP sensor is mounted on the side of the engine throttle body (Fig. 7). The sensor is connected to the throttle body with a rubber L-shaped fitting.

OXYGEN (O2S) SENSOR—PCM INPUT

The O2S sensor is located in the right exhaust down pipe (Fig. 8). It provides an input voltage to the powertrain control module (PCM) relating the oxygen content of the exhaust gas. The PCM uses this information to fine tune the air-fuel ratio by adjusting injector pulse width.

The O2S sensor produces voltages from 0 to 1 volt. This voltage will depend 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 a low voltage. When there is a lesser amount present (rich air-fuel mixture), it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining

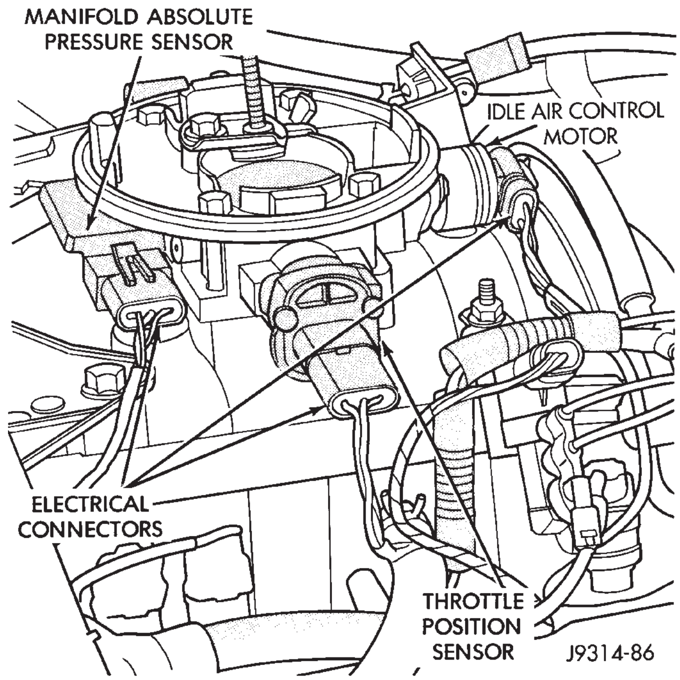

Fig. 7 MAP Sensor—Typical

correct sensor temperature at all times allows the system to enter into closed loop operation sooner.

In Closed Loop operation, the powertrain control module (PCM) monitors the O2S sensor input (along with other inputs). It then adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2S sensor input and adjusts injector pulse width to a preprogrammed value (based on other sensor inputs).

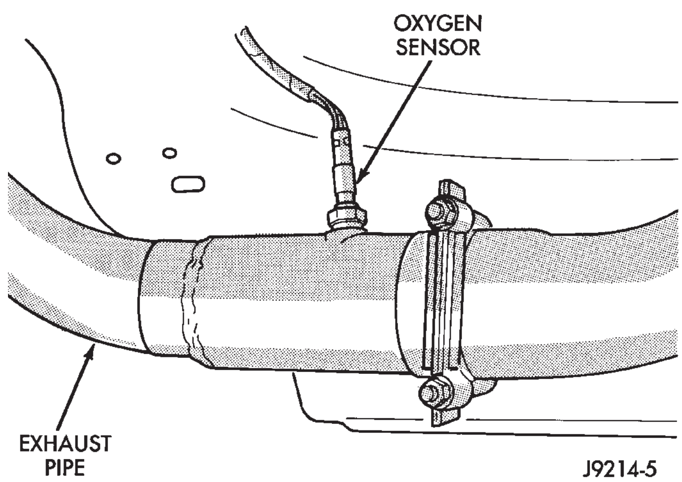

Fig. 8 Heated Oxygen Sensor—Typical

OVERDRIVE/OVERRIDE SWITCH

On vehicles equipped with an automatic transmission and overdrive, the powertrain control module (PCM) regulates the 3-4 overdrive up-shift and downshift through the overdrive solenoid. This solenoid is located in the transmission. An overdrive/override push-button switch is located on the instrument panel.

The PCM circuit for overdrive is controlled by inputs from the engine coolant temperature sensor and vehicle speed sensor. If coolant temperature and vehicle speed are not within the preset PCM specifications, the PCM will not allow the transmission to shift into overdrive. These preset PCM specifications must be met before the push-button switch will be allowed to control overdrive operation.

The overdrive/override push-button switch is normally closed (overdrive allowed) when the lamp is not illuminated. It opens (overdrive not allowed) when the operator presses the switch and the lamp is illuminated. The switch will revert to its normally closed position (lamp off) each time the ignition switch in turned on. The transmission downshifts if the operator presses the override switch while in overdrive.

Refer to Group 21 for more transmission information.

PARK/NEUTRAL SWITCH—PCM INPUT

The park/neutral switch is located on the transmission housing and provides an input to the powertrain control module (PCM). This will indicate that the automatic transmission is in Park, Neutral or a drive gear selection. This input is used to determine idle speed (varying with gear selection), fuel injector pulse width, ignition timing advance and vehicle speed control operation. Refer to Group 21, Transmissions, for testing, replacement and adjustment information.

POWER GROUND

The power ground is used to control ground circuits for the following powertrain control module (PCM) loads:

- Generator Field Winding
- 8 volt (PCM) power supply
- Fuel Injectors
- Ignition Coil

SCI RECEIVE—PCM INPUT

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.

SPEED CONTROL—PCM INPUT

The speed control system provides three separate inputs to the powertrain control module (PCM); On/Off, Set and Resume. The On/Off input informs the PCM that the speed control system has been activated. The Set input informs the PCM that a fixed vehicle speed has been selected. The Resume input indicates to the PCM that the previous fixed speed is requested.

The speed control operating range is from 50 km/h to 142 km/h (35 to 85 mph). Inputs that effect speed control operation are:

- Brake switch position
- Park/neutral switch
- Vehicle speed sensor
- Throttle position sensor

Refer to Group 8H for further speed control information.

SENSOR RETURN—PCM INPUT

Sensor Return provides a low noise ground reference for all system sensors.

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

The throttle position sensor (TPS) is mounted on the throttle body (Fig. 9). The TPS is a variable resistor that provides the powertrain control module (PCM) with an input signal (voltage) that represents throttle blade position. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the resistance of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from 1 volt at minimum throttle opening (idle), to 4 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

VEHICLE SPEED SENSOR—PCM INPUT

The speed sensor (Fig. 10) is located in the extension housing of the transmission (2WD) or on the transfer case extension housing (4WD). The sensor input is used by the powertrain control module (PCM) to determine vehicle speed and distance traveled.

The 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. 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 deceleration conditions, the PCM adjusts the idle air control (IAC) motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

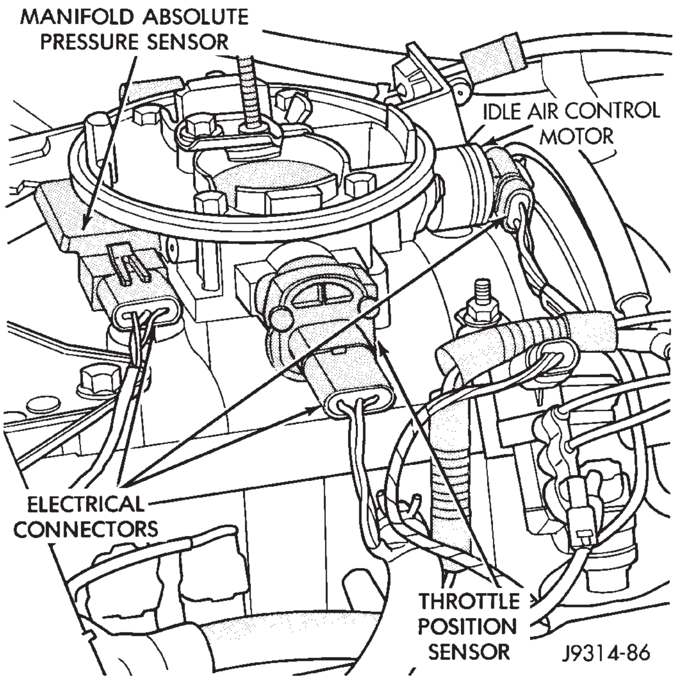

Fig. 9 Throttle Position Sensor and IAC Motor—Typical

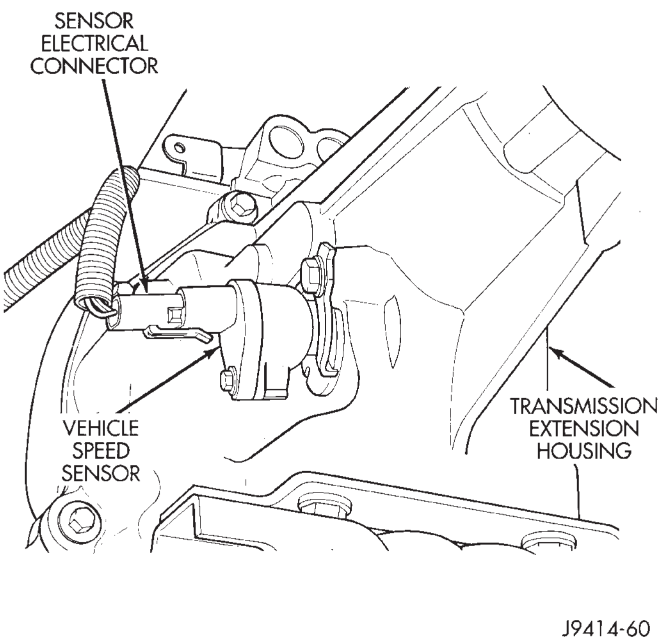

Fig. 10 Vehicle Speed Sensor—Typical

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

The powertrain control module (PCM) activates the A/C compressor through the A/C clutch relay. The PCM regulates A/C compressor operation by switching the ground circuit for the A/C clutch relay on and off. The relay is located in the power distribution center (PDC) (Fig. 11). For the location of the relay within the PDC, refer to label under PDC cover.

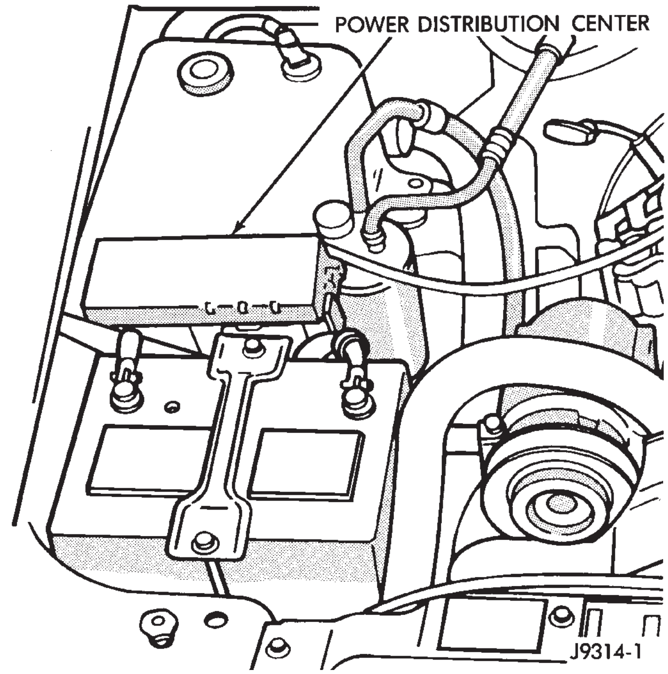

Fig. 11 Power Distribution Center (PDC)

When the PCM receives a request for A/C from the A/C evaporator switch, it will adjust the idle air control (IAC) motor position. This is done to increase idle speed. The PCM will then activate the A/C clutch through the A/C clutch relay. The PCM then adjusts the idle air control (IAC) stepper motor position to compensate for increased engine load from the A/C compressor.

By switching the ground path for the relay on and off, the PCM is able to cycle the A/C compressor clutch. This is based on changes in engine operating conditions. If, during A/C operation, the PCM senses low idle speeds or a wide open throttle condition, it will de-energize the relay. This prevents A/C clutch engagement. The relay will remain de-energized until the idle speed increases, or the wide open throttle condition exceeds 15 seconds, or no longer exists. The PCM will also de-energize the relay if engine coolant temperature exceeds 125°C (257°F).

IDLE AIR CONTROL (IAC) MOTOR—PCM OUTPUT

The IAC motor is mounted to the back of the throttle body (Fig. 9) and is controlled by the powertrain control module (PCM).

The throttle body has an air control passage that provides air for the engine at idle (the throttle plate is closed). The IAC motor pintle protrudes into the air control passage (Fig. 12) and regulates air flow through it. Based on various sensor inputs, the powertrain control module (PCM) adjusts engine idle speed by moving the IAC motor pintle in and out of the air control passage. The IAC motor is positioned when the ignition key is turned to the On position.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

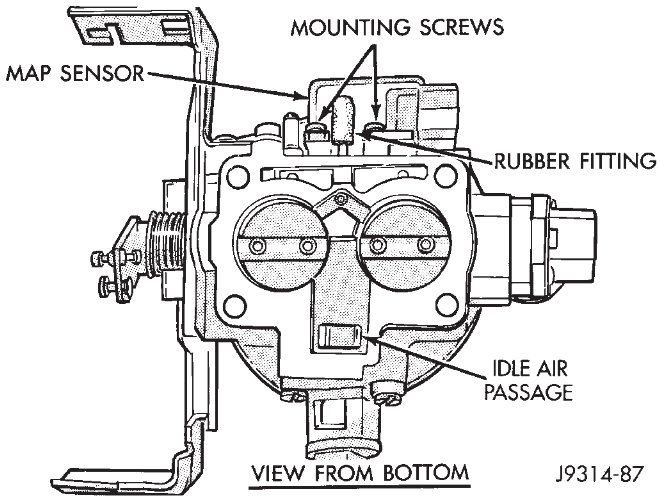

Fig. 12 Throttle Body Air Control Passage

AUTO SHUTDOWN (ASD) RELAY—PCM OUTPUT

The ASD relay is located in the power distribution center (PDC) (Fig. 11). For the location of this relay within the PDC, refer to label under PDC cover.

The ASD supplies battery voltage to the fuel pump, fuel injector, ignition coil, generator field winding and oxygen (O2S) sensor heating element. The ground circuit for the coil in the ASD relay is controlled by the powertrain control module (PCM). The PCM operates the relay by switching the ground circuit on and off.

The fuel pump relay is controlled by the PCM through same circuit that the ASD relay is controlled.

GENERATOR FIELD—PCM OUTPUT

The powertrain control module (PCM) regulates the charging system voltage within a range of 12.9 to 15.0 volts. Refer to Group 8A for charging system information.

GENERATOR LAMP—PCM OUTPUT

If the powertrain control module (PCM) senses a low charging condition in the charging system, it will illuminate the generator lamp on the instrument panel. For example, during low idle with all accessories turned on, the lamp may momentarily go on. Once the PCM corrects idle speed to a higher rpm, the lamp will go out. Refer to Group 8A for charging system information.

EGR (EXHAUST GAS RECIRCULATION) VALVE CONTROL SOLENOID—PCM OUTPUT

Refer to Group 25, Emission Control System for information. See EGR (Exhaust Gas Recirculation) System.

DATA LINK CONNECTOR—PCM OUTPUT

Refer to the previous paragraphs on Data Link Connector—PCM Input for information.

EVAP CANISTER PURGE SOLENOID—PCM OUTPUT

Refer to Group 25, Emission Control System. See EVAP Canister Purge Solenoid.

FUEL INJECTORS—PCM OUTPUT

The fuel injectors are attached to the fuel rail (Fig. 13). 5.2L engines use eight individual injectors for each cylinder.

The nozzle ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

The injectors are energized individually in a sequential order by the powertrain control module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

During start up, battery voltage is supplied to the injectors through the ASD relay. When the engine is operating, voltage is supplied by the charging system. The PCM determines injector pulse width based on various inputs.

MALFUNCTION INDICATOR LAMP—PCM OUTPUT

The malfunction indicator lamp illuminates each time the ignition key is turned on. It will stay on for approximately three seconds as a bulb test. The lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 14).

If the powertrain control module (PCM) receives an incorrect signal, or no signal from certain sensors or emission related systems, the lamp is turned on. This is a warning that the PCM has recorded a system or sensor malfunction. In some cases, when a problem is declared, the PCM will go into a limp-in mode. This is an attempt to keep the system operating. It signals an immediate need for service.

The lamp can also be used to display a Diagnostic Trouble Code (DTC). Cycle the ignition switch On-Off-On-Off-On within three seconds and any codes stored in the PCM memory will be displayed. This is

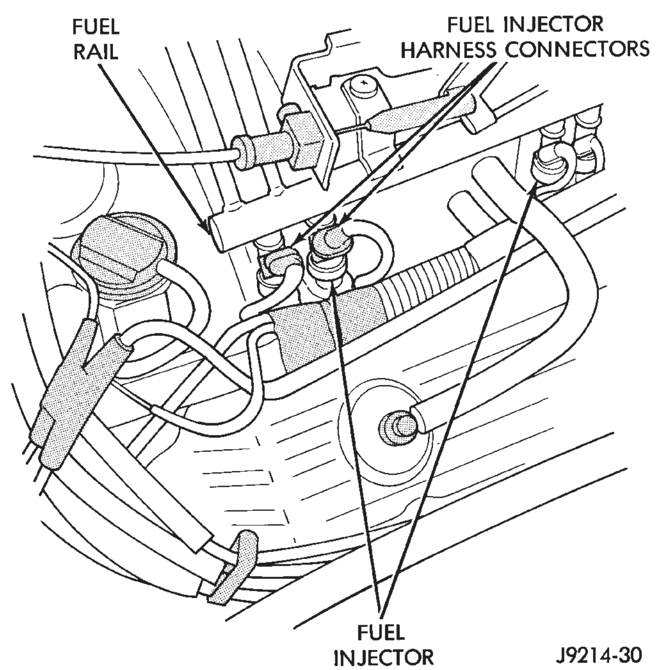

Fig. 13 Fuel Injectors—Typical

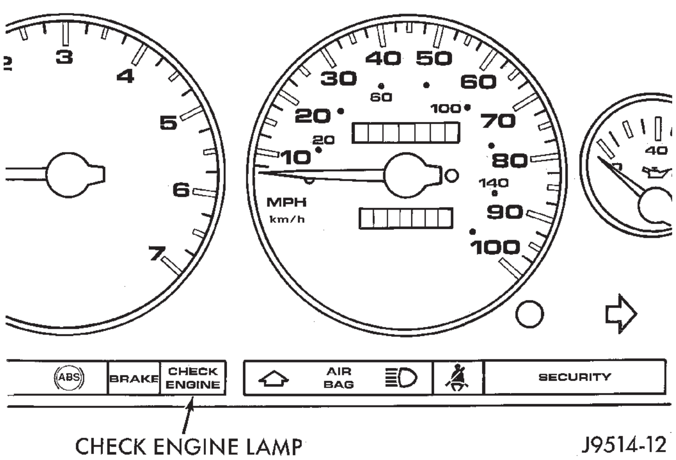

Fig. 14 Check Engine Lamp Location

done in a series of flashes representing digits. Refer to On-Board Diagnostics in the General Diagnosis section of this group for more information.

IGNITION COIL—PCM OUTPUT

System voltage is supplied to the ignition coil positive terminal. The powertrain control module (PCM) operates the ignition coil. **Base (initial) ignition timing is not adjustable.** The PCM adjusts ignition timing to meet changing engine operating conditions.

The ignition coil is located near the front of the right cylinder head (Fig. 15).

SCI TRANSMIT—PCM OUTPUT

SCI Transmit is the serial data communication transmit circuit for the DRB scan tool. The powertrain control module (PCM) transmits data to the DRB through the SCI Transmit circuit.

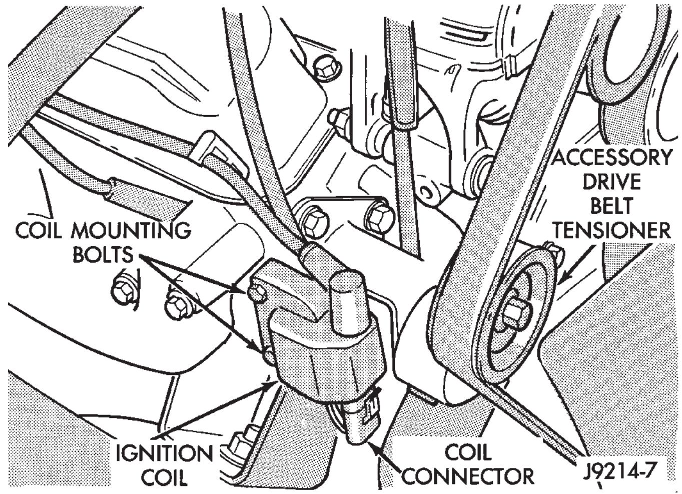

Fig. 15 Ignition Coil

SHIFT INDICATOR—PCM OUTPUT

Vehicles equipped with manual transmissions have an Up-Shift indicator lamp. The lamp is controlled by the powertrain control module (PCM). The lamp illuminates on the instrument panel to indicate when the driver should shift to the next highest gear for best fuel economy. The PCM will turn the lamp OFF after 3 to 5 seconds if the shift of gears is not performed. The up-shift lamp will remain off until the vehicle stops accelerating and is brought back to range of up-shift lamp operation. This will also happen if vehicle is shifted into fifth gear.

The indicator lamp is normally illuminated when the ignition switch is turned on and it is turned off when the engine is started up. With the engine running, the lamp is turned on/off depending upon engine speed and load.

SPEED CONTROL—PCM OUTPUT

Speed control operation is regulated by the powertrain control module (PCM). The PCM controls the vacuum to the throttle actuator through the speed control vacuum and vent solenoids. Refer to Group 8H for Speed Control Information.

TACHOMETER—PCM OUTPUT

The powertrain control module (PCM) supplies engine rpm values to the instrument cluster tachometer. Refer to Group 8E for tachometer information.

OPEN LOOP/CLOSED LOOP MODES OF OPERATION

As input signals to the powertrain control module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate 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.

MODES

- Open Loop
- Closed Loop

During Open Loop modes, the powertrain control module (PCM) receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensor is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensor input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

- The powertrain control module (PCM) pre-positions the idle air control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored
- Throttle position sensor (TPS) is monitored
- The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized through the fuel pump relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.
- The up-shift indicator lamp is illuminated (manual transmission only).

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The powertrain control module (PCM) receives inputs from:

- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Starter motor relay
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the powertrain control module (PCM) receives inputs from:

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the powertrain control module (PCM). The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

- The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.
- The PCM operates the A/C compressor clutch through the clutch relay. This is done if A/C has been selected by the vehicle operator and requested by the A/C thermostat.
- If the vehicle has a manual transmission, the up-shift lamp is operated by the PCM.
- When the engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the powertrain control module (PCM) receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensor

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the powertrain control module (PCM). The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the powertrain control module (PCM) receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen (O2S) sensor

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

ACCELERATION MODE

This is an Open Loop mode. The powertrain control module (PCM) recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the powertrain control module (PCM) receives the following inputs.

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply battery voltage to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

The PCM opens the ground circuit to the A/C clutch relay to disengage the A/C compressor clutch. This is done until the vehicle is no longer under deceleration (if the A/C system is operating).

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the powertrain control module (PCM) receives the following inputs.

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)

During wide open throttle conditions, the following occurs:

- Voltage is applied to the fuel injectors with the powertrain control module (PCM). The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.
- The PCM opens the ground circuit to the A/C clutch relay to disengage the A/C compressor clutch. This will be done for approximately 15 seconds if the air conditioning system is operating.

If the vehicle has a manual transmission, the upshift lamp is operated by the PCM.

When the PCM senses wide open throttle condition through the throttle position sensor (TPS), it will provide a ground for the EGR solenoid. This will prevent any EGR functions.

IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

THROTTLE BODY

Filtered air from the air cleaner enters the intake manifold through the throttle body (Fig. 16). Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors. The throttle body is mounted on the intake manifold. It contains an air control passage (Fig. 17) controlled by an idle air control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

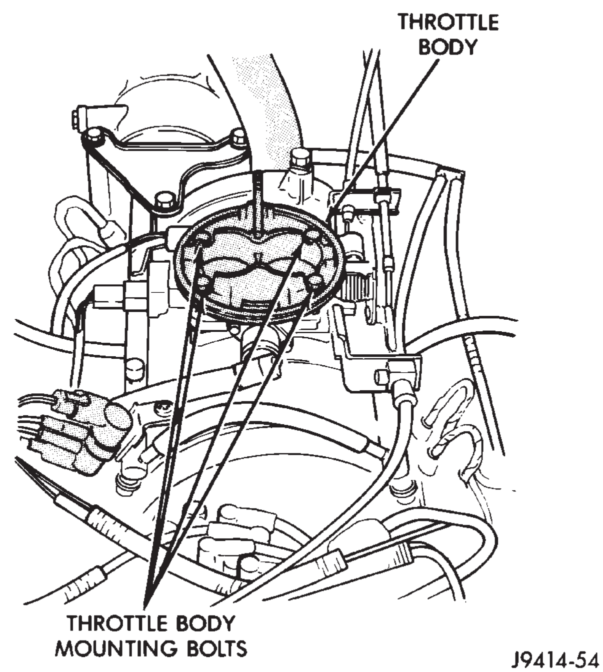

Fig. 16 Throttle Body—Typical

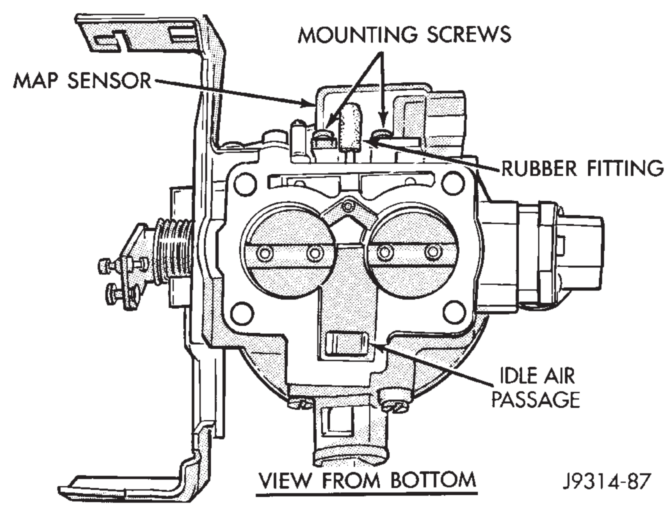

Fig. 17 Air Control Passage

The throttle position sensor (TPS), idle air control (IAC) motor and manifold absolute pressure sensor (MAP) are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle arm.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

FUEL RAIL

The fuel rail supplies fuel to the injectors and is mounted to the intake manifold (Fig. 18). The fuel pressure regulator is no longer attached to the fuel rail. It is now a part of the fuel pump module. The fuel pressure test port is integral with the rail and the rail is not repairable.

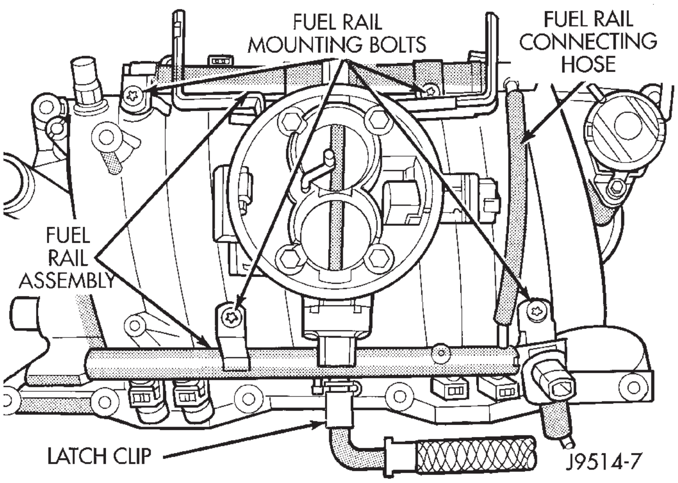

Fig. 18 Fuel Rail—Typical

FUEL PRESSURE REGULATOR

The fuel pressure regulator is no longer attached to the fuel rail. It is now a part of the fuel pump module. Refer to the Fuel Delivery section of this group for an operational description.

MULTI-PORT FUEL INJECTION (MFI)—5.2L V-8 ENGINE—GENERAL DIAGNOSIS

INDEX

VISUAL INSPECTION

A visual inspection for loose, disconnected, or incorrectly routed wires and hoses should be made. This should be done before attempting to diagnose or service the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Verify that the 60-way connector is fully inserted into the connector of the powertrain control module (PCM) (Fig. 1). Verify that the connector mounting bolt is tightened to 4 N·m (35 in. lbs.) torque.

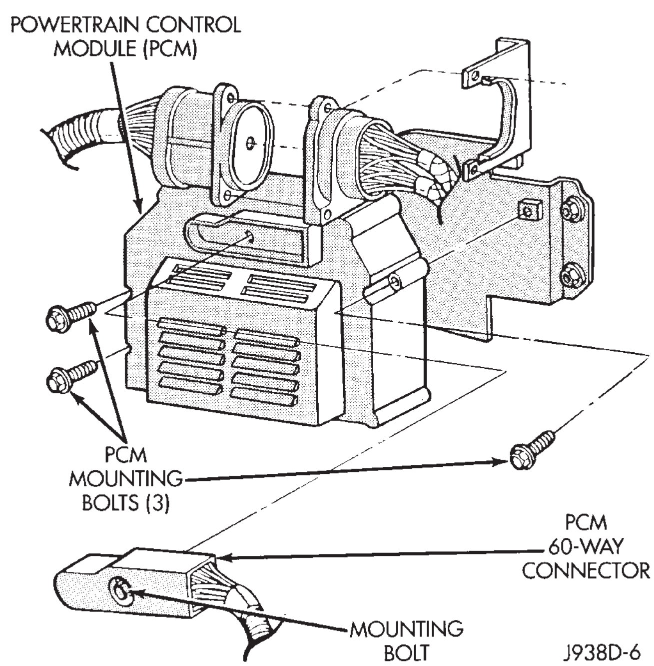

Fig. 1 Powertrain Control Module (PCM)

(2) Inspect the battery cable connections. Be sure that they are clean and tight.

(3) Inspect fuel pump relay and air conditioning compressor clutch relay (if equipped). Inspect the ASD relay connections. Inspect starter motor relay connections. Inspect relays for signs of physical damage and corrosion. The relays are located in the power distribution center (PDC) (Fig. 2). For the location of the relays within the PDC, refer to label under PDC cover.

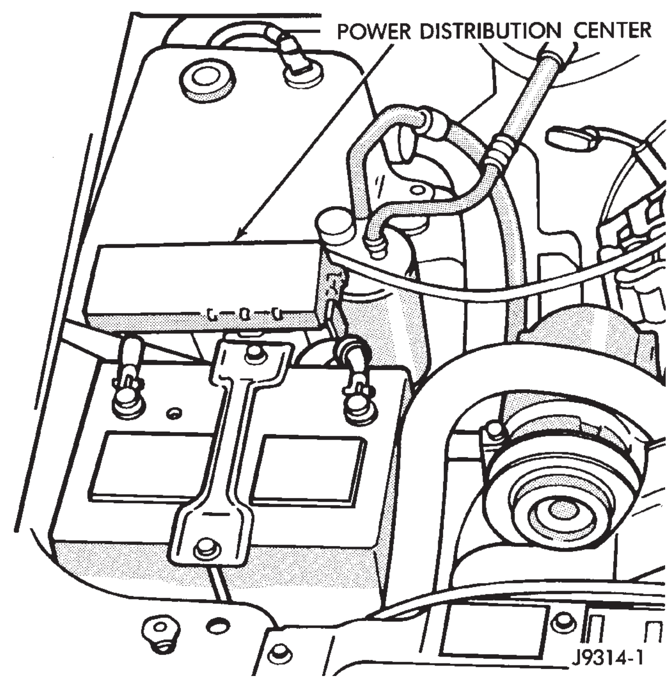

Fig. 2 Power Distribution Center (PDC)

(4) Inspect ignition coil connections. Verify that coil secondary cable is firmly connected to coil (Fig. 3).

(5) Verify that distributor cap is correctly attached to distributor. Be sure that spark plug cables are firmly connected to the distributor cap and the spark plugs are in their correct firing order. Be sure that coil cable is firmly connected to distributor cap and

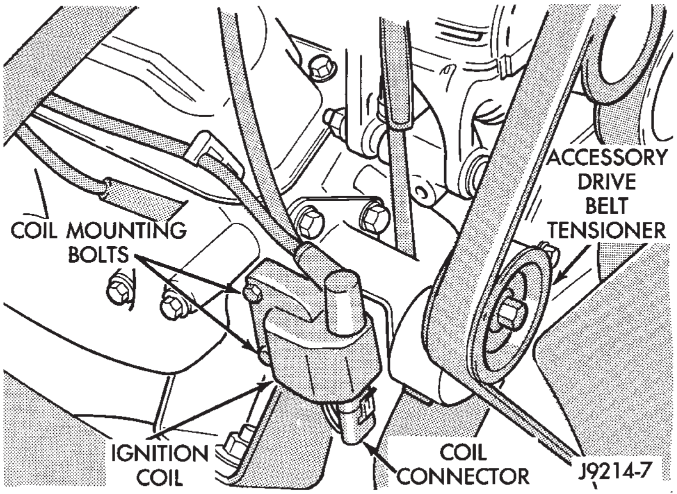

Fig. 3 Ignition Coil

coil. Be sure that camshaft position sensor wire connector (at the distributor) is firmly connected to harness connector. Inspect spark plug condition. Refer to Group 8D, Ignition. Connect vehicle to an oscilloscope and inspect spark events for fouled or damaged spark plugs or cables.

(6) Verify that generator output wire, generator connector and ground wire are firmly connected to the generator.

(7) Inspect the system body grounds for loose or dirty connections. Refer to Group 8W, Wiring for location of body ground connections.

(8) Verify positive crankcase ventilation (PCV) valve operation. Refer to Group 25, Emission Control System for additional information. Verify PCV valve hose is firmly connected to PCV valve and manifold (Fig. 4).

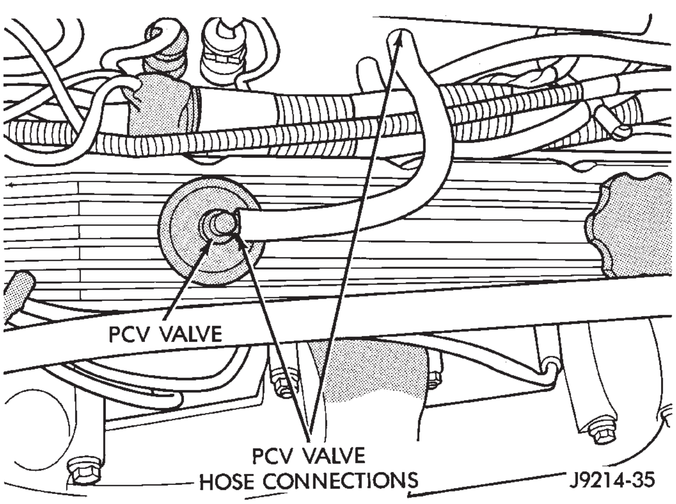

Fig. 4 PCV Valve Hose Connections

(9) Inspect fuel line/tube quick-connect fitting-to-fuel rail connections. Refer to Quick-Connect Fittings in this group for procedures.

(10) Verify that hose connections to all ports of vacuum fittings on intake manifold are tight and not leaking.

(11) Inspect accelerator cable, transmission throttle cable (if equipped) and cruise control cable connections (if equipped). Check their connections to the throttle arm of throttle body for any binding or restrictions.

(12) If equipped with vacuum brake booster, verify that vacuum booster hose is firmly connected to fitting on intake manifold. Also check connection to brake vacuum booster.

(13) Inspect the air cleaner inlet and air cleaner element for dirt or restrictions.

(14) Inspect radiator grille area, radiator fins and air conditioning condenser for restrictions.

(15) Verify that the intake manifold air temperature sensor wire connector is firmly connected to harness connector (Fig. 5).

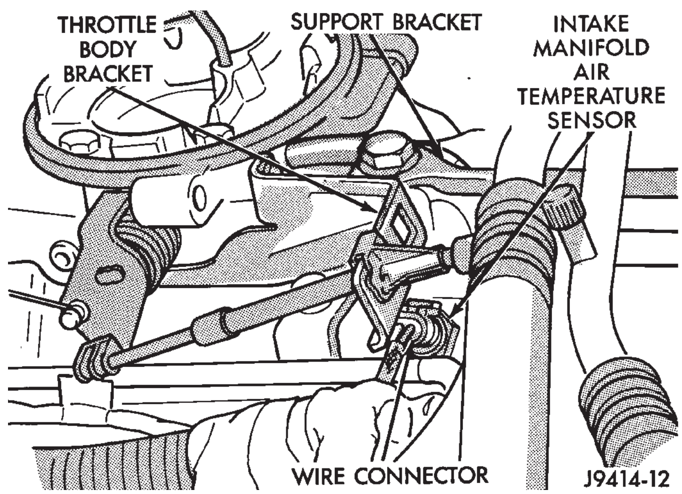

Fig. 5 Air Temperature Sensor—Typical

(16) Verify that MAP sensor electrical connector is firmly connected to MAP sensor (Fig. 6). Also verify that rubber L-shaped fitting from MAP sensor to the throttle body is firmly connected (Fig. 7).

(17) Verify that fuel injector wire harness connectors are firmly connected to injectors in the correct firing order. Each harness connector is numerically tagged with the injector number (INJ 1, INJ 2 etc.) of its corresponding fuel injector and cylinder number.

(18) Verify harness connectors are firmly connected to idle air control (IAC) motor, throttle position sensor (TPS) and manifold absolute pressure (MAP) sensor (Fig. 6).

(19) Verify that wire harness connector is firmly connected to the engine coolant temperature sensor (Fig. 8).

(20) Raise and support the vehicle.

(21) Verify that oxygen sensor wire connector is firmly connected to the sensor. Inspect sensor and connector for damage (Fig. 9).

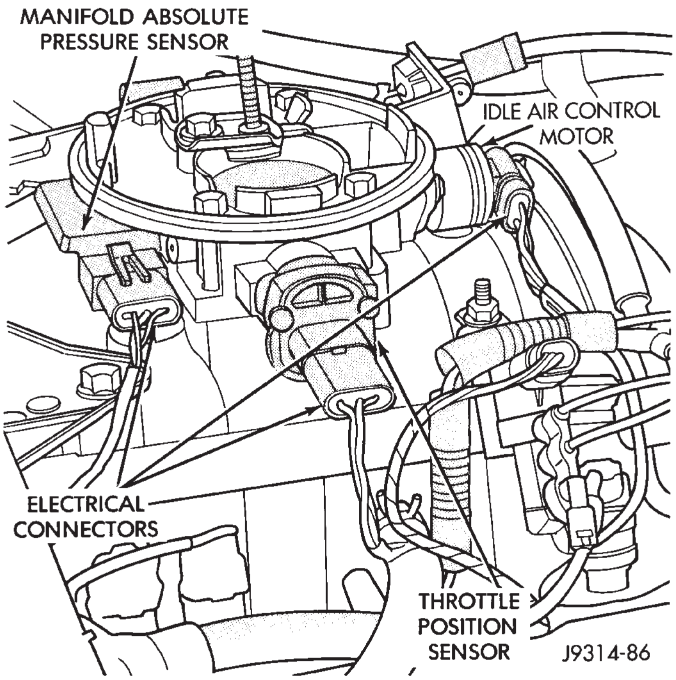

Fig. 6 MAP Sensor—Typical

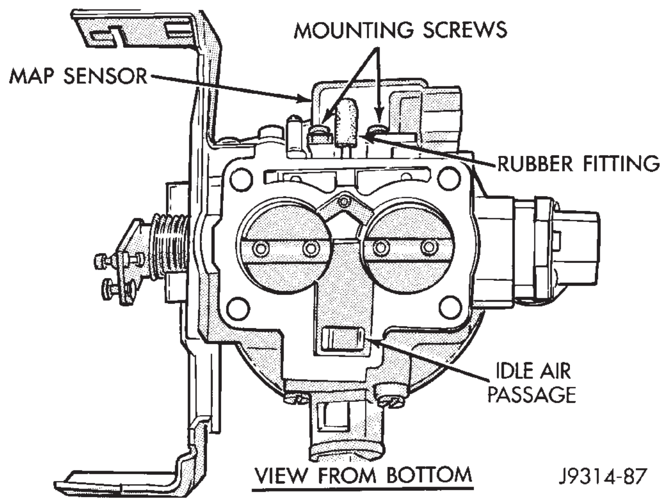

Fig. 7 Rubber L-Shaped Fitting—MAP Sensor-to-Throttle Body

(22) Inspect for pinched or leaking fuel lines/tubes. Inspect for pinched, cracked or leaking fuel hoses. Refer to Quick-Connect Fittings in this group for procedures.

(23) Inspect for exhaust system restrictions such as pinched exhaust pipes, collapsed muffler or plugged catalytic convertor.

(24) If equipped with automatic transmission, verify that electrical harness is firmly connected to park/neutral switch. Refer to Automatic Transmission section of Group 21.

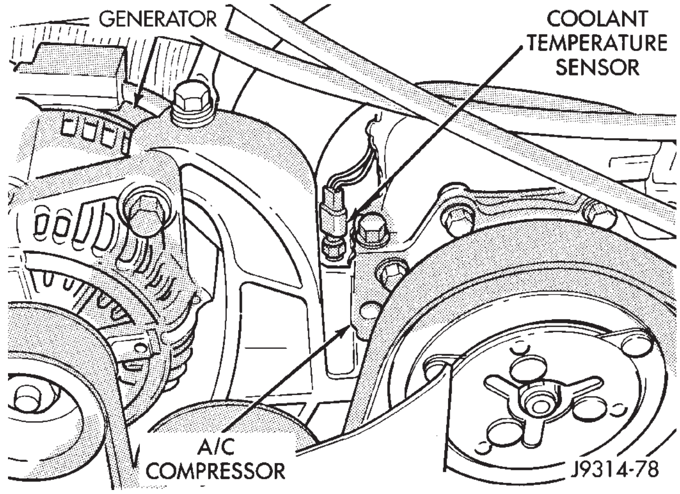

Fig. 8 Engine Coolant Temperature Sensor—Typical

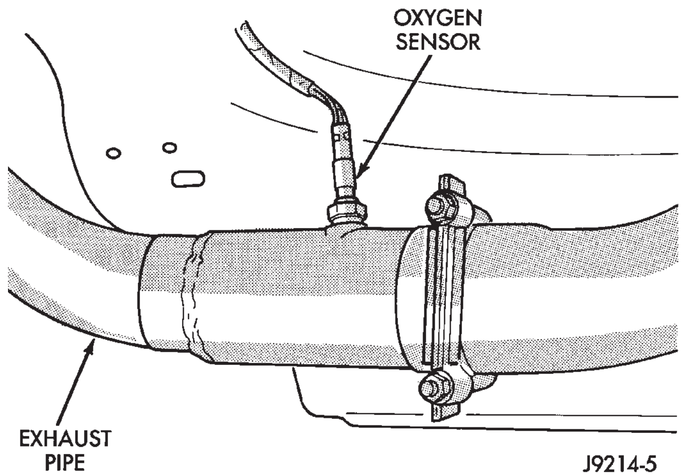

Fig. 9 Oxygen Sensor—Typical

(25) Verify that the harness connector is firmly connected to the vehicle speed sensor (Fig. 10).

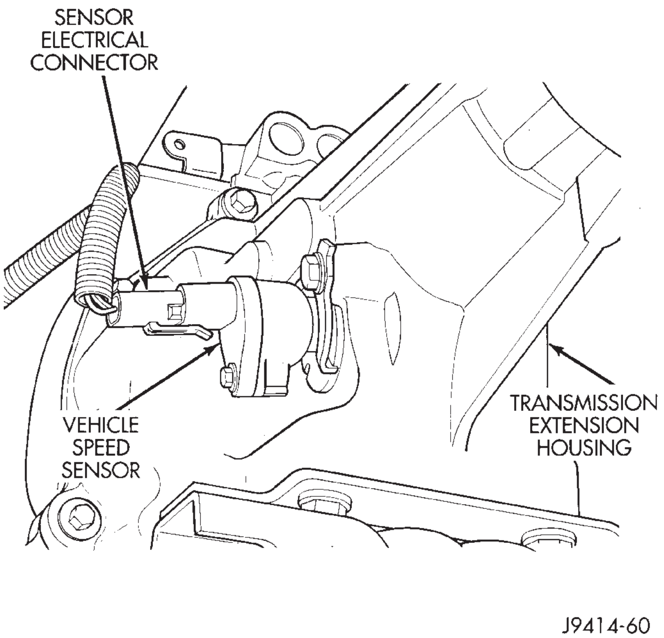

Fig. 10 Vehicle Speed Sensor—Typical

(26) Verify that fuel pump/gauge sender unit wire connector is firmly connected to harness connector.

(27) Inspect fuel hoses at fuel filter for cracks or leaks.

(28) Inspect transmission torque convertor housing (automatic transmission) or clutch housing (manual transmission) for damage to timing ring on drive plate/flywheel.

(29) Verify that battery cable and solenoid feed wire connections to the starter solenoid are tight and clean. Inspect for chaffed wires or wires rubbing up against other components.

POWERTRAIN CONTROL MODULE (PCM) 60-WAY CONNECTOR

For PCM 60-way connector wiring schematics, refer to Group 8W, Wiring Diagrams.

PCM SYSTEM SCHEMATICS

A powertrain control system schematics for the 5.2L (V-8) engine is shown in figure 11.

The schematic is displayed as a quick reference only. It is not intended to be all-inclusive. Refer to the Wiring Diagrams section for detailed information.

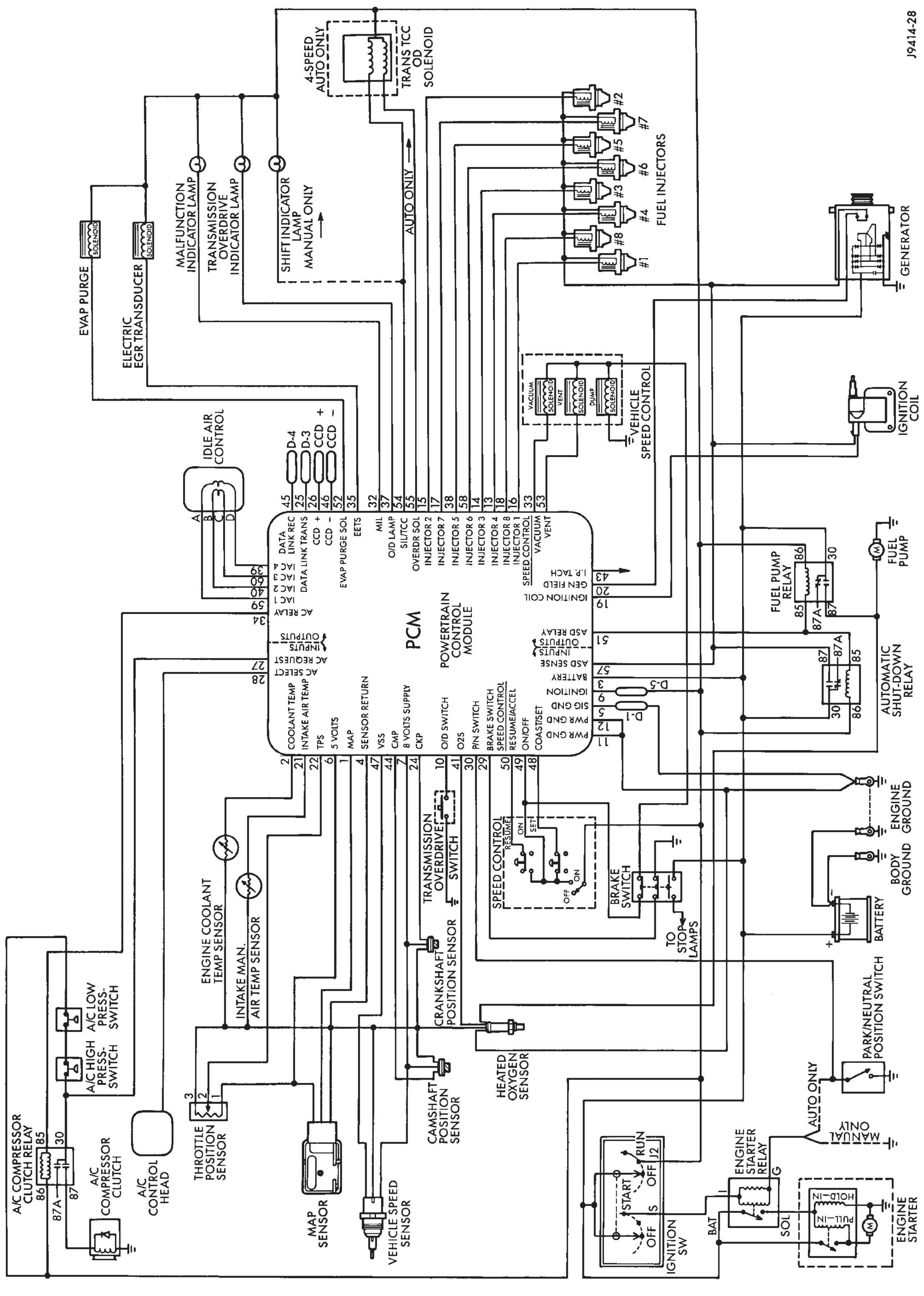

Fig. 11 System Schematic—5.2L Engine

AUTOMATIC SHUTDOWN (ASD) RELAY TESTING

To perform a complete test of the ASD relay and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the relay only, refer to Relays—Operation/Testing in this section of the group.

CAMSHAFT POSITION SENSOR TESTING

Refer to Group 8D, Ignition Systems for testing.

ENGINE COOLANT TEMPERATURE SENSOR TEST

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) Disconnect wire harness connector from coolant temperature sensor (Fig. 12).

Engines with air conditioning: When removing the connector from sensor, do not pull directly on wiring harness. Fabricate an L-shaped hook tool from a coat hanger (approximately eight inches long). Place the hook part of tool under the connector for removal. The connector is snapped onto the sensor. It is not equipped with a lock type tab.

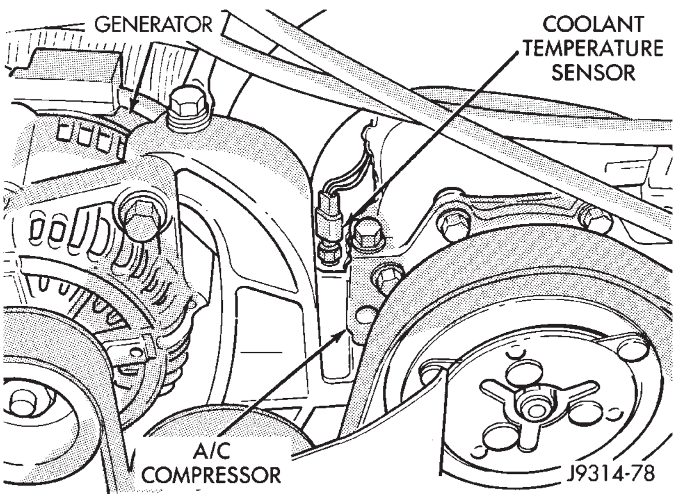

Fig. 12 Coolant Temperature Sensor—Typical

(2) Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter. The resistance (as measured across the sensor terminals) should be less than 1340 ohms with the engine warm. Refer to the Coolant Temperature sensor/Intake Air Temperature sensor resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

(3) Test continuity of the wire harness. Do this between the powertrain control module (PCM) wire harness connector terminal 2 and the sensor connector terminal. Also test continuity of wire harness terminal 4 to the sensor connector terminal. Repair the wire harness if an open circuit is indicated.

SENSOR RESISTANCE (OHMS)—COOLANT TEMPERATURE SENSOR/INTAKE AIR TEMPERATURE SENSOR

TEMPERATURE		RESISTANCE (OHMS)	
C	F	MIN	MAX
−40	−40	291,490	381,710
−20	−4	85,850	108,390
−10	14	49,250	61,430
0	32	29,330	35,990
10	50	17,990	21,810
20	68	11,370	13,610
25	77	9,120	10,880
30	86	7,370	8,750
40	104	4,900	5,750
50	122	3,330	3,880
60	140	2,310	2,670
70	158	1,630	1,870
80	176	1,170	1,340
90	194	860	970
100	212	640	720
110	230	480	540
120	248	370	410

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(4) After tests are completed, connect electrical connector to sensor. The sensor connector is symmetrical (not indexed). It can be installed to the sensor in either direction.

FUEL PUMP RELAY TESTING

For testing this relay, refer to Relays—Operation/Testing in this section of the group.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR TEST

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) Disconnect the wire harness connector from the intake manifold air temperature sensor (Fig. 13).

(2) Test the resistance of the sensor with an input impedance (digital) volt-ohmmeter. The resistance (as measured across the sensor terminals) should be less than 1340 ohms with the engine warm. Refer to the Coolant Temperature sensor/Intake Air Temperature sensor resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

(3) Test the resistance of the wire harness. Do this between the powertrain control module (PCM) wire harness connector terminal 21 and the sensor connector terminal. Also check between terminal 4 to the sensor connector terminal. Repair the wire harness as necessary if the resistance is greater than 1 ohm.

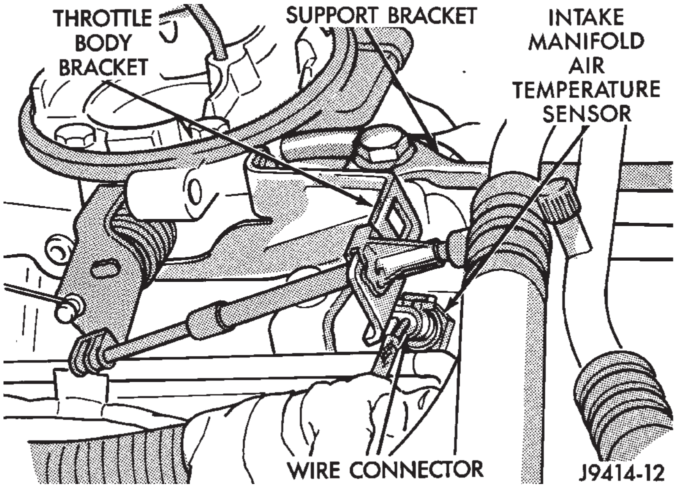


Fig. 13 Air Temperature Sensor—Typical

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

To perform a complete test of MAP sensor (Fig. 14) and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the MAP sensor only, refer to the following:

(1) Inspect the rubber L-shaped fitting from the MAP sensor to the throttle body (Fig. 15). Repair as necessary.

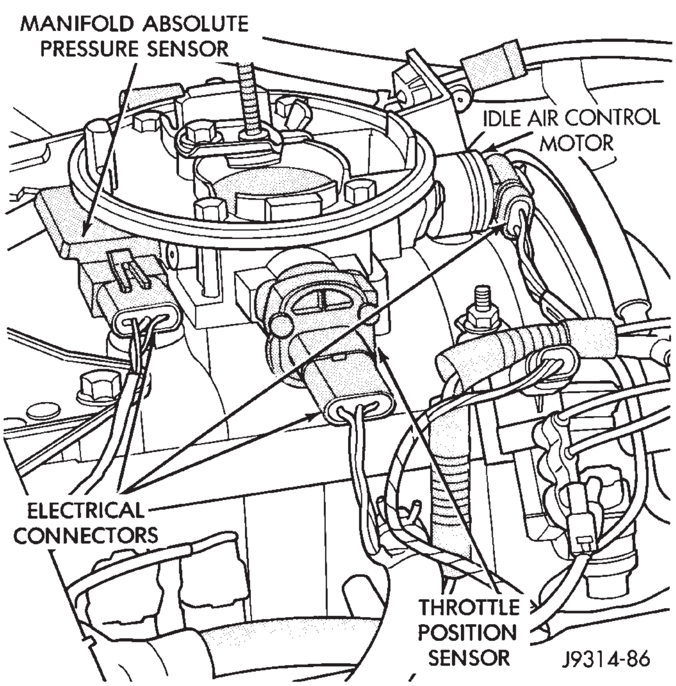


Fig. 14 MAP Sensor—Typical

CAUTION: When testing the MAP sensor, be sure that the harness wires are not damaged by the test meter probes.

(2) Test the MAP sensor output voltage at the MAP sensor connector between terminals A and B (Fig. 16). With the ignition switch ON and the engine

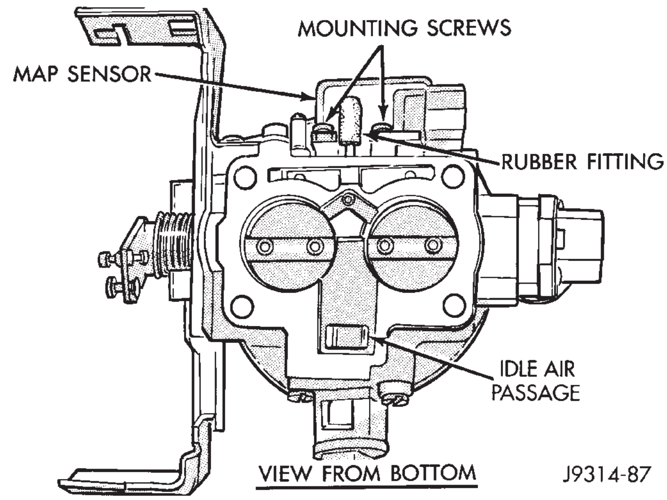


Fig. 15 Rubber L-Shaped Fitting—MAP Sensor-to-Throttle Body

OFF, 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.

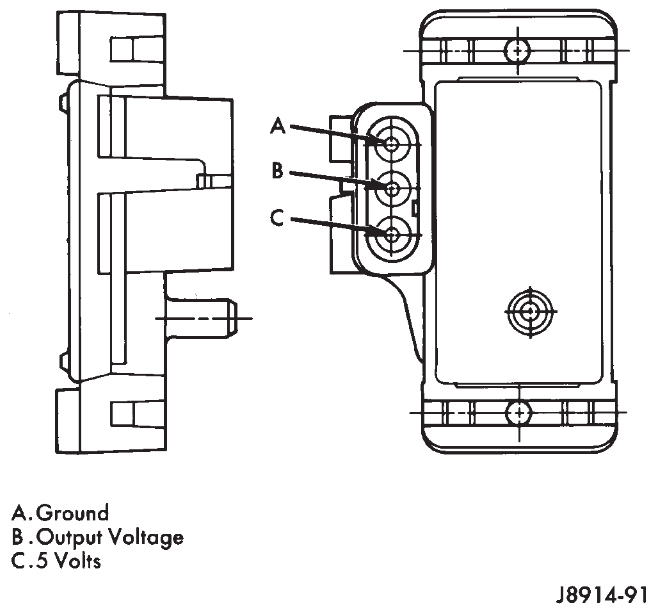


Fig. 16 MAP Sensor Connector Terminals—Typical

(3) Test powertrain control module (PCM) pin-1 for the same voltage described above to verify the wire harness condition. Repair as necessary.

(4) Test MAP sensor supply voltage at sensor connector between terminals A and C (Fig. 16) with the ignition ON. The voltage should be approximately 5 volts ($\pm$0.5V). Five volts ($\pm$0.5V) should also be at terminal 6 of the powertrain control module (PCM) wire harness connector. Repair or replace the wire harness as necessary.

(5) Test the MAP sensor ground circuit at sensor connector terminal A (Fig. 16) and PCM connector terminal/pin-4. Repair the wire harness if necessary.

(6) Test the MAP sensor ground circuit at the PCM

connector between terminal/pin-4 and terminal/pin-11 with an ohmmeter. If the ohmmeter indicates an open circuit, inspect for a defective sensor ground connection. Refer to Group 8W, Wiring Diagrams for location of this connection. If the ground connection is good, replace the PCM. If terminal/pin-4 has a short circuit to 12 volts +, correct this condition before replacing the PCM.

CRANKSHAFT POSITION SENSOR TEST

To perform a complete test of this sensor (Fig. 17) and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the sensor only, refer to the following:

(1) Near the rear of the right cylinder head, disconnect the sensor pigtail harness connector from the main wiring harness.

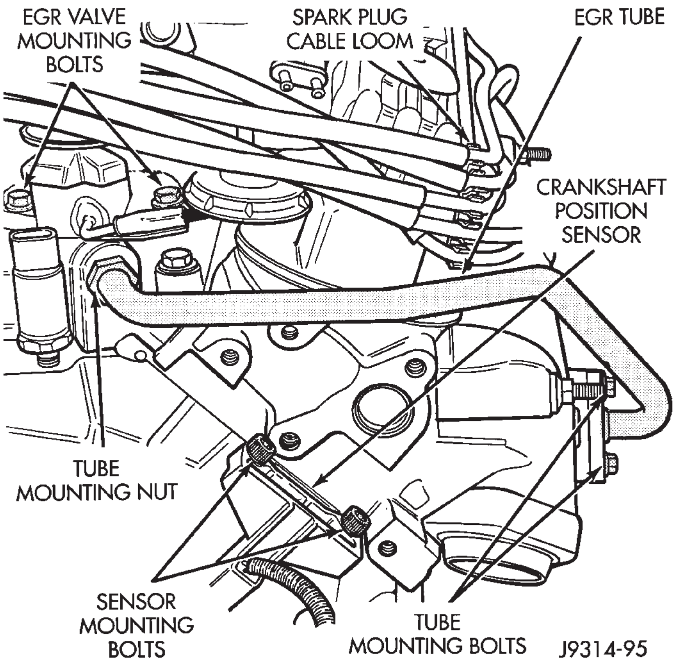


Fig. 17 Crankshaft Position Sensor

(2) Place an ohmmeter across terminals B and C (Fig. 18). Ohmmeter should be set to 1K-to-10K scale for this test. The meter reading should be open (no resistance). Replace sensor if a low resistance is indicated.

THROTTLE POSITION SENSOR (TPS) TEST

To perform a complete test of the TPS and its circuitry, refer to the DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the TPS only, refer to the following:

The TPS can be tested with a digital voltmeter. The center terminal of the TPS is the output terminal (Fig. 19).

With the ignition key in the ON position, check the TPS output voltage at the center terminal wire of the connector. Check this at idle (throttle plate closed)

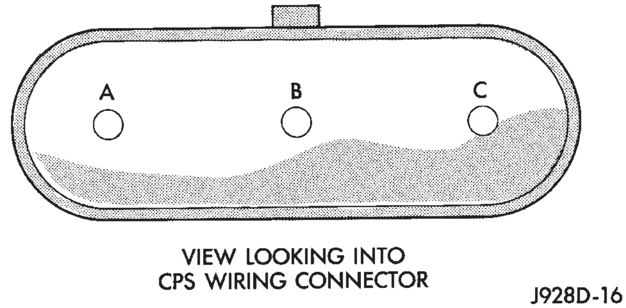


Fig. 18 Sensor Wiring Connector

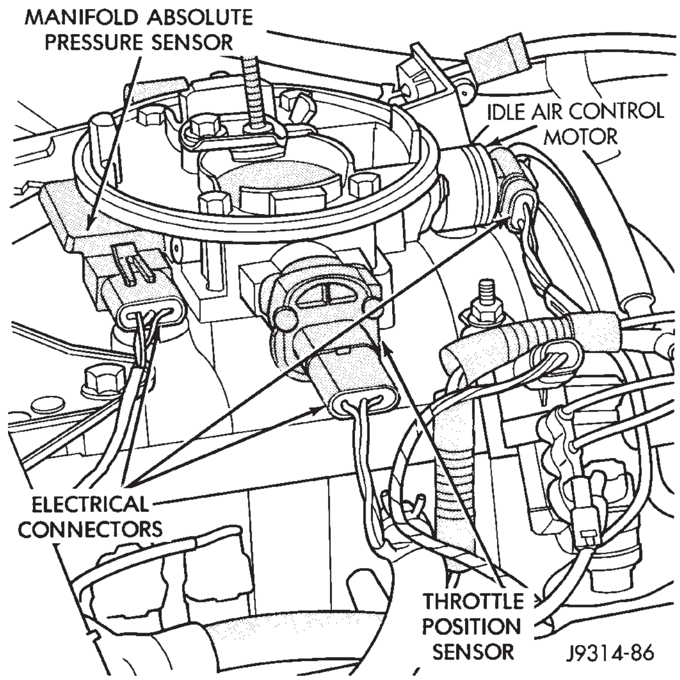


Fig. 19 TPS Connector and IAC Motor—Typical

and at wide open throttle (WOT). At idle, TPS output voltage should must be greater than 200 millivolts. At wide open throttle, TPS output voltage must be less than 4.8 volts. The output voltage should increase gradually as the throttle plate is slowly opened from idle to WOT.

THROTTLE BODY MINIMUM AIR FLOW CHECK

5.2L V-8 ENGINE ONLY

The following test procedure has been developed to check throttle body calibrations for correct idle conditions. The procedure should be used to diagnose the throttle body for conditions that may cause idle problems. **This procedure should be used only after normal diagnostic procedures have failed to produce results that indicate a throttle body related problem. Be sure to check for proper operation of the idle air control motor before performing this test.**

A special fixed orifice tool (number 6714) (Fig. 20) must be used for the following test.

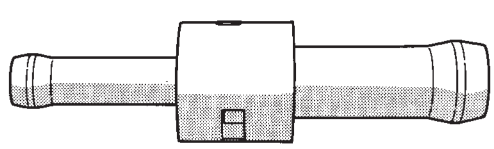


Fig. 20 Fixed Orifice Tool

(1) Start the engine and bring to operating temperature. Be sure all accessories are off before performing this test.

(2) Shut off the engine and remove the air intake tube at the throttle body.

(3) Disconnect the vacuum line at the PCV valve (Fig. 21).

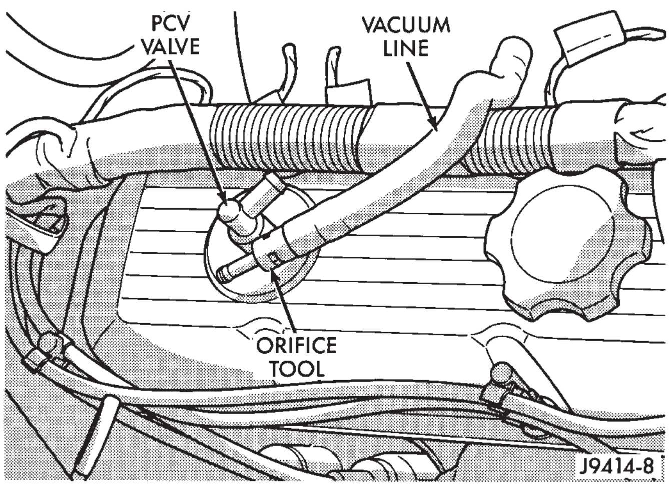


Fig. 21 Install Orifice Tool

(4) Install the 0.185 inch orifice tool (number 6714) into the disconnected vacuum line in place of the PCV valve (Fig. 21).

(5) Disconnect the idle purge vacuum line from fitting at throttle body. This vacuum line is located on the front of throttle body next to the MAP sensor (Fig. 22). Cap the fitting at throttle body after vacuum line has been removed.

(6) Connect the DRB scan tool to the data link connector (Fig. 23) on the vehicle. Refer to the appropriate Powertrain Diagnostic Procedures service manual for DRB operation.

(7) Start the engine.

(8) Using the DRB scan tool, scroll through the menus as follows: select—System, select—Engine, select—Fuel and Ignition, select—Actuator Tests, select—Engine rpm and select—Minimum Air Flow.

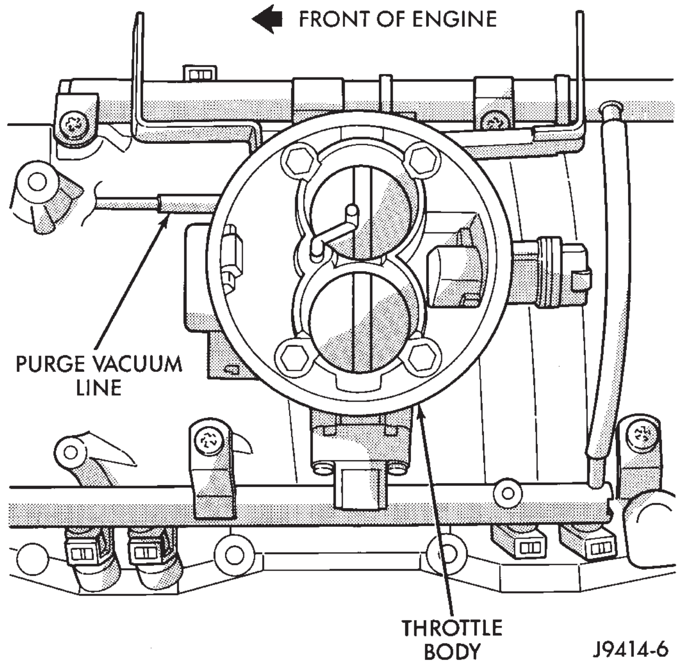


Fig. 22 Idle Purge Line

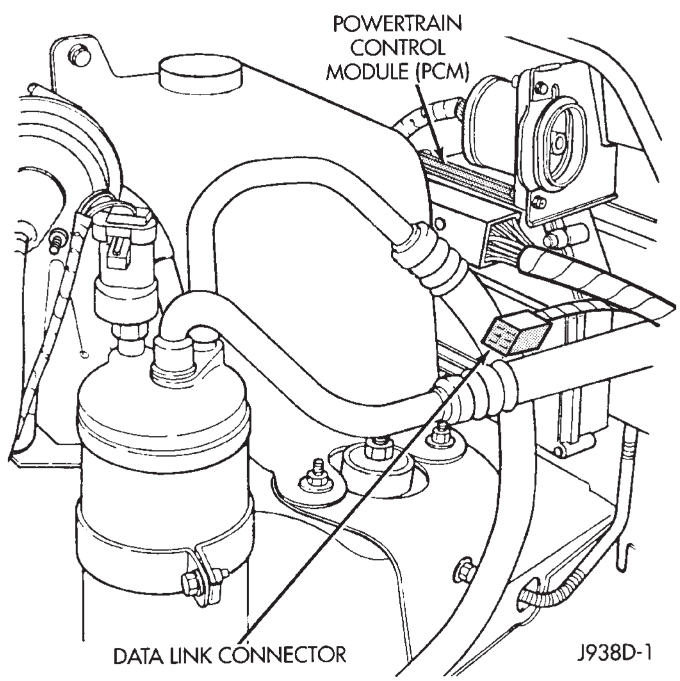


Fig. 23 Data Link Connector Location

The DRB scan tool will count down to stabilize the idle rpm and display the minimum air flow idle rpm. The idle rpm should be between **500 and 900 rpm.** If the idle speed is outside of these specifications, replace the throttle body. Refer to Throttle Body in the Component Removal/Installation section of this group.

(9) Disconnect the DRB scan tool from the vehicle.

(10) Remove cap from idle purge fitting at throttle body and install vacuum line.

(11) Remove orifice tool and connect vacuum line to PCV valve.

(12) Install air cleaner element housing.

VEHICLE SPEED SENSOR TEST

To perform a complete test of the sensor and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual.

OXYGEN (O2S) SENSOR HEATING ELEMENT TEST

To perform a complete test of O2S sensor and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the O2S only, refer to the following:

The O2S sensor is located on the right exhaust down pipe (Fig. 24). The O2S heating element can be tested with an ohmmeter as follows:

Disconnect the O2S sensor connector. Connect the ohmmeter test leads across the white wire terminals of the sensor connector. Resistance should be between 5 and 7 ohms. Replace the sensor if the ohmmeter displays an infinity (open) reading.

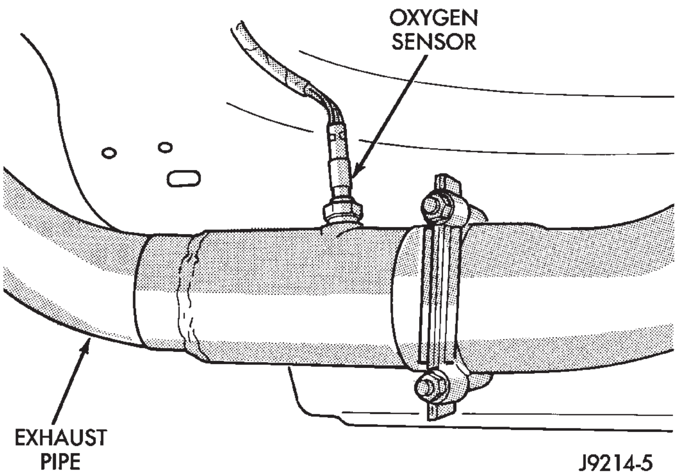


Fig. 24 Oxygen Sensor—Typical

IDLE AIR CONTROL (IAC) MOTOR TEST

To perform a complete test of IAC motor (Fig. 19) and its circuitry, refer to DRB scan tool and appropriate Powertrain Diagnostics Procedures manual. To test the IAC motor only, special IAC motor exerciser tool number 7558 (Fig. 25) may be used.

CAUTION: Proper safety precautions must be taken when testing the IAC motor.

- Set the parking brake and block the drive wheels
- Route all tester cables away from the cooling fans, drive belt, pulleys and exhaust components
- Provide proper ventilation while operating the engine
- Always return the engine idle speed to normal before disconnecting the exerciser tool

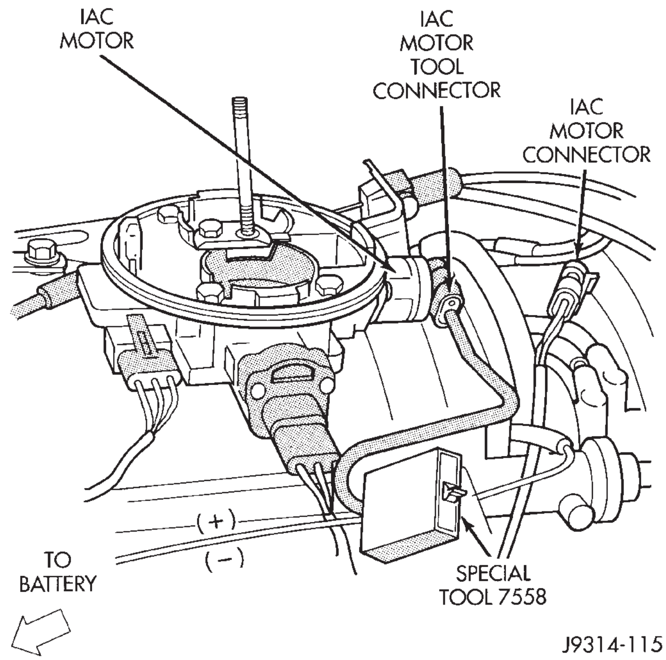


Fig. 25 IAC Motor Testing—Typical

(1) With the ignition OFF, disconnect the IAC motor wire connector at throttle body (Fig. 25).

(2) Plug the exerciser tool (7558) harness connector into the IAC motor (Fig. 25).

(3) Connect the red clip of exerciser tool (7558) to battery positive terminal. Connect the black clip to negative battery terminal. The red lamp on the exerciser tool will be illuminated when the exerciser is properly connected to battery.

(4) Start engine.

When the switch is in the HIGH or LOW position, the lamp on the exerciser tool will flash. This indicates that voltage pulses are being sent to the IAC stepper motor.

(5) Move the switch to the HIGH position. The engine speed should increase. Move the switch to the LOW position. The engine speed should decrease.

(a) If the engine speed changes while using the exerciser tool, the IAC motor is functioning properly. Disconnect the exerciser tool and connect the IAC stepper motor wire connector to the stepper motor.

(b) If the engine speed does not change, turn the ignition OFF and proceed to step (6). Do not disconnect exerciser from the IAC stepper motor.

(6) Remove the IAC stepper motor from the throttle body.

CAUTION: When checking IAC motor operation with the motor removed from the throttle body, do not extend the pintle (Fig. 26) more than 6.35 mm (.250 in). If the pintle is extended more than this amount, it may separate from the IAC stepper motor. The IAC motor must be replaced if the pintle separates from the motor.

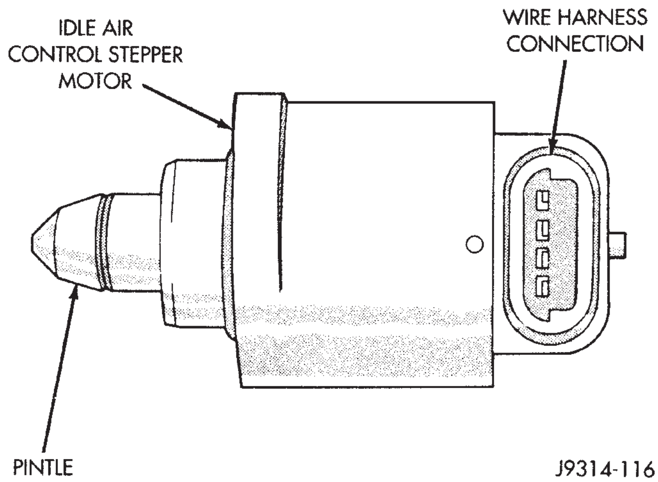


Fig. 26 IAC Stepper Motor Pintle—Typical

(7) With the ignition OFF, cycle the exerciser tool switch between the HIGH and LOW positions. Observe the pintle. The pintle should move in-and-out of the motor.

(a) If the pintle does not move, replace the IAC motor. Start the engine and test the replacement motor operation as described in step (5).

(b) If the pintle operates properly, check the IAC motor bore in the throttle body bore for blockage and clean as necessary. Install the IAC motor and retest. If blockage is not found, refer to the DRB scan tool and the appropriate Powertrain Diagnostics Procedures service manual.

RELAYS—OPERATION/TESTING

OPERATION

The following operations/tests apply to these relays only: automatic shutdown (ASD) and fuel pump. For operations/tests on all other relays, refer to the appropriate section of this service manual.

These relays are located in the power distribution center (PDC) (Fig. 27). For the location of the relay within the PDC, refer to label under PDC cover.

The relay terminal numbers from (Fig. 28) can be found on the bottom of the relay.

- Terminal number 30 is connected to battery voltage and can be switched or B+ (hot) at all times.
- The center terminal number 87A is connected (a circuit is formed) to terminal 30 in the de-energized (normally OFF) position.
- Terminal number 87 is connected (a circuit is formed) to terminal 30 in the energized (ON) position. Terminal number 87 then supplies battery voltage to the component being operated.
- Terminal number 86 is connected to a switched (+) power source.
- Terminal number 85 is grounded by the powertrain control module (PCM).

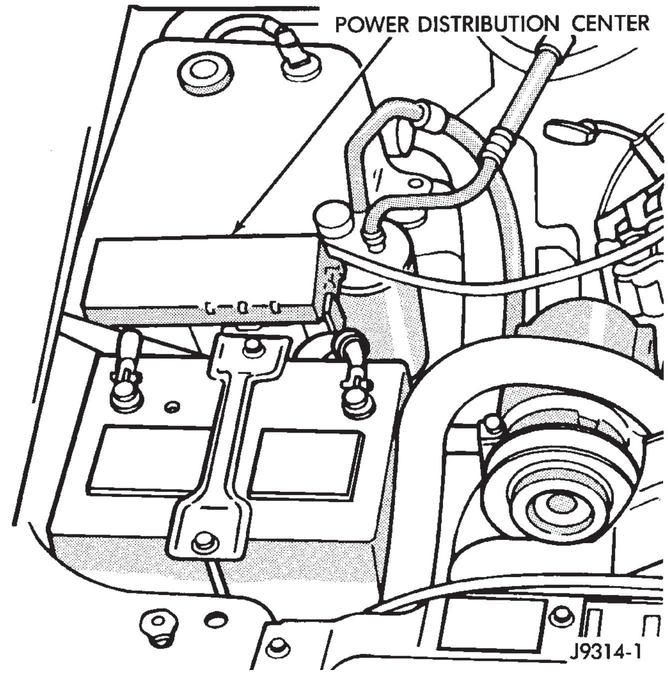


Fig. 27 Power Distribution Center (PDC)

TESTING

(1) Remove relay before testing.

(2) Using an ohmmeter, perform a resistance test between terminals 85 and 86. Resistance value (ohms) should be 75 ±5 ohms for resistor equipped relays.

(3) Connect the ohmmeter between terminals number 87A and 30. Continuity should be present at this time.

(4) Connect the ohmmeter between terminals number 87 and 30. Continuity should not be present at this time.

(5) Use a set of jumper wires (16 gauge or smaller). Connect one jumper wire between terminal number 85 (on the relay) to the ground side (-) of a 12 Volt power source.

(6) Attach the other jumper wire to the positive side (+) of a 12V power source. Do not connect this jumper wire to relay at this time.

CAUTION: Do not allow the ohmmeter to contact terminals 85 or 86 during these tests. Damage to ohmmeter may result.

(7) Attach the other jumper wire (12V +) to terminal number 86. This will activate the relay. Continuity should now be present between terminals number 87 and 30. Continuity should not be present between

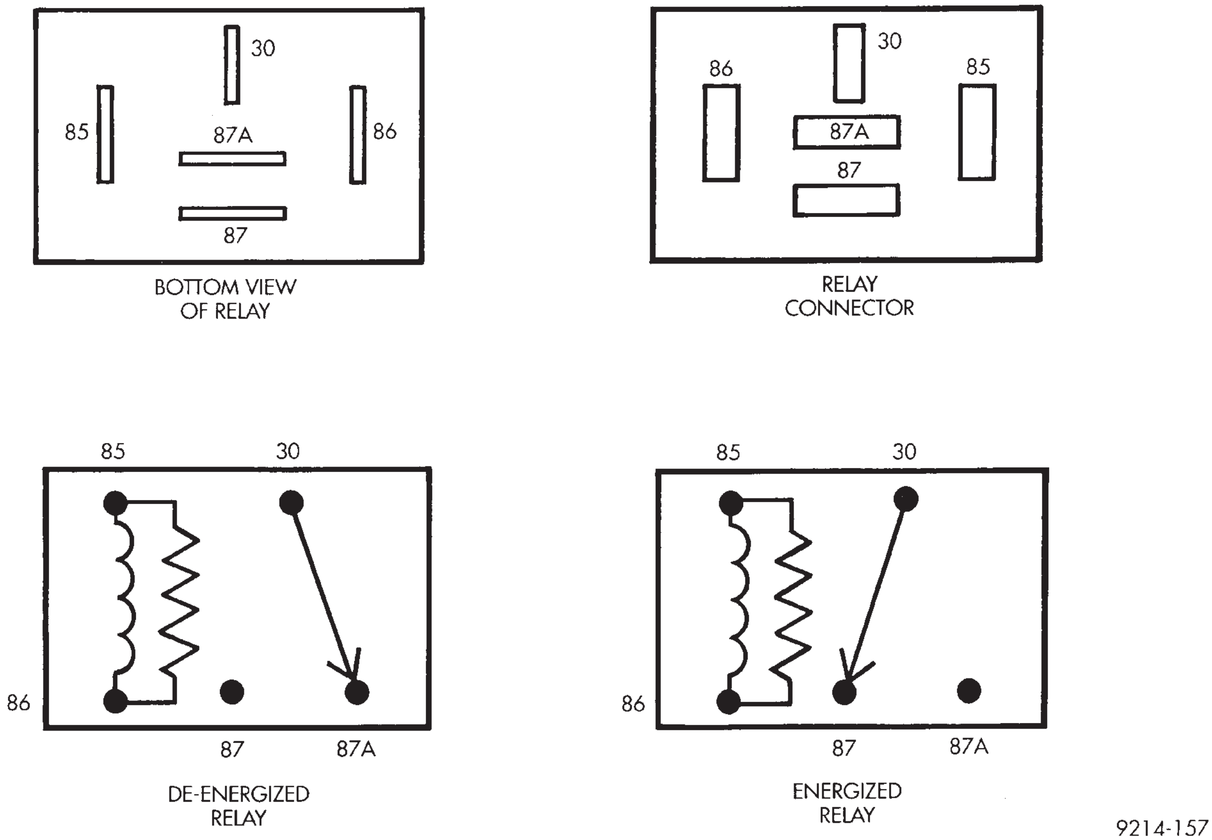


Fig. 28 Relay Terminals

terminals number 87A and 30.

(8) Disconnect jumper wires from relay and 12 Volt power source.

If continuity or resistance tests did not pass, replace relay. If tests passed, refer to Group 8W, Wiring Diagrams for wiring schematics and for additional circuit information.

STARTER MOTOR RELAY TEST

Refer to Group 8A, Battery/Starting/Charging System Diagnostics, for starter motor relay testing.

FUEL INJECTOR TEST

Disconnect the fuel injector wire harness connector from the injector (Fig. 29). Place an ohmmeter across the injector terminals. Resistance reading should be approximately 14.5 ohms ±1.2 ohms at 20°C (68°F). Proceed to following Fuel Injector diagnosis chart. **When performing the following tests from the chart, do not leave electrical current applied to the injector for longer than five seconds. Damage to injector coil or internal injector seals could result.**

FUEL PUMP PRESSURE TEST

Refer to Fuel Pump Pressure Test in the Fuel Delivery System section of this group.

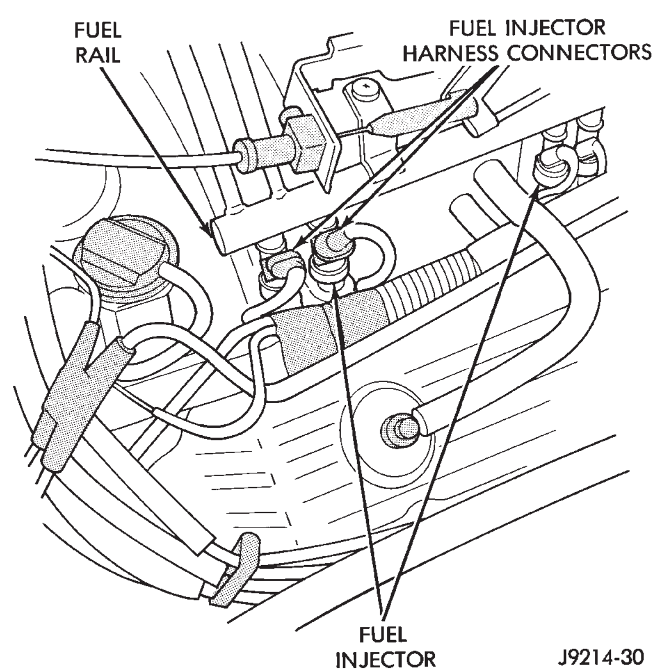


Fig. 29 Fuel Injector Wiring Connector—Typical

ON-BOARD DIAGNOSTICS (OBD)

The powertrain control module (PCM) has been programmed to monitor many different circuits of the fuel injection system. If a problem is sensed in a monitored circuit often enough to indicate an actual

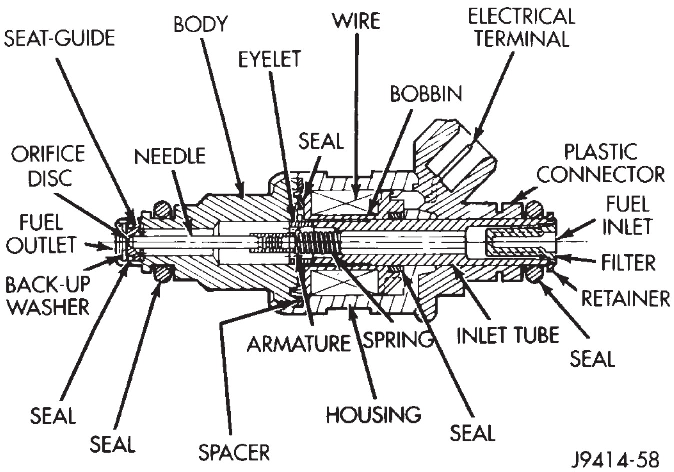


Fig. 30 Fuel Injector Internal Components—Typical

problem, a Diagnostic Trouble Code (DTC) is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. If the problem is repaired or ceases to exist, the PCM cancels the DTC after 51 engine starts.

Certain criteria must be met for a diagnostic trouble code (DTC) to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine temperature and/or input voltage to the PCM.

It is possible that a DTC for a monitored circuit may not be entered into memory even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. Example: assume that one of the criteria for the MAP sensor circuit is that the engine must be operating between 750 and 2000 rpm to be monitored for a DTC. If the MAP sensor output circuit shorts to ground when the engine rpm is above 2400 rpm, a 0 volt input will be seen by the PCM. A DTC will not be entered into memory because the condition does not occur within the specified rpm range.

A DTC indicates that the powertrain control module (PCM) has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

There are several operating conditions that the PCM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non-Monitored Circuits in this section.

MONITORED CIRCUITS

The powertrain control module (PCM) can detect certain problems in the fuel injection system.

Open or Shorted Circuit - The PCM can determine if sensor output (which is the input to PCM) is within proper range. It also determines if the circuit is open or shorted.

Output Device Current Flow - The PCM senses whether the output devices are hooked up.

If there is a problem with the circuit, the PCM senses whether the circuit is open, shorted to ground (-), or shorted to (+) voltage.

Oxygen Sensor - The PCM can determine if the oxygen sensor is switching between rich and lean. This is, once the system has entered Closed Loop. Refer to Open Loop/Closed Loop Modes Of Operation in the Component Description/System Operation section for an explanation of Closed (or Open) Loop operation.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A Diagnostic Trouble Code (DTC) may not be displayed for these conditions.

Fuel Pressure: Fuel pressure is controlled by the fuel pressure regulator. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply line. However, these could result in a rich or lean condition causing an oxygen sensor DTC to be stored in the PCM.

Secondary Ignition Circuit: The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open circuited spark plug cables.

Engine Timing: The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket or crankshaft sprocket. The PCM also cannot detect an incorrectly indexed distributor. However, these could result in a rich or lean condition causing an oxygen sensor DTC to be stored in the PCM.

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.

Fuel Injector Malfunctions: The PCM cannot determine if the fuel injector is clogged, or the wrong injector is installed. However, these could result in a rich or lean condition causing an oxygen sensor DTC to be stored in the PCM.

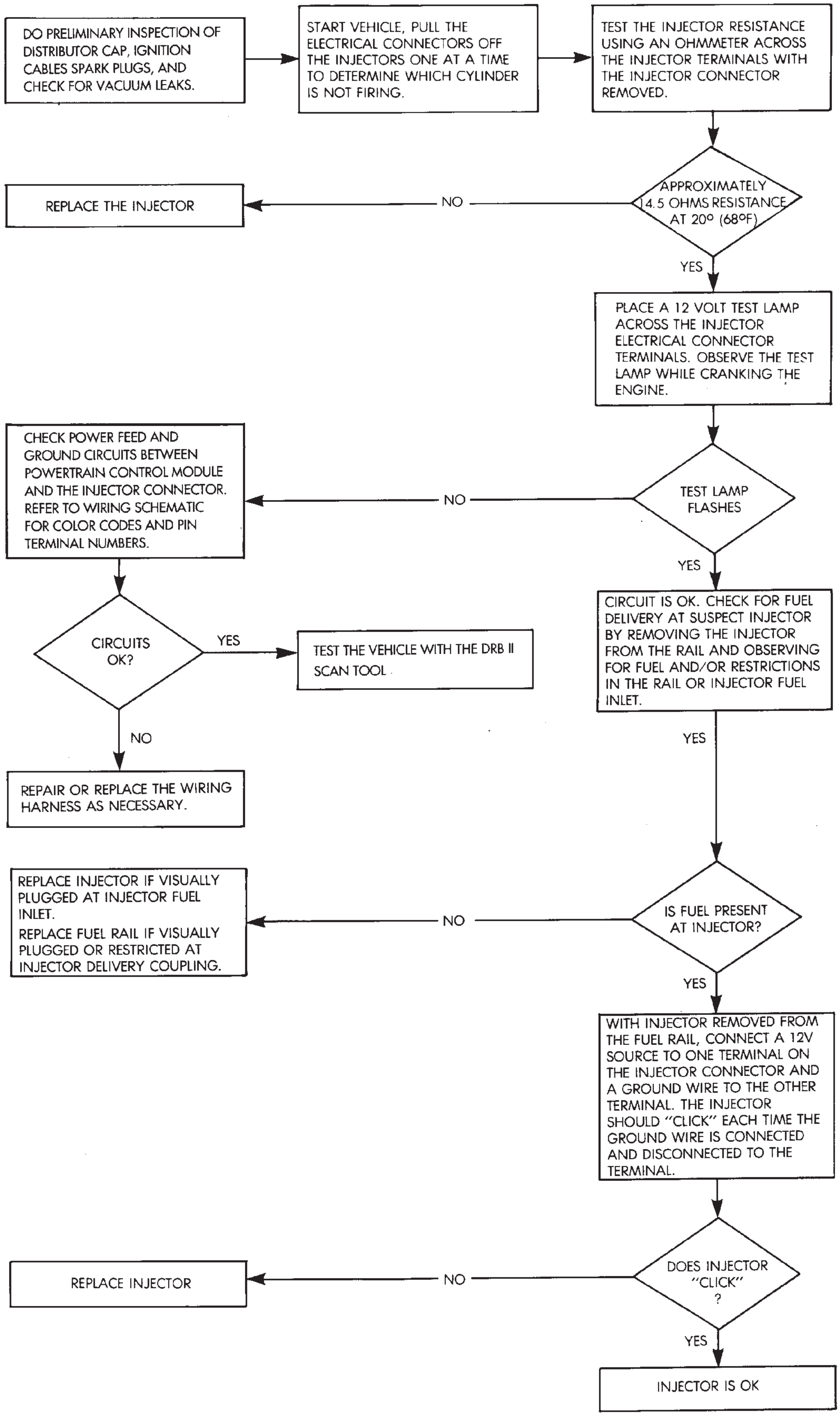
Excessive Oil Consumption: Although the PCM monitors exhaust stream oxygen content through oxygen sensor (closed loop), it cannot determine excessive oil consumption.

Throttle Body Air Flow: The PCM cannot detect a clogged or restricted air cleaner inlet or air cleaner element.

Evaporative System: The PCM will not detect a restricted, plugged or loaded EVAP canister.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the PCM. However, a vacuum leak at the MAP sensor will be monitored and a diagnostic trouble code (DTC) will be generated by the PCM.

INJECTOR DIAGNOSIS—VEHICLE RUNS ROUGH AND/OR HAS A MISS



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Powertrain Control Module (PCM) System Ground: The PCM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

Powertrain Control Module (PCM) Connector Engagement: The PCM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The powertrain control module (PCM) compares input signal voltages from each input device. It will establish high and low limits that are programmed into it for that device. If the input voltage is not within specifications and other Diagnostic Trouble Code (DTC) criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the PCM when it senses a high or low input voltage from the control system device in question.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored Diagnostic Trouble Code (DTC) can be displayed by cycling the ignition key On-Off-On-Off-On within three seconds and observing the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 31).

They can also be displayed through the use of the Diagnostic Readout Box (DRB scan tool). The DRB connects to the data link connector in the vehicle (Fig. 32). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.

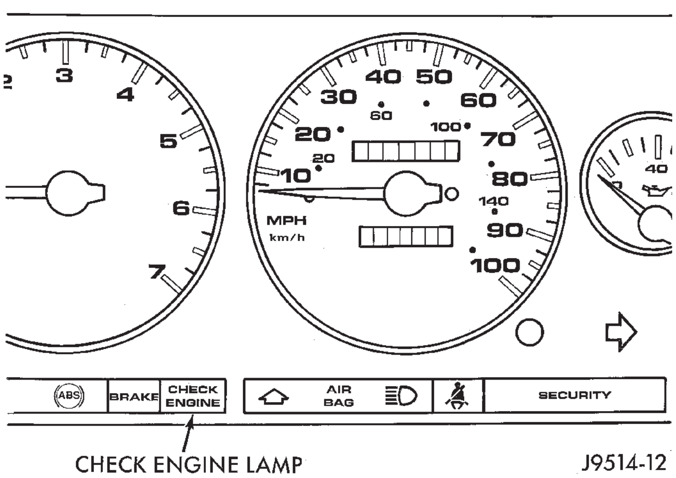

Fig. 31 Check Engine Lamp Location

EXAMPLES:

• If the lamp (Fig. 31) flashes 1 time, pauses and flashes 2 more times, a flashing Diagnostic Trouble Code (DTC) number 12 is indicated. If this code is observed, it is indicating that the battery has been disconnected within the last 50 key-on cycles. It could also indicate that battery voltage has been disconnected to the PCM. In either case, other DTC's may have been erased.

• If the lamp flashes 3 times, pauses and flashes 1 more time, a Diagnostic Trouble Code (DTC) number 31 is indicated.

• If the lamp flashes 1 time, pauses and flashes 4 more times, a Diagnostic Trouble Code (DTC) number 14 is indicated.

After any stored DTC information has been observed, the display will end with a flashing DTC number 55. This will indicate the end of all stored information.

Refer to the Diagnostic Trouble Code (DTC) charts for DTC identification.

If the problem is repaired or ceases to exist, the powertrain control module (PCM) cancels the DTC after 51 engine starts.

Diagnostic Trouble Codes indicate the results of a failure, but never identify the failed component directly.

The circuits of the data link connector are shown in (Fig. 33).

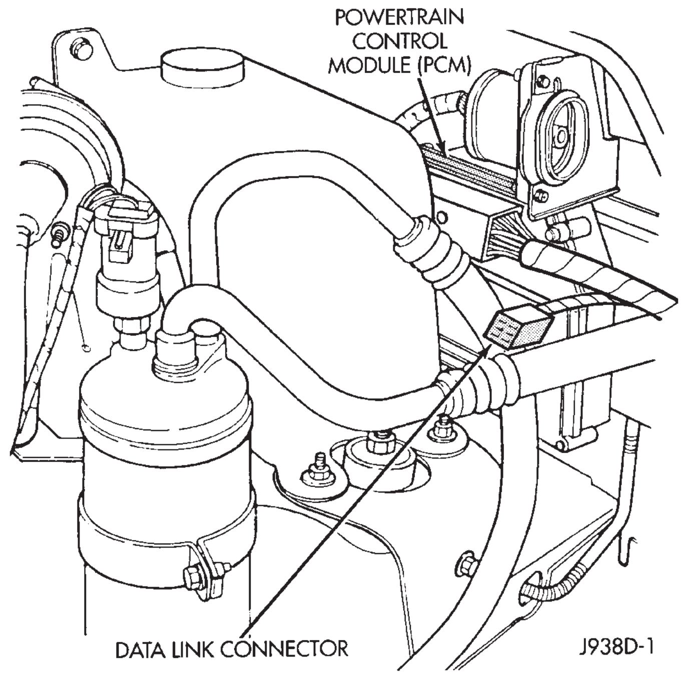

Fig. 32 Data Link Connector Location—Typical

ERASING TROUBLE CODES

Use the DRB scan tool to erase a Diagnostic Trouble Code (DTC). Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

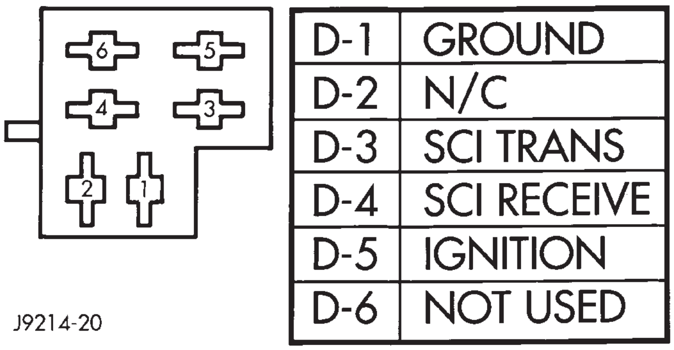

Fig. 33 Data Link Connector Schematic

DIAGNOSTIC TROUBLE CODE (DTC)

On the following pages, a list of diagnostic trouble codes is provided for the 5.2L V-8 engine. A DTC indicates that the powertrain control module (PCM) has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
11*	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**	No Change in MAP From Start to Run	No difference recognized between the engine MAP reading and the barometric (atmospheric) pressure reading at start-up.
14**	MAP Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
	or	
	MAP Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
15**	No Vehicle Speed Sensor Signal	No vehicle distance (speed) sensor signal detected during road load conditions.
17*	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (thermostat).
21**	O2S Stays at Center	Neither rich or lean condition detected from the oxygen sensor input.
	or	
	O2S Shorted to Voltage	Oxygen sensor input voltage maintained above the normal operating range.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS—CONTINUED

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
22**	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above maximum acceptable voltage.
	or	
	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below minimum acceptable voltage.
23**	Intake Air Temp Sensor Voltage Low	Intake manifold air temperature sensor input below the minimum acceptable voltage.
	or	
	Intake Air Temp Sensor Voltage High	Intake manifold air temperature sensor input above the maximum acceptable voltage.
24**	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
	or	
	Throttle Position Sensor Voltage Low	Throttle position sensor input below the minimum acceptable voltage.
25**	Idle Air Control Motor Circuits	A shorted condition detected in one or more of the idle air control motor circuits.
27*	Injector #1 Control Circuit	Injector #1 output driver does not respond properly to the control signal.
	or	
	Injector #2 Control Circuit	Injector #2 output driver does not respond properly to the control signal.
	or	
	Injector #3 Control Circuit	Injector #3 output driver does not respond properly to the control signal.
	or	
	Injector #4 Control Circuit	Injector #4 output driver does not respond properly to the control signal.
	or	
	Injector #5 Control Circuit	Injector #5 output driver does not respond properly to the control signal.
	or	
	Injector #6 Control Circuit	Injector #6 output driver does not respond properly to the control signal.
	or	

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS—CONTINUED

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
	Injector #7 Control Circuit	Injector #7 output driver does not respond properly to the control signal.
	or	
	Injector #8 Control Circuit	Injector #8 output driver does not respond properly to the control signal.
31**	EVAP Solenoid Circuit	An open or shorted condition detected in the EVAP solenoid circuit.
32**	EGR Solenoid Circuit	An open or shorted condition detected in the EGR solenoid circuit.
	or	
	EGR System Failure	A mechanical problem found in EGR system (vacuum line leak, defective EGR valve, plugged EGR tube, etc.).
33*	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay circuit.
34*	Speed Control Solenoid Circuits	An open or shorted condition detected in the Speed Control vacuum or vent solenoid circuits.
	or	
	Speed Control Switch Always Low	Speed Control switch input below the minimum acceptable voltage.
	or	
	Speed Control Switch Always High	Speed Control switch input above the maximum acceptable voltage.
41**	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
42*	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
44*	Battery Temp Sensor Volts out of Limit	An open or shorted condition exists in the engine coolant temperature sensor circuit or a problem exists in the PCM's battery temperature voltage circuit.
46**	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
47**	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.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS—CONTINUED

Diagnostic Trouble Code	DRB Scan Tool Display	Description of Diagnostic Trouble Code
51**	O2S Signal Stays Below Center (Lean)	Oxygen sensor signal input indicates lean air/fuel ratio condition during engine operation.
52**	O2S Signal Stays Above Center (Rich)	Oxygen sensor signal input indicates rich air/fuel ratio condition during engine operation.
53*	Internal PCM Failure	PCM Internal fault condition detected.
	or	
	PCM Failure SPI (Serial Peripheral Interface) Communications	PCM Internal fault condition detected.
54*	No Cam Sync Signal at PCM	No fuel sync (camshaft signal) detected during engine cranking.
55*	Display not shown on DRB scan tool	Completion of diagnostic trouble code display on the Malfunction Indicator Lamp (Check Engine Lamp).
62*	PCM Failure SRI miles not stored	Unsuccessful attempt to update SRI (service reminder indicator) miles in the PCM EEPROM.
63*	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the PCM.

* Check Engine Lamp will not illuminate at all times 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 will illuminate during engine operation if this Diagnostic Trouble Code was recorded.

MULTI-PORT FUEL INJECTION (MFI)—5.2L V-8 ENGINE—COMPONENT REMOVAL/INSTALLATION

INDEX

AIR CLEANER HOUSING

REMOVAL

(1) Unlock clean air hose clamp (Fig. 1) at air cleaner cover. To unlock the clamp, attach adjustable pliers to clamp and rotate pliers as shown in figure 2. Remove clean air hose at cover.

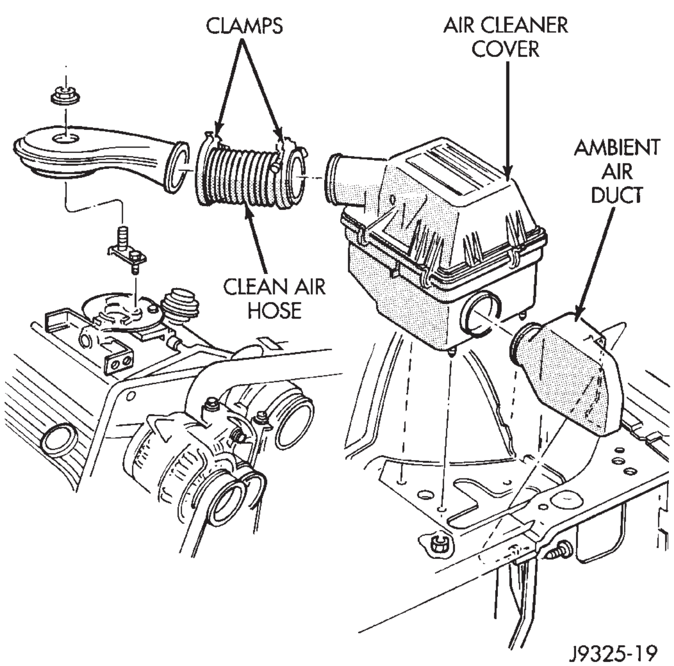

Fig. 1 Air Cleaner—5.2L V-8 Engine

(2) Remove crankcase breather/filter hose at air cleaner cover.

(3) From under vehicle, remove three housing nuts (Fig. 1).

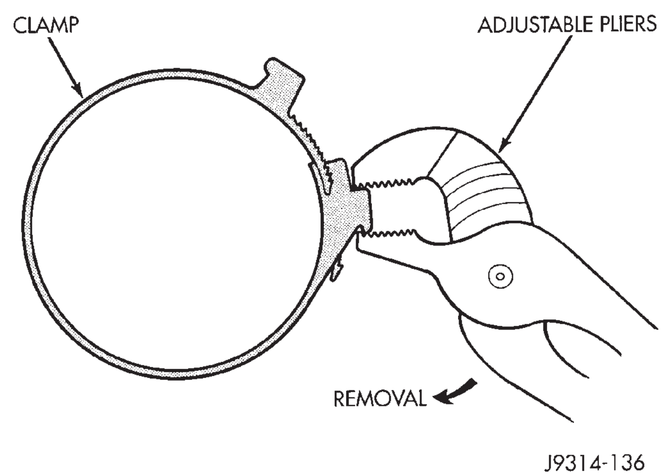

Fig. 2 Clamp Removal

(4) Release the air cleaner housing from the ambient air duct and remove housing from vehicle.

INSTALLATION

(1) Position air cleaner housing to body and ambient air duct (Fig. 1).

(2) Install three nuts and tighten to 10 N·m (93 in. lbs.) torque.

(3) Install crankcase breather/filter hose to cover.

(4) Install clamp to cover. Compress the clamp snugly with adjustable pliers as shown in figure 3.

AIR CLEANER ELEMENT

REMOVAL/INSTALLATION

(1) Pry back the six clips retaining the air cleaner cover to the air cleaner housing (Fig. 4).

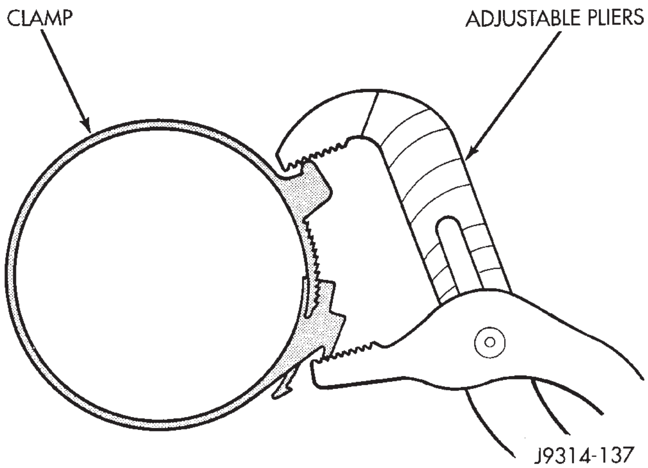

Fig. 3 Clamp Installation

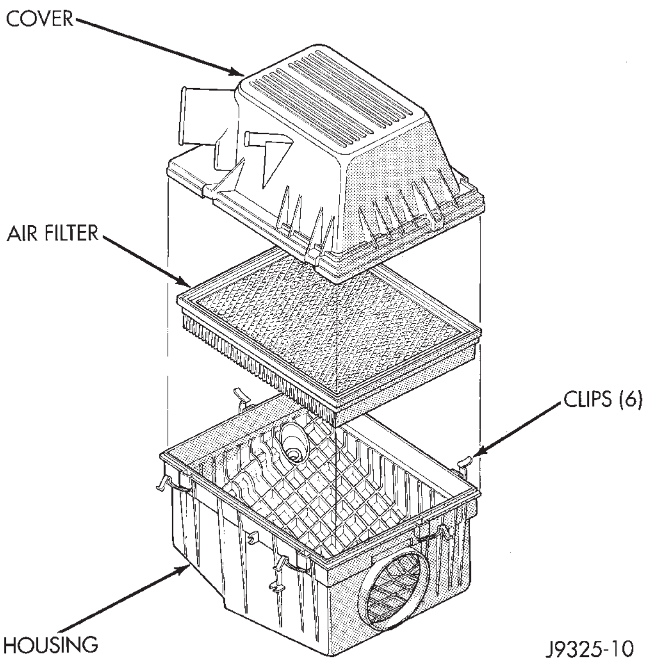

Fig. 4 Typical Air Cleaner Element Removal/ Installation

(2) Lift the cover up and position to the side.

(3) Remove air cleaner element.

(4) Clean the inside of air cleaner housing before installing new element.

(5) Reverse the preceding operation for installation. Be sure the air cleaner cover is properly seated to air cleaner housing.

ACCELERATOR PEDAL AND THROTTLE CABLE

Refer to the Accelerator Pedal and Throttle Cable section of this group for removal/installation procedures.

AIR CONDITIONING (A/C) CLUTCH RELAY

The A/C clutch relay is located in the power distribution center (PDC) (Fig. 5). For location of this relay within the PDC, refer to label attached to bottom of PDC cover.

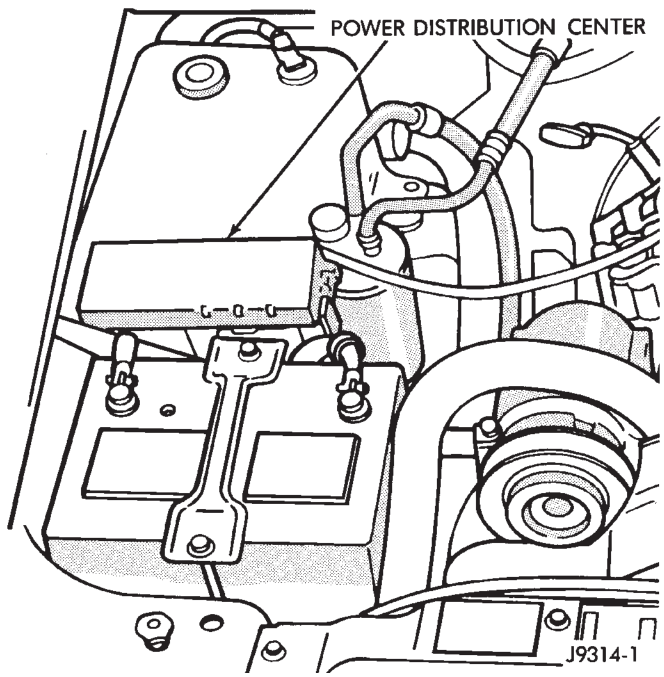

Fig. 5 Power Distribution Center (PDC)

AUTOMATIC SHUTDOWN (ASD) RELAY

The ASD relay is located in the power distribution center (Fig. 5) (PDC). For location of this relay within the PDC, refer to label attached to bottom of PDC cover.

BRAKE SWITCH

Refer to Group 5, Brakes for removal/installation procedures.

CAMSHAFT POSITION SENSOR

For removal/installation procedures, refer to Group 8D, Ignition System. See Camshaft Position Sensor.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR

The intake manifold air temperature sensor is located in the front/side of the intake manifold (Fig. 6).

REMOVAL

(1) Remove air cleaner assembly.

(2) Disconnect electrical connector at sensor (Fig. 6).

(3) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor to intake manifold. Tighten to 28 N·m (20 ft. lbs.) torque.

(2) Install electrical connector.

(3) Install air cleaner.

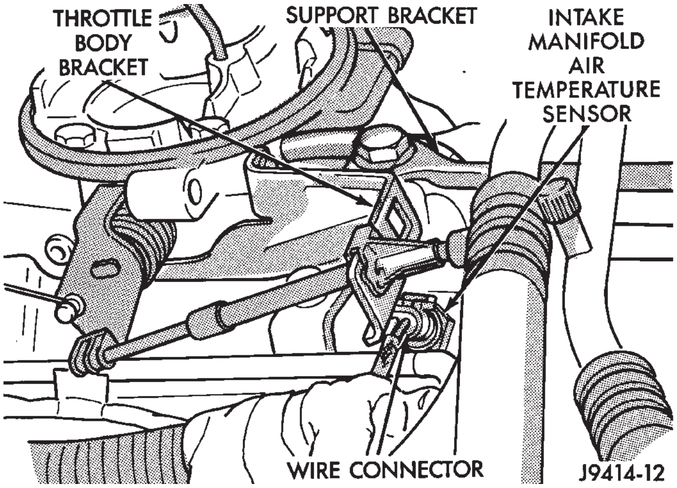

Fig. 6 Air Temperature Sensor—Typical

CRANKSHAFT POSITION SENSOR

For removal and installation procedures, refer to Group 8D, Ignition System.

ENGINE COOLANT TEMPERATURE SENSOR

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from sensor (Fig. 7).

Engines with air conditioning: When removing the connector from sensor, do not pull directly on wiring harness. Fabricate an L-shaped hook tool from a coat hanger (approximately eight inches long). Place the hook part of tool under the connector for removal. The connector is snapped onto the sensor. It is not equipped with a lock type tab.

(3) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor.

(2) Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

The sensor connector is symmetrical (not indexed). It can be installed to the sensor in either direction.

(4) Replace any lost engine coolant. Refer to Group 7, Cooling System.

EVAP CANISTER PURGE SOLENOID

Refer to Group 25, Emission Control System for removal/installation procedures.

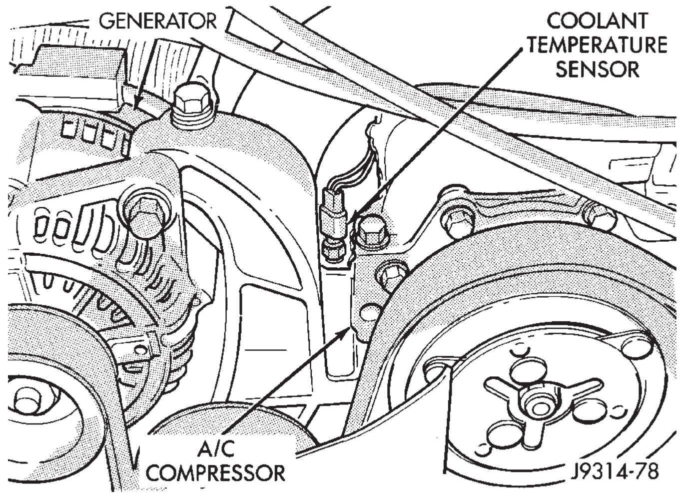

Fig. 7 Coolant Temperature Sensor—Typical

FUEL FILTER

Refer to the Fuel Delivery System section of this group for removal/installation procedures.

FUEL INJECTOR(S)

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE TURNED OFF. BEFORE SERVICING THE FUEL INJECTOR(S), THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

To release fuel pressure, refer to the Fuel Delivery System section of this group. See Fuel System Pressure Release Procedure.

To remove one or more fuel injectors, the fuel rail assembly must be removed from engine.

REMOVAL

(1) Remove air duct at throttle body.

(2) Remove fuel rail assembly. Refer to Fuel Rail removal in this section.

(3) Remove the clip(s) retaining the injector(s) to fuel rail (Figs. 8 or 9).

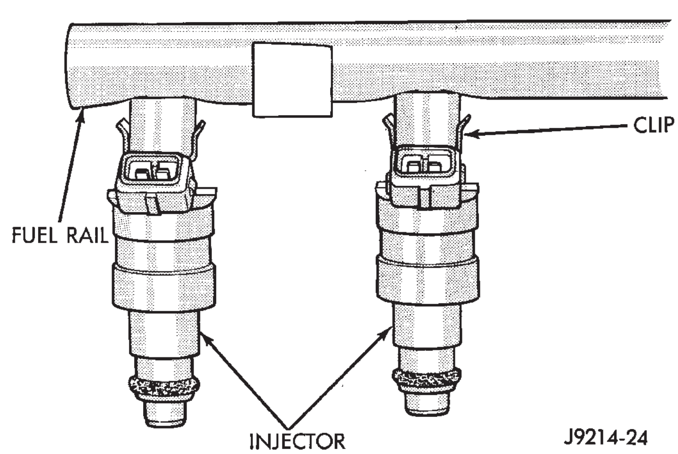

Fig. 8 Injector Mounting

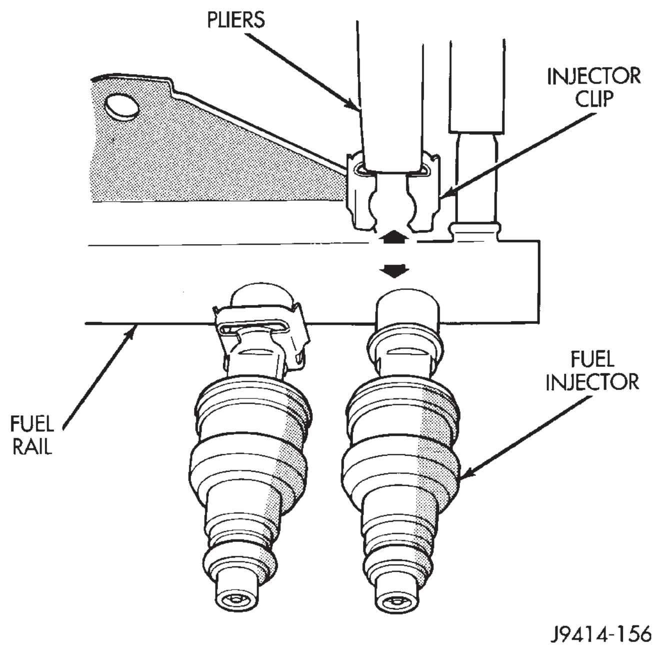

Fig. 9 Injector Retaining Clips—Typical Injector

(4) Remove injector(s) from fuel rail.

INSTALLATION

(1) Apply a small amount of clean engine oil to each fuel injector o-ring. This will help in fuel rail installation.

(2) Install injector(s) and injector clip(s) to fuel rail.

(3) Install fuel rail assembly. Refer to Fuel Rail installation.

(4) Install air duct to throttle body.

(5) Start engine and check for leaks.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is part of the fuel pump module and is not serviced separately. If it needs replacement, the fuel pump module assembly must be replaced. See Fuel Pump Module in the Fuel Delivery section of this group for procedures.

FUEL PUMP MODULE

Refer to the Fuel Delivery System section of this group for removal/installation procedures.

FUEL PUMP RELAY

The fuel pump relay is located in the power distribution center (PDC) (Fig. 5). For location of this relay within the PDC, refer to label attached to bottom of PDC cover.

FUEL RAIL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE TURNED OFF. BEFORE SERVICING THE FUEL RAIL ASSEMBLY, THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

To release fuel pressure, refer to the Fuel Delivery System section of this group. See Fuel System Pressure Release Procedure.

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate the rail halves at the connecting hose (Fig. 10). Due to the design of this connecting hose, it does not use any clamps. Never attempt to install a clamping device of any kind to the hose. When removing the fuel rail assembly for any reason, be careful not to bend or kink the connecting hose.

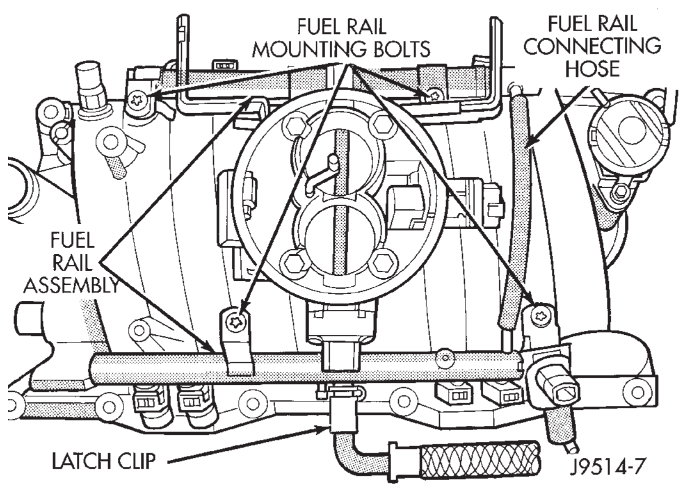

Fig. 10 Fuel Rail Assembly—Typical

REMOVAL

(1) Remove negative battery cable at battery.

(2) Remove air duct at throttle body.

(3) Perform the fuel system pressure release procedure. Refer to the Fuel Delivery System section of this group.

(4) Remove throttle body from intake manifold. Refer to Throttle Body removal in this group.

(5) If equipped with air conditioning, remove the A/C compressor-to-intake manifold support bracket (three bolts) (Fig. 11).

(6) Disconnect electrical connectors at all fuel injectors (Fig. 12). The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification.

(7) Remove EVAP canister purge solenoid/bracket assembly (Fig. 13) from intake manifold.

(8) Disconnect the fuel supply line at the fuel rail. For procedures, refer to Fuel Tubes/Lines/Hoses and Clamps, or Quick-Connect Fittings in the Fuel Delivery System section of this group.

(9) Remove the remaining fuel rail mounting bolts (Fig. 10).

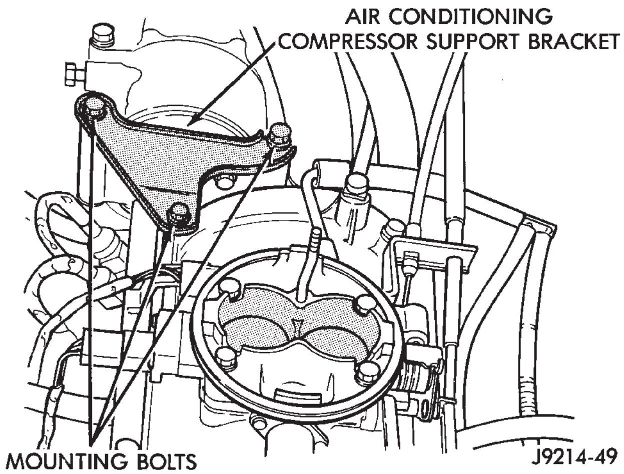

Fig. 11 A/C Compressor Support Bracket—Typical

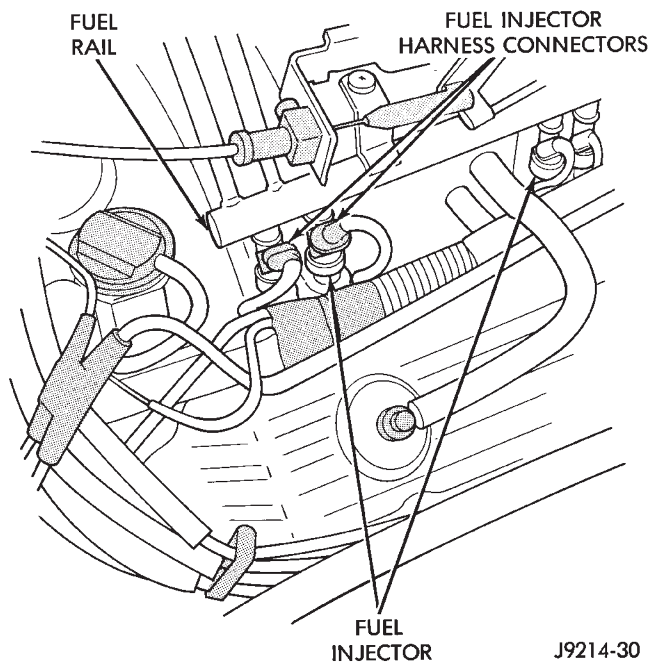

Fig. 12 Fuel Injector Connectors—Typical

(10) Gently rock and pull the **left** fuel rail until the fuel injectors just start to clear the intake manifold. Gently rock and pull the **right** fuel rail until the fuel injectors just start to clear the intake manifold. Repeat this procedure (left/right) until all fuel injectors have cleared the intake manifold.

(11) Remove fuel rail (with injectors attached) from engine.

(12) Remove the clip(s) retaining the injector(s) to fuel rail (Fig. 14).

INSTALLATION

(1) Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.

(2) Install injector(s) and injector clip(s) to fuel rail.

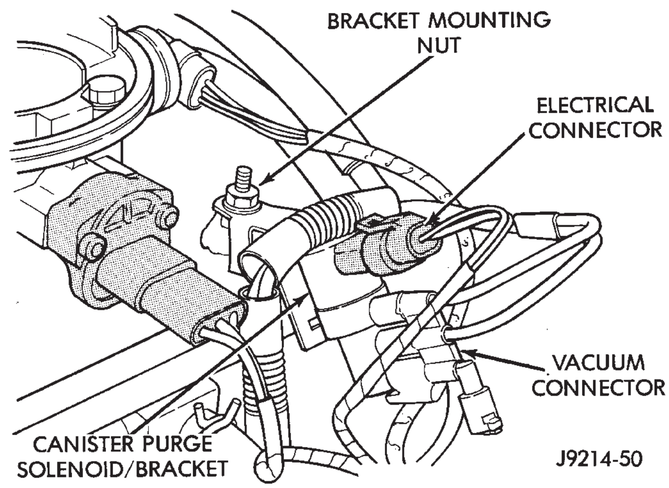

Fig. 13 EVAP Canister Purge Solenoid

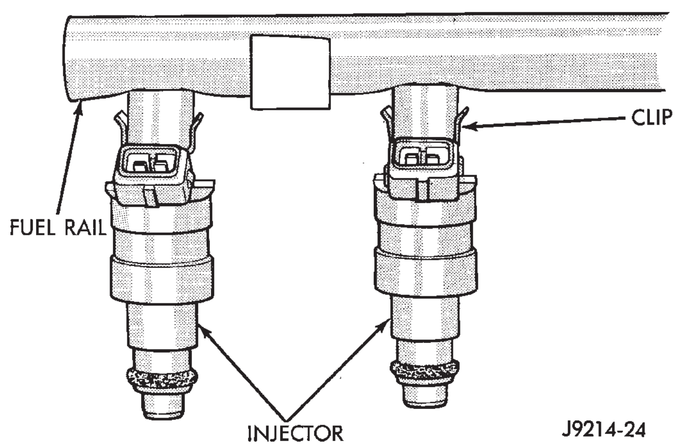

Fig. 14 Fuel Injector Clip

(3) Position the fuel rail/fuel injector assembly to the injector openings on the intake manifold.

(4) Guide each injector into the intake manifold. Be careful not to tear the injector o-ring.

(5) Push the **right** fuel rail down until fuel injectors have bottomed on injector shoulder. Push the **left** fuel rail down until fuel injectors have bottomed on injector shoulder.

(6) Install fuel rail mounting bolts.

(7) Install EVAP canister purge solenoid to intake manifold.

(8) Connect electrical connector to intake manifold air temperature sensor.

(9) Connect wiring to all fuel injectors. The injector wiring harness is numerically tagged.

(10) Install the A/C support bracket (if equipped).

(11) Install throttle body to intake manifold. Refer to Throttle Body installation in this section of the group.

(12) Install fuel supply line to fuel rail. Refer to Fuel Tubes/Lines/Hoses and Clamps, or Quick-Connect Fittings in the Fuel Delivery System section of this group.

(13) Install air duct at throttle body.
(14) Connect battery cable to battery.
(15) Start engine and check for leaks.

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE EVEN WITH THE ENGINE TURNED OFF. BEFORE SERVICING THE FUEL PUMP, FUEL LINES, FUEL FILTER, OR FUEL INJECTOR(S), THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

To release fuel pressure, refer to the Fuel Delivery System section of this group. See Fuel System Pressure Release Procedure.

FUEL TANKS

Refer to the Fuel Tank section of this group for removal/installation procedures.

FUEL TANK PRESSURE RELIEF/ROLLOVER VALVE

Refer to the Fuel Tank section of this group for removal/installation procedures.

FUEL TUBES/LINES/HOSES AND CLAMPS

Refer to Fuel Tubes/Lines/Hoses and Clamps in the Fuel Delivery System section of this group for removal/installation procedures.

Also refer to Quick-Connect Fittings in the Fuel Delivery System section of this group for removal/installation procedures.

IDLE AIR CONTROL (IAC) MOTOR

The IAC motor is located on the back of the throttle body (Fig. 15).

REMOVAL

(1) Remove air duct at throttle body.
(2) Disconnect electrical connector from IAC motor.
(3) Remove two mounting bolts (Fig. 16).
(4) Remove IAC motor from throttle body.

INSTALLATION

(1) Install IAC motor to throttle body.
(2) Install and tighten two mounting bolts to 7 N·m (60 in. lbs.) torque.
(3) Install electrical connector.
(4) Install air duct to throttle body.

IGNITION COIL

Refer to Group 8D, Ignition Systems for removal/installation procedures.

INTAKE MANIFOLD

Refer to Group 11, Exhaust System and Intake Manifold for removal/installation procedures.

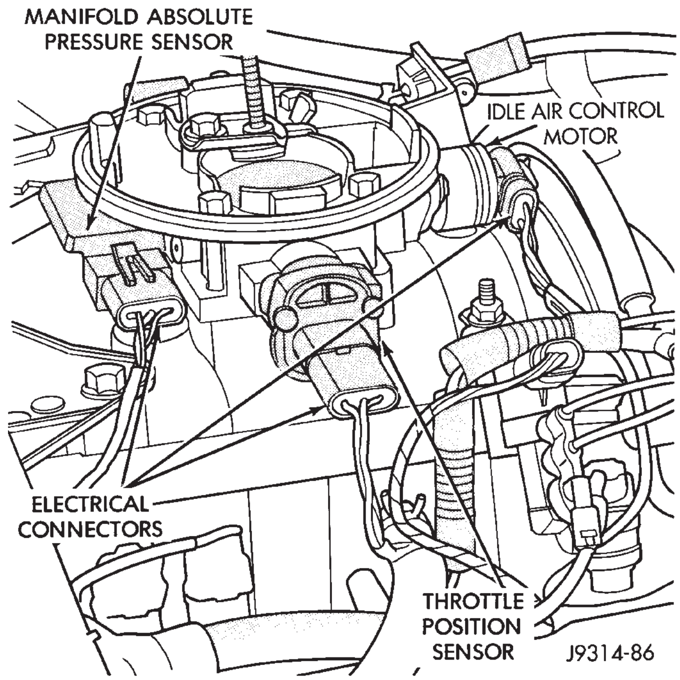

Fig. 15 Idle Air Control Motor and MAP Sensor

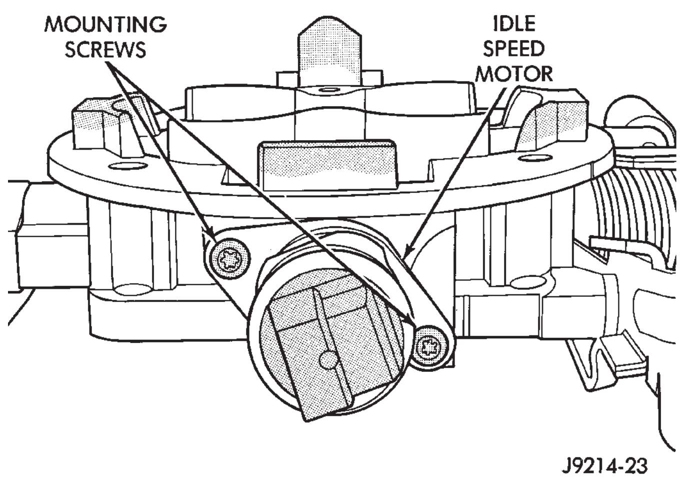

Fig. 16 Mounting Bolts—IAC Motor

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The MAP sensor is located on the front of the throttle body (Fig. 17). An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 18).

REMOVAL

The throttle body must be removed from the intake manifold for MAP sensor removal.

(1) Remove air duct at throttle body.
(2) Remove throttle body. Refer to Throttle Body removal in this section.
(3) Remove two MAP sensor mounting bolts (Fig. 18).

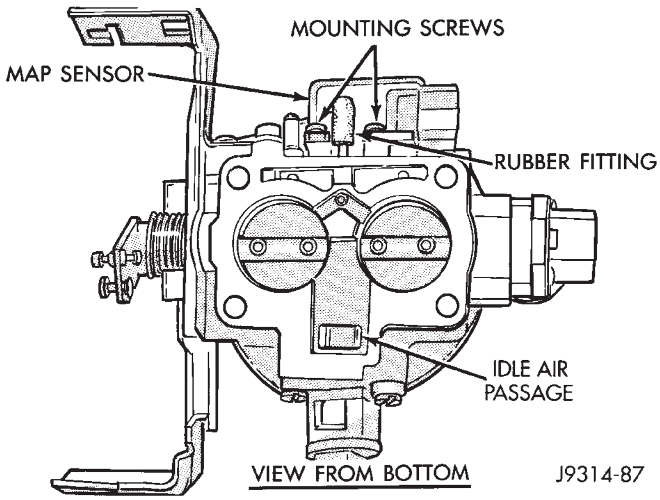

Fig. 17 MAP Sensor L-Shaped Rubber Fitting

(4) While removing MAP sensor, slide the vacuum rubber L-shaped fitting (Fig. 18) from the throttle body.

(5) Remove rubber L-shaped fitting from MAP sensor.

INSTALLATION

(1) Install rubber L-shaped fitting to MAP sensor.

(2) Position sensor to throttle body while guiding rubber fitting over throttle body vacuum nipple.

(3) Install MAP sensor mounting bolts. Tighten screws to 3 N·m (25 in. lbs.) torque.

(4) Install throttle body. Refer to Throttle Body installation in this section.

(5) Install air duct to throttle body.

OXYGEN (O2S) SENSOR

The O2S sensor is located in the right exhaust down-pipe below the exhaust manifold flange (Fig. 18).

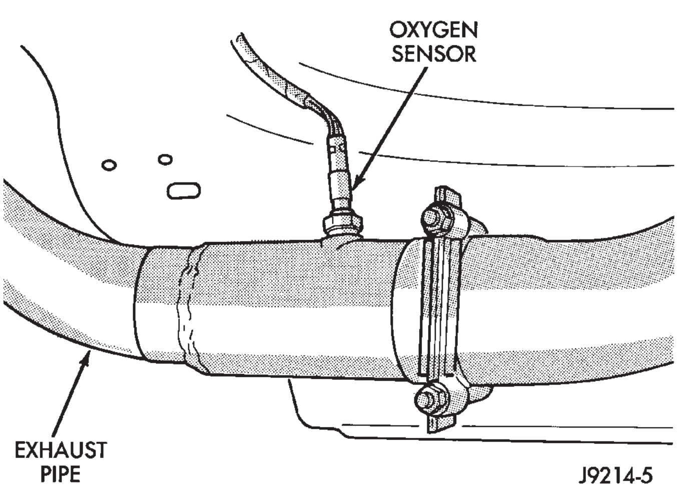

Fig. 18 Oxygen Sensor

REMOVAL

WARNING: THE EXHAUST MANIFOLD BECOMES VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support the vehicle.

(2) Disconnect the wire connector from the O2S sensor.

CAUTION: When disconnecting the sensor electrical connector, do not pull directly on wire going into sensor.

(3) Remove the O2S sensor from the exhaust manifold. Snap-On oxygen sensor wrench (number YA 8875) may be used for removal and installation.

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to the threads of a new oxygen sensor.**

(1) Install the O2S sensor into the exhaust manifold. Tighten to 30 N·m (22 ft. lbs.) torque.

(2) Connect the O2S sensor wire connector.

(3) Lower the vehicle.

PARK/NEUTRAL SWITCH

Refer to Group 21, Transmission and Transfer Case for removal/installation procedures.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is located on the cowl panel in the right/rear side of the engine compartment (Fig. 19).

REMOVAL

(1) Disconnect the negative battery cable at the battery.

(2) Remove the coolant reserve/overflow tank (one bolt and two nuts) (Fig. 20)

(3) Loosen the 60-Way connector mounting bolt (Fig. 21).

(4) Remove the electrical connector by pulling straight back.

(5) Remove the three PCM mounting bolts (Fig. 21).

(6) Remove PCM.

INSTALLATION

(1) Check the pins in 60-way electrical connector for damage. Repair as necessary.

(2) Install PCM. Tighten three mounting bolts to 1 N·m (9 in. lbs.) torque.

(3) Engage 60-way connector into PCM. Tighten connector mounting bolt to 4 N·m (35 in. lbs.) torque.

(4) Install coolant reserve/overflow tank.

(5) Connect negative cable to battery.

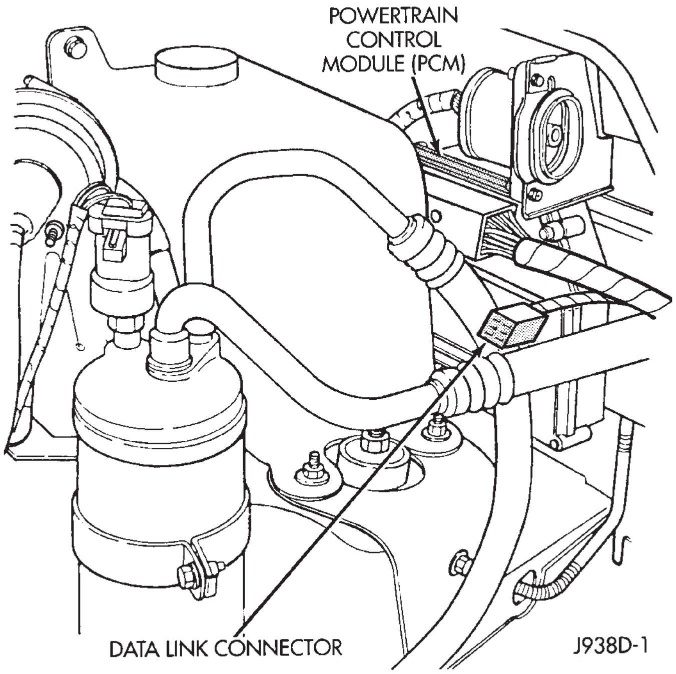

Fig. 19 Powertrain Control Module (PCM) Location

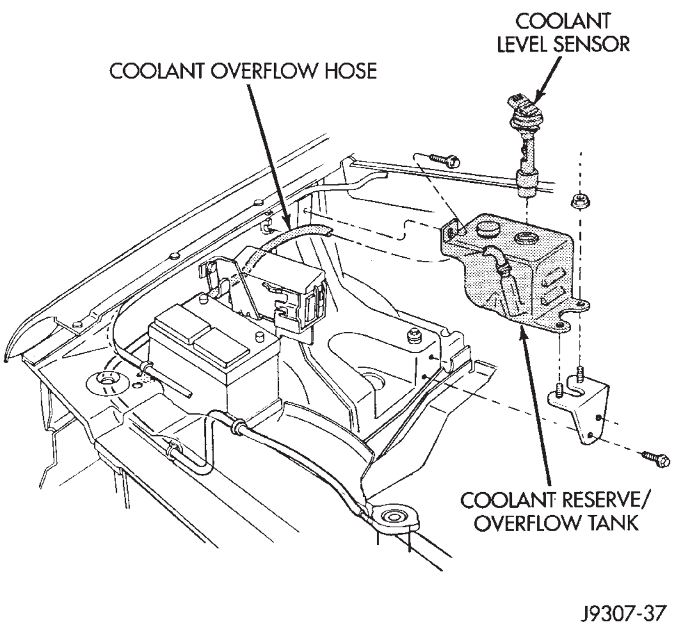

Fig. 20 Coolant Reserve/Overflow Tank Mounting

QUICK-CONNECT FITTINGS

Refer to the Fuel Delivery System section of this group for removal/installation procedures.

THROTTLE BODY

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the powertrain control module (PCM).

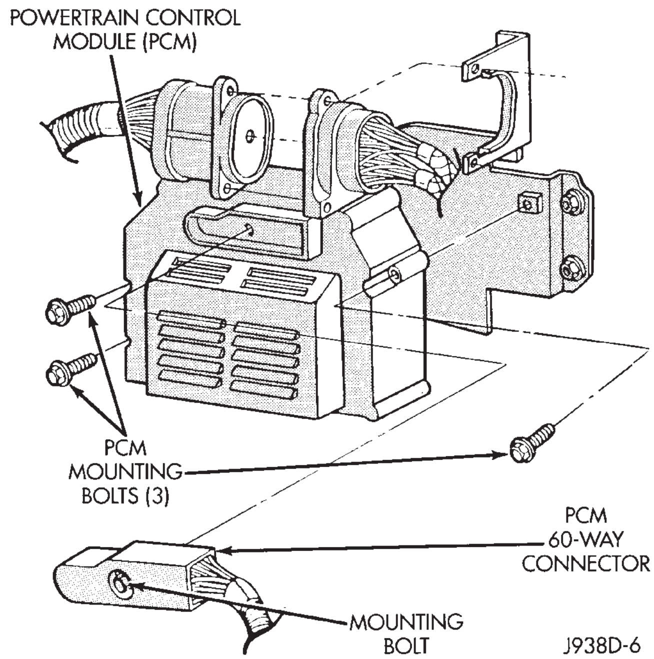

Fig. 21 Powertrain Control Module (PCM) Mounting

REMOVAL

(1) Remove the air duct at throttle body.

(2) Disconnect throttle body electrical connectors at MAP sensor, IAC motor and TPS (Fig. 22).

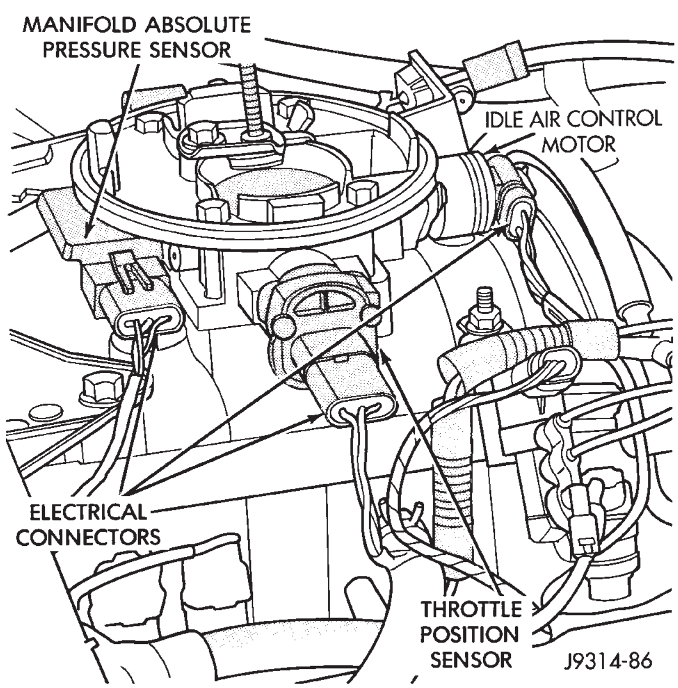

Fig. 22 Throttle Body and TPS—Typical

(3) Remove vacuum line at throttle body.

(4) Remove (unsnap) all control cables from throttle body (lever) arm. Refer to the Accelerator Pedal and Throttle Cable section of this group for additional information.

(5) Remove four throttle body mounting bolts (Fig. 23).

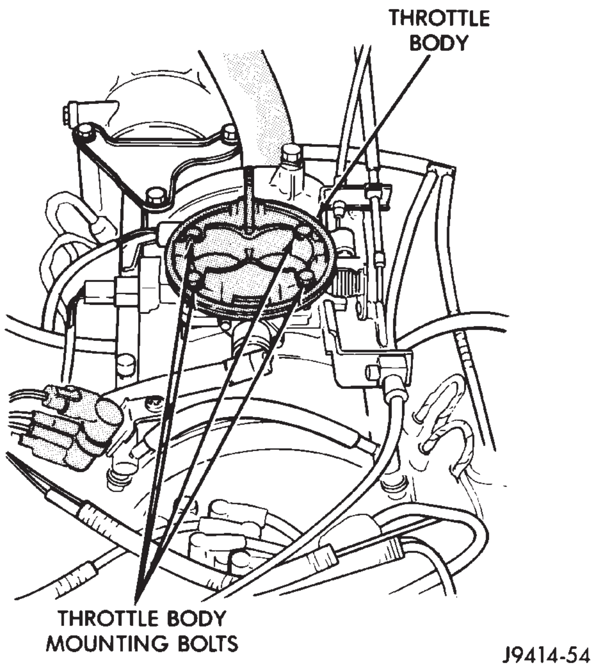

Fig. 23 Throttle Body Mounting Bolts—Typical

(6) Remove throttle body from intake manifold.
(7) Discard old throttle body-to-intake manifold gasket.

INSTALLATION

(1) Clean the mating surfaces of the throttle body and the intake manifold.
(2) Install new throttle body-to-intake manifold gasket.
(3) Install throttle body to intake manifold.
(4) Install four mounting bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.
(5) Install control cables.

CAUTION: When the automatic transmission throttle cable is connected, it MUST be adjusted.

(6) If equipped with an automatic transmission, connect and adjust the transmission line pressure cable. Refer to Group 21, Transmissions for adjustment procedure.
(7) Install vacuum line to throttle body.
(8) Install electrical connectors.
(9) Install air duct to throttle body.

THROTTLE POSITION SENSOR (TPS)

REMOVAL

The TPS is located on the side of the throttle body (Fig. 22).
(1) Remove air intake tube at throttle body.
(2) Disconnect TPS electrical connector.
(3) Remove two TPS mounting bolts (Fig. 24).

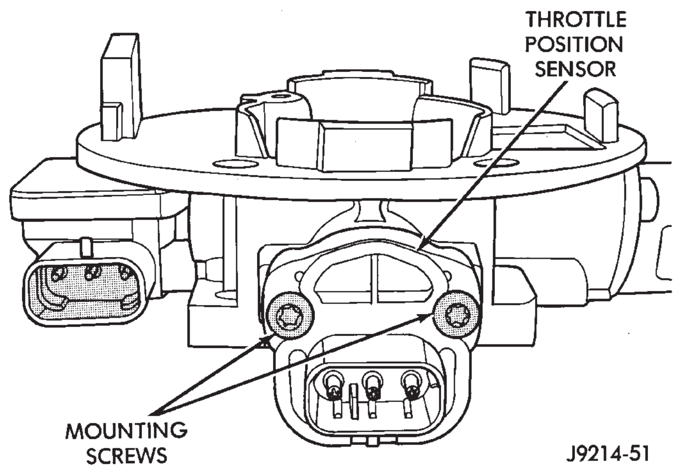

Fig. 24 TPS Mounting Bolts

(4) Remove TPS from throttle body.

INSTALLATION

The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 25). The TPS must be installed so that it can be rotated a few degrees. If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs. The TPS will be under slight tension when rotated.

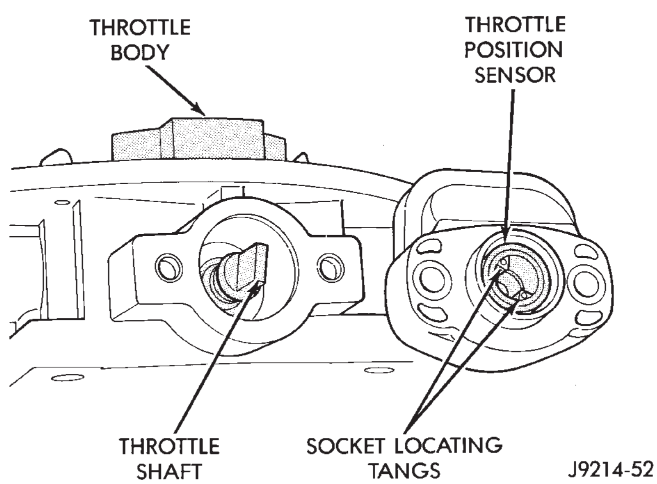

Fig. 25 TPS Installation

(1) Install the TPS and two retaining bolts.
(2) Tighten bolts to 7 N·m (60 in. lbs.) torque.
(3) Manually operate the throttle control lever by hand to check for any binding of the TPS.
(4) Connect TPS electrical connector to TPS.
(5) Install air intake tube.

VEHICLE SPEED SENSOR

The vehicle speed sensor (Fig. 26) is located on the extension housing of the transmission on 2WD models. It is located on the transfer case on 4WD models.

REMOVAL

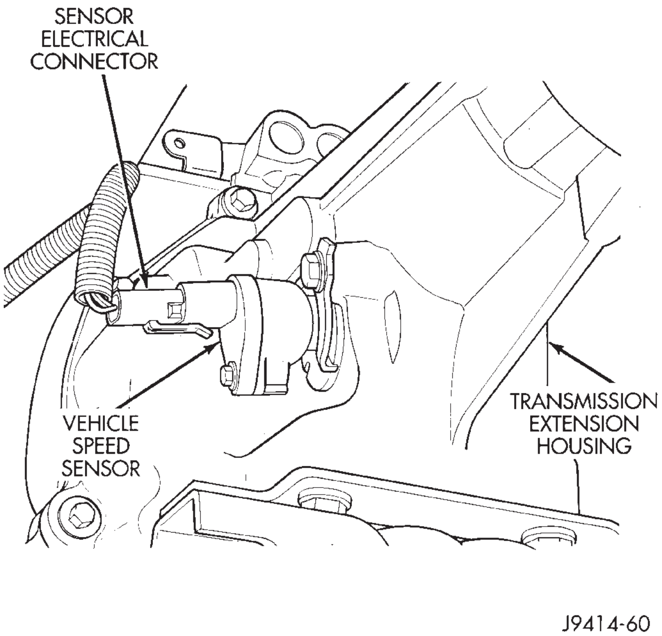

Fig. 26 Vehicle Speed Sensor Location—Typical

(1) Raise and support vehicle.

(2) Disconnect the electrical connector from the sensor.

(3) Remove the sensor mounting bolt (Fig. 27).

(4) Remove the sensor (pull straight out) from the speedometer pinion gear adapter (Fig. 27). Do not remove the gear adapter from the transmission.

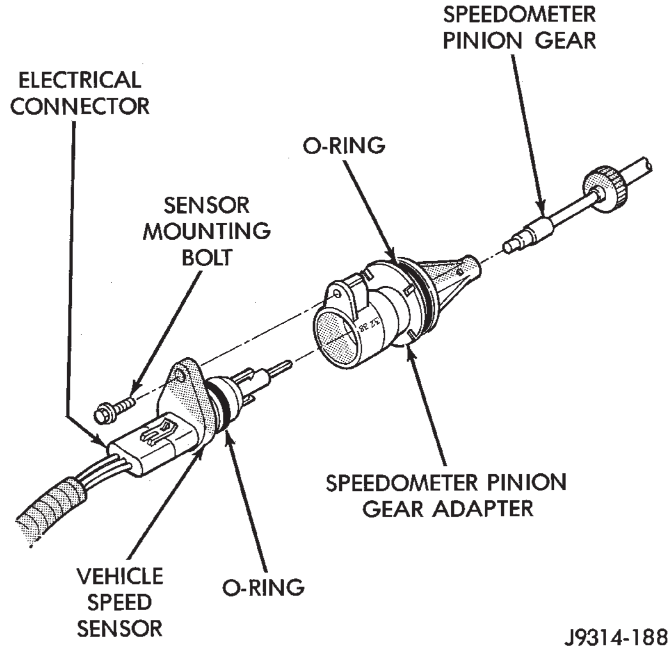

Fig. 27 Sensor Removal/Installation—Typical

INSTALLATION

(1) Clean the inside of speedometer pinion gear adapter before installing speed sensor.

(2) Install sensor into speedometer gear adapter and install mounting bolt. **Before tightening bolt, verify speed sensor is fully seated (mounted flush) to speedometer pinion gear adapter.**

(3) Tighten sensor mounting bolt to 2.2 N·m (20 in. lbs.) torque.

(4) Connect electrical connector to sensor.

SPECIFICATIONS

GENERAL INFORMATION

The following specifications are published from the latest information available at the time of publication. **If anything differs between the specifications found on the Vehicle Emission Control Information (VECI) label and the following specifications, use specifications on VECI label.** The VECI label is located in the engine compartment.

FUEL SYSTEM PRESSURE

The fuel system operating pressure for either 4.0L 6-cylinder or 5.2L V-8 engines is 255-283 kPa (39 psi ± 2 psi). This is measured at the fuel rail test port. Pump output pressure at the fuel pump module outlet fitting is 269-283 kPa (39-41 psi).

FUEL TANK CAPACITIES

FUEL TANK	LITERS*	GALLONS*
ALL MODELS	87	23.0

*Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerances, ambient temperature and refill procedures.

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TORQUE

DESCRIPTION	TORQUE
Accelerator Pedal Mounting Nuts	10 N·m (92 in. lbs.)
Engine Coolant Temperature Sensor 4.0L	28 N·m (21 ft. lbs.)
Engine Coolant Temperature Sensor 5.2L	11 N·m (8 ft. lbs.)
Crankshaft Position Sensor 4.0L	18 N·m (15 ft. lbs.)
Fuel Filter Retaining Strap Bolt	7 N·m (66 in. lbs.)
Fuel Rail Mounting Bolts	27 N·m (20 ft. lbs.)
Idle Air Control Motor Mounting Bolts	7 N·m (60 in. lbs.)
Intake Manifold Air Temperature Sensor	28 N·m (20 ft. lbs.)
MAP Sensor Mounting Bolt 5.2L	3 N·m (25 in. lbs.)
Oxygen Sensor	30 N·m (22 ft. lbs.)
PCM 60-Way Connector Mounting Bolt	4 N·m (35 in. lbs.)
PCM Mounting Bolts	1 N·m (9 in. lbs.)
Throttle Body Mounting Bolts (4.0L)	12 N·m (9 ft. lbs.)
Throttle Body Mounting Bolts (5.2L)	23 N·m (200 in. lbs.)
Throttle Position Sensor Bolts	7 N·m (60 in. lbs.)

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PROPELLER SHAFTS

CONTENTS

GENERAL INFORMATION

PROPELLER SHAFTS

The function of a prop shaft is to transmit power from one point to another in a smooth action. The shaft is designed to send torque through an angle from the transmission (transfer case on 4WD vehicles) to the axle (Fig. 1).

The propeller shaft must operate through constantly changing relative angles between the transmission and axle. It must also be capable of changing length while transmitting torque. The axle rides suspended by springs in a floating motion. This means the propeller shaft must be able to change angles when going over various roads. This is accomplished through universal joints, which permit the propeller shaft to operate at different angles. The slip joints (or yokes) permit contraction or expansion.

Tubular propeller shafts are balanced by the manufacturer with weights spot welded to the tube.

The propeller shaft is designed and built with the yoke lugs in line with each other which is called phasing. This design produces the smoothest running condition. An out of phase shaft can cause a vibration.

Before undercoating a vehicle, the propeller shaft and the U-joints should be covered. This will prevent the undercoating from causing an unbalanced condition and vibration.

CAUTION: Use exact replacement hardware for attaching the propeller shafts. This will ensure safe operation. The specified torque must always be applied when tightening the fasteners.

4WD FRONT PROPELLER SHAFTS

The 4WD vehicles use 3 types of front propeller shaft. Type 1 and Type 2 have a single cardan joint at the axle end and a double cardan joint at the transfer case end. The difference between Type 1 and 2 is the slip yoke. Type 1 uses a dustcap and seal to protect the slip yoke from dirt (Fig. 2). Type 2 uses a rubber boot to protect the slip yoke (Fig. 3).

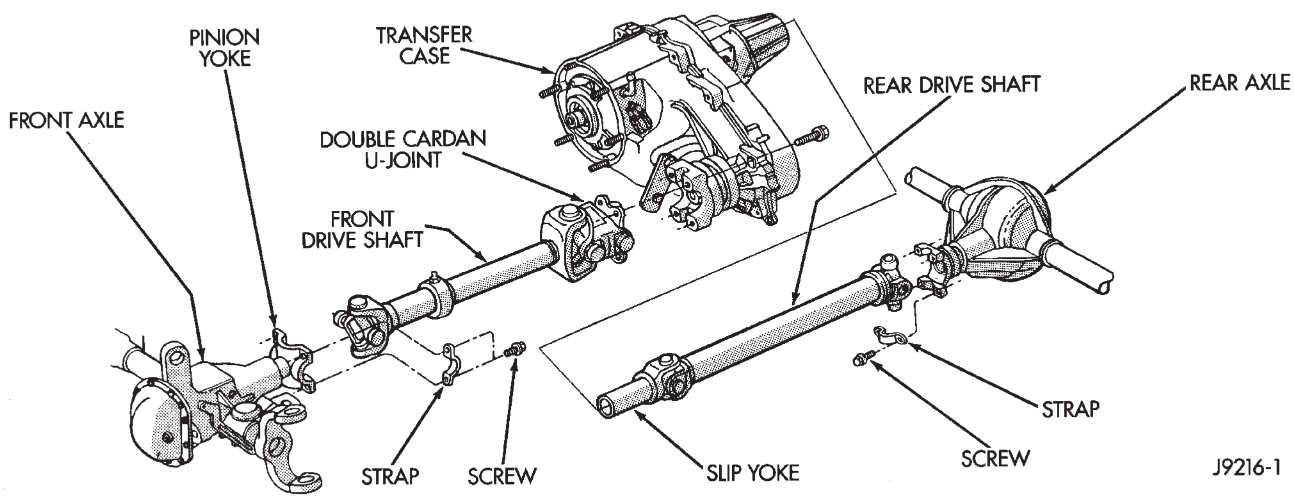

Fig. 1 Front & Rear Propeller Shafts 4WD

The third propeller shaft used Type 3 has no slip yoke. This shaft uses a double cardan joint at the transfer case end and a constant velocity joint (CV) at the front axle end (Fig. 4). The CV joint contracts and extends which eliminates the need for a slip yoke. The CV joint has a splined shaft which allows the overall shaft length to be adjusted for optimum joint travel. This spline shaft is locked in place with a nut. **Never attempt to adjust the shaft length. The overall shaft length is preset during manufacturing.**

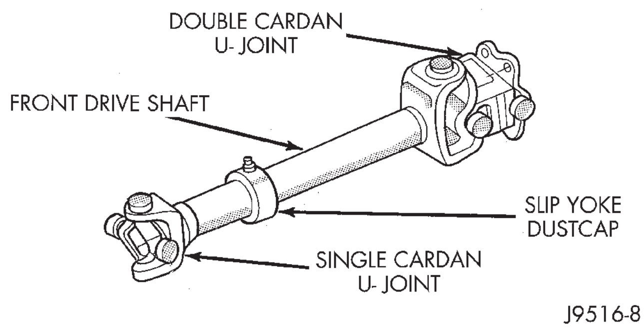

Fig. 2 Type 1 Front Propeller Shaft

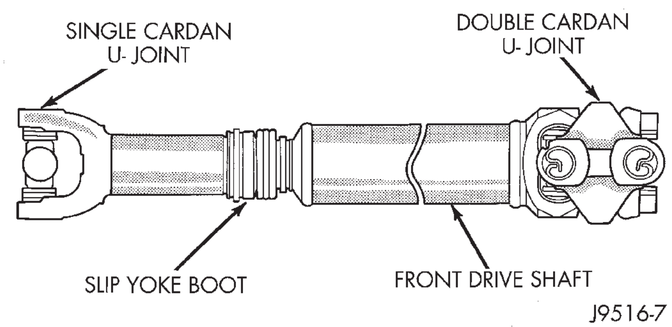

Fig. 3 Type 2 Front Propeller Shaft

UNIVERSAL JOINTS

Three different types of universal joints are used (Fig. 5,6 & 7). These joints are not repairable if worn or damaged they must be replaced. If a vehicle has a damaged constant velocity joint or boot (Fig. 7) the propeller shaft must be replaced.

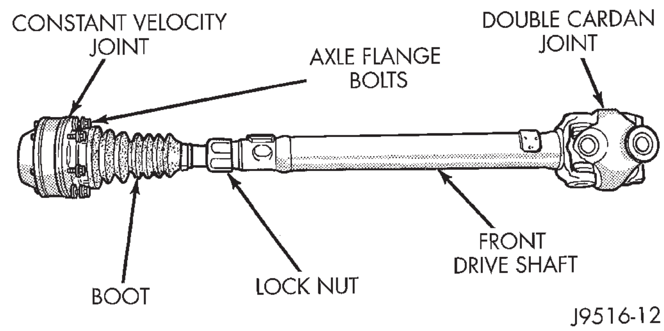

Fig. 4 Type 3 Front Propeller Shaft

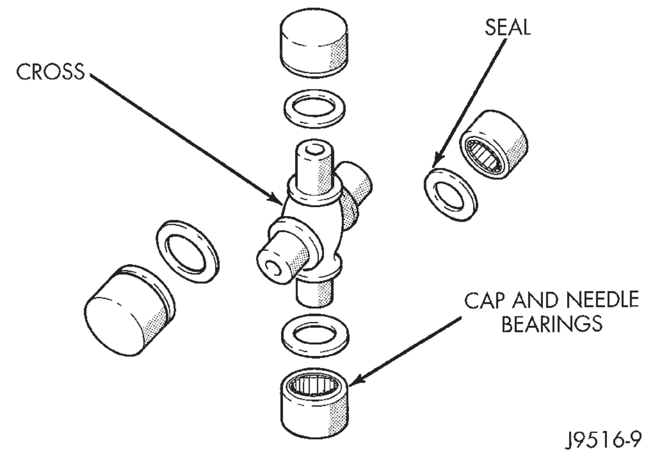

Fig. 5 Single Cardan U-Joint (Typical)

LUBRICATION

The slip yoke on the Type 1 front shaft is equipped with a lubrication fitting. Use a multi-purpose NLGI Grade 2 EP lubricant, refer to Group 0, Lubrication and Maintenance for additional information. The factory installed U-joints are lubricated for the life of the vehicle and do not need re-lubrication. All U-joints should be inspected for leakage and damage each time the vehicle is serviced. If seal leakage or damage exists, the U-joint should be replaced.

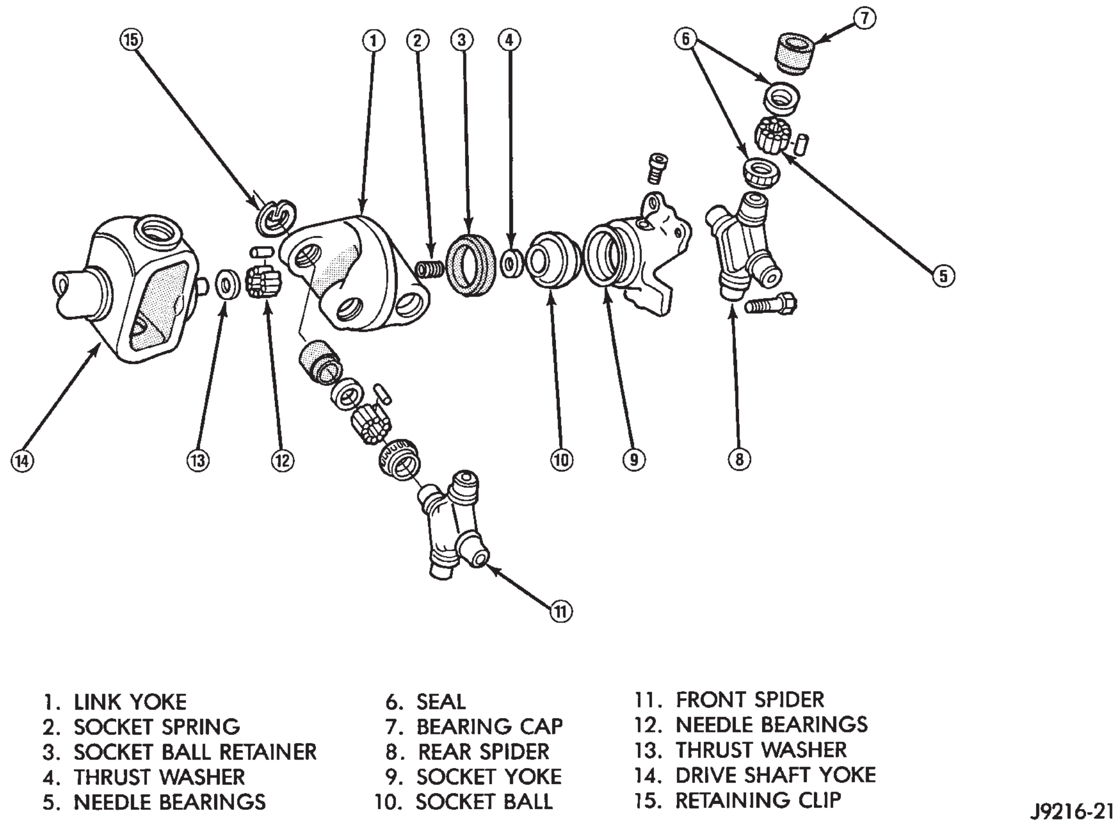

Fig. 6 Double Cardan U-Joint

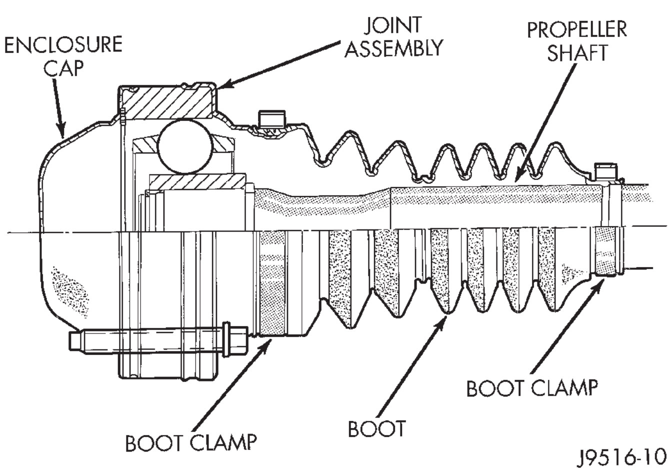

Fig. 7 Constant Velocity Joint

SERVICE DIAGNOSIS/PROCEDURES

INDEX

VIBRATION

Tires that are out-of-round or wheels that are unbalanced will cause a low frequency vibration. Refer to Group 22, Tires And Wheels for additional information.

Brake drums that are unbalanced will cause a harsh, low frequency vibration. Refer to Group 5, Brakes for additional information.

Driveline vibration can also result from loose or damaged engine mounts. Refer to Group 21, Transmissions for additional information.

Propeller shaft vibration will increase as the vehicle speed is increased. A vibration that occurs within a specific speed range is **not** caused by propeller shaft unbalance. Defective universal joints or an incorrect propeller shaft angle are usually the cause.

UNBALANCE

If propeller shaft unbalance is suspected, it can be verified with the following procedure.

Removing and re-indexing the propeller shaft 180° may eliminate some vibrations.

- Clean all the foreign material from the propeller shaft and the universal joints (mud, undercoating, etc.).
- Inspect the propeller shaft for missing balance weights, broken welds, and bent areas. **If the propeller shaft is bent, it must be replaced.**
- Ensure the universal joints are not worn, are properly installed, and are correctly aligned with the shaft.
- Check the universal joint clamp screws torque.

(1) Raise the vehicle.

(2) Remove the wheel and tires. Install the wheel lug nuts to retain the brake drums.

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

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

(5) Install a screw clamp at **Position 1** (Fig. 1).

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

DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
PROPELLER SHAFT	a. Undercoating or other foreign material on shaft. b. Loose U-joint clamp screws. c. Loose or bent U-joint yoke or excessive runout. d. Incorrect drive line angularity. e. Rear spring center bolt not in seat. f. Worn U-joint bearings. g. Propeller shaft damaged (bent tube) or out of balance. h. Broken rear spring. i. Excessive runout or unbalanced condition. j. Excessive drive pinion gear shaft yoke runout.	a. Clean exterior of shaft and wash with solvent. b. Tighten screws properly. c. Install replacement yoke. d. Correct angularity e. Loosen spring U-bolts and seat center bolts. f. Replace U-joint. g. Install replacement propeller shaft. h. Replace rear spring. i. Reindex propeller shaft 180°, test and correct as necessary. j. Reindex propeller shaft 180° and evaluate.
UNIVERSAL JOINT NOISE	a. U-joint clamp screws loose. b. Lack of lubrication.	a. Tighten screws with specified torque. b. Replace U-joint.

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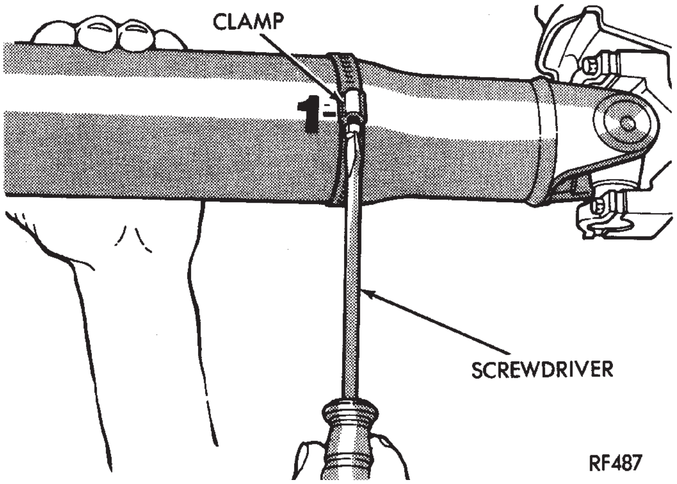

Fig. 1 Clamp Screw At Position 1

(7) If there is no change in vibration, the vibration may not be caused by prop shaft unbalance.

(8) If the vibration decreased, install a second clamp (Fig. 2). Repeat the vibration test.

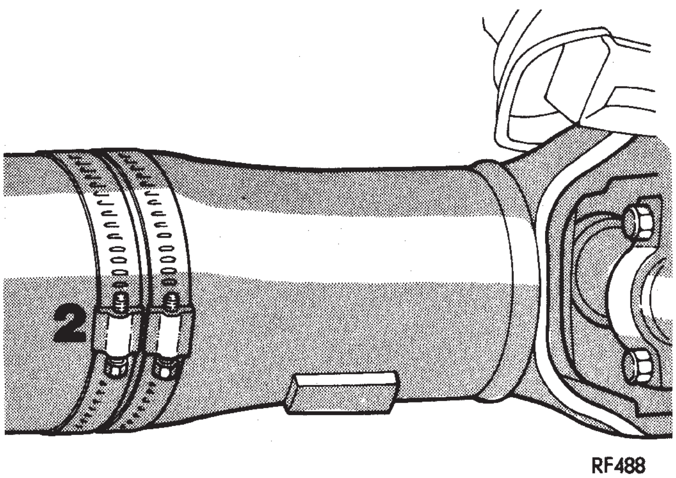

Fig. 2 Two Clamp Screws At The Same Position

(9) If the clamps cause an additional unbalanced condition. Separate the clamp screws (1/4 inch above and 1/4 inch below the mark). Repeat the vibration test (Fig. 3).

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

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

(12) If the amount of vibration remains unacceptable, perform the procedures at the front end of the propeller shaft.

RUNOUT

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

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

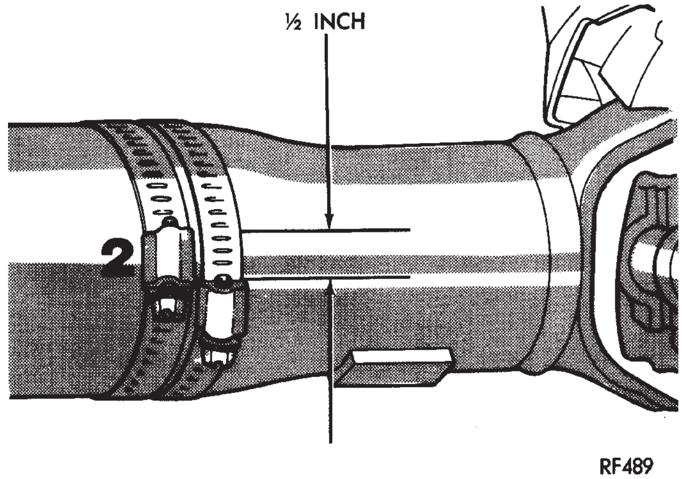

Fig. 3 Clamp Screws Separated

(3) Measure runout at the center and ends away from welds.

(4) Refer to Runout Specifications chart.

(5) Replace the propeller shaft if the runout exceeds the limit.

RUNOUT SPECIFICATIONS

Front of shaft	0.010 in. (0.25 mm)
Center of shaft	0.015 in. (0.38 mm)
Rear of shaft	0.010 in. (0.25 mm)

NOTE: Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. Under 30 inches the max. runout is 0.20 inch for full length of the tube.

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UNIVERSAL JOINT ANGLE MEASUREMENT

INFORMATION

When two shafts intersect at a common universal joint, the angle is called the operating angle. The larger the operating angle, the larger the amount of acceleration and deceleration of the joint. For every revolution there are two accelerations and deceleration of the universal joint. This speeding up and slowing down of the joint must be cancelled to produce a smooth power flow. This is done through phasing and proper universal joint working angles.

A propeller shaft is properly phased when the yoke ends are on the same plane or in line. A twisted shaft will throw the yokes out of phase and cause a noticeable vibration.

When taking universal joint angle measurements or checking phasing with two piece shafts, consider each shaft separately. On 4WD vehicles, the front shaft input (pinion shaft) angle has priority over the caster angle.

Ideally the driveline system should have:

- **Angles that are equal or opposite within 1 degree of each other**
- **Have a 3 degree maximum operating angle**
- **Have at least a 1/2 degree continuous operating (propeller shaft) angle**

Engine speed (R.P.M.) is the main factor in determining maximum allowable operating angles. As a guide to maximum normal operating angles refer to the chart listed (Fig. 4).

PROPELLER SHAFT R.P.M.	MAX. NORMAL OPERATING ANGLES
5000	3°
4500	3°
4000	4°
3500	5°
3000	5°
2500	7°
2000	8°
1500	11°

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Fig. 4 Maximum Angles and R.P.M.

INSPECTION

Before measuring universal joint angles, the following must be done.

- Inflate all tires to correct pressure.
- **Check angles in the same loaded or unloaded condition as when the vibration occurred. Prop shaft angles will change according to the amount of load in the vehicle. Always check angles in loaded and unloaded conditions.**
- Check the condition of all suspension springs and verify all fasteners are torqued to specifications.
- Check the condition of the engine and transmission mounts. Verify all fasteners are torqued to specifications.

MEASUREMENT

To accurately check driveline alignment, raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn. Remove snap rings from universal joint so Inclinometer 7663 (J-23498A) base sits flat on cap.

(1) Rotate the shaft until transmission/transfer case output yoke bearing is facing downward.

Always make measurements from front to rear.

(2) Place Inclinometer on yoke bearing (A) parallel to the shaft (Fig. 5). Center bubble in sight glass and record measurement.

This measurement will give you the transmission or OUTPUT YOKE ANGLE (A).

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

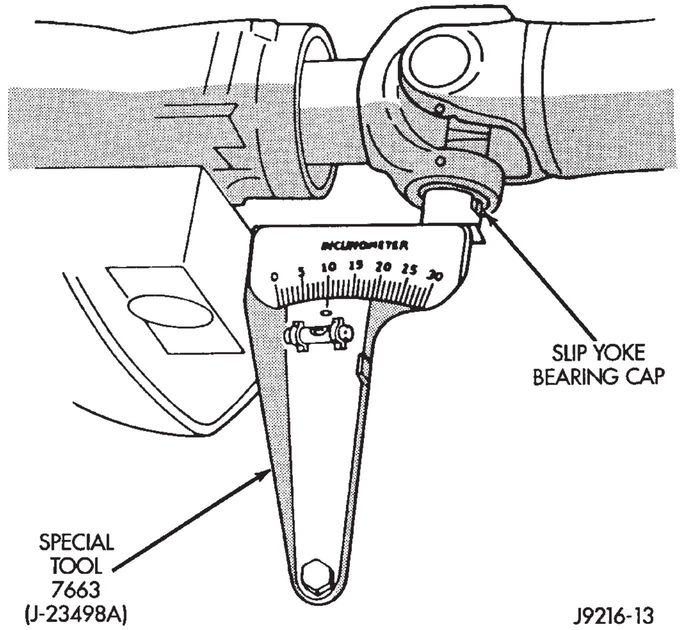


Fig. 5 Front (Output) Angle Measurement (A)

This measurement will give you the PROPELLER SHAFT ANGLE (C).

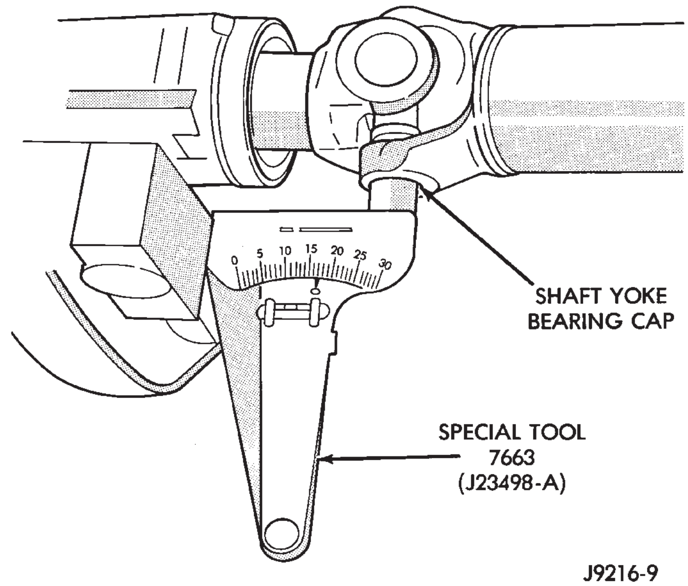


Fig. 6 Propeller Shaft Angle Measurement (C)

(4) Subtract smaller figure from larger (C minus A) to obtain transmission OUTPUT OPERATING ANGLE.

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

This measurement will give you the pinion shaft or INPUT YOKE ANGLE (B).

(6) Subtract smaller figure from larger (C minus B) to obtain axle INPUT OPERATING ANGLE.

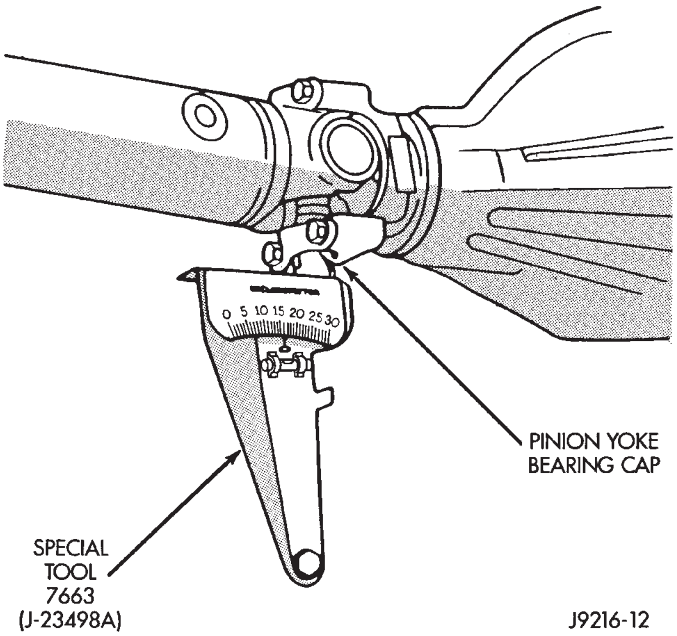


Fig. 7 Rear (Input) Angle Measurement (B)

Refer to rules given below and the example in (Fig. 8) for additional information.

• Good cancellation of u-joint operating angles (within 1°)
• Operating angles less than 3°
• At least 1/2 of one degree continuous operating (propeller shaft) angle

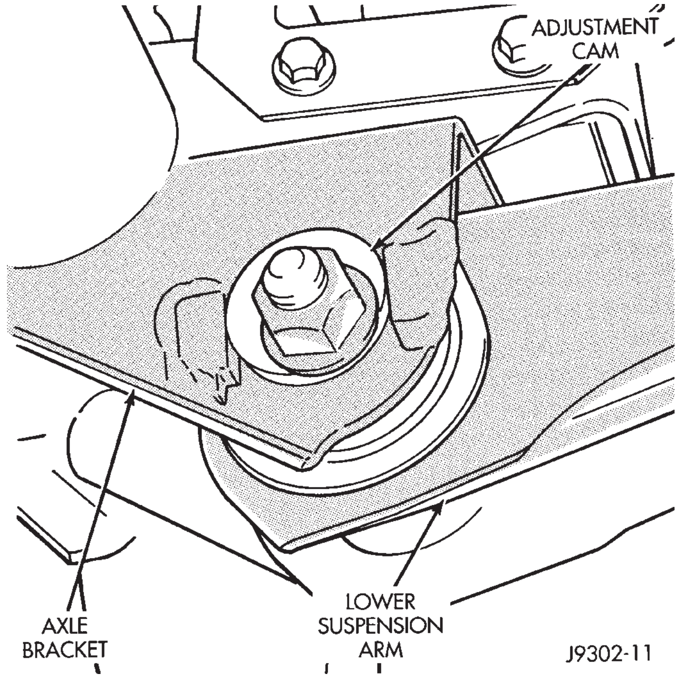


Fig. 9 Angle Adjustment With Cams

ADJUSTMENT WITH CAMS

Adjust the angle by rotating cams on the upper suspension arms (Fig. 9). On 4WD vehicles, the front shaft input (pinion shaft) angle has priority over the caster angle.

A cam service kit is available to adjust the rear propeller shaft angle. The cam kit is installed in the upper suspension arms at the axle.

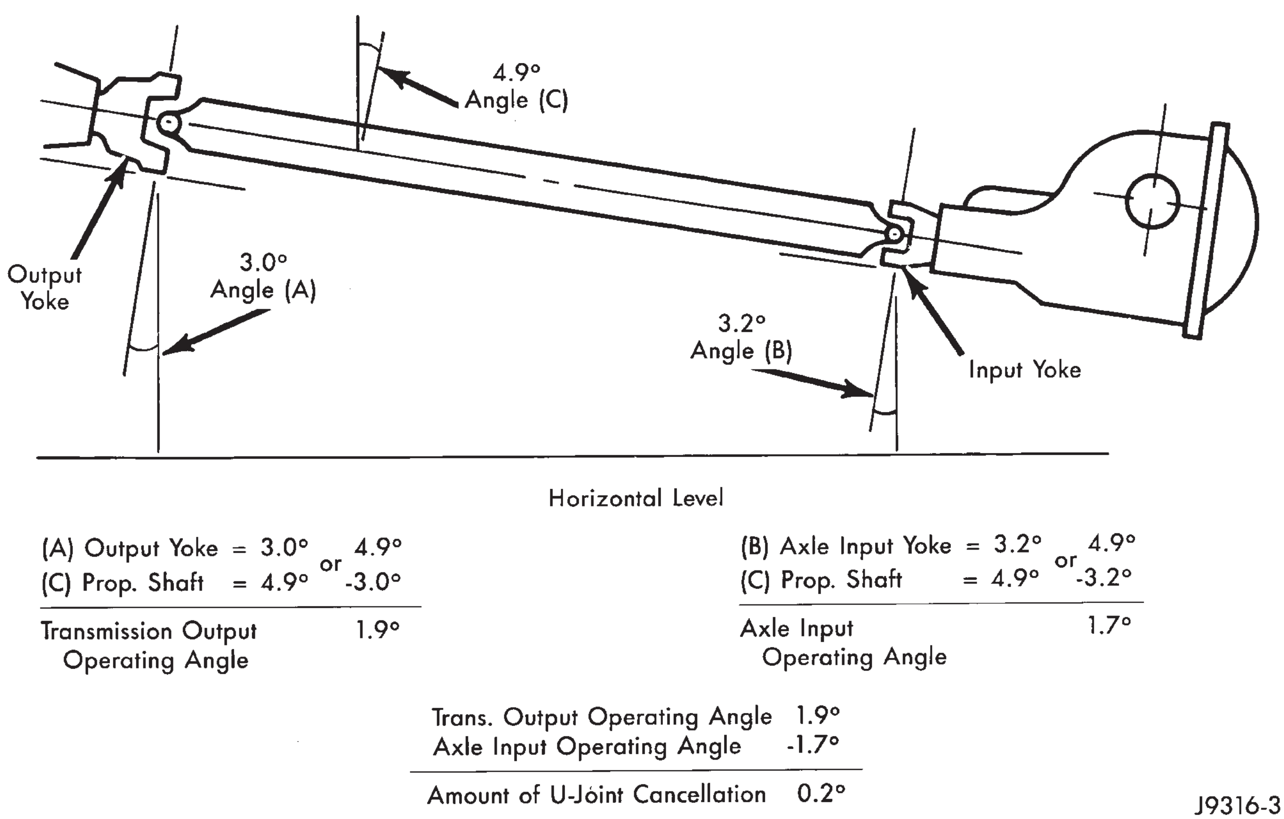


Fig. 8 Universal Joint Angle Example

PROPELLER SHAFT REPLACEMENT

PRECAUTIONS

Use exact replacement hardware for attaching the propeller shafts. This will ensure safe operation. The specified torque must always be applied when tightening the fasteners.

It is important to mark the propeller shaft yoke and axle or transmission yoke before removal (Fig. 1). This will assure correct phasing and eliminate possible vibration.

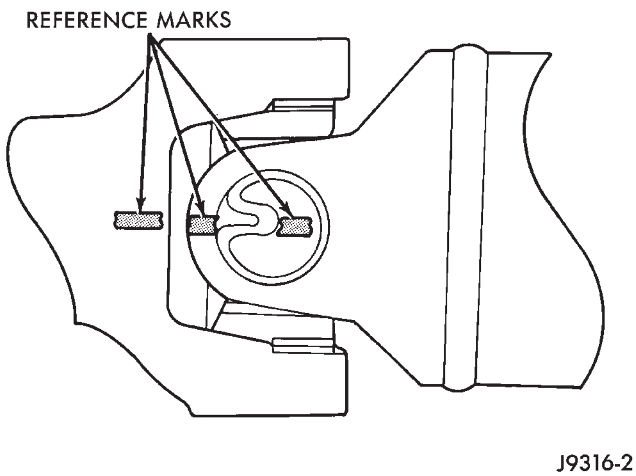


Fig. 1 Reference Marks on Yokes

CAUTION: Do not allow the propeller shaft to drop or hang from either universal joint during removal. Attach it to the vehicle underside with wire to prevent damage to the universal joints.

CAUTION: It is important to protect the machined external surface of the slip yoke from damage. If damaged, the transmission extension seal could be damaged and leak.

FRONT TYPE 1 AND TYPE 2

REMOVAL

(1) Shift the transmission and transfer case (if applicable) to Neutral position. Raise the vehicle. Remove skid plates (if equipped) from frame, refer to Group 13, Frames.

(2) Scribe alignment marks on the yokes at the transfer case and axle pinion. Place marks at the pinion shaft and at each end of the propeller shaft. These marks will be used for installation reference (Fig. 2).

(3) Remove U-joint bolts and straps from pinion yoke.

(4) Remove bolts from transfer case yoke and remove the propeller shaft.

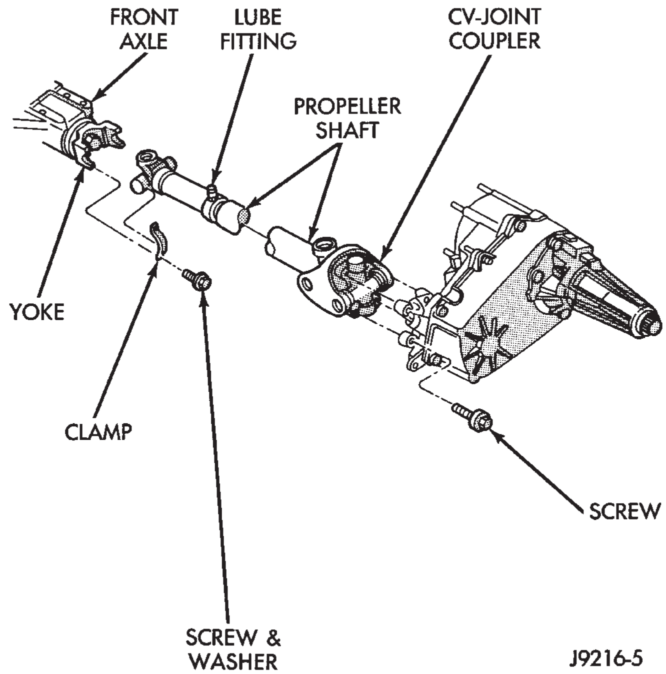


Fig. 2 Front Propeller Shaft

INSTALLATION

(1) Position the propeller shaft with the yoke reference marks aligned. Install the propeller shaft (Fig. 2).

(2) Install U-joint straps and bolts to pinion yoke and tighten to 19 N·m (14 ft. lbs.) torque.**Replace U-joint straps and bolts must be installed.**

(3) Install transfer case yoke bolts and tighten to 27 N·m (20 ft. lbs.) torque.

FRONT TYPE 3

REMOVAL

(1) Shift the transmission and transfer case (if applicable) to Neutral position. Raise the vehicle. Remove skid plates (if equipped) from frame, refer to Group 13, Frames.

(2) Scribe alignment marks on the yoke at the transfer case and the axle flange. Place marks at the pinion shaft and at each end of the propeller shaft. These marks will be used for installation reference.

(3) Remove 6 bolts at the pinion yoke.

(4) Remove bolts from transfer case yoke and push the shaft into the CV joint and remove the shaft.

INSTALLATION

(1) Position the propeller shaft with the yoke reference marks aligned. Install the propeller shaft.

(2) Install bolts to pinion flange and tighten to 41 N·m (30 ft. lbs.) torque.

(3) Install transfer case yoke bolts and tighten to 27 N·m (20 ft. lbs.) torque.

1995 Grand Cherokee
Publication No. 81-370-5147
TSB 26-02-95 April, 1995

CAUTION: If this shaft is replaced the new shaft length must be measured and adjusted before the vehicle is driven.

TYPE 3 SHAFT MEASUREMENT

This measurement is taken with the shaft installed and the vehicle at curb height.

(1) Place vehicle on floor or drive-on hoist at curb height.

(2) Take a measure from the CV joint cup to the end of the CV boot (Fig. 3).

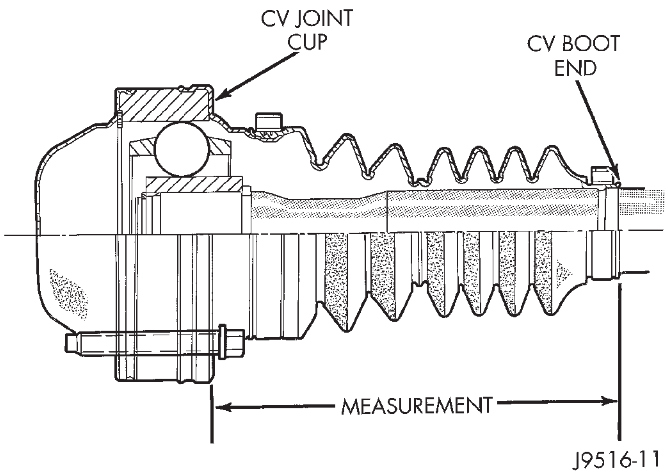


Fig. 3 Measurement

(3) Adjust by loosening the lock nut and moving the one end of the shaft in or out of the other end.

<u>(4) When the shaft is adjusted to the correct length (Fig. 3) 138.2 mm (5.44 in.) ±4.5 mm tighten the lock-nut (Fig. 4) to 115 N·m (85 ft. lbs.).</u>

CAUTION: This is a one time adjustment and must not be readjusted.

REAR

REMOVAL

(1) Shift the transmission and transfer case (if applicable) to Neutral position. Raise the vehicle.

(2) Scribe alignment marks at the pinion yoke and at each end of the propeller shaft.

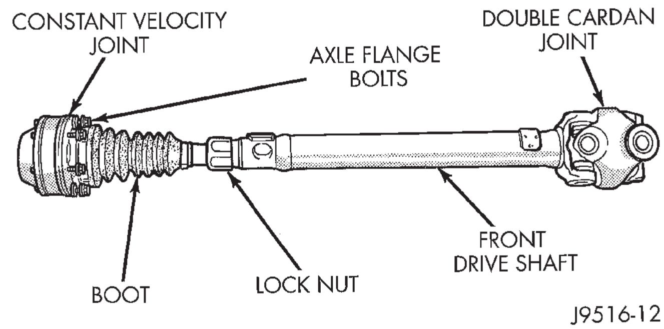


Fig. 4 Lock-nut

(3) Remove U-joint bolts and straps from pinion yoke.

(4) Slide the slip yoke off transmission/transfer case output shaft. Remove the propeller shaft (Fig. 5).

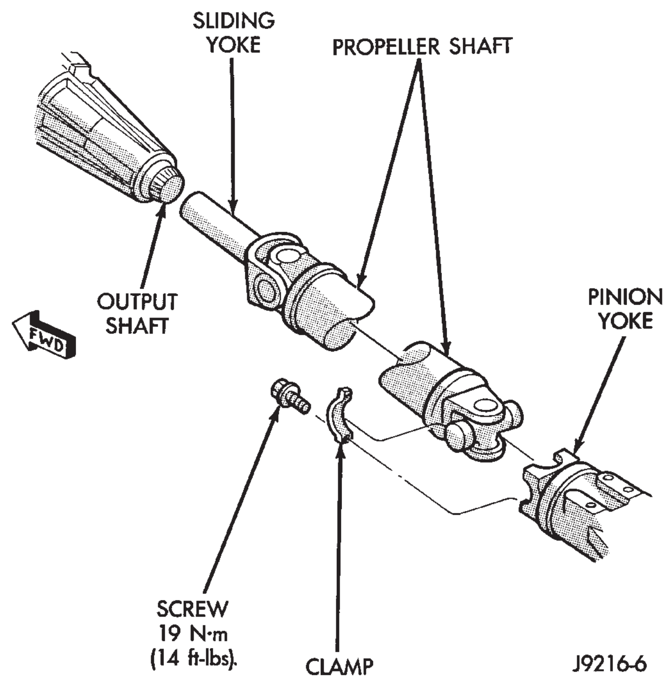


Fig. 5 Rear Propeller Shaft

INSTALLATION

(1) Slide the slip yoke on the transmission/transfer case output shaft. Align the installation reference marks at the pinion yoke. Install the propeller shaft.

(2) Install U-joint straps and bolts and tighten to 19 N·m (14 ft. lbs.) torque. **Replacement U-joint straps and bolts must be installed.**

UNIVERSAL JOINT REPLACEMENT

PRECAUTIONS

It is very important to put reference marks on the yokes before removal or component service (Fig. 1). This will assure correct phasing and eliminate possible vibration.

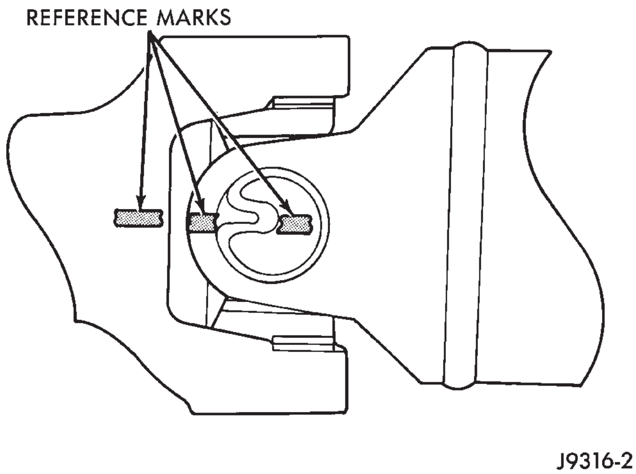


Fig. 1 Reference Marks on Yokes

CONSTANT VELOCITY JOINT

The most common failure of CV-joints is torn or ripped boots and subsequent lubricant loss or contamination. Look for lubricant around the exterior of boot. Check for a punctured or torn boot or retaining clamp loose.

The constant velocity joint found on the Type 3 front propeller shaft is not serviceable. If the joint is worn or damaged the shaft must be replaced. Refer to Type 3 front propeller shaft for procedure.

SINGLE CARDAN

REMOVAL/DISASSEMBLY

Single cardan universal joints are not serviceable. If worn or leaking, they must be replaced as a unit.

(1) Remove the propeller shaft. Refer to Propeller Shaft Replacement in this Group.

(2) Paint or score alignment marks on the yokes and propeller shaft for installation reference.

(3) Using a soft drift, tap the outside of the bearing assembly to loosen snap ring.

(4) Remove snap rings from both sides of yoke (Fig. 2).

(5) Set the yoke in an arbor press or vise with a large socket beneath it. Position the yoke with the lube fitting pointing up (if equipped). Place a smaller socket on the upper bearing assembly and press it through to release the lower bearing assembly (Fig. 3).

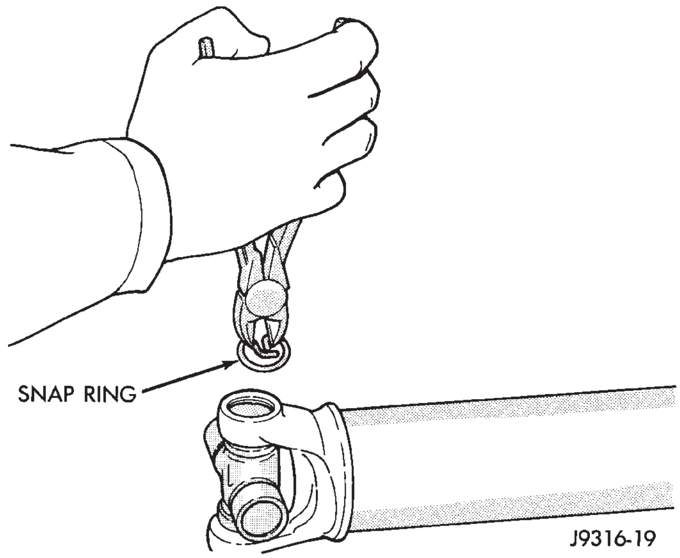


Fig. 2 Remove Snap Ring

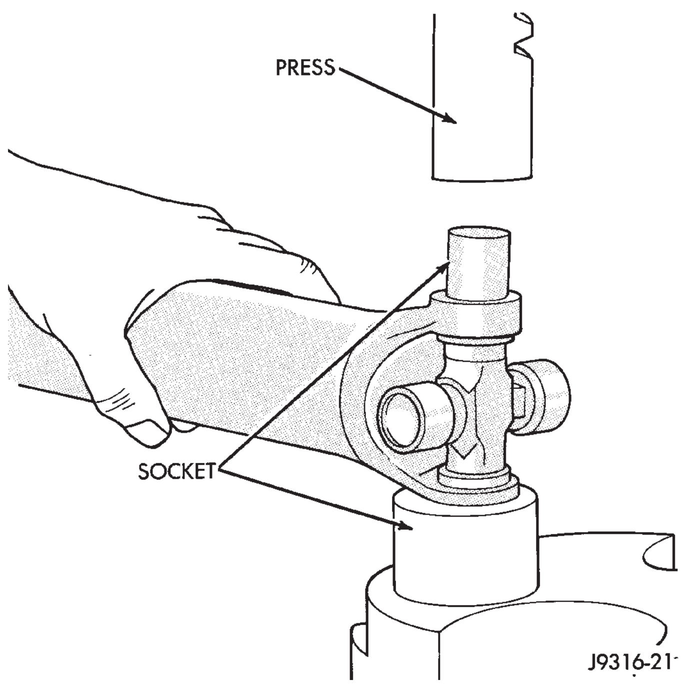


Fig. 3 Press Out Bearing

(6) If the bearing assembly will not pull out by hand after pressing, tap the base of the lug near it to dislodge.

(7) To remove the opposite bearing, turn the yoke over and straighten the cross in the open hole. Then carefully press the end of the cross until the remaining bearing can be removed (Fig. 4).

CAUTION: If the cross or bearing assembly are cocked when being pressed, the bearing assembly will score the walls of the yoke bore and ruin the yoke.

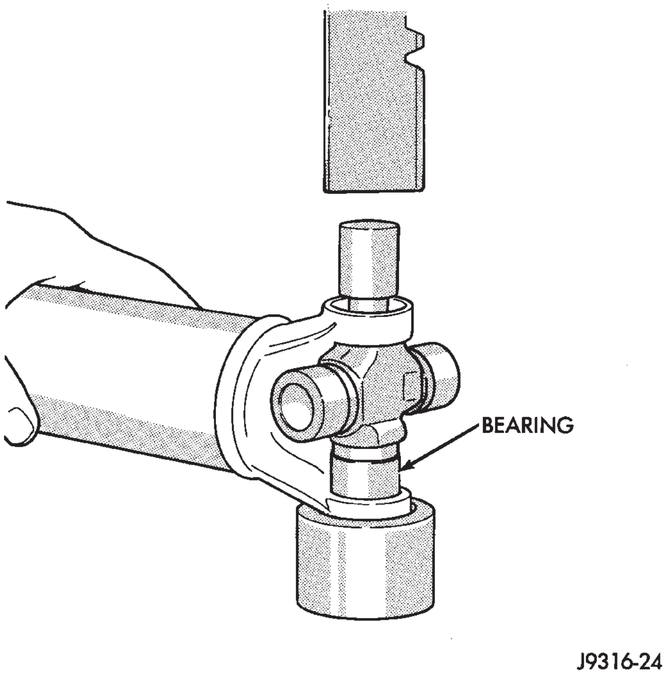


Fig. 4 Press Out Remaining Bearing

CLEANING AND INSPECTION

(1) Clean all the universal joint yoke bores with cleaning solvent and a wire brush.

(2) Inspect the yokes for distortion, cracks and worn bearing assembly bores.

ASSEMBLY/INSTALLATION

(1) Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to aid in installation.

(2) Position the cross in the yoke with its lube fitting (if equipped) pointing up (Fig. 5).

(3) Place a bearing assembly over the trunnion and align it with the cross hole (Fig. 6). Keep the needle bearings upright in the bearing assembly. A needle roller lying at the bottom will prevent proper assembly.

(4) Press the bearing assembly into the cross hole enough to install a snap ring. Install a snap ring.

(5) Repeat steps 3 and 4 to install the opposite bearing assembly. If the joint is stiff, strike the yoke with a soft hammer to seat the needle bearings. Install a snap ring.

(6) Add grease to lube fitting (if equipped).

(7) Install the propeller shaft. Refer to Propeller Shaft Replacement in this Group.

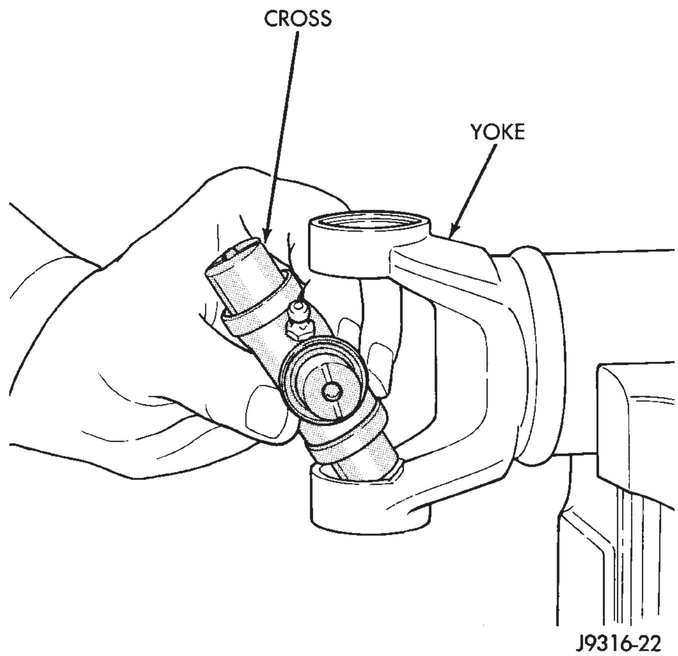


Fig. 5 Install Cross In Yoke

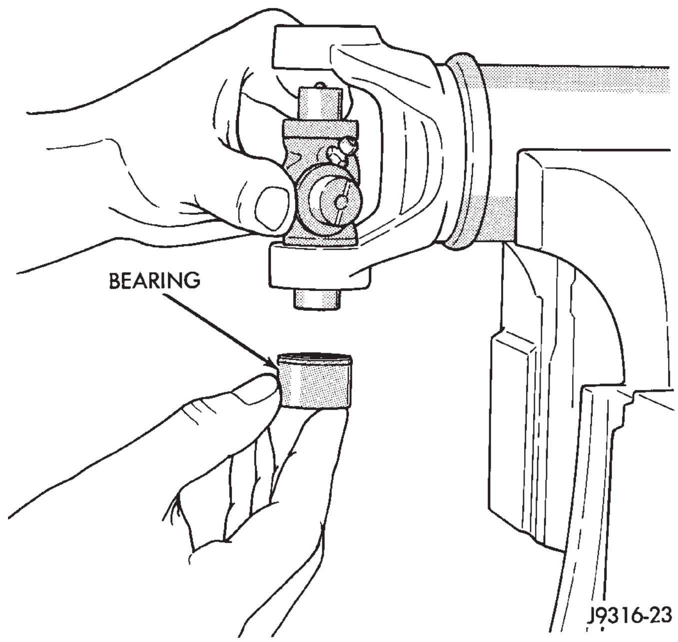


Fig. 6 Install Bearing On Trunnion

DOUBLE CARDAN

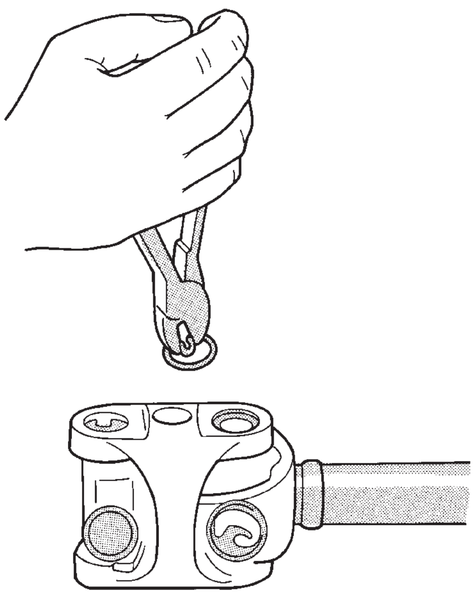
REMOVAL/DISASSEMBLY

Cardan universal joints are not serviceable. If worn or leaking, they must be replaced as a unit.

(1) Remove the propeller shaft. Refer to Propeller Shaft Replacement in this Group.

(2) Paint or score alignment marks on the yokes and propeller shaft for installation reference.

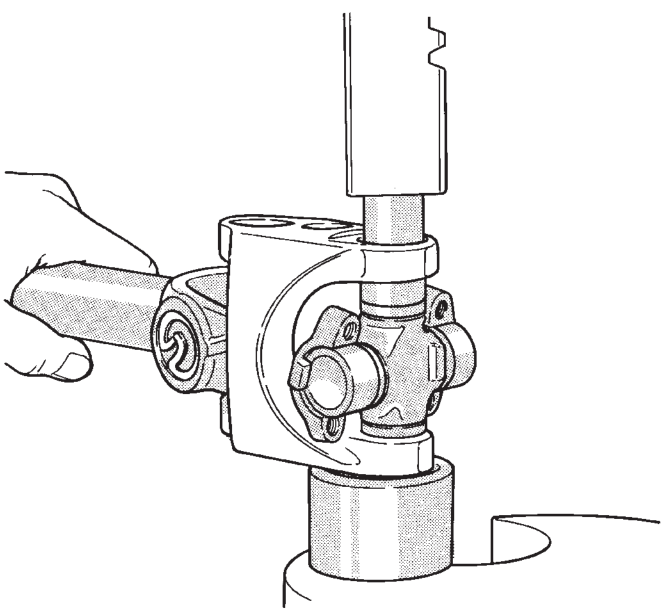
(3) Remove all the bearing assembly snap rings (Fig. 7).



J9316-5

Fig. 7 Remove Snap Rings

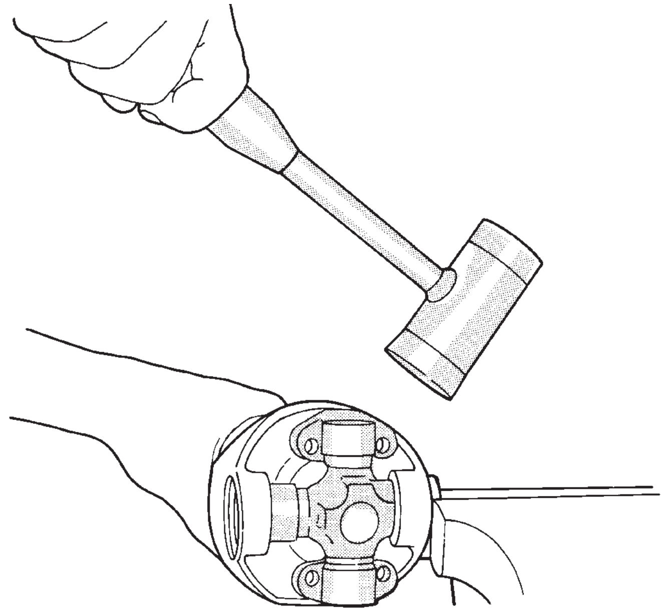
(4) Press the bearing assembly partially from the outboard side of the center yoke, enough to grasp by vise jaws (Fig. 8). Be sure to remove any lube fittings that may interfere with removal.



J9316-6

Fig. 8 Press Out Bearing

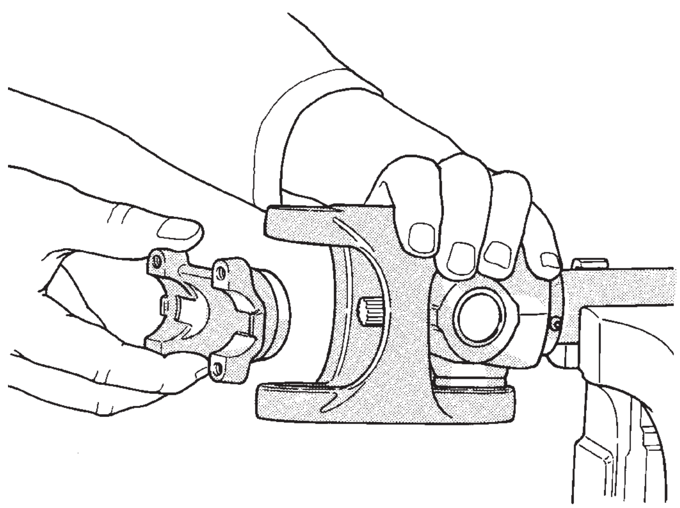
(5) Grasp the protruding bearing by vise jaws. Tap the tube yoke with a mallet and drift to dislodge from the yoke (Fig. 9).



J9316-7

Fig. 9 Remove Bearing From Yoke

(6) Flip assembly and repeat steps 4 and 5 for removing the opposite side bearing. This will allow removal of the cross centering kit assembly and spring (Fig. 10).



J9316-8

Fig. 10 Remove Centering Kit

(7) Press the remaining bearing assemblies out the other cross as described above to complete the disassembly.

CLEANING AND INSPECTION

(1) Clean all the U-joint yoke bores with cleaning solvent and a wire brush.

(2) Inspect the yokes for distortion, cracks and worn bearing assembly bores.

ASSEMBLY/INSTALLATION

During installation, ensure that the spiders and yokes are aligned to the reference marks.

(1) Fit a cross into the tube yoke (Fig. 11).

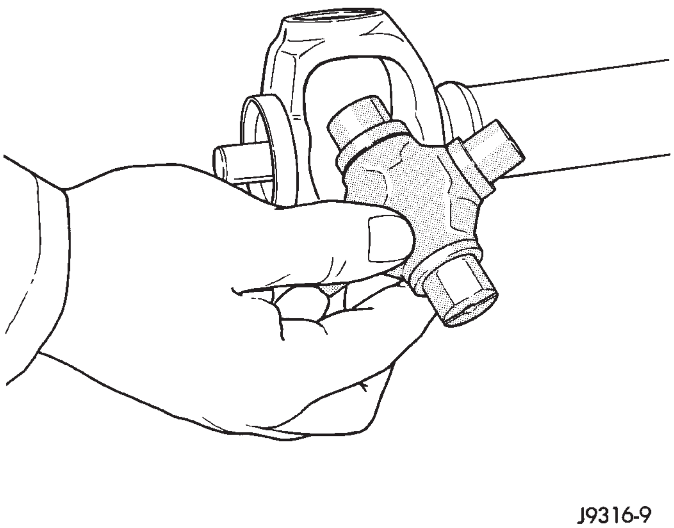


Fig. 11 Install Cross In Yoke

(2) Place a bearing assembly in a tube yoke hole and over a trunnion. Keep the needle bearings upright in the bearing assembly (Fig. 12). A needle roller lying at the bottom will prevent proper assembly. Be sure to remove any lube fittings that may interfere with removal.

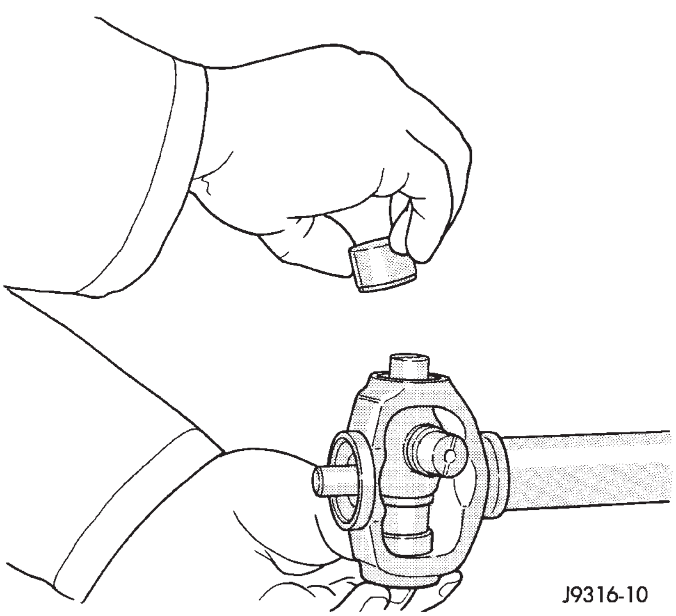


Fig. 12 Install Bearing Assembly

(3) Press the bearing assembly in place and install a snap ring (Fig. 13).

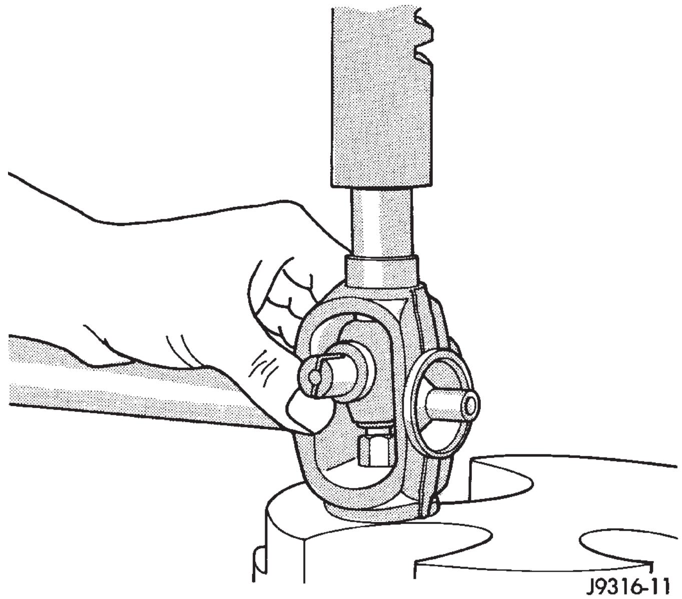


Fig. 13 Press In Bearing Assembly

(4) Flip the tube yoke and bearing assembly installation on the opposite trunnion. Install a snap ring (Fig. 14).

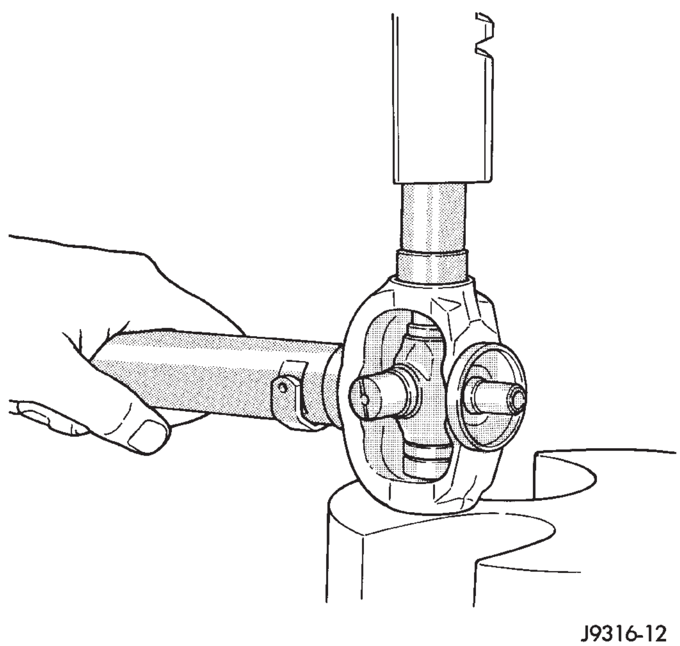


Fig. 14 Press In Bearing Assembly

(5) Fit the center yoke on the remaining two trunnions and press bearing assemblies in place, both sides (Fig. 15). Install a snap ring.

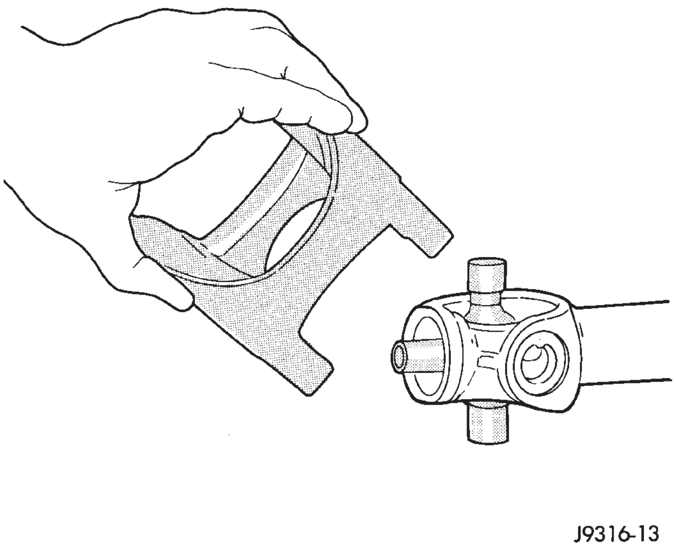


Fig. 15 Install Center Yoke

(6) Install the centering kit assembly inside the center yoke making sure the spring is in place (Fig. 16). Align the lube fitting on the centering kit with the lube fitting on the installed cross.

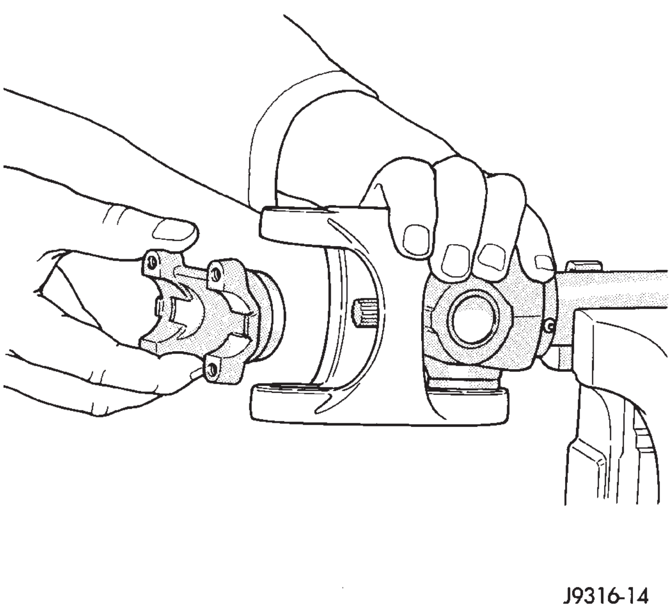


Fig. 16 Install Centering Kit

(7) Place two bearing assemblies on the remaining cross (opposite sides). Fit the open trunnions into the center yoke holes and the bearing assemblies into the centering kit (Fig. 17). Align the lube fitting on the cross with the other two lube fittings.

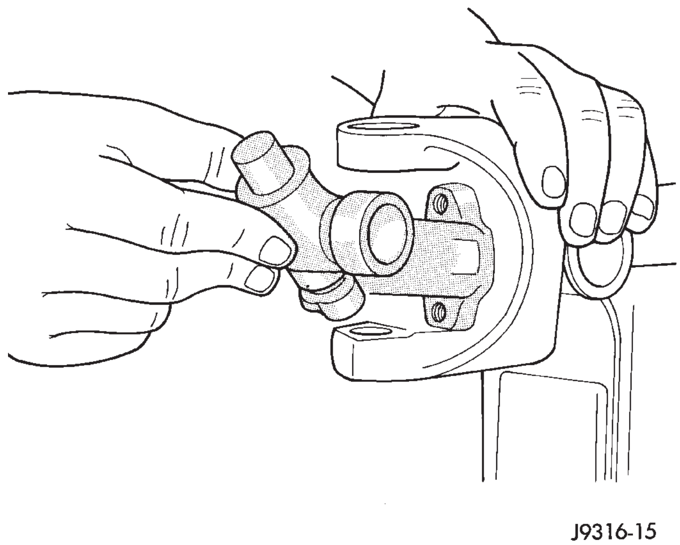


Fig. 17 Install Remaining Cross

(8) Press the remaining two bearing assemblies into place and install snap rings (Fig. 18).

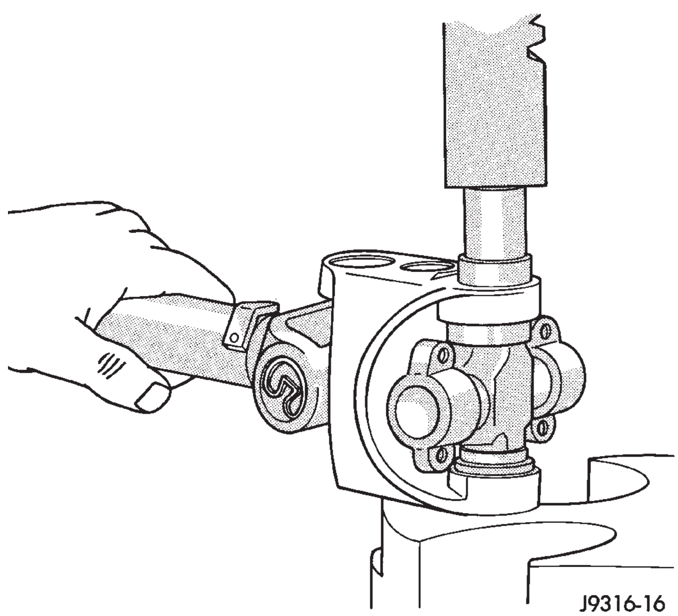


Fig. 18 Press In Bearing Assembly

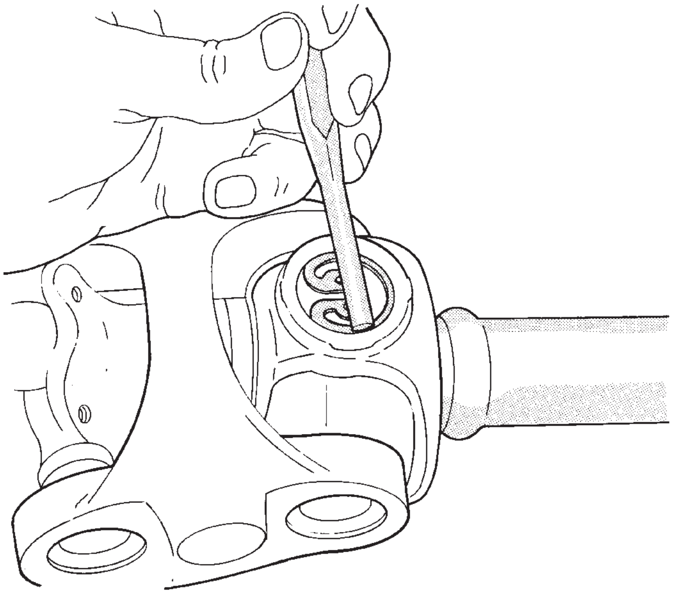


Fig. 19 Seat Snap Rings In Groove

(9) Tap the snap rings to allow them to seat into the grooves (Fig. 19).

(10) Check for proper assembly. Flex the CV joint beyond center, it should snap over-center in both directions when correctly assembled (Fig. 20).

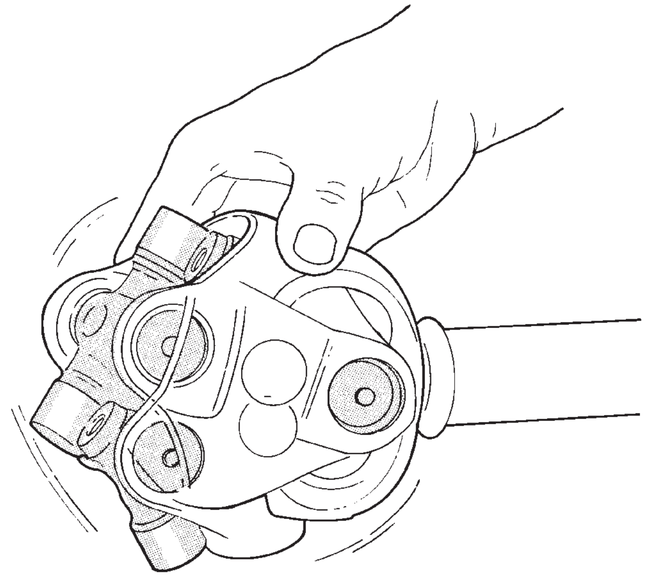


Fig. 20 Check Assembly

(11) Add grease to all three lube fittings.

(12) Install the propeller shaft. Refer to Propeller Shaft Replacement in this Group.

TORQUE SPECIFICATIONS

PROPELLER SHAFTS AND U-JOINTS

DESCRIPTION	TORQUE
Front Shaft	
Transfer Case Yoke Bolts	27 N·m (20 ft. lbs.)
Axle Yoke Bolts	19 N·m (14 ft. lbs.)
Type 3 Front Shaft	
Transfer Case Yoke Bolts	27 N·m (20 ft. lbs.)
Pinion Flange Bolts	41 N·m (30 ft. lbs.)
Lock Nut	115 N·m (85 ft. lbs.)
Rear Shaft	
Axle Yoke Bolts	19 N·m (14 ft. lbs.)

STEERING

CONTENTS

GENERAL INFORMATION

STEERING SYSTEM COMPONENTS

Power steering systems use the following (Fig. 1);

- Recirculating-ball steering gear
- Steering linkage
- Belt driven hydraulic steering pump with fluid reservoir
- Pump pressure and return hoses and fittings
- Steering column with shifter interlock
- Intermediate shaft between column and gear

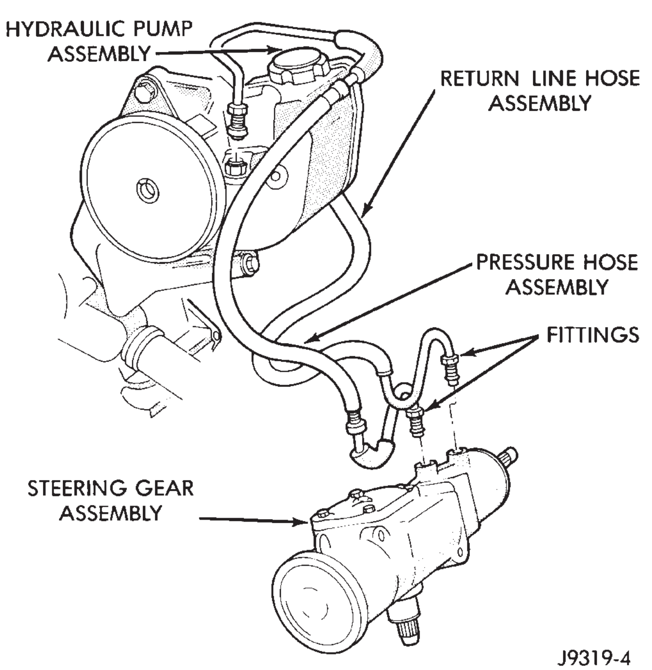


Fig. 1 Power Steering Systems

POWER STEERING GEAR

The steering gear is mounted on the left frame rail. The gear is joined to the intermediate shaft by a universal joint coupling. The coupling helps isolate noise and road shock from the interior.

The major internal components of the gear are the:

- Rotary valve assembly
- Steering worm shaft
- Rack piston assembly
- Pitman shaft

The movement of these parts, while turning or parking, is aided by hydraulic pressure and flow supplied by the pump. Manual steering is always available at times when the engine is not running or in the event of pump or belt failure. Steering effort is higher under such conditions.

The steering stub shaft, rotary valve, worm shaft, and rack piston assembly are all in line. All oil passages are internal within the gear housing except for the pressure and return hoses between the gear and the pump.

The power steering gear has a recirculating ball system. This acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the lower end and a bearing assembly at the upper end. When the worm shaft is turned right, the rack piston moves up in gear. Turning the worm shaft left moves the rack piston down in gear. The rack piston teeth mesh with the sector, which is part of the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the wheels through the steering linkage.

The control valve in the steering gear directs the power steering fluid to either side of the rack piston. The rack piston is assisted by hydraulic pressure. If the steering system loses hydraulic pressure, the vehicle can be controlled manually, but with higher steering effort.

An identification code located on the side cover designates the gear ratio (Fig. 2).

- Code JH designates 12.7:1 ratio without Trailer Tow
- Code PD designates 12.7:1 ratio with Trailer Tow

Trailer Tow gears have higher temperature resistant seals. Otherwise gears are interchangeable.

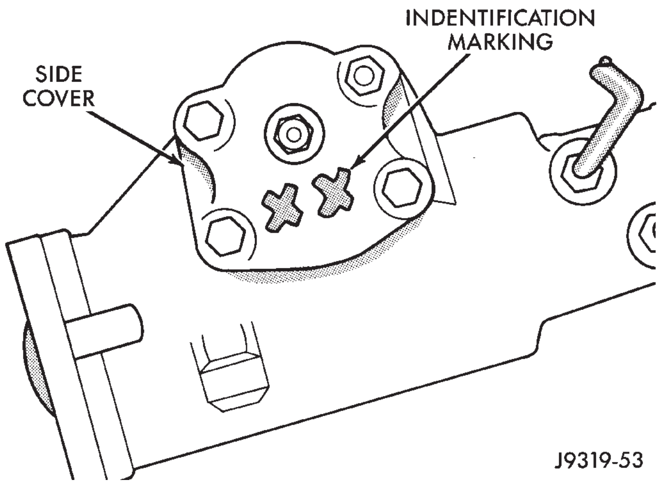


Fig. 2 Ratio Code Location

CAUTION: Vehicles equipped with H.D. Trailer Tow Package use high temperature seals in the power steering gear. The gears are identified with a YELLOW paint mark. The mark is on the pitman shaft side of the housing below the side cover. Use ONLY the correct seal kit when servicing the steering gear with this identification.

A recirculating ball steering gear is used with the power (assisted) steering system (Fig. 1). The power steering gear can be adjusted and internally serviced.

STEERING LINKAGE

The steering linkage consists of a pitman arm, drag link and tie rod. Adjustment sleeves are used on the tie rod and drag link for toe and steering wheel alignment. Refer to Group 2, Front Suspension and Axles for wheel alignment information.

POWER STEERING PUMP

Hydraulic pressure is provided for operation of the power steering gear by a belt driven power steering pump. The power steering pump is a constant flow rate and displacement, vane-type pump. The internal parts in the housing operate submerged in fluid. The flow control orifice is part of the high pressure line discharge fitting. The pressure relief valve inside the flow control valve limits the pump pressure.

Power steering pumps have different pressure and flow rates. They are not interchangeable with pumps installed in other vehicles.

The power steering pump is connected to the steering gear via high pressure and return hoses. The pump shaft has a pressed-on drive pulley that is belt driven by the crankshaft pulley (Fig. 3).

CAUTION: Vehicles equipped with H.D. Trailer Tow Package use high temperature seals in the power steering pump. The pumps are identified with a YELLOW label attached to the back of the reservoir. Use ONLY the correct seal kit when servicing the steering pump with this identification.

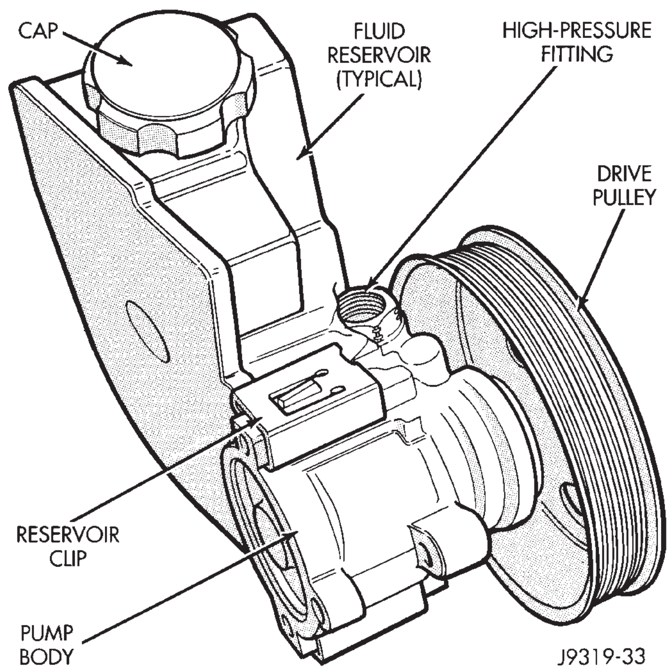


Fig. 3 TC-Series Pump

STEERING COLUMNS

Two general types of steering columns are installed on Grand Cherokee vehicles: a fixed, non-tilt column and a tilt column. The multi-position, tilt column is optionally available.

The column to gear intermediate shaft is equipped with universal joints. Rubber isolators are built into the shaft to absorb noise and vibration from the steering system.

Both types of steering columns have anti-theft provisions. They are energy-absorbing (collapse from impact in the event of a front end collision).

POWER STEERING SYSTEM DIAGNOSIS

HISS NOISE COMPLAINT

There is some noise in all power steering systems. One of the most common is a hissing sound most evident at stand still parking. Hiss is a high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every steering gear valve and results from high velocity fluid passing valve orifice edges. There is no relationship between this noise and performance of the steering. HISS MAY BE EXPECTED WHEN SLOWLY TURNING AT STANDSTILL. The noise transmission of this into the passenger compartment is controlled by the use of the universal joint coupling. There is a rubber isolator in the steering coupling (intermediate) shaft to muffle hiss. If hiss is extremely objectional, replace the shaft. If hiss is persistent, service the steering gear.

POWER STEERING PUMP PRESSURE TEST

(1) Check belt tension and adjust as necessary.

(2) Disconnect high pressure hose at gear or pump. Use a container for dripping fluid.

(3) Connect Gauge 6815 to both hoses using adapter fitting (Fig. 1). Connect spare pressure hose to gear or pump.

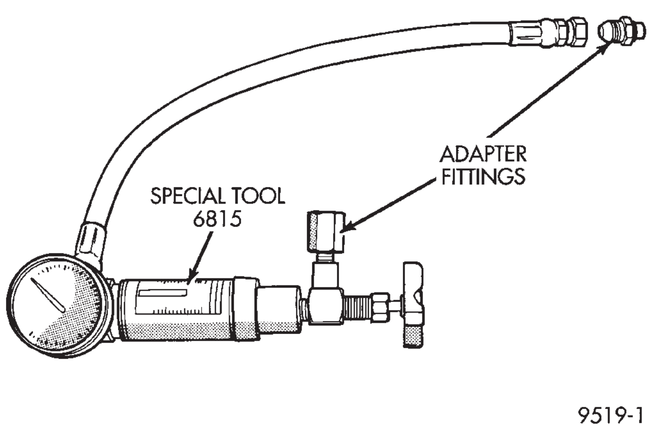


Fig. 1 Pressure Test Gauge

(4) Open the test valve completely.

(5) Start engine and let idle.

(6) Check fluid level, add fluid as necessary.

(7) 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).

CAUTION: The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than 5 seconds as the pump could be damaged.

(8) Close valve fully three times and record highest pressure indicated each time. **All three readings must be above specifications and within 345 kPa (50 psi) of each other.**

- Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
- Pressures 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 or pump damage will result.

(9) Open the test valve, turn steering wheel extreme left and right positions against the stops. Record the highest indicated pressure at each position. Compare readings to specifications. If highest output pressures are not the same against either stop, the gear is leaking internally and must be repaired.

PUMP OPERATING SPECIFICATIONS

ENGINE	RELIEF PRESSURE (P.S.I.)	FLOW (G.P.M.)
4.0L	1350–1450	2.4–2.8
5.2L	1350–1450	2.4–2.8

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POWER STEERING SYSTEM DIAGNOSIS

STEERING NOISES

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 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 valve orifice edges. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Damaged or mispositioned steering column coupler to dash panel seal. 2. Noisy valve in power steering gear.	1. Check for proper seal between steering column coupler and dash seal. 2. Replace steering gear.
RATTLE OR CLUNK	1. Gear loose on front crossmember. 2. Crossmember-to-frame bolts or studs loose. 3. Tie rod looseness (outer or inner). 4. Loose lower control arm to crossmember bolts. 5. Loose strut to body attaching bolts. 6. Pressure hose touching other parts of body. 7. Noise internal to gear. 8. Damaged front crossmember.	1. Check gear-to-crossmember mounting bolts. Tighten to specification. 2. Torque bolts and studs to specifications. 3. Check tie rod pivot points for wear. Replace if necessary. 4. Torque control arm bolts to specifications. 5. Check upper strut mount to body attaching bolts to see if torqued to specifications. 6. Adjust hose to proper position by loosening, repositioning and tightening fitting. Do not bend tubing. 7. Replace gear. 8. Replace front crossmember.
CHIRP OR SQUEAL (IN THE AREA OF PUMP) PARTICULARLYNOTICEABLE AT FULL WHEEL TRAVEL AND DURING STANDSTILL PARKING	1. Loose belt.	1. Adjust belt tension to specification.

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POWER STEERING SYSTEM DIAGNOSIS

STEERING NOISES — Continued

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 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 valve orifice edges. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.

CONDITION	POSSIBLE CAUSES	CORRECTION
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 hoses touching the vehicle body, can create a noise level that could bring complaints.		
WHINE OR GROWL (PUMP NOISE)	1. Low fluid level.	1. Fill to proper level and perform leakage diagnosis. (Recheck after system is free of aeration.)
	2. Hose touching vehicle body or frame.	2. Reposition hose. Replace hose if tube ends are bent.
	3. Extreme wear of pump internal parts.	3. Replace pump and flush system.
SUCKING AIR SOUND	1. Loose return line clamp.	1. Tighten or replace clamp.
	2. Missing O-ring on hose connection.	2. Inspect connection and replace O-ring as required.
	3. Low fluid level.	3. Fill to proper level and perform leakage diagnosis.
	4. Air leak between reservoir and pump.	4. Inspect and replace reservoir as required.
SQUEAK OR RUB SOUND	1. Sound from steering column.	1. Check for squeak in steering column. Inspect for contact between shroud intermediate shaft, column, and wheel. (Realign if necessary.) (a) Check for lack of grease on steering column, dash to lower coupling seal.
	2. Sound internal to steering gear.	2. Replace gear.
SCRUBBING/KNOCKING	1. Incorrect tire size.	1. Verify tire size is the same as originally supplied.
	2. Check clearance between tires and other vehicle components, through full travel.	2. Correct as necessary.
	3. Check for interference between steering gear and other components.	3. Correct as necessary.
	4. Incorrect gear supplied.	4. Replace gear.

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POWER STEERING SYSTEM DIAGNOSIS

BINDS STICKS SEIZED

CONDITION	POSSIBLE CAUSES	CORRECTION
CATCHES, STICKS IN CERTAIN POSITIONS OR DIFFICULT TO TURN	1. Low fluid level.	1. Fill to proper level and perform leakage diagnosis.
	2. Tires not properly inflated.	2. Inflate tires to proper pressure.
	3. Lack of lube in ball joints.	3. Lubricate where possible.
	4. Lack of lube in outer tie rod ends.	4. Lubricate where possible.
	5. Loose pump belt.	5. Tighten or replace belt.
	6. Faulty pump flow control (Verify cause using Pump Test Procedure).	6. Replace pump.
	7. Excessive friction in steering column or intermediate shaft.	7. Correct condition. (See Steering Column Service Procedure.)
	8. Steering column coupling binding.	8. Realign as necessary.
	9. Binding upper strut bearing.	9. Correct binding condition.
	10. Excessive friction in steering gear.	10. Replace steering gear.

SHAKE SHUDDER VIBRATION

CONDITION	POSSIBLE CAUSES	CORRECTION
VIBRATION OF THE STEER-ING WHEEL AND/OR DASH DURING DRY PARK OR LOW SPEED STEERING MANEUVERS	1. Air in 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 proper pressure.
	3. Excessive engine vibration.	3. Make sure that engine is running properly.
	4. Loose tie rod end.	4. Check inner and outer tie rod and jam nut for excessive free play.
	5. Overcharged air conditioning system.	5. Check air conditioning pump head pressure. (See Air Conditioning Refrigerant System Diagnosis).

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POWER STEERING SYSTEM DIAGNOSIS

LOW ASSIST, NO ASSIST, OR 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 proper pressure.
	2. Low fluid level.	2. Add power steering fluid as required and perform leakage diagnosis.
	3. Loose belt.	3. Tighten or replace belt.
	4. Lack of ball joint lubrication.	4. Lubricate or replace as required.
	5. Low pressure pump (Verify using Pump Test Procedure).	5. Verify cause using Pump Test Procedure. Replace pump if necessary.
	6. High internal leak gear.	6. Check steering system using test procedure. If steering gear is at fault, replace steering gear.

POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tires not properly inflated.	1. Inflate tires to proper pressure.
	2. Improper front wheel alignment.	2. Check and adjust as necessary.
	3. Lack of lubrication in ball joint.	3. Replace as required or lubricate.
	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 steering shaft. Turn the steering wheel and listen for internal rubbing in column.
	6. Steering wheel rubbing.	6. Adjust covers.
	7. Damaged, mis-positioned or un-lubricated steering column coupler to dash seal.	7. Correct condition.
	8. Binding upper strut bearing.	8. Repair binding condition.
	9. Tight steering shaft bearing.	9. Replace steering column.
	10. Excessive friction in steering coupler.	10. Replace steering coupler.
	11. High friction in steering gear.	11. Replace steering gear.
	12. Steering coupler mispositioned to steering gear (rubbing).	12. Reposition coupling.

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POWER STEERING SYSTEM DIAGNOSIS

LOOSE STEERING

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE WHEEL KICKBACK OR TOO MUCH STEERING WHEEL PLAY	1. Air in system.	1. Add fluid.
	2. Gear loose on crossmember.	2. Check gear to crossmember mounting bolts. Tighten to specification.
	3. Free play in steering column.	3. Check and replace as required.
	4. Loose ball joints.	4. Check and replace as required.
	5. Pinch bolt loose on ball joint.	5. Check pinch bolts and tighten as required to specified torque.
	6. Front wheel bearings loose or worn.	6. Tighten hub nut or replace with new parts as necessary.
	7. Loose outer tie rod ends.	7. Check and replace as required.
	8. Loose inner tie rod ends.	8. Replace gear.
	9. Defective steering gear rotary valve.	9. Replace gear.

VEHICLE LEADS TO THE SIDE

CONDITION	POSSIBLE CAUSES	CORRECTION
WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Radial tire lead.	1. Rotate tires as recommended in Tire Service.
	2. Front end misaligned.	2. Align front end as recommended in Wheel Alignment Service Procedure.
	3. Wheel braking.	3. Check for dragging brakes as directed in Brake Service Procedure.
	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-AFT LOOSENESS	1. Steering wheel to steering column shaft nut not securely tightened.	1. Torque not to proper torque specification.
	2. Steering column lower bearing spring retainer slipped on steering column shaft.	2. Replace steering column.

J9519-37

POWER STEERING SYSTEM DIAGNOSIS

FLUID LEAK

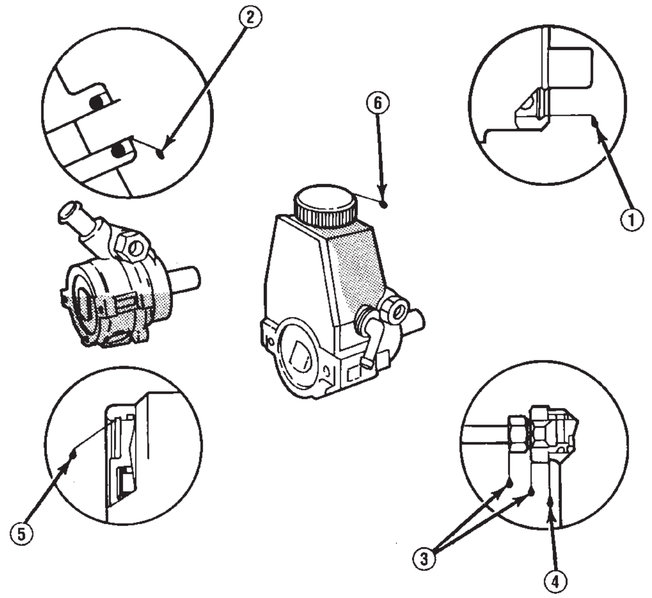
CONDITION	POSSIBLE CAUSES	CORRECTION
LOW FLUID LEVEL WITH: • NO VISIBLE SIGNS OF LEAKS ON THE STEERING GEAR, PUMP, ON FLOOR, OR ANYWHERE ELSE	1. Overfilled reservoir. 2. Hose connections at pump or gear.	1. Adjust fill level. 2. Check for loose fittings and tighten to specifications. If fittings are tight, examine for damaged or missing O-ring and replace as required.
LOW FLUID LEVEL WITH: • VISIBLE LEAK ON STEERING GEAR, PUMP, FLOOR, OR ANYWHERE ELSE	3. Pump or gear leak.	3. Identify location of leak and repair or replace as indicated in Power Steering Pump and/or Gear sections of this service manual.

FOAMY OR MILKY FLUID

CONDITION	POSSIBLE CAUSES	CORRECTION
AERATION AND OVER-FLOW OF FLUID	1. Air leaks.	1. Check for air leak as described under sucking air and correct.
	2. Low fluid level.	2. Extremely cold temperatures may cause system aeration if the oil level is low. Add fluid as required.
	3. Cracked pump housing.	3. Remove pump from vehicle and separate reservoir from housing. Check expansion plug and housing for cracks. Replace pump as required.
	4. Water contamination.	4. Drain and refill fluid if there is evidence of contamination.

9119-7

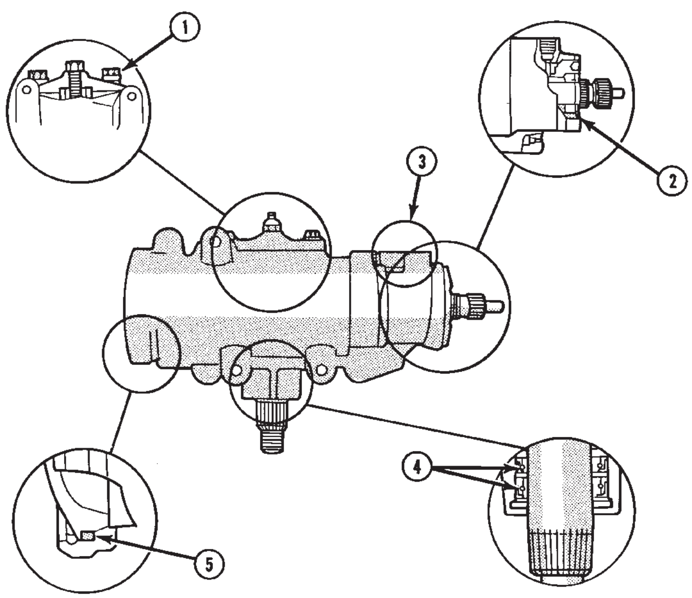
PUMP LEAKAGE DIAGNOSIS



1. BUSHING (BEARING) WORN, SEAL WORN. REPLACE PUMP.
2. REPLACE RESERVOIR O-RING SEAL.
3. TORQUE HOSE FITTING NUT TO 35 N•m (25 ft. lbs.). IF LEAKAGE PERSISTS, REPLACE O-RING SEAL.
4. TORQUE FITTING TO 75 N•m (55 ft. lbs.). IF LEAKAGE PERSISTS, REPLACE O-RING SEAL.
5. REPLACE PUMP.
6. CHECK OIL LEVEL; IF LEAKAGE PERSISTS WITH THE LEVEL CORRECT AND CAP TIGHT, REPLACE THE CAP.

J9319-74

GEAR LEAKAGE DIAGNOSIS



1. SIDE COVER LEAK - TORQUE SIDE COVER BOLTS TO 60 N•m (45 FT. LBS.). REPLACE THE SIDE COVER SEAL IF THE LEAKAGE PERSISTS.
2. ADJUSTER PLUG SEAL - REPLACE THE ADJUSTER PLUG SEALS.
3. PRESSURE LINE FITTING - TORQUE THE HOSE FITTING NUT TO 27 N•m (20 FT. LBS.). IF LEAKAGE PERSISTS, REPLACE THE SEAL.
4. PITMAN SHAFT SEALS - REPLACE THE SEALS.
5. TOP COVER SEAL - REPLACE THE SEAL.

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POWER STEERING PUMP

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SERVICE INFORMATION

CAUTION: Vehicles equipped with H.D. Trailer Tow Package use high temperature seals in the power steering pump. The pumps are identified with a YELLOW label attached to the back of the reservoir. Use ONLY the correct seal kit when servicing the steering pump with this identification.

The power steering pump internal components are not to be serviced or adjusted. If a malfunction or an internal fluid leak occurs, the complete unit must be replaced. A reservoir, cap, and O-ring seal kit are the only service components available.

PRESSURE AND RETURN HOSE REPLACEMENT

Cap hose open ends and pump/steering gear fittings to prevent entry of foreign material.

WARNING: POWER STEERING FLUID (AND PUMP COMPONENTS) AND THE EXHAUST SYSTEM CAN BE EXTREMELY HOT IF THE ENGINE HAS BEEN RECENTLY OPERATING. DO NOT START THE ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW THE HOSES TO TOUCH A HOT EXHAUST MANIFOLD.

REMOVAL

(1) Place a drain pan under the pump and gear.

(2) Disconnect the pressure and return hose from the steering gear.

(3) Disconnect the pressure and return hose from the pump (Fig. 1). Drain the fluid from pump and reservoir (Fig. 1).

INSTALLATION

(1) Wipe hose ends, pump and gear unions clean.

(2) Install the pressure hose on the pump and gear. Rotate the pressure hose CLOCKWISE so the rubber insulators on the tube contacts the reservoir and gear side cover. Tighten the fittings at the pump and gear to 28 N·m (21 ft. lbs.) torque.

(3) Install the return hose on the pump and gear. Rotate the return hose CLOCKWISE so the tube contacts the pressure hose insulator. Tighten the fitting at the gear to 28 N·m (21 ft. lbs.) torque.

(4) Install a clamp on the return hose at the pump reservoir fitting.

(5) Add power steering fluid. Refer to Power Steering Pump Initial Operation in this section.

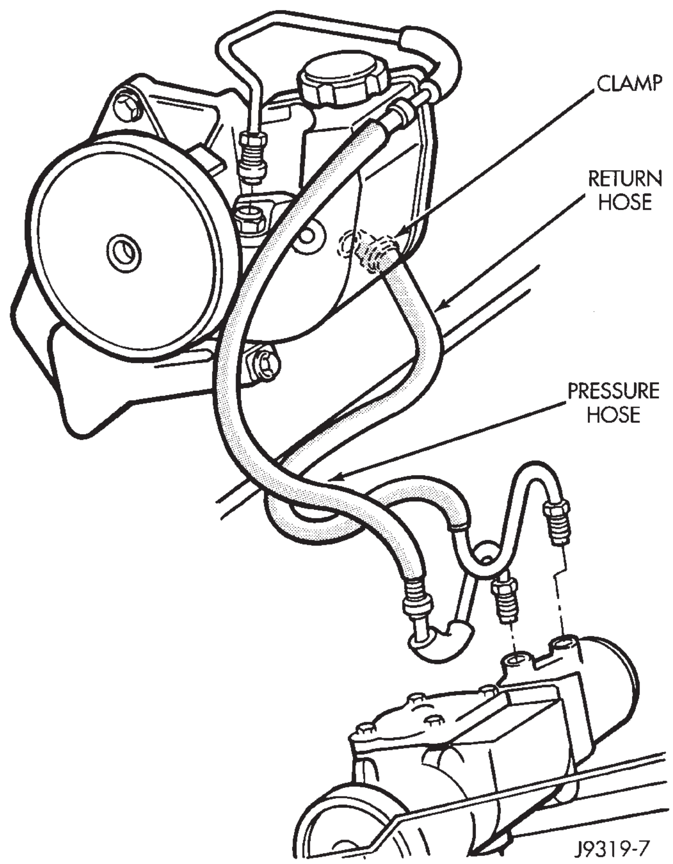


Fig. 1 Power Steering Lines

PUMP REPLACEMENT— 4.0L

REMOVAL

CAUTION: The drive belt tension must be released before removing the pump. If the belt is not loosened, the pump pulley could be damaged.

(1) Remove serpentine drive belt. Refer to Group 7, Cooling for additional information.

FASTENER TORQUE			
LETTER	N•m	IN. LBS.	FT. LBS.
A	57	—	42
B	28	250	21
C	47	—	35

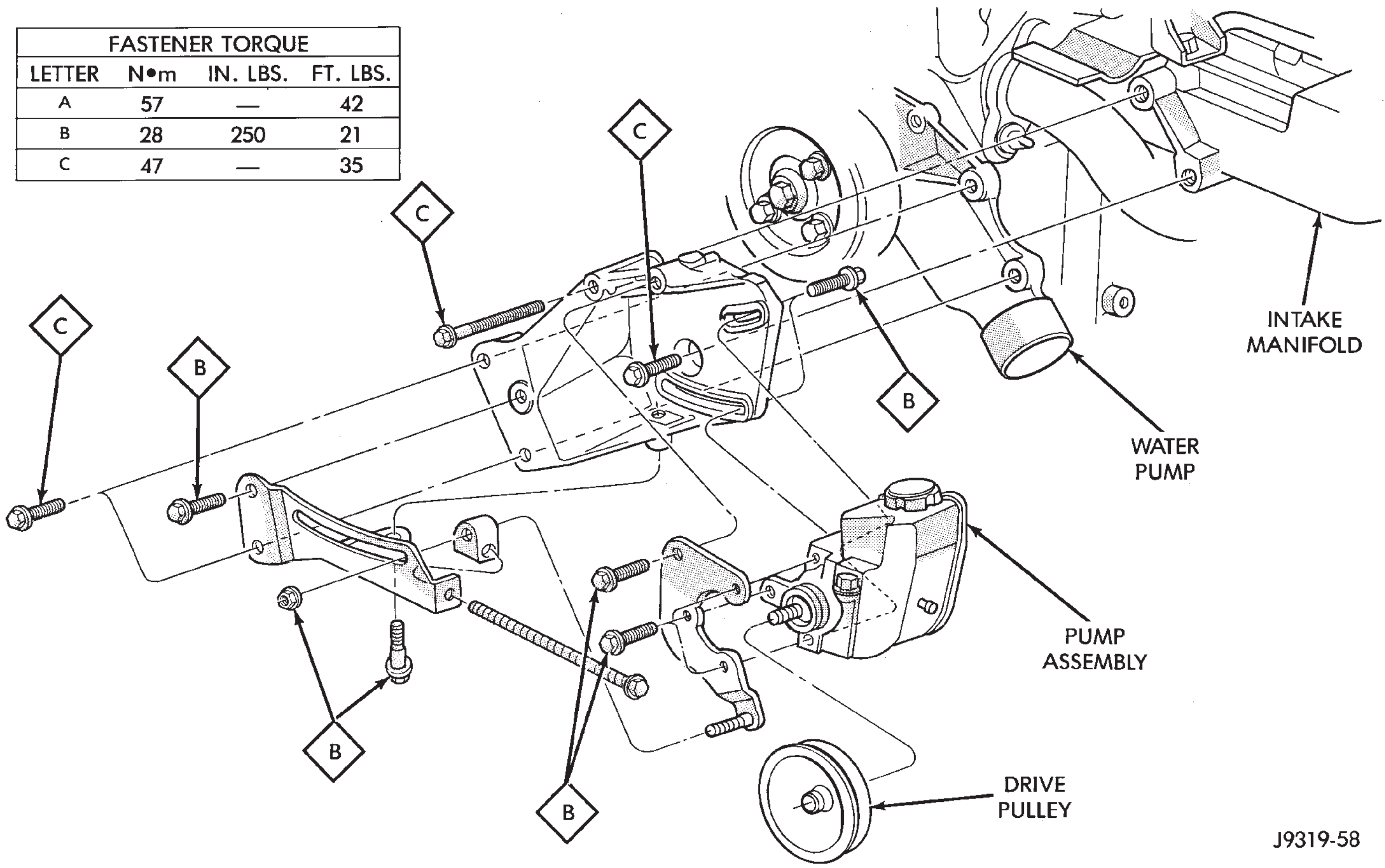


Fig. 2 Pump Mounting—6 Cylinder

(2) Place a drain pan under pump.

(3) Remove pressure and return hoses from pump. Refer to Pressure and Return Hose Replacement in this section.

(4) Remove 2 rear bracket-to-pump bolts (Fig. 2).

(5) Remove lower nut at adjustment bracket.

(6) Remove adjuster bolt.

(7) Remove upper pivot bolt.

(8) Tilt pump forward and remove pump and front bracket assembly from engine bracket.

(9) Remove adjuster collar at lower stud on pump bracket.

(10) Remove pulley from pump. Refer to Drive Pulley Replacement in this section (Fig. 4).

(11) Remove 3 adjustment bracket-to-pump bolts.

INSTALLATION

(1) Install 3 adjustment bracket-to-pump bolts. Tighten to 28 N·m (21 ft. lbs.) torque.

(2) Install pulley on pump. Refer to Drive Pulley Replacement in this section (Fig. 5).

(3) Install lower adjuster collar on adjuster bracket stud (Fig. 2).

(4) Tilt pump rearward and install pump onto engine bracket.

(5) Install upper pivot bolt.

(6) Install lower adjuster bolt.

(7) Install lower adjuster stud nut.

(8) Install 2 rear engine bracket to pump bolts. Tighten to 28 N·m (21 ft. lbs.) torque.

(9) Install the serpentine drive belt. Refer to Group 7, Cooling for additional information.

(10) Install the pressure and return hoses to pump. Refer to Pressure and Return Hose Replacement in this section.

(11) Add power steering fluid. Refer to Power Steering Pump Initial Operation in this section.

PUMP REPLACEMENT— 5.2L V/8

REMOVAL

CAUTION: The drive belt tension must be released before removing the pump. If the belt is not loosened, the pump pulley could be damaged.

(1) Remove the serpentine drive belt. Refer to Group 7, Cooling for additional information.

(2) Place a drain pan under the pump.

(3) Remove the pressure and return hoses from pump. Refer to Pressure and Return Hose Replacement in this section.

(4) Remove the bolts that attach the pump to the bracket on the engine block (Fig. 3).

(5) If necessary, remove the bracket to engine block bolts (Fig. 3).

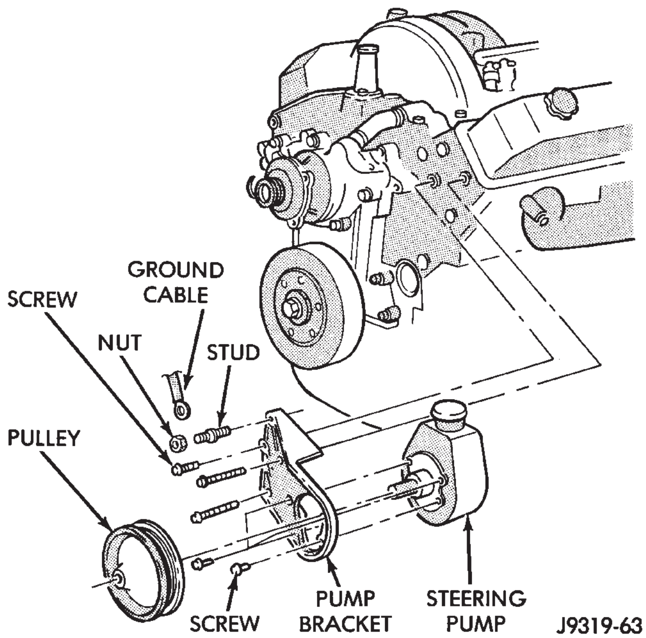


Fig. 3 Pump Mounting—5.2L V/8

INSTALLATION

(1) Install the bracket to the engine block. Tighten the bolts to 41 N·m (30 ft. lbs.) torque.

(2) Mount the pump on the bracket.

(3) Install the bolts through the pump and into the bracket. Tighten the bolts to 27 N·m (20 ft. lbs.) torque.

(4) Install the serpentine drive belt. Refer to Group 7, Cooling for additional information.

(5) Install the pressure and return hoses to pump. Refer to Pressure and Return Hose Replacement in this section.

(6) Add power steering fluid. Refer to Power Steering Pump Initial Operation in this section.

DRIVE PULLEY REPLACEMENT

REMOVAL

(1) Remove power steering pump. Refer to Pump Replacement in this section.

(2) Remove the drive pulley with Puller C-4333 (Fig. 4).

Do not hammer on any part of drive pulley, damage will occur to the pump and pulley.

INSTALLATION

(1) Install pulley with Installer C-4063-B (Fig. 5). Do not use the tool adapters.

(2) Be sure tool and pulley remain aligned and NOT cocked with the pump shaft.

(3) Press the pulley flush with the end of the pump shaft (Fig. 6).

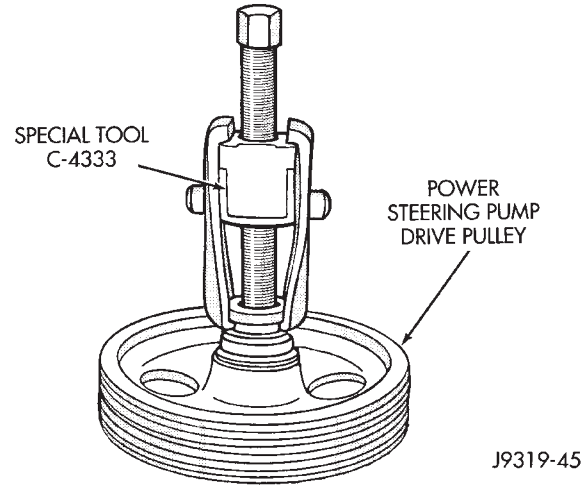


Fig. 4 Remove Drive Pulley—Typical

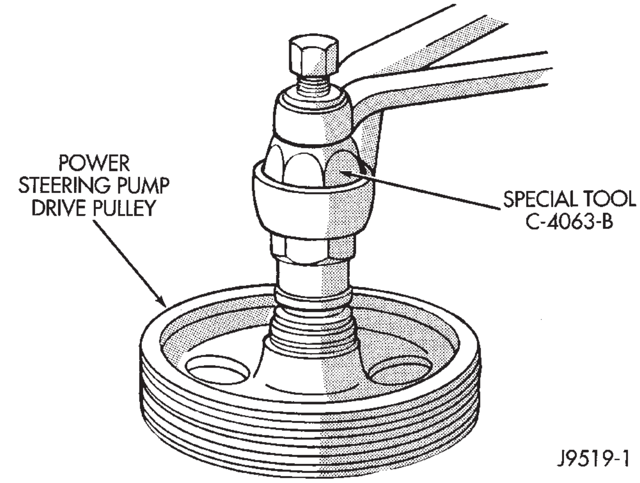


Fig. 5 Install Drive Pulley—Typical

(4) Install power steering pump. Refer to Pump Replacement in this section.

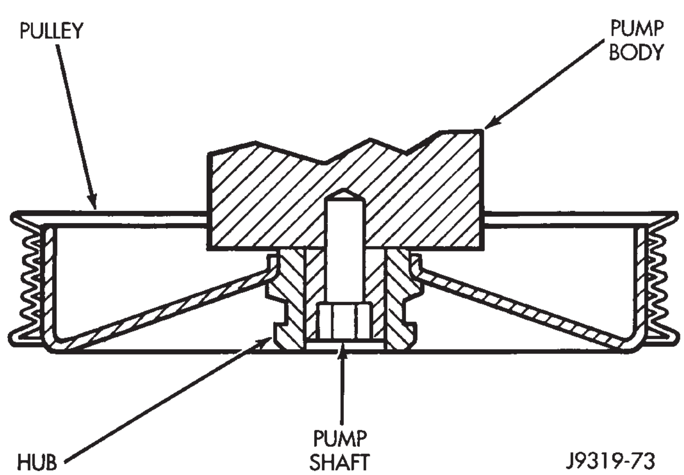


Fig. 6 Pump Shaft Location

RESERVOIR REPLACEMENT

REMOVAL

(1) Remove power steering pump. Refer to Pump Replacement in this section.

(2) Clean exterior of pump with solvent.

(3) Clamp the pump body in a soft jaw vice.

(4) Pry up tab and slide the retaining clip off (Fig. 7).

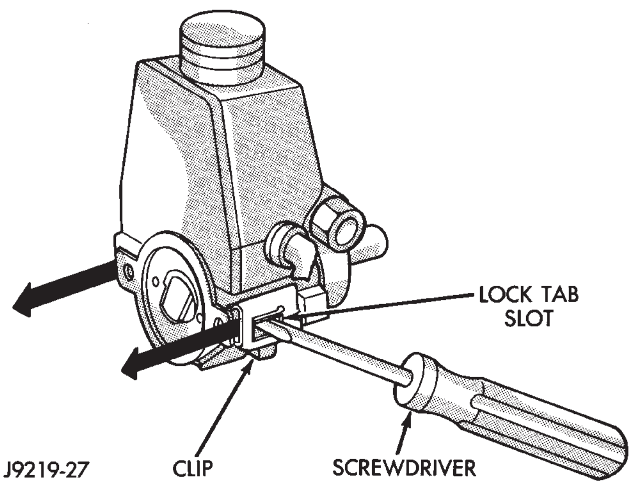


Fig. 7 Remove Reservoir Clips—Typical

(5) Remove fluid reservoir from pump body. Remove and discard O-ring seal (Fig. 8).

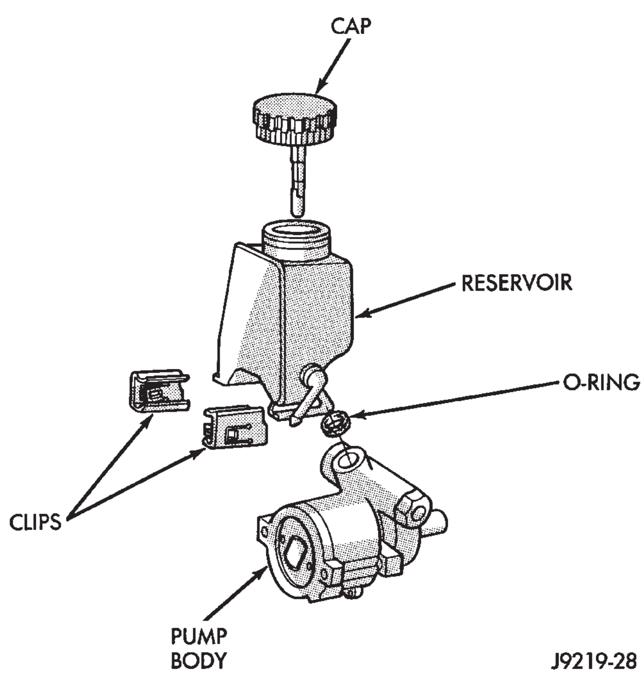


Fig. 8 Remove Reservoir—Typical

INSTALLATION

(1) Lubricate new O-ring Seal with Mopar® Power Steering Fluid or equivalent.

(2) Install O-ring seal in housing.

(3) Install reservoir onto housing.

(4) Slide and tap in reservoir retainer clips until tab locks to housing.

(5) Install power steering pump. Refer to Pump Replacement in this section.

FLOW CONTROL VALVE FITTING O-RING SEAL

REMOVAL

(1) Clean area around fitting to prevent dirt from entering pump. Remove pressure hose from pump fitting.

(2) Remove fitting from pump housing (Fig. 9). **Prevent flow control valve and spring from sliding out of housing bore.**

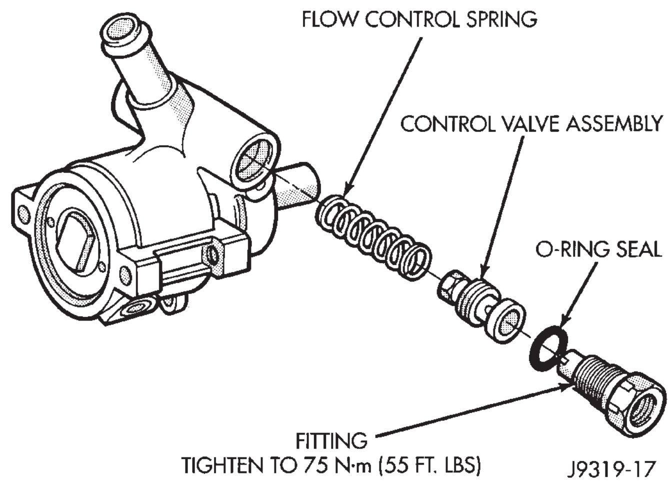


Fig. 9 Flow Control Valve Fitting

(3) Remove and discard O-ring seal.

INSTALLATION

(1) If necessary, clean and install flow control valve and spring in pump housing bore. **Be sure the hex nut end of the valve is facing in toward the pump.**

(2) Install O-ring seal onto fitting (Fig. 9).

(3) Install flow control valve in pump housing and tighten to 75 N·m (55 ft. lbs.) torque.

(4) Install pressure hose to valve.

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 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.

STEERING LINKAGE

INDEX

SERVICE INFORMATION

The steering linkage consists of a pitman arm, drag link, tie rod, and steering dampener. Adjustment sleeves are used on the tie rod and drag link for toe and steering wheel alignment.

Refer to Group 2, Front Suspension and Axle for additional information.

The tie rod end ball stud seals should be inspected during all oil changes.

A damaged ball stud seal requires removal of the seal. Inspect the tie rod end ball stud at the throat opening. Check for lubricant loss, contamination, ball stud wear or corrosion. If these conditions exist, replace the tie rod. A replacement seal can be installed if lubricant is in good condition. Otherwise, a complete replacement ball stud end should be installed. Lubricate the tie rod end with MOPAR® Multi-Mileage Lubricant, or equivalent product.

Use a Puller tool C-3894-A for tie rod removal. Failure to use this tool could damage the ball stud and seal (Fig. 1).

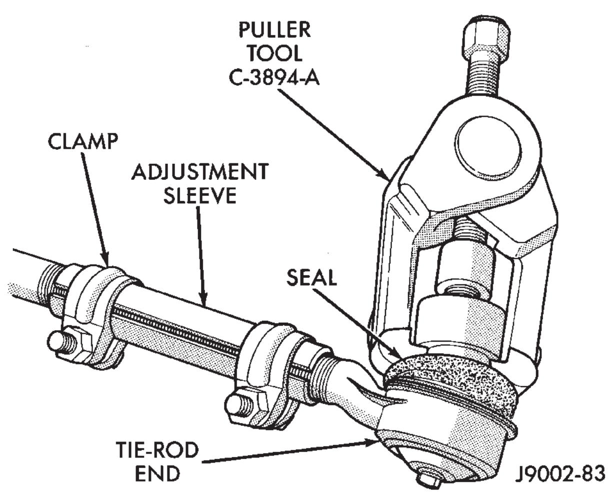


Fig. 1 Ball Stud Removal

TIE ROD

REMOVAL

(1) Remove the cotter pins and nuts at the steering knuckle and drag link (Fig. 2).

(2) Loosen the ball studs with a puller tool to remove the tie rod.

(3) If necessary, loosen the end clamp bolts and remove the tie rod ends from the tube.

INSTALLATION

(1) If necessary, install the tie rod ends in the tube (Fig. 2). Position the tie rod clamp as shown (Fig. 3). Tighten to 27 N·m (20 ft. lbs.) torque.

(2) Install the tie rod on the drag link and steering knuckle. Install the retaining nuts.

(3) Tighten the ball stud nut on the steering knuckle to 47 N·m (35 ft. lbs.) torque. Tighten the ball stud nut to drag link to 47 N·m (35 ft. lbs.) torque. Install new cotter pins and bend end 60°.

DRAG LINK

REMOVAL

(1) Remove the cotter pins and nuts at the steering knuckle and drag link (Fig. 2).

(2) Remove the steering dampener ball stud from the drag link with a puller tool.

(3) Remove the drag link from the steering knuckle with a puller tool. Remove the same for tie rod and pitman arm.

(4) If necessary, loosen the end clamp bolts and remove the tie rod end from the link.

INSTALLATION

(1) Install the drag link adjustment sleeve and tie rod end. Position clamp bolts as shown (Fig. 3).

(2) Position the drag link at the steering linkage (Fig. 2).

Install the drag link to the steering knuckle nut. Do the same for the tie rod and pitman arm.

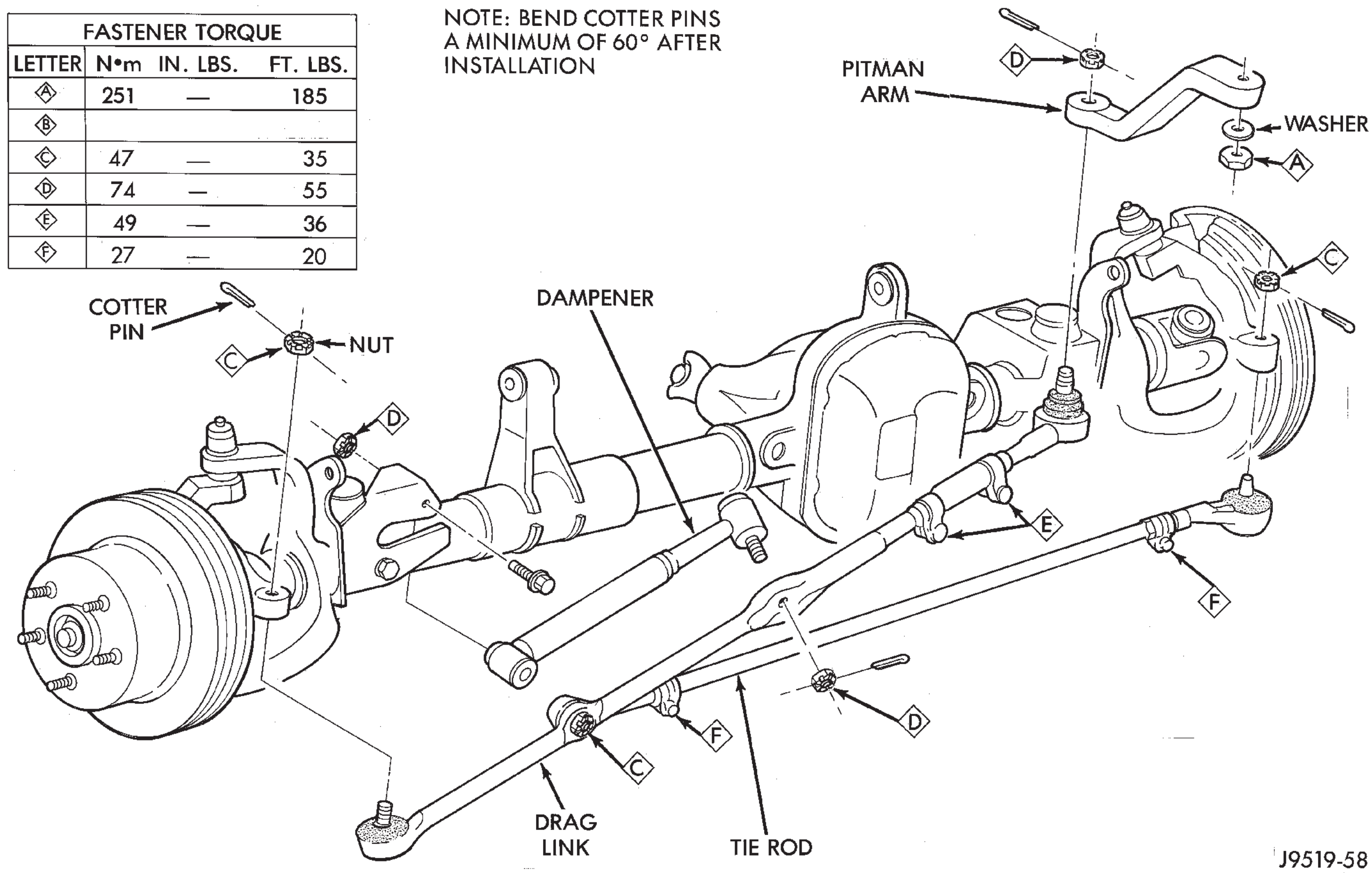
(3) Tighten the nut at the steering knuckle to 47 N·m (35 ft. lbs.) torque. Tighten the pitman and tie rod ball stud nuts to 47 N·m (35 ft. lbs.) torque. Install new cotter pins and bend end 60°.

(4) Install the steering dampener onto the drag link. Tighten the nut to 47 N·m (35 ft. lbs.) torque. Install a new cotter pin and bend end 60°.

STEERING DAMPENER

REMOVAL

(1) Place the front wheels in a straight ahead position.



FASTENER TORQUE			
LETTER	N•m	IN. LBS.	FT. LBS.
A	251	—	185
B			
C	47	—	35
D	74	—	55
E	49	—	36
F	27	—	20

Fig. 2 Steering Linkage

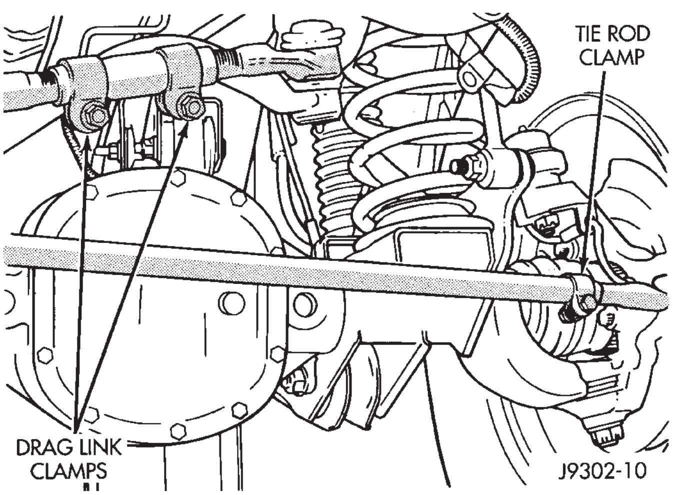


Fig. 3 Tie Rod/Drag Link Clamp Bolt

(2) Remove the steering dampener retaining nut and bolt from the axle bracket (Fig. 2).

(3) Remove the cotter pin and nut from the ball stud at the drag link (Fig. 2).

(4) Remove the steering dampener ball stud from the drag link using C-3894-A puller tool.

INSTALLATION

(1) Install the steering dampener to the axle bracket and drag link.

(2) Install the steering dampener bolt in the axle bracket. Tighten the nut to 74 N·m (55 ft. lbs.) torque.

(3) Install the ball stud nut at the drag link. Tighten the nut to 74 N·m (55 ft. lbs.) torque. Install a new cotter pin.

PITMAN ARM

REMOVAL

(1) Remove the cotter pin and nut from the drag link at the pitman arm.

(2) Remove the drag link ball stud from the pitman arm with a puller.

(3) Remove the nut and washer from the steering gear shaft. Mark the pitman shaft and pitman arm for installation reference. Remove the pitman arm from steering gear with Puller 7998 or C-4150-A (Fig. 4).

INSTALLATION

(1) Align and install the pitman arm on steering gear shaft.

(2) Install the washer and nut on the shaft. Tighten the nut to 251 N·m (185 ft. lbs.) torque.

(3) Install drag link ball stud to pitman arm (Fig. 4). Install and tighten nut to 74 N·m (55 ft. lbs.) torque. Install a new cotter pin.

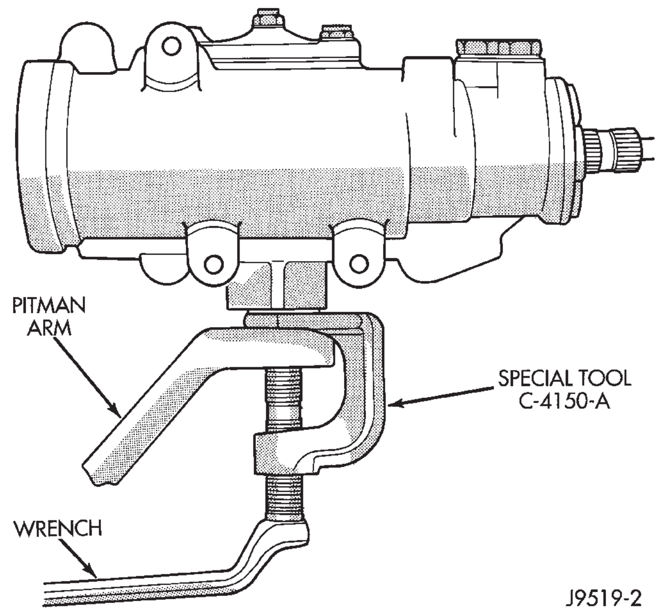


Fig. 4 Pitman Arm Removal

RECIRCULATING BALL POWER STEERING GEAR

INDEX

SERVICE INFORMATION

CAUTION: Vehicles equipped with H.D. Trailer Tow Package use high temperature seals in the power steering gear. The gears are identified with a YELLOW paint mark. The mark is on the pitman shaft side of the housing below the side cover. Use ONLY the correct seal kit when servicing the steering gear with this identification.

A recirculating ball steering gear is used with the power (assisted) steering system (Fig. 1). The power steering gear can be adjusted and internally serviced.

Discard all O-ring seals during disassembly, they are not re-usable.

Safety goggles should be worn at all times when involved with power steering gear or pump service.

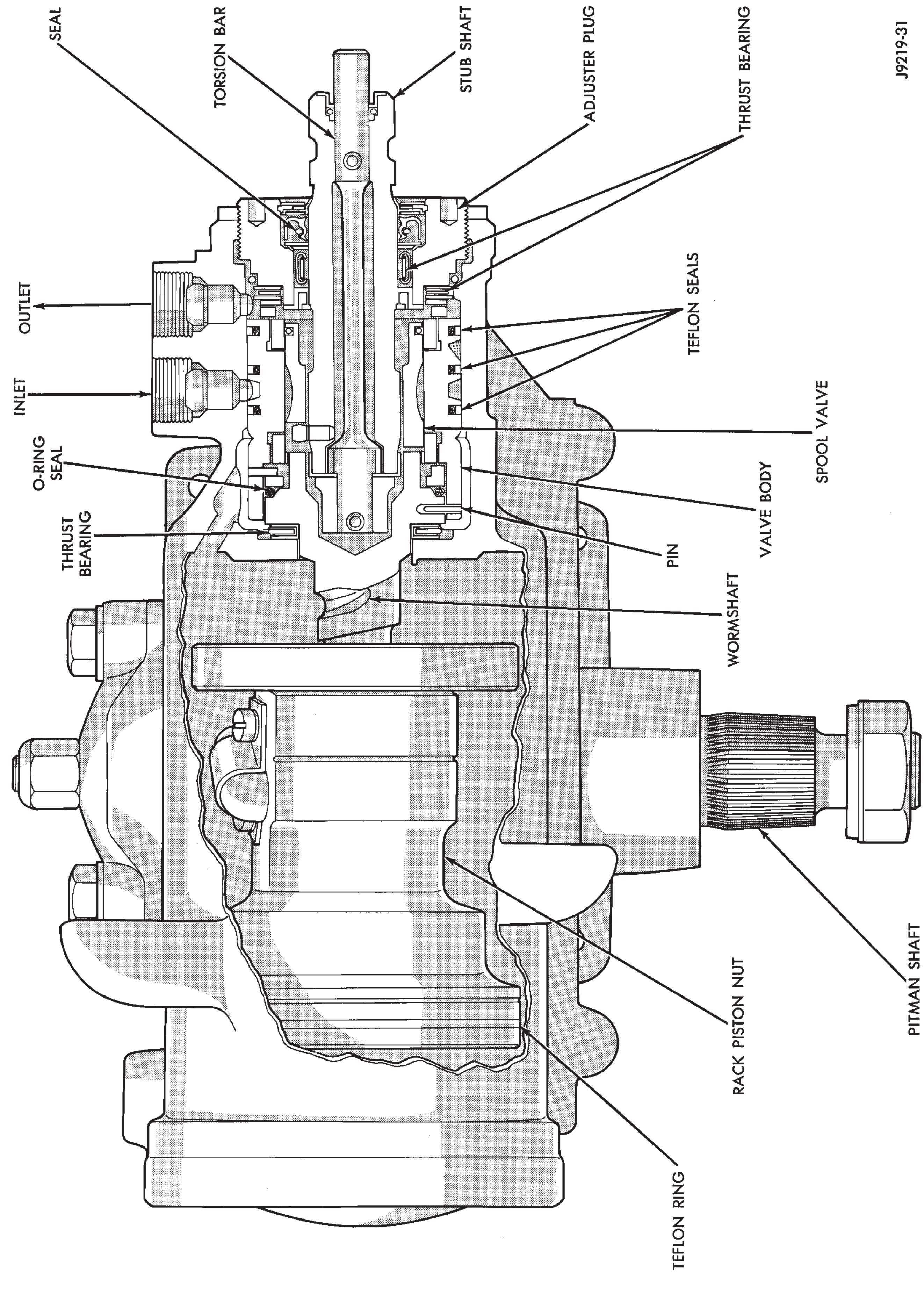


Fig. 1 Power Steering Gear

PITMAN SHAFT SEALS—IN CAR REPLACEMENT

REMOVAL

(1) Remove pitman arm from gear. Refer to Pitman Arm Removal in Steering Linkage.

(2) Clean exposed end of pitman shaft and housing. Use a wire brush to clean the shaft splines.

(3) Remove retaining ring with snap ring pliers (Fig. 2).

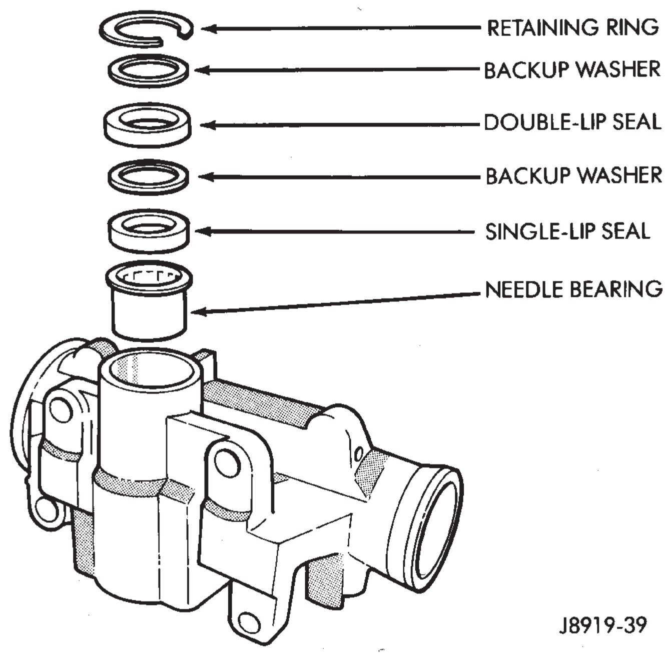


Fig. 2 Pitman Shaft Seals

CAUTION: Use care not to score the housing bore when prying out seals and washers.

(4) Remove backup washer and double lip seal with screwdriver.

• Start the engine and turn the steering wheel fully to the LEFT to force out the seals and washers.

• Stop the engine.

(5) Remove backup washer and single lip seal with screwdriver.

(6) Inspect the housing for burrs and remove if necessary. Inspect the pitman shaft seal surface for roughness and pitting. If pitted replace shaft.

INSTALLATION

(1) Install single lip seal with Installer or a suitable size deep socket (Fig. 3).

(2) Coat the double lip seal and washer with grease.

(3) Install the backup washer.

(4) Install the double lip seal.

(5) Install the backup washer.

(6) Install the retainer ring with snap ring pliers.

(7) Center the steering gear.

(8) Install the pitman arm. Refer to Pitman Arm Installation in Steering Linkage.

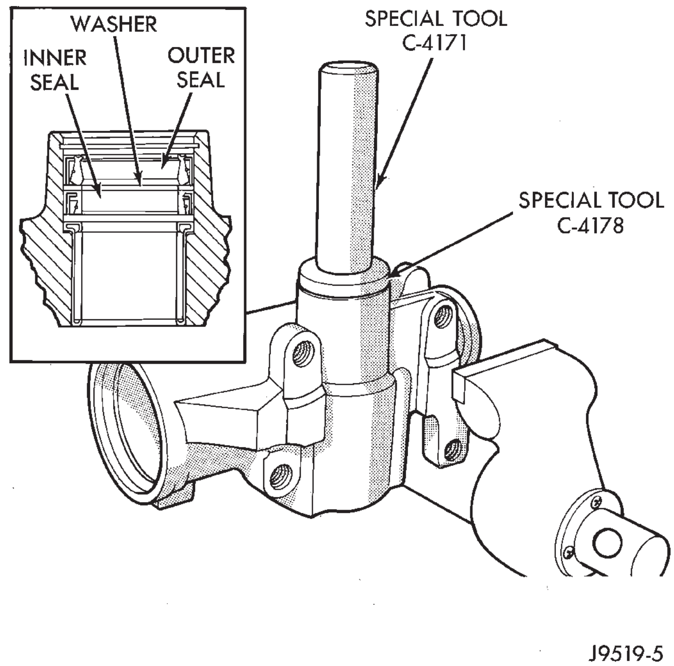


Fig. 3 Pitman Shaft Seal Installation

(9) Add power steering fluid. Refer to Power Steering Initial Operation.

INTERMEDIATE SHAFT COUPLING

REMOVAL

(1) Place the front wheels in the straight ahead position.

(2) Remove the column intermediate (coupling) shaft stone shield (Fig. 4).

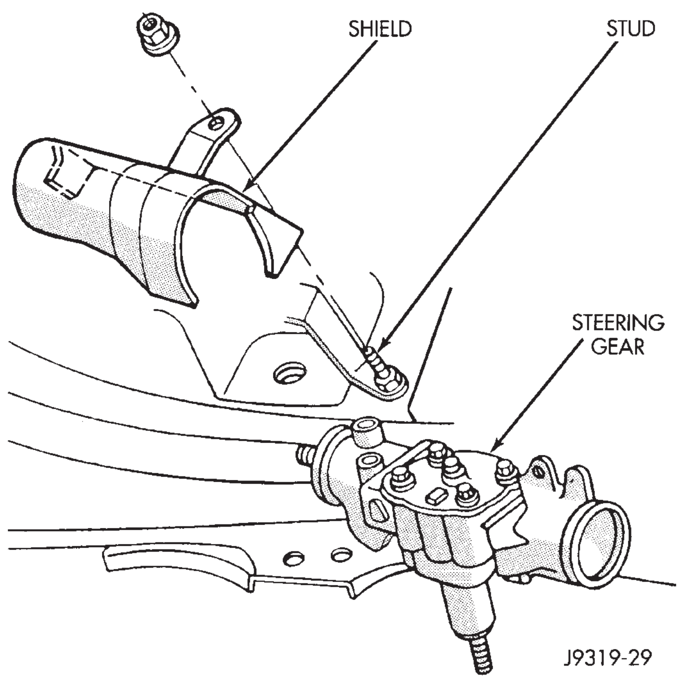


Fig. 4 Shaft Stone Shield

(3) Remove the shaft pinch bolt at the steering gear and column (Fig. 5). Unbolt steering gear from frame rail to remove shaft. Refer to Steering Gear Replacement in this section.

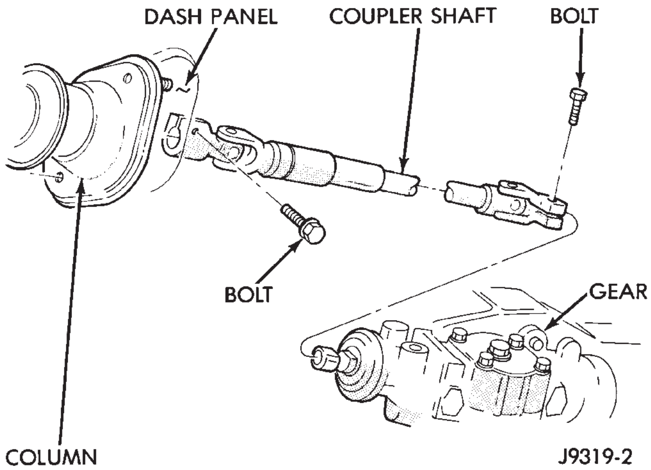


Fig. 5 Coupling Shaft

INSTALLATION

(1) Align the intermediate (coupling) shaft to the steering gear and column.

(2) Position the steering gear on the frame. Refer to Steering Gear Replacement in this section.

(3) Install and tighten the pinch bolts to 45 N·m (33 ft. lbs.) torque.

(4) Install the intermediate (coupling) shaft stone shield.

STEERING GEAR REPLACEMENT

REMOVAL

(1) Place the front wheels in the straight ahead position with the steering wheel centered.

(2) Disconnect and cap the fluid hoses from steering gear. Refer to Pressure and Return Hose Replacement in this group.

(3) Remove the column coupler shaft from the gear. Refer to the removal procedures in this section.

(4) Remove pitman arm from gear. Refer to Pitman Arm Removal in the Steering Linkage section.

(5) Remove the steering gear retaining bolts and nuts. Remove the steering gear from the vehicle (Fig. 6).

INSTALLATION

(1) Align the column coupler shaft to steering gear. Refer to Column Coupler installation in this section.

(2) Position the steering gear on the frame rail and install the bolts. Tighten the bolts to 88 N·m (65 ft. lbs.) torque.

(3) Align and install the pitman arm. Refer to Pitman Arm Installation in the Steering Linkage section.

(4) Connect fluid hoses to steering gear. Refer to Pressure and Return Hose Replacement in this group.

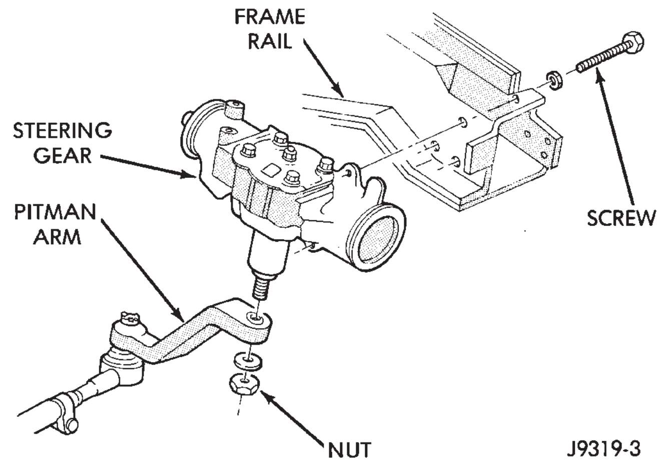


Fig. 6 Steering Gear Mounting

STEERING GEAR ADJUSTMENTS

SERVICE INFORMATION

Adjusting the steering gear in the vehicle is **NOT** recommended. Remove the gear from the vehicle and mount in a vise. Drain the power steering fluid and make the following adjustments in this order:

- FIRST - worm thrust bearing preload
- SECOND - over-center preload adjustment

WORM THRUST BEARING PRELOAD ADJUSTMENT

(1) Remove adjuster plug locknut (Fig. 7).

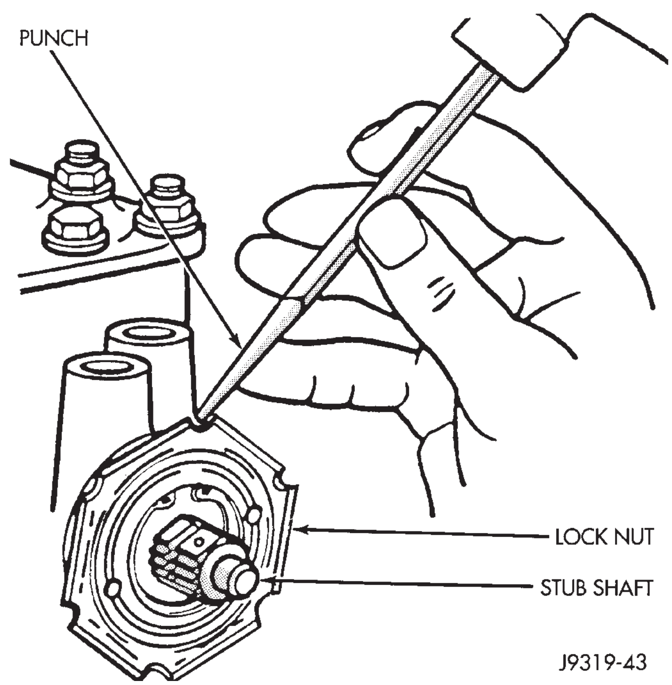


Fig. 7 Loosening the Adjuster Plug Locknut

(2) Turn the adjuster in with Spanner Wrench C-4381. Tighten the plug and thrust bearing in the housing until firmly bottomed in housing.

(3) Place an index mark on the housing even with one of the holes in adjuster plug (Fig. 8).

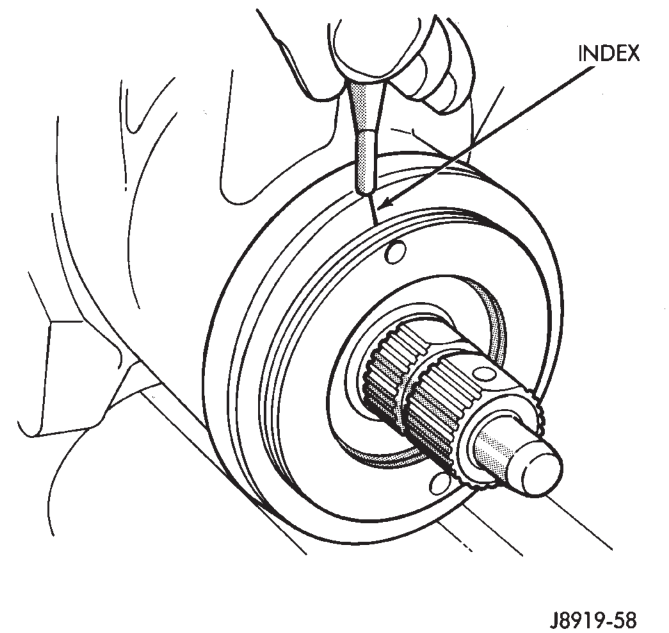


Fig. 8 Alignment Marking On Housing

(4) Measure back (counterclockwise) 13 mm (0.50 in) and mark housing (Fig. 9).

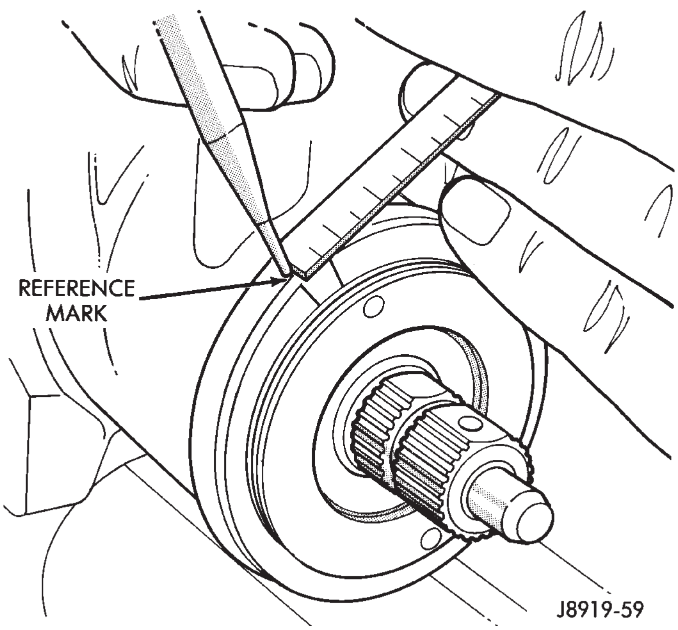


Fig. 9 Remarking The Housing

(5) Rotate adjustment cap back (counterclockwise) with spanner wrench until hole is aligned with the second mark (Fig. 10).

(6) Install and tighten locknut to 109 N·m (80 ft. lbs.) torque. Be sure adjustment cap does not turn while tightening the locknut.

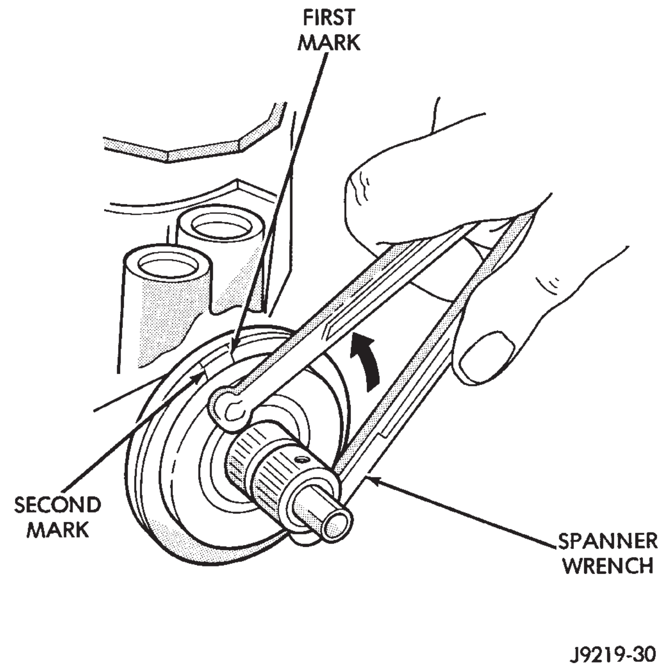


Fig. 10 Aligning To The Second Mark

OVER-CENTER ADJUSTMENT

(1) Rotate the stub shaft from stop to stop and count the number of turns.

(2) Starting at either stop turn the stub shaft back 1/2 the total number of turns. This is the center of the gear travel (Fig. 11).

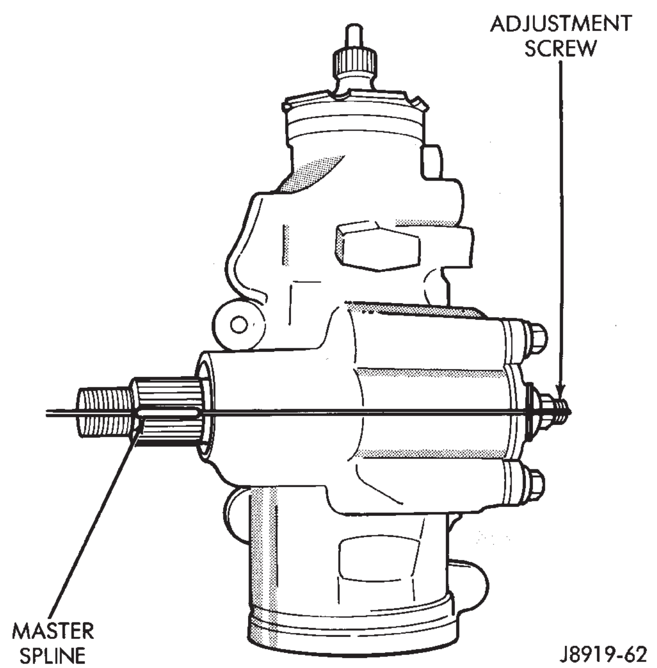


Fig. 11 Steering Gear Centered

(3) Turn the pitman shaft adjuster screw back (COUNTERCLOCKWISE) until extended, then turn back in (CLOCKWISE) one full turn.

(4) Rotate the stub shaft 1/2 turn off center (180 degrees).

(5) Place the torque wrench in the vertical position on the stub shaft. Rotate the wrench 45 degrees each side of 1/2 off center and record the highest rotational torque at 1/2 off center (Fig. 12). Value should not exceed 1.7 N·m (15 in. lbs).

(6) Return stub shaft to center position.

(7) Turn the adjuster in until torque to turn stub shaft is 0.7 to 1.1 N·m (6 to 10 in. lbs.) more than reading in Step 5.

(8) Prevent the adjuster screw from turning while tightening adjuster lock nut. Tighten the adjuster lock nut to 49 N·m (36 ft. lbs.).

GEAR DISASSEMBLY INFORMATION

CAUTION: Cleanliness is extremely important when repairing a power steering gear. Keep the bench, tools and components clean at all times. Thoroughly clean the exterior of the gear with cleaning solvent before disassembly. Drain as much of the fluid as possible. Use protective vise jaws at all times when clamping components. During assembly, lubricate all components with power steering fluid except when instructed otherwise (Fig. 13).

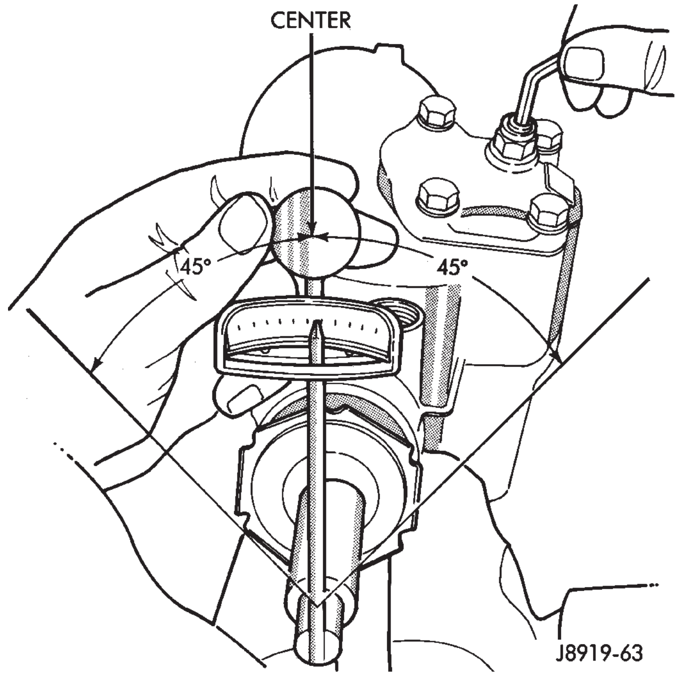


Fig. 12 Checking Over-center Rotation Torque

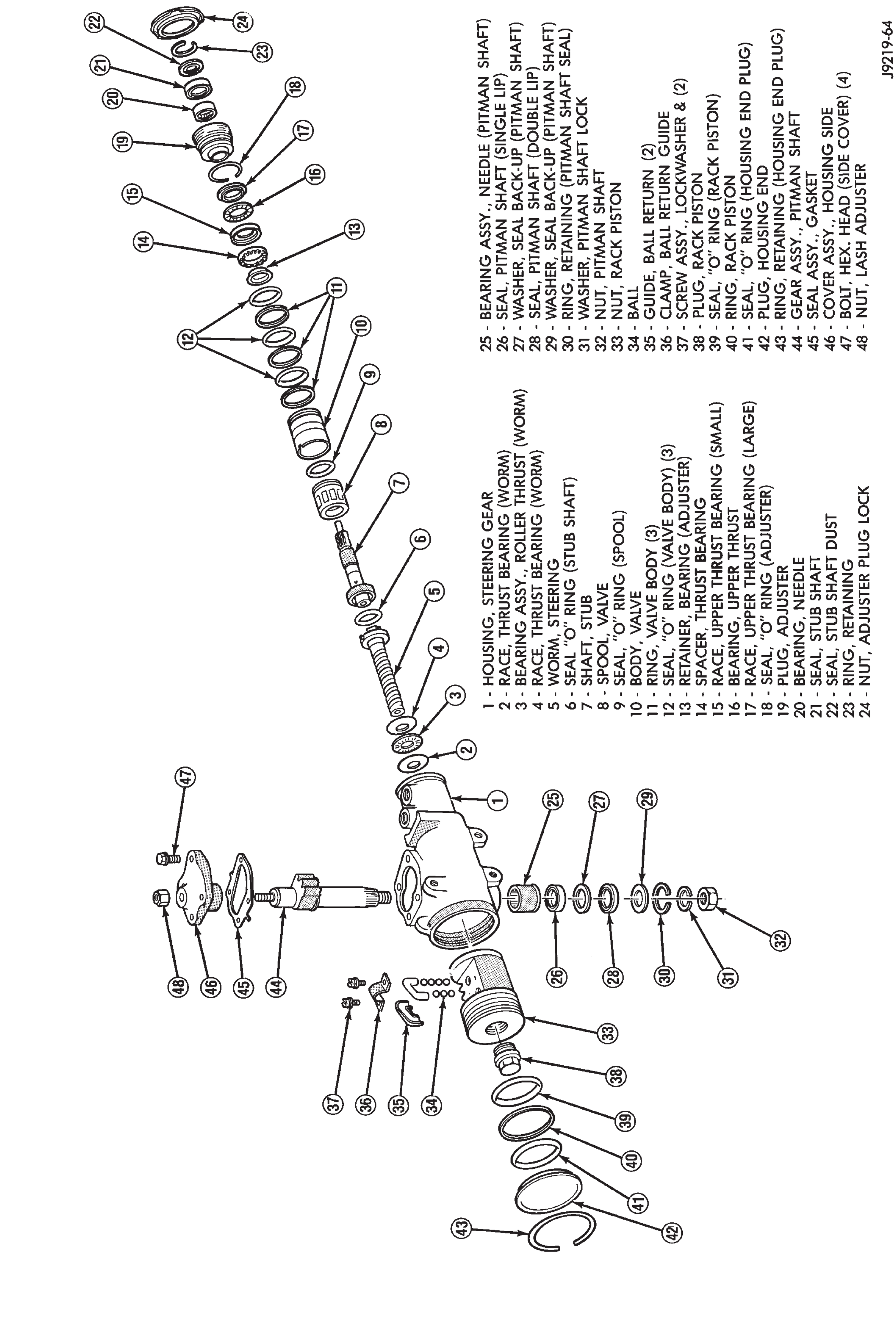


Fig. 13 Power Steering Gear

PITMAN SHAFT AND SIDE COVER REPLACEMENT

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

(2) Remove pitman arm from steering gear. Refer to Pitman Arm Removal in the Steering Linkage section.

(3) Rotate stub shaft back and forth to drain power steering fluid.

DISASSEMBLE

- Clean exposed end of pitman shaft and housing
- Clean pitman shaft spline with a wire brush

(1) Remove preload adjuster nut.

(2) Remove side cover bolts. Rotate stub shaft with socket to center gear.

(3) Remove side cover, gasket and pitman shaft as an assembly.

(4) Remove pitman shaft from the side cover (Fig. 14).

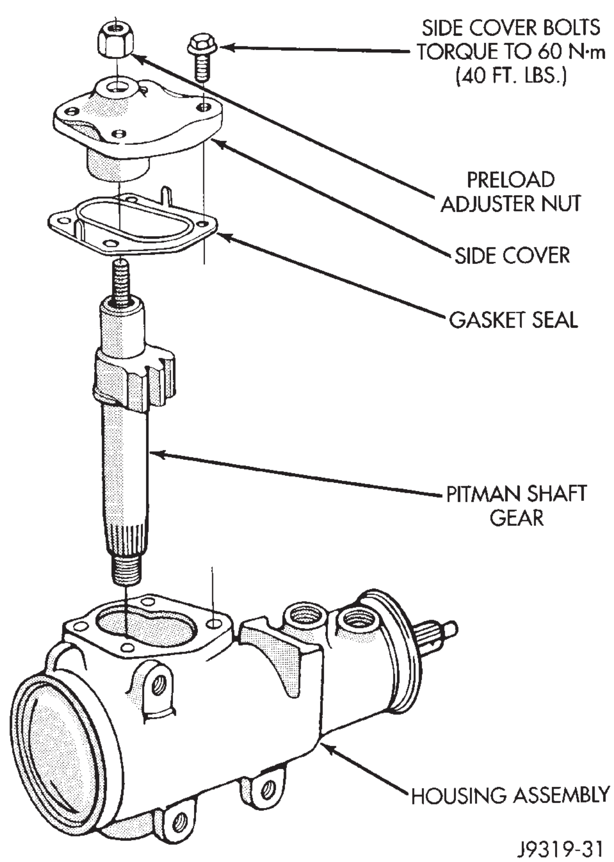


Fig. 14 Side Cover and Pitman Shaft

ASSEMBLE

(1) Install pitman shaft to side cover by screwing shaft in until it fully seats to side cover.

(2) Install preload adjuster nut. **Do not tighten nut until after pitman shaft adjustment has been made.**

(3) Install gasket to side cover and bend tabs around edges of side cover.

(4) Install pitman shaft assembly and side cover to housing.

(5) Install side cover bolts and tighten to 60 N·m (44 ft. lbs.).

(6) Adjust pitman shaft, refer to Over-Center Adjustment.

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

(2) Install pitman arm onto steering gear. Refer to Steering Linkage in this group.

HOUSING END PLUG

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

(2) Remove pitman arm from steering gear. Refer to Steering Linkage in this group.

(3) Rotate stub shaft back and forth to drain power steering fluid.

DISASSEMBLE

- Rotate stub shaft back and forth to drain fluid

(1) Rotate retaining ring until one end is under the hole in the housing. Unseat and force ring from groove (Fig. 15).

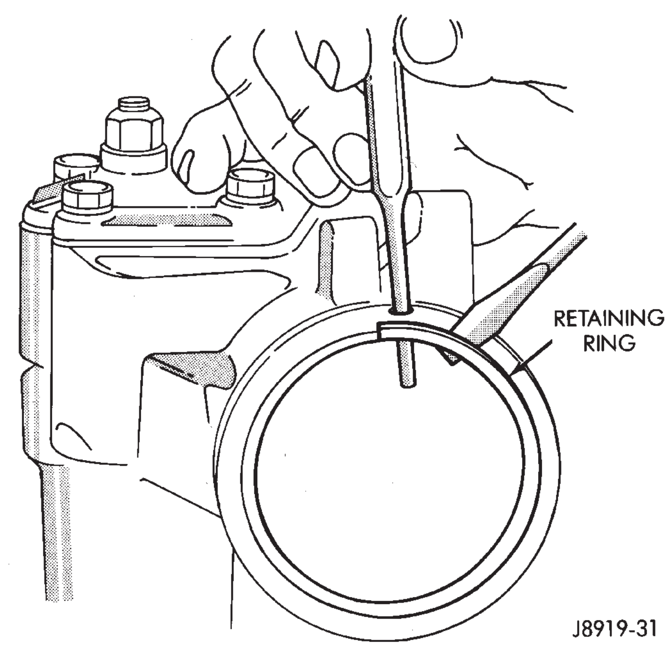


Fig. 15 End Plug Retaining Ring

(2) Rotate stub shaft slowly COUNTER-CLOCKWISE to remove end plug out from housing (Fig. 16).

CAUTION: Do not turn stub shaft any farther than necessary. The recirculating balls will drop out of the rack piston circuit and fall inside the rack piston chamber.

(3) Remove O-ring seal (Fig. 16).

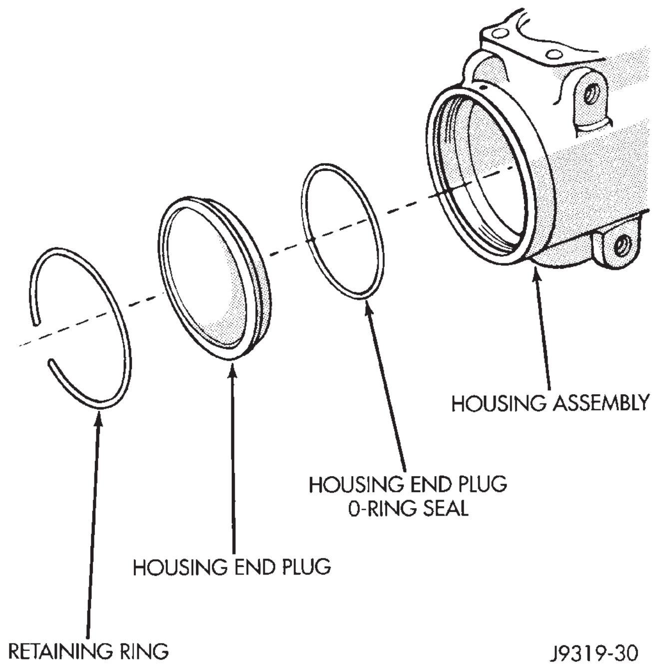


Fig. 16 End Plug Components

ASSEMBLE

- Lubricate O-ring seal with power steering fluid

(1) Install O-ring into housing.

(2) Install plug, tap lightly with a plastic mallet to seat it.

(3) Install retaining ring with open end 25 mm (1 inch) from access hole (Fig. 17).

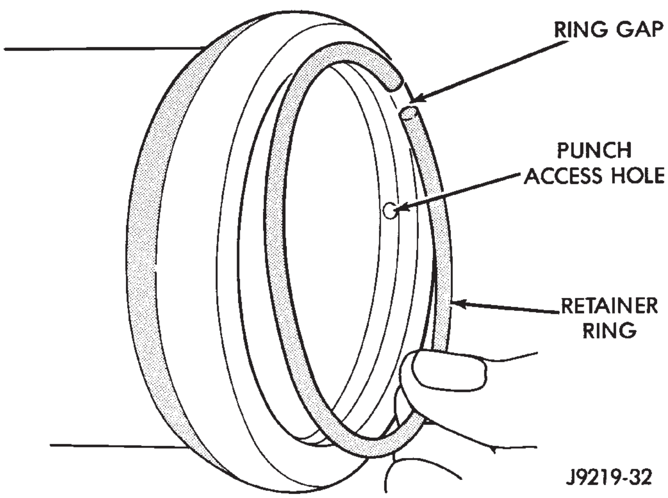


Fig. 17 Installing The Retaining Ring

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

(2) Install pitman arm onto steering gear. Refer to Steering Linkage in this group.

ADJUSTER PLUG ASSEMBLY REPLACEMENT

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

DISASSEMBLE

(1) Remove adjuster plug lock nut from housing.

(2) Remove adjuster plug from housing with Spanner Wrench C-4381 (Fig. 18).

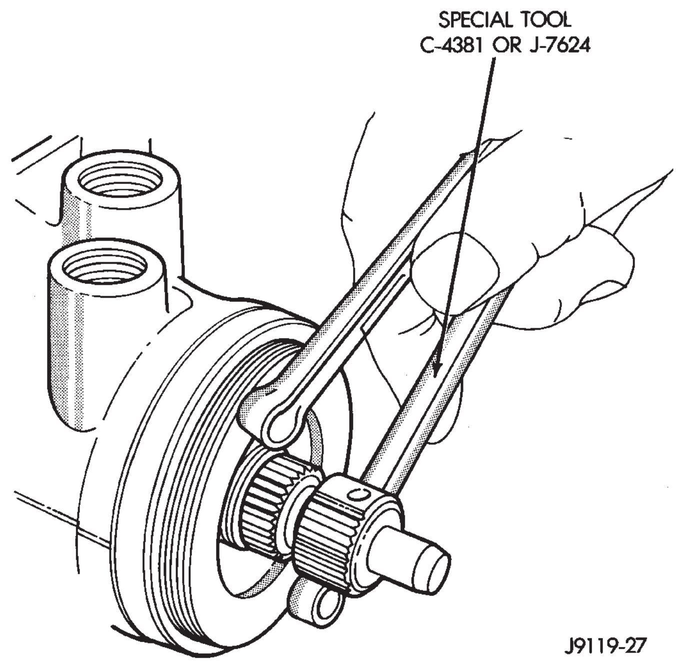


Fig. 18 Remove/Install Adjustment Plug

(3) Remove thrust washer bearing retainer from adjuster plug with screwdriver (Fig. 19).

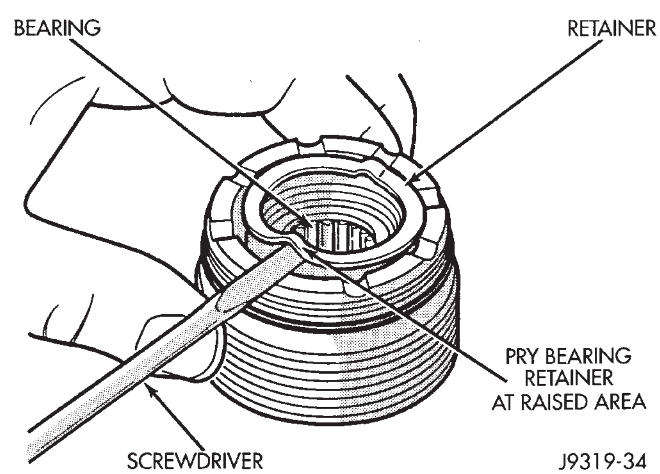


Fig. 19 Remove Retainer

(4) Remove bearing spacer, races and thrust bearing (Fig. 20).

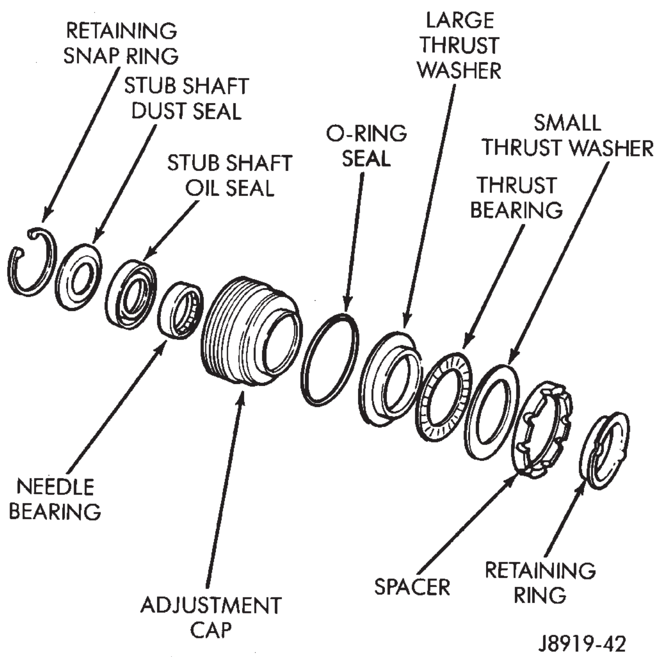


Fig. 20 Adjustment Plug (Cap) Components

(5) Remove O-ring seal.

(6) Remove retaining snap ring.

(7) Remove needle bearing, dust seal and lip seal with tool C-4177 and handle C-4171 (Fig. 21).

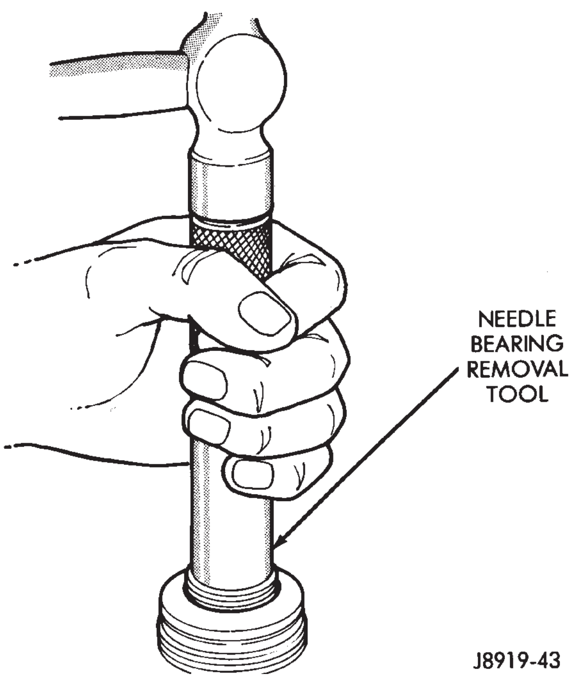


Fig. 21 Needle Bearing Removal

ASSEMBLE

CAUTION: Needle bearing must be installed with identification on bearing facing tool to prevent damage to bearing.

(1) Install needle bearing into adjuster plug with tool C-4177 and handle C-4171.

(2) Apply white petroleum grease on lip seal. Install lip seal into adjuster plug with tool C-4177 and handle C-4171.

(3) Apply white petroleum grease to dust seal cavity and install dust seal into adjuster plug with tool C-4177 and handle C-4171.

(4) Install retainer snap ring.

(5) Install O-ring seal to adjuster plug.

(6) Install large bearing race, thrust bearing, small bearing race and bearing spacer to adjuster plug.

(7) Install thrust washer bearing retainer to adjuster plug (Fig. 22).

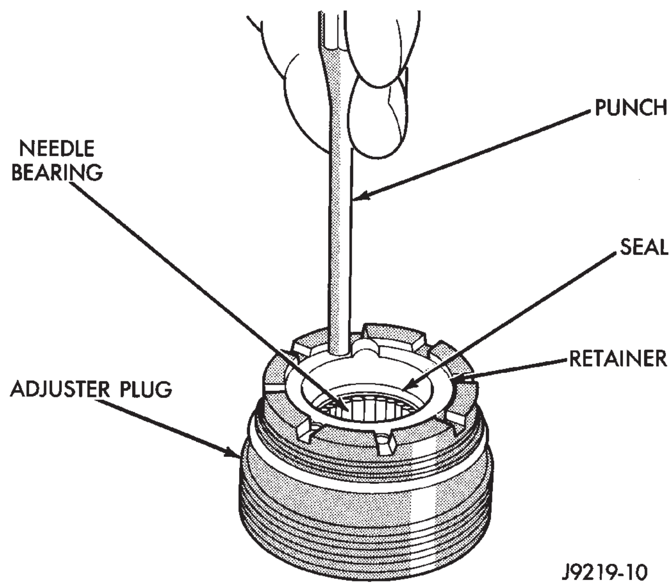


Fig. 22 Install Retainer

CAUTION: When installing adjuster plug, care should be taken NOT to cut the seals.

(8) Install adjuster plug into housing with Spanner Wrench C-4381.

(9) Adjust bearing preload, refer to Thrust Bearing Preload Adjustment.

(10) Install adjuster plug lock nut, and using a punch (drift) in a notch, tighten securely (Fig. 23). **Hold adjuster plug to maintain alignment of the marks.**

(11) Adjust pitman shaft. Refer to Over-Center Adjustment.

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

VALVE REPLACEMENT

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

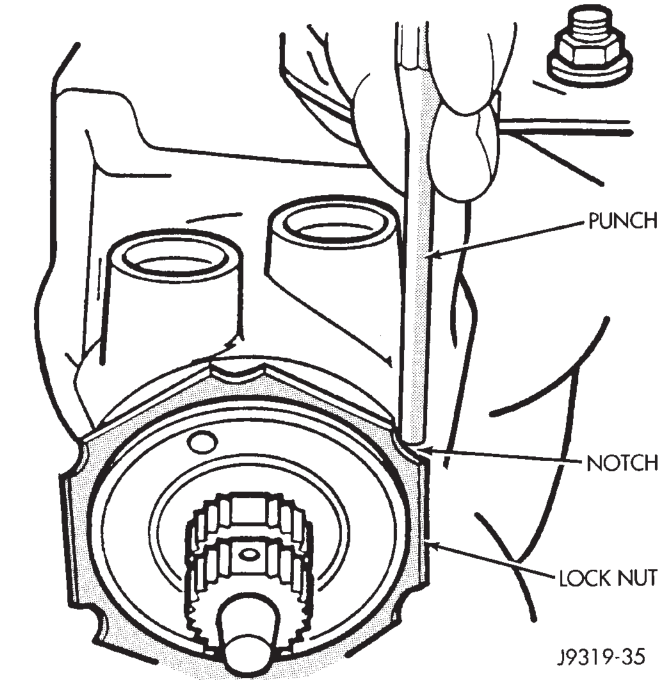


Fig. 23 Tighten Lock Nut

DISASSEMBLE

(1) Remove adjuster plug, refer to Adjuster Plug Assembly Replacement.

(2) Remove stub shaft and valve assembly (Fig. 24).

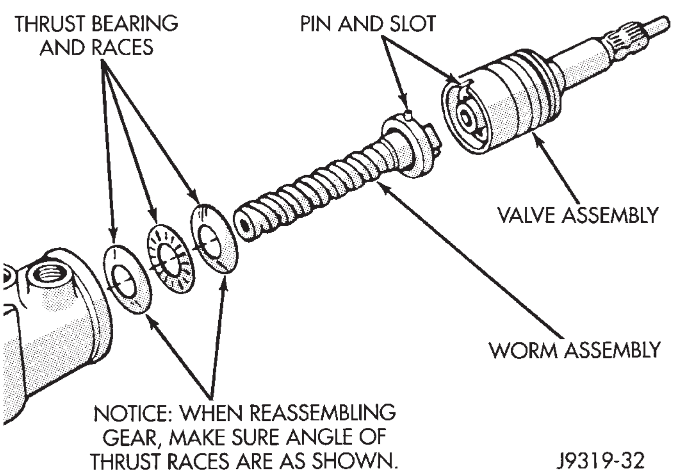


Fig. 24 Bearing, Worm and Valve Assembly

(3) Remove stub shaft from valve assembly, if necessary.

• Tap stub shaft lightly on a block of wood to loosen shaft cap

• Pull cap and valve body and disengage stub shaft pin from hole in valve body (Fig. 25).

(4) Remove valve assembly if necessary.

• Remove valve spool by pulling and rotating from valve body (Fig. 26).

• Remove valve spool O-ring seal

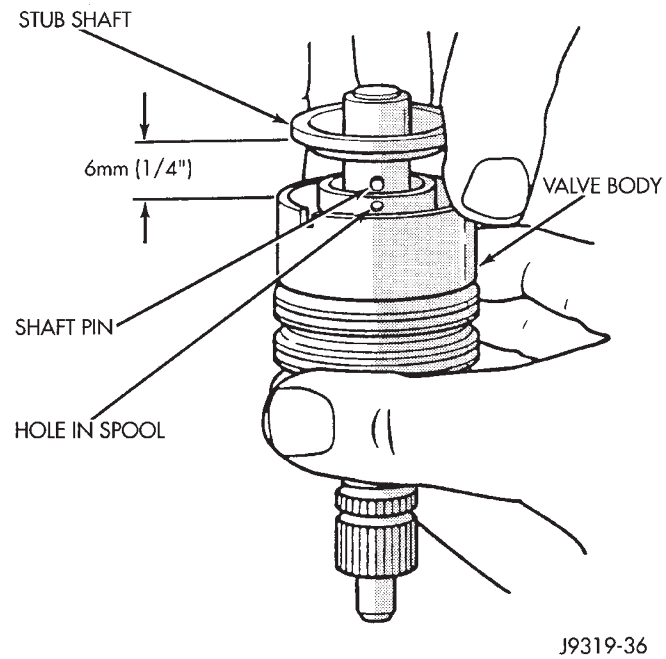


Fig. 25 Remove and Install Stub Shaft

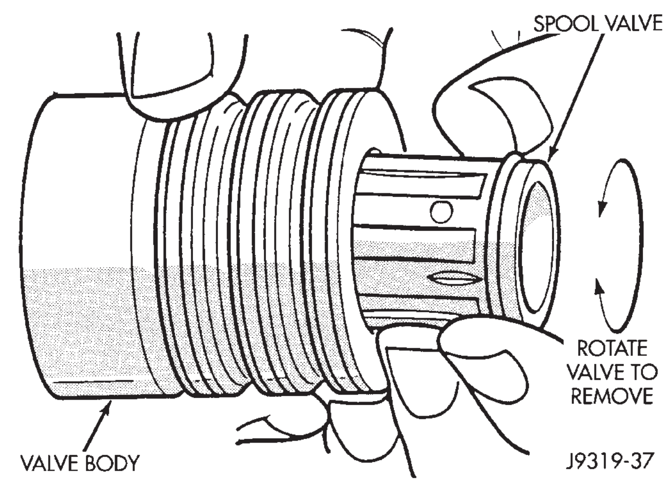


Fig. 26 Remove and Install Spool

• Remove valve body teflon rings and O-ring seals (Fig. 27).

ASSEMBLE

(1) Install valve spool O-ring seal to valve spool.

(2) Lubricate valve spool and O-ring seal with power steering fluid.

(3) Install valve spool to valve body by pushing and rotating. Hole in valve spool for stub pin must be accessible from opposite end of valve body.

(4) Assemble stub shaft to valve spool, if necessary and insert pin (Fig. 28).

• Notch in stub shaft cap MUST fully engage valve body pin and seat against valve body shoulder.

(5) Install O-ring seals and teflon rings to valve body.

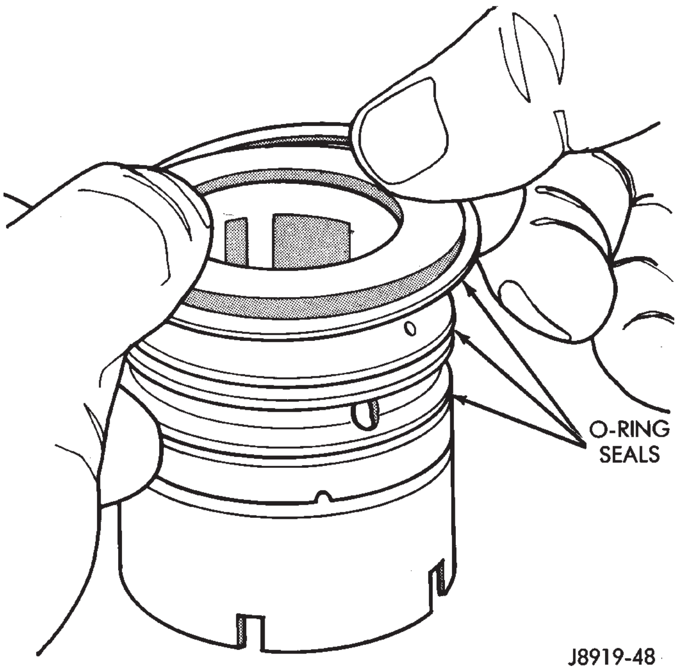


Fig. 27 Remove and Install Valve Seals

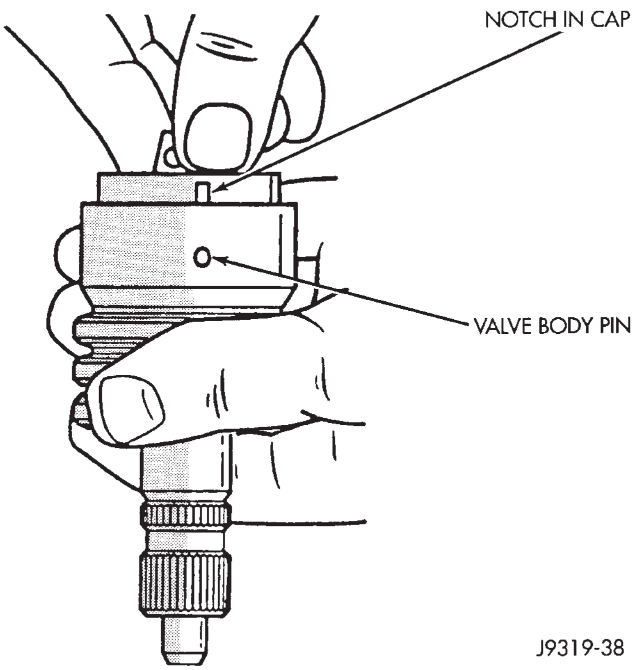


Fig. 28 Stub Shaft Installation

(6) Lubricate O-ring seals and teflon rings with power steering fluid.

(7) Install stub shaft and valve assembly to worm shaft, fitting on worm shaft to slot in the valve assembly.

(8) Adjust Thrust Bearing Preload Adjustment and Over-Center Adjustment. Refer to Steering Gear Adjustments in this section.

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

RACK PISTON AND WORM SHAFT REPLACEMENT

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

DISASSEMBLE

(1) Remove pitman shaft and side cover. Refer to Side Cover and Pitman Shaft Replacement in this section.

(2) Remove housing plug end. Refer to Housing End Plug Replacement in this section.

(3) Turn stub shaft COUNTERCLOCKWISE until the rack piston begins to come out of the housing.

(4) Remove rack piston plug (Fig. 29).

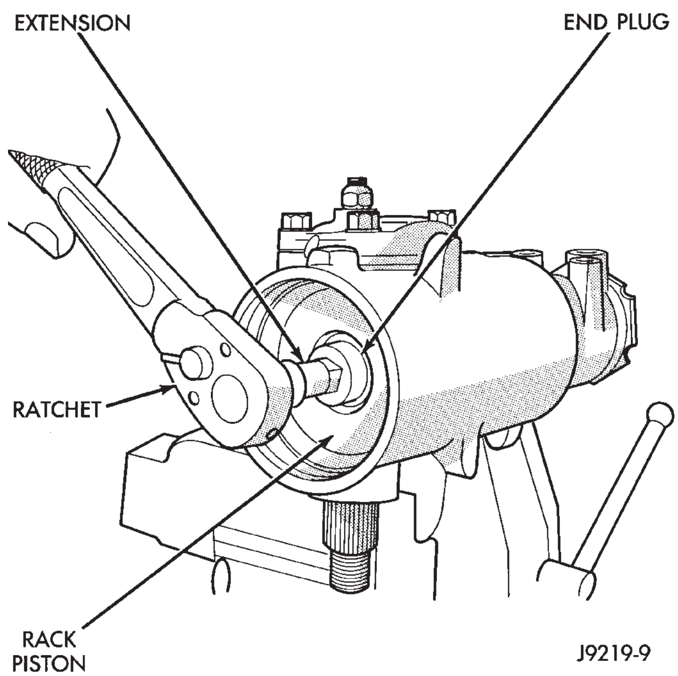


Fig. 29 Remove and Install Rack Piston End Plug

(5) Insert Arbor C-4175 into bore of rack piston (Fig. 30). Hold tool tightly against worm shaft while turning the stub shaft COUNTERCLOCKWISE.

• The rack piston will be forced onto the tool and hold the rack piston balls in place.

(6) Remove the rack piston, rack balls, and tool together from housing.

(7) Remove valve. Refer to Valve Replacement in this section.

(8) Remove worm shaft.

(9) Remove thrust bearing and races.

(10) Remove tool from rack piston.

(11) Remove rack piston balls.

(12) Remove screws, clamp and ball guide.

(13) Remove teflon ring and O-ring seal (Fig. 31).

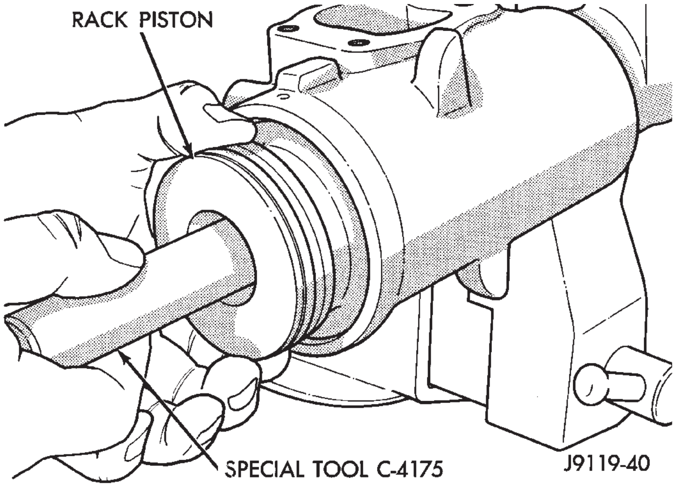


Fig. 30 Remove and Install Rack Piston

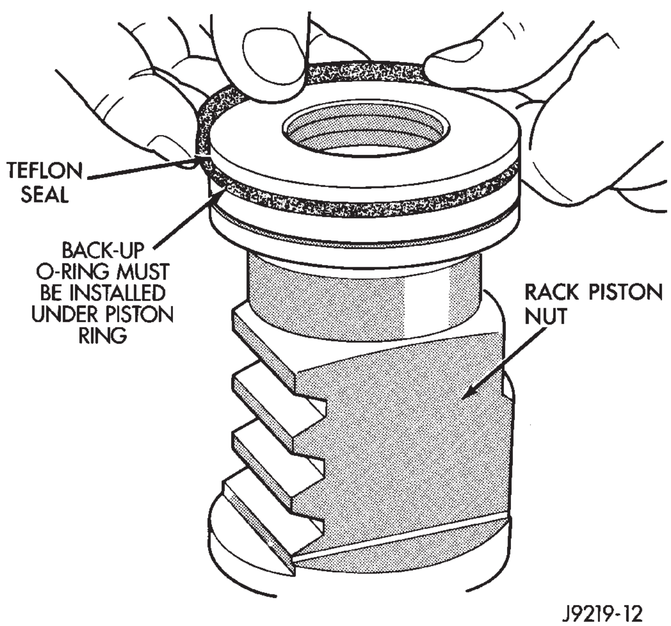


Fig. 31 Remove and Install Seal on Rack Piston

CLEAN AND INSPECTION

(1) Wash all components in clean solvent and dry with compressed air.

(2) Check for scores, nicks or burrs on the rack piston finished surface. Slight wear is normal on the worm gear surfaces.

ASSEMBLE

(1) Install O-ring seal and teflon ring and lubricate with power steering fluid.

(2) Install worm shaft to rack piston outside of housing. Fully seat worm shaft to rack piston and align worm shaft spiral groove with rack piston ball guide hole (Fig. 32).

WARNING: MAKE SURE ALL RACK PISTON BALLS ARE REINSTALLED IN THE RACK PISTON. IMPROPER INSTALLATION MAY RESULT IN PERSONAL INJURY.

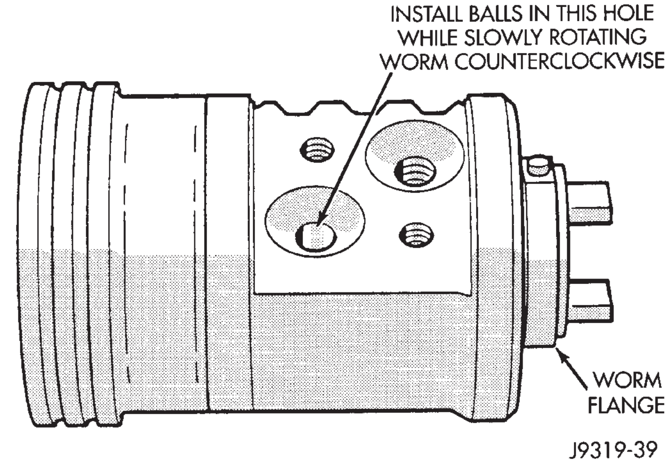


Fig. 32 Installing Balls in Rack Piston

There are 24 balls in the rack piston circuit, 12 are black and 12 are silver (Chrome). The black rack piston balls are smaller than the silver balls. THE BLACK AND SILVER BALLS MUST BE INSTALLED ALTERNATELY INTO THE RACK PISTON AND BALL GUIDE. This procedure will maintain worm shaft preload.

(3) Lubricate and install rack piston balls through return guide hole while turning wormshaft COUNTERCLOCKWISE.

(4) Install remaining balls to guide using grease or petroleum jelly at each end to hold in place (Fig. 33).

(5) Install guide onto rack piston and return with

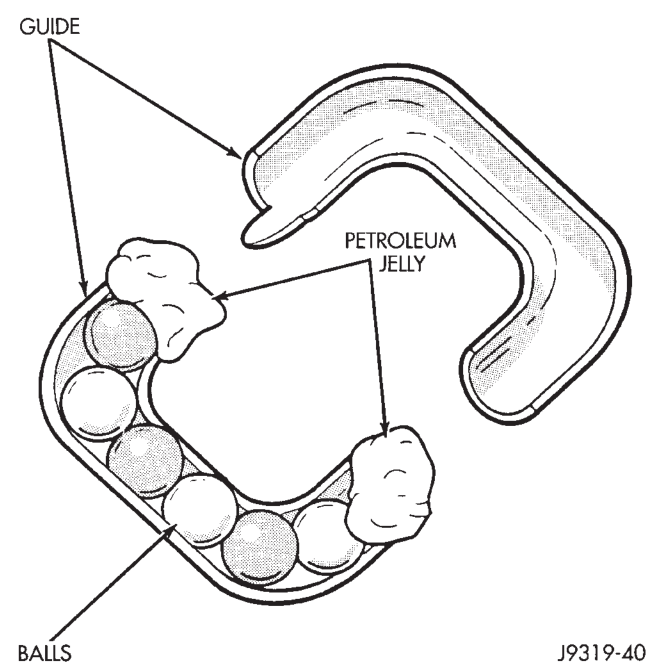


Fig. 33 Balls in the Return Guide

clamp and screws. Tighten screws to 58 N·m (43 in. lbs.) torque.

(6) Insert Arbor C-4175 into bore of rack piston. Hold tool tightly against worm shaft while turning

the stub shaft COUNTERCLOCKWISE.

• The rack piston will be forced onto the tool and hold the rack piston balls in place.

(7) Install the races and thrust bearing to worm shaft (Fig. 34).

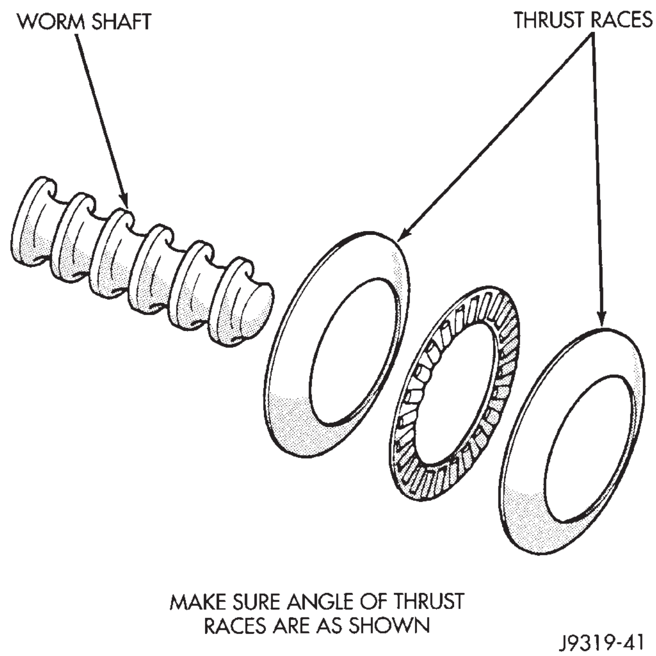


Fig. 34 Worm Shaft and Bearing

(8) Install worm shaft to housing.

(9) Install valve. Refer to Valve Replacement in this section.

(10) Install rack piston to worm shaft from tool, compress seals.

• Hold Arbor tightly against worm shaft and turn stub shaft CLOCKWISE until rack piston is seated on worm shaft.

WARNING: MAKE SURE ALL RACK PISTON BALLS ARE REINSTALLED IN THE RACK PISTON. IMPROPER INSTALLATION MAY RESULT IN PERSONAL INJURY.

(11) Install rack piston plug and tighten to 150 N·m (111 ft. lbs.) torque.

(12) Install housing end plug. Refer to Housing End Plug Replacement in this section.

(13) Install pitman shaft and side cover. Refer to Side Cover and Pitman Shaft Replacement in this section.

(14) Adjust steering gear. Refer to Steering Gear Adjustments in this section.

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

PITMAN SHAFT SEALS AND BEARING REPLACEMENT

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

DISASSEMBLE

(1) Remove pitman arm from gear. Refer to Pitman Arm Removal in Steering Linkage.

(2) Clean exposed end of pitman shaft and housing. Use a wire brush to clean the shaft splines.

(3) Remove retaining ring with snap ring pliers (Fig. 35).

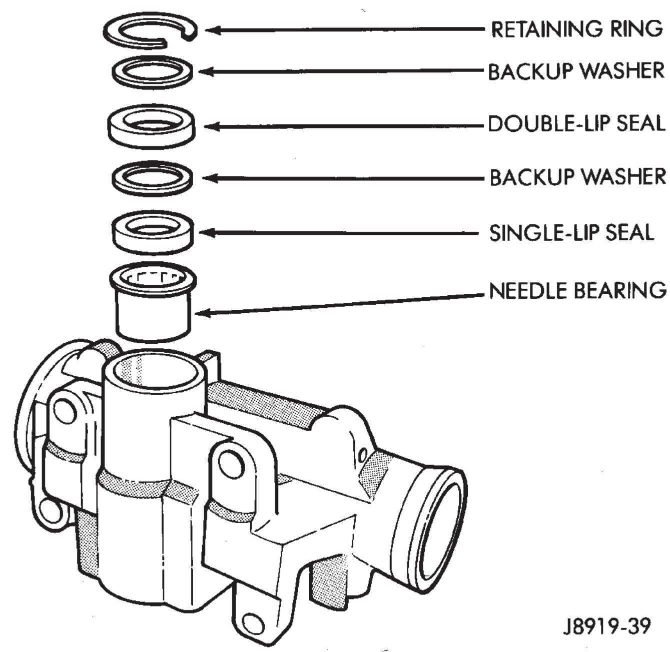


Fig. 35 Pitman Shaft Seals

CAUTION: Use care not to score the housing bore when prying out seals and washers.

(4) Remove backup washer and double lip seal with screwdriver.

(5) Remove backup washer and single lip seal with screwdriver.

(6) Inspect the housing for burrs and remove if necessary.

(7) Remove needle bearing from side cover area of housing using tool C-4177 and handle C-4171 (Fig. 36).

ASSEMBLE

(1) Install needle bearing into housing using tool C-4178 and handle C-4171 (Fig. 37).

(2) Install single lip seal with Installer tool C-4178 and handle C-4171 or a suitable size socket (Fig. 38).

(3) Coat the double lip seal and washer with grease.

(4) Install the backup washer.

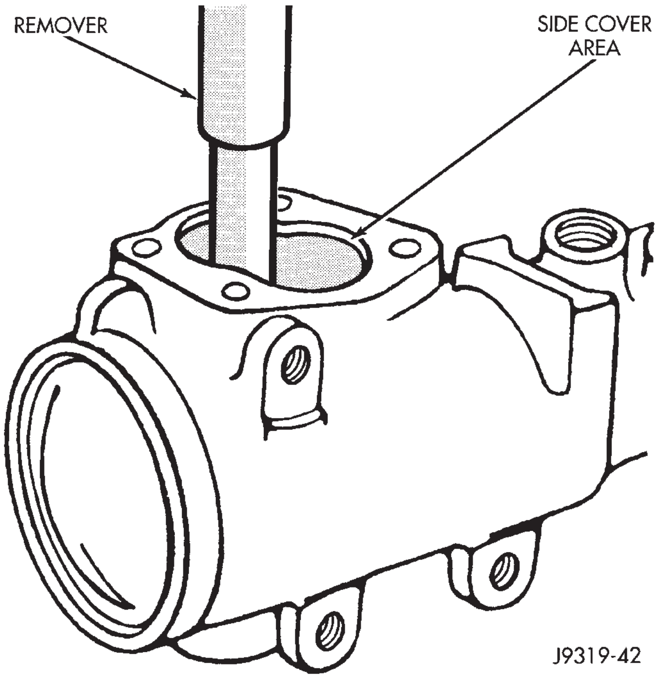


Fig. 36 Needle Bearing Removal

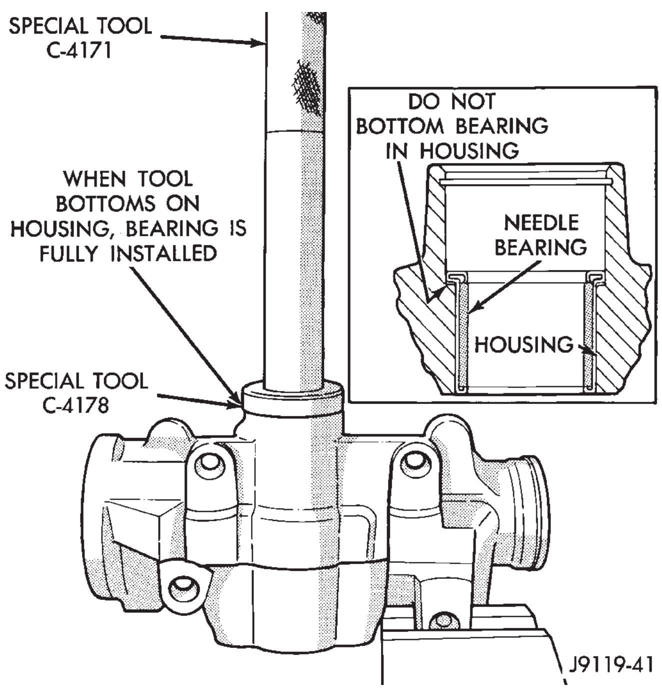


Fig. 37 Pitman Shaft Bearing Installation

(5) Install the double lip seal.
(6) Install the backup washer.
(7) Install the retainer ring with snap ring pliers.
(8) Install the pitman shaft and side cover. Refer to Side Cover and Pitman Shaft Replacement in this section.

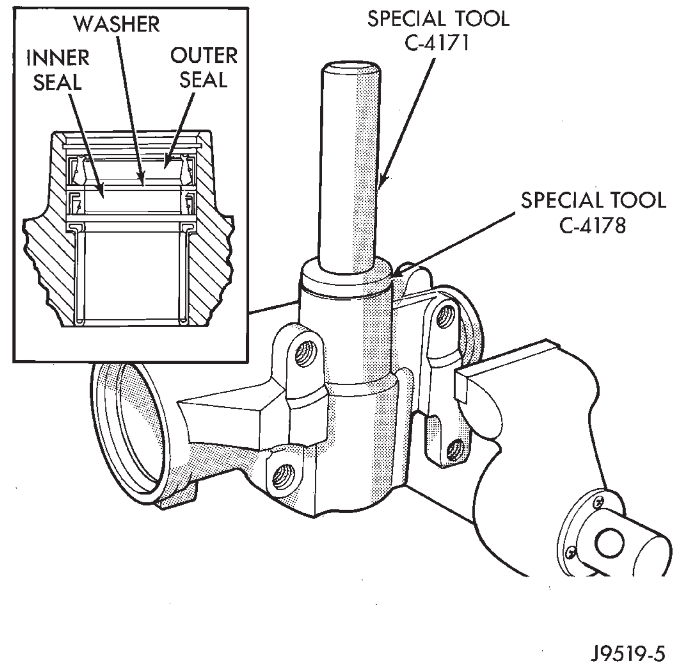


Fig. 38 Pitman Shaft Seal Installation

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

CHECK VALVE REPLACEMENT

REMOVE

(1) Remove steering gear from vehicle. Refer to Power Steering Gear Replacement in this section.

DISASSEMBLE

CAUTION: Use care not to damage the threads of the housing when prying out check valve.

(1) Remove valve by prying from housing with a small screwdriver.

ASSEMBLE

(1) Install the valve into the housing with a 3/8-inch diameter piece of tubing 100 mm (4 inches) long.

INSTALL

(1) Install steering gear. Refer to Power Steering Gear Replacement in this section.

POWER STEERING GEAR SPECIFICATIONS

Steering Gear Type . . . . Recirculating ball with hydraulic assist.

Ratio Code (Top of Gear)
- BH, NZ 14:1
- BF, XS 13-16:1
- AL 12.7:1

Steering Gear Hydraulic Fluid . . . . Use Mopar Power Steering Fluid, or equivalent.

Steering Gear Lubricants . . . . Lubricate pitman shaft seals, bearings races, and rack piston recirculating balls with petroleum jelly. Lubricate all other parts with power steering fluid.

Steering Gear Adjustments:
Wormshaft Bearing Preload Torque . . . . . 0.45–1.13 N·m (4 to 10 in-lbs)

Pitman Shaft Overcenter Drag Torque:
New Gear
(less than 400 miles/640 km) . . . . 0.45–0.90 N·m (4 to 8 in-lbs) in addition to wormshaft bearing preload but not to exceed combined total of 2 N·m (18 in-lbs).

Used Gear
(over 400 miles/640 km) . . . . 0.5–0.6 N·m (4 to 5 in-lbs) in addition to wormshaft bearing preload but not to exeed combined total of 2 N·m (18 in-lbs).

Caution: Gears must be adjusted exactly as outlined in Steering Gear Adjustments-On Bench. Failure to adhere to the recommended procedures may result in gear damage or improper steering response.

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STEERING COLUMN

INDEX

SERVICE INFORMATION

WARNING: THE AIR BAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO SERVICE 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. THIS HARDWARE IS SPECIFICALLY DESIGNED FOR THE AIR BAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS IN THE PARTS BOOK.

BEFORE SERVICING A COLUMN EQUIPPED WITH AIR BAG, REFER TO GROUP 8M, ELECTRICAL FOR PROPER AND SAFE PROCEDURES.

The Acustar columns (Fig.1) have been designed to be serviced as an assembly; less wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the column from the vehicle. For additional information on electrical components refer to Group 8, Electrical.

CAUTION: Bumping, jolting and hammering on the steering column shaft must be avoided during all service procedures.

CAUTION: Disconnect negative (ground) cable from the battery before servicing any component on the column.

Safety goggles should be worn at all times when involved with steering column service.

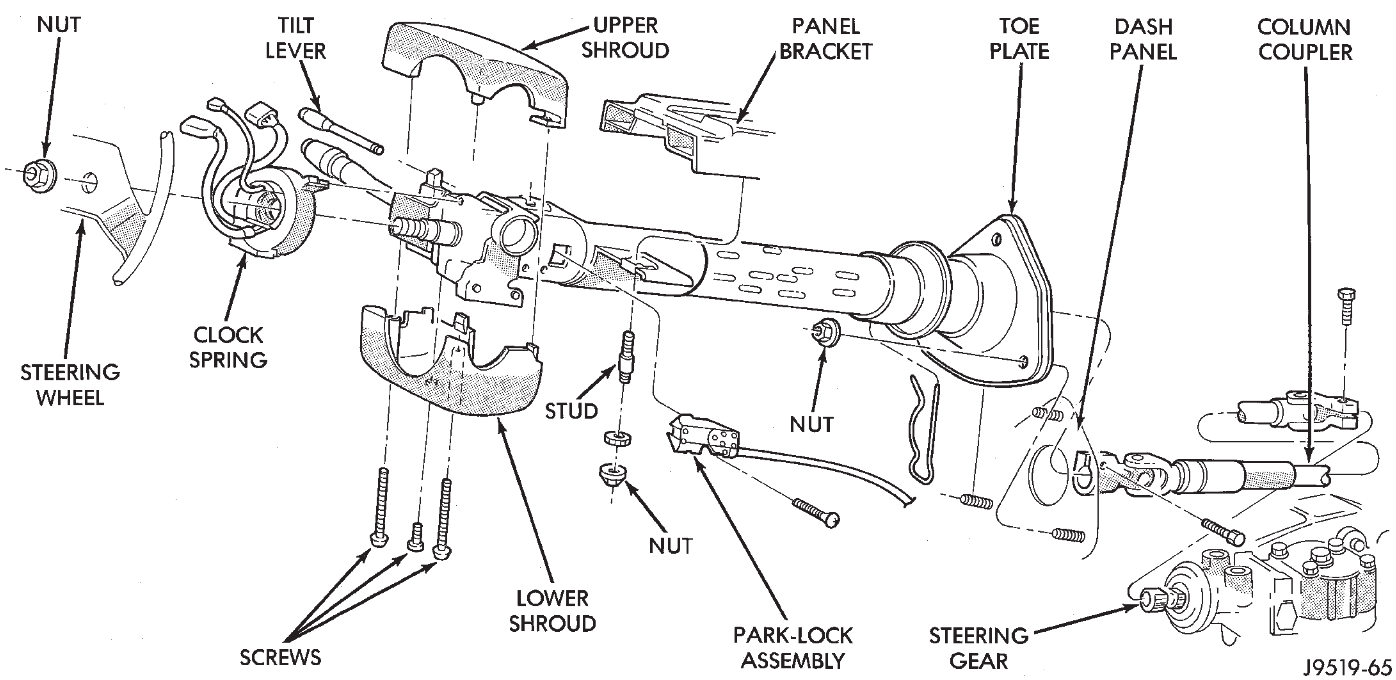

Fig. 1 Acustar Steering Column

STEERING WHEEL

WARNING: BEFORE SERVICING AIR BAG SYSTEM, REMOVE AND ISOLATE THE BATTERY NEGATIVE (-) CABLE (GROUND) FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT AND POSSIBLE INJURY. WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT THE BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES, THEN BEGIN AIR BAG REMOVAL.

REMOVAL

(1) Make sure the front wheels are in the **straight ahead** position and steering column locked in place.

(2) Disconnect the battery negative (ground) cable and isolate.

(3) Wait 2 minutes for the reserve capacitor to discharge before removing undeployed air bag module.

(4) Remove the air bag module and speed control switch (if equipped) and disconnect the wire feeds (Fig. 2).

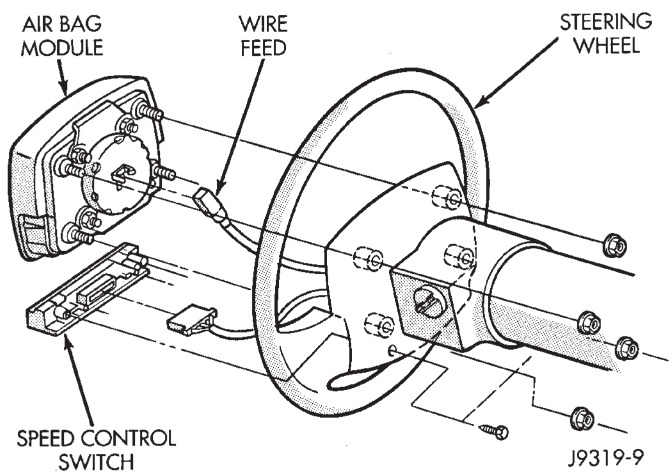

Fig. 2 Air Bag Module and Speed Control

(5) Disconnect the wire feed to the horn buttons.

(6) Remove the steering wheel retaining nut. Score or paint alignment marks on the column shaft and steering wheel (if none exist) for installation reference.

(7) Remove the steering wheel with a universal puller (Fig. 3). **Do not hammer or jolt the steering column or shaft during removal of the wheel.**

INSTALLATION

(1) Install the steering wheel on column with the scored marks or master splines aligned. Ensure the wheel compresses the 2 lock tabs on the clockspring.

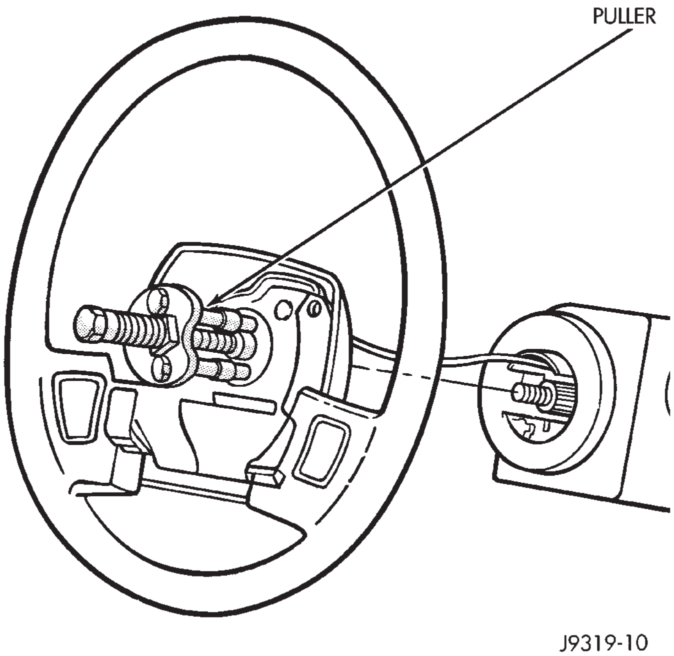

Fig. 3 Steering Wheel Removal

(2) Pull the air bag and speed control wires through the lower, larger hole in the steering wheel. Pull the horn wire through the smaller hole at the top.

WARNING: ENSURE THE AIR BAG WIRES ARE NOT PINCHED.

(3) Install the retaining nut and tighten to 61 N·m (45 ft. lbs.) torque. **Force the steering wheel down on the shaft with the retaining nut only. Do not hammer or shock the column with sudden impact to install the wheel.**

(4) Connect the wire feed to the horn buttons.

(5) Connect the wire feeds to the air bag module and speed control switch (Fig. 2). Tighten the air bag module nuts to 10 N·m (90 in. lbs.) torque.

WARNING: ENSURE THE AIR BAG WIRE CONNECTION IS COMPLETELY SEATED. THE LATCHING CLIP ARMS MUST BE VISIBLE ON TOP OF THE CONNECTOR HOUSING ON THE MODULE.

(6) Do not connect the battery ground (negative) cable. Refer to Air Bag System Check within Group 8M for additional information.

CLOCKSPRING

WARNING: BEFORE SERVICING AIR BAG SYSTEM, REMOVE AND ISOLATE BATTERY NEGATIVE (-) CABLE (GROUND) FROM VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT, AND POSSIBLE INJURY. WHEN AN UNDEPLOYED AIR BAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT THE BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES, THEN BEGIN AIR BAG REMOVAL.

REMOVAL

(1) Place the front wheels in the straight ahead position before starting the repair.

(2) Disconnect battery negative cable and isolate.

(3) Wait 2 minutes for the reserve capacitor to discharge before removing undeployed module.

(4) Remove the steering wheel and air bag, refer to Steering Wheel Removal.

(5) Remove upper and lower steering column shrouds to gain access to the clockspring wiring.

(6) Release wire connector at clockspring.

(7) Pull clockspring assembly from column by lifting locking fingers as necessary. The clockspring cannot be repaired, and must be replaced if faulty.

INSTALLATION

(1) Snap clockspring assembly onto column. If clockspring is not properly positioned, follow the centering procedures before installing steering wheel.

(2) Connect the wire connector to the clockspring.

WARNING: ENSURE CLOCKSPRING WIRE CONNECTION IS COMPLETELY SEATED. THE LATCHING CLIP ARMS MUST BE PROPERLY ENGAGED ON THE MODULE.

(3) Install upper and lower steering column shrouds. Be sure wiring is inside of shrouds and not pinched.

(4) Install the steering wheel and air bag module, refer to Steering Wheel Installation.

CENTERING PROCEDURE

If the rotating tape within the clockspring is not positioned properly, the clockspring may fail during use. The following procedures MUST BE USED to center the clockspring;

- If it is not known to be properly positioned
- If the front wheels were moved from the straight ahead position

(1) Place the front wheels in the straight ahead position before starting the procedure.

(2) Depress the 2 locking tabs to disengage the locking mechanism (Fig. 4).

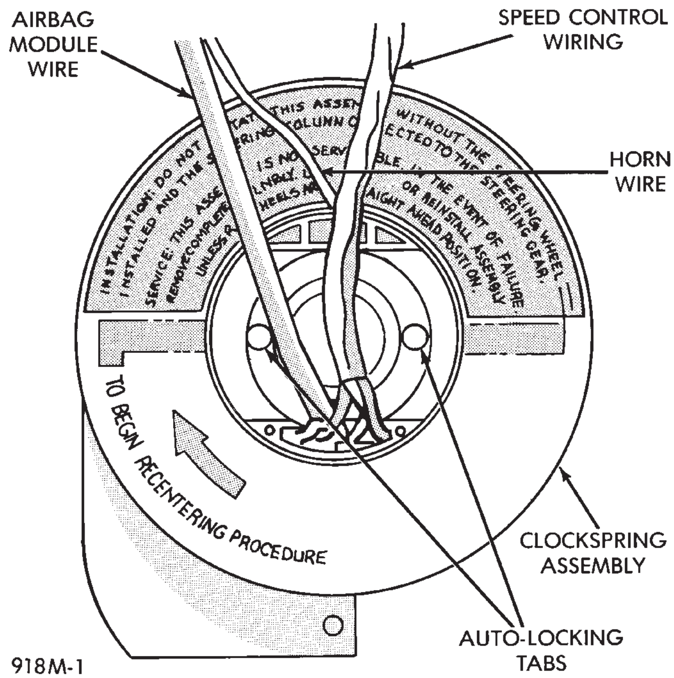

Fig. 4 Clockspring (Auto-Locking)

(3) Keeping the mechanism disengaged, rotate the clockspring rotor in the CLOCKWISE DIRECTION to the end of the travel. Do not apply excessive torque.

(4) From the end of travel, rotate the rotor 2 1/2 full turns in the COUNTER CLOCKWISE direction. The horn wire should end up at the top and the squib wire at the bottom (Fig. 4).

(5) Install the steering wheel and air bag module, refer to Steering Wheel Installation.

COLUMN ASSEMBLY REPLACEMENT

CAUTION: Bumping, jolting and hammering on the steering column shaft and gear shift tube must be avoided during all service procedures.

REMOVAL

(1) Make sure the front wheels are in the **straight ahead** position.

(2) Observe Cautions and disconnect the negative (ground) cable from the battery.

(3) Remove steering wheel from column, refer to Steering Wheel-Removal and observe Cautions/Warnings.

(4) Remove column coupler upper pinch bolt (Fig. 5).

(5) Remove the trim panel column cover and support plate (Fig. 6).

(6) Remove tilt lever (if equipped) from column.

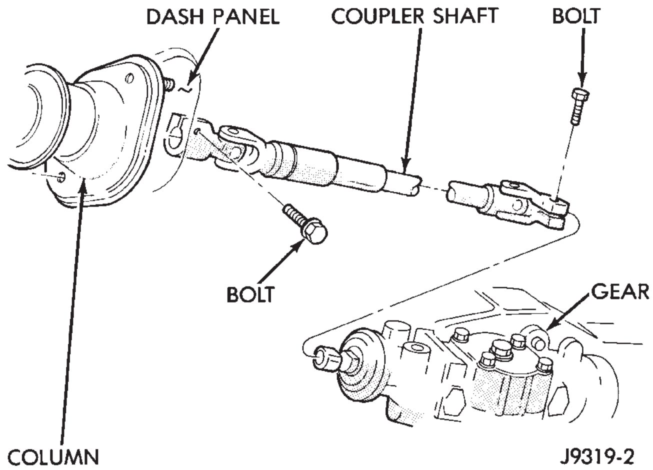

Fig. 5 Column Coupler Shaft

(7) Remove the upper and lower lock housing shrouds (Fig. 1).

(8) Remove the heater cross over tube from under the column.

(9) Loosen the panel bracket nuts/studs to allow the column to drop.

(10) Remove the wiring harness from steering column (Fig. 7).

(11) Remove the Interlock cable from the steering column. Refer to Automatic Transmission Shifter/Ignition Interlock in this group.

(12) Remove the toe plate to dash panel nuts (Fig. 1).

(13) Remove the panel bracket nuts/studs and remove the column. Use care to avoid damaging the paint or trim.

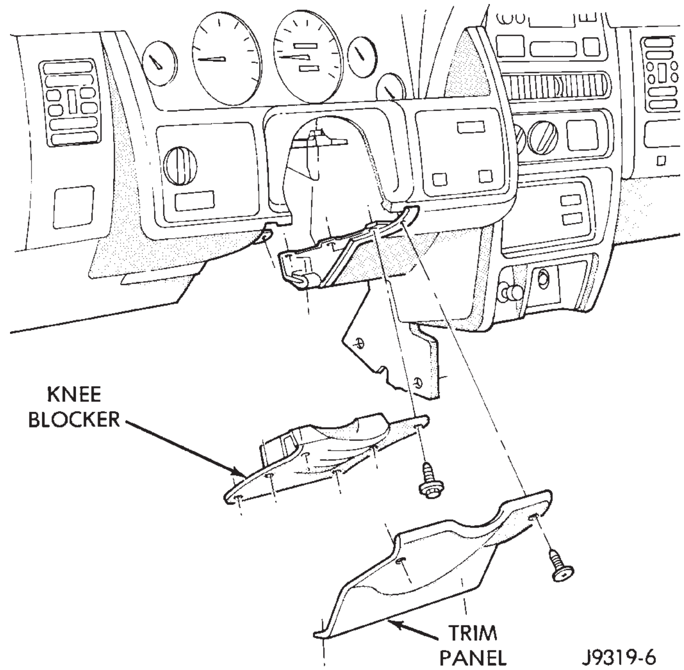

Fig. 6 Trim Panel Column Cover

INSTALLATION

CAUTION: Bumping, jolting and hammering on the steering column shaft and gear shift tube must be avoided during all service procedures.

(1) With the front wheels in the straight ahead position. Align and install the column to coupler. **Do not apply force at the top of the steering column shaft.**

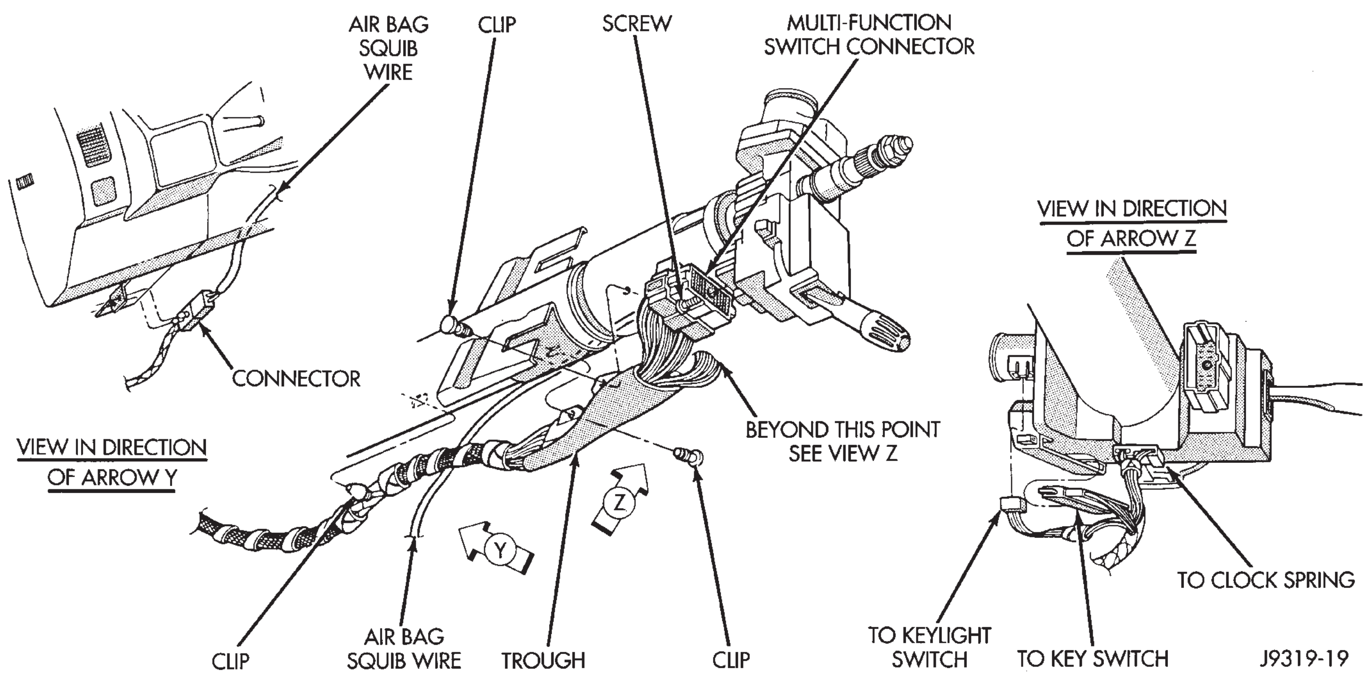

Fig. 7 Steering Column Wiring Harness

(2) Ensure the ground clip is on the left spacer slot (Fig. 8).

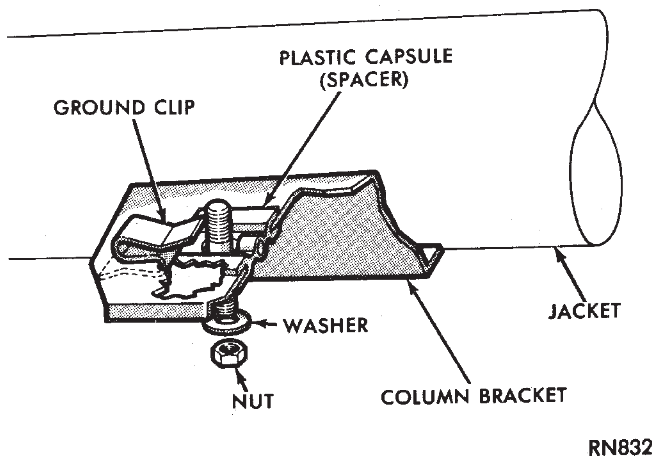

Fig. 8 Ground Clip & Spacer Installation

(3) Install the Interlock cable from the steering column. Refer to Automatic Transmission Shifter/Ignition Interlock in this group.

(4) Install wiring harness connections to steering column (Fig. 7).**Ensure the wiring is not pinched and all connections are correctly locked in place.**

(5) Install shaft coupler pinch bolt loose, load column up to panel bracket.

(6) Be sure both spacers are fully seated in the column support bracket. Tighten the column panel bracket support nuts/studs to 12 N·m (105 in. lbs.) torque. **Ensure the nut is installed on the SHORT threaded side of the stud (Fig. 1).**

(7) Tighten the toe plate attaching nuts (Fig. 1) to 12 N·m (105 in. lbs.) torque.

(8) Tighten the coupler pinch bolt to 47 N·m (35 ft. lbs.) torque.

(9) Install the heater cross over tube under the column.

(10) Install the upper and lower shrouds. Install the tilt lever (if equipped).

(11) Install the trim panel column cover and support plate.

(12) Install the steering wheel, refer to Steering Wheel Installation and observe cautions.

(13) Remove the column shaft shipping lock pin (installed in service column).

(14) Connect the battery ground (negative) cable.

COLUMN COMPONENT SERVICE

The Acustar columns have been designed to be serviced as an assembly; less wiring, switches, shrouds, steering wheel, etc. Also most steering column components can be serviced without removing the column from the vehicle. For additional information on electrical components refer to Group 8, Electrical.

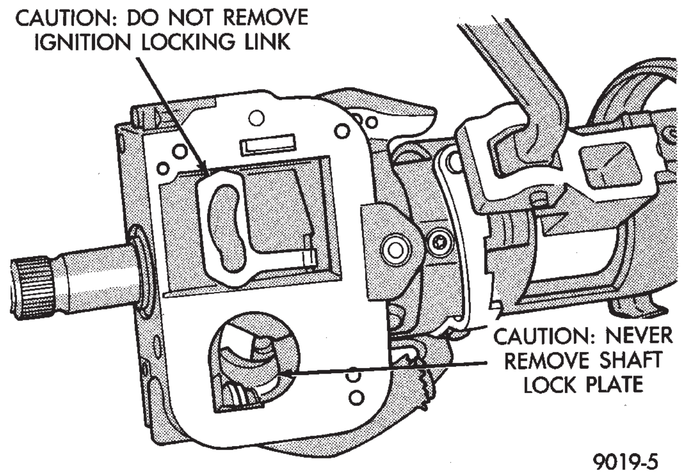

Fig. 9 Observe Cautions

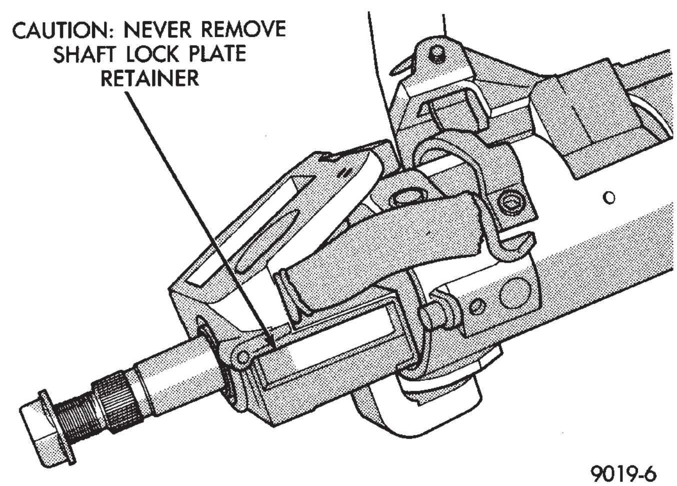

Fig. 10 Observe Cautions

AUTOMATIC TRANSMISSION SHIFTER/IGNITION INTERLOCK MECHANISM

The automatic transmission Shifter/Ignition Interlock, is a cable operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 1). The system locks the shifter into the PARK position. The Interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. When the key is in the OFF or RUN position the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position (Fig. 2). Unless the shifter is fully locked into the PARK position.

INTERLOCK CABLE REPLACEMENT

REMOVAL

(1) Lower the steering column. Refer to Column Assembly Replacement in this group.

(2) Remove two screws retaining the interlock mechanism to the column (Fig. 3). Unsnap the mechanism from column.

(3) Remove the center console and related trim. Refer to Group 23, Body.

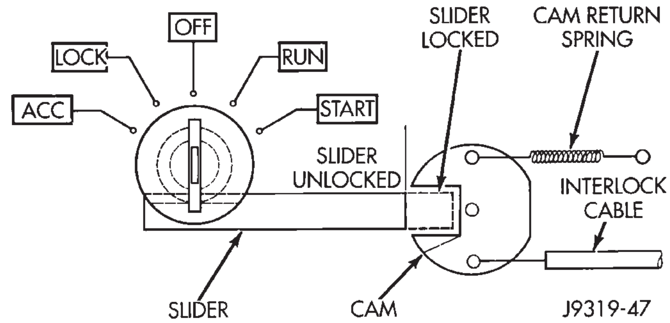

Fig. 2 Ignition Key Cylinder Actuation

(4) Disconnect the cable eyelet from the bellcrank (Fig. 4).

(5) Disconnect and remove the cable from the shift bracket.

(6) Remove the accelerator pedal (the cable routes under the pedal), refer to Group 14, Fuel Systems. Release the cable from the accelerator pedal clip. Move the carpet as necessary to remove the cable.

INSTALLATION/ADJUSTMENT

(1) Snap the cable base assembly into the large square opening in the steering column.

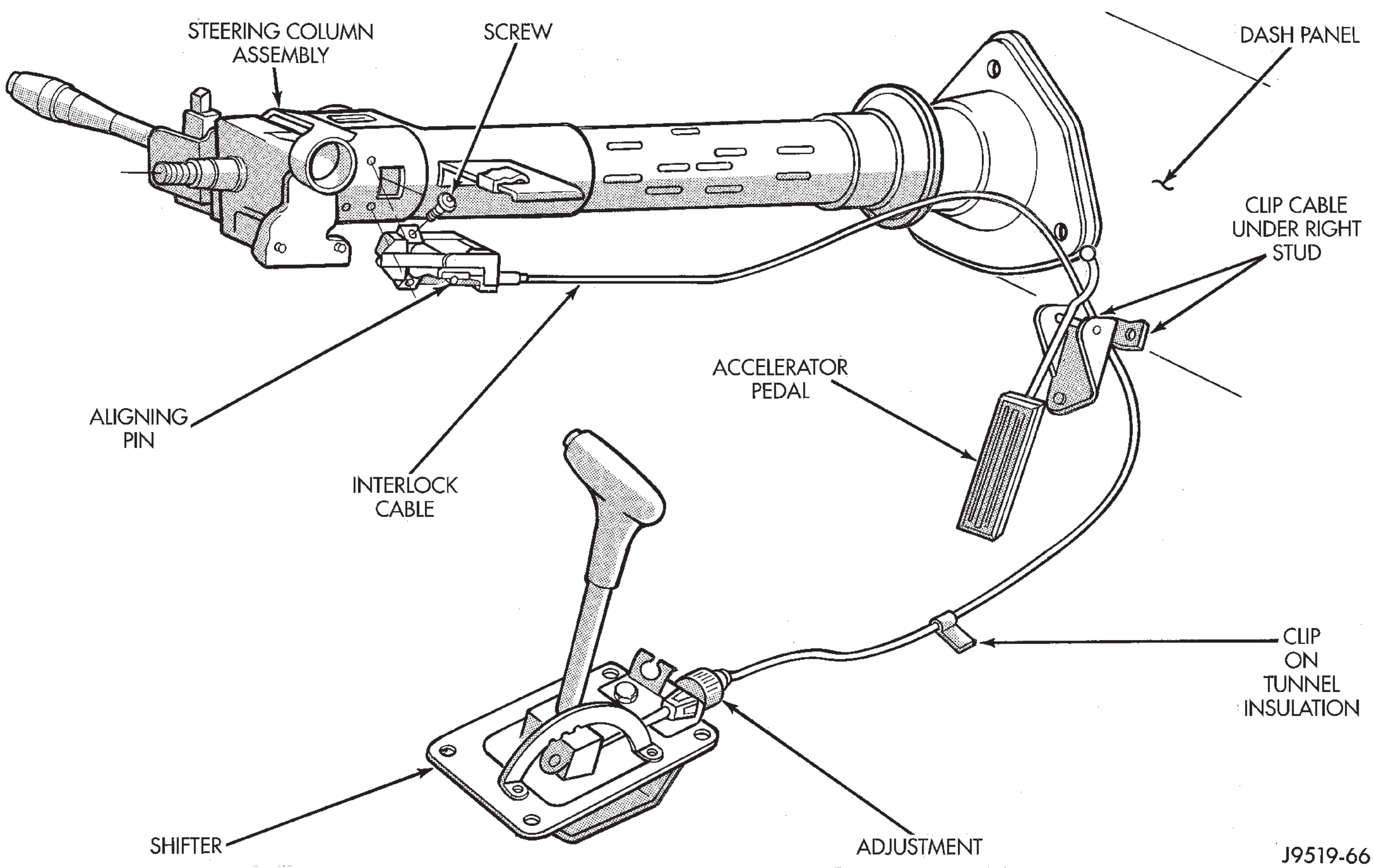

Fig. 1 Ignition Interlock Cable Routing

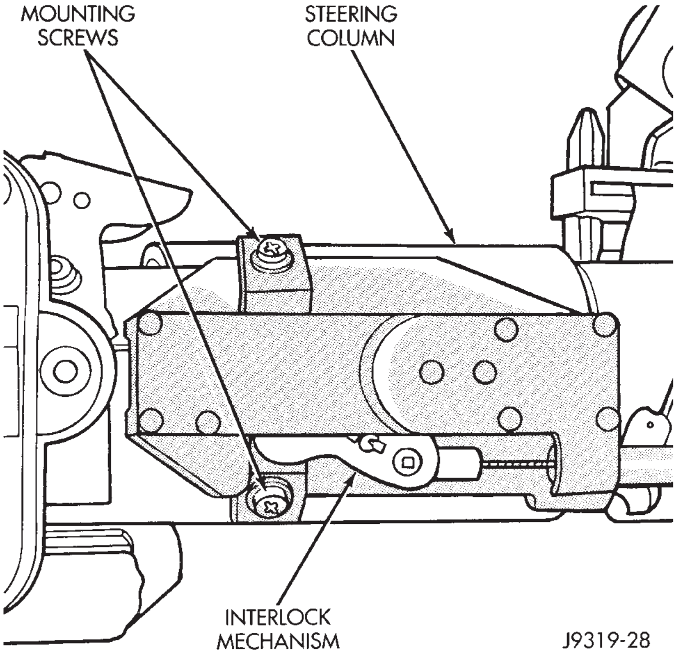

Fig. 3 Interlock Mechanism on Column

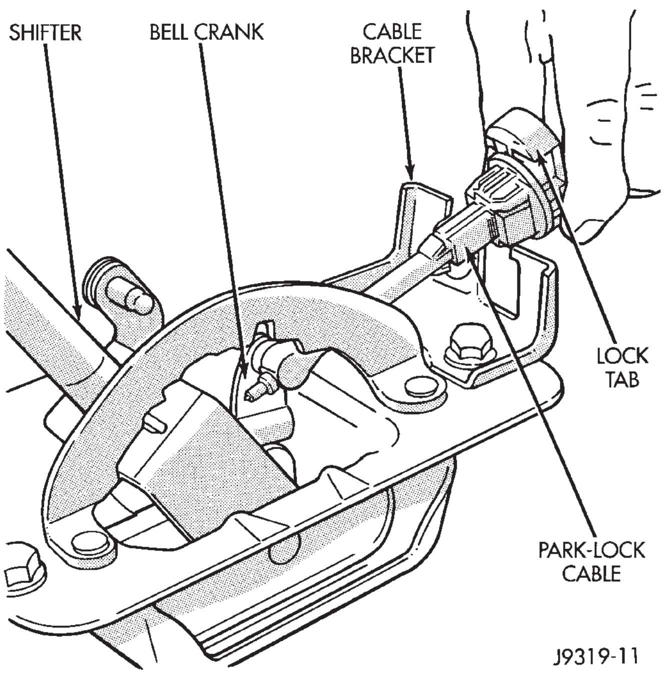

Fig. 4 Cable and Shifter

(2) Secure the plastic base with two (2) self tapping screws (Fig. 3).

CAUTION: Interlock cable must be clipped to the RIGHT HAND STUD under the throttle pedal. This is to prevent interference with the throttle pedal.

(3) Route the cable between the accelerator pedal mounting studs and secure with clip (Fig. 1). Be sure clip is on right hand stud.

(4) Place the ignition key cylinder in the ACCESSORY position.

(5) Remove shipping pin from plastic base.

(6) Connect the cable eyelet to the bellcrank pin (Fig. 10).

(7) Place gear selector in PARK.

(8) Push the spring-loaded cable adjuster forward and snap cable into bracket (Fig. 3).

(9) Push the cable adjuster lock clamp downward to lock it.

(10) Install the center console and related trim. Refer to Group 23, Body.

(11) Test the park-lock cable operation.

(12) Load the steering column up to the bracket. Refer to Column Assembly Replacement in this group.

TEST/INSPECTION

(1) Turn the ignition switch key to the LOCK position.

(2) Press inward on the gear selector handle release button, the button should not move.

(3) Turn the ignition switch key to the ON position.

(4) Press inward on the gear selector handle release button.

(5) Move the gear selector handle to the DRIVE or NEUTRAL position.

(6) Attempt to turn the ignition switch key to the LOCK position.

(7) If the park-lock cable is correctly adjusted, the key will not turn to the LOCK position.

(8) Press inward on the gear selector handle release button and move the gear selector handle to the PARK position.

(9) Turn the ignition switch key to the LOCK position. If the park-lock cable is correctly adjusted, the key will turn to the LOCK position.

(10) If additional cable adjustment is required, slide the adjuster forward or rearward to obtain the correct position. Refer to Group 21, Transmission for additional information involving shift cable adjustment.

TORQUE SPECIFICATIONS

STEERING GEAR

DESCRIPTION	TORQUE
Adjustment Plug Initial Adjustment	109 N•m (80 ft. lbs.)
Adjustment Plug Locknut	109 N•m (80 ft. lbs.)
Adjustment Screw Locknut	49 N•m (36 ft. lbs.)
Coupler Shaft Pinch Bolts	44 N•m (33 ft. lbs.)
Gear to Frame Bolts	88 N•m (65 ft. lbs.)
Pitman Arm (Shaft) Nut	251 N•m (185 ft. lbs.)
Return Guide Clamp Screw	58 N•m (43 in. lbs.)
Rack-Piston Plug	102 N•m (75 ft. lbs.)
Side Cover Bolts	60 N•m (44 ft. lbs.)

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STEERING LINKAGE

DESCRIPTION	TORQUE
Drag Link to Steering Knuckle Nut	74 N•m (55 ft. lbs.)
Drag Link to Pitman Arm Nut	74 N•m (55 ft. lbs.)
Drag Link Adjustment Clamp Nut	49 N•m (36 ft. lbs.)
Pitman Arm (Shaft) Nut	251 N•m (185 ft. lbs.)
Steering Dampener to Axle Bracket Nut	74 N•m (55 ft. lbs.)
Steering Dampener to Drag Link Nut	74 N•m (55 ft. lbs.)
Tie Rod to Steering Knuckle Nut	47 N•m (35 ft. lbs.)
Tie Rod Clamp Nut	27 N•m (20 ft. lbs.)

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STEERING PUMP

DESCRIPTION	TORQUE
Adjustment Bracket Bolts	28 N•m (21 ft. lbs.)
Flow Control Valve to Pump Body	75 N•m (55 ft. lbs.)
High Pressure Fluid Fitting at Pump and Gear	28 N•m (21 ft. lbs.)
Return Fluid Fitting at Gear	28 N•m (21 ft. lbs.)
5.2L Pump Bracket to Block	41 N•m (30 ft. lbs.)
5.2L Pump Body to Bracket	27 N•m (20 ft. lbs.)

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STEERING COLUMN

DESCRIPTION	TORQUE
Air Bag Module Nuts	10 N·m (90 in. lbs.)
Steering Wheel to Column Shaft Nut	61 N·m (45 ft. lbs.)
Toe Plate Bolts/Nuts	12 N·m (105 in. lbs.)
Upper Bracket Support Stud/Nuts	12 N·m (105 in. lbs.)
Coupler Shaft Pinch Bolts	29 N·m (21 ft. lbs.)

J9519-67

TRANSMISSION AND TRANSFER CASE

CONTENTS

AX 15 MANUAL TRANSMISSION

INDEX

GENERAL INFORMATION

The AX 15 is a five speed, synchromesh, manual transmission. Fifth gear is an overdrive range with a ratio of 0.79:1. The shift mechanism is integral and mounted in the shift tower portion of the adapter housing (Fig. 1). The AX 15 is used with 4.0L (I6) engines.

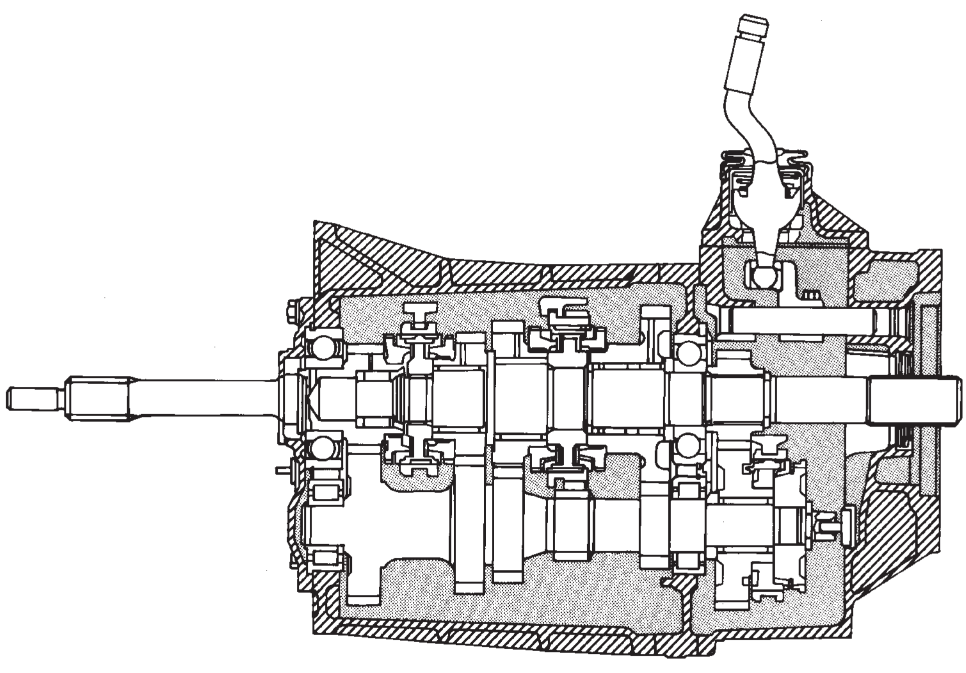


Fig. 1 AX 15 Manual Transmission

TRANSMISSION IDENTIFICATION

The AX 15 identification code numbers are on the bottom surface of the transmission gear case (Fig. 2).

The first number represents year of manufacture. For example, 4 would represent 1994. The second and third numbers indicate month of manufacture. For example, 11 would represent November. The last series of numbers is the transmission serial number.

TRANSMISSION SHIFT PATTERN

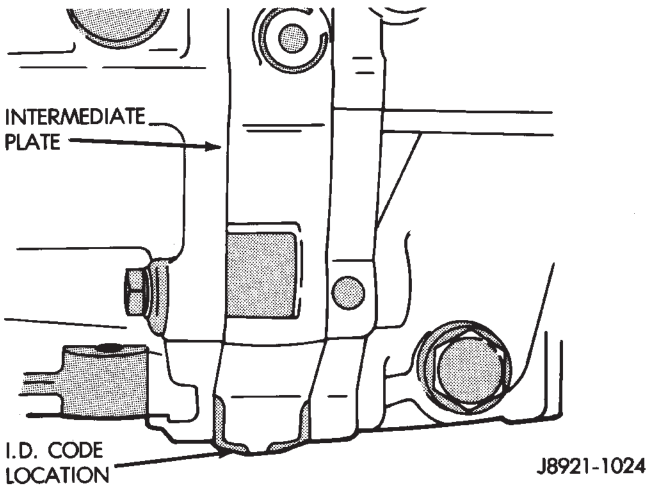


Fig. 2 Transmission Identification Code Location

The AX 15 shift pattern is shown in Figure 3. First and second and third and fourth gear ranges are in an H pattern. Fifth and reverse gear ranges are also in line at the right of the H pattern (Fig. 3).

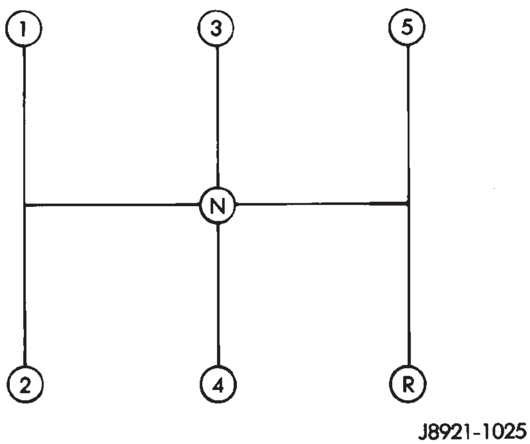


Fig. 3 AX 15 Shift Pattern

TRANSMISSION LUBRICANT

Recommended lubricant for AX 15 transmissions is Mopar SAE 75W-90, API Grade GL-5 gear lubricant.

Correct lubricant level is from the bottom edge, to no more than 6 mm (1/4 in.) below the bottom edge of the fill plug hole.

Lubricant capacity is approximately 3.10 liters (3.27 qts.).

TRANSMISSION SWITCH AND PLUG LOCATIONS

The fill plug is at the driver side of the gear case (Fig. 4).

The drain plug and backup light switch are on the passenger side of the gear case (Fig. 5).

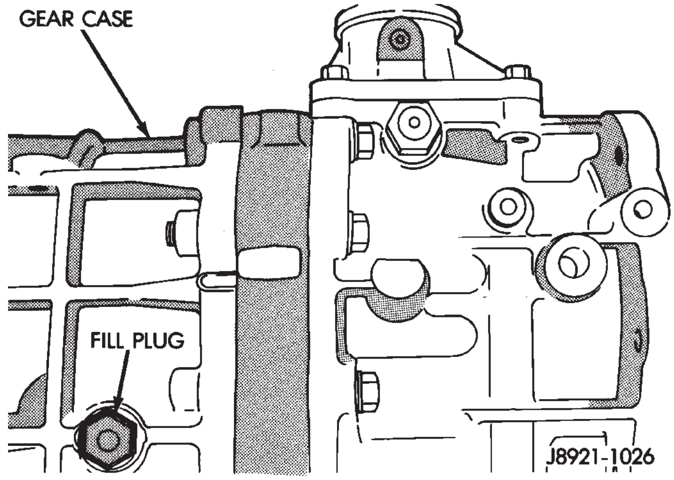


Fig. 4 Fill Plug Location

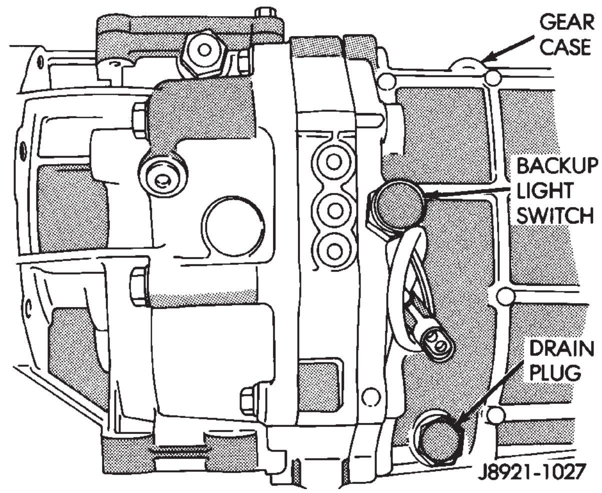


Fig. 5 Drain Plug And Backup Light Switch Location

TRANSMISSION GEAR RATIOS

AX 15 transmission gear ratios are:

First gear - 3.83:1
Second gear - 2.33:1
Third gear - 1.44:1
Fourth gear - 1.00:1
Fifth gear - 0.79:1
Reverse - 4.22:1

TRANSMISSION DIAGNOSIS

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill, or an incorrect lubricant level check.

Leaks can occur at the mating surfaces of the gear case, intermediate plate and adapter housing, or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at the rear of the adapter housing will be from the housing oil seals. Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non-recommended sealer.

A leak at the front of the transmission are from the front bearing retainer or retainer seal. Lubricant may be seen dripping from the clutch housing after extended operation. If the leak is severe, it may also contaminate the clutch disc causing slip, grab and chatter.

Transmissions filled from air or electrically powered lubricant containers can be underfilled. This generally happens when the container delivery mechanism is improperly calibrated. Always check the lubricant level after filling to avoid an under fill condition.

A correct lubricant level check can only be made when the vehicle is level; use a drive-on hoist to ensure this. Also allow the lubricant to settle for a minute or so before checking. These recommendations will ensure an accurate check and avoid an under-or-overfill condition.

HARD SHIFTING

Hard shifting is usually the result of a low lubricant level, improper or contaminated lubricants, component damage, incorrect clutch adjustment, or by a damaged clutch pressure plate or disc.

Substantial lubricant leaks can result in gear, shift rail, synchro and bearing damage. If a leak goes undetected for an extended period, the first indications of a problem are hard shifting and noise.

Incorrect or contaminated lubricants also contribute to hard shifting. The consequence of using non-recommended lubricants is noise, excessive wear, internal bind and hard shifting.

Improper clutch release is a frequent cause of hard shifting. Incorrect adjustment or a worn, damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts can result.

Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears can generate a mild whine that may only be audible at extreme speeds.

Severe transmission noise is generally the result of a lubricant problem, or internal component damage. Insufficient, improper, or contaminated lubricant can promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear breakage.

SPEEDOMETER SERVICE

Rear axle gear ratio and tire size determine speedometer pinion requirements. If the pinion must be replaced, refer to the parts catalogue information for the correct part.

SPEEDOMETER ASSEMBLY REMOVAL

(1) Raise vehicle.
(2) Disconnect wires from vehicle speed sensor.
(3) Remove adapter clamp and screw (Fig. 6).

ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

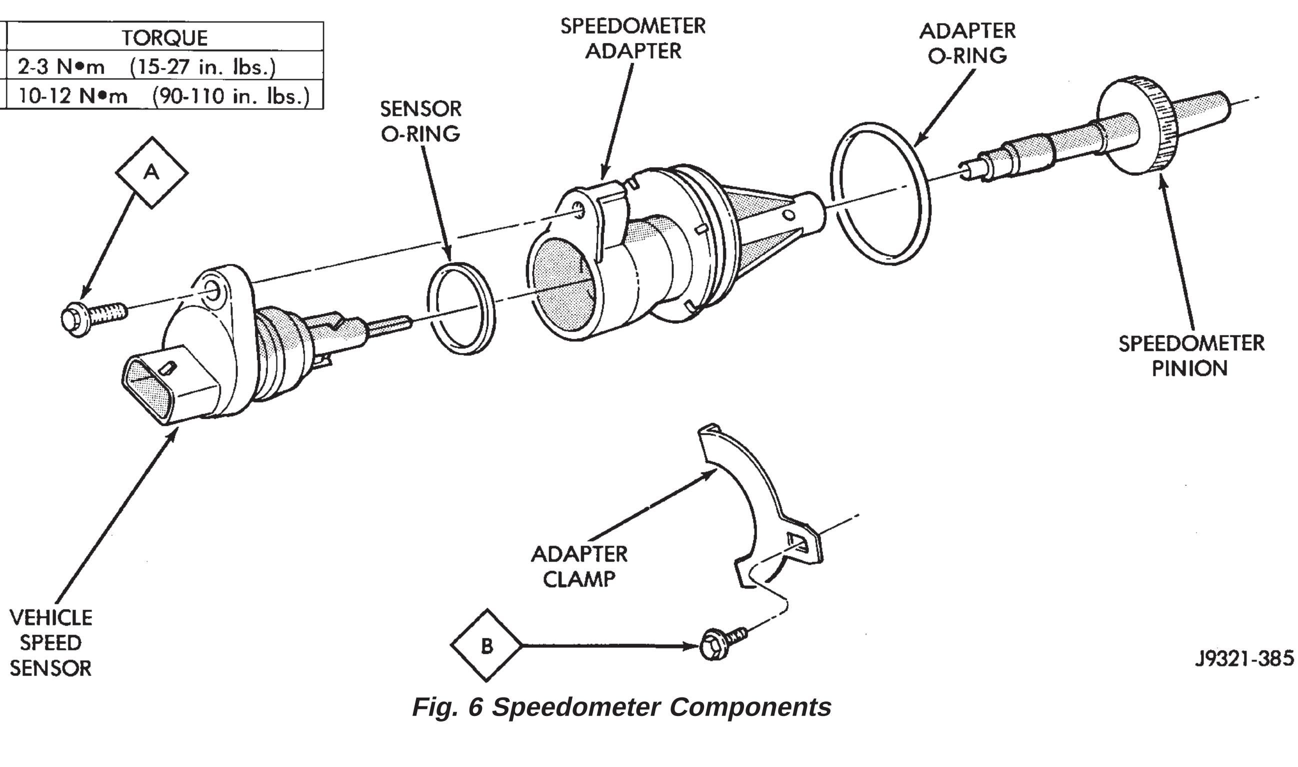


Fig. 6 Speedometer Components

(4) Remove speed sensor and speedometer adapter as assembly.

(5) Remove speed sensor retaining screw and remove sensor from adapter.

(6) Remove speedometer pinion from adapter.

(7) Inspect sensor and adapter O-rings (Fig. 6). Remove and discard O-rings if worn or damaged.

(8) Inspect terminal pins in speed sensor. Clean pins with Mopar electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or pins are loose, severely corroded, or damaged.

SPEEDOMETER INSTALLATION AND INDEXING

(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.

(2) Install new O-rings on speed sensor and speedometer adapter if necessary (Fig. 6).

(3) Lubricate sensor and adapter O-rings with transmission fluid.

(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.

(5) Install speedometer pinion in adapter.

(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.

(7) Note index numbers on adapter body (Fig. 7). These numbers will correspond to number of teeth on pinion.

(8) Install speedometer assembly in housing.

(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.

(12) Lower vehicle and top off transmission fluid level if necessary.

TRANSMISSION REMOVAL

(1) Shift transmission into Neutral.

(2) Raise vehicle on hoist.

(3) Remove skid plate.

(4) Mark front and rear propeller shafts for installation alignment (Fig. 8). Then remove shafts.

(5) Disconnect transfer case shift linkage from shift lever, or range lever.

(6) Disconnect harness wires at vehicle speed sensor (Fig. 6).

(7) Remove harness wires from clips on transmission case.

(8) Disconnect transmission and transfer case vent hoses.

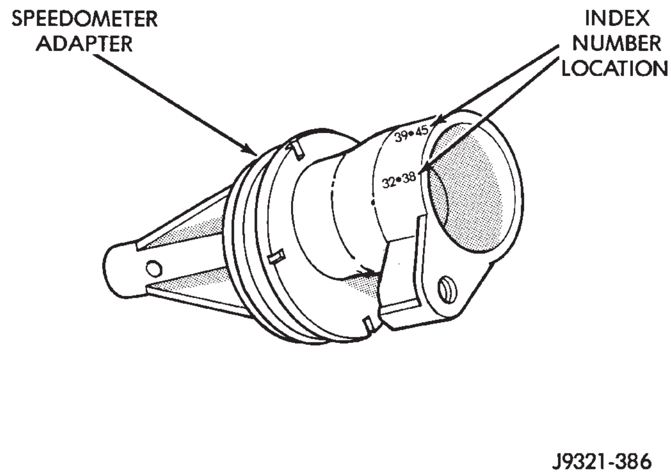


Fig. 7 Location Of Index Numbers On Speedometer Adapter

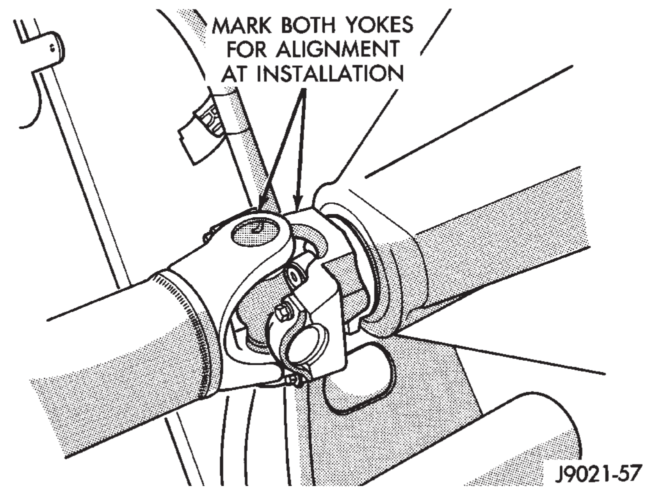


Fig. 8 Marking Propeller Shaft And Axle Yoke

(9) Disconnect wires at transfer case electrical switch.

(10) Support transmission with transmission jack. Secure transmission on jack with safety chains.

(11) Support engine with jack positioned under clutch housing or oil pan flange.

(12) Remove bolts/nuts attaching rear mount to crossmember (Fig. 9).

(13) Remove rear crossmember.

(14) Remove transfer case attaching nuts and remove transfer case from transmission.

(15) Lower transmission enough to provide access to shift lever.

(16) Reach up and around transmission case and unseat shift lever dust boot from transmission shift tower (Fig. 10). Move boot upward on shift lever for access to lever retainer.

(17) Disengage transmission shift lever as follows:

(a) Reach up and around transmission case and press shift lever retainer downward with your fingers.

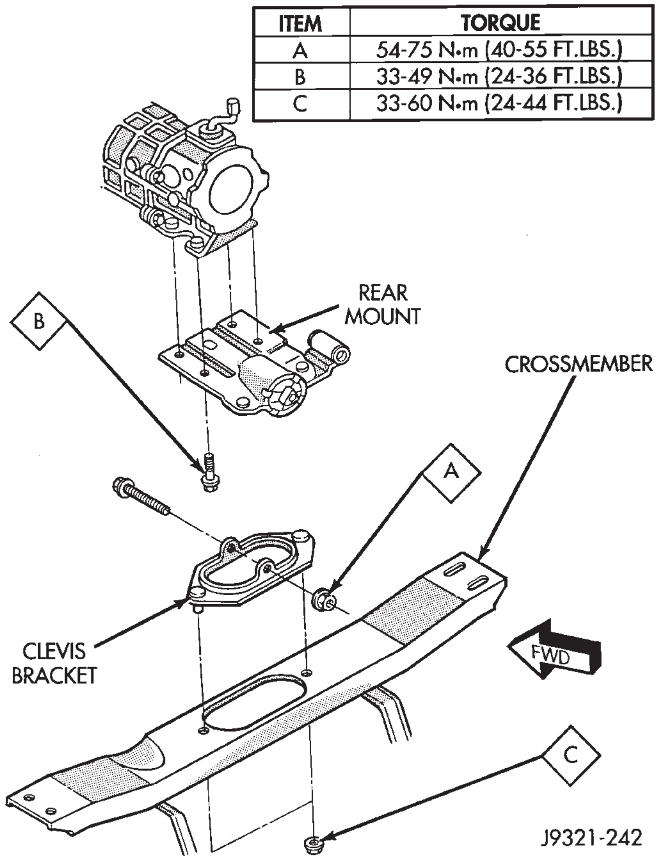


Fig. 9 Transmission Rear Mounting

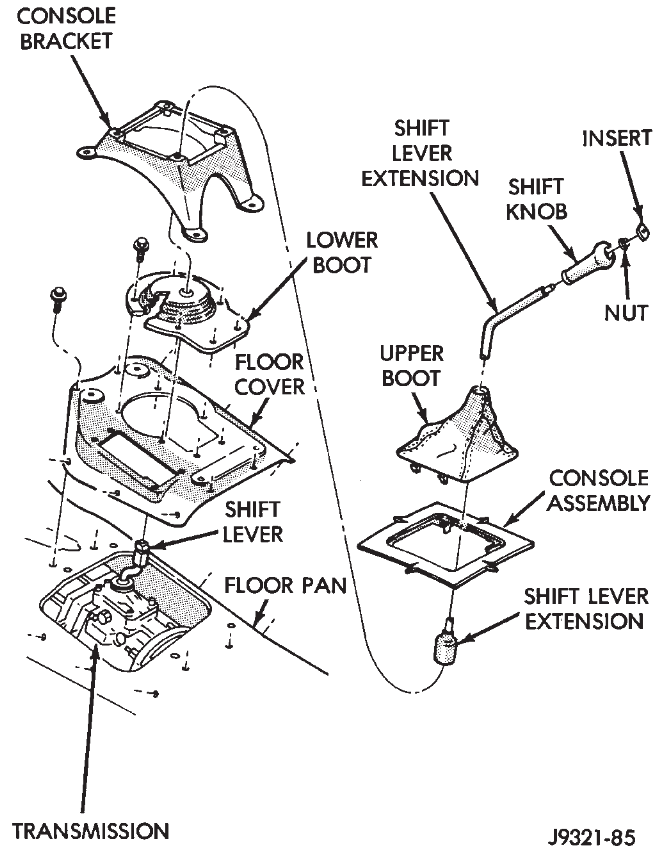


Fig. 10 Shift Lever Attachment

(b) Turn retainer counterclockwise to release it.

(c) Lift lever and retainer out of shift tower (Fig. 10). **It is not necessary to remove shift lever from floorpan boot. Simply leave lever in place for later installation.**

(18) Disconnect and remove engine timing sensor. Retain sensor attaching screws.

(19) Remove clutch slave cylinder from clutch housing. Move cylinder aside for working clearance and access to other components.

(20) Remove bolts attaching clutch housing to engine.

(21) Pull transmission rearward until clutch housing is clear of engine. Then remove transmission from under vehicle.

TRANSMISSION INSTALLATION

(1) Mount transmission and clutch housing assembly on transmission jack. Secure assembly with safety chains.

(2) Lubricate pilot bearing and transmission input shaft splines with Mopar high temperature grease.

(3) Align transmission input shaft and clutch disc splines and seat clutch housing on engine.

(4) Install and tighten bolts that clutch housing to engine. Tighten bolts to 61 N·m (45 ft. lbs.) torque.

(5) Lower transmission for access to transmission shift tower.

(6) Reach up and around transmission and insert shift lever in shift tower. Press lever retainer downward and turn it clockwise to lock it in place. Then install lever dust boot on shift tower.

(7) Align transfer case and transmission shafts and install transfer case. Tighten transfer attaching nuts to 35 N·m (26 ft. lbs.) torque.

(8) Move adjustable support stand from under engine and reposition it under transmission. Then remove transmission jack.

(9) Install rear crossmember. Tighten crossmember-to-frame bolts to 41 N·m (30 ft. lbs.) torque. Tighten transmission-to-rear support bolts/nuts to 45 N·m (33 ft. lbs.) torque.

(10) Install slave cylinder in clutch housing. Tighten cylinder attaching nuts securely.

(11) Connect or install engine timing sensor, if removed.

(12) Connect transfer case electrical switch wires.

(13) Connect transfer case shift rod to range lever.

(14) Connect transmission and transfer case vent hoses and indicator switch wires.

(15) Connect backup light switch wires.

(16) Connect vehicle speed sensor wires.

(17) Align and install front/rear propeller shafts. Tighten shaft U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(18) Install skid plate if removed. Tighten bolts to 42 N·m (31 ft. lbs.) torque. Tighten stud nuts to 17 N·m (150 in. lbs.) torque.

(19) Top off transmission and transfer lubricant levels.

(20) Lower vehicle.

TRANSMISSION DISASSEMBLY AND OVERHAUL

ADAPTER HOUSING REMOVAL

(1) Remove release bearing, release lever and release fork from clutch housing. Then remove clutch housing from transmission.

(2) Remove backup light switch. Then remove drain plug (Fig. 1) and drain transmission lubricant into pan.

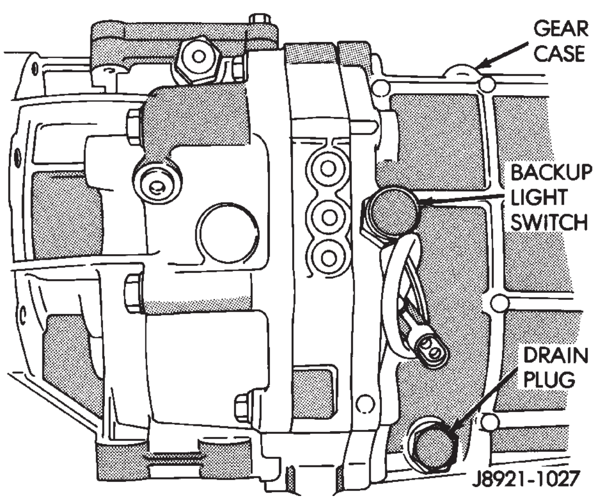


Fig. 1 Drain Plug And Backup Light Switch Location

(3) Remove shift tower bolts and remove tower from adapter or extension housing (Fig. 2).

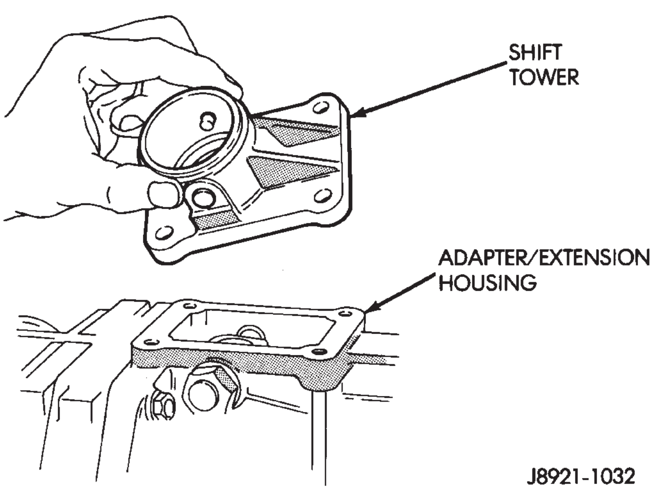


Fig. 2 Shift Tower Removal/Installation

(4) Remove gasket from shift tower (Fig. 3).

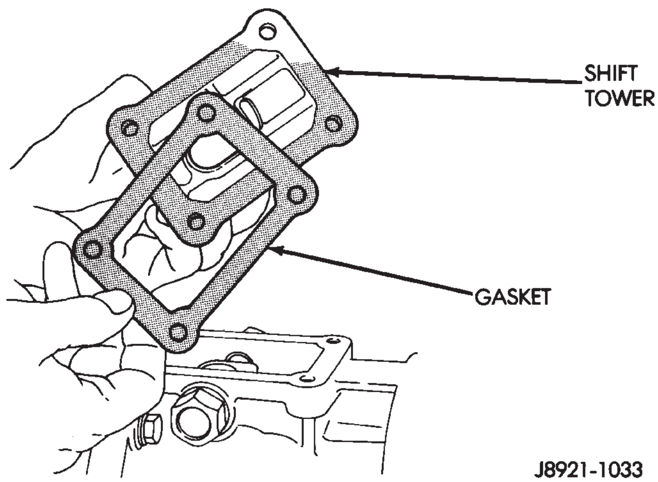


Fig. 3 Shift Tower Gasket Removal/Installation

(5) Remove shift arm retainer bolt (Fig. 4).

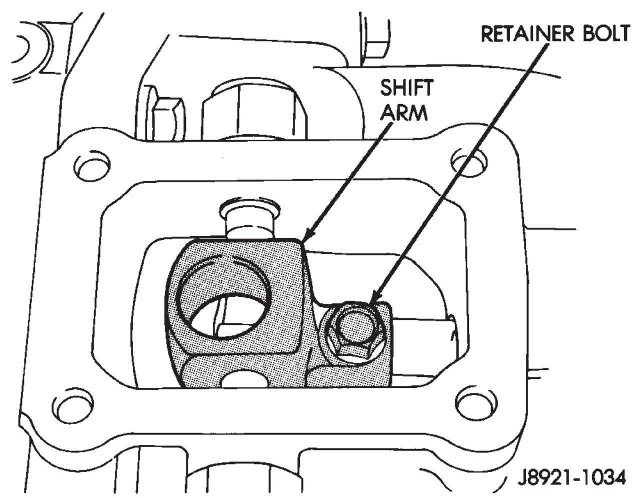


Fig. 4 Shift Arm Retainer Bolt Removal/Installation

(6) Loosen and remove restrictor pins (Fig. 5).

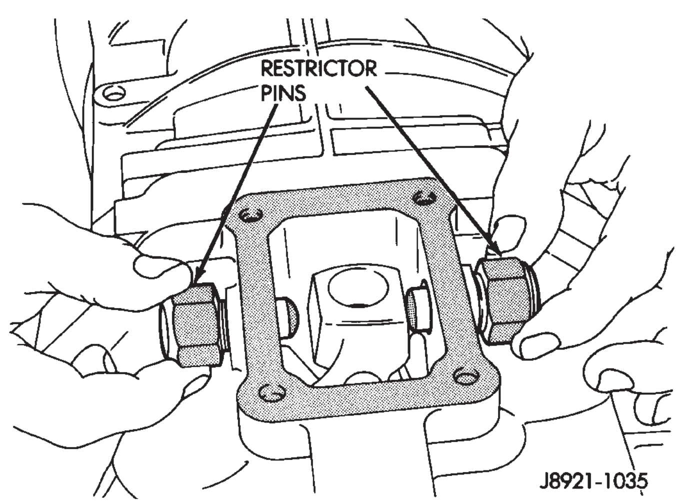


Fig. 5 Removing/Installing Restrictor Pins

(7) Remove shift arm shaft plug (Fig. 6).

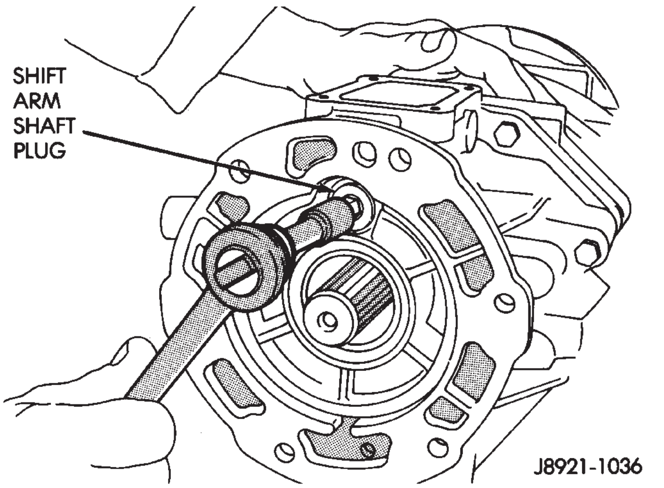


Fig. 6 Removing/Installing Shift Arm Shaft Plug (4WD)

(8) Remove shift arm shaft with large magnet (Fig. 7).

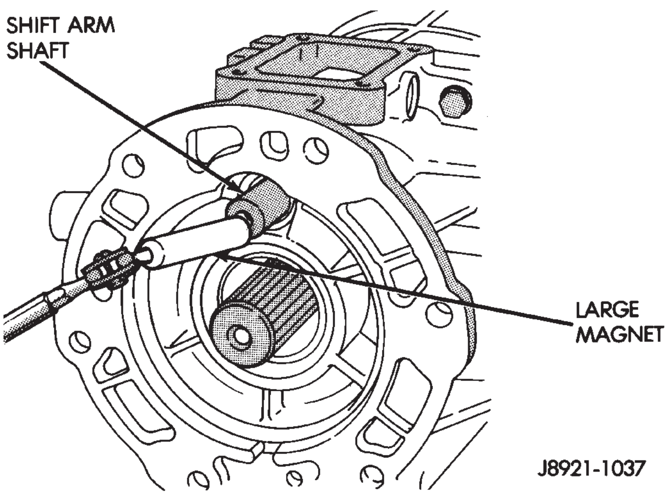


Fig. 7 Removing/Installing Shift Arm Shaft (4WD)

(9) Remove shift arm (Fig. 8).

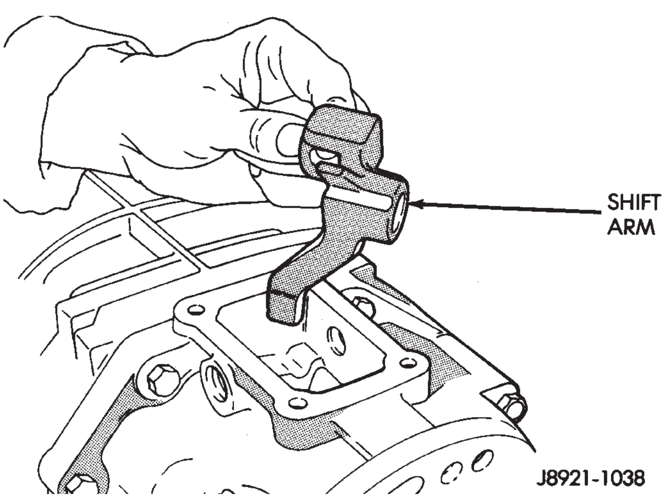


Fig. 8 Shift Arm Removal/Installation

(10) Remove plug for reverse shift head lock ball. Plug is at right side of adapter housing near backup light switch (Fig. 9).

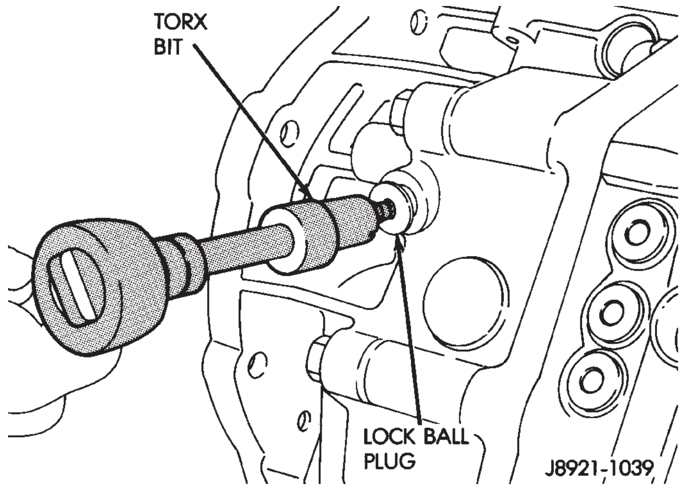


Fig. 9 Removing/Installing Lock Ball Plug

(11) Remove lock ball spring with pencil magnet (Fig. 10).

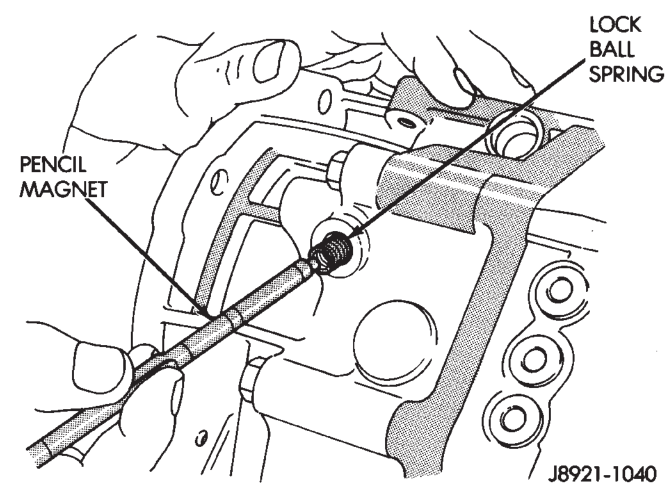


Fig. 10 Removing/Installing Lock Ball Spring

(12) Remove shift head lock ball with pencil magnet (Fig. 11).

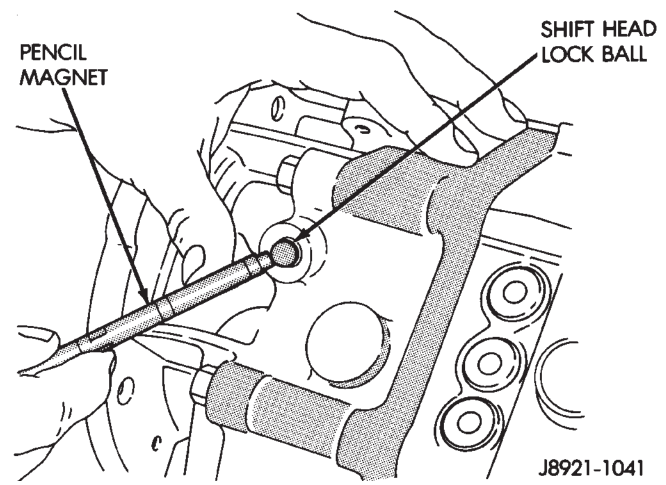


Fig. 11 Removing/Installing Shift Head Lock Ball

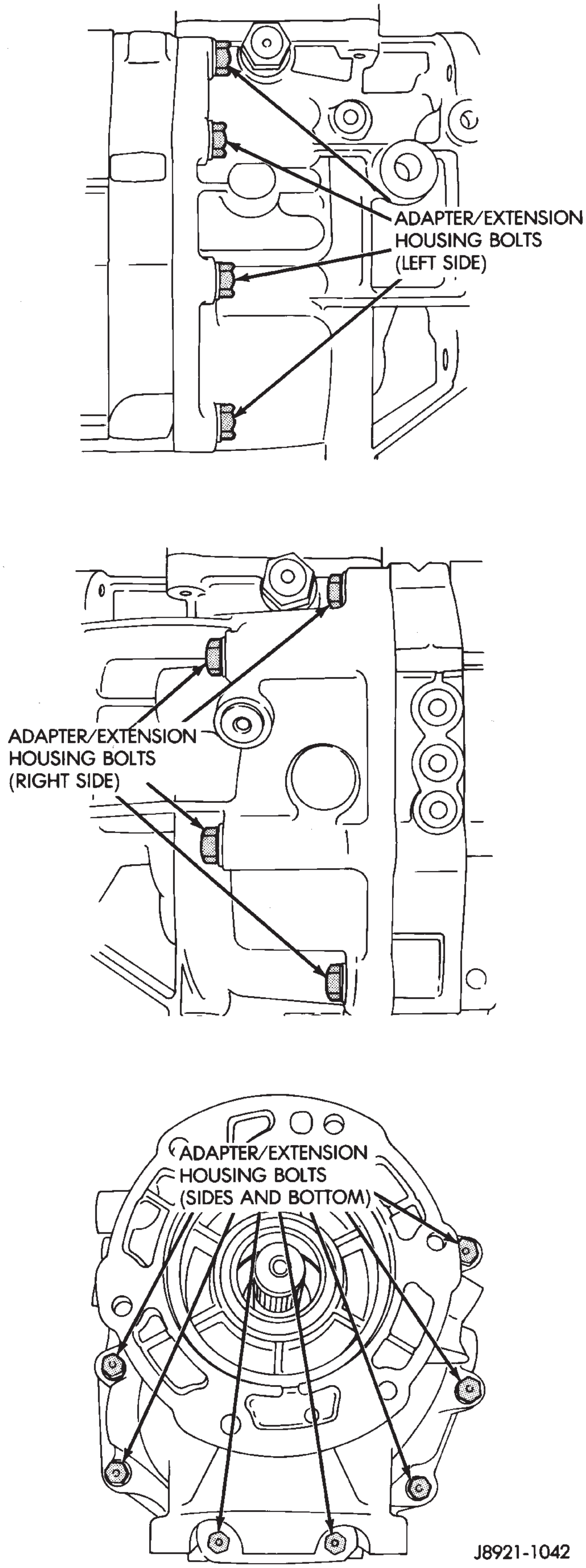


Fig. 12 Adapter Housing Bolt Locations

(13) Remove adapter housing bolts (Fig. 12).

(14) Loosen adapter/extension housing with rubber mallet (Fig. 13).

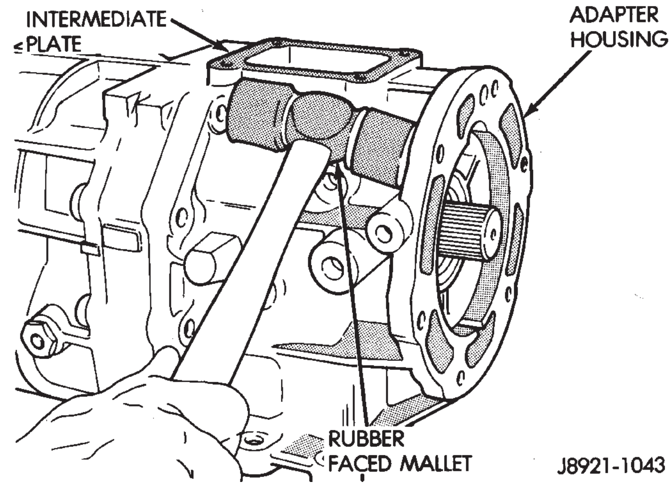


Fig. 13 Loosening Adapter Housing

(15) Remove housing after loosening it (Fig. 14)

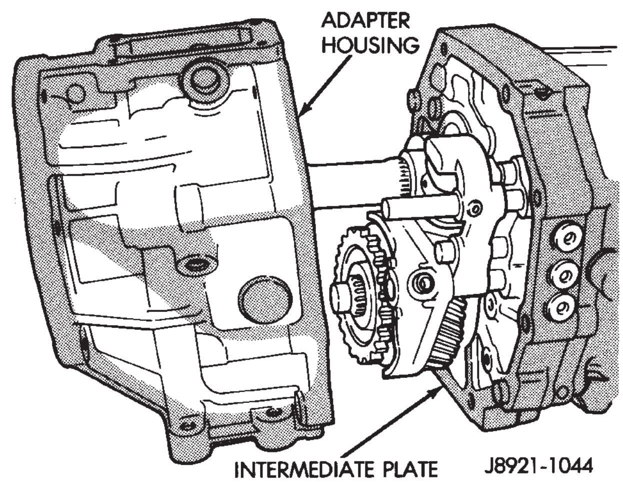


Fig. 14 Adapter Housing Removal

(16) Remove adapter housing oil seal with a pry tool (Fig. 15).

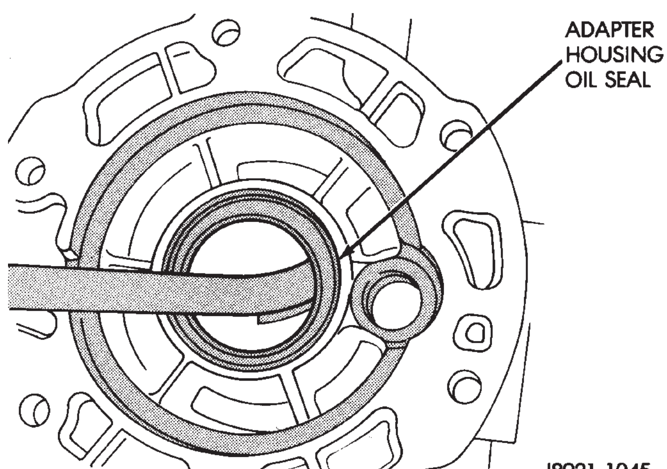


Fig. 15 Removing Adapter Housing Seal

GEAR CASE REMOVAL

(1) Remove bearing retainer bolts and remove retainer (Fig. 16).

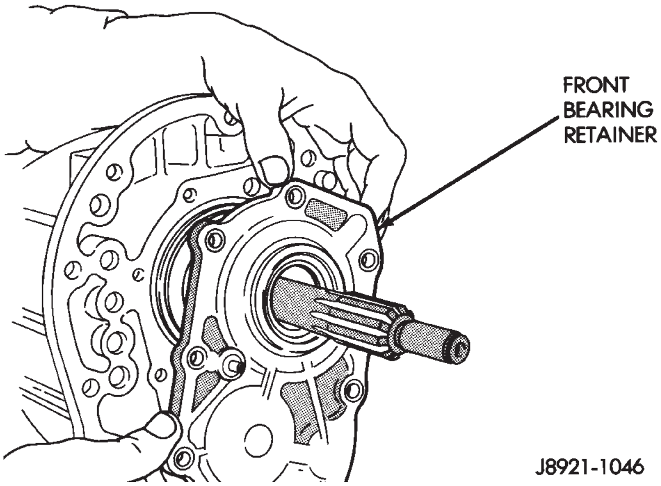


Fig. 16 Front Bearing Retainer Removal

(2) Remove retainer oil seal with pry tool (Fig. 17).

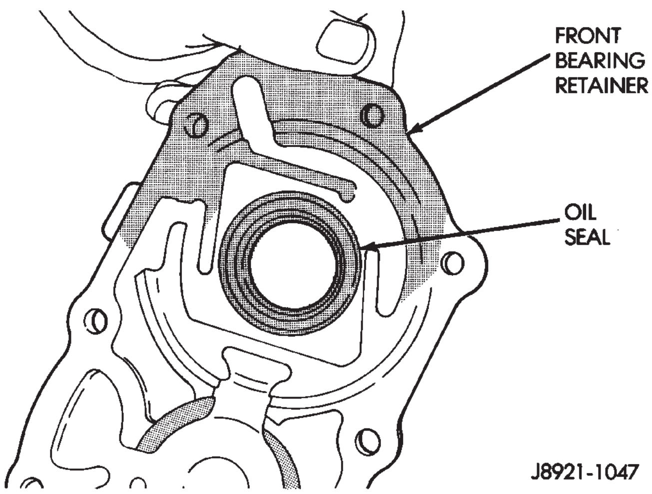


Fig. 17 Front Bearing Retainer Seal Location

(3) Remove input shaft bearing snap ring (Fig. 18).

(4) Remove cluster gear front bearing snap ring (Fig. 19).

(5) Loosen gear case by tapping it away from intermediate plate with rubber mallet (Fig. 20).

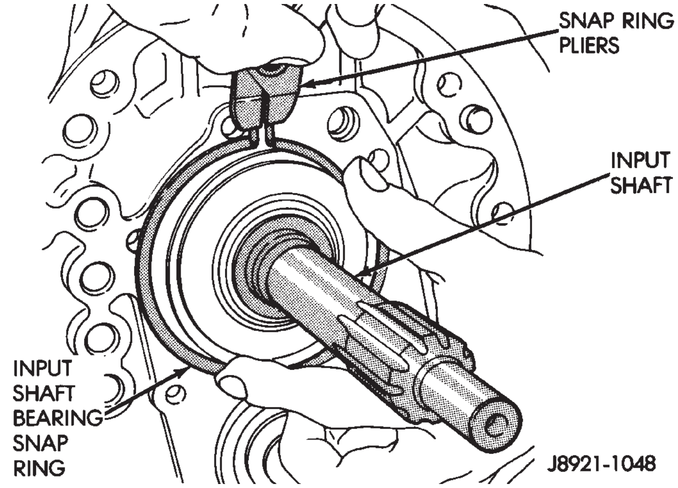


Fig. 18 Removing Input Shaft Bearing Snap Ring

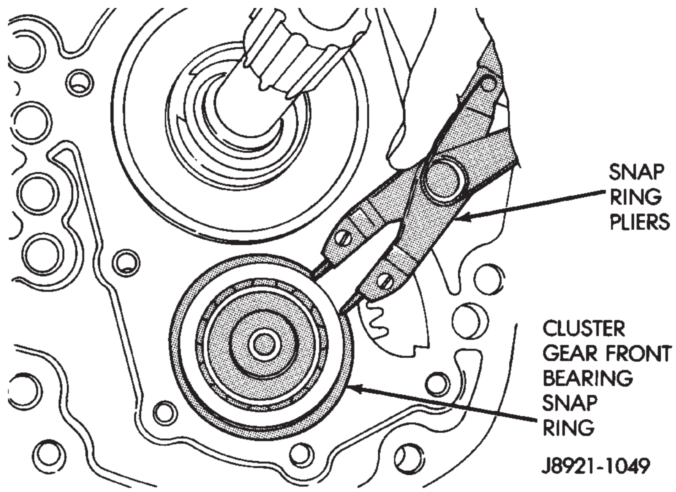


Fig. 19 Removing Cluster Gear Front Bearing Snap Ring

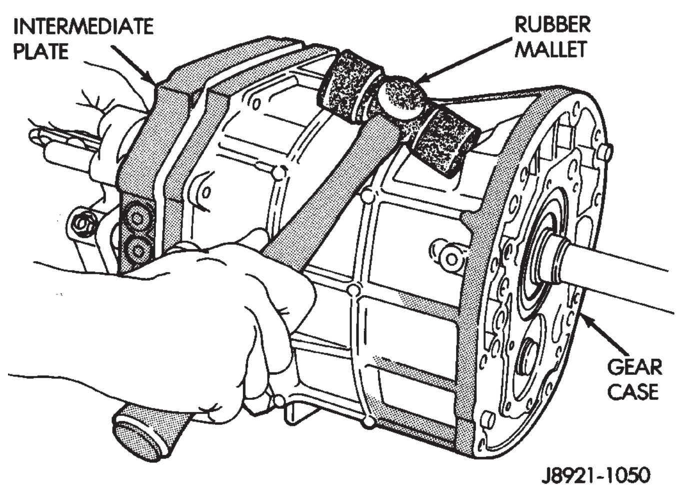


Fig. 20 Loosening Gear Case

(6) Remove gear case from geartrain and intermediate plate (Fig. 21).

(7) Remove speedometer gear snap ring and remove speedometer gear and spacer from output shaft.

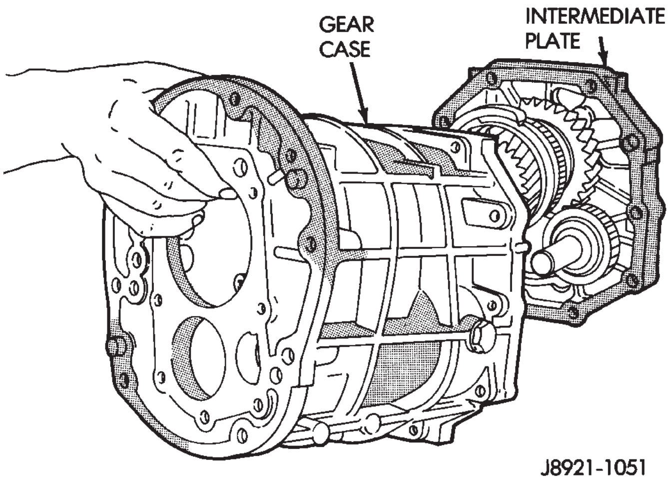


Fig. 21 Gear Case Removal

FIFTH GEAR AND SYNCHRO ASSEMBLY REMOVAL

(1) Remove three lock ball plugs from intermediate plate (Fig. 22).

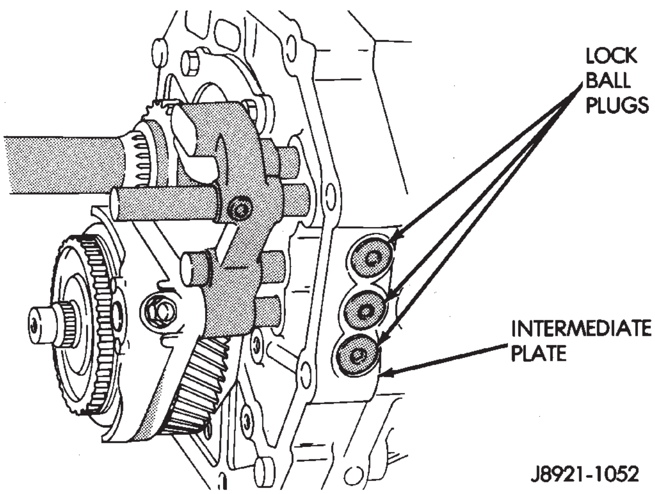


Fig. 22 Lock Ball Plug Locations

(2) Remove three lock ball springs and lock balls from intermediate plate with pencil magnet (Fig. 23).

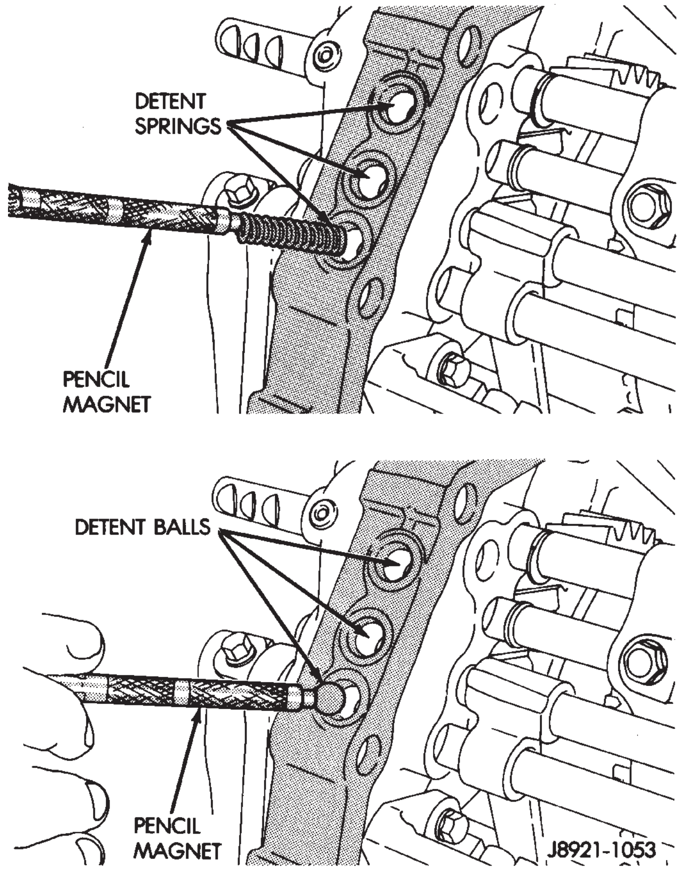


Fig. 23 Removing/Installing Lock Ball And Spring

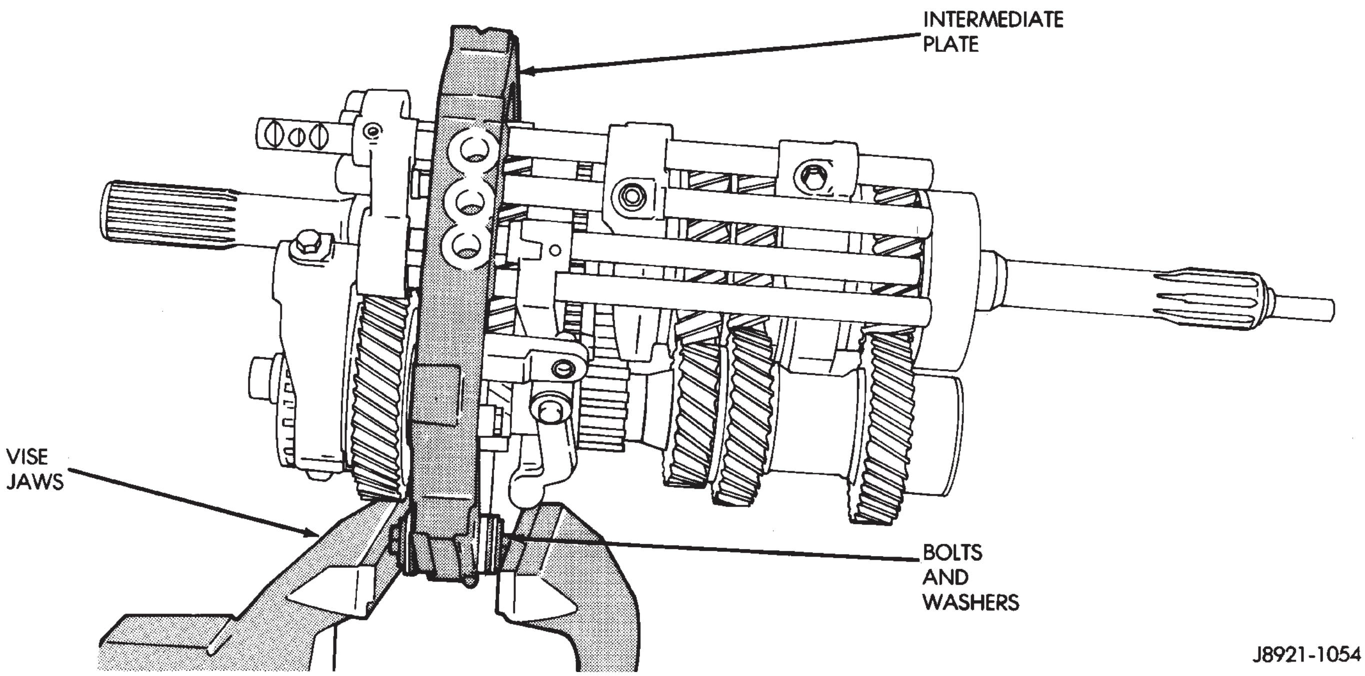


Fig. 24 Mounting Intermediate Plate And Geartrain In Vise

(3) Mount intermediate plate and geartrain assembly in vise as follows:

(a) Insert two spare bolts in one bottom bolt hole in intermediate plate. Insert bolts from opposite sides of plates (Fig. 24).

(b) Install enough flat washers under each bolt head to prevent bolts from touching (Fig. 24).

(c) Tape bolts and washers in place and mount intermediate plate in vise (Fig. 24).

(d) Clamp vise jaws securely against bolt heads (Fig. 24). **Do not clamp vise jaws on intermediate plate. Clamp only on bolt heads.**

(4) Remove fifth gear snap ring (Fig. 25). Retain snap ring for assembly reference. It is a select fit component.

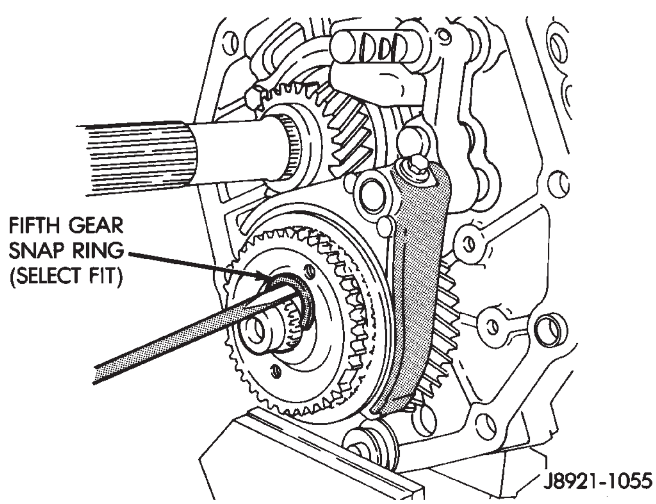


Fig. 25 Fifth Gear Snap Ring Removal

(5) Remove E-ring that secures reverse shift arm to fork (Fig. 26).

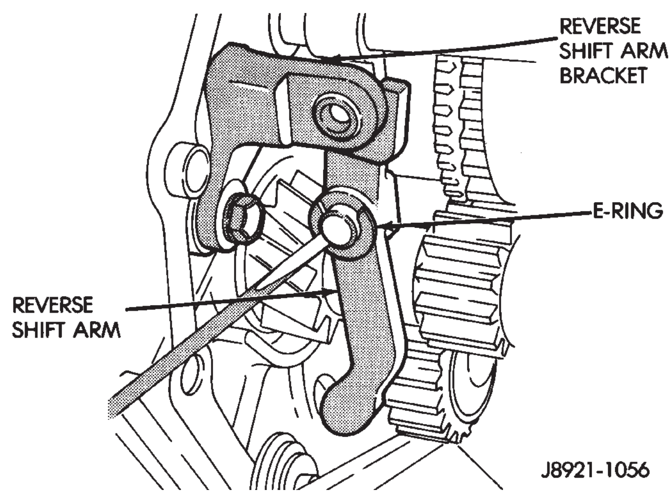


Fig. 26 Reverse Shift Arm E-Ring Removal

(6) Remove bolts attaching reverse shift arm bracket to intermediate plate. Then remove bracket (Fig. 27).

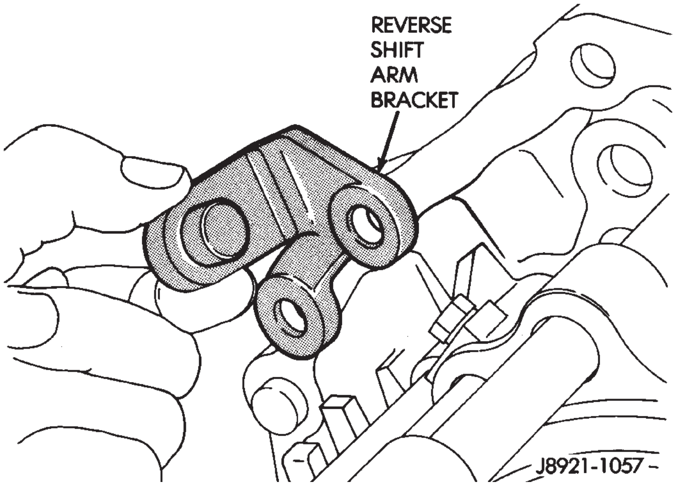


Fig. 27 Reverse Shift Arm Bracket Removal

(7) Remove reverse shift arm and shoe (Fig. 28).

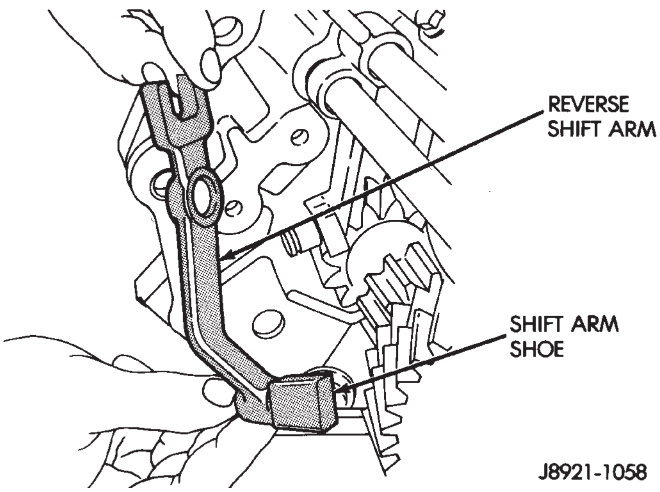


Fig. 28 Reverse Shift Arm And Shoe Removal

(8) Remove fifth gear shift fork set screw (Fig. 29).

(9) Move fifth gear shift rail forward until it clears shift fork.

(10) Remove fifth gear shift fork from synchro sleeve (Fig. 30).

(11) Remove reverse shift rail and reverse shift head as assembly (Fig. 31).

(12) Measure thrust clearance between counter fifth gear and thrust ring with feeler gauge. Clearance should be 0.10 to 0.40 mm (0.003 to 0.019 in.). If clearance exceeds limits, gear and/or ring will have to be replaced.

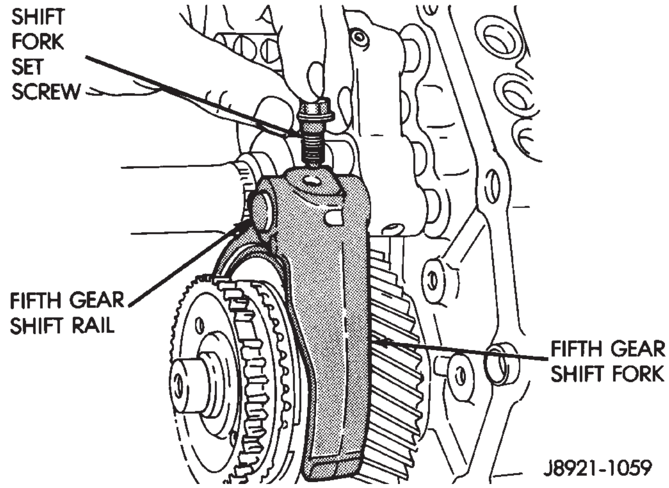


Fig. 29 Fifth Gear Fork Set Screw Removal

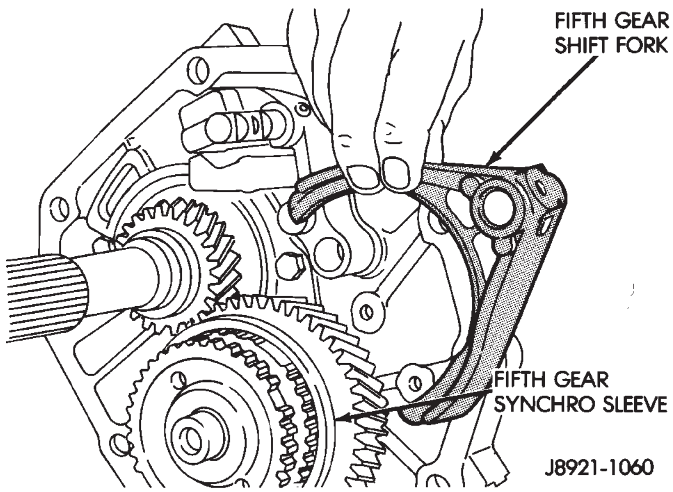


Fig. 30 Fifth Gear Shift Fork Removal

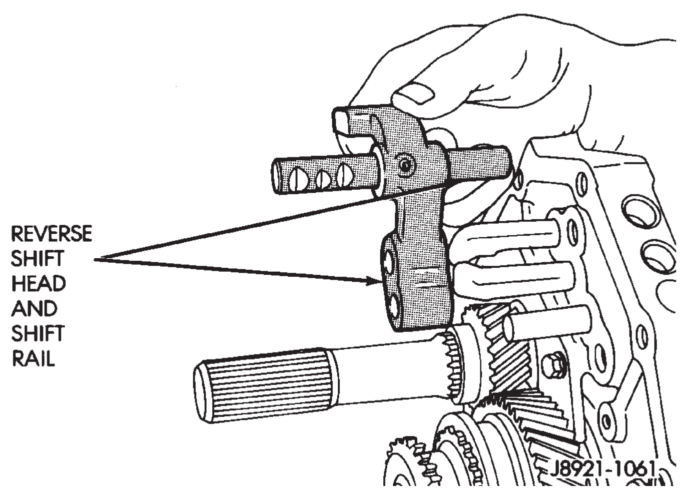


Fig. 31 Reverse Shift Head And Rail Removal

(13) Loosen fifth spline gear with standard two-jaw puller (Fig. 32). **Position puller jaws behind fifth counter gear as shown.**

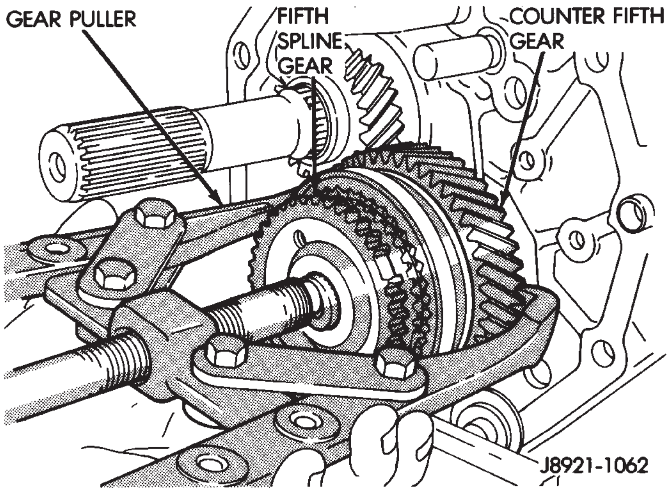


Fig. 32 Loosening Fifth Spline Gear

(14) Remove fifth spline gear (Fig. 33).

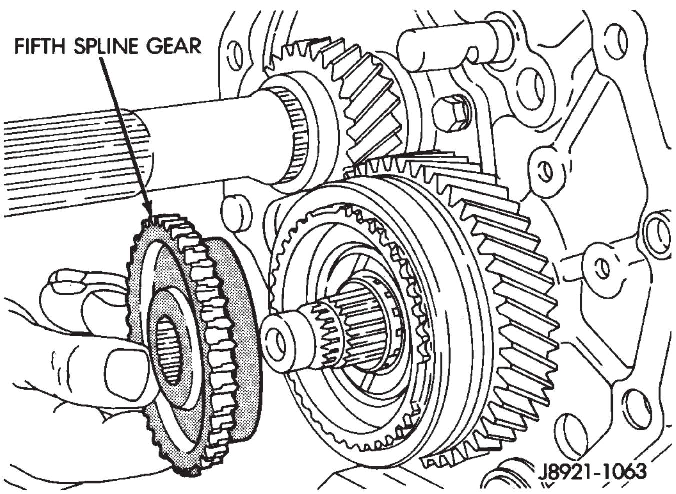


Fig. 33 Fifth Spline Gear Removal

(15) Remove fifth gear synchro ring (Fig. 34).

(16) Remove fifth gear synchro and sleeve assembly (Fig. 35).

(17) Remove counter fifth gear thrust ring (Fig. 36).

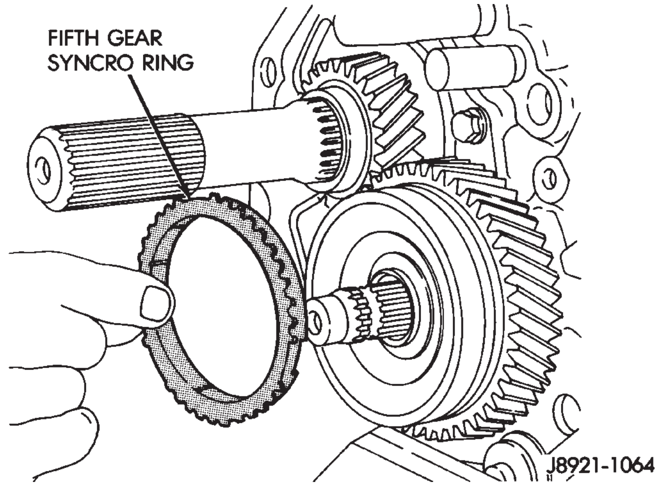


Fig. 34 Fifth Gear Synchro Ring Removal

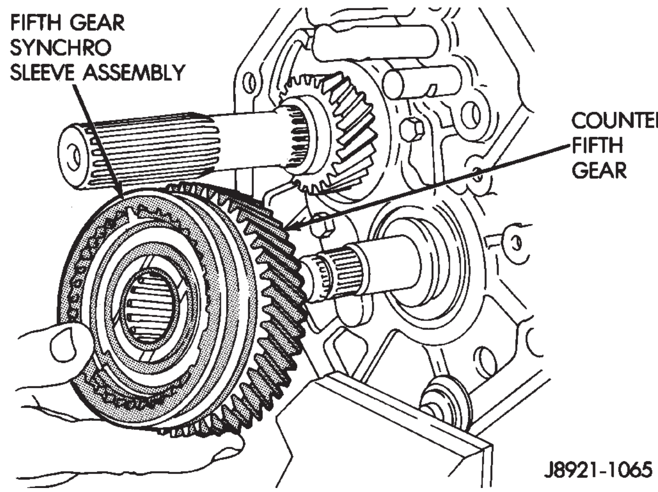


Fig. 35 Counter Fifth Gear And Synchro Assembly Removal

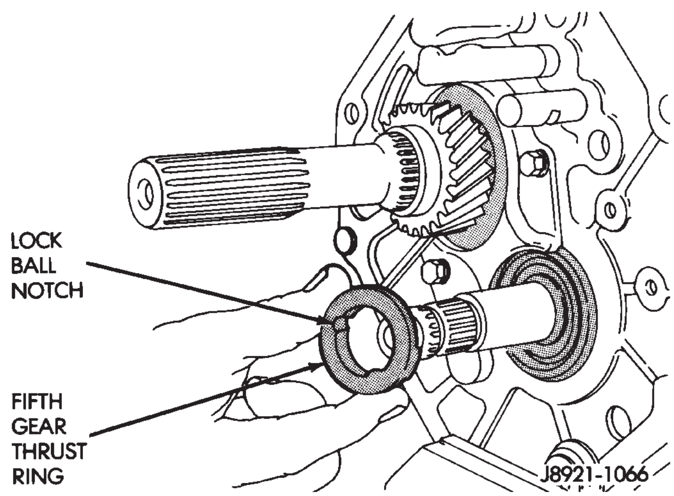


Fig. 36 Fifth Gear Thrust Ring Removal

(18) Remove thrust ring lock ball with pencil magnet (Fig. 37).

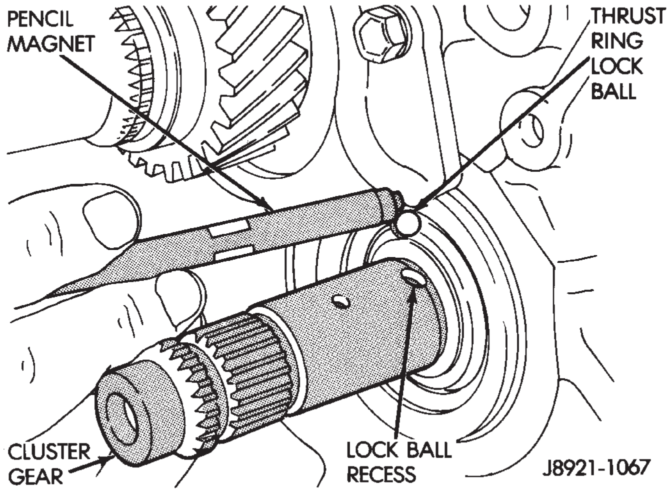


Fig. 37 Thrust Ring Lock Ball Removal

(19) Remove bolts attaching output shaft rear bearing retainer to intermediate plate (Fig. 38).

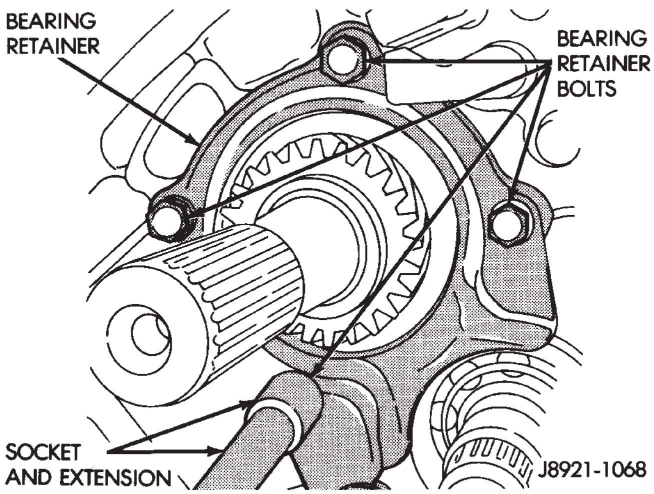


Fig. 38 Output Shaft Rear Bearing Retainer Bolt Removal

(20) Remove rear bearing retainer (Fig. 39).
(21) Remove reverse idler gear and shaft (Fig. 40).

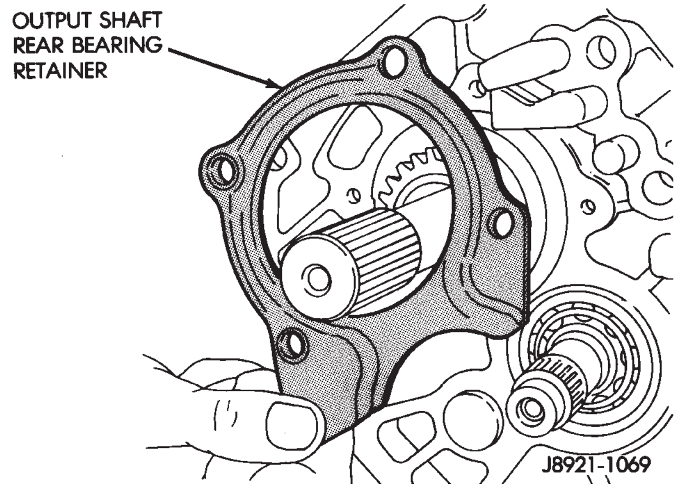


Fig. 39 Output Shaft Rear Bearing Retainer Removal

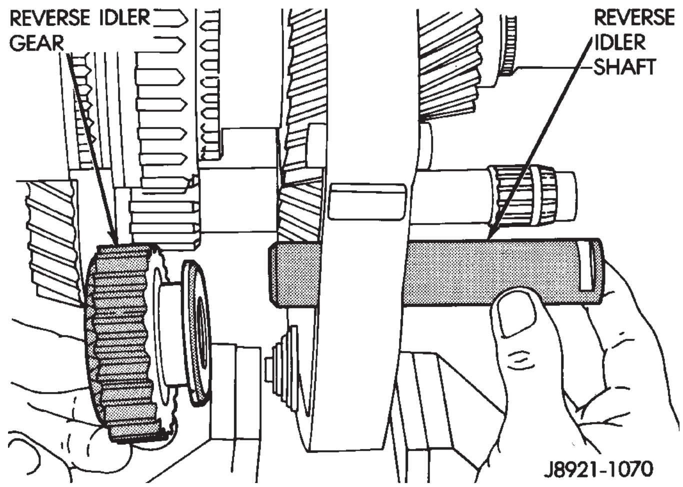


Fig. 40 Reverse Idler Gear And Shaft Removal

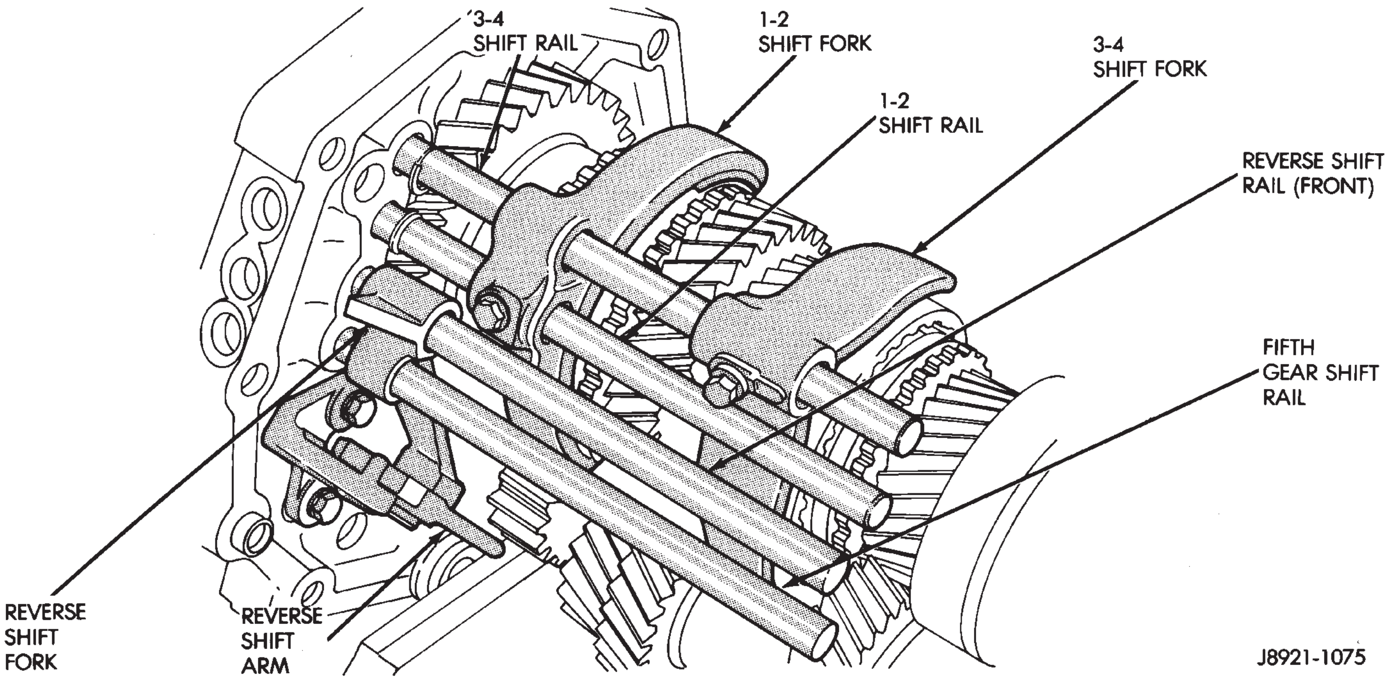


Fig. 41 Shift Rail Identification

SHIFT RAIL AND FORK REMOVAL

There are a total of five shift rails in the AX 15 transmission. The 1-2, 3-4, fifth gear and front reverse shift rails are shown in Figure 41.

Two shift rails are used for reverse gear range. The front reverse rail is at the forward side of the intermediate plate (Fig. 41). The short rear reverse rail and reverse shift head are at the rear side of the intermediate plate.

It is not necessary to remove the shift rails if they are in good condition. Only the shift forks need be removed for access to the shafts and gears.

(1) Remove fifth gear shift rail (Fig. 41). Catch lock ball in your hand as rail comes out of intermediate plate.

(2) Remove 1-2 and 3-4 shift rail C-rings with two screwdrivers of equal size and length (Fig. 42).

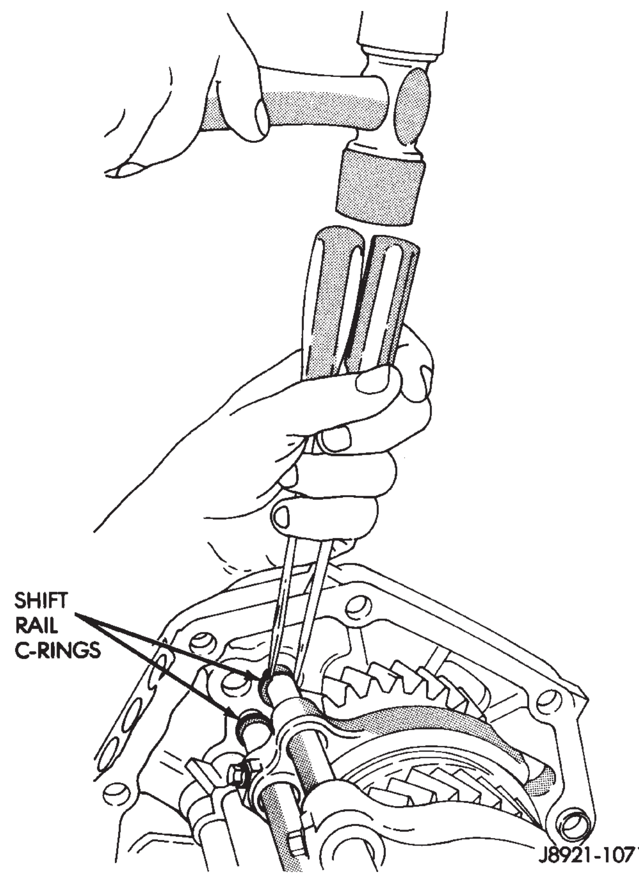


Fig. 42 Shift Rail C-Ring Removal

(3) Remove shift fork set screws (Fig. 43).

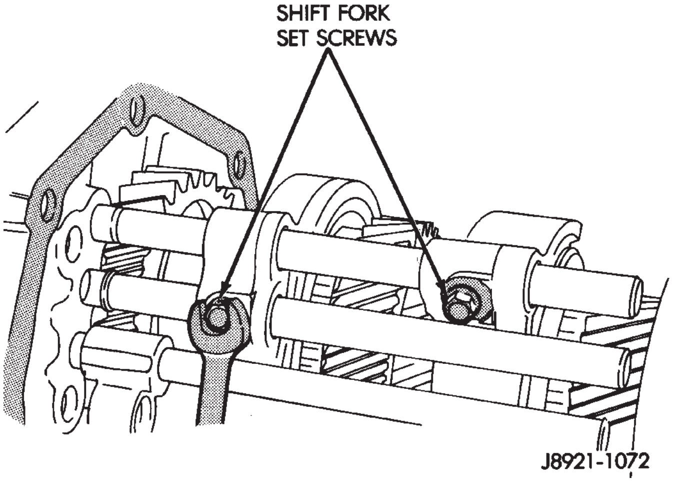


Fig. 43 Shift Fork Set Screw Removal

(4) Remove 3-4 shift rail from shift fork and intermediate plate (Fig. 44).

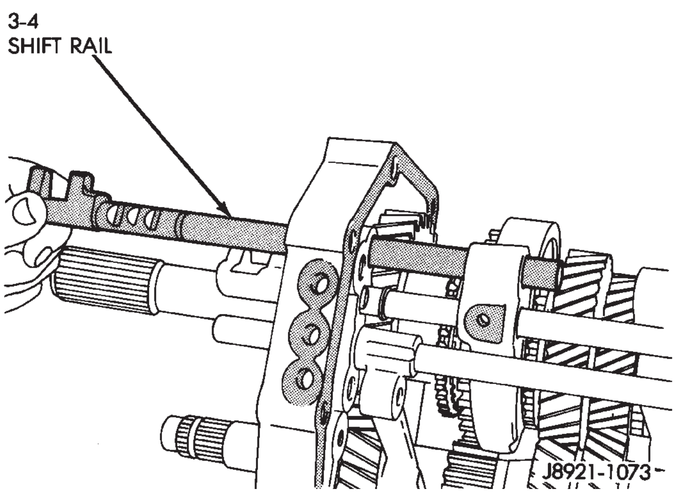


Fig. 44 Removing 3-4 Shift Rail

(5) Remove 3-4 shift rail interlock plug from intermediate plate with magnet (Fig. 45).

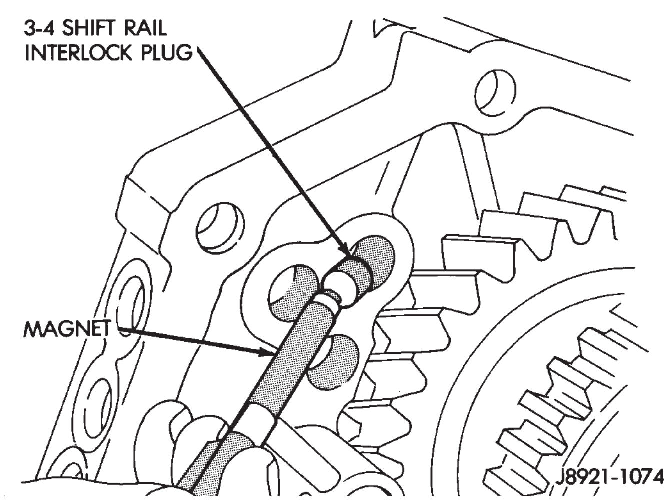


Fig. 45 Removing 3-4 Shift Rail Interlock Plug

(6) Remove 1-2 shift rail from shift fork and intermediate plate (Fig. 46).

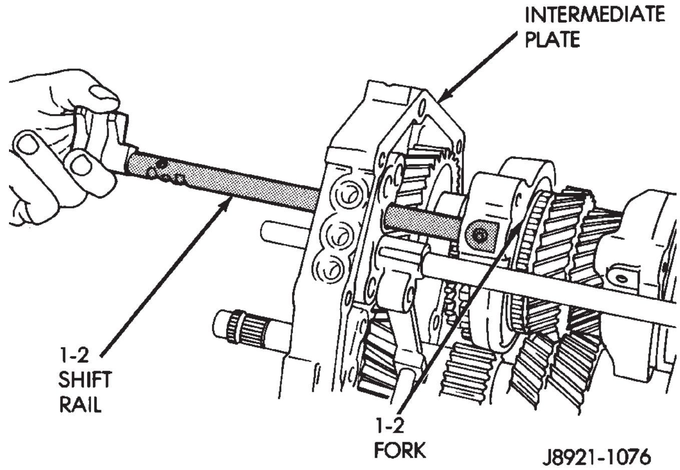


Fig. 46 Removing 1-2 Shift Rail

(7) Remove 1-2 shift rail interlock pin from shift rail (Fig. 47).

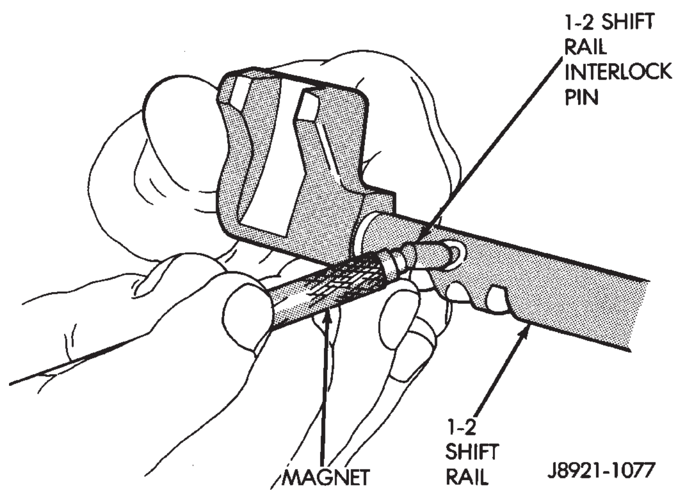


Fig. 47 Removing 1-2 Shift Rail Interlock Pin

(8) Remove 1-2 shift rail interlock plug from intermediate plate (Fig. 48).

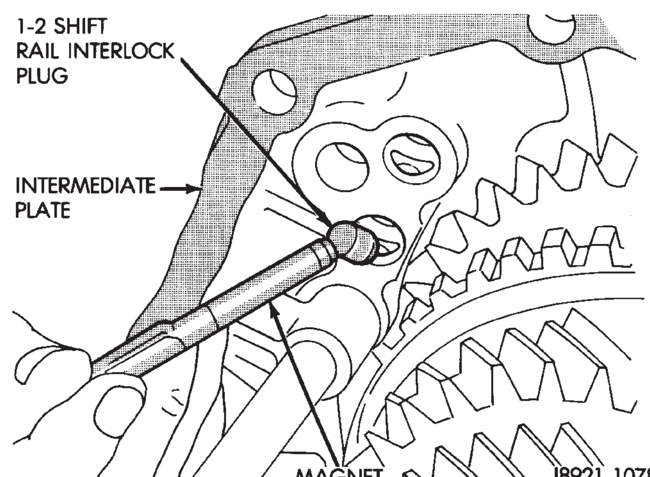


Fig. 48 Removing 1-2 Shift Rail Interlock Plug

(9) Lift reverse shift fork upward and remove fifth gear shift rail lock ball (Fig. 49).

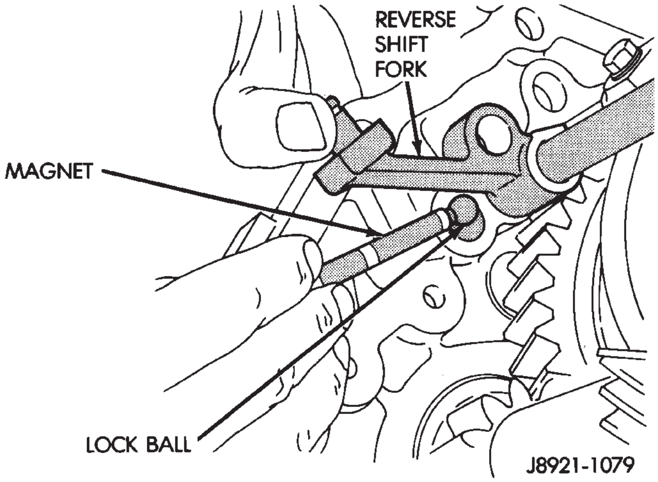


Fig. 49 Fifth Gear Shift Rail Lock Ball Removal

(10) Remove 3-4 shift fork (Fig. 50).
(11) Remove 1-2 shift fork (Fig. 50).

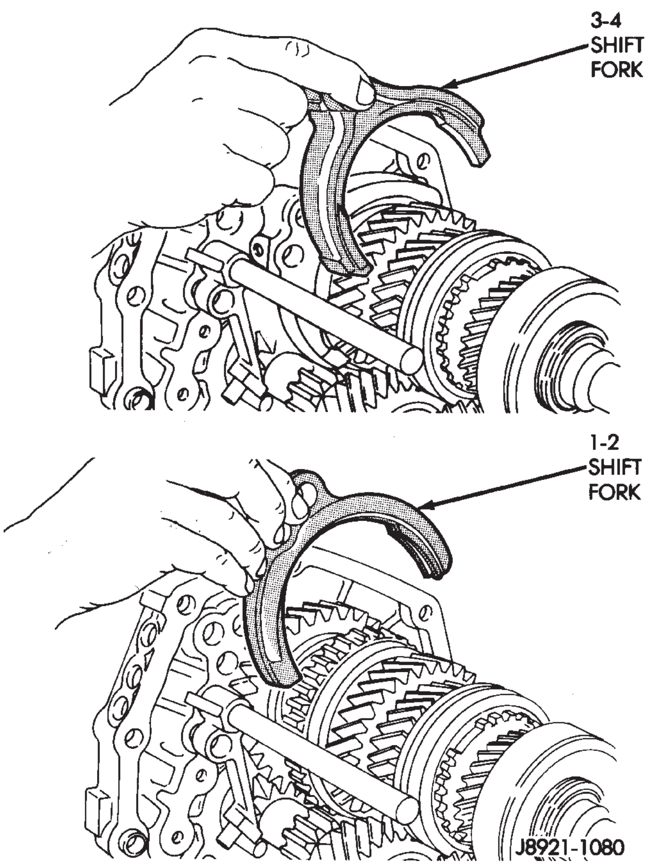


Fig. 50 Shift Fork Removal

(12) Remove reverse shift rail C-ring with two equal length and size screwdrivers (Fig. 51).
(13) Remove reverse shift rail and fork (Fig. 52).

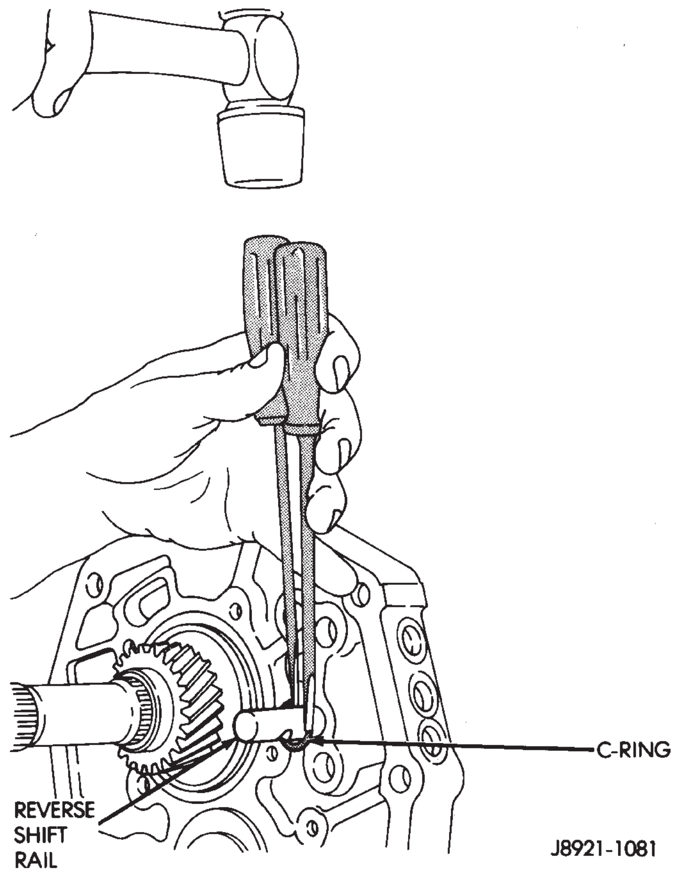


Fig. 51 Reverse Shift Rail C-Ring Removal

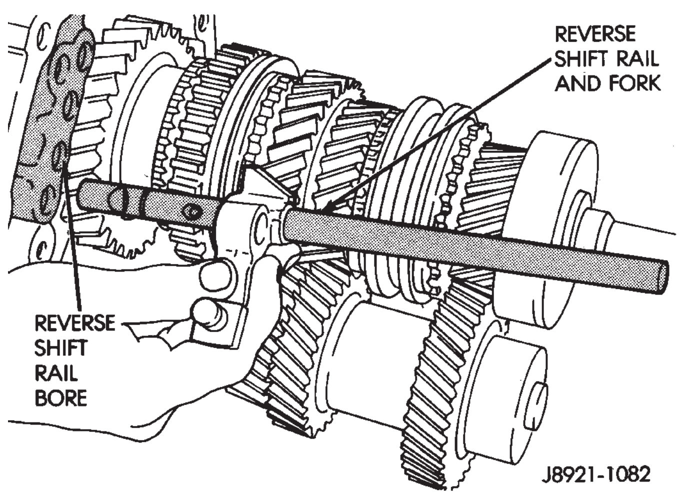


Fig. 52 Reverse Shift Rail And Fork Removal

(14) Remove interlock pin from reverse shift rail (Fig. 53).

(15) Position shift rails, shift forks, lock balls, interlock plugs and interlock pins on the workbench in order of removal. This will help in identifying components during inspection and assembly.

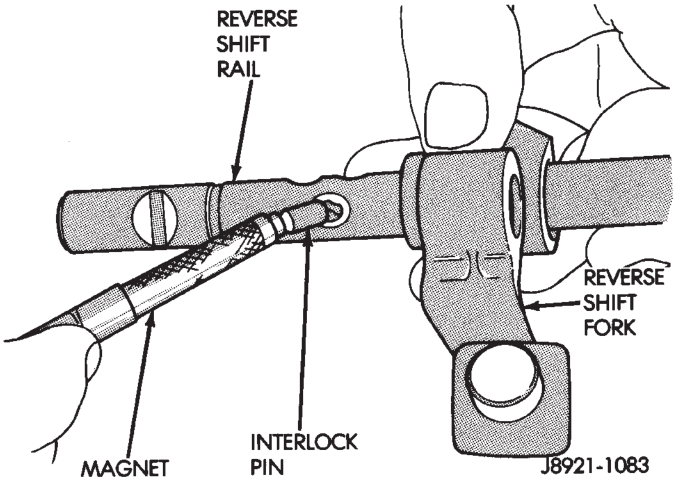


Fig. 53 Reverse Shift Rail Interlock Pin Removal

OUTPUT SHAFT AND CLUSTER GEAR REMOVAL

(1) Remove output shaft rear bearing snap ring (Fig. 54).

(2) Remove cluster gear rear bearing snap ring (Fig. 54).

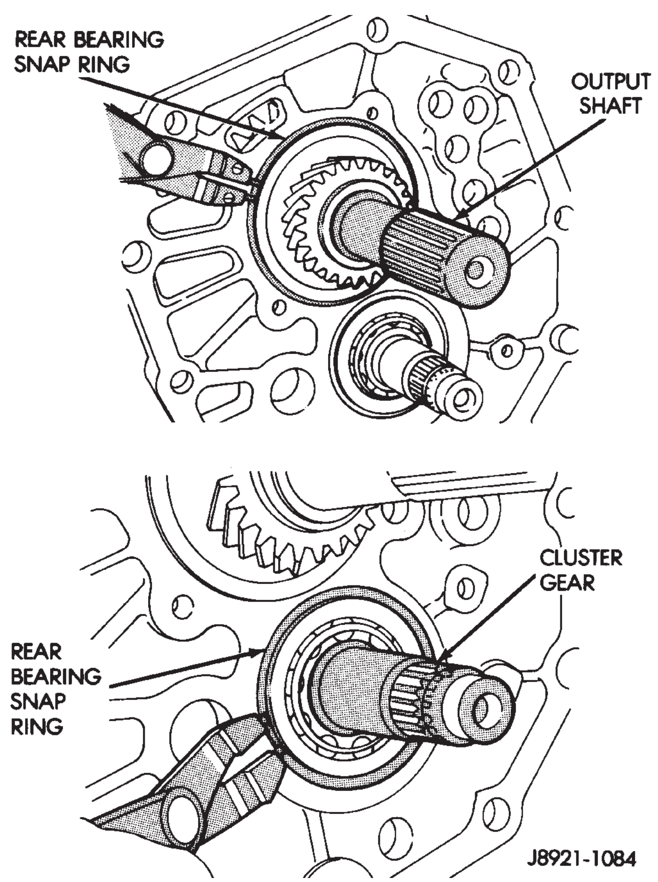


Fig. 54 Removing Bearing Snap Rings

(3) Tap end of output shaft with mallet to unseat and start rear bearing out of intermediate plate (Fig. 55).

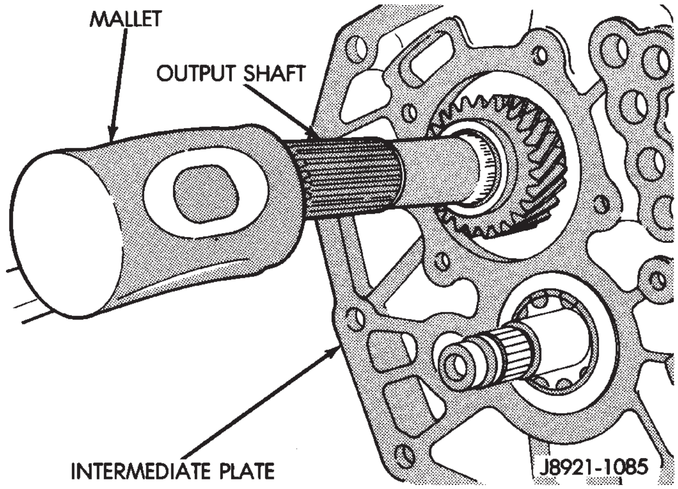


Fig. 55 Unseating Output Shaft Rear Bearing

(4) Remove output shaft by rocking it lightly until rear bearing comes out of intermediate plate (Fig. 56).

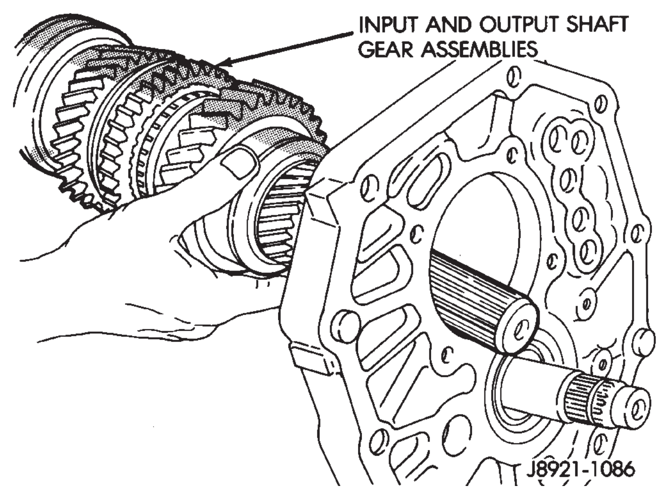


Fig. 56 Input And Output Shaft Removal

(5) Remove cluster gear by pulling it straight out of rear bearing (Fig. 57).

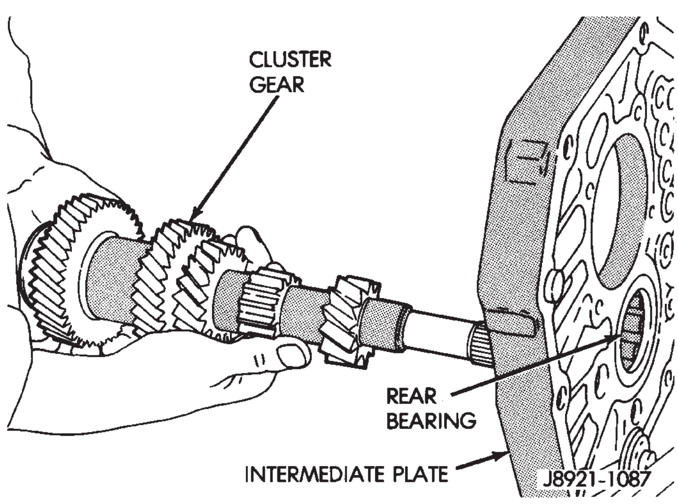


Fig. 57 Cluster Gear Removal

(6) Remove cluster gear rear bearing from intermediate plate (Fig. 58).

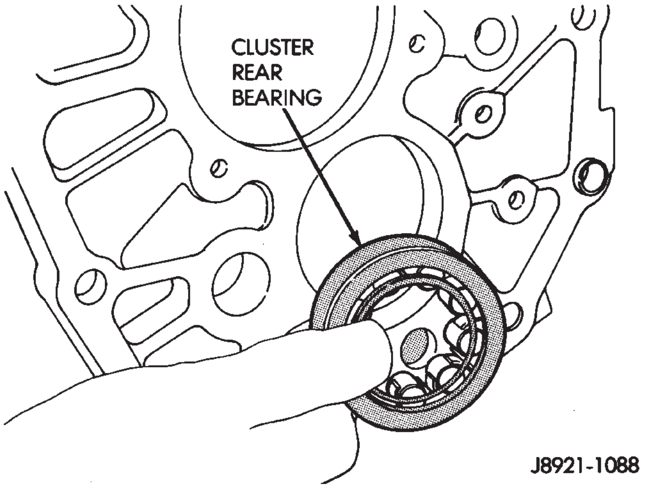


Fig. 58 Removing Cluster Gear Rear Bearing

(7) Remove input shaft from output shaft (Fig. 59).

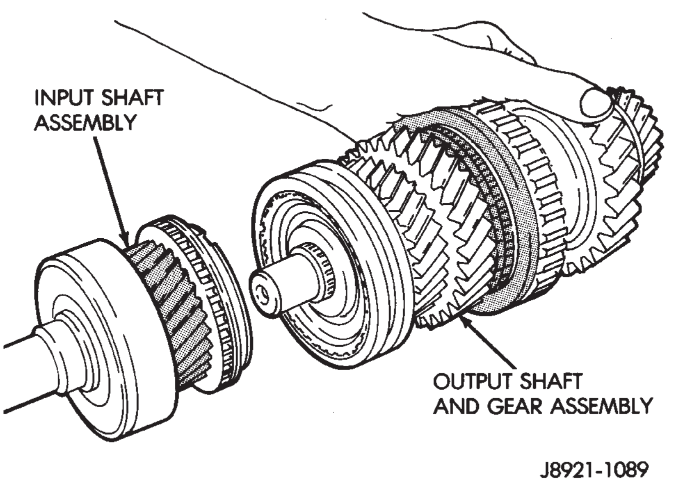


Fig. 59 Input Shaft Removal

(8) Remove output shaft pilot bearing from input shaft (Fig. 60).

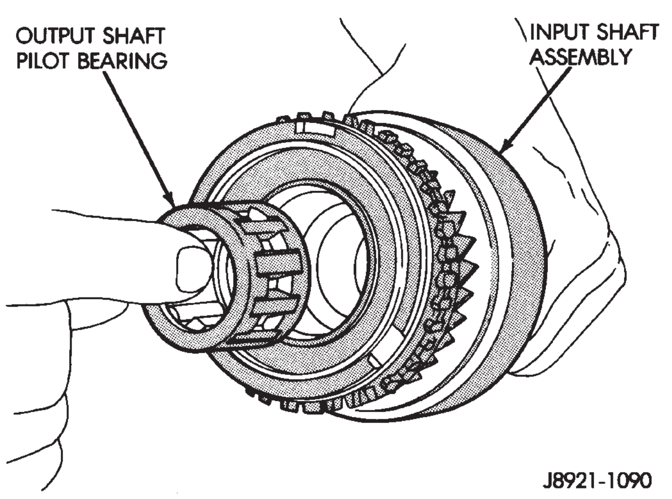


Fig. 60 Input Shaft Pilot Bearing Removal

(9) Remove synchro ring from input shaft (Fig. 61).

(10) Remove bearing snap ring and press bearing off input shaft (Fig. 61).

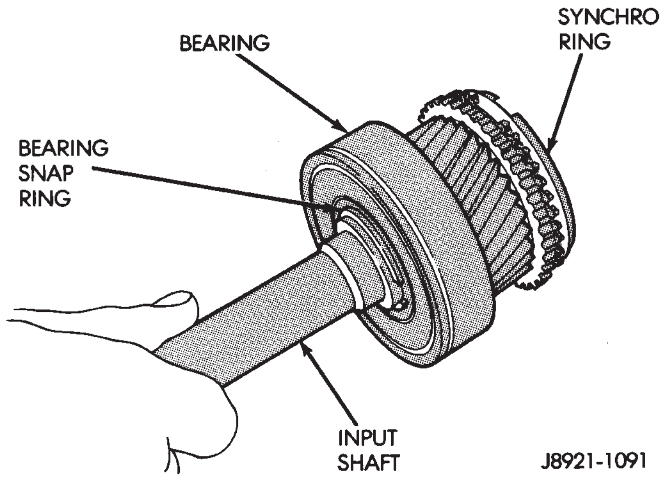


Fig. 61 Input Shaft Components

OUTPUT SHAFT DISASSEMBLY

(1) Measure thrust clearance of output shaft first, second and third gears with feeler gauge (Fig. 62).

- First gear clearance should be 0.10 to 0.40 mm (0.003 to 0.0197 in).
- Second-third gear clearance should be 0.10 to 0.30 mm (0.003 to 0.0118 in.).

(2) If first gear thrust clearance is incorrect, replace gear and thrust washer. **If second or third gear clearance is incorrect, either gear and bearing, or output shaft flange is worn. Refer to output shaft inspection in Cleaning and Inspection section.**

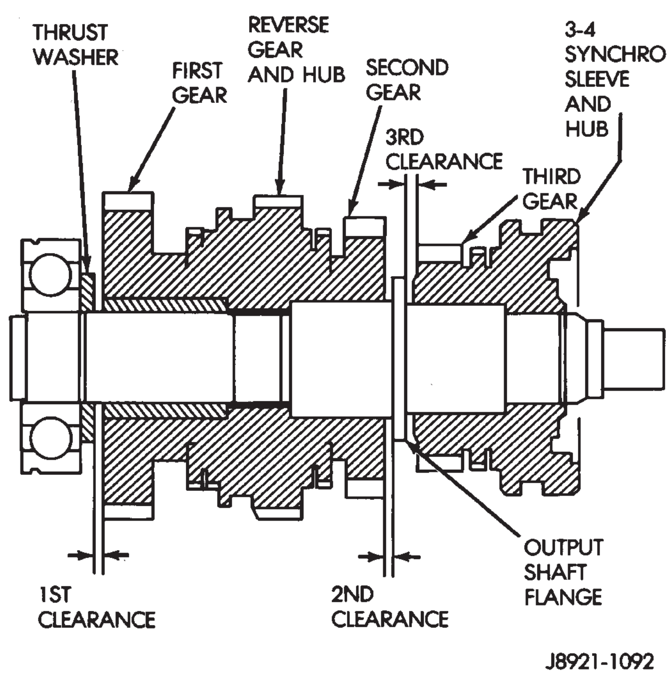


Fig. 62 Checking Output Shaft Gear Thrust Clearance

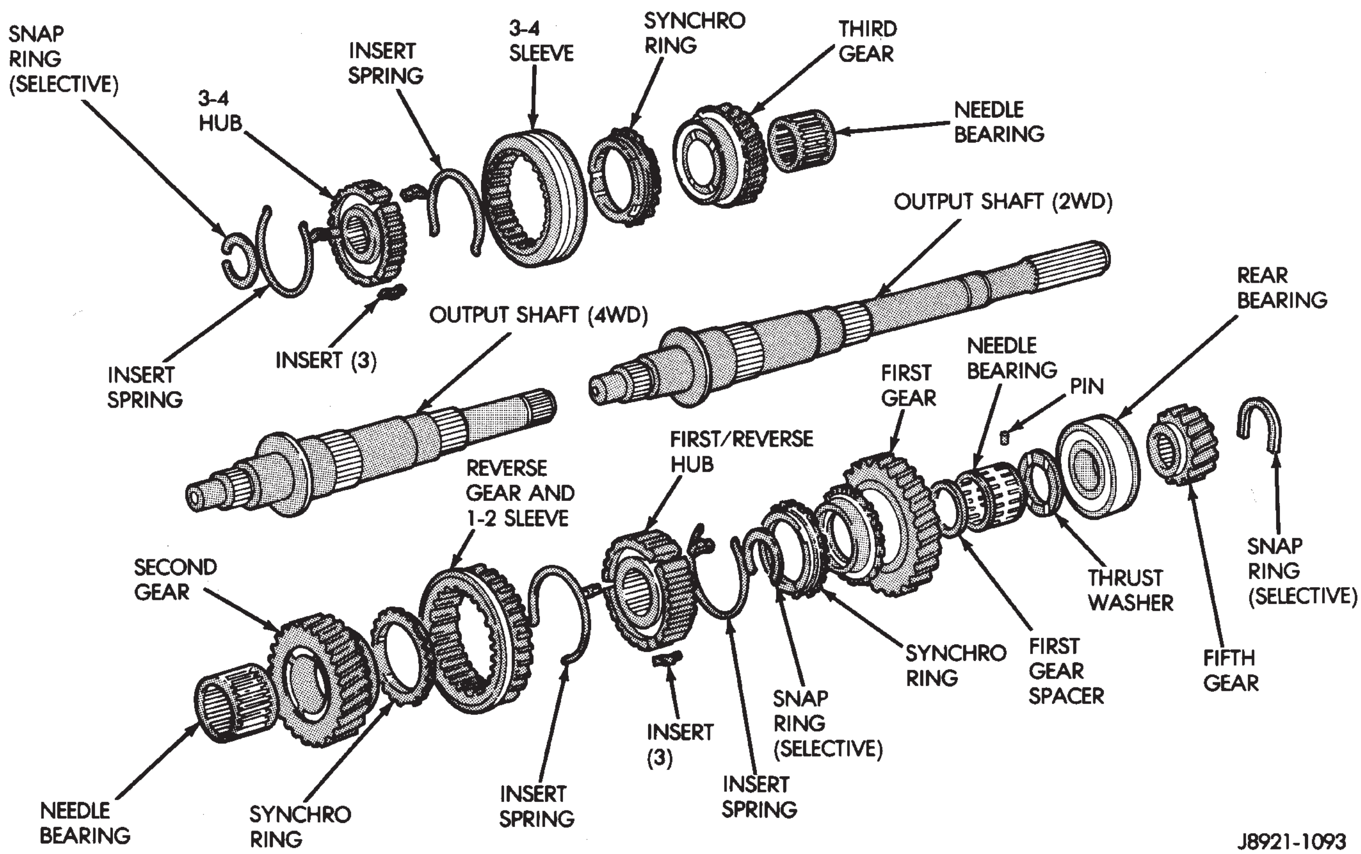


Fig. 63 Output Shaft And Gears

(3) Press fifth gear and rear bearing off rear of output shaft.

(4) Remove thrust washer, pin, and first gear and bearing (Fig. 62).

(5) Remove first/reverse hub snap ring (Fig. 63).

(6) Remove synchro ring.

(7) Press reverse gear and first/reverse hub off shaft as assembly.

(8) Remove remaining synchro ring and second gear and bearing (Fig. 63).

(9) Remove snap ring at front of output shaft (Fig. 63).

(10) Press 3-4 hub and sleeve off output shaft as assembly (Fig. 63).

(11) Remove synchro ring.

(12) Remove third gear and needle bearing (Fig. 63).

TRANSMISSION CLEANING AND INSPECTION

Clean the transmission components in solvent. Then dry the cases, gears, shift mechanism and shafts with compressed air. **Dry the bearings with clean, dry shop towels only. Never use compressed air on the bearings. This could damage the bearing rollers.**

Replace components that are obviously worn, cracked, chipped or damaged.

Inspect the transmission case. Replace the case if cracked or porous or if any of the bearing and gear bores are damaged.

Output Shaft Inspection

Measure thickness of the output shaft flange with a micrometer (Fig. 64). Minimum allowable flange thickness is 4.70 mm (0.185 in).

If shaft flange thickness is OK but previously measured second/third gear thrust clearance was incorrect (Fig. 62), replace the necessary gear and needle bearing as an assembly.

Check diameter of the first, second and third gear bearing surfaces of the output shaft (Fig. 64). Minimum allowable diameters are:

- 38.86 mm (1.529 in.) for first gear surface
- 46.86 mm (1.844 in.) for second gear surface
- 37.86 mm (1.490 in.) for third gear surface

Check output shaft runout with V-blocks and a dial indicator (Fig. 64). Maximum allowable runout is 0.06 mm (0.0024 in.).

Replace the output shaft if any surface measured fails to meet stated tolerance.

Cluster Gear Inspection

Inspect the cluster gear teeth. Replace the gear if any teeth are worn or damaged or if the bearing surfaces are damaged.

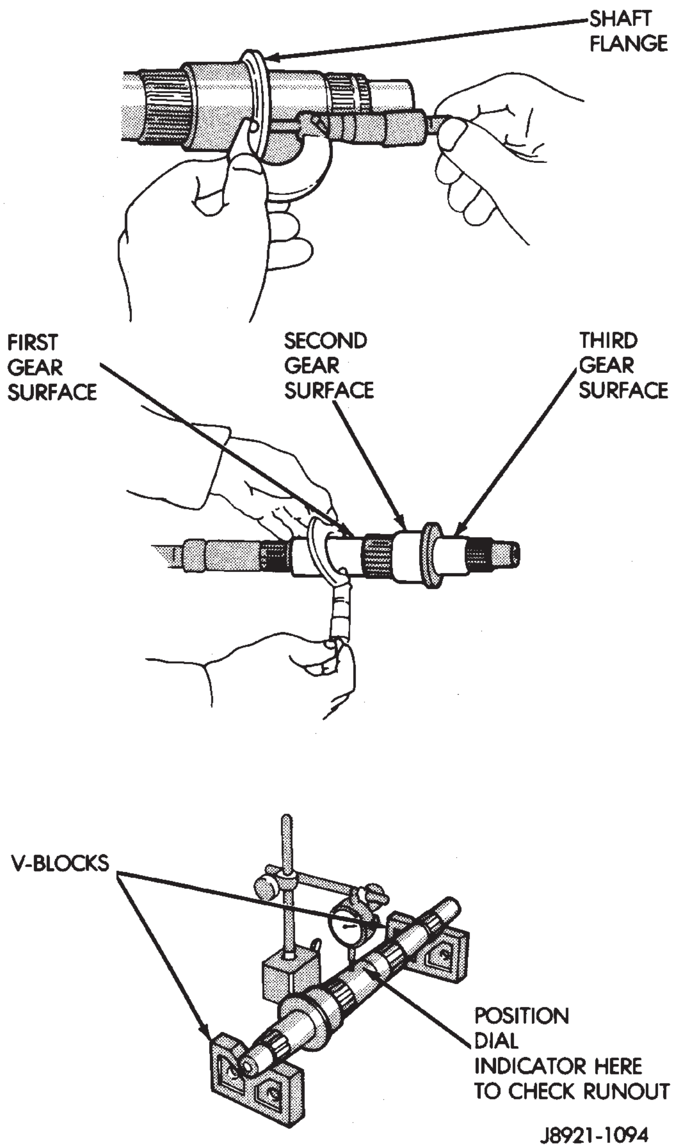


Fig. 64 Checking Output Shaft Tolerances

Check diameter of the cluster gear journal with a micrometer (Fig. 65). Minimum allowable diameter is 27.860 mm (1.096 in.).

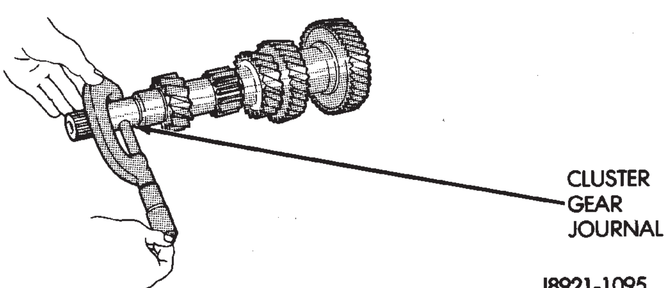


Fig. 65 Checking Cluster Gear Journal Diameter

Check condition of the cluster gear front bearing. Replace the bearing if worn, noisy, or damaged.

GEAR AND SYNCHRO INSPECTION

Install the synchro rings on their respective gears. Rotate each ring on the gear and note synchro action. Replace any synchro ring that exhibits a lack of braking action or binds on the gear. Also replace any ring that is worn or has chipped or broken teeth.

Measure end clearance between the synchro ring and the gear with a feeler gauge (Fig. 66). Clearance should be 0.06 mm to 1.6 mm (0.024 to 0.063 in.).

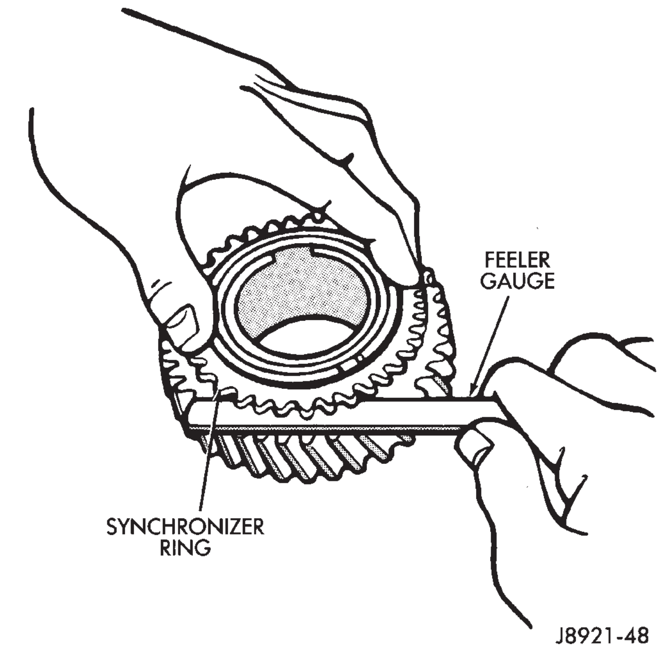


Fig. 66 Checking Synchro Ring End Clearance

Install the needle bearings in the first, second and third gears. Then install the gears on the output shaft and check shaft-to-gear clearance with a dial indicator (Fig. 67).

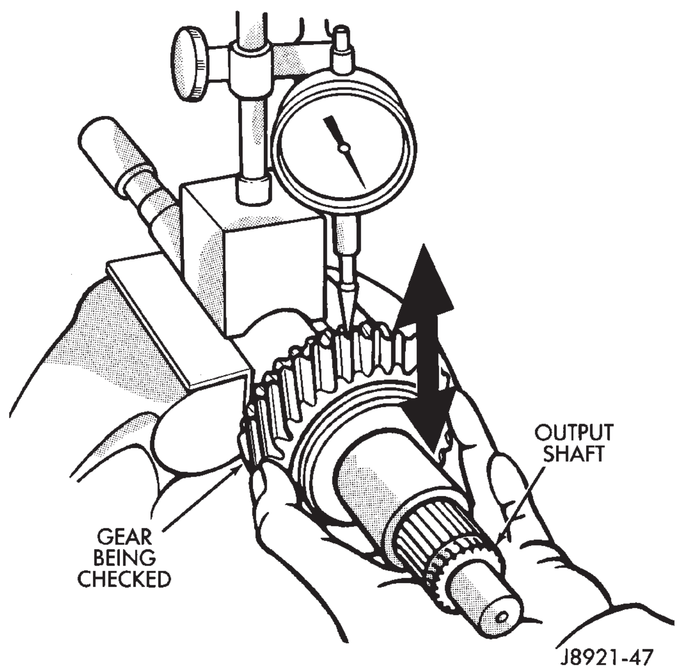


Fig. 67 Checking Gear-To-Shaft Clearance

Maximum allowable clearance is 0.16 mm (0.0063 in.). If any gear exhibits excessive clearance, replace the gear and needle bearing.

Check clearance between the shift forks and synchro sleeves with a feeler gauge (Fig. 68). Clearance should not exceed 1.0 mm (0.039 in.). Replace the synchro sleeve (and matching hub) if clearance exceeds the stated limit.

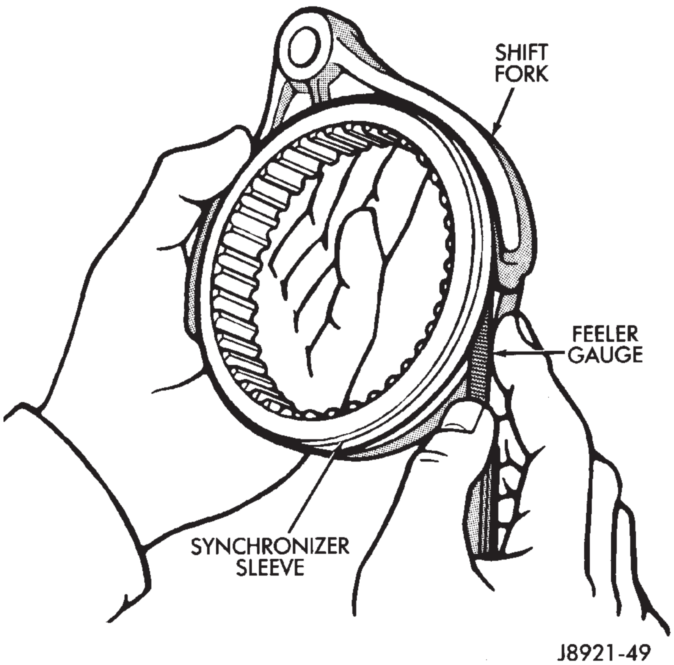


Fig. 68 Checking Shift Fork-To-Sleeve Clearance

Check condition of the reverse idler gear bushing (Fig. 69). Replace the gear if the bushing is scored or worn.

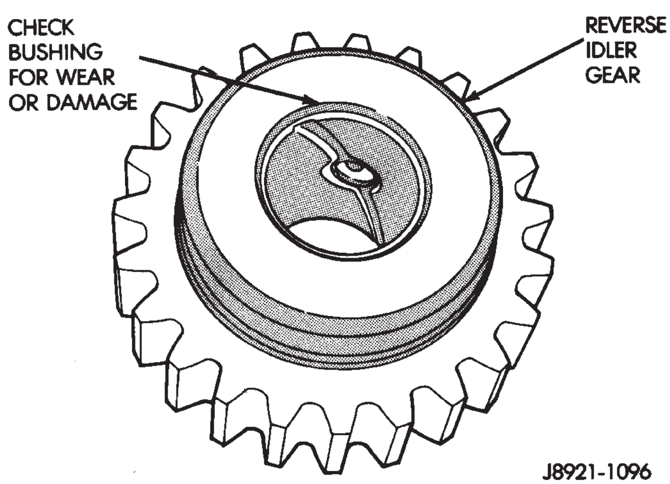


Fig. 69 Reverse Idler Gear Bushing

Gear Case, Housing And Intermediate Plate

Clean the case, housing and plate with solvent and dry with compressed air. Replace any component that is cracked, warped or damaged in any way.

Inspect the threads in the case, housing and plate. Minor thread damage can be repaired with steel thread inserts if necessary. However, do not attempt to repair if the cracks are evident around any threaded hole.

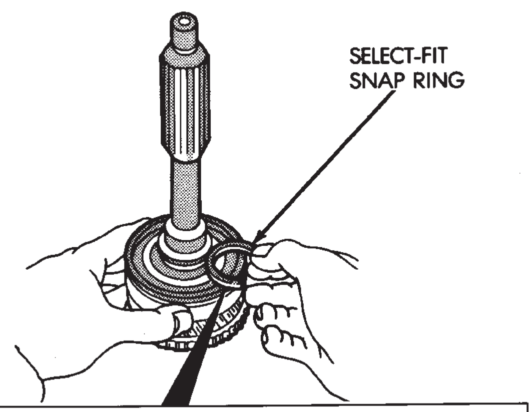
Inspect the reverse pin in the adapter/extension housing. Replace the pin if worn or damaged. Refer to the replacement procedure in the Transmission Assembly section.

TRANSMISSION ASSEMBLY AND ADJUSTMENT

Lubricate the transmission components with gear lubricant during assembly. Use petroleum jelly to lubricate seal lips and/or hold parts in place during installation.

FRONT BEARING/BEARING SEAL/REVERSE SHAFT PIN INSTALLATION

(1) Press front bearing on input shaft. Then secure bearing with thickest snap ring that will fit in shaft groove (Fig. 70).



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	2.10 - 2.15	(0.0827 - 0.0846)
B	2.15 - 2.20	(0.0846 - 0.0866)
C	2.20 - 2.25	(0.0866 - 0.0886)
D	2.25 - 2.30	(0.0886 - 0.0906)
E	2.30 - 2.35	(0.0906 - 0.0925)
F	2.35 - 2.40	(0.0925 - 0.0945)
G	2.40 - 2.45	(0.0945 - 0.0965)

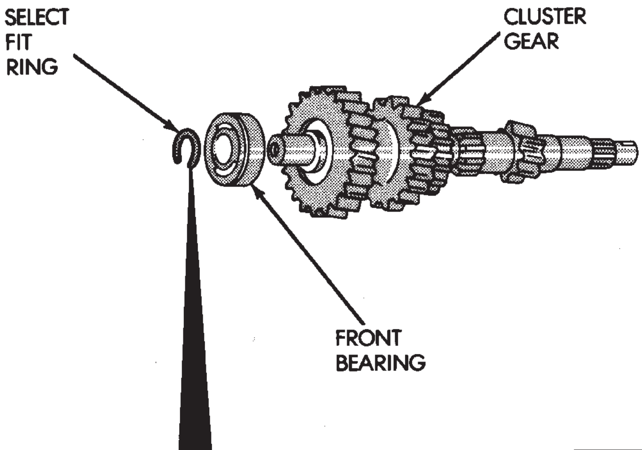
J8921-1097

Fig. 70 Selecting Input Shaft Front Bearing Snap Ring

(2) Press front bearing on cluster gear. Then secure bearing with thickest snap ring that will fit in ring groove on gear (Fig. 71).

(3) Install new oil seals in front bearing retainer and adapter housing (Fig. 72). Installation depth for bearing retainer seal is 10.5 to 11.5 mm (0.414 to 0.453 in.).

(4) Install reverse shaft and shaft retaining pin in adapter housing. Then install access hole plug with torx bit (Fig. 73).



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	2.00 - 2.05	(0.0787 - 0.0807)
B	2.05 - 2.10	(0.0807 - 0.0827)
C	2.10 - 2.15	(0.0827 - 0.0846)
D	2.15 - 2.20	(0.0846 - 0.0866)
E	2.20 - 2.25	(0.0866 - 0.0886)

J8921-1098

Fig. 71 Selecting Cluster Gear Front Bearing Snap Ring

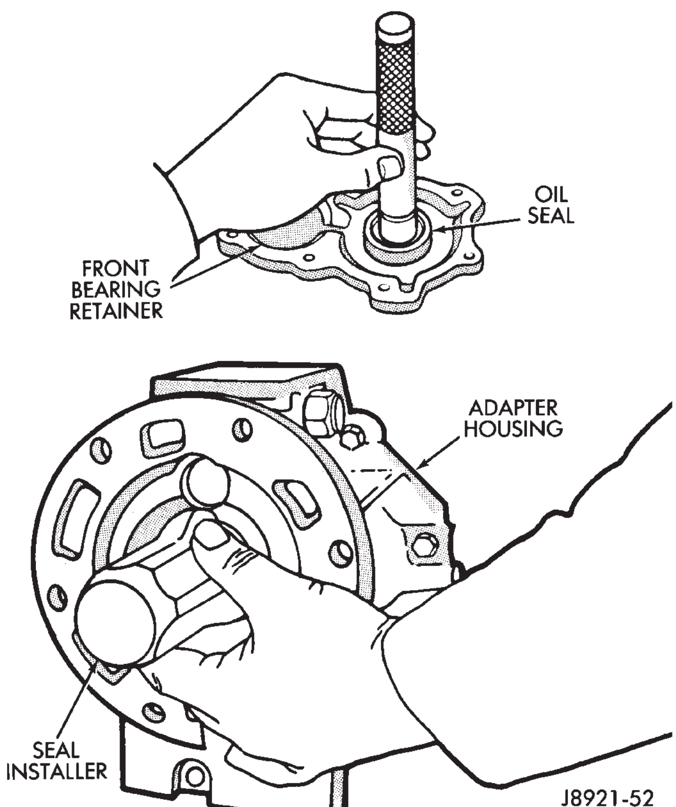


Fig. 72 Oil Seal Installation

(5) Lubricate reverse shaft and gear components with Mopar 75W-90 gear lubricant.

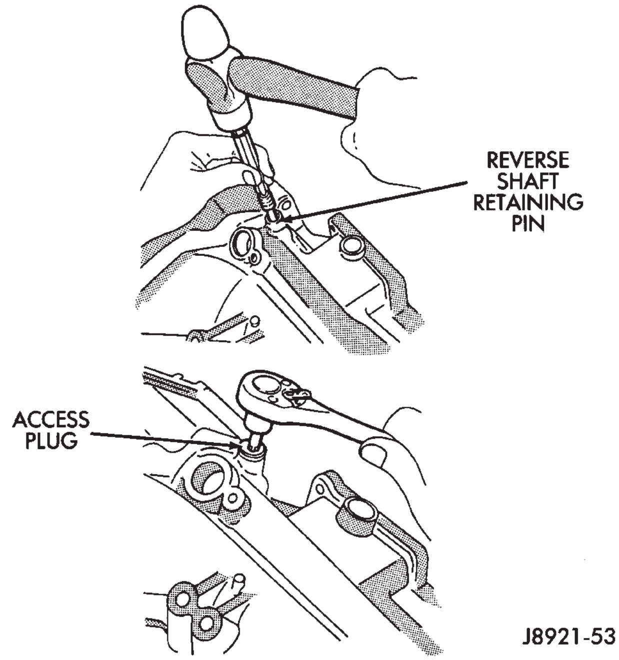


Fig. 73 Installing Reverse Shaft Pin

OUTPUT SHAFT ASSEMBLY

(1) Lubricate output shaft journals, gears and needle bearings with recommended gear lubricant.

(2) Install third gear and needle bearing on shaft (Fig. 63)

(3) Install synchro ring on third gear (Fig. 63).

(4) Assemble 1-2 and 3-4 synchro hubs and sleeves (Fig.74).

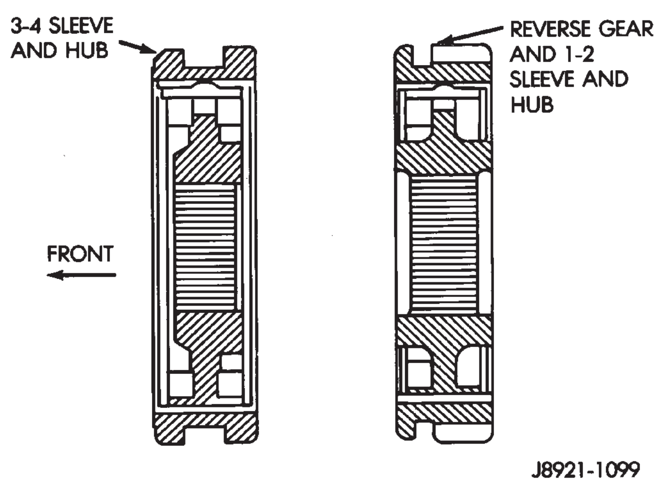


Fig. 74 Synchro Sleeve And Hub Identification

(5) Install inserts and springs in synchro sleeves. Position open ends of springs 180° apart as shown (Fig. 75).

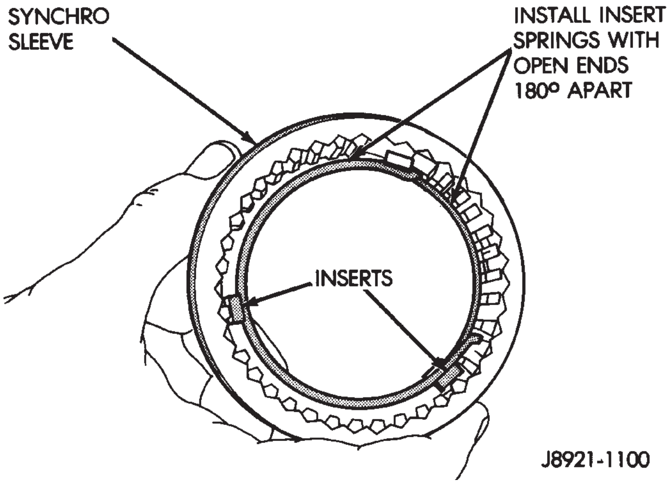
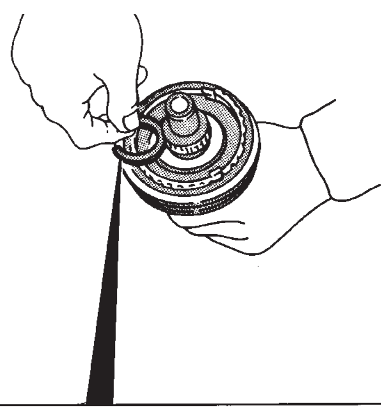


Fig. 75 Insert Spring Position

(6) Install 3-4 synchro hub and sleeve on output shaft. Press hub onto shaft if necessary.

(7) Install 3-4 synchro hub snap ring (Fig. 76). Use thickest snap ring that will fit in shaft groove.



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	1.80 - 1.85	(0.0709 - 0.0728)
B	1.85 - 1.90	(0.0728 - 0.0748)
C	1.90 - 1.95	(0.0748 - 0.0768)
D	1.95 - 2.00	(0.0768 - 0.0787)
E	2.00 - 2.05	(0.0787 - 0.0807)
F	2.05 - 2.10	(0.0807 - 0.0827)
G	2.10 - 2.15	(0.0827 - 0.0846)

J8921-1101

Fig. 76 Installing 3-4 Synchro Hub Snap Ring

(8) Verify third gear thrust clearance with feeler gauge (Fig. 56). Clearance should be 0.10 to 0.25 mm (0.004 to 0.010 in.).

(9) Lubricate remaining output shaft gears and bearings with gear lubricant.

(10) Install second gear and needle bearing on shaft (Fig. 78).

(11) Install synchro ring on second gear (Fig. 78).

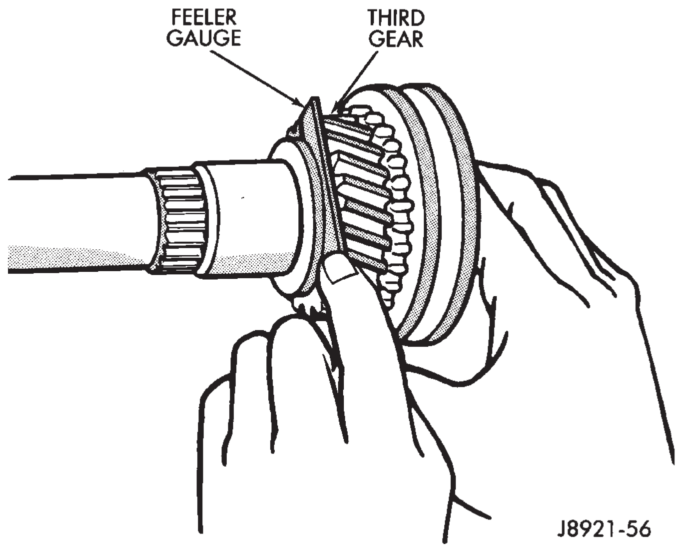
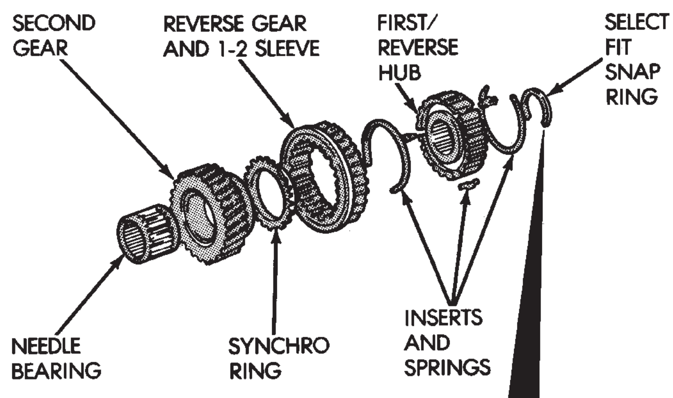


Fig. 77 Checking Third Gear Clearance

(12) Assemble first/reverse hub, insert springs, inserts, reverse gear and 1-2 sleeve (Fig. 78). **Be sure spring ends are 180° apart. Note that splines in hub bore are chamfered on one side. Install hub so chamfered side faces front of output shaft.**

(13) Press assembled hub and sleeve on output shaft.

(14) Install selective snap ring (Fig. 78). Use thickest snap ring that will fit in output shaft groove.



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
B	2.35 - 2.40	(0.0925 - 0.0945)
C	2.40 - 2.45	(0.0945 - 0.0965)
D	2.45 - 2.50	(0.0965 - 0.0984)
E	2.50 - 2.55	(0.0984 - 0.1004)
F	2.55 - 2.60	(0.1004 - 0.1024)
G	2.60 - 2.65	(0.1024 - 0.1043)

J8921-1102

Fig. 78 Second Gear And Synchro Assembly

(15) Install synchro ring on first gear (Fig. 79).

(16) Install first gear spacer on shaft and against selective fit snap ring (Fig. 79).

(17) Install first gear and needle bearing (Fig. 79) on output shaft.

(18) Install locating pin and thrust washer on shaft (Fig. 79).

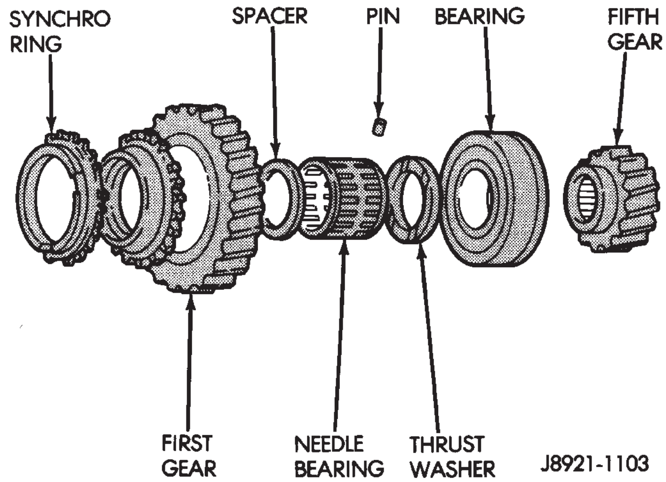


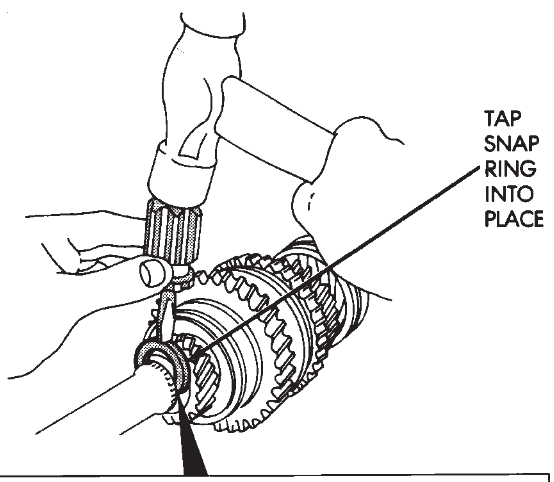
Fig. 79 First And Fifth Gear Components

(19) Press rear bearing on shaft. Position bearing snap ring groove so it is closest to end of output shaft.

(20) Check first and second gear thrust clearance with feeler gauge (Fig. 62).

- First gear clearance should be 0.10 to 0.40 mm (0.003 to 0.0197 in.)
- Second gear clearance should be 0.10 to 0.30 mm (0.003 to 0.0118 in.)

(21) Press fifth gear onto output shaft. Then install select fit snap ring (Fig. 80). Use thickest snap ring that will fit in shaft groove.



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	2.75 - 2.80	(0.1083 - 0.1102)
B	2.80 - 2.85	(0.1002 - 0.1122)
C	2.85 - 2.90	(0.1122 - 0.1142)
D	2.90 - 2.95	(0.1142 - 0.1161)
E	2.95 - 3.00	(0.1161 - 0.1181)
F	3.00 - 3.05	(0.1181 - 0.1201)
G	3.05 - 3.10	(0.1201 - 0.1220)
H	3.10 - 3.15	(0.1220 - 0.1240)
J	3.15 - 3.20	(0.1240 - 0.1260)
K	3.20 - 3.25	(0.1260 - 0.1280)
L	3.25 - 3.30	(0.1280 - 0.1299)
M	3.30 - 3.35	(0.1299 - 0.1319)

J8921-1104

Fig. 80 Selecting Fifth Gear Snap Ring

(22) Lubricate input shaft pilot bearing with petroleum jelly and install bearing in shaft (Fig. 60).

(23) Install input shaft on output shaft (Fig. 59). Be sure output shaft hub is fully seated in pilot bearing.

OUTPUT SHAFT AND CLUSTER GEAR INSTALLATION

(1) Mount intermediate plate in vise (Fig. 24).

(2) Lubricate cluster gear journal and rear bearing with petroleum jelly or gear lubricant.

(3) Install cluster gear rear bearing in intermediate plate (Fig. 81). Be sure snap ring groove in bearing is rearward as shown.

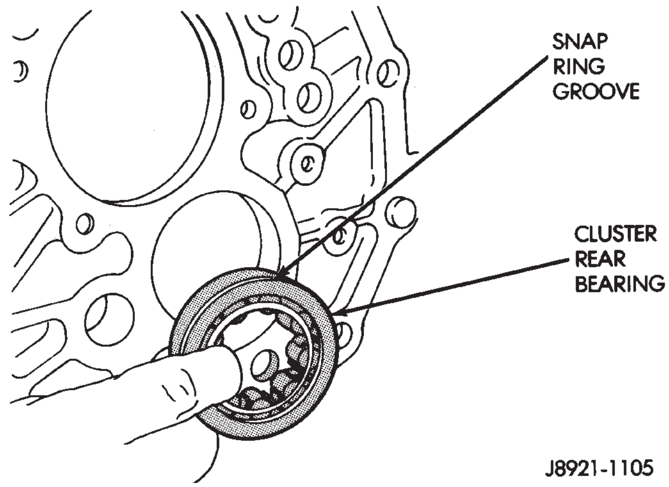


Fig. 81 Installing Cluster Gear Rear Bearing

(4) Start cluster gear into bearing (Fig. 57). Then hold bearing and push gear into place. Use plastic or rawhide mallet to seat bearing if necessary.

(5) Start output shaft rear bearing in intermediate plate. Push shaft rearward and tap intermediate plate with mallet to seat bearing.

(6) Install snap rings on cluster and output shaft **rear** bearings only (Fig. 82). Do not install front bearing snap rings at this time.

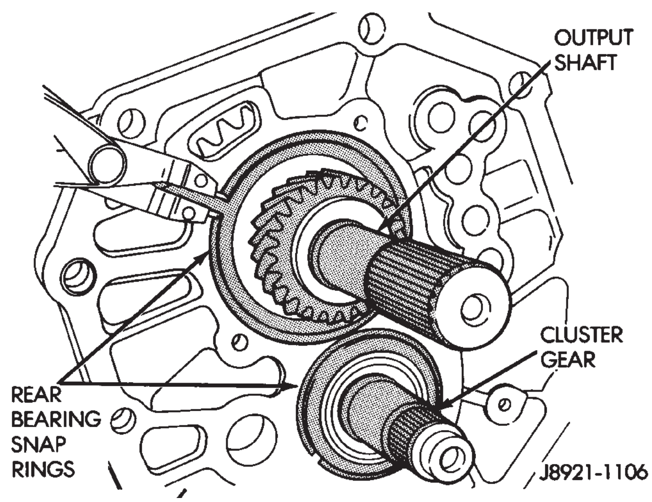


Fig. 82 Installing Rear Bearing Snap Rings

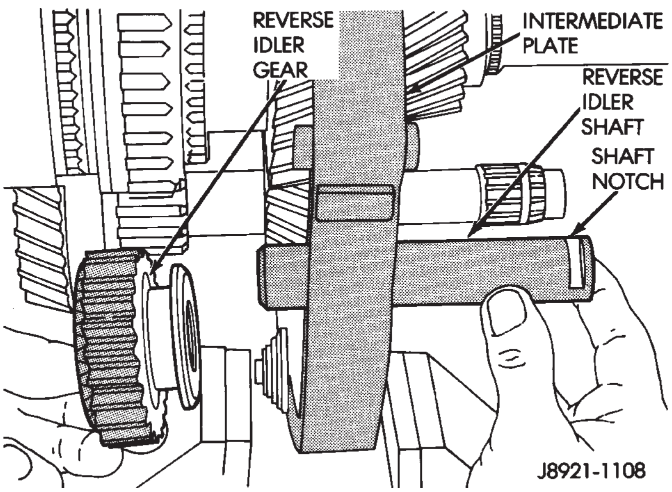


Fig. 83 Installing Reverse Idler Gear And Shaft

(7) Install reverse idler gear and shaft (Fig. 83).

(8) Position rear bearing retainer over output shaft and rear bearing. **Be sure bearing retainer tab is engaged in reverse idler shaft notch (Fig. 84).**

(9) Install and tighten rear bearing retainer bolts to 18 N·m (13 ft-lbs).

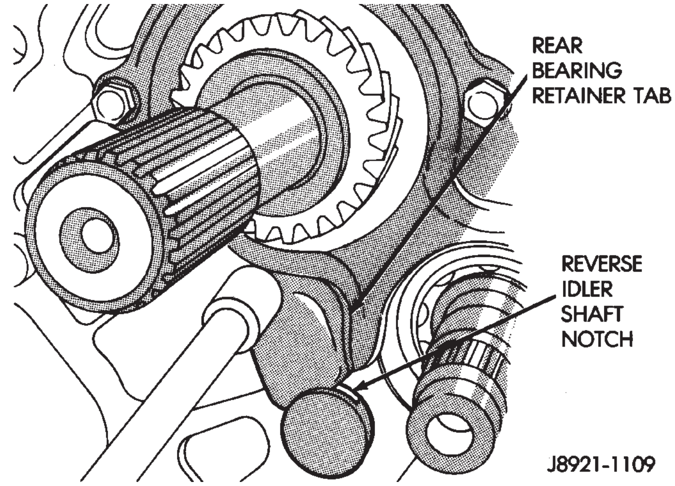


Fig. 84 Installing Rear Bearing Retainer

SHIFT RAIL AND FORK INSTALLATION

The shift rail interlock pins, balls and plugs must be installed in the correct sequence for proper shifting. Refer to the installation diagram (Fig. 85) during assembly.

Coat the intermediate plate shift rail bores and the interlock balls, pins and plugs with a thick covering of petroleum jelly before assem-

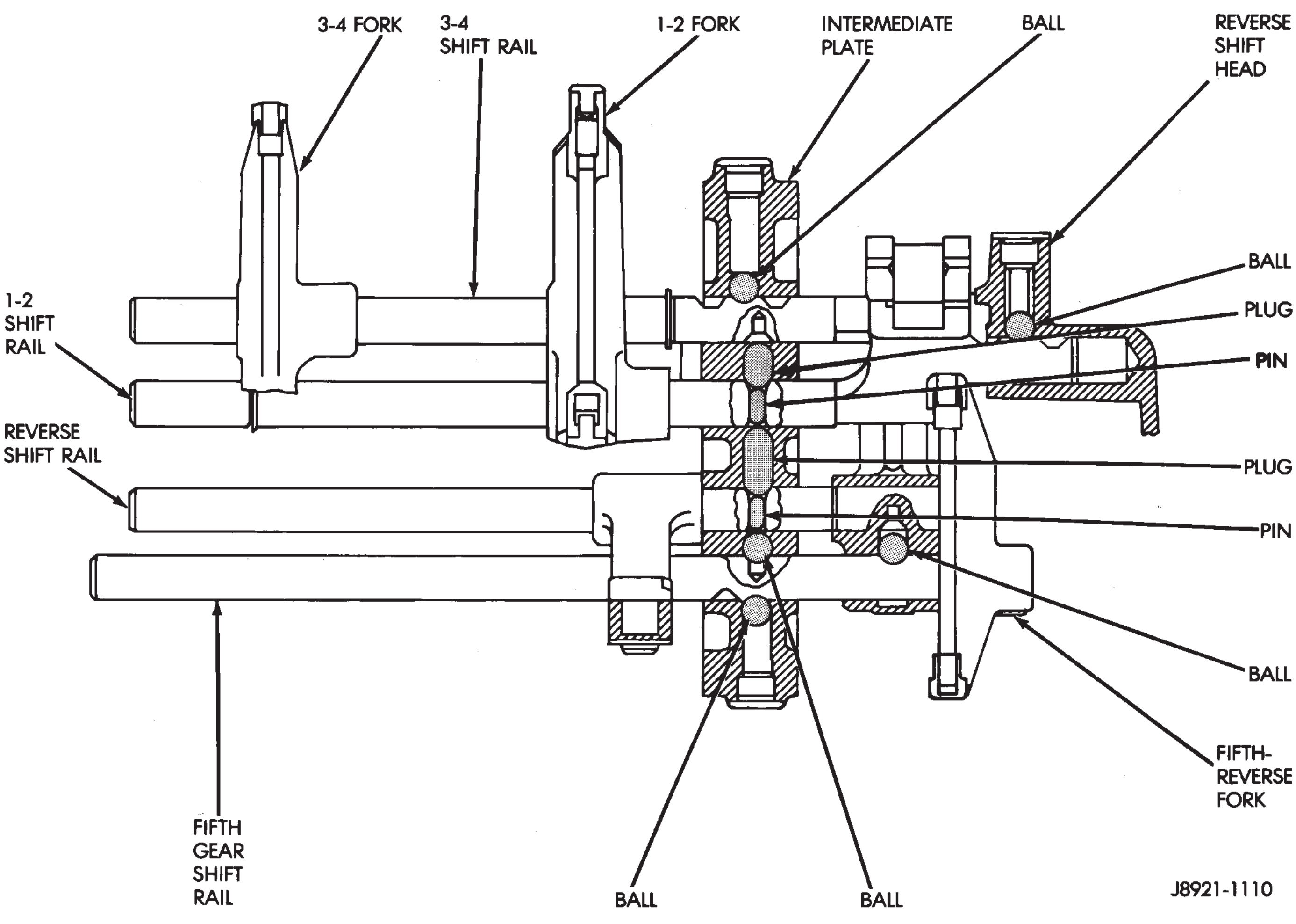


Fig. 85 Shift Rail Ball-Plug-Pin Position

bly. The jelly will hold the interlock components in place making installation easier. Use a pencil magnet to hold and insert the interlocks. Then use a small screwdriver to push the interlock components into place.

(1) Coat reverse rail interlock pin with petroleum jelly and install pin in rail (Fig. 86).

(2) Install reverse shift rail in intermediate plate (Fig. 87).

(3) Install reverse shift rail C-ring (Fig. 51).

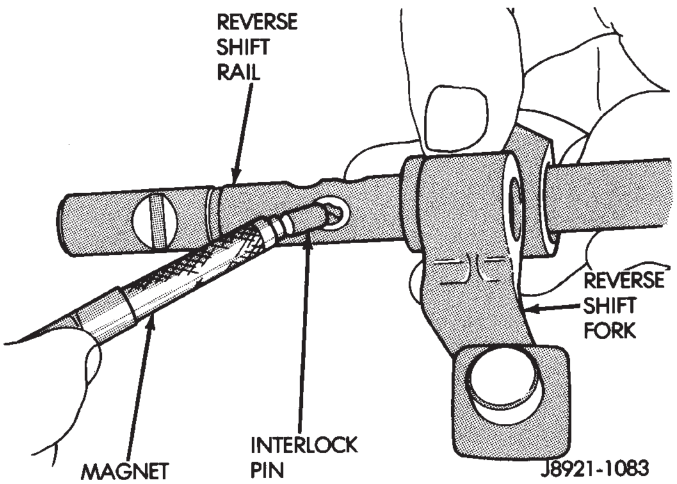


Fig. 86 Installing Reverse Shift Rail Interlock Pin

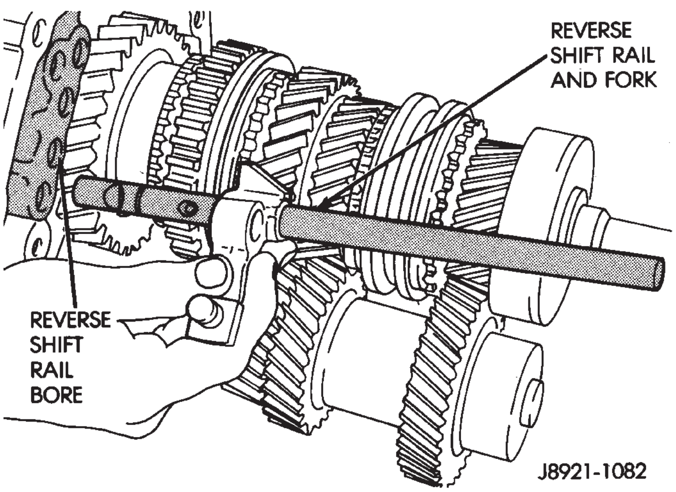


Fig. 87 Installing Reverse Shift Rail And Fork

(4) Position 1-2 and 3-4 shift forks in synchro sleeves (Fig. 88).

(5) Coat reverse rail lock ball with petroleum jelly. Then tilt reverse shift fork upward and insert ball in intermediate plate (Fig. 89).

(6) Coat 1-2 shift rail interlock plug with petroleum jelly and install it in intermediate plate bore (Fig. 90).

(7) Coat 1-2 shift rail interlock pin with petroleum jelly and insert it in shift rail (Fig. 91).

(8) Install 1-2 shift rail in intermediate plate and 1-2 fork (Fig. 92).

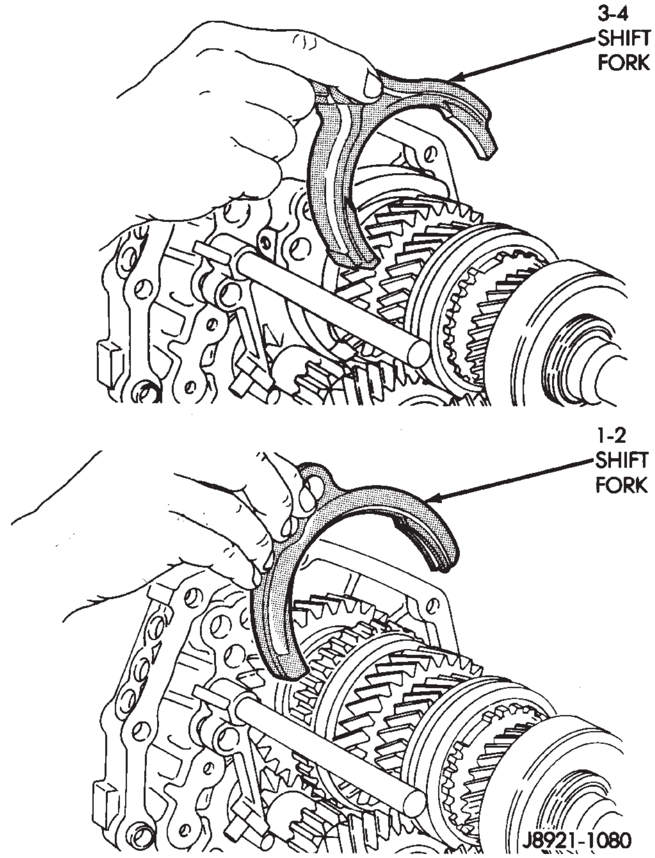


Fig. 88 Shift Fork Installation

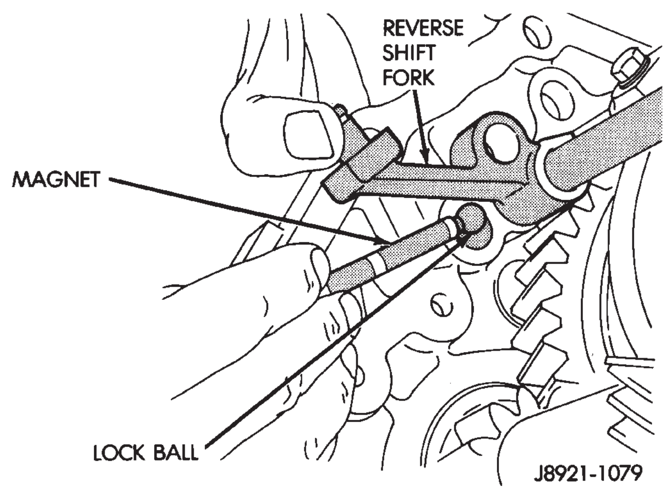


Fig. 89 Installing Reverse Shift Rail Lock Ball

(9) Coat 3-4 shift rail interlock plug with petroleum jelly and install plug in intermediate plate (Fig. 93).

(10) Install 3-4 shift rail in intermediate plate and in both shift forks (Fig. 94).

(11) Verify that none of the interlock balls, plugs, or pins were displaced during shift rail installation.

(12) Install and tighten shift fork setscrews to 20 N·m (14 ft. lbs.) torque (Fig. 95).

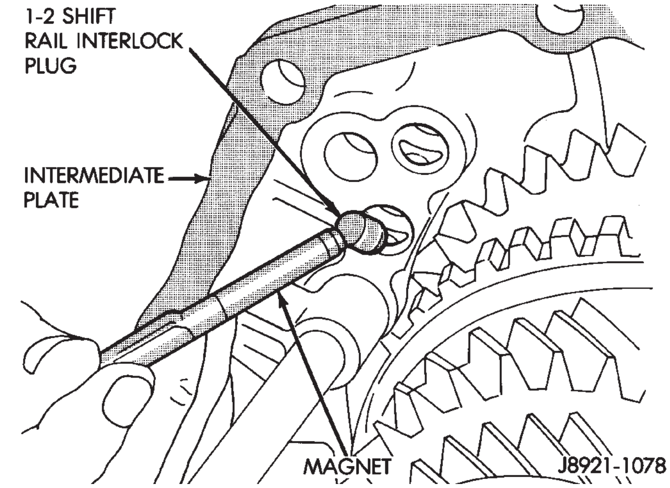


Fig. 90 Installing 1-2 Shift Rail Interlock Plug

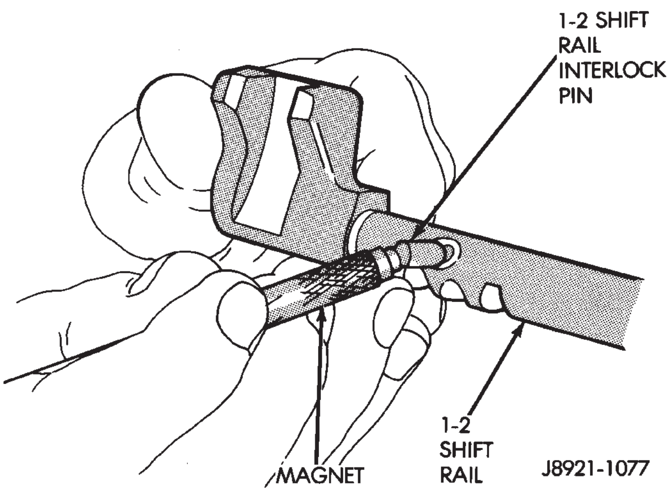


Fig. 91 Installing 1-2 Shift Rail Interlock Pin

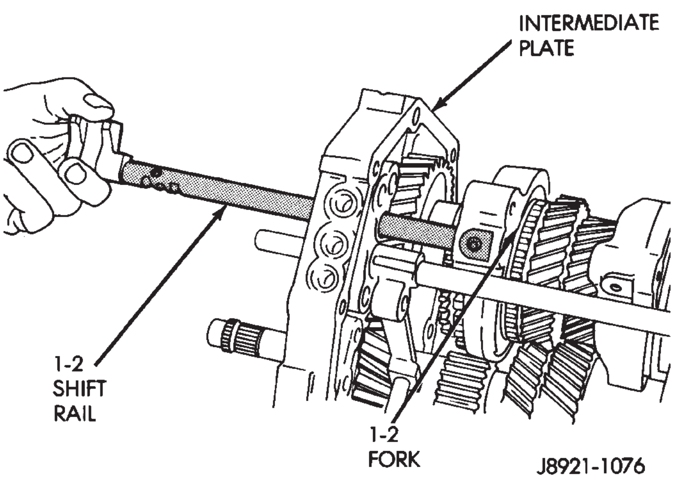


Fig. 92 Installing 1-2 Shift Rail

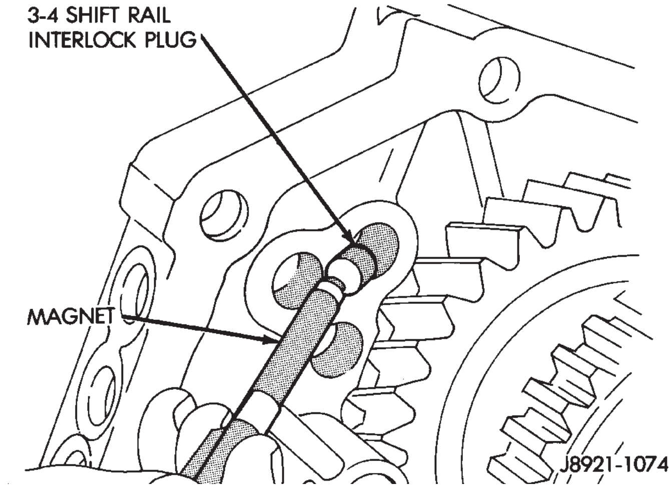


Fig. 93 Installing 3-4 Shift Rail Interlock Plug

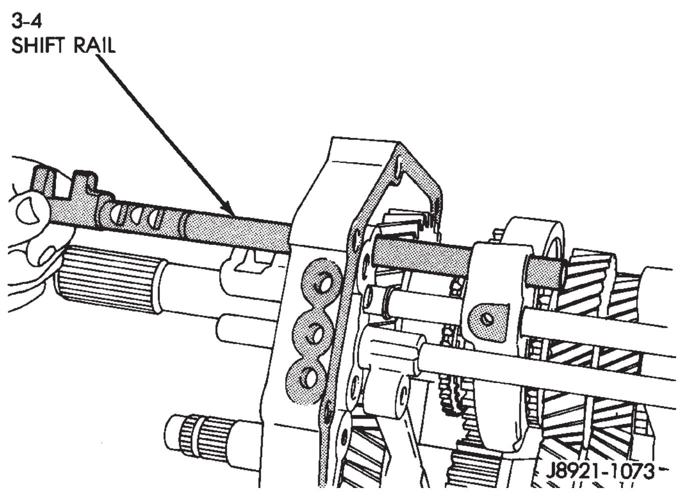


Fig. 94 Installing 3-4 Shift Rail

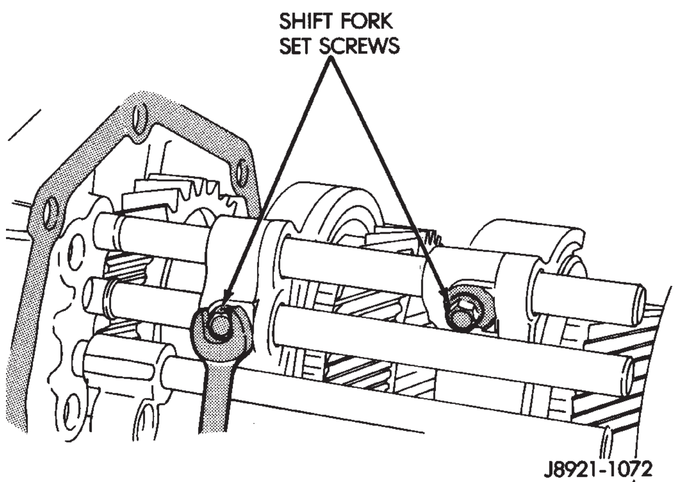


Fig. 95 Installing Shift Fork Set Screws

(13) Install 1-2 and 3-4 shift rail C-rings (Fig. 96).

(14) Insert fifth gear shift rail through reverse shift fork. **Then slide rail into intermediate plate just far enough to secure interlock ball. Do not fully install shift rail at this time.**

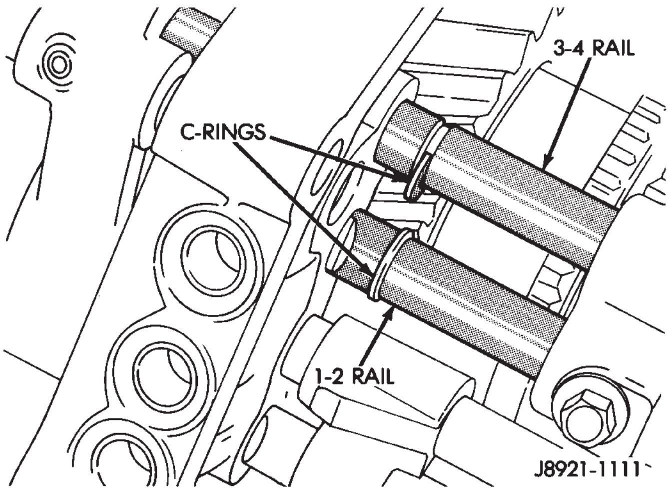


Fig. 96 Installing Shift Rail C-Rings

FIFTH-REVERSE GEAR AND SHIFT COMPONENT INSTALLATION

(1) Install thrust ring lock ball in cluster gear journal (Fig. 97). Use petroleum jelly to hold ball in place.

(2) Install fifth gear thrust ring (Fig. 98). Be sure thrust ring notch fits over lock ball.

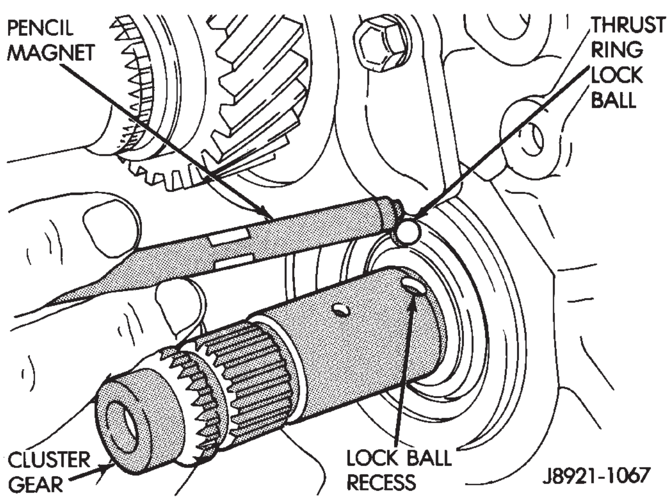


Fig. 97 Installing Thrust Ring Lock Ball

(3) Assemble counter fifth gear, synchro sleeve, inserts and insert springs (Fig. 99).

(4) Lubricate two-piece bearing with petroleum jelly and install it in counter fifth gear (Fig. 100).

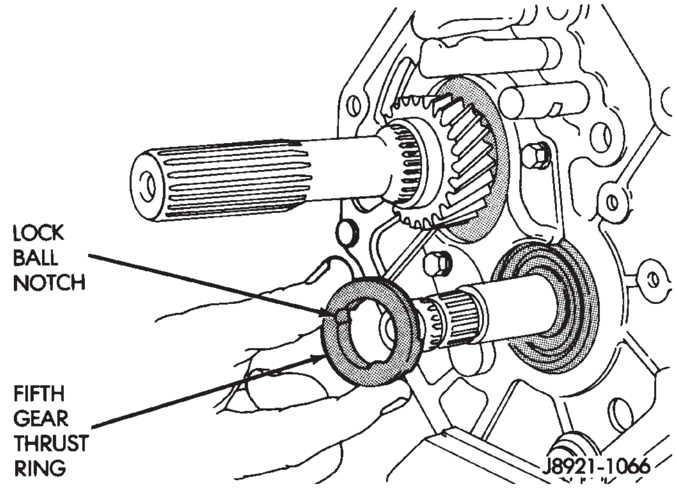


Fig. 98 Installing Fifth Gear Thrust Ring

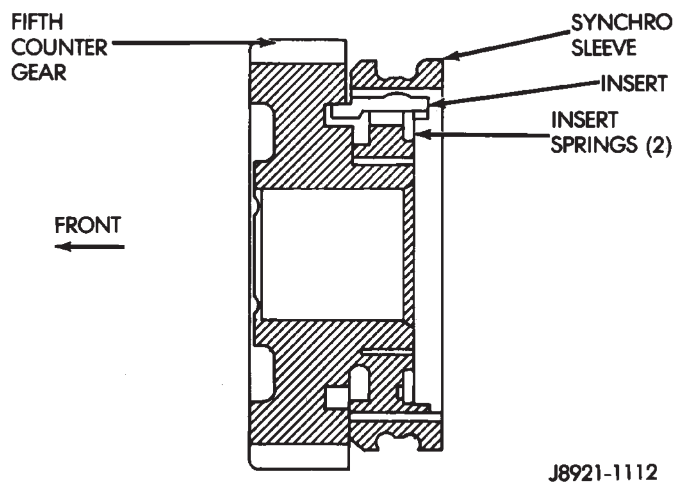


Fig. 99 Assembling Fifth Gear And Synchro Assembly

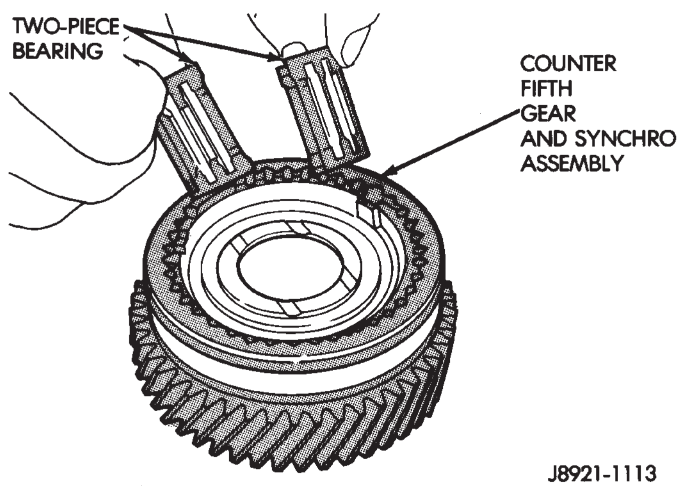


Fig. 100 Installing Counter Fifth Gear Bearing

(5) Install counter fifth gear and synchro assembly on cluster gear journal (Fig. 101).

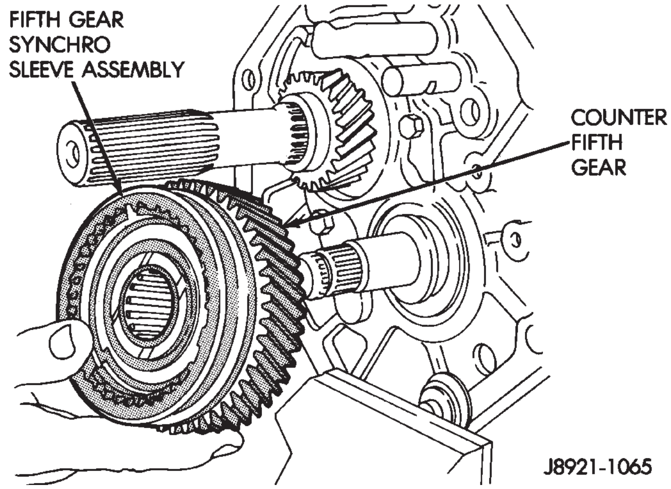


Fig. 101 Installing Counter Fifth Gear And Sleeve

(6) Install synchro ring in synchro sleeve (Fig. 102).

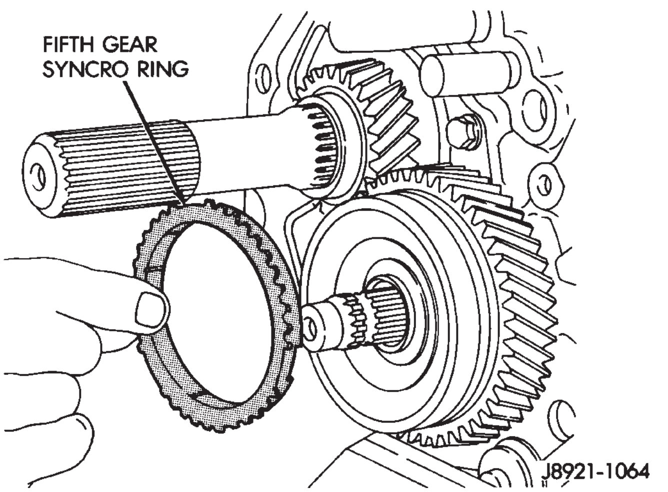


Fig. 102 Installing Fifth Gear Synchro Ring

(7) Install fifth spline gear on cluster journal (Fig. 103). Tap spline gear into place with plastic mallet if necessary.

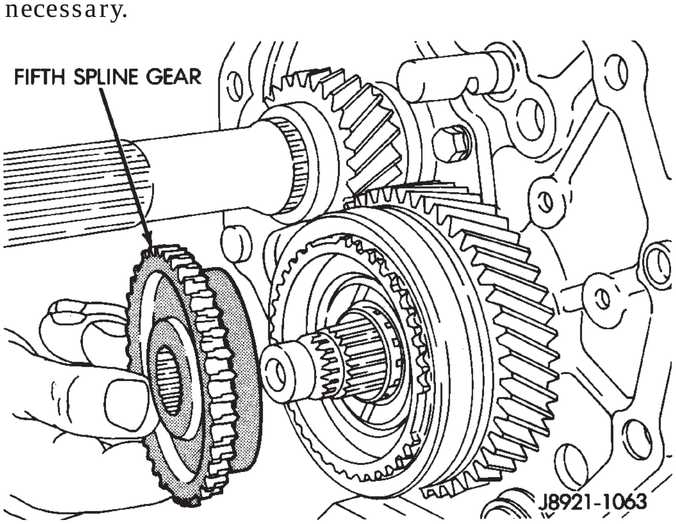
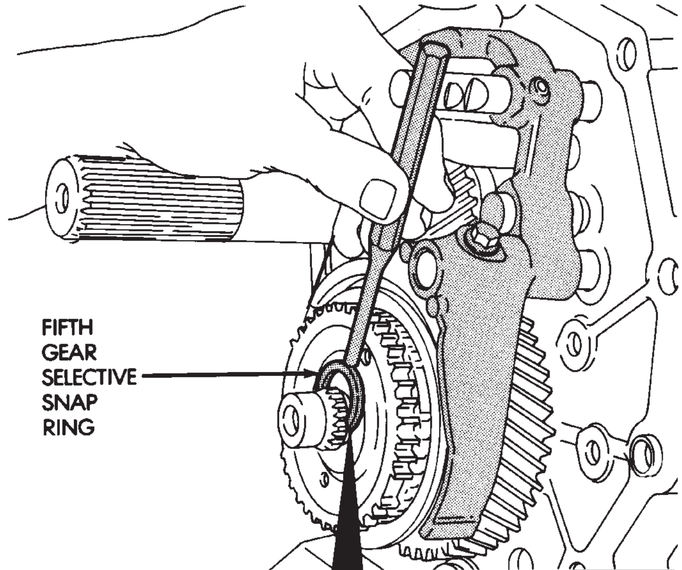


Fig. 103 Installing Fifth Spline Gear

(8) Install fifth gear selective snap ring (Fig. 104). Use thickest snap ring that will fit in shaft groove.



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	2.85 - 2.90	(0.1122 - 0.1142)
B	2.90 - 2.95	(0.1142 - 0.1161)
C	2.95 - 3.00	(0.1161 - 0.1181)
D	3.00 - 3.05	(0.1181 - 0.1201)
E	3.05 - 3.10	(0.1201 - 0.1220)
F	3.10 - 3.15	(0.1220 - 0.1240)
G	3.15 - 3.20	(0.1240 - 0.1260)
H	3.20 - 3.25	(0.1260 - 0.1280)

J8921-1114

Fig. 104 Installing Fifth Gear Snap Ring

(9) Install reverse shift head and rail (Fig. 105). Then install lock ball in shift head.

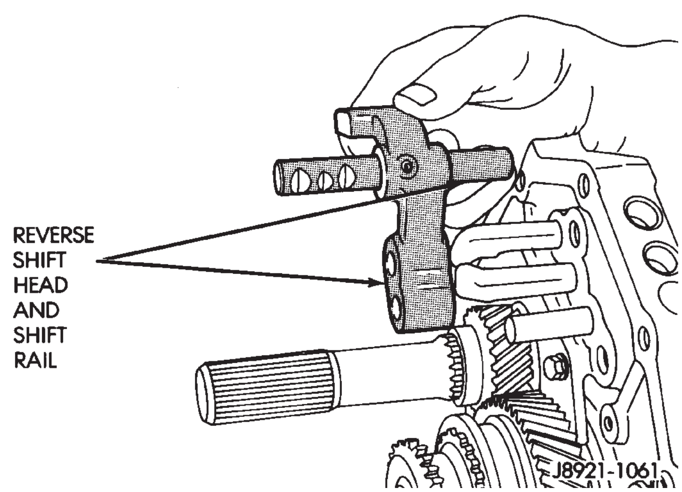


Fig. 105 Installing Reverse Shift Head And Rail

(10) Position fifth gear shift fork in synchro sleeve (Fig. 106).

(11) Install fifth gear shift rail (Fig. 107). Slide rail through fork, shift head, intermediate plate and reverse shift fork. Be sure interlock ball is not displaced during installation.

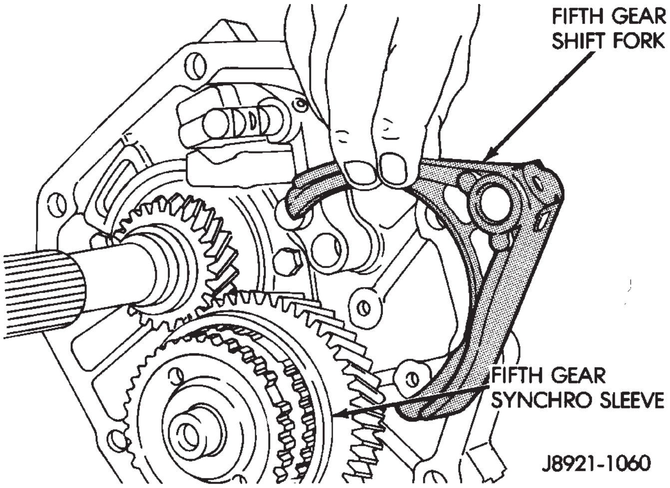


Fig. 106 Fifth Gear Shift Fork Installation

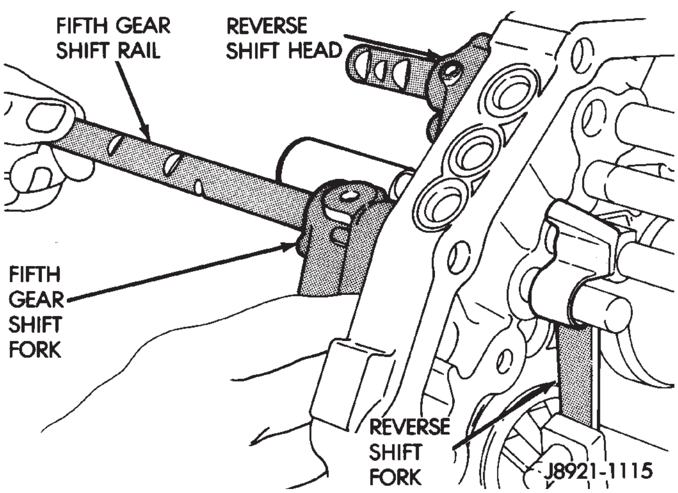


Fig. 107 Fifth Gear Shift Rail Installation

(12) Align screw holes in shift fork and rail and install set screw (Fig. 108). Tighten screw to 20 N·m (15 ft. lbs.) torque.

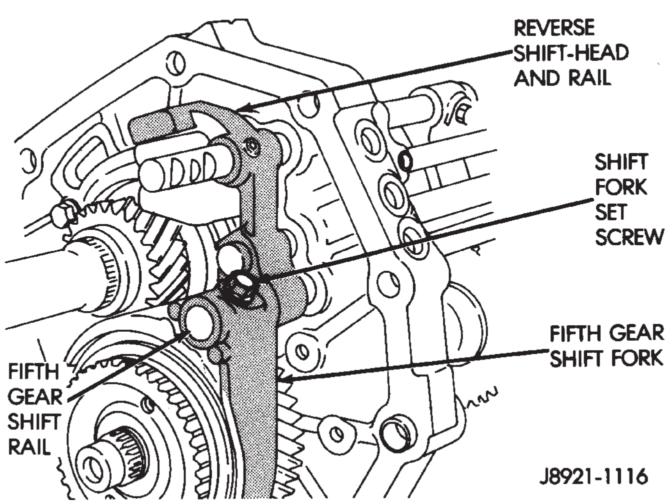


Fig. 108 Shift Fork Set Screw Installation

(13) Install lock balls and springs in intermediate plate (Fig. 109). Then install and tighten lock ball plugs to 19 N·m (14 ft. lbs.) torque.

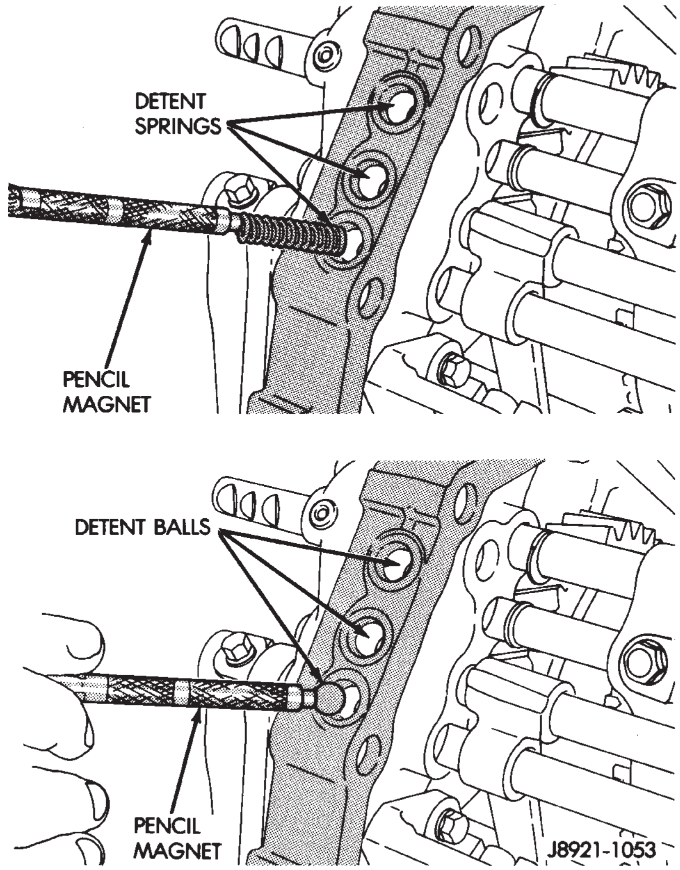


Fig. 109 Detent Ball And Spring Installation

(14) Install reverse shift arm bracket (Fig. 110). Tighten bracket bolts to 18 N·m (13 ft. lbs.) torque.

(15) Install reverse shift arm (Fig. 110). Position arm on reverse fork pin and engage it with pin on shift arm bracket.

(16) Verify that shift arm shoe is engaged in reverse idler gear. Then secure shift arm to pin on reverse fork with new E-clip.

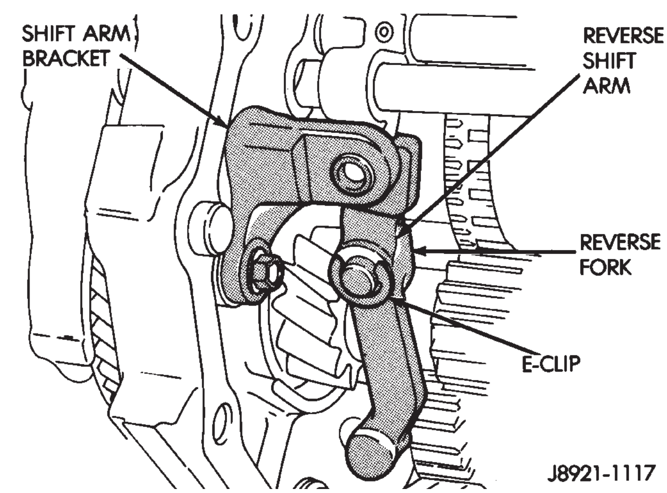


Fig. 110 Reverse Shift Arm And Bracket Installation

GEAR CASE AND ADAPTER INSTALLATION

(1) Dismount intermediate plate and gear assemblies from vise.

(2) Clean mating surfaces of intermediate plate and transmission gear case with wax and grease remover. Then wipe dry with a clean cloth.

(3) Apply 3 mm (1/8 in.) wide bead of Mopar Gasket Maker, or Loctite 518 to mating surface of gear case. Keep sealer bead inside bolt holes as shown (Fig. 111).

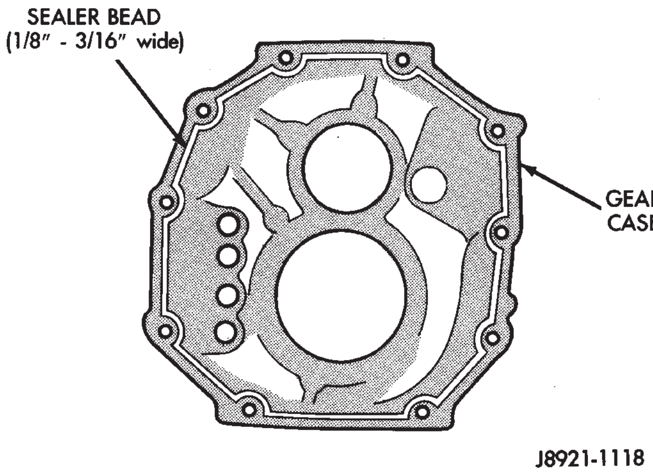


Fig. 111 Applying Sealer To Gear Case

(4) Install gear case (Fig. 112). Align shift rails and bearings in case and tap case into position.

(5) Verify that gear case is seated on intermediate plate dowel pins.

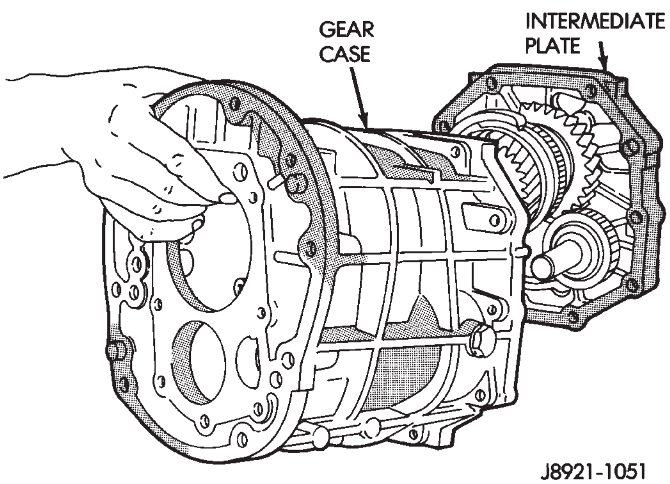


Fig. 112 Gear Case Installation

(6) Install front bearing snap rings (Fig. 113).

(7) Clean gear case and front bearing retainer sealing surfaces with wax and grease remover. Then wipe dry with a clean cloth.

(8) Install new seal in front bearing retainer. Then lubricate seal lip with petroleum jelly. **Installation depth for seal is 10.5 to 11.5 mm (0.413 to 0.453 in.).**

(9) Apply a 3 mm (1/8 in.) wide bead of Mopar Gasket Maker, or Loctite 518 to front bearing retainer sealing surface.

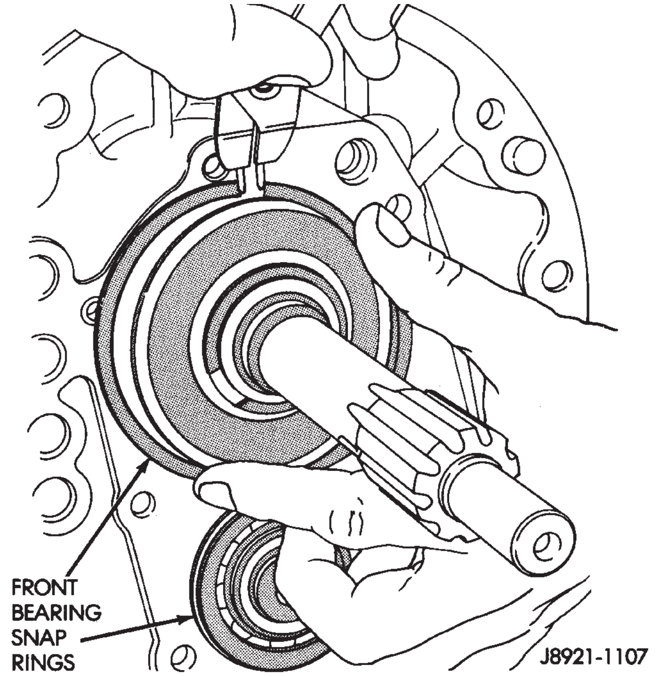


Fig. 113 Front Bearing Snap Ring Installation

(10) Align and install front bearing retainer (Fig. 114). Be sure retainer is properly seated on case and bearings.

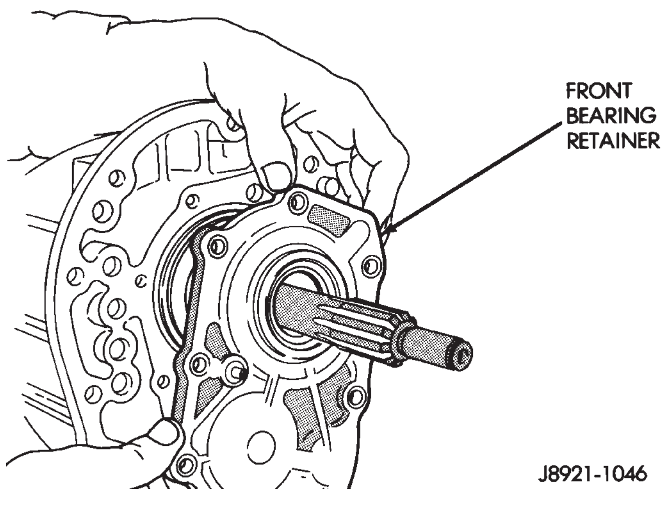


Fig. 114 Installing Front Bearing Retainer

(11) Install and tighten front bearing retainer bolts to 17 N·m (12 ft. lbs.) torque.

(12) On models with extension housing, install speedometer gear, lock ball and retaining rings (Fig. 115). Be sure lock ball is engaged in gear.

(13) Inspect condition of reverse pin in adapter/extension housing (Fig. 116). If pin is worn or damaged, replace it as follows:

(a) Remove roll pin access plug (Fig. 117).

(b) Tap roll pin out of housing with pin punch (Fig. 118). Then remove old reverse pin.

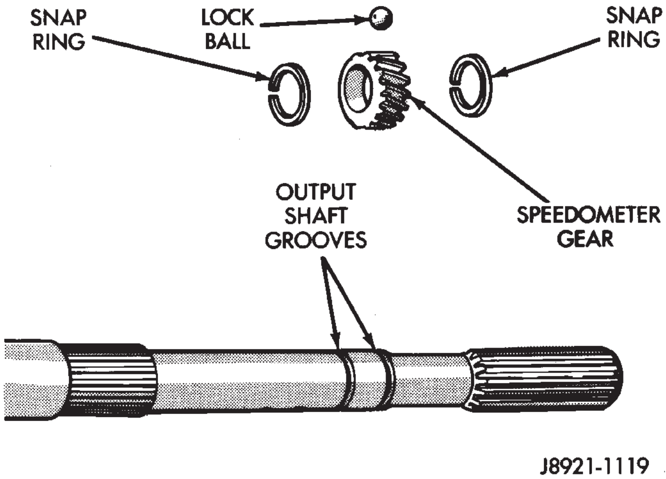


Fig. 115 Speedometer Gear Installation (2WD Models)

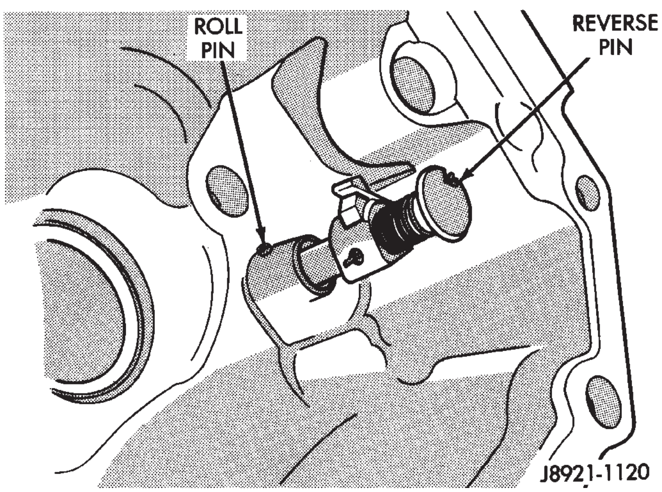


Fig. 116 Reverse Pin Position

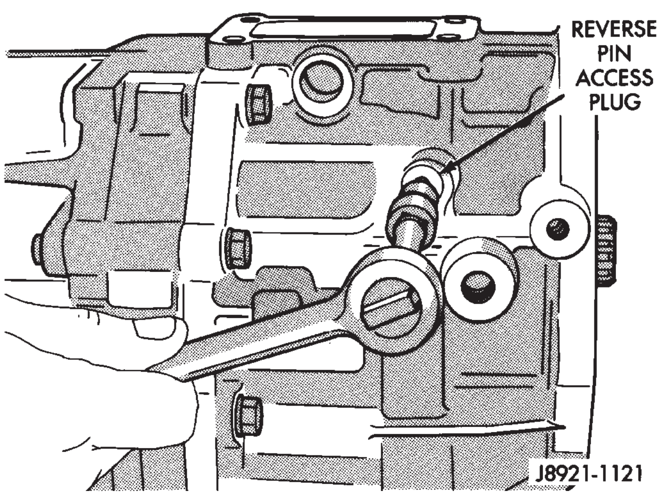


Fig. 117 Access Plug Removal/Installation

(c) Install new reverse pin and secure it with roll pin. Then install and tighten access plug to 19 N·m (14 ft. lbs.) torque.

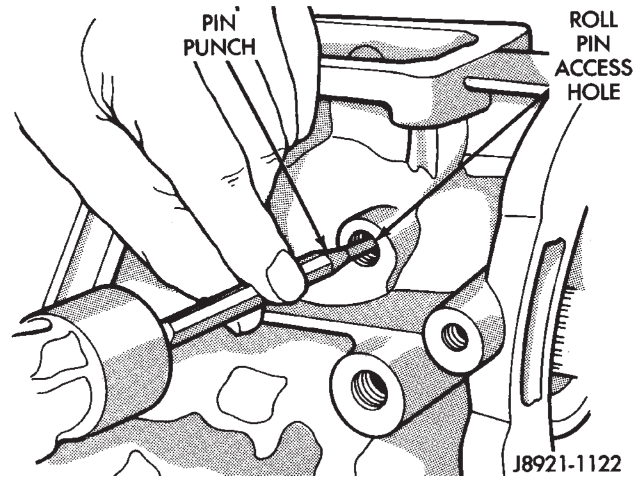


Fig. 118 Roll Pin Removal/Installation

(14) Clean sealing surfaces of adapter or extension housing and intermediate plate with wax and grease remover. Then wipe dry with a clean cloth.

(15) Apply 3 mm (1/8 in.) wide bead of Mopar Gasket Maker, or Loctite 518 to sealing surface of adapter or extension housing. Keep sealer bead inside bolt holes as shown in Figure 111.

(16) Align and install adapter or extension housing on intermediate plate (Fig. 119). Be sure housing is seated on intermediate plate dowel pins.

(17) Coat threads of housing attaching bolts with Mopar silicone sealer. Then install and tighten bolts to 37 N·m (27 ft. lbs.) torque.

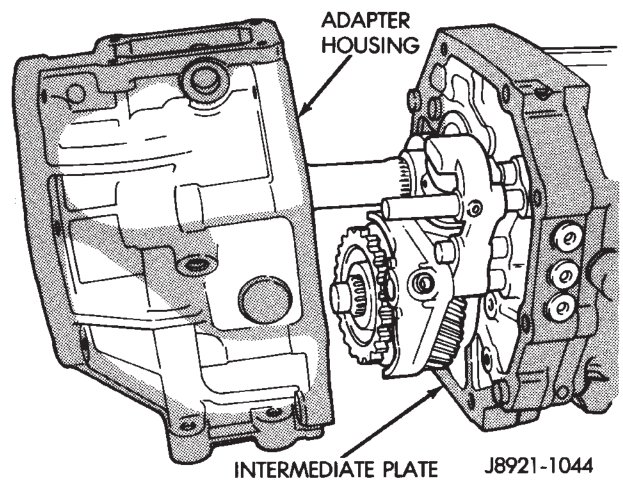


Fig. 119 Adapter/Extension Housing Installation

(18) Install detent ball (Fig. 120).

(19) Install detent spring (Fig. 121).

(20) Install detent access plug (Fig. 122). Tighten plug to 19 N·m (14 ft. lbs.) torque.

(21) Lubricate shift arm shaft and install it in adapter housing (Fig. 123).

(22) Position shift arm in adapter housing (Fig. 124). Be sure arm is engaged in shift rails.

(23) Align shift arm with shaft and push shaft into arm.

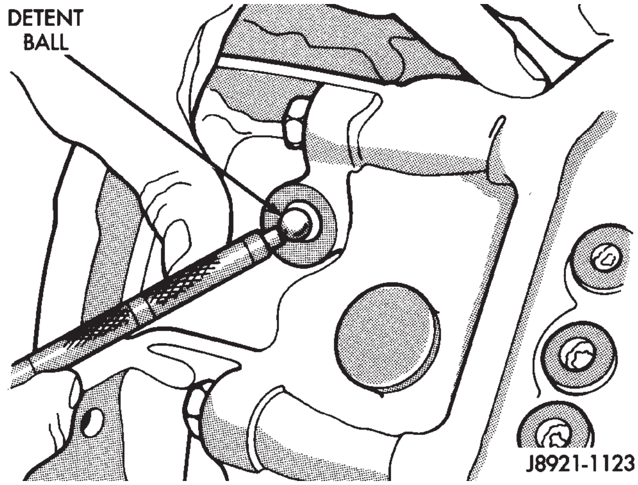


Fig. 120 Installing Detent Ball

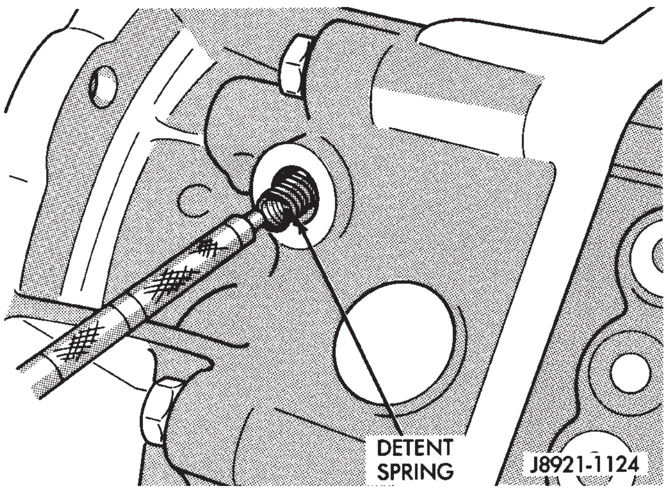


Fig. 121 Installing Detent Spring

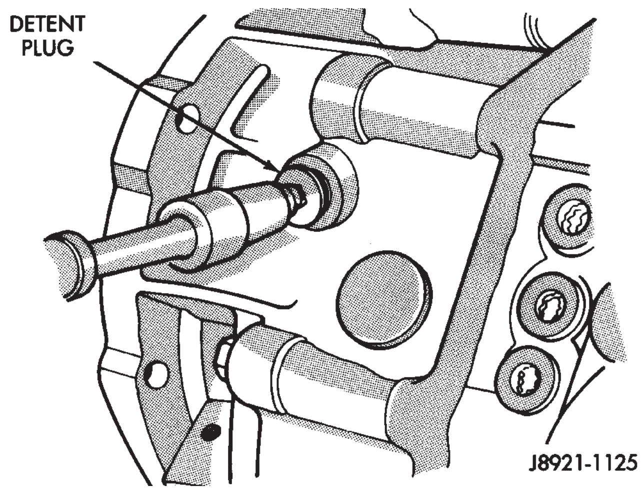


Fig. 122 Installing Detent Access Plug

(24) Rotate shift arm shaft until set screw holes in shaft and arm are aligned.

(25) Install and tighten shift arm set screw to 38 N·m (28 ft. lbs.) torque (Fig. 125).

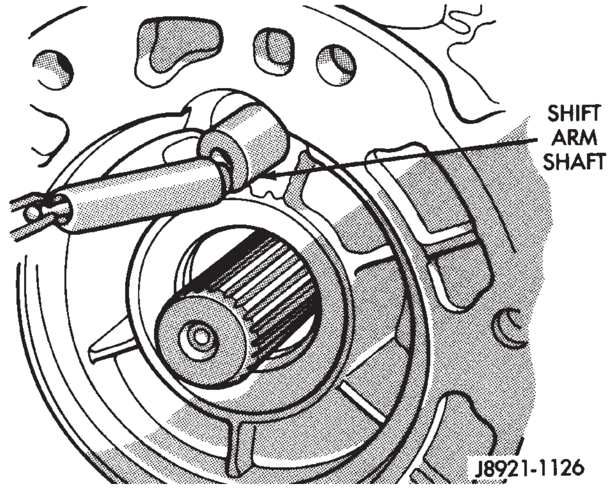


Fig. 123 Installing Shift Arm Shaft

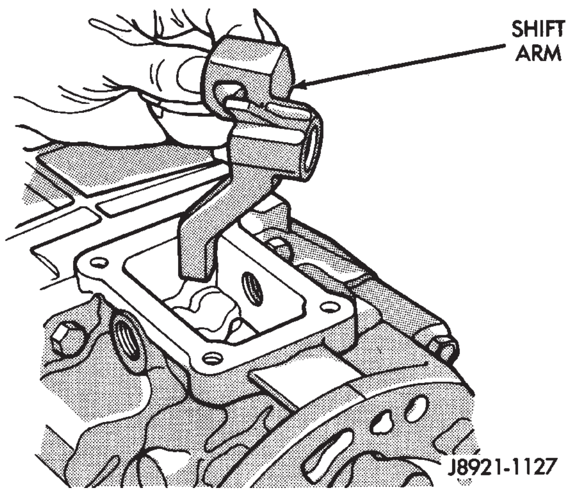


Fig. 124 Shift Arm Installation

(26) Install and tighten restrictor pins to 19 N·m (14 ft. lbs.) torque (Fig. 125).

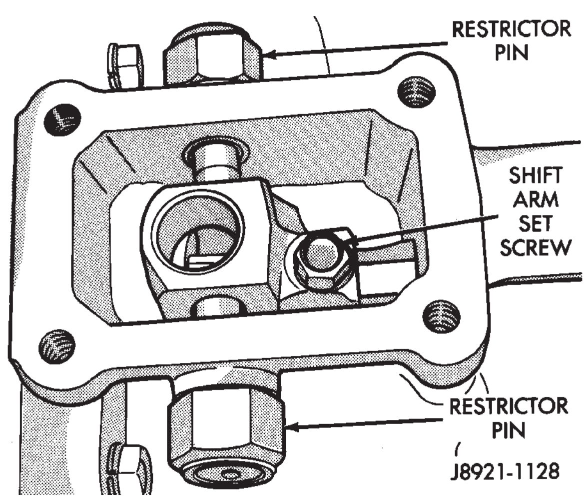


Fig. 125 Set Screw And Restrictor Pin Installation

(27) Install and tighten shift arm shaft access plug to 19 N·m (14 ft. lbs.) torque (Fig. 126).

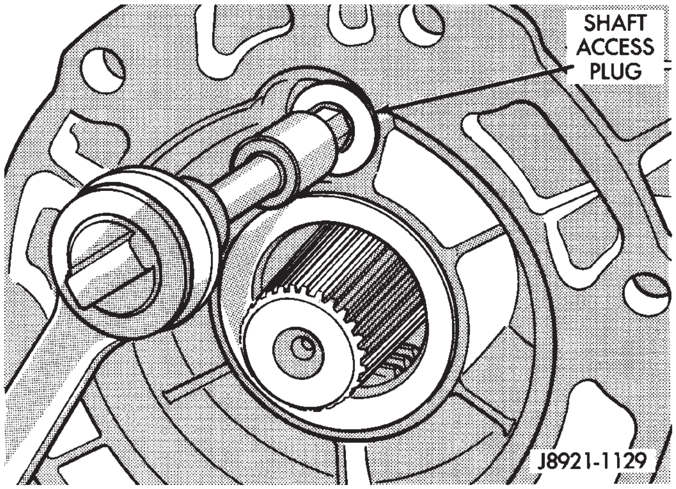


Fig. 126 Access Plug Installation

(28) Position new shift tower gasket on adapter housing (Fig 127).

(29) Install shift tower (Fig. 128). Tighten tower attaching bolts to 18 N·m (13 ft. lbs.) torque.

(30) Install new gasket on backup light switch and install switch. Tighten switch to 37 N·m (27 ft. lbs.) torque.

(31) Install new washer on drain plug. Then install and tighten plug to 37 N·m (27 ft. lbs.) torque.

(32) If transmission will be filled with gear lubricant before installation, place transmission in a level position. Then fill with Mopar 75W-90, grade GL-5 gear lubricant.

(33) Install new washer on fill plug. Then install and tighten plug to 37 N·m (27 ft. lbs.) torque.

(34) Install clutch housing and hydraulic concentric bearing.

(35) On models with extension housing, install new seal in housing with suitable size installer tool (Fig. 129). Lubricate seal lips with petroleum jelly before installation.

(36) On models with extension housing, install speedometer driven gear, speedometer adapter and speed sensor.

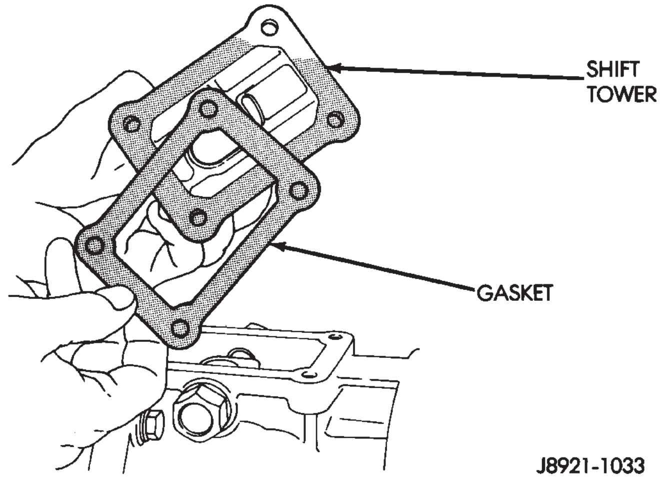


Fig. 127 Shift Tower Gasket Installation

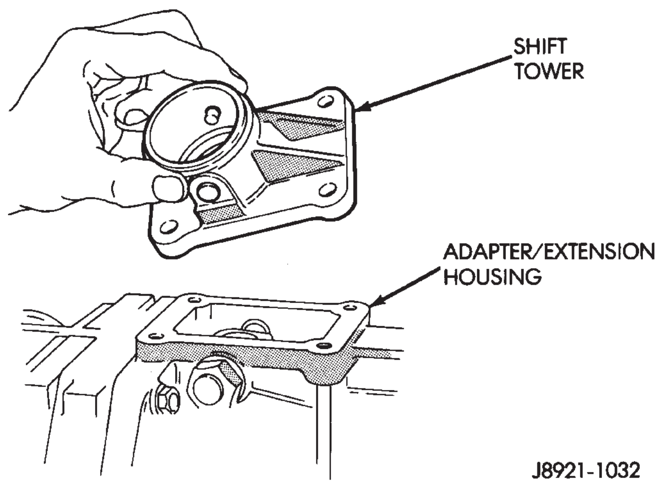


Fig. 128 Shift Tower Installation

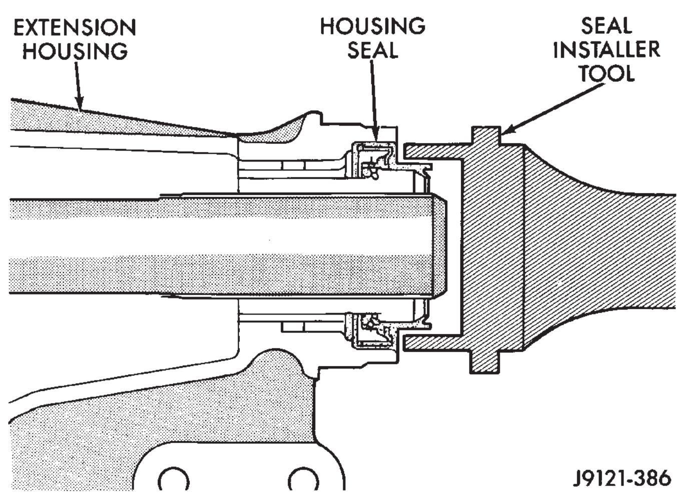


Fig. 129 Installing Extension Housing Seal

42RE AUTOMATIC TRANSMISSION

CONTENTS

GENERAL INFORMATION

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TRANSMISSION DESCRIPTION

The Chrysler 42RE is a 4-speed, fully automatic transmission with an electronic governor. It is used with 4.0L engines.

Mechanical and hydraulic components in the 42RE are similar to those in RH series transmissions. The main difference involves the method of producing governor pressure for shift control. The 42RE uses electronic components to develop governor pressure. A mechanical governor is used to generate governor pressure in the RH series.

First through third gear ranges are provided by the clutches, bands, overrunning clutch and planetary gear sets in the transmission unit. Fourth gear range is provided by the overdrive unit which contains an overdrive clutch, direct clutch, planetary gear set and overrunning clutch.

The overdrive clutch is applied in fourth gear only. The direct clutch is applied in all ranges except fourth gear.

The 42RE valve body transfer plate is different. It is designed to accept a governor body and different hydraulic circuitry. The governor pressure solenoid valve and sensor are mounted in this body. The transfer plate channels line pressure to the solenoid valve through the governor body. It also channels governor pressure from the solenoid valve to the governor circuit. It is the solenoid valve that develops necessary governor pressure.

The 42RE overdrive unit is different from previous overdrive units. It is shorter in length as a result of eliminating the mechanical governor assembly including the governor tubes and governor support.

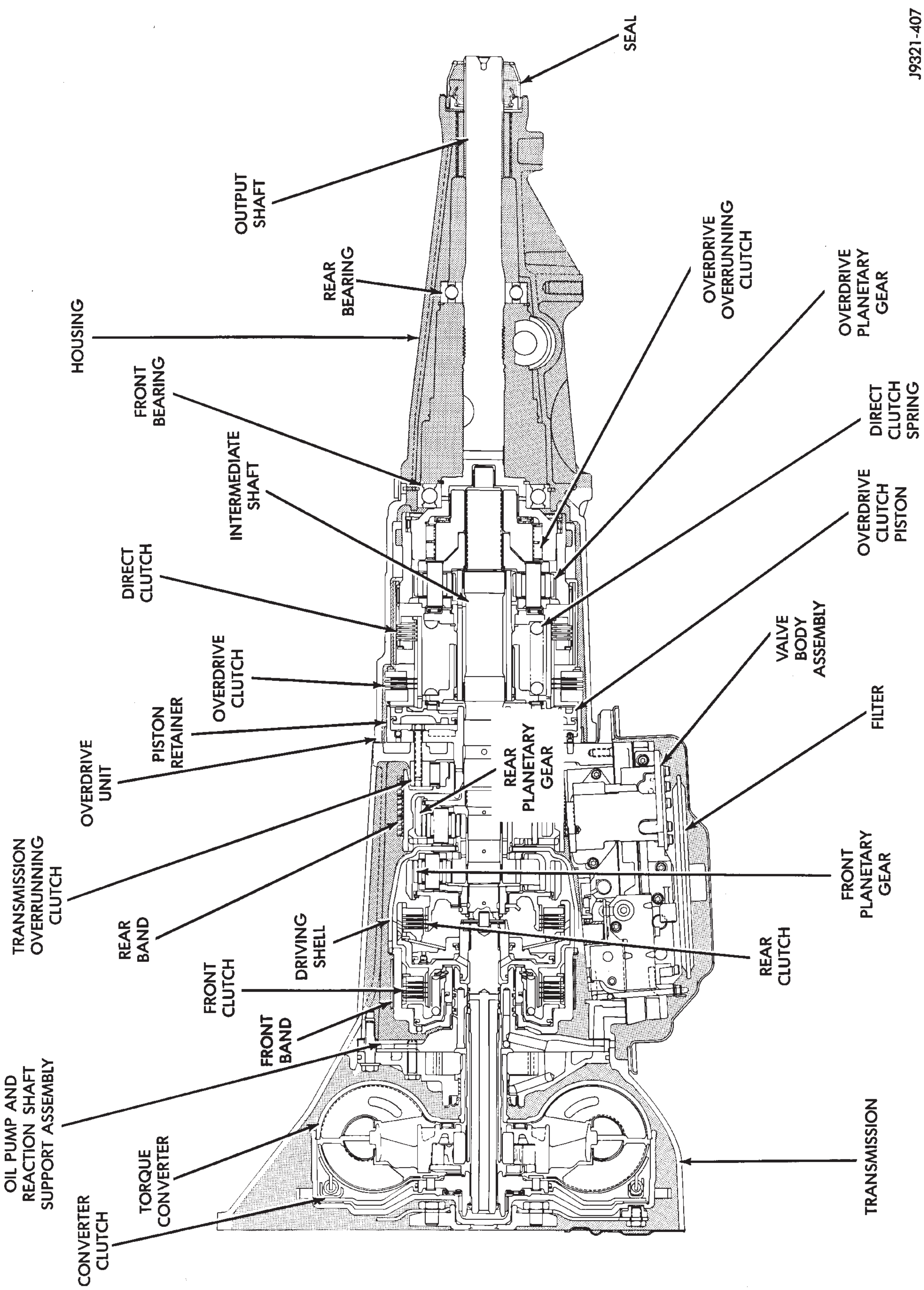

Fig. 1 42RE Automatic Transmission (4 x 2 Model)

TORQUE CONVERTER

A three element torque converter is used for all applications (Fig. 1). Converter elements consist of the turbine, stator and impeller. The converter also contains an overrunning clutch and a converter clutch mechanism.

The converter clutch is an electronically controlled mechanism. The clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures.

The converter clutch is engaged in fourth gear and in third gear when the overdrive control switch is in the OFF position.

An overrunning clutch is mounted in the stator hub. This one-way clutch prevents the stator from turning in a direction opposite to engine rotation. This retains the torque multiplication feature of the converter.

The torque converter is not a serviceable component. It should be replaced as an assembly when diagnosis indicates a malfunction has occurred, or when a major malfunction causes debris to enter the converter.

GEAR RATIOS

Forward Gear ratios for the 42RE transmission are:

- First gear = 2.74:1
- Second gear = 1.54:1
- Third gear = 1.00:1
- Fourth gear = 0.69:1.

RECOMMENDED FLUID

The only fluid recommended for the 42RE transmission is Mopar ATF Plus, type 7176.

Dexron II is not really recommended and should only be used when ATF Plus is not available.

TRANSMISSION IDENTIFICATION

The transmission part/identification numbers and codes are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2).

The first letter/number group is the assembly part number. The next number group the transmission build date. The last number group is the transmission serial number. Refer to this information when ordering replacement parts.

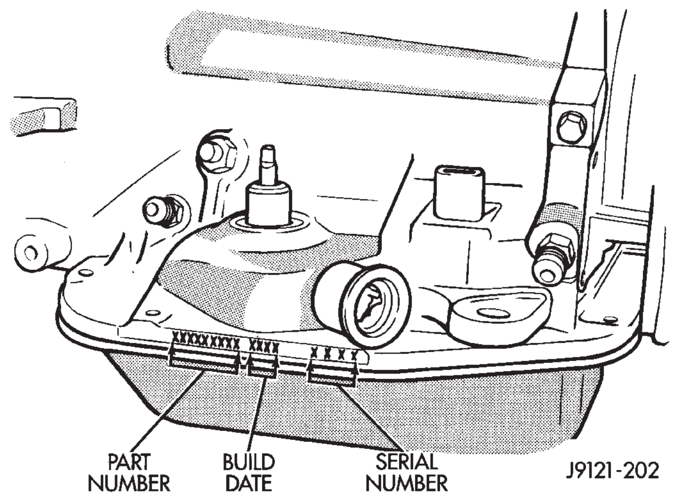

Fig. 2 Transmission Identification Number And Code Location

ELECTRONIC GOVERNOR COMPONENTS

Governor pressure is developed and controlled electronically in the 42RE transmission. Components used for development and control of governor pressure include:

- governor body
- new design valve body transfer plate
- governor pressure solenoid valve
- governor pressure sensor
- fluid temperature thermister
- transmission speed sensor
- throttle position sensor
- transmission control module (TCM)

Governor Pressure Solenoid Valve

The solenoid valve generates the governor pressure needed for upshifts and downshifts. It is an electrohydraulic device and is located in the governor body on the valve body transfer plate (Fig. 3).

The inlet side of the solenoid valve is exposed to normal transmission line pressure. The outlet side of the valve leads to the valve body governor circuit.

The solenoid valve regulates line pressure to produce governor pressure. The average current supplied to the solenoid controls governor pressure. One amp current produces zero kPa/psi governor pressure. Zero amps sets the maximum governor pressure.

The transmission control module (TCM) supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC) and is provided through the battery terminal on the module.

The solenoid is polarity sensitive. The TCM energizes the solenoid by grounding it through the power ground terminal on the transmission control module.

Governor Pressure Sensor

The governor pressure sensor measures output pressure of the governor pressure solenoid valve (Fig. 4).

The sensor output signal provides the necessary feedback to the transmission control module. This feedback is needed to adequately control governor pressure.

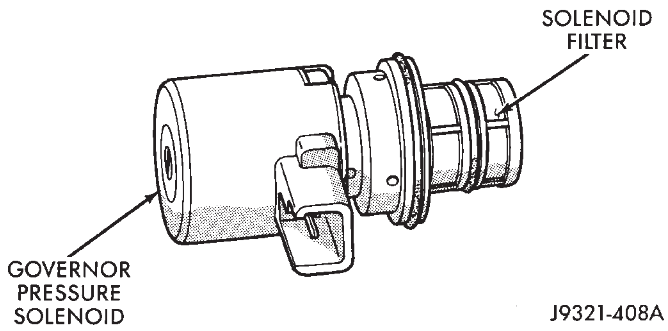

Fig. 3 Governor Pressure Solenoid Valve

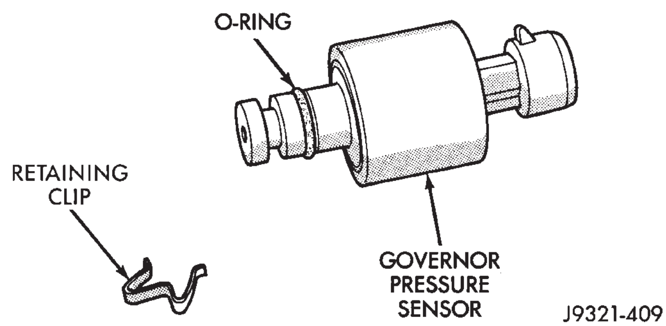

Fig. 4 Governor Pressure Sensor

Governor Body And Transfer Plate

A different transfer plate is used with the 42RE valve body. The transfer plate is designed to supply transmission line pressure to the governor pressure solenoid valve and to return governor pressure. The governor pressure solenoid valve is mounted in the governor body. The body is bolted to the lower side of the transfer plate (Fig. 5).

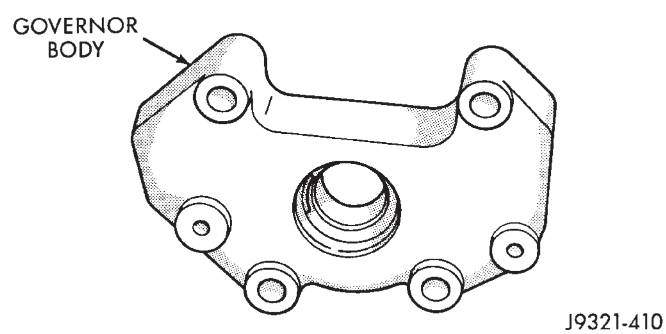

Fig. 5 Governor Body

Transmission Fluid Temperature Thermister

Transmission fluid temperature readings are supplied to the transmission control module by the thermister (Fig. 6). The temperature readings are used to control engagement of the fourth gear overdrive clutch, the converter clutch, and governor pressure. Normal resistance value for the thermister at room temperature is approximately 1000 ohms.

The transmission control module (TCM) prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 1°C (30°F).

If fluid temperature exceeds 126°C (260°F), the transmission control module will cause a 4-3 downshift and engage the converter clutch. Engagement is according to the third gear converter clutch engagement schedule.

The overdrive OFF lamp in the instrument panel, also illuminates when the shift back to third occurs. The transmission will not allow fourth gear operation until fluid temperature decreases to approximately 110°C (230°F).

The thermistor is mounted on the solenoid assembly (Fig. 6). It is immersed in transmission fluid at all times.

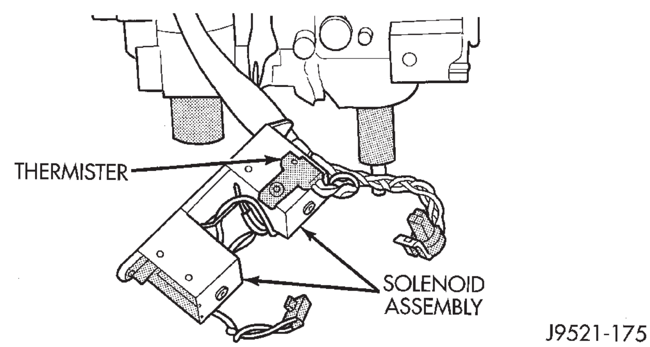

Fig. 6 Thermister Location

Transmission Speed Sensor

The speed sensor (Fig. 7), is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed. The sensor used with the 42RE transmission is the same as is used in Chrysler 41TE and 42LE front drive automatic transmissions.

Speed sensor signals are triggered by the park gear lugs as they rotate past the sensor pickup face. Input signals from the sensor are sent to the transmission control module for processing.

The vehicle speed sensor also serves as backup to the transmission speed sensor. Signals from this sensor are shared with the powertrain control module.

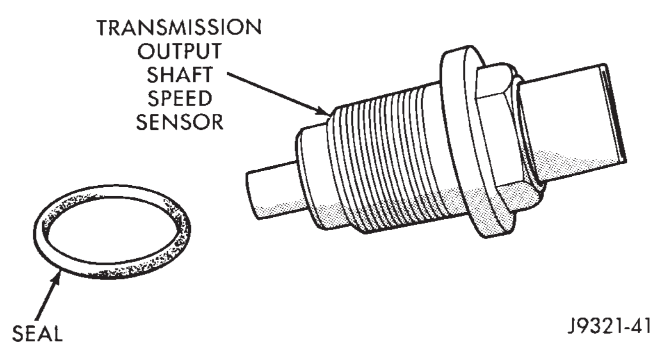

Fig. 7 Transmission Speed Sensor

Throttle Position Sensor (TPS)

The TPS provides throttle position input signals to both the transmission control module and powertrain controller. This input signal is used to determine overdrive and converter clutch shift schedule and to select the proper governor curve.

Transmission Control Module (TCM)

The TCM controls operation of the converter clutch, overdrive clutch, and governor pressure solenoid.

The control module determines transmission shift points based on input signals from the transmission thermistor, transmission output shaft speed sensor, crankshaft position sensor, vehicle speed sensor and throttle position sensor.

Operating voltage is supplied through the battery terminal on the control module. The ignition voltage signal is supplied through a terminal on the ABS control module.

The DRB scan tool can be used to check operation of the control module and transmission electrical components. The diagnostic connector (for the scan tool) is located under the driver side of the instrument panel. The connector has a 6-way terminal and is blue in color.

GOVERNOR PRESSURE CURVES

There are four governor pressure curves programmed into the transmission control module. The different curves allow the control module to adjust governor pressure for varying conditions.

One curve is used for operation when fluid temperature is at, or below 10°C (50°F).

A second curve is used when fluid temperature is at, or above 10°C (50°F) during normal city, or highway driving.

A third curve is used during wide open throttle operation. The fourth curve is used when driving with the transfer case in low range.

TRANSMISSION SHIFTING

Shift valve operation with the electronic governor is basically unchanged. The 1-2 and 2-3 upshift sequence occurs exactly the same as in non-electronic governor transmissions.

The shift valves are still moved by a combination of throttle and governor pressure. The only real difference is that governor pressure is generated by electrical components instead of a mechanical valve and weight assembly.

The conditions under which a shift to fourth will not occur, also remain the same. These being:

- shift to third not yet completed
- overdrive switch is in OFF position
- vehicle speed too low for 3-4 shift to occur
- transmission fluid temperature is below 10°C (50°F) or above 121°C (250°F).

CONVERTER CLUTCH ENGAGEMENT

The torque converter clutch is engaged by the clutch solenoid on the valve body. The clutch can be engaged in third and fourth gear ranges depending on overdrive control switch position.

If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph).

If the control switch is in the OFF position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

OVERDRIVE OFF SWITCH

The overdrive Off switch is located in the instrument panel. The switch is a momentary contact device that signals the TCM to toggle current status of the overdrive function. At key-on, overdrive operation is allowed.

Pressing the switch once causes the overdrive Off mode to be entered and the overdrive Off switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off.

The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a fourth gear upshift.

The control switch has an indicator light. The light illuminates when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

The control switch indicator light is also used to signal fault flash codes for diagnostic purposes.

QUICK FILL VALVE

The 3-4 quick fill valve provides faster engagement of the overdrive clutch during 3-4 upshifts. The valve temporarily bypasses the clutch piston feed orifice at the start of a 3-4 upshift. This exposes a larger passage into the piston retainer resulting in a much faster clutch fill and apply sequence.

The quick fill valve does not bypass the regular clutch feed orifice throughout the 3-4 upshift. Instead, once a predetermined pressure develops within the clutch, the valve closes the bypass. Clutch fill is then completed through the regular feed orifice.

CONVERTER DRAINBACK VALVE

The drainback valve is located in the transmission cooler outlet (pressure) line. The valve prevents fluid from draining from the converter into the cooler and lines when the vehicle is shut down for lengthy periods.

Production valves have a hose nipple at one end, while the opposite end is threaded for a flare fitting. Some early valves have hose nipples at both ends. All valves have an arrow mark (or similar mark) to indicate direction of flow through the valve.

TRANSMISSION CHANGES AND PARTS INTERCHANGEABILITY

1995 transmissions are similar to previous models but only in appearance. Current transmissions are dimensionally different and have different hydraulic circuitry. Do not interchange parts.

Transmission changes affect the governor weight assembly, low-reverse drum, front annulus, boost valve tube retainer, fluid cooling system, and valve body check balls.

The thrust plate and front annulus have changed. The thrust plate now has two locating tabs and the annulus support hub has been remachined to accommodate the new plate tabs.

Plastic check balls are now used in some valve bodies. The new check balls entered production as a running change. The plastic and steel check balls are not interchangeable.

A converter drainback check valve has been added to the fluid cooler system. The one-way valve is located in the transmission outlet (pressure) line. The valve prevents fluid drainback when the vehicle is parked for lengthy periods.

The boost valve tube retainer has been lengthened and an extra tab added to better secure the tube.

42RE TRANSMISSION DIAGNOSIS

INDEX

DIAGNOSIS PROCEDURES

Begin diagnosis by checking the easily accessible items such as fluid level, fluid condition and throttle cable/shift linkage adjustments. A road test will determine if further diagnosis is necessary.

Procedures outlined in this section should be performed in the following sequence to realize the most accurate results:

(1) Preliminary diagnosis
(2) Fluid Level and condition
(3) Leak tests (if fluid level is low)
(4) Linkage Adjustment
(5) Overdrive control switch test
(6) Road test
(7) Stall test
(8) Hydraulic pressure test
(9) Air pressure tests
(10) Analyze test results and consult diagnosis charts

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are driveable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVEABLE

(1) Check for TCM fault codes with DRB scan tool, or with fault flash codes at lamp in overdrive Off switch.

(2) Check fluid level and condition.

(3) Adjust throttle and gearshift linkage if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts and engages.

(5) Perform stall test if complaint is based on sluggish acceleration. Or, if abnormal throttle opening is needed to maintain normal speeds with a properly tuned engine.

(6) Perform hydraulic pressure test if shift problems were noted during road test.

(7) Perform air pressure test to check clutch-band operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken, disconnected, binding throttle valve cable, or lever.

(3) Check for cracked, leaking cooler lines, or loose, missing pressure port plugs.

(4) Raise vehicle, start engine, shift transmission into gear and note following:

(a) If propeller shafts turn but wheels do not, problem is with differential or axle shafts.

(b) If propeller shafts do not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged drive plate, converter, oil pump or input shaft.

(c) If propeller shafts do not turn and transmission is not noisy, perform hydraulic pressure test to determine if problem is a hydraulic or mechanical.

CHECKING FLUID LEVEL AND CONDITION

(1) Place vehicle on level surface. This is important for an accurate reading.

(2) Do not check level until fluid is at normal hot operating temperature of approximately 180°F. This is necessary to avoid false readings which could produce under or over fill condition.

(3) Start and run engine at curb idle speed and apply parking brakes.

(4) Shift transmission through all gear ranges and back to Neutral.

(5) Clean top of filler tube and dipstick to keep dirt out of tube.

(6) Remove dipstick and check fluid level as follows:

(a) Dipstick has three fluid level indicating marks which are a MIN dot mark, an OK mark and a MAX fill arrow mark:

(b) Correct level is to Full, or MAX arrow mark on dipstick. This is correct maximum hot fluid level. Acceptable level is between OK mark and max arrow mark on dipstick.

(c) If level is at, or below MIN/ADD level, add only enough fluid to restore correct level. Mopar ATF Plus, type 7176 is the required fluid.

CAUTION: Do not overfill the transmission. Overfilling may cause leakage out the pump vent which can be mistaken for a pump seal leak. In addition, overfilling will also cause fluid aeration and foaming as the excess fluid is picked up and churned by the gear train. This will reduce the life of the fluid significantly.

(7) Check fluid condition. Fluid color should range from dark rad to pink and be free of particles and sludge.

(a) If fluid is discolored, or smells burned but transmission operation was OK, flush cooler and lines and change fluid and filter. Then road test again to confirm proper operation.

(b) If fluid is black, dark brown, turned to sludge, contains extensive amount of metal or friction material particles, transmission will need overhaul (especially if shift problems were evident during road test).

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal.

If the transmission is overfilled, the gears churn the fluid into foam, aerating the fluid and causing the same conditions that occur with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve, clutch and servo operation.

Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

CAUSES OF BURNED FLUID

Burned, discolored fluid is a result of overheating which has two primary causes.

The first cause is a result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris.

The second primary cause is heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter during repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission for some time, an overhaul may also be necessary; especially if shift problems had developed.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in re-contamination and a shop comeback. Flushing applies to auxiliary coolers as well. The torque converter and drainback valve should also be replaced whenever a failure generates sludge and debris. This is necessary because converter flushing procedures will not remove all of the contaminants.

OVERDRIVE ELECTRICAL CONTROLS

The electrical controls governing the shift into fourth gear consist of the overdrive off switch in the instrument panel and the overdrive solenoid on the valve body.

The overdrive off switch, valve body solenoid, case connectors and related wiring can all be tested with a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

DIAGNOSTIC TROUBLE FLASH CODES

Diagnostic trouble flash codes are provided for diagnosis purposes. The lamp in the overdrive off switch is used to signal the various flash codes.

The flash codes and type of fault indicated are outlined in the Flash Code Chart (Fig. 1).

To view flash codes, proceed as follows:

(a) Turn ignition key on and off three times. Then leave overdrive off switch in normal overdrive (on) position.

(b) Immediately begin counting number of flashes displayed by overdrive off switch indicator lamp.

(c) Flash codes will correspond to powertrain control module in duration and spacing.

(d) A code 55 identifies end of flash code transmission

FAULT CODE	FAULT DESCRIPTION
11	Engine RPM input
12	Output shaft sensor input
13	Vehicle speed input
14	Governor pressure sensor input
15	Throttle position sensor input
16	Transmission fluid temperature input
17	Overdrive override (control) switch input
18	System voltage
19	Internal fault in module
21	Governor pressure solenoid output
22	Overdrive solenoid output
23	Converter clutch solenoid output
24	Overdrive override (control switch) lamp output
25	Internal fault in module
26	Governor pressure sensor offset drift
55	End of code transmission

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Fig. 1 42RE DIAGNOSTIC TROUBLE FLASH CODE CHART

TRANSMISSION THROTTLE VALVE AND SHIFT CABLES

Transmission throttle cable adjustment is important to proper operation. This adjustment positions the valve body throttle valve which controls shift speed, quality and part throttle downshift sensitivity.

If cable setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle downshifts may be very sensitive. Refer to the In-Vehicle Service section for adjustment procedure.

Shift cable adjustment is important because it positions the valve body manual valve. Incorrect adjustment will cause creep in Neutral, premature clutch wear, delayed engagement in all gear ranges, or a no-start in Park or Neutral.

Proper operation of the park/neutral position switch will provide a quick check of linkage adjustment. Refer to the In-Vehicle Service section for linkage adjustment procedure.

ROAD TESTING

Before road testing, be sure the fluid level and all cable adjustments have been checked and reset if necessary. Observe engine performance during the road test. A poorly tuned engine will not allow an accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare, which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul may be necessary to restore normal operation.

A slipping clutch or band can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch and Band Application chart (Fig. 2) provides a basis for analyzing road test results.

ANALYZING THE ROAD TEST

Refer to the Clutch and Band Application chart (Fig. 2) and note which elements are in use in the various gear ranges.

Note that the rear clutch is applied in all forward ranges (D, 2, 1). The transmission overrunning clutch is applied in first gear (D, 2 and 1 ranges) only. The rear band is applied in 1 and R range only.

Note that the overdrive clutch is applied only in fourth gear and the overdrive direct clutch and overrunning clutch are applied in all ranges except fourth gear.

For example: If slippage occurs in first gear in D and 2 range but not in 1 range, the transmission overrunning clutch is faulty. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that the front and rear clutches are applied simultaneously only in D range third and fourth gear. If the

SHIFT LEVER POSITION	TRANSMISSION CLUTCHES AND BANDS					OVERDRIVE CLUTCHES		
	FRONT CLUTCH	FRONT BAND	REAR CLUTCH	REAR BAND	OVERRUN. CLUTCH	OVERDRIVE CLUTCH	DIRECT CLUTCH	OVERRUN. CLUTCH
Reverse	X			X			X	
Drive Range								
First			X		X		X	X
Second		X	X				X	X
Third	X		X				X	X
Fourth	X		X			X		
2-Range (Manual) Second)		X	X		X		X	X
1-Range (Manual Low)			X	X	X		X	X

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Fig. 2 Clutch And Band Application Chart

transmission slips in third gear, either the front clutch or the rear clutch is slipping.

If the transmission slips in fourth gear but not in third gear, the overdrive clutch is slipping. By selecting another gear which does not use these clutches, the slipping unit can be determined. For example, if the transmission also slips in Reverse, the front clutch is slipping. If the transmission does not slip in Reverse, the rear clutch is slipping.

If slippage occurs during the 3-4 shift or only in fourth gear, the overdrive clutch is slipping. Similarly, if the direct clutch were to fail, the transmission would lose both reverse gear and overrun braking in 2 position (manual second gear). If the transmission slips in any other two forward gears, the transmission rear clutch is probably slipping.

If the transmission will not shift to fourth gear, the control switch, overdrive solenoid or related wiring may also be the problem cause.

This process of elimination can be used to identify a slipping unit and check operation. Proper use of the Clutch and Band Application Chart is the key.

Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless a malfunction is obvious, such as no drive in D range first gear, do not disassemble the transmission. Perform the hydraulic and air pressure tests to help pinpoint the problem cause.

HYDRAULIC PRESSURE TEST

Hydraulic test pressures range from a low of one psi (6.895 kPa) governor pressure, to 300 psi (2068 kPa) at the rear servo pressure port in reverse.

An accurate tachometer and test gauges are required for the pressure test. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, front servo, and overdrive pressure ports. Test Gauge C-3293-SP has a 300 psi range and is used at the rear servo port where pressures range from 250 to 290 psi. In cases where two test gauges are required, the 300 psi gauge can be used at any of the other test ports.

PRESSURE TEST PORT LOCATIONS

Test ports are located at both sides of the transmission case (Fig. 3).

Line pressure is checked at the accumulator port on the right side of the case. The front servo pressure port is at the right side of the case just behind the filler tube opening.

The rear servo and governor pressure ports are at the right rear of the transmission case. The overdrive clutch pressure port is at the left rear of the case (Fig. 3).

HYDRAULIC PRESSURE TEST PROCEDURE

Test One—Transmission In 1 Range

This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Test Gauges C-3292 and C-3293-SP

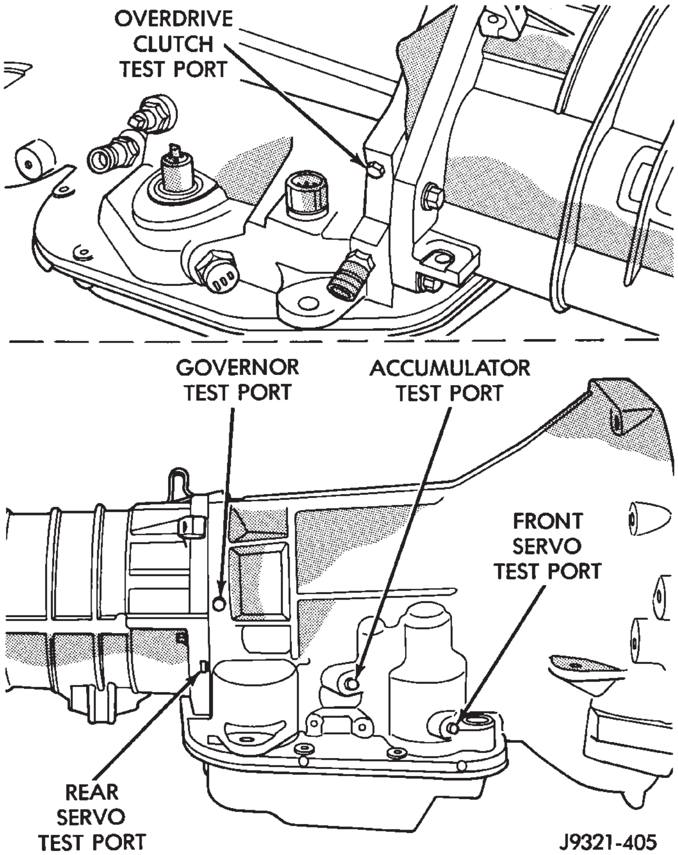

Fig. 3 Pressure Test Port Locations

are required for this test. Gauge C-3292 has a 100 psi range. Gauge C-3293-SP has a 300 psi range.

(1) Connect tachometer to engine. Position tachometer so it can be observed from driver seat if helper will be operating engine. Raise vehicle on hoist that will allow rear wheels to rotate freely.

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port (Fig. 3).

(3) Disconnect throttle and gearshift cables from levers on transmission valve body manual shaft.

(4) Have helper start and run engine at 1000 rpm.

(5) Move transmission shift lever fully forward into 1 range.

(6) Gradually move transmission throttle lever from full forward to full rearward position and note pressures on both gauges:

(a) Line pressure at accumulator port should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as throttle lever is moved rearward.

(b) Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two—Transmission In 2 Range

This test checks pump output, line pressure and pressure regulation. Use 100 psi Test Gauge C-3292 for this test.

(1) Leave vehicle in place on hoist and leave Test Gauge C-3292 connected to accumulator port.

(2) Have helper start and run engine at 1000 rpm.

(3) Move transmission shift lever one detent rearward from full forward position. This is 2 range.

(4) Move transmission throttle lever from full forward to full rearward position and read pressure on gauge:

(5) Line pressure should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as lever is moved rearward.

Test Three—Transmission In D Range Third Gear

This test checks pressure regulation and condition of the clutch circuits. Use both pressure Test Gauges C-3292 and C-3293-SP for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and also leave Gauge C-3292 in place at accumulator port.

(3) Move Gauge C-3293-SP over to front servo port for this test.

(4) Have helper start and run engine at 1600 rpm for this test.

(5) Move transmission shift lever two detents rearward from full forward position. This is D range.

(6) Read pressures on both gauges as transmission throttle lever is gradually moved from full forward to full rearward position:

(a) Line pressure at accumulator in D range third gear, should be 54-60 psi (372-414 kPa) with throttle lever forward and increase as lever is moved rearward.

(b) Front servo pressure in D range third gear, should be within 3 psi (21 kPa) of line pressure up to kickdown point.

Test Four—Transmission In Reverse

This test checks pump output, pressure regulation and the front clutch and rear servo circuits. Use 300 psi Test Gauge C-3293-SP for this test.

(1) Leave vehicle on hoist and leave gauge C3292 in place at accumulator port.

(2) Move 300 psi Gauge C-3293-SP back to rear servo port.

(3) Have helper start and run engine at 1600 rpm for test.

(4) Move transmission shift lever four detents rearward from full forward position. This is Reverse range.

(5) Move transmission throttle lever fully forward then fully rearward and note reading at Gauge C-3293-SP.

(6) Pressure should be 145 - 175 psi (1000-1207 kPa) with throttle lever forward and increase to 230 - 280 psi (1586-1931 kPa) as lever is gradually moved rearward.

Test Five—Governor Pressure

This test checks governor operation by measuring governor pressure response to changes in vehicle speed. It is usually not necessary to check governor operation unless shift speeds are incorrect or if the transmission will not downshift. The test should be performed on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port (Fig. 3).

(2) Move transmission shift lever two detents rearward from full forward position. This is D range.

(3) Have helper start and run engine at curb idle speed. Then firmly apply service brakes so wheels will not rotate.

(4) Note governor pressure:

(a) Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.

(b) If pressure exceeds 20.6 kPa (3 psi), a fault exists in governor pressure control system.

(5) Release brakes, slowly increase engine speed, and observe speedometer and pressure test gauge. Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.

(6) Pressure rise should be smooth and drop back to no more than 20.6 kPa (3 psi) after engine returns to curb idle and brakes are applied to prevent wheels from rotating.

(7) Compare results of pressure test with analysis chart (Fig. 4).

Test Six—Transmission In Overdrive Fourth Gear

This test checks line pressure at the overdrive clutch in fourth gear range. Use 300 psi Test Gauge C-3292 for this test. The test should be performed on the road or on a chassis dyno.

(1) Remove tachometer. It will not be used for this test.

(2) Move 300 psi Gauge to overdrive clutch pressure test port. Then remove other gauge and reinstall test port plug.

(3) Lower vehicle.

(4) Turn OD switch on.

(5) Secure test gauge so it can be viewed from drivers seat.

(6) Start engine and shift into D range.

(7) Increase vehicle speed gradually until 3-4 shift occurs and note gauge pressure.

(8) Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-827 kPa (90-120 psi) at 1/2 to 3/4 throttle. Note that pressure can increase to around 896 kPa (130 psi) at full throttle.

(9) Return to shop or move vehicle off chassis dyno.

TEST CONDITION	INDICATION
Line pressure OK during any one test	Pump and regulator valve OK
Line Pressure OK in R but low in D, 2, 1	Leakage in rear clutch area (servo, clutch seals, governor support seal rings)
Pressure Low in D Fourth Gear Range	Overdrive clutch piston seal, or check ball problem
Pressure OK in 1, 2 but low in D3 and R	Leakage in front clutch area (servo, clutch seals, retainer bore, pump seal rings)
Pressure OK in 2 but low in R and 1	Leakage in rear servo
Front servo pressure low in 2	Leakage in servo; broken servo ring or cracked servo piston
Pressure low in all positions	Clogged filter, stuck regulator valve, worn or faulty pump, plugged fluid cooler
Governor pressure too high at idle speed, or governor pressure low at all mph figures	Faulty governor pressure solenoid, transmission control module, or governor pressure sensor
Lubrication/line pressure low at all throttle positions	Clogged fluid cooler or lines, seal rings leaking, output shaft plugged with debris, worn bushings in pump or clutch retainer

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Fig. 4 Pressure Test Analysis Chart

CONVERTER STALL TEST

Stall testing involves determining maximum engine rpm obtainable at full throttle with the rear wheels locked and the transmission in D range. This test checks the holding ability of the converter overrunning clutch and both of the transmission clutches. When stall testing is completed, refer to the Stall Speed Analysis.

WARNING: NEVER ALLOW ANYONE TO STAND DIRECTLY IN LINE WITH THE VEHICLE FRONT OR REAR DURING A STALL TEST. ALWAYS BLOCK THE WHEELS AND APPLY THE SERVICE AND PARKING BRAKES DURING THE TEST.

STALL TEST PROCEDURE

(1) Connect tachometer to engine. Position tachometer so it can be viewed from driver seat.

(2) Check transmission fluid level. Add fluid if necessary.

(3) Drive vehicle to bring transmission fluid up to normal operating temperature. Vehicle can be driven on road, or on chassis dyno if shop is so equipped.

(4) Block front wheels.

(5) Fully apply service and parking brakes.

(6) Open throttle completely and record maximum engine rpm registered on tachometer. It takes 4-10 seconds to reach max rpm. **However, once max rpm has been achieved, do not hold wide open throttle for more than 4-5 seconds.**

CAUTION: Stalling the converter causes a rapid increase in fluid temperature. To avoid fluid overheating, hold the engine at maximum rpm for no more than 5 seconds. If engine exceeds 2300 rpm during the test, release the accelerator pedal immediately; transmission clutch slippage is occurring.

(7) Stall speeds should be in 1800-2300 rpm range.

(8) If a second stall test is required, cool fluid down before proceeding. Shift into Neutral and run engine at 1000 rpm for 20-30 seconds to cool fluid.

(9) Refer to Stall Test Analysis.

STALL TEST ANALYSIS

STALL SPEED TOO HIGH

If stall speed exceeds 2300 rpm, transmission clutch slippage is indicated.

STALL SPEED LOW

Low stall speeds with a properly tuned engine indicate a torque converter overrunning clutch problem. The condition should be confirmed by road testing before to converter replacement.

Stall speeds 250-350 rpm below normal indicates the converter overrunning clutch is slipping. The vehicle will also exhibit poor acceleration but operate normally once highway cruise speeds are reached. Torque converter replacement will be necessary.

STALL SPEED NORMAL BUT ACCELERATION POOR

If stall speeds are normal (1800-2300 rpm) but abnormal throttle opening is required for acceleration, or to maintain cruise speed, the converter overrunning clutch is seized. The torque converter will have to be replaced.

CONVERTER NOISE DURING TEST

A whining noise caused by fluid flow is normal during a stall test. However, loud metallic noises indicate a damaged converter. To confirm that noise is originating from the converter, operate the vehicle at light throttle in Drive and Neutral on a hoist and listen for noise coming from the converter housing.

AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION

Air pressure testing can be used to check transmission front/rear clutch and band operation with the transmission either in the vehicle, or on the work bench as a final check after overhaul.

Air pressure testing requires that the oil pan and valve body be removed from the transmission. The servo and clutch apply passages are shown in Figure 5.

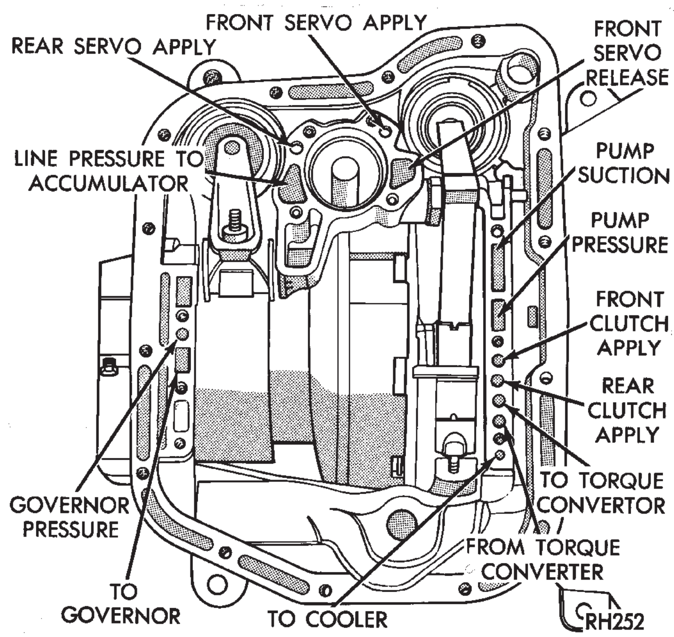

Fig. 5 Air Pressure Test Passages

FRONT CLUTCH AIR TEST

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage (Fig. 5). Piston movement can be felt and a soft thud heard as the clutch applies.

REAR CLUTCH AIR TEST

Place one or two fingers on the clutch housing and apply air pressure through rear clutch apply passage. Piston movement can be felt and a soft thud heard as the clutch applies.

FRONT SERVO AIR TEST

Apply air pressure to the front servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring tension should release the servo when air pressure is removed.

REAR SERVO AIR TEST

Apply air pressure to the rear servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring tension should release the servo when air pressure is removed.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two items must be established before repair. First, it must be verified that a leak condition actually exists. And second, the true source of the leak must be determined.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or refill after repair.

Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump O-ring or pump body leaks follow the same path as a seal leak (Fig. 6).

Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 6).

Pump seal or gasket leaks usually travel down the inside of the converter housing.

Front band lever shaft plug leaks are generally deposited on the housing and not on the converter.

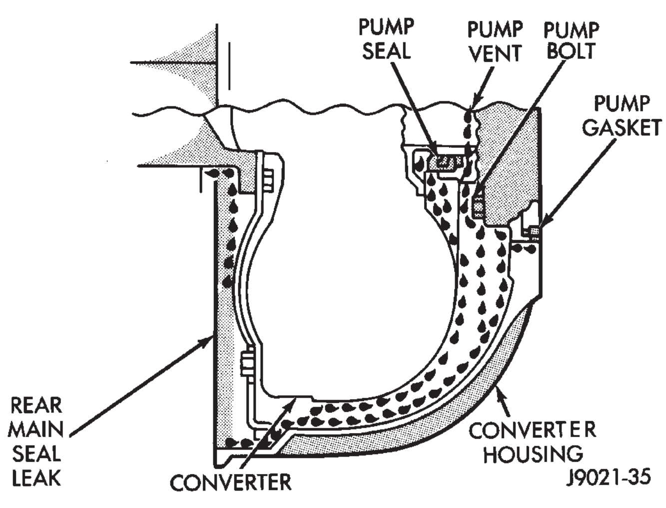

Fig. 6 Converter Housing Leak Paths

LEAK DIAGNOSIS PROCEDURE

(1) Raise rear of vehicle and allow accumulated fluid to drain out of converter housing.

(2) Check and adjust transmission fluid level.

(3) Raise vehicle. Remove converter housing dust cover and wipe as much fluid as possible from converter housing.

(4) Fabricate test probe (Fig. 7). Attach probe to converter housing with a dust shield bolt.

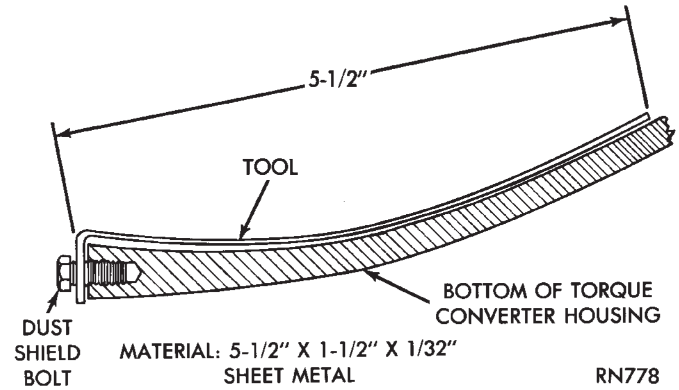

Fig. 7 Converter Housing Leak Test Probe

(5) Have a helper run engine at 2500 rpm (with transmission in Neutral) for two minutes; then stop engine.

(6) Inspect test probe and converter housing. If leak is evident, note color of fluid:

(a) If fluid is red/pink, leak is from transmission part. Proceed with diagnosis.

(b) If fluid is brown or green, oil leak is from engine. Refer to engine leak diagnosis procedures in Group 9.

(7) Determine where transmission fluid is leaking from:

(a) If probe **upper surface is wet with transmission fluid, converter or seal are at fault. Fluid across probe upper surface indicates converter or seal leak.**

(b) If transmission fluid is leaking **under** probe, it is coming from pump housing area (Fig. 8).

(8) Fluid leaking under probe could be from: pump seal and/or bushing, pump vent, front band lever shaft access plug, pump bolts, or porous spots in pump body or transmission case (Fig. 8).

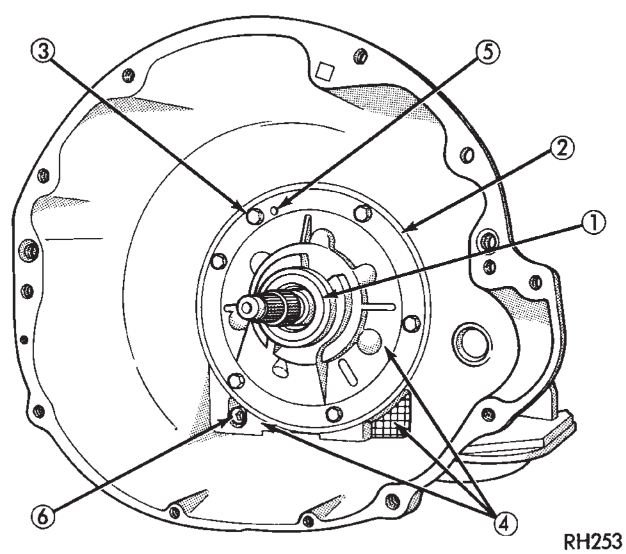

Fig. 8 Pump Area Inspection Points

(9) If porous spots in transmission case or pump body are suspected leak source, pressurize transmission as described in Leak Testing With Air Pressure.

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are: (a) leaks at the weld joint around the outside diameter weld and (b) leaks at the converter hub weld (Fig. 9).

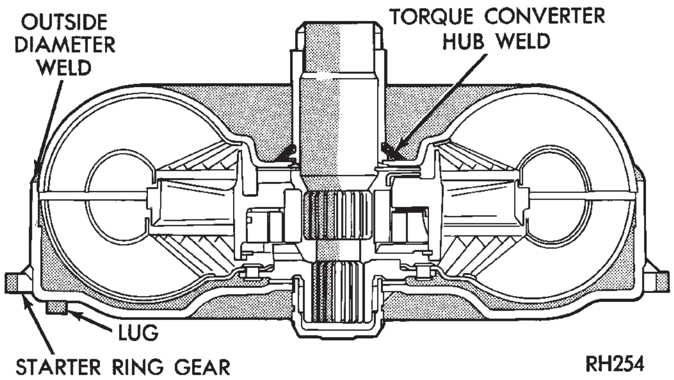

Fig. 9 Converter Potential Leak Points

LEAK TESTING WITH AIR PRESSURE

This test involves closing off all openings and pressurizing the transmission to 8 psi with Air Pump 7700.

A soapy water solution is applied to suspected leak points before and during the pressure test. Leaks will be indicated by the presence of air bubbles coming through the solution.

Some transmission openings such as the fill tube and front cooler line fitting can be closed off with a rubber plug or similar device. Plugs can secured with wire or duct tape.

The transmission rear output shaft opening is closed off simply by leaving the transfer case bolted in place. However, if the transfer case has been removed, a shipping plug can used to close off this opening.

The torque converter hub opening in the pump and the pump vent require special tools to close them off. The converter hub seal cap is made from thin wall tube and a 3.17 mm (1/8 in.) thick disc (Fig. 10). A retaining strap is needed to secure the seal cup for testing. The strap can be made from 31.75 mm (1-1/4 in.) wide stock (Fig. 11). The strap attaching hole positions are approximate only. Measure hole position on the converter housing before drilling.

The pump vent tool is made from 6.35 mm (1/4 in.) rod and 4.76 mm (3/16 in.) plate (Fig. 12).

The fabricated tools can all be made from mild steel or aluminum stock.

AIR PRESSURE LEAK TEST PROCEDURE

(1) Install vent plug, converter hub seal cup and cup retaining strap (Fig. 13).

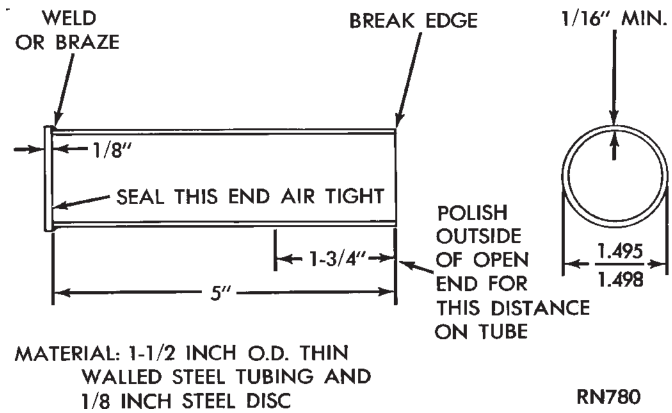

Fig. 10 Converter Hub Seal Cup

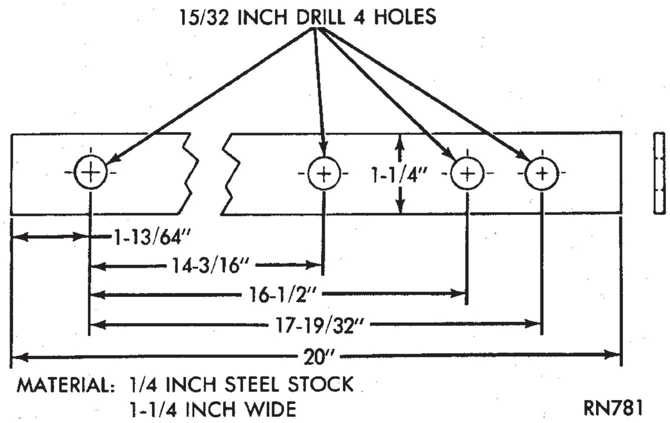

Fig. 11 Seal Cup Retaining Strap

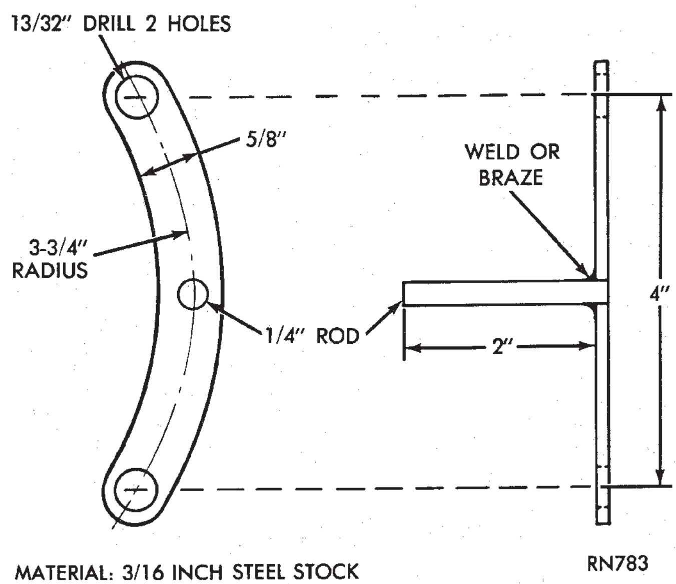

Fig. 12 Pump Vent Plug

CAUTION: Be sure the surfaces of the hub seal cup are smooth and free of nicks, scratches, or burrs. Surface irregularities on the cup will damage the pump seal if not removed. Sand and/polish the cup with 400 grit sandpaper or crocus cloth to smooth the surface if necessary.

(2) Close off remaining transmission openings with rubber plugs, or stoppers or similar devices. **Do not close off rear cooler line fitting. Hand operated air pump will be attached to this fitting.**

(3) Attach Air Pump 7700 to rear cooler line fitting. Connect a length of copper tube to fitting. Then attach pump hose to tube with hose clamp (Fig. 14).

(4) Apply a thick soapy water solution to suspected leak areas.

CAUTION: The recommended test pressure is 8 psi. The maximum allowable test pressure is 10 psi. Do not exceed specified pressure.

(5) Pressurize transmission to 8 psi with air pump.

(6) Observe suspected leak areas. Air bubbles appearing in soapy water solution indicate leak points.

(7) Remove test tools and plugs after test completion and make necessary repairs as described in Leak Correction procedure.

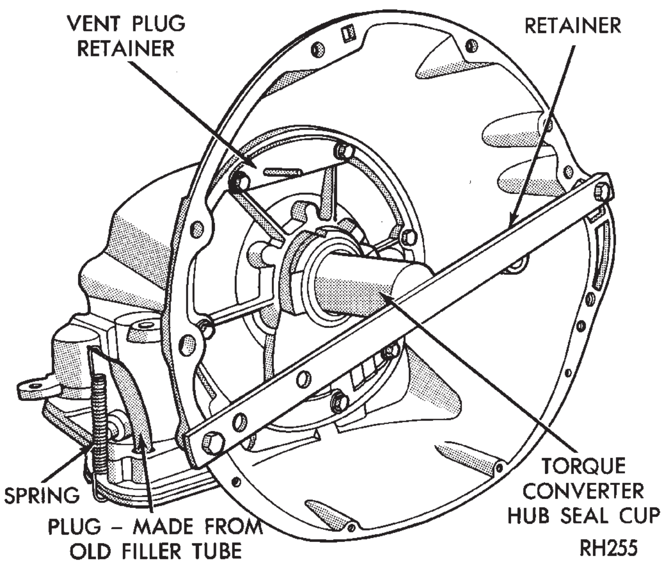

Fig. 13 Vent Plug And Hub Seal Cup Installation

CONVERTER HOUSING AREA LEAK CORRECTION

(1) Remove converter.

(2) Tighten front band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out when oil pump is removed.

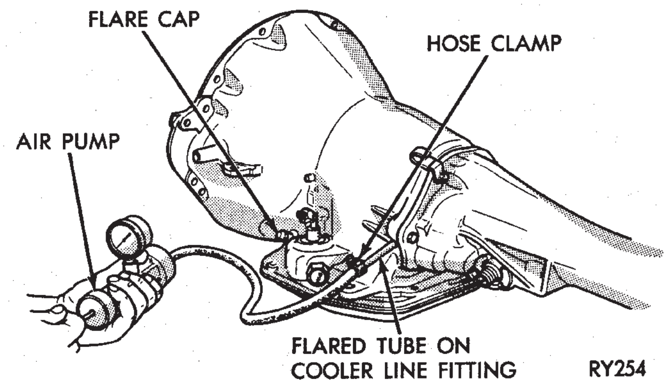

Fig. 14 Typical Method Of Pressurizing Transmission

(3) Remove oil pump and remove pump seal. Inspect pump housing drainback and vent holes for obstructions. Clear holes with solvent and wire.

(4) Inspect pump bushing and converter hub. If bushing is scored, replace it. If converter hub is scored, either polish it with crocus cloth or replace converter if scoring is severe.

(5) Install new pump seal, O-ring, gasket, bushing. Replace oil pump if cracked, porous or damaged in any way.

(6) Loosen front band lever shaft access plug three turns. Apply Mopar silicone sealant, or Permatex No. 2 or equivalent to plug threads and tighten plug to 17 N·m (150 in-lbs) torque.

(7) Adjust front band.

(8) Lubricate pump seal and converter hub with transmission fluid or petroleum jelly and install converter.

(9) Install transmission and converter housing dust shield.

(10) Lower vehicle.

DIAGNOSIS AND HYDRAULIC FLOW CHARTS

The diagnosis charts are generic. They apply to RE and RH transmissions equally except for RH mechanical governor fault information. The charts provide information on transmission, overdrive, and converter faults.

The flow charts outline hydraulic circuitry for all operating ranges including park and neutral. Circuit flow for converter clutch application in fourth gear is also provided.

TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE).	1. Engine idle speed too high.	1. Check/adjust idle speed.
	2. Driver "riding" accelerator pedal during shift.	2. Advise owner/operator.
	3. Throttle cable or linkage misadjusted.	3. Adjust cable or linkage; setting is either too long or too short.
	4. Band adjustment needed.	4. Adjust front/rear bands.
	5. Loose mounting bolts.	5. Check engine, transmission, propeller shaft, crossmember, and axle bolt torque; tighten loose bolts and replace missing bolts.
	6. Worn or damaged U-joints.	6. Remove propeller shaft and replace U-joints.
	7. Loose axle pinion nut.	7. Replace nut and check pinion threads before installing new nut; replace pinion gear if threads are damaged.
	8. Hydraulic pressure is incorrect.	8. Check pressures; remove, overhaul, or adjust valve body as needed; repair oil pump if necessary.
NOTE: The shift from neutral to reverse is normally quite firm. Hydraulic pressure at the rear servo can approach 300 psi in reverse gear. Do not confuse a firm engagement with a truly harsh engagement.	9. Accumulator piston spring, or or seal worn or damaged.	9. Remove valve body and replace piston, seal, or spring as needed.
	10. Faulty converter clutch if equipped.	10. Replace converter and flush cooler and lines before installing new converter.
	11. Clutch, band, or planetary component is damaged.	11. Remove, disassemble, and repair transmission as necessary.
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Engine idle speed too low.	1. Adjust idle speed.
	2. Low fluid level.	2. Correct level and check for leaks.
	3. Gearshift cable or linkage out of adjustment.	3. Adjust cable or linkage, or repair as needed.
	4. Rear band out of adjustment.	4. Adjust band.
	5. Valve body filter plugged.	5. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	6. Oil pump gears worn or damaged or pump body or seal is damaged, allowing pump to take in air, causing fluid aeration.	6. Remove transmission and replace oil pump.
	7. Reaction shaft seal rings worn or broken.	7. Remove transmission, remove oil pump, and replace seal rings.
	8. Governor valve stuck or valve shaft is loose or damaged.	8. Remove and inspect governor components; replace worn or damaged parts.
	9. Low hydraulic pressure.	9. Perform pressure test, remove transmission, and repair as needed.
	10. Clutch, band, or servo damage.	10. Remove and disassemble transmission and repair as necessary.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT AFTER VEHICLE HAS NOT BEEN DRIVEN FOR EXTENDED PERIOD	1. Fluid in torque converter drained back into transmission sump.	1. Normal condition that will not harm the converter or transmission. Converter will fill with fluid once shift lever is moved from park.
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Low fluid level.	1. Correct fluid level and check for leaks.
	2. Throttle cable or linkage out of adjustment.	2. Adjust linkage or cable as described in service section.
	3. Throttle cable or linkage is binding.	3. Disassemble, clean, and adjust linkage; replace linkage grommets if worn or cracked. Replace cable if seized.
	4. Gearshift cable or linkage out of adjustment.	4. Adjust as described in service section.
	5. Fluid filter partially clogged.	5. Replace filter. If filter and fluid contained clutch material or metal particles, overhaul is necessary.
	6. Air in fluid due to overfill condition or air leakage into pump suction passages.	6. Drain fluid to correct level if overfilled. If fluid is highly aerated (full of bubbles and foamy), oil pump gasket or seal may have failed, or pump body is porous or cracked.
	7. Clutch or servo problem.	7. Remove valve body and air test clutch, band and servo operation; disassemble and repair transmission as needed.
	8. Front band out of adjustment (may cause harsh 1-2 shift).	8. Adjust band.
NO REVERSE (D RANGES OK)	1. Gearshift cable or linkage out of adjustment or damaged.	1. Repair or replace parts as needed.
	2. Rear band out of adjustment.	2. Adjust band.
	3. Valve body malfunction (stuck/damaged manual valve, regulator valve, or check ball).	3. Remove and service valve body; replace valve body if any valves or valve bores are worn or damaged.
	4. Rear servo or front clutch malfunction.	4. Remove and disassemble transmission; replace worn, damaged servo and clutch parts as necessary.
HAS FIRST-REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor valve, shaft, weights, or body damaged.	1. Remove governor assembly and repair as necessary.
NO DRIVE RANGE (REVERSE OK)	1. Gearshift cable or linkage loose, damaged, out of adjustment.	1. Repair or replace cable or linkage components.
	2. Low fluid level.	2. Correct fluid level and check for leaks.
	3. Valve body malfunction (manual valve or shaft damaged or 1-2 shift valve stuck).	3. Remove and disassemble valve body; replace as assembly if any valves or bores are damaged.
	4. Rear clutch failure.	4. Remove and disassemble transmission and rear clutch; repair/replace worn, damaged parts as needed.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE RANGE (REVERSE OK) - CONT.	5. Transmission overrunning clutch failure. 6. Input shaft seal rings worn or damaged.	5. Remove and disassemble transmission; replace overrunning clutch. 6. Remove and disassemble transmission; replace seal rings and any other worn or damaged parts.
NO DRIVE OR REVERSE (VEHICLE) WILL NOT MOVE	1. Low fluid level. 2. Gearshift cable or linkage loose, damaged, or misassembled. 3. Failure of driveline component, such as U-joint, axle shaft, case component, etc. 4. Low fluid pressure due to worn or damaged oil pump. 5. Transmission internal component damaged. 6. Valve body malfunction (seized valve, damaged manual lever, valve body screws loose or overtightened causing distortion and bind).	1. Add fluid and check for leaks if drive is restored. 2. Adjust, and reassemble linkage as needed; replace worn, damaged cable. 3. Perform preliminary inspection procedure for vehicle that will not move; refer to procedure in diagnosis section. 4. Perform pressure test to confirm low pressure; replace pump body and/or gears if necessary. 5. Remove and disassemble transmission; repair or replace failed components as needed. 6. Remove, disassemble, and inspect valve body; replace valve body (as assembly) if any valve or bore is damaged; clean and reassemble correctly if all parts are in good condition.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Governor valve sticking. 2. Valve body malfunction.	1. Remove, clean, and inspect; replace faulty parts. 2. Remove, clean, and inspect; look for stuck 1-2 valve or governor plug.
SLIPS IN LOW GEAR ONLY, BUT NOT IN 1 POSITION	1. Overrunning clutch faulty, not holding.	1. Replace overrunning clutch.
SLIPS IN FORWARD DRIVE RANGES	1. Low fluid level. 2. Air in fluid (fluid is foamy, full of bubbles), shifts are spongy, caused by air getting into pump suction passages. 3. Gearshift or throttle linkage/cable out of adjustment. 4. Low hydraulic pressures due to worn pump, incorrect control pressure adjustments, valve body warpage or malfunction, sticking governor, leaking seal rings, clutch seals leaking, servo leaks, clogged filter, or cooler lines. 5. Accumulator piston cracked, spring broken or seal worn. 6. Clutch or servo malfunction, leaking seal or worn plates. 7. Overrunning clutch worn, not holding (slips in 1 only).	1. Add fluid and check for leaks. 2. Check for bad pump gasket or seals, dirt between pump halves, and loose pump bolts or defective O-ring at filler tube. 3. Adjust linkage/cable. 4. Perform hydraulic and air pressure tests to determine cause. 5. Inspect and repair as necessary. 6. Air pressure check clutch-servo operation and repair as required. 7. Replace clutch.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN REVERSE ONLY	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Aerated fluid; see Slips in Forward Drive Ranges.	2. See Slips in Forward Drive Ranges.
	3. Gearshift linkage or cable out of adjustment.	3. Adjust linkage/cable.
	4. Rear band out of adjustment.	4. Adjust band.
	5. Hydraulic pressure too low due to worn pump, worn seal rings, clutch or servo seal leakage.	5. Perform hydraulic pressure tests to determine cause.
	6. Worn front clutch, leaking rear servo, or worn rear band.	6. Air pressure check clutch-servo operation and repair as required.
	7. B and-linkage binding.	7. Inspect and repair as required.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Incorrect throttle cable adjustment.	1. Adjust cable.
	2. Incorrect gear shift linkage/cable adjustment.	2. Adjust linkage/cable.
	3. Front band out of adjustment.	3. Adjust band.
	4. Hydraulic pressures too high or too low due to sticking governor, valve body malfunction, or incorrect hydraulic control pressure adjustments.	4. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	5. Front servo, band, or linkage malfunction.	5. Air pressure test operation and repair as necessary.
	6. Clutch or servo malfunction.	6. Air pressure test operation and repair as necessary.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Gearshift or throttle linkage or cable of adjustment.	1. Adjust linkage. Repair linkage if worn or damaged. Replace cable if damaged.
	2. Front band out of adjustment.	2. Adjust band.
	3. Governor valve stuck closed; loose output shaft support or governor housing bolts, worn pump, leaking seal rings, or valve body problem (i.e., stuck 1-2 shift valve or governor plug).	3. Check line and governor pressures to determine cause; correct as required.
	4. Clutch or servo malfunction.	4. Air pressure check operation of clutches and bands; repair faulty component.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor valve sticking in partially open position.	1. Remove governor; clean, inspect, and repair as required.
	2. Valve body malfunction.	2. Remove, clean, and inspect. Look for sticking 1-2 valve, 2-3 valve, governor plug, or broken springs.
	3. Front servo piston cocked in bore.	3. Inspect servo and repair as required.
	4. Front band linkage malfunction.	4. Inspect linkage and look for bind in linkage.
	5. Incorrect throttle or gearshift linkage or cable adjustment.	5. Adjust linkage or cable.
CREEPS IN NEUTRAL	1. Gearshift linkage or cable out of adjustment.	1. Adjust linkage or cable.
	2. Valve body malfunction (warped body, cross leakage).	2. Perform hydraulic pressure test to determine cause and repair as required.
	3. Transmission clutch dragging.	3. Air pressure check operation of clutches and repair as required.
	4. Converter clutch dragging.	4. Replace converter.
DRAGS OR LOCKS UP	1. Front or rear band out of adjustment.	1. Adjust bands.
	2. Servo band or linkage malfunction (i.e., binding linkage, warped band, servo piston stuck.	2. Air pressure check servo operation and repair as required.
	3. Dragging clutch (does not release fully).	3. Air pressure check clutch operation and repair as required.
	4. Broken or seized planetary gears.	4. Remove, inspect, and repair as required (look for debris in oil pan).
	5. Overrunning clutch worn, broken, or seized.	5. Remove and inspect clutch, repair as required.
GROWLING, GRATING, OR SCRAPING NOISES	1. Planetary gear set broken or seized.	1. Check for debris in oil pan and repair as required.
	2. Overrunning clutch worn, seized, or broken.	2. Inspect and check for debris in oil pan; repair as required.
	3. Oil pump components scored, binding, or broken.	3. Remove, inspect, and repair as required.
	4. Output shaft bearing or bushing damaged.	4. Remove, inspect, and repair as required.
	5. Faulty clutch operation.	5. Perform air pressure check and repair as required.
	6. Governor support (park gear) binding or seal rings broken.	6. Remove, inspect, and repair as required.
	7. Front and rear bands out of adjustment.	7. Adjust bands.
BUZZING NOISE	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Air being drawn into pump suction passages.	2. Check pump for porous casting, scores on mating surfaces, and excess rotor clearance; repair as required.
	3. Overrunning clutch damaged.	3. Replace clutch.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
BUZZING NOISE - CONT.	4. Valve body misassembled, bolts loose, weak spring, or mis-positioned valve or check ball.	4. Remove, disassemble, inspect valve body; reassemble correctly if necessary; replace assembly if valves or springs are damaged.
OIL COMES OUT FILLER TUBE	1. Transmission overfilled.	1. Drain fluid to correct level; remove neutral switch and drain through switch hole with suction gun.
	2. Breather vent in oil pump blocked.	2. Inspect and clear blockage.
	3. Fluid cooler or cooler lines plugged.	3. Flush cooler and lines.
	4. Air in fluid (aerated).	4. See "Slips in Forward Drive Ranges."
	5. Oil filter clogged.	5. Replace filter; determine the reason for clogged condition and repair.
	6. Rear servo piston or seal failure.	6. Check hydraulic pressure at servo in reverse (will register low or fluctuate rapidly).
	7. Valve body switch valve sticking.	7. Remove and clean valve.
OIL LEAKS (ITEMS LISTED REPRESENT POSSIBLE LEAK POINTS AND SHOULD ALL BE CHECKED).	1. Speedometer adapter.	1. Replace both adapter seals.
	2. Pan gasket.	2. Tighten pan screws to 150 inch-pounds; if leaks persist, replace gasket, **do not overtighten screws.**
	3. Filler tube (where tube enters case).	3. Replace O-ring seal.
	4. Fluid lines and fittings.	4. Tighten fittings; if leaks persist, replace fittings and lines if necessary.
	5. Valve body manual lever shaft seal.	5. Replace shaft seal.
	6. Pressure port plug loose.	6. Tighten to correct torque; replace plug if leak persists.
	7. Rear bearing access plate.	7. Replace gasket.
	8. Gasket damaged or bolts are loose.	8. Replace bolts or gasket or tighten bolts.
	9. Adapter/extension gasket damaged.	9. Replace gasket.
	10. Neutral switch.	10. Replace switch and gasket.
	11. Converter housing area.	11. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return, oil in front pump housing, or hole plugged. Check for leaks past O-ring seal on pump, or past pump-to-case bolts; pump housing porous, oil coming out vent due to overfill or leak past front band shaft access plug.
	12. Cooler line fittings and hoses.	12. Replace fittings and hoses.
	13. Pump seal.	13. Replace seal.
	14. Torque converter.	14. Replace converter.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
OVERHEAT DURING COMMERCIAL OPERATION OR WHILE TRAILER TOWING (FLUID DARK AND BURNEDWITH SOME SLUDGE FORMATION)	1. Vehicle not properly equipped for trailer towing or commercial use.	1. Be sure vehicle is equipped with recommended optional components (i.e., HD springs, transmission, axle, larger CID engine, auxiliary cooler, correct axle ratio, etc.). If vehicle is not so equipped, it should not be used for severe service operation.
	2. Vehicle not equipped with auxiliary fluid cooler.	2. Drain fluid, change filter, and install auxiliary cooler.
	3. Extensive idling time or operation in heavy traffic in hot weather.	3. Cut down on idling time; shift into neutral every so often and run engine at 1000 rpm to help circulate fluid through cooler.
	4. Tow vehicle overloaded (exceeding vehicle tow capacity).	4. Be sure vehicle is properly equipped to handle load; do not tow Class III-type loads with a vehicle that is only rated for Class I or II operation.
	5. Air flow to auxiliary cooler blocked by snow plow, front mounted spare tire, bug screen, or similar item.	5. Remove or reposition item causing air flow blockage.
OVERHEAT DURING NORMAL OPERATION (FLUID DISCOLORED, SMELLS BURNED)	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Fluid cooler, lines blocked, or cooler cracked (oil in engine coolant).	2. Flush cooler and lines and replace radiator if transmission fluid has entered coolant.
	3. Switch valve sticking.	3. Remove, disassemble, clean valve body.
	4. Clutch pack clearance incorrect (too tight).	4. Check and correct as required.
	5. Bands too tight.	5. Adjust bands.
NO START IN PARK OR NEUTRAL	1. Gearshift linkage or cable out of adjustment.	1. Adjust linkage or cable.
	2. Neutral switch wire broken or open.	2. Check continuity with test lamp; repair as required.
	3. Faulty park/neutral position switch.	3. Refer to service section for test and replacement procedure.
	4. Valve body manual lever assembly bent, worn, broken, or not aligned with switch.	4. Inspect lever assembly and replace if damaged.
SLUGGISH ACCELERATION AT LOW SPEEDS OR REQUIRES EXCESSIVE THROTTLE OPENING TO MAINTAIN HIGHWAY SPEEDS	1. Poor engine performance.	1. Check engine and repair as required.
	2. Gearshift or throttle linkage/cable out of adjustment.	2. Adjust linkage/cable.
	3. Transmission clutches slipping.	3. Perform stall test and repair as required.
	4. Overrunning clutch in converter not holding.	4. Perform stall test and repair converter if clutch has failed.
	5. Converter overrunning clutch stuck.	5. Replace converter.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FLUID CONTAMINATED (DISCOLORED, FULL OF SLUDGE AND/OR METAL AND FRICTION MATERIAL PARTICULAR)	1. If contamination occurred shortly after overhaul, fluid cooler and lines were not flushed and flow tested. This is especially true when original overhaul was to correct a problem that generated a large amount of debris, such as a gear failure or a clutch pack failure. Note: Flushing the cooler and lines is mandatory after a failure of the converter lockup clutch.	1. If contamination is severe, cooler flushing, converter replacement, and another overhaul may be necessary; particularly so if shift problems were also present.
	2. Incorrect fluid used in transmission.	2. If transmission is operating properly, drain fluid, reverse flush cooler and lines, and change fluid and filter. However, if shift problem has developed, converter replacement and transmission overhaul may be required.
	3. Main cooler in radiator is cracked, allowing engine coolant to enter transmission.	3. Replace radiator (and cooler) and flush lines. If problem was diagnosed early enough, fluid and filter change may only be necessary. If contamination period was prolonged, overhaul and converter replacement may be required.
	4. Severe overload results in overheat, fluid breakdown, and accelerated wear, especially in high ambient temperatures. Most frequent causes are: • Vehicle is not properly equipped for heavy duty service. • Tow vehicle and boat or trailer are both overloaded. • Trailer or boat are too large for tow vehicle (load exceeds rated capacity of tow vehicle).	4. Repair transmission, flush cooler, and lines. Replace converter if necessary. Install auxiliary cooler if needed. Also install HD cooling system if needed. If tow vehicle and unit being towed are both overloaded, the only repair is to reduce the load to rated limits. However, if trailer or boat is too large for tow vehicle, the only option is for the owner to move up to properly-equipped and load-rated tow vehicle.

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OVERDRIVE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 3-4 UPSHIFT	1. Fourth gear overdrive switch (on dash) in OFF position.	1. Turn control switch to ON position.
	2. Overdrive circuit fuse blown.	2. Replace fuse; determine why fuse failed and repair as necessary (i.e., shorts, grounds in circuit).
	3. Fourth gear overdrive switch shorted, open, wires loose.	3. Replace switch if shorted or open and repair loose or damaged wires.
	4. Overdrive solenoid or circuit wire loose, shorted, open.	4. Check wires/connections with 12V test lamp and voltmeter; repair damaged or loose wires/connections as necessary.
	5. Solenoid feed orifice in valve body is blocked.	5. Remove, disassemble, clean valve body thoroughly.
	6. Fourth gear overdrive solenoid failure.	6. Verify solenoid failure with test lamp and replace solenoid.
	7. Sensor failure (distance sensor or coolant sensor).	7. Test both sensors with test lamp or volt/ohmmeter and replace faulty sensor.
	8. Neutral switch open or shorted or switch wire to PCM is damaged (loss of park/neutral input to PCM).	8. Test switch as described in service section and replace if necessary.
	9. PCM faulty.	9. Check with tester and replace if necessary.
	10. Overdrive piston seal failure.	10. Replace both seals.
	11. Wrong overdrive piston spacer.	11. Remove unit, check end play, and install correct spacer.
	12. Low hydraulic pressure.	12. Pressure test transmission to determine cause.
SLIPS IN OVERDRIVE FOURTH GEAR	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Overdrive piston or seal malfunction.	2. Remove overdrive unit; replace piston seals if worn; replace piston if damaged; if piston retainer is damaged, it will be necessary to remove and disassemble the transmission.
	3. Overdrive clutch pack worn.	3. Remove overdrive unit and rebuild clutch pack.
	4. 3-4 shift valve, timing valve, or accumulator malfunction.	4. Remove and overhaul valve body. Replace accumulator seals. Make sure all valves operate freely in bores and do not bind or stick. Make sure valve body screws are correctly tightened and separator plates are properly positioned.
	5. Overdrive piston retainer bleed orifice blown out.	5. Disassemble transmission, remove retainer, and replace orifice.
	6. Overdrive unit thrust bearing failure.	6. Disassemble overdrive unit and replace thrust bearing (No. 1 thrust bearing is between overdrive piston and clutch hub; No. 2 thrust bearing is between the planetary gear and the direct clutch spring plate; No. 3thrust bearing is between overrunning clutch hub and output shaft).

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OVERDRIVE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED 3-4 UPSHIFT (SLOWTO ENGAGE)	1. Low fluid level. 2. Overdrive solenoid or wiring is faulty. 3. Overdrive piston spacer too thin. 4. Overdrive clutch pack worn. 5. TPS faulty. 6. Overdrive clutch bleed orifice plugged.	1. Add fluid and check for leaks. 2. Test solenoid and check wiring for loose/ corroded connections, or shorts/ground; replace solenoid if faulty and repair wiring if necessary. 3. Remove unit; measure end play and select proper spacer. 4. Remove unit and rebuild clutch pack. 5. Replace TPS 6. Disassemble transmission and replace orifice.
3-4 UPSHIFT OCCURS BEFORE COMPLETION OF 2-3 UPSHIFT	1. Overdrive solenoid connector or wiring problem. 2. Overdrive solenoid malfunction. 3. Coolant temperature or TPS malfunction. 4. Valve body malfunction. 5. PCM malfunction.	1. Test connector and wiring for loose connections, shorts, or ground, and repair as needed. 2. Replace solenoid. 3. Test each sensor for continuity, short, ground, and replace as necessary. 4. Remove, disassemble, clean, and inspect valve body components; make sure all valves and plugs slide freely in bores; polish valves with crocus cloth if needed. 5. Test PCM with DRB II tester and replace controller if faulty.
NO 4-3 DOWNSHIFT	1. Circuit wiring and/or connectors shorted. 2. Lockup solenoid not venting. 3. Overdrive solenoid not venting. 4. 3-4 shift, shuttle, timing valve, or accumulator malfunction. 5. PCM malfunction. 6. TPS malfunction.	1. Test wiring and connectors with test lamp and volt/ohmmeter; repair wiring as necessary; replace connectors and/or harnesses as required. 2. Remove valve body and replace solenoid if seized or shorted. 3. Remove valve body and replace solenoid if seized or shorted. 4. Remove valve body; remove and disassemble lower housing and 3-4 accumulator housing; replace seals and clean valves as necessary; be sure all valves slide freely in bores. 5. Check operation with DRB II tester; replace controller only if faulty. 6. Replace TPS.
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control switch open-shorted. 2. Overdrive solenoid wiring or connectors faulty. 3. Overdrive or lockup solenoid not venting. 4. PCM malfunction.	1. Test and replace switch if faulty. 2. Check solenoid wiring and connections for shorts/grounds; repair as necessary. 3. Test solenoids and replace if seized or shorted. 4. Test with DRB II tester; replace controller if faulty.

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OVERDRIVE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH 1-2, 2-3, OR 3-2 SHIFTS	1. Converter clutch solenoid failure.	1. Remove valve body and replace solenoid.
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR (A500)	1. Converter clutch solenoid, relay, or wiring problem.	1. Test solenoid, relay, and wiring for continuity, shorts, or grounds; replace solenoid and relay if faulty; repair wiring and connectors as necessary.
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive clutch discs, plates, or snap rings damaged. 2. Overdrive piston or planetary thrust bearing brinnelled, installed wrong, or damaged. 3. Output shaft bearings brinnelled, scored, damaged. 4. Planetary gears worn, chipped, damaged. 5. Overdrive unit overrunning clutch rollers rough, scored, or output bushings are worn.	1. Remove unit and rebuild clutch pack. 2. Remove and disassemble unit; replace either thrust bearing if damaged. 3. Remove and disassemble unit; replace either bearing if damaged. 4. Remove and overhaul overdrive unit. 5. Remove and overhaul overdrive unit.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct clutch spring collapsed or broken. 2. Direct clutch pack worn. 3. Rear band out of adjustment. 4. Front clutch malfunction. 5. Overdrive thrust bearing failure.	1. Remove and disassemble unit; check clutch pack and replace spring. 2. Disassemble unit and rebuild clutch pack. 3. Adjust band. 4. Air pressure test clutch operation; remove and rebuild if necessary. 5. Disassemble geartrain and replace bearings.
NO 1-2 OR 2-3 UPSHIFT (HAS LOW AND REVERSE ONLY)	1. Governor component loose, worn, or damaged.	1. Remove and disassemble unit; replace worn or damaged governor components as needed.

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TORQUE CONVERTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
CONVERTER CLUTCH WILL NOT ENGAGE	1. Circuit fuse open.	1. Replace fuse. Check for circuit short if fuse blows again.
	2. Solenoid or relay wiring disconnected, open, shorted.	2. Repair wiring or replace harness.
	3. Clutch solenoid or relay malfunction (short, open, stuck).	3. Replace as needed.
	4. Sticking converter clutch or switch valve.	4. Remove and disassemble valve body. Clean and free-up valves.
	5. Clutch module tube loose, module cover not secured, or module components misassembled.	5. Remove valve body. Reposition tube, secure cover, or reassemble components.
	6. Converter clutch failure, turbine hub leak, or overrunning clutch (in converter) failed.	6. Replace torque converter.
	7. Oil pump fault (gears worn, seal leaks, housing damaged or loose, reaction shaft seal rings worn.	7. Remove and rebuild pump as needed.
	8. Input shaft seal rings worn, damaged.	8. Remove and repair or replace as needed.
CONVERTER CLUTCH WILL NOT DISENGAGE	1. Converter clutch or switch valve sticking.	1. Remove, disassemble valve body. Clean and free-up valves.
	2. Valve body fault (loose screws causing cross leakage, misassembled clutch module parts, etc.).	2. Remove and service valve body. Replace as assembly if valves, bores, plugs, housings, transfer plate, etc., are damaged.
CONVERTER CLUTCH STAYS ENGAGED AT TOO LOW A SPEED	1. Converter solenoid fault (sticking, check ball).	1. Replace solenoid.
	2. Clutch module fault.	2. Remove valve body and examine module. Check valves, springs, connecting tube, and end cover for misassembly, damage, being loose.
	3. Valve body fault.	3. Remove and service valve body. Look for stuck clutch and switch valve, loose housing screws, clutch solenoid wire damage, etc.
VIBRATION OR SHUDDER **DURING** CONVERTER CLUTCH ENGAGEMENT	1. Low fluid level.	1. Top off level and check for leaks.
	2. Incorrect fluid.	2. Drain and refill with MOPAR ATF Plus type 7176.
	3. Engine problem: (a) ignition fault (b) fuel system fault.	3. Diagnose with DRB scan tool and correct as needed.
	4. Torque converter fault: (a) out of balance (b) clutch failure (c) turbine hub seal leak.	4. Replace converter.

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TORQUE CONVERTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
VIBRATION OR SHUDDER **DURING** CONVERTER CLUTCH ENGAGEMENT - CONT.	5. Oil pump fault: (a) leaking seals, seal rings (b) pump gears worn (c) pump bolts loose (d) reaction shaft/pump bushing damage (e) vent damaged.	5. Remove and overhaul pump.
	6. Valve body malfunction.	6. Remove and service valve body. Look for loose screws, misassembled parts, stuck valves, etc.
SHUDDER **AFTER** CLUTCH ENGAGEMENT	1. Engine fuel or ignition problem.	1. Diagnose with scan tool and correct as needed.
	2. Exhaust system problem (pipes grounding against chassis, or restrictions in converter, muffler, or pipe).	2. Realign grounded pipes. Replace restricted parts.
	3. Incorrect fluid.	3. Drain and refill with MOPAR ATF Plus, type 7176.
	4. Throttle valve cable out of adjustment.	4. Adjust cable.
	5. Low fluid level.	5. Top off fluid and check for leak.
	6. Converter clutch failure.	6. Replace torque converter.
	7. Restriction in cooler system.	7. Reverse flush system. Replace radiator, if cooler is restricted.
	8. Valve body malfunction.	8. Remove and service valve body. Look for failed solenoid, sticking valves, loose attaching screws, misassembled parts.
	9. Oil pump pressure low.	9. Remove and overhaul pump. Replace bushings, seals, seal rings, and gears as needed.
CONVERTER CLUTCH CHATTERS **DURING** ENGAGEMENT WHEN COLD	1. Low fluid level.	1. Top off level and check for leaks.
	2. Incorrect fluid.	2. Drain and refill with MOPAR ATF Plus type 7176.
	3. Torque converter fault: (a) out of balance (b) converter clutch failed (c) turbine hub seal leak.	3. Replace converter.
VIBRATION **AFTER** CONVERTER CLUTCH ENGAGEMENT	1. Exhaust pipes grounding against body.	1. Realign exhaust components.
	2. Engine fuel or ignition problem.	2. Diagnose with DRB scan tool and repair as needed.
	3. Throttle valve cable needs adjustment.	3. Adjust cable.
	4. Converter balance problem or internal damage.	4. Replace converter.

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TORQUE CONVERTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
CONVERTER VIBRATION WHEN ENGINE IS "REVVED" IN NEUTRAL	1. Converter out of balance.	1. Replace converter.
LOCKS OR DRAGS IN LOW OR SECOND	1. Oil cooler, cooler lines, or fittings are plugged.	1. Reverse flush lines and fittings. Replace radiator if cooler is completely plugged. Overhaul transmission and replace converter if large quantities of clutch material and/or metal particles are cause of plugging.
	2. Oil pump fault.	2. Remove and overhaul pump. Look for worn seals or reaction shaft seal rings, pump body cracks, loose bolts, worn gears, bushings.
	3. Valve body fault.	3. Remove and service valve body. Look for loose or misassembled parts, failed solenoid, stuck valves, etc.
STALLS, OR IS SLUGGISH IN REVERSE	1. Plugged cooler lines, fittings, or cooler.	1. Reverse flush lines and cooler. Replace radiator if cooler is completely plugged. Overhaul transmission and replace converter if plugging is caused by large quantities of clutch material and/or metal particles.
	2. Oil pump fault.	2. Remove and overhaul pump. Look for worn seals, or reaction shaft seal rings, pump body cracks, loose bolts, worn gears or bushings.
	3. Valve body malfunction.	3. Remove and service valve body. Look for stuck converter and switch valves, loose screws, misassembled parts, failed solenoid, etc.
FLUID COMES OUT FILL TUBE (OVERHEATING)	1. Vehicle not properly equipped for severe service operation such as trailer towing.	1. Vehicle must be equipped with HD cooling system, auxiliary cooler, and correct engine/transmission/axle ratio combination.
	2. Air flow through radiator and cooler partially blocked by plow, front mount spare tire, protective screen, etc.	2. Move equipment as needed to restore
	3. Transmission overfilled.	3. Remove excess fluid at cooler line or with suction tube inserted in filler tube.
	4. Cooler lines, fittings, or cooler plugged.	4. Reverse flush cooler lines and fittings.
	5. Transmission vent restricted.	5. Remove transmission and either open the vent or replace the pump body if the vent cannot be repaired.
	6. Stuck switch valve.	6. Remove valve body and free up the valve.

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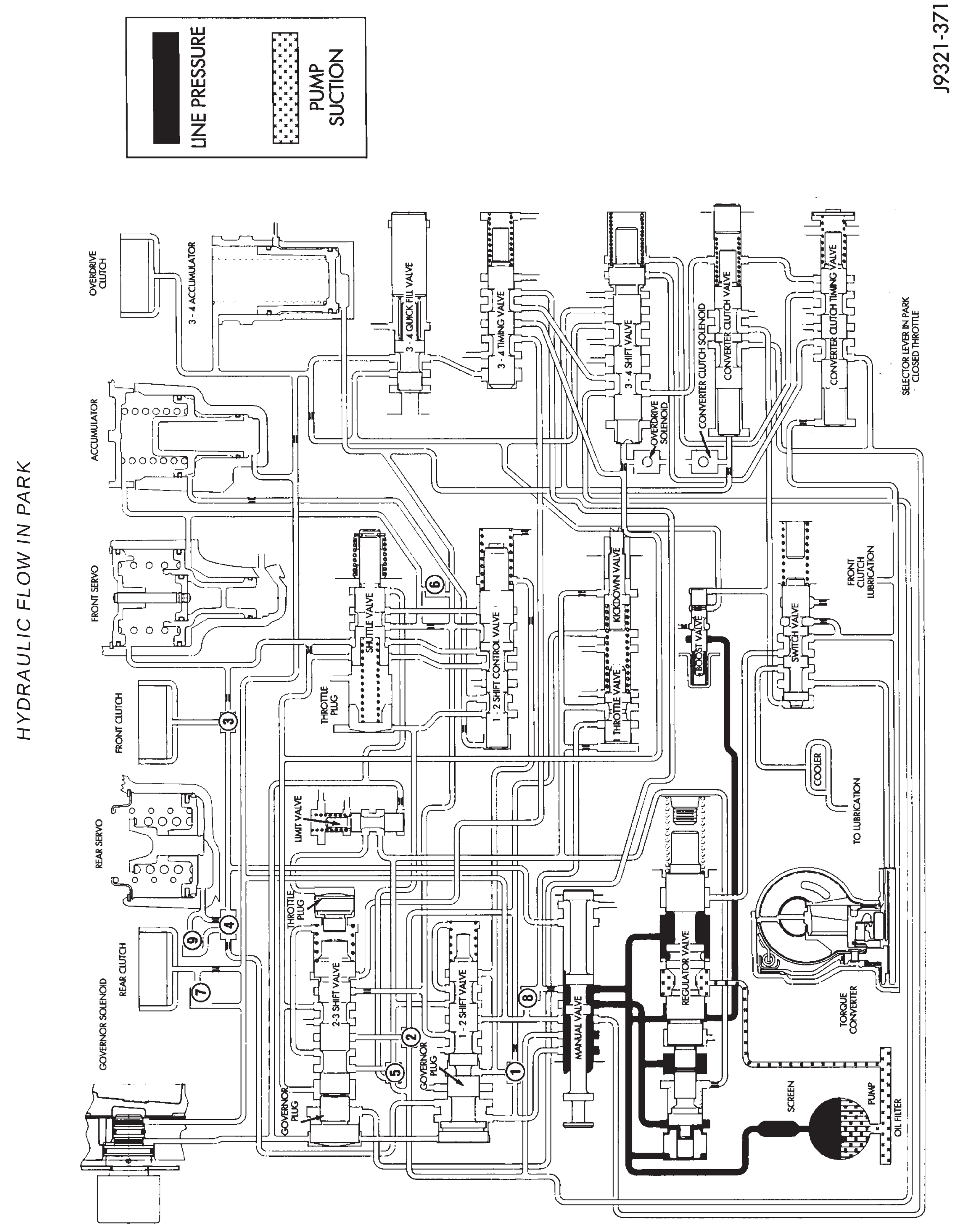
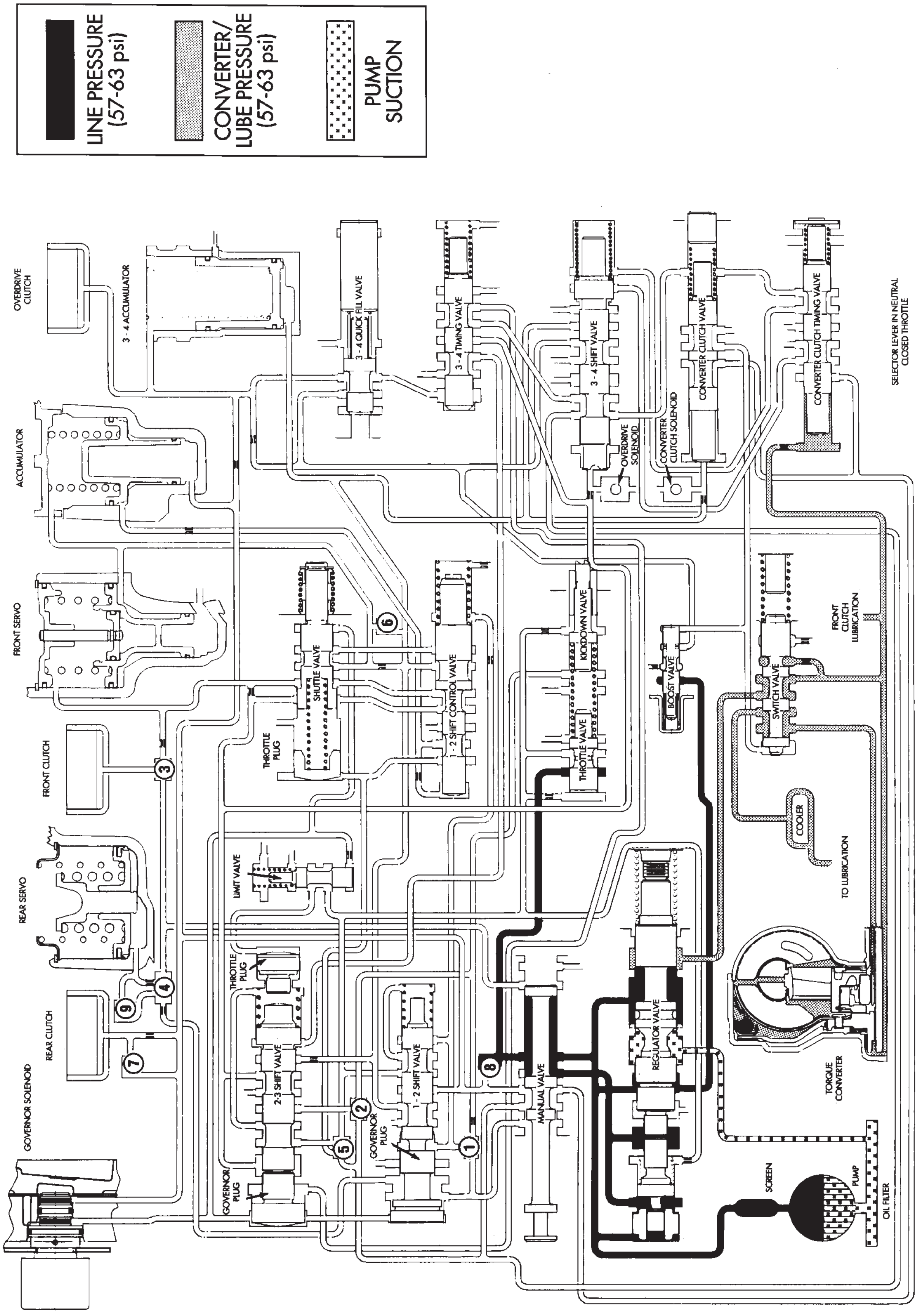
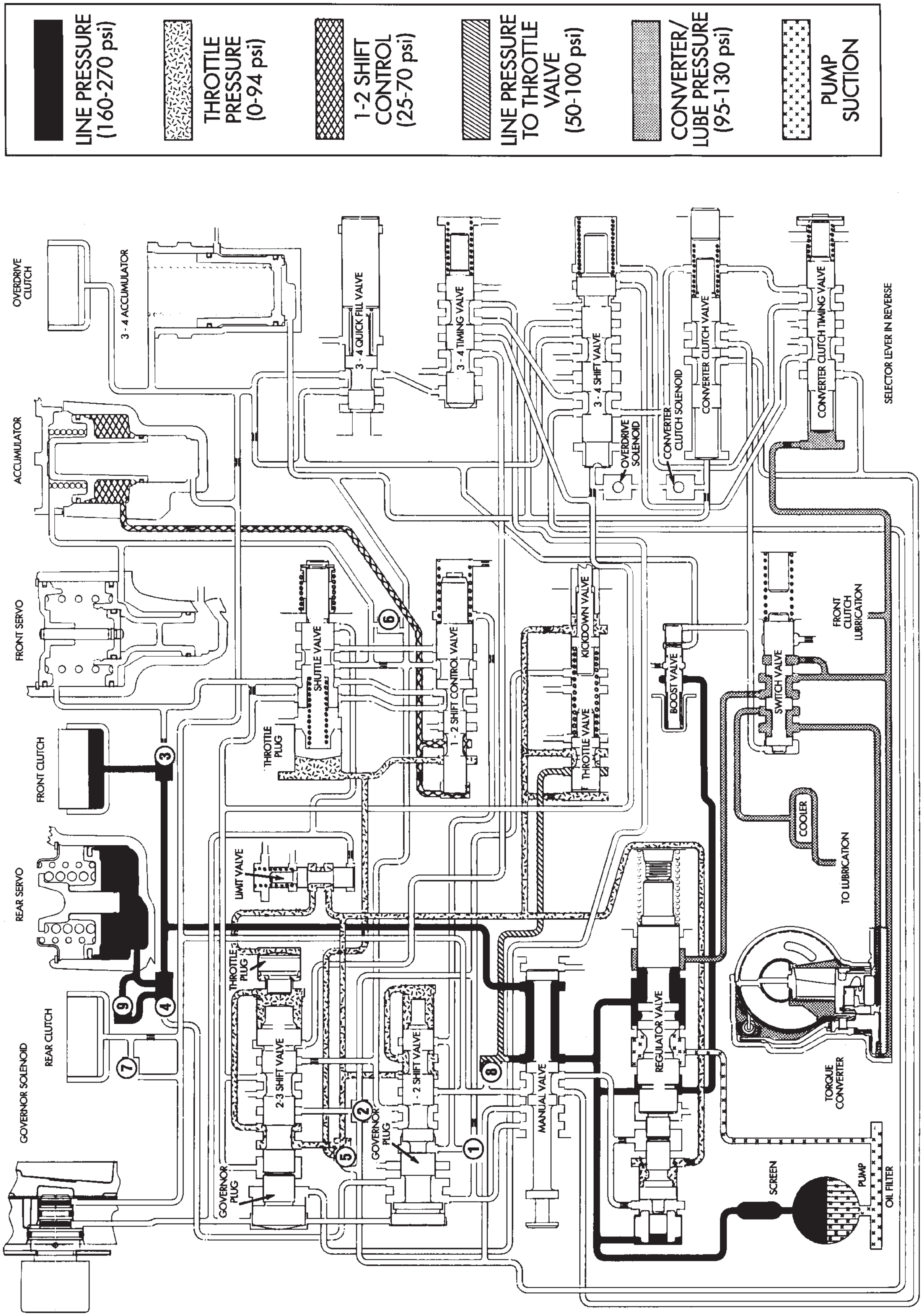

HYDRAULIC FLOW IN PARK
LINE PRESSURE
PUMP SUCTION
J9321-371
OVERDRIVE CLUTCH
3 - 4 ACCUMULATOR
ACCUMULATOR
FRONT SERVO
FRONT CLUTCH
REAR SERVO
REAR CLUTCH
GOVERNOR SOLENOID
3 - 4 QUICK FILL VALVE
3 - 4 TIMING VALVE
3 - 4 SHIFT VALVE
OVERDRIVE SOLENOID
CONVERTER CLUTCH SOLENOID
CONVERTER CLUTCH VALVE
CONVERTER CLUTCH TIMING VALVE
SELECTOR LEVER IN PARK CLOSED THROTTLE
SHUTTLE VALVE
THROTTLE PLUG
1 - 2 SHIFT CONTROL VALVE
KICKDOWN VALVE
THROTTLE VALVE
BOOST VALVE
SWITCH VALVE
FRONT CLUTCH LUBRICATION
COOLER
TO LUBRICATION
LIMIT VALVE
THROTTLE PLUG
2-3 SHIFT VALVE
1 - 2 SHIFT VALVE
GOVERNOR PLUG
GOVERNOR PLUG
MANUAL VALVE
REGULATOR VALVE
TORQUE CONVERTER
SCREEN
PUMP
OIL FILTER
1
2
3
4
5
6
7
8
9

HYDRAULIC FLOW IN NEUTRAL



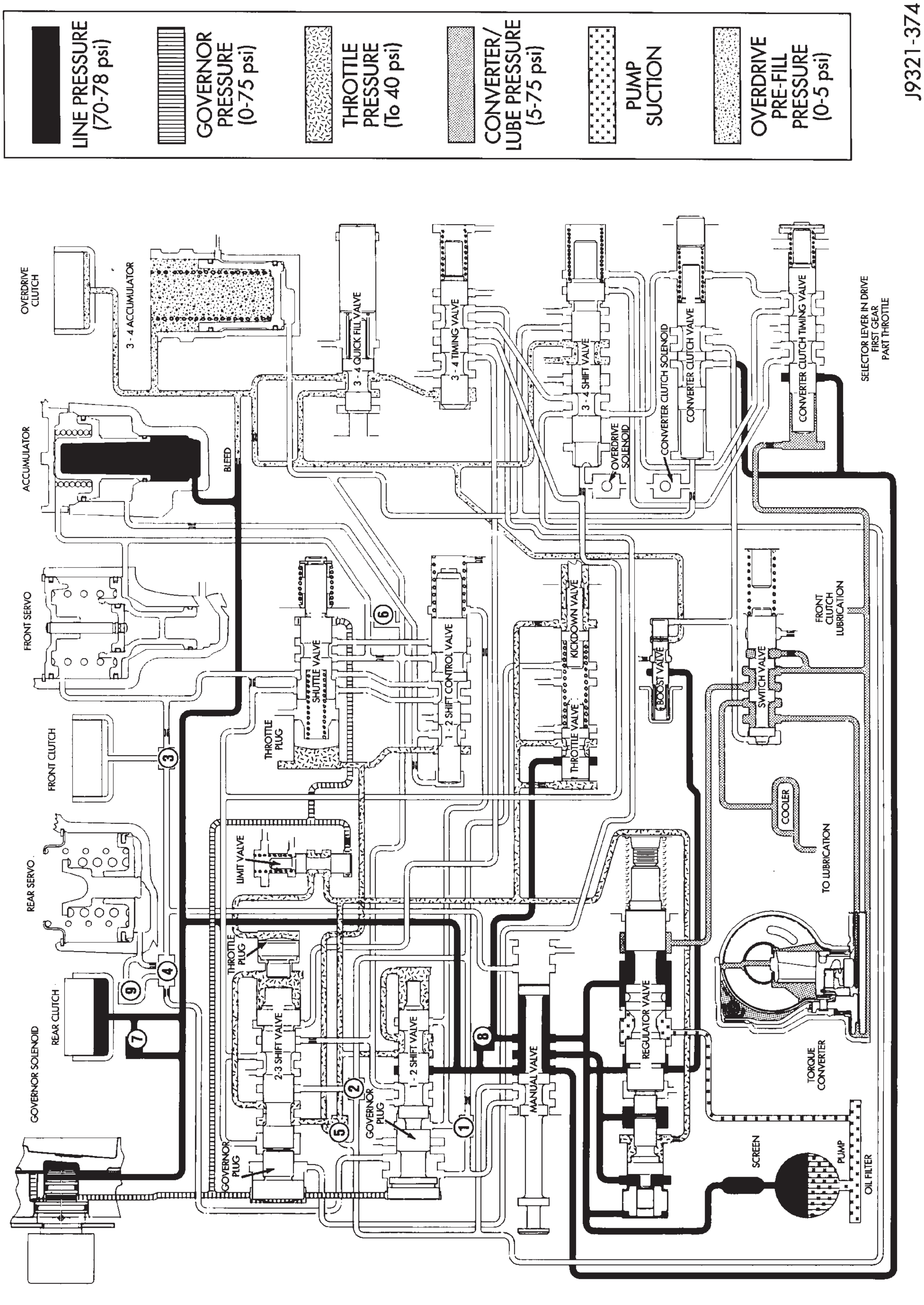
J9321-372



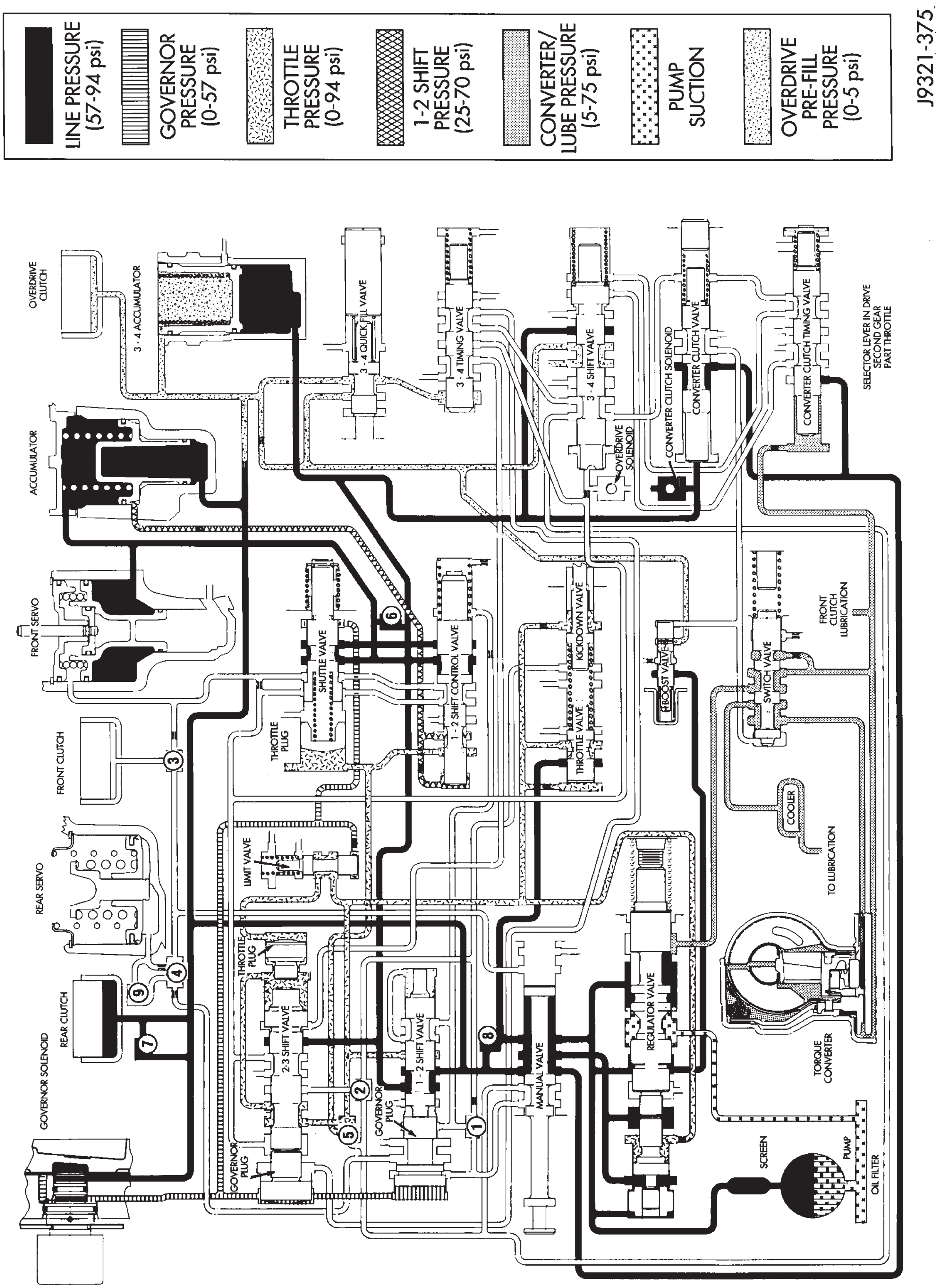
HYDRAULIC FLOW IN REVERSE

J9321-373

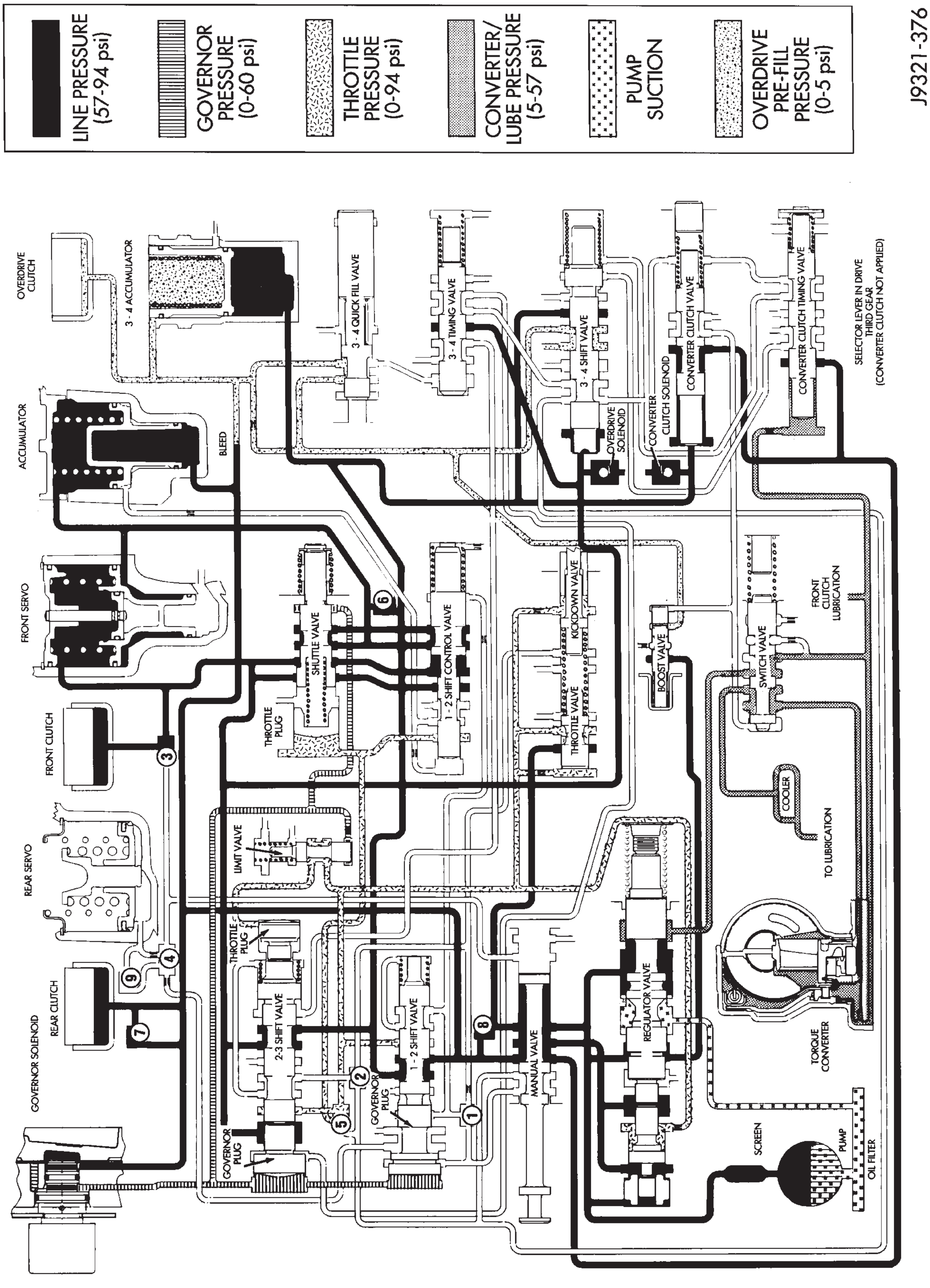
HYDRAULIC FLOW IN DRIVE FIRST GEAR



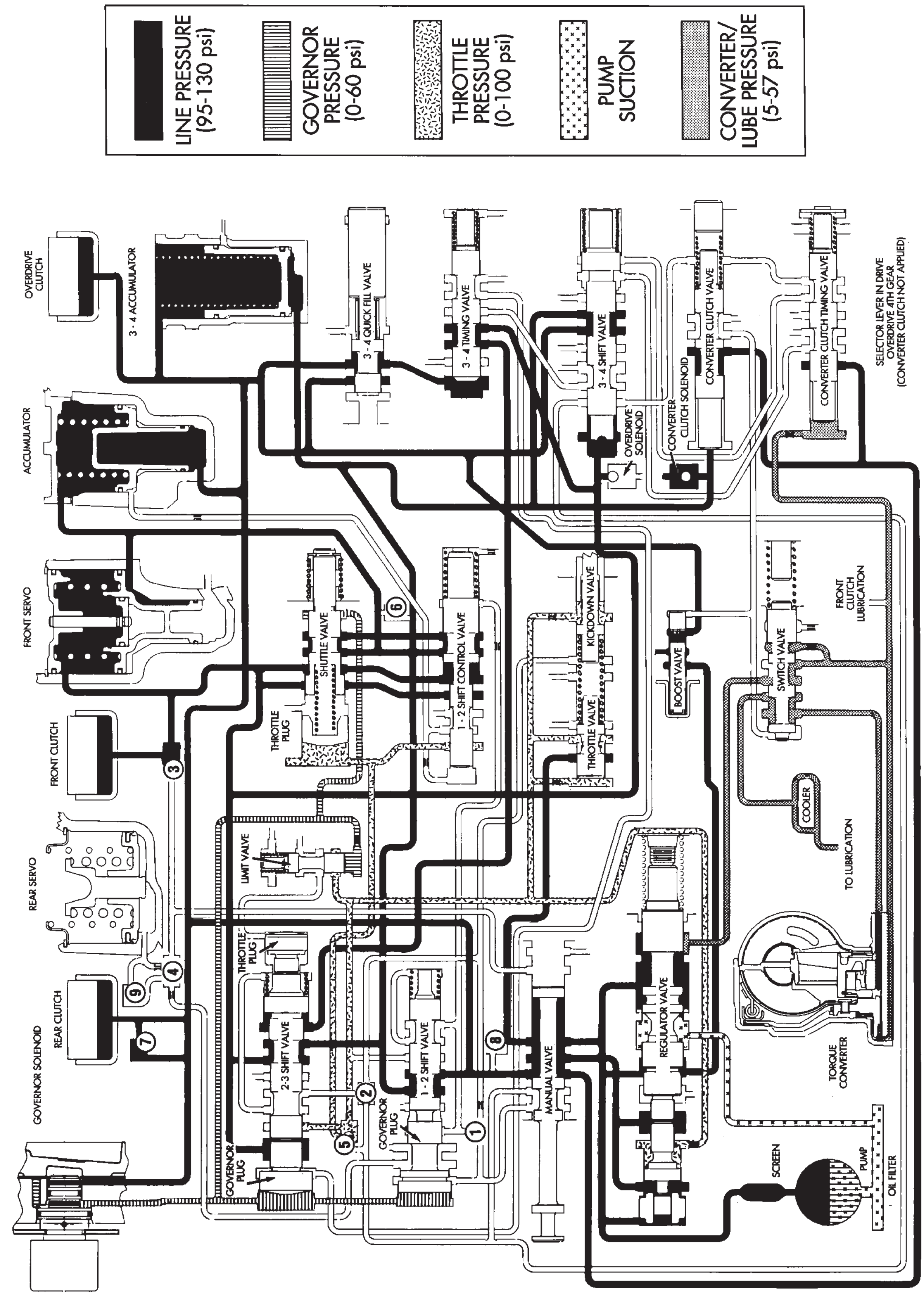
HYDRAULIC FLOW IN DRIVE SECOND GEAR



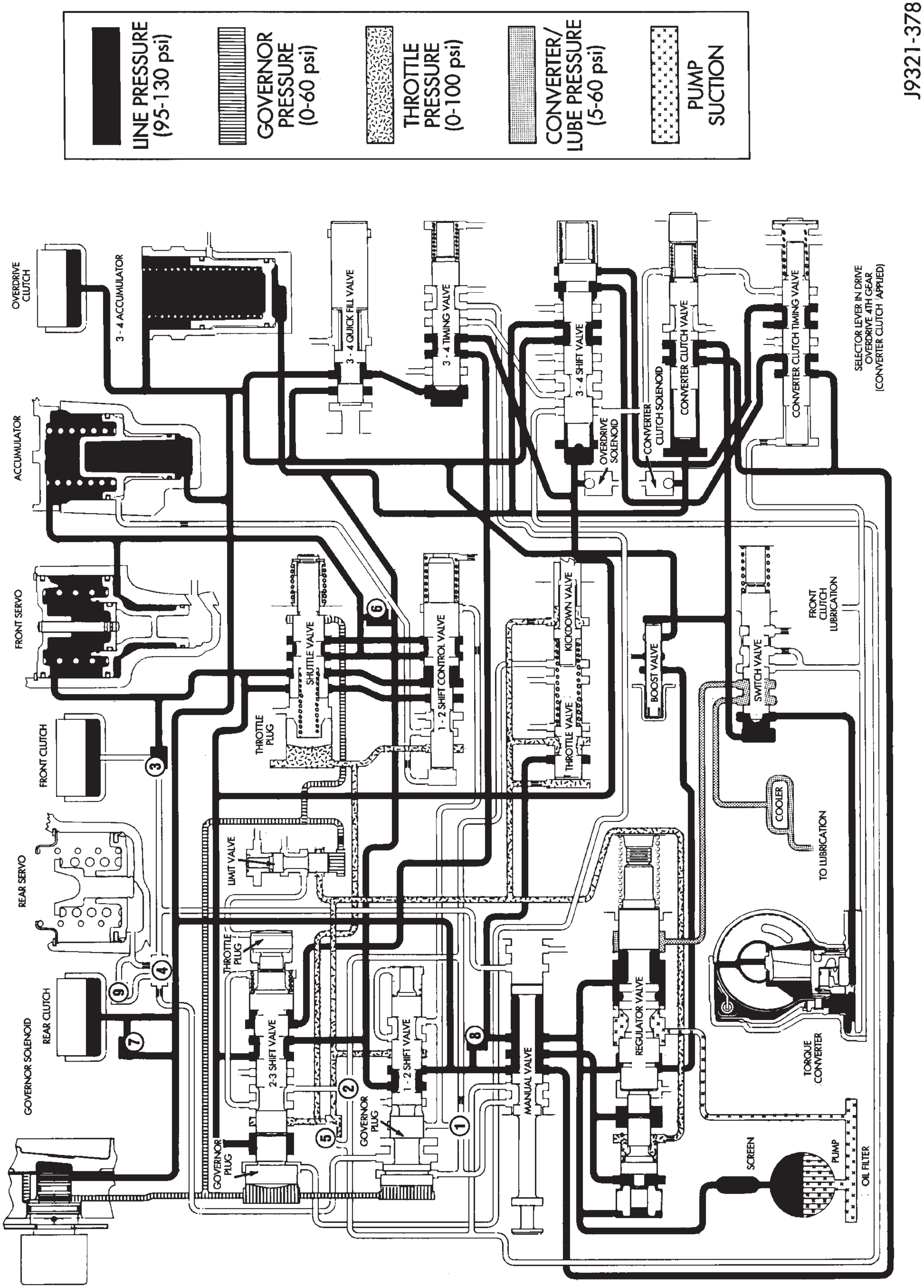
HYDRAULIC FLOW IN DRIVE THIRD GEAR

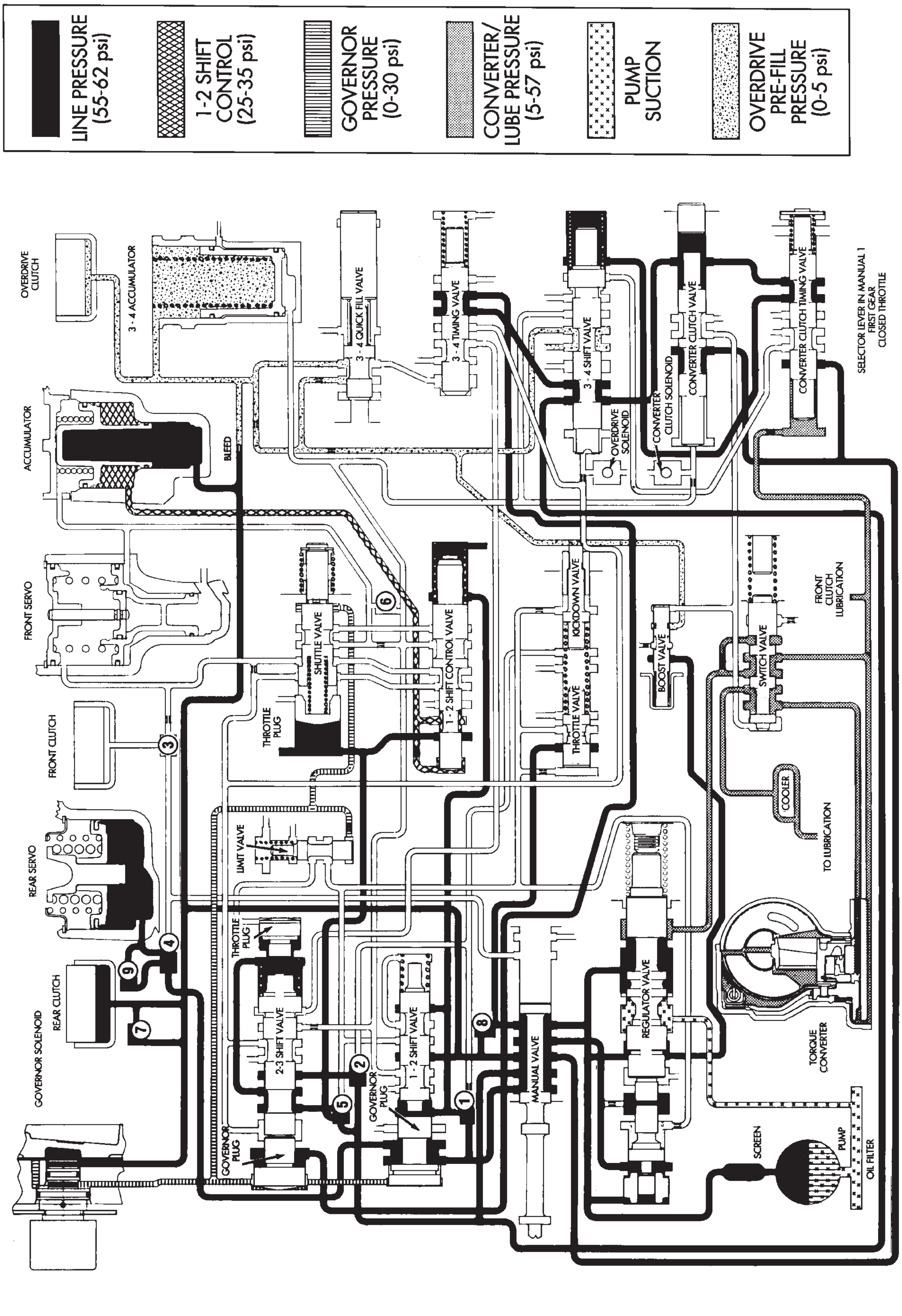


HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)

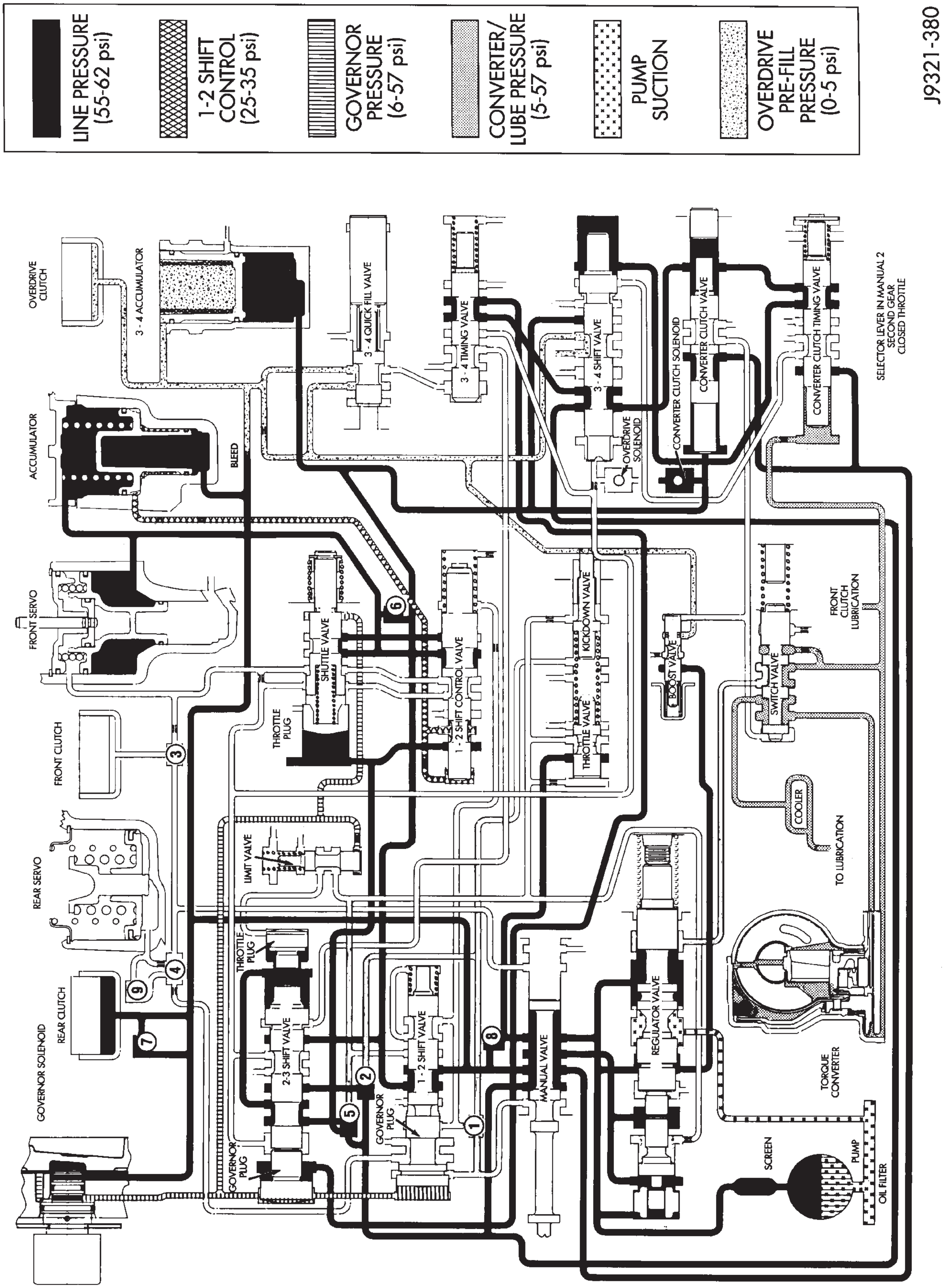


HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH APPLIED)



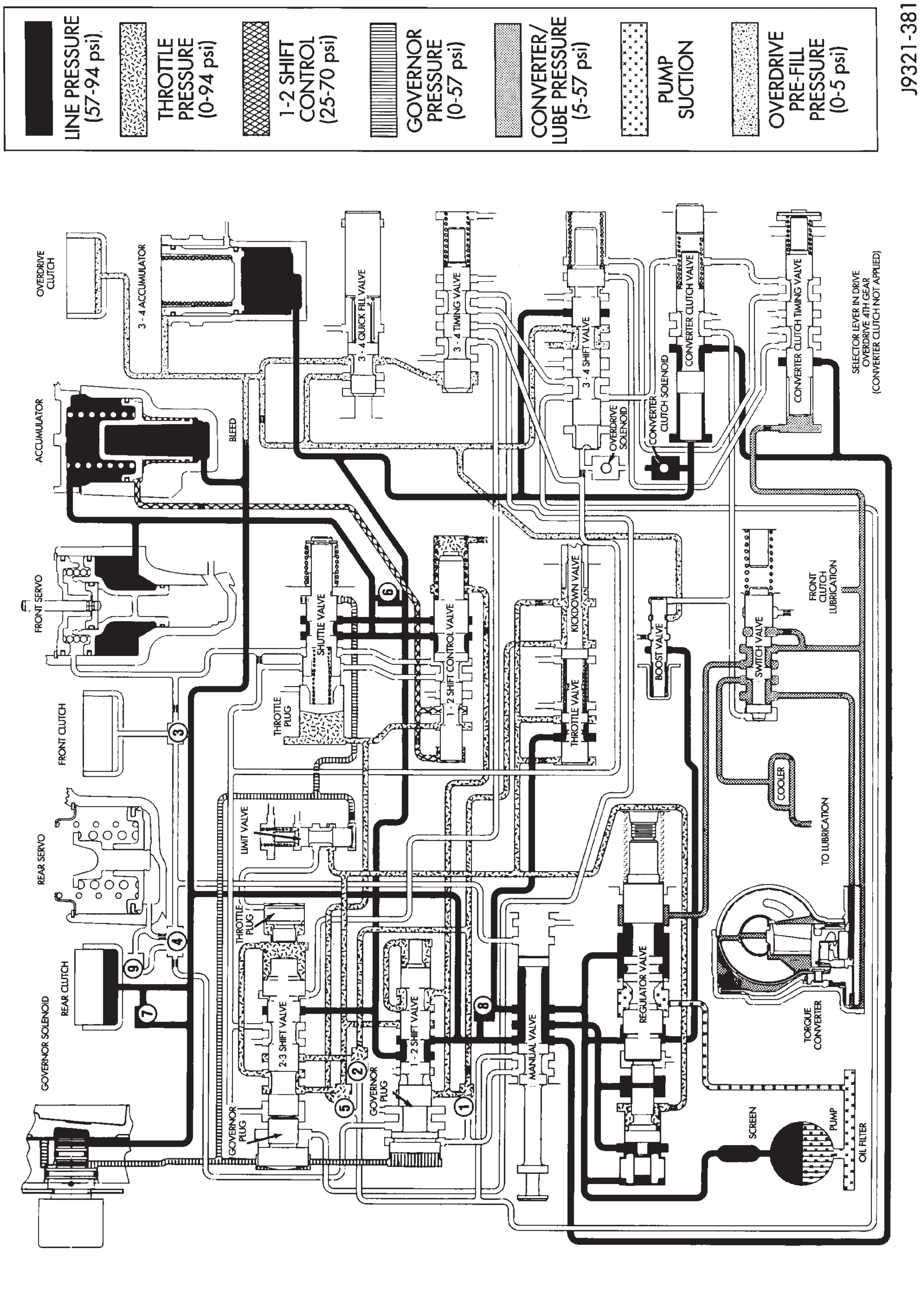


HYDRAULIC FLOW IN MANUAL LOW (1)



HYDRAULIC FLOW IN MANUAL SECOND (2)

HYDRAULIC FLOW DURING FULL THROTTLE 3-2 DOWNSHIFT



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42RE IN-VEHICLE SERVICE

INDEX

PARK LOCK SERVICE

The park lock components are located within the overdrive unit and cannot be serviced in the vehicle. The overdrive unit must be removed and disassembled for access to the park lock components.

Refer to the sections dealing with transmission/overdrive removal, installation and overhaul sections for overdrive unit repair procedures.

OIL PUMP SEAL

The transmission and torque converter must be removed for access to the oil pump seal. Oil pump seal replacement procedures are described in the Transmission Removal/Installation section.

RECOMMENDED FLUID

The recommended and preferred fluid for 42RE transmissions is Mopar ATF Plus, type 7176.

Dexron II fluid is not really recommended and should only be used when ATF Plus is not available.

TRANSMISSION FLUID LEVEL CHECK

Transmission fluid level should be checked monthly under normal operation. If the vehicle is used for trailer towing or similar heavy load hauling, check fluid level and condition weekly.

Fluid level is checked with the engine running at curb idle speed, the transmission in Neutral, parking brakes applied, and the transmission fluid at normal operating temperature (hot).

Transmission fluid level should be checked monthly under normal operation. If the vehicle is used for trailer towing or similar heavy load hauling, check fluid level and condition weekly.

FLUID LEVEL CHECK PROCEDURE

(1) Transmission fluid must be at normal operating temperature for accurate fluid level check. Drive vehicle if necessary to bring fluid temperature up to normal hot operating temperature of 82°C (180°F).

(2) Position vehicle on level surface. This is extremely important for accurate fluid level check.

(3) Start and run engine at curb idle speed.

(4) Apply parking brakes.

(5) Shift transmission momentarily into all gear ranges. Then shift transmission back to **Neutral.**

(6) Clean top of filler tube and dipstick to keep dirt from entering tube.

(7) Remove dipstick and check fluid level as follows:

(a) Dipstick has three fluid level indicator levels which are a MIN dot, an OK area, and a MAX fill arrow.

(b) Correct maximum level is to MAX arrow mark on dipstick. Correct acceptable level is to OK mark within crosshatch area. Incorrect level is at or below MIN dot.

(c) If fluid is low, add only enough Mopar ATF Plus to restore correct level. Do not overfill.

CAUTION: Do not overfill the transmission. Overfilling may cause leakage out the pump vent which can be mistaken for a pump seal leak. Overfilling will also cause fluid aeration and foaming as the excess fluid is picked up and churned by the gear train. This will significantly reduce fluid life.

(8) If transmission is overfilled, fluid can be removed with 1/8 to 3/16 in. diameter tubing and suction gun. Tubing will have to be adapted to nozzle of gun and be long enough to extend down fill tube and into transmission oil pan.

FLUID AND FILTER CHANGE

NORMAL CHANGE INTERVAL

The fluid and filter should be changed (and the bands adjusted) at recommended maintenance intervals, or whenever the transmission has been disassembled for any reason.

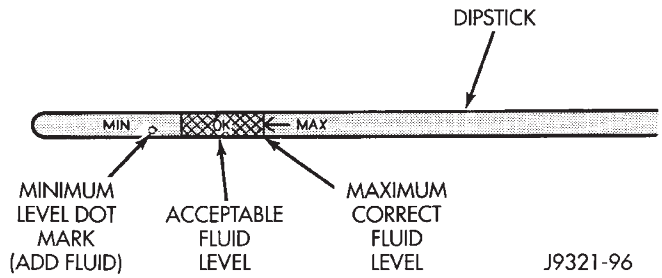


Fig. 1 Typical Dipstick Fluid Level Marks

Refer to the Driveline section in Group O, Lubrication and Maintenance for recommended change intervals. Refer to the fluid/filter replacement and band adjustment procedures in this section.

SEVERE USAGE CHANGE INTERVAL

Under severe usage, the fluid and filter should be changed and the bands adjusted at 12,000 mile (19 000 Km) intervals.

Severe usage is defined as:

(a) More than half of vehicle operation occurs in heavy city traffic during hot weather (above 90° F).

(b) Vehicle is used for taxi, police, limousine, or similar commercial operation.

(c) Vehicle is used for trailer towing or heavy load hauling.

When the factory fluid is drained, refill the transmission with Mopar ATF Plus, type 7176 fluid.

FLUID/FILTER REPLACEMENT PROCEDURE

(1) Raise vehicle.

(2) Remove oil pan and drain fluid.

(3) Clean oil pan and pan magnet. Then clean remaining gasket material from gasket surface of transmission case.

(4) Remove fluid filter screws and remove filter.

(5) Position new filter on valve body and install filter screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

(6) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 150 in. lbs. (17 N·m) torque.

(7) Lower vehicle and refill transmission with Mopar ATF Plus, type 7176 fluid.

REFILLING AFTER OVERHAUL OR FLUID/FILTER CHANGE

The best way to refill the transmission after a fluid change or overhaul is as follows:

(1) If transmission has been overhauled, install transmission in vehicle.

(2) Remove dipstick and insert clean funnel in transmission fill tube.

(3) Add following initial quantity of Mopar ATF Plus to transmission:

(a) If fluid/filter change was performed, add **3 pints (1-1/2 quarts)** of ATF Plus to transmission.

(b) If transmission was completely overhauled and torque converter was replaced or drained, add **12 pints (6 quarts)** of ATF Plus to transmission.

(4) Apply parking brakes.

(5) Start and run engine at normal curb idle speed.

(6) Apply service brakes and shift transmission through all gear ranges then back to Neutral but leave engine running.

(7) Remove funnel, insert dipstick and check fluid level. Add only enough fluid to bring level to Full mark on dipstick. **Do not overfill.**

(8) When fluid level is correct, shut engine off, release park brake, remove funnel, and reseat dipstick in fill tube.

TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT

The transmission throttle valve is operated by a cam on the throttle lever. The throttle lever is operated by an adjustable cable (Fig. 2). The cable is attached to an arm mounted on the throttle lever shaft. A lock button at the engine-end of the cable is provided for cable adjustment.

A correctly adjusted throttle valve cable will cause the throttle lever on the transmission to move simultaneously with the throttle body lever from the idle position. Proper adjustment will allow simultaneous movement without causing the transmission throttle lever to either move ahead of, or lag behind the lever on the throttle body.

CHECKING THROTTLE VALVE CABLE ADJUSTMENT

(1) Turn ignition key to OFF position.

(2) Remove air cleaner.

(3) Verify that lever on throttle body is at curb idle position. Then verify that transmission throttle lever (Fig. 3) is also at idle (fully forward) position.

(4) Slide cable off attachment stud on throttle body lever (Fig. 4).

(5) Compare position of cable end to attachment stud on throttle body lever (Fig. 4):

(a) Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction.

(b) If cable end and attachment stud are misaligned (off center), cable will have to be adjusted as described in Throttle Valve Cable Adjustment procedure.

(6) Reconnect cable end to attachment stud. Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle body.

(a) If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.

(b) If transmission throttle lever moves ahead of, or lags behind throttle body lever, cable adjustment will be necessary. Or, if throttle body lever prevents transmission lever from returning to closed position, cable adjustment will be necessary.

THROTTLE VALVE CABLE ADJUSTMENT PROCEDURE

(1) Turn ignition switch to OFF position.

(2) Remove air cleaner if necessary.

(3) Disconnect cable end from attachment stud. **Carefully slide cable off stud. Do not pry or pull cable off.**

(4) Verify that transmission throttle lever is in fully closed position. Then be sure lever on throttle body is at curb idle position.

(5) Press cable lock button inward to release cable (Fig. 4). Lock button only has to move about 2 mm (0.070 in.) to release cable in adjuster head.

(6) Center cable end on attachment stud to within 1 mm (0.039 in.) and release lock button.

(7) Check cable adjustment. Be sure transmission throttle lever and lever on throttle body move simultaneously as described in cable adjustment checking procedure.

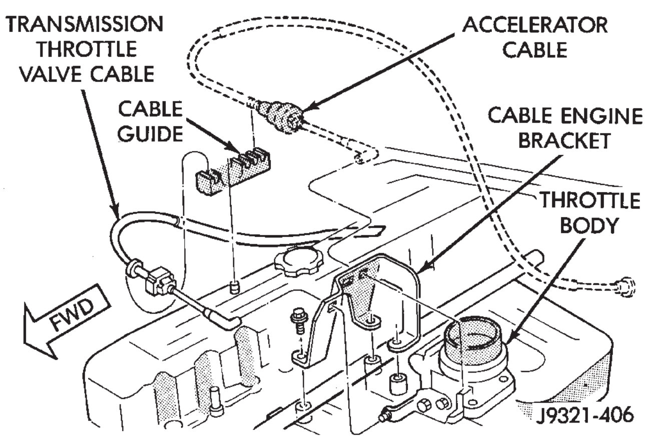


Fig. 2 Throttle Cable Attachment At Engine

GEARSHIFT CABLE ADJUSTMENT

Check adjustment by starting the engine in Park and Neutral. Adjustment is OK if the engine starts only in these positions. Adjustment is incorrect if the engine starts in one but not both positions. If the engine starts in any position other than Park or Neutral, or if the engine will not start at all, the park/neutral position switch may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Release cable adjuster clamp (at transmission end of cable) to unlock cable (Fig. 5).

(4) Unsnap cable from cable bracket (Fig. 5).

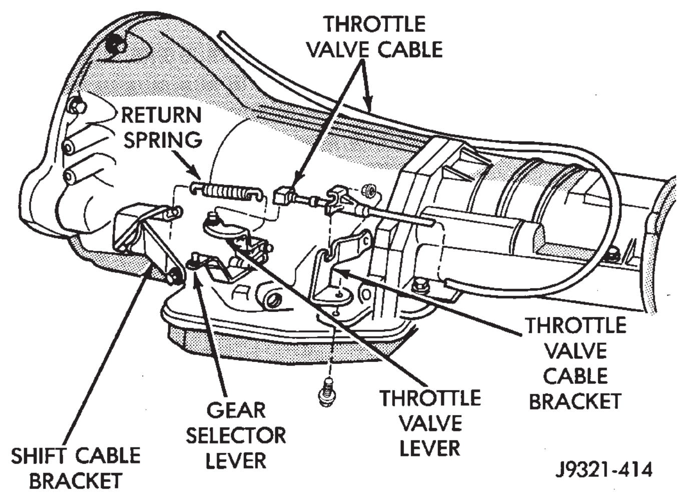


Fig. 3 Throttle Cable Attachment At Transmission

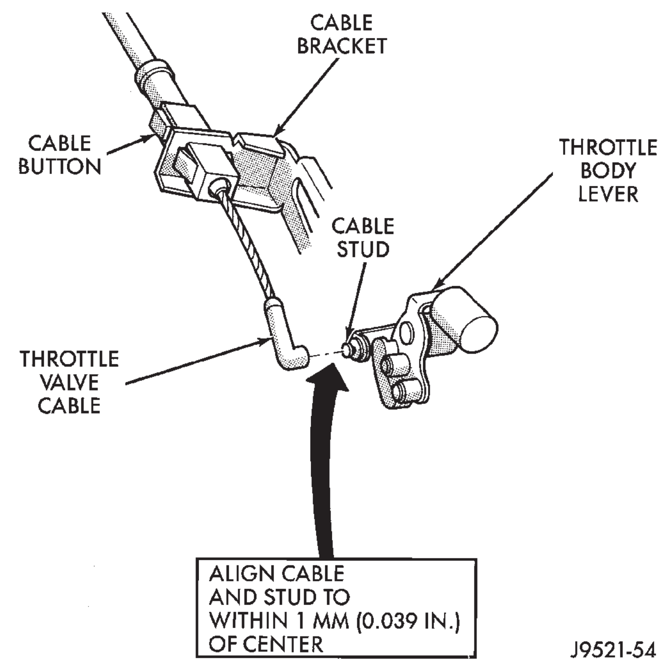


Fig. 4 Throttle Valve Cable Adjustment

(5) Check transmission shift lever position by moving it all the way rearward into Park detent.

(6) Verify positive engagement of park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(7) Snap cable into cable bracket on transmission.

(8) Lock shift cable by pressing cable adjuster clamp down until it snaps into place.

(9) Check engine starting. Engine should start only in Park and Neutral.

(10) Lower vehicle.

PARK INTERLOCK CABLE ADJUSTMENT

(1) Shift transmission into Park.

(2) Turn ignition switch to Accessory position.

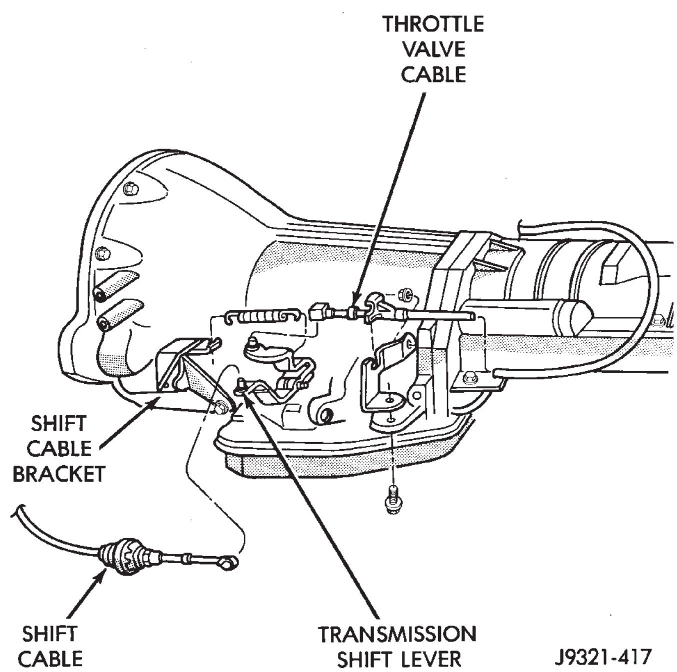


Fig. 5 Shift Cable Attachment At Transmission

CAUTION: Be sure the ignition switch is in the Accessory position for cable adjustment. The cable and lever mechanism will not adjust correctly if the switch lock cylinder is in Park position.

(3) Remove shift lever bezel and console screws. Raise bezel and console for access to cable.

(4) Pull cable lock button up to release cable (Fig. 6).

(5) Pull cable forward. Then release cable and press cable lock button down until it snaps in place.

(6) Check cable adjustment as follows:

(a) Place shift lever in Park.

(b) Check shift handle release button and ignition lock cylinder operation. Release button should be in released (out) position and ignition lock cylinder should rotate freely from Off to Lock.

(c) Next, place shift lever in D or R position and check ignition lock cylinder operation again. Cylinder should not rotate from Off to Lock position.

(d) Check shift lever operation. Shifting out of Park position should only be possible when ignition lock cylinder is in Off, Run, or Start positions. Shift lever should be locked-in when lock cylinder is in Accessory and Lock positions.

FRONT BAND ADJUSTMENT

The front band adjusting screw is located on the driver side of the transmission case above the manual valve and throttle valve levers.

ADJUSTMENT PROCEDURE

(1) Raise vehicle.

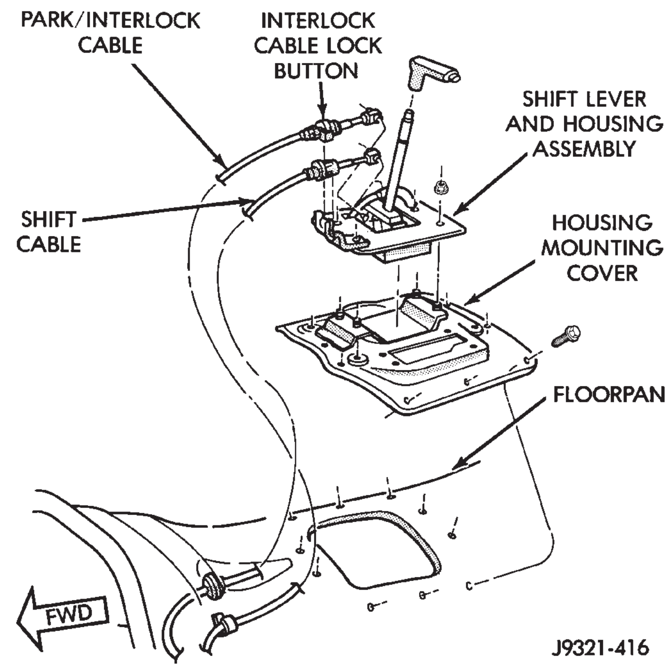


Fig. 6 Shift And Park Interlock Cables

(2) Loosen band adjusting screw locknut. Then back locknut off 4-5 turns. Be sure adjusting screw turns freely in case. Lubricate screw threads if necessary.

(3) Tighten band adjusting screw to 8 N·m (72 in. lbs.) torque with inch pound Torque Wrench C-3380-A, a 3-in. extension and 5/16 socket (Fig. 7).

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw (Fig. 8), tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

(4) Back off band adjusting screw **3-5/8 turns**.

(5) Hold adjuster screw in position and tighten locknut to 41 N·m (30 ft. lbs.) torque.

(6) Lower vehicle.

REAR BAND ADJUSTMENT

The transmission oil pan must be removed for access to the rear band adjusting screw.

(1) Raise vehicle.

(2) Remove transmission oil pan and drain fluid.

(3) Loosen band adjusting screw locknut 5-6 turns. Be sure adjusting screw turns freely in lever. Lubricate screw threads if necessary.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque (Fig. 9). Use inch-pound Torque Wrench C-3380-A for adjustment.

(5) Back off band adjusting screw 4 turns.

(6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(7) Clean oil pan, pan magnet and gasket surface of case. Also inspect and replace fluid filter if necessary.

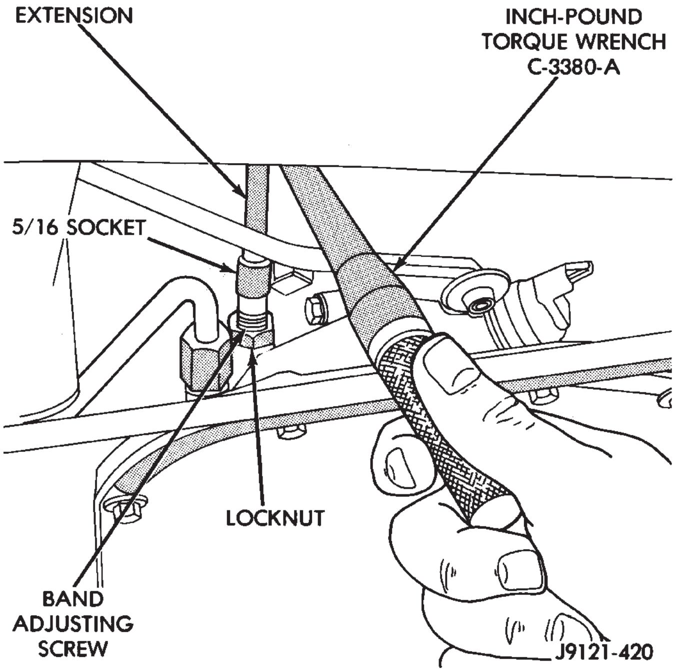


Fig. 7 Front Band Adjustment

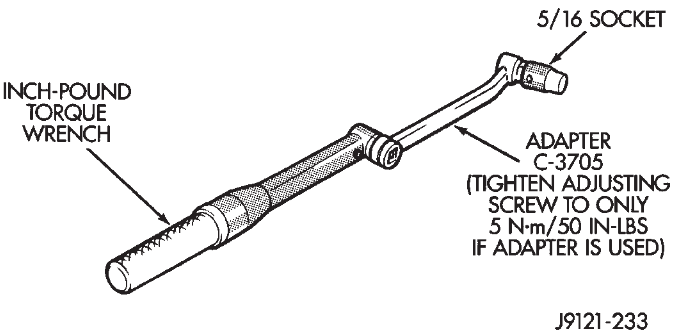


Fig. 8 Using Band Adjustment Adapter Tool C-3705

(8) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (150 in. lbs.) torque.

(9) Lower vehicle and refill transmission with recommended fluid.

SPEEDOMETER SERVICE

Rear axle gear ratio and tire size determine speedometer pinion requirements. If the pinion must be replaced, refer to the parts catalogue information for the correct part.

SPEEDOMETER ASSEMBLY REMOVAL

(1) Raise vehicle.

(2) Disconnect wires from vehicle speed sensor.

(3) Remove adapter clamp and screw (Fig. 10).

(4) Remove speed sensor and speedometer adapter as assembly.

(5) Remove speed sensor retaining screw and remove sensor from adapter.

(6) Remove speedometer pinion from adapter.

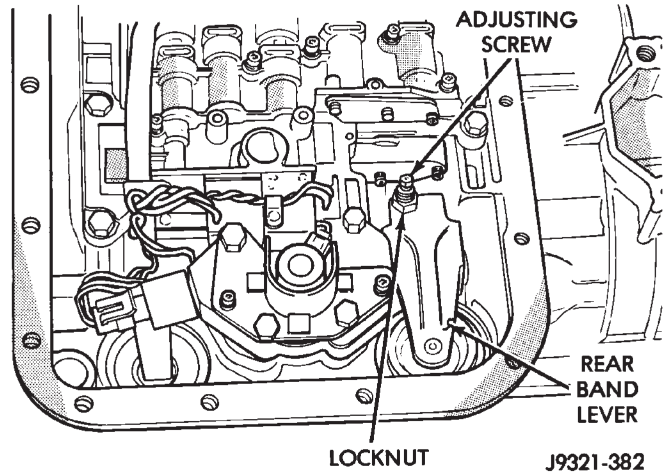


Fig. 9 Rear Band Adjusting Screw Location

(7) Inspect sensor and adapter O-rings (Fig. 9). Remove and discard O-rings if worn or damaged.

(8) Inspect terminal pins in speed sensor. Clean pins with Mopar electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or pins are loose, severely corroded, or damaged.

SPEEDOMETER INSTALLATION AND INDEXING

(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.

(2) Install new O-rings on speed sensor and speedometer adapter if necessary (Fig. 10).

(3) Lubricate sensor and adapter O-rings with transmission fluid.

(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.

(5) Install speedometer pinion in adapter.

(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.

(7) Note index numbers on adapter body (Fig. 11). These numbers will correspond to number of teeth on pinion.

(8) Install speedometer assembly in housing.

(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.

(12) Lower vehicle and top off transmission fluid level if necessary.

ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

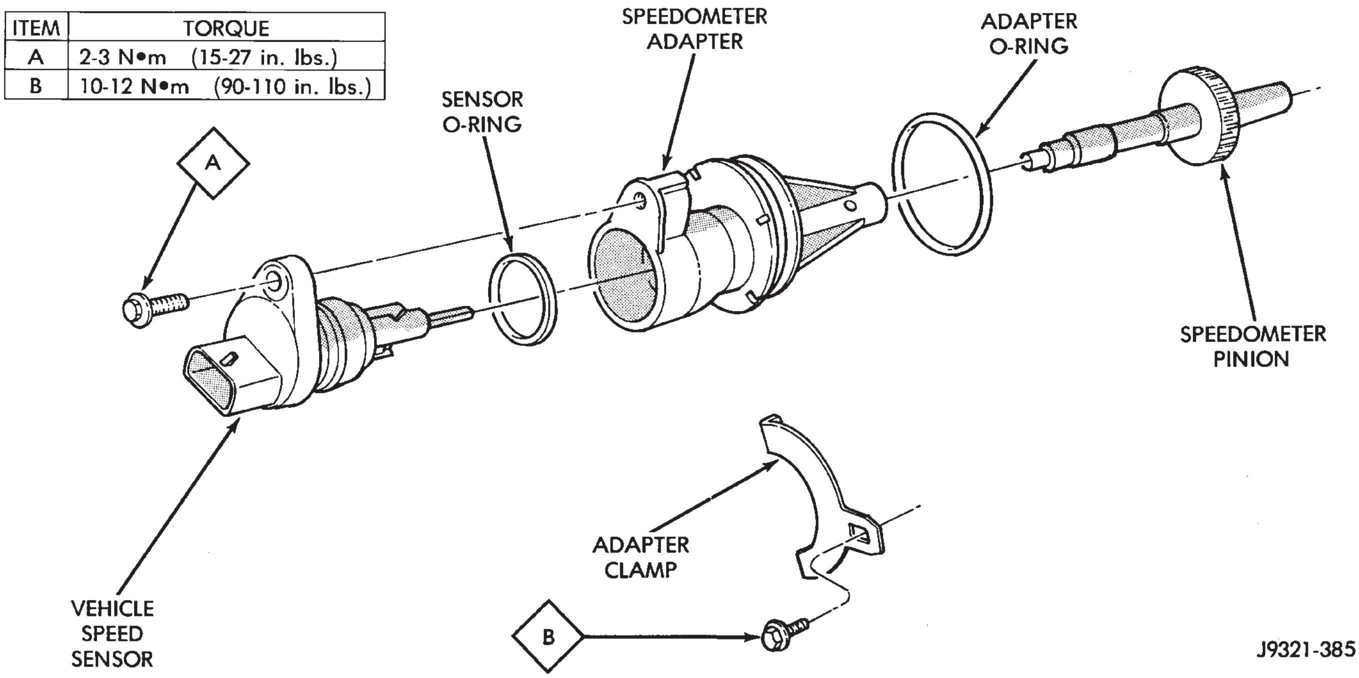


Fig. 10 Speedometer Components

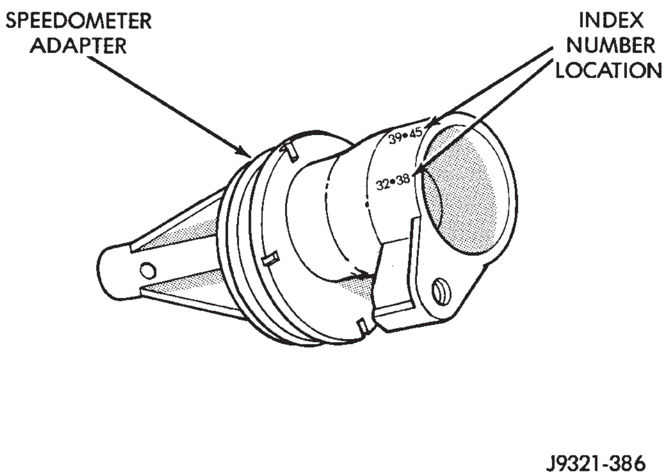


Fig. 11 Location Of Index Numbers On Speedometer Adapter

PARK/NEUTRAL POSITION SWITCH

The center terminal of the switch is the starter circuit terminal. It provides the ground for the starter solenoid circuit through the selector lever in Park and Neutral positions only. The outer terminals on the switch are for the backup lamp circuit.

SWITCH TEST

(1) Verify that gearshift linkage is correctly adjusted before testing. Switch will not operate properly if linkage adjustment is incorrect.

(2) To test switch, remove wiring connector. Then test continuity between center terminal and transmission case. Continuity should exist only when transmission is in Park or Neutral.

(3) Shift transmission into reverse and test continuity at switch outer terminals.

(a) Continuity should exist only when transmission is in Reverse.

(b) Continuity should not exist between outer terminals and case.

PARK/NEUTRAL POSITION SWITCH REPLACEMENT

(1) Raise vehicle and position drain pan under switch.

(2) Disconnect switch wires and remove switch from case.

(3) Move shift lever to Park and Neutral positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 12).

(4) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.

(5) Connect switch wires, lower vehicle and top off transmission fluid level.

VALVE BODY SERVICE

GENERAL SERVICE INFORMATION

The valve body can be removed for service without having to remove the entire transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to the procedures in the Transmission Unit Subassembly Overhaul section.

The only replaceable valve body components are:

- manual lever
- manual lever washer, seal, E-clip and shaft seal
- manual lever detent ball

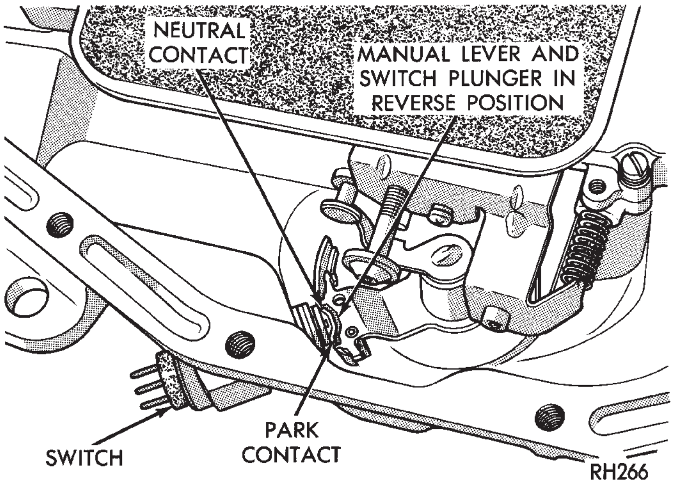


Fig. 12 Park/Neutral Position Switch Contacts

- throttle lever
- fluid filter
- pressure adjusting screw bracket
- governor pressure solenoid
- governor pressure sensor
- converter clutch/overdrive solenoid assembly and harness (includes sump temperature thermister)
- governor housing gasket
- solenoid case connector O-rings

The remaining valve body components are serviced only as part of a complete valve body assembly.

VALVE BODY REMOVAL

(1) Shift transmission into Neutral.

(2) Raise vehicle.

(3) Remove gearshift and throttle levers from shaft of valve body manual lever.

(4) Disconnect wires at park/neutral position switch.

(5) Disconnect wires at park/neutral position switch and solenoid case connector (Fig. 13).

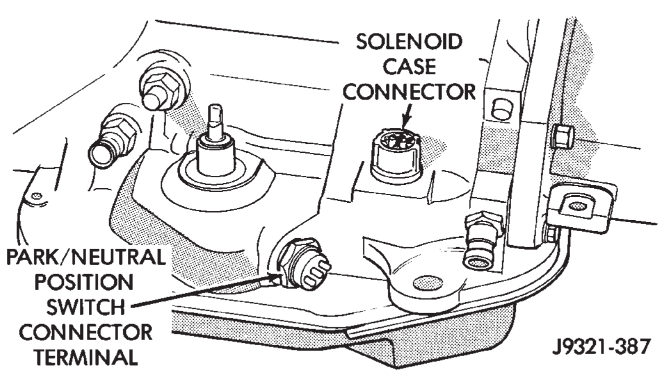


Fig. 13 Transmission Case Connector Locations

(6) Position drain pan under transmission oil pan.

(7) Remove transmission oil pan and gasket.

(8) Remove fluid filter from valve body.

(9) Remove bolts attaching valve body to transmission case.

(10) Lower valve body enough to remove accumulator piston and springs.

(11) Work manual lever shaft and electrical connector out of transmission case. Then lower valve body, rotate it away from case, pull park rod out of sprag and remove valve body (Fig. 14).

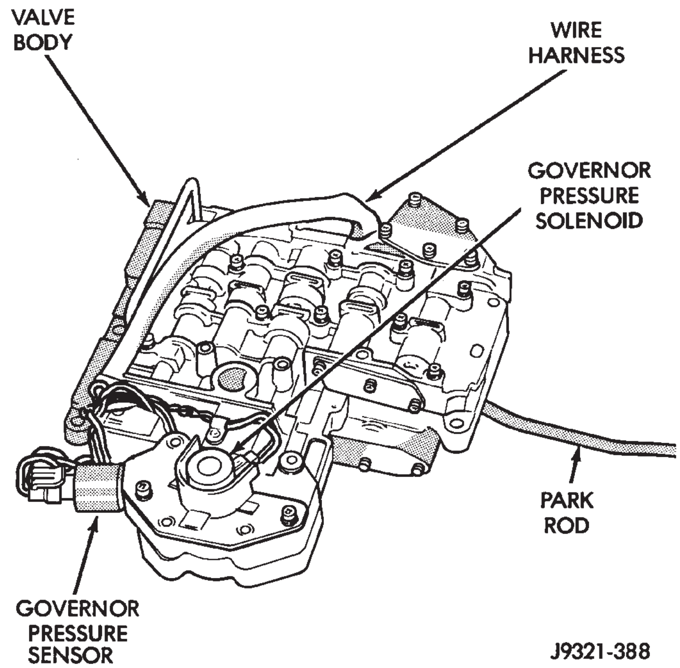


Fig. 14 42RE Valve Body

VALVE BODY INSTALLATION

(1) Verify that park/neutral position switch has NOT been installed in case. Valve body cannot be installed if switch is in place.

(2) Check condition of O-ring seals on valve body harness connector (Fig. 15). Replace seals on connector body if cut or worn.

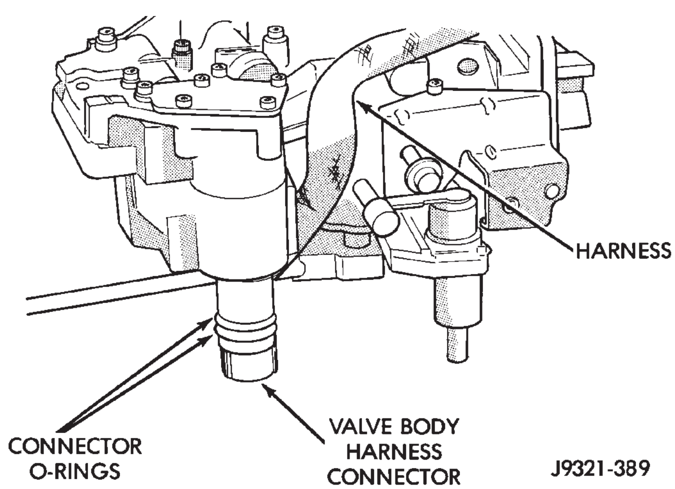


Fig. 15 Valve Body Harness Connector O-Ring Seal Locations

(3) Check condition of manual lever shaft seal in transmission case. Replace seal if lip is cut, or worn. Install new seal with 15/16 deep well socket (Fig. 16).

(4) Check condition of seals on accumulator piston (Fig. 17). Install new piston seals if necessary.

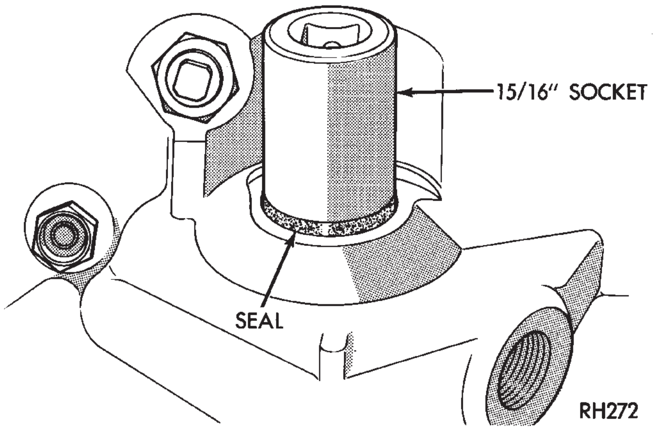


Fig. 16 Manual Lever Shaft Seal Installation

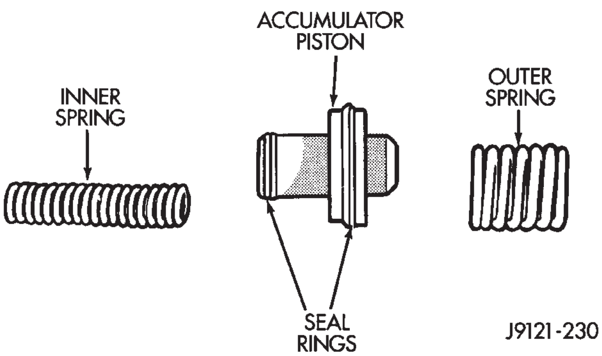


Fig. 17 Accumulator Piston Components

(5) Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.

(6) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.

(7) Lubricate seal rings on valve body harness connector with Ru-Glyde, or petroleum jelly.

(8) Position valve body on case and work end of park lock rod into and through pawl sprag. Turn propeller shaft to align sprag and park lock teeth if necessary. Rod will make click noise as it enters pawl. Move rod to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into this cavity. If the rod enters the cavity during installation, it will become bent when the overdrive bolts are tightened. The rod will then have to be replaced because it is not repairable.

(9) Install accumulator springs and piston in case. Then swing valve body over piston and outer spring to hold it in place.

(10) Align accumulator piston and outer spring, manual lever shaft and electrical connector in case. Then seat valve body on case and install one or two bolts to hold valve body in place.

(11) Tighten valve body bolts alternately and evenly to 11 N·m (100 in. lbs.) torque.

(12) Install new fluid filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.) torque.

(13) Install and connect park/neutral position switch in case.

(14) Install throttle and gearshift levers on valve body manual lever shaft.

(15) Check and adjust front and rear bands if necessary.

(16) Connect valve body overdrive and converter clutch solenoid wires to case connector.

(17) Install oil pan and new gasket. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(18) Lower vehicle and fill transmission with Mopar ATF Plus, type 7176 fluid.

(19) Check and adjust gearshift and throttle valve cables if necessary.

TRANSMISSION CONTROL MODULE (TCM) SERVICE

Use the DRB scan tool to diagnose TCM function whenever a fault is suspected. **Replace the module only when scan tool diagnosis indicates a fault has actually occurred.**

TCM REPLACEMENT

The TCM is located on the driver side of the dash adjacent to the steering column. The module and harness connector are accessible from under the instrument panel (Fig. 18).

The module has integral mounting studs for attachment to the dash panel. A retaining plate and two locknuts secure the module to the dash (Fig. 18). Although the module is inside the vehicle, the retaining plate and locknuts are on the engine compartment side of the dash panel.

TCM REMOVAL

(1) In engine compartment, remove module locknuts and remove module retaining plate. **Locknuts and retaining plate are on driver side of engine compartment near brake booster.**

(2) In vehicle interior, reach up under instrument panel and slide module out of dash.

(3) Work module downward until module harness connector is accessible.

(4) Lift release tab on harness connector (Fig. 18). Pull connector out of module and remove module from vehicle.

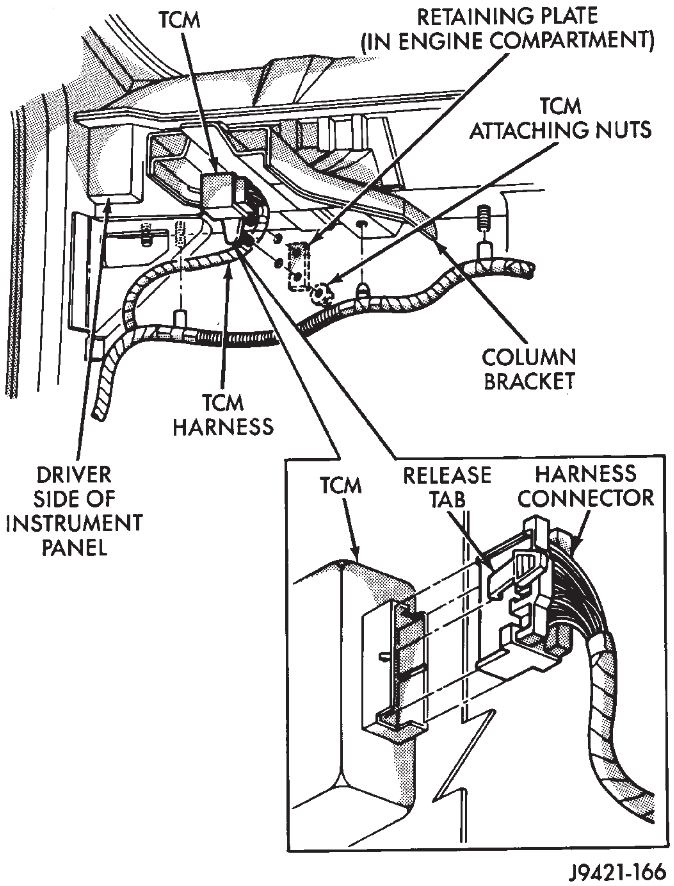


Fig. 18 TCM Location And Mounting

TCM INSTALLATION

(1) Carefully align and plug harness connector into module. Verify that connector is fully seated before proceeding.

(2) Work module upward into position on dash. Then slide module studs into mounting holes in dash.

(3) In engine compartment, install retaining plate on module studs. Then install and tighten locknuts to 14-16 N·m (129-144 in. lbs.) torque.

TRANSMISSION COOLER LINE AND FITTING SERVICE

The transmission cooler lines are attached with quick connect fittings. Two types of fitting will be used.

Some early production models will have the type 2 fitting used in prior years. This fitting requires a release tool to disconnect the cooler line from the fitting (Fig. 19).

Later production models will have a new style fitting that does not require any type of release tool. This fitting has a plastic insert with built-in release tabs (Fig. 20).

Cooler Line And Fitting Service

The cooler lines and fittings are NOT serviceable. Damaged fittings or cooler lines are to be replaced as assemblies.

Fittings swedged into cooler line hoses (Fig. 21) are serviced only as part of the entire cooler line.

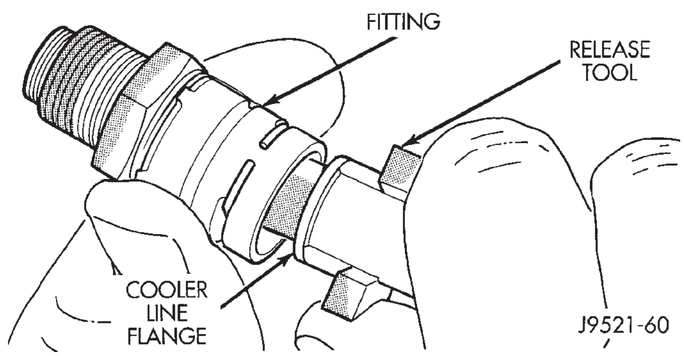


Fig. 19 Disconnecting Cooler Line With Release Tool (Type 2 Fitting)

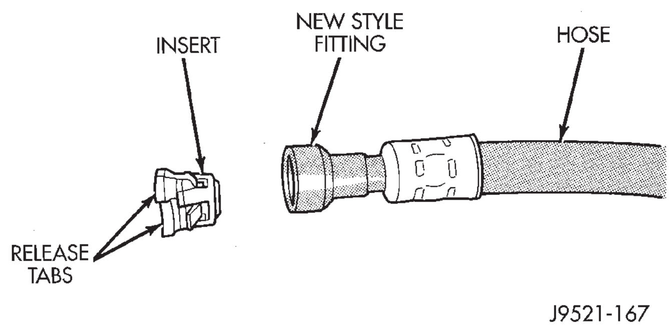


Fig. 20 New Style Fitting With Release Tabs On Insert

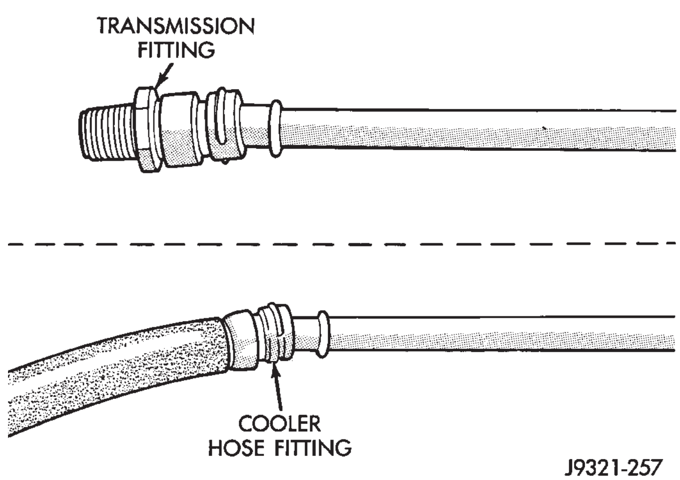


Fig. 21 Cooler Line Fitting Placement

DISCONNECTING COOLER LINES WITH NEW STYLE FITTING

The new style fitting does **not** require any kind of release tool. The fittings have built-in release tabs.

The tabs only require finger pressure to compress them and release the cooler line.

Note that the fitting insert remains on the cooler line after release (Fig. 22). **It is not necessary to remove the insert from the cooler line unless the insert is damaged.**

If the fitting insert is damaged, simply spread the release tabs far enough to release the insert and slide it off the cooler line (Fig. 23).

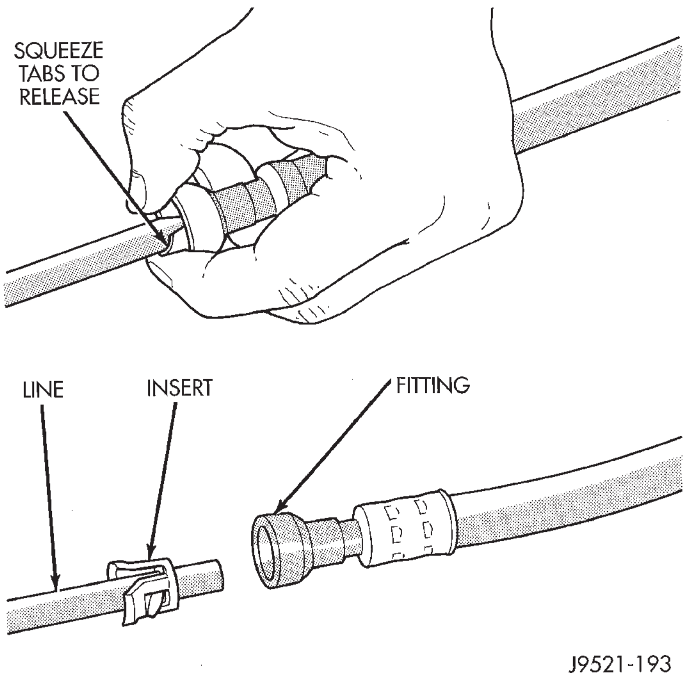


Fig. 22 Disconnecting New Style Fitting From Cooler Line

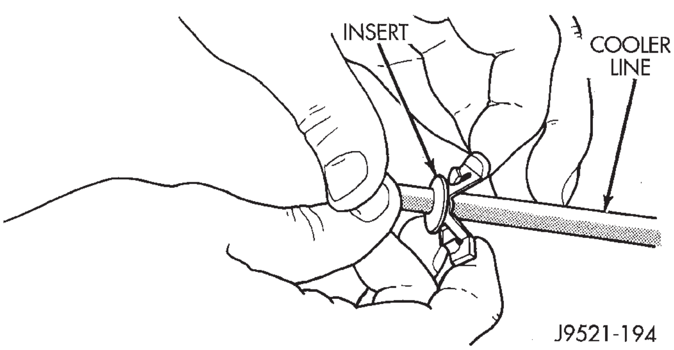


Fig. 23 Removing Fitting Insert From Cooler Line

DISCONNECTING COOLER LINES WITH TYPE 2 FITTING

(1) If fitting and cooler line are encrusted with dirt, mud, or grease, clean fitting and cooler line with Mopar spray type carburetor or brake cleaner. Plastic release tool will not fit into retainer clip if fitting is full of foreign material.

(2) Slide small plastic release tool into fitting until tool bottoms against cooler line flange (Fig. 19).

(3) Push and turn release tool to spread retainer clip and pull cooler line out of fitting (Fig. 19).

(4) Cover open ends of cooler lines and fittings to prevent dirt entry.

(5) Inspect condition of fitting. Replace transmission fitting as an assembly if fitting body or retainer clip is damaged. Replace cooler line as assembly, if fitting swedged into cooler line hose, is damaged.

CONNECTING COOLER LINES (ALL TYPES)

(1) If transmission or radiator fittings require replacement, apply Mopar Lock N' Seal, or Loctite 242 to fitting threads before installation.

(2) Wipe off cooler line and fitting with clean, dry cloth.

(3) Insert cooler line into fitting. Then push line inward until retainer clip secures line. A snap or click sound will be heard and felt through the line when the retainer clip seats behind the cooler line flange.

(4) **Pull outward on cooler lines to verify that they are properly secured.**

CAUTION: The wire retainer clips in Type 2 fittings secure the cooler lines in the fittings. If the clips are deformed, or distorted, normal fluid pressure could unseat the lines resulting in fluid loss and transmission damage. Be very sure the cooler lines are firmly secured by the retainer clip as described in step (4) above.

CONVERTER DRAINBACK CHECK VALVE SERVICE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator lower tank. The valve prevents fluid drainback when the vehicle is parked for lengthy periods. The valve check ball is spring loaded and has an opening pressure of approximately 2 psi.

The valve is serviced as an assembly; it is not repairable. Do not clean the valve if restricted, or contaminated by sludge, or debris. If the valve fails, or if a transmission malfunction occurs that generates sludge and/or clutch particles and metal shavings, the valve must be replaced.

The valve must be removed whenever the cooler and lines are reverse flushed. The valve can be flow tested when necessary. The procedure is exactly the same as for flow testing a cooler.

If the valve is restricted, installed backwards, or in the wrong line, it will cause an overheat condition and possible transmission failure.

CAUTION: The drainback valve is a one-way valve. As such, it must be properly oriented in terms of flow direction. In addition, the valve must only be installed in the pressure line. Otherwise flow will be blocked causing overheat and eventual transmission failure.

TRANSMISSION COOLER FLOW TESTING

The transmission main and auxiliary coolers, plus the drainback valve, should be flow tested whenever fluid overheating is noted.

Restricted flow caused by contamination, or a cooler malfunction, reduces lubrication fluid flow throughout the transmission. This can result in fluid overheating, fluid breakdown, bushing wear, shift problems and component failure.

Normal color of transmission fluid varies from bright red, to light pink. Fluid overheating is indicated when fluid color ranges from orange-brown to black, and the fluid smells burned, or contains sludge.

CAUTION: If a transmission malfunction contaminates the fluid with clutch disc and metal particles, the cooler and lines must be reverse flushed thoroughly. Flushing will prevent sludge and particles from flowing back into the transmission and converter after repair.

Cooler flow is tested by measuring the amount of fluid pumped through the cooler in a specified time by the transmission oil pump. **The same flow test procedure is used for the drainback valve, main cooler, and auxiliary cooler.**

Cooler And Drainback Valve Flow Test Procedure

(1) Test flow through **drainback valve** as follows:

(a) Add extra quart of ATF Plus to transmission.

(b) Disconnect pressure line at radiator fitting, or at drainback valve and position hose or valve end in one quart test container.

(c) Shift transmission into neutral, run engine at idle speed for 20 seconds, and note flow from valve. Use stopwatch to check test time.

(d) Replace drainback valve if flow is less than one quart in 20 seconds, is intermittent, or does not flow at all.

(e) Connect pressure hose to radiator fitting and proceed to cooler flow test.

(2) Test flow through **main cooler** as follows:

(a) Disconnect cooler return (rear) line at transmission and place it in one quart test container.

(b) Add extra quart of fluid to transmission.

(c) Shift transmission into neutral, run engine at idle speed for 20 seconds, and note flow from valve. Use stopwatch to check test time.

(d) Replace cooler if fluid flow is less than one quart in 20 seconds, is intermittent, or does not flow at all.

(3) If vehicle is equipped with **auxiliary cooler**, test cooler flow as described in step (2).

TRANSMISSION COOLER REVERSE FLUSHING

The flushing procedure applies to standard and auxiliary coolers alike. Although pressure equipment is preferred, reverse flushing can be performed with hand operated equipment as follows.

(1) Disconnect cooler pressure and return lines at transmission (Fig. 24).

(2) Remove and discard drainback valve. Install fabricated hose and fitting in place of valve.

(3) Position drain pan under cooler pressure line to catch material flushed through cooler and lines.

(4) Reverse flush cooler using hand operated suction gun filled with mineral spirits. Insert gun nozzle (or hose) into cooler return line. Then force mineral spirits into line and through cooler.

(5) Continue reverse flushing until fluid coming out of cooler pressure line is clear. **Replace cooler if fluid cannot be pumped through.**

(6) Clear flushing materials from cooler and lines with short pulses of compressed air. Insert air gun nozzle into cooler return line and continue short air pulses until all fluid is cleared from cooler and lines.

(7) Pump one quart of fresh automatic transmission fluid through cooler and lines before reconnecting lines.

(8) Install new drainback valve in pressure line.

(9) Check and adjust transmission fluid level as described in this section.

TRANSMISSION COOLER REPLACEMENT

Main Cooler Replacement

The main transmission cooler is located in the radiator lower tank. The cooler is not a serviceable component. If the cooler is damaged in any way, the radiator will have to be replaced.

Auxiliary Cooler Replacement

(1) Remove grille.

(2) Remove screws and U-nuts securing cooler to radiator support.

(3) Tag cooler hoses for installation reference.

(4) Position drain pan under cooler hoses.

(5) Loosen cooler connecting hose clamps and disconnect hoses.

(6) Remove auxiliary cooler. Replace cooler hoses if cracked or leaking.

(7) Connect cooler hoses.

(8) Position cooler on radiator and install cooler attaching U-nuts and screws.

(9) Tighten cooler hose clamps securely.

(10) Install grille.

(11) Check and adjust transmission fluid level.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and in the valve body can be repaired with Heli-Coil or similar quality thread inserts. Essentially, repair consists of drilling out the worn or damaged threads, tapping the hole with a special tap and installing the thread insert into the tapped hole.

ITEM	TORQUE
A	2-4 N•m (18-35 IN.LBS.)
B	18-23 N•m (159-203 IN.LBS.)
C	13-19 N•m (115-165 IN.LBS.)

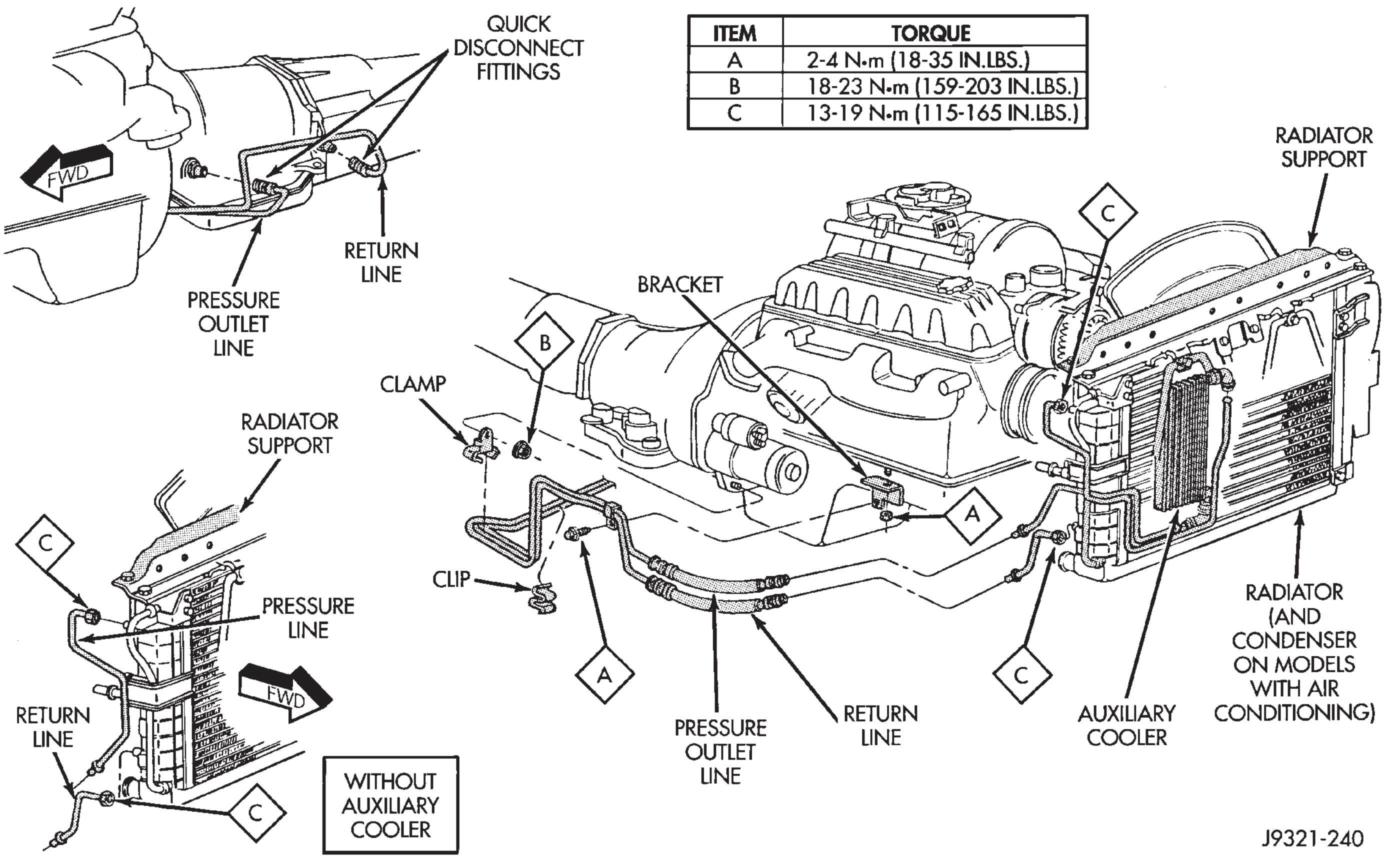


Fig. 24 Transmission Cooler Line Identification

This procedure returns the hole threads to original size. Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers. Stainless steel inserts are recommended.

42RE TRANSMISSION/OVERDRIVE REMOVAL AND INSTALLATION

INDEX

GENERAL INFORMATION

The overdrive unit can be removed for service without having to remove the entire transmission assembly. However if the transmission, torque converter, converter driveplate, or oil pump requires service, the complete transmission assembly must be removed for access to these components.

If only the overdrive unit must be removed, refer to the Overdrive Unit Removal/Installation procedures. If the complete transmission assembly must be removed, refer to the Transmission Removal/Installation procedures.

TRANSMISSION REMOVAL (2-WHEEL DRIVE)

(1) Disconnect battery negative cable.

(2) Raise vehicle on hoist.

(3) Remove skid plate if equipped.

(4) If transmission is being removed for repair, remove oil pan, drain fluid and reinstall pan on case.

(5) Mark propeller shaft for installation reference. Then disconnect and remove propeller shaft.

(6) Disconnect vehicle speed sensor wires, transmission solenoid wires and park/neutral position switch wires.

(7) Disconnect wires from transmission speed sensor at rear of overdrive unit.

(8) Remove exhaust system Y-pipe for working clearance.

(9) Unclip wire harnesses from transmission clips.

(10) Disconnect throttle valve and gearshift cables from levers on valve body manual shaft. Move cables aside and secure them to underbody.

(11) Remove dust cover from transmission converter housing.

(12) Disconnect and remove starter motor.

(13) Remove bolts attaching converter to driveplate.

(14) Disconnect cooler lines at transmission fittings. Refer to In-Vehicle Service section for procedures.

(15) Support transmission with transmission jack.

(16) Remove bolts/nuts attaching rear insulator to rear crossmember. Then remove rear crossmember.

(17) Lower transmission for access to converter housing upper bolts and crankshaft position sensor.

(18) Disconnect crankshaft position sensor. Retain sensor attaching screws.

(19) Remove transmission fill tube and tube O-ring seal.

(20) Remove bolts attaching transmission to engine block.

(21) Slide transmission away from engine and install C-clamp on converter housing to hold converter in place.

(22) Lower transmission and move from under vehicle.

(23) If transmission is to be serviced, remove it from jack and position it on bench.

TRANSMISSION REMOVAL (4-WHEEL DRIVE)

(1) Raise vehicle on hoist.

(2) Remove skid plate, if equipped.

(3) Mark front and rear propeller shafts and U-joints for alignment reference (Fig. 1).

(4) Disconnect and remove both propeller shafts.

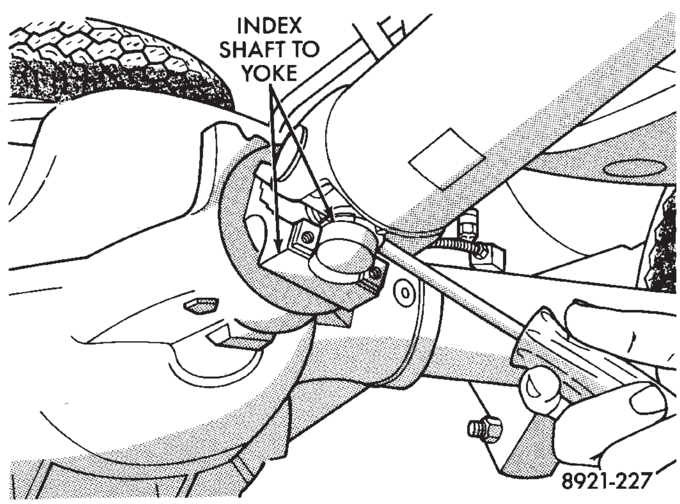


Fig. 1 Marking Propeller Shaft And Yoke For Alignment Reference

(5) Disconnect vehicle speed sensor and transmission output shaft speed sensor wires.

(6) Disconnect electrical wires from clips on transmission and transfer case.

(7) Disconnect transfer case shift linkage at transfer case range lever. Then remove linkage bracket bolts and remove linkage and bracket from transfer case. Move linkage aside for clearance.

(8) Remove nuts attaching transfer case to overdrive unit gear case.

(9) Remove transfer case. Support transfer case with transmission jack. Secure transfer case to jack with safety chains. Then move transfer case rearward and off transmission.

(10) Remove transfer case from transmission jack and place transfer case on bench.

(11) Support transmission with transmission jack.

(12) Remove nuts and bolts attaching transmission mount to crossmember.

(13) Remove bolts and nuts attaching crossmember to frame rails.

(14) Rotate crossmember diagonally to clear frame rails and remove crossmember.

(15) Disconnect exhaust pipes at manifold and at converter and/or muffler connections as needed. Then remove Y-pipe from vehicle and move remaining pipes aside for working clearance.

(16) Disconnect crankshaft position sensor.

(17) Disconnect transmission shift linkage at shift lever on transmission.

(18) Remove transmission shift linkage torque shaft assembly from retainers on transmission and frame rail. Move linkage aside for working clearance.

(19) Remove brackets that attach transmission to engine block, if equipped.

(20) Remove dust shield cover from front side of transmission converter housing.

(21) Remove starter motor bolts. Pull starter rearward until clear of housing and position it out of way on nearby component. Starter does not have to be removed from vehicle nor does cable have to be disconnected.

(22) Remove bolts attaching torque converter to drive plate.

(23) Disconnect cooler lines at quick disconnect fittings in transmission. Refer to In-Vehicle Service section for procedures.

(24) Disconnect solenoid and park/neutral position switch wires at transmission.

(25) Remove transmission fill tube and dipstick.

(26) Lower transmission for access to converter housing upper bolts.

(27) Remove bolts attaching transmission converter housing to engine. Note that some bolts may be accessible only from front (engine) side of housing.

(28) Move transmission rearward until clear of engine block dowels. On some models, part of hem flange joining vehicle cab and dash panel may interfere with transmission removal. Peen this part of flange over with a mallet if necessary.

(29) Secure torque converter in housing with small C-clamp.

(30) Lower transmission and remove it from under vehicle.

(31) Remove C-clamp and remove converter from transmission. Place converter on workbench for inspection or reassembly. Cover converter hub with clean, lint free cloth.

(32) Oil pump, converter and driveplate can now be serviced if necessary. Refer to information in this section.

OIL PUMP SEAL REPLACEMENT

The pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transmission case.

Seal Removal

Remove the seal with Special Tool C-3861-B (Fig. 2). To use the remover tool, First start the tool into the seal by hand. Next, thread the tool into the seal as far as it will go. Use a wrench on the tool hex to turn the tool. Continue tightening until all the tool threads firmly grip the metal part of the seal. Then tighten the tool puller screw to withdraw the seal from the pump body.

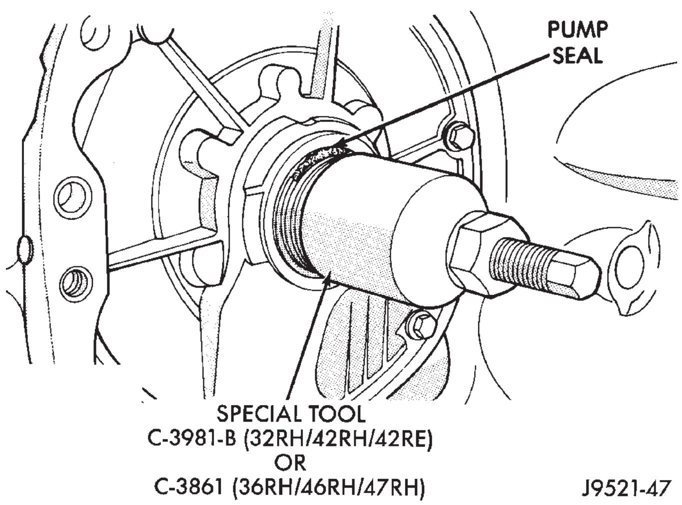


Fig. 2 Oil Pump Seal Removal

Seal Installation

Use Installer Tool C-4193-A (Fig. 3). To use the tool, place the seal in the pump opening with the seal lip facing inward. Then tap the seal into place with the installer tool.

TORQUE CONVERTER AND DRIVE PLATE SERVICE

After the transmission has been removed, the drive plate and torque converter can removed for service access, or replacement.

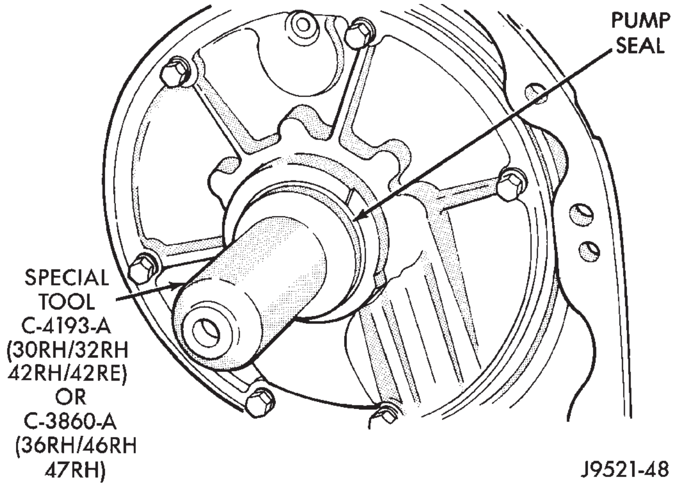


Fig. 3 Oil Pump Seal Installation

Torque Converter

The torque converter is not a serviceable component. If the converter is contaminated by a transmission malfunction, or damaged in any way, it must be replaced as an assembly. **Do not attempt to flush a converter contaminated by metal or clutch facing particles. Flushing will not remove these contaminants.**

Different length bolts are used with the various size torque converters; they are not all the same length. Therefore, it is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the modulated clutch surfaces inside the converter. If new bolts are required, use the bolts specified in the parts catalogue only.

Driveplate

The driveplate should be inspected whenever the torque converter is removed. Replace the plate if bent, distorted, or if cracks around the bolt holes are evident.

New bolts should be used to secure the driveplate if removed or replaced. Apply Mopar Lock N' Seal or Loctite 242 to the bolt threads before installation to ensure retention.

TRANSMISSION INSTALLATION (2-WHEEL DRIVE)

CAUTION: The transmission cooler and lines must be flushed if repair was to correct a problem that generated sludge, metal particles, or clutch friction material. The torque converter should also be replaced when contaminated by a malfunction. The transmission, fluid and converter will be contaminated again if residue/debris is not flushed from the cooler and lines beforehand.

(1) Mount transmission on jack. Secure transmission to jack with safety chains.

(2) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish hub and notches with crocus cloth or 400 grit paper if necessary. Hub must be smooth to avoid damaging pump seal.

(3) Lubricate converter hub and pump seal lip with Mopar high temperature wheel bearing grease.

(4) Verify that converter is fully seated. Use straight edge and steel ruler to check seating (Fig. 4). Surface of converter lugs should be 12.7 mm (1/2 in.) to rear of straight edge when converter is fully seated.

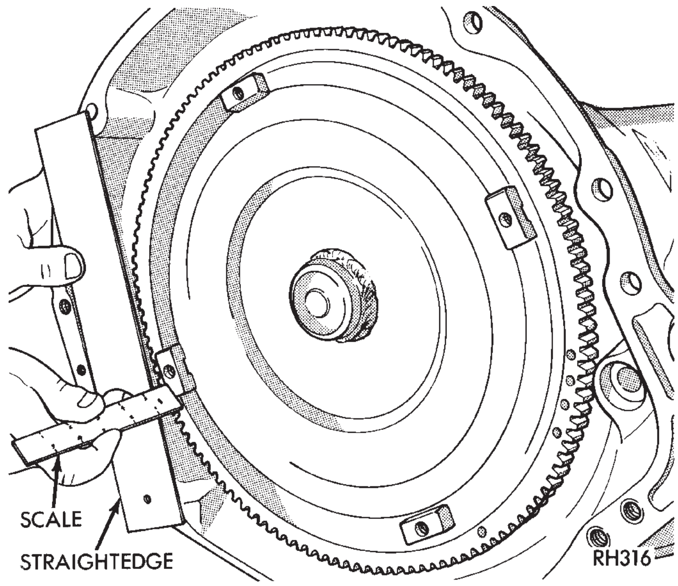


Fig. 4 Checking Torque Converter Seating

(5) Temporarily secure converter with C-clamp attached to housing or with metal strap attached across converter housing.

(6) Check condition of converter driveplate. Replace driveplate if cracked, distorted or damaged.

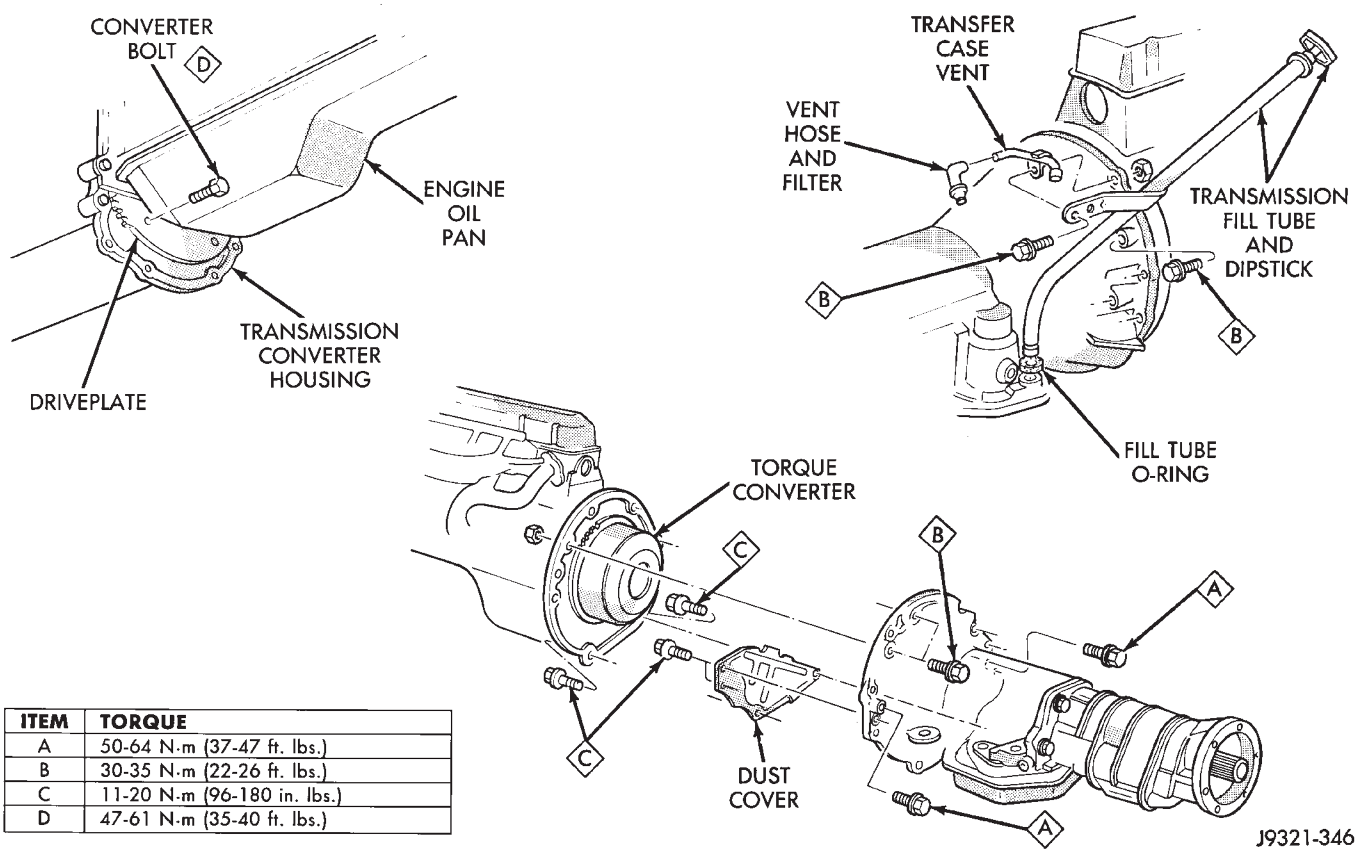
(7) Verify that transmission dowel pins are seated in engine block and protrude far enough to held transmission in alignment.

(8) Coat torque converter pilot hub of crankshaft with light coat of Mopar high temperature wheel bearing grease.

(9) Move transmission under vehicle and position it at rear of engine. Remove C-clamp or strap used to secure converter in housing.

(10) Align transmission with engine dowels and align converter with driveplate.

(11) Move transmission forward until seated on engine block dowels. Then install one or two transmission attaching bolts to hold transmission in place (Fig. 5).



ITEM	TORQUE
A	50-64 N·m (37-47 ft. lbs.)
B	30-35 N·m (22-26 ft. lbs.)
C	11-20 N·m (96-180 in. lbs.)
D	47-61 N·m (35-40 ft. lbs.)

Fig. 5 Transmission And Fill Tube Mounting

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the modulated clutch surfaces in the converter. If new bolts are required, use the bolts specified in the parts catalogue only.

(12) Verify converter bolt length. Bolt measurement is from bottom (underside) of bolt head to end of bolt threads. On 9.5 in. 3-lug converter bolts should be 11.7 mm (0.46 in.). On 10.75 in. 4-lug converter bolts should be 11.2 mm (0.44 in.).

(13) Install torque converter bolts. Tighten bolts to following torques: 54 N·m (40 ft. lbs.) with 9.5 in. 3-lug converter, or 31 N·m (270 in. lbs.) with 10.75 in 4-lug converter

(14) Install and tighten remaining transmission attaching bolts (Fig. 6).

(15) Connect crankshaft position sensor.

(16) Install dust cover on transmission converter housing. Two small vise grip pliers van be used to hold and align cover during installation.

(17) Install and connect starter motor.

(18) Connect transmission shift and throttle valve cables to valve body manual shaft and transmission brackets.

(19) Fasten wire harnesses in clips on transmission case.

(20) Connect wires to solenoids, park/neutral position switch, transmission speed sensor and vehicle speed sensor.

(21) Install transmission fill tube and O-ring.

(22) Install rear crossmember and attach rear insulator to transmission and crossmember.

(23) Connect cooler lines to fittings. Pull lines outward to verify that they are securely seated and retained in fittings.

(24) Align and install propeller shaft. **Clean and lubricate slip yoke before installation.**

(25) Install exhaust system components.

(26) Lower vehicle.

(27) Connect battery negative cable.

(28) Fill or top off transmission fluid level with Mopar ATF Plus, type 7176.

(29) Check transmission control cable adjustments. Readjust cables if necessary.

TRANSMISSION INSTALLATION—4-WHEEL DRIVE

CAUTION: The transmission cooler and lines must be flushed if repair was to correct a problem that generated sludge, metal particles, or clutch friction material. The converter and drainback valve should also be replaced when contaminated. The transmission, fluid and converter will be contaminated again if residue/debris is not flushed from the cooler and lines beforehand.

(1) Mount transmission on jack. Secure transmission to jack with safety chains.

(2) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish hub and notches with crocus cloth or 400 grit paper if necessary. Hub must be smooth to avoid damaging pump seal.

(3) Lubricate converter hub and pump seal lip with Mopar high temperature wheel bearing grease.

(4) Verify that converter is fully seated. Use straight edge and steel ruler to check seating (Fig. 4). Surface of converter lugs should be 12.7 mm (1/2 in.) to rear of straight edge when converter is fully seated.

(5) Temporarily secure converter with C-clamp attached to housing or with metal strap attached across converter housing.

(6) Check condition of converter driveplate. Replace driveplate if cracked, distorted or damaged.

(7) Verify that transmission dowel pins are seated in engine block and protrude far enough to held transmission in alignment.

(8) Coat torque converter pilot hub of crankshaft with light coat of Mopar high temperature wheel bearing grease.

(9) Move transmission under vehicle and position it at rear of engine. Remove C-clamp or strap used to secure converter in housing.

(10) Align transmission with engine dowels and align converter with driveplate.

(11) Move transmission forward until seated on engine block dowels. Then install one or two transmission attaching bolts to hold transmission in place.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the modulated clutch surfaces in the converter. If new bolts are required, use the bolts specified in the parts catalogue only.

(12) Verify converter bolt length. Bolt measurement is from bottom (underside) of bolt head to end of bolt threads.

• On 9.5 in. 3-lug converter bolts should be 11.7 mm (0.46 in.)

• On 10.75 in. 4-lug converter bolts should be 11.2 mm (0.44 in.)

(13) Install torque converter bolts. Tighten bolts to following torques: 54 N·m (40 ft. lbs.) with 9.5 in. 3-lug converter, or 31 N·m (270 in. lbs.) with 10.75 in 4-lug converter.

(14) Install and tighten remaining transmission attaching bolts (Fig. 5).

(15) Install dust cover on transmission converter housing. Two small vise grip pliers van be used to hold and align cover during installation.

(16) Install starter motor.

(17) Install strut brackets that secure transmission to engine block and front axle.

(18) Connect crankshaft position sensor.

(19) Install transmission fill tube. Install new O-ring seal on tube before installation (Fig. 6).

(20) Connect exhaust Y-pipe to engine exhaust manifolds.

(21) Install shift linkage torque bracket.

(22) Connect shift linkage to transmission.

(23) Connect solenoid and park/neutral position switch wires.

(24) Connect wires to transmission speed sensor and vehicle speed sensor.

(25) Install crossmember on frame rails. Place crossmember at 45° angle to rails. Insert crossmember between rails and rotate crossmember into place.

(26) Install rear mount bolts/nuts.

(27) Install crossmember bolts/nuts.

(28) Remove transmission jack.

(29) Install transfer case (Fig. 6).

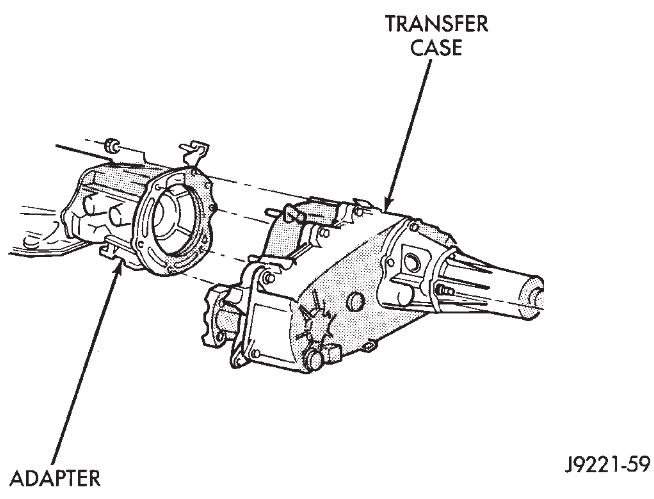


Fig. 6 Transfer Case Attachment

(30) Install and tighten 3/8 transfer case attaching nuts to 47 N·m (35 ft. lbs.) torque, or 5/16 nuts to 35 N·m (26 ft. lbs.) torque.

(31) Install damper on transfer case rear retainer if equipped. Tighten damper nuts to 54 N·m (40 ft. lbs.) torque.

(32) Install and connect transfer case shift linkage.

(33) Connect transmission cooler lines to quick connect fittings on transmission case. Pull outward on lines to be sure they are secured in fittings.

(34) Align and install remaining exhaust components. Tighten all clamp and bracket bolts and nuts securely. Be sure exhaust components are clear of all chassis and driveline components.

(35) Align and install front and rear propeller shafts. Tighten U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(36) Verify that all linkage components, hoses and electrical wires have been connected.

(37) Check transfer case fluid level. Add Mopar ATF Plus, or Dexron II fluid if necessary. Correct level is to edge of fill plug hole. Be sure transfer case is level before checking or adding fluid.

(38) Install transfer case skid plate, if equipped.

(39) Lower vehicle.

(40) Connect battery negative cable.

(41) Refill transmission with Mopar ATF Plus, type 7176 fluid.

(42) Check and adjust engine oil level as necessary.

(43) Check and adjust transmission and transfer case shift linkage if necessary.

(44) Check and adjust transmission shift and throttle valve cables if necessary.

OVERDRIVE UNIT REMOVAL (4-WHEEL DRIVE)

(1) Disconnect battery negative cable.

(2) Raise vehicle on hoist.

(3) Remove transfer case skid plate, if equipped.

(4) Mark front and rear propeller shafts and U-joints for alignment reference (Fig. 1).

(5) Disconnect and remove both propeller shafts.

(6) Disconnect vehicle speed sensor and transmission speed sensor wires.

(7) Disconnect vacuum or indicator switch hoses/ wires at transfer case.

(8) Disconnect transfer case shift linkage at transfer case range lever. Then remove linkage bracket bolts and remove linkage and bracket from transfer case. Move linkage aside for clearance.

(9) Remove nuts attaching transfer case to overdrive unit.

(10) Remove transfer case. Support transfer case with transmission jack (secure transfer case to jack with safety chains). Then move transfer case rearward and off overdrive case.

(11) Remove transfer case from jack and position it on bench.

(12) Support transmission with adjustable jack stand. Position wood block between jack and transmission case.

(13) Remove nuts and bolts attaching transmission mount to center crossmember.

(14) Remove nuts and bolts attaching crossmember to frame rails.

(15) Rotate crossmember diagonally to clear frame rails and remove crossmember.

(16) Support overdrive unit with transmission jack.

(17) Remove bolts attaching overdrive unit to transmission (Fig. 8).

CAUTION: The overdrive unit must be fully supported during removal. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

(18) Carefully slide overdrive unit off intermediate shaft. Do not tilt overdrive unit during removal. Keep it as level as possible.

(a) If overdrive unit does not require service, **immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch (Fig. 9). If misalignment occurs, overdrive unit may have to be disassembled in order to realign splines.**

(b) If overdrive unit requires service, refer to Overdrive Unit Overhaul procedures.

(19) Remove and retain bearing and select fit spacer. These parts may remain on overdrive piston, rear of transmission case, sliding hub, or intermediate shaft during removal.

(20) Place several clean shop towels on a bench. Then position unit on towels to absorb spilled fluid.

(21) Position overdrive unit over drain pan and tilt unit to drain residual fluid from case. Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

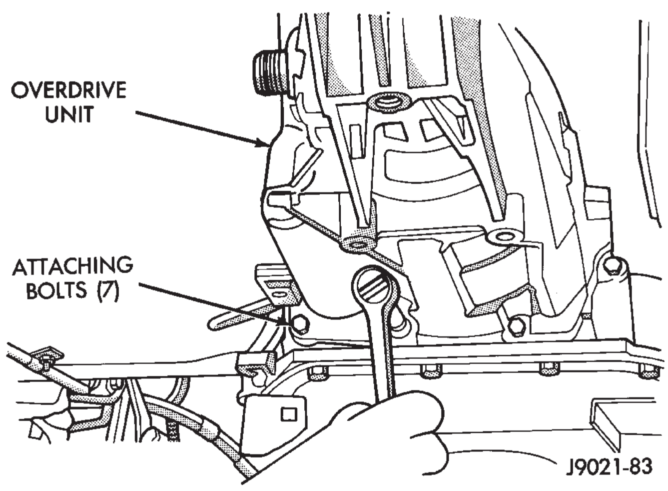


Fig. 7 Removing/Installing Overdrive Unit Attaching Bolts

OVERDRIVE UNIT INSTALLATION (4-WHEEL DRIVE)

(1) Be sure Alignment Tool 6227-2 is still fully seated in splines of overdrive planetary gear and overrunning clutch. If misalignment occurs, overdrive will have to be disassembled in order to realign splines.

(2) If original case gasket is in good condition, proceed to step (6). If overdrive piston retainer was not

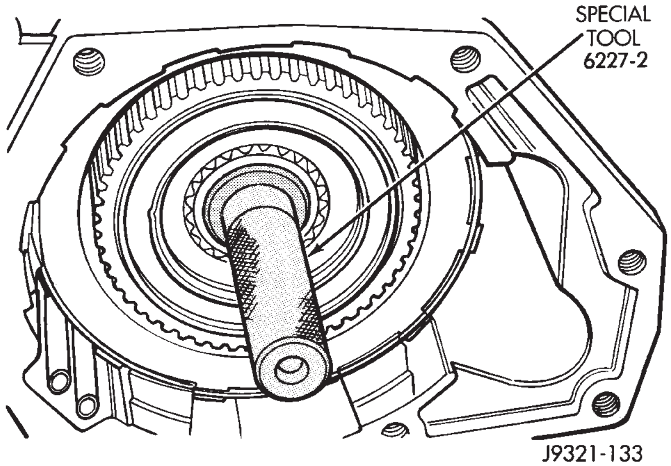


Fig. 8 Overdrive Spline Alignment Tool Installation

removed during service and original case gasket is not reusable, prepare new gasket as described in steps (3) through (5).

(3) Cut out old case gasket around piston retainer with razor knife.

(4) Use old gasket as template and trim new gasket to fit (Fig. 9).

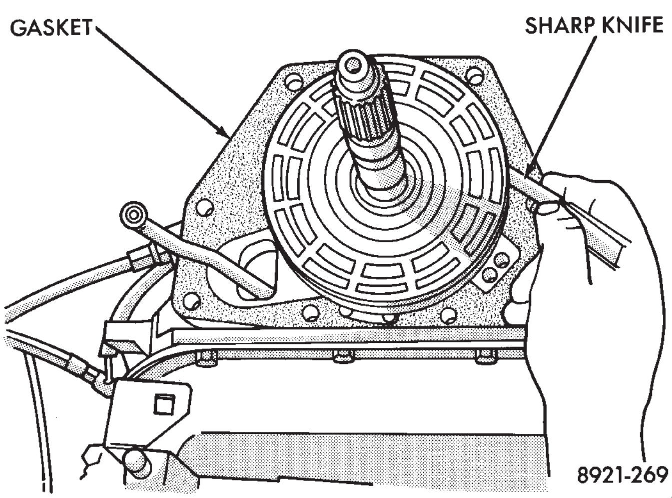


Fig. 9 Trimming Replacement Overdrive Case Gasket

(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. **Do not use any type of sealer to secure gasket. Use petroleum jelly only.**

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 10).

(7) Install overdrive piston in retainer, if removed. Lubricate piston seals with Ru-Glyde, Door-Eze or petroleum jelly to ease installation. Be sure piston locating lugs are aligned in piston retainer.

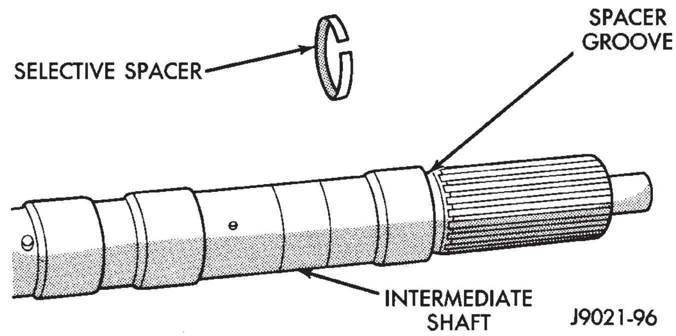


Fig. 10 Intermediate Shaft Selective Spacer Location

(8) Install thrust bearing in overdrive clutch hub. Use liberal quantity of petroleum jelly to hold bearing in position.

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(9) Install thrust plate in overdrive piston hub (Fig. 11). Use liberal amount of petroleum jelly to hold thrust plate in position.

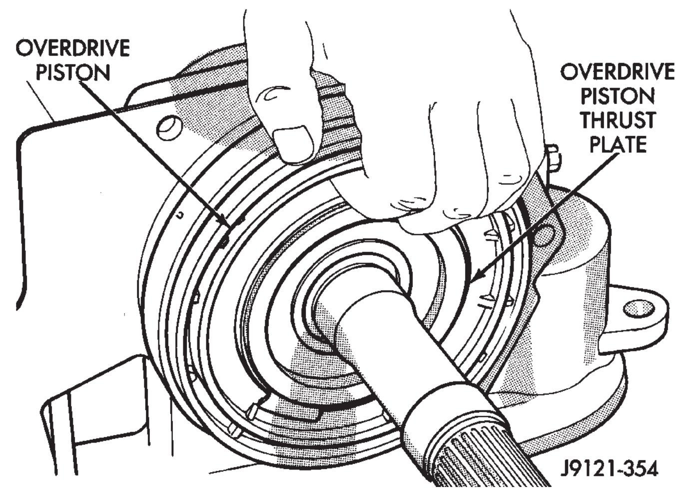


Fig. 11 Installing Overdrive Piston Thrust Plate

(10) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Tool 6227-2 (Fig. 9). **Overdrive unit cannot be fully installed if splines have rotated out of alignment. If misaligned has occurred, overdrive will have to be disassembled in order to realign splines.**

(11) Install overdrive unit as follows:

(a) Raise overdrive unit and carefully slide it straight onto intermediate shaft. **Avoid tilting overdrive unit during installation as planetary gear and overrunning clutch splines could rotate out of alignment. If misalignment occurs, overdrive will have to be disassembled in order to realign splines.**

(b) Align and carefully insert park rod into park pawl. Rod will make click noise as it enters pawl. Move rod rearward slightly.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into this cavity. If the rod enters the cavity during installation, it will become bent when the overdrive bolts are tightened. The rod will then have to be replaced because it is not repairable.

(c) Work overdrive unit forward on intermediate shaft until seated against transmission case. If unit is not fully seated, tighten overdrive bolts to draw unit against transmission case.

(12) Apply Mopar Lock N' Seal or Loctite 242 to threads of overdrive attaching bolts.

(13) Install and tighten overdrive unit attaching bolts to 34 N·m (25 ft. lbs.).

(14) Install transfer case. Tighten 5/16 nuts to 35 N·m (26 ft. lbs.) and 3/8 nuts to 47 N·m (35 ft. lbs.).

(15) Connect transmission throttle valve and gear shift cables and connect transfer case shift linkage.

(16) Install crossmember and rear mount.

(17) Connect all necessary electrical wires.

(18) Install and index speedometer adapter and pinion if removed (Fig. 12).

(19) Align and connect propeller shafts. Tighten U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(20) Check and adjust fluid level in transfer case. Use Mopar Dexron II.

(21) Install skid plate, if equipped.

(22) Check and adjust transmission and transfer case shift linkage if necessary.

(23) Lower vehicle.

(24) Check and adjust transmission fluid level. Use Mopar ATF Plus, type 7176 fluid.

OVERDRIVE UNIT REMOVAL (2-WHEEL DRIVE)

(1) Disconnect battery negative cable.

(2) Raise vehicle on hoist.

(3) Remove exhaust Y-pipe, catalytic converter and tailpipe.

(4) Mark propeller shaft and U-joint for alignment reference (Fig. 1).

(5) Disconnect and remove propeller shaft.

(6) Disconnect vehicle speed sensor and transmission speed sensor wires.

(7) Support transmission with adjustable jack stand and wood block.

(8) Remove nuts and bolts attaching transmission mount to center crossmember.

(9) Remove nuts and bolts attaching crossmember to frame rails.

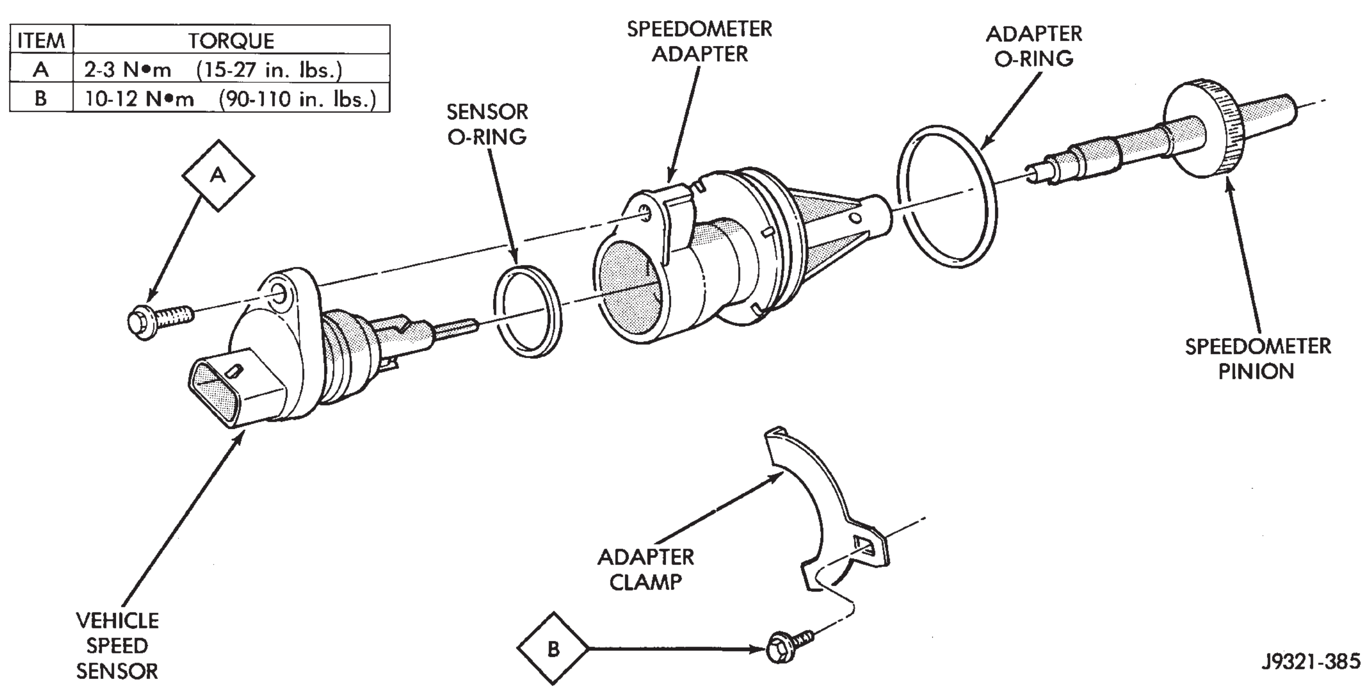
(10) Rotate crossmember diagonally to clear frame rails and remove crossmember.

(11) Support overdrive unit with transmission jack.

(12) Remove bolts attaching overdrive unit to transmission (Fig. 8).

CAUTION: The overdrive unit must be fully supported during removal. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

(13) Carefully slide overdrive unit off intermediate shaft. Do not tilt overdrive unit during removal. Keep it as level as possible.



ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

Fig. 12 Speedometer Components

(a) If overdrive unit does not require service, **immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch (Fig. 9). If misalignment occurs, overdrive unit may have to be disassembled in order to realign splines.**

(b) If overdrive unit requires service, refer to Overdrive Unit Overhaul procedures.

(14) Remove and retain bearing and select fit spacer. These parts may remain on overdrive piston, rear of transmission case, sliding hub, or intermediate shaft during removal.

(15) Place several clean shop towels on a bench. Then position unit on towels to absorb spilled fluid.

(16) Position overdrive unit over drain pan and tilt unit to drain residual fluid from case. Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

OVERDRIVE UNIT INSTALLATION (2-WHEEL DRIVE)

(1) Be sure Alignment Tool 6227-2 is still fully seated in splines of overdrive planetary gear and overrunning clutch. If misalignment occurs, overdrive will have to be disassembled in order to realign splines.

(2) If original case gasket is in good condition, proceed to step (6). If overdrive piston retainer was not removed during service and original case gasket is not reusable, prepare new gasket as described in steps (3) through (5).

(3) Cut out old case gasket around piston retainer with razor knife.

(4) Use old gasket as template and trim new gasket to fit (Fig. 9).

(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. **Do not use any type of sealer to secure gasket. Use petroleum jelly only.**

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 10).

(7) Install overdrive piston in retainer, if removed. Lubricate piston seals with Ru-Glyde, Door-Eze or petroleum jelly to ease installation. Be sure piston locating lugs are aligned in piston retainer.

(8) Install thrust bearing in overdrive clutch hub. Use liberal quantity of petroleum jelly to hold bearing in position.

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(9) Install thrust plate in overdrive piston hub (Fig. 12). Use liberal amount of petroleum jelly to hold thrust plate in position.

(10) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Tool 6227-2 (Fig. 8). **Overdrive unit cannot be fully installed if splines have rotated out of alignment. If misaligned has occurred, overdrive will have to be disassembled in order to realign splines.**

(11) Install overdrive unit as follows:

(a) Raise overdrive unit and carefully slide it straight onto intermediate shaft. **Avoid tilting overdrive unit during installation as planetary gear and overrunning clutch splines could rotate out of alignment. If misalignment occurs, overdrive will have to be disassembled in order to realign splines.**

(b) Align and carefully insert park rod into park pawl. Rod will make click noise as it enters pawl. Move rod slightly to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and ha not displaced into this case cavity. If the rod enters the cavity during installation, it will become bent when the overdrive bolts are tightened. If this occurs, the rod will have to be replaced because it is not repairable.

(c) Work overdrive unit forward on intermediate shaft until seated against transmission case. If unit is not fully seated, tighten overdrive bolts to draw it up against transmission case.

(12) Apply Mopar Lock N' Seal or Loctite 242 to threads of overdrive attaching bolts.

(13) Install and tighten overdrive unit attaching bolts to 34 N·m (25 ft. lbs.).

(14) Connect transmission throttle valve and gear shift cables.

(15) Install crossmember and rear mount.

(16) Connect all necessary electrical wires.

(17) Install and index speedometer adapter and pinion (Fig. 13). Refer to In-Vehicle Service section for indexing procedure.

(18) Align and connect propeller shaft. Tighten U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(19) Install exhaust system components.

(20) Lower vehicle.

(21) Connect battery negative cable.

(22) Check and adjust transmission shift and throttle valve cables if necessary.

(23) Check and adjust transmission fluid level. Use Mopar ATF Plus, type 7176 fluid.

42RE TRANSMISSION OVERHAUL

INDEX

TRANSMISSION DISASSEMBLY

(1) Remove torque converter if not previously removed.

(2) Clean transmission exterior with steam gun or with solvent. Wear eye protection during cleaning operations.

(3) Remove shift and throttle levers from valve body manual lever shaft.

(4) Remove transmission speed sensor and O-ring seal from overdrive unit (Fig. 1).

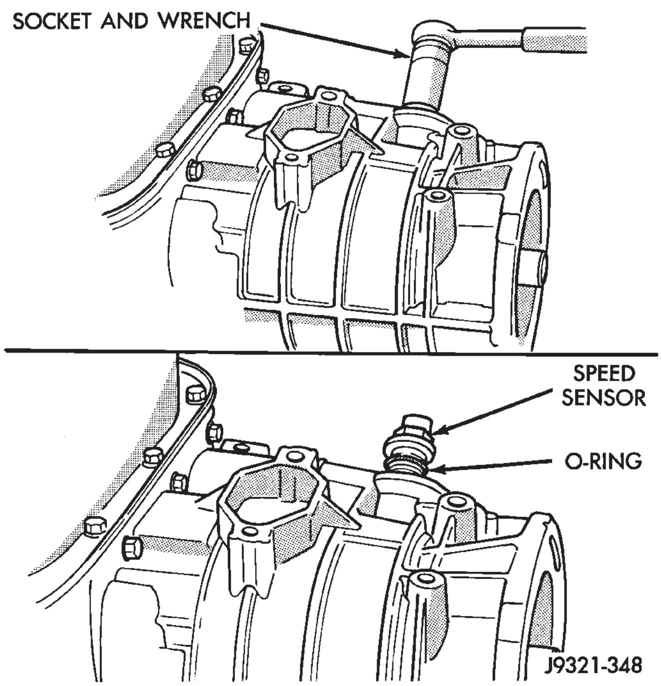


Fig. 1 Transmission Speed Sensor Removal/ Installation

(5) Place transmission in upright position (Fig. 2).

(6) Remove bolts attaching overdrive unit to transmission case (Fig. 2). An 11 mm socket is required. Note position of all wiring clips and bolts for installation reference.

(7) Lift overdrive unit up and off transmission intermediate shaft (Fig. 3).

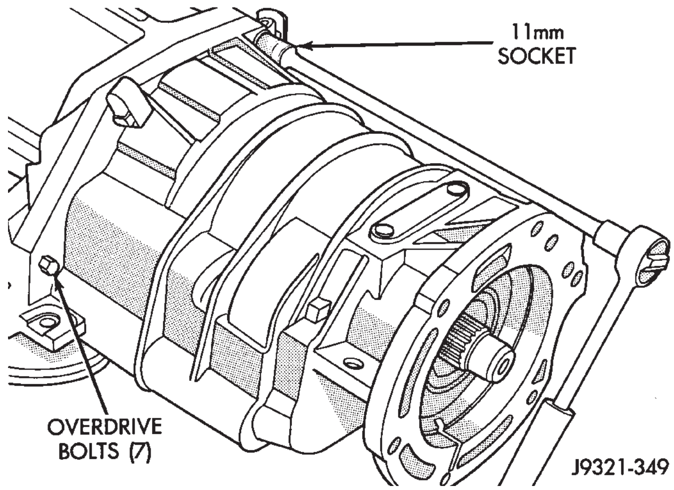


Fig. 2 Removing/Installing Overdrive Unit Attaching Bolts

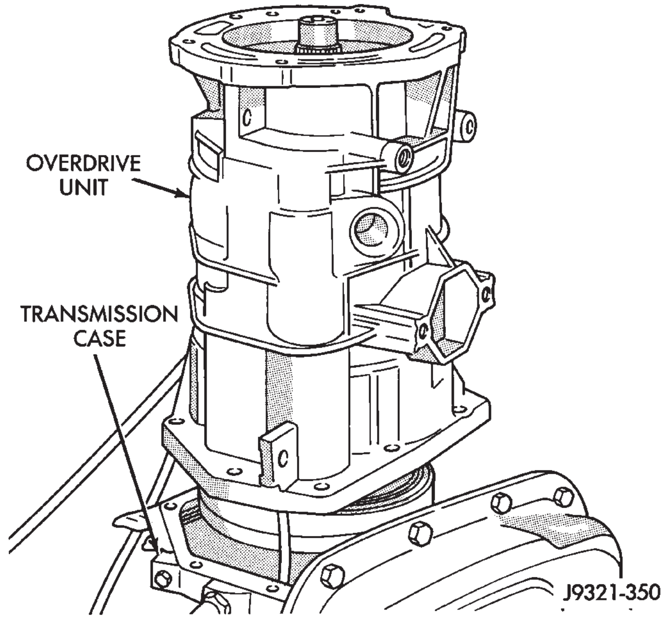


Fig. 3 Overdrive Unit Removal

(a) If overdrive unit does not require service, insert Alignment Tool 6227-2 in overrunning clutch and planetary gear splines to maintain alignment

(Fig. 4). **If clutch and gear splines rotate out of alignment, overdrive unit may have to be disassembled in order to realign splines.**

(b) If overdrive unit **does** requires service, refer to Overdrive Unit Overhaul section.

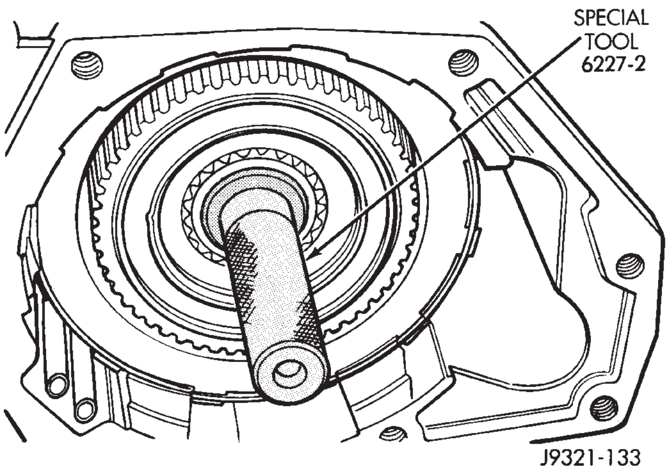


Fig. 4 Overdrive Spline Alignment Tool Installation

(8) Remove thrust bearing and thrust plate from overdrive piston (Fig. 5).

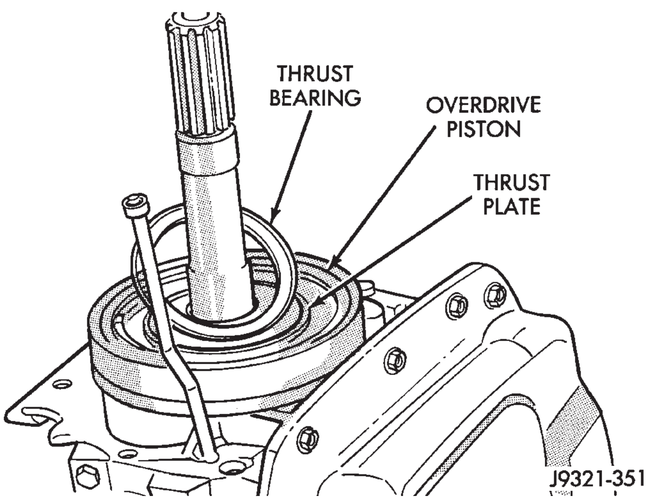


Fig. 5 Thrust Bearing And Plate Removal

(9) Place transmission in horizontal position.

(10) Remove transmission oil pan and gasket.

(11) Remove oil filter from valve body (Fig. 6). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.

(12) Remove overdrive piston from retainer (Fig. 7).

(13) Remove pump oil seal with Special Tool C-3981B (Fig. 8). Be sure to tighten tool threads completely into seal before using puller bolt to withdraw seal.

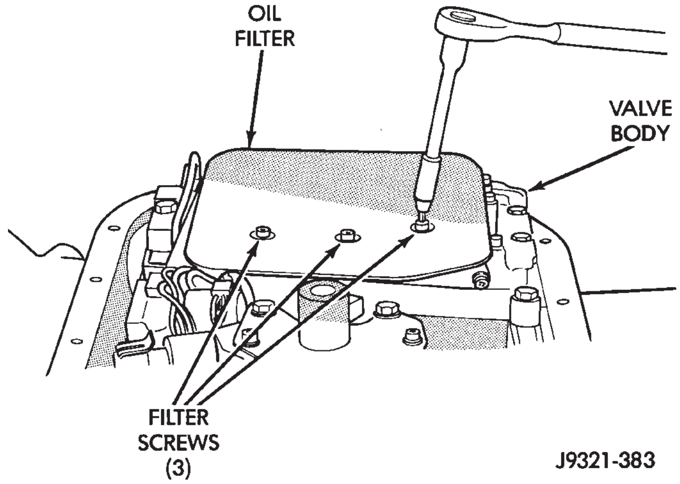


Fig. 6 Oil Filter Removal/Installation

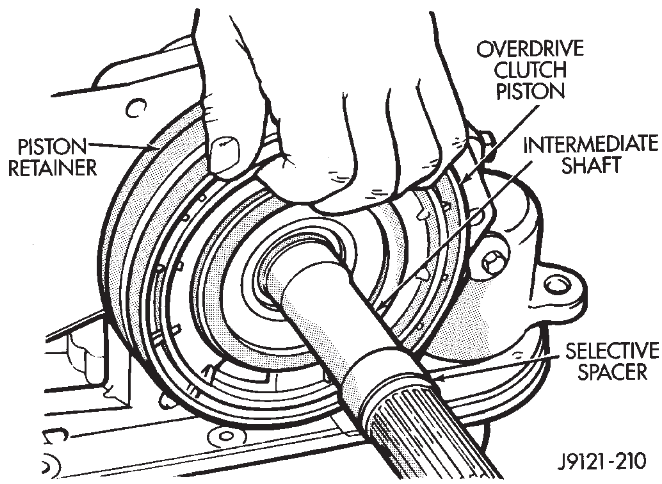


Fig. 7 Overdrive Piston Removal

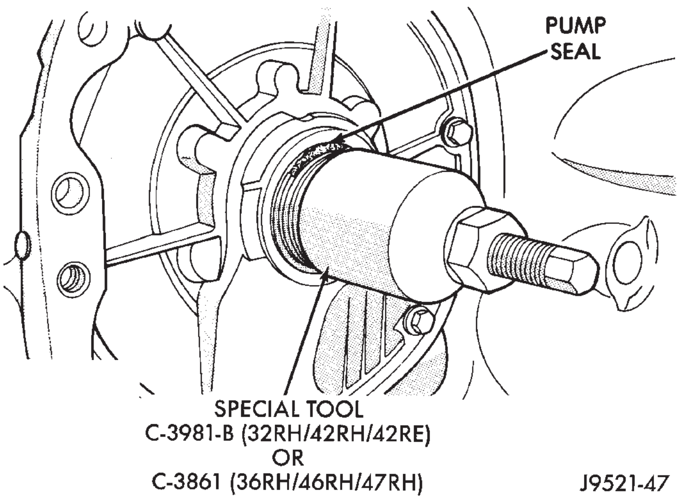


Fig. 8 Oil Pump Seal Removal

(14) Remove park/neutral position switch (Fig. 9).

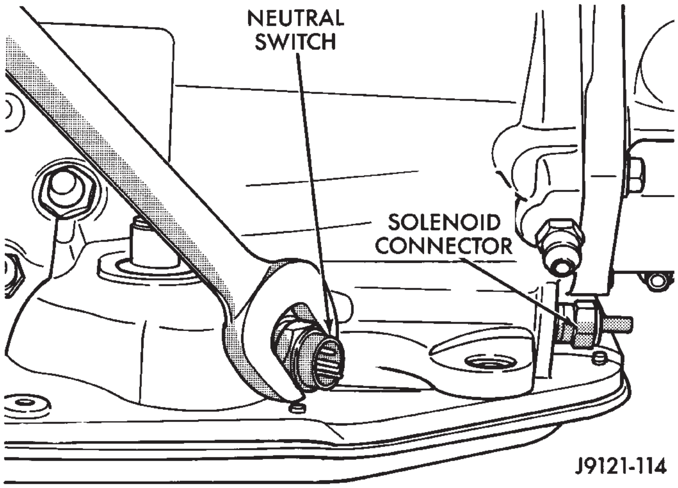


Fig. 9 Park/Neutral Position Switch Removal/ Installation

(15) Remove hex head bolts attaching valve body to transmission case (Fig. 10). A total of 10 bolts are used. Note different bolt lengths for assembly reference.

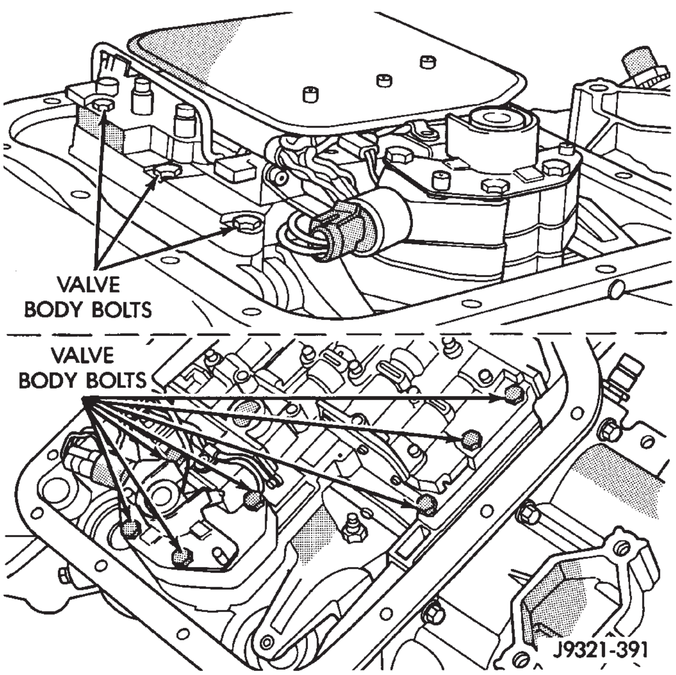


Fig. 10 Valve Body Bolt Locations

(16) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 11). **Exercise care during removal as governor pressure solenoid and transducer can both be damaged by rough handling.**

(17) Remove accumulator piston and inner and outer springs (Fig. 11).

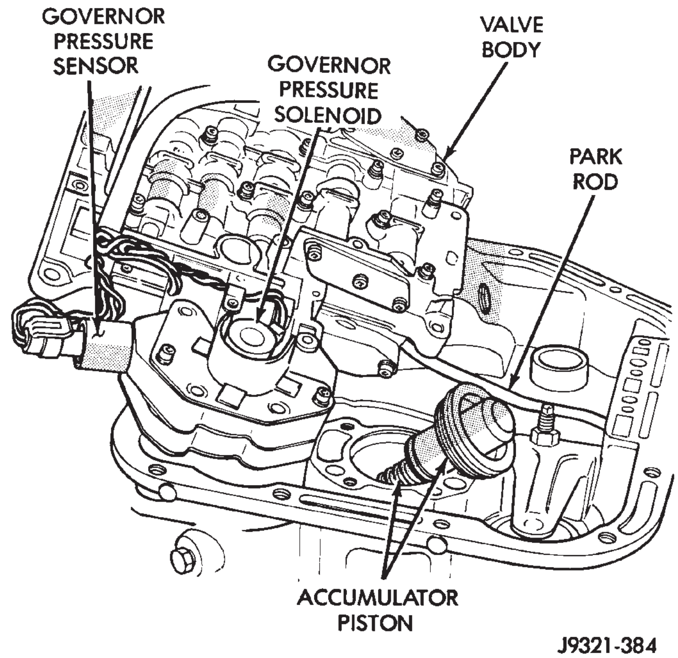


Fig. 11 Valve Body Removal

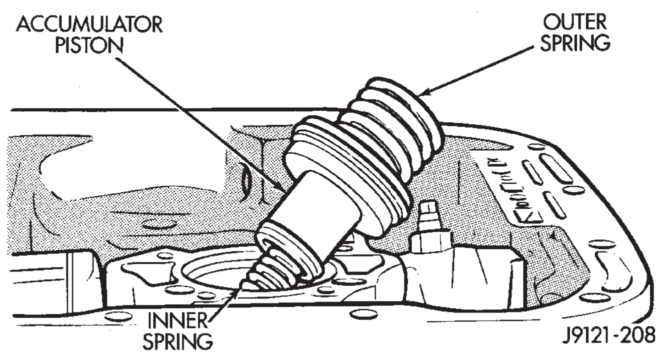


Fig. 12 Accumulator Piston And Springs

(18) Remove front band lever shaft access plug (Fig. 13). Plug is accessible through converter housing. Use 1/4 inch drive extension to remove plug as shown.

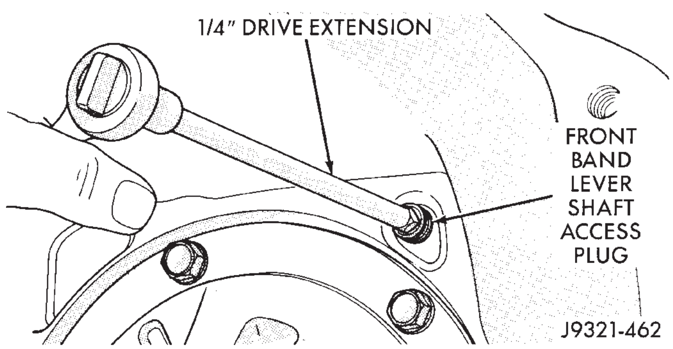


Fig. 13 Removing/Installing Front Band Lever Shaft Access Plug

(19) Loosen front band adjusting screw locknut 4-5 turns. Then tighten band adjusting screw until band

is tight around front clutch retainer. This prevents front/rear clutches from coming out with pump and possibly damaging clutch or pump components.

(20) Remove oil pump bolts.

(21) Thread bolts of Slide Hammer Tools C-3752 into threaded holes in pump body flange (Fig. 14).

(22) Bump slide hammer weights outward to remove pump and reaction shaft support assembly from case (Fig. 14).

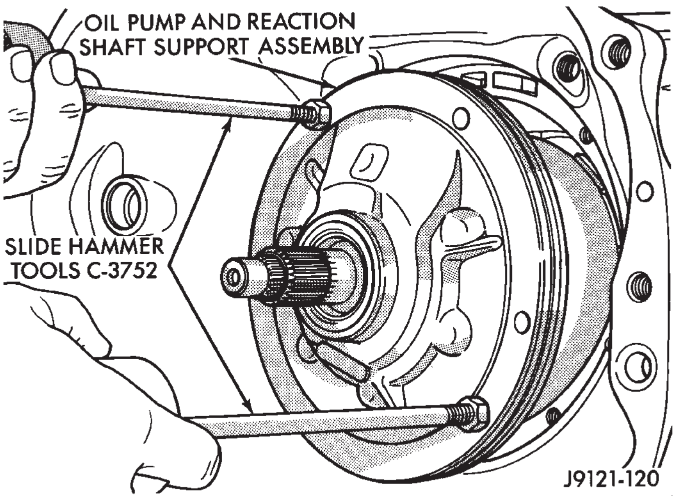


Fig. 14 Removing Oil Pump And Reaction Shaft Support Assembly

(23) Loosen front band adjusting screw until band is completely loose.

(24) Squeeze front band together and remove band strut (Fig. 15).

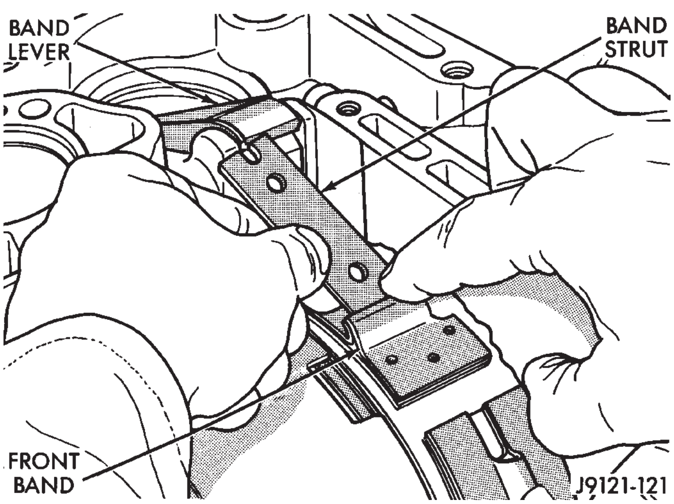


Fig. 15 Removing/Installing Front Band Strut

(25) Remove front band lever shaft with pencil magnet. Pin is accessible from converter housing side of case (Fig. 16).

(26) Remove front band lever (Fig. 17)

(27) Slide front band rearward and onto driving shell. Band will not be removed until after front/rear clutch removal.

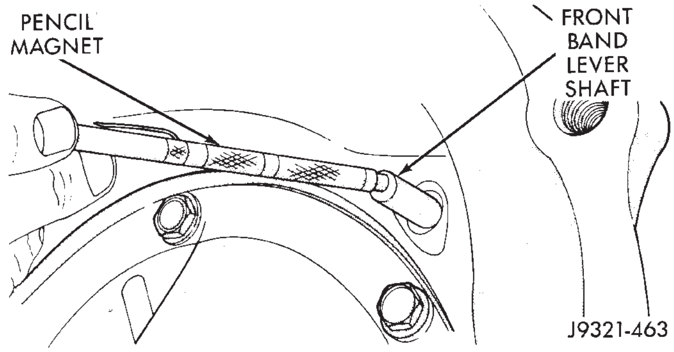


Fig. 16 Removing Front Band Lever Shaft

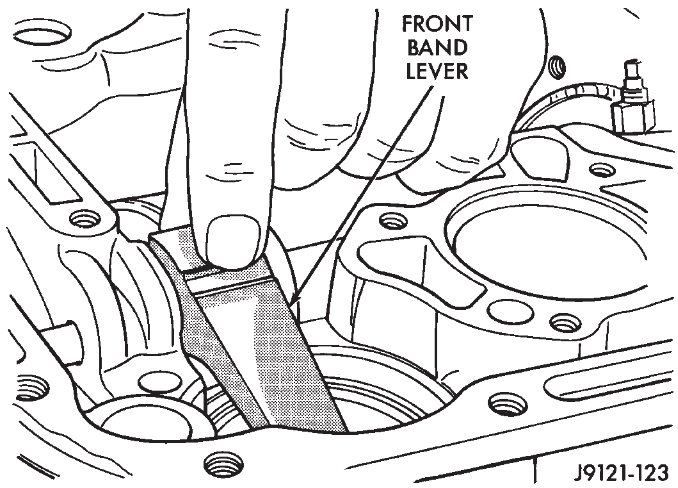


Fig. 17 Removing/Installing Front Band Lever

(28) Remove front and rear clutch units as assembly. Grasp input shaft, hold clutch units together and remove them from case (Fig. 18).

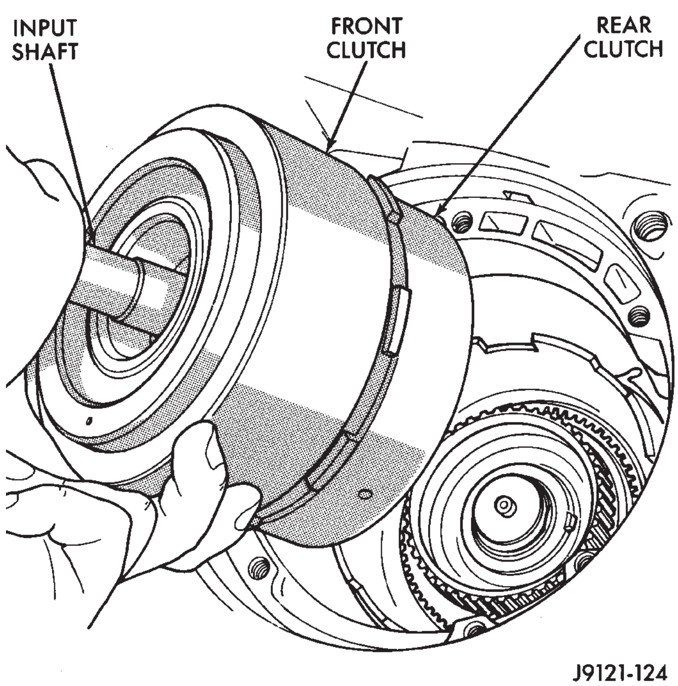


Fig. 18 Removing Front/Rear Clutch Assemblies

(29) Lift front clutch off rear clutch (Fig. 19). Set clutch units aside for overhaul.

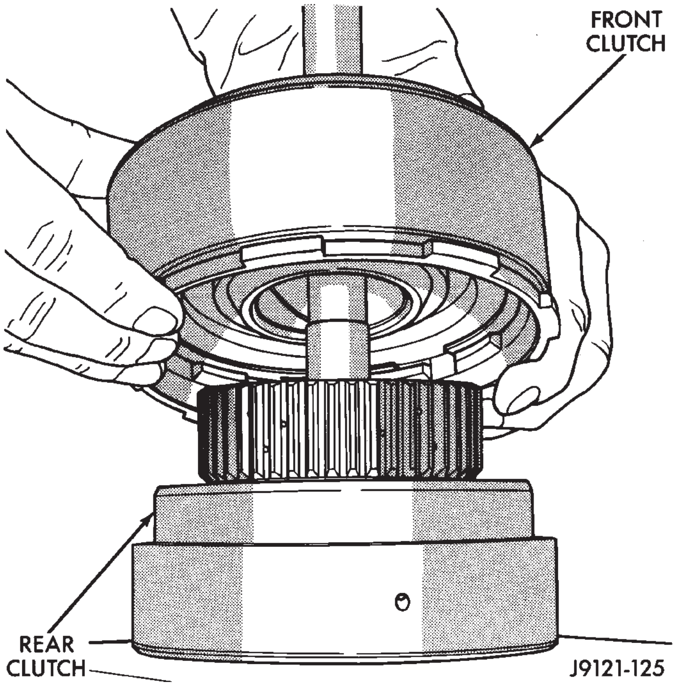


Fig. 19 Separating Front/Rear Clutch Assemblies

(30) Remove intermediate shaft thrust washer from front end of shaft or from rear clutch hub (Fig. 20).

(31) Remove output shaft thrust plate from intermediate shaft hub (Fig. 21).

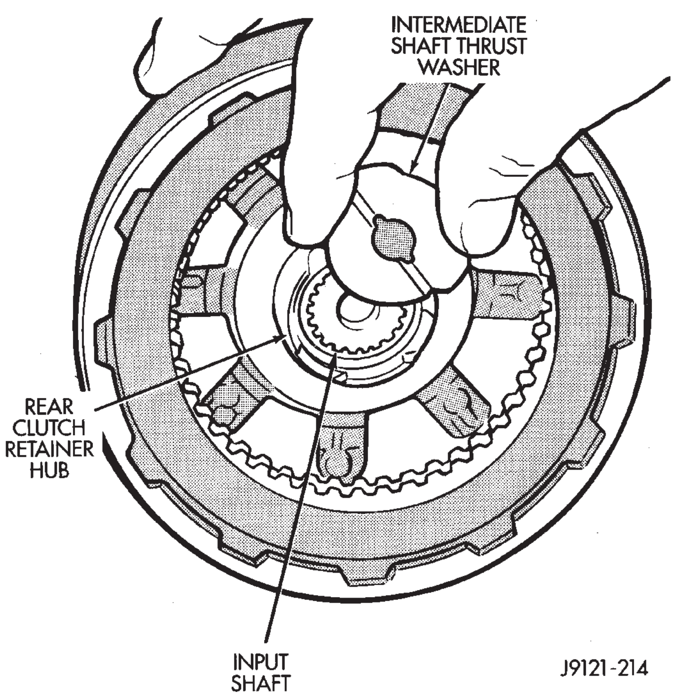


Fig. 20 Removing Intermediate Shaft Thrust Washer

(32) Slide front band off driving shell (Fig. 22) and remove band from case.

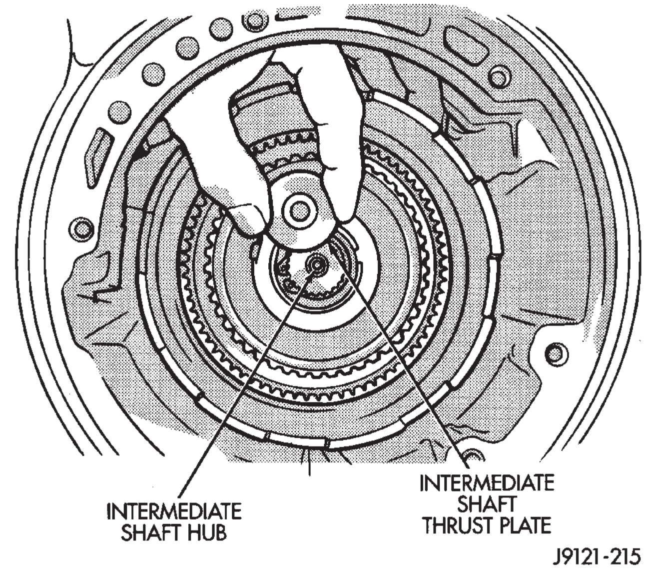


Fig. 21 Removing Intermediate Shaft Thrust Plate

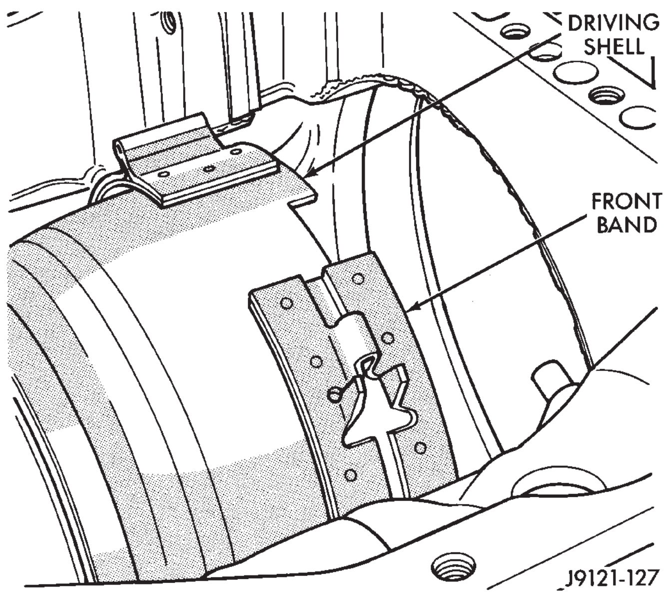


Fig. 22 Front Band Removal/Installation

(33) Remove planetary geartrain as assembly (Fig. 23). Support geartrain with both hands during removal. Do not allow machined surfaces on intermediate shaft or overdrive piston retainer to become nicked or scratched.

(34) Loosen rear band adjusting screw 4-5 turns.

(35) Remove low-reverse drum snap ring (Fig. 24).

(36) Remove bolts attaching overdrive piston retainer to rear of case (Fig. 25). Then remove piston retainer and gasket.

(37) Remove rear band pivot and reaction pins (Fig. 26). Use parallel jaw snap ring pliers to remove pins. Insert and spread plier jaws in pin bore to grip pin. Then twist and pull pins to remove them.

(38) Remove rear band lever.

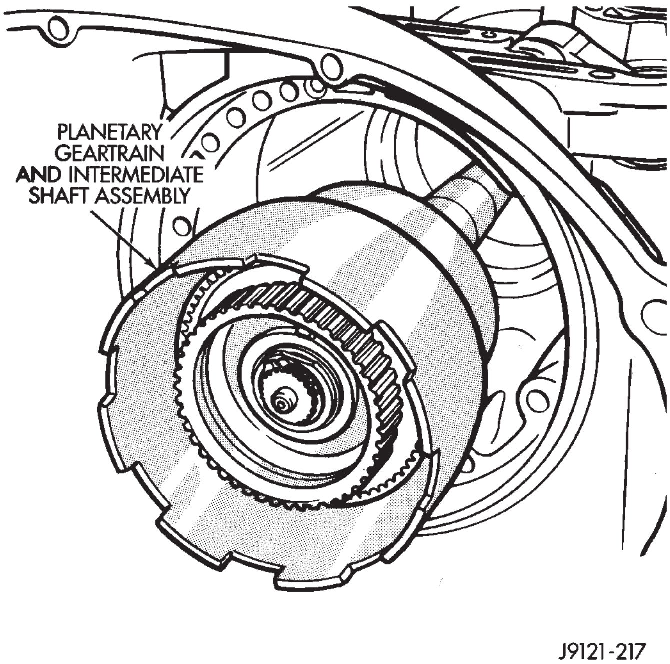


Fig. 23 Removing Planetary Geartrain And Intermediate Shaft Assembly

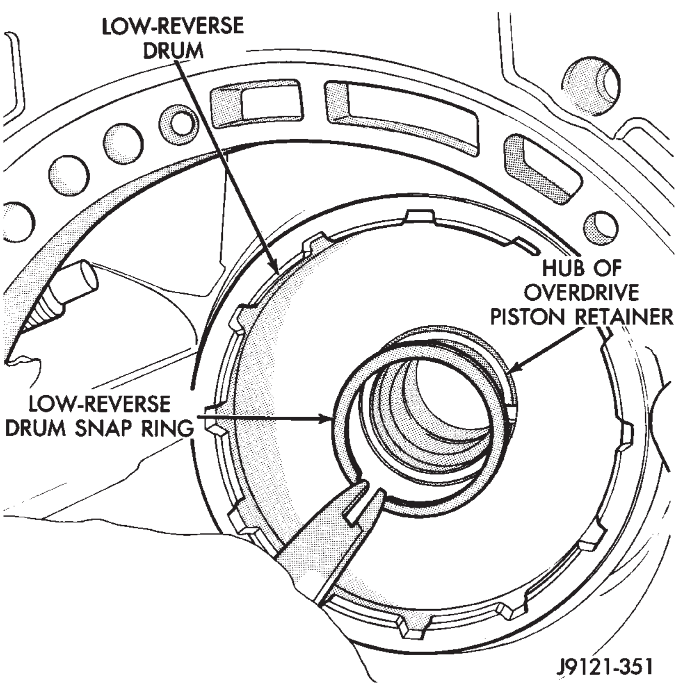


Fig. 24 Removing Low-Reverse Drum Snap Ring

(39) Remove low-reverse drum and rear band as assembly. Turn drum clockwise and pull outward to remove it from overrunning clutch (Fig. 27).

(40) Remove bolts attaching overrunning clutch cam to case (Fig. 28).

(41) Remove overrunning clutch cam and roller clutch assembly as a unit (Fig. 29). Turn cam back and forth and tilt it inward to remove it from case.

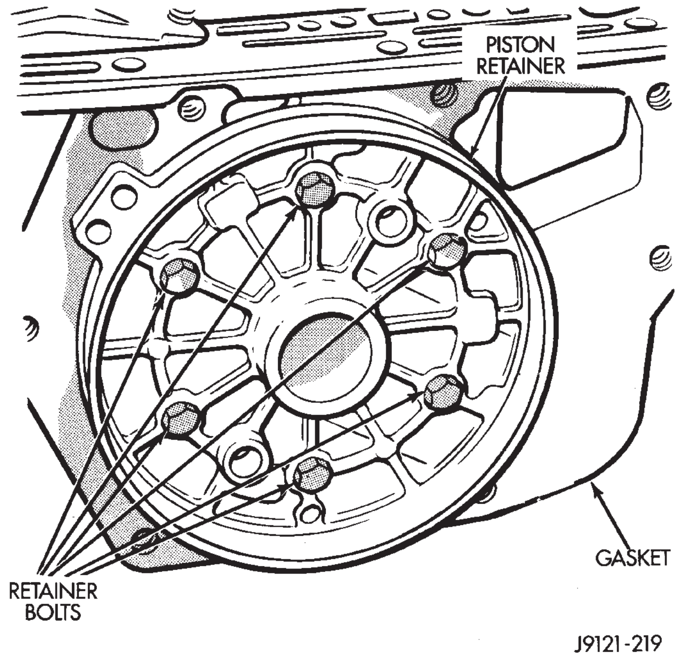


Fig. 25 Overdrive Piston Retainer Bolt Location

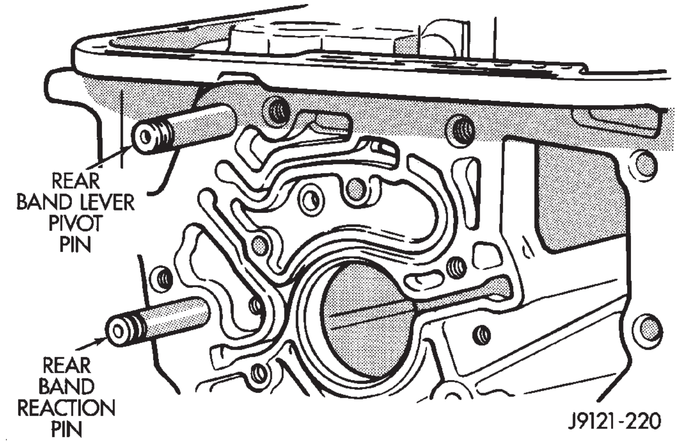


Fig. 26 Rear Band And Lever Pin Location

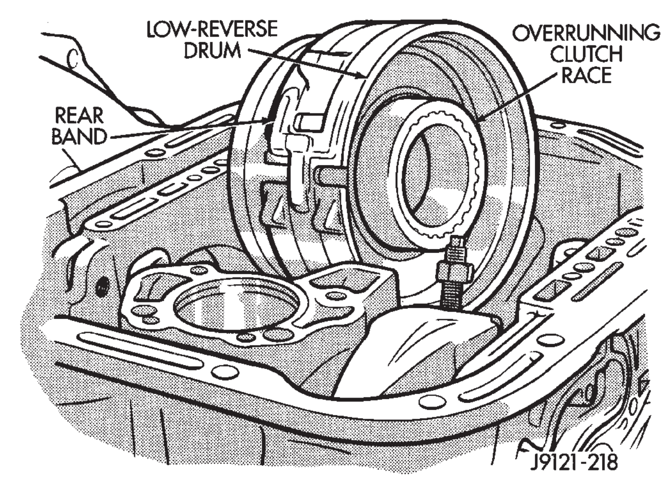


Fig. 27 Low-Reverse Drum And Rear Band Removal

(42) Compress front servo rod guide about 1/8 inch with Valve Spring Compressor C-3422-B (Fig. 30). A

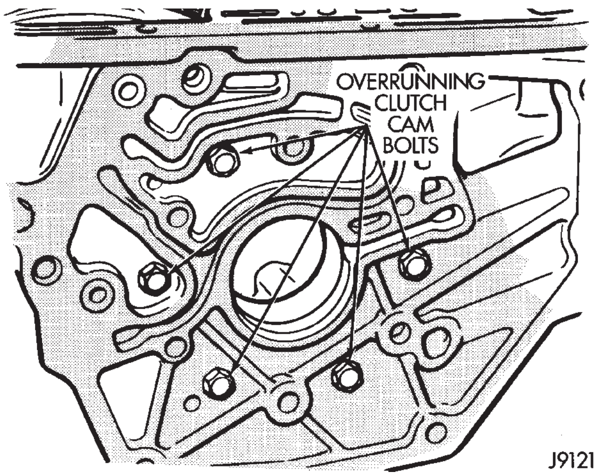


Fig. 28 Overrunning Clutch Cam Bolt Locations

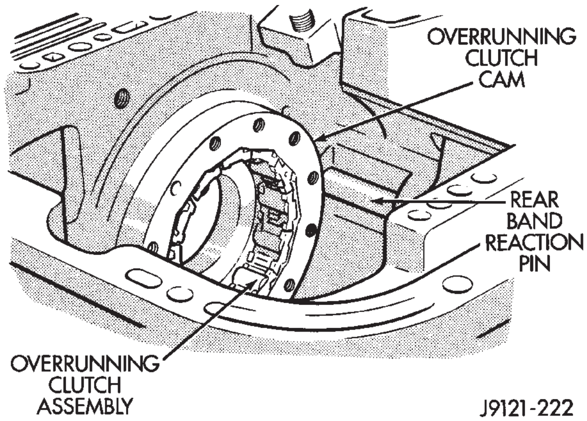


Fig. 29 Overrunning Clutch Assembly Removal

C-clamp and Special Tool C-4470 can also be used to compress rod guide.

(43) Remove front servo rod guide snap ring. **Exercise caution when removing snap ring. Servo bore can be scratched or nicked if care is not exercised.**

(44) Remove compressor tools and remove front servo rod guide, spring and servo piston.

(45) Compress rear servo spring retainer about 1/16 inch with Valve Spring Compressor C-3422-B (Fig. 31). A C-clamp and Tool C-4470 or SP-5560 can also be used to compress spring retainer.

(46) Remove rear servo spring retainer snap ring. Then remove compressor tools and remove rear servo spring and piston.

(47) Inspect transmission and overdrive components. **If major components such as the overdrive unit, front clutch, or oil pump require service, refer to appropriate overhaul procedure.**

OVERHAUL SERVICE INFORMATION

Inspect the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and accelerated wear of other components. However, do not replace bushings as a matter of course. Replace bushings only when they are actually worn, or scored.

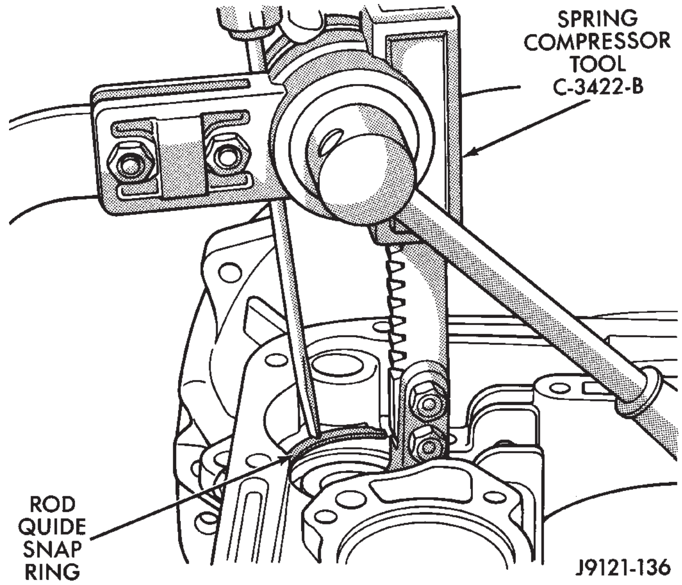


Fig. 30 Compressing Front Servo Rod Guide

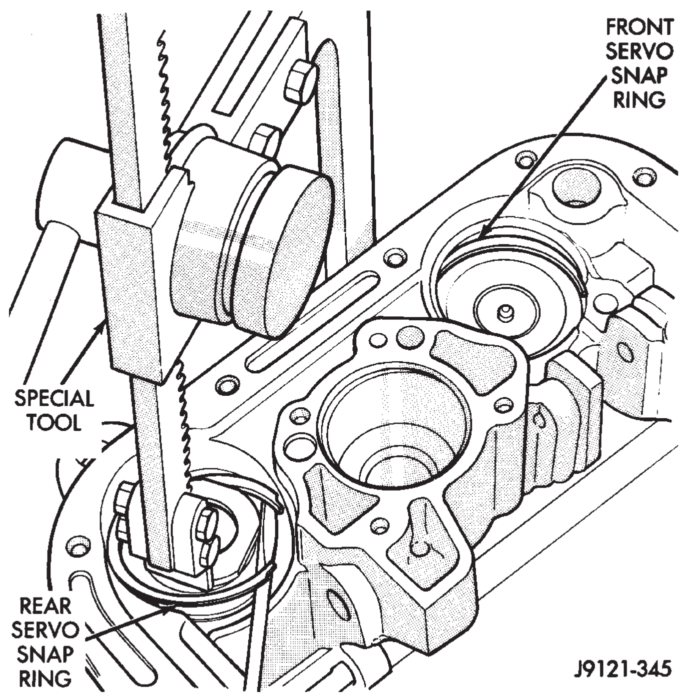


Fig. 31 Compressing Rear Servo Spring

Use recommended tools to replace bushings. The tools are sized and designed to remove, install, and seat bushings correctly. The bushing replacement tools are included in Bushing Tool Set C-3887-J, or C-3887-B.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced. The sun gear is replaced as an assembly if the bushings are damaged.

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive jobbers. Stainless steel inserts are recommended.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar ATF Plus, Type 7176 transmission fluid during overhaul and assembly. Use Mopar Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to lubricate and hold parts in place during reassembly.

TRANSMISSION CASE CLEANING AND INSPECTION

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

Lubricate the front band adjusting screw threads with petroleum jelly and thread the screw part-way into the case. Be sure the screw turns freely.

OVERRUNNING CLUTCH, LOW-REVERSE DRUM AND OVERDRIVE PISTON RETAINER INSPECTION AND OVERHAUL

If the overrunning clutch and cam came out with the low-reverse drum, remove the cam and clutch from the drum as follows: Thread two clutch cam bolts into the cam. Then lift the clutch and cam out of the drum with the bolts (Fig. 32). Rotate the cam back and forth to ease removal if necessary.

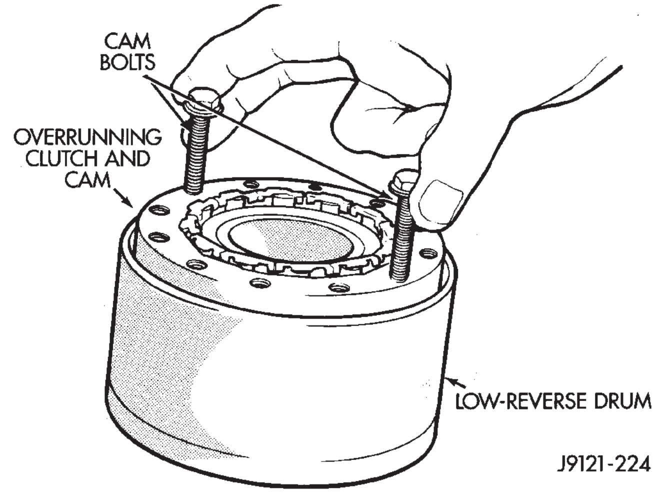


Fig. 32 Removing Overrunning Clutch From Low-Reverse Drum

CLEANING AND INSPECTION

Clean the clutch rollers, springs and retainer, clutch cam, low-reverse drum and overdrive piston retainer in solvent. Air dry the rollers after cleaning.

Inspect condition of each clutch part after cleaning. Replace the rollers and the retainer and spring assembly if the rollers, springs or spring retainer are worn or damaged. Replace the clutch cam if worn, cracked or damaged.

Inspect the overrunning clutch race and low-reverse drum. Replace the drum and race as an assembly if either part is worn, scored or damaged.

Examine the overdrive piston retainer carefully for wear, cracks, scoring or other damage. Be sure the retainer hub is a snug fit in the case and low-reverse drum. Replace the retainer if worn or damaged.

OVERRUNNING CLUTCH ASSEMBLY

(1) Install clutch rollers in spring retainer (Fig. 33). Be sure springs are seated squarely against rollers.

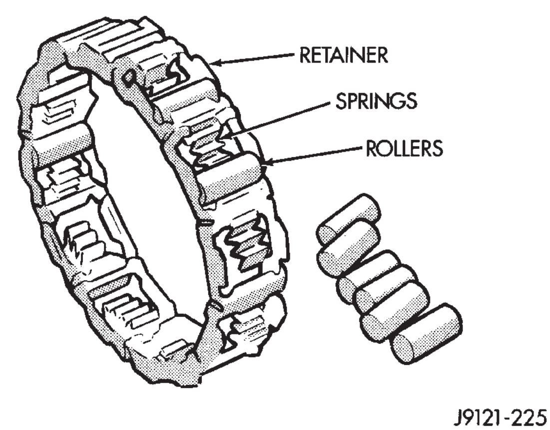


Fig. 33 Installing Overrunning Clutch Rollers In Retainer

(2) Install roller and spring assembly in clutch cam (Fig. 34).

(3) Lubricate overrunning clutch rollers, springs cam and race with transmission fluid. Verify component installation before proceeding. Bolt holes in clutch cam are countersunk on one side. Be sure this side of cam will face rearward as shown (Fig. 34).

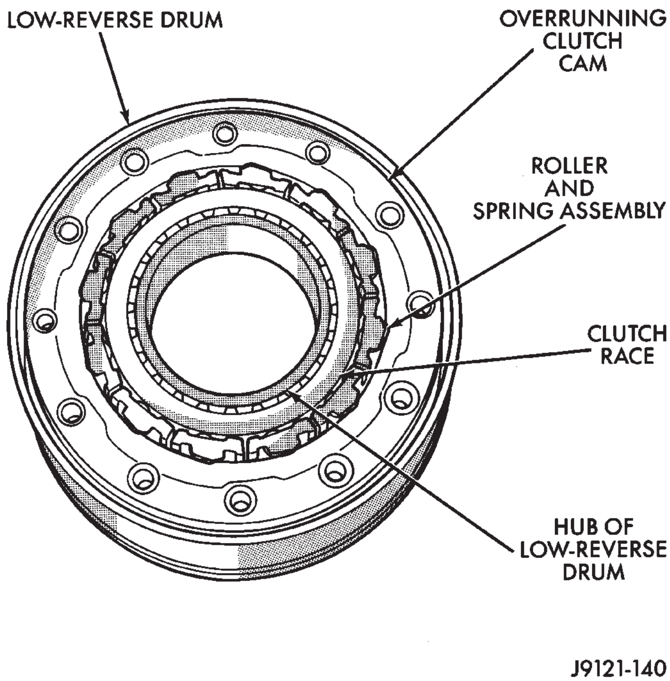


Fig. 34 Checking Overrunning Clutch Installation

(4) Inspect bolt holes in overrunning clutch cam. Note that one hole is **not** threaded. Identify location of non threaded hole with paint mark for assembly reference (Fig. 35).

(5) Set assembly aside for final installation after overhaul is complete.

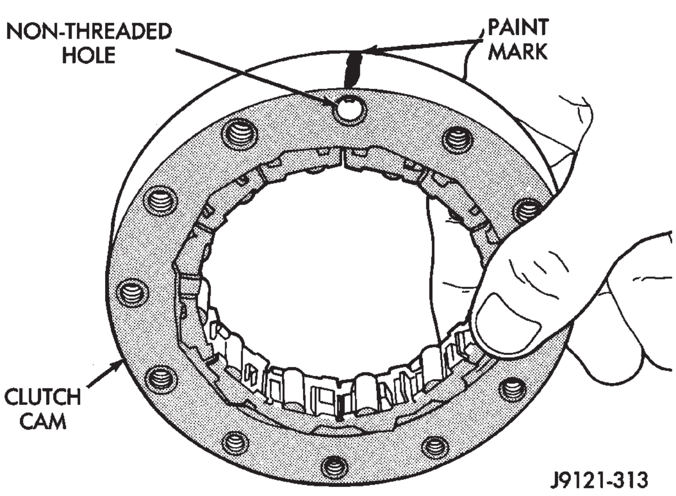


Fig. 35 Marking Location Of Non-Threaded Hole In Clutch Cam

OIL PUMP AND REACTION SHAFT SUPPORT OVERHAUL

PUMP AND SUPPORT DISASSEMBLY

(1) Remove seal from around pump housing (Fig. 36).

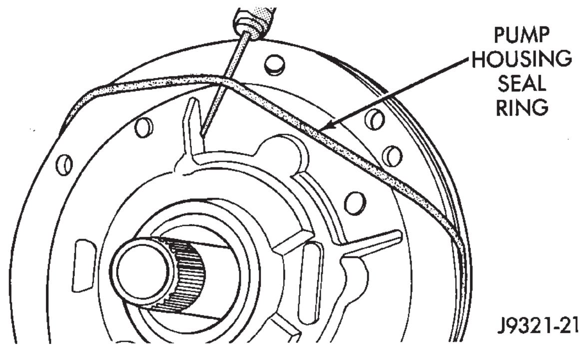


Fig. 36 Removing Pump Housing Seal

(2) Loosen bolts that attach pump body to support (Fig. 37).

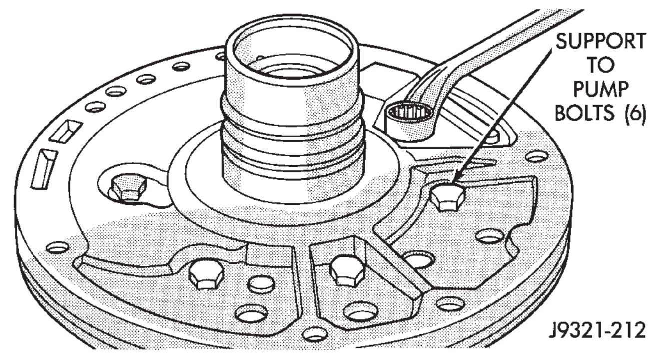


Fig. 37 Loosening Pump Support Bolts

(3) Remove pump-to-support bolts and separate support from pump housing (Fig. 38).

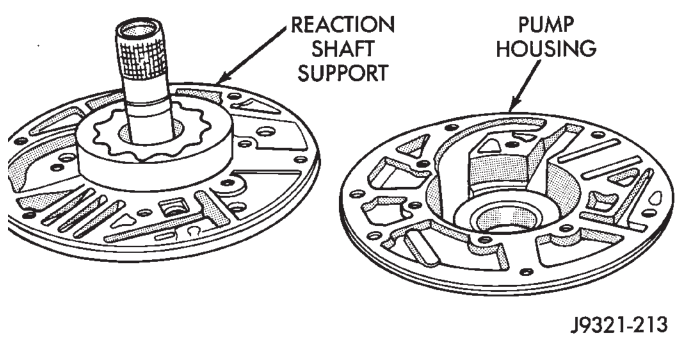


Fig. 38 Separating Pump Housing From Reaction Shaft Support

(4) Remove inner and outer gears from reaction shaft support (Fig. 39).

(5) If pump seal was not removed during transmission disassembly, remove seal with punch and hammer.

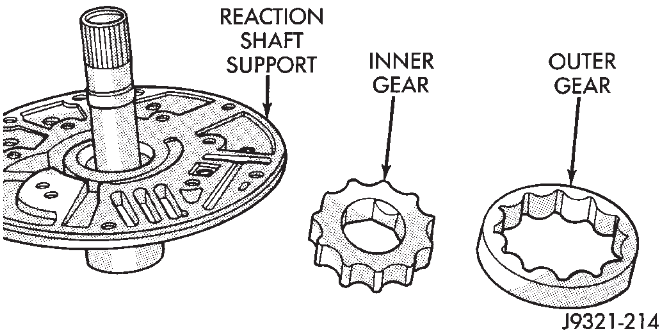


Fig. 39 Pump Gear Removal

(6) Remove front clutch thrust washer from support hub (Fig. 40). Note position of chamfer on washer inside diameter for installation reference. Chamfer side faces pump.

OIL PUMP AND REACTION SHAFT SUPPORT CLEANING AND INSPECTION

Clean pump and reaction shaft support components with solvent and dry them with compressed air.

Inspect the pump housing and support components. Replace the housing or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged.

Replace the pump gears if pitted, worn chipped, or damaged. Inspect the thrust washer for wear or damage. Replace the washer if necessary. **Note that the inner gear used in 1993 and later 42RE oil pumps has a new design drive lug. The new design incorporates drive flats instead of the square lug used previously. The torque converter hub has also been redesigned to accept the new drive. If pump gear replacement is necessary, be very sure to order and install the new style gears.**

Inspect the pump and reaction shaft support bushings. Minor bushing wear is acceptable. Replace the bushings only if scored, or severely worn.

Install the gears in the pump housing and measure end clearance with a feeler gauge and straightedge (Fig. 41). End clearance should be 0.010 - 0.06 mm (0.0004 - 0.0025 in.).

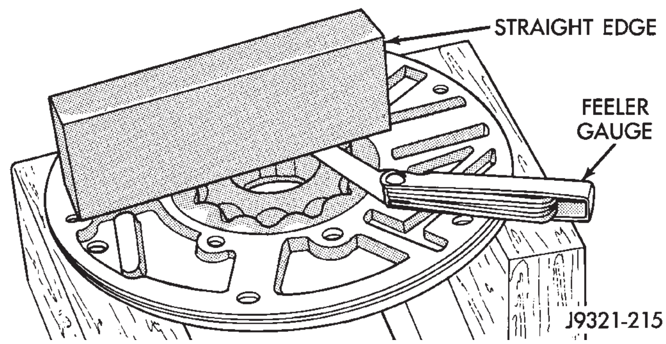


Fig. 41 Measuring Pump Gear End Clearance

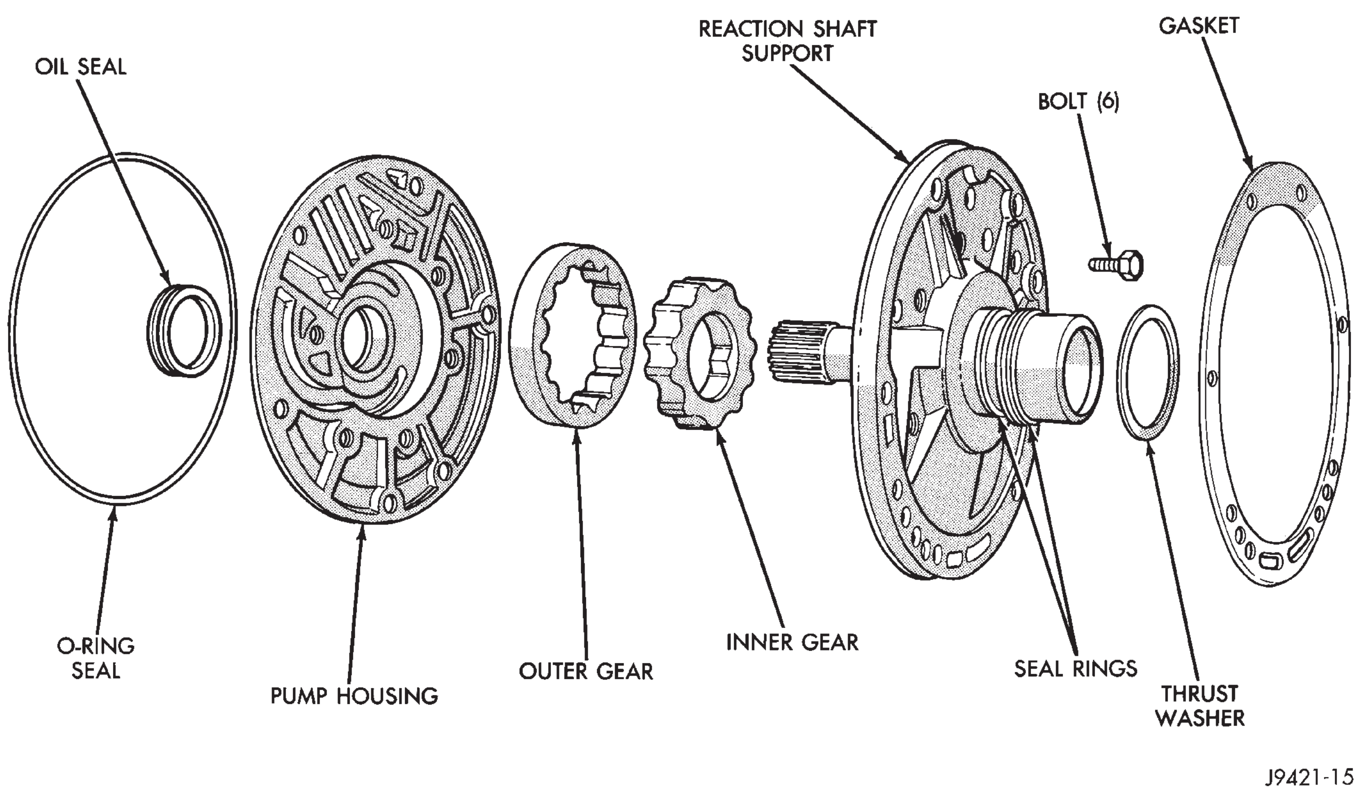


Fig. 40 Oil Pump And Reaction Shaft Support Components

Measure clearance between the outer gear and the pump body (Fig. 42). Clearance should be 0.08 - 0.19 mm (0.0035 - 0.0075 in.).

Measure gear tooth clearance with a feeler gauge. Align one tooth of the outer gear in inner gear and measure clearance (Fig. 43). Clearance should be 0.08 - 0.19 mm (0.0035 - 0.0075 in.).

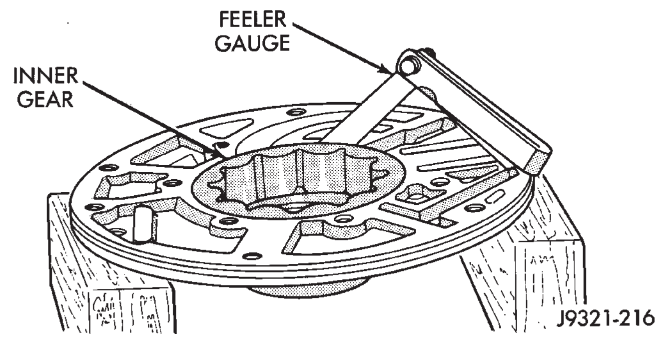


Fig. 42 Measuring Pump Housing-To-Inner Gear Clearances

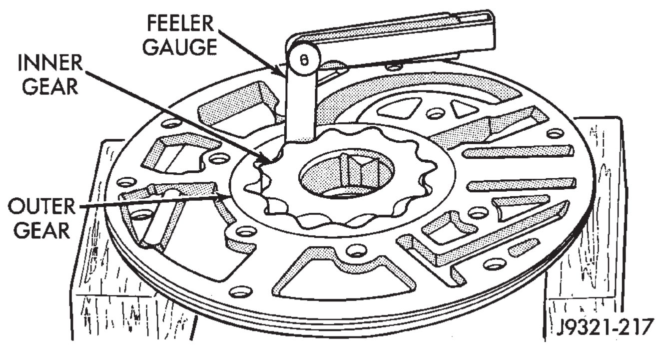


Fig. 43 Measuring Pump Gear Tooth Clearance

REPLACING OIL PUMP BUSHING

(1) Remove pump bushing with Tool Handle C-4171 and Bushing Remover SP-3551 (Fig. 44).

(2) Install new pump bushing with Tool Handle C-4171 and Bushing Installer SP-5117 (Fig. 44). Bushing should be flush with pump housing bore.

(3) Stake new pump bushing in two places with blunt punch (Fig. 45). Remove burrs from stake points with knife blade afterward.

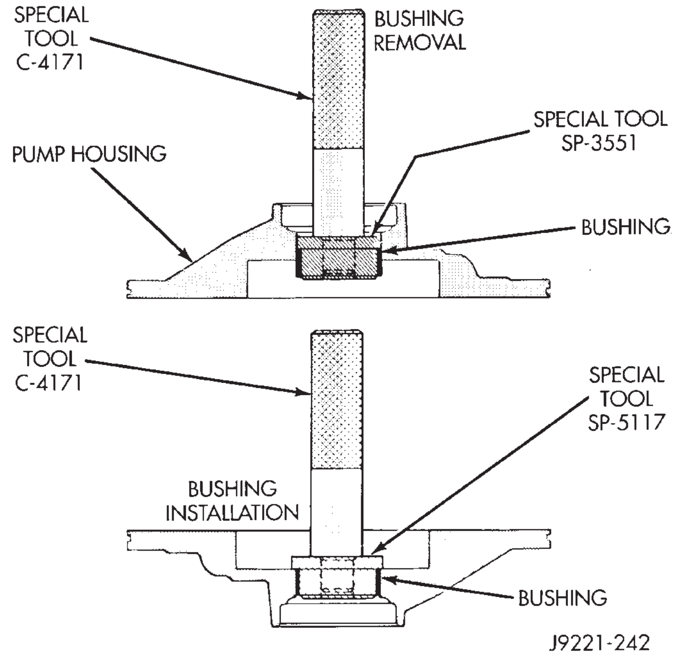


Fig. 44 Removing Oil Pump Bushing

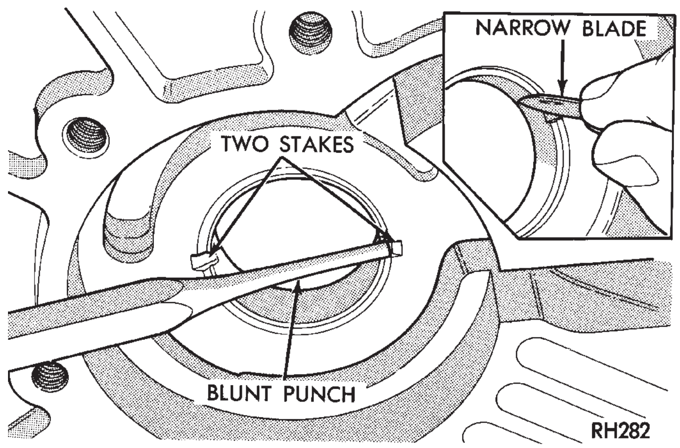


Fig. 45 Staking Oil Pump Bushing

REPLACING REACTION SHAFT SUPPORT BUSHING

(1) Assemble Bushing Remover Tools SP-1191, 3633 and 5324 (Fig. 46). **Do not clamp any part of reaction shaft or support in vise.**

(2) Hold Cup Tool SP-3633 firmly against reaction shaft and thread remover SP-5324 into bushing as far as possible by hand. Then thread remover tool 3-4 additional turns into bushing with a wrench.

(3) Turn remover tool hex nut down against remover cup to pull bushing from shaft. Clean all chips from shaft after bushing removal.

(4) Lightly grip old bushing in vise or with pliers and back remover tool out of bushing.

(5) Assemble Bushing Installer Tools C-4171 and SP-5325 (Fig. 46).

(6) Slide new bushing onto Installer Tool SP-5325.

(7) Position reaction shaft support upright on a clean smooth surface.

(8) Align bushing in bore. Then tap bushing into place until Bushing Installer SP-5325 bottoms.

(9) Clean reaction shaft support thoroughly after installing bushing.

ASSEMBLING OIL PUMP AND REACTION SHAFT SUPPORT

(1) Lubricate gear bore in pump housing with transmission fluid.

(2) Lubricate pump gears with transmission fluid.

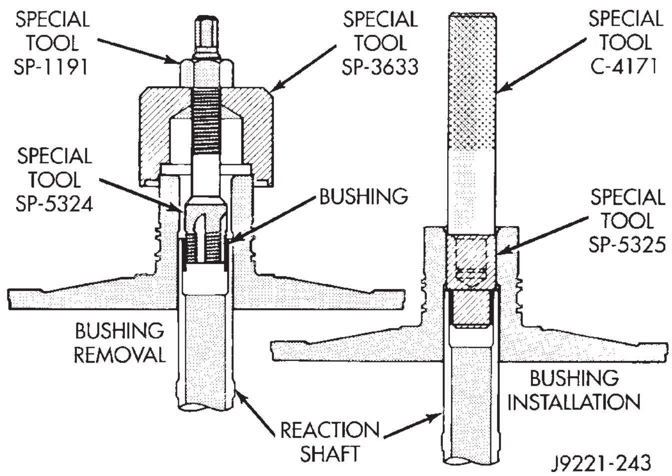


Fig. 46 Replacing Reaction Shaft Support Bushing

(3) Support pump housing on wood blocks (Fig. 47).

(4) Install outer gear in pump housing (Fig. 47). Gear can be installed either way (it is not a one-way fit).

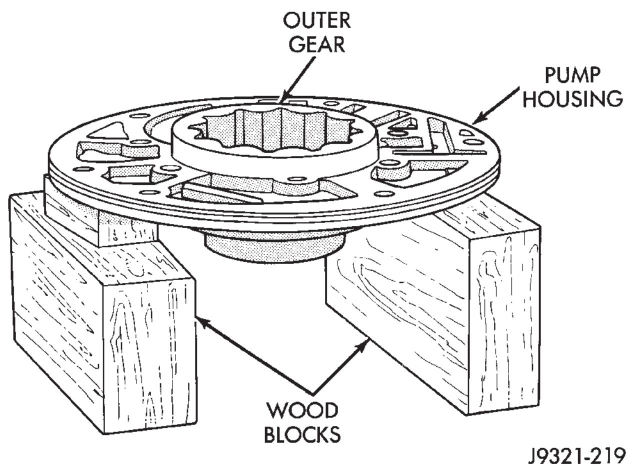


Fig. 47 Supporting Pump And Installing Outer Gear

(5) Install pump inner gear (Fig. 48).

CAUTION: The pump inner gear is a one-way fit. The bore on one side of the gear inside diameter is chamfered. Be sure the chamfered side faces forward (to front of pump).

(6) Install new thrust washer on hub of reaction shaft support. Lubricate washer with transmission fluid or petroleum jelly.

CAUTION: The thrust washer is a one-way fit. The washer inside diameter is chamfered on one side. Be sure the washer is installed with the chamfered side facing forward.

(7) If reaction shaft seal rings are being replaced, install new seal rings on support hub (Fig. 49). Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.

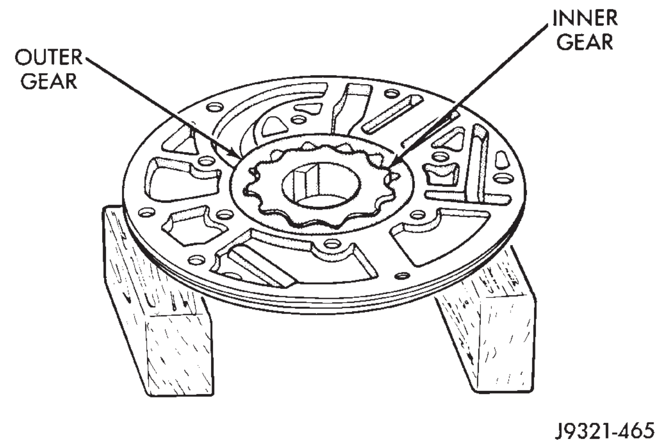


Fig. 48 Pump Inner Gear Installation

CAUTION: The reaction shaft support seal rings will break if overspread, or twisted. If new rings are being installed, spread them only enough for installation. Also be very sure the ring ends are securely hooked together after installation. Otherwise, the rings will either prevent pump installation, or break during installation.

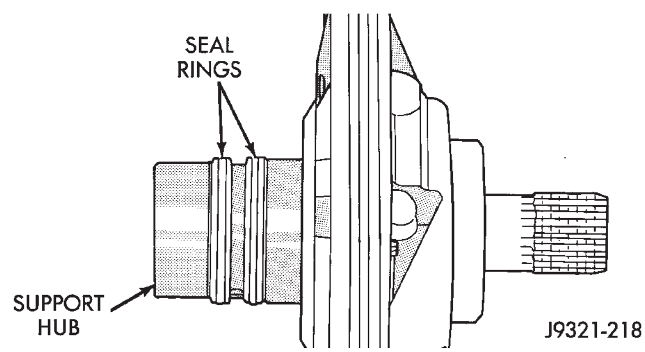


Fig. 49 Hub Seal Ring Position

(8) Install reaction shaft support on pump housing (Fig. 50).

(9) Align reaction support on pump housing. Use alignment marks made at disassembly. Or, rotate support until bolt holes in support and pump housing are all aligned (holes are offset for one-way fit).

(10) Install all bolts that attach support to pump housing. Then tighten bolts finger tight.

(11) Tighten support-to-pump bolts to required torque as follows:

(a) Reverse pump assembly and install it in transmission case. Position pump so bolts are facing out and are accessible.

(b) Secure pump assembly in case with 2 or 3 bolts, or with pilot studs.

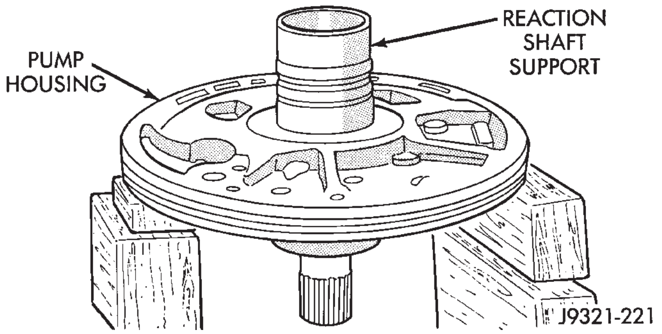


Fig. 50 Assembling Reaction Shaft Support And Pump Housing

(c) Tighten support-to-pump bolts to 20 N·m (15 ft. lbs.).

(d) Remove pump assembly from transmission case.

(12) Install new oil seal in pump with Special Tool C-4193 and Tool Handle C-4171 (Fig. 51). Be sure seal lip faces inward.

(13) Install new seal ring around pump housing. Be sure seal is properly seated in groove.

(14) Lubricate lip of pump oil seal with petroleum jelly. Lubricate pump seal with Ru-Glyde or petroleum jelly.

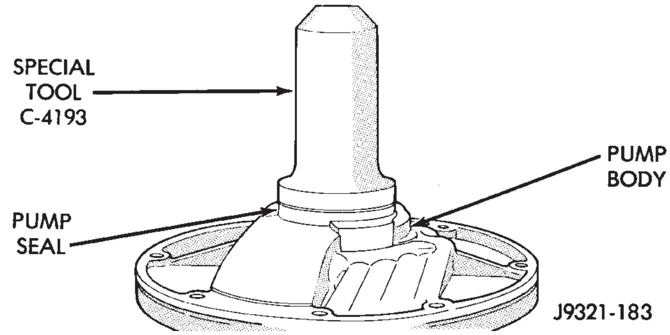


Fig. 51 Pump Oil Seal Installation

FRONT CLUTCH OVERHAUL

FRONT CLUTCH DISASSEMBLY

(1) Remove waved snap ring and remove pressure plate, clutch plates and clutch discs (Fig. 52).

(2) Compress clutch piston spring with Compressor Tool C-3575-A (Fig. 53). Be sure legs of tool are seated squarely on spring retainer before compressing spring.

(3) Remove retainer snap ring and remove compressor tool.

(4) Remove spring retainer and clutch spring. Note position of retainer on spring for assembly reference.

(5) Remove clutch piston from clutch retainer. Remove piston by rotating it up and out of retainer.

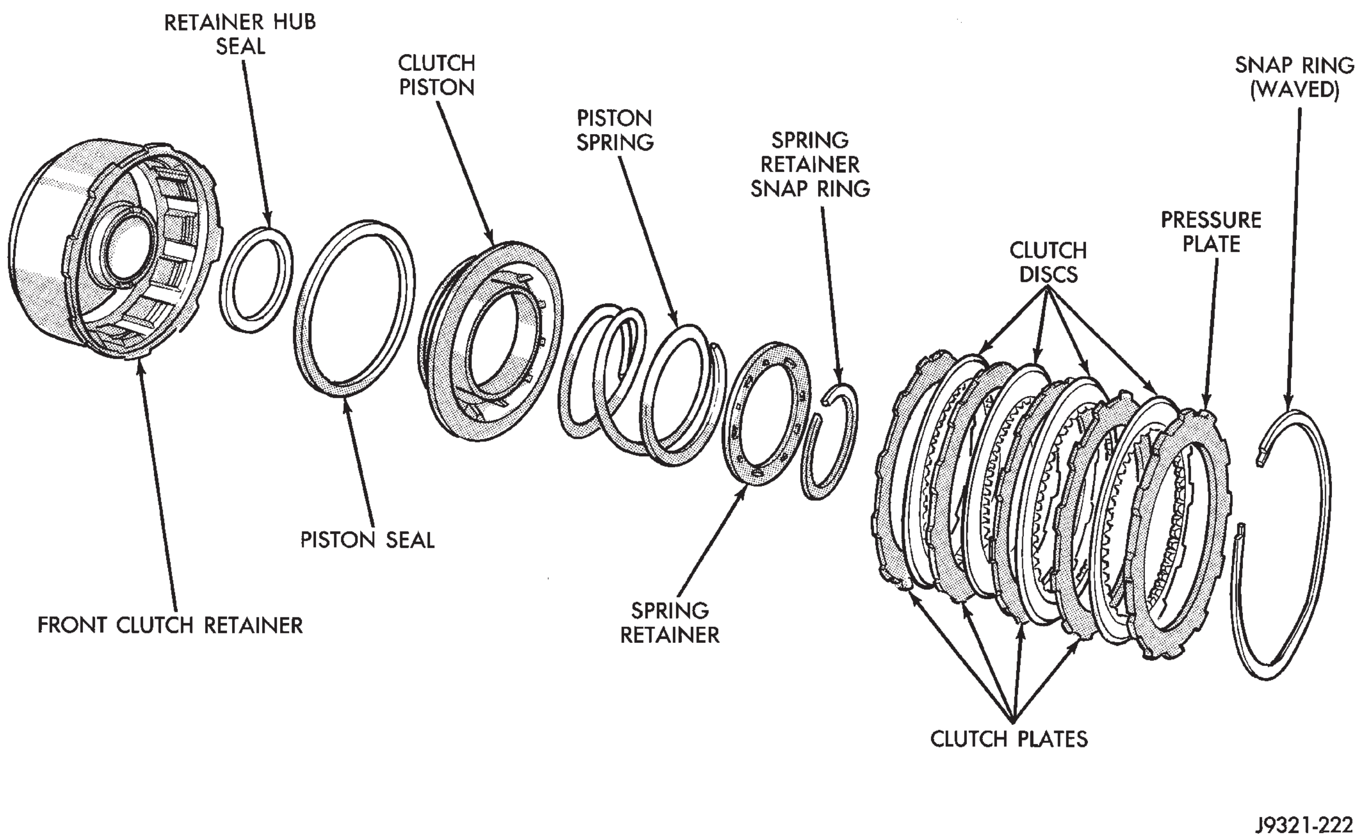


Fig. 52 Front Clutch Components

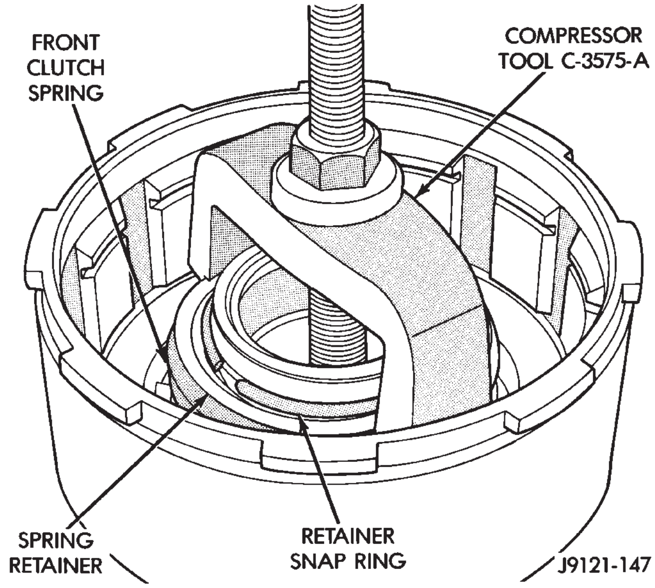


Fig. 53 Compressing Front Clutch Piston Spring

(6) Remove seals from clutch piston and clutch retainer hub. Discard both seals as they are not reusable.

FRONT CLUTCH INSPECTION

Clean the front clutch components in solvent and dry them with compressed air only. Do not use rags or shop towels to dry any of the clutch parts. Lint from such materials will adhere to the component surfaces and could restrict or block fluid passages after assembly.

Replace the clutch discs if warped, worn, scored, burned or charred, or if the facing is flaking off. Replace the steel plates if heavily scored, warped, or broken. Be sure the driving lugs on the plates are in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the clutch spring and spring retainer if either is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The steel plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged.

Check action of the check ball in the retainer (Fig. 54). The ball must move freely and not stick.

Inspect the clutch retainer bushings carefully (Fig. 55). The retainer bushings are not serviceable. It will be necessary to replace the retainer if either bushing is scored, or worn.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

FRONT CLUTCH ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seals on piston and in hub of retainer. Be sure lip of each seal faces interior of clutch retainer.

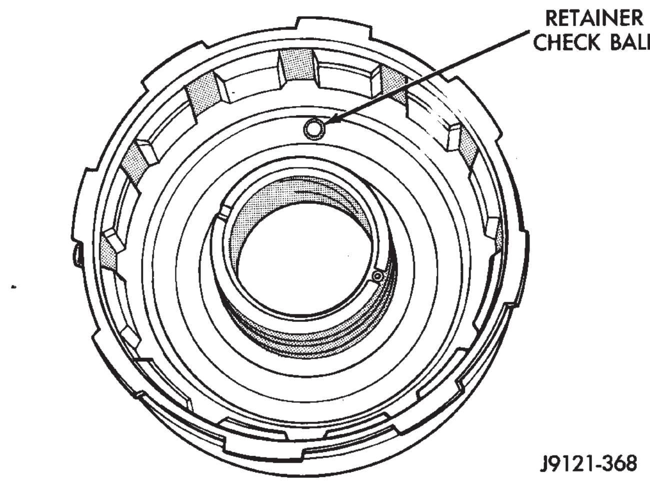


Fig. 54 Front Clutch Piston Retainer Check Ball Location

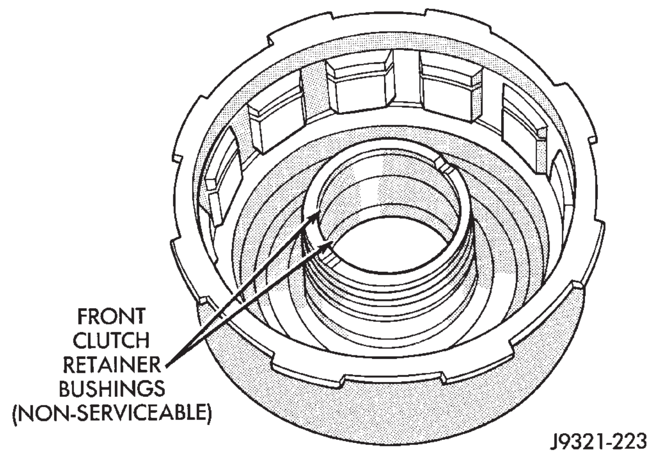


Fig. 55 Retainer Bushing Locations

(3) Lubricate lips of piston and retainer seals with liberal quantity of Mopar Door Ease, or with Ru-Glyde. Then lubricate retainer hub, bore and piston with transmission fluid.

(4) Install clutch piston in retainer (Fig. 56). Use twisting motion to seat piston in bottom of retainer. **Do not attempt to push the piston straight in. This could fold the seals over causing leakage and clutch slip.**

(5) Position spring in clutch piston (Fig. 57).

(6) Position spring retainer on top of piston spring (Fig. 58). **Make sure retainer is properly installed. Small raised tabs should be facing upward. Semicircular lugs on underside of retainer are for positioning retainer in spring.**

(7) Compress piston spring and retainer with Compressor Tool C-3575-A (Fig. 53). Then install new snap ring to secure spring retainer and spring.

(8) Install clutch plates and discs (Fig. 52). Install steel plate then disc until all plates and discs are installed. Four discs are required.

(9) Install pressure plate and waved snap ring (Fig. 52).

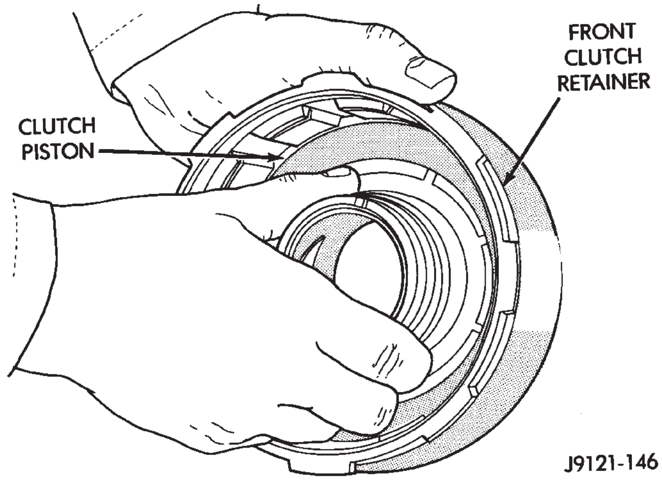


Fig. 56 Front Clutch Piston Installation

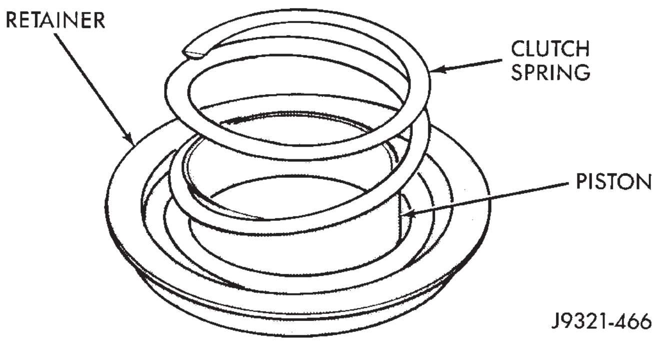


Fig. 57 Clutch Spring Installation

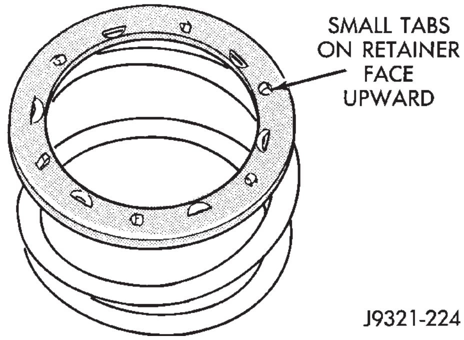


Fig. 58 Correct Spring Retainer Installed Position

(10) Check clutch plate clearance (Fig. 59). Clearance should be 1.70 to 3.40 mm (0.067 to 0.134 in.). If clearance is incorrect, clutch discs, pressure plates and snap ring may have to be changed.

REAR CLUTCH OVERHAUL

REAR CLUTCH DISASSEMBLY

(1) Remove plastic thrust washer from forward side of clutch retainer.

(2) Remove selective clutch pack snap ring (Fig. 60).

(3) Remove top pressure plate, clutch discs, steel plates, bottom pressure plate and wave spring (Fig. 60).

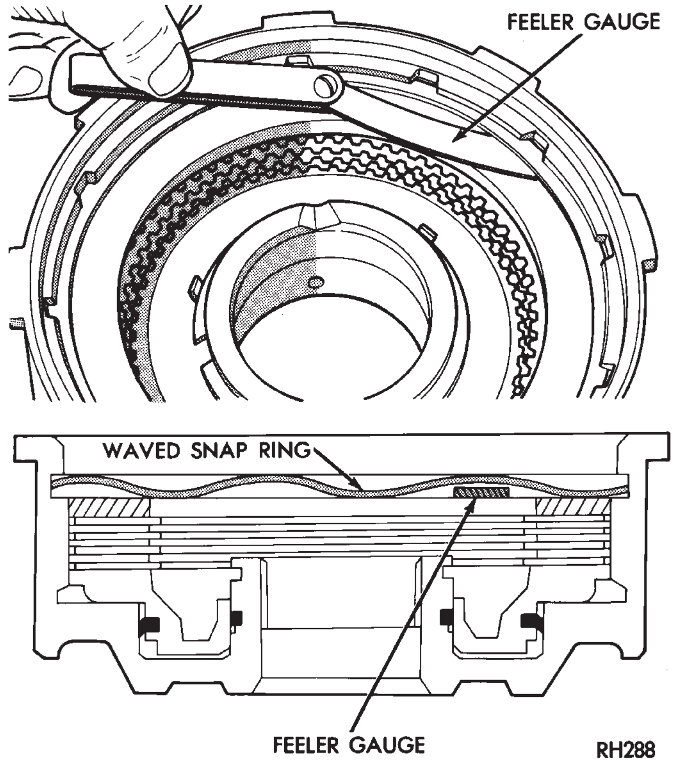


Fig. 59 Measuring Front Clutch Pack Clearance

(4) Remove clutch piston. Grasp piston and rotate piston up and out of retainer.

(5) Remove and discard piston seals.

(6) Remove input shaft snap ring (Fig. 61).

(7) Press input shaft out of retainer with shop press and suitable size press tool (Fig. 62).

(8) Remove input shaft front/rear seal rings.

REAR CLUTCH INSPECTION

Clean the clutch components with solvent and dry them with compressed air. Do not use rags or shop towels to dry any of the clutch parts. Lint from such materials will adhere to component surfaces and could restrict or block fluid passages after assembly.

Replace the clutch discs if warped, worn, scored, burned/charred, the lugs are damaged, or if the facing is flaking off. Replace the top and bottom pressure plates if scored, warped, or cracked. Be sure the driving lugs on the pressure and clutch plates are also in good condition. The lugs must not be bent, cracked or damaged in any way.

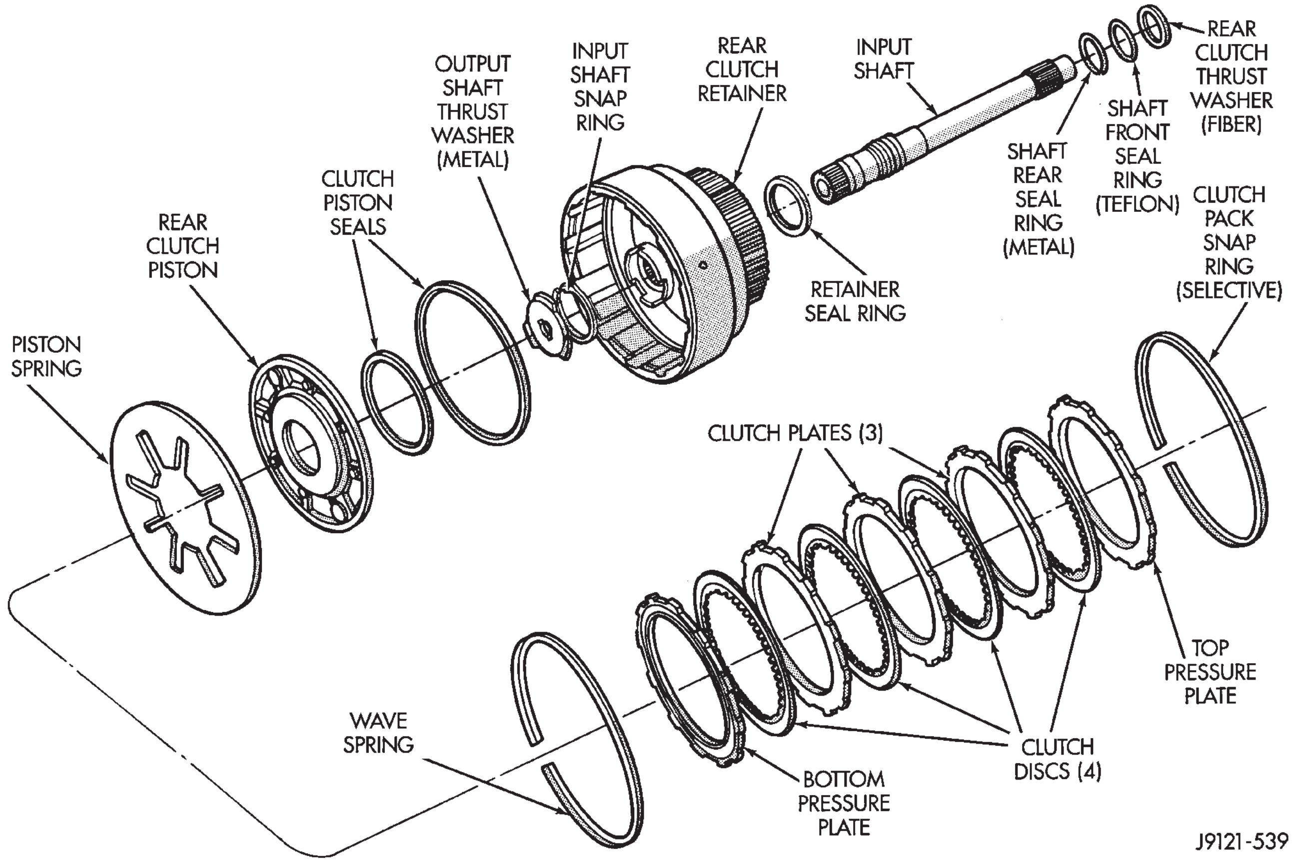


Fig. 60 Rear Clutch Components

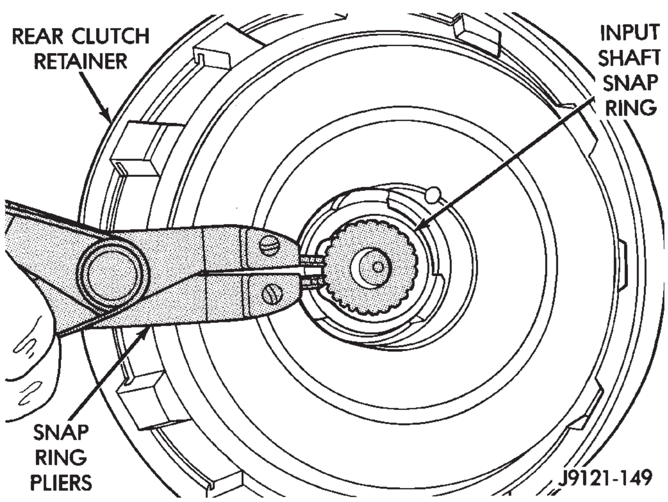


Fig. 61 Removing/Installing Input Shaft Snap Ring

Replace the piston spring and wave spring if either part is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The clutch and pressure plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged. Also check action of the check ball in the piston. The check ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or doubt exists about bushing condition.

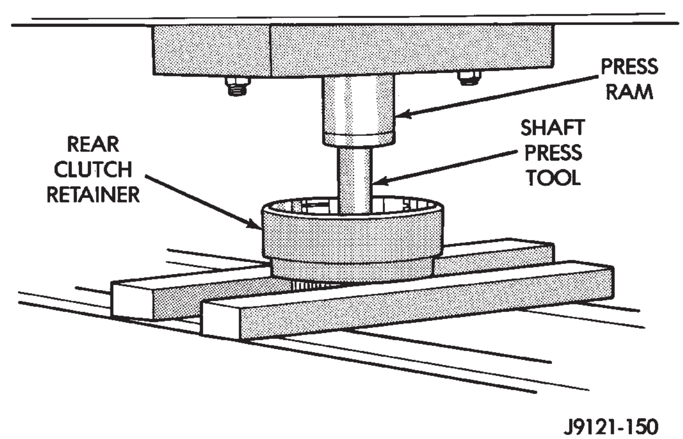


Fig. 62 Removing Input Shaft From Rear Clutch Retainer

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check condition of the fiber thrust washer and metal output shaft thrust washer. Replace either washer if worn or damaged.

Check condition of the seal rings on the input shaft and clutch retainer hub. Replace the seal rings only if obviously damaged. The input shaft front seal ring is teflon with chamfered ends. The rear ring is metal with interlocking ends.

Check the input shaft for wear, or damage. Replace the shaft if worn, scored or damaged in any way.

REAR CLUTCH ASSEMBLY

(1) Soak clutch discs in transmission fluid.

(2) Install new seal rings on clutch retainer hub and input shaft (Figs. 63 and 64).

(a) Be sure clutch hub retainer seal ring is fully seated in groove (Fig. 63). Ring must not be twisted, or distorted.

(b) Note that input shaft front seal ring is teflon and rear seal ring is metal (Fig. 64). Be sure chamfered ends of teflon ring are properly joined and that ends of rear ring are securely hooked together.

(c) Lubricate retainer and shaft seal rings with light coat of petroleum jelly after installation.

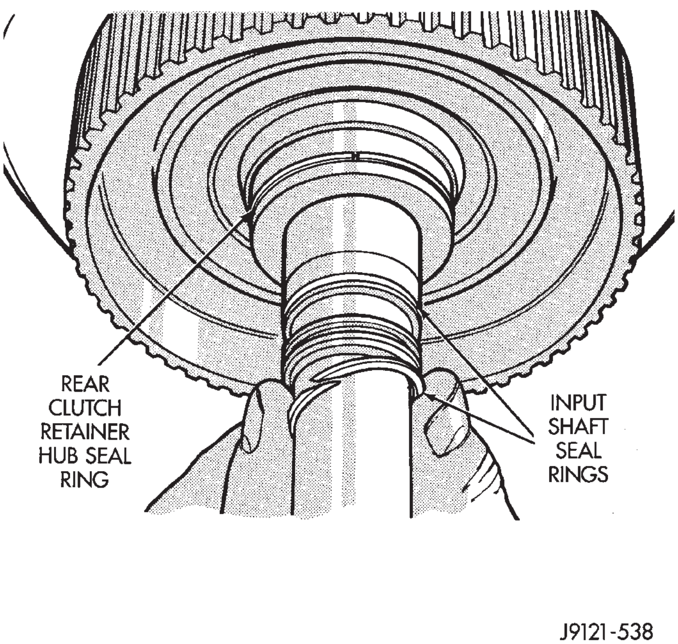


Fig. 63 Installing Rear Clutch Retainer And Input Shaft Seal Rings

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then press input shaft into retainer (Fig. 65).

(4) Install input shaft retaining ring (Fig. 61).

(5) Install new seals on clutch piston. **Be sure lip of each seal faces interior of clutch retainer.**

(6) Lubricate lip of piston seals with liberal quantity of Mopar Door Ease, or with Ru-Glyde. Then lubricate retainer hub and bore with transmission fluid.

(7) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. **Do not attempt to push the piston straight in. This could fold the seals over causing leakage and clutch slip.**

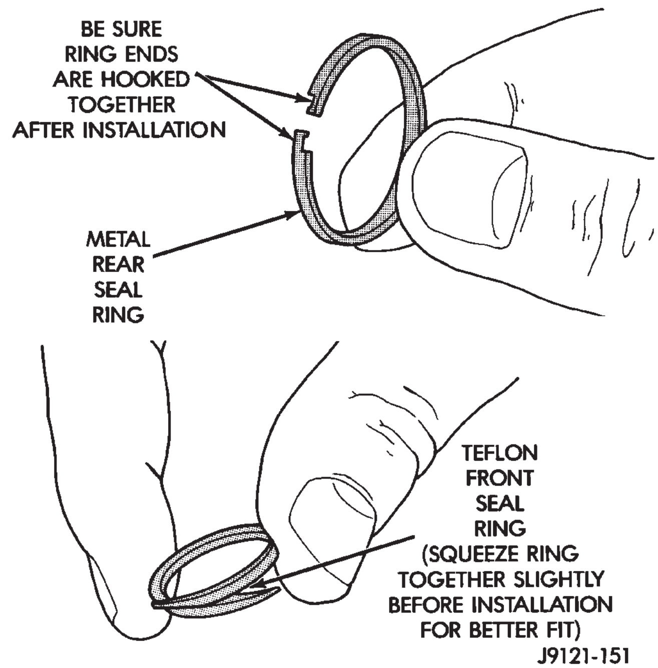


Fig. 64 Input Shaft Seal Ring Identification

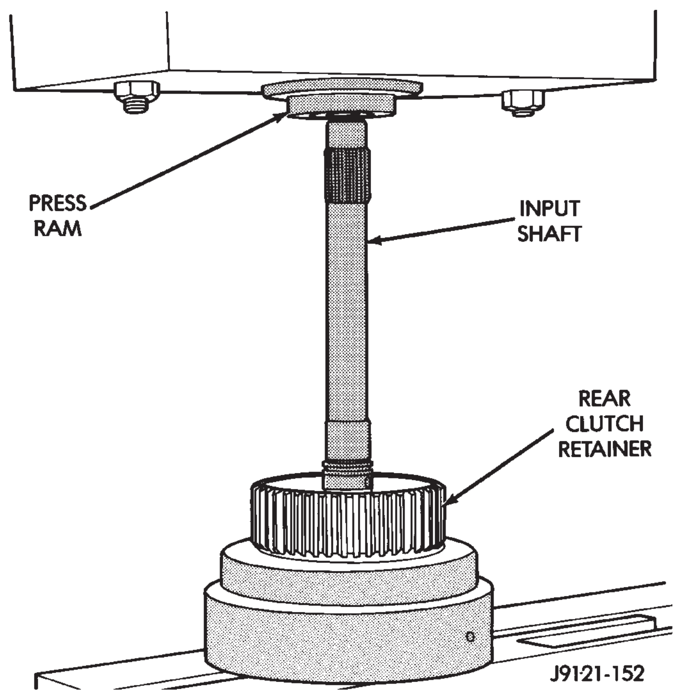


Fig. 65 Pressing Input Shaft Into Rear Clutch Retainer

(8) Install piston spring in retainer and on top of piston (Fig. 56). Concave side of spring faces up as shown.

(9) Install wave spring in retainer (Fig. 66). Be sure spring is completely seated in retainer groove.

(10) Install bottom pressure plate (Fig. 60). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

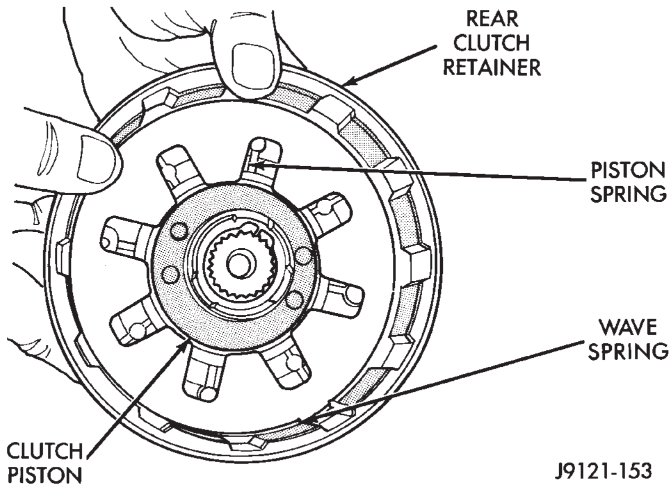


Fig. 66 Piston And Wave Spring Position

(11) Install first clutch disc in retainer on top of bottom pressure plate. Then install a clutch plate followed by a clutch disc until entire clutch pack is installed. Four clutch discs and three steel plates are required.

(12) Install top pressure plate (Fig. 60).

(13) Install selective snap ring (Fig. 60). Be sure snap ring is fully seated in retainer groove.

(14) Measure clutch pack clearance (Fig. 67). Clearance should be 0.64 to 1.14 mm (0.025 to 0.045 in.). If clearance is incorrect, adjust clearance with select fit snap ring.

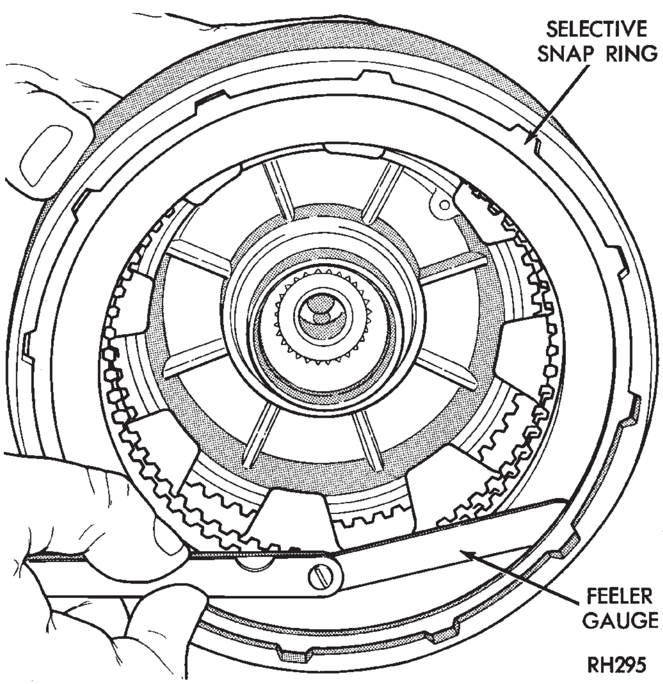


Fig. 67 Checking Rear Clutch Pack Clearance

(15) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 68). Use enough petroleum jelly to hold washer in place.

(16) Set rear clutch aside for installation during final assembly.

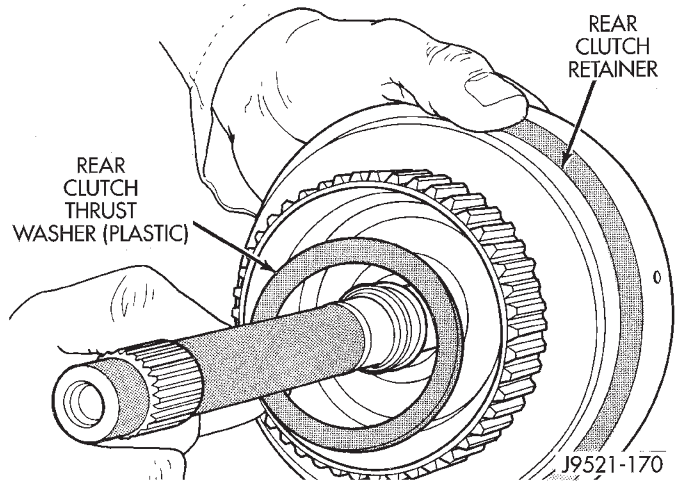


Fig. 68 Installing Rear Clutch Thrust Washer

PLANETARY GEAR TRAIN AND INTERMEDIATE SHAFT OVERHAUL

GEARTRAIN DISASSEMBLY (FIG. 69)

(1) Remove snap ring, tabbed thrust washer and thrust plate from front of output shaft.

(2) Remove front annulus gear and support assembly.

(3) Remove front planetary front thrust washer.

(4) Remove front planetary gear.

(5) Remove front planetary rear thrust washer.

(6) Remove sun gear and driving shell.

(7) Remove snap ring that retains sun gear in driving shell and remove sun gear and thrust plates. Note thrust plate position for assembly reference.

(8) Remove tabbed thrust washer from rear planetary gear.

(9) Remove rear planetary gear from rear annulus gear and remove annulus gear from intermediate shaft.

(10) Remove snap rings securing annulus gears to supports. Then separate each gear from support.

PLANETARY GEARTRAIN INSPECTION

Clean the planetary components in solvent and dry them with compressed air.

Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Inspect the geartrain spacers, thrust plates, snap rings, and thrust washers. Replace any part that is worn or damaged. Do not attempt to reuse these parts.

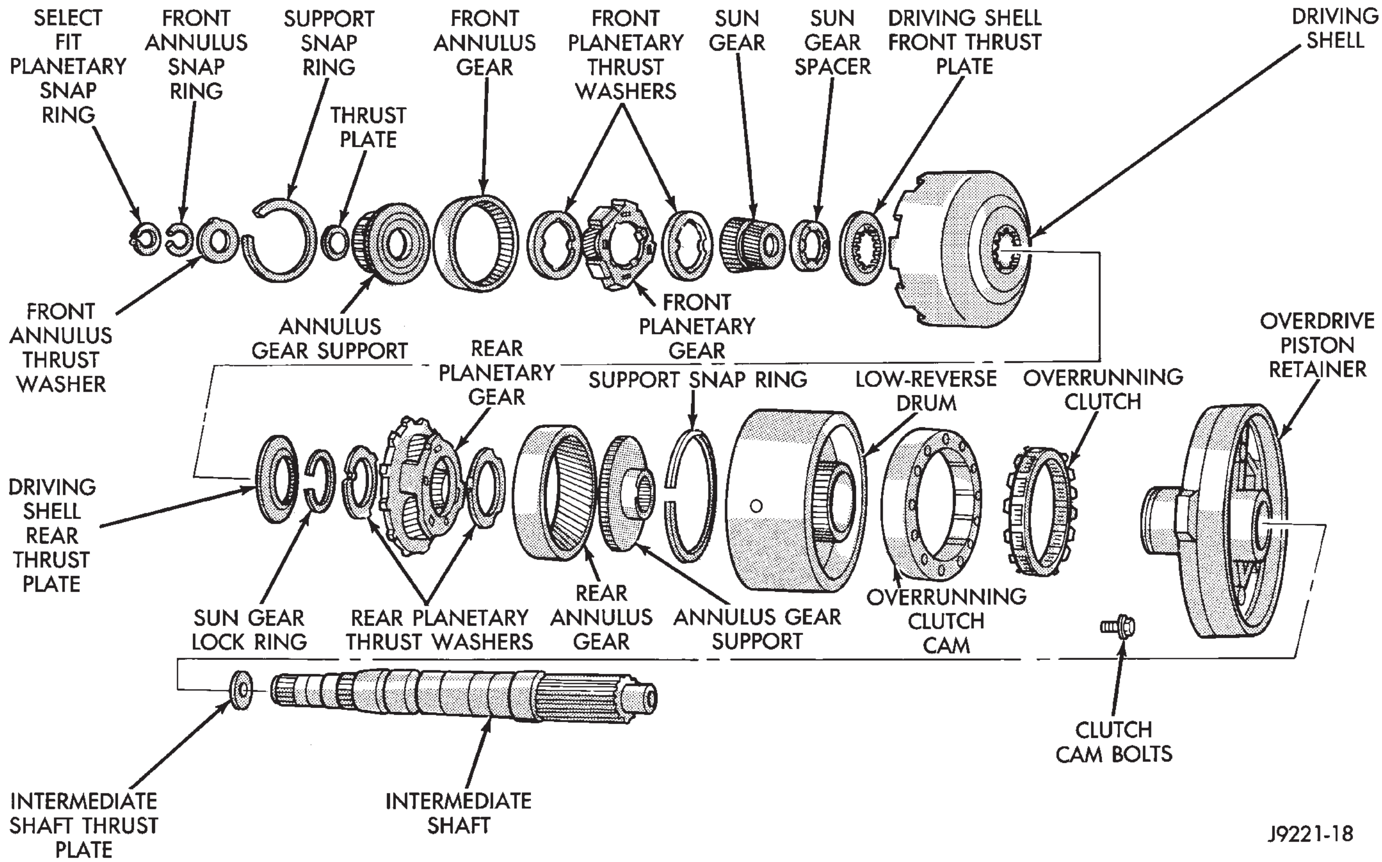


Fig. 69 Transmission Planetary Gear Train

Inspect the intermediate shaft carefully. Pay particular attention to the machined bushing/bearing surfaces on the shaft.

Replace the intermediate shaft if any machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location. Be sure the select spacer groove on the shaft is in good condition. Trial fit the spacer if necessary.

PLANETARY GEARTRAIN ASSEMBLY

(1) Lubricate intermediate shaft and planetary components with transmission fluid. Use petroleum jelly to lubricate and hold thrust washers and plates in position.

(2) Assemble rear annulus gear and support if disassembled. Be sure support snap ring is seated and that shoulder side of support faces rearward.

(3) Install rear thrust washer on rear planetary gear (Fig. 70). Use enough petroleum jelly to hold washer in place. Also be sure washer tabs are properly engaged in gear slots.

(4) Install rear annulus over and onto rear planetary gear (Fig. 70).

(5) Install assembled rear planetary and annulus gear on intermediate shaft (Fig. 71). Verify that assembly is fully seated on shaft.

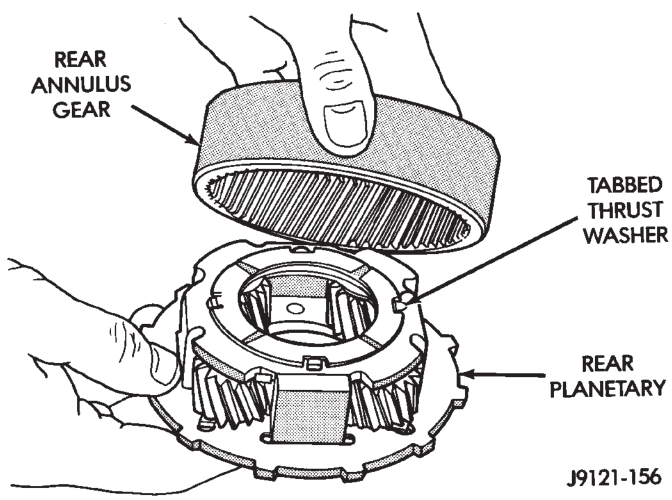


Fig. 70 Assembling Rear Annulus And Planetary Gear

(6) Install front thrust washer on rear planetary gear (Fig. 72). Use enough petroleum jelly to hold washer on gear.

(7) Install spacer on sun gear (Fig. 73).

(8) Install thrust plate over sun gear and on top of spacer (Fig. 74). Note that thrust plates are interchangeable. Use either plate on sun gear and rear of driving shell.

(9) Insert sun gear into driving shell (Fig. 75).

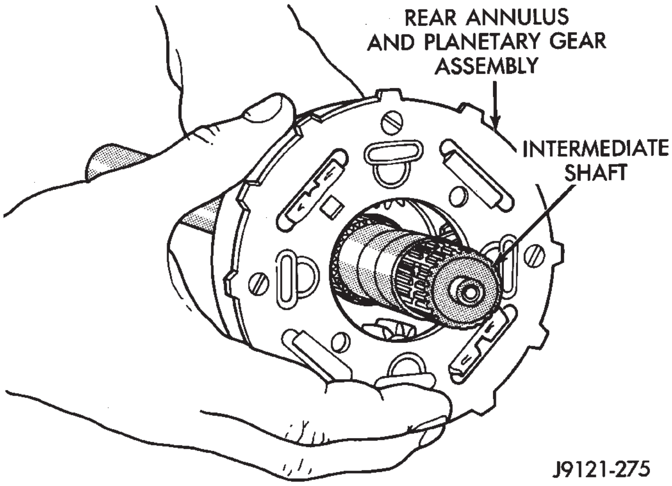


Fig. 71 Installing Assembled Rear Annulus And Planetary Gear On Intermediate Shaft

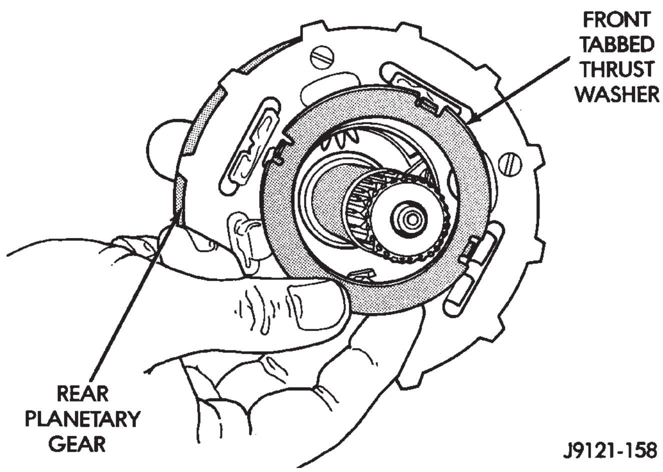


Fig. 72 Installing Rear Planetary Front Thrust Washer

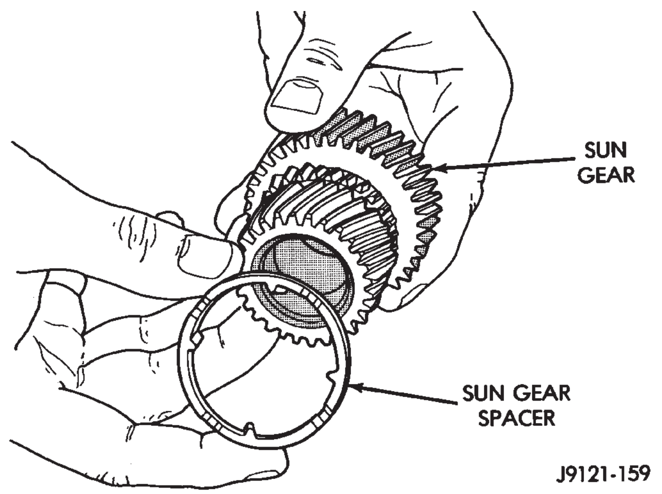


Fig. 73 Installing Sun Gear Spacer

(10) Hold sun gear in position and install rear thrust plate. Plate goes over sun gear at rear of driving shell (Fig. 75).

(11) Position wood block on bench and support sun gear on block (Fig. 76). This makes it easier to align and install sun gear lock ring. Keep wood block handy as it will also be used for geartrain end play check.

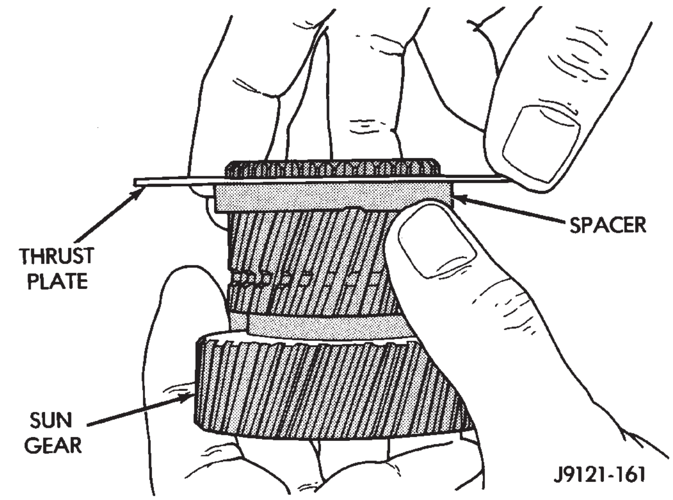


Fig. 74 Installing Spacer And Thrust Plate On Sun Gear

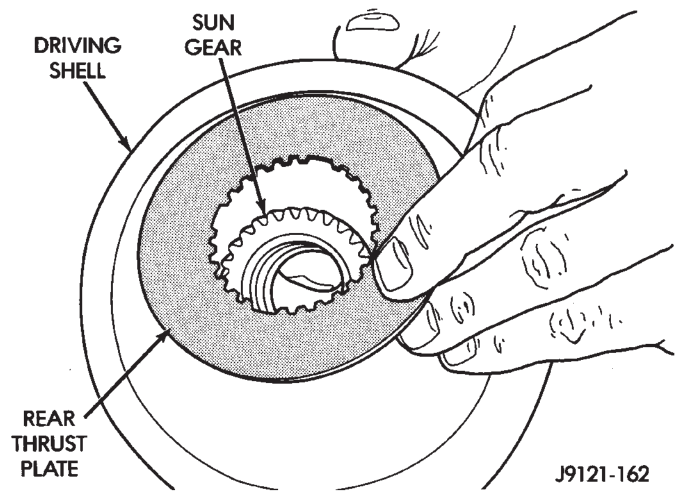


Fig. 75 Installing Sun Gear And Rear Thrust Plate In Driving Shell

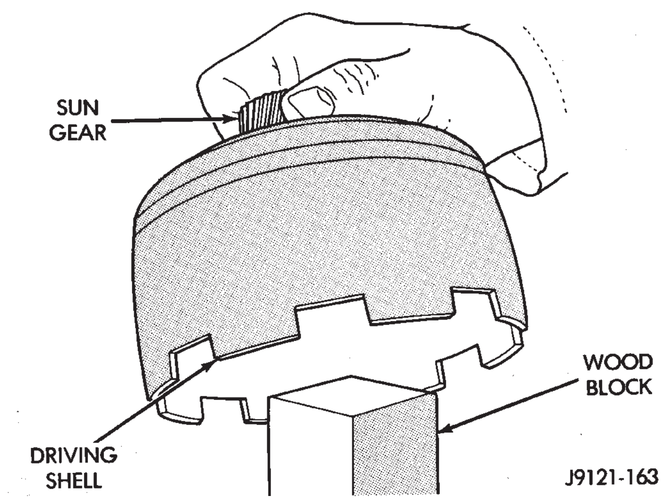


Fig. 76 Supporting Sun Gear On Wood Block

(12) Align rear thrust plate on driving shell and install sun gear lock ring. Be sure ring is fully seated in sun gear ring groove (Fig. 77).

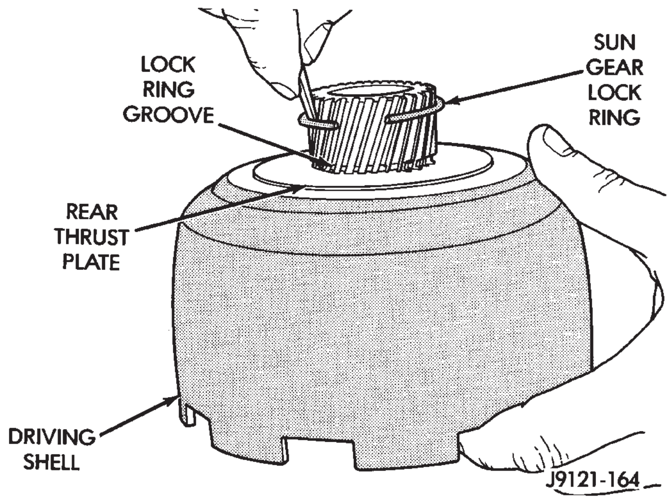


Fig. 77 Installing Sun Gear Lock Ring

(13) Install assembled driving shell and sun gear on intermediate shaft (Fig. 78).

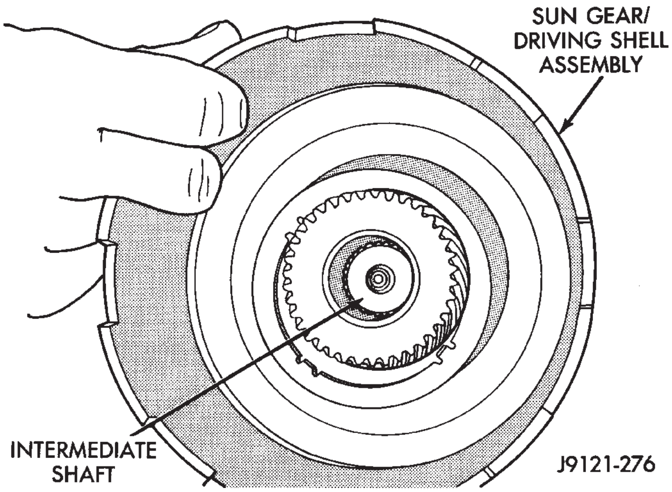


Fig. 78 Installing Assembled Sun Gear And Driving Shell On Intermediate Shaft

(14) Install rear thrust washer on front planetary gear (Fig. 79). Use enough petroleum jelly to hold washer on gear and be sure washer tabs are all properly seated.

(15) Assemble front annulus gear and support if necessary.

(16) Position thrust plate on front annulus gear support (Fig. 80). Use liberal quantity of petroleum jelly to hold plate in place.

(17) Install front planetary gear on intermediate shaft and in driving shell (Fig. 81).

(18) Install front thrust washer on front planetary gear (Fig. 81). Use enough petroleum jelly to hold washer in place on gear and be sure washer tabs are seated.

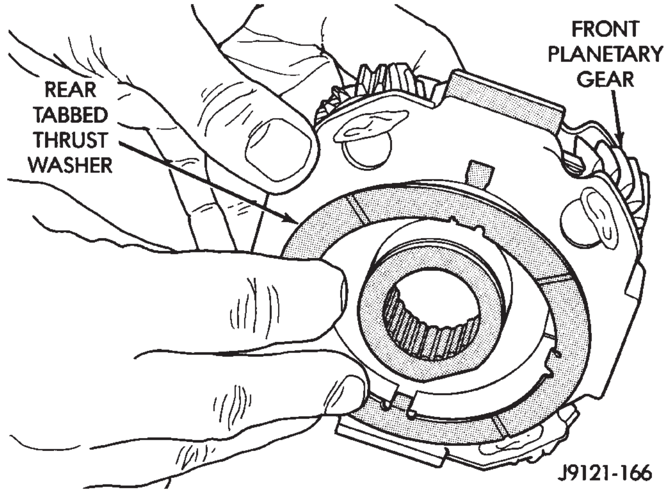


Fig. 79 Installing Rear Thrust Washer On Front Planetary Gear

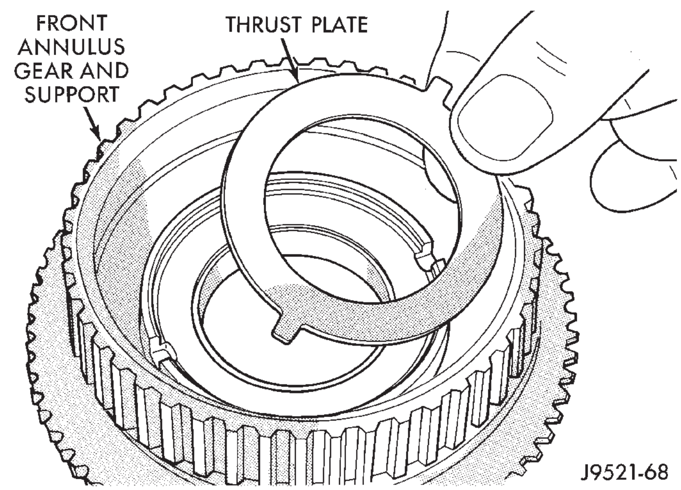


Fig. 80 Installing Thrust Plate On Front Annulus Support

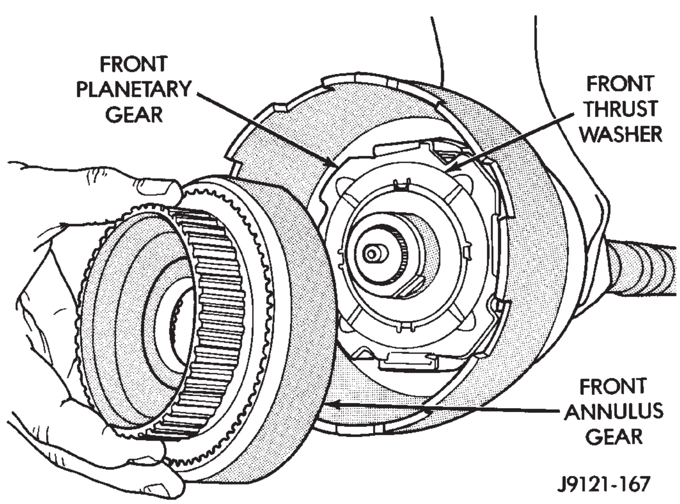


Fig. 81 Installing Front Planetary And Annulus Gears

(19) Assemble front annulus gear and support. Be sure support snap ring is seated.

(20) Install front annulus thrust washer (Fig. 82). Align flat on washer with flat on planetary hub. Also be sure washer tab is facing forward.

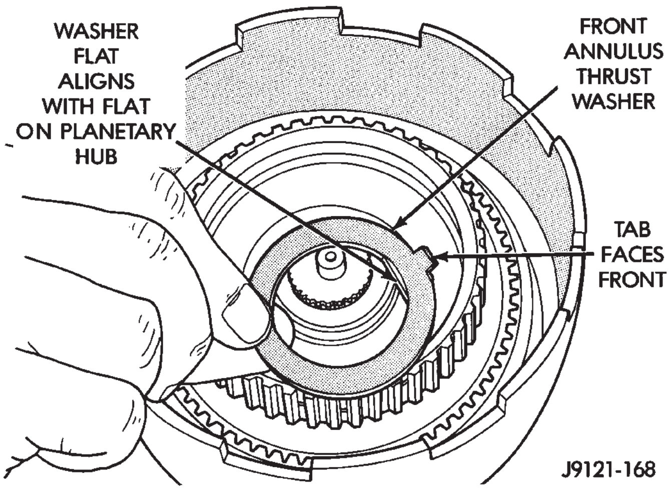


Fig. 82 Installing Front Annulus Thrust Washer

(21) Install front annulus snap ring (Fig. 83). Use snap ring pliers to avoid distorting ring during installation. Also be sure ring is fully seated.

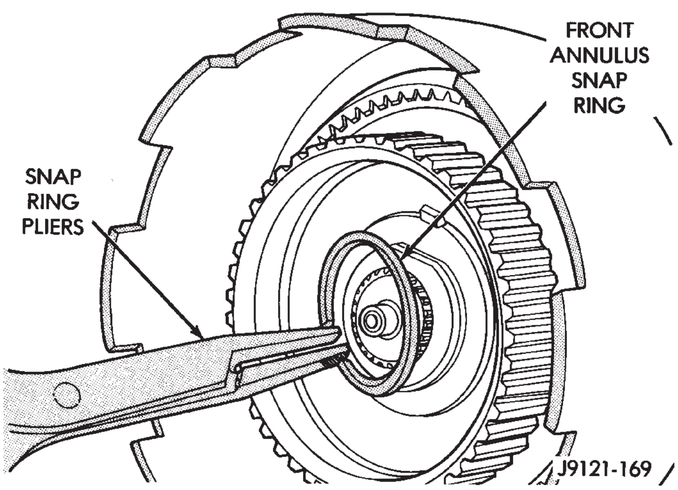


Fig. 83 Installing Front Annulus Snap Ring

(22) Install planetary selective snap ring with snap ring pliers (Fig. 84). Be sure ring is fully seated.

(23) Turn planetary geartrain assembly over so driving shell is facing workbench. Then support geartrain on wood block positioned under forward end of output shaft. This is necessary so geartrain components will move forward for accurate end play check.

(24) Check planetary geartrain end play with feeler gauge (Fig. 85). Gauge goes between shoulder on intermediate shaft and end of rear annulus support.

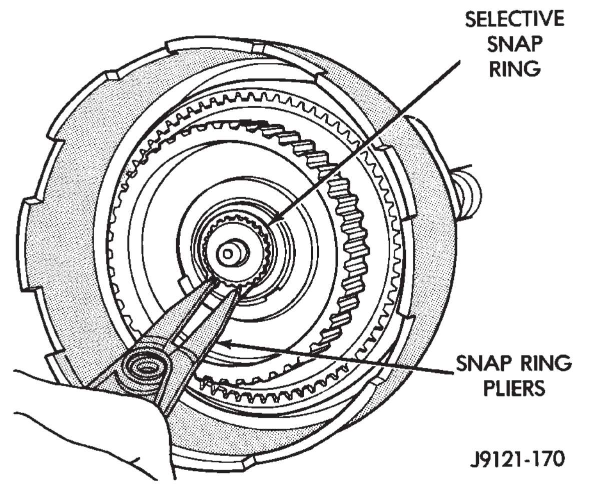


Fig. 84 Installing Planetary Selective Snap Ring

(25) Geartrain end play should be 0.12 to 1.22 mm (0.005 to 0.048 in.). If end play is incorrect, snap ring (or thrust washers) may have to be replaced. Snap ring is available in three different thicknesses for adjustment purposes.

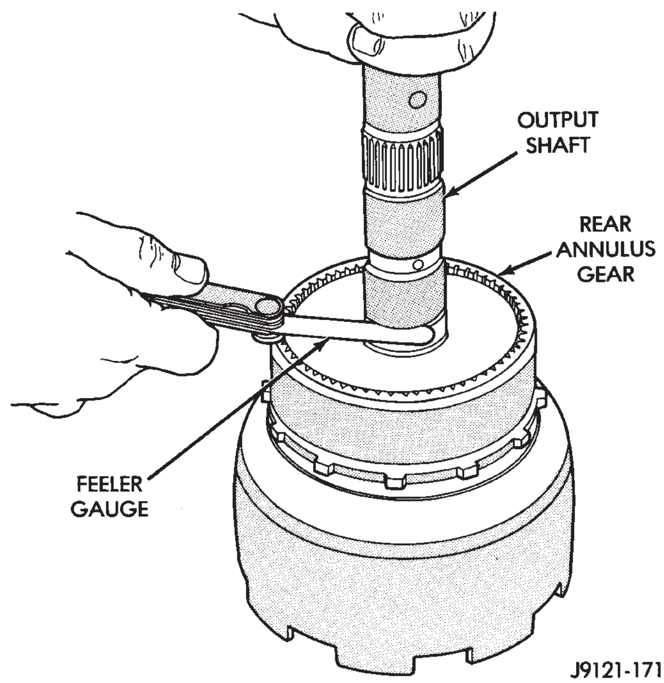


Fig. 85 Checking Planetary Geartrain End Play

FRONT SERVO AND BAND OVERHAUL

FRONT SERVO DISASSEMBLY (FIG. 86)

(1) Remove small snap ring from servo piston.

(2) Remove piston, rod, springs and guide.

(3) Remove and discard servo piston rings and O-ring.

FRONT BAND AND SERVO INSPECTION

Clean the servo components with solvent and dry them with compressed air.

Inspect the servo components. Replace the springs if collapsed, distorted or broken. Replace the guide, rod and piston if cracked, bent, or worn. Discard the servo snap ring if distorted or warped.

Replace the front band if distorted, the lining is burned or flaking off, or excessively worn.

Check the servo piston bore for wear. Replace the piston and rod as an assembly if either part is worn or damaged.

Replace any servo component if doubt exists about its condition. Do not reuse suspect parts.

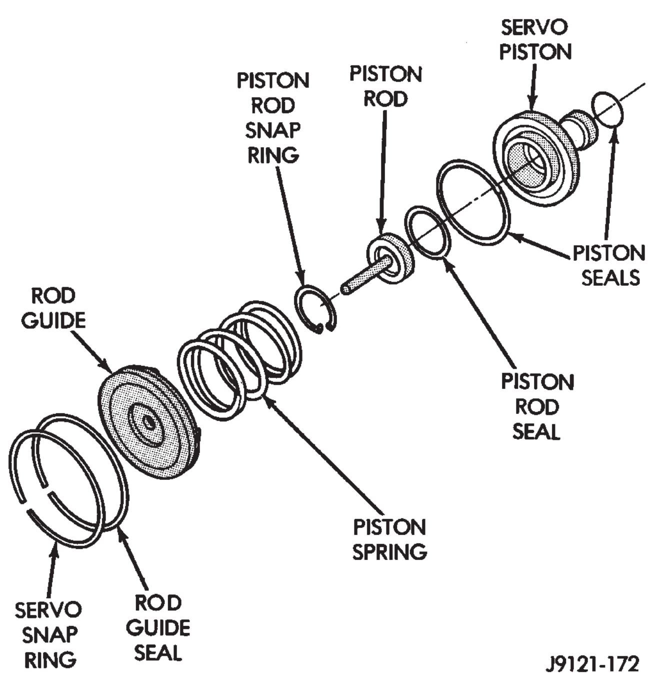


Fig. 86 Front Servo Components

ASSEMBLING FRONT SERVO PISTON

(1) Lubricate seal rings and O-rings with petroleum jelly. Lubricate other servo parts with transmission fluid.

(2) Install new O-ring on servo piston rod.

(3) Install new seal on piston rod guide and install new seal rings on piston.

(4) Assemble rod, piston, servo springs and snap ring (Fig. 86).

REAR SERVO AND BAND OVERHAUL

REAR SERVO PISTON DISASSEMBLY

(1) Remove seal from servo piston. Note which way seal lip faces for assembly reference.

(2) Compress cushion spring in vise only enough to allow piston plug snap ring removal (Fig. 87). Use wood block between vise jaws and end of piston plug to keep plug aligned and in position.

(3) Remove snap ring from end of piston plug (Fig. 87).

(4) Open vise and remove wood block, piston plug, cushion spring and servo piston.

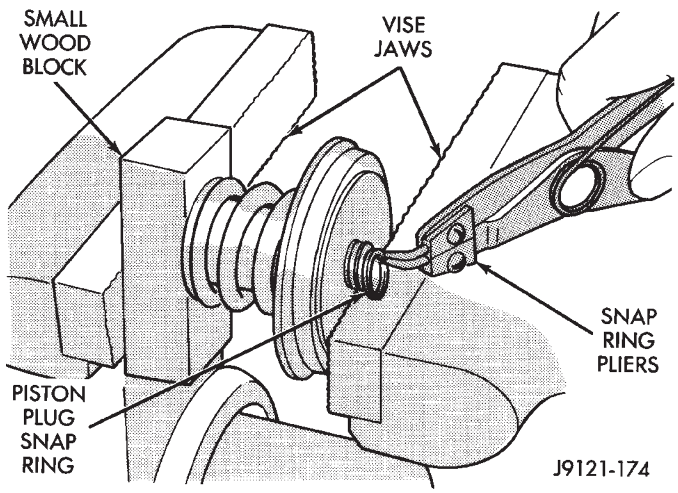


Fig. 87 Removing/Installing Servo Piston Plug Snap Ring

REAR SERVO INSPECTION

Clean the servo components (Fig. 88) with solvent and dry them with compressed air.

Check rear band condition. Replace the band if distorted, the lining is burned or flaking off, or the lining is excessively worn. Check the band pivot and reaction pins. Minor pin scoring can be cleaned up with crocus cloth. However, replace the pins if worn, severely scored, or cracked. Replace the pin O-rings.

Inspect the servo components. Replace the servo and cushion springs if collapsed, distorted or broken. Replace the plug or piston if cracked, bent, or worn. Discard the servo snap ring and spring retainer if distorted or warped.

If doubt exists about the condition of any servo component, replace it. Do not reuse suspect parts.

ASSEMBLING REAR SERVO PISTON

(1) Assemble piston plug, cushion spring and piston (Fig. 88).

(2) Compress cushion spring in vise and install piston plug snap ring (Fig. 87).

(3) Install new seal on piston. Be sure seal lip is toward servo bore (Fig. 89).

(4) Lubricate piston seal with petroleum jelly. Lubricate other servo parts with transmission fluid.

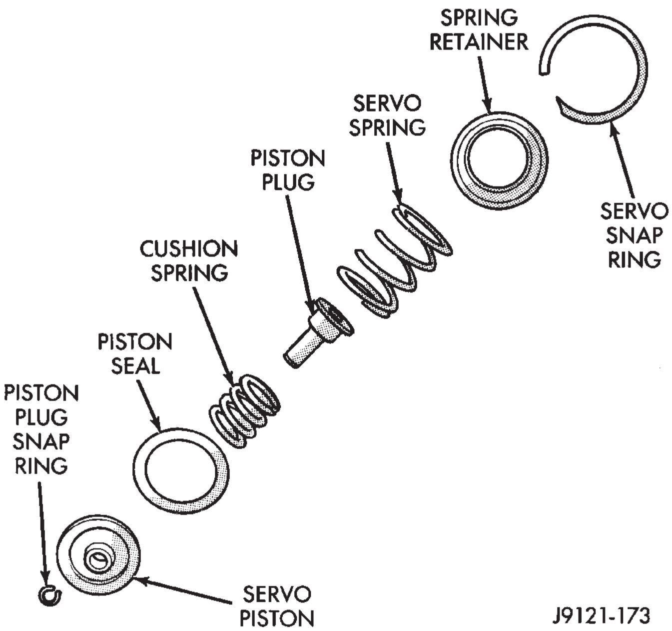


Fig. 88 Rear Servo Components

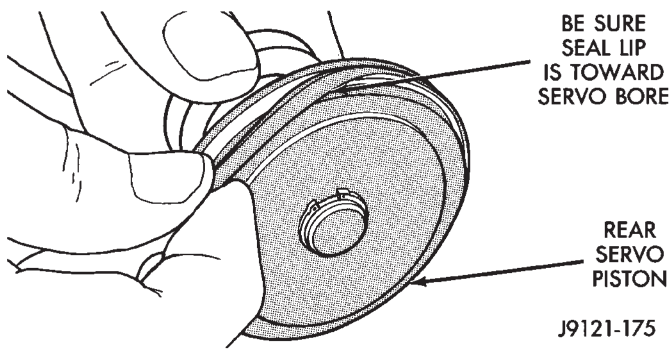


Fig. 89 Installing Rear Servo Piston Seal

VALVE BODY SERVICE AND ADJUSTMENT

VALVE BODY MAIN COMPONENT DISASSEMBLY

CAUTION: Do not clamp any valve body component in a vise. This practice can damage the component resulting in unsatisfactory operation after assembly and installation. Do not use pliers to remove any of the valves, plugs or springs and do not force any of the components out or into place. The valves and valve body housings will be damaged if force is used. Tag or mark the valve body springs for reference as they are removed. Do not allow them to become intermixed.

(1) Disconnect wires from governor pressure sensor and solenoid (Fig. 90).

(2) Remove screws attaching governor body and retainer plate to transfer plate (Fig. 91).

(3) Remove retainer plate, governor body and gasket from transfer plate (Fig. 92).

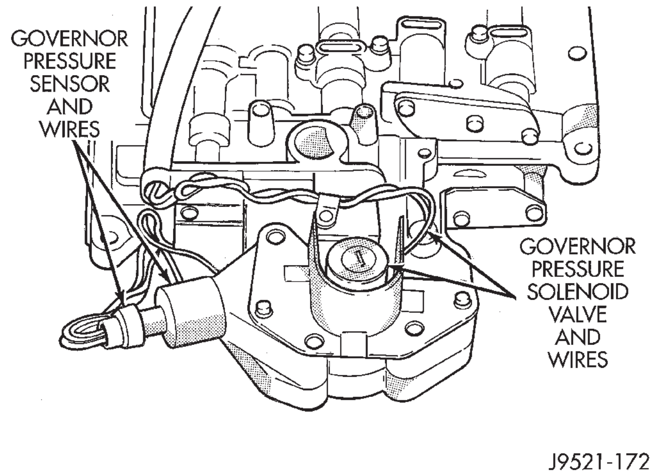


Fig. 90 Governor Pressure Solenoid And Sensor Wire Locations

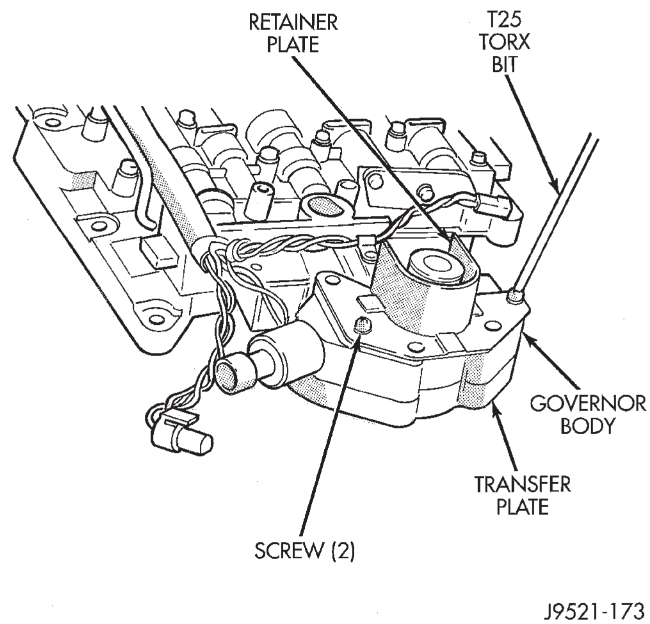


Fig. 91 Governor Body And Retainer Plate Attaching Screw Removal/Installation

(4) Disconnect wires from governor pressure sensor, if not done previously (Fig. 93).

(5) Remove governor pressure sensor from governor body. Sensor is retained in body with M-shaped spring clip (Fig. 93). Remove clip with small pointed tool and slide sensor out of body.

(6) Remove governor pressure solenoid by pulling it straight out of bore in governor body (Fig. 94). Remove and discard solenoid O-rings if worn, cut, or torn.

(7) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 95). **Retain**

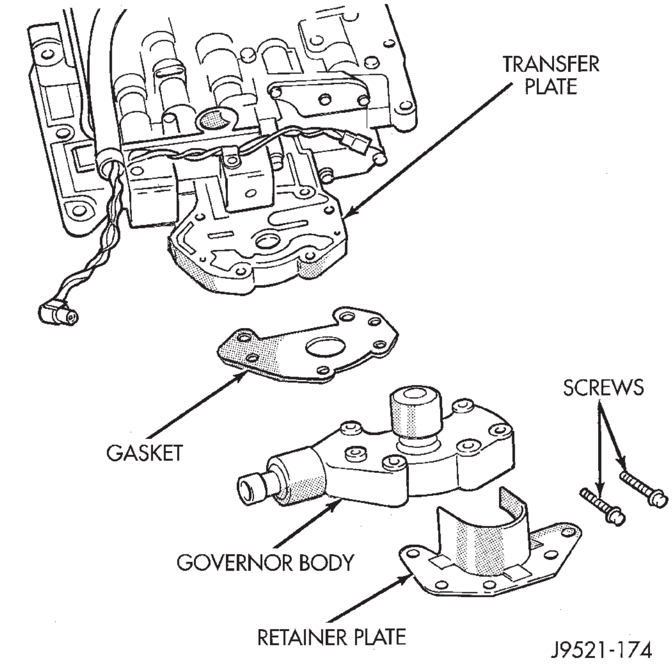


Fig. 92 Governor Body, Retainer Plate And Gasket Removal

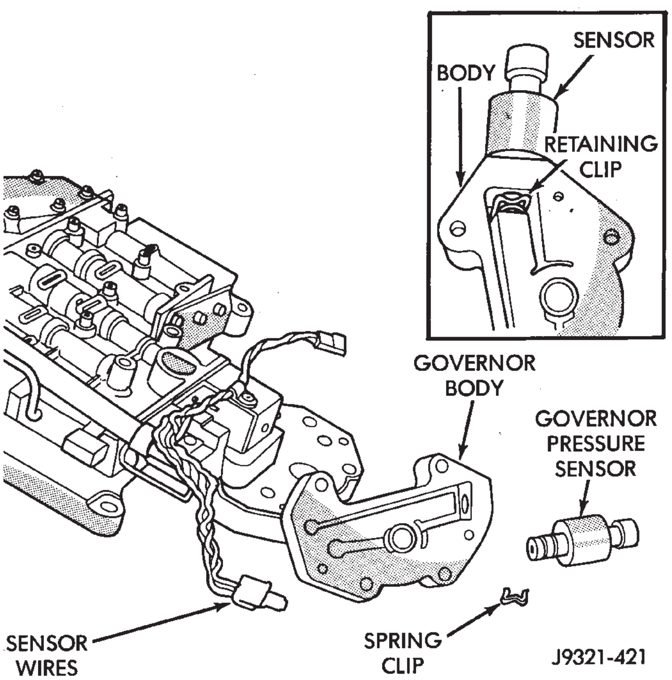


Fig. 93 Governor Pressure Sensor Removal

shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.

(8) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 96).

(9) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 97).

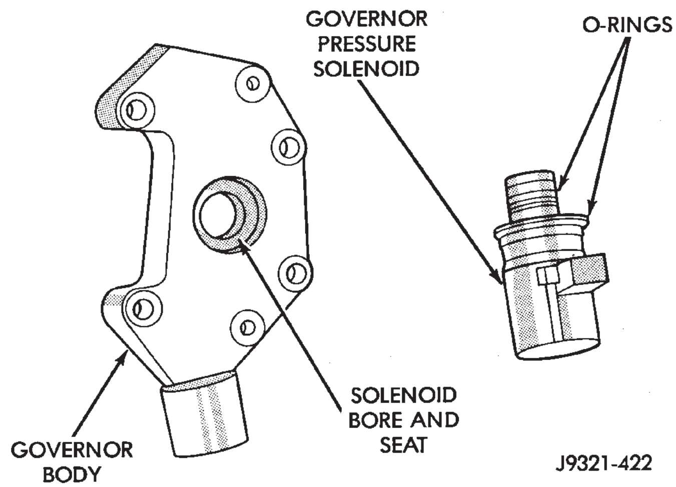


Fig. 94 Governor Pressure Solenoid Removal

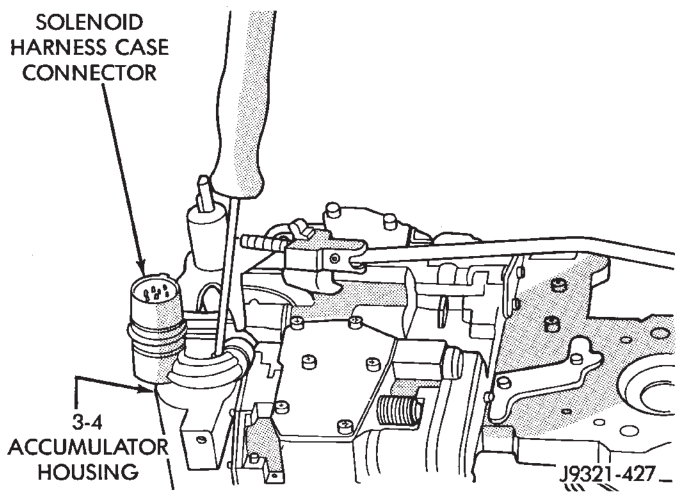


Fig. 95 Removing/Installing Solenoid Harness Case Connector Shoulder Bolt

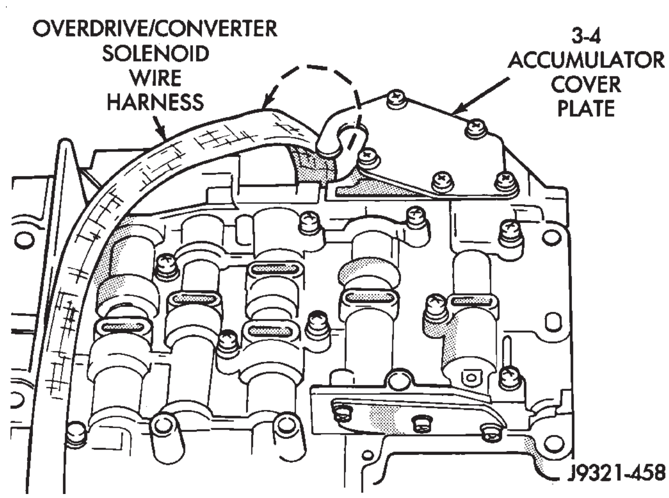


Fig. 96 Unhooking Solenoid Harness From Accumulator Cover Plate

(10) Remove solenoid and harness assembly from valve body (Fig. 98).

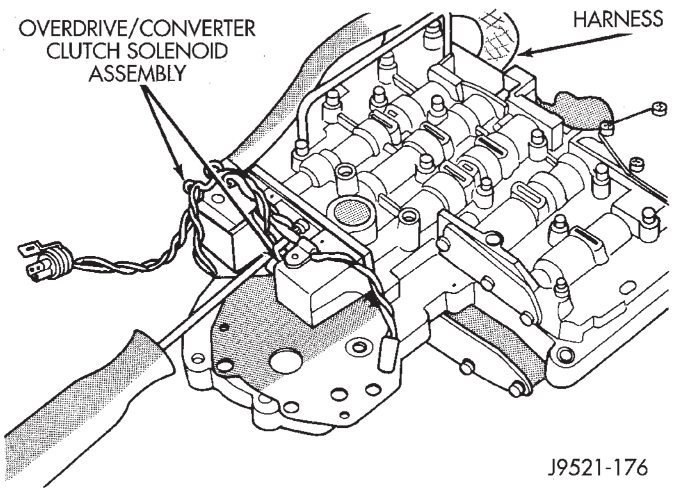


Fig. 97 Removing Solenoid Assembly Screws

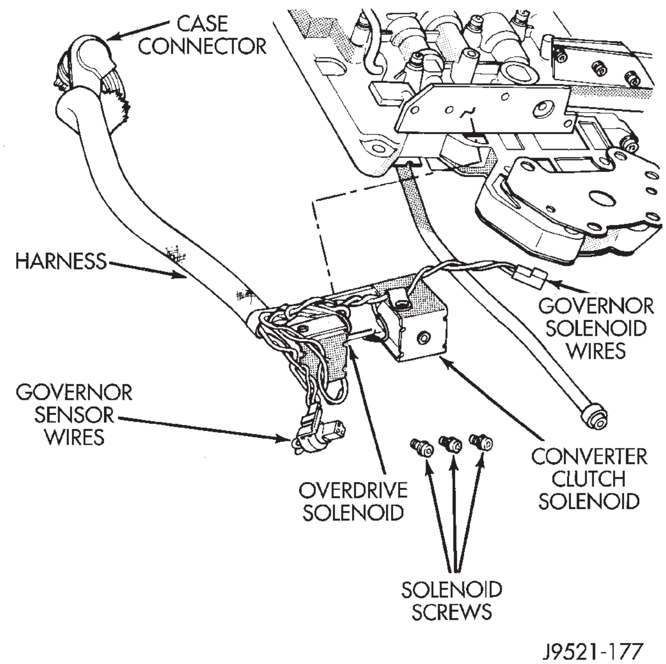


Fig. 98 Solenoid Assembly Removal

(11) Remove boost valve cover (Fig. 99).

(12) Remove boost valve retainer, valve spring and boost valve (Fig. 100).

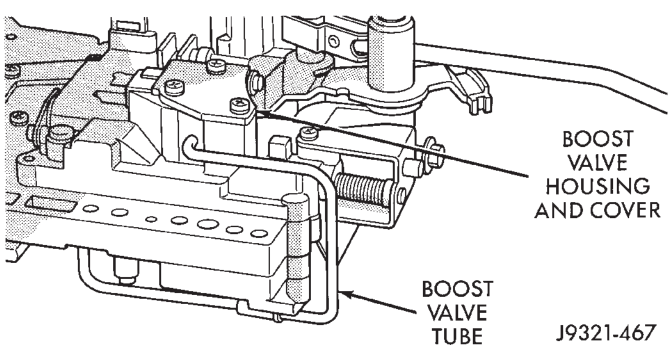


Fig. 99 Boost Valve Cover Location

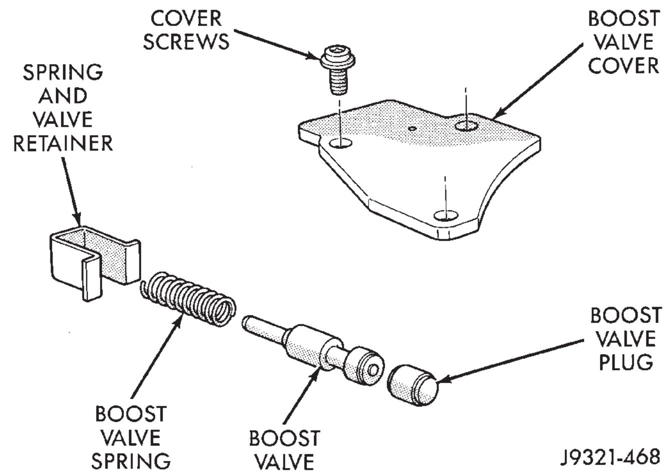


Fig. 100 Boost Valve Components

(13) Secure detent ball and spring with Retainer Tool 6583 (Fig. 101).

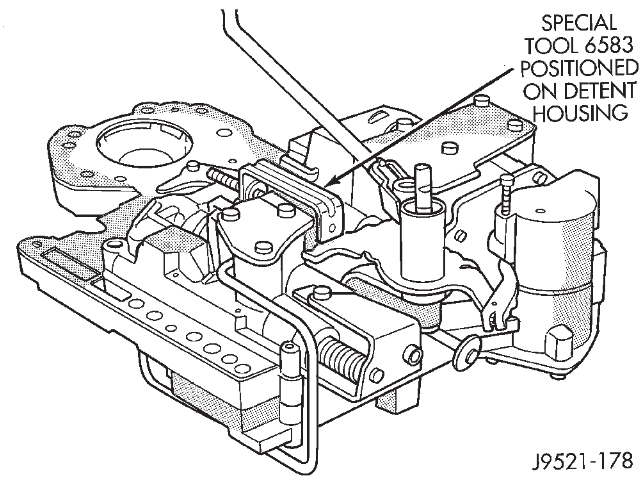


Fig. 101 Securing Detent Ball And Spring

(14) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 102).

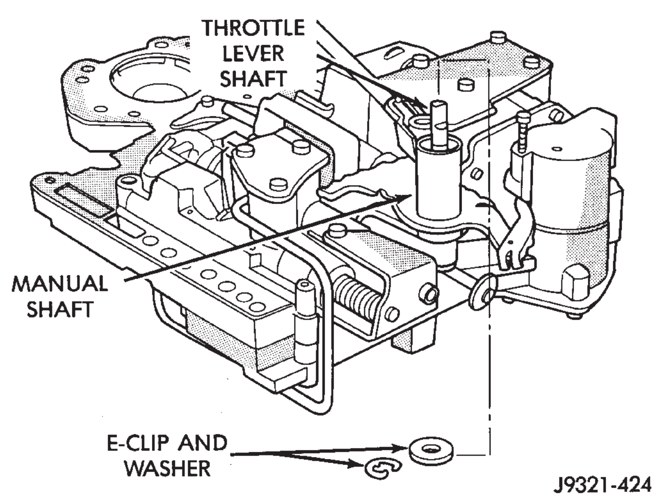


Fig. 102 Throttle Lever E-Clip And Washer Removal

(15) Remove manual lever and throttle lever (Fig. 103). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.

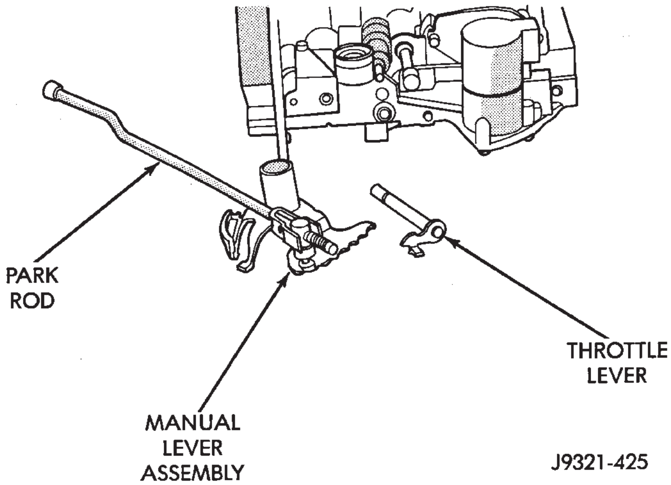


Fig. 103 Manual And Throttle Lever Removal

(16) Position pencil magnet next to detent housing to catch detent ball and spring. Then carefully remove Retainer Tool 6583 and remove detent ball and spring (Fig. 104).

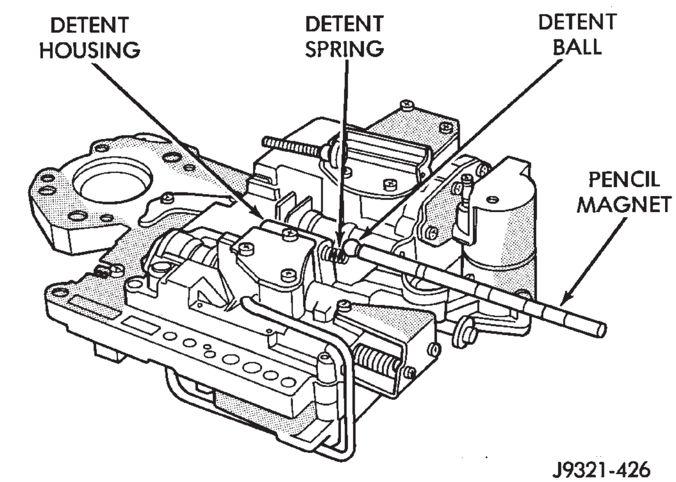


Fig. 104 Detent Ball And Spring Removal

(17) Remove park rod E-clip and separate rod from manual lever (Fig. 105).

(18) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 106). Hold bracket firmly against spring tension while removing last screw.

(19) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 107). **Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.**

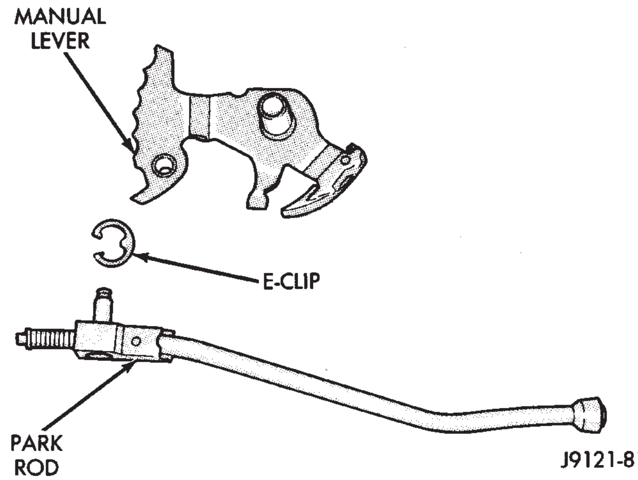


Fig. 105 Park Rod Removal

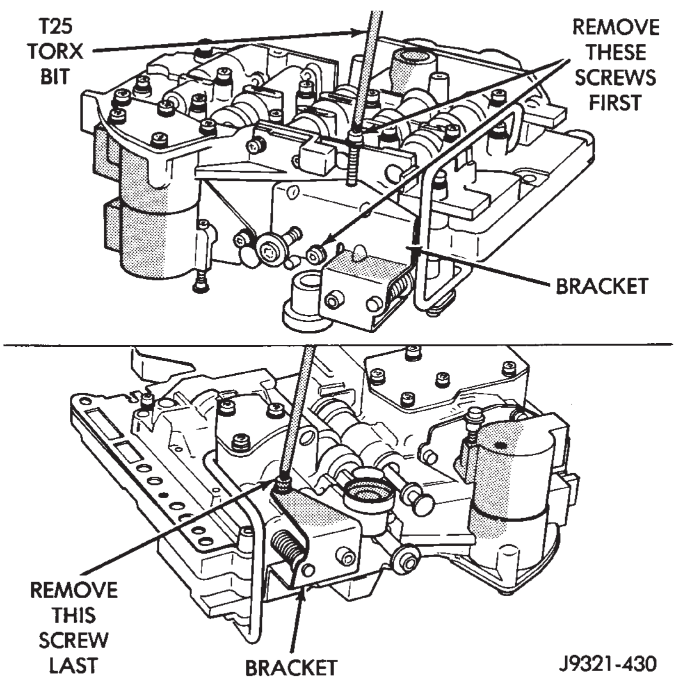


Fig. 106 Adjusting Screw Bracket Fastener Removal/Installation

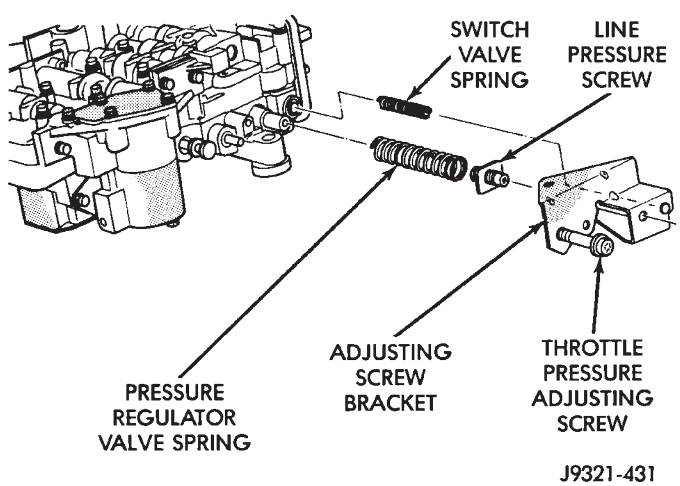


Fig. 107 Adjusting Screw Bracket And Spring Removal

(20) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 108).

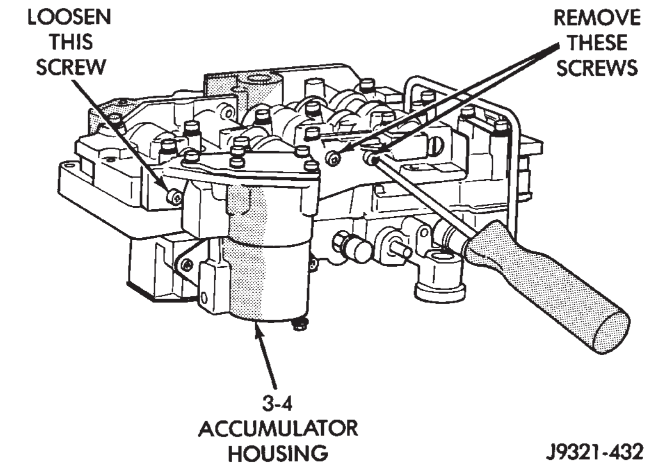


Fig. 108 Accumulator Housing Screw Locations

(21) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter clutch valve plug and spring (Fig. 109).

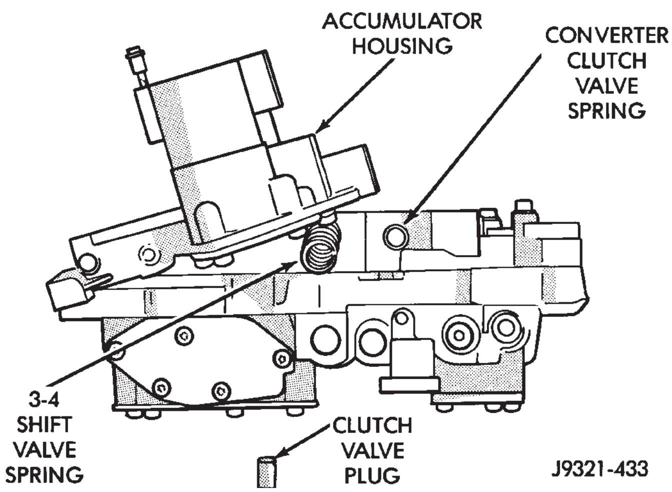


Fig. 109 Removing 3-4 Shift And Converter Clutch Valve Springs And Plug

(22) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 110).

(23) Remove pressure regulator valve spring from lower housing (Fig. 111).

(24) Bend back tabs on boost valve tube brace (Fig. 112).

(25) Remove boost valve connecting tube (Fig. 113). Disengage tube from upper housing port first. Then rock opposite end of tube back and forth to work it out of lower housing.

CAUTION: Do not use tools to loosen or pry the connecting tube out of the valve body housings. Loosen and remove the tube by hand only.

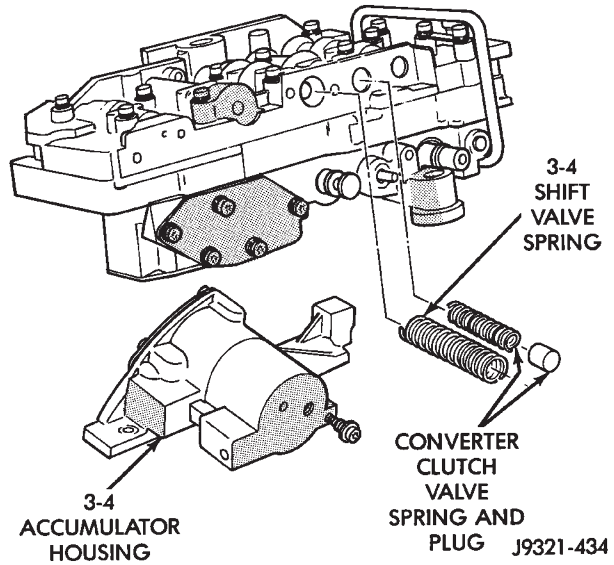


Fig. 110 3-4 Accumulator Housing, Valve Springs And Plug Removal

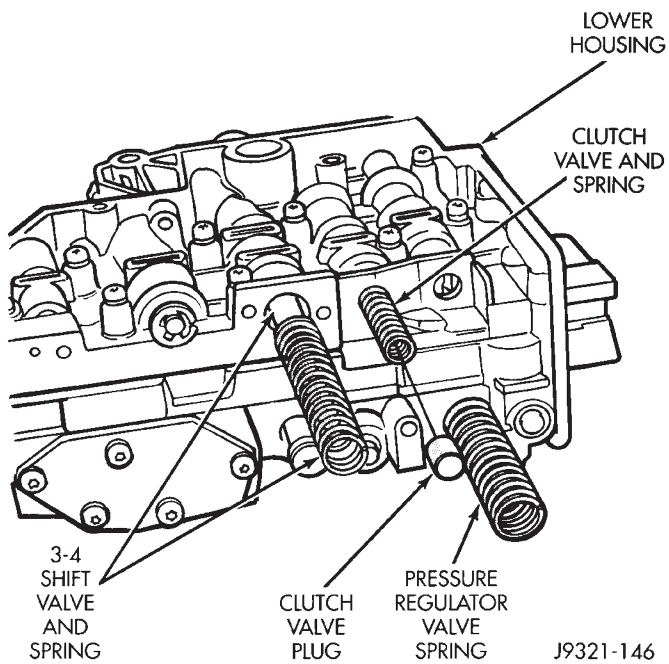


Fig. 111 Lower Housing Valve Spring Locations

(26) Turn valve body over so lower housing is facing upward (Fig. 114). In this position, the two check balls in upper housing will remain in place and not fall out when lower housing and separator plate are removed.

(27) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 114). **Note position of boost valve tube brace for assembly reference.**

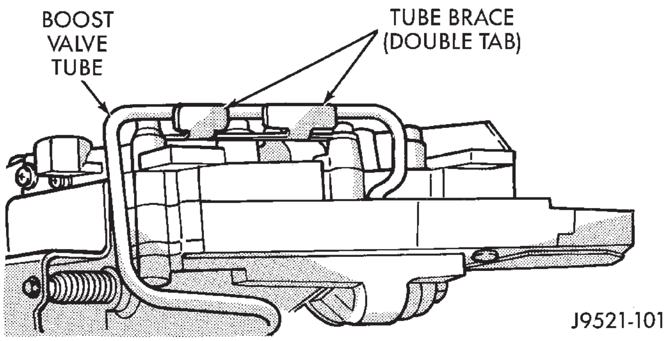


Fig. 112 Boost Valve Tube Brace (Double Tab Style)

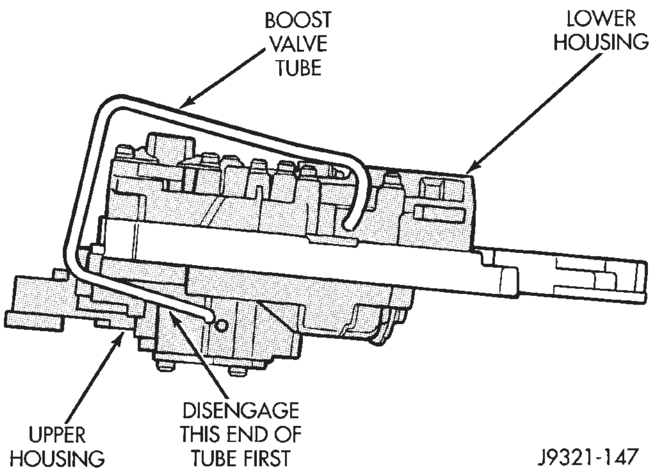


Fig. 113 Boost Valve Tube Removal

(28) Remove lower housing and overdrive separator plate from transfer plate (Fig. 114).

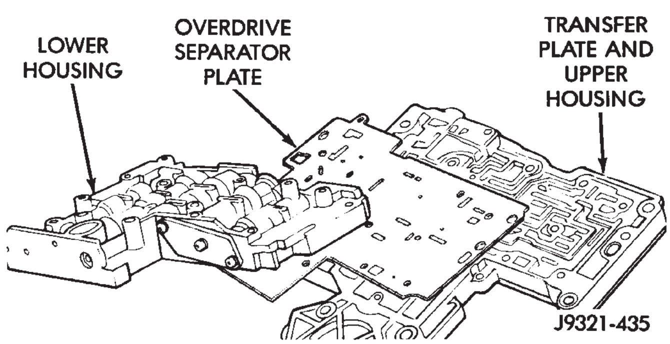


Fig. 114 Lower Housing Removal

(29) Remove transfer plate from upper housing (Fig. 115).

(30) Turn transfer plate over so upper housing separator plate is facing upward (Fig. 116).

(31) Remove brace plate from lower housing separator plate and transfer plate (Fig. 116).

(32) Remove upper housing separator plate from transfer plate (Fig. 117). Note position of filter in separator plate for assembly reference.

(33) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 118). **Check balls will be steel on some early production models and plastic on later production models.**

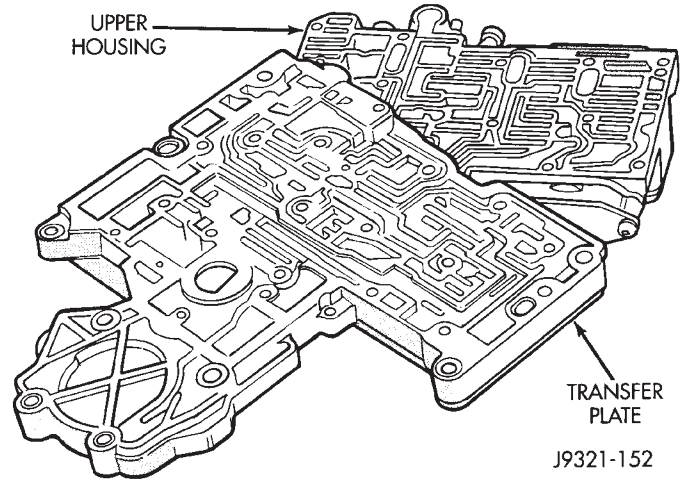


Fig. 115 Removing Transfer Plate From Upper Housing

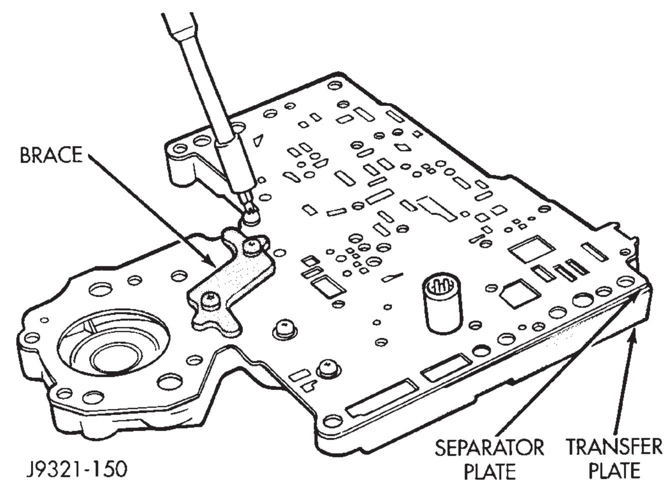


Fig. 116 Brace Plate Removal

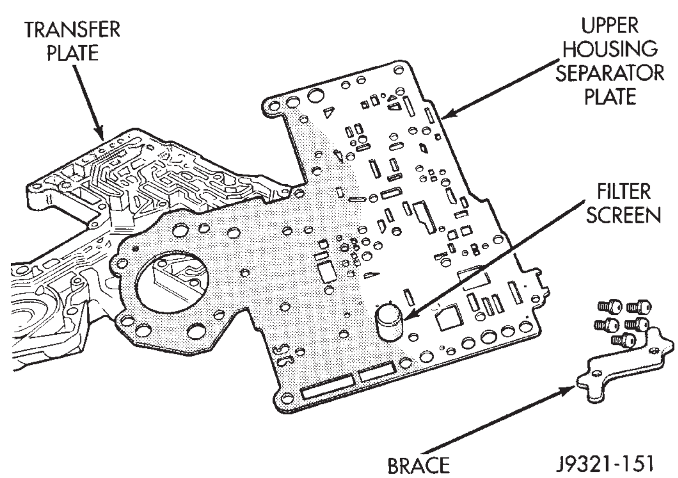


Fig. 117 Upper Housing Separator Plate Removal

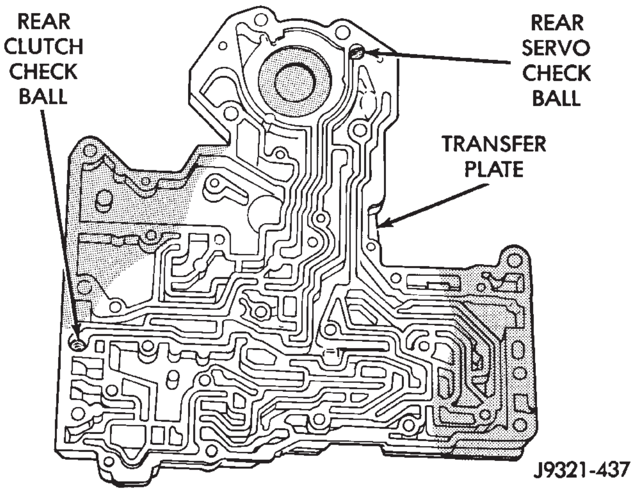


Fig. 118 Rear Clutch And Rear Servo Check Ball Locations

VALVE BODY UPPER HOUSING DISASSEMBLY

(1) Note location of check balls in valve body upper housing (Fig. 119). Then remove the one large diameter and the six smaller diameter check balls. **Check balls will be steel on some early production models and plastic on later production models.**

(2) Remove E-clip that secure shuttle valve secondary spring on valve stem (Fig. 120).

(3) Remove governor plug and shuttle valve covers (Fig. 121).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 121).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 122).

(7) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 122).

(8) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 122). Also remove shuttle valve primary spring if not removed in prior step.

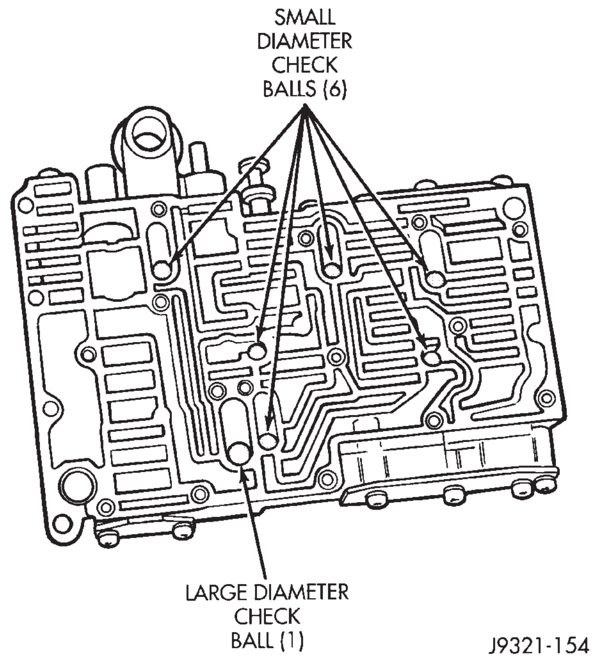


Fig. 119 Check Ball Locations In Upper Housing

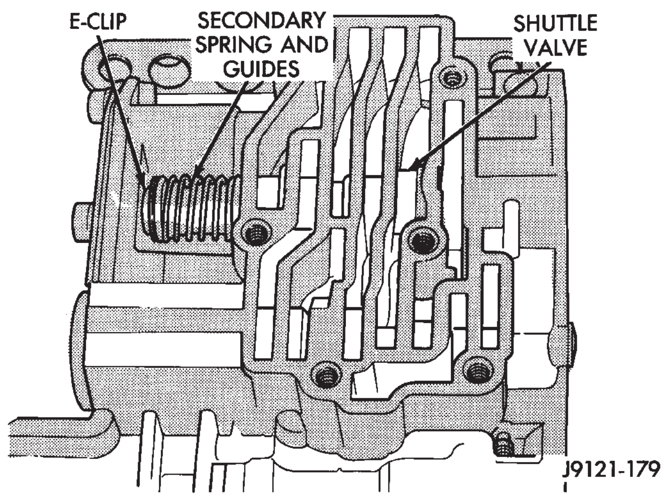


Fig. 120 Shuttle Valve E-Clip And Secondary Spring Location

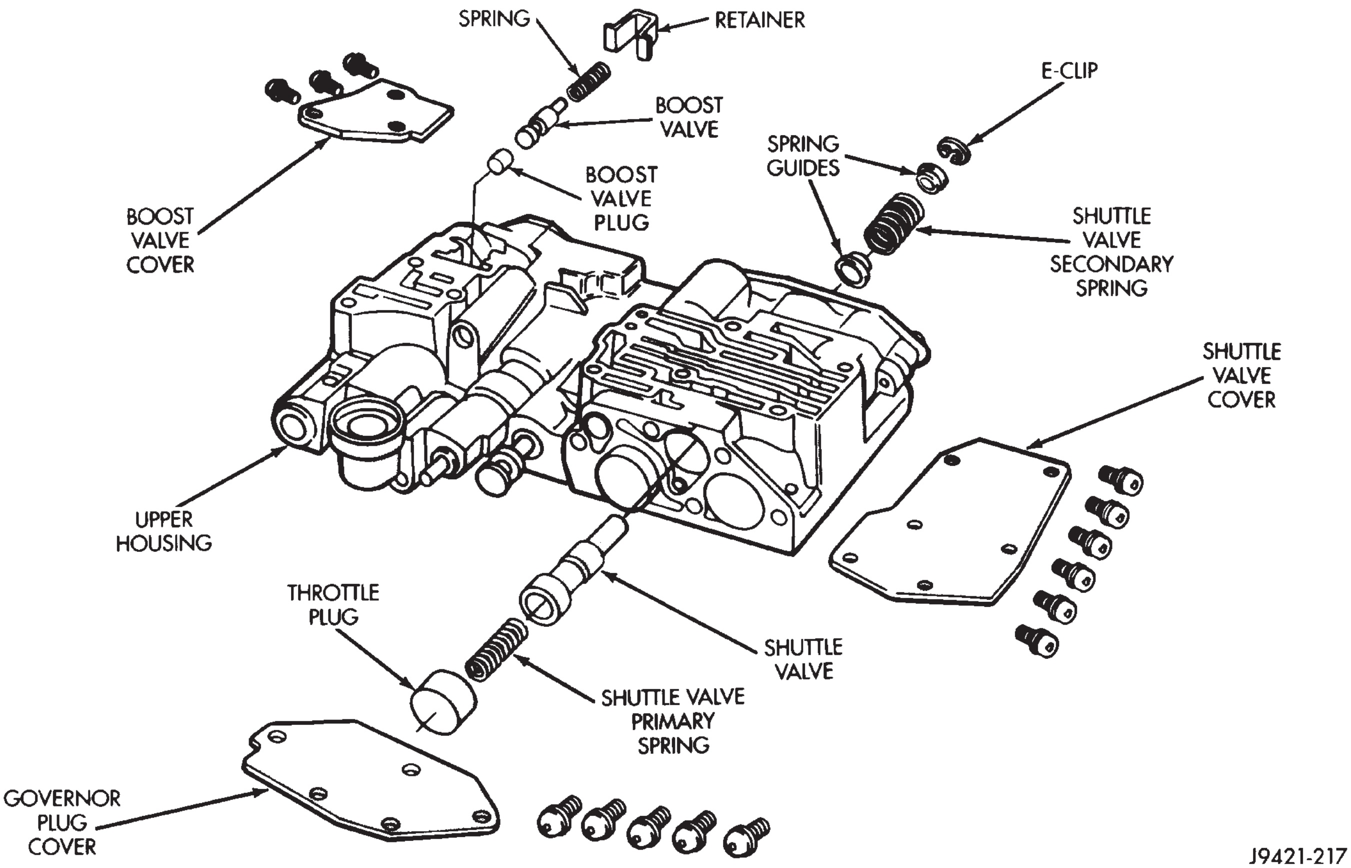


Fig. 121 Shuttle And Boost Valve Components

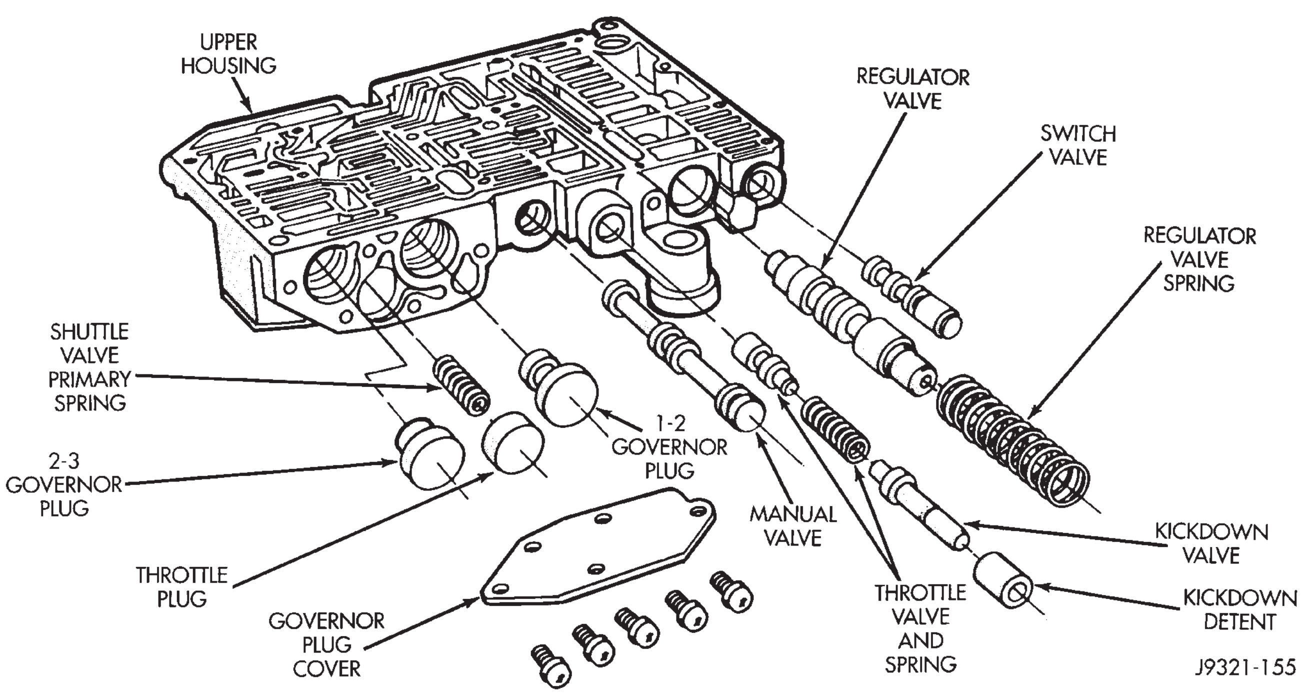


Fig. 122 Upper Housing Control Valve Locations

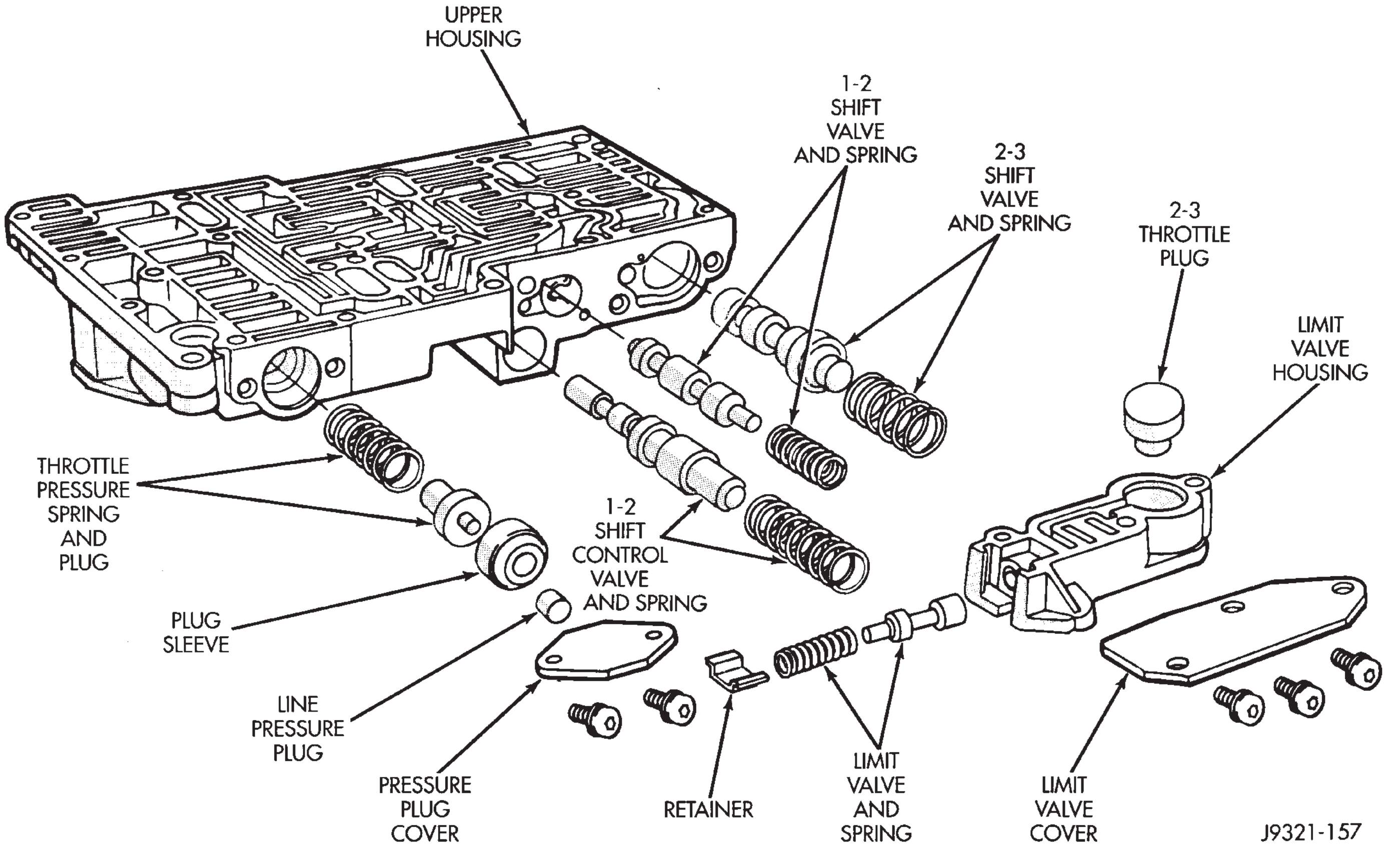


Fig. 123 Upper Housing Shift Valve And Pressure Plug Locations

(9) Turn upper housing around and remove limit valve and shift valve covers (Fig. 123).

(10) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 123).

(11) Remove 1-2 shift control valve and spring (Fig. 123).

(12) Remove 1-2 shift valve and spring (Fig. 123).

(13) Remove 2-3 shift valve and spring from valve body (Fig. 123).

(14) Remove pressure plug cover (Fig. 123).

(15) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 123).

VALVE BODY LOWER HOUSING DISASSEMBLY (FIG. 124)

(1) Remove timing valve cover.

(2) Remove 3-4 timing valve and spring.

(3) Remove 3-4 quick fill valve, spring and plug.

(4) Remove 3-4 shift valve and spring.

(5) Remove converter clutch valve, spring and plug.

(6) Remove converter clutch timing valve, retainer and valve spring.

3-4 ACCUMULATOR HOUSING DISASSEMBLY (FIG. 125)

(1) Remove end plate from housing.

(2) Remove piston spring.

(3) Remove piston. Remove and discard piston seals.

VALVE BODY CLEANING AND INSPECTION

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the governor solenoid and sensor and the dual solenoid and harness assembly by wiping them off with dry shop towels only.

Dry the parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials will adhere to the valve body components. Lint will interfere with valve operation and may clog filters and fluid passages.**

Wipe the governor pressure sensor and solenoid valve with dry, lint free shop towels only. The O-rings on the sensor and solenoid valve are the only serviceable components (Figs. 126 and 127). Be sure the vent ports in the solenoid valve are open and not

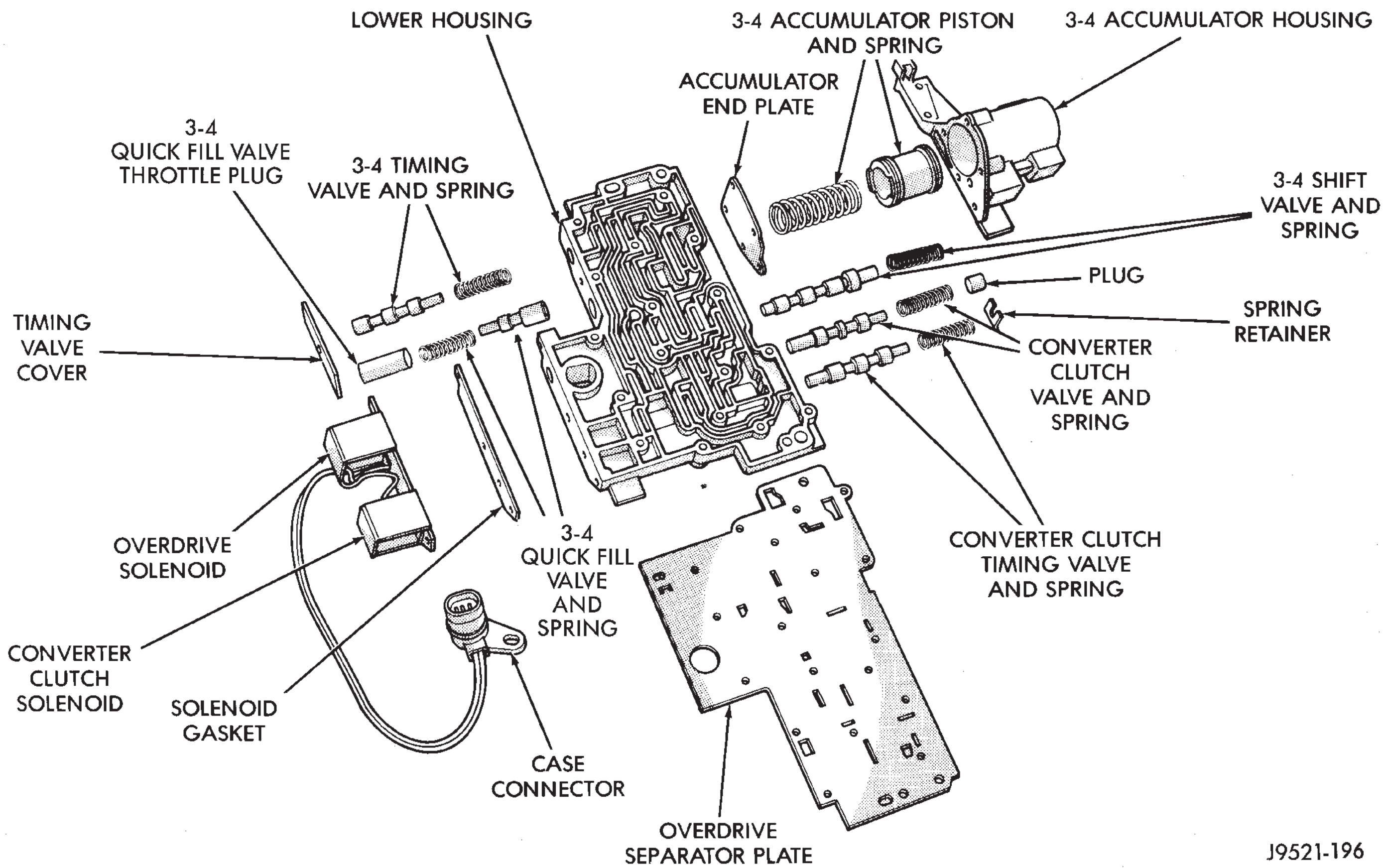


Fig. 124 Lower Housing Shift Valves And Springs

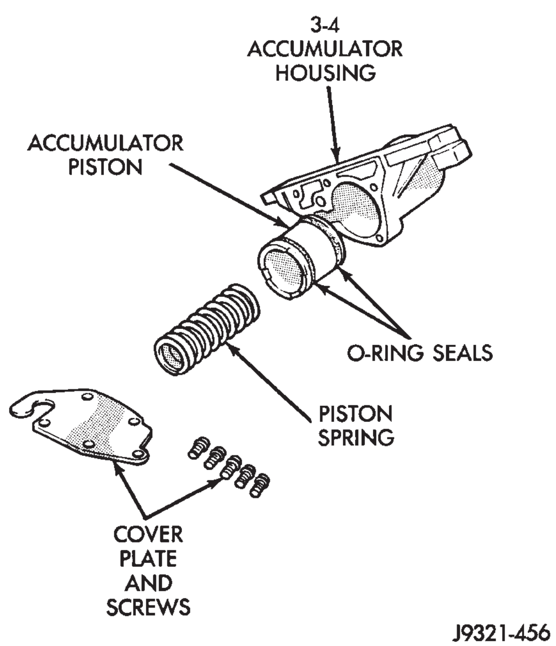


Fig. 125 3-4 Accumulator Housing Components

blocked by dirt or debris. Replace the valve and/or sensor only when DRB II scan tool diagnosis indicates this is necessary. Or, if either part has sustained physical damage (dented, deformed, broken, etc.).

CAUTION: Do not turn the small screw at the end of the solenoid valve for any reason. Turning the screw in either direction will ruin solenoid calibration and result in solenoid failure. In addition, the filter on the solenoid valve is NOT serviceable. Do not try to remove the filter as this will damage the valve housing.

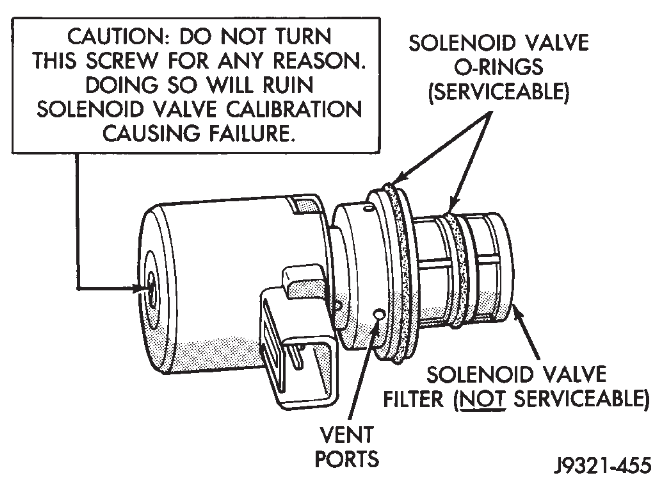


Fig. 126 Governor Pressure Solenoid Valve O-Ring And Vent Location

Inspect the throttle and manual valve levers and shafts (Fig. 128). Do not attempt to straighten a bent

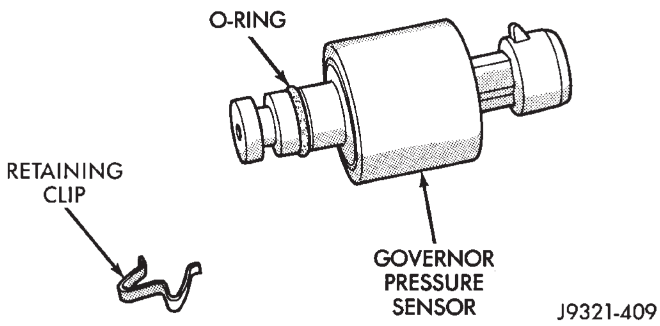


Fig. 127 Governor Pressure Sensor O-Ring Location

shaft or correct a loose lever. Replace these components if worn, bent, loose or damaged in any way.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

CAUTION: Many of the valves and plugs, such as the throttle valve, shuttle valve plug, 1-2 shift valve and 1-2 governor plug, are made of coated aluminum. Aluminum components are identified by the dark color of the special coating applied to the surface (or by testing with a magnet). Do not sand aluminum valves or plugs under any circumstances. This practice could damage the special coating causing the valves/plugs to stick and bind.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Check the two separator plates for distortion or damage of any kind. Inspect the upper housing, lower housing, 3-4 accumulator housing, and transfer plate carefully. Be sure all fluid passages are clean and clear. Check condition of the upper housing and transfer plate check balls as well. The check balls and ball seats must not be worn or damaged.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

The only serviceable valve body components are listed below. The remaining valve body components are serviced only as part of a complete valve body assembly. Serviceable parts are:

- dual solenoid and harness assembly
- solenoid gasket
- solenoid case connector O-rings and shoulder bolt
- switch valve and spring
- pressure adjusting screw and bracket assembly
- throttle lever
- manual lever and shaft seal
- throttle lever shaft seal, washer, and E-clip
- fluid filter and screws
- detent ball and spring
- valve body screws
- governor pressure solenoid
- governor pressure sensor and retaining clip
- park lock rod and E-clip

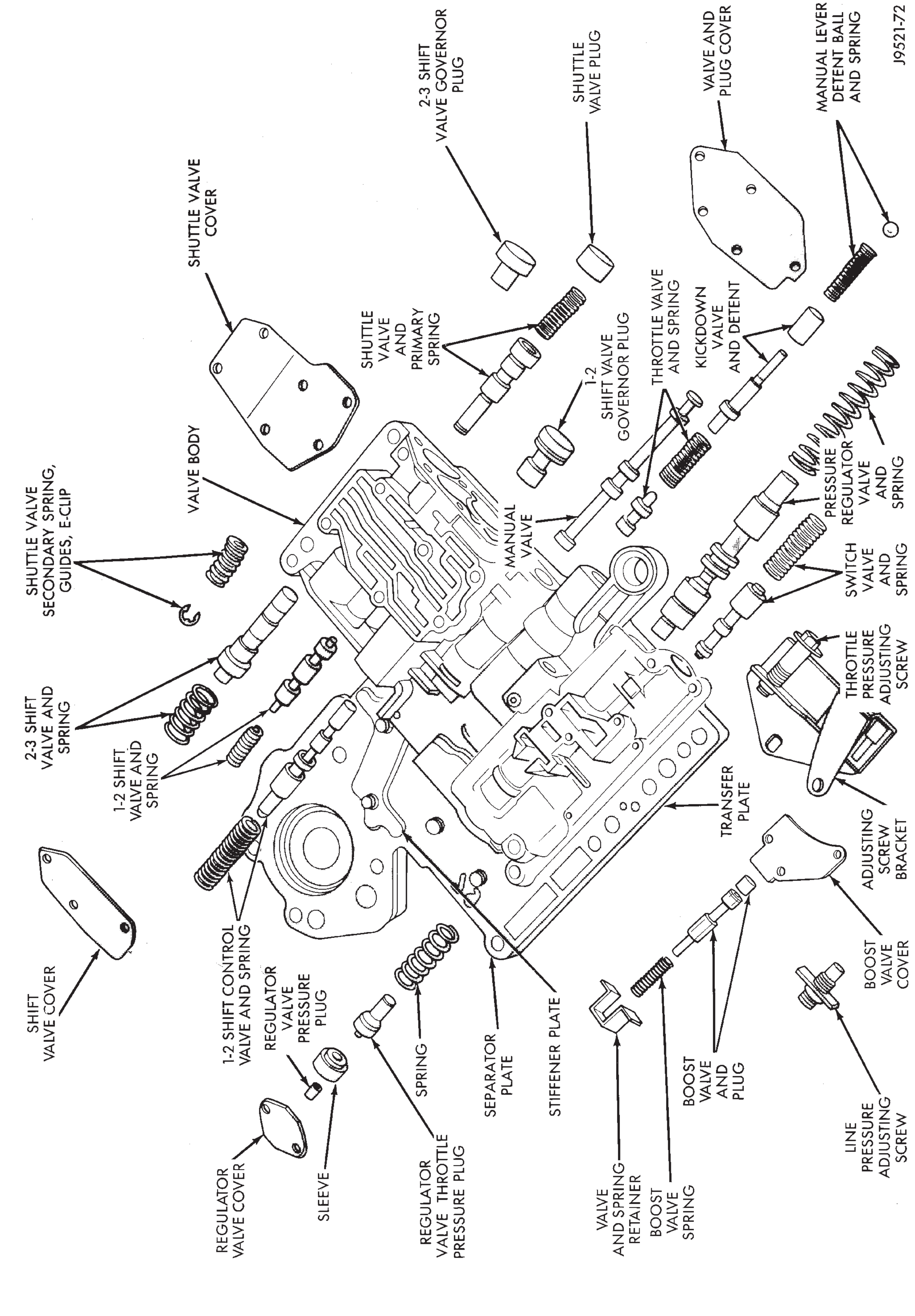


Fig. 128 Upper Housing Valves, Plug, Springs And Brackets

VALVE BODY REASSEMBLY

CAUTION: Do not force valves or plugs into place during reassembly. If the valve body bores, valves and plugs are free of distortion or burrs, the valve body components should all slide into place easily. In addition, do not overtighten the transfer plate and valve body screws during reassembly. Overtightening can distort the housings resulting in valve sticking, cross leakage and unsatisfactory operation. Tighten valve body screws to recommended torque only.

Lower Housing Assembly (Fig. 124)

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid.

(2) Install 3-4 timing valve spring and valve in lower housing.

(3) Install 3-4 quick fill valve in lower housing.

(4) Install 3-4 quick fill valve spring and plug in housing.

(5) Install timing valve end plate. Tighten end plate screws to 4 N·m (35 in. lbs.) torque.

(6) Install 3-4 shift valve and spring.

(7) Install converter clutch valve, spring and plug.

(8) Install converter clutch timing valve and spring.

3-4 Accumulator Assembly (Fig. 125)

(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid.

(2) Install new seal rings on accumulator piston.

(3) Install piston and spring in housing.

(4) Install end plate on housing.

Transfer Plate Assembly

(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 118). **Some early production valve bodies will have steel check balls while later models will have the new plastic check balls.**

(2) Install filter screen in upper housing separator plate (Fig. 129).

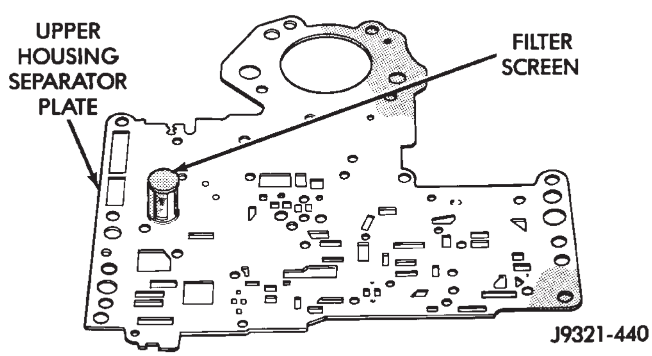


Fig. 129 Separator Plate Filter Screen Installation

(3) Align and position upper housing separator plate on transfer plate (Fig. 116).

(4) Install brace plate (Fig. 116). Tighten brace attaching screws to 4 N·m (35 in. lbs.) torque.

(5) Install remaining separator plate attaching screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

Assembling Upper And Lower Housings

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 119). Seven check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter. **Some early production valve bodies will have steel check balls while later models will have the new plastic check balls.**

(2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 130). Be sure filter screen is seated in proper housing recess.

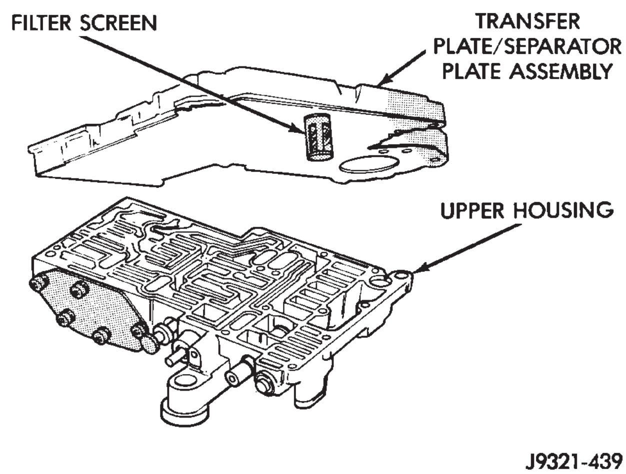


Fig. 130 Installing Transfer Plate On Upper Housing

(3) Position lower housing separator plate on transfer plate (Fig. 131).

(4) Install lower housing on assembled transfer plate and upper housing (Fig. 132).

(5) Install and start valve body screws by hand. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 132).

Upper Housing Valve And Plug Installation (Figs. 122, 123, 124)

(1) Lubricate valves, plugs, springs with clean transmission fluid.

(2) Assemble regulator valve line pressure plug, sleeve, throttle plug and spring. Insert assembly in upper housing and install cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(3) Install 1-2 and 2-3 shift valves and springs.

(4) Install 1-2 shift control valve and spring.

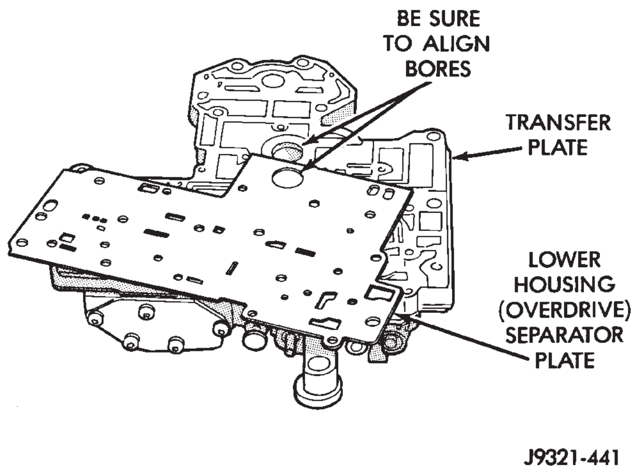


Fig. 131 Lower Housing Separator Plate Installation

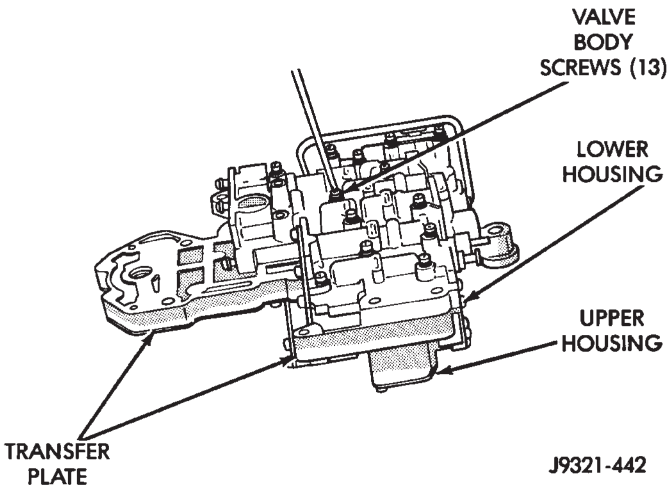


Fig. 132 Installing Lower Housing On Transfer Plate And Upper Housing

(5) Install shift valve cover plate.

(6) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Hold shuttle valve in place.

(c) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(d) Verify that spring and E-clip are properly seated before proceeding.

(7) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(8) Install 1-2 and 2-3 valve governor plugs in valve body.

(9) Install shuttle valve primary spring and throttle plug.

(10) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

(11) Install manual valve.

(12) Install throttle valve and spring.

(13) Install kickdown valve and detent.

(14) Install pressure regulator valve.

(15) Install switch valve.

Boost Valve Tube And Brace Installation

(1) Position valve body assembly so lower housing is facing upward (Fig. 113).

(2) Lubricate tube ends and housing ports with transmission fluid or petroleum jelly.

(3) Start tube in lower housing port first. Then swing tube downward and work opposite end of tube into upper housing port (Fig. 113).

(4) Insert and seat each end of tube in housings.

(5) Slide tube brace under tube and into alignment with valve body screw holes (Fig. 133).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 133).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 134).

(8) **Tighten all valve body housing screws to 4 N·m (35 in. lbs.) torque after tube and brace are installed. Tighten screws in diagonal pattern starting at center and working outward.**

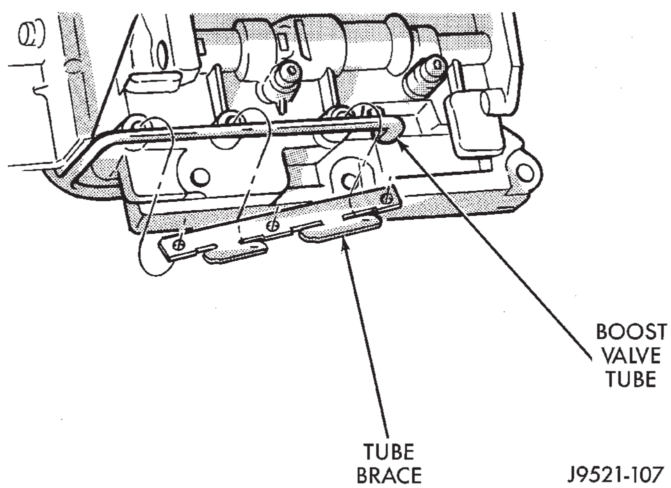


Fig. 133 Boost Valve Tube And Brace Installation

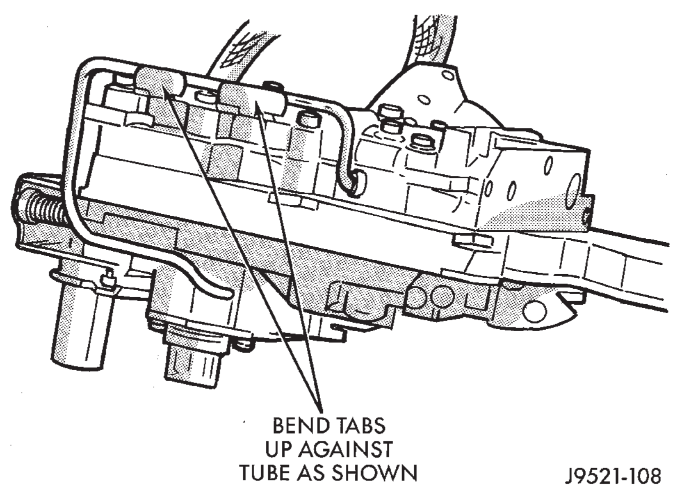


Fig. 134 Securing Boost Valve Tube With Brace Tabs

3-4 Accumulator Installation

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 135).

(2) Loosely attach accumulator housing with right-side screw (Fig. 135). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(4) Swing accumulator housing upward over valve springs and plug.

(5) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 136).

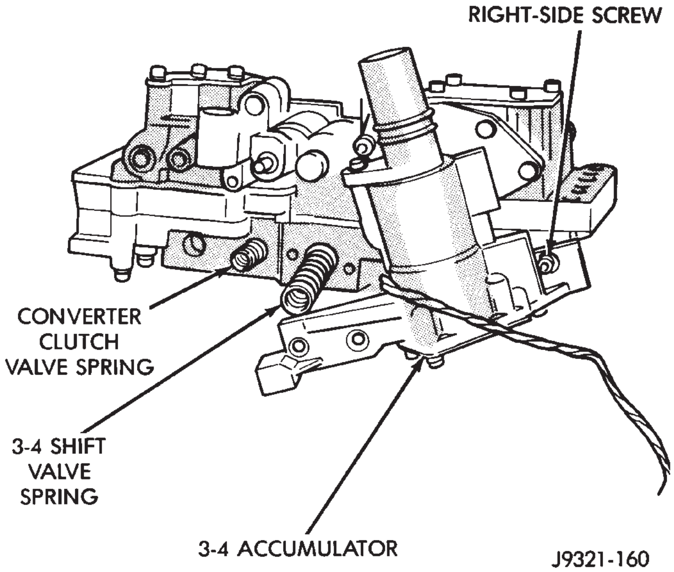


Fig. 135 Installing Converter Clutch And 3-4 Shift Valve Springs

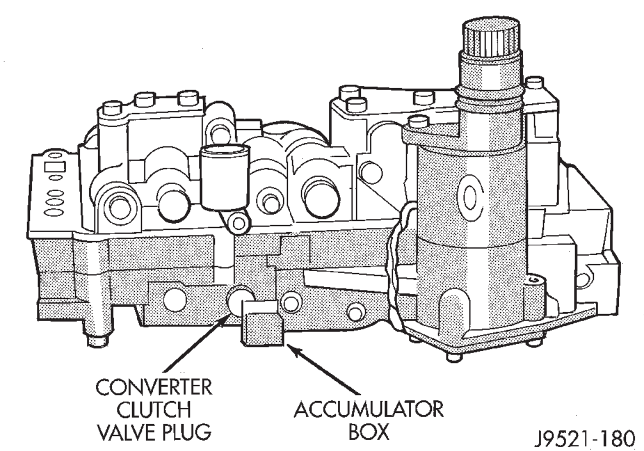


Fig. 136 Seating 3-4 Accumulator On Lower Housing

(6) Attach solenoid case connector to 3-4 accumulator with shoulder-type screw. Connector has small locating tang that fits in dimple at top of accumulator housing (Fig. 95). Seat tang in dimple before tightening connector screw.

(7) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(8) Verify that solenoid wire harness is properly routed (Figs. 95 and 96). **Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.**

Valve Body Final Assembly And Adjustment

(1) Insert manual lever detent spring in upper housing.

(2) Position line pressure adjusting screw in adjusting screw bracket.

(3) Install spring on end of line pressure regulator valve.

(4) Install switch valve spring on tang at end of adjusting screw bracket.

(5) Position adjusting screw bracket on valve body. Align valve springs and press bracket into place. Install short, upper bracket screws first and long bottom screw last. Verify that valve springs and bracket are properly aligned. Then tighten all three bracket screws to 4 N·m (35 in. lbs.) torque.

(6) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(7) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 101).

(8) Align manual lever with detent ball and manual valve. Hold throttle lever upward. Then press down on manual lever until fully seated. Remove detent ball retainer tool after lever is seated.

(9) Then Install manual lever seal, washer and E-clip.

(10) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(11) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 137).

(12) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(13) Obtain new fluid filter for valve body but do not install filter at this time.

(14) If line pressure and/or throttle pressure adjustment screw settings were not disturbed, continue with overhaul or reassembly. However, if adjustment

screw settings **were** moved or changed, readjust as described in Valve Body Control Pressure Adjustment procedure.

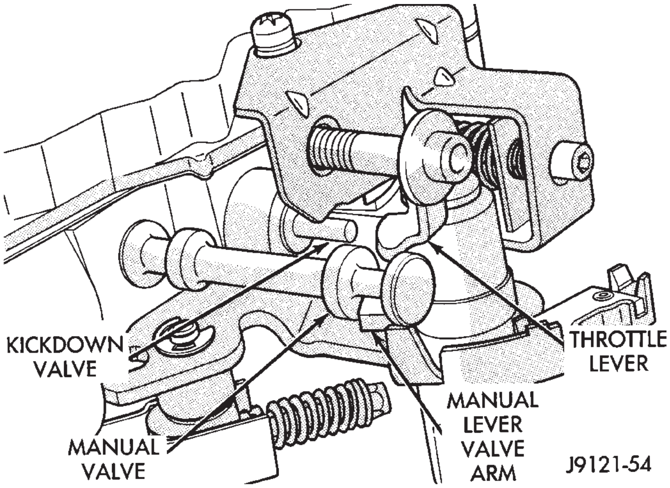


Fig. 137 Manual And Throttle Lever Alignment

GOVERNOR BODY, SENSOR AND SOLENOID INSTALLATION

CAUTION: Do not turn the small screw at the end of the governor pressure solenoid valve for any reason (Fig. 126). Turning the screw in either direction will ruin solenoid calibration and result in solenoid failure. In addition, the filter on the solenoid valve is NOT serviceable. Do not try to remove the filter as this will damage the solenoid valve housing.

(1) Turn valve body assembly over so accumulator side of transfer plate is facing down.

(2) Install new O-rings on governor pressure solenoid and sensor (Figs. 126 and 127).

(3) Lubricate solenoid and sensor O-rings with clean transmission fluid.

(4) Install governor pressure sensor in governor body. Then secure sensor with M-shaped retaining clip (Fig. 93).

(5) Install governor pressure solenoid in governor body (Fig. 94). Push solenoid in until it snaps into place in body.

(6) Position governor body gasket on transfer plate (Fig. 92).

(7) Install retainer plate on governor body and around solenoid (Fig. 90). Be sure solenoid connector is positioned in retainer cutout.

(8) Align screw holes in governor body and transfer plate. Then install and tighten governor body screws to 4 N·m (35 in. lbs.) torque.

(9) Connect harness wires to governor pressure solenoid and governor pressure sensor (Fig. 90).

VALVE BODY CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body which are, line pressure and throttle pressure.

Line and throttle pressure work together as each affects shift quality and timing. Both adjustments must be performed properly and in the correct sequence. Line pressure is adjusted first and throttle pressure is adjusted last.

Line Pressure Adjustment

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 138).

Distance should be 33.4 mm (1-5/16 inch).

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

The 33.4 mm (1-5/16 inch) setting is an approximate setting. Because of manufacturing tolerances, it may be necessary to vary from this dimension to obtain desired pressure.

One complete turn of the adjusting screw changes line pressure approximately 1-2/3 psi (9 kPa). Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.

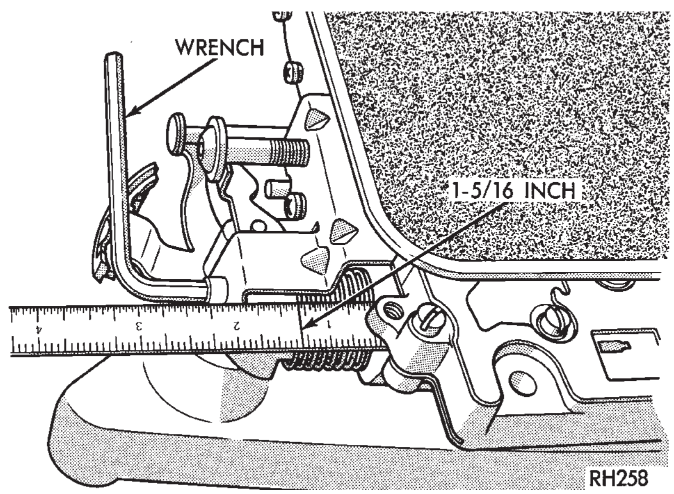


Fig. 138 Line Pressure Adjustment

Throttle Pressure Adjustment

Insert Gauge C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 139).

Push the gauge tool inward to compress the kickdown valve against the spring and bottom the throttle valve.

Maintain pressure against kickdown valve spring. Turn throttle lever stop screw until the screw head touches throttle lever tang and the throttle lever cam touches gauge tool.

The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

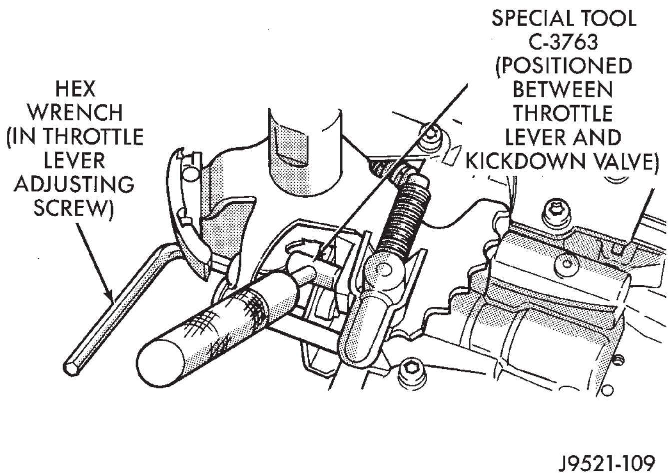


Fig. 139 Throttle Pressure Adjustment

TRANSMISSION ASSEMBLY AND ADJUSTMENT

Assembly Tips

Do not allow dirt, grease, or foreign material to enter the case or transmission components during assembly. Keep the transmission case and components clean. Also make sure the tools and workbench area used for assembly operations are equally clean.

Shop towels used for wiping off tools and hands must be made from **lint free** material. Lint will stick to transmission parts and could interfere with valve operation, or even restrict fluid passages.

Lubricate the transmission components with Mopar transmission fluid during reassembly. Use Mopar Door Ease, or Ru-Glyde on seals and O-rings to ease installation.

Petroleum jelly can also be used to hold thrust washers, thrust plates and gaskets in position during assembly. However, **do not** use chassis grease, bearing grease, white grease, or similar lubricants on any transmission part. These types of lubricants can eventually block or restrict fluid passages and interfere with valve operation. Use petroleum jelly only.

Do not force parts into place. The transmission components and sub-assemblies are easily installed by hand when properly aligned.

If a part seems extremely difficult to install, it is either misaligned or incorrectly assembled. Also verify that thrust washers, thrust plates and seal rings are correctly positioned before assembly. These parts can interfere with proper assembly if mispositioned (or "left out" by accident).

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright or as close to this position as possible. Either tilt the case upward with wood blocks, or cut a hole in the bench large enough for the output shaft. Then lower the shaft through the hole and support the transmission case directly on the bench.

TRANSMISSION ASSEMBLY PROCEDURE

(1) Install rear servo piston, spring and retainer (Fig. 140). Install spring on top of servo piston and install retainer on top of spring.

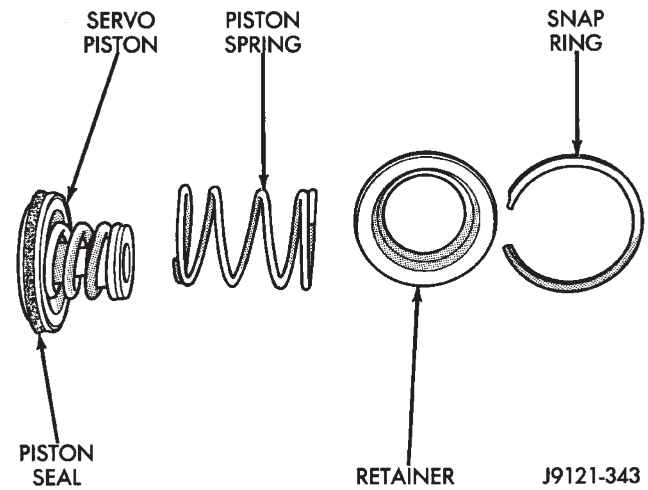


Fig. 140 Rear Servo Components

(2) Install front servo piston assembly, servo spring and rod guide (Fig. 141).

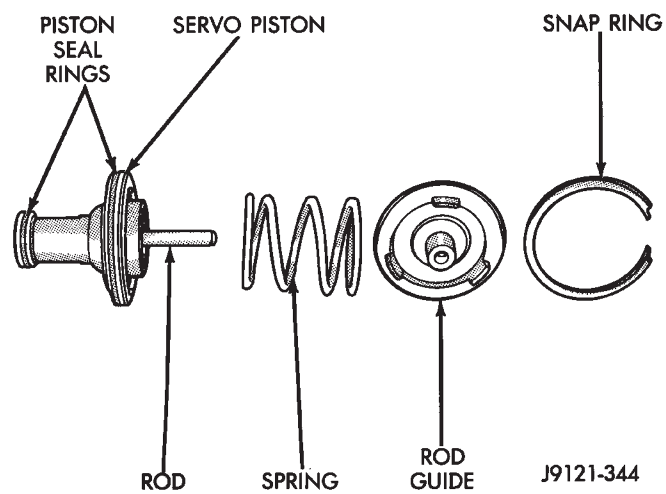


Fig. 141 Front Servo Components

(3) Compress front/rear servo springs with Valve Spring Compressor C-3422-B and install each servo snap ring (Fig. 142).

(4) Examine bolt holes in overrunning clutch cam. Note that one hole is **not threaded** (Fig. 143). This hole must align with blank area in clutch cam bolt circle (Fig. 144). Mark hole location on clutch cam and blank area in case with grease pencil, paint stripe, or scribe mark for assembly reference.

(5) Mark location of non-threaded hole in clutch cam and blank area in bolt circle with grease pencil.

(6) Align and install overrunning clutch and cam in case (Fig. 145). **Be sure cam is correctly installed. Bolt holes in cam are slightly counter-**

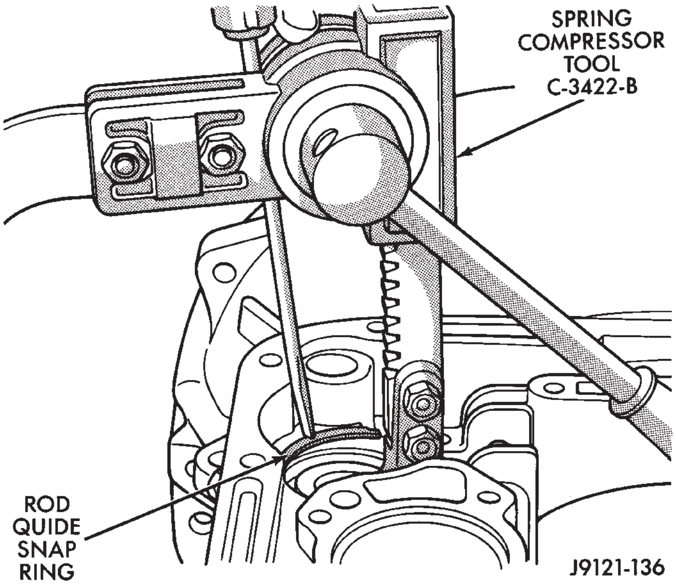


Fig. 142 Compressing Front/Rear Servo Springs

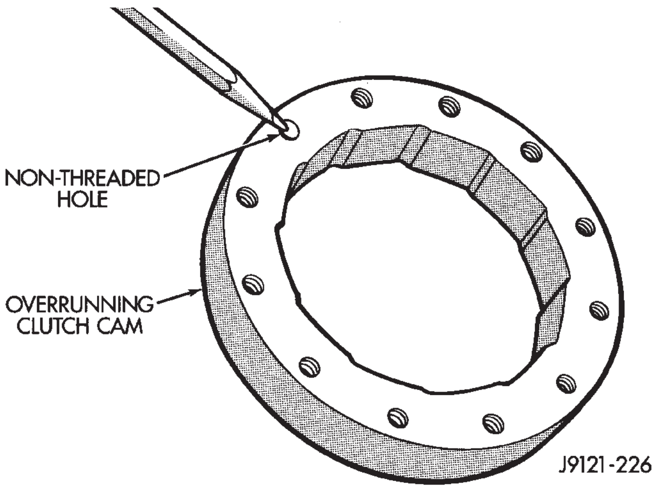


Fig. 143 Location Of Non-Threaded Hole In Clutch Cam

sunk on one side. Be sure this side of cam faces rearward (toward piston retainer).

(7) Verify that non-threaded hole in clutch cam is properly aligned. Check alignment by threading a bolt into each bolt hole. Adjust clutch cam position if necessary.

(8) Install and tighten overrunning clutch cam bolts to 17 N·m (13 ft. lbs.) torque. Note that clutch cam bolts are shorter than piston retainer bolts.

(9) Lubricate clutch cam rollers with transmission fluid.

(10) Install rear band reaction pin (Fig. 146). Be sure pin is fully seated in case.

(11) Install rear band in case (Fig. 147). Be sure twin lugs on band are seated against reaction pin.

(12) Install low-reverse drum and check overrunning clutch operation as follows:

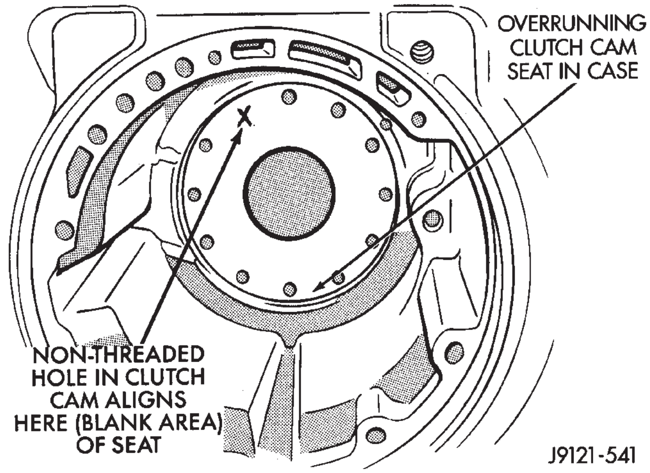


Fig. 144 Location Of Blank Area In Clutch Cam Bolt Circle

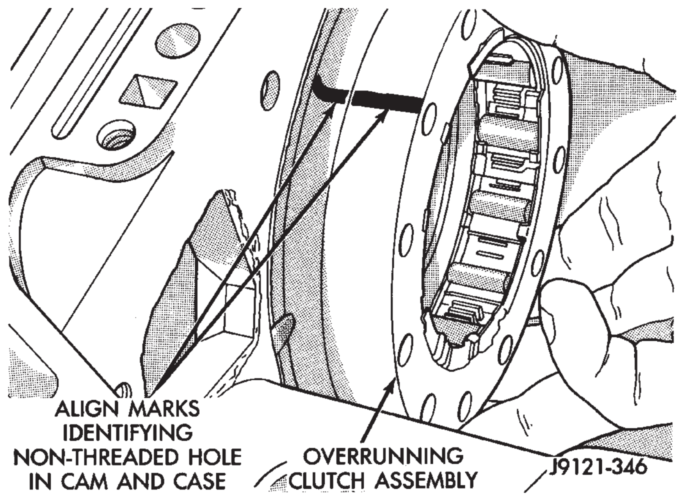


Fig. 145 Overrunning Clutch Installation

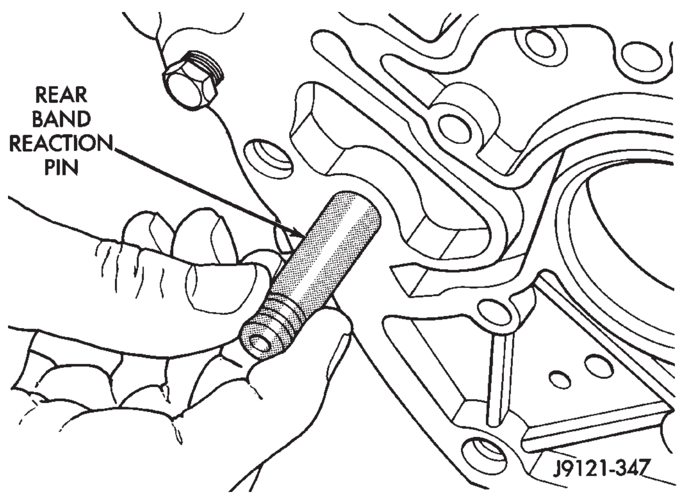


Fig. 146 Installing Rear Band Reaction Pin

(a) Lubricate overrunning clutch race (on drum hub) with transmission fluid.

(b) Guide drum through rear band.

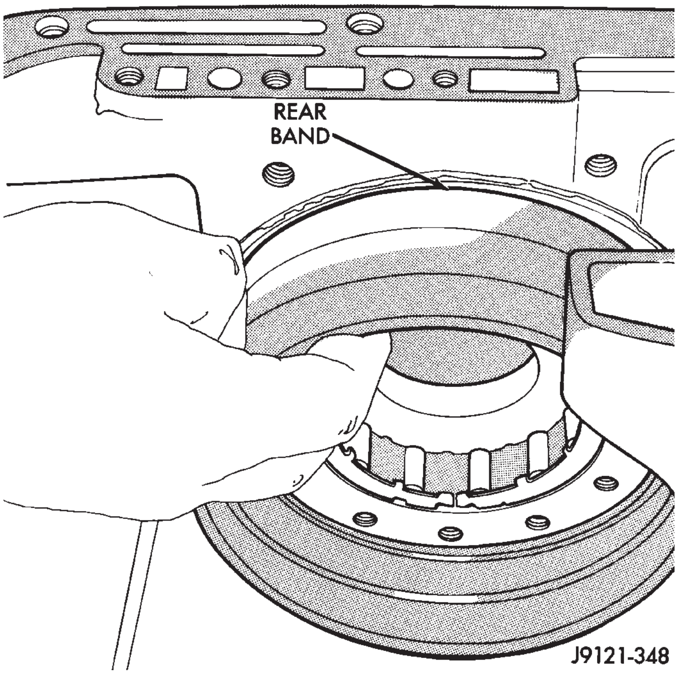


Fig. 147 Rear Band Installation

(c) Tilt drum slightly and start race (on drum hub) into overrunning clutch rollers.

(d) Press drum rearward and turn it in clockwise direction until drum seats in overrunning clutch (Fig. 148).

(e) Turn drum back and forth. **Drum should rotate freely in clockwise direction and lock in counterclockwise direction (as viewed from front of case).**

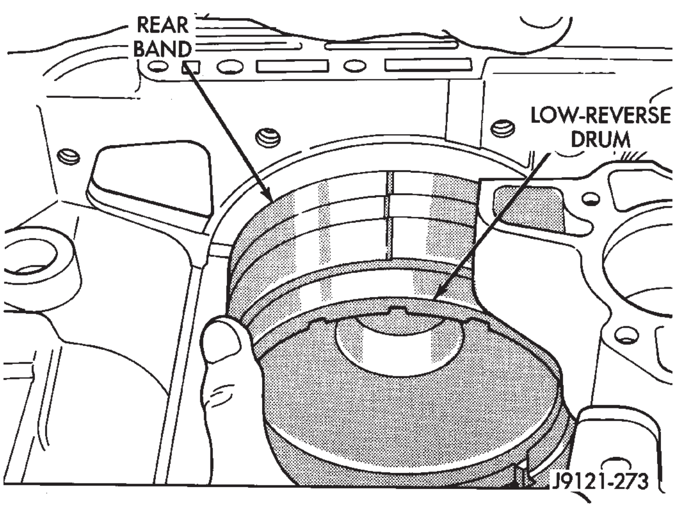


Fig. 148 Installing Low-Reverse Drum

(13) Install new gasket at rear of transmission case. Use petroleum jelly to hold gasket in place. Be sure to align governor feed holes in gasket with feed passages in case (Fig. 149). Also install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.

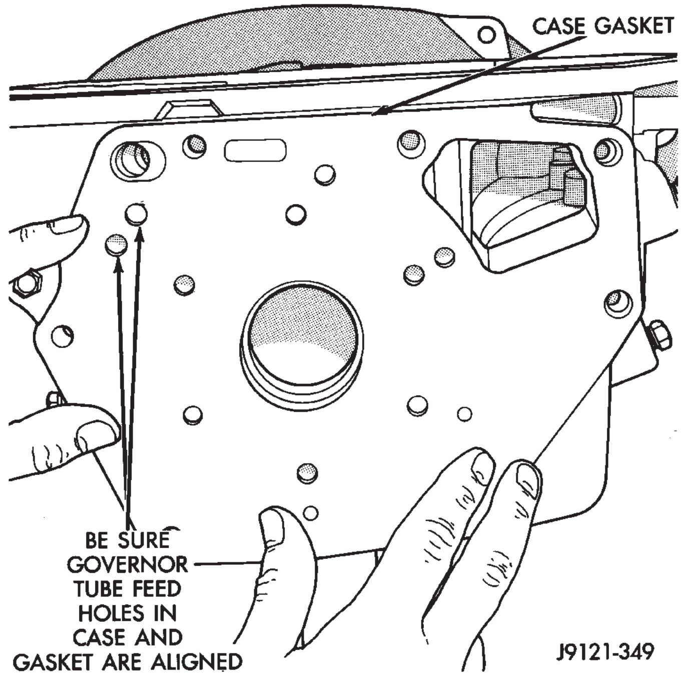


Fig. 149 Installing/Aligning Case Gasket

(14) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 150). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

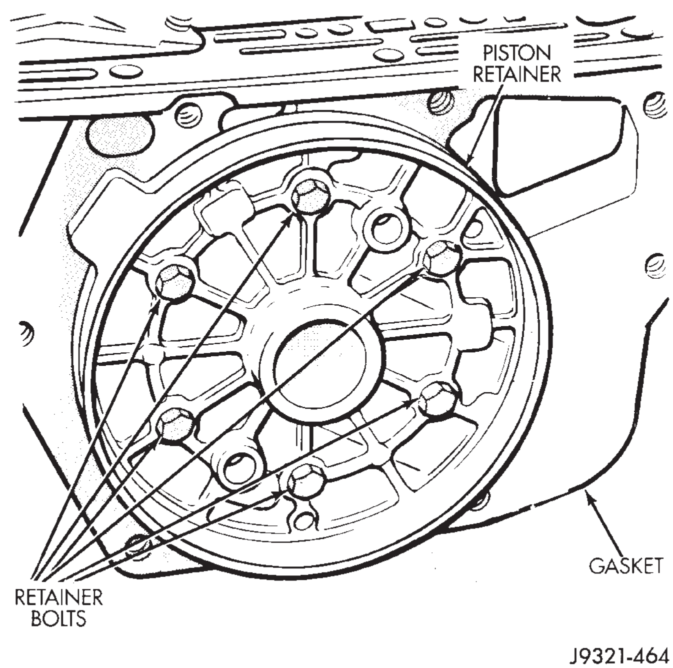


Fig. 150 Aligning Overdrive Piston Retainer

(15) Install snap ring that secures low-reverse drum to hub of piston retainer (Fig. 151).

(16) Install rear band lever and pivot pin (Fig. 152). Align lever with pin bores in case and push pivot pin into place.

(17) Install planetary geartrain assembly (Fig. 153)

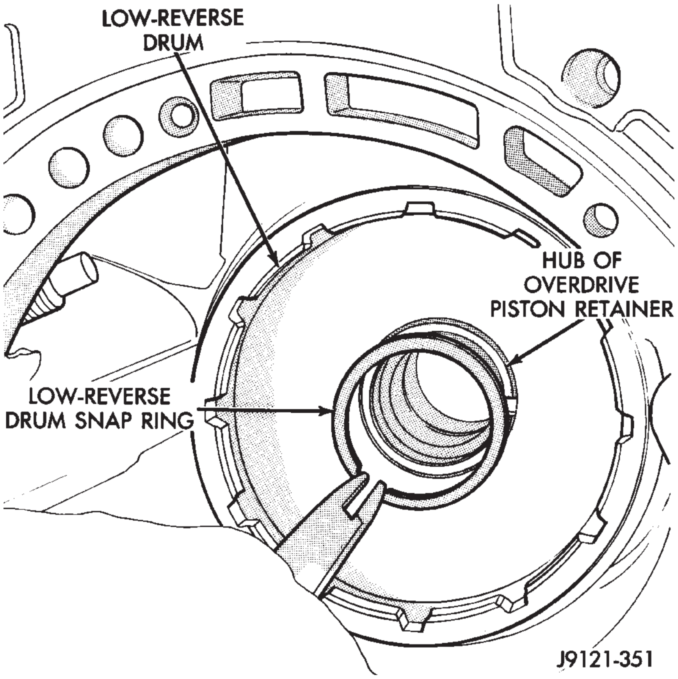


Fig. 151 Installing Low-Reverse Drum Retaining Snap Ring

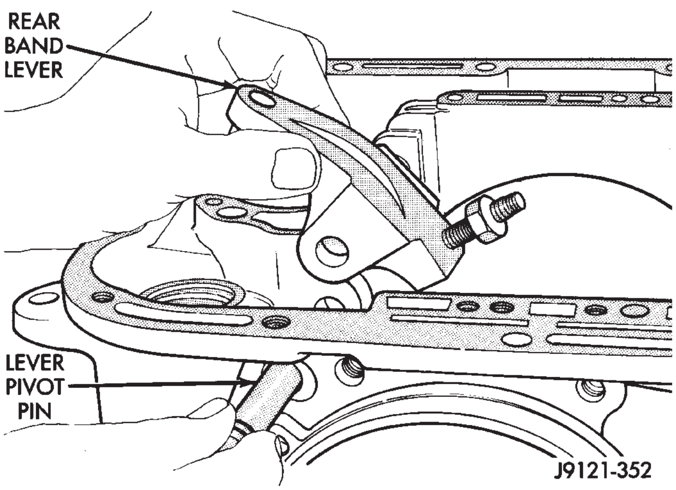


Fig. 152 Rear Band Lever And Pivot Pin Installation

(18) Install thrust plate on intermediate shaft hub (Fig. 154). Use petroleum jelly to hold thrust plate in place.

(19) Check seal ring on rear clutch retainer hub (Fig. 49) and seal rings on input shaft (Fig. 155). Verify that diagonal-cut ends of teflon seal rings are properly joined and ends of metal ring are correctly hooked together. Also verify that shaft seal rings are installed in sequence shown.

(20) Check rear clutch thrust washer (Fig. 156). Use additional petroleum jelly to hold washer in place if necessary.

(21) Align clutch discs in front clutch and install front clutch on rear clutch (Fig. 157). Rotate front clutch retainer back and forth until completely seated on rear clutch.

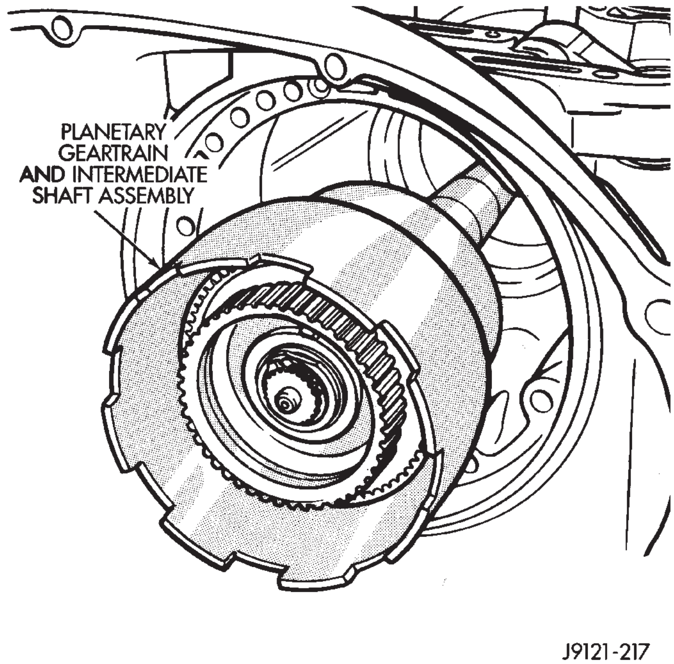


Fig. 153 Installing Planetary Geartrain

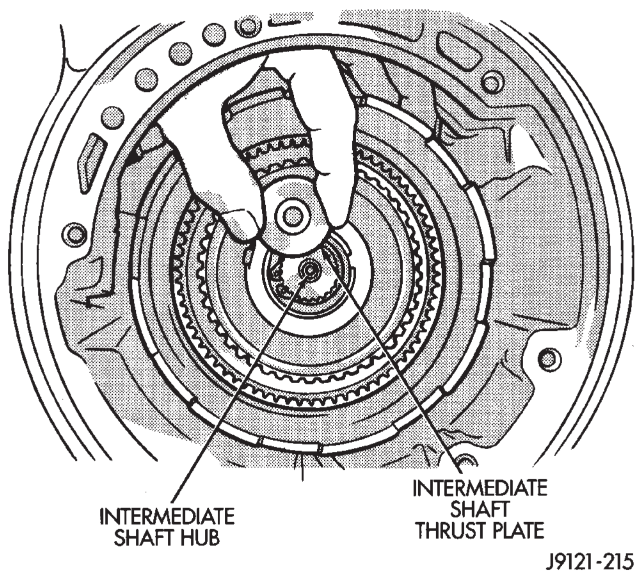


Fig. 154 Installing Intermediate Shaft Thrust Plate

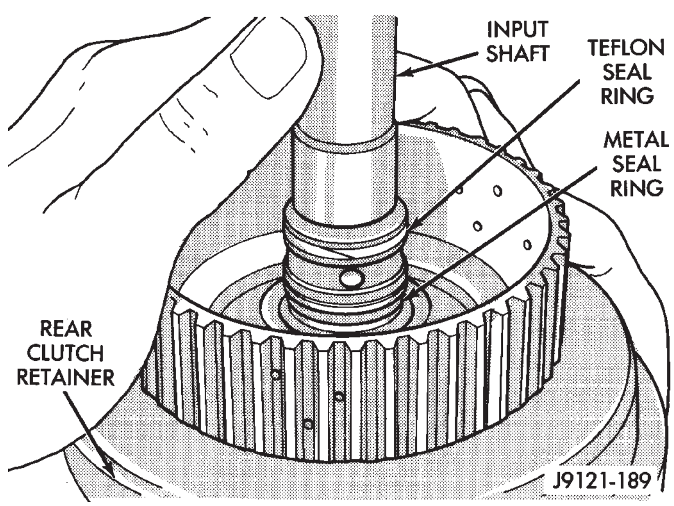


Fig. 155 Input Shaft Seal Ring Location

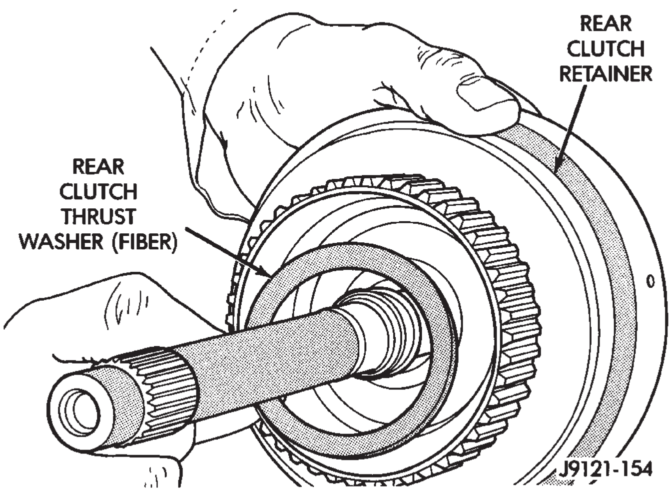


Fig. 156 Installing Rear Clutch Thrust Washer

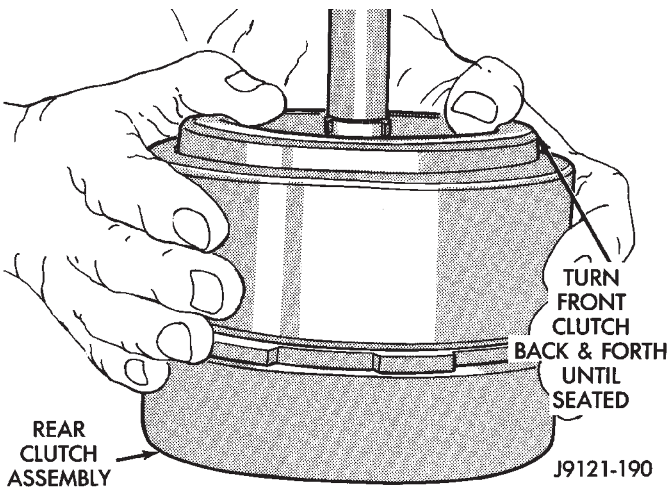


Fig. 157 Assembling Front And Rear Clutch Units

(22) Coat intermediate shaft thrust washer with petroleum jelly. Then install washer in rear clutch hub (Fig. 158). Use enough petroleum jelly to hold washer in place. **Be sure grooved side of washer faces rearward (toward output shaft) as shown. Also note that washer only fits one way in clutch hub.** Note thickness of this washer. It is a select fit part and is used to control transmission end play.

(23) Align drive teeth on rear clutch discs with small screwdriver (Fig. 159). This makes installation on front planetary easier.

(24) Raise front end of transmission upward as far as possible and support case with wood blocks. Front/rear clutch and oil pump assemblies are easier to install if transmission is as close to upright position as possible.

(25) Install front and rear clutch units as assembly (Fig. 160). Align rear clutch with front annulus gear and install assembly in driving shell. **Be sure output shaft thrust washer and thrust plate are not displaced during installation.**

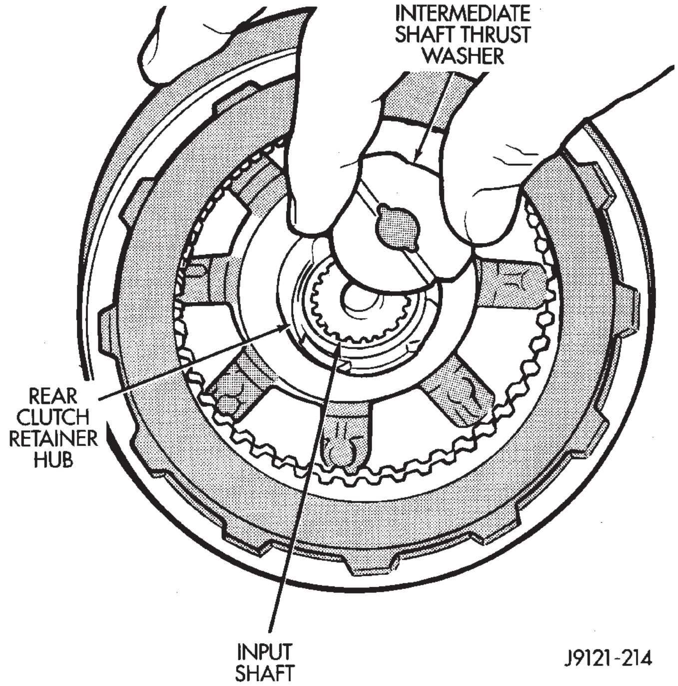


Fig. 158 Installing Intermediate Shaft Thrust Washer

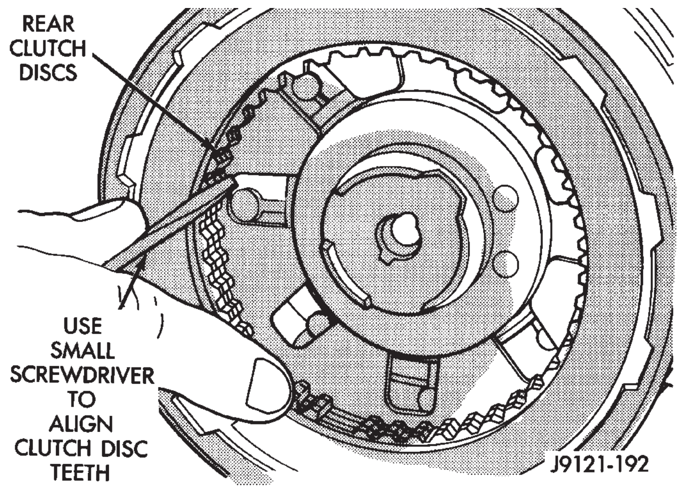


Fig. 159 Aligning Rear Clutch Disc Lugs

(26) Carefully work assembled clutches back and forth to engage and seat rear clutch discs on front annulus gear. Also be sure front clutch drive lugs are fully engaged in slots of driving shell after installation.

(27) Slide front band over front clutch retainer (Fig. 161).

(28) Insert front band lever pivot shaft part way into case (Fig. 161).

(29) Install front band lever, strut and adjusting screw (Fig. 162).

(30) Push front band lever shaft completely into place. Then tighten band adjusting screw until band just grips clutch retainer. Verify that front/rear clutches are still seated before continuing.

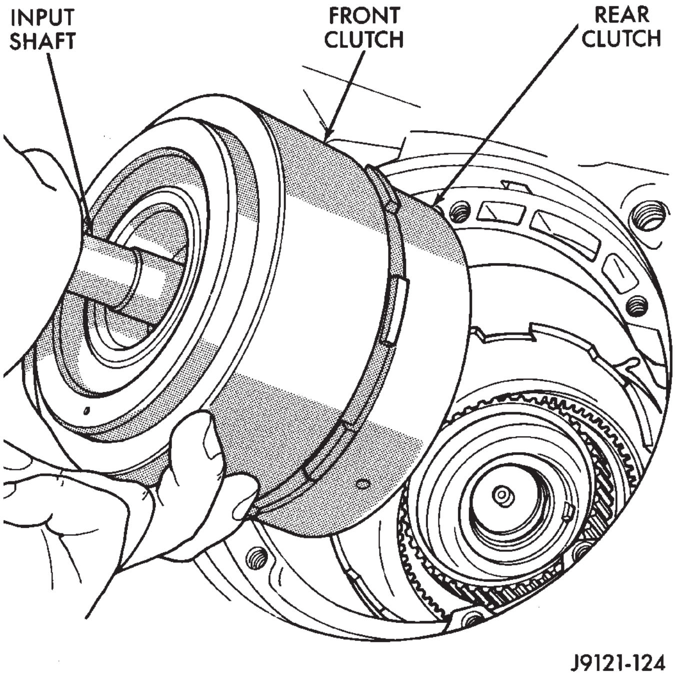


Fig. 160 Installing Front/Rear Clutch Assemblies

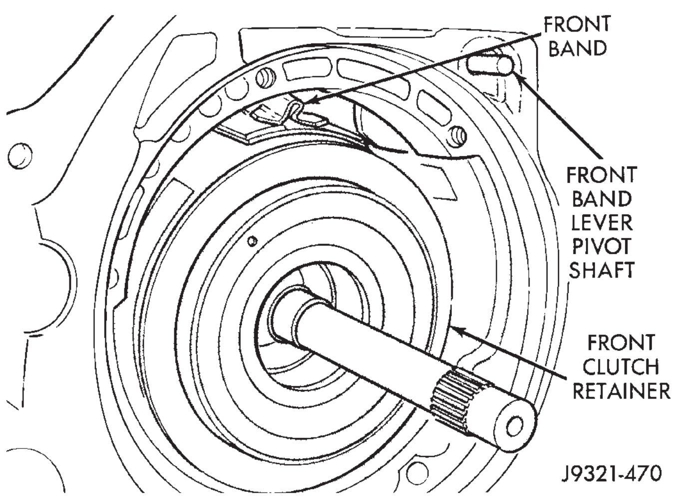


Fig. 161 Installing Front Band And Reaction Pin

(31) Coat band reaction pin access plug with sealer and install plug in converter housing.

(32) Check seal rings on reaction shaft support hub. Verify that seal rings are hooked together and that front clutch thrust washer is properly positioned (Fig. 163). Use extra petroleum jelly to hold thrust washer in place if necessary.

CAUTION: The thrust washer bore ID is chamfered on one side. Make sure this side of the washer is facing toward the front of the transmission.

(33) Thread two Pilot Stud Tools C-3288-B into bolt holes in oil pump flange (Fig. 164).

(34) Align and install oil pump gasket (Fig. 164).

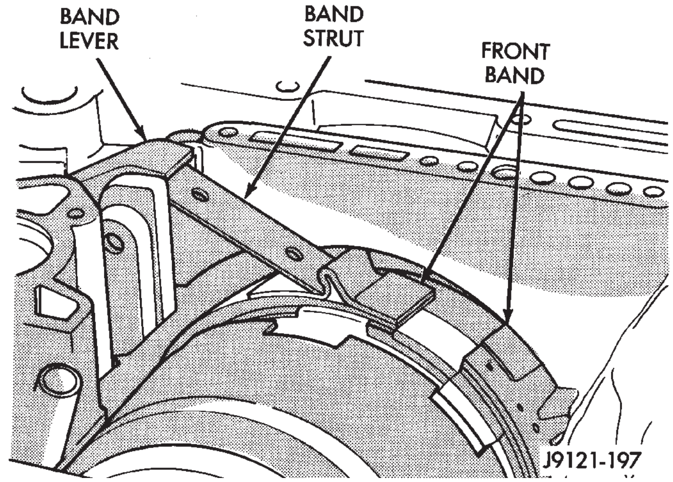


Fig. 162 Front Band Linkage Installation

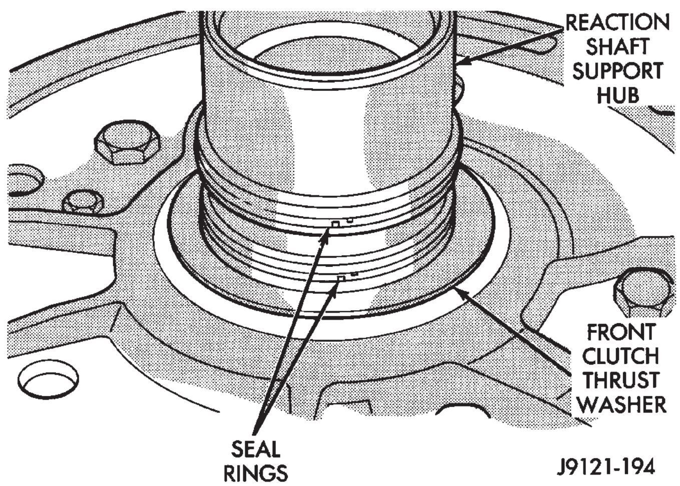


Fig. 163 Reaction Shaft Support Seal Rings And Front Clutch Thrust Washer Position

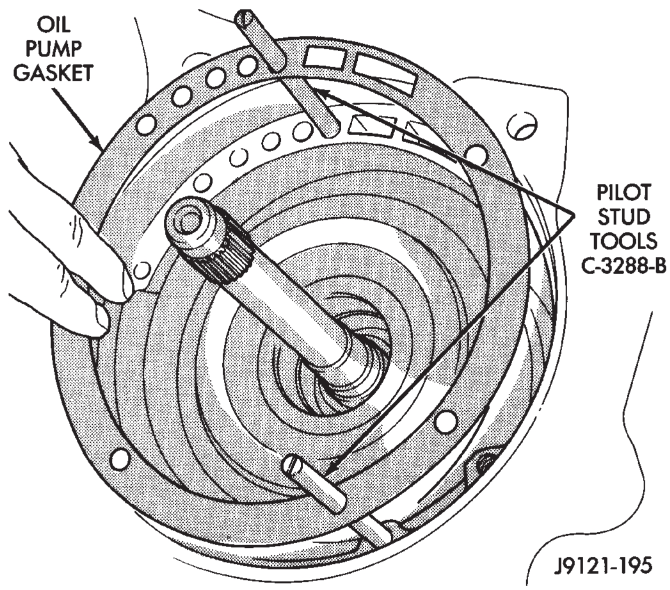


Fig. 164 Installing Pilot Studs And Oil Pump Gasket

(35) Lubricate oil pump body seal with Ru-Glyde, or petroleum jelly. Lubricate pump shaft seal lip with petroleum jelly.

(36) Install oil pump (Fig. 165). Align and position pump on pilot studs. Slide pump down studs and work it into front clutch hub and case by hand. Then install 2 or 3 pump bolts to hold pump in place.

(37) Remove pilot stud tools and install remaining oil pump bolts. Tighten bolts alternately in diagonal pattern to 20 N·m (15 ft. lbs.).

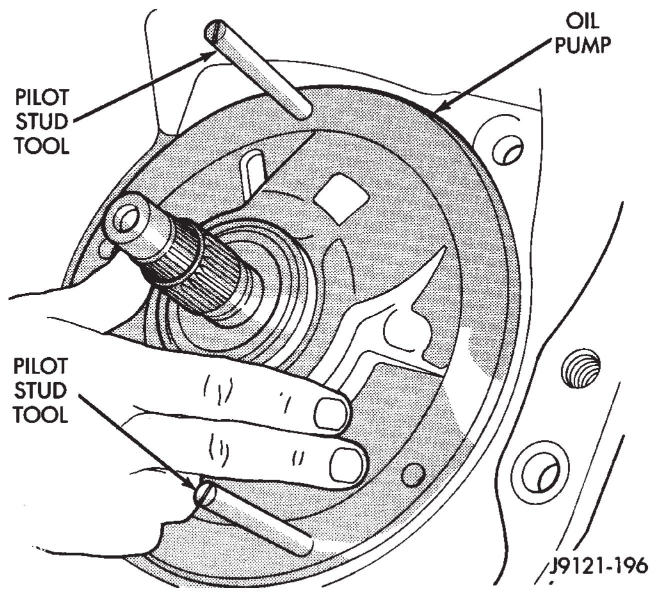


Fig. 165 Installing Oil Pump Assembly In Case

(38) Install new seals on overdrive piston. Then lubricate seals with Mopar Door Ease, or Ru-Glyde.

(39) Install overdrive piston in retainer. **Align locating lugs on piston in locating bores in retainer** (Fig. 166). Use thin plastic strip or feeler gauge to help guide piston outer seal into retainer.

(40) Install spacer on intermediate shaft, if not previously installed.

(41) Install overdrive piston thrust plate (Fig. 167). Use liberal quantity of petroleum jelly to hold thrust plate in position on piston.

(42) Install overdrive piston thrust bearing in direct clutch hub (Fig. 168). Use liberal quantity of petroleum jelly to hold thrust bearing in place. **Note that one side of bearing has dark coated surface. This surface faces overdrive piston. Also be sure raised shoulder on inside diameter of bearing faces forward as well.**

(43) Apply small amount of petroleum jelly to pilot hub of intermediate shaft.

(44) Verify alignment of splines in overdrive unit planetary gear and overrunning clutch. Be sure Alignment Tool 6227-2 is still fully seated (Fig. 169). **If planetary gear and overrunning clutch splines become misaligned, overdrive unit cannot be fully installed on intermediate shaft.**

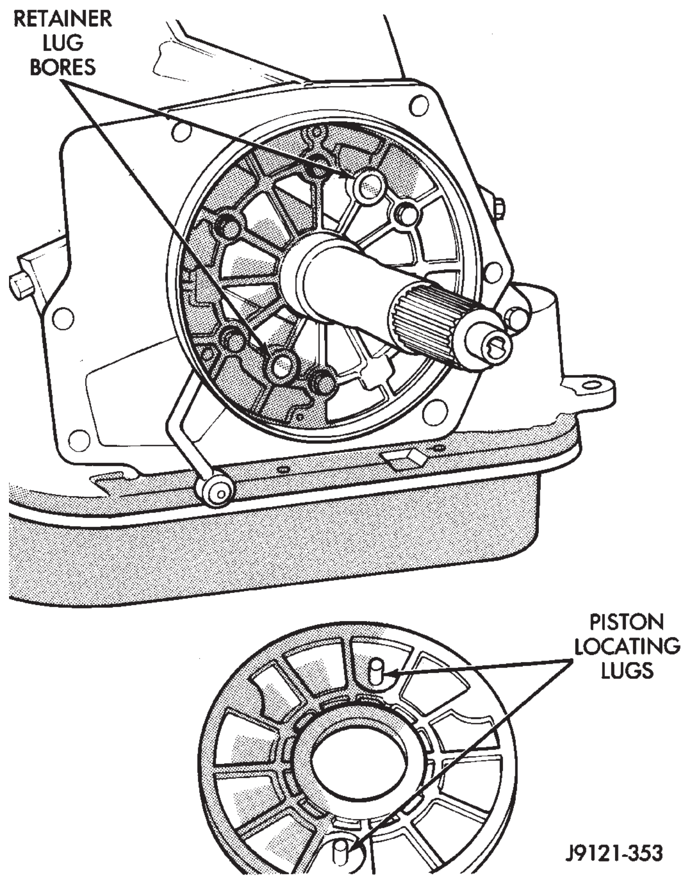


Fig. 166 Overdrive Piston Alignment

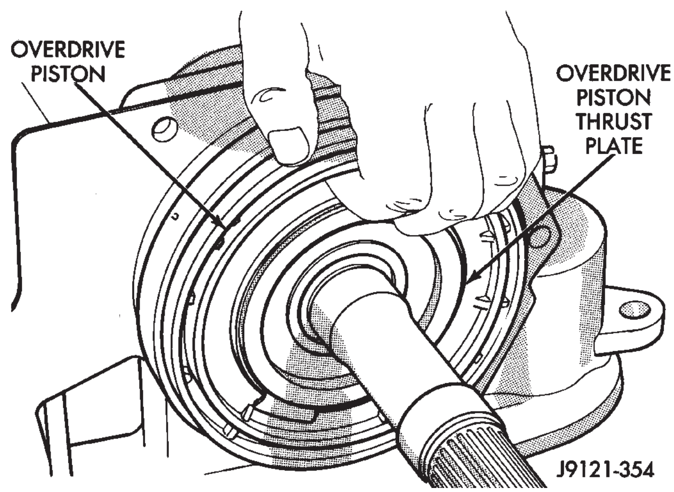


Fig. 167 Installing Overdrive Piston Thrust Plate

Overdrive unit may have to be disassembled in order to realign splines.

(45) Carefully withdraw alignment tool from overdrive unit.

(46) Lubricate intermediate shaft splines and bushing surfaces with transmission fluid or petroleum jelly.

(47) Install overdrive unit. Note that intermediate shaft is snug fit in overdrive planetary gear and overrunning clutch. If overdrive unit will not seat

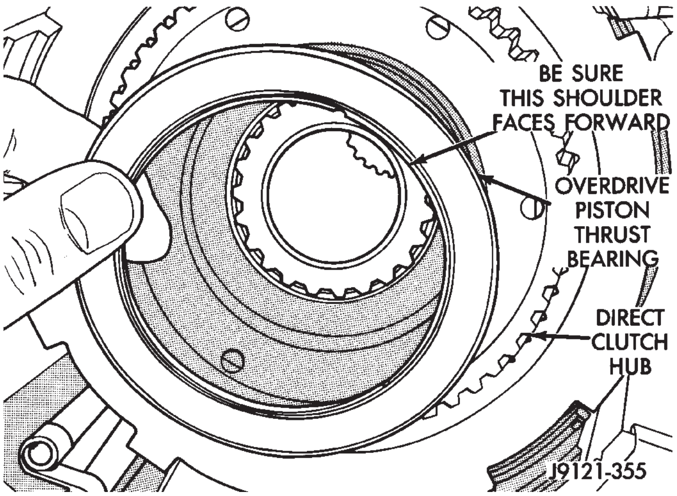


Fig. 168 Installing Overdrive Piston Thrust Bearing

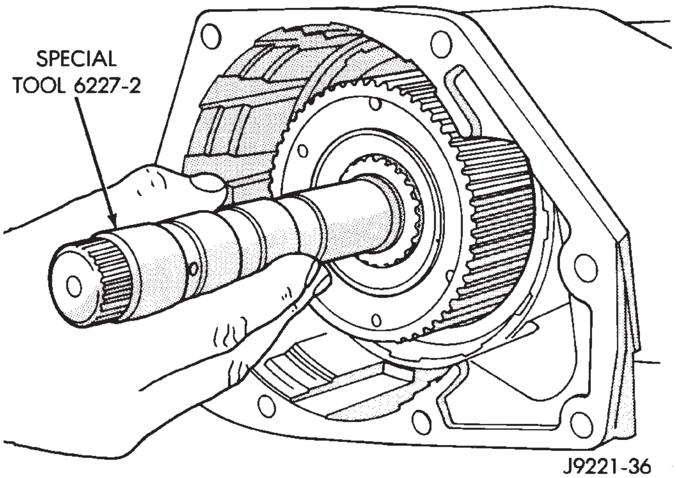


Fig. 169 Checking Alignment Of Overdrive Planetary Gear And Overrunning Clutch Splines

gear and clutch splines may be misaligned.

(48) Apply 1-2 drops of Mopar thread adhesive (or Loctite 242) to overdrive unit attaching bolts. Then install and tighten bolts to 34 N· (25 ft. lbs.) torque. **Be sure wire harness clips are placed on appropriate overdrive bolts beforehand.**

(49) Measure and if necessary, correct input shaft end play as follows (Fig. 170):

(a) Be sure overdrive unit is installed on transmission. **End play cannot be properly checked with overdrive unit off transmission.**

(b) Attach dial indicator to converter housing.

(c) Position indicator plunger against input shaft and zero indicator.

(d) Move input shaft in and out and record reading. End play should be 0.56 - 2.31 mm (0.022 - 0.091 in.). Proceed to step (e) if end play is not within specified limits.

(e) Intermediate shaft thrust washer (in hub of rear clutch retainer) controls end play. Washer is a select fit part and can be changed to adjust end play. If end play turns out to be incorrect, remove oil pump, and clutches. Then install thinner/thicker thrust washer as necessary.

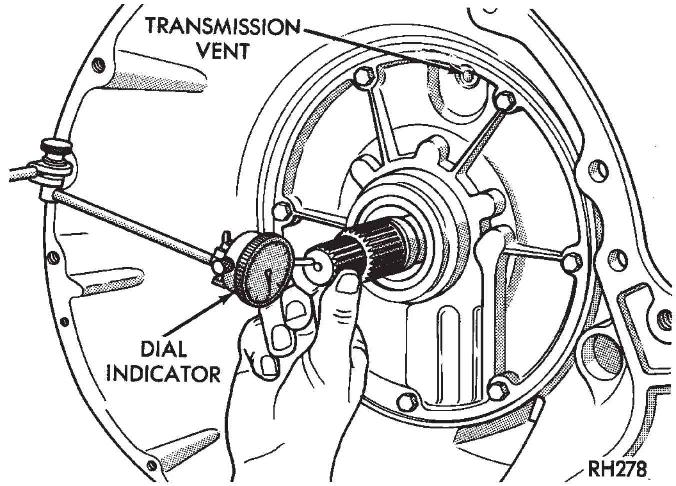


Fig. 170 Measuring Input Shaft End Play

(50) Install accumulator piston and inner and outer springs (Fig. 11).

(51) Verify that park/neutral position switch has **not** been installed in case. Valve body can not be installed if switch is in position.

(52) Verify that valve body solenoid harness is secured in 3-4 accumulator housing cover plate.

(53) Install valve body as follows:

(a) Align and carefully insert park rod into pawl. Rod will make click noise as it enters pawl. Move rod slightly to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into the cavity. If the rod enters the cavity during installation, it will become bent when the overdrive bolts are tightened. If this occurs, the rod will have to be removed and replaced.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are fully seated in case. Also be sure valve body wiring is not pinched or kinked.

(c) Install and start all valve body attaching bolts by hand. Then tighten bolts evenly, in a diagonal pattern to 12 N·m (105 in. lbs.) torque. **Do not overtighten valve body bolts. This could result in distortion and cross leakage after installation.**.

(54) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(55) Adjust front and rear bands as follows:

(a) Loosen band adjusting screw locknuts.

(b) Tighten each band adjusting screw to 5 N·m (72 in. lbs.) with torque wrench.

(c) **Back off front band adjusting screw 3-5/8 turns.**

(d) Back off rear band screw 4 turns.

(e) Tighten each adjusting screw locknut. Hold adjusting screws with wrench to prevent turning when tightening locknut.

(56) Install seal on park/neutral position switch (Fig. 171). Then install and tighten switch to 34 N·m (25 ft. lbs.).

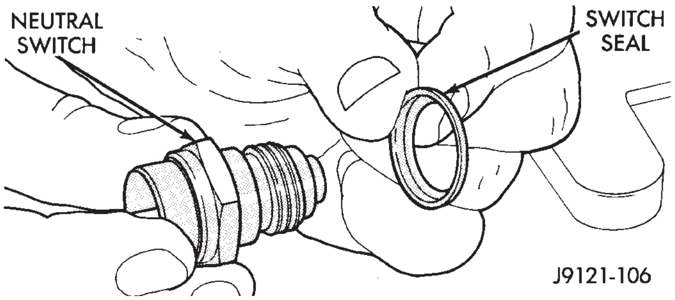


Fig. 171 Park/Neutral Position Switch Seal Position

(57) Install magnet in oil pan. Magnet goes on small protrusion at corner of pan.

(58) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(59) Install new valve body manual shaft seal in case (Fig. 172). Lubricate seal lip and manual shaft with petroleum jelly. Start seal over shaft and into case. Seat seal with 15/16 inch, deep well socket.

(60) Install throttle valve and shift selector levers on valve body manual lever shaft.

(61) Cap or cover transmission openings (cooler line fittings, filler tube bore, etc.) to prevent dirt entry.

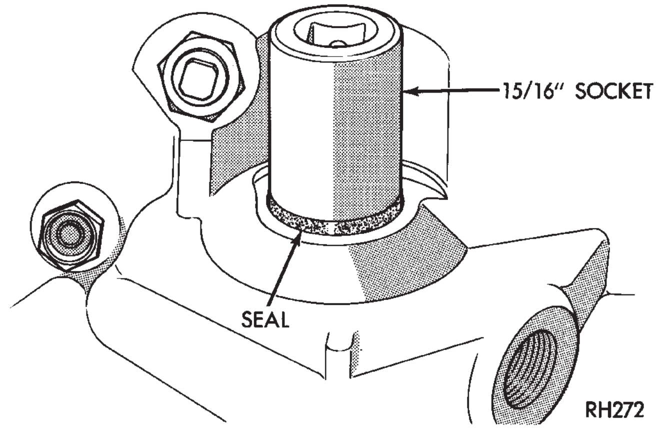


Fig. 172 Installing Manual Lever Shaft Seal

(62) Install torque converter. Use C-clamp or metal strap to hold converter in place for installation.

(63) Install transmission speed sensor in overdrive case (Fig. 1).

(64) Mount transmission on jack for installation in vehicle.

(65) Apply dielectric grease to terminal pins of solenoid case connector and neutral switch.

CAUTION: The transmission cooler and lines must be reverse flushed if overhaul corrected a malfunction that generated sludge, metal particles, or clutch friction material. The torque converter should also be replaced if contaminated by the same malfunction. Debris and residue not flushed from the cooler and lines will flow back into the transmission and converter. The result could be a repeat failure and shop comeback.

42RE OVERDRIVE UNIT OVERHAUL

INDEX

OVERDRIVE UNIT DISASSEMBLY

OVERDRIVE REMOVAL

(1) Remove transmission speed sensor and O-ring seal from overdrive case (Fig. 1).

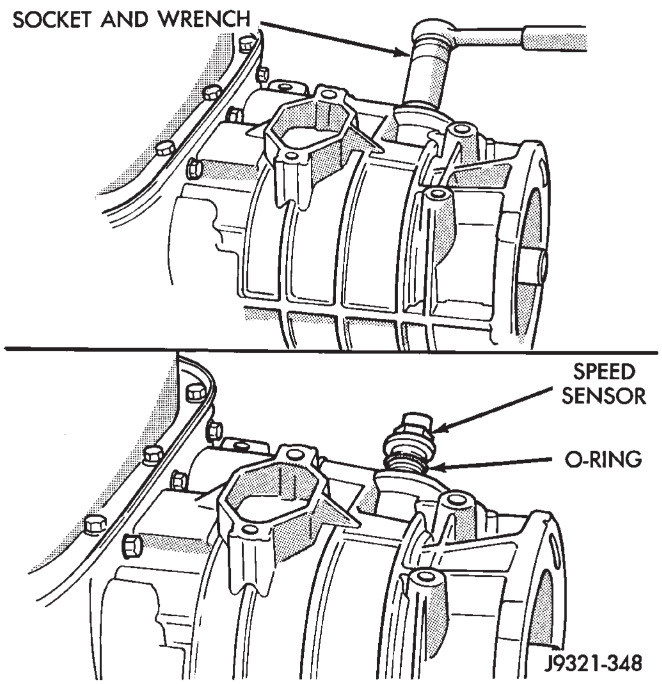


Fig. 1 Transmission Speed Sensor Removal/ Installation

(2) Place transmission in upright position (Fig. 2).

(3) Remove bolts attaching overdrive unit to transmission case (Fig. 2). Note position of wire harness clips for installation reference.

(4) Lift overdrive unit up and off transmission case and intermediate shaft (Fig. 3).

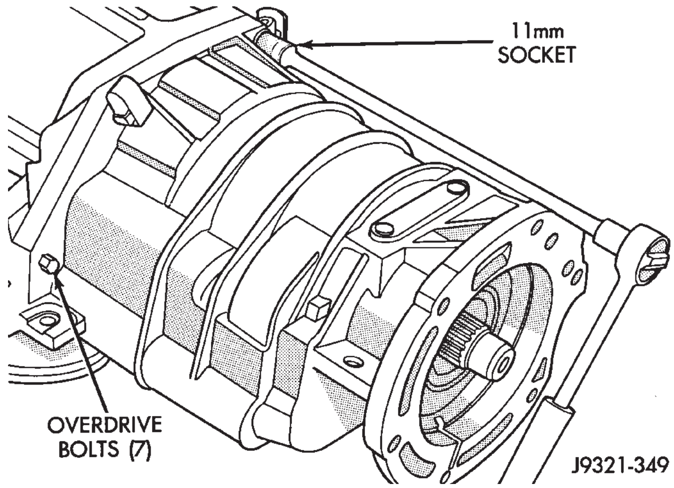


Fig. 2 Overdrive Unit Attaching Bolt Removal

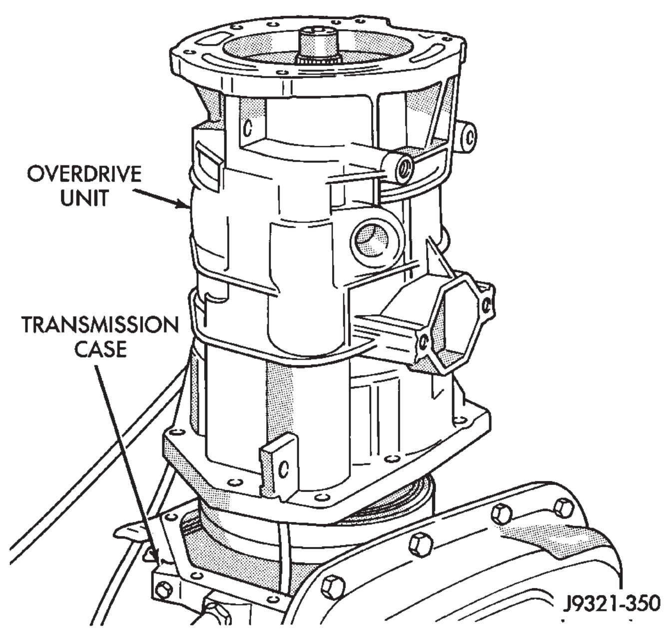


Fig. 3 Overdrive Unit Removal/Installation

(5) Remove overdrive piston thrust bearing (Fig. 4).

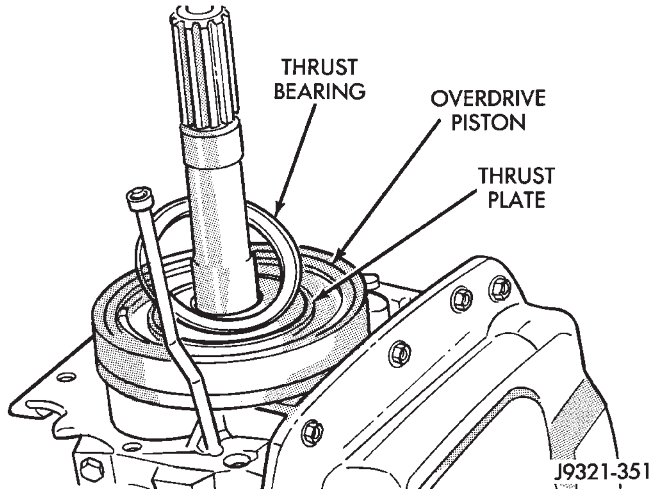


Fig. 4 Overdrive Piston Thrust Bearing Removal/ Installation

OVERDRIVE PISTON REMOVAL

(1) Remove overdrive piston thrust plate (Fig. 5). Retain thrust plate. It is a select fit part and may possibly be reused.

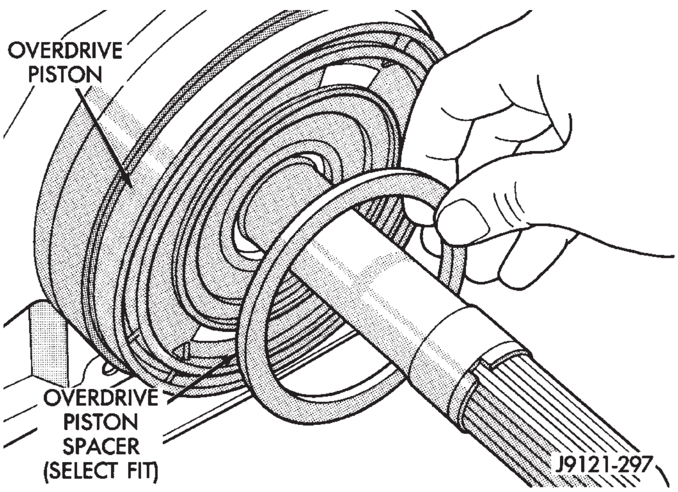


Fig. 5 Overdrive Piston Thrust Plate Removal/ Installation

(2) Remove intermediate shaft spacer (Fig. 6). Retain spacer. It is a select fit part and may possibly be reused.

(3) Remove overdrive piston from retainer (Fig. 7).

OVERDRIVE CLUTCH PACK REMOVAL

(1) Remove overdrive clutch pack wire retaining ring (Fig. 8).

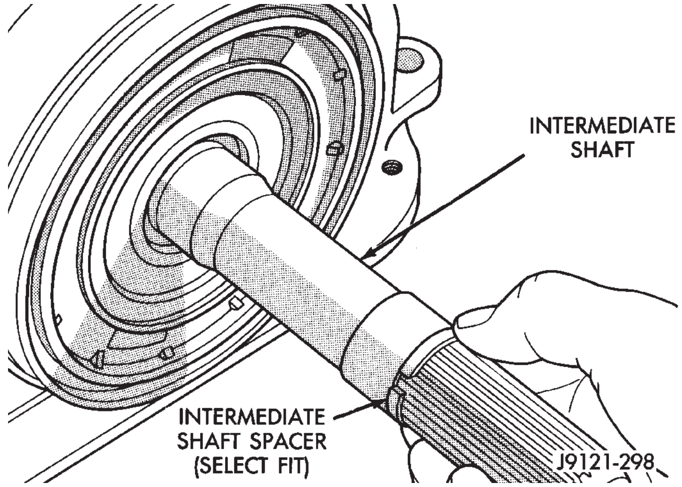


Fig. 6 Intermediate Shaft Spacer Location

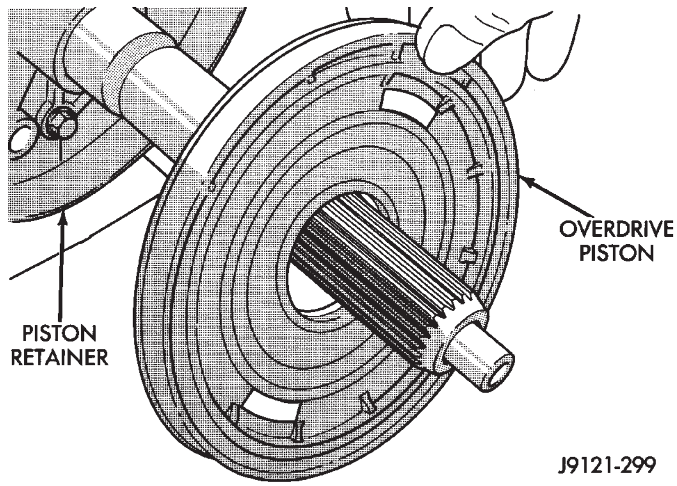


Fig. 7 Overdrive Piston Removal

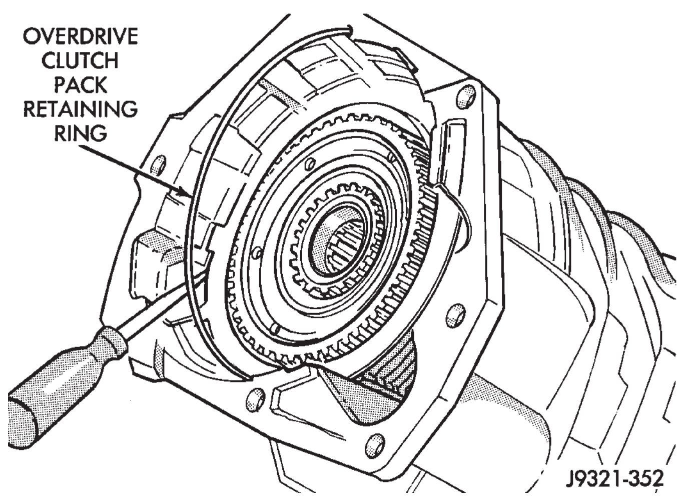


Fig. 8 Removing Overdrive Clutch Pack Retaining Ring

(2) Remove overdrive clutch pack (Fig. 9).

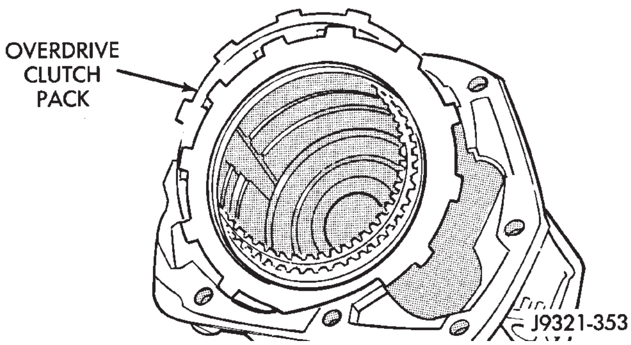


Fig. 9 Overdrive Clutch Pack Removal

(3) Note position of clutch pack components for assembly reference (Fig. 10). Thick reaction plate goes to front as shown.

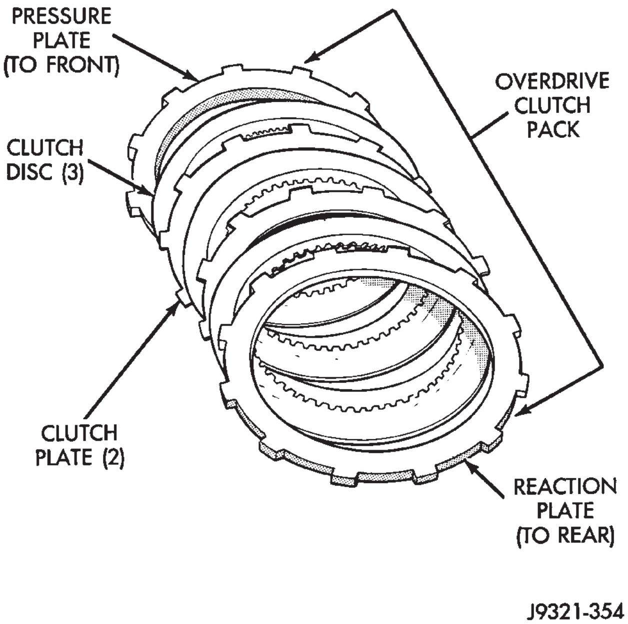


Fig. 10 Overdrive Clutch Component Position

OVERDRIVE GEARTRAIN REMOVAL

(1) Remove overdrive clutch wave spring (Fig. 11).

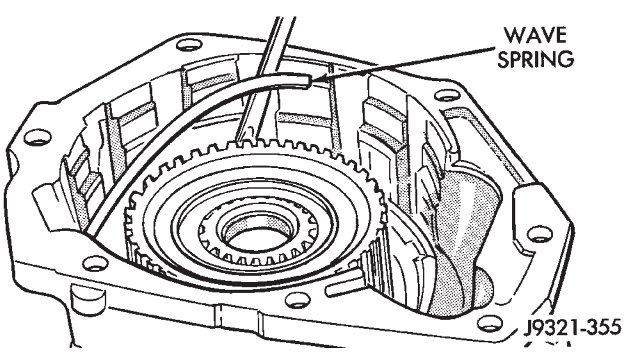


Fig. 11 Overdrive Clutch Wave Spring Removal/ Installation

(2) Remove overdrive clutch reaction snap ring (Fig. 12). Note that snap ring is located in same groove as wave spring.

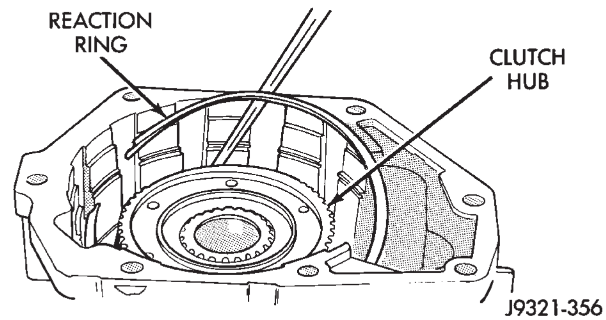


Fig. 12 Overdrive Clutch Reaction Snap Ring Removal/Installation

(3) Remove Torx head screws that attach access cover and gasket to overdrive case (Fig. 13). A T25 size Torx head bit is required.

(4) Remove access cover and gasket (Fig. 14).

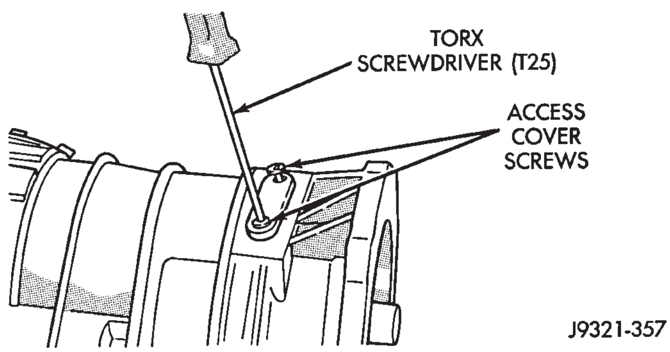


Fig. 13 Access Cover Screw Removal/Installation

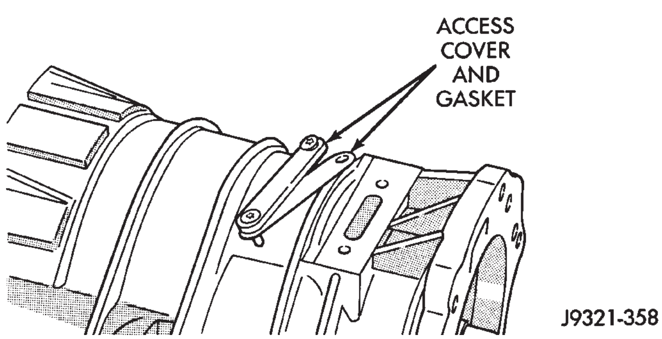


Fig. 14 Access Cover And Gasket Removal/ Installation

(5) Expand output shaft bearing snap ring with expanding-type snap ring pliers. Then push output shaft forward to release shaft bearing from locating ring (Fig. 15).

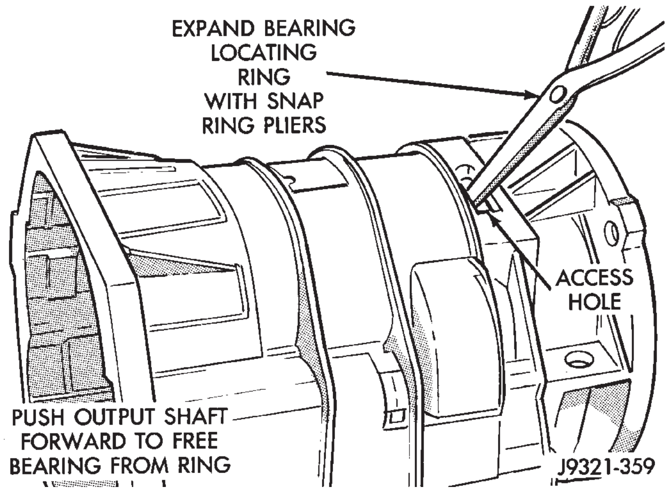


Fig. 15 Releasing Bearing From Locating Ring

(6) Lift gear case up and off geartrain assembly (Fig. 16).

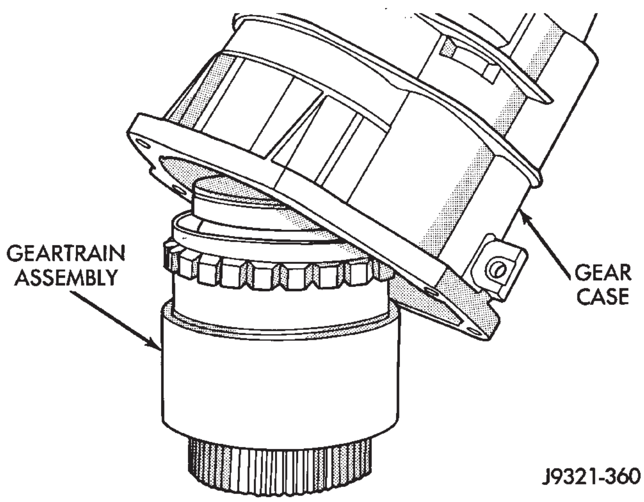


Fig. 16 Removing Gear Case From Geartrain Assembly

(7) Remove snap ring that retains rear bearing on output shaft (Fig. 17).

(8) Remove rear bearing from output shaft (Fig. 18).

DIRECT CLUTCH, HUB AND SPRING REMOVAL

WARNING: THE NEXT STEP IN DISASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE SPRING COMPRESSOR TOOL 6227-1 AND A HYDRAULIC SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

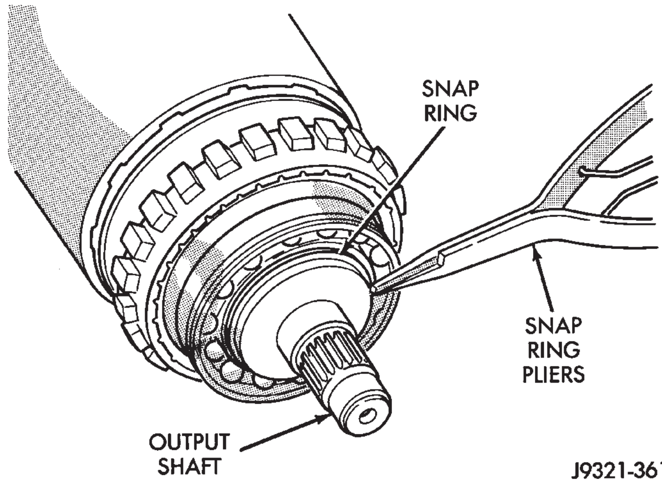


Fig. 17 Rear Bearing Snap Ring Removal/ Installation

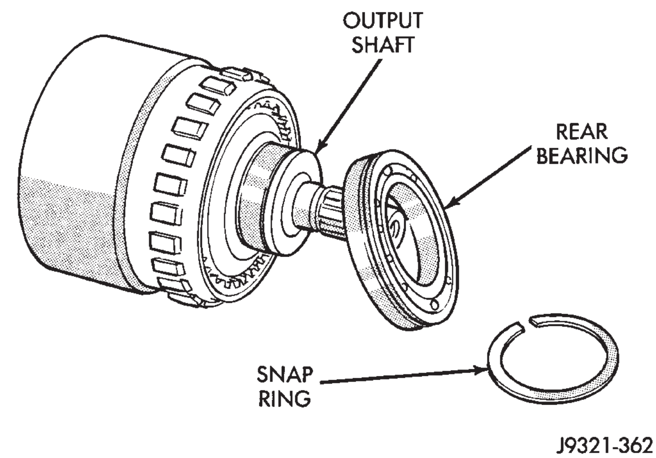


Fig. 18 Rear Bearing Removal

(1) Mount geartrain assembly in shop press (Fig. 19).

(2) Position Compressor Tool 6227-1 on clutch hub (Fig. 19). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(3) Use Special Tool C-3995-A (or similar size tool) at top of Tool 6227-1 to help distribute load and provide needed extra press length (Fig. 19).

(4) Apply press pressure slowly. Compress hub and spring far enough to expose clutch hub retaining ring and relieve spring pressure on clutch pack snap ring (Fig. 19).

(5) Remove direct clutch pack snap ring (Fig. 20).

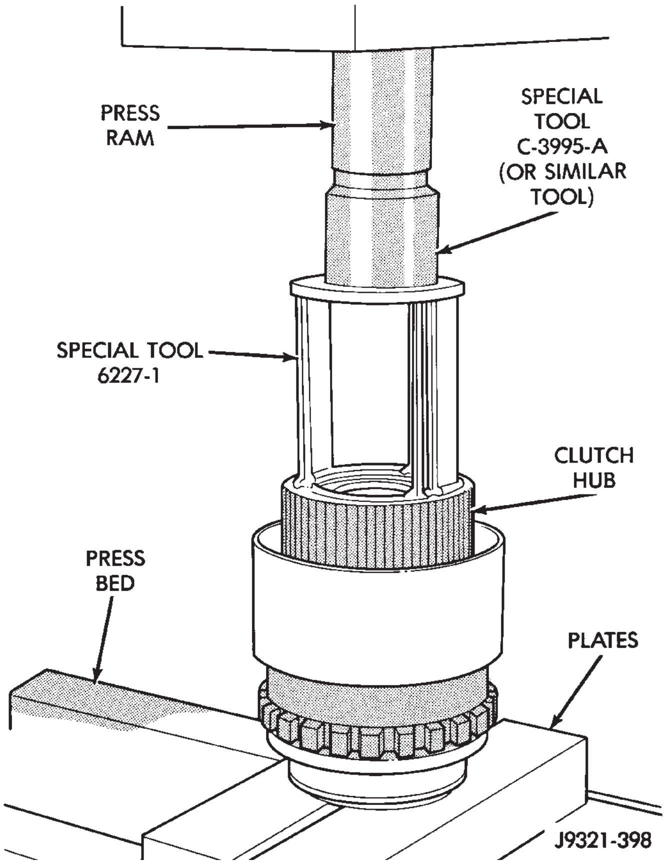


Fig. 19 Geartrain Mounted In Shop Press

(6) Remove direct clutch hub retaining ring (Fig. 21).

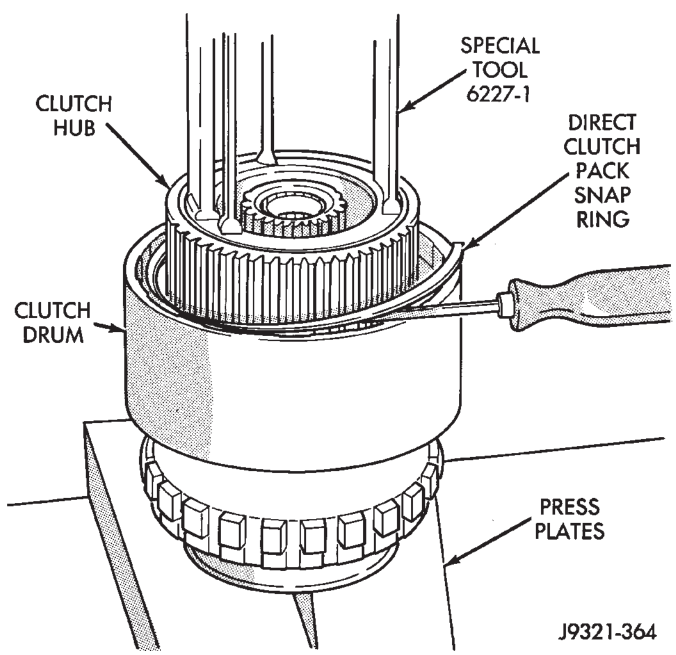


Fig. 20 Direct Clutch Pack Snap Ring Removal

(7) Release press load **slowly and completely (Fig. 22).**

(8) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 22).

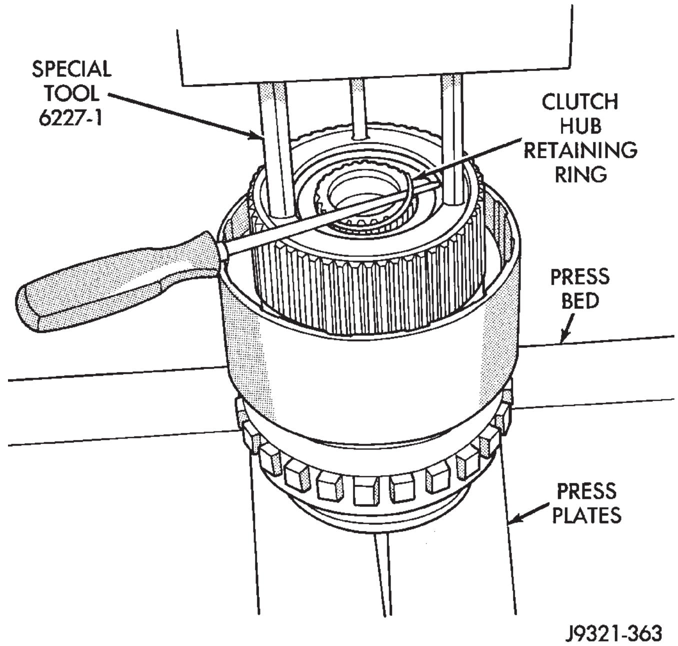


Fig. 21 Direct Clutch Hub Retaining Ring Removal

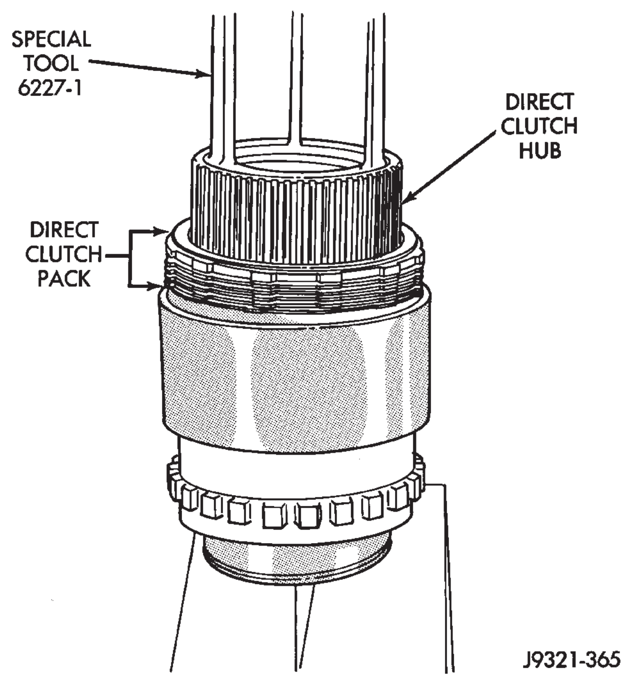


Fig. 22 Direct Clutch Pack Removal

GEARTRAIN DISASSEMBLY

(1) Remove direct clutch hub and spring (Fig. 23).

(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 24).

(3) Remove overrunning clutch assembly with expanding type snap ring pliers (Fig. 25). Insert pliers

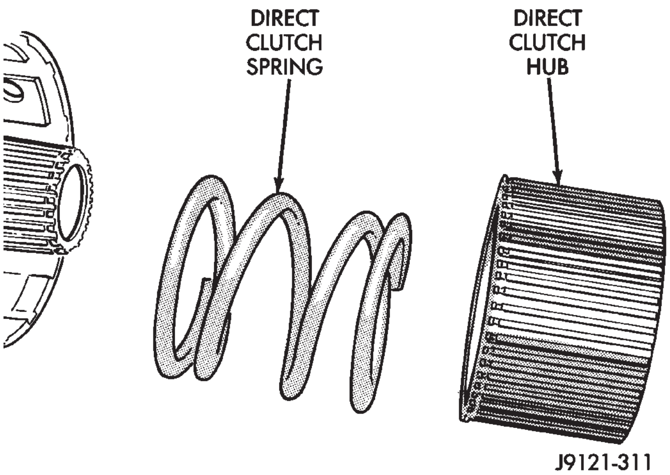


Fig. 23 Direct Clutch Hub And Spring Removal

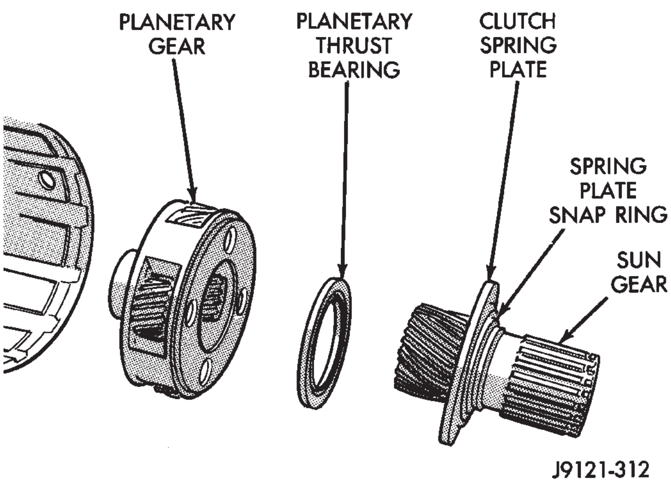


Fig. 24 Removing Sun Gear, Thrust Bearing And Planetary Gear

into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

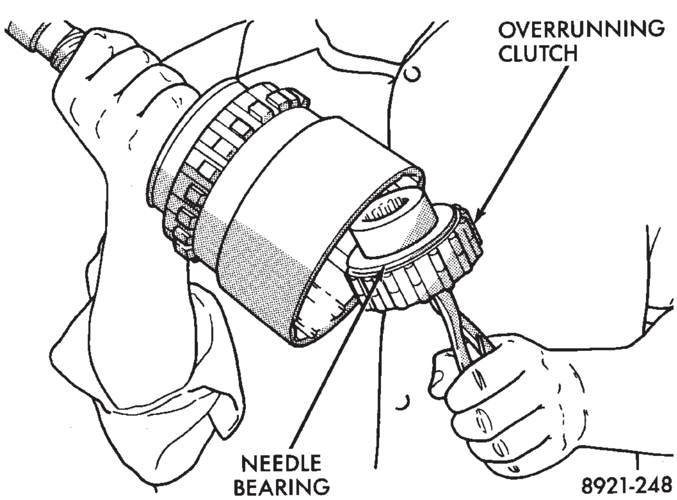


Fig. 25 Overrunning Clutch Assembly Removal/ Installation

(4) Remove thrust bearing from overrunning clutch hub (Fig. 26).

(5) Remove overrunning clutch from hub (Fig. 26).

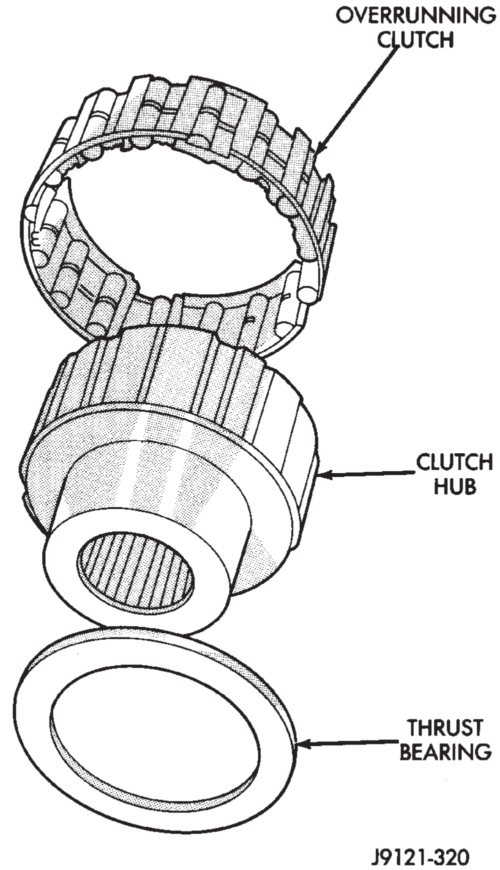


Fig. 26 Overrunning Clutch Components

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 27). Use small center punch or scriber to make alignment marks.

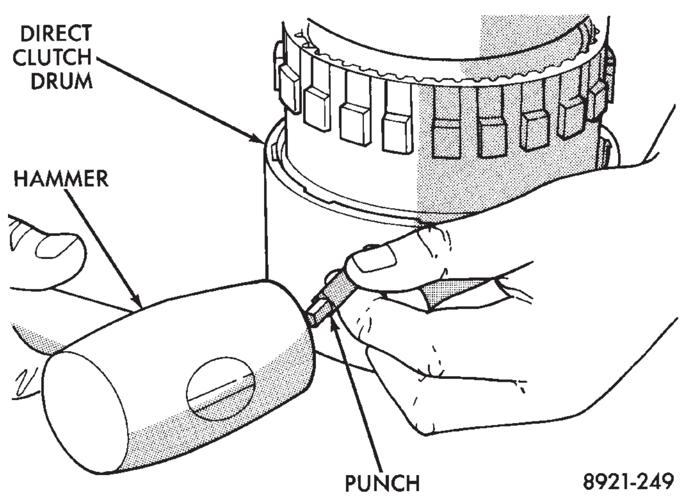


Fig. 27 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

(7) Remove direct clutch drum rear retaining ring (Fig. 28).

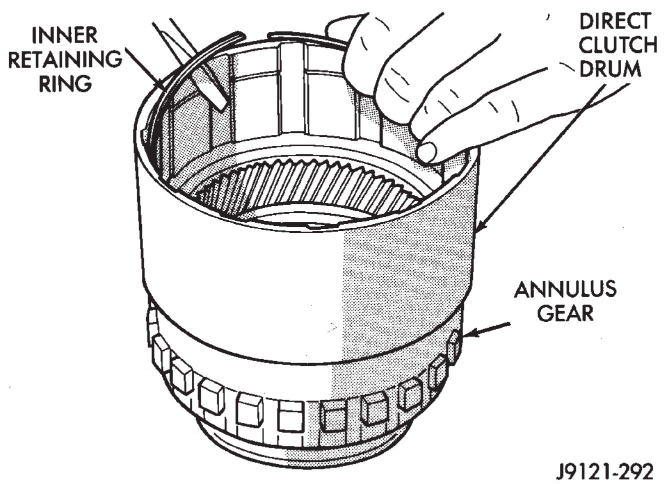


Fig. 28 Clutch Drum Inner Retaining Ring Removal

(8) Remove direct clutch drum outer retaining ring (Fig. 29).

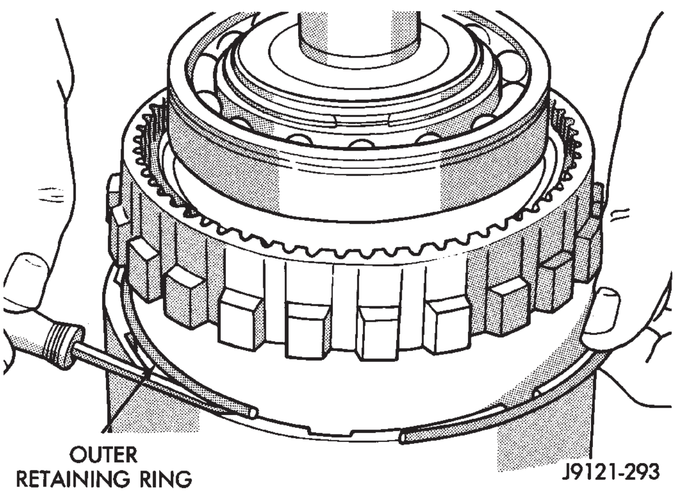


Fig. 29 Clutch Drum Outer Retaining Ring Removal

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 30). Use punch or scriber to mark gear and shaft.

(10) Remove snap ring that secures annulus gear on output shaft (Fig. 31). Use two screwdrivers to unseat and work snap ring out of groove as shown.

(11) Remove annulus gear from output shaft (Fig. 32). Use rawhide or plastic mallet to tap gear off shaft.

GEAR CASE AND PARK LOCK DISASSEMBLY

(1) Remove locating ring from gear case.

(2) Remove park pawl shaft retaining bolt and remove shaft, pawl and spring.

(3) Remove reaction plug snap ring and remove reaction plug.

(4) Remove output shaft seal. Use punch or tool similar to Seal Remover C-3981.

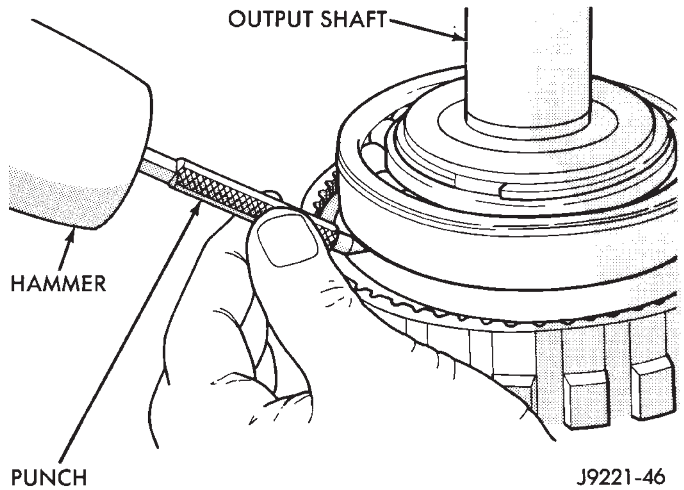


Fig. 30 Marking Annulus Gear And Output Shaft For Assembly Alignment

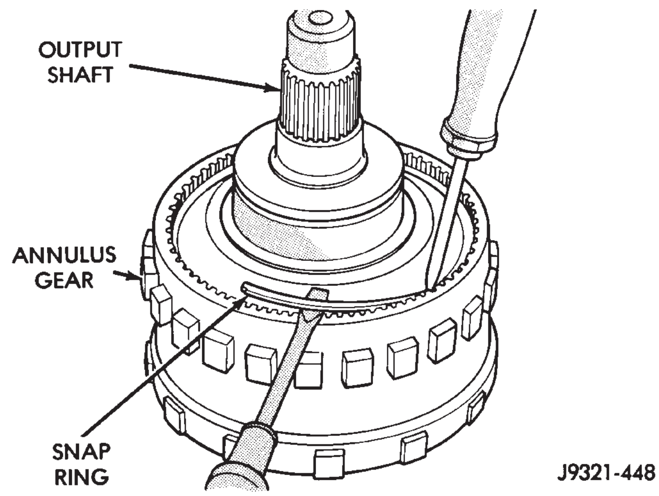


Fig. 31 Annulus Gear Snap Ring Removal

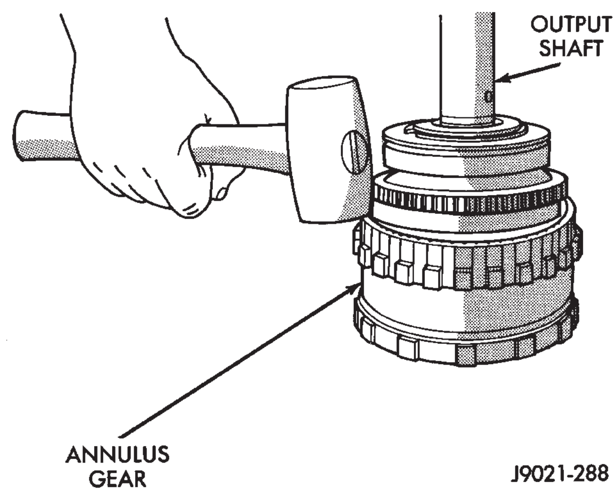


Fig. 32 Annulus Gear Removal

OVERDRIVE COMPONENT CLEANING AND INSPECTION

Clean the geartrain (Fig. 33) and case components (Fig. 34) with solvent. Dry all parts except the bearings with compressed air. Allow bearings to air dry.

Do not use shop towels for wiping parts dry unless the towels are made from a lint-free material. A sufficient quantity of lint (from shop towels, cloths, rags, etc.) could plug the transmission filter and fluid passages.

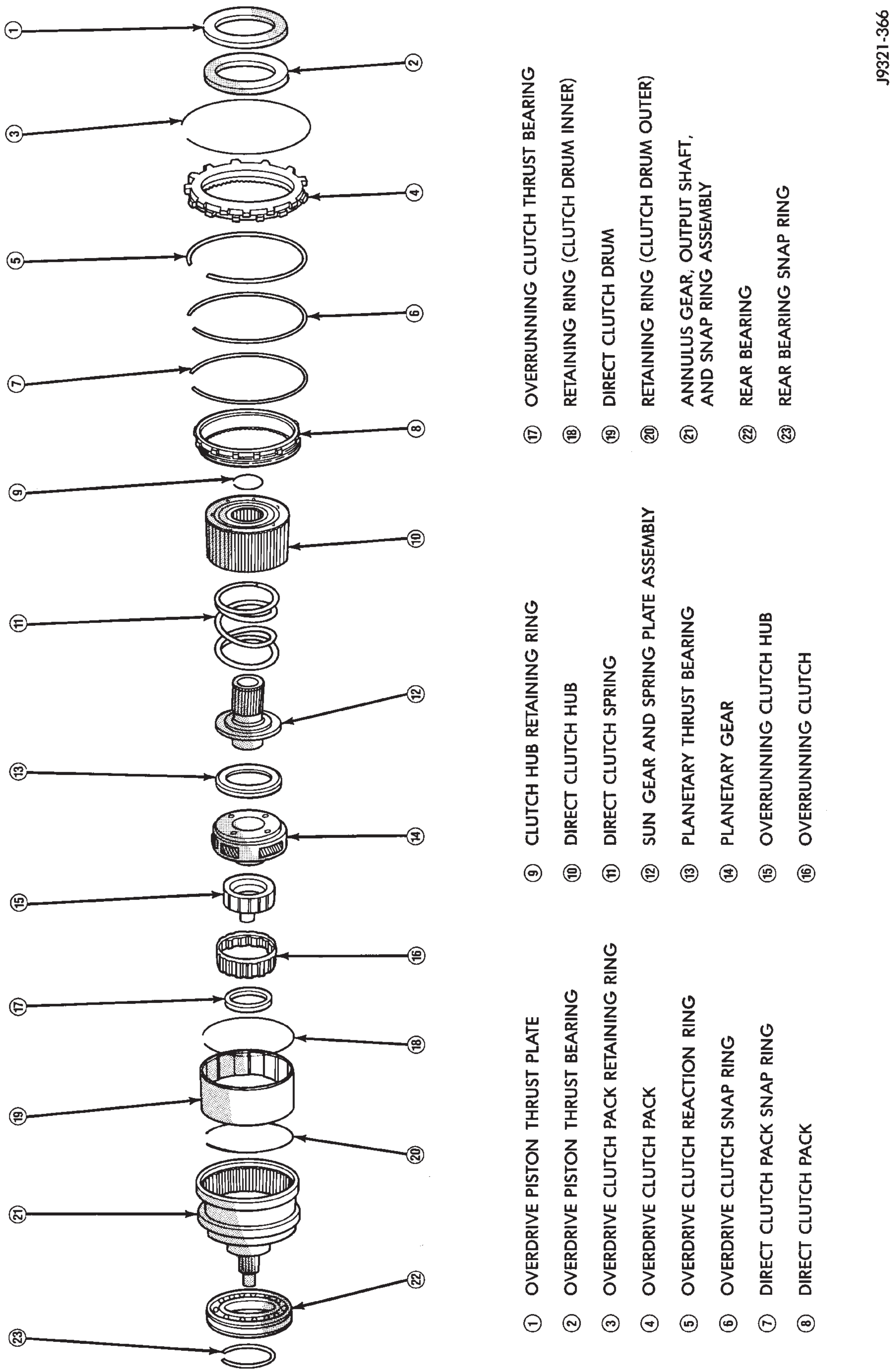
Discard the old case gasket and seals. Do not attempt to salvage these parts. They are not reusable. Replace any of the overdrive unit snap rings if distorted or damaged.

Minor nicks or scratches on components can be smoothed with crocus cloth. However, do not attempt to reduce severe scoring on any components with abrasive materials. Replace severely scored components; do not try to salvage them.

Check condition of the park lock components and the overdrive gear case (Fig. 34).

Replace the case if cracked, scored, or damaged. Replace the park lock pawl, plug, or spring if worn or damaged. Be sure the knob at the end of the park lock rod is in good condition. Replace the rod if the knob is worn or the rod itself is bent or distorted. Do not attempt to straighten the rod.

Check the bushings in the overdrive case. Replace the bushings if severely scored or worn. Also replace the case seal if loose, distorted, or damaged.



1 OVERDRIVE PISTON THRUST PLATE
2 OVERDRIVE PISTON THRUST BEARING
3 OVERDRIVE CLUTCH PACK RETAINING RING
4 OVERDRIVE CLUTCH PACK
5 OVERDRIVE CLUTCH REACTION RING
6 OVERDRIVE CLUTCH SNAP RING
7 DIRECT CLUTCH PACK SNAP RING
8 DIRECT CLUTCH PACK
9 CLUTCH HUB RETAINING RING
10 DIRECT CLUTCH HUB
11 DIRECT CLUTCH SPRING
12 SUN GEAR AND SPRING PLATE ASSEMBLY
13 PLANETARY THRUST BEARING
14 PLANETARY GEAR
15 OVERRUNNING CLUTCH HUB
16 OVERRUNNING CLUTCH
17 OVERRUNNING CLUTCH THRUST BEARING
18 RETAINING RING (CLUTCH DRUM INNER)
19 DIRECT CLUTCH DRUM
20 RETAINING RING (CLUTCH DRUM OUTER)
21 ANNULUS GEAR, OUTPUT SHAFT, AND SNAP RING ASSEMBLY
22 REAR BEARING
23 REAR BEARING SNAP RING

Fig. 33 Overdrive Geartrain Components

Examine the overdrive and direct clutch discs and plates (Fig. 32). Replace the discs if the facing is worn, severely scored, or burned and flaking off. Replace the clutch plates if worn, heavily scored, or cracked. Check the lugs on the clutch plates for wear. The plates should slide freely in the drum. Replace the plates or drum if binding occurs.

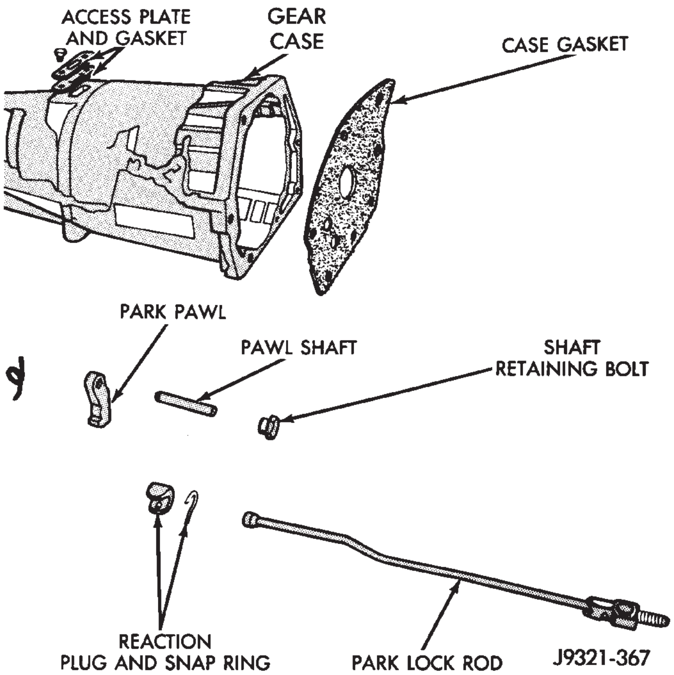


Fig. 34 Overdrive Gear Case And Park Lock Components

Check condition of the annulus gear, direct clutch hub, clutch drum and clutch spring (Fig. 32). Replace the gear, hub and drum if worn or damaged. Replace the spring if collapsed, distorted, or cracked. Be sure the splines and lugs on the gear, drum and hub are in good condition. The clutch plates and discs should slide freely in these components.

Inspect the thrust bearings and spring plate (Fig. 33). Replace the plate if worn or scored. Replace the bearings if rough, noisy, brinnelled, or worn.

Inspect the planetary gear assembly and the sun gear and bushings (Fig. 34). If either the sun gear or the bushings are damaged, replace the gear and bushings as an assembly. The gear and bushings are not serviced separately.

The planetary carrier and pinions must be in good condition. Also be sure the pinion pins are secure and in good condition. Replace the carrier if worn or damaged.

Inspect the overrunning clutch and race. The race surface should be smooth and free of scores. Replace the overrunning clutch assembly or the race if either assembly is worn or damaged in any way.

Check the machined surfaces on the output shaft. These surfaces should be clean and smooth. Very minor nicks or scratches can be polished down with crocus cloth. Replace the shaft if worn, severely scored, or damaged in any way.

Inspect the output shaft bushings (Fig. 35). The small bushing is the intermediate shaft pilot bushing. The large bushing is the overrunning clutch hub bushing. Replace either bushing if scored, pitted, cracked, or worn. Remove the annulus gear from the output shaft if bushing replacement is required. This will provide more working room and make bushing replacement easier.

The bushings can be removed with “blind hole puller tools” such as Snap-On set CG40CB for small bushings and set CG46 for large bushings. New bushings can be installed with tools from an all purpose installer kit such as the Snap-On A257 bushing driver set.

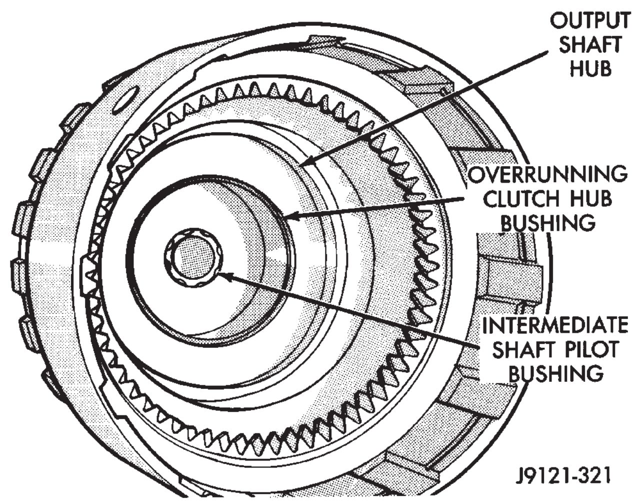


Fig. 35 Output Shaft Bushing Location

OVERDRIVE UNIT ASSEMBLY AND ADJUSTMENT

GEARTRAIN AND DIRECT CLUTCH ASSEMBLY

(1) Soak direct clutch and overdrive clutch discs in Mopar ATF Plus transmission fluid. Allow discs to soak for 10-20 minutes.

(2) Install new pilot bushing and clutch hub bushing in output shaft if necessary (Fig. 34). Lubricate new (or old) bushings with petroleum jelly, or transmission fluid.

(3) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap ring (Fig. 36).

(4) Align and install clutch drum on annulus gear (Fig. 37). Be sure drum is engaged in annulus gear lugs.

(5) Install clutch drum outer retaining ring (Fig. 37).

(6) Slide clutch drum forward and install inner retaining ring (Fig. 38).

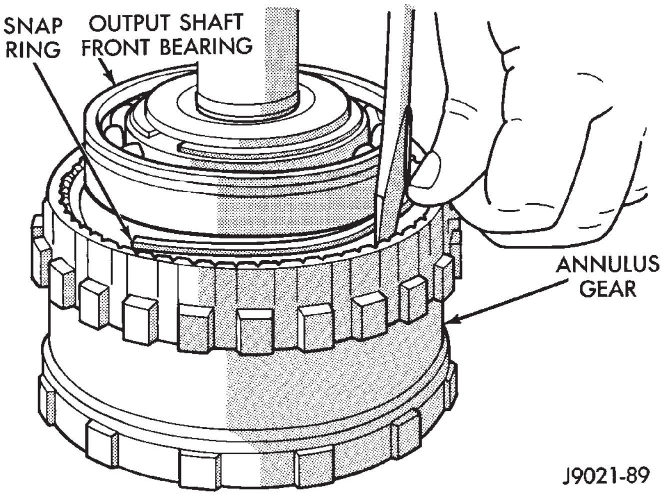


Fig. 36 Annulus Gear Installation

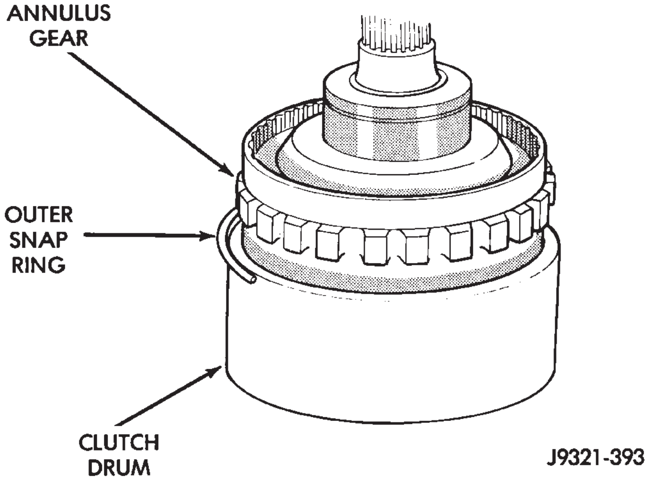


Fig. 37 Clutch Drum And Outer Retaining Ring Installation

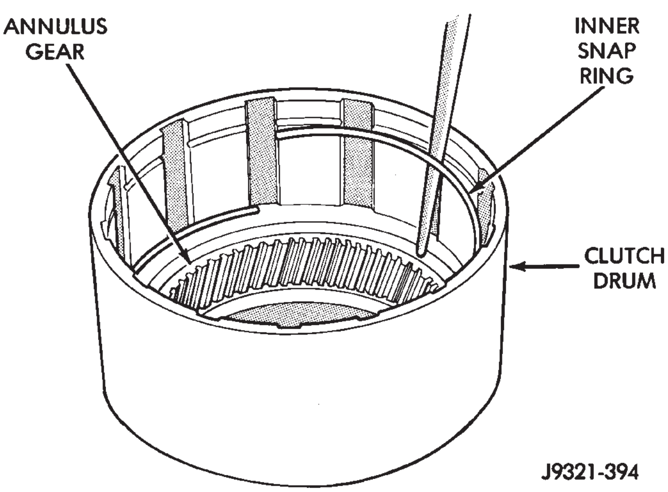


Fig. 38 Clutch Drum Inner Retaining Ring Installation

(7) Install rear bearing and snap ring on output shaft (Fig. 39). Be sure locating ring groove in bearing is toward rear.

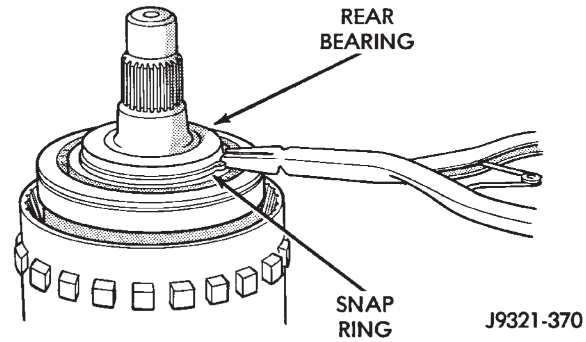


Fig. 39 Rear Bearing And Snap Ring Installation

(8) Install overrunning clutch on hub (Fig. 40). **Note that clutch only fits one way. Shoulder on clutch should seat in small recess at edge of hub.**

(9) Install thrust bearing on overrunning clutch hub (Fig. 41). Use generous amount of petroleum jelly to hold bearing in place for installation. **Bearing fits one way only. Be sure bearing is seated squarely against hub. Reinstall bearing if it does not seat squarely.**

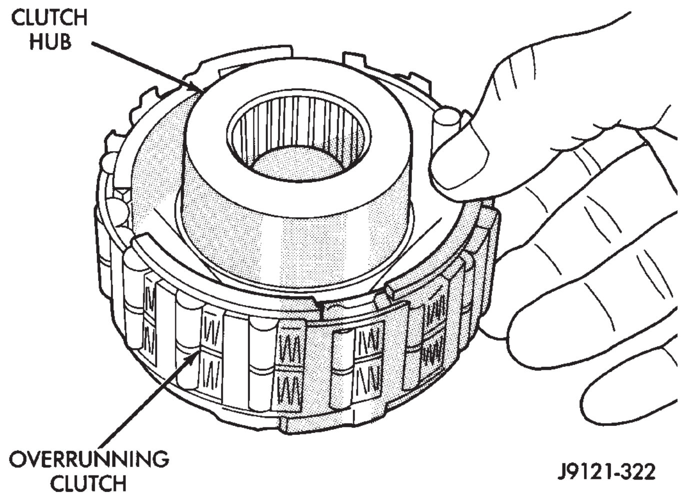


Fig. 40 Assembling Overrunning Clutch And Hub

(10) Install overrunning clutch in output shaft (Fig. 42). Insert snap ring pliers in hub splines. Expand pliers to grip hub. Then install assembly with counterclockwise, twisting motion.

(11) Install planetary gear in annulus gear (Fig. 43). **Be sure planetary pinions are fully seated in annulus gear before proceeding.**

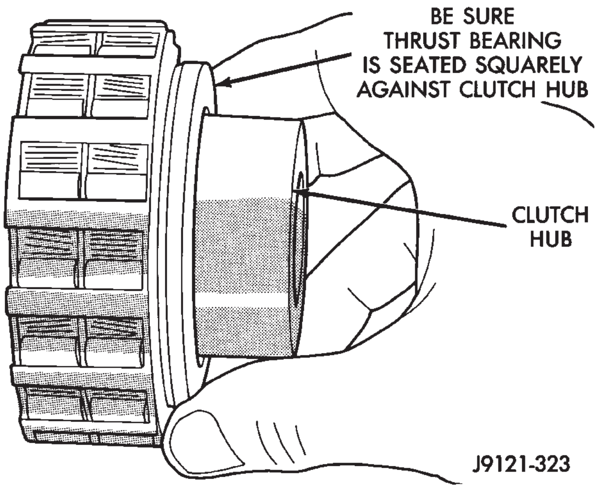


Fig. 41 Overrunning Clutch Thrust Bearing Installation

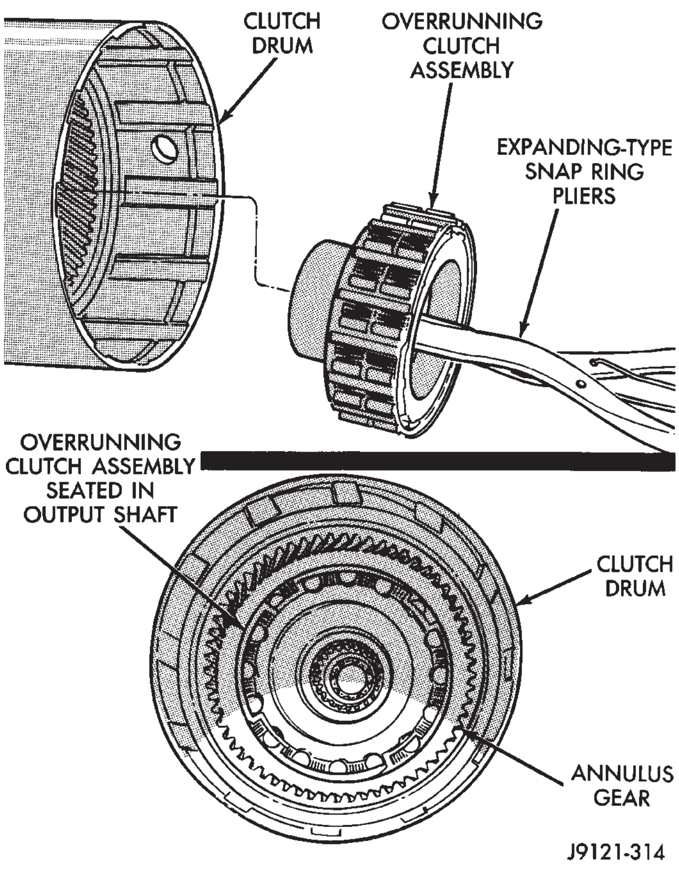


Fig. 42 Overrunning Clutch Installation

(12) Install direct clutch spring plate on sun gear. Shoulder side of plate should face outward and toward front. Then secure plate to sun gear with snap ring (Fig. 44).

(13) Coat planetary thrust bearing and bearing contact surface of spring plate with generous amount of petroleum jelly. This will help hold bearing in place during installation.

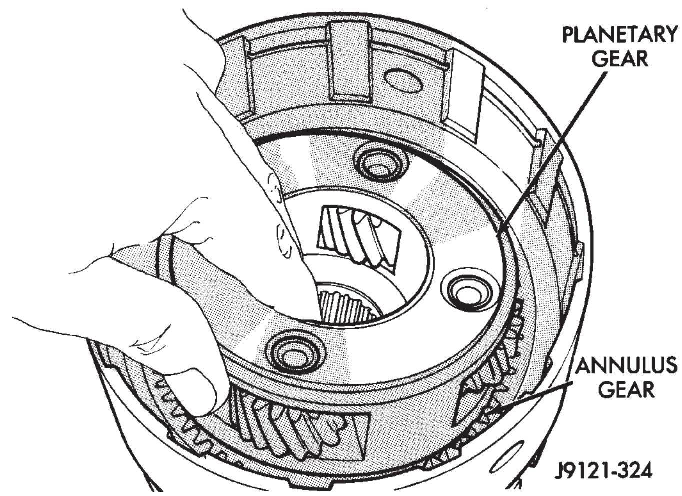


Fig. 43 Planetary Gear Installation

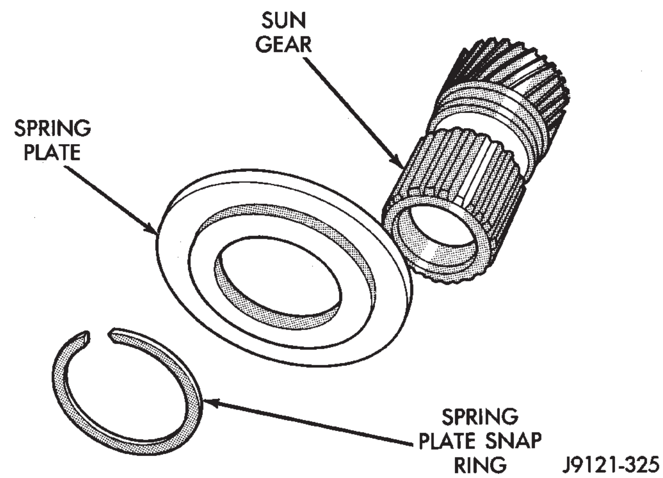


Fig. 44 Sun Gear And Spring Plate Assembly

(14) Install planetary thrust bearing on sun gear (Fig. 45). Slide bearing onto gear and seat it against spring plate as shown. **Bearing fits one way only. If it does not seat squarely against spring plate, remove and reposition bearing.**

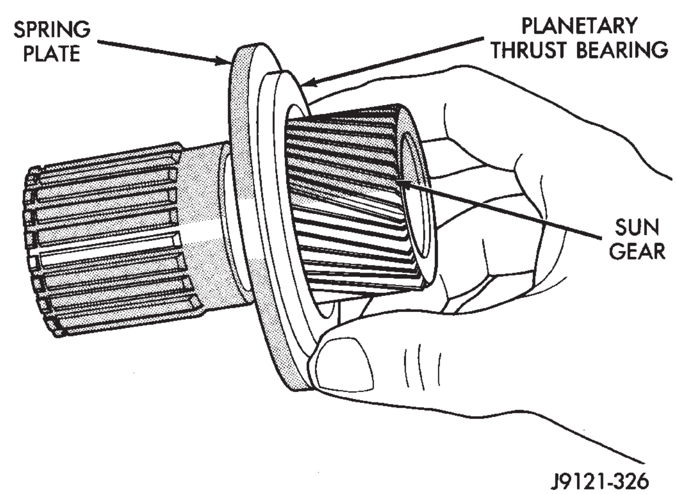


Fig. 45 Planetary Thrust Bearing Installation

(15) Install assembled sun gear, spring plate and thrust bearing (Fig. 46). Be sure sun gear and thrust bearing are fully seated before proceeding.

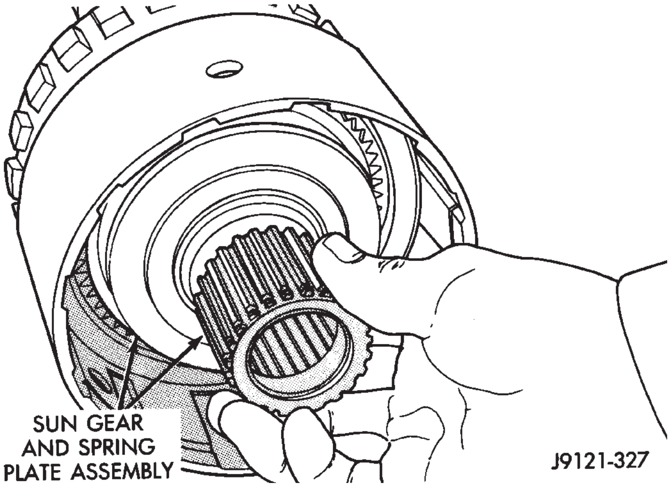


Fig. 46 Sun Gear Installation

(16) Mount assembled output shaft, annulus gear, and clutch drum in shop press. Direct clutch spring, hub and clutch pack are easier to install with assembly mounted in press.

(17) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 47). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

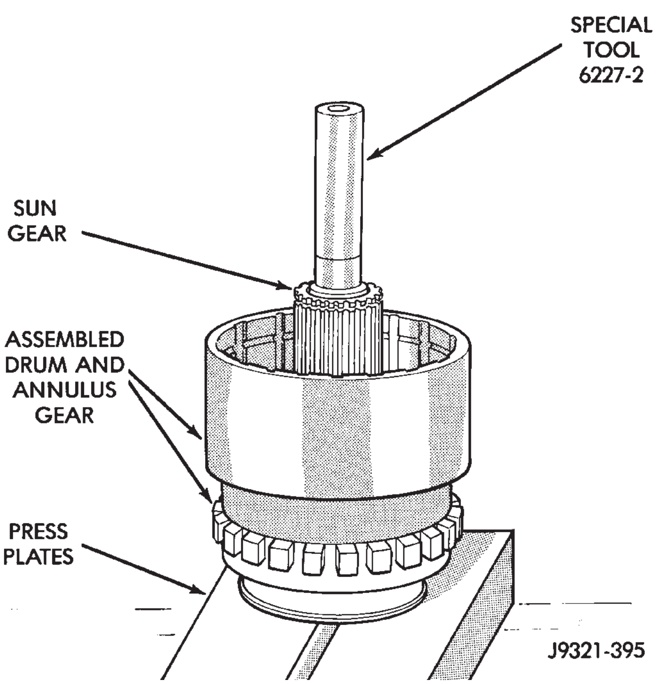


Fig. 47 Alignment Tool Installation

(18) Install direct clutch spring (Fig. 48). Be sure spring is properly seated on spring plate.

(19) Assemble and install direct clutch pack on hub as follows:

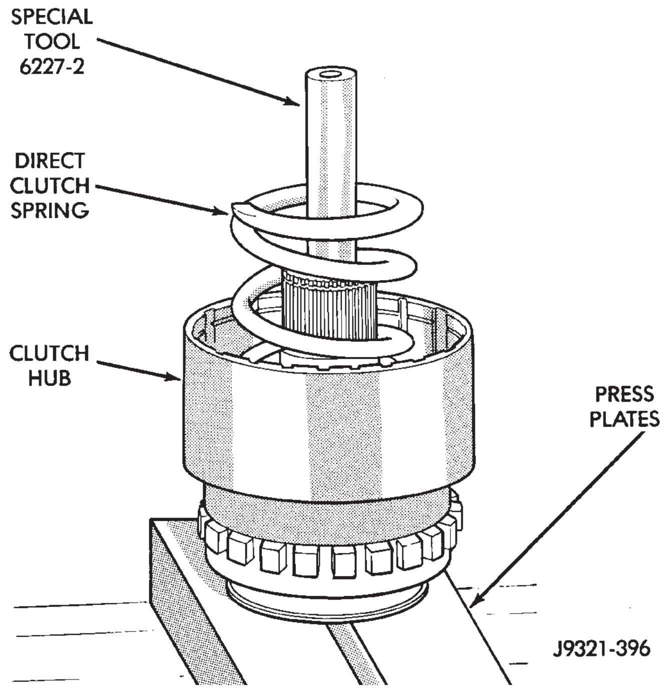


Fig. 48 Direct Clutch Spring Installation

(a) Assemble clutch pack components (Fig. 49).

(b) Install direct clutch reaction plate on clutch hub first. **Note that one side of reaction plate is counterbored. Be sure this side faces rearward. Splines at rear of hub are raised slightly. Counterbore in plate fits over raised splines. Plate should be flush with this end of hub (Fig. 50).**

(c) Install first clutch disc followed by a steel plate until 6 discs and 5 plates have been installed.

(d) Install pressure plate. This is last clutch pack item to be installed. **Be sure plate is installed with shoulder side facing upward (Fig. 51).**

(20) Install clutch hub and clutch pack on direct clutch spring (Fig. 52). **Be sure hub is started on sun gear splines before proceeding.**

WARNING: THE NEXT STEP IN GEARTRAIN ASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH HUB AND SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE COMPRESSOR TOOL C-6227-1 AND A HYDRAULIC-TYPE SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(21) Carefully **remove** Alignment Tool 6227-2 from clutch and hub splines. Withdraw tool slowly to avoid

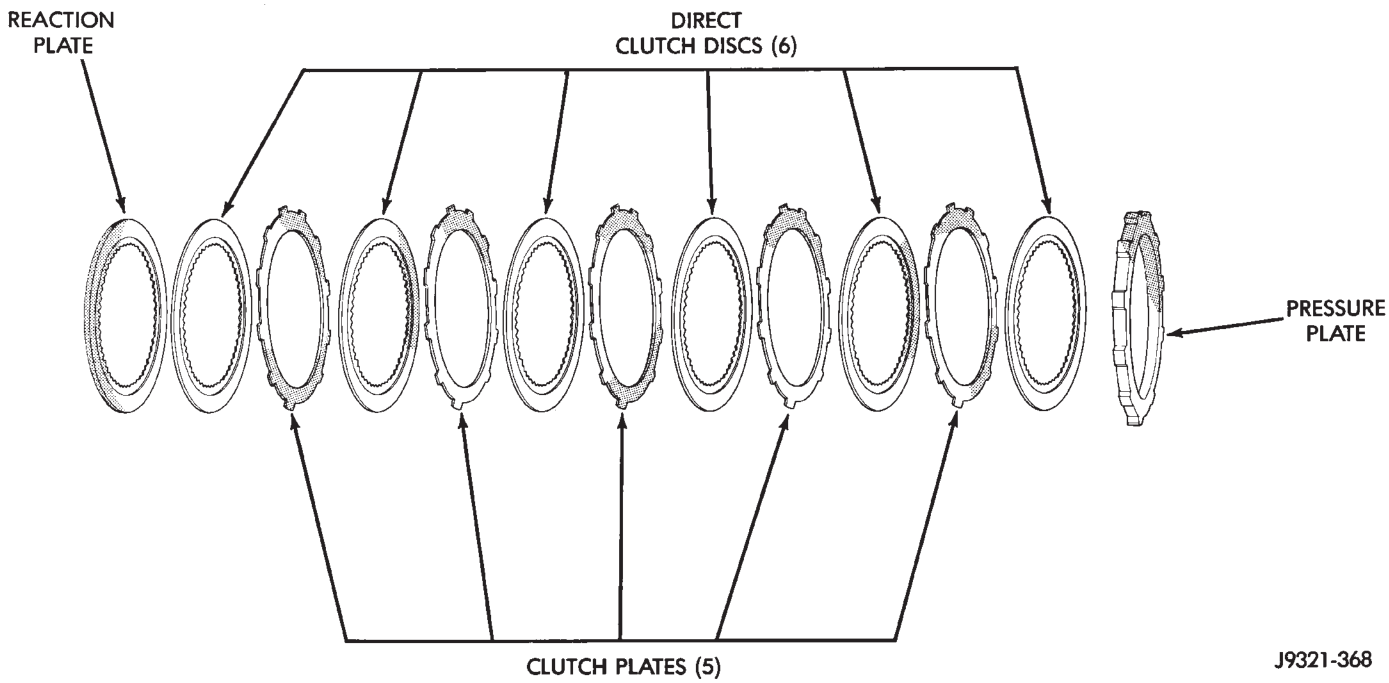


Fig. 49 Direct Clutch Pack Components

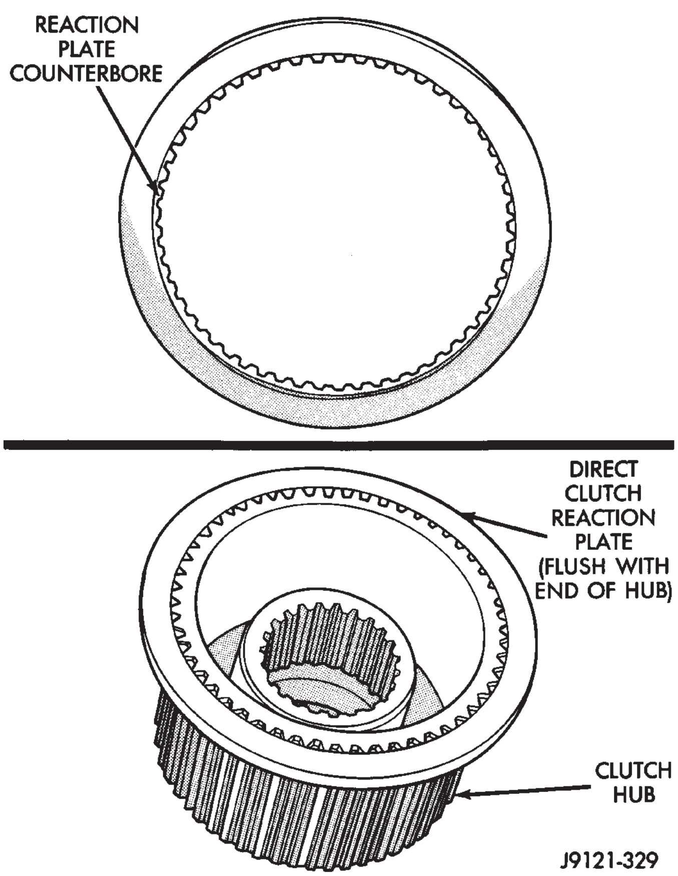


Fig. 50 Correct Position Of Direct Clutch Reaction Plate

spline misalignment. Tool must be removed at this point to provide room for compressor tool movement.

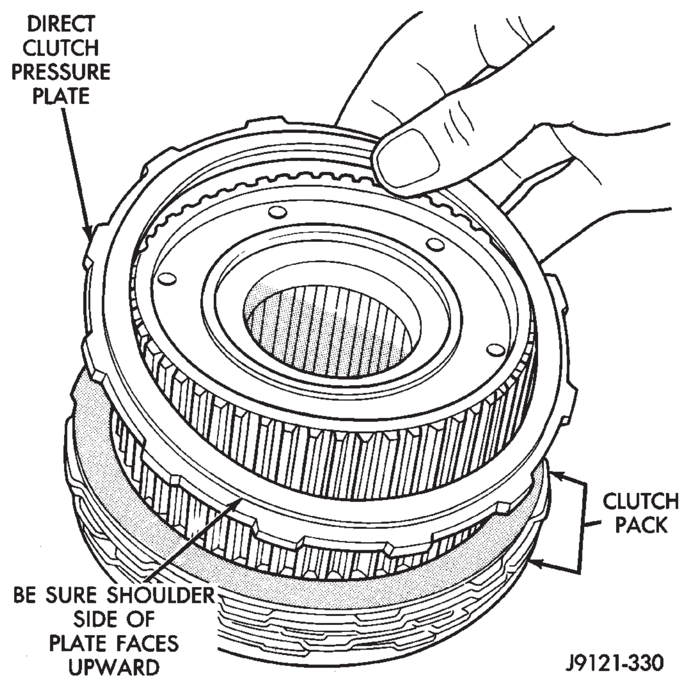


Fig. 51 Correct Position Of Direct Clutch Pressure Plate

(22) Position Compressor Tool 6227-1 on clutch hub (Fig. 53).

(23) Position Tool C-3995-A or similar type tool on top of Tool 6227-1 (Fig. 19).

(24) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

(25) Slide direct clutch pack upwards on hub (Fig. 53). Then set clutch pack on edge of clutch hub and compressor tool as shown.

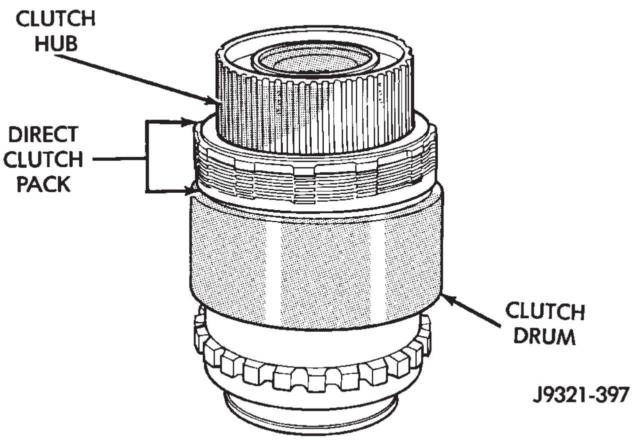


Fig. 52 Direct Clutch Pack And Clutch Hub Installation

(26) Slowly compress clutch hub and spring (Fig. 53). Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

(27) Realign clutch pack on hub and seat clutch discs and plates in clutch drum (Fig. 53).

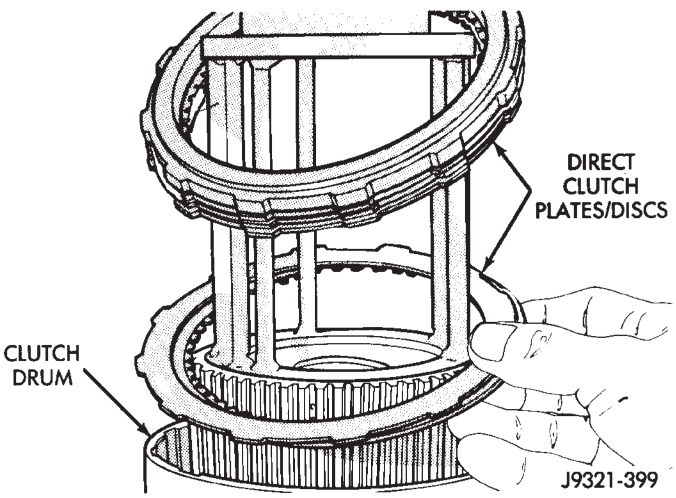


Fig. 53 Seating Clutch Pack In Drum

(28) Install direct clutch pack snap ring (Fig. 54). **Be very sure snap ring is fully seated in clutch drum ring groove.**

(29) Install clutch hub retaining ring (Fig. 55). **Be very sure retaining ring is fully seated in sun gear ring groove.**

(30) Slowly release press ram, remove compressor tools and remove geartrain assembly.

GEAR CASE ASSEMBLY AND INSTALLATION

(1) Position park pawl and spring in case and install park pawl shaft (Fig. 34). Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.

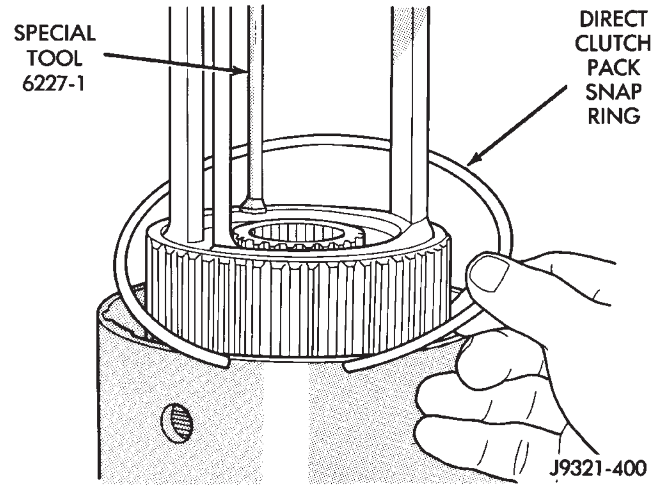


Fig. 54 Direct Clutch Pack Snap Ring Installation

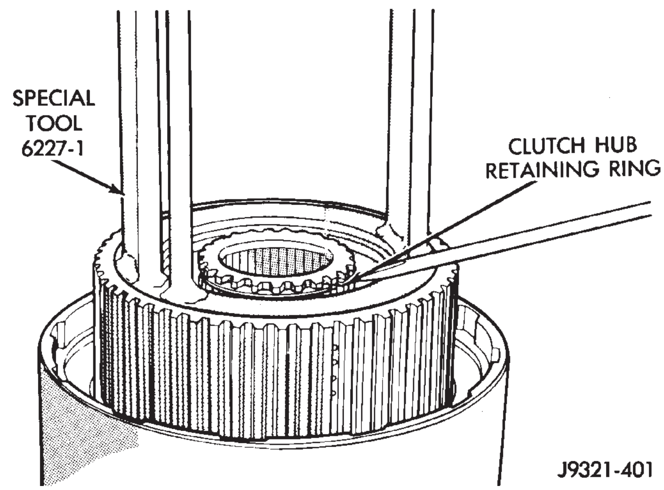


Fig. 55 Clutch Hub Retaining Ring Installation

(2) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.

(3) Install park lock reaction plug. **Note that plug has locating pin at rear (Fig. 56). Be sure pin is seated in hole in case before installing snap ring.**

(4) Install reaction plug snap ring (Fig. 57). **Compress snap ring only enough for installation; do not distort it.**

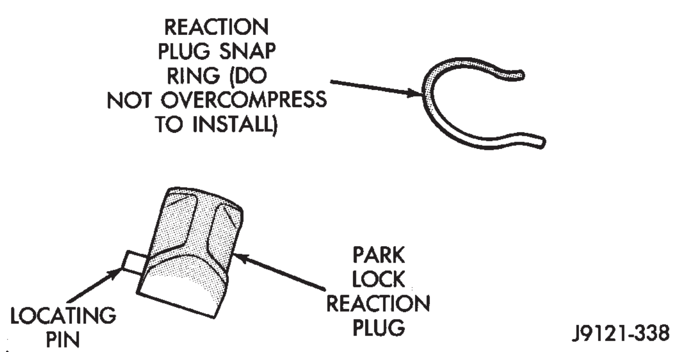


Fig. 56 Reaction Plug Locating Pin And Snap Ring

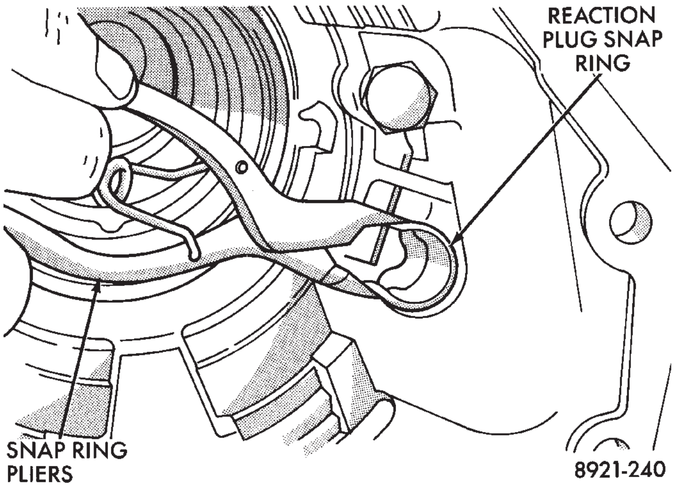


Fig. 57 Reaction Plug And Snap Ring Installation

(5) Install new seal in gear case (Fig. 58). On 4x4 gear case, use Tool Handle C-4171 and Installer 5062 (or similar size tool) to seat seal in case. On 4 x 2 gear case, use same tool handle and suitable size installer to seat seal in case.

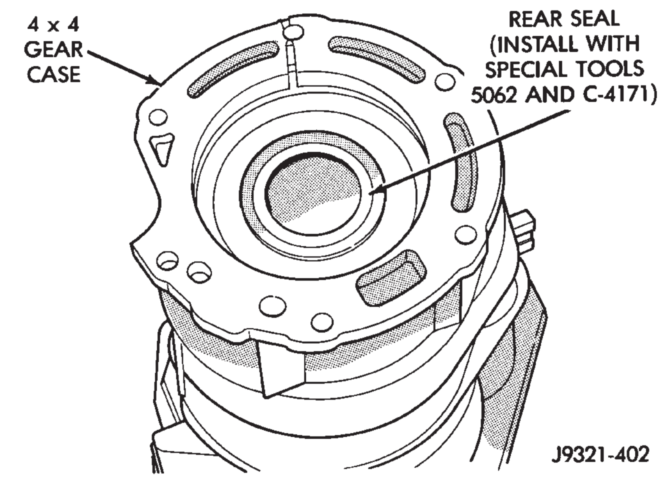


Fig. 58 Rear Seal Installation (In 4x4 Gear Case)

(6) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 59).

(7) Support geartrain on Tool 6227-1 (Fig. 60). Be sure tool is securely seated in clutch hub.

(8) Install overdrive gear case on geartrain (Fig. 60).

(9) Expand front bearing locating ring with snap ring pliers (Fig. 61). Then slide case downward until locating ring locks in bearing groove and release snap ring.

(10) Install locating ring access cover and gasket in overdrive unit case (Fig. 62).

OVERDRIVE CLUTCH INSTALLATION

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 63).

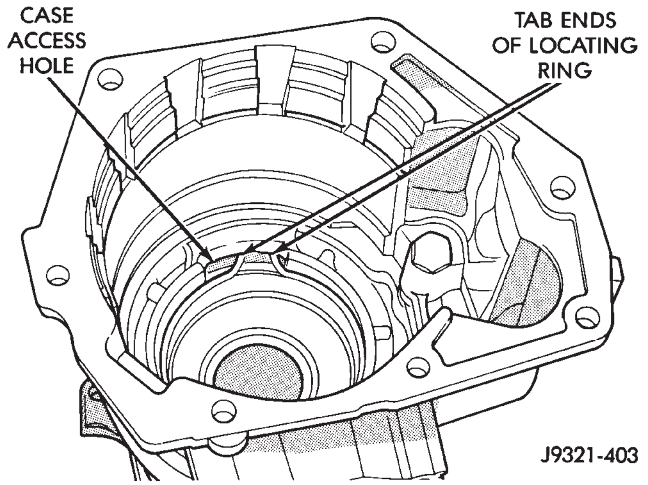


Fig. 59 Correct Rear Bearing Locating Ring Position

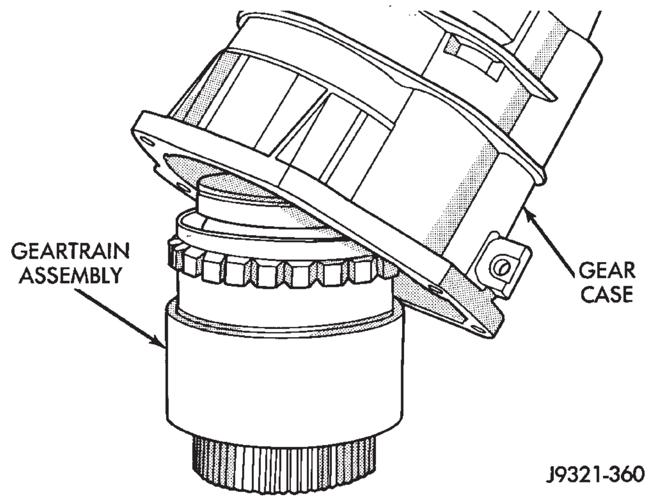


Fig. 60 Overdrive Gear Case Installation

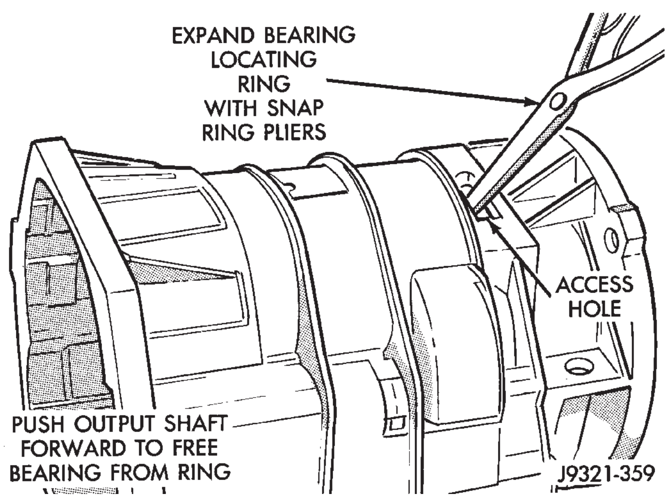


Fig. 61 Seating Locating Ring In Rear Bearing

(2) Install wave spring on top of reaction ring (Fig. 64). **Reaction ring and wave ring both fit in same ring groove.** Use screwdriver to seat each ring securely in groove.

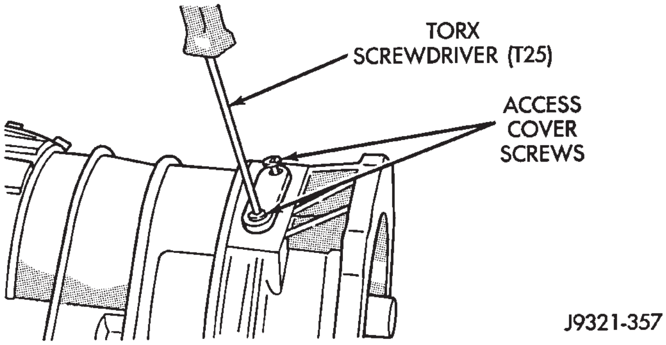


Fig. 62 Locating Ring Access Cover And Gasket Installation

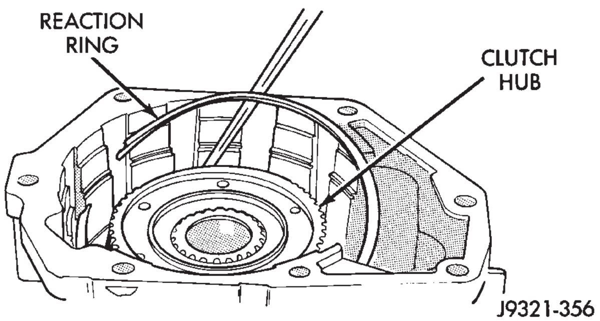


Fig. 63 Overdrive Clutch Reaction Ring Installation

(3) Assemble overdrive clutch pack (Fig. 65).

(4) Install overdrive clutch reaction plate first. **Note that reaction plate is thinner than pressure plate.**

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

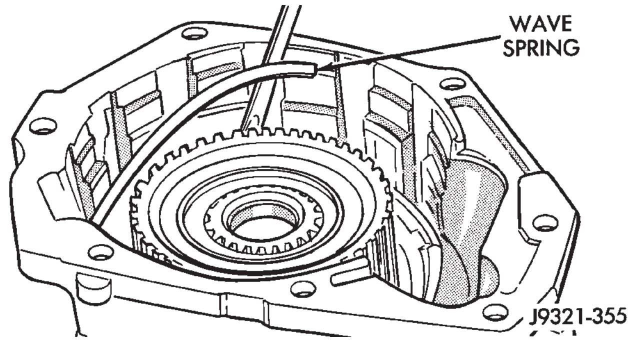


Fig. 64 Overdrive Clutch Wave Spring Installation

(6) Verify clutch pack. 3 clutch discs, 2 steel plates, 1 reaction plate and 1 pressure plate are required.

(7) Install clutch pack pressure plate. Note that pressure plate is thickest plate in clutch pack.

(8) Install clutch pack wire-type retaining ring (Fig. 66).

SHAFT END PLAY ADJUSTMENT

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness **intermediate shaft spacer** as follows:

(a) Insert Special Tool 6312 through sun gear, planetary gear and into pilot bushing in output shaft. Be sure tool bottoms against planetary shoulder.

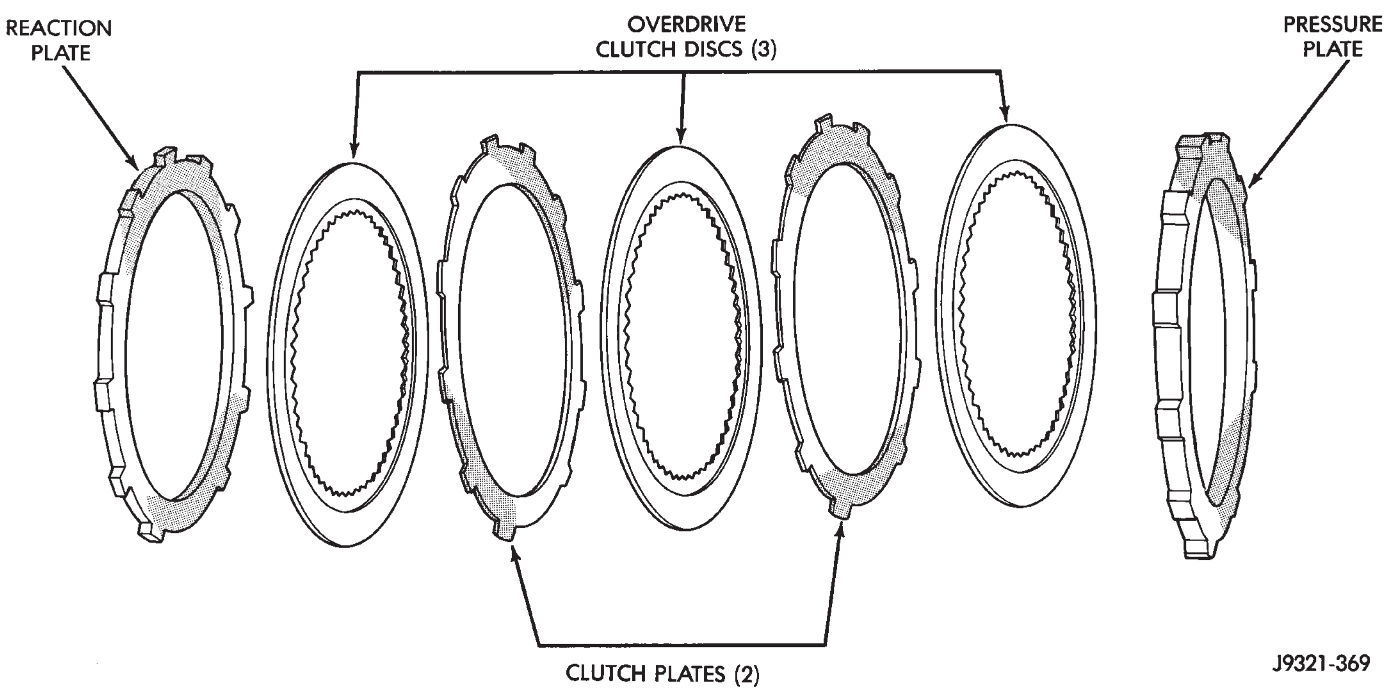


Fig. 65 Overdrive Clutch Components

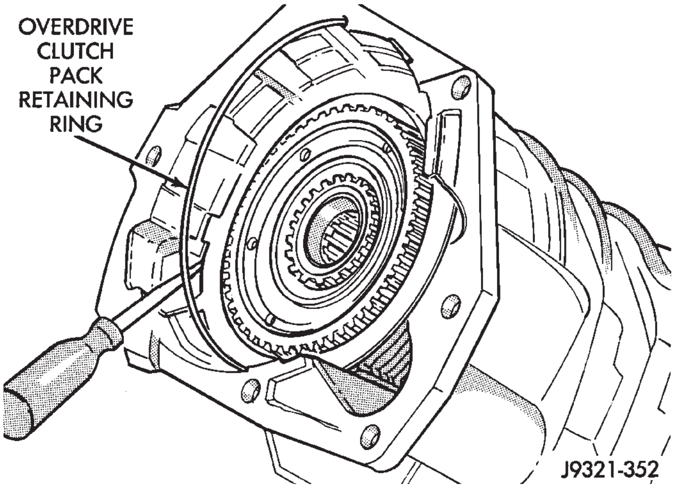


Fig. 66 Overdrive Clutch Pack Retaining Ring Installation

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 67). Then position Dial Caliper C-4962 over gauge tool.

(c) Extend sliding scale of dial caliper downward through gauge tool slot until scale contacts end of Gauge Alignment Tool 6312. Lock scale in place. Remove dial caliper tool and note distance measured (Fig. 67).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 68).

(e) Remove Gauge Alignment Tool 6312.

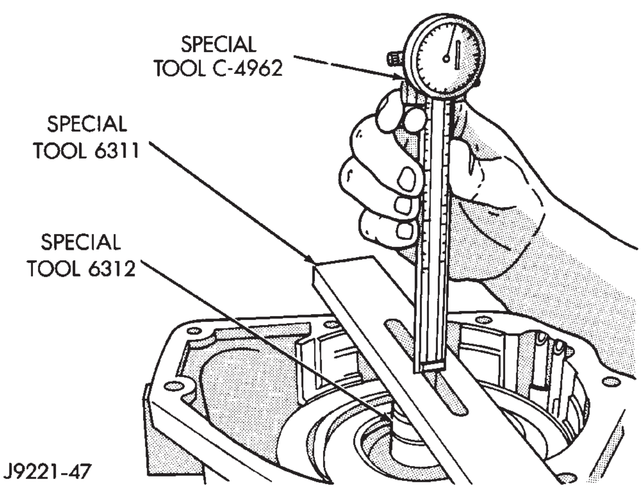


Fig. 67 Shaft End Play Measurement

(3) Determine correct thickness **overdrive piston thrust plate** as follows:

(a) Position Gauge Tool 6311 across face of overdrive case. Then position Dial Caliper C-4962 over gauge tool (Fig. 69).

(b) Measure distance to clutch hub thrust bearing seat at four points 90° apart. Then average measurements by adding them and dividing by 4.

(c) Select and install required thrust plate from information in thrust plate chart (Fig. 70).

End Play Measurement (Inches)	Spacer Thickness (Inches)
.7336 - .7505	.158 - .159
.7506 - .7675	.175 - .176
.7676 - .7855	.193 - .194
.7856 - .8011	.211 - .212

J9121-341

Fig. 68 Intermediate Shaft End Play Spacer Selection

(4) Leave Alignment Tool 6227-2 in place. Tool will keep planetary and clutch hub splines in alignment until overdrive unit is ready for installation on transmission.

(5) Transmission speed sensor can be installed at this time if desired. However, it is recommended that sensor not be installed until after overdrive unit is secured to transmission.

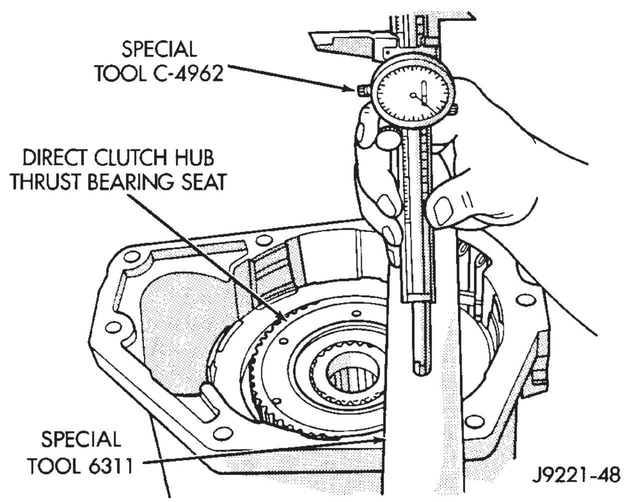


Fig. 69 Overdrive Piston Thrust Plate Measurement

End Play Measurement (Inches)	Spacer Thickness (Inches)
1.7500 - 1.7649	.108 - .110
1.7650 - 1.7799	.123 - .125
1.7800 - 1.7949	.138 - .140
1.7950 - 1.8099	.153 - .155
1.8100 - 1.8249	.168 - .170
1.8250 - 1.8399	.183 - .185
1.8400 - 1.8549	.198 - .200
1.8550 - 1.8699	.213 - .215
1.8700 - 1.8849	.228 - .230
1.8850 - 1.8999	.243 - .245

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Fig. 70 Overdrive Piston Thrust Plate Selection

46RH AUTOMATIC TRANSMISSION

CONTENTS

GENERAL INFORMATION

INDEX

TRANSMISSION DESCRIPTION

The Chrysler 46RH automatic transmission is a 4-speed, fully automatic units with an overdrive fourth gear range. The 46RH is used with 5.2L (V8) engines.

The 46RH is a dual unit design. The assembly consists of a three speed automatic transmission with an overdrive unit attached at the rear (Fig. 1). The overdrive unit provides a fourth gear overdrive ratio of 0.69 to 1.

The 46RH valve body has an additional housing. This housing contains the extra valving and electrical solenoids that provide overdrive fourth gear range.

The governor and park lock assemblies are located inside the overdrive unit in 46RH transmissions. The overdrive unit must be removed and disassembled for service access to the park lock and governor components.

First through third gear ranges are provided by the clutches, bands, overrunning clutch and planetary gear sets in the transmission unit. Fourth gear range is provided by the overdrive unit which contains an overdrive clutch, direct clutch, planetary gear set and overrunning clutch.

The overdrive clutch is applied in fourth gear only. The direct clutch is applied in all ranges except fourth gear.

TORQUE CONVERTER

A three element torque converter is used for all applications. The converter consists of the front cover and pump, stator and overrunning clutch, turbine and a modulated converter clutch mechanism.

The converter clutch mechanism consists of a clutch piston, clutch springs and the clutch disc material (Fig. 4). The clutch provides optimum torque transfer and economy when applied.

The clutch disc is attached to the converter front cover. The clutch piston and clutch springs are attached to the turbine hub. The springs dampen engine firing impulses and loads during the initial phase of converter clutch engagement.

Clutch engagement is controlled by the converter clutch valve. The valve is located in the transmission valve body. Clutch engagement occurs in drive range at speeds above approximately 48-56 km/h (30-35 mph).

GEAR RATIOS

46RH forward gear ratios are:

- First gear = 2.45:1
- Second gear = 1.45:1
- Third gear = 1.00:1
- Fourth gear = 0.69:1.

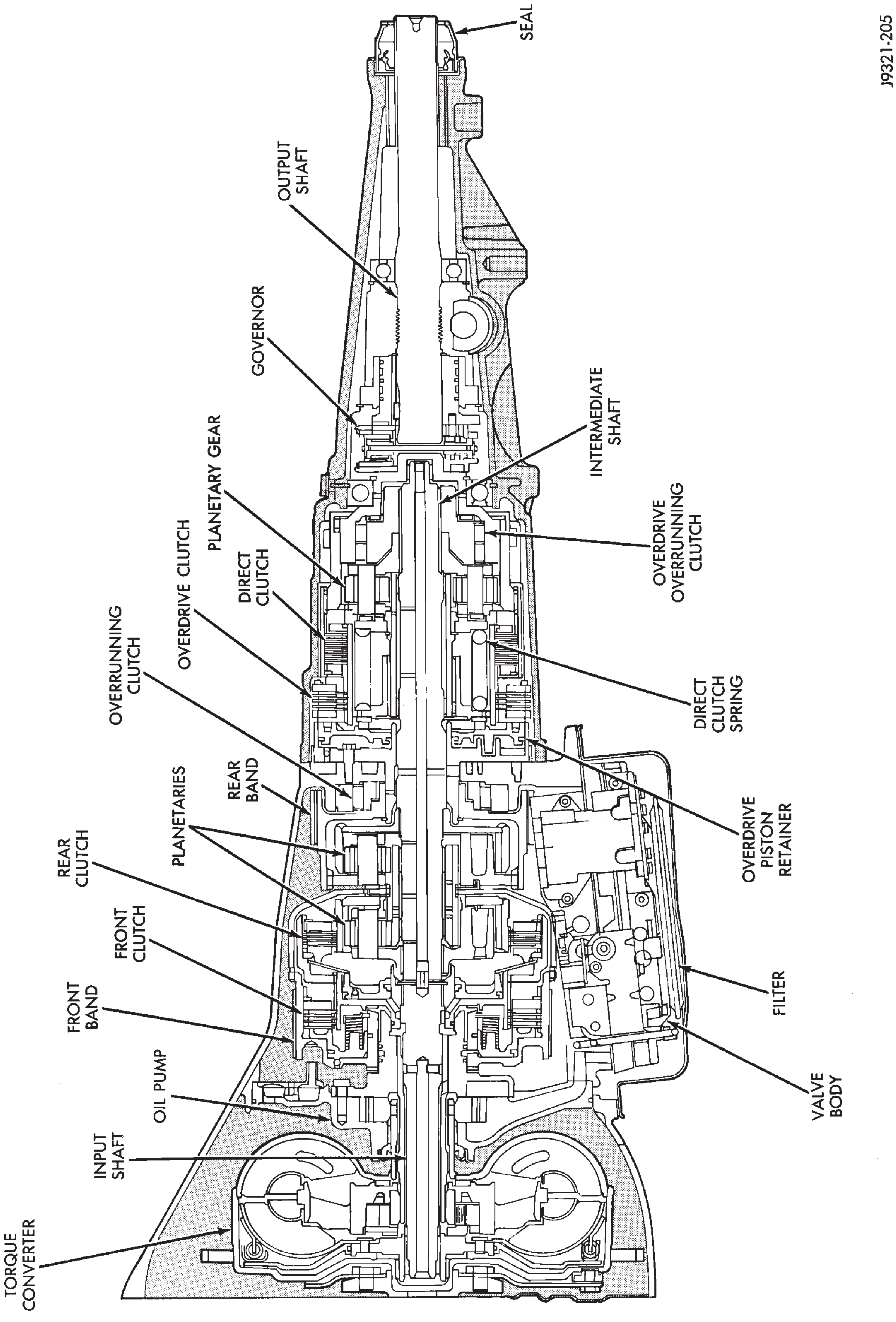

Fig. 1 46RH Transmission And Overdrive Unit

RECOMMENDED FLUID

The recommended and preferred fluid for 46RH transmissions is Mopar ATF Plus, type 7176.

Mopar Dexron II is not really recommended and should only be used when ATF Plus is not avilable.

TRANSMISSION IDENTIFICATION

The transmission part/identification numbers and codes are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2).

The first letter/number group is the assembly part number. The next number group the transmission build date. The last number group is the transmission serial number. Refer to this information when ordering replacement parts.

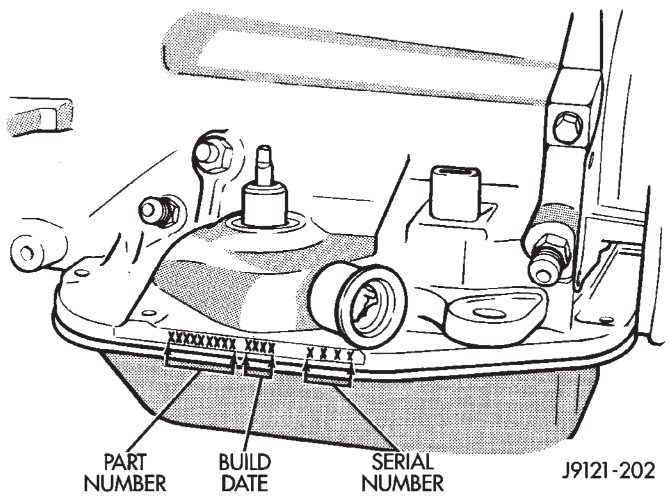

Fig. 2 Transmission Identification Code Location

FOURTH GEAR OVERDRIVE COMPONENTS

Components in the transmission section of 46RH transmissions are similar to those in Chrysler 3-speed automatic transmissions. Main component differences concern the valve body and the parts which connect the overdrive unit to the transmission.

46RH models have three transmission shafts. An intermediate shaft is used between the input and output shafts as a connecting device between the transmission and overdrive unit. The output shaft is in the overdrive unit. The intermediate shaft is supported by the overdrive piston retainer and piloted in the output shaft (Fig. 1).

The overdrive piston and retainer are located at the rear of the transmission case. The retainer serves as both the rear support and pressure chamber for the overdrive piston. The intermediate shaft is splined to the planetary assembly and overrunning clutch (Fig. 1).

The governor components and speedometer drive are located on the overdrive output shaft. Two bearings support the output shaft. The governor is operated by fluid pressure supplied through pressure tubes. The tubes are permanently attached to the governor support.

Governor pressure and overdrive clutch pressure taps are provided in the transmission case for pressure testing purposes.

The overdrive unit contains a direct clutch, an overdrive clutch and an overrunning clutch. Fourth gear range is provided by an additional planetary gear set in the overdrive unit.

The direct clutch is applied by spring pressure. A high load spring rated at approximately 830 pounds (5520 kPa), holds the clutch in engagement. The sun gear, direct clutch sliding hub and drum are connected to the annulus gear for direct drive. For coasting or reverse gear, power flows only through the direct clutch.

A timing valve disengages the torque converter clutch prior to a 4-3 downshift. The clutch solenoid, engagement valve, and timing valve are actuated in fourth gear range.

The 46RH valve body is similar to the standard three speed valve body. However, additional components are used to provide fourth gear overdrive range (Fig. 3). The additional valve body components include:

- a separate housing for the overdrive valves and plugs
- an overdrive solenoid
- a converter clutch solenoid
- a 3-4 shift valve
- a 3-4 timing valve
- a 3-4 accumulator
- a 3-4 quick fill valve
- an overdrive separator plate
- a boost valve

The separate housing for the 3-4 shift valves is attached to the lower part of the valve body assembly.

GEARSHIFT MECHANISM

The gear shift mechanism provides six ranges which are:

- park (P)
- reverse (R)
- neutral (N)
- drive (D)
- manual second (2)
- manual low (1)

Manual low (1) range provides first gear only. Overrun braking is also provided in this range. Manual second (2) range provides first and second gear only.

Drive range provides first, second third and overdrive fourth gear ranges. The shift into overdrive fourth gear range occurs only after the transmission has completed the shift into D third gear range. No further movement of the shift mechansism is required to complete the 3-4 shift.

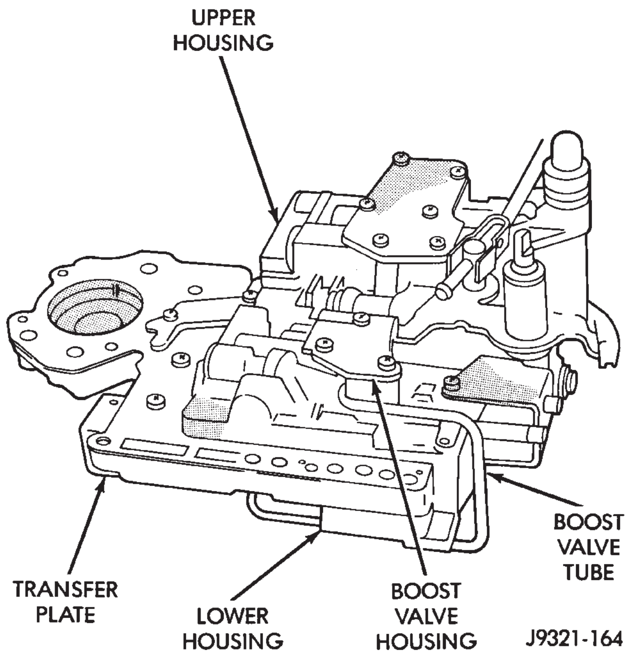

Fig. 3 46RH Valve Body

The fourth gear upshift occurs automatically when the overdrive control switch is in the ON position.

OVERDRIVE OFF SWITCH

The overdrive Off switch is located in the instrument panel. The switch is a momentary contact device that signals the TCM to toggle current status of the overdrive function. At key-on, overdrive operation is allowed.

Pressing the switch once causes the overdrive Off mode to be entered and the overdrive Off switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off.

The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a fourth gear upshift.

The control switch has an indicator light. The light illuminates when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

The control switch indicator light is also used to signal fault flash codes for diagnostic purposes.

HYDRAULIC CONTROL SYSTEM

The 46RH hydraulic control system provides fully automatic operation. The system performs five basic functions which are: pressure supply, pressure regulation, flow control, clutch/band application, and lubrication.

PRESSURE REGULATION

The pressure regulator valve maintains line pressure. The amount of pressure developed is controlled by throttle pressure which is dependent on the degree of throttle opening. The regulator valve is located in the valve body.

The throttle valve determines line pressure and shift speed. Governor pressure increases in proportion to vehicle speed. The throttle valve controls upshift and downshift speeds by regulating pressure according to throttle position.

Shift Valve Flow Control

The manual valve is operated by the gearshift linkage and provides the operating range selected by the driver.

The 1-2 shift valve provides 1-2 or 2-1 shifts and the 2-3 shift valve provides 2-3 or 3-2 shifts.

The kickdown valve provides forced 3-2 or 3-1 downshifts depending on vehicle speed. Downshifts occur when the throttle is opened beyond downshift detent position. Detent is reached just before wide open throttle position.

The 2-3 valve throttle pressure plug provides 3-2 downshifts at varying throttle openings depending on vehicle speed.

The 1-2 shift control valve transmits 1-2 shift pressure to the accumulator piston. This controls kickdown band capacity on 1-2 upshifts and 3-2 downshifts.

The 3-4 shift valve, quick fill valve, timing valve and accumulator are only actuated when the overdrive solenoid is energized.

The solenoid contains a check ball that controls a vent port to the 3-4 valve. The check ball either diverts line pressure away from or directly to, the 3-4 valve. Energizing the solenoid causes the check ball to close the vent port allowing line pressure to act upon the 3-4 valve.

The limit valve determines maximum speed at which a 3-2 part throttle kickdown can be made. On transmissions without a limit valve, maximum speed for a 3-2 kickdown is at detent position.

The 2-3 shuttle valve has two functions. First is fast front band release and smooth engagement during lift-foot 2-3 upshifts. The second is to regulate front clutch and band application during 3-2 downshifts.

The 3-4 timing valve is moved by line pressure coming through the 3-4 shift valve. The timing valve holds the 2-3 shift valve in an upshift position. The purpose is to prevent the 2-3 valve from up or downshifting before the 3-4 valves.

The 3-4 accumulator is mounted on the overdrive housing. It performs the same function as the 2-3 accumulator. It is used to smooth engagement during the 3-4 shift.

BOOST VALVE

The boost valve provides increased fluid apply pressure for converter clutch and overdrive clutch engagement.

The boost valve is connected to the overdrive clutch circuit via a tube connected between the valve body upper and lower housings. The valve is connected to the converter clutch circuit via the regulator valve, switch valve and 3-4 valves.

Hydraulic circuitry for the boost valve is shown in the hydraulic flow diagrams. The diagrams are located at the end of the transmission diagnosis and test section.

During converter clutch engagement in fourth gear, the valve supplies full line pressure directly to the clutch. The increased pressure available at the clutch provides smooth shifting and positive engagement.

The 3-4 upshift causes the boost valve to increase line pressure to the overdrive clutch. Pressure also increases with throttle opening. This ensures positive clutch engagement during periods of high throttle opening acceleration.

QUICK FILL VALVE

The 3-4 quick fill valve provides faster engagement of the overdrive clutch during 3-4 upshifts. The valve temporarily bypasses the clutch piston feed orifice at the start of a 3-4 upshift. This exposes a larger passage into the piston retainer resulting in a much faster clutch fill and apply sequence.

The quick fill valve does not bypass the regular clutch feed orifice throughout the 3-4 upshift. Instead, once a predetermined pressure develops within the clutch, the valve closes the bypass. Clutch fill is then completed through the regular feed orifice.

CONVERTER CLUTCH CONTROL

The converter clutch valve applies the converter clutch when supplied with line pressure through the converter clutch solenoid. The solenoid is mounted on the valve body and energized by an electrical signal from the powertrain control module. Electronic control of converter clutch operation includes clutch release at closed throttle during warmup and during part throttle acceleration. The boost valve provides additional apply pressure for converter clutch application.

The switch valve directs fluid apply pressure to the converter clutch in one position and releases it in the opposite position. It also directs oil to the cooling and lube circuits. The switch valve regulates oil pressure to the torque converter by limiting maximum oil pressure to 130 psi.

CONVERTER DRAINBACK VALVE

The drainback valve is located in the transmission cooler outlet (pressure) line. The valve prevents fluid from draining from the converter into the cooler and lines when the vehicle is shut down for lengthy periods.

Production valves have a hose nipple at one end, while the opposite end is threaded for a flare fitting. Some early valves have hose nipples at both ends. All valves have an arrow mark (or similar mark) to indicate direction of flow through the valve.

FOURTH GEAR SHIFT SEQUENCE

The overdrive clutch is applied in fourth gear only. The direct clutch is applied in all ranges except fourth gear.

Fourth gear overdrive range is electronically controlled and hydraulically activated. Various sensor inputs are supplied to the powertrain control module to operate the overdrive solenoid on the valve body. The solenoid contains a check ball that opens and closes a vent port in the 3-4 shift valve feed passage.

The overdrive solenoid (and check ball) are not energized in first, second, third or reverse gear. The vent port remains open diverting line pressure from the 2-3 shift valve away from the 3-4 shift valve.

The overdrive switch must be in the On position to transmit signals to the solenoid. A 3-4 upshift occurs only when the overdrive solenoid is energized by an electrical signal from the powertrain control module (PCM).

The solenoid is energized upon receiving a signal from the PCM. This causes the check ball to close the vent port. Closing the vent port allows line pressure from the 2-3 shift valve to act directly upon the 3-4 valves.

Line pressure acting on the 3-4 shift valve overcomes valve spring tension moving the valve to the upshift position. This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator and ultimately to the overdrive piston.

Line pressure through the timing valve moves the overdrive piston into contact with the overdrive clutch.

The overdrive clutch is engaged and the direct clutch is disengaged to complete the 3-4 upshift. The boost valve provides increased fluid apply pressure to the overdrive clutch during the 3-4 upshift and during fourth gear acceleration.

The overdrive piston engages the overdrive clutch by pressing directly against the clutch pressure plate. The direct clutch is disengaged once spring load is relieved. The direct clutch is released just before the overdrive clutch is applied.

The 3-4 accumulator cushions overdrive clutch engagement to smooth the transition into fourth gear. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

Converter clutch engagement in overdrive fourth gear is controlled by sensor inputs to the powertrain control module. Inputs to the control module that determine clutch engagement are:

- coolant temperature (verifies temperature minimum of 60° F)
- engine speed
- vehicle speed
- throttle position
- manifold vacuum (MAP sensor)

TRANSMISSION CHANGES AND PARTS INTERCHANGEABILITY

1995 transmissions are similar to previous models but only in appearance. Current transmissions are dimensionally different and have different hydraulic circuitry. Do not interchange parts.

Tranmission changes affect the governor weight assembly, low-reverse drum, front annulus, boost valve tube retainer, fluid cooling system, and valve check balls.

A check ball has been added to the rear servo circuit. The check ball is located in the transfer plate.

The governor weight assembly now consists of the inner and outer weights, a smaller weight spring, and a new intermediate weight. A spacer has been added to the weight bore in the governor body to help secure the new weight assembly.

The low-reverse drum has a spotface in the hub for a double tab thrust washer. The drum and new thrust washer are used on all 46RH transmissions.

Plastic check balls are now used in some valve bodies. The new check balls entered production as a running change. The plastic and steel check balls are not interchangeable.

A converter drainback check valve has been added to the fluid cooler system. The one-way valve is located in the transmission outlet (pressure) line. The valve prevents fluid drainback when the vehicle is parked for lengthy periods.

The boost valve tube retainer has been lengthened and an extra tab added to better secure the tube.

46RH TRANSMISSION DIAGNOSIS

INDEX

GENERAL INFORMATION

Begin diagnosis by checking the easily accessible items such as fluid level, fluid condition and throttle cable/shift linkage adjustments. A road test will determine if further diagnosis is necessary.

Procedures outlined in this section should be performed in the following sequence to realize the most accurate results:

(1) preliminary diagnosis
(2) fluid Level and condition
(3) leak checks (if fluid level is low)
(4) throttle and shift linkage adjustment
(5) overdrive control switch test
(6) road test
(7) stall test
(8) hydraulic pressure test
(9) air pressure tests
(10) analyze test results
(11) refer to diagnosis charts

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are driveable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVEABLE

(1) Check fluid level and condition.

(2) Check throttle cable and gearshift linkage adjustments if complaint was based on delayed, erratic, or harsh shifts.

(3) Road test vehicle and note how transmission engages, upshifts, downshifts.

(4) Perform stall test if complaint is based on sluggish acceleration or if abnormal throttle opening is needed to maintain normal speeds with a properly tuned engine.

(5) Perform hydraulic pressure test if shift problems were noted during road test.

(6) Perform air pressure test to check clutch-band operation if hydraulic pressure test is inconclusive.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken, disconnected shift linkage.

(3) Check for cracked, leaking cooler lines, or loose, missing pressure port plugs.

(4) Raise vehicle, start engine, shift transmission into gear and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shafts does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged drive plate, converter, oil pump, input shaft, planetary gear, clutches.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic pressure test to determine if problem is hydraulic or mechanical.

CHECKING FLUID LEVEL AND CONDITION

(1) Place vehicle on level surface. This is important for an accurate reading.

(2) Do not check level until fluid is at normal operating temperature of approximately 82°C (180°F). This is necessary to avoid false readings which could produce under or over fill condition,

(3) Fully apply parking brakes.

(4) Start and run engine at curb idle speed. Then shift transmission through all gear ranges and back to Neutral.

(5) Clean top of filler tube and dipstick to keep dirt out of tube.

(6) Remove dipstick and check **fluid level** as follows:

(a) Dipstick has three fluid level indicating marks which are a MIN dot mark, an OK mark and a MAX fill arrow mark:

(b) Correct level is to MAX arrow nark on dipstick. This is correct maximum hot fluid level. Acceptable level is between OK mark and max arrow mark on dipstick.

(c) If level is at, or below MIN level dot on dipstick, add only enough fluid to restore correct level. Mopar ATF Plus, type 7176 is the recommended and preferred fluid.

CAUTION: Do not overfill the tranmission. Overfilling may cause leakage out the pump vent which can be mistaken for a pump seal leak. In addition, overfilling will also cause fluid aeration and foaming as the excess fluid is picked up and churned by the gear train. This will significantly reduce fluid life.

(7) Check and note **fluid condition** as follows:

(a) Fluid should be dark to light red in color and free of particles and sludge.

(b) If fluid is orange, brown, or smells slightly burned, flow test and reverse flush cooler and lines. Then change fluid and filter and road test again to confirm proper operation.

(c) If fluid is black, dark brown, turned to sludge, contains extensive amount of metal or friction material particles, transmission will need overhaul. Main and auxiliary coolers and cooler lines will have to be flow tested and reverse flushed as well.

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal.

If the transmission is overfilled, the gears churn the fluid into foam, aerating the fluid and causing the same conditions that occur with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve, clutch and servo operation.

Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

CAUSES OF BURNED FLUID

Burned, discolored fluid is a result of overheating which has two primary causes.

The first cause is a result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris.

The second primary cause is heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter during repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission for some time, an overhaul may also be necessary; especially if shift problems had developed.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in re-contamination and a shop comeback. Flushing applies to auxiliary coolers as well. The torque converter and drainback valve should also be replaced whenever a failure generates sludge and debris. This is necessary because converter flushing procedures will not remove all of the contaminants.

OVERDRIVE ELECTRICAL CONTROLS

The electrical controls governing the shift into fourth gear consist of the control switch on the instrument panel and the overdrive solenoid on the valve body. The control switch is in circuit with the solenoid and must be in the On position to energize the solenoid. The transmission must also have reached third gear range before the shift to fourth gear will occur.

The control switch, valve body solenoid, case connectors and related wiring can all be tested with a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

TRANSMISSION CONTROL CABLE ADJUSTMENTS

Transmission throttle valve cable adjustment is extremely important to proper operation. This adjustment positions the throttle valve which controls shift speed, quality and part throttle downshift sensitivity.

If cable setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle downshifts may be very sensitive. Refer to the In Vehicle Service section for adjustment procedure.

Shift cable adjustment is important because it positions the valve body manual valve. Incorrect adjustment will cause creeping in Neutral, premature clutch wear, delayed engagement in any gear, or a no-start in Park or Neutral position.

Proper operation of the park/neutral position switch will provide a quick check of cable adjustment. Refer to the In-Vehicle Service section for linkage adjustment procedure.

ROAD TESTING

Before road testing, be sure the fluid level and all linkage adjustments have been checked and adjusted if necessary. Observe engine performance during the road test. A poorly tuned engine will not allow an accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare, which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul may be necessary to restore normal operation.

A slipping clutch or band can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch and Band Application chart (Fig. 4) provides a basis for analyzing road test results.

ANALYZING THE ROAD TEST

Refer to the Clutch and Band Application chart (Fig. 1) and note which elements are in use in the various gear ranges.

Note that the rear clutch is applied in all forward ranges (D, 2, 1). The transmission overrunning clutch is applied in first gear (D, 2 and 1 ranges) only. The rear band is applied in 1 and R range only.

Note that the overdrive clutch is applied only in fourth gear and the overdrive direct clutch and overrunning clutch are applied in all ranges except fourth gear.

For example: If slippage occurs in first gear in D and 2 range but not in 1 range, the transmission overrunning clutch is faulty. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that the front and rear clutches are applied simultaneously only in D range third and fourth gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping.

If the transmission slips in fourth gear but not in third gear, the overdrive clutch is slipping. By selecting another gear which does not use these clutches, the slipping unit can be determined. For example, if the transmission also slips in Reverse, the front clutch is slipping. If the transmission does not slip in Reverse, the rear clutch is slipping.

If slippage occurs during the 3-4 shift or only in fourth gear, the overdrive clutch is slipping. Similarly, if the direct clutch were to fail, the transmission would lose both reverse gear and overrun braking in 2 position (manual second gear). If the transmission slips in any other two forward gears, the transmission rear clutch is probably slipping.

If the transmission will not shift to fourth gear, the control switch, overdrive solenoid or related wiring may also be the problem cause.

This process of elimination can be used to identify a slipping unit and check operation. Proper use of the Clutch and Band Application Chart is the key.

Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless a malfunction is obvious, such as no drive in D range first gear, do not disassemble the transmission. Perform the hydraulic and air pressure tests to help pinpoint the problem cause.

HYDRAULIC PRESSURE TEST

Hydraulic test pressures range from a low of one psi (6.895 kPa) governor pressure, to 300 psi (2068 kPa) at the rear servo pressure port in reverse.

An accurate tachometer and two test gauges are required for the pressure test. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, and front servo pressure ports. Test Gauge C-3293 has a 300 psi range and is used at the rear servo port and overdrive test ports where pressures are higher. In cases where two test gauges are required, the 300 psi gauge can be used at any of the other test ports.

SHIFT LEVER POSITION	TRANSMISSION CLUTCHES AND BANDS					OVERDRIVE CLUTCHES		
	FRONT CLUTCH	FRONT BAND	REAR CLUTCH	REAR BAND	OVERRUN. CLUTCH	OVERDRIVE CLUTCH	DIRECT CLUTCH	OVERRUN. CLUTCH
Reverse	X			X			X	
Drive Range								
First			X		X		X	X
Second		X	X				X	X
Third	X		X				X	X
Fourth	X		X			X		
2-Range (Manual) Second)		X	X		X		X	X
1-Range (Manual Low)			X	X	X		X	X

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Fig. 4 Clutch And Band Application Chart

Pressure Test Port Locations

There are pressure test ports at the accumulator, front servo, and rear servo. Governor and overdrive clutch pressure test ports are located at the left and right rear sides of the case (Fig. 5).

Line pressure is checked at the accumulator port on the right side of the case. The front servo pressure port is at the right side of the case just behind the filler tube opening.

The rear servo and governor pressure ports are at the right rear of the transmission case. The overdrive clutch pressure port is at the left rear of the case (Fig. 5).

HYDRAULIC PRESSURE TEST PROCEDURE

Test One—Transmission In 1 Range

This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Test Gauges C-3292 and C-3293-SP are required for this test. Gauge C-3292 has a 100 psi range. Gauge C-3293-SP has a 300 psi range.

(1) Connect tachometer to engine. Position tachometer so it can be observed from driver seat if helper will be operating engine. Raise vehicle on hoist that will allow rear wheels to rotate freely.

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port (Fig. 5).

(3) Disconnect throttle and gearshift cables from levers on transmission valve body manual shaft.

(4) Have helper start and run engine at 1000 rpm.

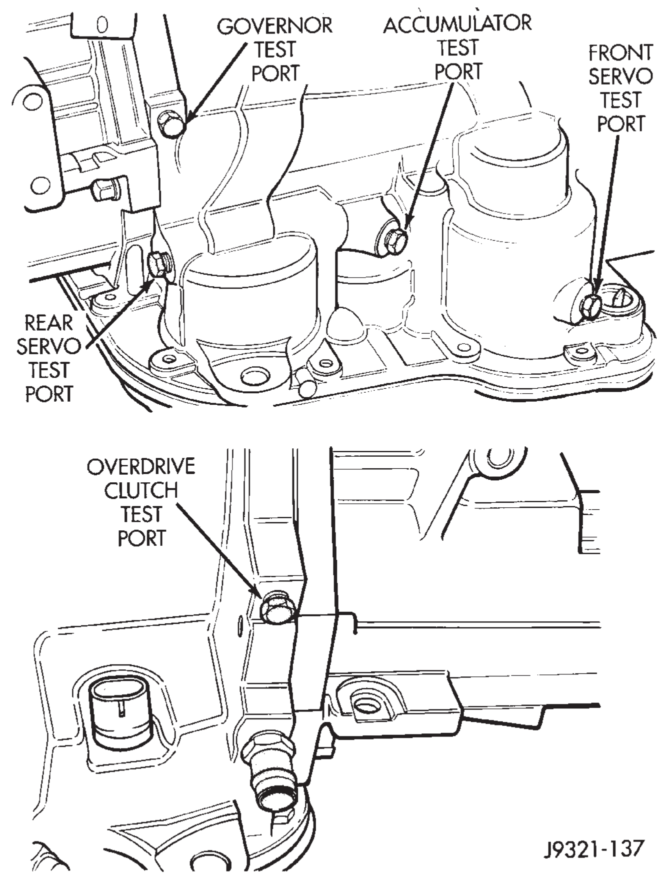

Fig. 5 Pressure Test Port Locations

(5) Move transmission shift lever fully forward into 1 range.

(6) Gradually move transmission throttle lever from full forward to full rearward position and note pressures on both gauges:

(a) Line pressure at accumulator port should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as throttle lever is moved rearward.

(b) Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two—Transmission In 2 Range

This test checks pump output, line pressure and pressure regulation. Use 100 psi Test Gauge C-3292 for this test.

(1) Leave vehicle in place on hoist and leave Test Gauge C-3292 connected to accumulator port for this test.

(2) Have helper start and run engine at 1000 rpm.

(3) Move transmission shift lever one detent rearward from full forward position. This is 2 range.

(4) Move transmission throttle lever from full forward to full rearward position and read pressure on gauge:

(5) Line pressure should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as lever is moved rearward.

Test Three—Transmission In D Range Third Gear

This test checks pressure regulation and condition of the clutch circuits. Use both pressure Test Gauges C-3292 and C-3293-SP for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and also leave Gauge C-3292 in place at accumulator port.

(3) Move Gauge C-3293-SP over to front servo port for this test.

(4) Have helper start and run engine at 1600 rpm for this test.

(5) Move transmission shift lever two detents rearward from full forward position. This is D range.

(6) Read pressures on both gauges as transmission throttle lever is gradually moved from full forward to full rearward position:

(a) Line pressure at accumulator in D range third gear, should be 54-60 psi (372-414 kPa) with throttle lever forward and increase as lever is moved rearward.

(b) Front servo pressure in D range third gear, should be within 3 psi (21 kPa) of line pressure up to kickdown point.

Test Four—Transmission In Reverse

This test checks pump output, pressure regulation and the front clutch and rear servo circuits. Use 300 psi Test Gauge C-3293-SP for this test.

(1) Leave vehicle on hoist and leave gauge C3292 in place at accumulator port.

(2) Move 300 psi Gauge C-3293-SP back to rear servo port.

(3) Have helper start and run engine at 1600 rpm for test.

(4) Move transmission shift lever four detents rearward from full forward position. This is Reverse range.

(5) Move transmission throttle lever fully forward then fully rearward and note reading at Gauge C-3293-SP.

(6) Pressure should be 145 - 175 psi (1000-1207 kPa) with throttle lever forward and increase to 230 - 280 psi (1586-1931 kPa) as lever is gradually moved rearward.

Test Five—Governor Pressure

This test checks governor operation by measuring governor pressure response to changes in vehicle speed. It is usually not necessary to check governor operation unless shift speeds are incorrect or if the transmission will not downshift. The test should be performed on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port (Fig. 5).

(2) Move transmission shift lever two detents rearward from full forward position. This is D range.

(3) Have helper start and run engine at curb idle speed. Then firmly apply service brakes so wheels will not rotate.

(4) Note governor pressure:

(a) Governor pressure should be no more than 10 kPa (1-1/2 psi) at curb idle speed and wheels not rotating.

(b) If pressure exceeds 10 kPa (1-1/2 psi)3 psi, a governor fault exists. Valve, or weight is sticking, E-clip has come off shaft, or leak exists at tubes.

(5) Release brakes, slowly increase engine speed, and observe speedometer and pressure test gauge. Governor pressure should increase in proportion to vehicle speed, or approximately 6.89 kPa (1 psi) for every 1 mph.

(6) Pressure rise should be smooth and drop back to no more than 10 kPa (1-1/2 psi) after engine returns to curb idle speed and brakes are applied to prevent wheel rotation.

(7) Compare results of pressure test with analysis chart (Fig. 6).

Test Six—Transmission In Overdrive Fourth Gear

This test checks line pressure at the overdrive clutch in fourth gear range. Use 300 psi Test Gauge C-3292 for this test. The test should be performed on the road or on a chassis dyno.

(1) Remove tachometer. It will not be used for this test.

(2) Move 300 psi Gauge to overdrive clutch pressure test port. Then remove other gauge and reinstall test port plug.

(3) Lower vehicle.

(4) Turn OD switch on.

(5) Secure test gauge so it can be viewed from drivers seat.

(6) Start engine and shift into D range.

(7) Increase vehicle speed gradually until 3-4 shift occurs and note gauge pressure.

(8) Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-827 kPa (90-120 psi) at 1/2 to 3/4 throttle. Note that pressure can increase to around 896 kPa (130 psi) at full throttle.

(9) Return to shop or move vehicle off chassis dyno.

TEST CONDITION	INDICATION
Line pressure OK during any one test	Pump and regulator valve OK
Line Pressure OK in R but low in D, 2, 1	Leakage in rear clutch area (servo, clutch seals, governor tubes)
Pressure Low in D Fourth Gear Range	Overdrive clutch piston seal, or check ball problem
Pressure OK in 1, 2 but low in D3 and R	Leakage in front clutch area (servo, clutch seals, retainer bore, pump seal rings)
Pressure OK in 2 but low in R and 1	Leakage in rear servo
Front servo pressure low in 2	Leakage in servo; broken servo ring or cracked servo piston
Pressure low in all positions	Clogged filter, stuck regulator valve, worn or faulty pump, plugged fluid cooler
Governor pressure too high at idle speed	Governor valve sticking open
Governor pressure low at all mph figures	Governor valve sticking closed
Lubrication pressure low at all throttle positions	Clogged oil cooler, lines, drain-back valve, seal rings leaking, output shaft plugged with debris, worn bushings in pump or clutch retainer

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Fig. 6 Pressure Test Analysis Chart

CONVERTER STALL TEST

Stall testing involves determining maximum engine rpm obtainable at full throttle with the rear wheels locked and the transmission in D range. This test checks the holding ability of the the converter overrunning clutch and both of the transmission clutches. When stall testing is completed, refer to the Stall Speed Specifications chart and Stall Speed Diagnosis guides.

WARNING: NEVER ALLOW ANYONE TO STAND DIRECTLY IN LINE WITH THE VEHICLE FRONT OR REAR DURING A STALL TEST. ALWAYS BLOCK THE WHEELS AND APPLY THE SERVICE AND PARKING BRAKES DURING THE TEST.

STALL TEST PROCEDURE

(1) Connect tachometer to engine. Position tachometer so it can be viewed from driver seat.

(2) Check transmission fluid level. Add fluid if necessary.

(3) Start and run engine until transmission fluid reaches normal operating temperature.

(4) Block front wheels.

(5) Fully apply service and parking brakes.

(6) Stall speeds should be in 1750-2300 rpm range. Perform stall test as described in next.

(7) Open throttle completely and record maximum engine rpm registered on tachometer. It will take from 4-10 seconds to reach max rpm. **However, once max rpm has been achieved, do not hold wide open throttle for more than 4-5 seconds.**

CAUTION: Stalling the converter causes a rapid increase in fluid temperature. To avoid fluid overheating, hold wide open throttle for no more than 4-5 seconds after reaching peak rpm. In addition, if engine exceeds 2300 rpm, release accelerator pedal immediately as transmission clutch slippage is occurring.

(8) If a second stall test is required, cool fluid down as follows before proceeding: Shift into Neutral, and run engine at 1000 rpm with transmission for 20-30 seconds to cool fluid.

(9) Refer to Stall Test Analysis.

STALL TEST ANALYSIS

Stall Speed Too High

Stall speeds over 2300 rpm indicates transmission clutch slippage.

Stall Speed Too Low

Low stall speeds with a properly tuned engine indicate a torque converter overrunning clutch problem. The condition should be confirmed by road testing prior to converter replacement.

Stall speeds 250-350 rpm below normal indicates the converter overrunning clutch is slipping. The vehicle will also exhibit poor acceleration but operate normally once highway cruise speeds are reached. Torque converter replacement will be necessary.

Stall Speed Normal But Acceleration Is Sluggish

If stall speeds are normal (1800-2300 rpm) but abnormal throttle opening is required for acceleration, or to maintain cruise speeds, the converter overrunning clutch is seized. The torque converter will have to be replaced.

CONVERTER NOISE DURING TEST

A whining noise caused by fluid flow is normal during a stall test. However, loud metallic noises indicate a damaged converter. To confirm that noise is originating from the converter, operate the vehicle at light throttle in Drive and Neutral on a hoist and listen for noise coming from the converter housing.

AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION

Air pressure testing can be used to check transmission front/rear clutch and band operation with the transmission either in the vehicle, or on the work bench as a final check after overhaul.

Air pressure testing requires that the oil pan and valve body be removed from the transmission. The servo and clutch apply passages are shown in Figure 7.

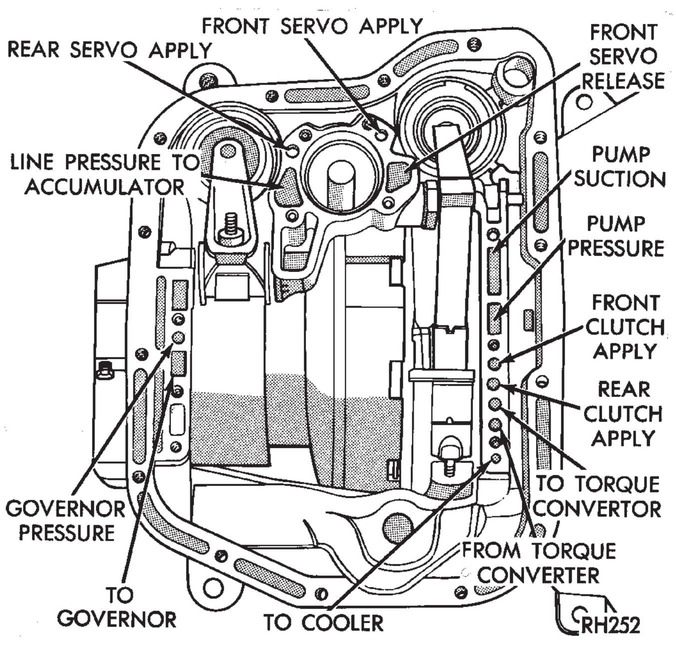

Fig. 7 Air Pressure Test Passages

FRONT CLUTCH AIR TEST

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage (Fig. 8). Piston movement can be felt and a soft thud heard as the clutch applies.

REAR CLUTCH AIR TEST

Place one or two fingers on the clutch housing and apply air pressure through rear clutch apply passage (Fig. 7). Piston movement can be felt and a soft thud heard as the clutch applies.

FRONT SERVO AIR TEST

Apply air pressure to the front servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring tension should release the servo when air pressure is removed.

REAR SERVO AIR TEST

Apply air pressure to the rear servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring tension should release the servo when air pressure is removed.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two items must be established before repair. First, it must be verified that a leak condition actually exists. And second, the true source of the leak must be determined.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or refill after repair.

Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump O-ring or pump body leaks follow the same path as a seal leak (Fig. 8).

Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 8).

Pump seal or gasket leaks usually travel down the inside of the converter housing.

Front band lever pin plug leaks are generally deposited on the housing and not on the converter.

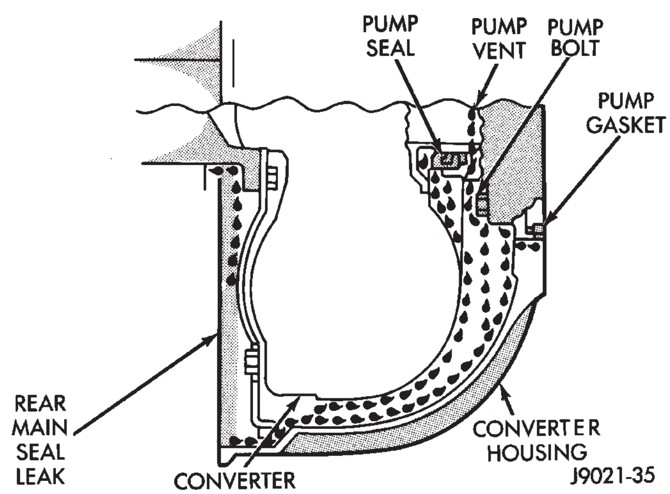

Fig. 8 Converter Housing Leak Paths

LEAK DIAGNOSIS PROCEDURE

(1) Raise rear of vehicle and allow accumulated fluid to drain out of converter housing.

(2) Check and adjust transmission fluid level.

(3) Raise vehicle. Remove converter housing dust cover and wipe as much fluid as possible from converter housing.

(4) Fabricate test probe (Fig. 9). Attach probe to converter housing with a dust shield bolt.

(5) Have a helper run engine at 2500 rpm (with transmission in Neutral) for two minutes; then stop engine.

(6) Inspect test probe and converter housing. If leak is evident, note color of fluid:

(a) If fluid is red/pink, leak is from transmission part. Proceed with diagnosis.

(b) If fluid is brown or green, oil leak is from engine. Refer to engine leak diagnosis procedures in Group 9.

(7) Determine where transmission fluid is leaking from:

(a) If probe **upper surface is wet with transmission fluid, converter or seal are at fault. Fluid across probe upper surface indicates converter or seal leak.**

(b) If transmission fluid is leaking **under** probe, it is coming from pump housing area (Fig. 8).

(8) Fluid leaking under probe could be from: pump seal and/or bushing, pump vent, front band lever shaft access plug, pump bolts, or porous spots in pump body or transmission case (Fig. 8).

(9) If porous spots in transmission case or pump body are suspected leak source, pressurize transmission as described in Leak Testing With Air Pressure.

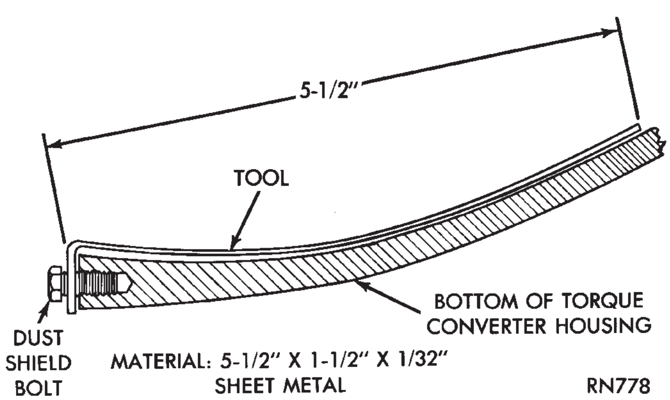

Fig. 9 Leak Test Probe

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are: (a) leaks at the weld joint around the outside diameter weld (Fig. 9) and (b) leaks at the converter hub weld (Fig. 11).

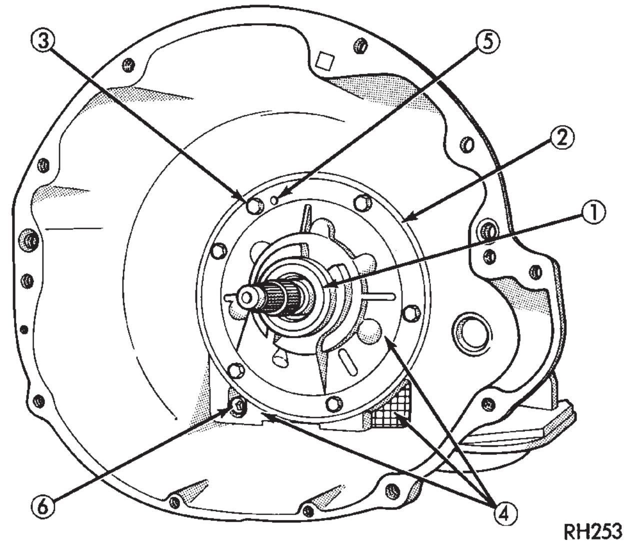

Fig. 10 Pump Area Inspection Points

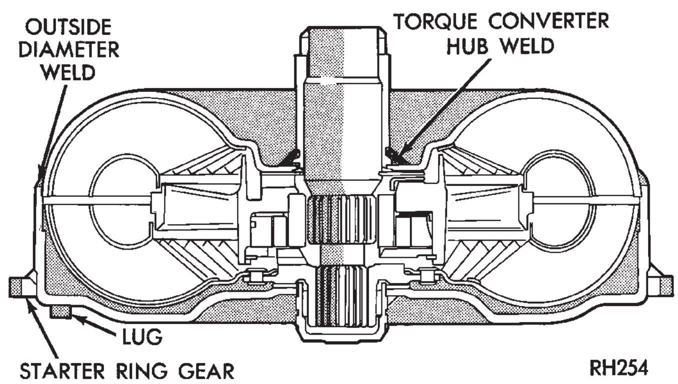

Fig. 11 Converter Leak Points (Typical)

LEAK TESTING WITH AIR PRESSURE

This test involves closing off all openings and pressurizing the transmission to 8 psi with hand operated Air Pump 7700.

A soapy water solution is applied to suspected leak points before and during the pressure test. Leaks will be indicated by the presence of air bubbles coming through the solution.

Some transmission openings such as the fill tube and front cooler line fitting can be closed off with a rubber plug or similar device. Plugs can secured with wire or duct tape.

The transmission rear output shaft opening is closed off simply by leaving the transfer case bolted in place. However, if the transfer case has been removed, a shipping plug can be used to close off this opening.

The torque converter hub opening in the pump and the pump vent require special tools to close them off. The converter hub seal cap is made from thin wall tube and a 3.17 mm (1/8 in.) thick disc (Figs. 12 and 13). A retaining strap is needed to secure the seal cup for testing (Fig. 14). The strap attaching hole positions are approximate only. Measure hole position on the converter housing before drilling.

The pump vent plug is made from 6.35 mm (1/4 in.) rod and 4.76 mm (3/16 in.) plate (Fig. 14).

The fabricated tools can all be made from mild steel or aluminum stock.

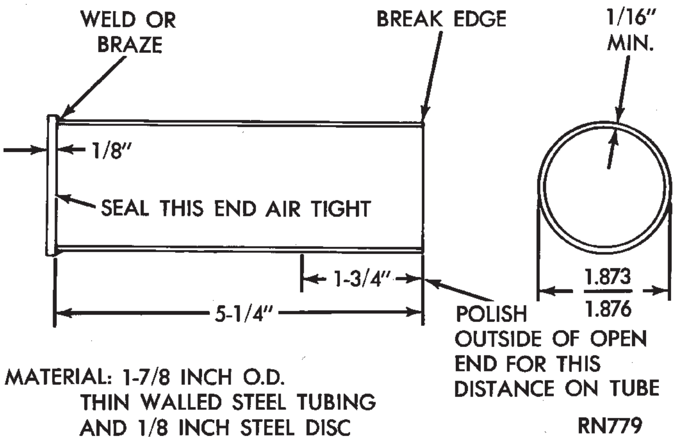

Fig. 12 Converter Hub Seal Cup

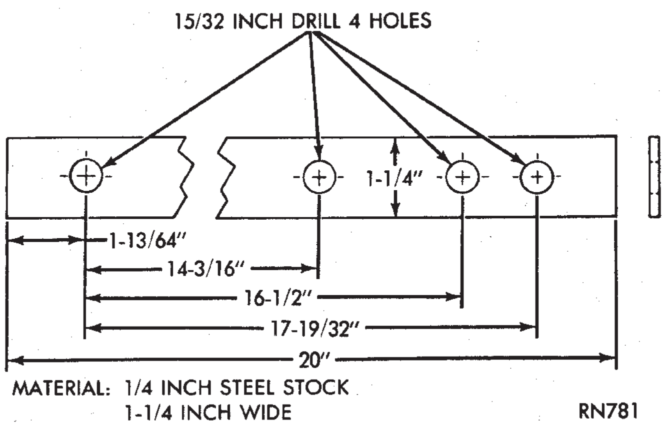

Fig. 13 Seal Cup Retaining Strap

AIR PRESSURE LEAK TEST PROCEDURE

(1) Install vent plug, converter hub seal cup and cup retaining strap (Fig. 15).

CAUTION: Be sure the surfaces of the hub seal cup are smooth and free of nicks, scratches, or burrs. Surface irregularities on the cup will damage the pump seal if not removed. Sand and/polish the cup with 400 grit sandpaper or crocus cloth to smooth the surface if necessary.

(2) Close off remaining transmission openings with rubber plugs, or stoppers or similar devices. **Do not close off rear cooler line fitting. Hand operated air pump will be attached to this fitting.**

(3) Attach Air Pump 7700 to rear cooler line fitting. Connect a length of copper tube to fitting. Then attach pump hose to tube with hose clamp (Fig. 16).

(4) Apply a thick soapy water solution to suspected leak areas.

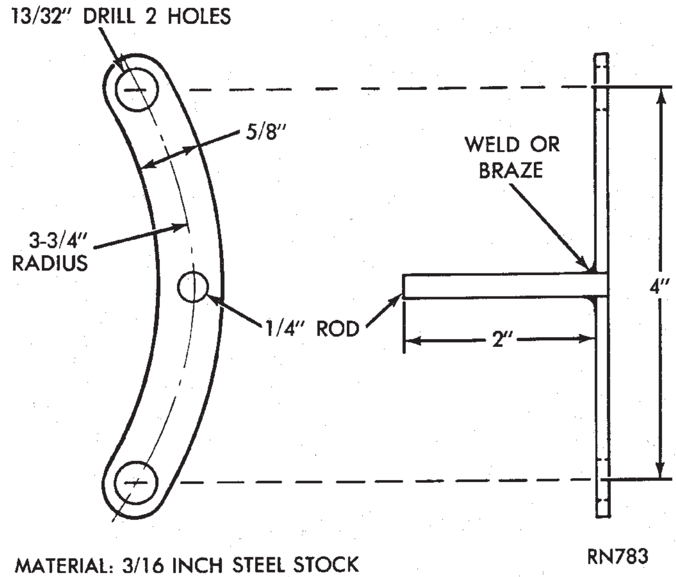

Fig. 14 Pump Vent Plug

CAUTION: The recommended test pressure is 8 psi. The maximum allowable test pressure is 10 psi. Do not exceed specified pressure.

(5) Pressurize transmission to 8 psi with air pump.

(6) Observe suspected leak areas. Air bubbles appearing in soapy water solution indicate leak points.

(7) Remove test tools and plugs after test completion and make necessary repairs as described in Leak Correction procedure.

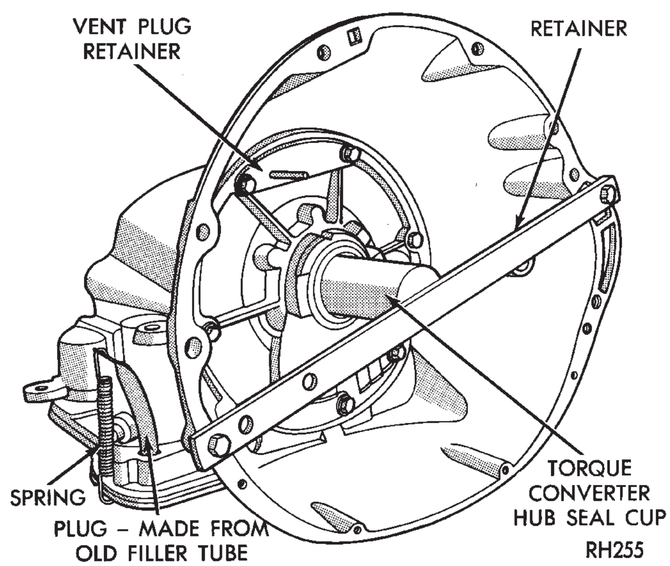

Fig. 15 Vent Plug And Hub Seal Cup Installation

CONVERTER HOUSING AREA LEAK CORRECTION

(1) Remove converter.

(2) Tighten front band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out when oil pump is removed.

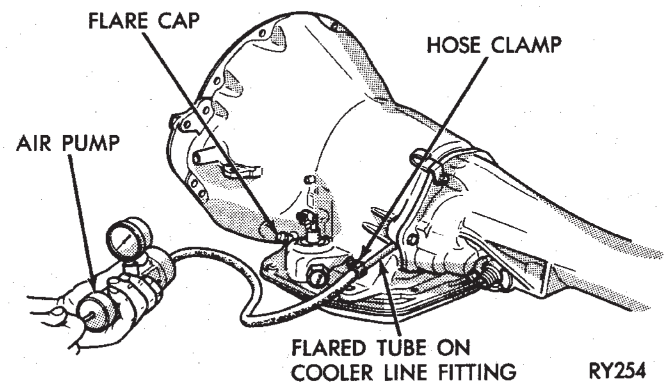

Fig. 16 Typical Method of Pressurizing Transmission

(3) Remove oil pump and remove pump seal. Inspect pump housing drainback and vent holes for obstructions. Clear holes with solvent and wire.

(4) Inspect pump bushing and converter hub. If bushing is scored, replace it. If converter hub is scored, either polish it with crocus cloth or replace converter if scoring is severe.

(5) Install new pump seal, O-ring, gasket, bushing. Replace oil pump if cracked, porous or damaged in any way.

(6) Loosen kickdown lever pin access plug three turns. Apply Permatex No. 2 or equivalent to plug threads and tighten plug to 17 N·m (150 in-lbs) torque.

(7) Adjust front band.

(8) Lubricate pump seal and converter hub with transmission fluid or petroleum jelly and install converter.

(9) Install transmission and converter housing dust shield.

(10) Lower vehicle.

DIAGNOSIS CHARTS

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive and converter fault conditions.

The hydraulic flow charts outline fluid flow and hydraulic circuitry. Circuit flow is provided for all gear ranges. Approximate working pressures are also supplied for each gear range.

TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE).	1. Engine idle speed too high.	1. Check/adjust idle speed.
	2. Driver "riding" accelerator pedal during shift.	2. Advise owner/operator.
	3. Throttle cable or linkage misadjusted.	3. Adjust cable or linkage; setting is either too long or too short.
	4. Band adjustment needed.	4. Adjust front/rear bands.
	5. Loose mounting bolts.	5. Check engine, transmission, propeller shaft, crossmember, and axle bolt torque; tighten loose bolts and replace missing bolts.
	6. Worn or damaged U-joints.	6. Remove propeller shaft and replace U-joints.
	7. Loose axle pinion nut.	7. Replace nut and check pinion threads before installing new nut; replace pinion gear if threads are damaged.
	8. Hydraulic pressure is incorrect.	8. Check pressures; remove, overhaul, or adjust valve body as needed; repair oil pump if necessary.
NOTE: The shift from neutral to reverse is normally quite firm. Hydraulic pressure at the rear servo can approach 300 psi in reverse gear. Do not confuse a firm engagement with a truly harsh engagement.	9. Accumulator piston spring, or or seal worn or damaged.	9. Remove valve body and replace piston, seal, or spring as needed.
	10. Faulty converter clutch if equipped.	10. Replace converter and flush cooler and lines before installing new converter.
	11. Clutch, band, or planetary component is damaged.	11. Remove, disassemble, and repair transmission as necessary.
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Engine idle speed too low.	1. Adjust idle speed.
	2. Low fluid level.	2. Correct level and check for leaks.
	3. Gearshift cable or linkage out of adjustment.	3. Adjust cable or linkage, or repair as needed.
	4. Rear band out of adjustment.	4. Adjust band.
	5. Valve body filter plugged.	5. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	6. Oil pump gears worn or damaged or pump body or seal is damaged, allowing pump to take in air, causing fluid aeration.	6. Remove transmission and replace oil pump.
	7. Reaction shaft seal rings worn or broken.	7. Remove transmission, remove oil pump, and replace seal rings.
	8. Governor valve stuck or valve shaft is loose or damaged.	8. Remove and inspect governor components; replace worn or damaged parts.
	9. Low hydraulic pressure.	9. Perform pressure test, remove transmission, and repair as needed.
	10. Clutch, band, or servo damage.	10. Remove and disassemble transmission and repair as necessary.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT AFTER VEHICLE HAS NOT BEEN DRIVEN FOR EXTENDED PERIOD	1. Fluid in torque converter drained back into transmission sump.	1. Normal condition that will not harm the converter or transmission. Converter will fill with fluid once shift lever is moved from park.
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Low fluid level.	1. Correct fluid level and check for leaks.
	2. Throttle cable or linkage out of adjustment.	2. Adjust linkage or cable as described in service section.
	3. Throttle cable or linkage is binding.	3. Disassemble, clean, and adjust linkage; replace linkage grommets if worn or cracked. Replace cable if seized.
	4. Gearshift cable or linkage out of adjustment.	4. Adjust as described in service section.
	5. Fluid filter partially clogged.	5. Replace filter. If filter and fluid contained clutch material or metal particles, overhaul is necessary.
	6. Air in fluid due to overfill condition or air leakage into pump suction passages.	6. Drain fluid to correct level if overfilled. If fluid is highly aerated (full of bubbles and foamy), oil pump gasket or seal may have failed, or pump body is porous or cracked.
	7. Clutch or servo problem.	7. Remove valve body and air test clutch, band and servo operation; disassemble and repair transmission as needed.
	8. Front band out of adjustment (may cause harsh 1-2 shift).	8. Adjust band.
NO REVERSE (D RANGES OK)	1. Gearshift cable or linkage out of adjustment or damaged.	1. Repair or replace parts as needed.
	2. Rear band out of adjustment.	2. Adjust band.
	3. Valve body malfunction (stuck/ damaged manual valve, regulator valve, or check ball).	3. Remove and service valve body; replace valve body if any valves or valve bores are worn or damaged.
	4. Rear servo or front clutch malfunction.	4. Remove and disassemble transmission; replace worn, damaged servo and clutch parts as necessary.
HAS FIRST-REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor valve, shaft, weights, or body damaged.	1. Remove governor assembly and repair as necessary.
NO DRIVE RANGE (REVERSE OK)	1. Gearshift cable or linkage loose, damaged, out of adjustment.	1. Repair or replace cable or linkage components.
	2. Low fluid level.	2. Correct fluid level and check for leaks.
	3. Valve body malfunction (manual valve or shaft damaged or 1-2 shift valve stuck).	3. Remove and disassemble valve body; replace as assembly if any valves or bores are damaged.
	4. Rear clutch failure.	4. Remove and disassemble transmission and rear clutch; repair/replace worn, damaged parts as needed.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE RANGE (REVERSE OK) - CONT.	5. Transmission overrunning clutch failure. 6. Input shaft seal rings worn or damaged.	5. Remove and disassemble transmission; replace overrunning clutch. 6. Remove and disassemble transmission; replace seal rings and any other worn or damaged parts.
NO DRIVE OR REVERSE (VEHICLE) WILL NOT MOVE	1. Low fluid level. 2. Gearshift cable or linkage loose, damaged, or misassembled. 3. Failure of driveline component, such as U-joint, axle shaft, case component, etc. 4. Low fluid pressure due to worn or damaged oil pump. 5. Transmission internal component damaged. 6. Valve body malfunction (seized valve, damaged manual lever, valve body screws loose or overtightened causing distortion and bind).	1. Add fluid and check for leaks if drive is restored. 2. Adjust, and reassemble linkage as needed; replace worn, damaged cable. 3. Perform preliminary inspection procedure for vehicle that will not move; refer to procedure in diagnosis section. 4. Perform pressure test to confirm low pressure; replace pump body and/or gears if necessary. 5. Remove and disassemble transmission; repair or replace failed components as needed. 6. Remove, disassemble, and inspect valve body; replace valve body (as assembly) if any valve or bore is damaged; clean and reassemble correctly if all parts are in good condition.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Governor valve sticking. 2. Valve body malfunction.	1. Remove, clean, and inspect; replace faulty parts. 2. Remove, clean, and inspect; look for stuck 1-2 valve or governor plug.
SLIPS IN LOW GEAR ONLY, BUT NOT IN 1 POSITION	1. Overrunning clutch faulty, not holding.	1. Replace overrunning clutch.
SLIPS IN FORWARD DRIVE RANGES	1. Low fluid level. 2. Air in fluid (fluid is foamy, full of bubbles), shifts are spongy, caused by air getting into pump suction passages. 3. Gearshift or throttle linkage/cable out of adjustment. 4. Low hydraulic pressures due to worn pump, incorrect control pressure adjustments, valve body warpage or malfunction, sticking governor, leaking seal rings, clutch seals leaking, servo leaks, clogged filter, or cooler lines. 5. Accumulator piston cracked, spring broken or seal worn. 6. Clutch or servo malfunction, leaking seal or worn plates. 7. Overrunning clutch worn, not holding (slips in 1 only).	1. Add fluid and check for leaks. 2. Check for bad pump gasket or seals, dirt between pump halves, and loose pump bolts or defective O-ring at filler tube. 3. Adjust linkage/cable. 4. Perform hydraulic and air pressure tests to determine cause. 5. Inspect and repair as necessary. 6. Air pressure check clutch-servo operation and repair as required. 7. Replace clutch.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN REVERSE ONLY	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Aerated fluid; see Slips in Forward Drive Ranges.	2. See Slips in Forward Drive Ranges.
	3. Gearshift linkage or cable out of adjustment.	3. Adjust linkage/cable.
	4. Rear band out of adjustment.	4. Adjust band.
	5. Hydraulic pressure too low due to worn pump, worn seal rings, clutch or servo seal leakage.	5. Perform hydraulic pressure tests to determine cause.
	6. Worn front clutch, leaking rear servo, or worn rear band.	6. Air pressure check clutch-servo operation and repair as required.
	7. B and-linkage binding.	7. Inspect and repair as required.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Incorrect throttle cable adjustment.	1. Adjust cable.
	2. Incorrect gear shift linkage/cable adjustment.	2. Adjust linkage/cable.
	3. Front band out of adjustment.	3. Adjust band.
	4. Hydraulic pressures too high or too low due to sticking governor, valve body malfunction, or incorrect hydraulic control pressure adjustments.	4. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	5. Front servo, band, or linkage malfunction.	5. Air pressure test operation and repair as necessary.
	6. Clutch or servo malfunction.	6. Air pressure test operation and repair as necessary.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Gearshift or throttle linkage or cable of adjustment.	1. Adjust linkage. Repair linkage if worn or damaged. Replace cable if damaged.
	2. Front band out of adjustment.	2. Adjust band.
	3. Governor valve stuck closed; loose output shaft support or governor housing bolts, worn pump, leaking seal rings, or valve body problem (i.e., stuck 1-2 shift valve or governor plug).	3. Check line and governor pressures to determine cause; correct as required.
	4. Clutch or servo malfunction.	4. Air pressure check operation of clutches and bands; repair faulty component.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor valve sticking in partially open position.	1. Remove governor; clean, inspect, and repair as required.
	2. Valve body malfunction.	2. Remove, clean, and inspect. Look for sticking 1-2 valve, 2-3 valve, governor plug, or broken springs.
	3. Front servo piston cocked in bore.	3. Inspect servo and repair as required.
	4. Front band linkage malfunction.	4. Inspect linkage and look for bind in linkage.
	5. Incorrect throttle or gearshift linkage or cable adjustment.	5. Adjust linkage or cable.
CREEPS IN NEUTRAL	1. Gearshift linkage or cable out of adjustment.	1. Adjust linkage or cable.
	2. Valve body malfunction (warped body, cross leakage).	2. Perform hydraulic pressure test to determine cause and repair as required.
	3. Transmission clutch dragging.	3. Air pressure check operation of clutches and repair as required.
	4. Converter clutch dragging.	4. Replace converter.
DRAGS OR LOCKS UP	1. Front or rear band out of adjustment.	1. Adjust bands.
	2. Servo band or linkage malfunction (i.e., binding linkage, warped band, servo piston stuck.	2. Air pressure check servo operation and repair as required.
	3. Dragging clutch (does not release fully).	3. Air pressure check clutch operation and repair as required.
	4. Broken or seized planetary gears.	4. Remove, inspect, and repair as required (look for debris in oil pan).
	5. Overrunning clutch worn, broken, or seized.	5. Remove and inspect clutch, repair as required.
GROWLING, GRATING, OR SCRAPING NOISES	1. Planetary gear set broken or seized.	1. Check for debris in oil pan and repair as required.
	2. Overrunning clutch worn, seized, or broken.	2. Inspect and check for debris in oil pan; repair as required.
	3. Oil pump components scored, binding, or broken.	3. Remove, inspect, and repair as required.
	4. Output shaft bearing or bushing damaged.	4. Remove, inspect, and repair as required.
	5. Faulty clutch operation.	5. Perform air pressure check and repair as required.
	6. Governor support (park gear) binding or seal rings broken.	6. Remove, inspect, and repair as required.
	7. Front and rear bands out of adjustment.	7. Adjust bands.
BUZZING NOISE	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Air being drawn into pump suction passages.	2. Check pump for porous casting, scores on mating surfaces, and excess rotor clearance; repair as required.
	3. Overrunning clutch damaged.	3. Replace clutch.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
BUZZING NOISE - CONT.	4. Valve body misassembled, bolts loose, weak spring, or mis-positioned valve or check ball.	4. Remove, disassemble, inspect valve body; reassemble correctly if necessary; replace assembly if valves or springs are damaged.
OIL COMES OUT FILLER TUBE	1. Transmission overfilled.	1. Drain fluid to correct level; remove neutral switch and drain through switch hole with suction gun.
	2. Breather vent in oil pump blocked.	2. Inspect and clear blockage.
	3. Fluid cooler or cooler lines plugged.	3. Flush cooler and lines.
	4. Air in fluid (aerated).	4. See "Slips in Forward Drive Ranges."
	5. Oil filter clogged.	5. Replace filter; determine the reason for clogged condition and repair.
	6. Rear servo piston or seal failure.	6. Check hydraulic pressure at servo in reverse (will register low or fluctuate rapidly).
	7. Valve body switch valve sticking.	7. Remove and clean valve.
OIL LEAKS (ITEMS LISTED REPRESENT POSSIBLE LEAK POINTS AND SHOULD ALL BE CHECKED).	1. Speedometer adapter.	1. Replace both adapter seals.
	2. Pan gasket.	2. Tighten pan screws to 150 inch-pounds; if leaks persist, replace gasket, **do not overtighten screws.**
	3. Filler tube (where tube enters case).	3. Replace O-ring seal.
	4. Fluid lines and fittings.	4. Tighten fittings; if leaks persist, replace fittings and lines if necessary.
	5. Valve body manual lever shaft seal.	5. Replace shaft seal.
	6. Pressure port plug loose.	6. Tighten to correct torque; replace plug if leak persists.
	7. Rear bearing access plate.	7. Replace gasket.
	8. Gasket damaged or bolts are loose.	8. Replace bolts or gasket or tighten bolts.
	9. Adapter/extension gasket damaged.	9. Replace gasket.
	10. Neutral switch.	10. Replace switch and gasket.
	11. Converter housing area.	11. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return, oil in front pump housing, or hole plugged. Check for leaks past O-ring seal on pump, or past pump-to-case bolts; pump housing porous, oil coming out vent due to overfill or leak past front band shaft access plug.
	12. Cooler line fittings and hoses.	12. Replace fittings and hoses.
	13. Pump seal.	13. Replace seal.
	14. Torque converter.	14. Replace converter.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
OVERHEAT DURING COMMERCIAL OPERATION OR WHILE TRAILER TOWING (FLUID DARK AND BURNEDWITH SOME SLUDGE FORMATION)	1. Vehicle not properly equipped for trailer towing or commercial use.	1. Be sure vehicle is equipped with recommended optional components (i.e., HD springs, transmission, axle, larger CID engine, auxiliary cooler, correct axle ratio, etc.). If vehicle is not so equipped, it should not be used for severe service operation.
	2. Vehicle not equipped with auxiliary fluid cooler.	2. Drain fluid, change filter, and install auxiliary cooler.
	3. Extensive idling time or operation in heavy traffic in hot weather.	3. Cut down on idling time; shift into neutral every so often and run engine at 1000 rpm to help circulate fluid through cooler.
	4. Tow vehicle overloaded (exceeding vehicle tow capacity).	4. Be sure vehicle is properly equipped to handle load; do not tow Class III-type loads with a vehicle that is only rated for Class I or II operation.
	5. Air flow to auxiliary cooler blocked by snow plow, front mounted spare tire, bug screen, or similar item.	5. Remove or reposition item causing air flow blockage.
OVERHEAT DURING NORMAL OPERATION (FLUID DISCOLORED, SMELLS BURNED)	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Fluid cooler, lines blocked, or cooler cracked (oil in engine coolant).	2. Flush cooler and lines and replace radiator if transmission fluid has entered coolant.
	3. Switch valve sticking.	3. Remove, disassemble, clean valve body.
	4. Clutch pack clearance incorrect (too tight).	4. Check and correct as required.
	5. Bands too tight.	5. Adjust bands.
NO START IN PARK OR NEUTRAL	1. Gearshift linkage or cable out of adjustment.	1. Adjust linkage or cable.
	2. Neutral switch wire broken or open.	2. Check continuity with test lamp; repair as required.
	3. Faulty park/neutral position switch.	3. Refer to service section for test and replacement procedure.
	4. Valve body manual lever assembly bent, worn, broken, or not aligned with switch.	4. Inspect lever assembly and replace if damaged.
SLUGGISH ACCELERATION AT LOW SPEEDS OR REQUIRES EXCESSIVE THROTTLE OPENING TO MAINTAIN HIGHWAY SPEEDS	1. Poor engine performance.	1. Check engine and repair as required.
	2. Gearshift or throttle linkage/cable out of adjustment.	2. Adjust linkage/cable.
	3. Transmission clutches slipping.	3. Perform stall test and repair as required.
	4. Overrunning clutch in converter not holding.	4. Perform stall test and repair converter if clutch has failed.
	5. Converter overrunning clutch stuck.	5. Replace converter.

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TRANSMISSION DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FLUID CONTAMINATED (DISCOLORED, FULL OF SLUDGE AND/OR METAL AND FRICTION MATERIAL PARTICULAR)	1. If contamination occurred shortly after overhaul, fluid cooler and lines were not flushed and flow tested. This is especially true when original overhaul was to correct a problem that generated a large amount of debris, such as a gear failure or a clutch pack failure. Note: Flushing the cooler and lines is mandatory after a failure of the converter lockup clutch.	1. If contamination is severe, cooler flushing, converter replacement, and another overhaul may be necessary; particularly so if shift problems were also present.
	2. Incorrect fluid used in transmission.	2. If transmission is operating properly, drain fluid, reverse flush cooler and lines, and change fluid and filter. However, if shift problem has developed, converter replacement and transmission overhaul may be required.
	3. Main cooler in radiator is cracked, allowing engine coolant to enter transmission.	3. Replace radiator (and cooler) and flush lines. If problem was diagnosed early enough, fluid and filter change may only be necessary. If contamination period was prolonged, overhaul and converter replacement may be required.
	4. Severe overload results in overheat, fluid breakdown, and accelerated wear, especially in high ambient temperatures. Most frequent causes are: • Vehicle is not properly equipped for heavy duty service. • Tow vehicle and boat or trailer are both overloaded. • Trailer or boat are too large for tow vehicle (load exceeds rated capacity of tow vehicle).	4. Repair transmission, flush cooler, and lines. Replace converter if necessary. Install auxiliary cooler if needed. Also install HD cooling system if needed. If tow vehicle and unit being towed are both overloaded, the only repair is to reduce the load to rated limits. However, if trailer or boat is too large for tow vehicle, the only option is for the owner to move up to properly-equipped and load-rated tow vehicle.

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OVERDRIVE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 3-4 UPSHIFT	1. Fourth gear overdrive switch (on dash) in OFF position.	1. Turn control switch to ON position.
	2. Overdrive circuit fuse blown.	2. Replace fuse; determine why fuse failed and repair as necessary (i.e., shorts, grounds in circuit).
	3. Fourth gear overdrive switch shorted, open, wires loose.	3. Replace switch if shorted or open and repair loose or damaged wires.
	4. Overdrive solenoid or circuit wire loose, shorted, open.	4. Check wires/connections with 12V test lamp and voltmeter; repair damaged or loose wires/connections as necessary.
	5. Solenoid feed orifice in valve body is blocked.	5. Remove, disassemble, clean valve body thoroughly.
	6. Fourth gear overdrive solenoid failure.	6. Verify solenoid failure with test lamp and replace solenoid.
	7. Sensor failure (distance sensor or coolant sensor).	7. Test both sensors with test lamp or volt/ohmmeter and replace faulty sensor.
	8. Neutral switch open or shorted or switch wire to PCM is damaged (loss of park/neutral input to PCM).	8. Test switch as described in service section and replace if necessary.
	9. PCM faulty.	9. Check with tester and replace if necessary.
	10. Overdrive piston seal failure.	10. Replace both seals.
	11. Wrong overdrive piston spacer.	11. Remove unit, check end play, and install correct spacer.
	12. Low hydraulic pressure.	12. Pressure test transmission to determine cause.
SLIPS IN OVERDRIVE FOURTH GEAR	1. Low fluid level.	1. Add fluid and check for leaks.
	2. Overdrive piston or seal malfunction.	2. Remove overdrive unit; replace piston seals if worn; replace piston if damaged; if piston retainer is damaged, it will be necessary to remove and disassemble the transmission.
	3. Overdrive clutch pack worn.	3. Remove overdrive unit and rebuild clutch pack.
	4. 3-4 shift valve, timing valve, or accumulator malfunction.	4. Remove and overhaul valve body. Replace accumulator seals. Make sure all valves operate freely in bores and do not bind or stick. Make sure valve body screws are correctly tightened and separator plates are properly positioned.
	5. Overdrive piston retainer bleed orifice blown out.	5. Disassemble transmission, remove retainer, and replace orifice.
	6. Overdrive unit thrust bearing failure.	6. Disassemble overdrive unit and replace thrust bearing (No. 1 thrust bearing is between overdrive piston and clutch hub; No. 2 thrust bearing is between the planetary gear and the direct clutch spring plate; No. 3thrust bearing is between overrunning clutch hub and output shaft).

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OVERDRIVE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED 3-4 UPSHIFT (SLOWTO ENGAGE)	1. Low fluid level. 2. Overdrive solenoid or wiring is faulty. 3. Overdrive piston spacer too thin. 4. Overdrive clutch pack worn. 5. TPS faulty. 6. Overdrive clutch bleed orifice plugged.	1. Add fluid and check for leaks. 2. Test solenoid and check wiring for loose/ corroded connections, or shorts/ground; replace solenoid if faulty and repair wiring if necessary. 3. Remove unit; measure end play and select proper spacer. 4. Remove unit and rebuild clutch pack. 5. Replace TPS 6. Disassemble transmission and replace orifice.
3-4 UPSHIFT OCCURS BEFORE COMPLETION OF 2-3 UPSHIFT	1. Overdrive solenoid connector or wiring problem. 2. Overdrive solenoid malfunction. 3. Coolant temperature or TPS malfunction. 4. Valve body malfunction. 5. PCM malfunction.	1. Test connector and wiring for loose connections, shorts, or ground, and repair as needed. 2. Replace solenoid. 3. Test each sensor for continuity, short, ground, and replace as necessary. 4. Remove, disassemble, clean, and inspect valve body components; make sure all valves and plugs slide freely in bores; polish valves with crocus cloth if needed. 5. Test PCM with DRB II tester and replace controller if faulty.
NO 4-3 DOWNSHIFT	1. Circuit wiring and/or connectors shorted. 2. Lockup solenoid not venting. 3. Overdrive solenoid not venting. 4. 3-4 shift, shuttle, timing valve, or accumulator malfunction. 5. PCM malfunction. 6. TPS malfunction.	1. Test wiring and connectors with test lamp and volt/ohmmeter; repair wiring as necessary; replace connectors and/or harnesses as required. 2. Remove valve body and replace solenoid if seized or shorted. 3. Remove valve body and replace solenoid if seized or shorted. 4. Remove valve body; remove and disassemble lower housing and 3-4 accumulator housing; replace seals and clean valves as necessary; be sure all valves slide freely in bores. 5. Check operation with DRB II tester; replace controller only if faulty. 6. Replace TPS.
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control switch open-shorted. 2. Overdrive solenoid wiring or connectors faulty. 3. Overdrive or lockup solenoid not venting. 4. PCM malfunction.	1. Test and replace switch if faulty. 2. Check solenoid wiring and connections for shorts/grounds; repair as necessary. 3. Test solenoids and replace if seized or shorted. 4. Test with DRB II tester; replace controller if faulty.

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OVERDRIVE DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH 1-2, 2-3, OR 3-2 SHIFTS	1. Converter clutch solenoid failure.	1. Remove valve body and replace solenoid.
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR (A500)	1. Converter clutch solenoid, relay, or wiring problem.	1. Test solenoid, relay, and wiring for continuity, shorts, or grounds; replace solenoid and relay if faulty; repair wiring and connectors as necessary.
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive clutch discs, plates, or snap rings damaged. 2. Overdrive piston or planetary thrust bearing brinnelled, installed wrong, or damaged. 3. Output shaft bearings brinnelled, scored, damaged. 4. Planetary gears worn, chipped, damaged. 5. Overdrive unit overrunning clutch rollers rough, scored, or output bushings are worn.	1. Remove unit and rebuild clutch pack. 2. Remove and disassemble unit; replace either thrust bearing if damaged. 3. Remove and disassemble unit; replace either bearing if damaged. 4. Remove and overhaul overdrive unit. 5. Remove and overhaul overdrive unit.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct clutch spring collapsed or broken. 2. Direct clutch pack worn. 3. Rear band out of adjustment. 4. Front clutch malfunction. 5. Overdrive thrust bearing failure.	1. Remove and disassemble unit; check clutch pack and replace spring. 2. Disassemble unit and rebuild clutch pack. 3. Adjust band. 4. Air pressure test clutch operation; remove and rebuild if necessary. 5. Disassemble geartrain and replace bearings.
NO 1-2 OR 2-3 UPSHIFT (HAS LOW AND REVERSE ONLY)	1. Governor component loose, worn, or damaged.	1. Remove and disassemble unit; replace worn or damaged governor components as needed.

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TORQUE CONVERTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
CONVERTER CLUTCH WILL NOT ENGAGE	1. Circuit fuse open.	1. Replace fuse. Check for circuit short if fuse blows again.
	2. Solenoid or relay wiring disconnected, open, shorted.	2. Repair wiring or replace harness.
	3. Clutch solenoid or relay malfunction (short, open, stuck).	3. Replace as needed.
	4. Sticking converter clutch or switch valve.	4. Remove and disassemble valve body. Clean and free-up valves.
	5. Clutch module tube loose, module cover not secured, or module components misassembled.	5. Remove valve body. Reposition tube, secure cover, or reassemble components.
	6. Converter clutch failure, turbine hub leak, or overrunning clutch (in converter) failed.	6. Replace torque converter.
	7. Oil pump fault (gears worn, seal leaks, housing damaged or loose, reaction shaft seal rings worn.	7. Remove and rebuild pump as needed.
	8. Input shaft seal rings worn, damaged.	8. Remove and repair or replace as needed.
CONVERTER CLUTCH WILL NOT DISENGAGE	1. Converter clutch or switch valve sticking.	1. Remove, disassemble valve body. Clean and free-up valves.
	2. Valve body fault (loose screws causing cross leakage, misassembled clutch module parts, etc.).	2. Remove and service valve body. Replace as assembly if valves, bores, plugs, housings, transfer plate, etc., are damaged.
CONVERTER CLUTCH STAYS ENGAGED AT TOO LOW A SPEED	1. Converter solenoid fault (sticking, check ball).	1. Replace solenoid.
	2. Clutch module fault.	2. Remove valve body and examine module. Check valves, springs, connecting tube, and end cover for misassembly, damage, being loose.
	3. Valve body fault.	3. Remove and service valve body. Look for stuck clutch and switch valve, loose housing screws, clutch solenoid wire damage, etc.
VIBRATION OR SHUDDER **DURING** CONVERTER CLUTCH ENGAGEMENT	1. Low fluid level.	1. Top off level and check for leaks.
	2. Incorrect fluid.	2. Drain and refill with MOPAR ATF Plus type 7176.
	3. Engine problem: (a) ignition fault (b) fuel system fault.	3. Diagnose with DRB scan tool and correct as needed.
	4. Torque converter fault: (a) out of balance (b) clutch failure (c) turbine hub seal leak.	4. Replace converter.

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TORQUE CONVERTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
VIBRATION OR SHUDDER **DURING** CONVERTER CLUTCH ENGAGEMENT - CONT.	5. Oil pump fault: (a) leaking seals, seal rings (b) pump gears worn (c) pump bolts loose (d) reaction shaft/pump bushing damage (e) vent damaged.	5. Remove and overhaul pump.
	6. Valve body malfunction.	6. Remove and service valve body. Look for loose screws, misassembled parts, stuck valves, etc.
SHUDDER **AFTER** CLUTCH ENGAGEMENT	1. Engine fuel or ignition problem.	1. Diagnose with scan tool and correct as needed.
	2. Exhaust system problem (pipes grounding against chassis, or restrictions in converter, muffler, or pipe).	2. Realign grounded pipes. Replace restricted parts.
	3. Incorrect fluid.	3. Drain and refill with MOPAR ATF Plus, type 7176.
	4. Throttle valve cable out of adjustment.	4. Adjust cable.
	5. Low fluid level.	5. Top off fluid and check for leak.
	6. Converter clutch failure.	6. Replace torque converter.
	7. Restriction in cooler system.	7. Reverse flush system. Replace radiator, if cooler is restricted.
	8. Valve body malfunction.	8. Remove and service valve body. Look for failed solenoid, sticking valves, loose attaching screws, misassembled parts.
	9. Oil pump pressure low.	9. Remove and overhaul pump. Replace bushings, seals, seal rings, and gears as needed.
CONVERTER CLUTCH CHATTERS **DURING** ENGAGEMENT WHEN COLD	1. Low fluid level.	1. Top off level and check for leaks.
	2. Incorrect fluid.	2. Drain and refill with MOPAR ATF Plus type 7176.
	3. Torque converter fault: (a) out of balance (b) converter clutch failed (c) turbine hub seal leak.	3. Replace converter.
VIBRATION **AFTER** CON-VERTER CLUTCH ENGAGEMENT	1. Exhaust pipes grounding against body.	1. Realign exhaust components.
	2. Engine fuel or ignition problem.	2. Diagnose with DRB scan tool and repair as needed.
	3. Throttle valve cable needs adjustment.	3. Adjust cable.
	4. Converter balance problem or internal damage.	4. Replace converter.

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TORQUE CONVERTER DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
CONVERTER VIBRATION WHEN ENGINE IS "REVVED" IN NEUTRAL	1. Converter out of balance.	1. Replace converter.
LOCKS OR DRAGS IN LOW OR SECOND	1. Oil cooler, cooler lines, or fittings are plugged.	1. Reverse flush lines and fittings. Replace radiator if cooler is completely plugged. Overhaul transmission and replace converter if large quantities of clutch material and/or metal particles are cause of plugging.
	2. Oil pump fault.	2. Remove and overhaul pump. Look for worn seals or reaction shaft seal rings, pump body cracks, loose bolts, worn gears, bushings.
	3. Valve body fault.	3. Remove and service valve body. Look for loose or misassembled parts, failed solenoid, stuck valves, etc.
STALLS, OR IS SLUGGISH IN REVERSE	1. Plugged cooler lines, fittings, or cooler.	1. Reverse flush lines and cooler. Replace radiator if cooler is completely plugged. Overhaul transmission and replace converter if plugging is caused by large quantities of clutch material and/or metal particles.
	2. Oil pump fault.	2. Remove and overhaul pump. Look for worn seals, or reaction shaft seal rings, pump body cracks, loose bolts, worn gears or bushings.
	3. Valve body malfunction.	3. Remove and service valve body. Look for stuck converter and switch valves, loose screws, misassembled parts, failed solenoid, etc.
FLUID COMES OUT FILL TUBE (OVERHEATING)	1. Vehicle not properly equipped for severe service operation such as trailer towing.	1. Vehicle must be equipped with HD cooling system, auxiliary cooler, and correct engine/transmission/axle ratio combination.
	2. Air flow through radiator and cooler partially blocked by plow, front mount spare tire, protective screen, etc.	2. Move equipment as needed to restore
	3. Transmission overfilled.	3. Remove excess fluid at cooler line or with suction tube inserted in filler tube.
	4. Cooler lines, fittings, or cooler plugged.	4. Reverse flush cooler lines and fittings.
	5. Transmission vent restricted.	5. Remove transmission and either open the vent or replace the pump body if the vent cannot be repaired.
	6. Stuck switch valve.	6. Remove valve body and free up the valve.

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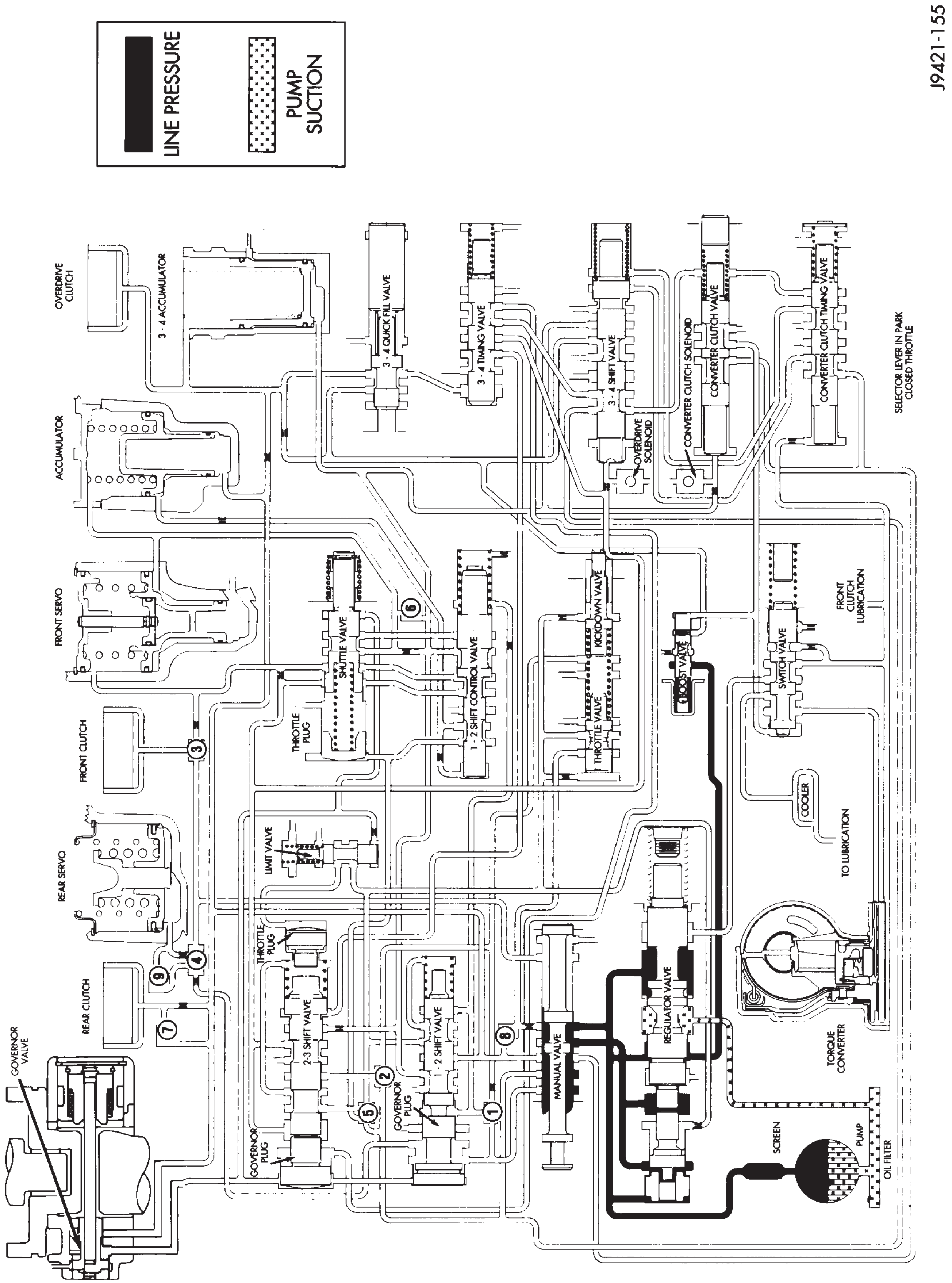
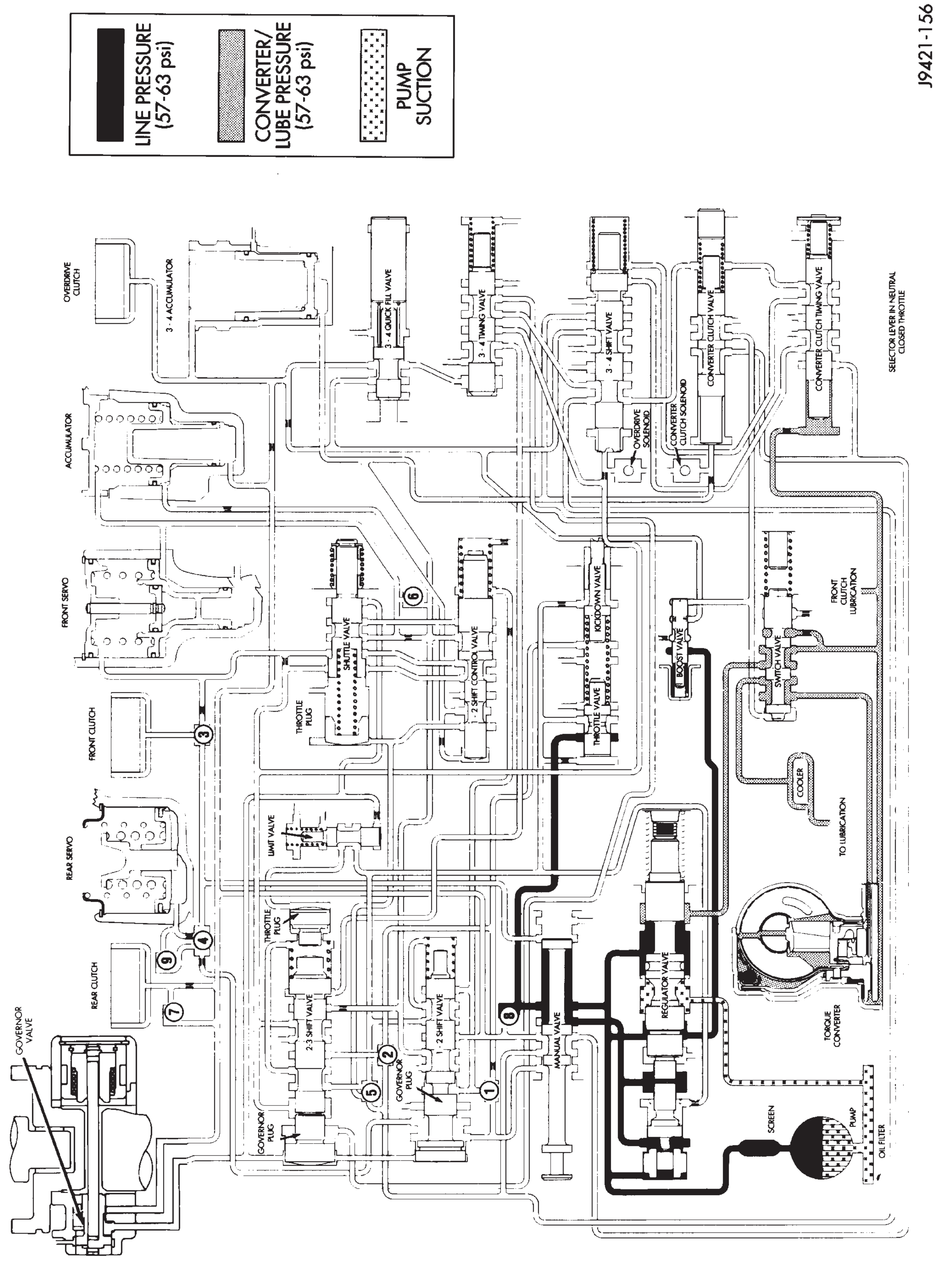
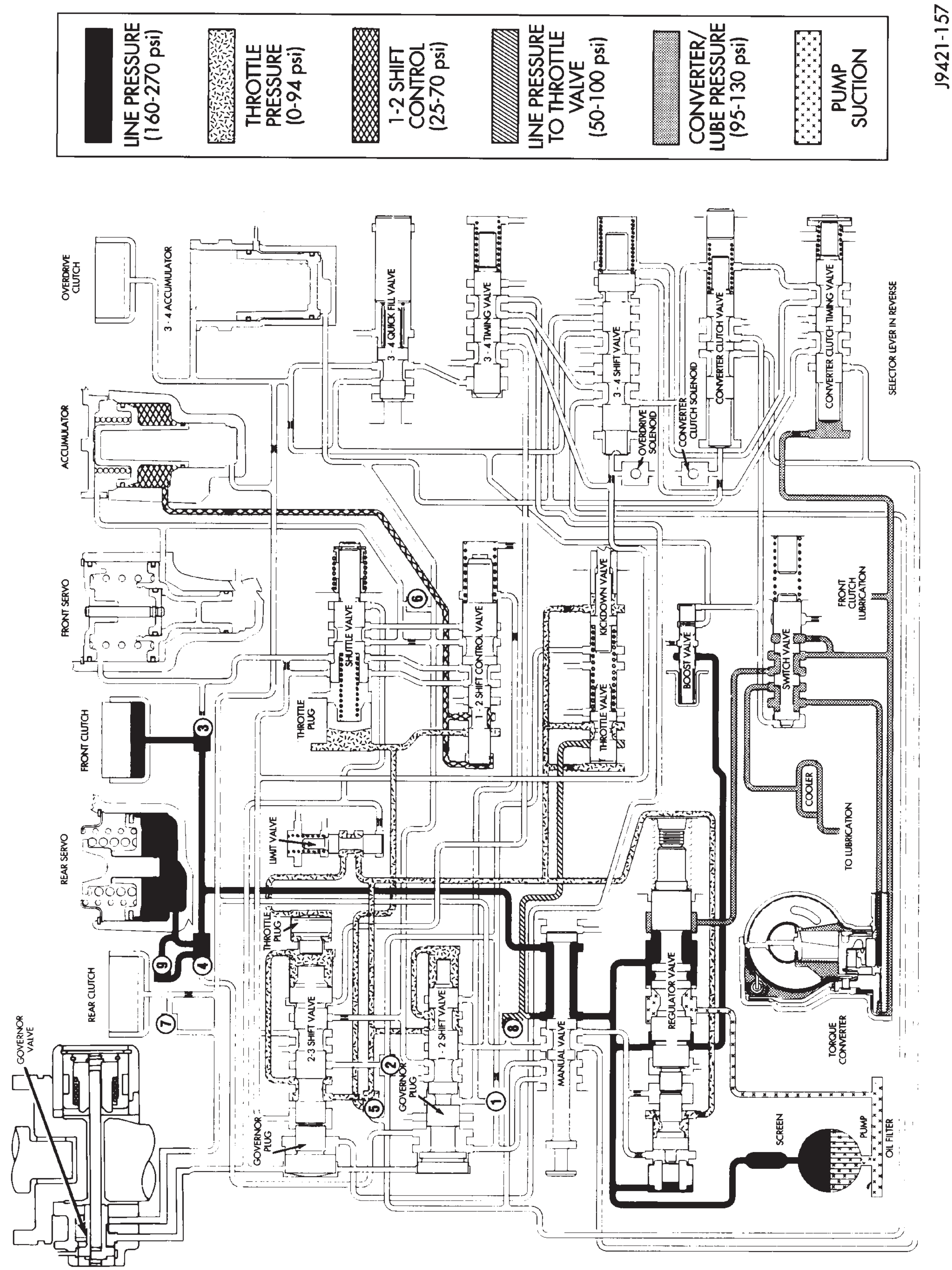


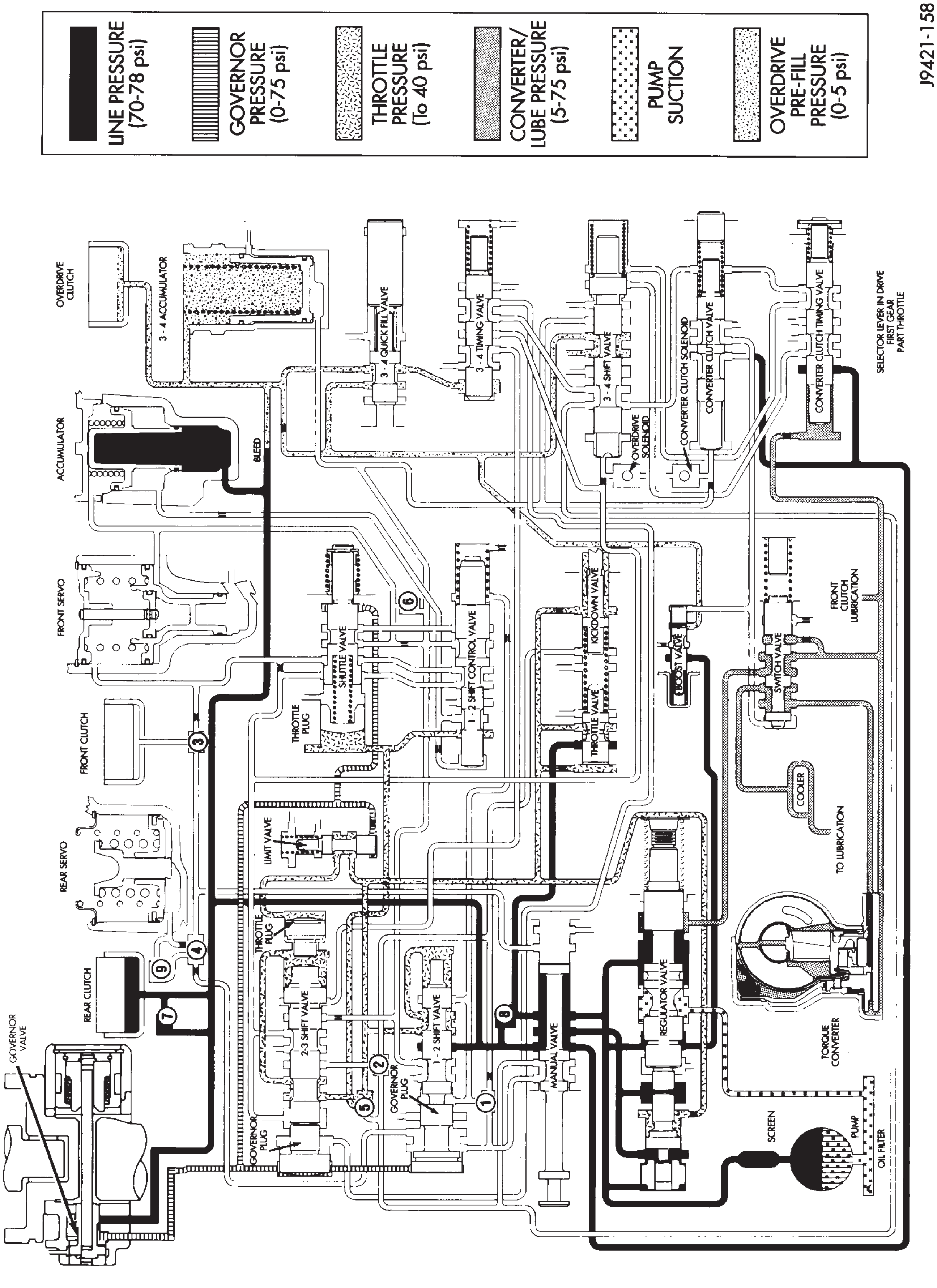
HYDRAULIC FLOW IN PARK



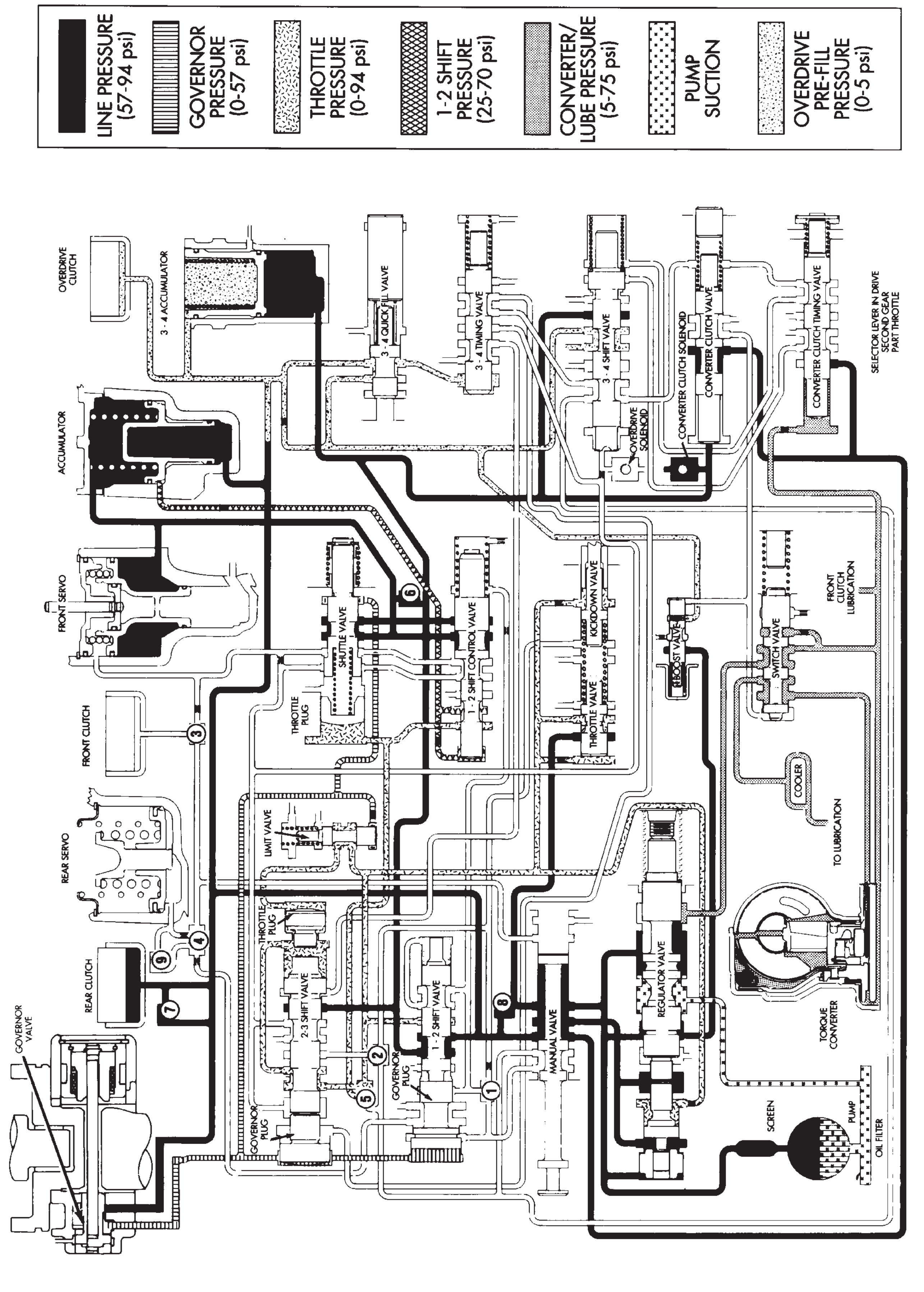
HYDRAULIC FLOW IN NEUTRAL

HYDRAULIC FLOW IN REVERSE



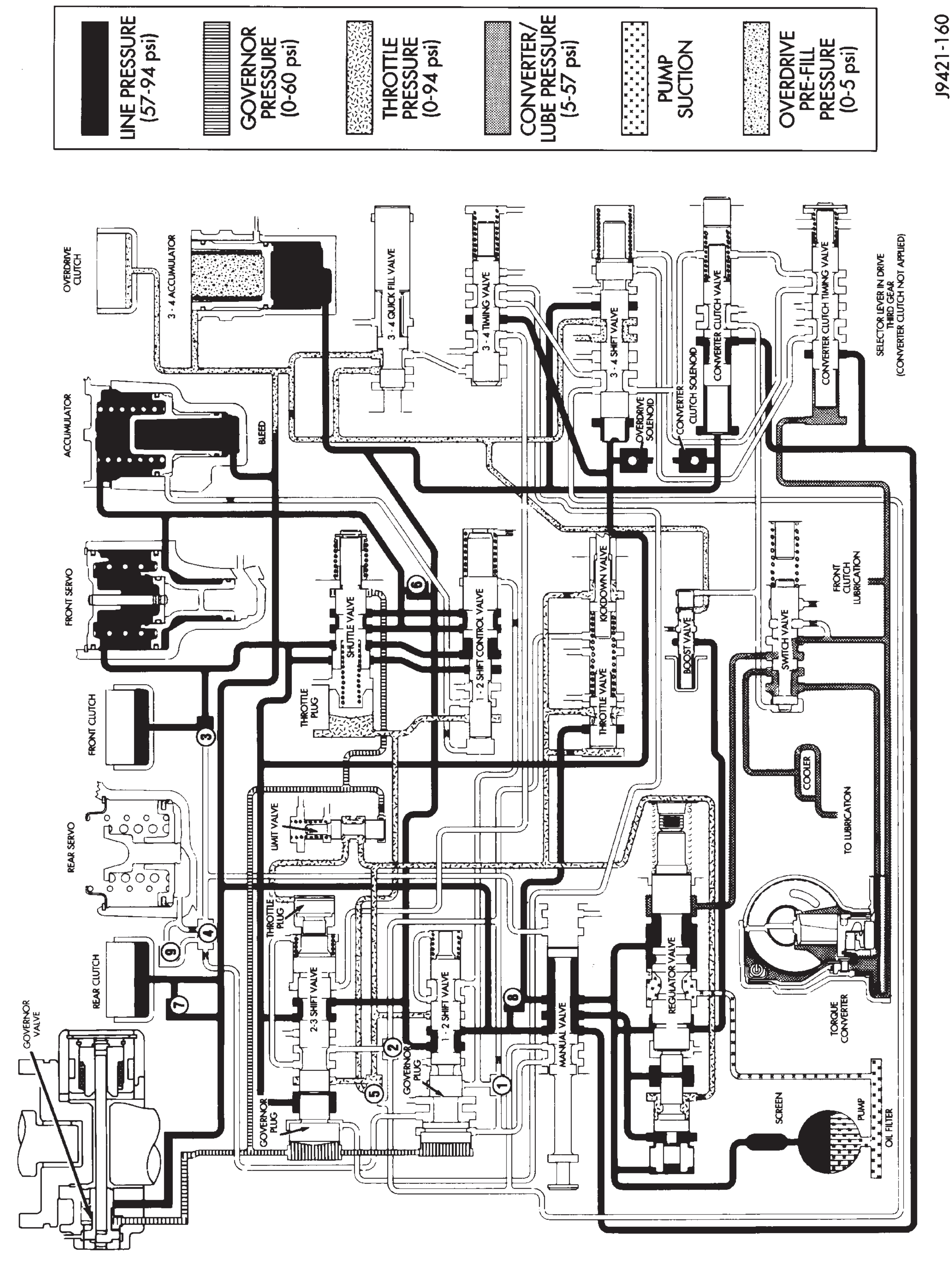


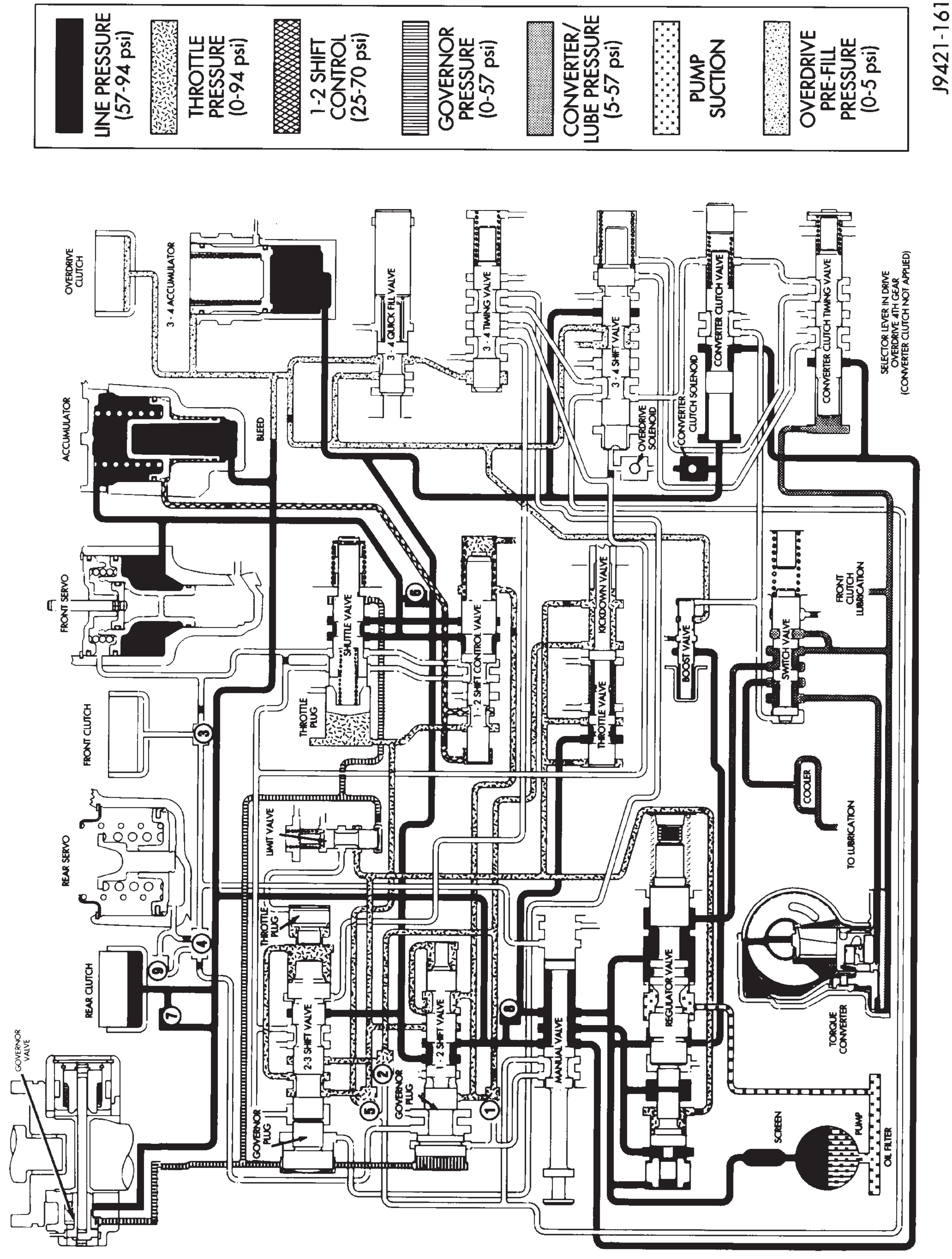
HYDRAULIC FLOW IN D FIRST GEAR



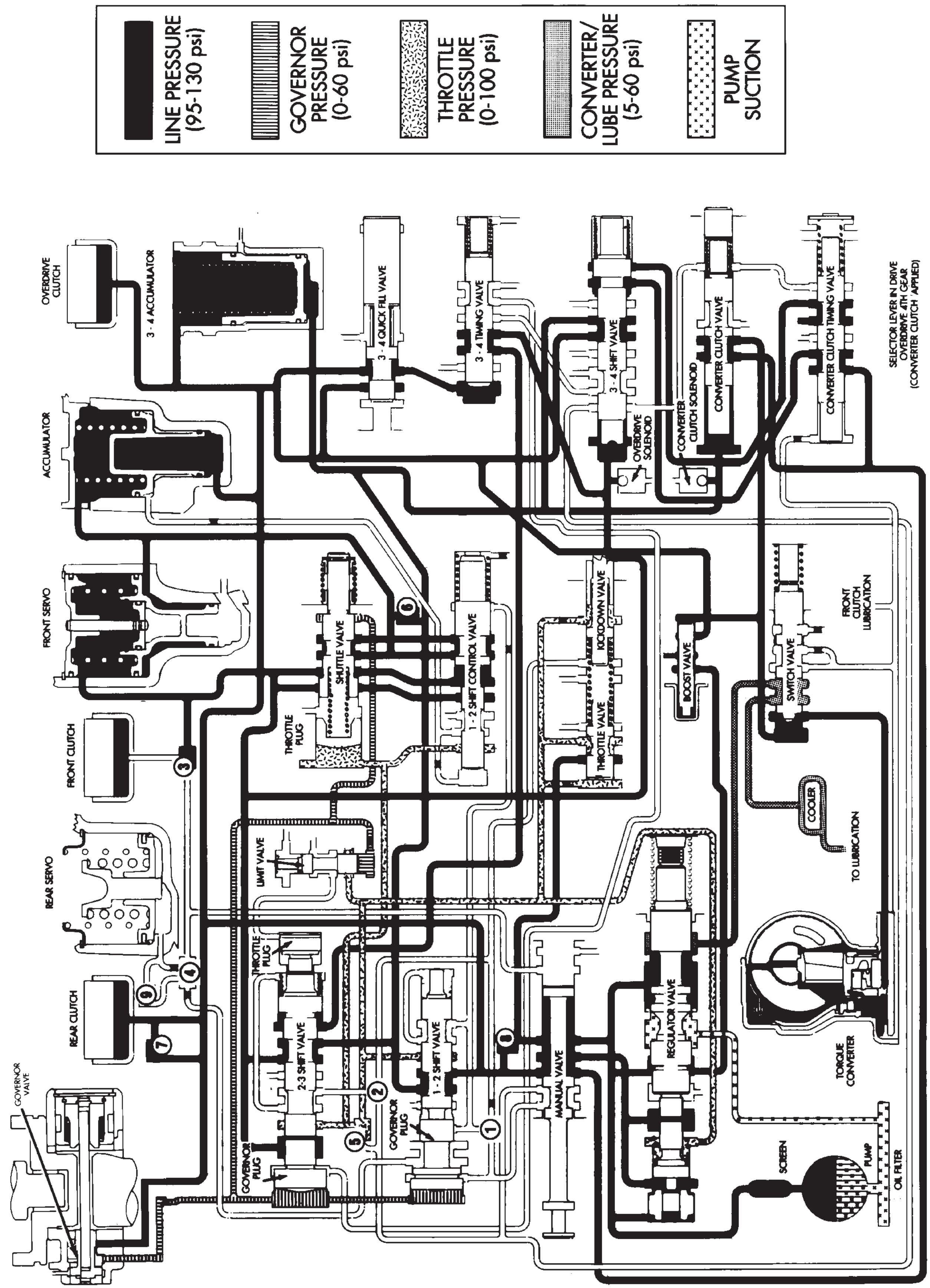
HYDRAULIC FLOW IN D SECOND GEAR

HYDRAULIC FLOW IN D THIRD GEAR





HYDRAULIC FLOW IN D FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)



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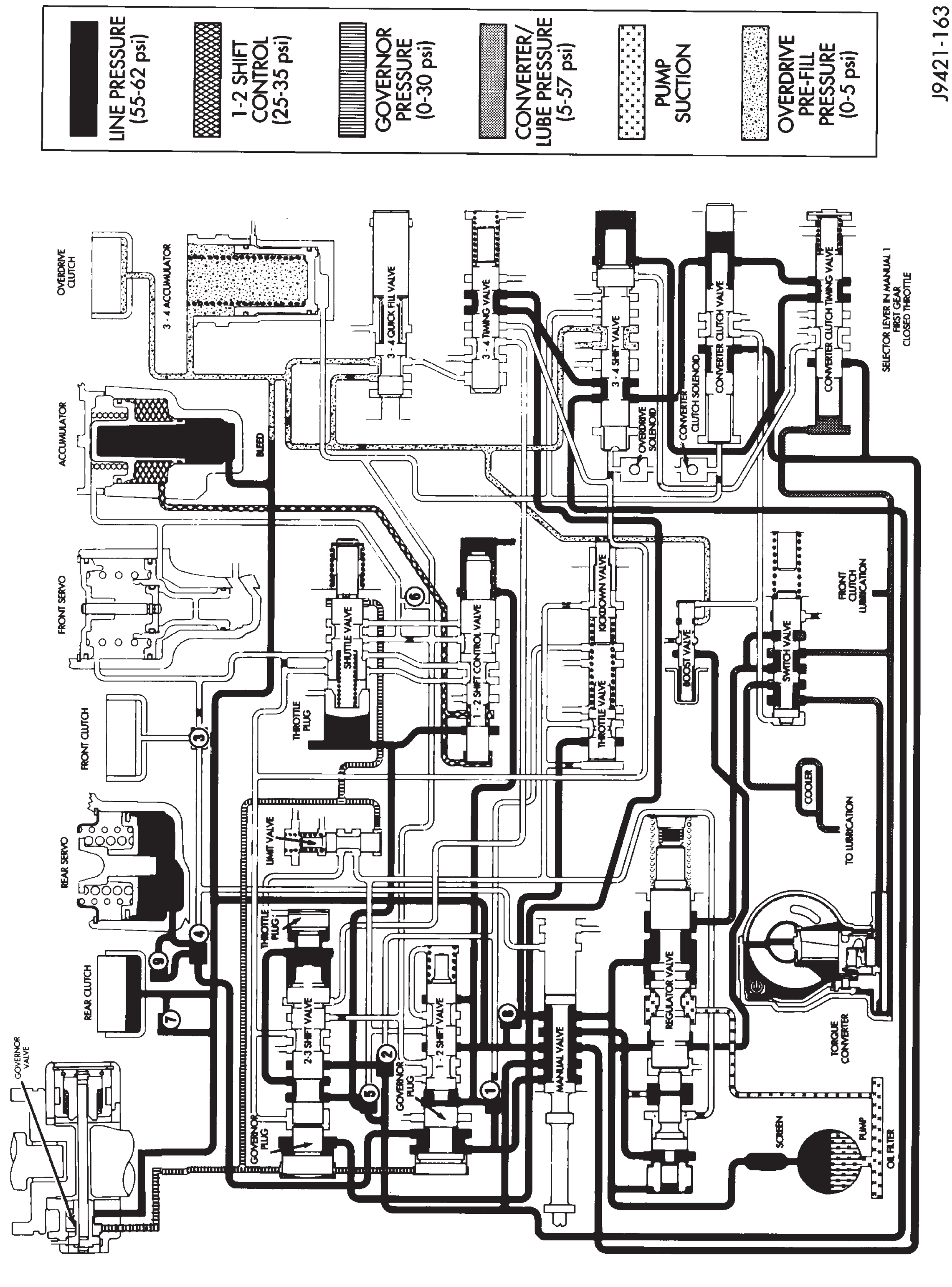
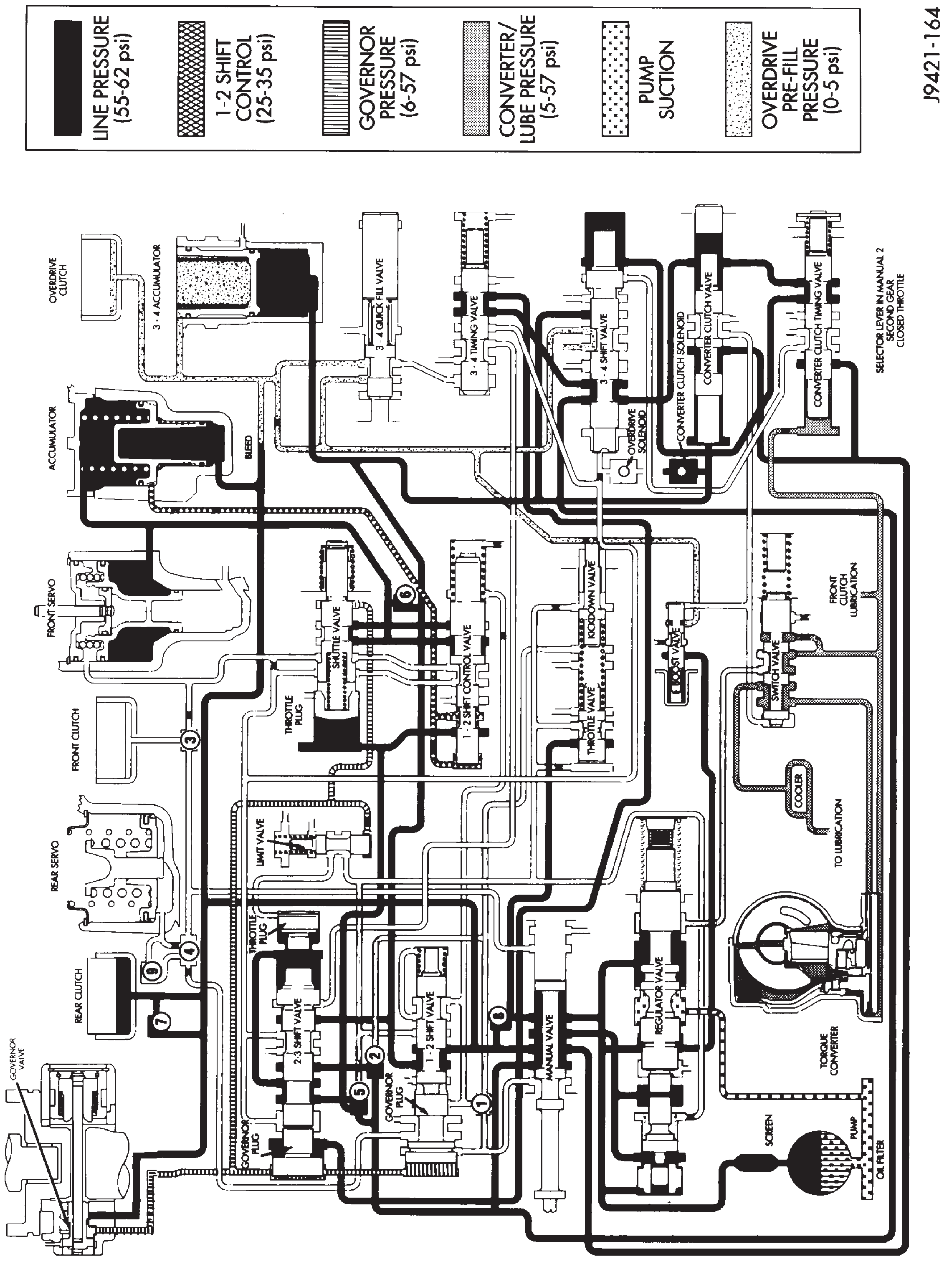
HYDRAULIC FLOW IN D FOURTH GEAR (CONVERTER CLUTCH APPLIED)



HYDRAULIC FLOW IN MANUAL FIRST GEAR (1)

HYDRAULIC FLOW IN MANUAL SECOND GEAR (2)



46RH IN-VEHICLE SERVICE

INDEX

GOVERNOR AND PARK LOCK SERVICE

The governor and park lock components are located within the overdrive unit and cannot be serviced in the vehicle. The overdrive unit must be removed and disassembled for access to the governor and park lock components.

Refer to the sections dealing with overdrive removal, installation and disassembly for repair procedures.

OIL PUMP SEAL

The transmission and torque converter must be removed for access to the oil pump seal. Oil pump seal replacement procedures are described in the Transmission/Converter Removal And Installation section.

RECOMMENDED FLUID

The recommended and preferred fluid for 46RH transmissions is Mopar ATF Plus, type 7176.

Mopar Dexron II is not really recommended and should only be used when ATF Plus is not available.

FLUID LEVEL CHECK

Transmission fluid level should be checked monthly under normal operation. If the vehicle is used for trailer towing or similar heavy load hauling, check fluid level and condition weekly.

Fluid level is checked with the engine running at curb idle speed, the transmission in Neutral, parking brakes applied, and the transmission fluid at normal operating temperature.

FLUID LEVEL CHECK PROCEDURE

(1) Transmission fluid must be at normal operating temperature for accurate fluid level check. Drive vehicle if necessary to bring fluid temperature up to normal hot operating temperature of 82°C (180°F).

(2) Position vehicle on level surface. This is extremely important for accurate fluid level check.

(3) Start and run engine at curb idle speed.

(4) Apply parking brakes.

(5) Shift transmission momentarily into all gear ranges. Then shift transmission back to Neutral.

(6) Clean top of filler tube and dipstick to keep dirt from entering tube.

(7) Remove dipstick and check fluid level as follows:

(a) Dipstick has three fluid level indicator levels (Fig. 1) which are a MIN dot, an OK crosshatch area, and a MAX fill arrow.

(b) Correct maximum level is to MAX arrow mark. Correct acceptable level is to OK mark in crosshatch area. Incorrect level is at or below MIN dot.

(c) If fluid is low, add only enough Mopar ATF Plus to restore correct level. Do not overfill.

CAUTION: Do not overfill the tranmission. Overfilling may cause leakage out the pump vent which can be mistaken for a pump seal leak. Overfilling will also cause fluid aeration and foaming as the excess fluid is picked up and churned by the gear train. This will significantly reduce fluid life.

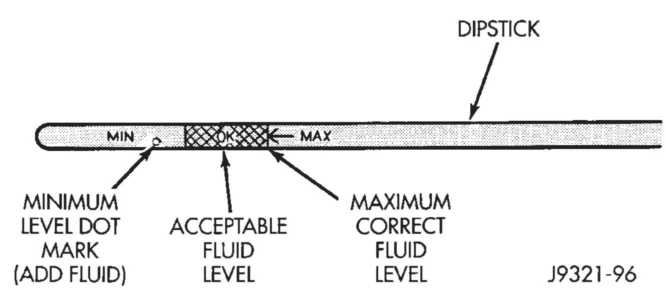


Fig. 1 Fluid Level Marks On Dipstick

FLUID AND FILTER REPLACEMENT

NORMAL CHANGE INTERVAL

The fluid and filter should be changed (and the bands adjusted) at recommended maintenance intervals, or whenever the transmission has been disassembled for any reason.

Refer to the Driveline section in Group O, Lubrication and Maintenance for recommended change intervals. Refer to the fluid/filter replacement and band adjustment procedures in this section.

SEVERE USAGE CHANGE INTERVAL

Under severe usage, the fluid and filter should be changed and the bands adjusted at 12,000 mile (19 000 Km) intervals.

Severe usage is defined as:

(a) More than half of vehicle operation occurs in heavy city traffic during hot weather (above 90° F).

(b) Vehicle is used for taxi, police, limousine, or similar commercial operation.

(c) Vehicle is used for trailer towing or heavy load hauling.

When the factory fluid is drained, refill the transmission with Mopar ATF Plus, type 7176 fluid.

FLUID/FILTER REPLACEMENT PROCEDURE

(1) Raise vehicle.

(2) Remove oil pan and drain fluid.

(3) Clean oil pan and pan magnet. Then clean remaining gasket material from gasket surface of transmission case.

(4) Remove fluid filter screws and remove filter.

(5) Position new filter on valve body and install filter screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

(6) Adjust rear band at this time if required.

(7) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 150 in. lbs. (17 N·m) torque.

(8) Adjust front band at this time if required.

(9) Lower vehicle and refill transmission with Mopar ATF Plus, type 7176 fluid. Refer to Refilling After Overhaul Or Fluid/Filter Change.

REFILLING AFTER OVERHAUL OR FLUID/FILTER CHANGE

The most effective way to avoid overfilling after a fluid change or overhaul is as follows:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar ATF Plus to transmission:

(a) If fluid/filter change was performed, add **3 pints (1-1/2 quarts)** of ATF Plus to transmission.

(b) If transmission was completely overhauled and torque converter was replaced or drained, add **12 pints (6 quarts)** of ATF Plus to transmission.

(3) Apply parking brakes.

(4) Start and run engine at normal curb idle speed.

(5) Apply service brakes, shift transmission through all gear ranges then back to Neutral but leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. Add only enough fluid to bring level to ADD mark on dipstick. **Do not overfill.**

(7) Drive vehicle until transmission fluid is at normal operating temperature. Then recheck fluid level as described in next step.

(8) Leave engine running at curb idle speed, shift into Neutral, and check fluid level again. This time, add only enough fluid to bring level up to Full mark **but do not overfill**.

(9) When fluid level is correct, shut engine off, release park brake, remove funnel, and reseat dipstick in fill tube.

TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT

The transmission throttle valve is operated by a cam on the throttle lever. The throttle lever is operated by an adjustable cable (Fig. 2). The cable is attached to an arm mounted on the throttle lever shaft. A lock button at the engine-end of the cable is provided for cable adjustment.

A correctly adjusted throttle valve cable will cause the throttle lever on the transmission to move simultaneously with the throttle body lever from the idle position. Proper adjustment will allow simultaneous movement without causing the transmission throttle lever to either move ahead of, or lag behind the lever on the throttle body.

CHECKING THROTTLE VALVE CABLE ADJUSTMENT

(1) Turn ignition key to OFF position.

(2) Remove air cleaner.

(3) Verify that lever on throttle body is at curb idle position. Then verify that transmission throttle lever (Fig. 3) is also at idle (fully forward) position.

(4) Slide cable off attachment stud on throttle body lever (Fig. 4).

(5) Compare position of cable end to attachment stud on throttle body lever (Fig. 4):

(a) Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction.

(b) If cable end and attachment stud are misaligned (off center), cable will have to be adjusted as described in Throttle Valve Cable Adjustment procedure.

(6) Reconnect cable end to attachment stud. Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle body.

(a) If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.

(b) If transmission throttle lever moves ahead of, or lags behind throttle body lever, cable adjustment will be necessary. Or, if throttle body lever prevents transmission lever from returning to closed position, cable adjustment will be necessary.

THROTTLE VALVE CABLE ADJUSTMENT PROCEDURE

(1) Turn ignition switch to OFF position.

(2) Remove air cleaner if necessary.

(3) Disconnect cable end from attachment stud. **Carefully slide cable off stud. Do not pry or pull cable off.**

(4) Verify that transmission throttle lever is in fully closed position. Then be sure lever on throttle body is at curb idle position.

(5) Press cable lock button inward to release cable (Fig. 4). Lock button only has to move about 2 mm (0.070 in.) to release cable in adjuster head.

(6) Center cable end on attachment stud to within 1 mm (0.039 in.) and release lock button.

(7) Check cable adjustment. Be sure transmission throttle lever and lever on throttle body move simultaneously as described in cable adjustment checking procedure.

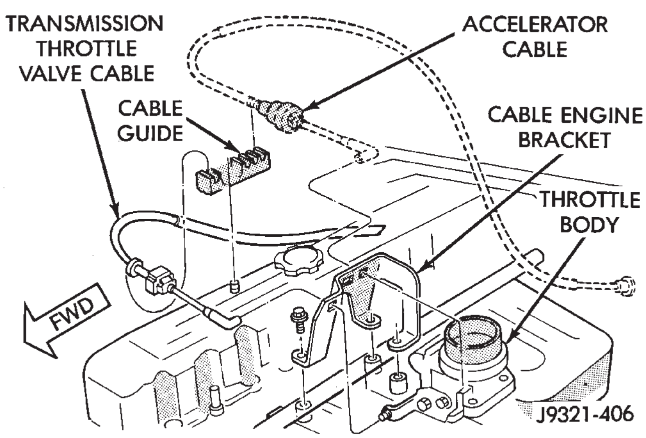


Fig. 2 Throttle Cable Attachment At Engine

GEARSHIFT CABLE ADJUSTMENT

Check adjustment by starting the engine in Park and Neutral. Adjustment is OK if the engine starts only in these positions. Adjustment is incorrect if the engine starts in one but not both positions. If the engine starts in any position other than Park or Neutral, or if the engine will not start at all, the park/neutral position switch may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

(2) Raise vehicle.

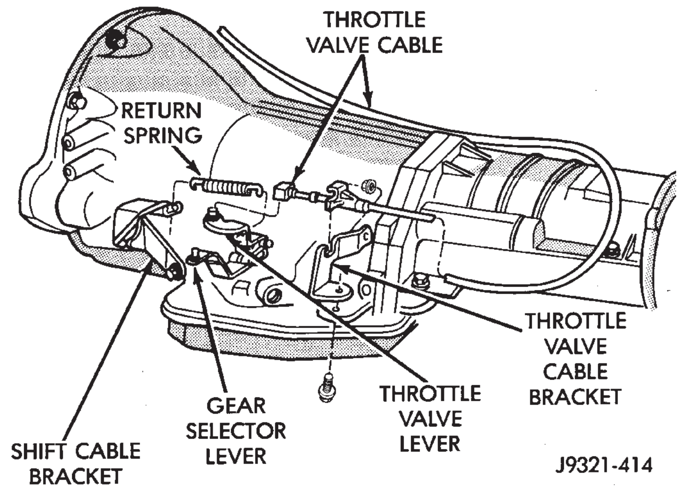


Fig. 3 Throttle Cable Attachment At Transmission

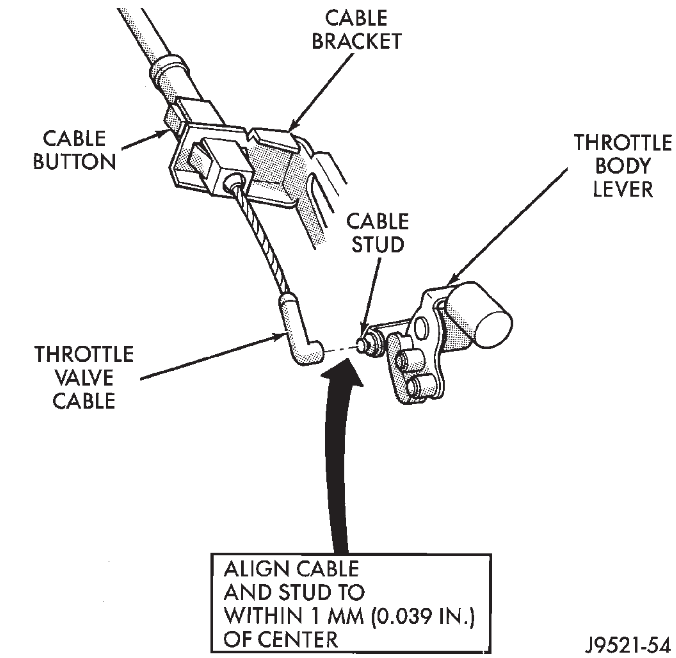


Fig. 4 Throttle Valve Cable Adjustment

(3) Release cable adjuster clamp (at transmission end of cable) to unlock cable (Fig. 5).

(4) Unsnap cable from cable bracket (Fig. 5).

(5) Check transmission shift lever position by moving it all the way rearward into Park detent.

(6) Verify positive engagement of park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(7) Snap cable into cable bracket on transmission.

(8) Lock shift cable by pressing cable adjuster clamp down until it snaps into place.

(9) Check engine starting. Engine should start only in Park and Neutral.

(10) Lower vehicle.

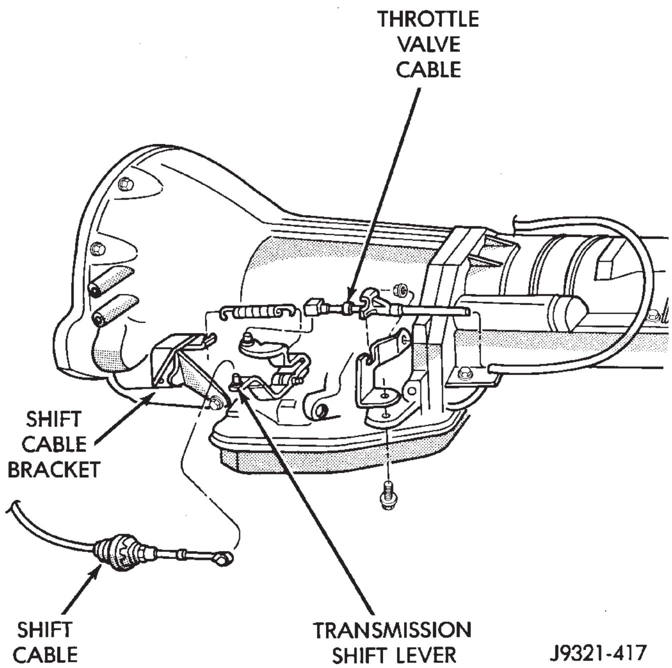


Fig. 5 Shift Cable Attachment At Transmission

PARK INTERLOCK CABLE ADJUSTMENT

(1) Shift transmission into Park.

(2) Turn ignition switch to Accessory position.

CAUTION: Be sure the ignition switch is in the Accessory position for cable adjustment. The cable and lever mechanism will not adjust correctly if the switch lock cylinder is in Park position.

(3) Remove shift lever bezel and console screws. Raise bezel and console for access to cable.

(4) Pull cable lock button up to release cable (Fig. 6).

(5) Pull cable forward. Then release cable and press cable lock button down until it snaps in place.

(6) Check cable adjustment as follows:

(a) Place shift lever in Park.

(b) Check shift handle release button and ignition lock cylinder operation. Release button should be in released (out) position and ignition lock cylinder should rotate freely from Off to Lock.

(c) Next, place shift lever in D or R position and check ignition lock cylinder operation again. Cylinder should not rotate from Off to Lock position.

(d) Check shift lever operation. Shifting out of Park position should only be possible when ignition lock cylinder is in Off, Run, or Start positions. Shift lever should be locked-in when lock cylinder is in Accessory and Lock positions.

FRONT BAND ADJUSTMENT

The front band adjusting screw is located on the driver side of the transmission case above the manual valve and throttle valve levers.

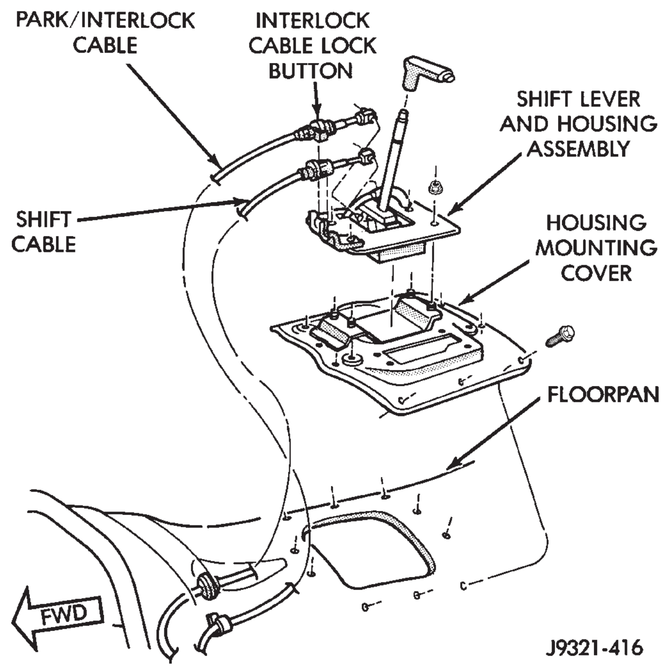


Fig. 6 Shift And Park Interlock Cables

ADJUSTMENT PROCEDURE

(1) Raise vehicle.

(2) Loosen band adjusting screw locknut. Then back locknut off 4-5 turns.

(3) Be sure adjusting screw turns freely in case. Lubricate screw threads with Mopar spray lube, LPS all purpose spray lube, or equivalent quality product.

(4) Tighten band adjusting screw to 8 N·m (72 in. lbs.) torque with inch pound Torque Wrench C-3380-A, a 3-in. extension and 5/16 socket (Fig. 7).

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw (Fig. 8), tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

(5) Back off band adjusting screw **2-7/8 turns.**

(6) Hold adjuster screw in position and tighten locknut to 41 N·m (30 ft. lbs.) torque.

(7) Lower vehicle.

REAR BAND ADJUSTMENT

The transmission oil pan must be removed for access to the rear band adjusting screw.

(1) Raise vehicle.

(2) Remove transmission oil pan and drain fluid.

(3) Loosen band adjusting screw locknut 5-6 turns.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque (Fig. 9). Use inch-pound Torque Wrench C-3380-A for adjustment.

(5) Back off band adjusting screw **two** turns.

(6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

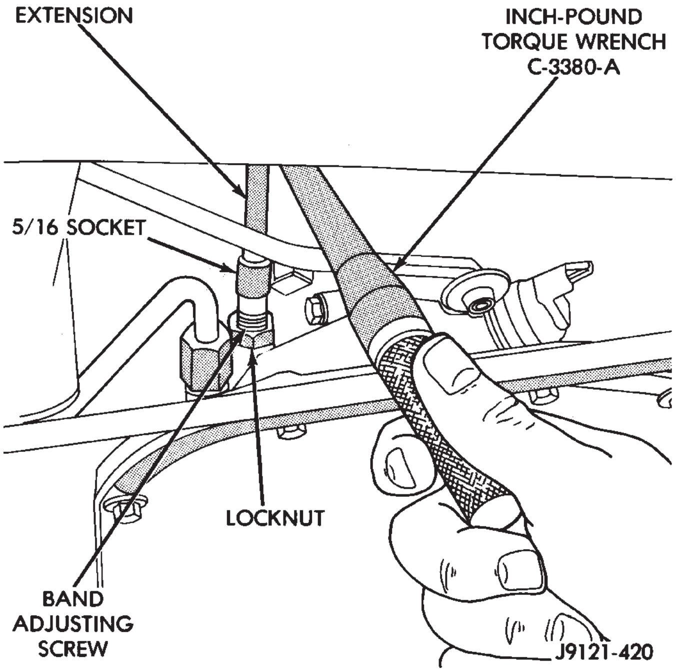


Fig. 7 Front Band Adjustment

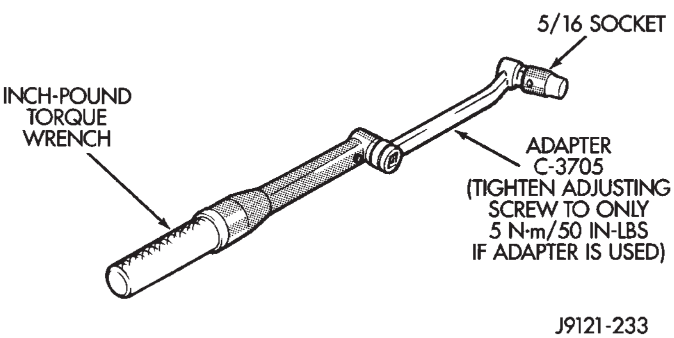


Fig. 8 Band Adjustment Adapter Tool Usage

(7) Clean oil pan, pan magnet and gasket surface of case. Also inspect and replace fluid filter if necessary.

(8) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (150 in. lbs.) torque.

(9) Lower vehicle and refill the transmission with Mopar ATF Plus, type 7176 fluid.

SPEEDOMETER SERVICE

Rear axle gear ratio and tire size determine speedometer pinion requirements. If the pinion must be replaced, refer to the parts catalogue information for the correct part.

SPEEDOMETER ASSEMBLY REMOVAL

(1) Raise vehicle.

(2) Disconnect wires from vehicle speed sensor.

(3) Remove adapter clamp and screw (Fig. 10).

(4) Remove speed sensor and speedometer adapter as assembly.

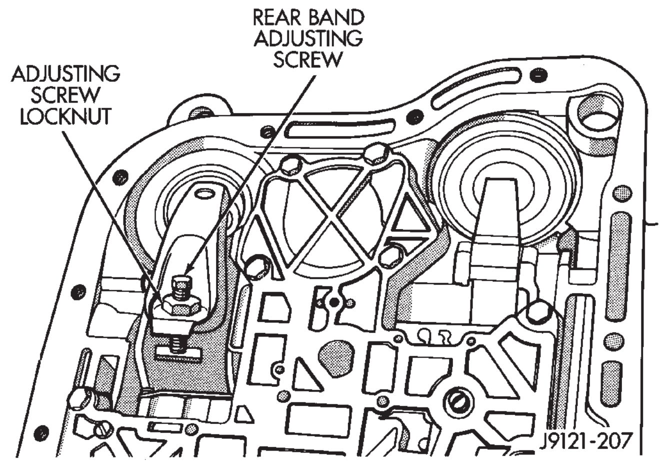


Fig. 9 Rear Band Adjustment Screw Location

(5) Remove speed sensor retaining screw and remove sensor from adapter.

(6) Remove speedometer pinion from adapter.

(7) Inspect sensor and adapter O-rings (Fig. 9). Remove and discard O-rings if worn or damaged.

(8) Inspect terminal pins in speed sensor. Clean pins with Mopar electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or pins are loose, severely corroded, or damaged.

SPEEDOMETER INSTALLATION AND INDEXING

(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.

(2) Install new O-rings on speed sensor and speedometer adapter if necessary (Fig. 10).

(3) Lubricate sensor and adapter O-rings with transmission fluid.

(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.

(5) Install speedometer pinion in adapter.

(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.

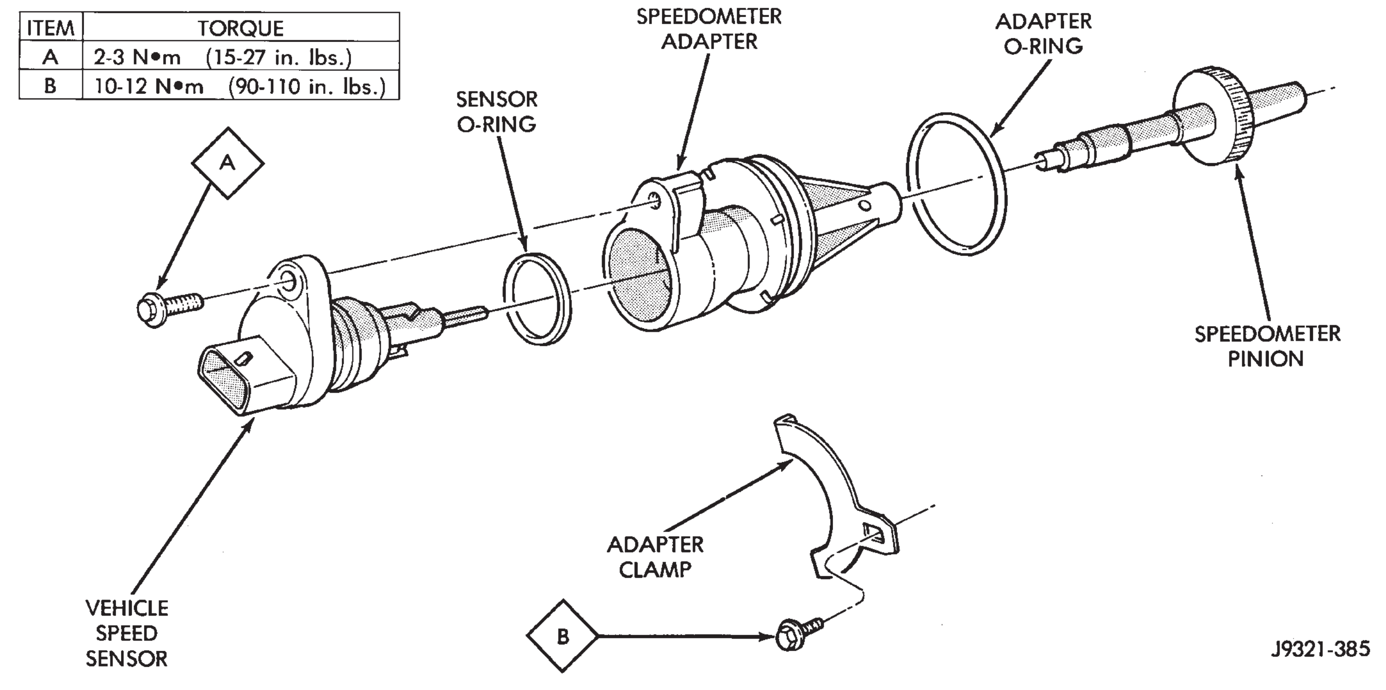
(7) Note index numbers on adapter body (Fig. 11). These numbers will correspond to number of teeth on pinion.

(8) Install speedometer assembly in housing.

(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.



ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

Fig. 10 Speedometer Components

(12) Lower vehicle and top off transmission fluid level if necessary.

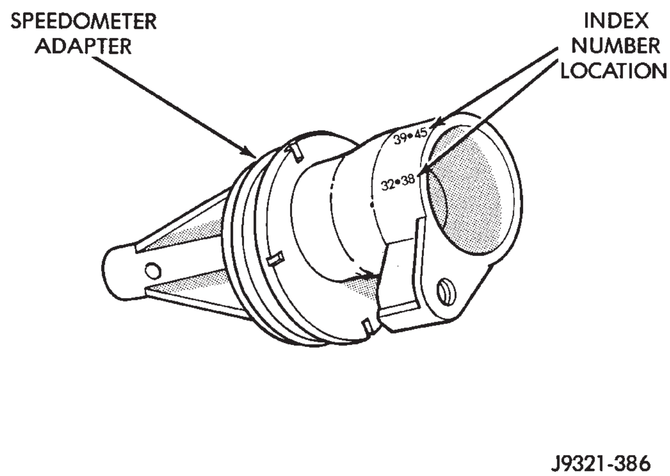


Fig. 11 Location Of Index Numbers On Speedometer Adapter

PARK/NEUTRAL POSITION SWITCH

The center terminal of the switch is the starter circuit terminal. It provides the ground for the starter solenoid circuit through the selector lever in Park and Neutral positions only. The outer terminals on the switch are for the backup lamp circuit.

SWITCH TEST

(1) Verify that gearshift linkage is correctly adjusted before testing. Switch will not operate properly if linkage adjustment is incorrect.

(2) To test switch, remove wiring connector. Then test continuity between center terminal and transmission case. Continuity should exist only when transmission is in Park or Neutral.

(3) Shift transmission into reverse and test continuity at switch outer terminals.

(a) Continuity should exist only when transmission is in Reverse.

(b) Continuity should not exist between outer terminals and case.

PARK/NEUTRAL POSITION SWITCH REPLACEMENT

(1) Raise vehicle and position drain pan under switch.

(2) Disconnect switch wires and remove switch from case.

(3) Move shift lever to Park and Neutral positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 12).

(4) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.

(5) Connect switch wires, lower vehicle and top off transmission fluid level.

SLIP YOKE SEAL REPLACEMENT—2-WHEEL DRIVE MODELS

(1) Raise vehicle.

(2) Mark propeller shaft U-joints for alignment reference. Then disconnect and remove shaft.

(3) Remove old seal from overdrive housing with Remover Tool C-3985-B (Fig. 13), or hammer and punch.

(4) Position new seal in housing opening. Then tap seal into place with Installer Tool C-3995-A or C-3972-A (Fig. 14).

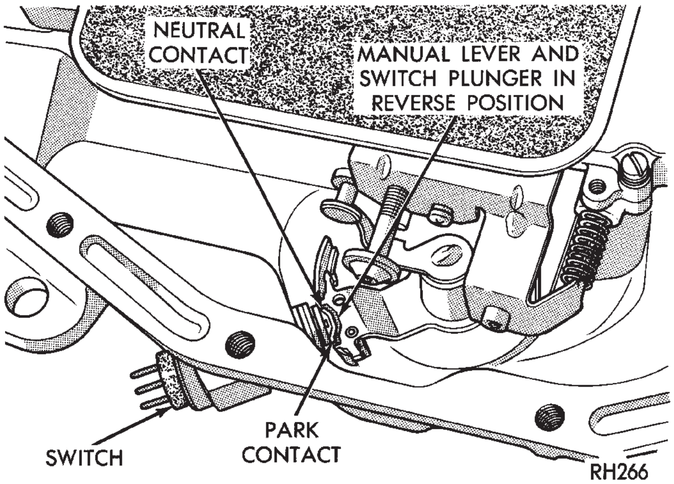


Fig. 12 Park/Neutral Position Switch Contacts

(5) Smooth surface of propeller shaft slip yoke with 400 grit paper if necessary. Clean yoke surface with solvent and wipe clean with shop cloth.

(6) Lubricate slip yoke and new seal with liberal quantity of Mopar multi mileage grease or petroleum jelly.

(7) Carefully guide propeller shaft slip yoke through seal, into housing and onto output shaft splines.

(8) Align and connect propeller shaft U-joint to axle yoke. Tighten clamp strap bolts to 19 N·m (170 in. lbs.) torque.

(9) Lower vehicle.

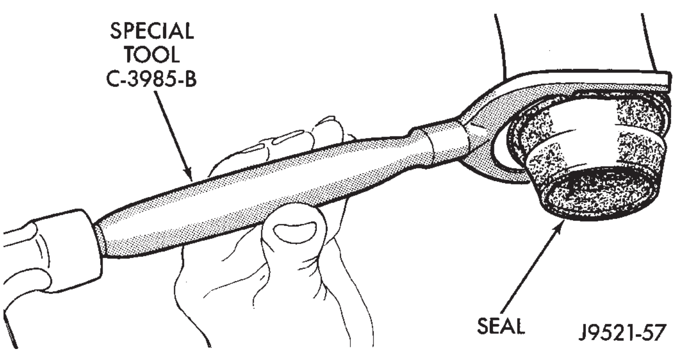


Fig. 13 Removing Slip Yoke Seal

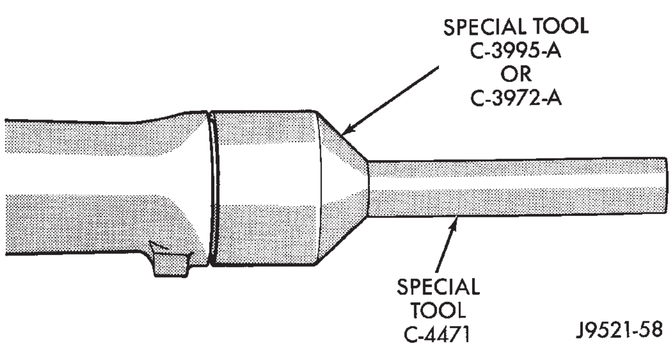


Fig. 14 Installing Slip Yoke Seal

VALVE BODY SERVICE

GENERAL SERVICE INFORMATION

The valve body can be removed for service without having to remove the entire transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to the valve body service procedures in the Transmission Overhaul section.

The only replaceable valve body components are:

- manual lever
- manual lever washer, seal, E-clip and shaft seal
- manual lever detent ball
- throttle lever
- fluid filter and screws
- solenoid assembly, connecter seal and shoulder screw
- switch valve and spring
- pressure adjusting screw bracket
- fluid temperature thermister

The remaining valve body components are serviced only as part of a complete valve body assembly.

VALVE BODY REMOVAL

(1) Shift transmission into Neutral.

(2) Raise vehicle.

(3) Remove gearshift and throttle levers from shaft of valve body manual lever.

(4) Disconnect and remove neutral switch.

(5) Disconnect valve body overdrive and converter clutch solenoid wires at case connector (Fig. 15).

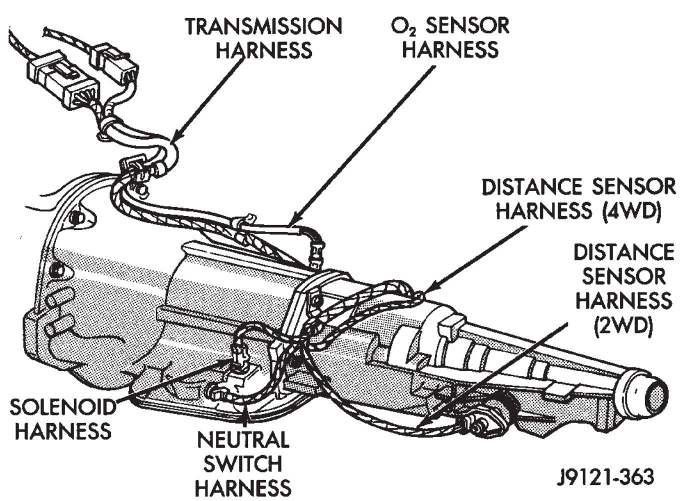


Fig. 15 Transmission Wire Harness Identification

(6) Position drain pan under transmission oil pan.

(7) Remove transmission oil pan and gasket.

(8) Remove fluid filter from valve body.

(9) Push valve body solenoid wire connector out of case.

(10) Remove valve body attaching bolts.

(11) Lower valve body slightly and remove accumulator piston and accumulator inner and outer springs.

(12) Push manual lever shaft and solenoid case connector out of transmission case. Lower valve body, rotate it away from case, pull park rod out of sprag and remove valve body (Fig. 16).

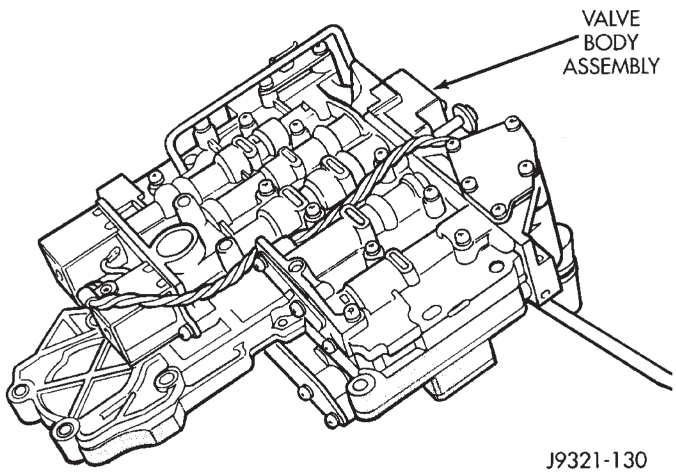


Fig. 16 46RH Valve Body

VALVE BODY INSTALLATION

(1) Verify that park/neutral position switch has NOT been installed in case. Valve body cannot be installed if switch is in place.

(2) Check condition of seals on valve body solenoid case connector. Replace seals if cut or worn.

(3) Check condition of manual lever shaft seal (in case). Remove seal if lip is cut, or worn. However do not install new seal at this time.

(4) Check condition of seals on accumulator piston (Fig. 17). Install new piston seals if necessary.

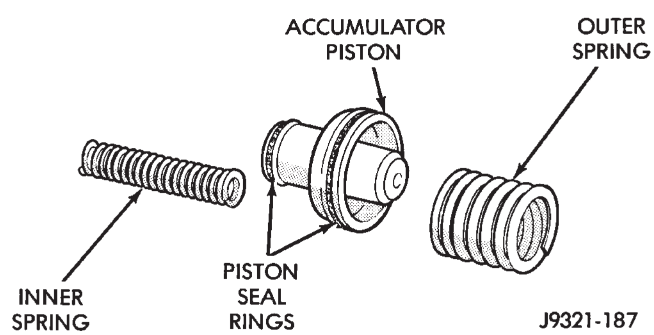


Fig. 17 Accumulator Piston And Springs

(5) Install inner spring in accumulator piston. Then install piston and spring in bore. Petroleum jelly can be used to hold piston in bore.

(6) Place valve body manual lever in low (1 position) so ball on park lock rod can be installed in sprag.

(7) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal (in case).

(8) Lubricate seal rings on solenoid case connector with petroleum jelly.

(9) Position accumulator piston outer spring on valve body.

(10) Raise valve body and work end of park lock rod into and through sprag. Use screwdriver to align sprag if necessary.

(11) Align accumulator springs, manual lever shaft and solenoid case connector. Then seat valve body on case and install one or two bolts to hold valve body in place.

(12) Tighten valve body bolts alternately and evenly to 11 N·m (100 in. lbs.) torque.

(13) Install new fluid filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.) torque.

(14) Install new manual lever shaft seal in case if necessary. Use 15/16 deep well socket to seat seal (Fig. 18).

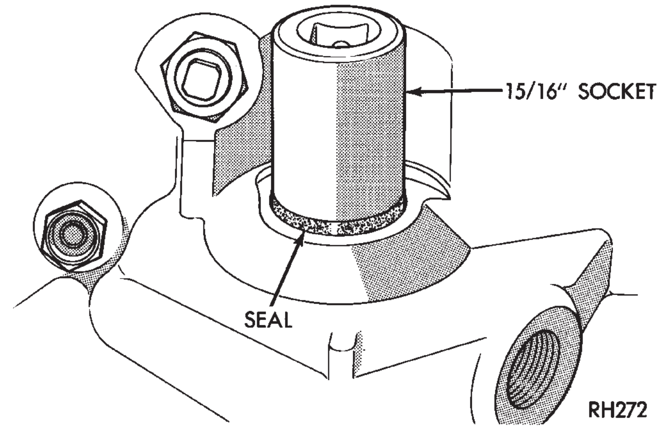


Fig. 18 Installing Manual Lever Shaft Seal

(15) Install and connect neutral switch in case.

(16) Install throttle and gearshift levers on valve body manual lever shaft.

(17) Check and adjust front and rear bands if necessary.

(18) Connect valve body overdrive and converter clutch solenoid wires to case connector.

(19) Install oil pan and new gasket. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(20) Lower vehicle and fill transmission with Mopar ATF Plus, type 7176 fluid.

(21) Check and adjust gearshift and throttle valve cables if necessary.

TRANSMISSION COOLER LINE AND FITTING SERVICE

The transmission cooler lines are attached with quick connect fittings. Two types of fitting will be used.

Some early production models will have the type 2 fitting used in prior years. This fitting requires a release tool to disconnect the cooler line from the fitting (Fig. 19).

Later production models will have a new style fitting that does not require any type of release tool. This fitting has a plastic insert with built-in release tabs (Fig. 20).

Cooler Line And Fitting Service

The cooler lines and fittings are NOT serviceable. Damaged fittings or cooler lines are to be replaced as assemblies.

Fittings swedged into cooler line hoses (Fig. 21) are serviced only as part of the entire cooler line.

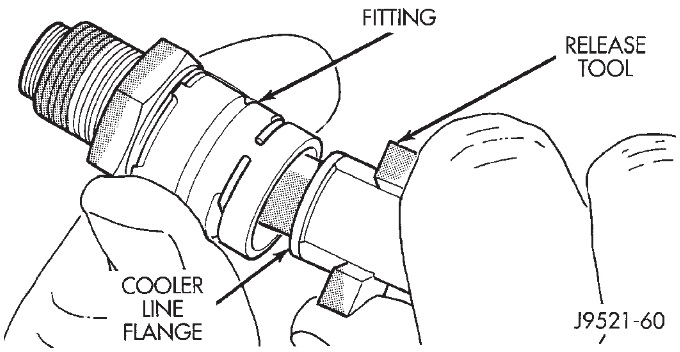


Fig. 19 Disconnecting Cooler Line With Release Tool (Type 2 fitting)

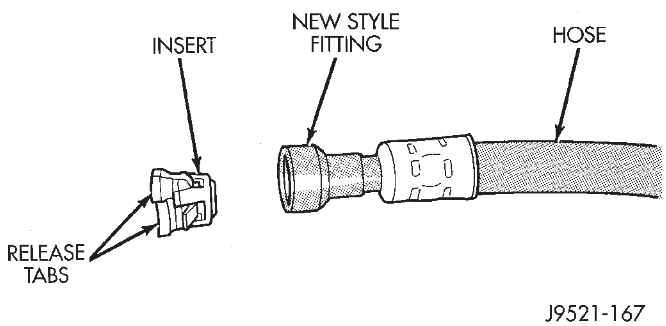


Fig. 20 New Style Fitting With Release Tabs On Insert

DISCONNECTING COOLER LINES WITH NEW STYLE FITTING

The new style fitting does **not** require any kind of release tool. The fittings have built-in release tabs. The tabs only require finger pressure to compress them and release the cooler line (Fig. 22).

Note that the fitting insert remains on the cooler line after release (Fig. 22). **It is not necessary to remove the insert from the cooler line unless the insert is damaged.**

If the fitting insert is damaged, simply spread the release tabs far enough to release the insert and slide it off the cooler line (Fig. 23).

DISCONNECTING COOLER LINES WITH TYPE 2 FITTING

(1) If fitting and cooler line are encrusted with dirt, mud, or grease, clean fitting and cooler line with

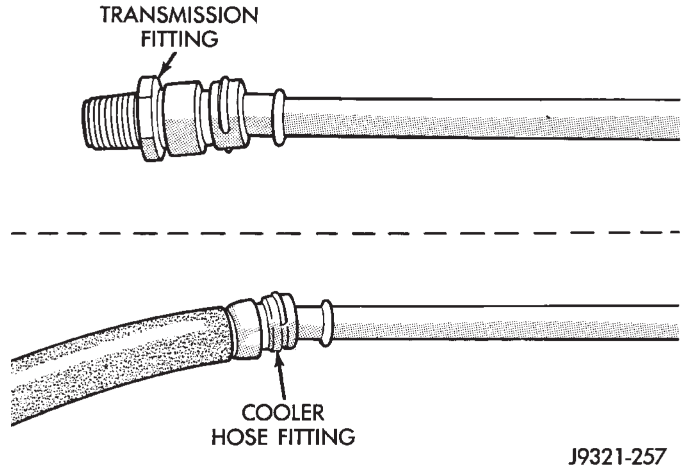


Fig. 21 Cooler Line Fitting Placement

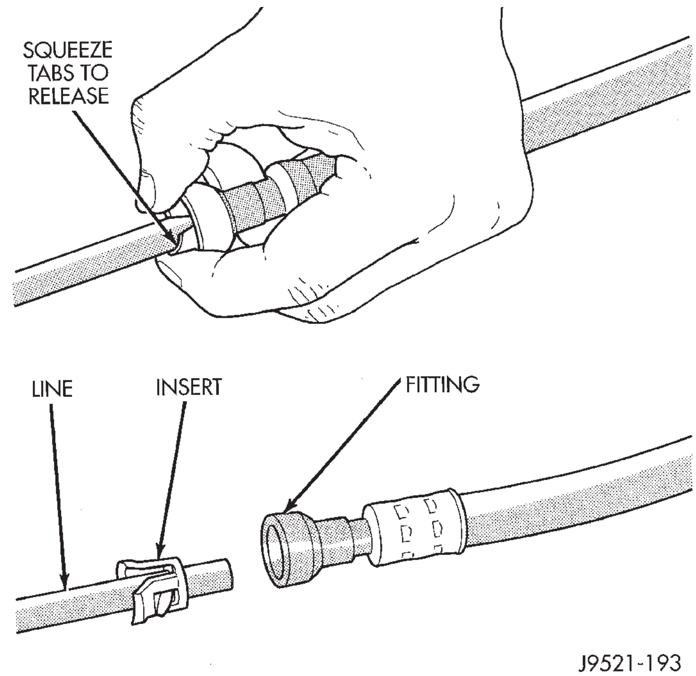


Fig. 22 Disconnecting New Style Fitting From Cooler Line

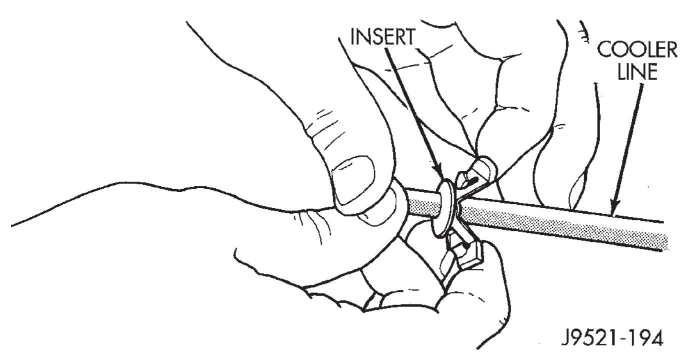


Fig. 23 Removing Fitting Insert From Cooler Line

Mopar spray type carburetor or brake cleaner. Plastic release tool will not fit into retainer clip if fitting is full of foreign material.

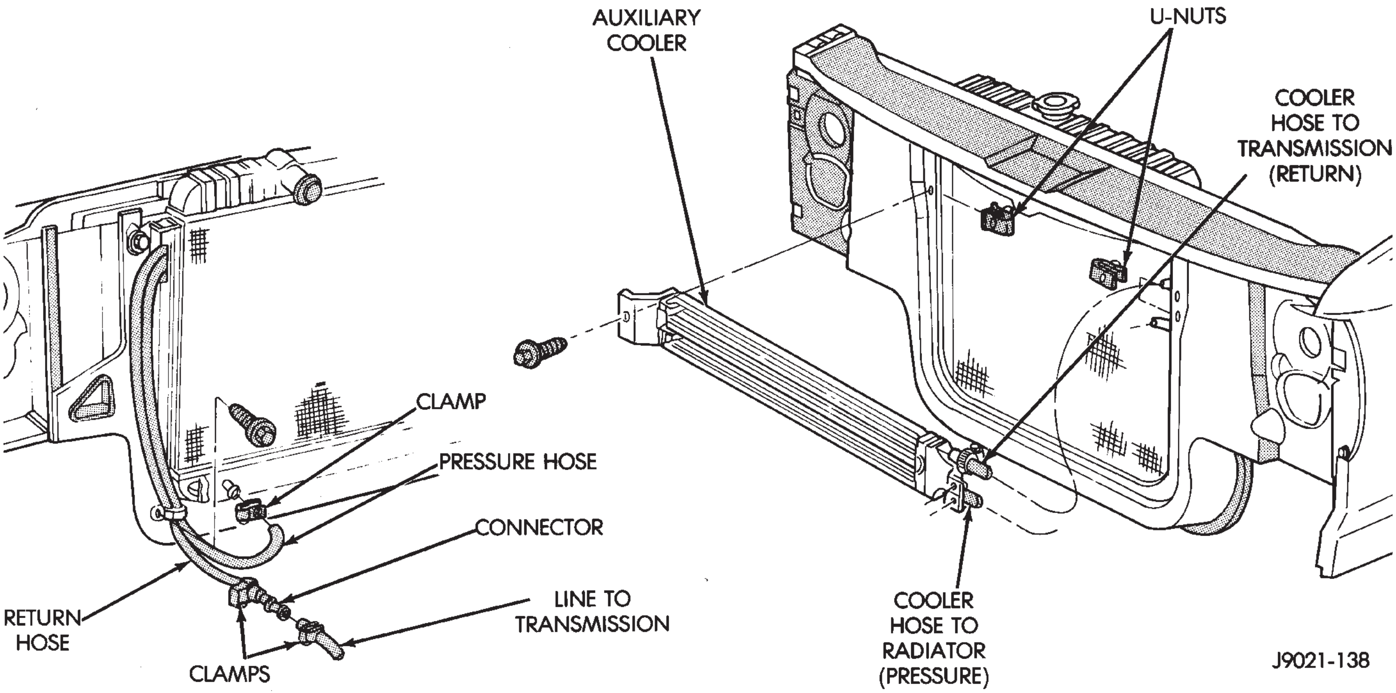


Fig. 24 Transmission Auxiliary Cooler Mounting

(2) Slide small plastic release tool into fitting until tool bottoms against cooler line flange (Fig. 19).

(3) Push and turn release tool to spread retainer clip and pull cooler line out of fitting (Fig. 19).

(4) Cover open ends of cooler lines and fittings to prevent dirt entry.

(5) Inspect condition of fitting. Replace transmission fitting as an assembly if fitting body or retainer clip is damaged. Replace cooler line as assembly, if fitting swedged into cooler line hose, is damaged.

CONNECTING COOLER LINES (ALL TYPES)

(1) If transmission or radiator fittings require replacement, apply Mopar Lock N' Seal, or Loctite 242 to fitting threads before installation.

(2) Wipe off cooler line and fitting with clean, dry cloth.

(3) Insert cooler line into fitting. Then push line inward until retainer clip secures line. A snap or click sound will be heard when the retainer clip seats behind the cooler line flange.

(4) **Pull outward on cooler lines to verify they are properly secured.**

CAUTION: It is extremely important that cooler line seating be checked as described in step (4). If the lines are not fully secured, normal fluid pressure could unseat the lines resulting in fluid loss and transmission damage.

CONVERTER DRAINBACK CHECK VALVE SERVICE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator lower tank. The valve prevents fluid drainback when the vehicle is parked for lengthy periods. The valve check ball is spring loaded and has an opening pressure of approximately 2 psi.

The valve is serviced as an assembly; it is not repairable. Do not clean the valve if restricted, or contaminated by sludge, or debris. If the valve fails, or if a transmission malfunction occurs that generates sludge and/or clutch particles and metal shavings, the valve must be replaced.

The valve must be removed whenever the cooler and lines are reverse flushed. The valve can be flow tested when necessary. The procedure is exactly the same as for flow testing a cooler.

If the valve is restricted, installed backwards, or in the wrong line, it will cause an overheat condition and possible transmission failure.

CAUTION: The drainback valve is a one-way valve. As such, it must be properly oriented in terms of flow direction. In addition, the valve must only be installed in the pressure line. Otherwise flow will be blocked causing overheat and eventual transmission failure.

TRANSMISSION COOLER FLOW TESTING

The transmission main and auxiliary coolers, plus the drainback valve, should be flow tested whenever fluid overheating is noted.

Restricted flow caused by contamination, or a cooler malfunction, reduces lubrication fluid flow throughout the transmission. This can result in fluid overheating, fluid breakdown, bushing wear, shift problems and component failure.

Normal color of transmission fluid varies from bright red, to light pink. Fluid overheating is indicated when fluid color ranges from orange-brown to black, and the fluid smells burned, or contains sludge.

CAUTION: If a transmission malfunction contaminates the fluid with clutch disc and metal particles, the cooler and lines must be reverse flushed thoroughly. Flushing will prevent sludge and particles from flowing back into the transmission and converter after repair.

Cooler flow is tested by measuring the amount of fluid pumped through the cooler in a specified time by the transmission oil pump. **The same flow test procedure is used for the drainback valve, main cooler, and auxiliary cooler.**

Cooler And Drainback Valve Flow Test Procedure

(1) Test flow through **drainback valve** as follows:

(a) Add extra quart of ATF Plus to transmission.

(b) Disconnect pressure line at radiator fitting, or at drainback valve and position hose or valve end in one quart test container.

(c) Shift transmission into neutral, run engine at idle speed for 20 seconds, and note flow from valve. Use stopwatch to check test time.

(d) Replace drainback valve if flow is less than one quart in 20 seconds, is intermittent, or does not flow at all.

(e) Connect pressure hose to radiator fitting and proceed to cooler flow test.

(2) Test flow through **main cooler** as follows:

(a) Disconnect cooler return (rear) line at transmission and place it in one quart test container.

(b) Add extra quart of fluid to transmission.

(c) Shift transmission into neutral, run engine at idle speed for 20 seconds, and note flow from valve. Use stopwatch to check test time.

(d) Replace cooler if fluid flow is less than one quart in 20 seconds, is intermittent, or does not flow at all.

(3) If vehicle is equipped with **auxiliary cooler**, test cooler flow as described in step (2).

TRANSMISSION COOLER REVERSE FLUSHING

The flushing procedure applies to standard and auxiliary coolers alike. Although pressure equipment is preferred, reverse flushing can be performed with hand operated equipment as follows.

(1) Identify and disconnect cooler pressure and return lines at transmission. Rear line is return line from cooler. Front line is pressure line to cooler.

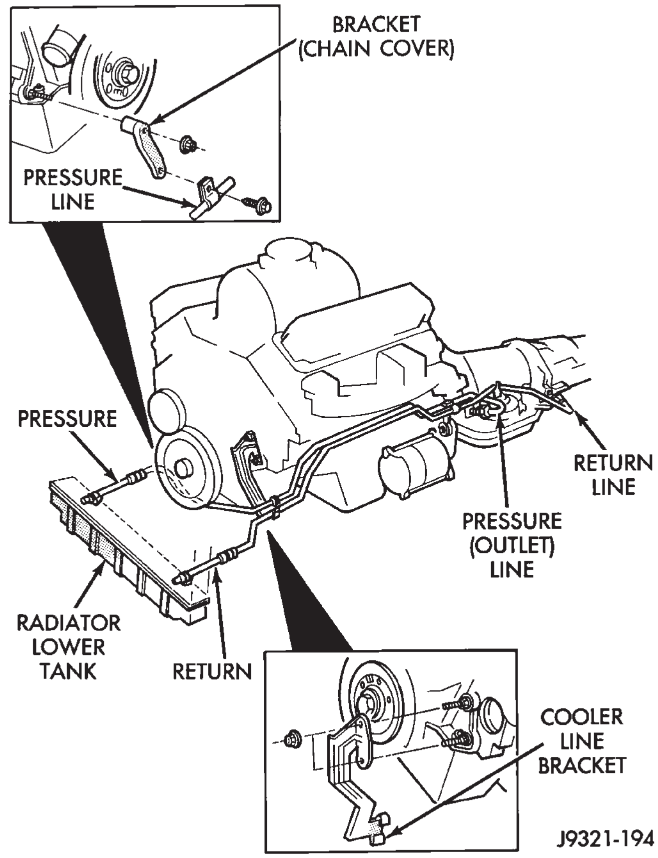


Fig. 25 Transmission Cooler Line Identification

(2) Position drain pan under cooler pressure line to catch material flushed through cooler and lines.

(3) Reverse flush cooler using hand operated suction gun filled with mineral spirits. Insert gun nozzle (or hose) into cooler return line. Then force mineral spirits into line and through cooler.

(4) Continue reverse flushing until fluid exiting cooler pressure line is clear and free from debris. **Replace cooler if fluid cannot be pumped through it.**

(5) Clear flushing materials from cooler and lines with short pulses of compressed air. Insert air gun nozzle into cooler return line and continue short air pulses until all fluid is cleared from cooler and lines.

(6) Pump one quart of fresh automatic transmission fluid through cooler and lines before reconnecting lines.

TRANSMISSION COOLER REPLACEMENT

Main Cooler Replacement

The main transmission cooler is located in the radiator lower tank. The cooler is not a serviceable component. If the cooler is damaged in any way, the radiator will have to be replaced.

Auxiliary Cooler Replacement

(1) Remove grille and air conditioning condenser if equipped.

(2) Remove screws and U-nuts securing cooler to radiator and support (Fig. 24).

(3) Tag cooler hoses for installation reference (Fig. 25).

(4) Position drain pan under cooler hoses.

(5) Loosen cooler connecting hose clamps and disconnect hoses.

(6) Remove auxiliary cooler.

(7) Connect cooler hoses.

(8) Position cooler on radiator and install cooler attaching U-nuts and screws.

(9) Tighten cooler hose clamps securely.

(10) Install grille and and air conditioning condenser.

(11) Check and adjust transmission fluid level.

(12) If air conditioning condenser lines were disconnected during service, evacuate and recharge system.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and in the valve body can be repaired with Heli-Coil or similar quality thread inserts. Essentially, repair consists of drilling out the worn or damaged threads, tapping the hole with a special tap and installing the thread insert into the tapped hole. This procedure returns the hole threads to original size. Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers. Stainless steel inserts are recommended.

46RH TRANSMISSION/OVERDRIVE REMOVAL—INSTALLATION

INDEX

GENERAL INFORMATION

The overdrive unit can be removed for service without having to remove the entire transmission assembly. However if the transmission, torque converter, converter driveplate, or oil pump requires service, the complete transmission assembly must be removed for access to these components.

If only the overdrive unit must be removed, refer to the Overdrive Unit Removal/Installation procedures. If the complete transmission assembly must be removed, refer to the Transmission Removal/Installation procedures.

TRANSMISSION AND CONVERTER REMOVAL

(1) Raise vehicle on hoist.

(2) If transmission will be disassembled after removal, remove transmission oil pan, drain fluid and reinstall oil pan.

(3) Remove skid plate, if equipped.

(4) Mark front and rear propeller shafts and U-joints for alignment reference (Fig. 1).

(5) Disconnect and remove both propeller shafts.

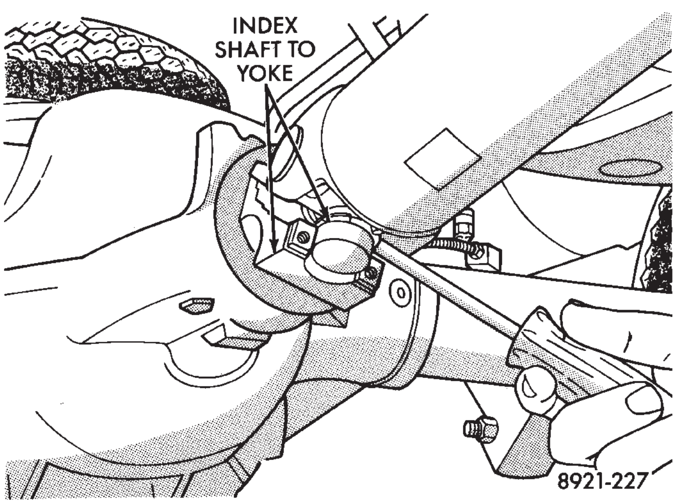


Fig. 1 Marking Propeller Shaft And Yoke For Alignment Reference

(6) Disconnect vehicle speed sensor wires.

(7) Disconnect vacuum vent hose at transfer case.

(8) Disconnect transfer case shift linkage at range lever. Then remove linkage bracket bolts and remove linkage and bracket from transfer case. Move linkage aside for clearance.

(9) Remove nuts attaching transfer case to overdrive unit gear case.

(10) Remove transfer case. Support transfer case with transmission jack. Secure transfer case to jack with safety chains. Then move transfer case rearward and off transmission.

(11) Remove transfer case from transmission jack and place transfer case on bench.

(12) Support transmission with transmission jack.

(13) Remove nuts and bolts attaching transmission mount to crossmember.

(14) Remove bolts and nuts attaching crossmember to frame rails.

(15) Rotate crossmember diagonally to clear frame rails and remove crossmember.

(16) Disconnect exhaust pipes at manifold and at converter and/or muffler connections as needed. Then remove Y-pipe from vehicle and move remaining pipes aside for working clearance.

(17) Disconnect and remove crankshaft position sensor. Retain sensor attaching bolts.

CAUTION: The crankshaft position sensor can be damaged if the transmission is removed (or installed) with the sensor still bolted to the converter housing. To avoid damage, remove the sensor before transmission removal.

(18) Disconnect transmission shift cable at shift lever on transmission.

(19) Disconnect throttle valve cable at transmission and cable mounting bracket.

(20) Remove brackets that attach transmission to engine block, if equipped.

(21) Remove dust shield cover from front side of transmission converter housing.

(22) Remove starter motor bolts. Pull starter rearward until clear of housing and position it out of way on nearby component. Starter does not have to be removed from vehicle nor does cable have to be disconnected.

(23) Remove bolts attaching torque converter to drive plate.

(24) Disconnect cooler lines at transmission quick disconnect fittings. Refer to In-Vehicle Service section for procedures.

(25) Disconnect solenoid and park/neutral position switch wires at transmission.

(26) Remove transmission fill tube and dipstick.

(27) Lower transmission for access to converter housing upper bolts.

(28) Remove bolts attaching transmission converter housing to engine. Note that some bolts may be accessible only from front (engine) side of housing.

(29) Move transmission rearward until clear of engine block dowels.

(30) Secure torque converter in housing with small C-clamp.

(31) Lower transmission and remove it from under vehicle.

(32) Remove C-clamp and remove converter from transmission. Place converter on workbench for inspection or reassembly. Cover converter hub with clean, lint free cloth.

(33) Oil pump, converter and driveplate can now be serviced if necessary. Refer to information in this section.

OIL PUMP SEAL REPLACEMENT

The pump oil seal can be replaced without removing the pump and reaction shaft support assembly from the transmission case.

Seal Removal

Remove the seal with Special Tool C-3861 (Fig. 3). To use the remover tool, First start the tool into the seal by hand. Next, thread the tool into the seal as far as it will go. Use a wrench on the tool hex to turn the tool. Continue tightening until all the tool threads firmly grip the metal part of the seal. Then tighten the tool puller screw to withdraw the seal from the pump body.

Seal Installation

Use Installer Tool C-3860-A (Fig. 4). To use the tool, place the seal in the pump opening with the seal lip facing inward. Then tap the seal into place with the installer tool. Tool Handle C-4171 may be used with either installer tool if desired.

TORQUE CONVERTER AND DRIVE PLATE SERVICE

After the transmission has been removed, the drive plate and torque converter can be replaced or removed for service access.

The torque converter is not a serviceable part. If the converter is contaminated by a transmission malfunction, or damaged in any way, it must be replaced as an assembly. **Do not attempt to flush a converter contaminated by metal or clutch facing particles. Flushing will not remove these contaminants.**

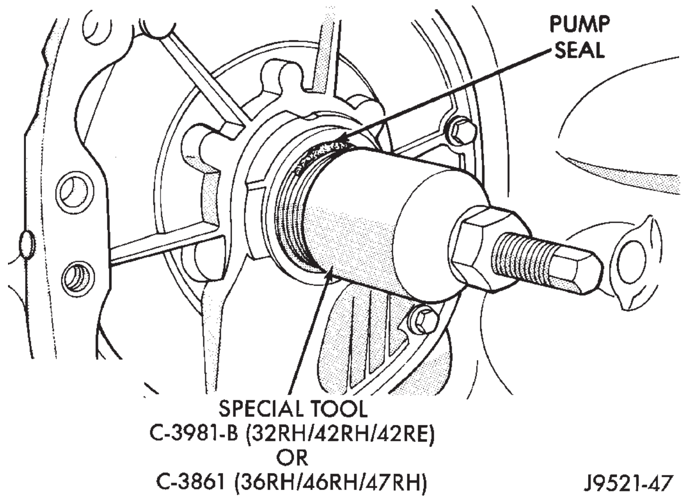


Fig. 3 Oil Pump Seal Removal

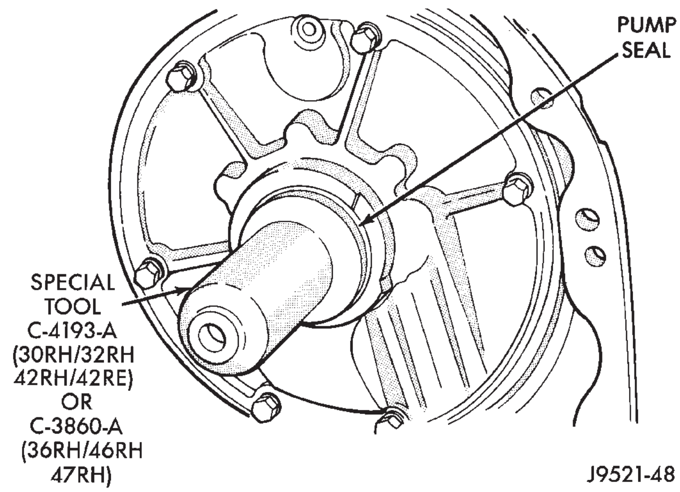


Fig. 4 Oil Pump Seal Installation

Inspect the driveplate. Replace the driveplate if the hub is cracked, or the plate is bent or damaged in any way. Use new bolts to secure the driveplate to the crankshaft and use Mopar Lock N' Seal, or Loctite 242 on the bolt threads before installation.

TRANSMISSION AND CONVERTER INSTALLATION

CAUTION: The transmission cooler and lines must be flushed if repair was to correct a problem that generated sludge, metal particles, or clutch friction material. The converter and drainback valve should also be replaced when contaminated. The transmission, fluid and converter will all be contaminated again if residue/debris is not flushed from the cooler and lines beforehand.

(1) Mount transmission on jack. Secure transmission to jack with safety chains.

(2) Check torque converter hub for sharp edges burrs, scratches, or nicks. Polish hub with crocus cloth or 400 grit paper if necessary. Hub must be smooth to avoid damaging pump seal.

(3) Lubricate converter pilot hub, drive hub and pump seal lip with Mopar ATF Plus or Dexron II transmission fluid.

(4) Align and install converter in oil pump. Verify that converter is fully seated. Use straight edge and steel ruler to check seating (Fig. 5). Surface of converter lugs should be 12.7 mm (1/2 in.) to rear of straight edge when converter is fully seated.

(5) Temporarily secure converter with C-clamp attached to housing or with metal strap attached across converter housing.

(6) Check condition of converter driveplate. Replace driveplate if cracked, distorted or damaged.

(7) Verify that transmission dowel pins are seated in engine block and protrude far enough to held transmission in alignment.

(8) Move transmission under vehicle and position it at rear of engine. Remove C-clamp or strap used to secure converter in housing.

(9) Align transmission with engine dowels and align converter with driveplate.

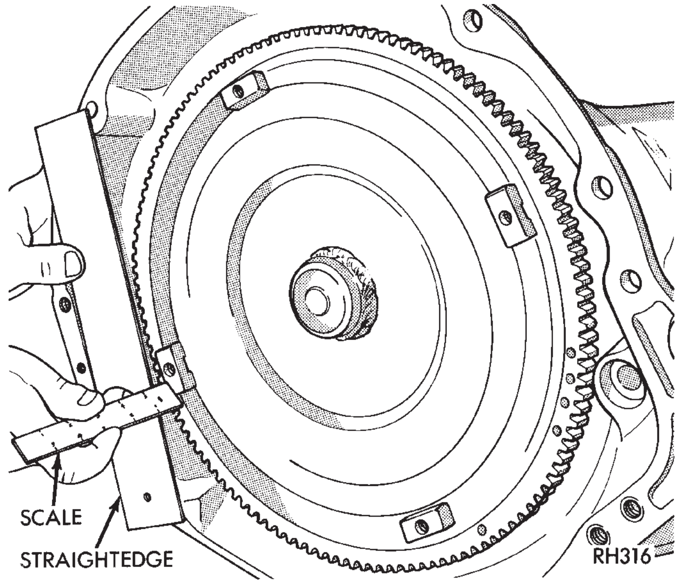


Fig. 5 Checking Torque Converter Seating

(10) Move transmission forward until seated on engine block dowels. Then install one or two transmission attaching bolts to hold transmission in place (Fig. 6).

ITEM	TORQUE
A	3-6 N•m (30-50 IN.LBS.)
B	27-54 N•m (20-40 FT.LBS.)
C	47-88 N•m (35-65 FT.LBS.)
D	9-14 N•m (80-120 IN.LBS.)

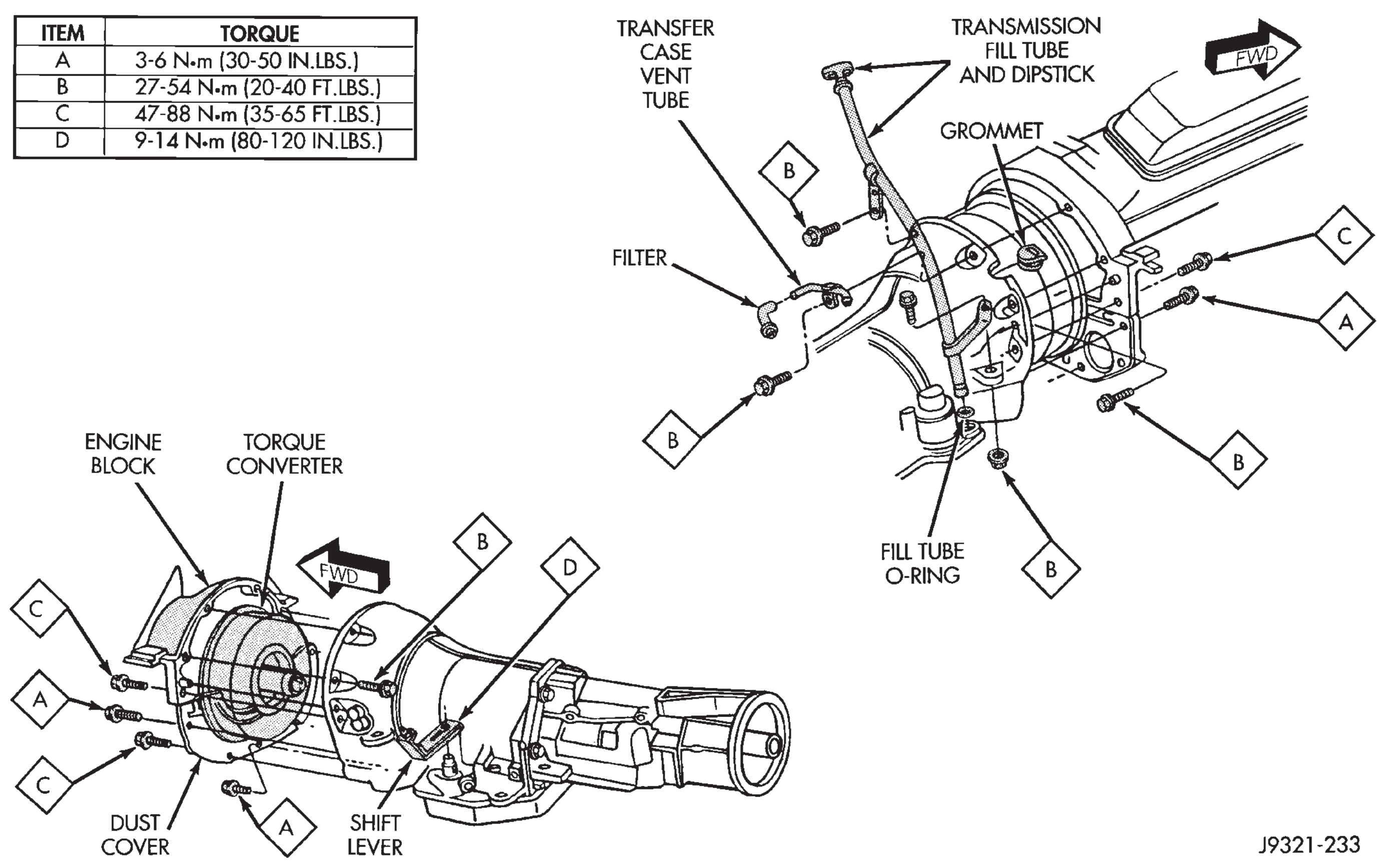


Fig. 6 Transmission And Fill Tube Mounting

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the modulated clutch surfaces in the converter. If new bolts are required, use the bolts specified in this procedure and in the parts catalogue only.

(11) Verify converter bolt length. Bolt measurement is from bottom (underside) of bolt head to end of bolt threads.

- 9.5 in., 3-lug converter bolts are 11.7 mm (0.46 in.) long
- 9.5 in., 4-lug converter bolts are 13.2 mm (0.52 in.) long
- 10.0 in., 4-lug converter bolts are 13.2 mm (0.52 in.) long
- 10.75 in., 4-lug converter bolts are 11.2 mm (0.44 in.) long

(12) Install torque converter bolts. Tighten bolts to following torque:

- 54 N·m (40 ft. lbs.) with 9.5 in., 3-lug converter
- 74 N·m (55 ft. lbs.) with 9.5 in., 4-lug converter
- 74 N·m (55 ft. lbs.) with 10.0 in., 4-lug converter
- 31 N·m (270 in. lbs.) with 10.75 in., 4-lug converter

(13) Install and tighten remaining transmission attaching bolts.

(14) Install dust cover on transmission converter housing. Two small vise grip pliers van be used to hold and align cover during installation.

(15) Install starter motor.

(16) Install strut brackets that secure transmission to engine block and front axle.

(17) Install and connect crankshaft position sensor. Be sure sensor grommet is securely in place.

(18) Install transmission fill tube. Install new O-ring seal on tube before installation (Fig. 6).

(19) Secure wire harnesses in clips on transmission and transfer case.

(20) Connect exhaust Y-pipe to engine exhaust manifolds.

(21) Install shift and throttle valve cables in brackets.

(22) Connect shift and throttle cables to transmission levers.

(23) Connect solenoid and park/neutral position switch wires.

(24) Install crossmember on frame rails. Place crossmember at 45° angle to rails. Insert crossmember between rails and rotate crossmember into place.

(25) Install bolts/nuts attaching transmission to rear mount (Fig. 7).

(26) Install bolts/nuts attaching crossmember to frame rails.

(27) Remove transmission jack.

(28) Install transfer case (Fig. 8). Align and position transfer case with transmission jack or with aid of helper. Tilt case upward and work into position on transmission mounting studs.

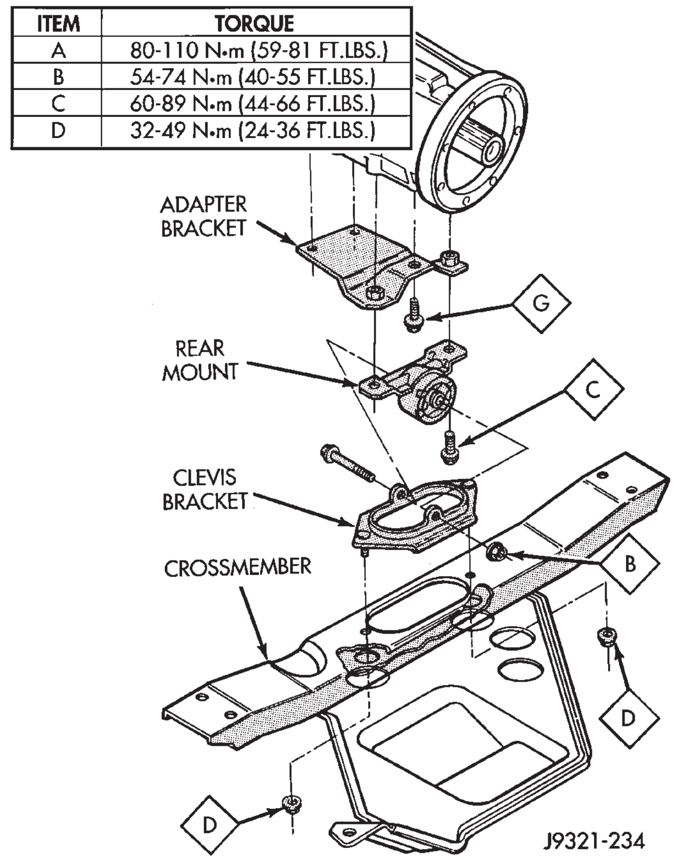


Fig. 7 Transmission Rear Mount Components

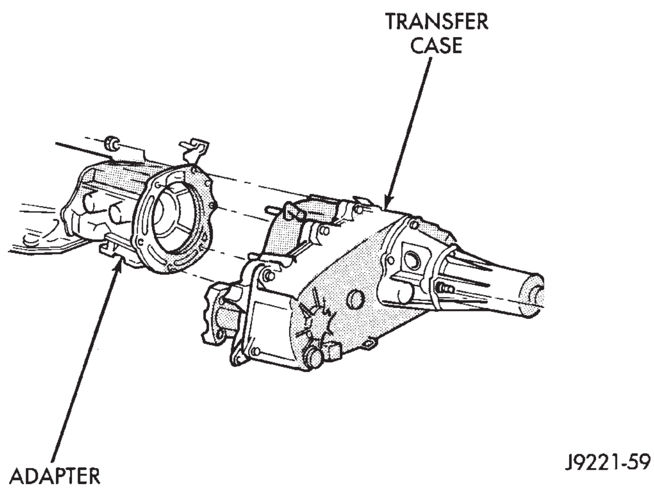


Fig. 8 Transfer Case Mounting

(29) Install and tighten transfer case attaching nuts to 47 N·m (35 ft. lbs.) torque.

(30) Install damper on transfer case rear retainer if equipped. Tighten damper nuts to 54 N·m (40 ft. lbs.) torque.

(31) Install and connect transfer case shift linkage.

(32) Connect transmission cooler lines to quick disconnect fittings. Refer to In-Vehicle Service section for procedures.

CAUTION: Be sure the cooler lines are fully secured by the fitting retainers. Otherwise, normal fluid pressure will force the cooler line out of the fitting causing fluid loss and transmission damage.

(33) Connect vehicle speed sensor wires. If vehicle is also equipped with speedometer cable, connect cable to sensor.

(34) Align and install remaining exhaust components. Tighten all clamp and bracket bolts and nuts securely. Be sure exhaust components are clear of all chassis and driveline components.

(35) Align and install propeller shaft(s). Tighten U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(36) Verify that all linkage components, hoses and electrical wires have been connected.

(37) Check transfer case fluid level. Add Mopar Dexron II, or ATF Plus if necessary. Correct level is to edge of fill plug hole. Be sure transfer case is level before checking or adding fluid.

(38) Install transfer case skid plate, if equipped.

(39) Lower vehicle.

(40) Refill transmission with Mopar ATF Plus, type 7176 fluid.

(41) Check and adjust transmission and transfer case shift linkage if necessary.

(42) Check and adjust transmission throttle valve cable if necessary.

OVERDRIVE UNIT REMOVAL

(1) Disconnect battery negative cable.

(2) Raise vehicle on hoist.

(3) Remove transfer case skid plate, if equipped.

(4) Mark front and rear propeller shafts and U-joints for alignment reference (Fig. 9).

(5) Disconnect and remove both propeller shafts.

(6) Disconnect vehicle speed sensor wires.

(7) Disconnect vacuum switch hoses at transfer case, if equipped.

(8) Disconnect transfer case shift linkage at transfer case range lever. Then remove linkage bracket bolts and remove linkage and bracket from transfer case. Move linkage aside for clearance.

(9) Remove nuts attaching transfer case to overdrive unit.

(10) Remove transfer case. Support transfer case with transmission jack (secure transfer case to jack with safety chains). Then move transfer case rearward and off overdrive case.

(11) Remove transfer case from jack and position it on bench.

(12) Support transmission with adjustable jack stand. Position wood block between jack and transmission case.

(13) Remove nuts and bolts attaching transmission mount to center crossmember.

(14) Remove nuts and bolts attaching crossmember to frame rails.

(15) Rotate crossmember diagonally to clear frame rails and remove crossmember.

(16) Support overdrive unit with transmission jack.

(17) Remove bolts attaching overdrive unit to transmission (Fig. 9).

CAUTION: The overdrive unit must be fully supported during removal. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

(18) Carefully slide overdrive unit off intermediate shaft. Do not tilt overdrive unit during removal. Keep it as level as possible.

(a) If overdrive unit does not require service, **immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch (Fig. 10). If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.**

(b) If overdrive unit requires service, refer to Overdrive Unit Overhaul procedures.

(19) Remove and retain bearing and select fit spacer. These parts may remain on overdrive piston, rear of transmission case, sliding hub, or intermediate shaft during removal.

(20) Place several clean shop towels on a bench. Then position unit on towels to absorb spilled fluid.

(21) Position overdrive unit over drain pan and tilt unit to drain residual fluid from case. Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

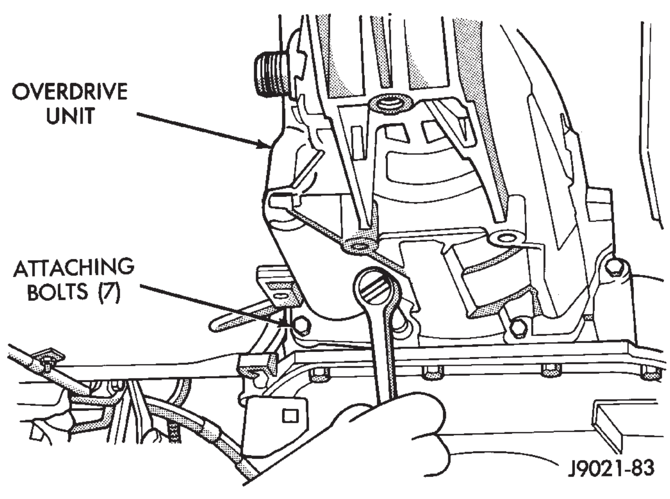


Fig. 9 Removing/Installing Overdrive Unit Attaching Bolts

OVERDRIVE UNIT INSTALLATION

(1) Be sure Alignment Tool 6227-2 is still fully seated in splines of overdrive planetary gear and

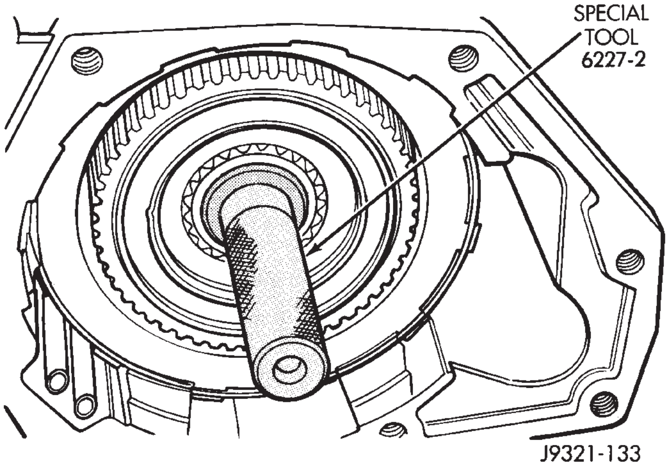


Fig. 10 Overdrive Spline Alignment Tool Installation

overrunning clutch. If misalignment occurs, overdrive will have to be disassembled in order to realign splines.

(2) If original case gasket is in good condition, proceed to step (6). If overdrive piston retainer was not removed during service and original case gasket is not reusable, prepare new gasket as described in steps (3) through (5).

(3) Cut out old case gasket around piston retainer with razor knife.

(4) Use old gasket as template and trim new gasket to fit (Fig. 11).

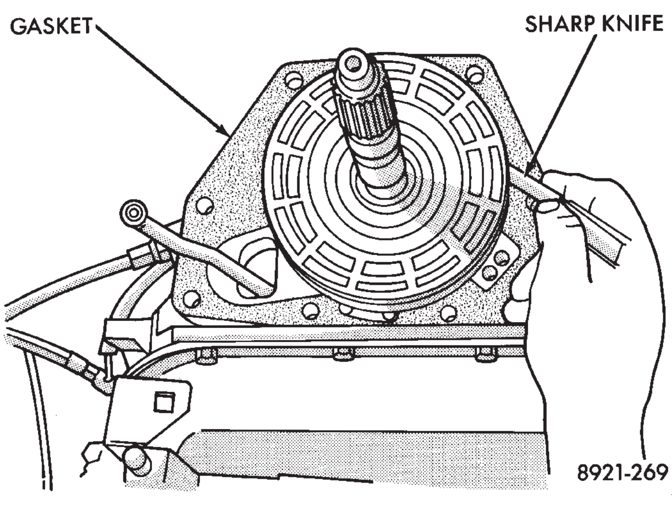


Fig. 11 Trimming Replacement Overdrive Case Gasket

(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. **Do not use any type of sealer to secure gasket. Use petroleum jelly only.**

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 12).

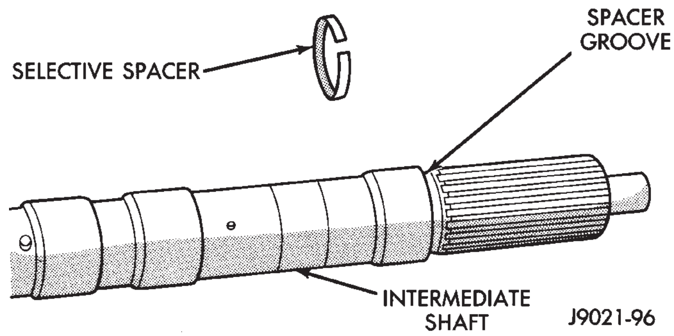


Fig. 12 Intermediate Shaft Selective Spacer Location

(7) Install overdrive piston in retainer, if removed. Lubricate piston seals with Ru-Glyde, Door-Eze or petroleum jelly to ease installation. Be sure piston locating lugs are aligned in piston retainer.

(8) Install thrust bearing in overdrive clutch hub. Use liberal quantity of petroleum jelly to hold bearing in position.

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(9) Install thrust plate in overdrive piston hub (Fig. 13). Use liberal amount of petroleum jelly to hold thrust plate in position.

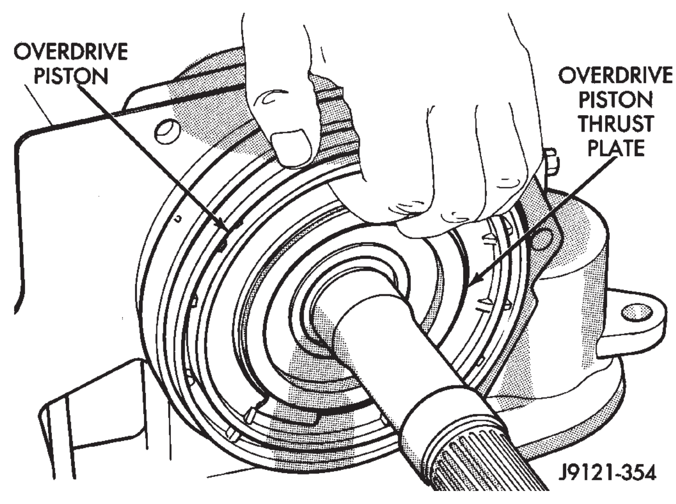


Fig. 13 Installing Overdrive Piston Thrust Plate

(10) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Tool 6227-2. **Overdrive unit cannot be fully installed if splines have rotated out of alignment. If misaligned has occurred, overdrive will have to be disassembled in order to realign splines.**

(11) Install overdrive unit as follows:

(a) Raise overdrive unit and carefully slide it straight onto intermediate shaft. **Avoid tilting overdrive unit during installation as planetary gear and overrunning clutch splines could rotate out of alignment. If misalignment**

occurs, overdrive will have to be disassembled in order to realign splines.

(b) Align and insert park rod into park pawl reaction plug.

(c) Align governor tubes in boss on overdrive piston retainer.

(d) Work overdrive unit forward on intermediate shaft until seated against transmission case. If unit will not seat fully, turn output shaft slightly with socket to align intermediate shaft and overdrive splines.

(12) Apply Mopar Lock N' Seal or Loctite 242 to threads of overdrive attaching bolts.

(13) Install and tighten overdrive unit attaching bolts to 34 N·m (25 ft. lbs.).

(14) Install transfer case. Tighten attaching nuts to 41 N·m (30 ft. lbs.) torque.

(15) Connect transmission and transfer case shift linkage.

(16) Install crossmember and rear mount.

(17) Connect all necessary electrical wires.

(18) Align and connect propeller shafts. Tighten U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(19) Check and adjust fluid level in transfer case. Use Mopar ATF Plus, or Dexron II to top off fluid level if necessary.

(20) Install skid plate, if equipped.

(21) Check and adjust transmission and transfer case shift linkage if necessary.

(22) Lower vehicle.

(23) Check and adjust transmission fluid level. Use Mopar ATF Plus, type 7176 fluid.

46RH TRANSMISSION OVERHAUL

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TRANSMISSION DISASSEMBLY

(1) Remove torque converter, if not previously removed.

(2) Clean transmission exterior with steam gun or solvent. Wear safety goggles while cleaning transmission.

(3) Remove shift and throttle levers from shaft of valve body manual lever.

(4) Remove bolts attaching overdrive unit to transmission case (Fig. 1). Note bolt locations as some bolts are different lengths.

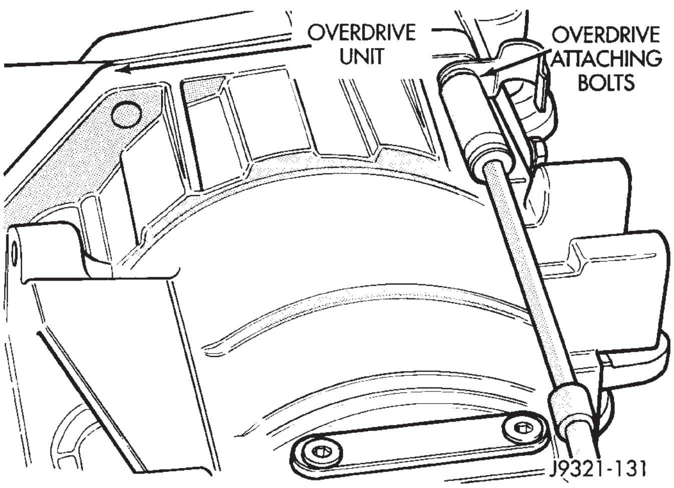

Fig. 1 Overdrive Attaching Bolt Removal

(5) Loosen overdrive unit. Use pry tool to start overdrive unit off intermediate shaft and transmission case. Position pry tool between flange on overdrive case and transmission rear servo boss (Fig. 2).

(6) Work overdrive unit rearward and off transmission intermediate shaft (Fig. 3).

(a) If overdrive unit does not require service, insert Alignment Tool 6227-2 in overdrive unit overrunning clutch and planetary gear to maintain spline alignment (Fig. 4). **If clutch and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.**

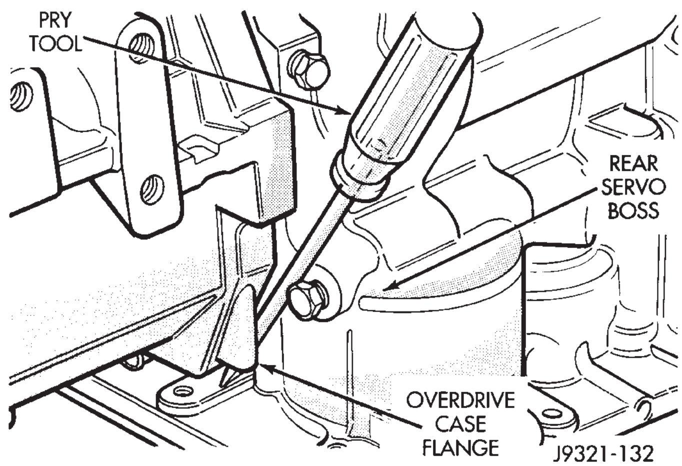

Fig. 2 Loosening Overdrive

(b) If overdrive unit does requires service, refer to Overdrive unit Overhaul section.

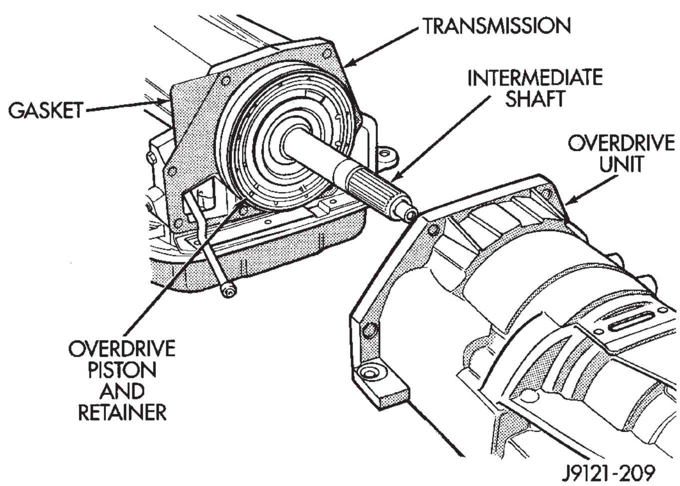

Fig. 3 Overdrive Removal

(7) Remove thrust plate from overdrive piston (Fig. 5).

(8) Remove overdrive piston from retainer (Fig. 6).

(9) Remove overdrive piston thrust bearing (Fig. 7).

(10) Mount transmission unit on Repair Stand

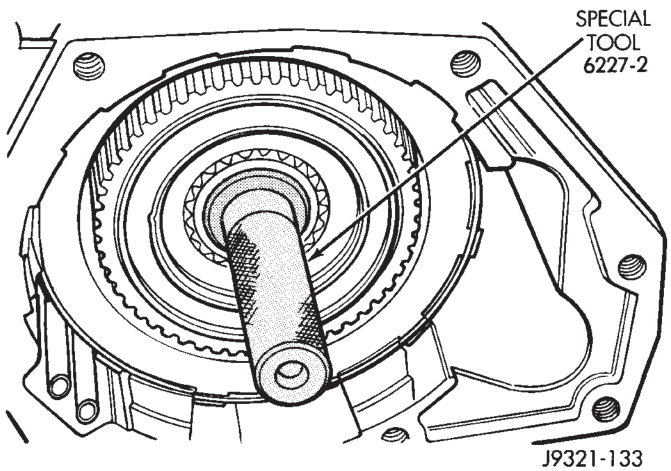

Fig. 4 Overdrive Spline Alignment Tool Installation

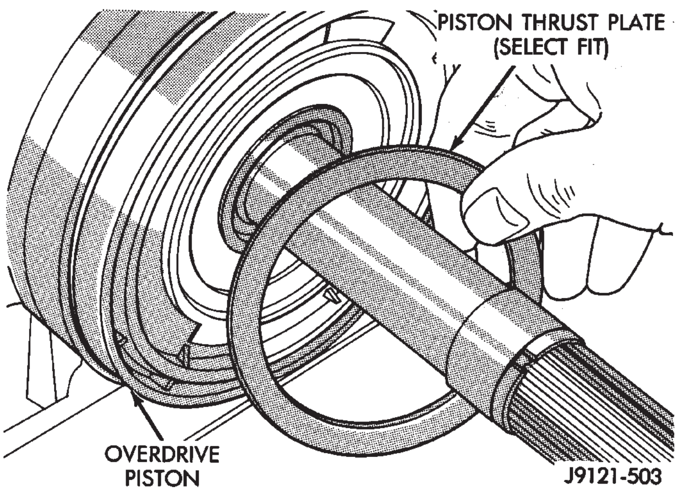

Fig. 5 Overdrive Piston Thrust Plate Removal

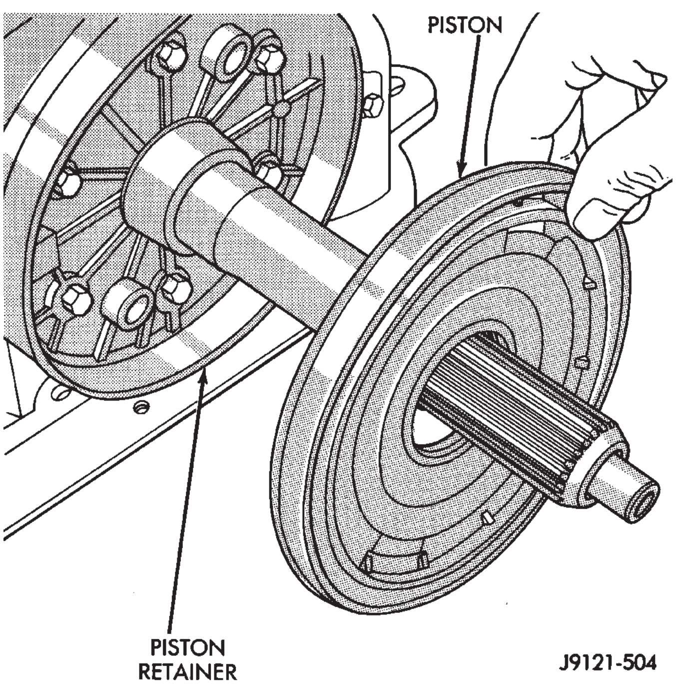

Fig. 6 Overdrive Piston Removal

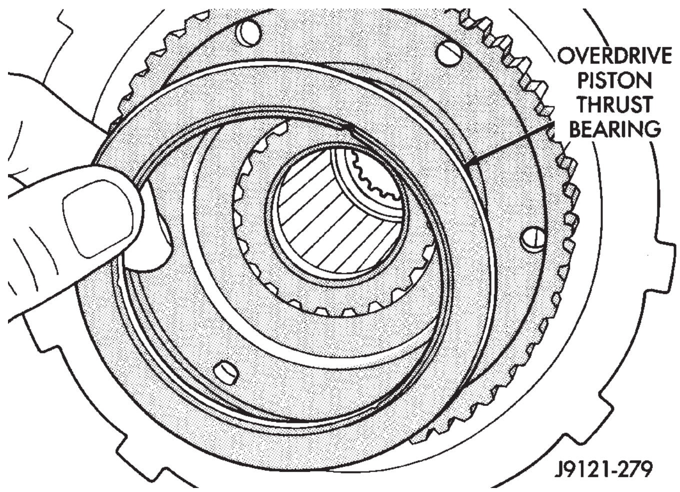

Fig. 7 Overdrive Piston Thrust Bearing Removal

C-3750-B, or support transmission with wood blocks.

(11) Remove pump oil seal with Special Tool C-3861 (Fig. 8). Be sure to tighten tool threads completely into seal before using puller bolt to withdraw seal.

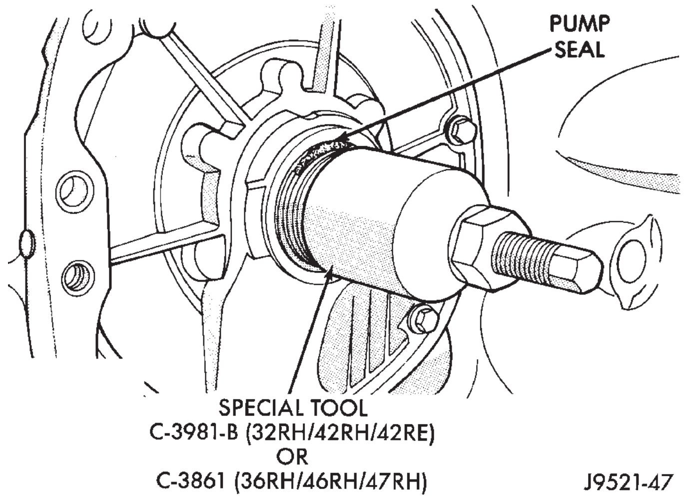

Fig. 8 Oil Pump Seal Removal

(12) Remove oil pan bolts and remove pan (Fig. 9) and gasket (Fig. 10). Oil pan magnet can be removed or left in pan as needed (Fig. 11). Exercise care when removing pan to avoid distorting or bending pan flange.

(13) Remove park/neutral position switch (Fig. 12). If switch gasket is in good condition, retain gasket and keep it with switch.

(14) Remove fluid filter attaching screws and remove filter (Fig. 13). Keep filter screws separate. They are longer than valve body screws.

(15) Remove hex head valve body attaching bolts (Fig. 14). A total of 10 hex head bolts are used to secure valve body to case. Note bolt locations as bolts are different lengths.

(16) Lift valve body upward. Push solenoid connector and manual lever shaft out of case. Then raise

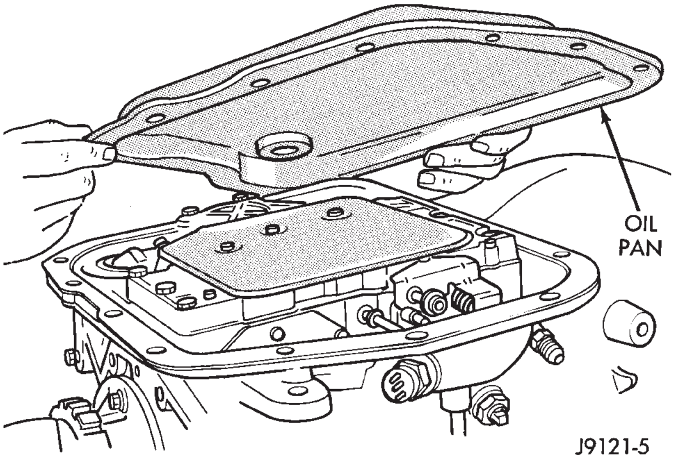

Fig. 9 Oil Pan Removal/Installation

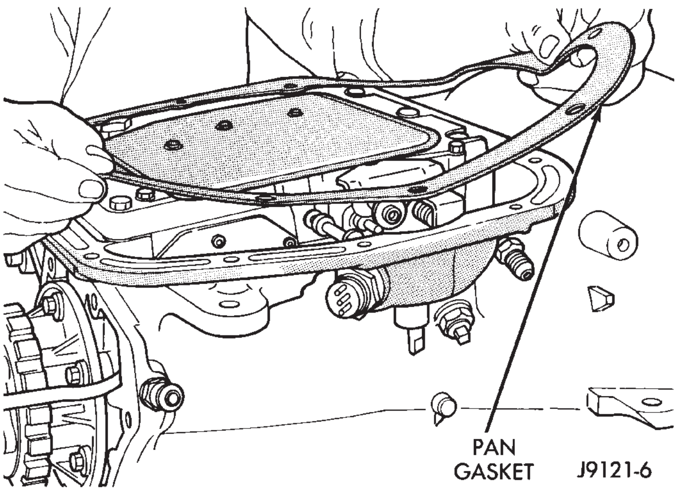

Fig. 10 Pan Gasket Removal/Installation

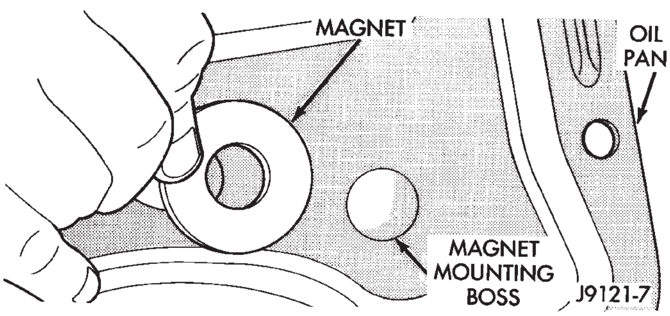

Fig. 11 Oil Pan Magnet Location

valve body, guide park rod out of case and remove valve body (Fig. 15). **Do not use boost valve tube to lift valve body.** Set valve body aside for disassembly, cleaning and inspection.

(17) Remove accumulator outer spring, piston, and inner spring (Fig. 16). Note position of piston and springs for assembly reference. Remove and discard piston seals if worn or cut.

(18) Remove front band lever pin access plug (Fig. 17). Use square end of 1/4 in. drive extension to remove plug as shown.

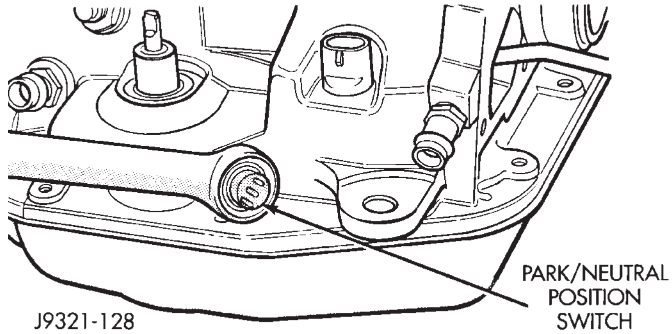

Fig. 12 Park/Neutral Position Switch Removal

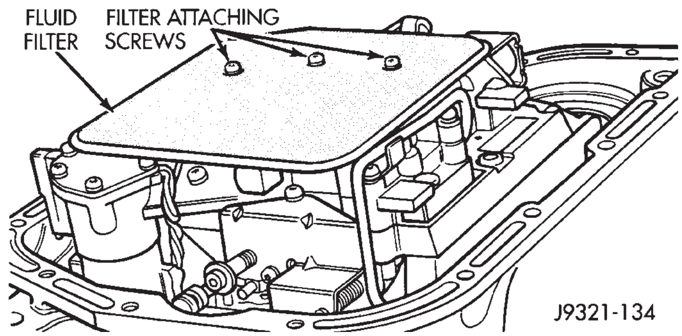

Fig. 13 Fluid Filter Removal/Installation

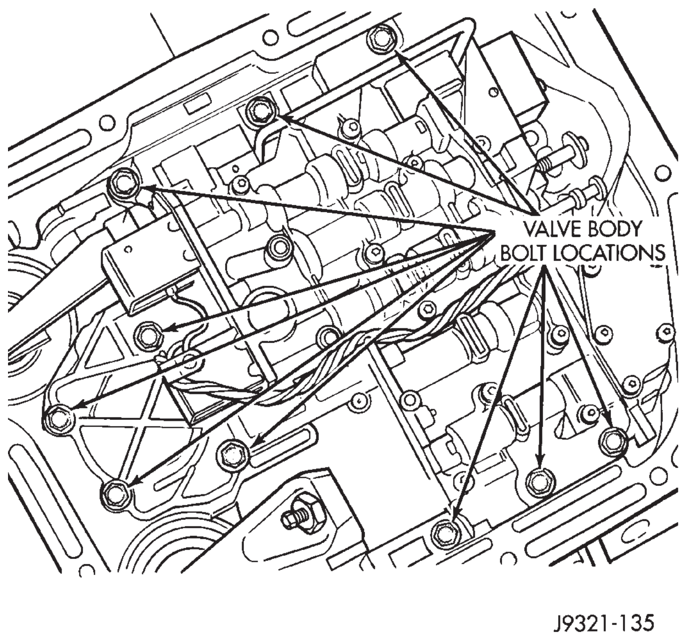

Fig. 14 Valve Body Bolt Locations

(19) Remove oil pump and reaction shaft support assembly as follows:

(a) Tighten front band adjusting screw until band is tight around front clutch retainer (Fig. 18). This will prevent retainer from coming out with pump and possibly damaging clutch or pump components.

(b) Remove oil pump bolts.

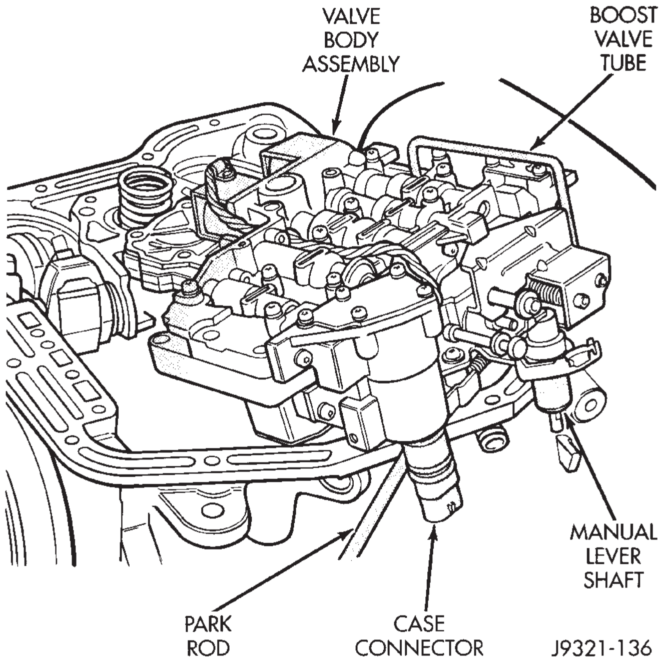

Fig. 15 Valve Body Removal

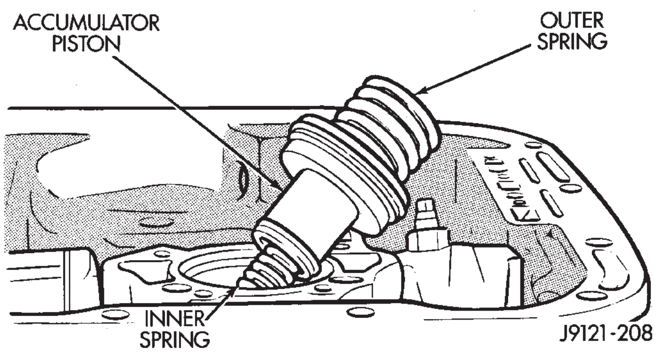

Fig. 16 Accumulator Component Removal

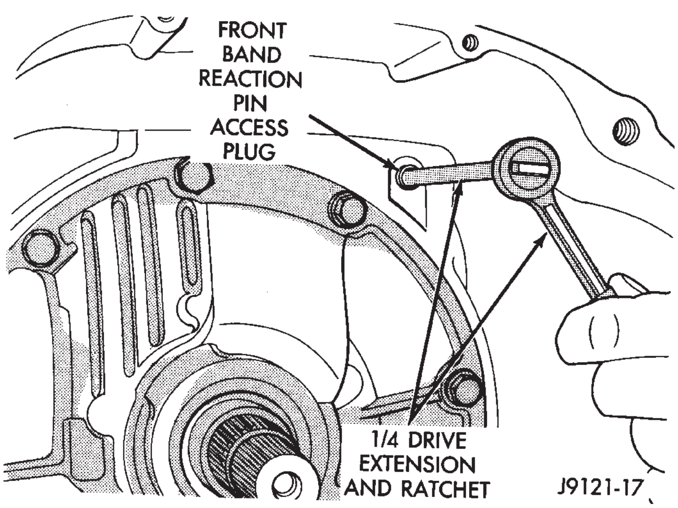

Fig. 17 Front Band Lever Pin Access Plug Removal/ Installation

(c) Thread Slide Hammer Tools C-3752 into threaded holes in flange of oil pump housing (Fig. 19).

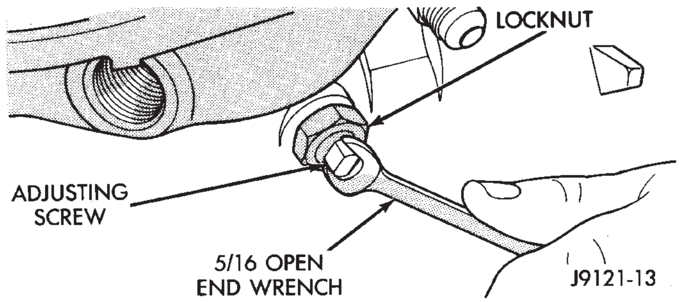

Fig. 18 Tightening Front Band To Hold Front Clutch In Place

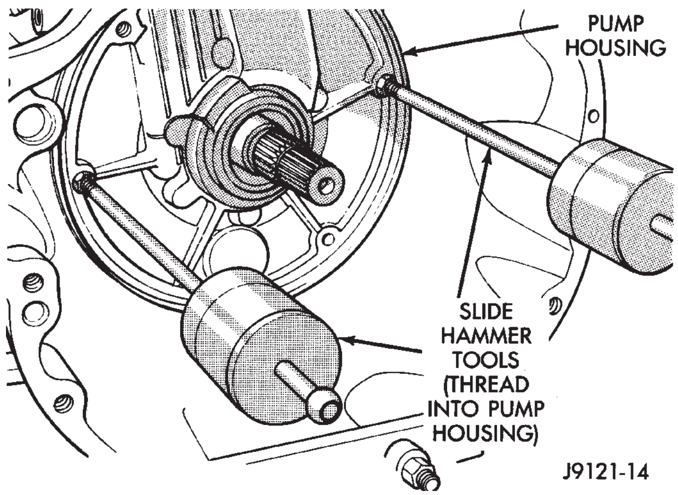

Fig. 19 Positioning Oil Pump Remover Tools

(d) Remove oil pump and reaction shaft support by bumping slide hammers outward alternately to pull pump from case (Fig. 20).

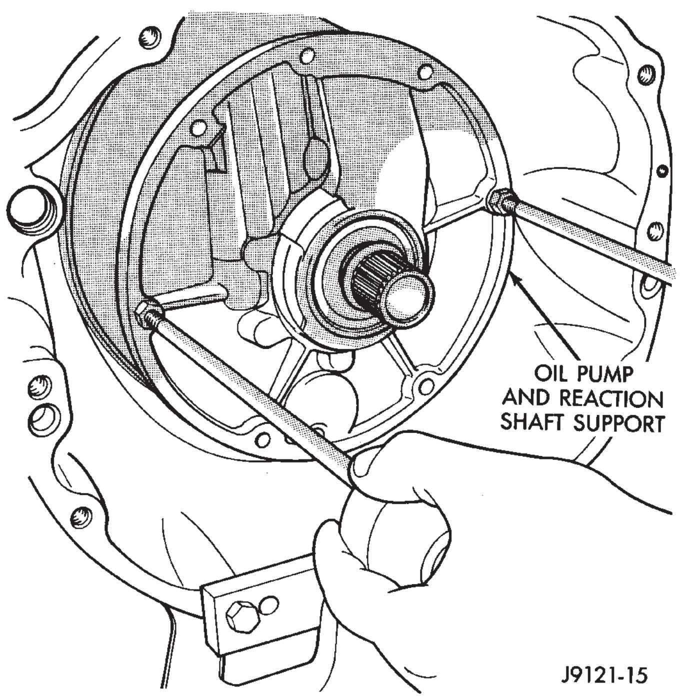

Fig. 20 Oil Pump Removal

(20) Remove oil pump gasket (Fig. 21). Note gasket position in case for assembly reference.

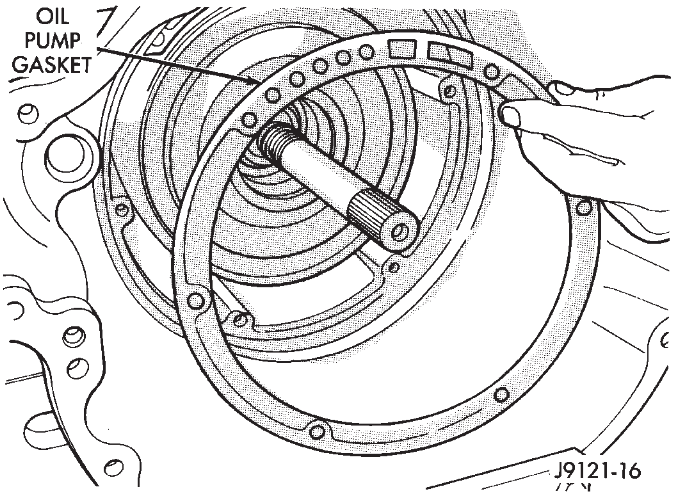

Fig. 21 Oil Pump Gasket Removal

(21) Loosen front band adjusting screw until band is completely loose.

(22) Remove front band strut and anchor (Fig. 22).

(23) Squeeze front band together slightly and slide band over front clutch retainer and out of case (Fig. 23).

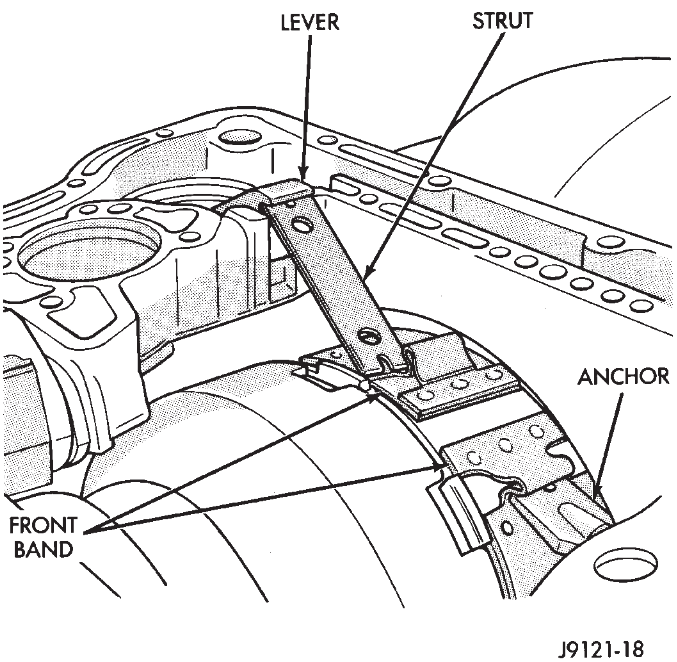

Fig. 22 Front Band Linkage

(24) Remove front and rear clutch assemblies as a unit (Fig. 24). Set assemblies aside for disassembly and inspection after removal.

(25) Remove front band reaction pin and lever. Start pin through lever and out of case bore with drift or punch. Then use pencil magnet to withdraw pin completely (Fig. 25).

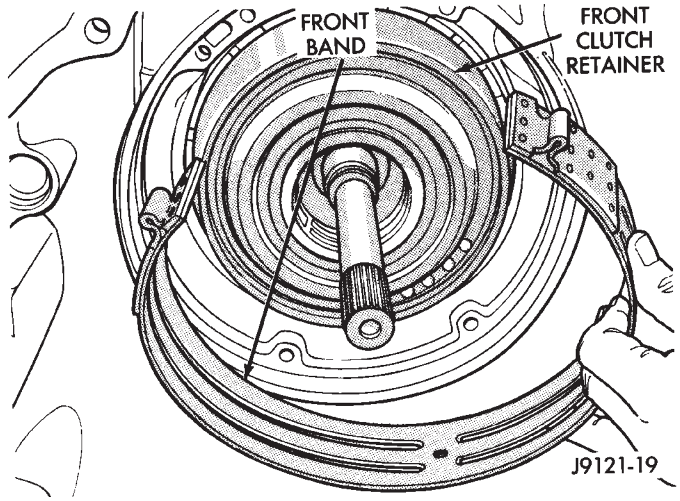

Fig. 23 Front Band Removal

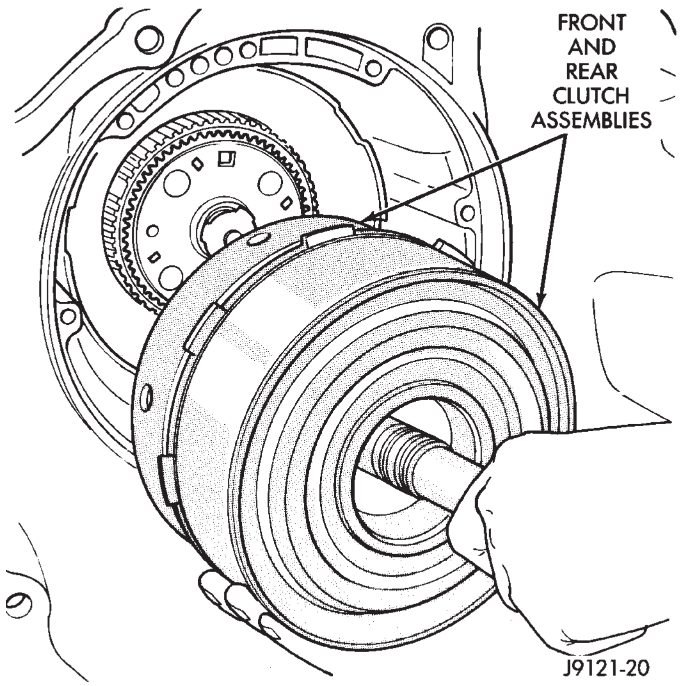

Fig. 24 Front/Rear Clutch Assembly Removal

(26) Remove intermediate shaft thrust washer. Triangular shaped washer will either be on shaft pilot hub or in rear clutch retainer (Fig. 26).

(27) Remove thrust plate from intermediate shaft hub (Fig. 27).

(28) Remove intermediate shaft-planetary geartrain assembly (Fig. 28). Set assembly aside for disassembly and inspection later in procedure.

(29) Loosen rear band locknut and loosen adjusting screw 3-4 turns.

(30) Remove snap ring that retains low-reverse drum and thrust washer on overdrive piston retainer hub (Fig. 29).

(31) Slide low-reverse drum and thrust washer off piston retainer hub and out of rear band (Fig. 30).

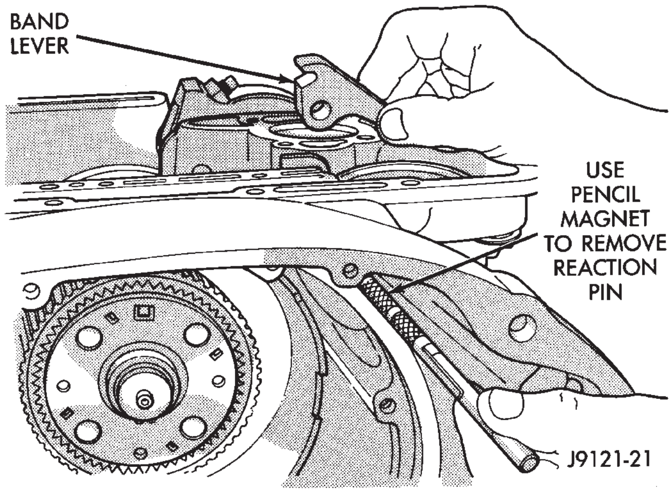

Fig. 25 Front Band Lever And Pin Removal

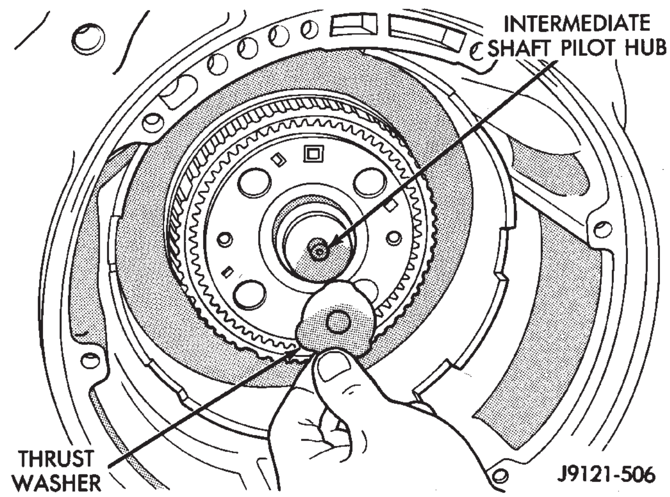

Fig. 26 Intermediate Shaft Thrust Washer Removal

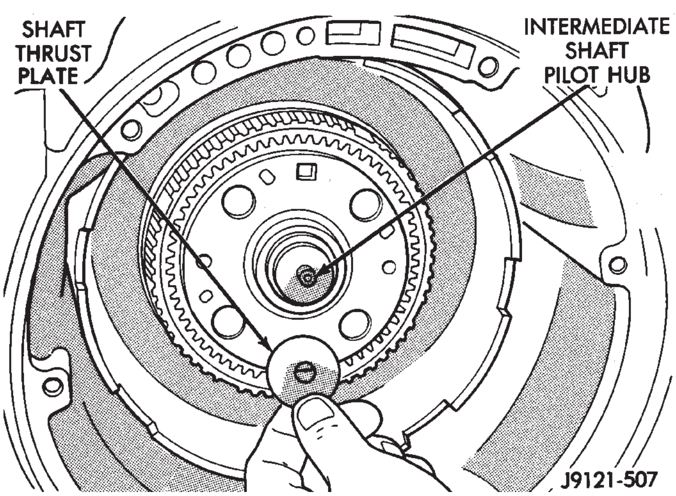

Fig. 27 Intermediate Shaft Thrust Plate Removal

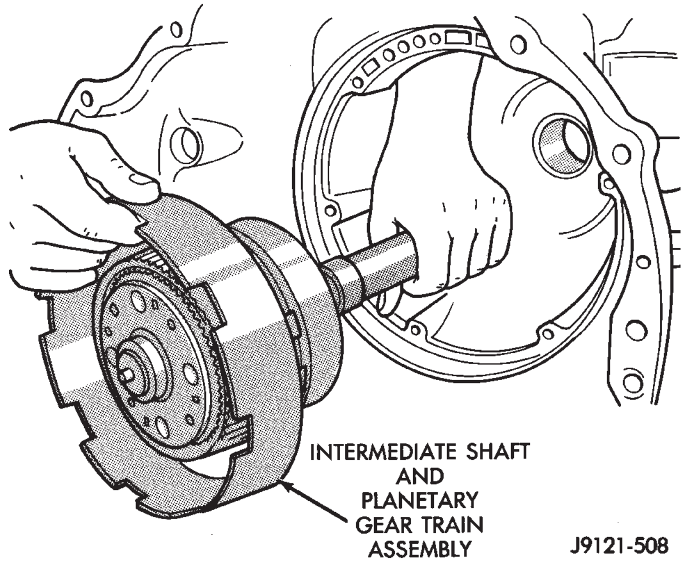

Fig. 28 Intermediate Shaft And Planetary Geartrain Assembly Removal/Installation

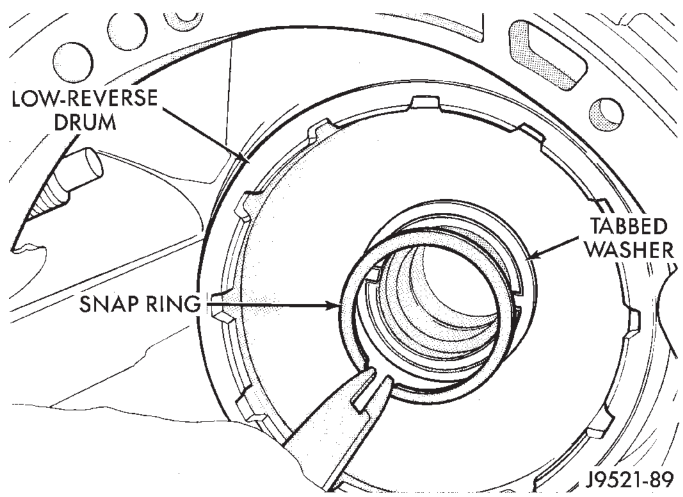

Fig. 29 Low-Reverse Drum Snap Ring Removal

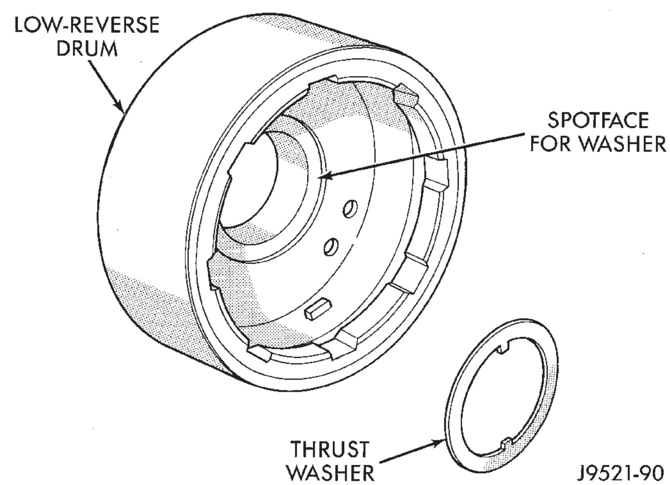

Fig. 30 Low-Reverse Drum And Thrust Washer

(32) Note that overrunning clutch race will remain on splines of low-reverse drum after removal (Fig. 31). **The race is a permanent press fit on the hub splines. Do not attempt to remove the race.**

(33) Remove overrunning clutch assembly (Fig. 32). Assembly can be removed without displacing rollers and springs if care is exercised. Note position of rollers and springs for assembly reference.

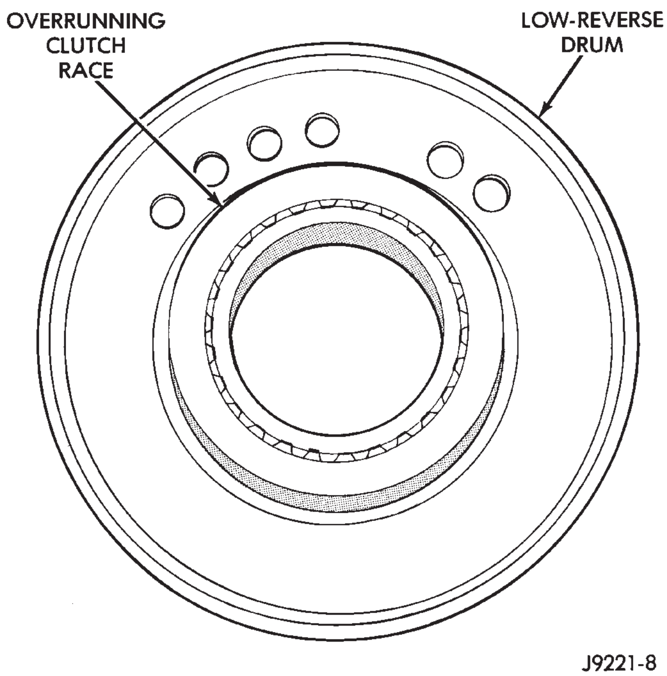

Fig. 31 Overrunning Clutch Race Position On Low-Reverse Drum

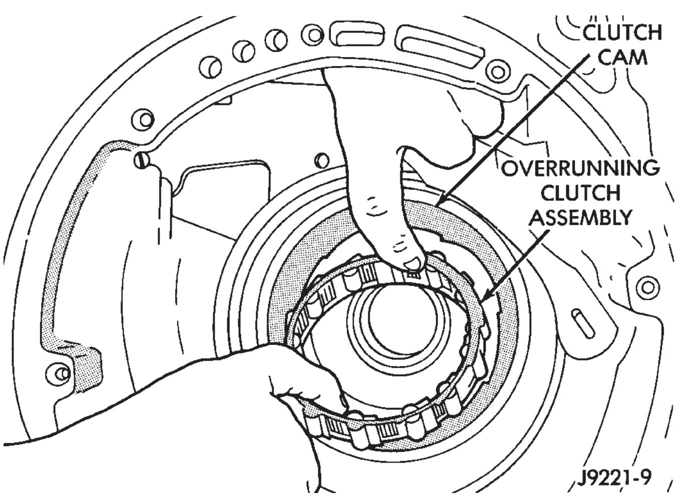

Fig. 32 Removing Overrunning Clutch Assembly

(34) Remove rear band adjusting lever, reaction lever and pin (Fig. 33).

(35) Remove strut from rear band. Keep strut with levers and pin for cleaning, inspection and assembly reference.

(36) Remove rear band and link (Fig. 34).

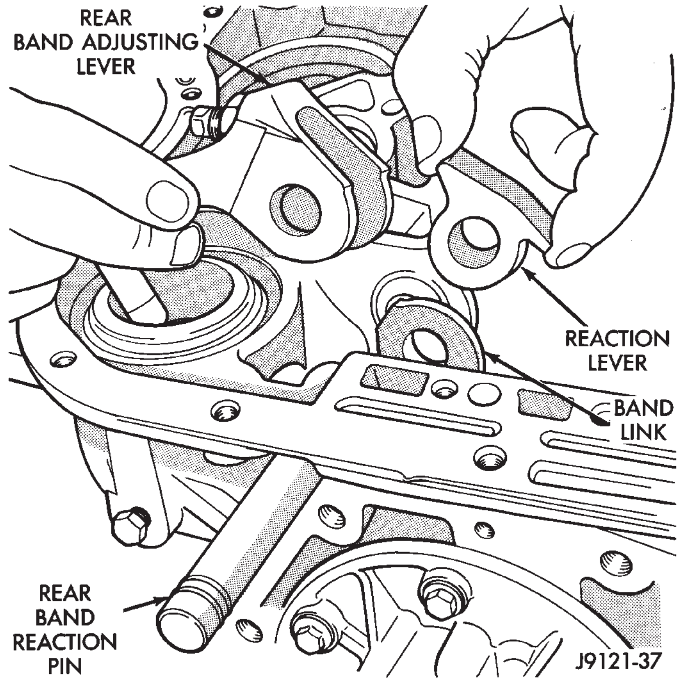

Fig. 33 Removing Rear Band Levers And Pins

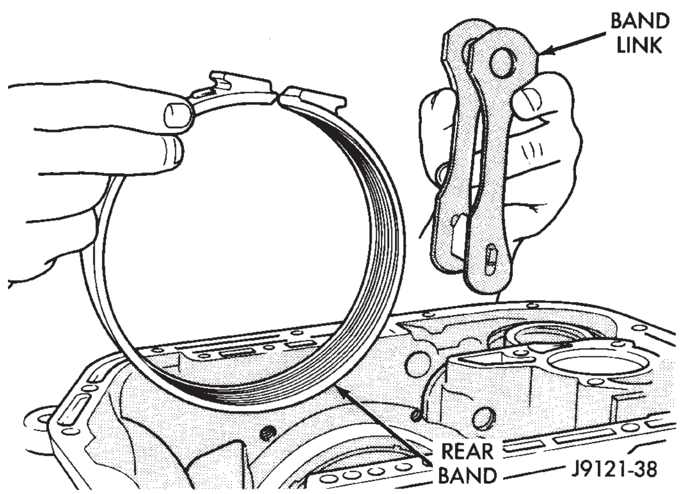

Fig. 34 Removing Rear Band And Link

(37) Compress front servo rod guide with large C-clamp and Tool C-4470, or Compressor Tool C-3422-B (Fig. 35). Compress guide only enough to permit snap ring removal (about 1/8 in.).

(38) Remove servo piston snap ring (Fig. 35). Unseat one end of ring. Then carefully work removal tool around back of ring until free of ring groove. **Exercise caution when removing snap ring. Servo bore can be scratched or nicked if care is not exercised.**

(39) Remove tools and remove servo piston and spring.

(40) Compress rear servo piston with C-clamp and Tool C-4470, or Valve Spring Compressor C-3422-B (Fig. 36). Compress servo spring retainer only enough to permit snap ring removal.

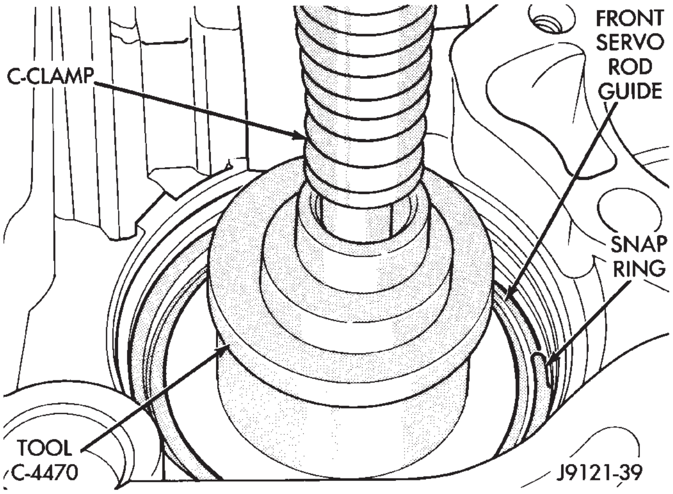

Fig. 35 Removing Front Servo Retaining Snap Ring

(41) Remove servo piston snap ring (Fig. 36). Start one end of ring out of bore. Then carefully work removal tool around back of snap ring until free of ring groove. **Exercise caution when removing snap ring. Servo bore can be scratched or nicked if care is not exercised.**

(42) Remove tools and remove rear servo retainer, spring and piston assembly.

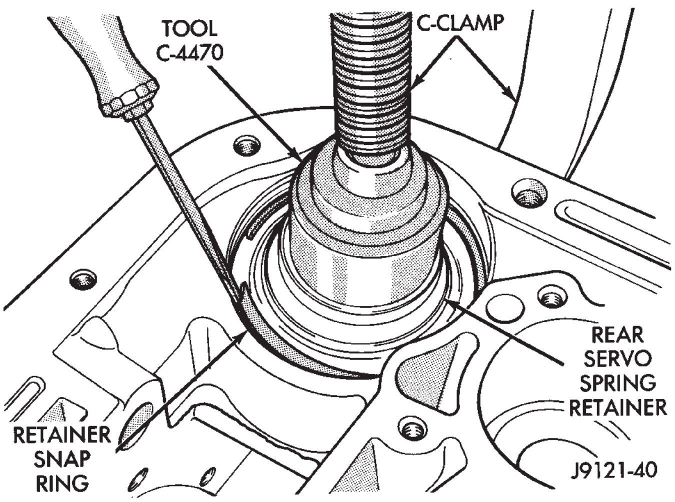

Fig. 36 Removing Rear Servo Retaining Snap Ring

(43) Remove overdrive piston retainer bolts and remove retainer from case (Fig. 37).

(44) Remove gasket from rear of case after removing piston retainer.

OVERHAUL SERVICE INFORMATION

Inspect all the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and accelerated wear of other components. Replace worn, or scored bushings, or if doubt exists about bushing condition.

Use recommended tools to replace bushings. The tools are sized and designed to remove, install and seat bushings correctly. The bushing replacement tools are included in Bushing Tool Sets C-3887-B, or C-3887-J.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced. Replace the sun gear and bushings as an assembly if damaged.

Heli-Coil inserts are recommended for repairing damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive jobbers. Stainless steel inserts are preferred.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar ATF Plus, Type 7176 transmission fluid during assembly. Use Mopar Door Ease, or Ru-Glyde to lubricate piston seals and O-rings. Use petroleum jelly on thrust washers and to hold parts in place during reassembly.

TRANSMISSION CASE CLEANING AND INSPECTION

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and will circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Inspect the case for cracks, porous spots, worn servo bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits damage or wear.

Lubricate the front band adjusting screw and locknut with petroleum jelly and thread it part way into the case. Be sure the screw turns freely and does not bind. Install the locknut on the screw after checking screw thread operation.

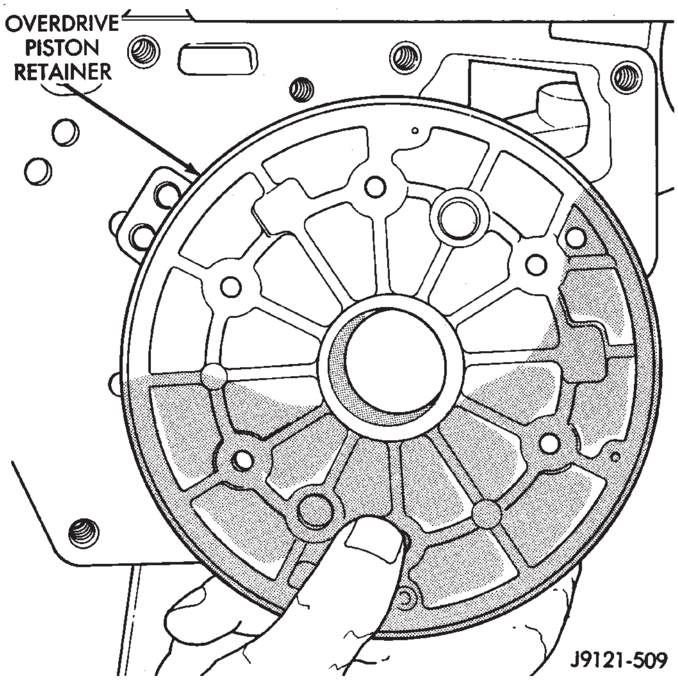

Fig. 37 Removing Overdrive Piston Retainer

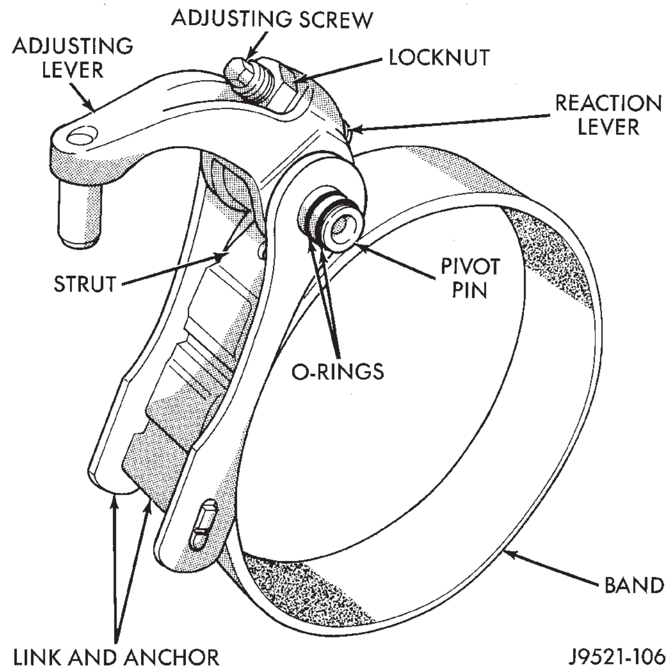

Fig. 38 Rear Band And Linkage

LOW-REVERSE DRUM AND REAR BAND SERVICE

Clean the drum in solvent but just wipe the drum thrust washer and rear band clean with lint free shop towels.

Examine the double tabbed thrust washer for wear (Fig. 30). If the washer is worn, or damaged, check the spotface area of the drum for wear also.

Examine the band and friction material closely. Replace the band if bent, or distorted. Also replace the band if the friction material is burnt, cracked, or flaking away from the band. If the grooves in the band are no longer visible, the band lining is severely worn and should be replaced.

Check the band lever, adjusting screw, locknut, pivot pin, link and strut (Fig. 38). Replace any component exhibiting wear, or damage.

Remove and replace the O-rings on the band pivot pin (Fig. 38). Lubricate the new O-rings with transmission fluid after they are installed on the pin.

OVERDRIVE PISTON AND RETAINER SERVICE

Remove and discard the piston seals. Use a pencil or length of thin plastic to remove the old seals. Do not use metal tools as they will scratch, or score the seal grooves.

Clean the piston and retainer in solvent but do not use any type of caustic materials for cleaning. Such materials may etch the piston surfaces causing damage.

Inspect the piston and retainer carefully. Replace either part if cracked, porous or damaged in any way. Check condition of the locating lugs on the piston. Be sure the lugs are in good condition and are not worn, chipped or broken.

Inspect the check ball in the piston (Fig. 39). Be sure the ball is secure and is not partially dislodged, or loose. Replace the piston if doubt exists about piston or check ball condition.

Check the governor feed tube boss in the retainer. Be sure the boss is in good condition and is not damaged in any way.

Carefully work new piston seals into place by hand. Apply a liberal coating of Mopar Door Ease, or Ru-Glyde to the seals to ease installation. Then cover the piston with paper or clean plastic sheeting to keep it dust free for assembly installation.

OVERRUNNING CLUTCH OVERHAUL

Inspect condition of the clutch cam, cage-type retainer, rollers, springs and clutch race.

Replace the clutch cam if worn or damaged. Also check fit of the cam in the transmission case. If the cam is loose, the case may be worn, or cracked.

The clutch race is permanently pressed onto the low-reverse drum hub. If either the drum or race are worn or damaged, replace the drum and race as an assembly. Check fit of the race on the low-reverse drum hub splines. Replace the drum and race as an assembly if the race is loose on the hub splines.

Examine the overrunning clutch assembly carefully. Replace assembly if the rollers, springs, or cage-type retainer are worn, or damaged.

If the clutch cam requires replacement, install a new cam as described in the following procedure.

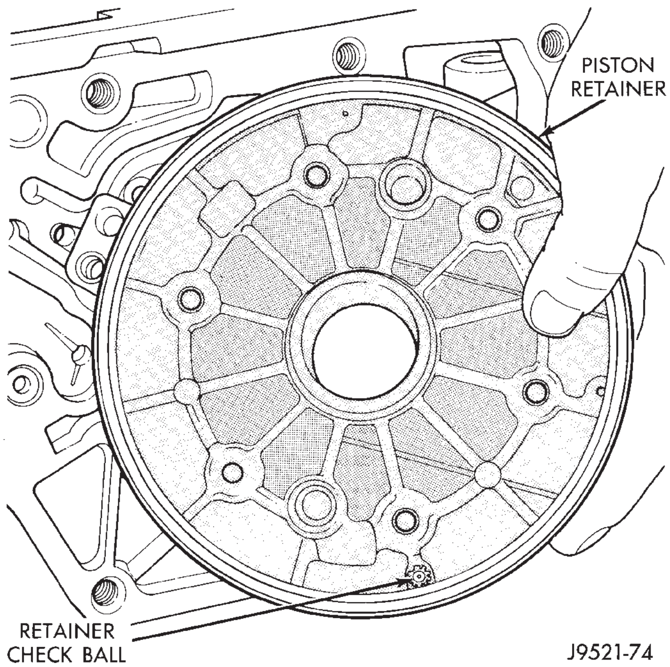

Fig. 39 Overdrive Piston

OVERRUNNING CLUTCH CAM REPLACEMENT

(1) Tap old cam out of case with pin punch. Insert punch through bolt holes at rear of case (Fig. 40). Alternate position of punch to avoid cocking cam during removal.

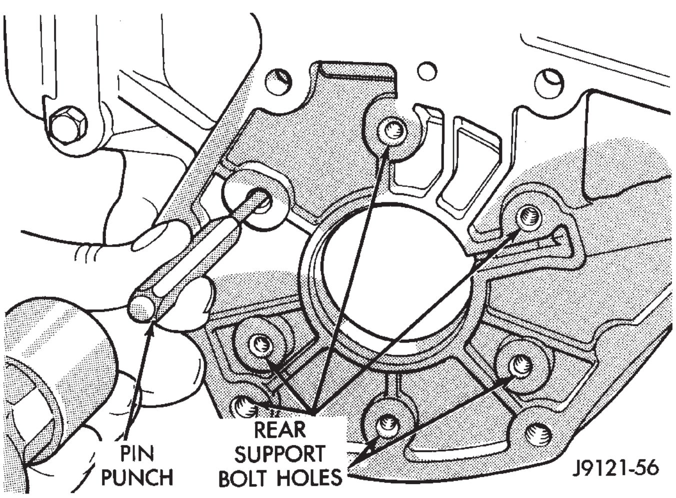

Fig. 40 Overrunning Clutch Cam Removal

(2) Clean clutch cam bore and case. Be sure to remove all chips/shavings generated during cam removal.

(3) Temporarily install overdrive piston retainer in case. Use 3-4 bolts to secure retainer.

(4) Align and start new clutch cam and spring retainer in case. Be sure serrations on cam and in case are aligned (Fig. 41). Then tap cam into case just enough to hold it in place.

(5) **Verify that cam is correctly positioned before proceeding any further. Narrow ends of cam ramps should be to left when cam is viewed from front end of case** (Fig. 41).

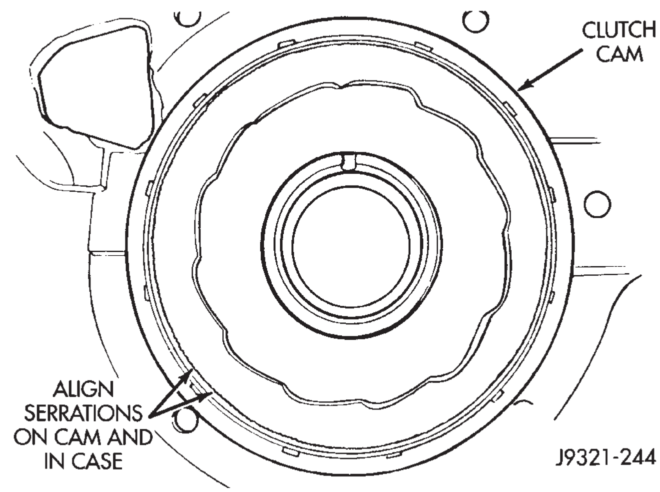

Fig. 41 Positioning Replacement Clutch Cam In Case

(6) Insert Adapter Tool SP-5124 into piston retainer (Fig. 42).

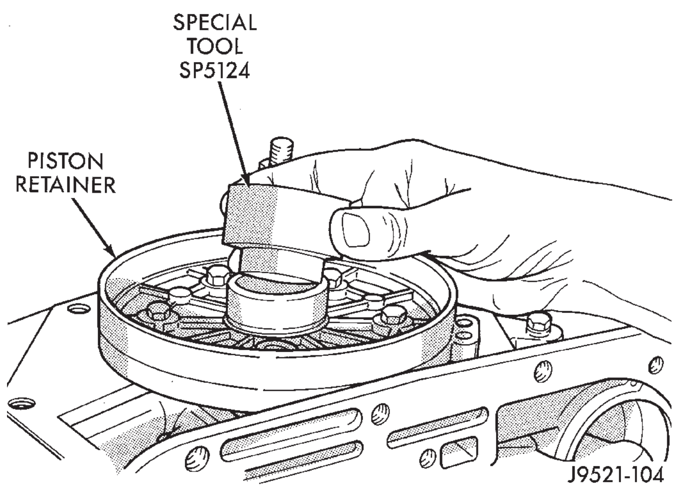

Fig. 42 Positioning Adapter Tool In Overdrive Piston Retainer

(7) Assemble Puller Bolt SP-3701 and Press Plate SP-3583-A (Fig. 43).

(8) Install assembled puller plate and bolt (Fig. 44). Insert bolt through cam, case and adapter tool. Be sure plate is seated squarely on cam.

(9) Hold puller plate and bolt in place and install puller nut SP 3701 on puller bolt (Fig. 45).

(10) Tighten puller nut to press clutch cam into case (Fig. 45). **Be sure cam is pressed into case evenly and does not become cocked.**

(11) Remove clutch cam installer tools.

(12) **Stake case in 12 places around clutch cam to help secure cam in case. Use blunt punch or chisel to stake case.**

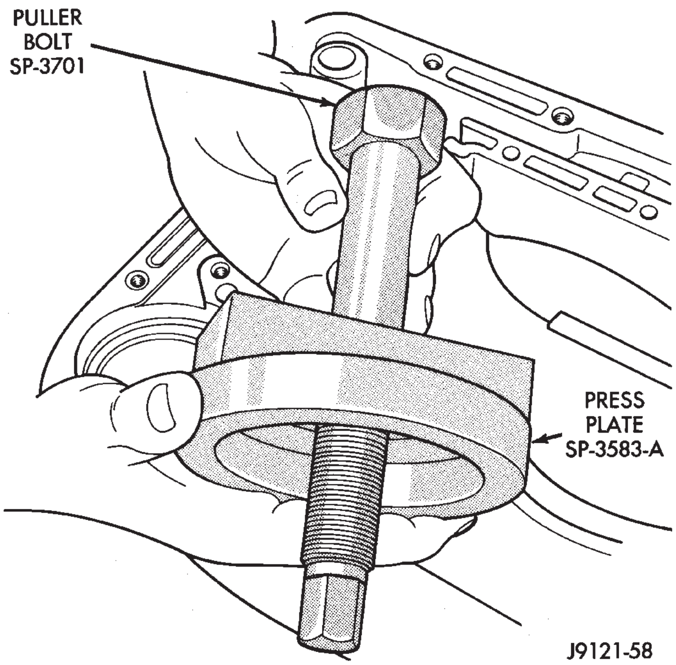

Fig. 43 Assembling Clutch Cam Puller Bolt And Press Plate

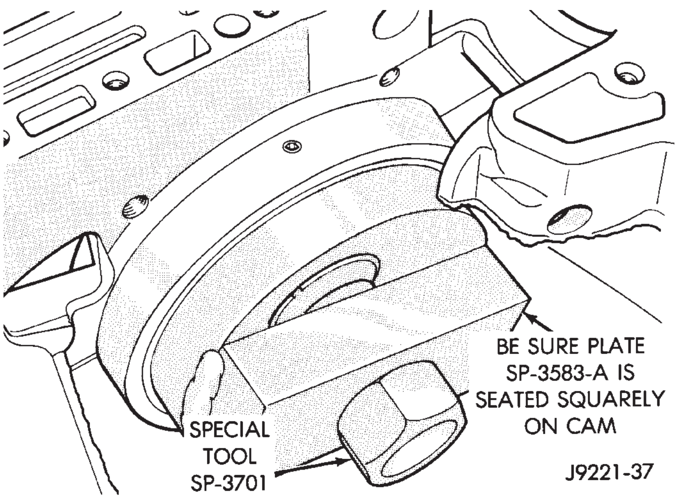

Fig. 44 Positioning Puller Plate On Clutch Cam

(13) Remove piston retainer from case. Recover retainer with plastic sheeting, or paper to keep it dust free.

(14) Clean case and cam thoroughly. Be sure any chips/shavings generated during cam installation are removed from case.

OVERRUNNING CLUTCH INSTALLATION

(1) Lubricate overdrive piston retainer hub, clutch race, clutch cam, and overrunning clutch rollers with transmission fluid.

(2) If any overrunning clutch rollers or springs came out of retainer, reinstall them as follows: Install and seat spring in retainer first. Then insert roller

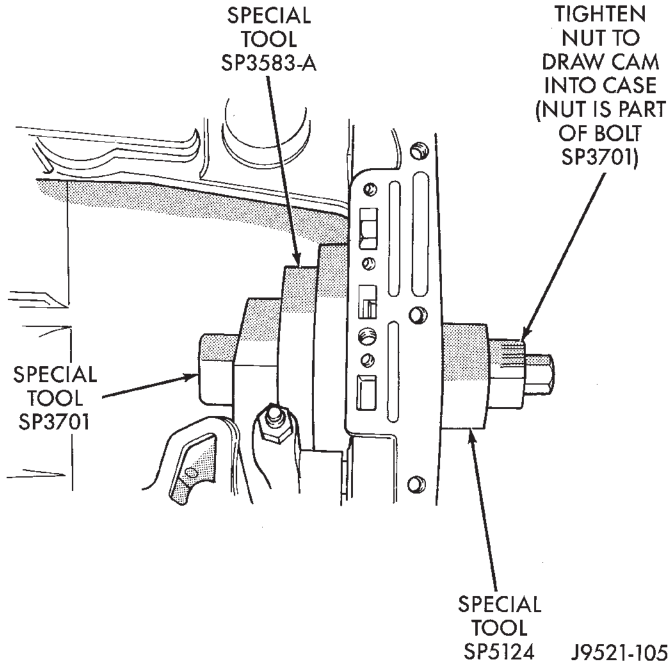

Fig. 45 Pressing New Overrunning Clutch Cam Into Case

between spring and retainer stop as shown (Fig. 46). Verify that each roller and spring are fully seated before proceeding.

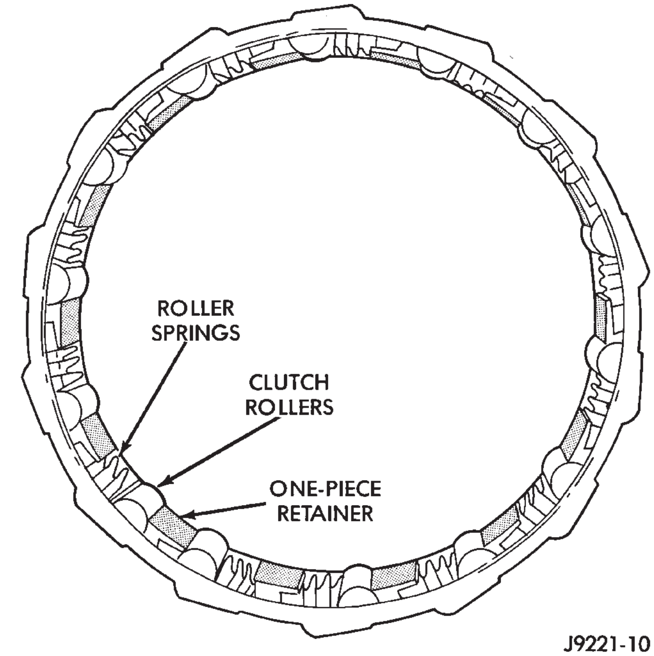

Fig. 46 Overrunning Clutch Roller And Spring Position In Retainer

(3) Install and seat clutch assembly in cam (Fig. 47). **The roller retainer is a one-way fit in the cam. The flanged side of the retainer should be**

facing outward. The retainer and rollers will slip easily into the cam when properly positioned.

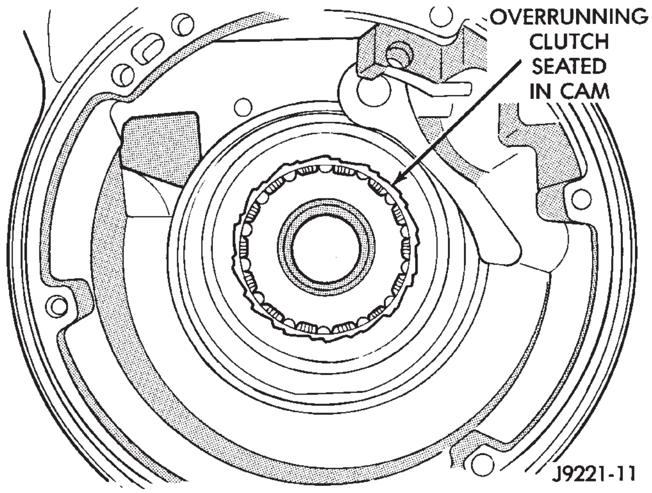

Fig. 47 Overrunning Clutch Seated In Cam

(4) Check overrunning clutch operation. Low-reverse drum should rotate freely in clockwise direction and lock in counterclockwise direction.

ACCUMULATOR OVERHAUL

Inspect the accumulator piston and seal rings (Fig. 48). Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.

Check condition of the accumulator inner and outer springs (Fig. 48). Replace the springs if the coils are cracked, distorted or collapsed.

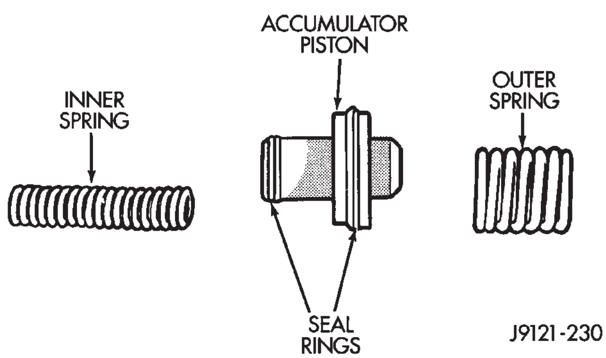

Fig. 48 Accumulator Components

FRONT SERVO AND BAND OVERHAUL

Clean the servo piston components with solvent and dry them with compressed air. Wipe the band clean with lint free shop towels.

Replace the front band if distorted, lining is burned, flaking off, or worn to the point where the grooves in the lining material are no longer visible.

Inspect the servo components. Replace the springs if collapsed, distorted or broken. Replace the guide, rod and piston if cracked, bent, or worn. Discard the servo snap ring if distorted or warped.

Check the servo piston bore for wear. If the bore is severely scored, or damaged, it will be necessary to replace the case.

Replace any servo component if doubt exists about condition. Do not reuse suspect parts.

FRONT SERVO PISTON OVERHAUL (FIG. 49)

(1) Remove seal ring from rod guide.

(2) Remove small snap ring from servo piston rod. Then remove piston rod, spring and washer from piston.

(3) Remove and discard servo component O-ring and seal rings.

(4) Lubricate new O-ring and seal rings with petroleum jelly and install them on piston, guide and rod.

(5) Install rod in piston. Install spring and washer on rod. Compress spring and install snap ring.

(6) Set servo components aside for installation during transmission reassembly.

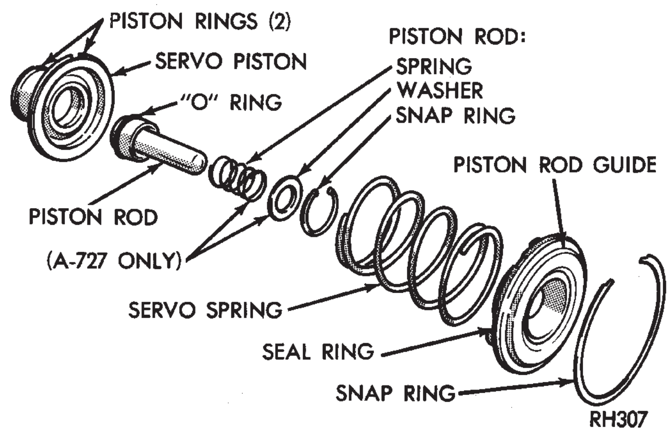

Fig. 49 Front Servo Components

REAR SERVO OVERHAUL

Remove and discard the servo piston seal ring. Then clean the servo components with solvent and dry with compressed air. Replace either spring if collapsed, distorted or broken. Replace the plug and piston if cracked, bent, or worn. Discard the servo snap rings and use a new ones at assembly.

REAR SERVO PISTON OVERHAUL (FIG. 50)

(1) Remove small snap ring and remove plug and spring from servo piston.

(2) Remove and discard servo piston seal ring.

(3) Lubricate piston and guide seals with petroleum jelly. Lubricate other servo parts with Mopar ATF Plus transmission fluid.

(4) Install new seal ring on servo piston.

(5) Assemble piston, plug, spring and new snap ring.

(6) Lubricate piston seal lip with petroleum jelly.

(7) Set servo components aside for assembly installation.

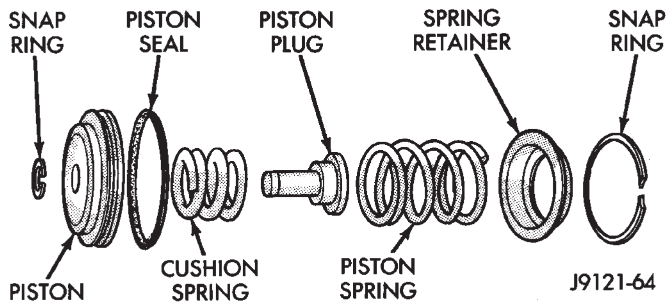

Fig. 50 Rear Servo Components

OIL PUMP AND REACTION SHAFT SUPPORT OVERHAUL

PUMP AND SUPPORT DISASSEMBLY

(1) Mark position of support in oil pump body for assembly alignment reference. Use scriber or paint to make alignment marks.

(2) Place pump body on two wood blocks.

(3) Remove reaction shaft support bolts and separate support from pump body (Fig. 51).

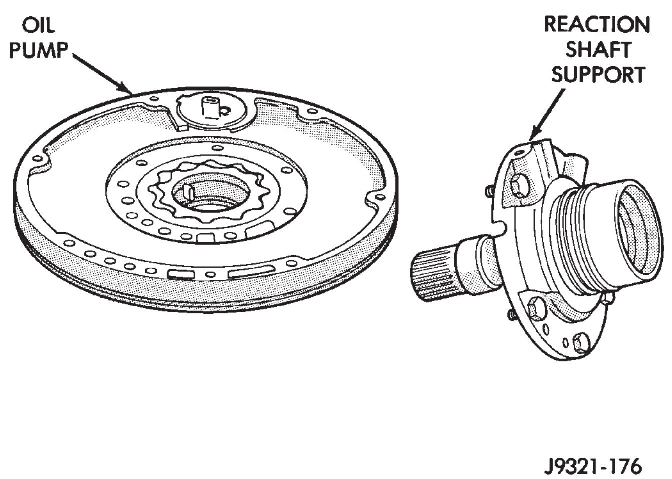

Fig. 51 Reaction Shaft Support Removal

(4) Remove pump inner and outer gears (Fig. 52).

(5) Remove O-ring seal from pump body (Fig. 53). Discard seal after removal.

(6) Remove oil pump seal with Remover Tool C-3981. Discard seal after removal.

INSPECTING PUMP AND SUPPORT

Clean pump and support components with solvent and dry them with compressed air.

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, severely worn, or no longer hooked together.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

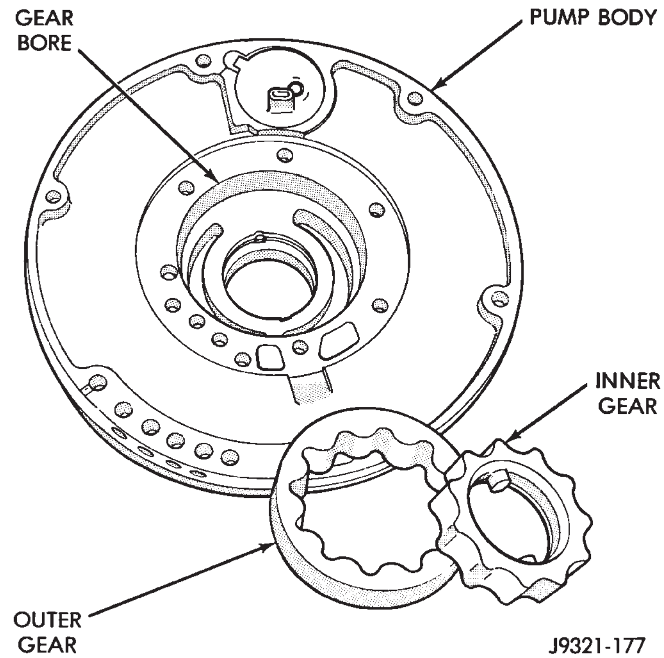

Fig. 52 Pump Gear Removal

Check the pump vent (Fig. 54). The vent must be secure. Replace the pump body if the vent is cracked, broken, or loose.

Inspect the pump bushing (Fig. 54). Then check the reaction shaft support bushing. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Install the gears in the pump body and measure end clearance with a feeler gauge and straightedge (Fig. 55). Straightedge should be resting on pump body as shown:

• End clearance between outer gear and straightedge should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.).

• End clearance between inner gear and straightedge should be 0.025 to 0.177 mm (0.001 to 0.007 in.).

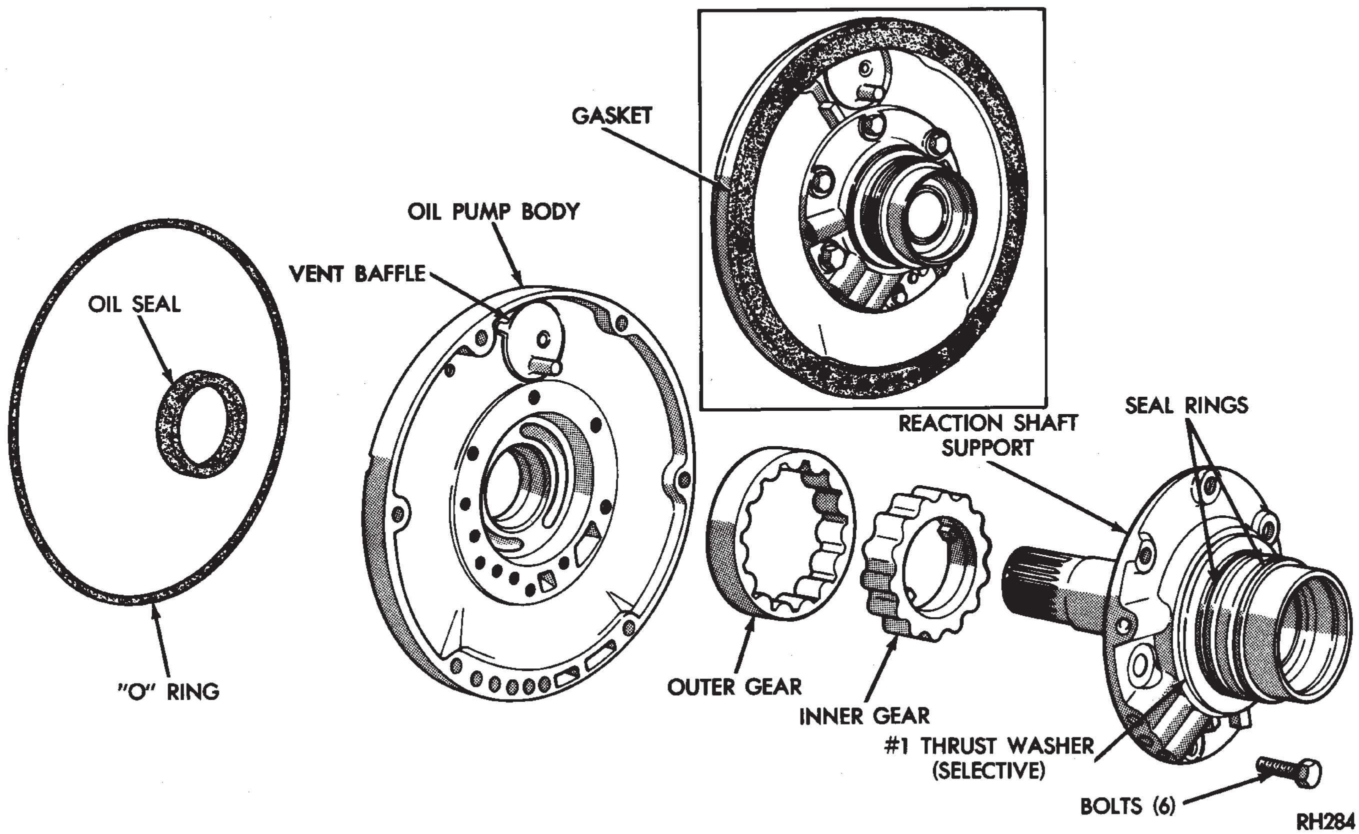

Fig. 53 Oil Pump And Reaction Shaft Components

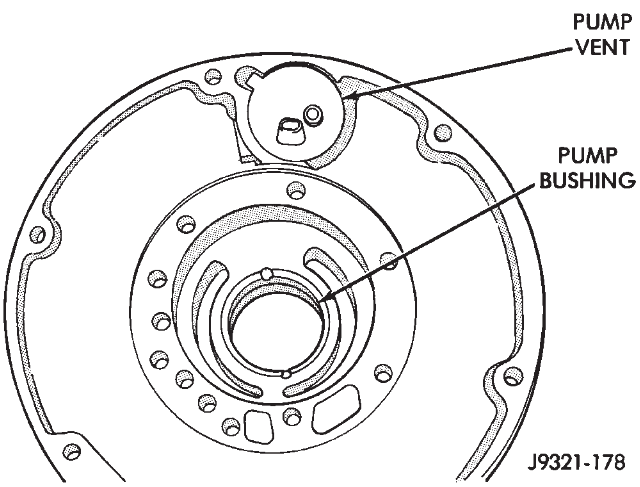

Fig. 54 Pump Vent And Bushing Location

Measure tip clearances with feeler gauge (Fig. 56):

• Clearance between inner gear tooth and outer gear should be 0.08 to 0.19 mm (0.0035 to 0.0075 in.).

• Clearance between outer gear and pump housing should also be 0.010 to 0.19 mm (0.0035 to 0.0075 in.).

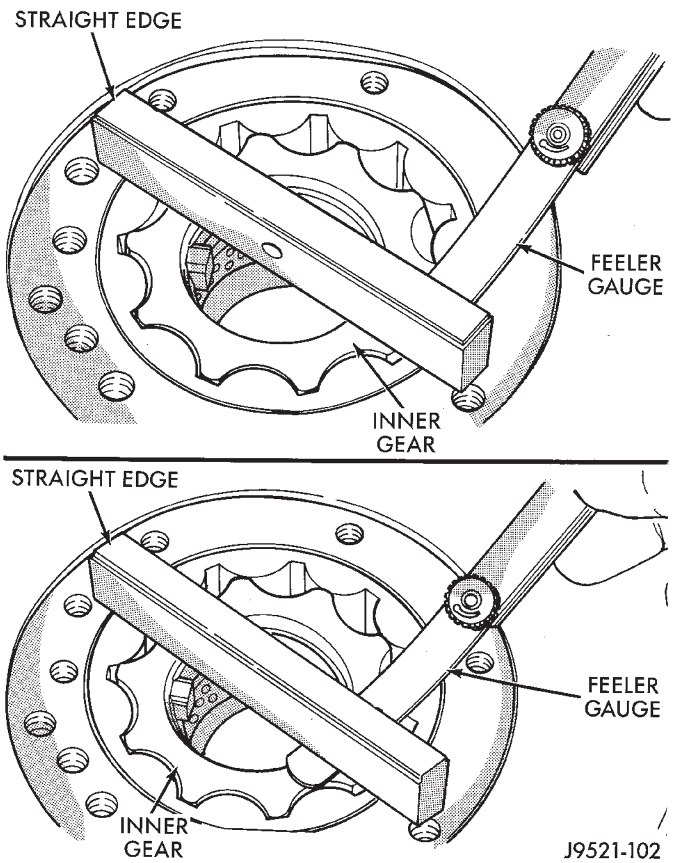

Fig. 55 Checking Pump Gear End Clearance

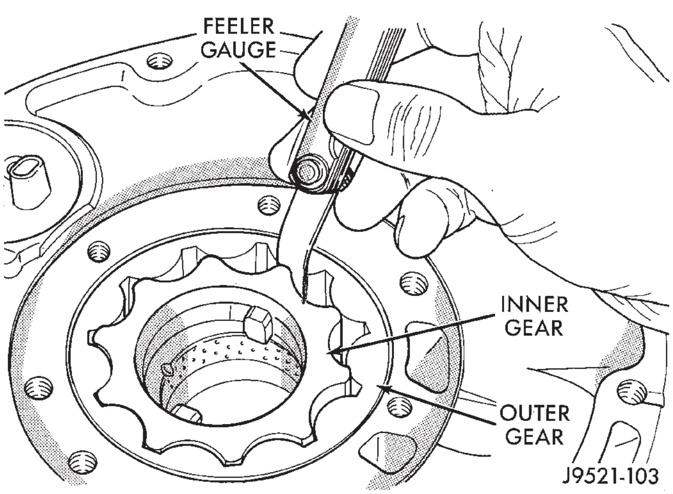

Fig. 56 Checking Pump Gear Tip Clearance

OIL PUMP BUSHING REPLACEMENT (FIG. 57)

(1) Position pump housing on clean, smooth surface with gear cavity facing down.

(2) Remove bushing with Tool Handle C-4171 and Bushing Remover SP-3550.

(3) Assemble Tool Handle C-4171 and Bushing Installer SP-5118.

(4) Place bushing on installer tool and start bushing into shaft.

(5) Tap bushing into place until Installer Tool SP-5118 bottoms in pump cavity. Keep tool and bushing square with bore. Do not allow bushing to become cocked during installation.

(6) Stake pump bushing in two places with blunt punch. Remove burrs from stake points with knife blade (Fig. 58).

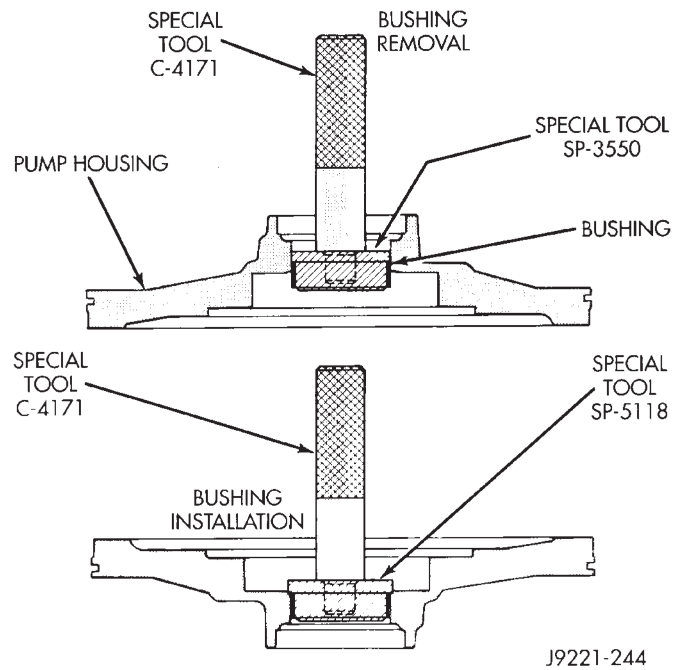

Fig. 57 Replacing Oil Pump Bushing

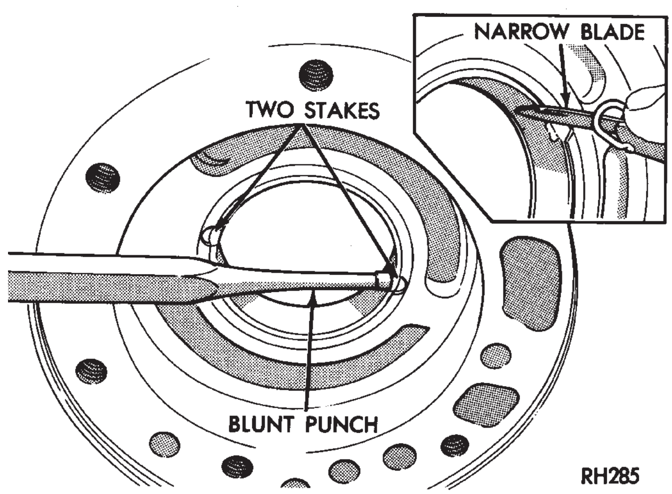

Fig. 58 Staking-Deburring Oil Pump Bushing

REPLACING REACTION SHAFT SUPPORT BUSHING (FIG. 59)

(1) Assemble Cup Tool SP-3633, Nut SP-1191 and Bushing Remover SP-5301.

(2) Hold cup tool firmly against reaction shaft. Thread remover tool into bushing as far as possible by hand.

(3) Using wrench, thread remover tool an additional 3-4 turns into bushing to firmly engage tool.

(4) Tighten tool hex nut against cup tool to pull bushing from shaft. Clean all chips from shaft and support after bushing removal.

(5) Place reaction shaft support upright on a clean, smooth surface.

(6) Assemble Bushing Installer Tools C-4171 and SP-5302. Then slide new bushing onto installer tool.

(7) Start bushing in shaft. Tap bushing into shaft until installer tool bottoms against support flange.

(8) Clean reaction shaft support thoroughly after bushing replacement (to remove any chips).

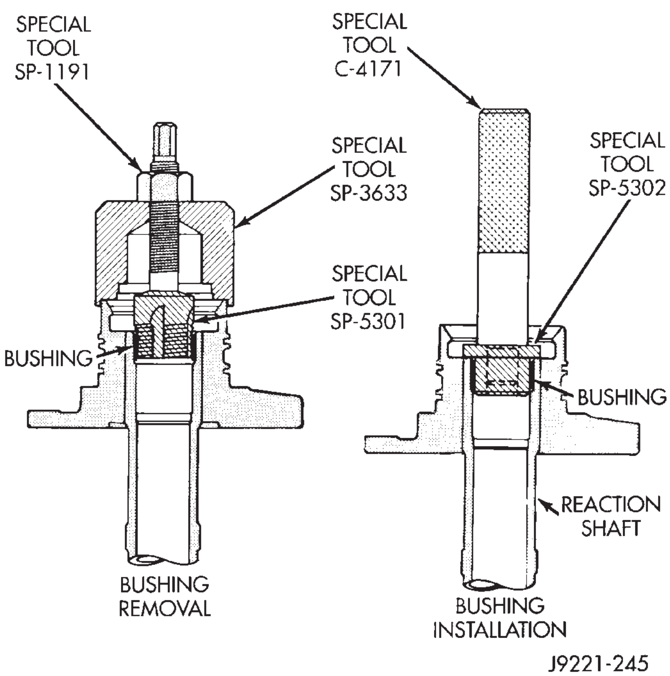

Fig. 59 Reaction Shaft Bushing Replacement

ASSEMBLING OIL PUMP AND REACTION SHAFT SUPPORT

(1) Lubricate pump gears with transmission fluid and install them in pump body.

(2) Install thrust washer on reaction shaft support hub. Lubricate washer with petroleum jelly or transmission fluid before installation.

(3) If reaction shaft seal rings are being replaced, install new seal rings on support hub. Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.

CAUTION: The reaction shaft support seal rings will break if overspread, or twisted. If new rings are being installed, spread them only enough for installation. Also be very sure the ring ends are securely hooked together after installation. Otherwise, the rings will either prevent pump installation, or break during installation.

(4) Align and install reaction shaft support on pump body.

(5) Install bolts attaching reaction shaft support to pump. Tighten bolts to 20 N·m (175 in. lbs.) torque.

(6) Install new pump seal with Installer Tool C-3860-A (Fig. 60). Use hammer or mallet to tap seal into place.

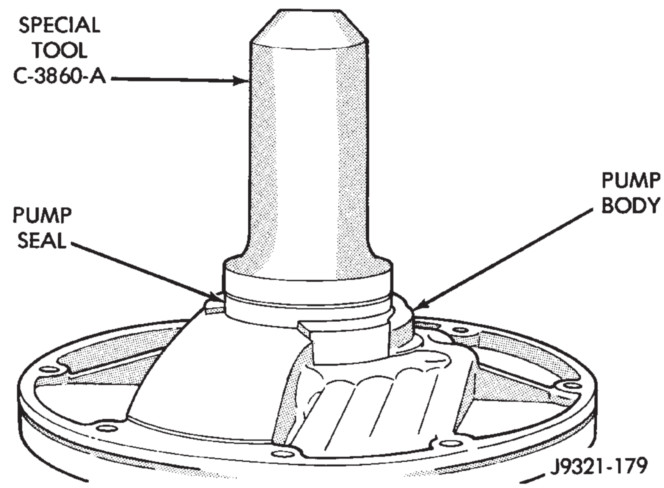

Fig. 60 Oil Pump Seal Installation

(7) Install new O-ring on pump body. Lubricate oil seal and O-ring with petroleum jelly.

(8) Cover pump assembly to prevent dust entry and set aside for assembly installation.

FRONT CLUTCH OVERHAUL

FRONT CLUTCH DISASSEMBLY

(1) Remove waved snap ring and remove reaction plate, clutch plates and clutch discs (Fig. 61). **Note number of plates and discs in clutch pack for assembly reference. Some models use 3 discs, while some may have 4 discs.**

(2) Compress clutch piston retainer and piston springs with Compressor Tool C-3863-A (Fig. 62).

(3) Remove retainer snap ring and remove compressor tool.

(4) Remove clutch piston springs. **Note position of piston springs for assembly reference.**

(5) Remove clutch piston from retainer with a twisting motion.

(6) Remove and discard clutch piston inner and outer seals.

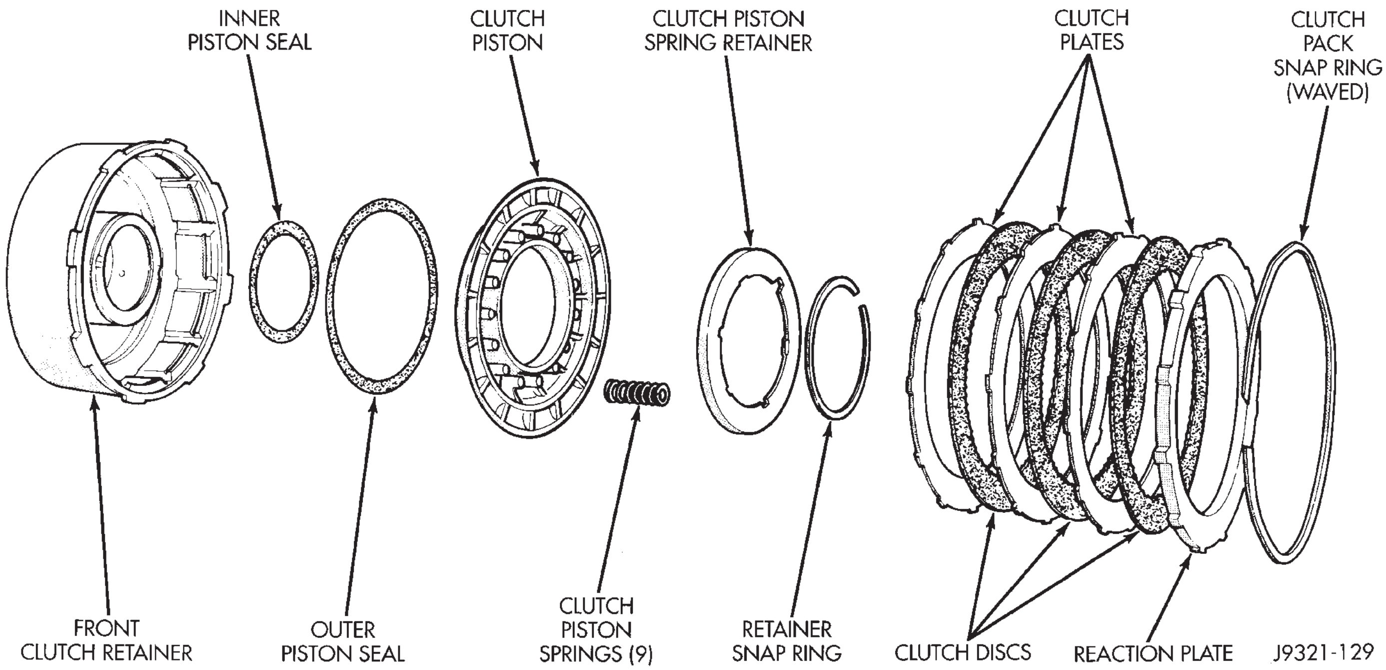

Fig. 61 Front Clutch Components

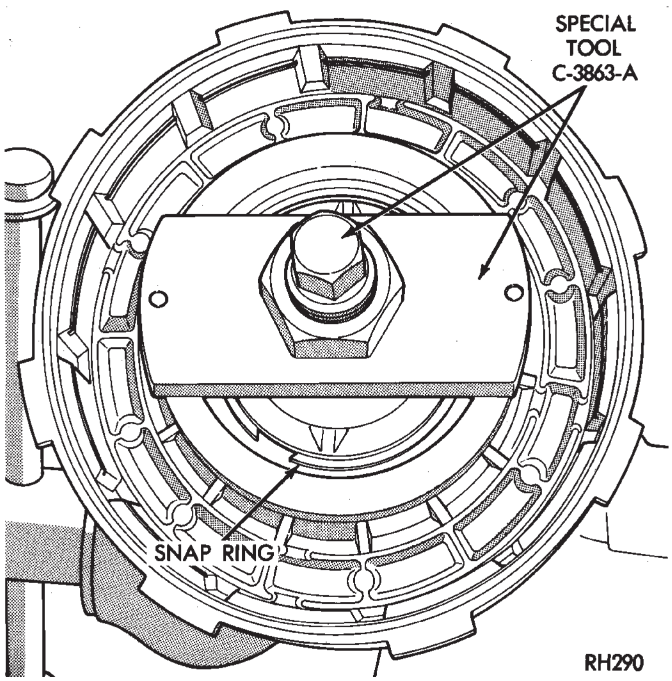

Fig. 62 Front Clutch Spring Retainer Snap Ring Removal

FRONT CLUTCH INSPECTION

Clean and inspect the front clutch components. Replace the clutch discs if warped, worn, scored, burned or charred, the lugs are damaged, or if the facing is flaking off. Replace the steel plates and reaction plate if heavily scored, warped, or broken. Be sure the driving lugs on the discs and plate are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston springs and spring retainer if either are distorted, warped or broken.

Check the lug grooves in the clutch piston retainer. The steel plates should slide freely in the slots. Replace the piston retainer if the grooves are worn or damaged. Also check action of the check ball in the piston retainer. The ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or there is any doubt about bushing condition.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check the clutch piston check ball. The ball should be securely in place. Replace the piston if the ball is missing, or seized in place.

FRONT CLUTCH RETAINER BUSHING REPLACEMENT (FIG. 63)

(1) Assemble Tool Handle C-4171 and Bushing Remover SP-3629.

(2) Insert remover tool in bushing and drive bushing straight out of clutch retainer.

(3) Mount Bushing Installer SP-5511 on tool handle.

(4) Slide new bushing onto installer tool and start bushing into retainer.

(5) Tap new bushing into place until installer tool bottoms against clutch retainer.

(6) Remove installer tools and clean retainer thoroughly.

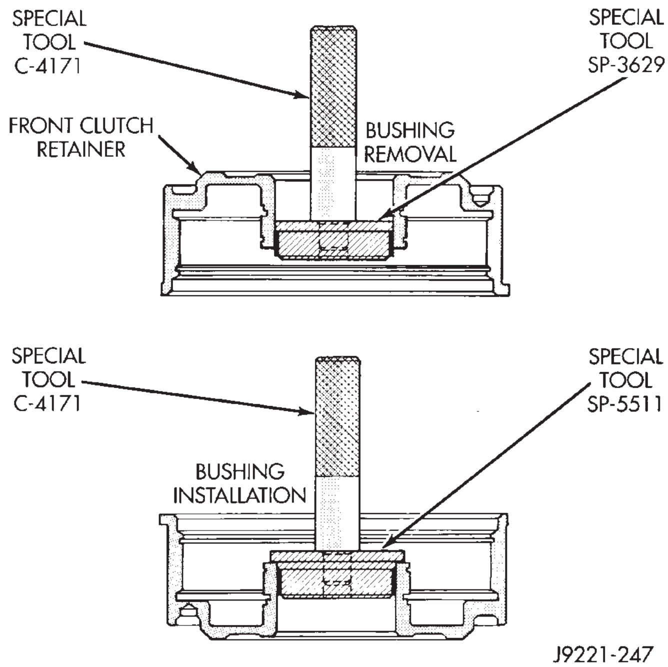

Fig. 63 Front Clutch Retainer Bushing Replacement Tools

FRONT CLUTCH ASSEMBLY

(1) Soak clutch discs in transmission fluid.

(2) Install new inner and outer seals on clutch piston. Be sure seal lips face interior of retainer.

(3) Lubricate new inner and outer piston seals with Ru-Glyde, or Mopar Door Ease.

(4) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.015 - 0.020 in. thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(5) Install and position clutch piston springs (Fig. 64). 46RH has 9 spring front clutch.

(6) Install spring retainer on top of piston springs.

(7) Compress spring retainer and piston springs with Tool C-3863-A.

(8) Install spring retainer snap ring and remove compressor tool.

(9) Install clutch plates and discs (Fig. 61). Three clutch discs, three steel plates and one reaction plate are required.

(10) Install reaction plate followed by waved snap ring.

(11) Check clutch pack clearance with feeler gauge (Fig. 65). Clearance between waved spring and pressure plate should 1.78 - 3.28 mm (0.070 - 0.129 in.). If clearance is incorrect, clutch plates, clutch discs, snap ring and pressure plate will have to be changed. Clutch pack waved snap ring is not select fit.

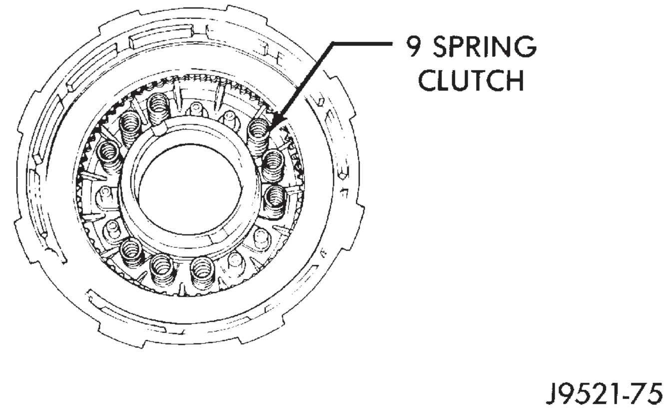

Fig. 64 Front Clutch Spring Position

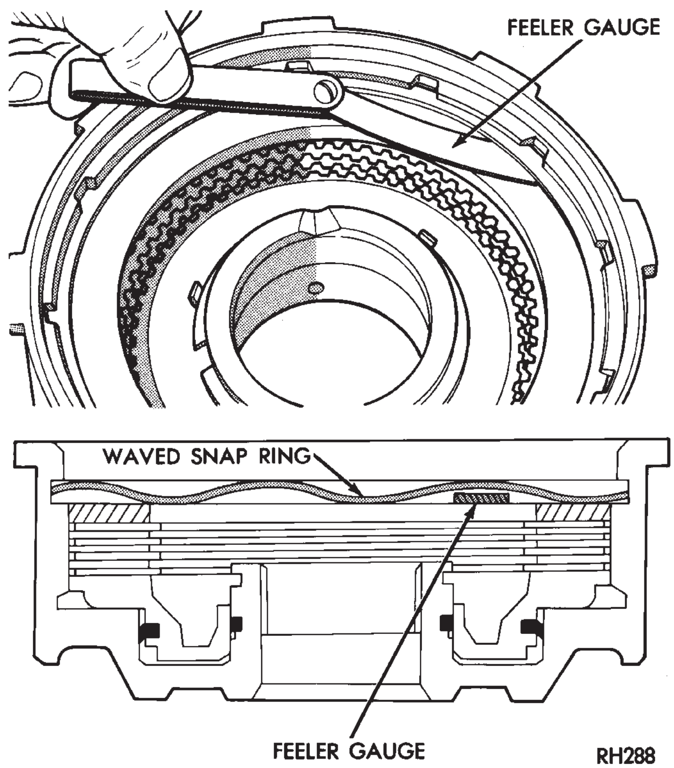

Fig. 65 Typical Method Of Measuring Front Clutch Pack Clearance

REAR CLUTCH OVERHAUL

REAR CLUTCH DISASSEMBLY (FIG. 66)

(1) Remove clutch pack select fit snap ring.

(2) Remove reaction plate and remove clutch plates and discs.

(3) Remove pressure plate, wave spring, spacer ring and piston spring from clutch retainer.

(4) Remove clutch piston from piston retainer with a twisting motion.

(5) Remove input shaft thrust washer, if washer remained in piston retainer hub during removal.

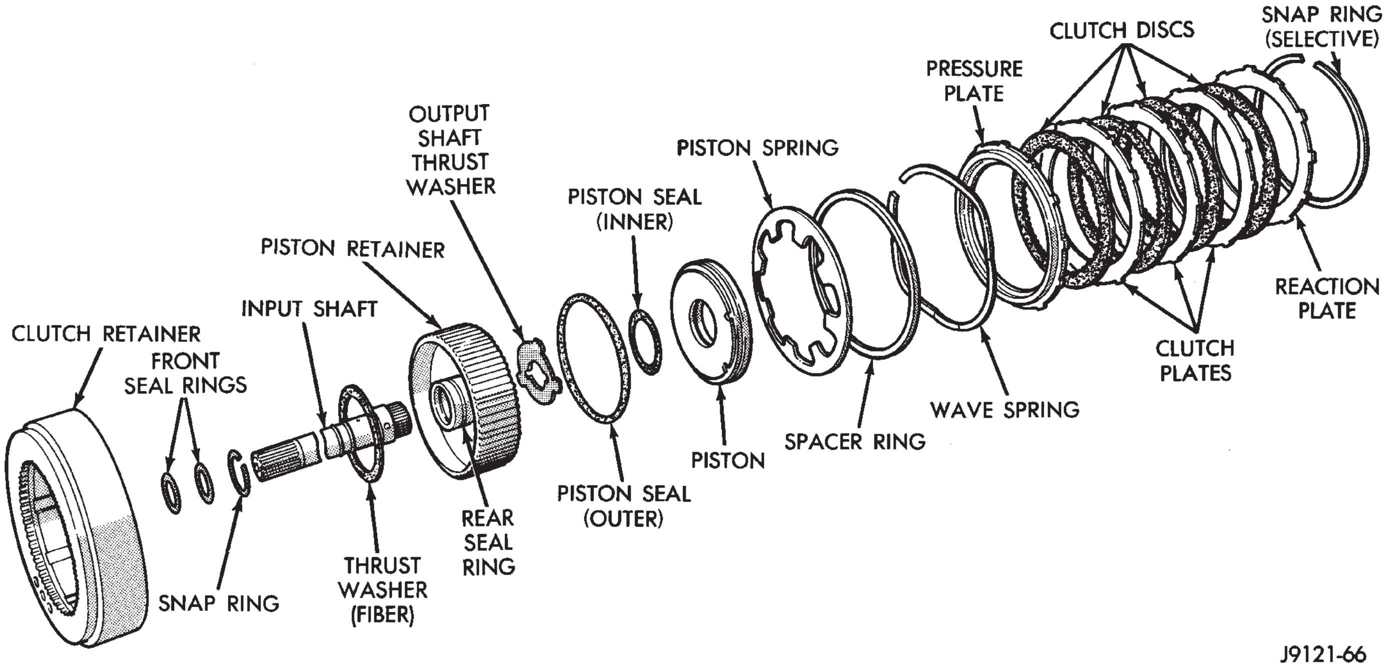

Fig. 66 Rear Clutch Components

(6) Remove seals from clutch piston. Discard seals after removal.

REAR CLUTCH INSPECTION

Clean the clutch components with solvent and dry them with compressed air.

Check condition of the input shaft seal rings. It is not necessary to remove or replace rings unless they are broken, cracked, or no longer securely hooked together.

Inspect the input shaft splines and machined surfaces. Very minor nicks or scratches can be smoothed off with crocus cloth. replace the shaft if the splines are damaged, or any of the machined surfaces are severely scored.

Replace the clutch discs if warped, worn, scored, burned/charred, the lugs are damaged, or if the facing is flaking off.

Replace the steel plates and the pressure plate if heavily scored, warped, or broken. Be sure the driving lugs on the discs and plates are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston spring and wave spring if either part is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The steel plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged. Also check action of the retainer check ball. The ball must move freely and not stick.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously damaged.

Check thrust washer condition. Washer thickness should be 1.55 to 1.60 mm (0.061 to 0.063 in.). Replace the washer if worn or damaged.

Check condition of the two seal rings on the input shaft and the single seal ring on the piston retainer hub. Replace the seal rings only if severely worn, cracked, or if they can no longer be hooked together.

INPUT SHAFT REPLACEMENT

If the input shaft must be replaced, first remove the retaining ring that secures the shaft in the piston retainer hub. Then press the old shaft out of the retainer with a shop press.

Lubricate the splines of the new shaft with petroleum jelly or ATF Plus. Then align the shaft in the piston retainer and carefully press it into place. Do not allow the shaft to become cocked during installation. The retainer can be cracked if misalignment occurs.

Install the shaft retaining ring after pressing the shaft into place. Be sure the ring is fully seated before proceeding with clutch assembly.

REAR CLUTCH ASSEMBLY

(1) Soak clutch discs in transmission fluid before assembly.

(2) Install new seals on clutch piston. Lubricate piston seals with Mopar Door Ease, or Ru-Glyde to ease installation. **Be sure seal lips face input shaft.**

(3) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.020″ thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(4) Assemble piston retainer and clutch retainer.

(5) Support clutch retainer with wood blocks, or insert input shaft through predrilled hole in workbench. Clutch pack components are easier to install if retainers are properly supported.

(6) Install piston spring in clutch retainer. Concave side of spring faces upward and away from clutch piston.

(7) Install spacer ring on top of piston spring.

(8) Install wave spring on top of spacer ring. Then seat wave spring in retainer groove. **If wave spring will not seat properly, spacer ring has probably shifted over and into wave spring groove in retainer. Use small screwdriver to realign spacer ring if necessary.**

(9) Install inner pressure plate in clutch retainer.

(10) Install first clutch disc followed by steel plate until all discs and plates are installed. Four clutch discs and steel plates are required (Fig. 66).

(11) Install reaction plate on top of last clutch disc.

(12) Install selective snap ring to secure clutch pack in retainer.

(13) Install new seal rings on input shaft if necessary (Fig. 67). Be very sure ring ends are all securely hooked together before proceeding.

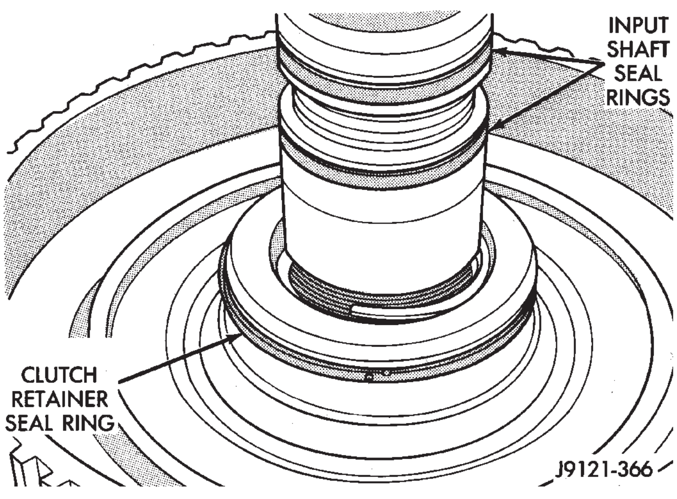

Fig. 67 Input Shaft Seal Ring Locations

(14) Check clutch pack clearance with feeler gauge (Fig. 68). Clearance should be 0.63 to 1.14 mm (0.025 to 0.045 in.).

(15) If clutch pack clearance is incorrect, clutch pack snap ring, may have to be replaced.

(16) Install thrust washer on piston retainer hub (Fig. 66). Use petroleum jelly to hold thrust washer in place.

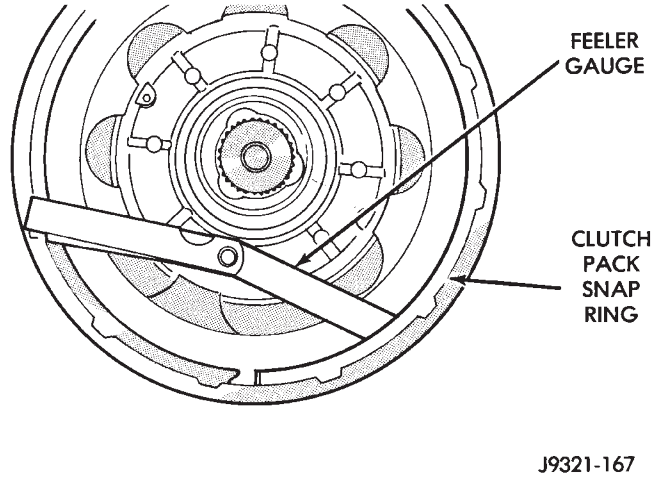

Fig. 68 Measuring Rear Clutch Pack Clearance

PLANETARY GEARTRAIN OVERHAUL

PLANETARY GEARTRAIN DISASSEMBLY

(1) Remove planetary snap ring from intermediate shaft (Fig. 69). Discard snap ring as it is not reusable.

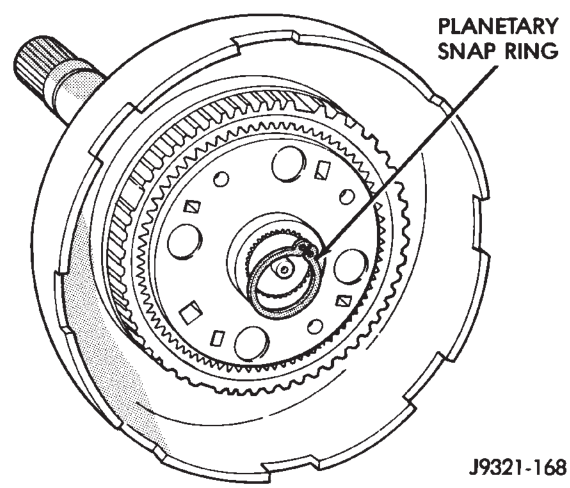

Fig. 69 Planetary Snap Ring Removal

(2) Remove front planetary gear and front annulus gear as assembly (Fig. 70).

(3) Remove front planetary gear and thrust washer from front annulus gear (Fig. 71). Note thrust washer position for assembly reference.

(4) Remove tabbed thrust washer from driving shell (Fig. 72). Note washer position for assembly reference.

(5) Remove sun gear and driving shell as assembly (Fig. 73).

(6) Remove tabbed thrust washer from rear planetary gear (Fig. 74). Note washer position on gear for assembly reference.

(7) Remove rear planetary gear and rear annulus gear from intermediate shaft (Fig. 75).

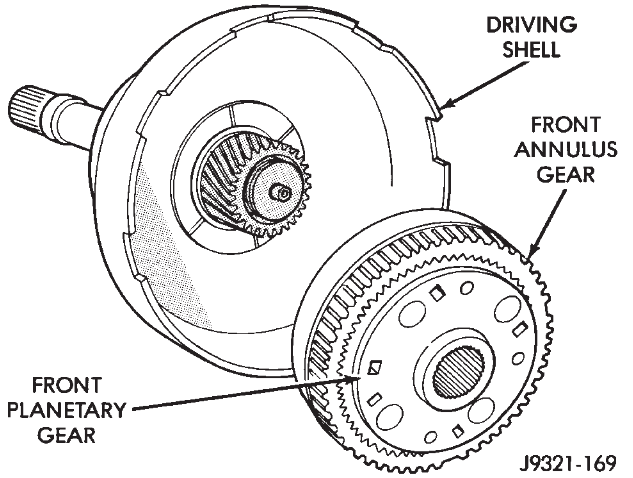

Fig. 70 Front Planetary And Annulus Gear Removal

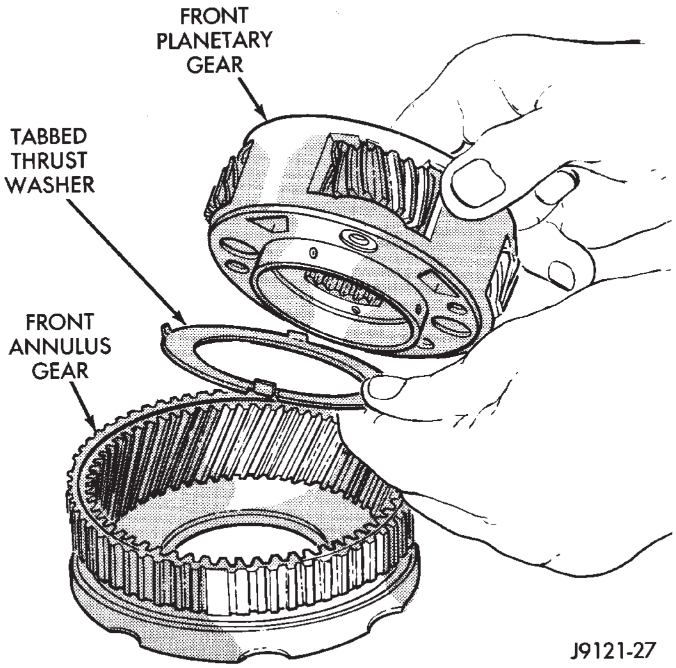

Fig. 71 Disassembling Front Planetary And Annulus Gears

(8) Remove thrust plate from rear annulus gear (Fig. 76).

PLANETARY GEARTRAIN CLEANING AND INSPECTION

Clean the intermediate shaft and planetary components (Fig. 77) in solvent and dry them with compressed air.

Inspect the planetary gear sets and annulus gears. The planetary pinions, shafts, washers, and retaining pins are serviceable. However, if a pinion carrier is damaged, the entire planetary gear set must be replaced as an assembly.

Replace the annulus gears if the teeth are chipped, broken, or worn, or the gear is cracked. Replace the planetary thrust plates and the tabbed thrust washers if cracked, scored or worn.

Inspect the machined surfaces of the intermediate shaft. Be sure the oil passages are open and clear. Replace the shaft if scored, pitted, or damaged.

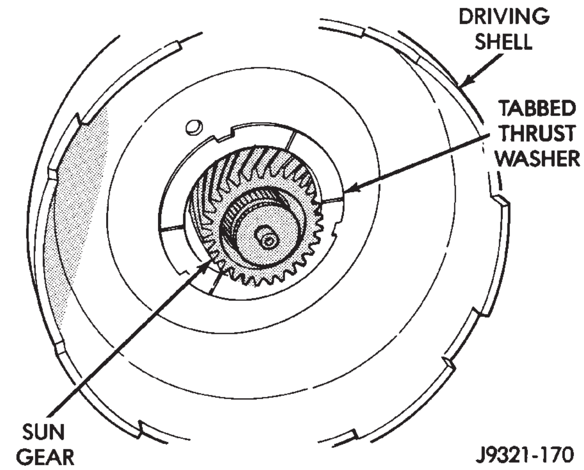

Fig. 72 Driving Shell Thrust Washer Removal

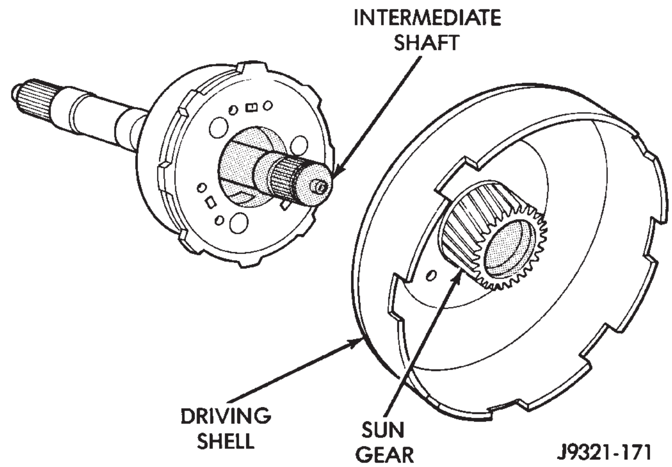

Fig. 73 Sun Gear And Driving Shell Assembly Removal

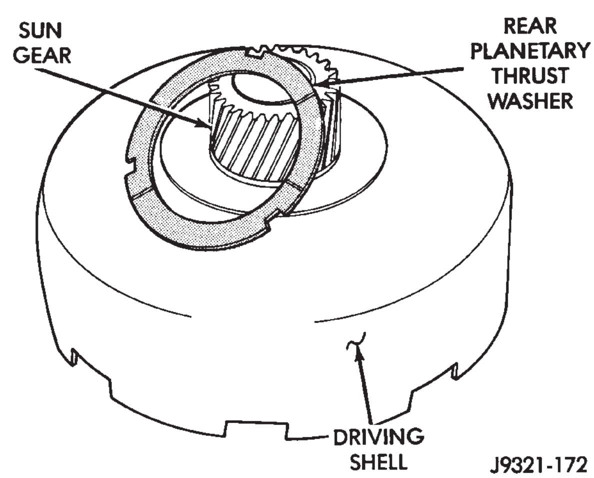

Fig. 74 Rear Planetary Thrust Washer Removal

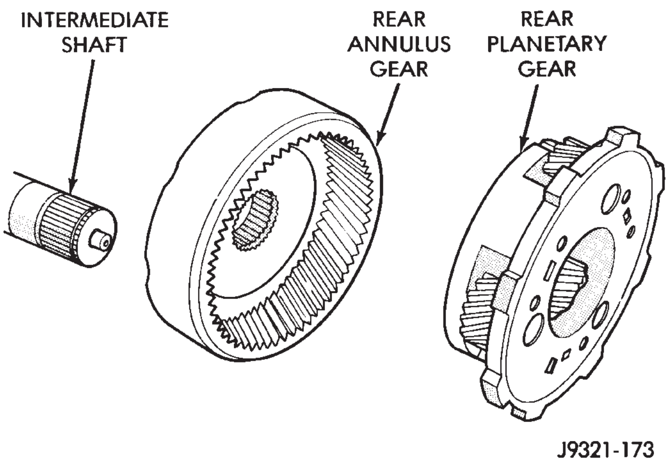

Fig. 75 Rear Planetary And Annulus Gear Removal

Inspect the sun gear and driving shell (Fig. 77). If either component is worn or damaged, remove the sun gear rear retaining ring and separate the sun gear and thrust plate from the driving shell. Then replace the necessary component.

Replace the sun gear as an assembly if the gear teeth are chipped or worn. Also replace the gear as an assembly if the bushings are scored or worn. The sun gear bushings are not serviceable. Replace the thrust plate if worn, or severely scored. Replace the driving shell if distorted, cracked, or damaged in any way.

Replace all snap rings during geartrain assembly. Reusing snap rings is not recommended.

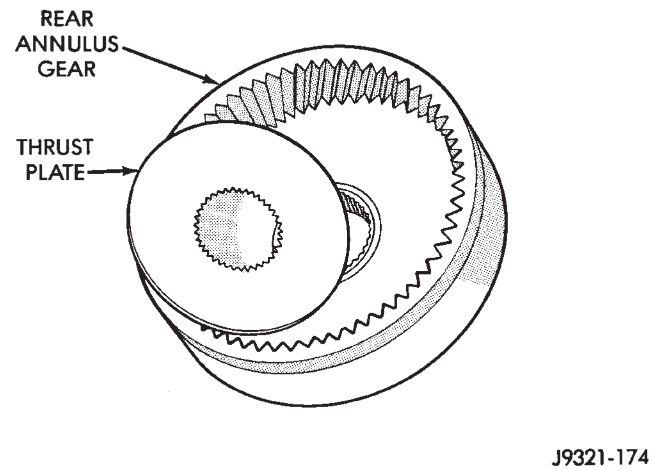

Fig. 76 Rear Annulus Thrust Plate Removal

PLANETARY GEARTRAIN ASSEMBLY AND ADJUSTMENT

(1) Lubricate sun gear and planetary gears with transmission fluid during assembly. Use petroleum jelly to lubricate intermediate shaft bushing surfaces, thrust washers and thrust plates and to hold these parts in place during assembly.

(2) Install front snap ring on sun gear and install gear in driving shell. Then install thrust plate over sun gear and against rear side of driving shell (Fig. 78). Install rear snap ring to secure sun gear and thrust plate in driving shell.

(3) Install rear annulus gear on intermediate shaft (Fig. 79).

(4) Install thrust plate in annulus gear (Fig. 80). Be sure plate is seated on shaft splines and against gear.

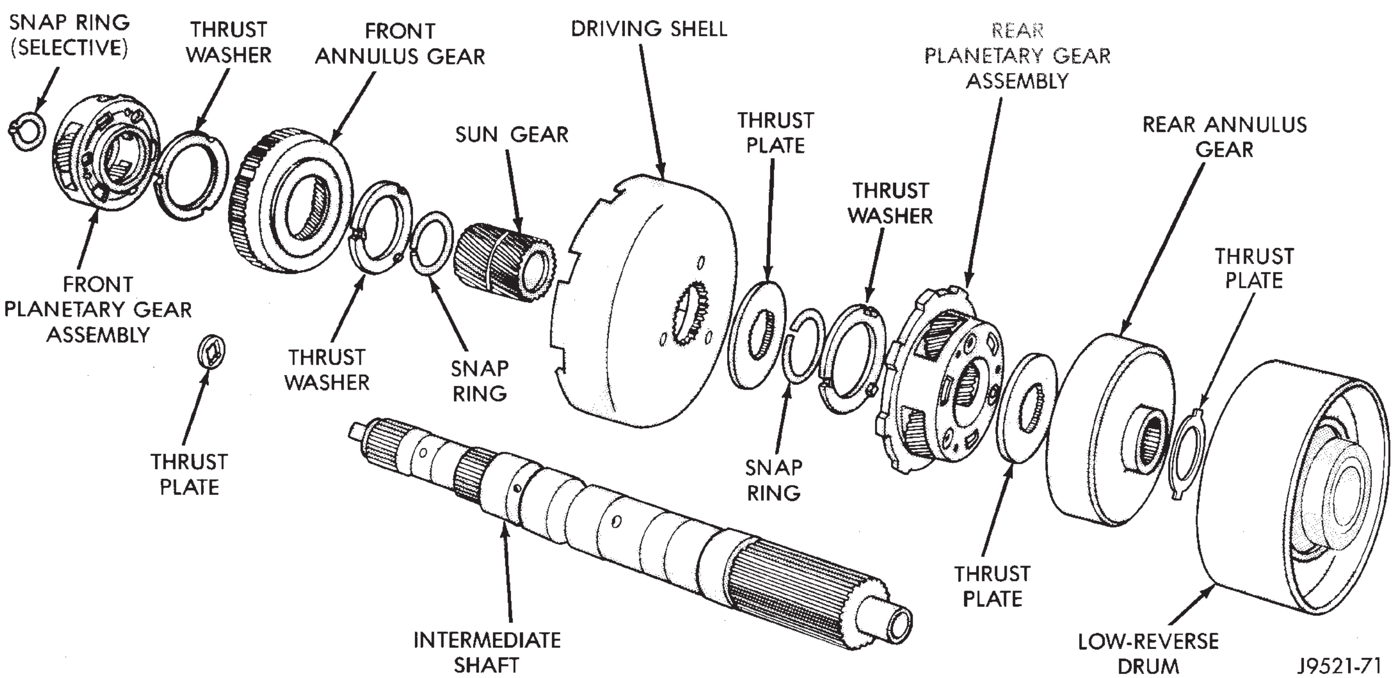

Fig. 77 Planetary Geartrain Components

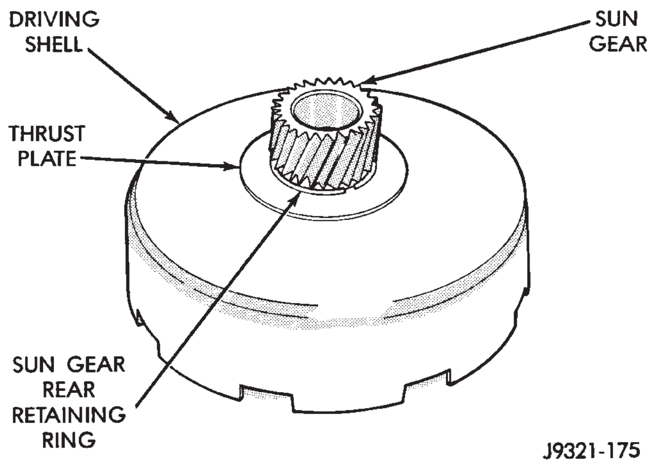

Fig. 78 Sun Gear Installation

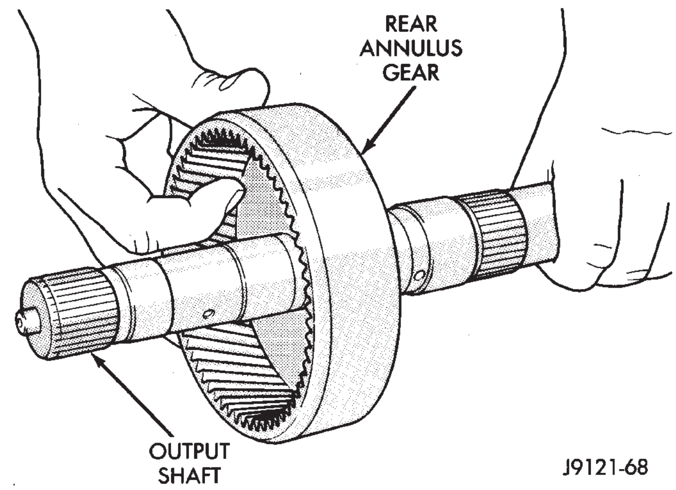

Fig. 79 Rear Annulus Installation On Intermediate Shaft

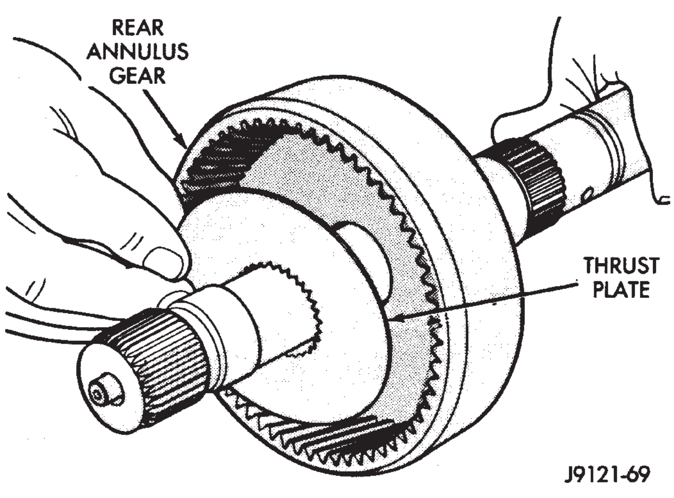

Fig. 80 Rear Annulus Thrust Plate Installation

(5) Install rear planetary gear in rear annulus gear (Fig. 81). Be sure planetary carrier is seated against annulus gear.

(6) Install tabbed thrust washer on front face of rear planetary gear (Fig. 82). Seat washer tabs in matching slots in face of gear carrier. Use extra petroleum jelly to hold washer in place if desired.

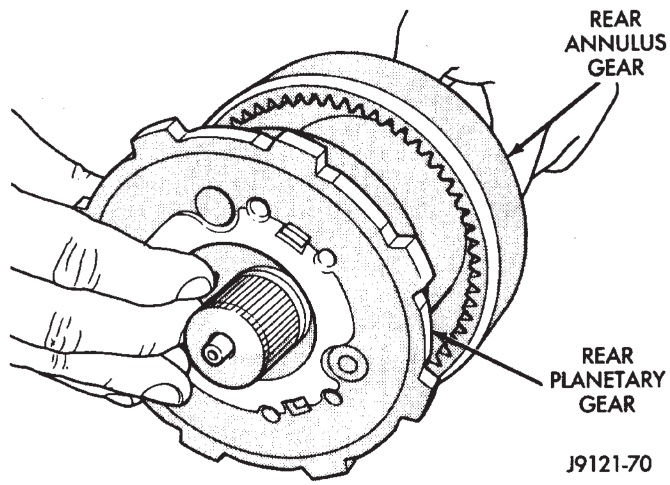

Fig. 81 Rear Planetary Gear Installation

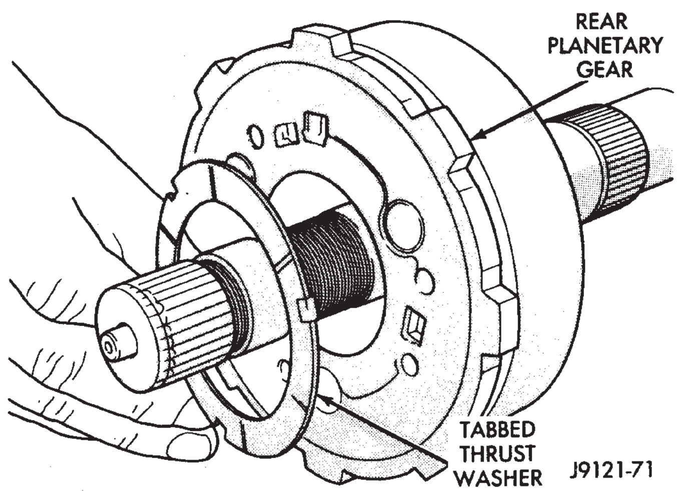

Fig. 82 Rear Planetary Thrust Washer Installation

(7) Lubricate sun gear bushings with petroleum jelly or transmission fluid.

(8) Install sun gear and driving shell on intermediate shaft (Fig. 83). Seat shell against rear planetary gear. Verify that thrust washer on planetary gear was not displaced during installation.

(9) Install tabbed thrust washer in driving shell (Fig. 84). be sure washer tabs are seated in tab slots of driving shell. Use extra petroleum jelly to hold washer in place if desired.

(10) Install tabbed thrust washer on front planetary gear (Fig. 85). Seat washer tabs in matching slots in face of gear carrier. Use extra petroleum jelly to hold washer in place if desired.

(11) Install front annulus gear over and onto front planetary gear (Fig. 86). Be sure gears are fully meshed and seated.

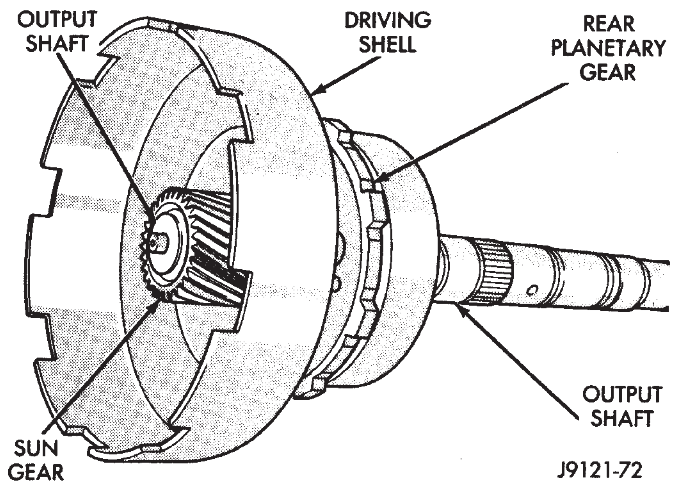

Fig. 83 Sun Gear And Driving Shell Installation

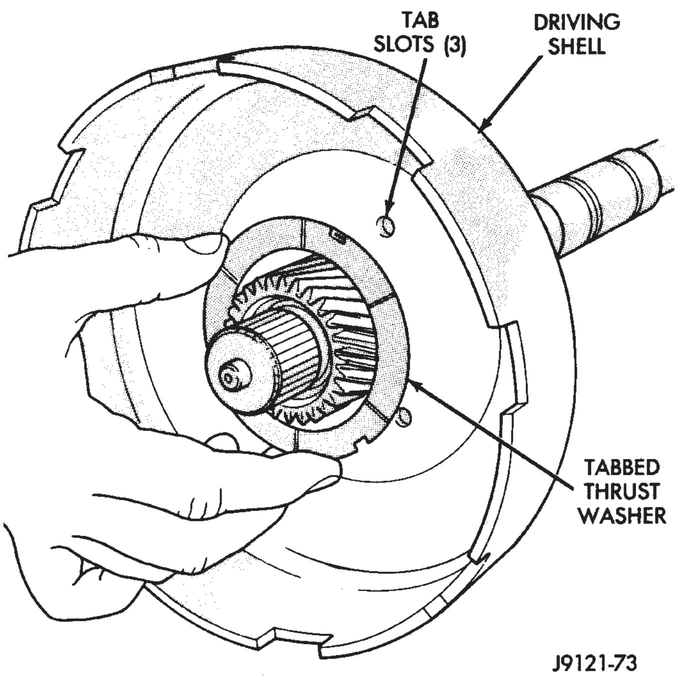

Fig. 84 Driving Shell Thrust Washer Installation

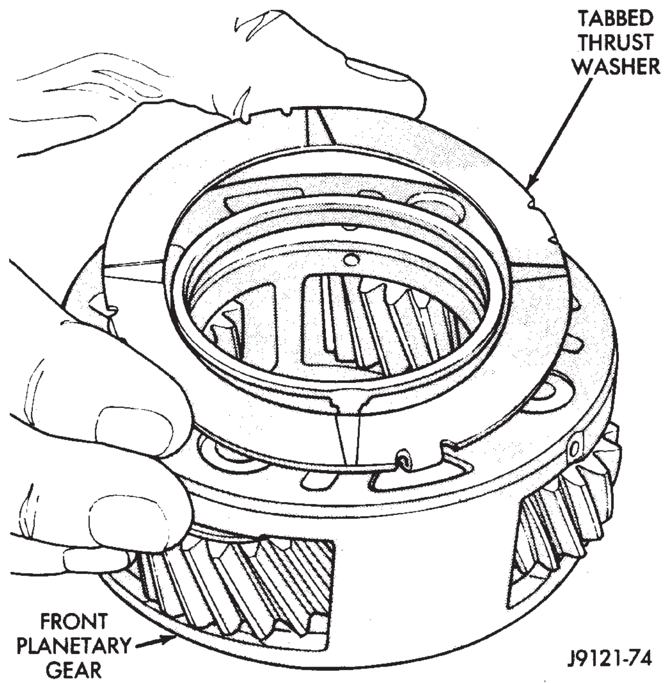

Fig. 85 Installing Thrust Washer On Front Planetary Gear

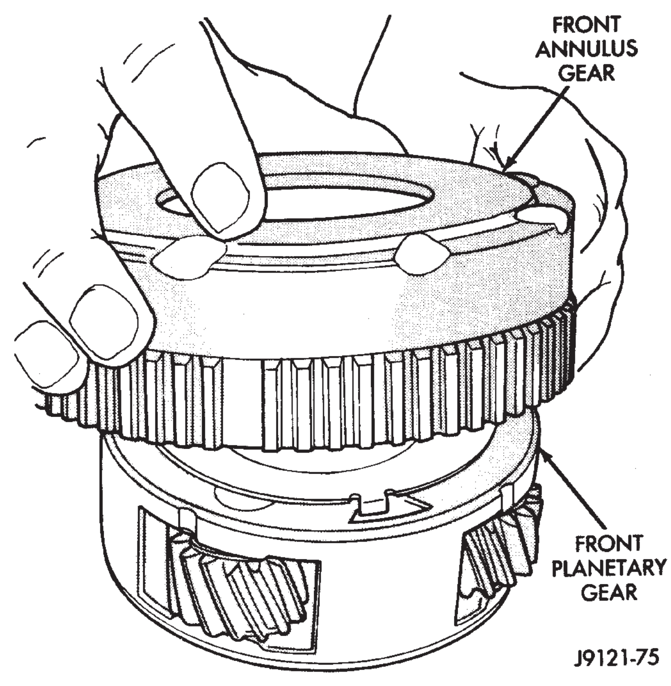

Fig. 86 Assembling Front Planetary And Annulus Gears

(12) Install front planetary and annulus gear assembly (Fig. 87). Hold gears together and slide them onto shaft. Be sure planetary pinions are seated on sun gear and that planetary carrier is seated on intermediate shaft.

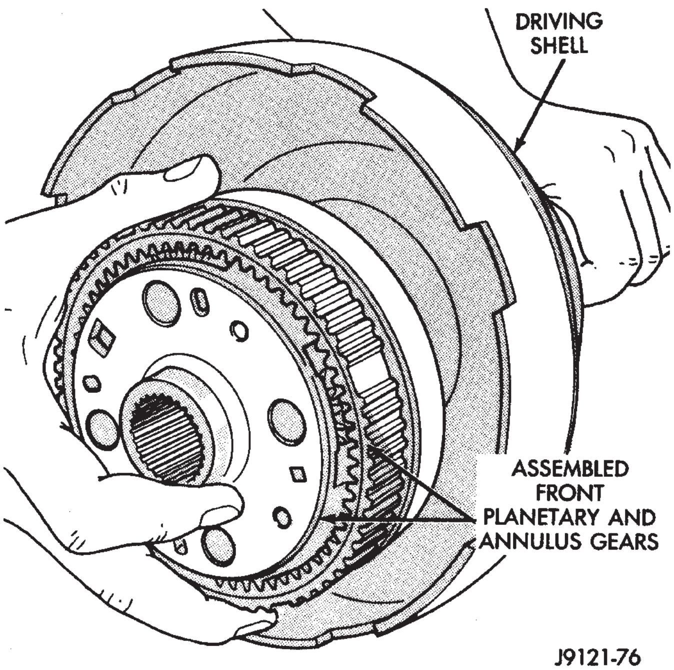

Fig. 87 Front Planetary And Annulus Gear Installation

(13) Place geartrain in upright position. Rotate gears to be sure all components are seated and properly assembled. Snap ring groove at forward end of intermediate shaft will be completely exposed when components are assembled correctly.

(14) Install new planetary snap ring in groove at end of intermediate shaft (Fig. 88).

(15) Turn planetary geartrain over. Position wood block under front end of intermediate shaft and support geartrain on shaft. Be sure all geartrain parts have moved forward against planetary snap ring. This is important for accurate end play check.

(16) Check planetary geartrain end play with feeler gauge (Fig. 89). Insert gauge between rear annulus gear and shoulder on intermediate shaft as shown. End play should be 0.15 to 1.22 mm (0.006 to 0.048 in.).

(17) If end play is incorrect, install thinner/thicker planetary snap ring as needed.

VALVE BODY SERVICE AND ADJUSTMENT

VALVE BODY MAIN COMPONENT DISASSEMBLY

CAUTION: Do not clamp any valve body component in a vise. This practice can damage the component resulting in unsatisfactory operation after assembly

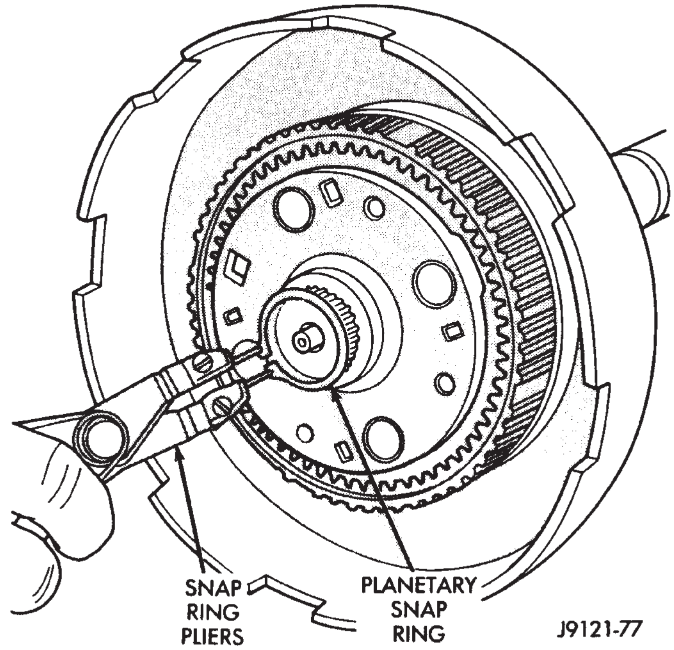

Fig. 88 Planetary Snap Ring Installation

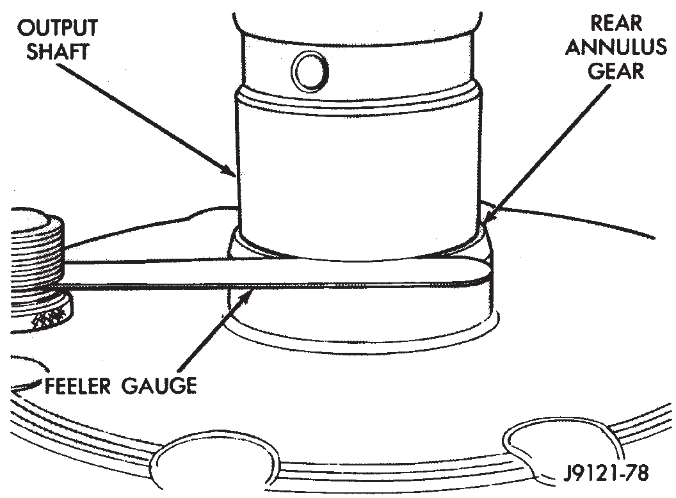

Fig. 89 Checking Planetary Geartrain End Play

and installation. Remove valves, plugs and springs with a pencil magnet. Do not use pliers to remove any of the valves, plugs or springs and do not force any of the components out or into place. The valves and valve body housings will be damaged if force is used. Tag or mark the valve body springs for reference as they are removed. Do not allow them to become intermixed.

(1) Remove boost valve cover (Fig. 90).

(2) Remove boost valve retainer, valve spring and boost valve (Fig. 91).

(3) Secure detent ball and spring with Retainer Tool 6583 (Fig. 92).

(4) Remove E-clip that secures throttle lever in manual lever (Fig. 93).

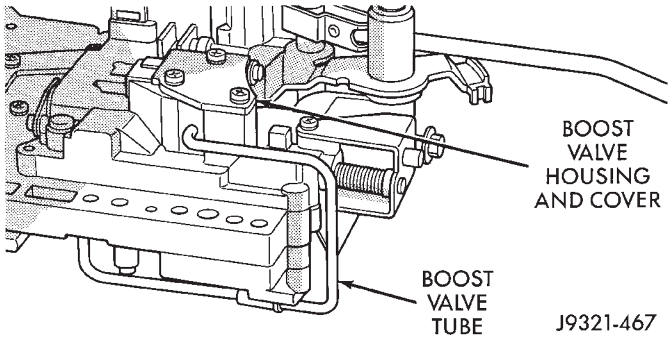

Fig. 90 Boost Valve Cover Location

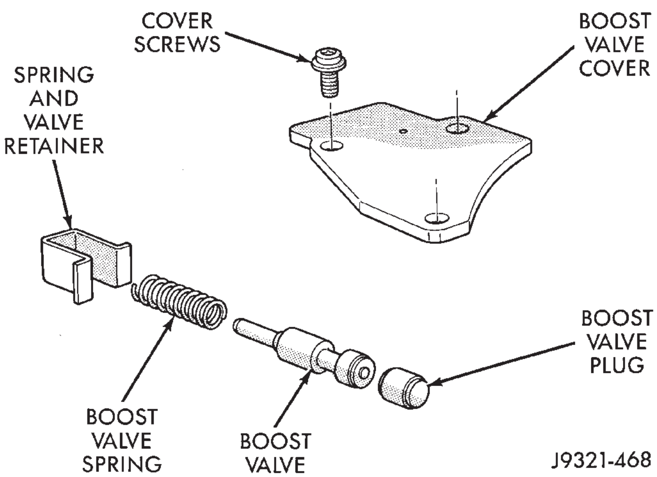

Fig. 91 Boost Valve Components

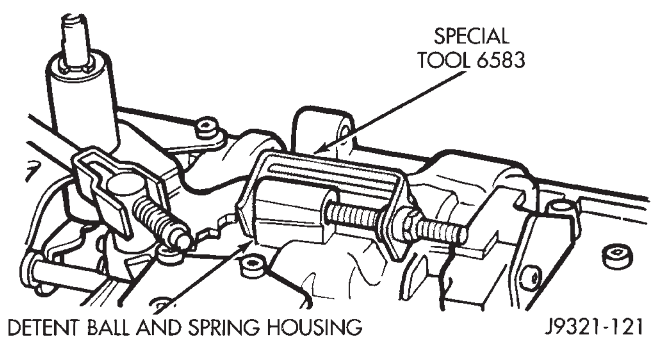

Fig. 92 Securing Detent Ball And Spring

(5) Lift and rotate manual lever far enough to clear detent housing.

(6) Remove retaining tool and remove detent ball and spring (Fig. 94).

(7) Remove washer at top of manual lever shaft. Then lift manual lever and park rod assembly upward and out of valve body (Fig. 95).

(8) Remove throttle lever from valve body housing (Fig. 96).

(9) Remove park rod E-clip and separate rod from manual lever (Fig. 97).

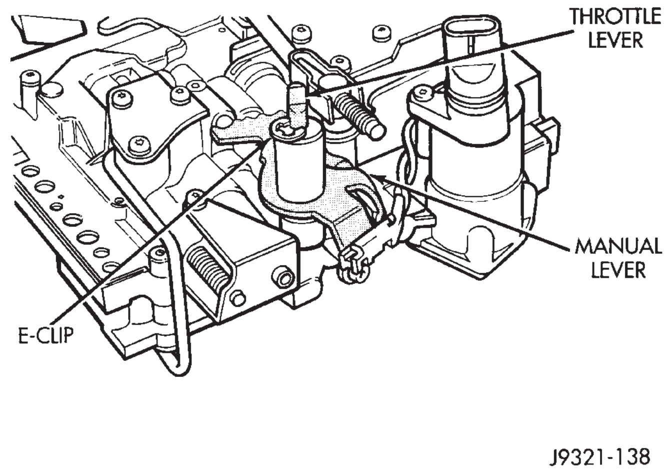

Fig. 93 Removing Throttle Lever E-Clip

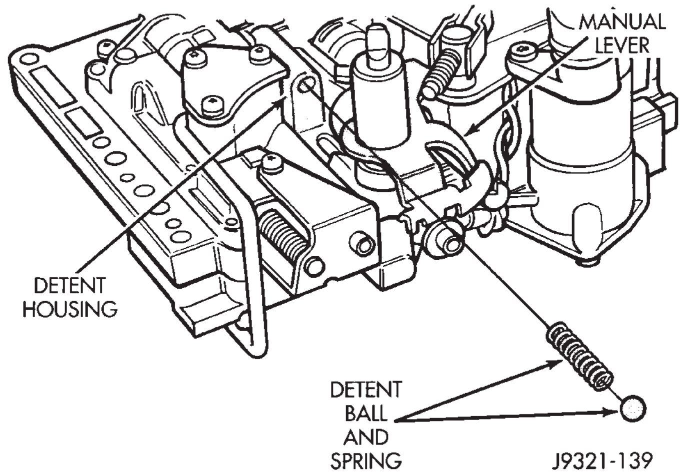

Fig. 94 Detent Ball And Spring Removal

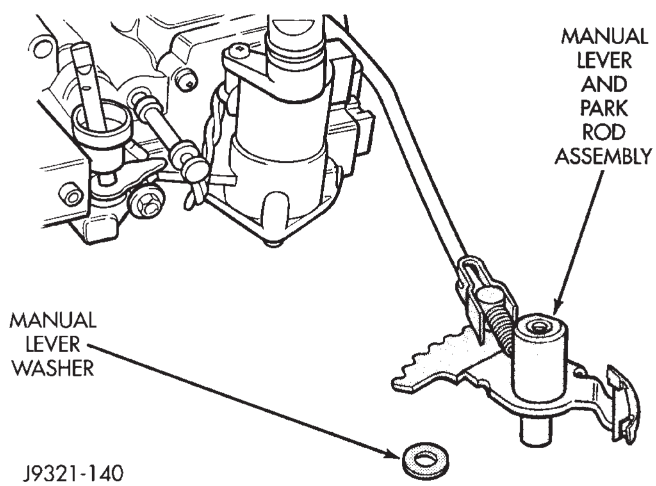

Fig. 95 Manual Lever Removal

(10) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate. Hold bracket firmly against spring tension while removing last screw.

(11) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator spring and switch

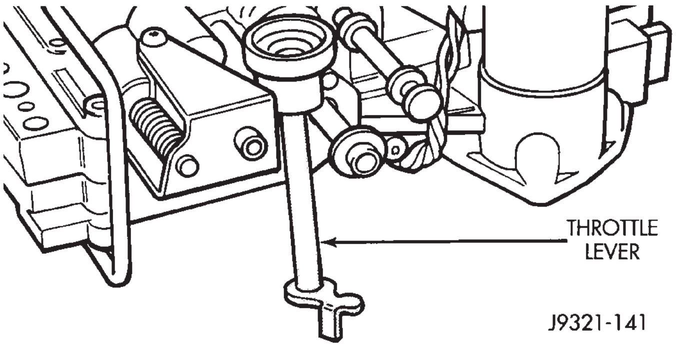

Fig. 96 Throttle Lever Removal

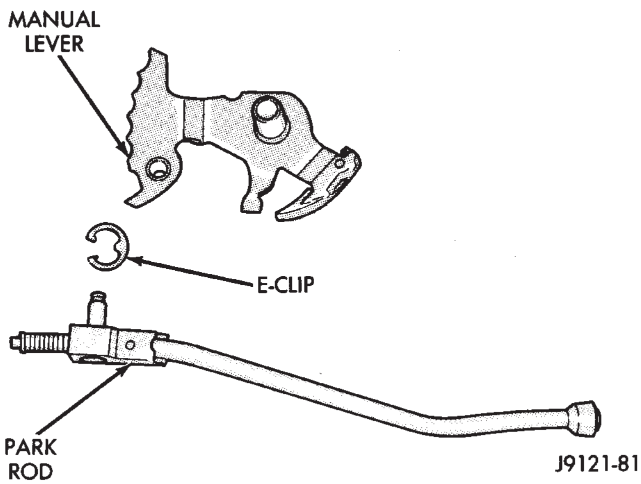

Fig. 97 Park Rod Removal

valve spring (Fig. 98). **Do not remove throttle pressure adjusting screw from bracket and do not disturb adjusting screw settings during removal.**

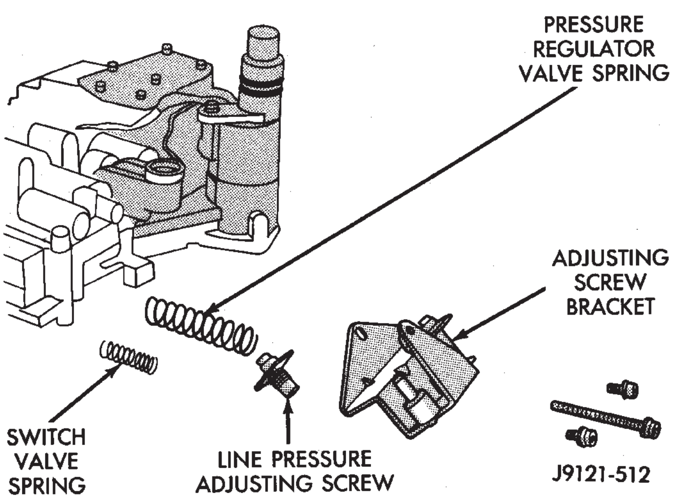

Fig. 98 Adjusting Screw Bracket And Spring Removal

(12) Remove solenoid connector from 3-4 accumulator housing (Fig. 99). **Note that connector is attached to housing with shoulder-type screw. Keep this screw with accumulator housing to avoid losing it.**

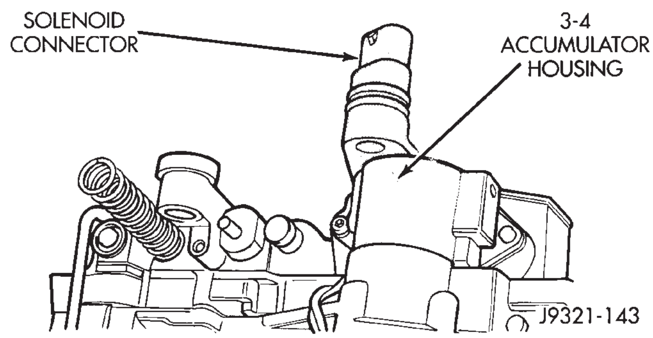

Fig. 99 Solenoid Connector Position

(13) Note routing of solenoid wires for assembly reference (Fig. 100).

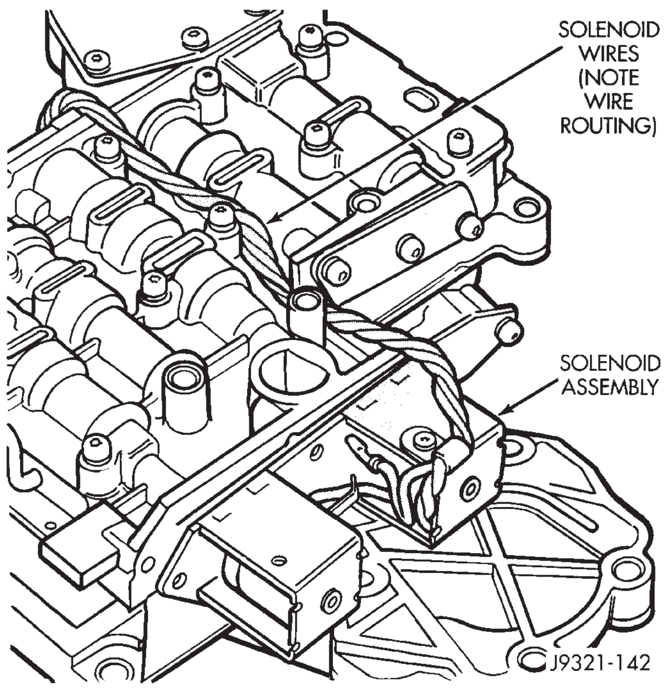

Fig. 100 Solenoid Wire Routing

(14) Remove screws attaching solenoid assembly to valve body lower housing and remove solenoid and connector assembly (Fig. 101).

(15) Remove 3-4 accumulator housing attaching screws and remove housing from valve body (Fig. 102).

(16) Remove following parts from valve body lower housing: 3-4 shift valve and spring; pressure regulator valve spring; clutch valve; clutch valve spring; and clutch valve plug (Fig. 103).

(17) Bend back tabs on boost valve tube brace (Fig. 104).

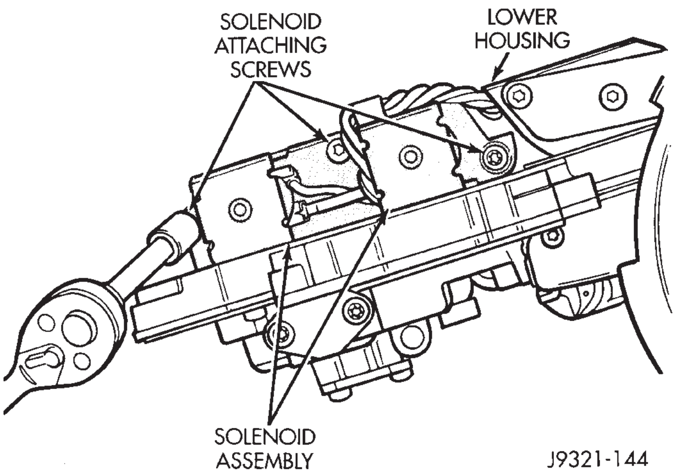

Fig. 101 Solenoid Assembly Removal

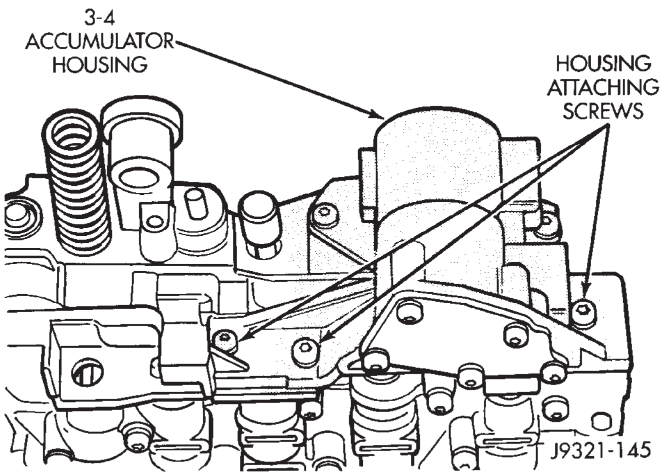

Fig. 102 Removing 3-4 Accumulator Housing

(18) Remove boost valve connecting tube (Fig. 105). Disengage tube from upper housing port first. Then rock opposite end of tube back and forth to work it out of lower housing.

CAUTION: Do not use tools to loosen or pry the connecting tube out of the valve body housings. Loosen and remove the tube by hand only.

(19) Turn valve body over so valve lower housing is facing upward. In this position, check balls in upper housing will remain in place and not fall out when lower housing and transfer plate are removed.

(20) Remove screws attaching valve body lower housing to upper housing and transfer plate. **Note position of boost valve tube brace for assembly reference.**

(21) Remove lower housing and overdrive separator plate from transfer plate (Fig. 106).

(22) Remove transfer plate from upper housing (Fig. 107).

(23) Turn transfer plate over so upper housing separator plate is facing upward (Fig. 108).

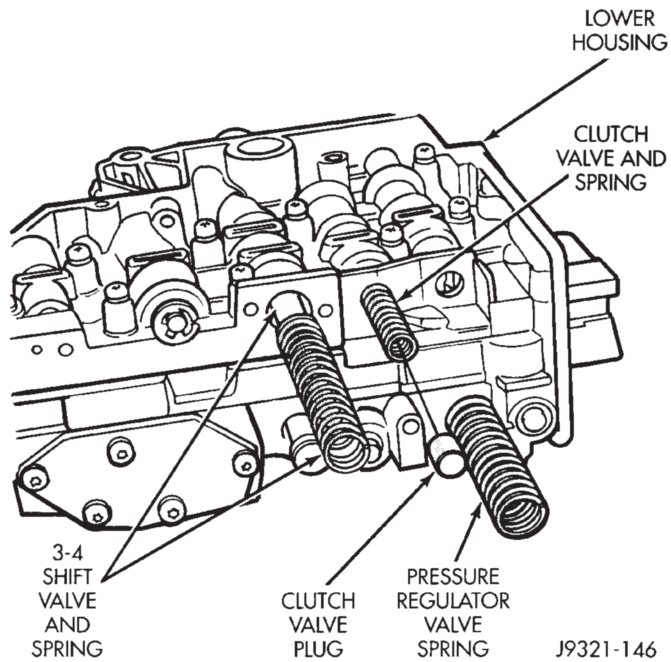

Fig. 103 Clutch Valve And 3-4 Shift Valve Locations

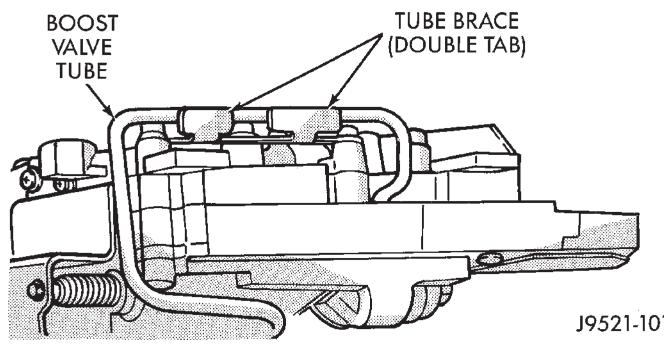

Fig. 104 Boost Valve Tube Brace (Double Tab Style)

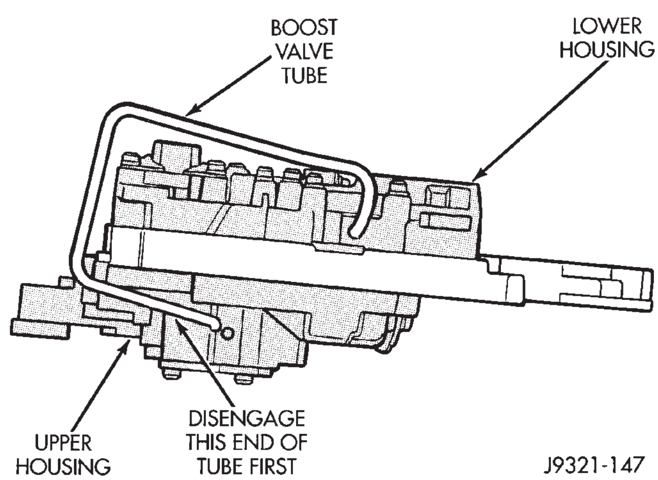

Fig. 105 Boost Valve Tube Removal

(24) Remove brace plate from lower housing separator plate and transfer plate (Fig. 108).

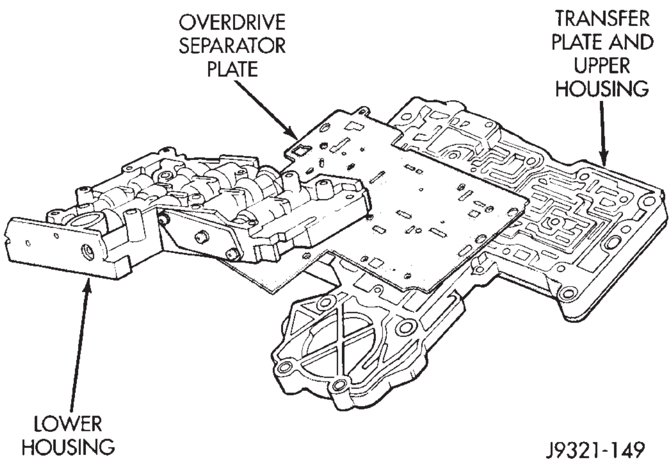

Fig. 106 Lower Housing Removal

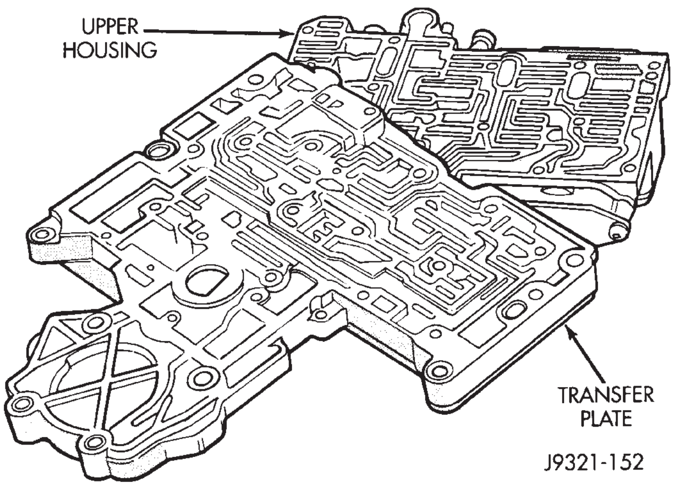

Fig. 107 Removing Transfer Plate From Upper Housing

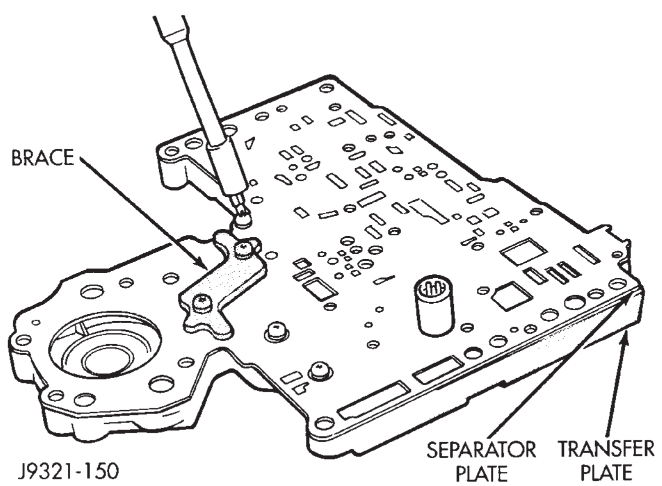

Fig. 108 Brace Plate Removal

(25) Remove upper housing separator plate from transfer plate (Fig. 109). Note position of filter in separator plate for assembly reference.

(26) Remove rear clutch and rear servo check balls from transfer plate. Note check ball locations for assembly reference before removing it (Fig. 110). Check ball will be plastic or steel depending on valve body production date.

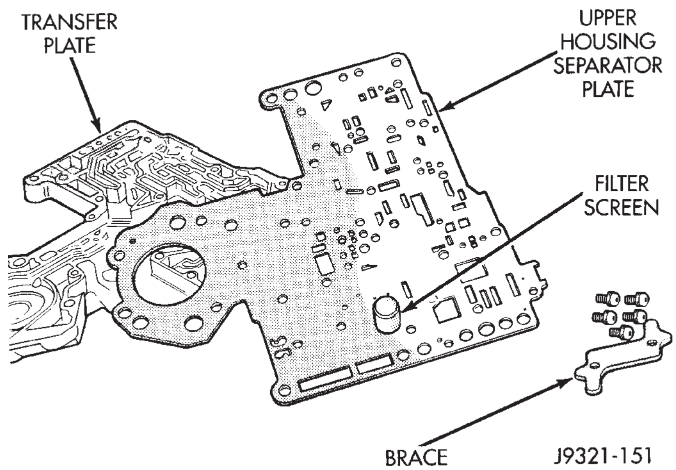

Fig. 109 Upper Housing Separator Plate Removal

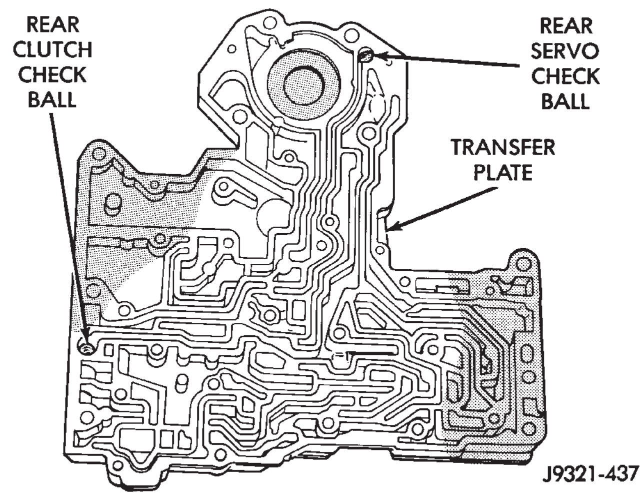

Fig. 110 Rear Clutch/Rear Servo Check Ball Locations

VALVE BODY UPPER HOUSING DISASSEMBLY

(1) Note location of check balls in valve body upper housing (Fig. 111). Then remove the one large and six smaller diameter check balls with magnet (total of 7 check balls are used).

(2) Remove E-clip that secure shuttle valve secondary spring on valve stem (Fig. 112).

(3) Remove governor plug and shuttle valve covers (Fig. 113).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 113).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 114).

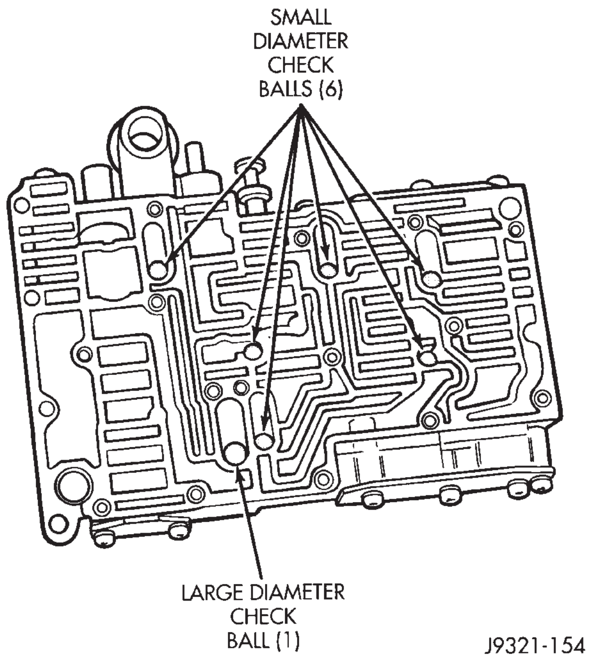

Fig. 111 Upper Housing Check Ball Locations

(7) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 114).

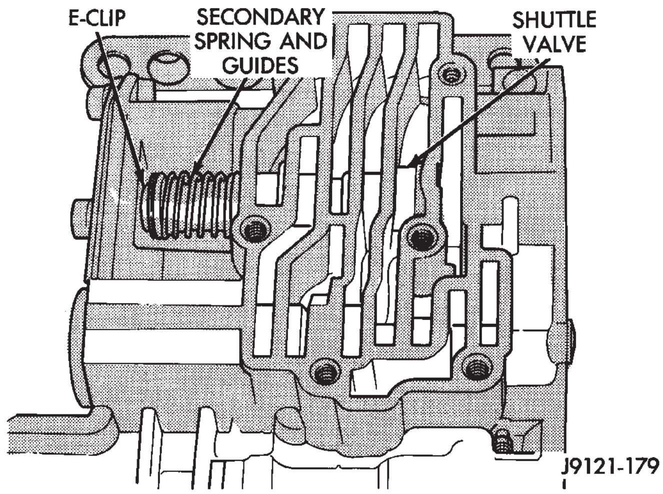

Fig. 112 Shuttle Valve E-Clip And Secondary Spring Location

(8) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 114). Also remove shuttle valve primary spring if not removed in prior step.

(9) Turn upper housing around and remove limit valve and shift valve covers (Fig. 115).

(10) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 115).

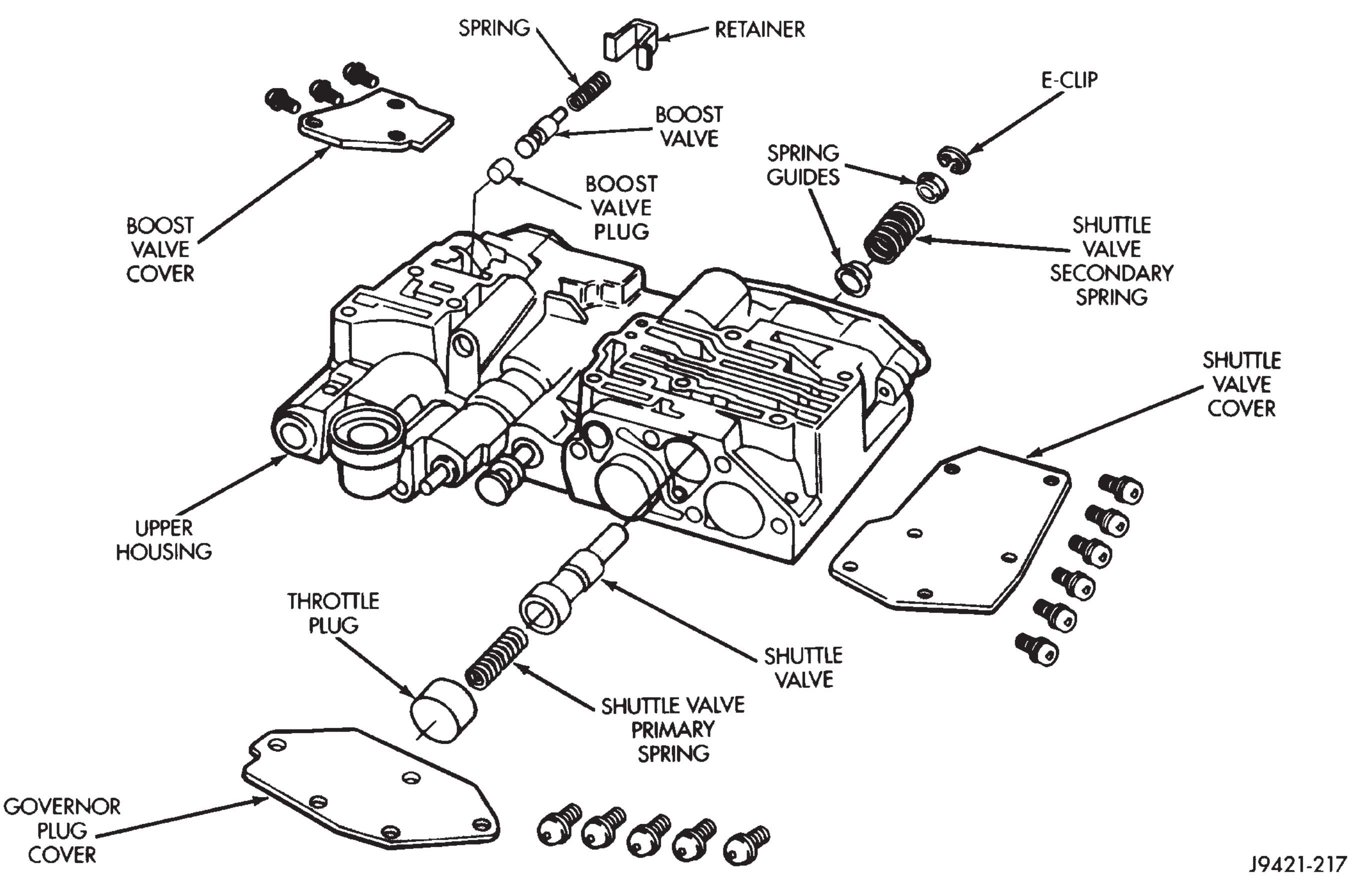

Fig. 113 Shuttle And Boost Valve Components

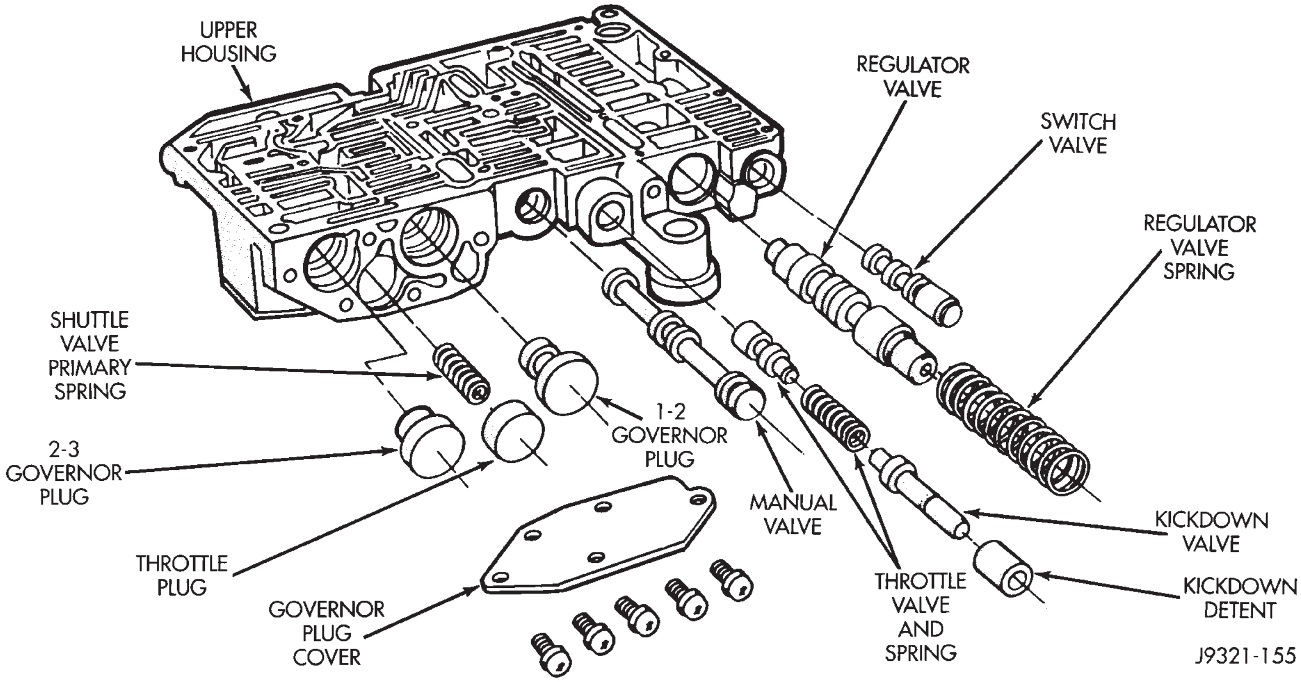

Fig. 114 Upper Housing Control Valve Locations

(11) Remove 1-2 shift control valve and spring (Fig. 115).

(12) Remove 1-2 shift valve and spring (Fig. 115).

(13) Remove 2-3 shift valve and spring from valve body (Fig. 115).

(14) Remove pressure plug cover (Fig. 115).

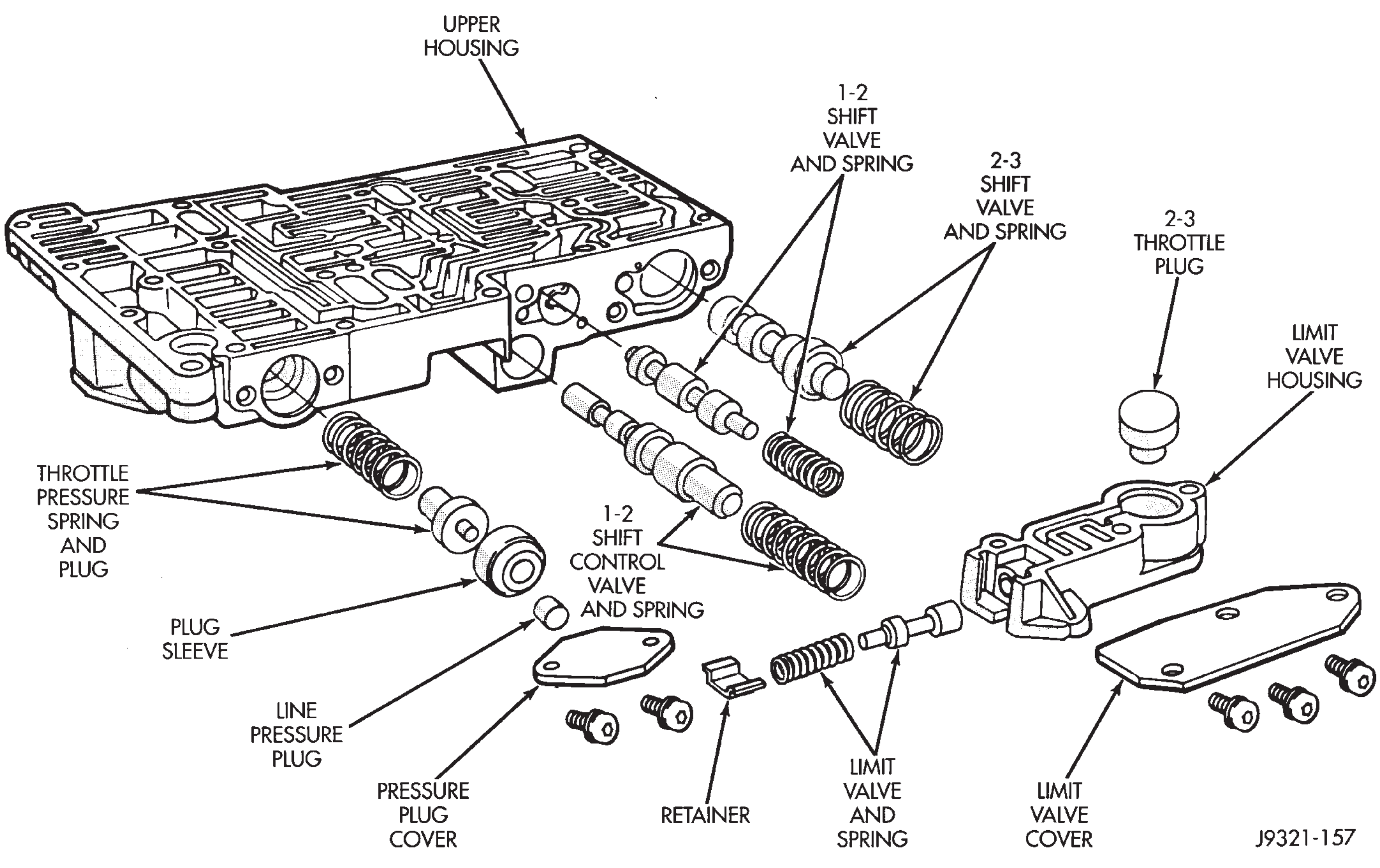

Fig. 115 Upper Housing Shift Valves And Pressure Plugs

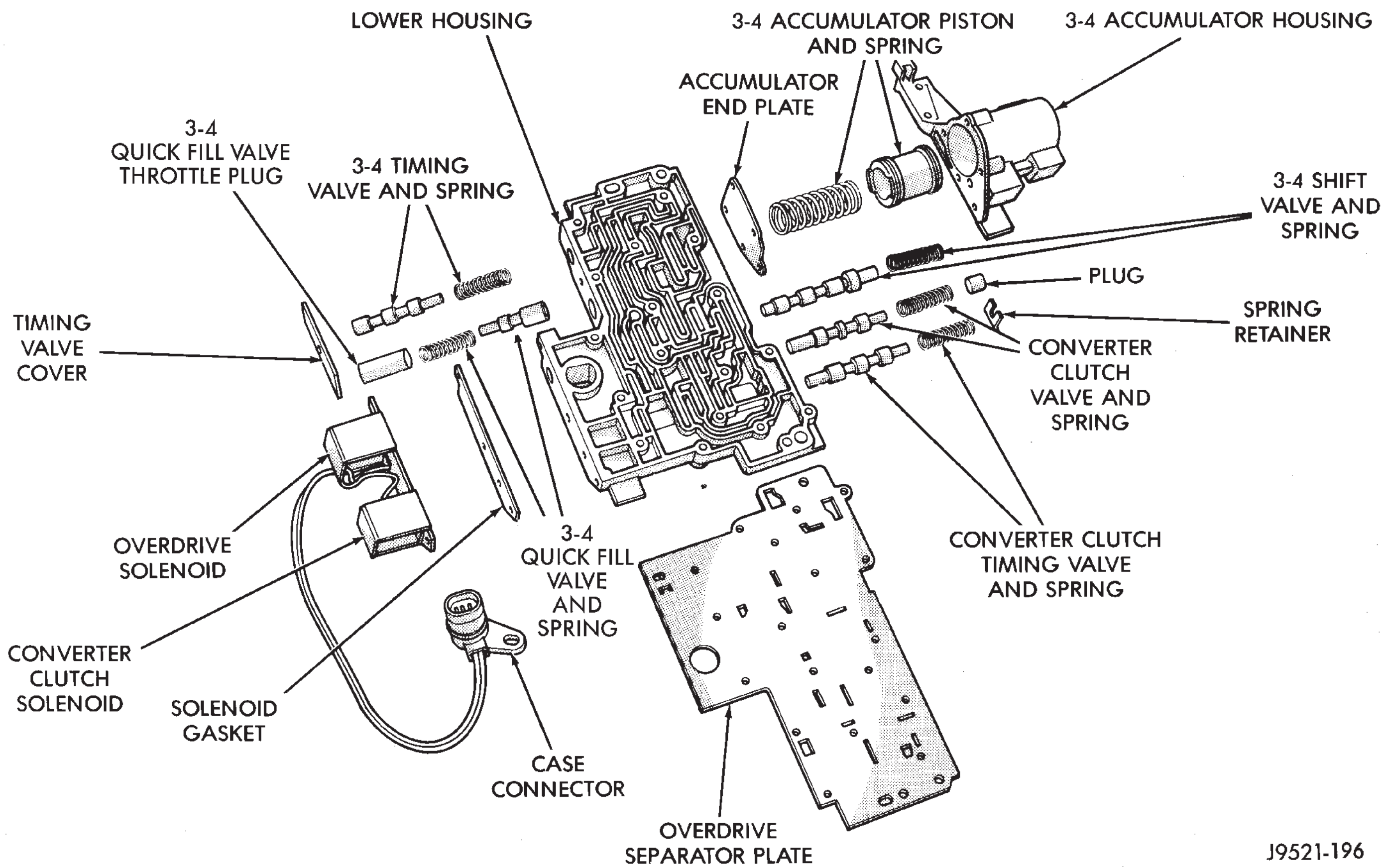

Fig. 116 Lower Housing Shift Valves And Springs

(15) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 115).

VALVE BODY LOWER HOUSING DISASSEMBLY (FIG. 116)

(1) Remove timing valve cover.

(2) Remove 3-4 timing valve and spring.

(3) Remove quick fill valve, spring, and plug.

(4) Remove 3-4 shift valve and spring.

(5) Remove converter clutch valve, spring and plug.

(6) Remove converter clutch timing valve, retainer and valve spring.

3-4 ACCUMULATOR HOUSING DISASSEMBLY (FIG. 117)

(1) Remove end plate from housing.

(2) Remove piston spring.

(3) Remove piston. Remove and discard piston seals.

VALVE BODY CLEANING AND INSPECTION

The only serviceable valve body components are:

- solenoid and connector assembly
- solenoid gasket
- park rod and E-clip
- switch valve and spring
- pressure adjusting screw bracket
- throttle valve lever
- manual lever
- manual shaft seal, washer, and E-clip
- fluid filter
- detent ball and spring

The remaining valve body components are serviced only as part of a complete valve body assembly.

Clean the valve body components with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Dry the parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials will stick to the valve body components. Lint will interfere with valve operation and may clog filters and fluid passages.**

Inspect the throttle and manual valve levers and shafts (Fig. 118). Do not attempt to straighten a bent shaft or correct a loose lever. Replace these components if worn, bent, loose or damaged in any way.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a

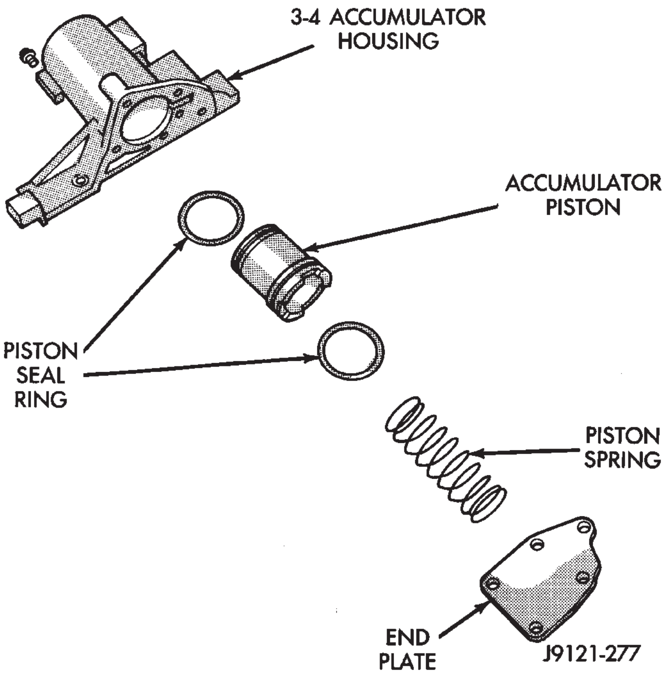

Fig. 117 3-4 Accumulator Housing Components

sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

CAUTION: Many of the valves and plugs, such as the throttle valve, shuttle valve plug, 1-2 shift valve and 1-2 governor plug, are made of coated aluminum. Aluminum components are identified by the dark color of the special coating applied to the surface (or by testing with a magnet). Do not sand aluminum valves or plugs with abrasive materials. This practice could damage the special coating and cause the valves and plugs to stick and bind.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves or plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Check the two separator plates for distortion or damage of any kind. Inspect the upper housing, lower housing, 3-4 accumulator housing, and transfer plate carefully. Be sure all fluid passages are clean and clear. Check condition of the upper housing and transfer plate check balls as well. The check balls and ball seats must not be worn or damaged.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

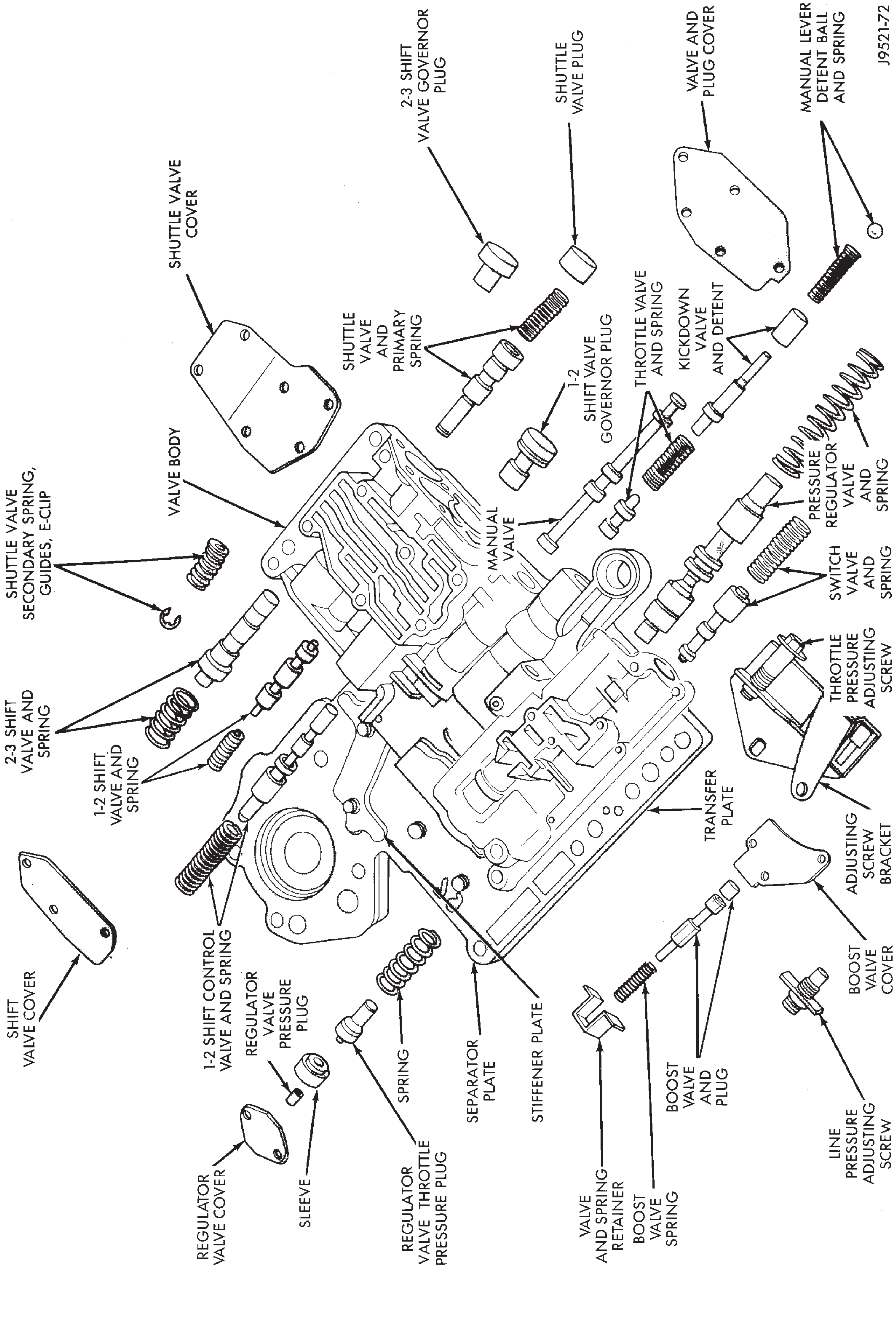

Fig. 118 Upper Housing Components

VALVE BODY REASSEMBLY

CAUTION: Do not force valves or plugs into place during reassembly. If the valve body bores, valves and plugs are free of distortion or burrs, the valve body components should all slide into place easily. In addition, do not overtighten the transfer plate and valve body screws during reassembly. Over-tightening can distort the housings resulting in valve sticking, cross leakage and unsatisfactory operation. Tighten valve body screws to recommended torque only.

Lower Housing Assembly (Fig. 116)

(1) Lubricate valves, springs, and the housing valve and plug bores with Mopar ATF Plus transmission fluid.
(2) Install 3-4 timing valve spring and valve in lower housing.
(3) Install 3-4 quick fill valve in lower housing.
(4) Install 3-4 quick fill valve spring and plug in housing.
(5) Install timing valve end plate. Tighten end plate screws to 4 N·m (35 in. lbs.) torque.
(6) Install 3-4 shift valve and spring.
(7) Install converter clutch valve, spring and plug.
(8) Install converter clutch timing valve and spring.

3-4 Accumulator Assembly (Fig. 117)

(1) Lubricate accumulator piston, seals and housing piston bore with ATF Plus, type 7176 fluid.
(2) Install new seal rings on accumulator piston.
(3) Install piston and spring in housing.
(4) Install end plate on housing.

Transfer Plate Assembly

(1) Install rear clutch check ball in transfer plate (Fig. 110).
(2) Install filter screen in upper housing separator plate (Fig. 109).
(3) Align and position upper housing separator plate on transfer plate (Fig. 109).
(4) Install brace plate (Fig. 108). Tighten brace attaching screws to 4 N·m (35 in. lbs.) torque.
(5) Install remaining separator plate attaching screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

Upper And Lower Housing Assembly

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 111). Seven check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter.
(2) Position transfer plate assembly on upper housing (Fig. 119).
(3) Position lower housing separator plate on transfer plate (Fig. 119).

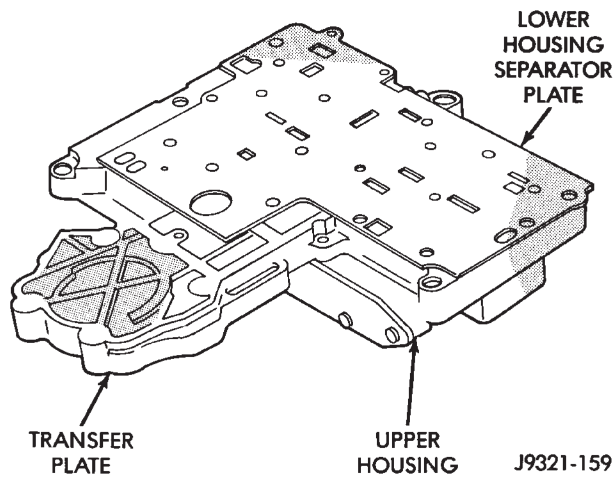

Fig. 119 Lower Housing Separator Plate Installation

(4) Install lower housing on assembled transfer plate and upper housing (Fig. 120).
(5) Install all valve body screws except three that secure boost valve tube brace. Start screws by hand and tighten just enough to hold assemblies together but not to required torque at this time. **Screws will not be fully tightened until after boost valve tube and brace are installed.**

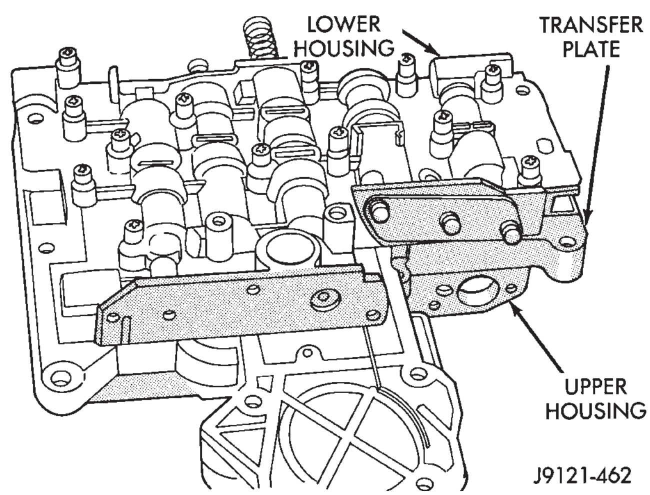

Fig. 120 Assembling Upper And Lower Housings

Upper Housing Valve And Plug Installation (Figs. 114, 115, 118)

(1) Lubricate valves, plugs, springs with Mopar ATF Plus transmission fluid.
(2) Assemble regulator valve line pressure plug, sleeve, throttle plug and spring. Insert assembly in upper housing and install cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.
(3) Install 1-2 and 2-3 shift valves and springs.
(4) Install 1-2 shift control valve and spring.

(5) Install shift valve cover plate.

(6) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Hold shuttle valve in place.

(c) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(d) Verify that spring and E-clip are properly seated before proceeding.

(7) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(8) Install 1-2 and 2-3 valve governor plugs in valve body.

(9) Install shuttle valve primary spring and throttle plug.

(10) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

(11) Install manual valve.

(12) Install throttle valve and spring.

(13) Install kickdown valve and detent.

(14) Install regulator valve.

(15) Install switch valve.

Boost Valve Tube And Brace Installation

(1) Position valve body assembly so lower housing is facing upward (Fig. 121).

(2) Lubricate tube ends and housing ports with transmission fluid or petroleum jelly.

(3) Start tube in lower housing port first. Then swing tube downward and work opposite end of tube into upper housing port (Fig. 121).

(4) Insert and seat each end of tube in housings.

(5) Slide tube brace under tube and into alignment with valve body screw holes (Fig. 121).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 121).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 122).

(8) **Tighten all valve body housing screws to 4 N·m (35 in. lbs.) torque after tube and brace are installed. Tighten screws in diagonal pattern starting at center and working outward.**

3-4 Accumulator Installation

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 123).

(2) Loosely attach accumulator housing with right-side screw (Fig. 123). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(4) Swing accumulator housing upward over valve springs and plug.

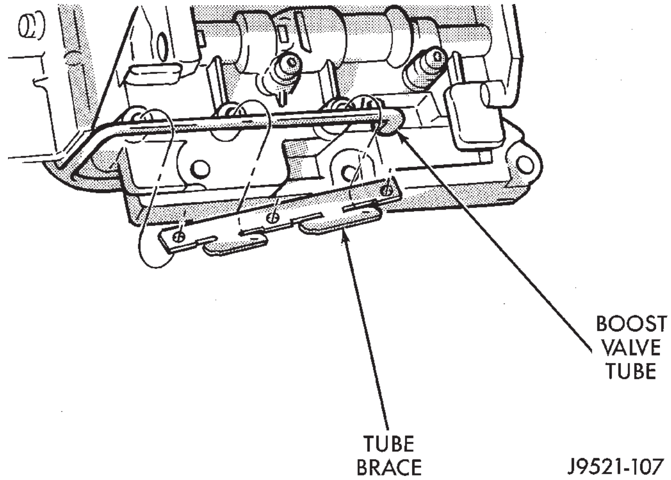

Fig. 121 Boost Valve Tube And Brace Installation

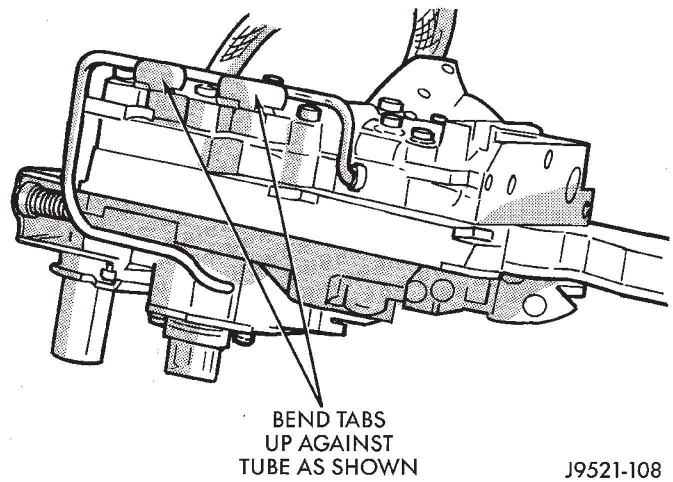

Fig. 122 Securing Boost Valve Tube With Brace Tabs

(5) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 124).

(6) Attach solenoid case connector to 3-4 accumulator with shoulder-type screw. Connector has small locating tang that fits in dimple at top of accumulator housing (Fig. 125). Seat tang in dimple before tightening connector screw.

(7) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(8) Verify that solenoid wires are properly routed. **Solenoid wires must be clear of rear band lever, manual lever and park rod.**

Valve Spring, Detent, And Bracket Installation

(1) Insert manual lever detent spring in upper housing.

(2) Position line pressure adjusting screw in adjusting screw bracket.

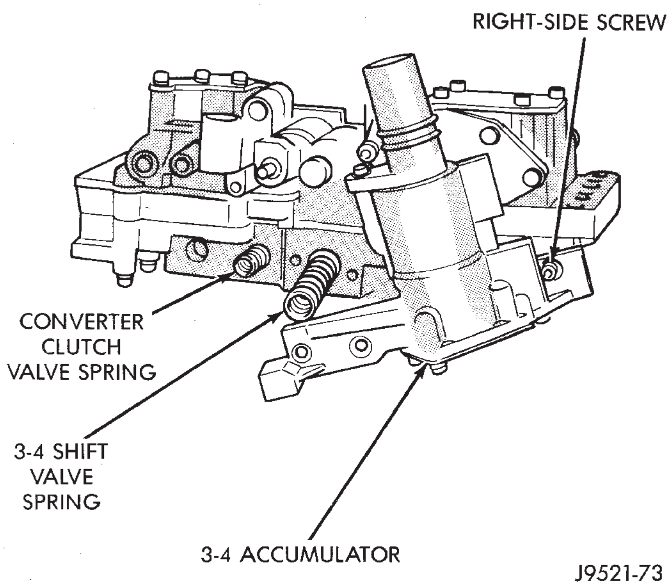

Fig. 123 Installing Converter Clutch And 3-4 Shift Valve Springs

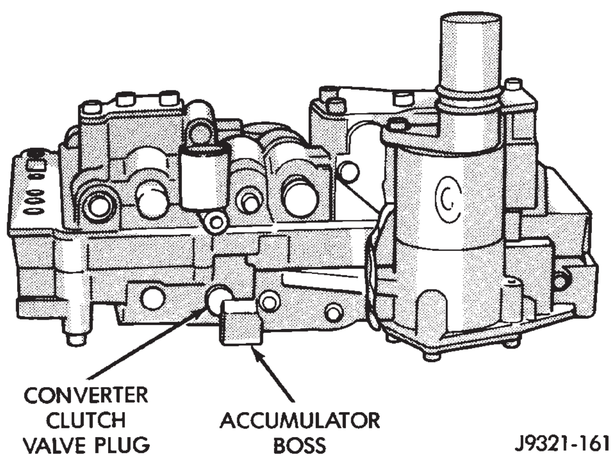

Fig. 124 Seating 3-4 Accumulator On Lower Housing

(3) Install spring on end of line pressure regulator valve.

(4) Install switch valve spring on tang at end of adjusting screw bracket.

(5) Position adjusting screw bracket on valve body. Align valve springs and press bracket into place. Install short, upper bracket screws first and long bottom screw last. Verify that valve springs and bracket are properly aligned. Then tighten all three bracket screws to 4 N·m (35 in. lbs.) torque.

(6) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(7) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 92).

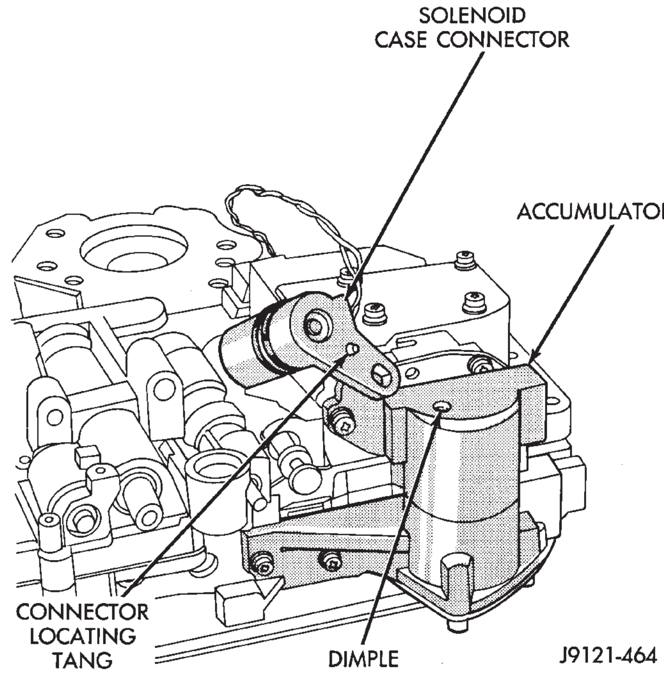

Fig. 125 Solenoid Connector Installation

(8) Align manual lever with detent ball and manual valve. Hold throttle lever upward. Then press down on manual lever until fully seated. Remove detent ball retainer tool after lever is seated.

(9) Then Install manual lever seal, washer and E-clip.

(10) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(11) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 126).

(12) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(13) Obtain new fluid filter for valve body but do not install filter at this time.

(14) If line pressure and/or throttle pressure adjustment screw settings were not disturbed, continue with overhaul or reassembly. However, if adjustment screw settings **were** moved or changed, readjust as described in Valve Body Control Pressure Adjustment procedure.

VALVE BODY CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body which are, line pressure and throttle pressure.

Line and throttle pressures are interdependent because each affects shift quality and timing. As a result, both adjustments must be performed properly and in the correct sequence. Adjust line pressure first and throttle pressure last.

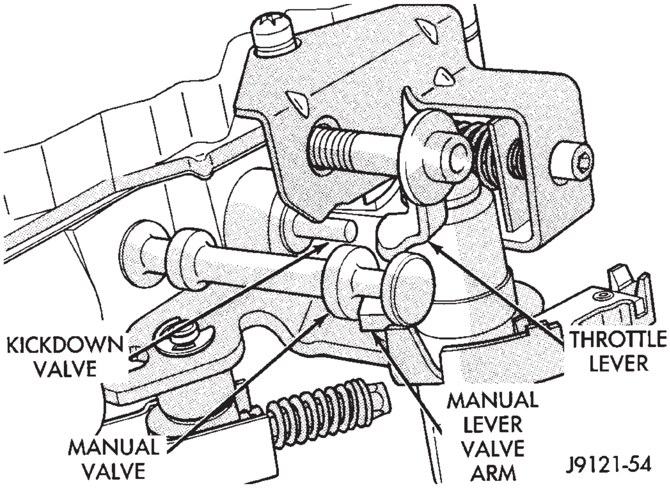

Fig. 126 Manual And Throttle Lever Alignment

Line Pressure Adjustment

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 127).

Distance should be 33.4 mm (1-5/16 in.).

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

The 33.4 mm (1-5/16 in.) setting is an approximate setting. Manufacturing tolerances may make it necessary to vary from this dimension to obtain desired pressure.

One complete turn of the adjusting screw changes line pressure approximately 1-2/3 psi (9 kPa).

Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.

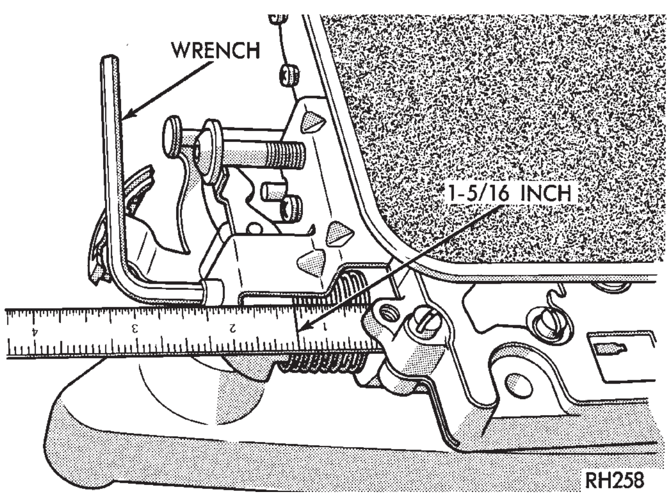

Fig. 127 Line Pressure Adjustment

Throttle Pressure Adjustment

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 128).

Push the gauge tool inward to compress the kickdown valve against the spring and bottom the throttle valve.

Maintain pressure against kickdown valve spring. Turn throttle lever stop screw until the screw head touches throttle lever tang and the throttle lever cam touches gauge tool.

The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

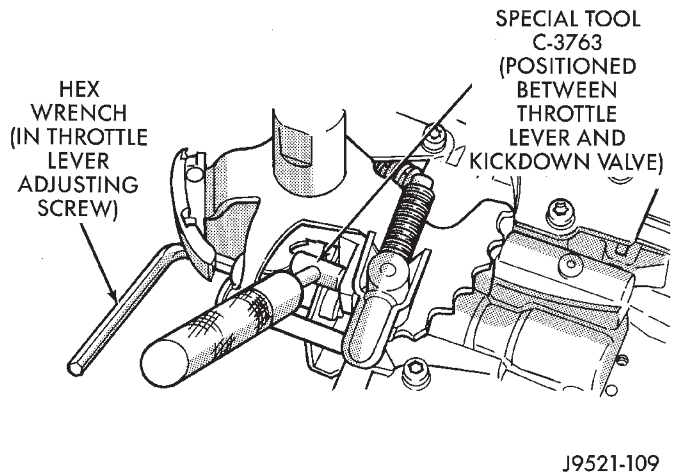

Fig. 128 Throttle Pressure Adjustment

TRANSMISSION ASSEMBLY

Assembly Tips

Do not allow dirt, grease, or foreign material to enter the case or transmission components during assembly. Keep the transmission case and components clean. Also make sure the tools and workbench area used for reassembly operations are equally clean.

Shop towels used for wiping off tools and your hands must be made from **lint free** materials. Lint will stick to transmission parts and could interfere with valve operation or even restrict fluid passages.

Lubricate transmission clutch and gear components with Mopar ATF Plus during reassembly. Soak clutch discs in transmission fluid before installation.

Use Mopar Door Ease, or Ru-Glyde on piston seals and O-rings to ease installation. Petroleum jelly can be used to lubricate and hold thrust washers and plates in position during assembly.

Do not use chassis grease, bearing grease, white grease, or similar lubricants on any part. These types of lubricants can eventually block or restrict fluid passages and valve operation. Use petroleum jelly only.

Do not force parts into place. The transmission components and sub-assemblies are easily installed by hand when properly aligned. If a part seems difficult to install, it is either misaligned or incorrectly assembled. Verify that thrust washers, thrust plates and seal rings are correctly positioned. These parts will prevent proper assembly is mispositioned (or “left out” by accident).

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright or as close to this position as possible. Either tilt the case upward with wood blocks, or cut a hole in the bench large enough for the intermediate shaft and rear support. Then lower the shaft and support into the hole and support the rear of the case directly on the bench.

FRONT/REAR SERVO INSTALLATION

(1) Lubricate rear servo piston seal with Mopar Door Ease or ATF Plus. Lubricate servo bore in case with ATF Plus.

(2) Install rear servo piston in case. Position piston at slight angle to bore and insert piston with twisting motion (Fig. 129).

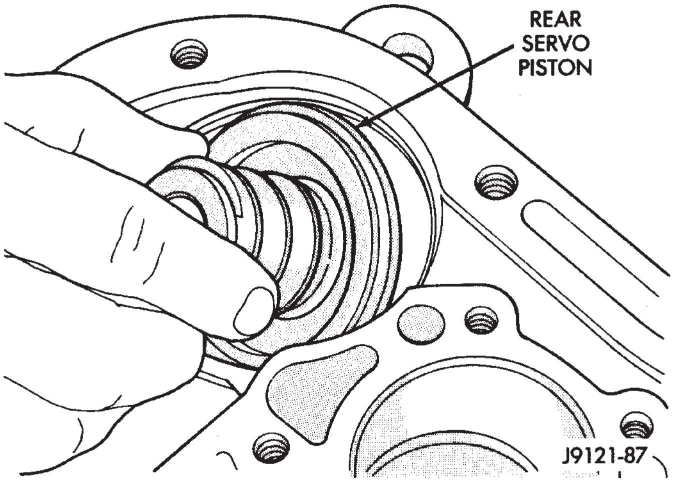

Fig. 129 Rear Servo Piston Installation

(3) Install rear servo spring and retainer in case bore (Fig. 130). Be sure spring is seated on piston.

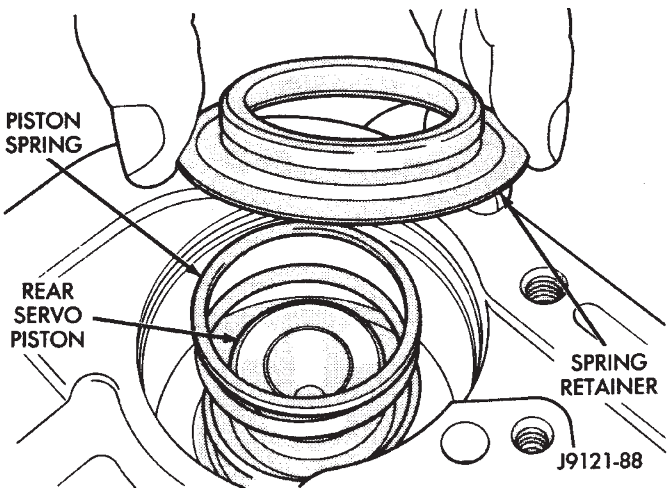

Fig. 130 Rear Servo Piston Spring And Retainer Installation

(4) Compress rear servo piston with C-clamp or Valve Spring Compressor C-3422-B and install servo piston snap ring (Fig. 131).

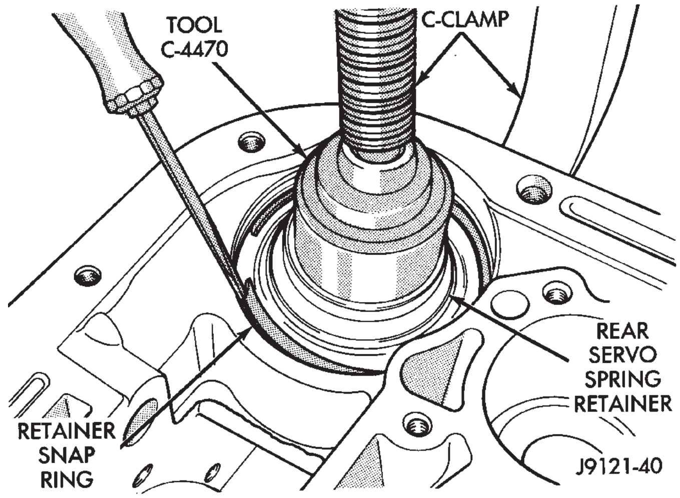

Fig. 131 Rear Servo Snap Ring Installation

(5) Lubricate front servo piston components and servo bore in case with transmission fluid.

(6) Install front servo piston in bore. Carefully “run” small, suitable tool around piston ring to press it back into groove and ease installation (Fig. 132). Rotate piston into bore at same time. Rock piston slightly to ease piston ring past snap ring groove and into bore.

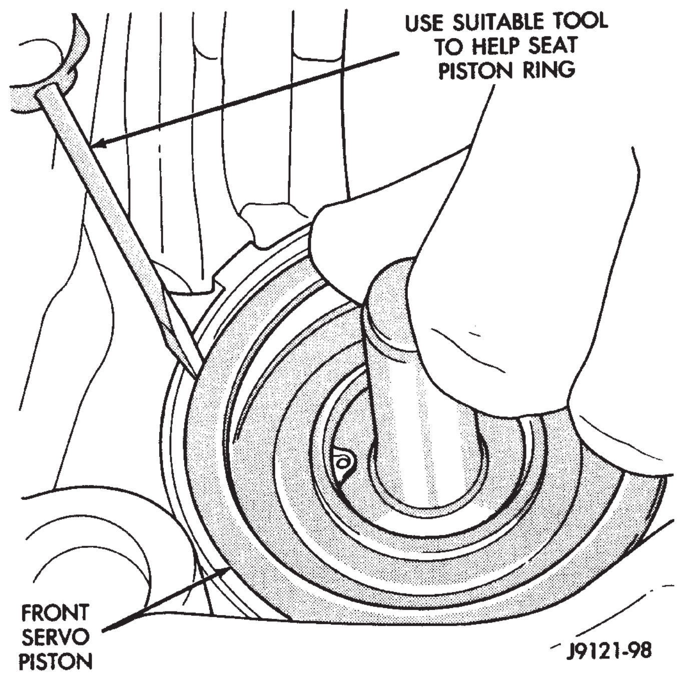

Fig. 132 Front Servo Piston Installation

(7) Bottom front servo piston in bore and install servo spring.

(8) Install front servo piston rod guide as follows:

(a) Place Tool SP-5560 (or similar size tool) on guide and position C-clamp on tool and case (Fig. 133).

(b) Slowly compress rod guide while simultaneously easing seal ring into bore with suitable tool.

(9) Install rod guide snap ring (Fig. 133).

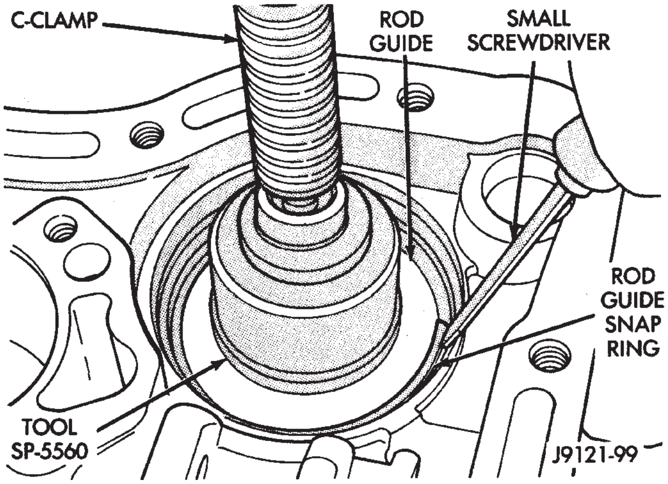

Fig. 133 Front Servo Rod Guide And Snap Ring Installation

OVERRUNNING CLUTCH, REAR BAND, LOW-REVERSE DRUM, AND OVERDRIVE PISTON RETAINER INSTALLATION

(1) Install new gasket at rear of transmission case. Use petroleum jelly to hold gasket in place. **Be sure to align governor feed holes in gasket with feed passages in case (Fig. 134). Install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer**.

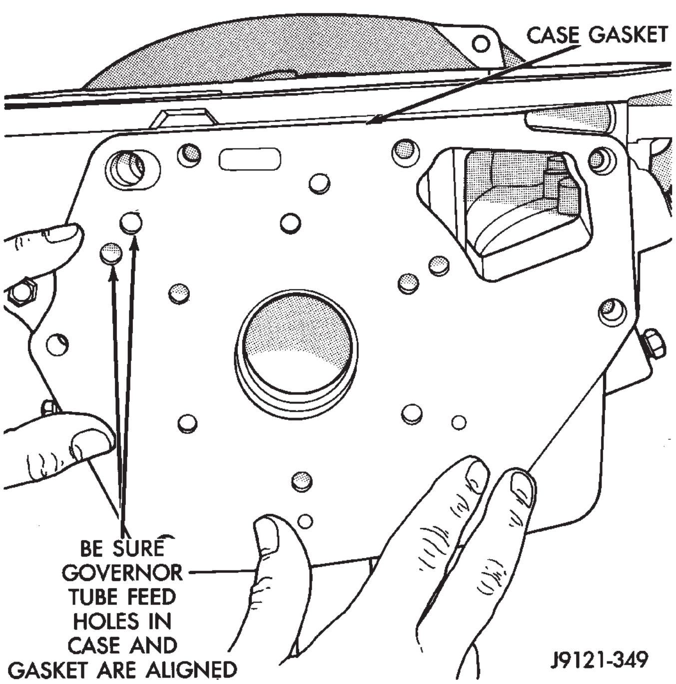

Fig. 134 Case Gasket Installation

(2) Install overdrive piston retainer. Be sure governor tube bores in retainer are aligned with governor feed passages in gasket and case (Fig. 135). Install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

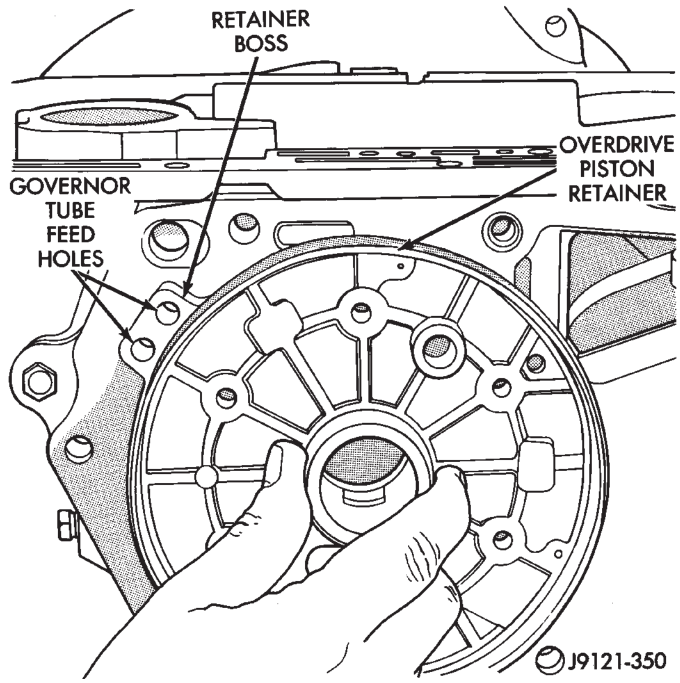

Fig. 135 Overdrive Piston Retainer Installation

(3) Install overrunning clutch components if not yet installed. Refer to Overrunning Clutch Overhaul in this section for procedures if necessary.

(4) Position rear band and link in case (Fig. 136).

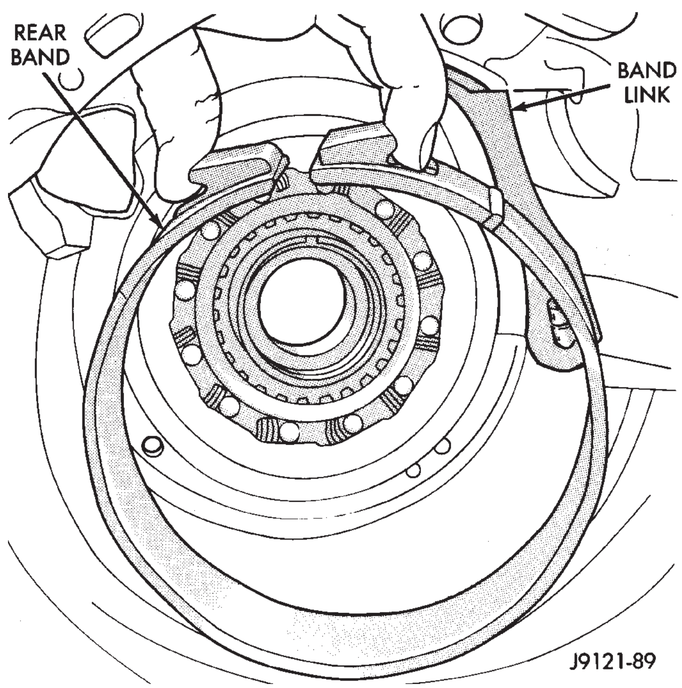

Fig. 136 Rear Band And Link Installation

(5) Install low-reverse drum (Fig. 137). Slide drum through rear band, onto piston retainer hub and into engagement with overrunning clutch and race.

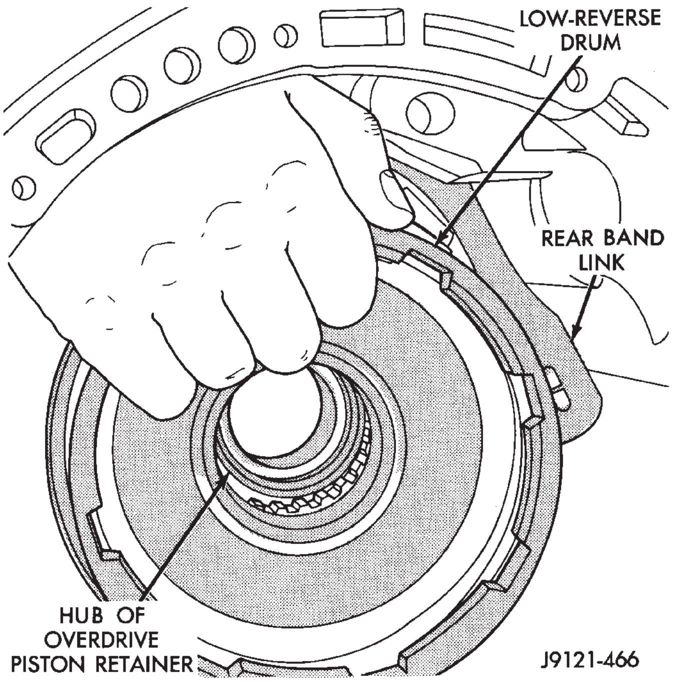

Fig. 137 Low-Reverse Drum Installation

(6) Install double tab thrust washer in low-reverse drum spotface (Fig. 138). Use petroleum jelly to hold washer in place. Make sure washer tabs are seated in notches.

(7) Install snap ring that secures low-reverse drum to piston retainer hub (Fig. 138).

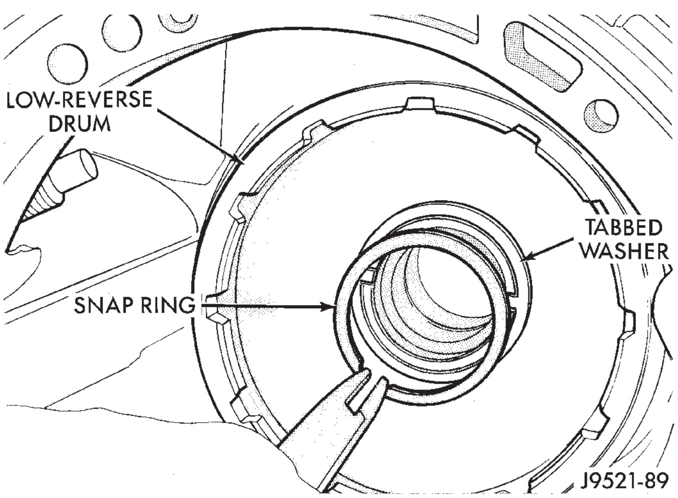

Fig. 138 Low-Reverse Drum Snap Ring Installation

(8) Insert band reaction pin part way into case and band link (Fig. 139).

(9) Install rear band adjusting lever, reaction lever, and strut (Fig. 140). Be sure levers and strut are aligned and engaged before seating band reaction pin in case.

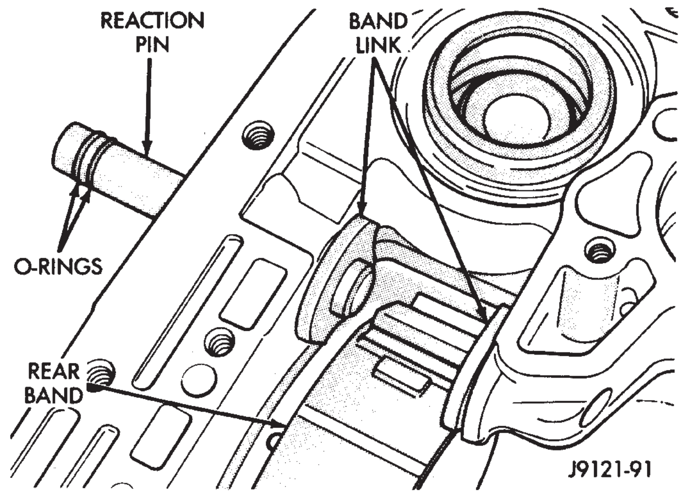

Fig. 139 Rear Band Reaction Pin Installation

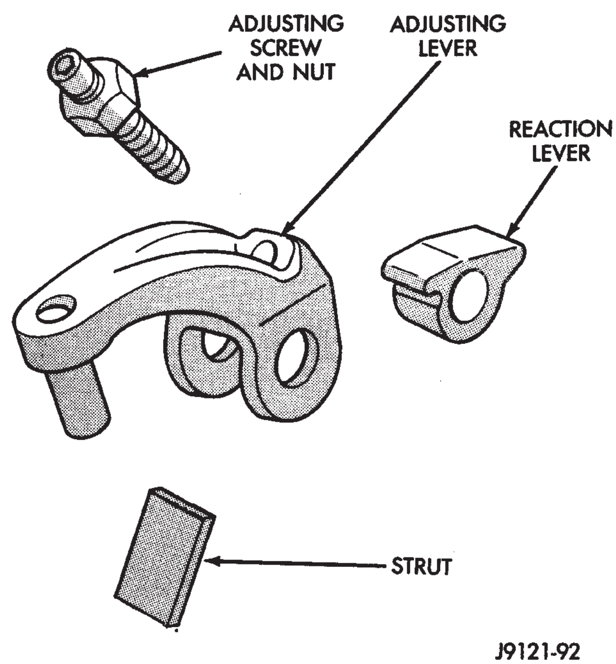

Fig. 140 Rear Band Levers And Strut

PLANETARY GEARTRAIN, FRONT/REAR CLUTCH, AND FRONT BAND INSTALLATION

(1) Install assembled intermediate shaft and planetary geartrain (Fig. 141). **Support shaft carefully during installation. Do not allow shaft bearing/bushing surfaces to become nicked or scratched.**

(2) Lubricate intermediate shaft thrust plate with petroleum jelly and install plate on shaft pilot hub (Fig. 142).

(3) Check input shaft front seal rings, fiber thrust washer and rear seal ring (Fig. 143). Be ends of rear seal ring are hooked together and diagonal cut ends of front seal rings are firmly seated against each other as shown. Lubricate seal rings with petroleum jelly after checking them.

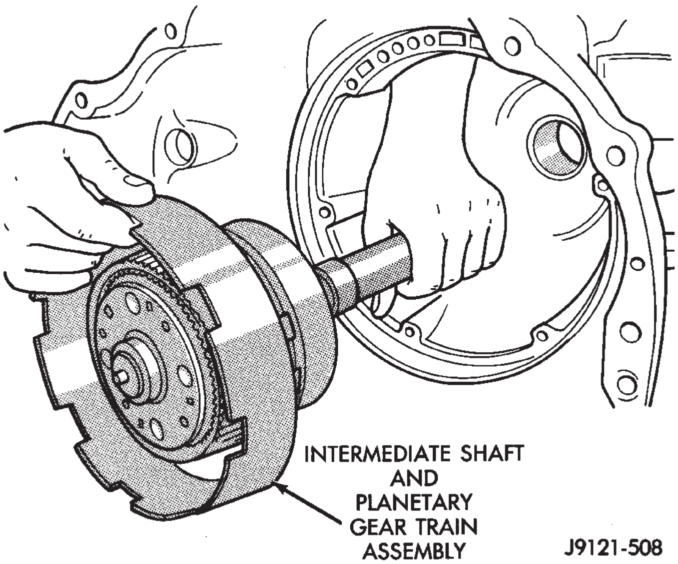

Fig. 141 Intermediate Shaft/Planetary Geartrain Installation

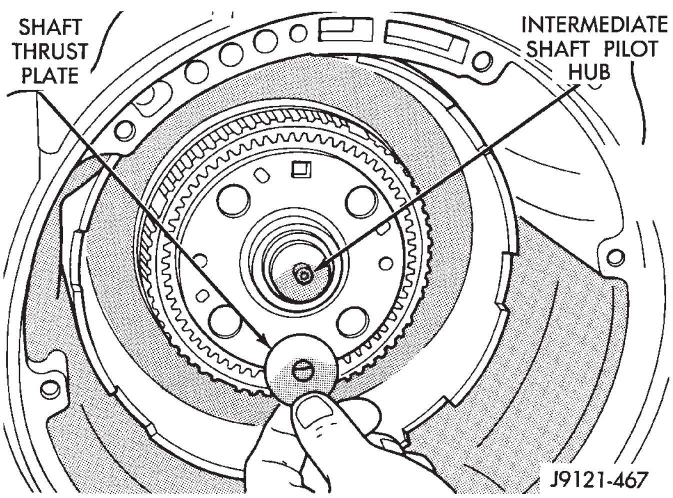

Fig. 142 Intermediate Shaft Thrust Plate Installation

(4) Assemble front and rear clutches (Fig. 144). Align lugs on front clutch discs. Mount front clutch on rear clutch. Turn front clutch retainer back and forth until front clutch discs are fully seated on rear clutch splined hub.

(5) Install intermediate shaft thrust washer in hub of rear clutch retainer (Fig. 145). Use petroleum jelly to hold washer in place. Position washer so grooves are facing outward. **Washer only fits one way in clutch retainer hub.**

(6) Place transmission case in upright position, or place blocks under front end of transmission repair stand to tilt case rearward. This makes it easier to install front/rear clutch assembly.

(7) Align discs in rear clutch. Then install and engage assembly in front planetary and driving shell (Fig. 146). Turn clutch retainers back and forth until both clutches are seated.

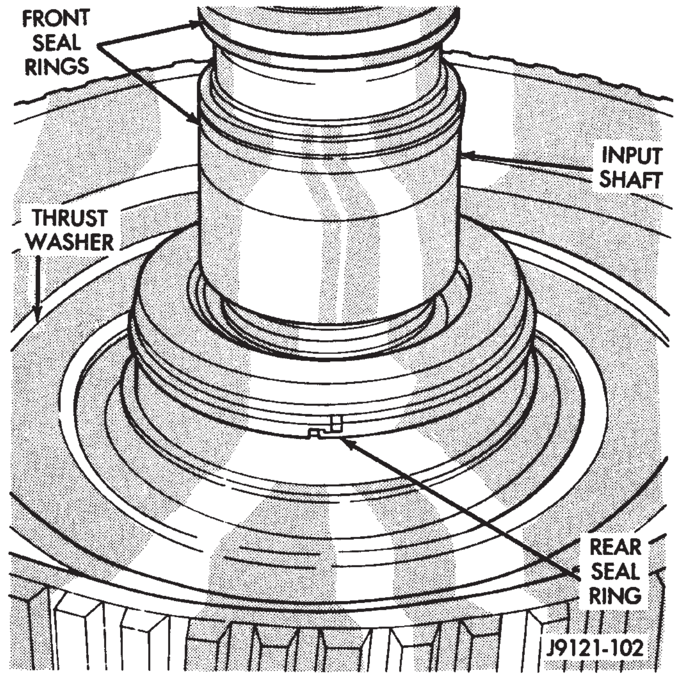

Fig. 143 Input Shaft Seal Ring And Thrust Washer Installation

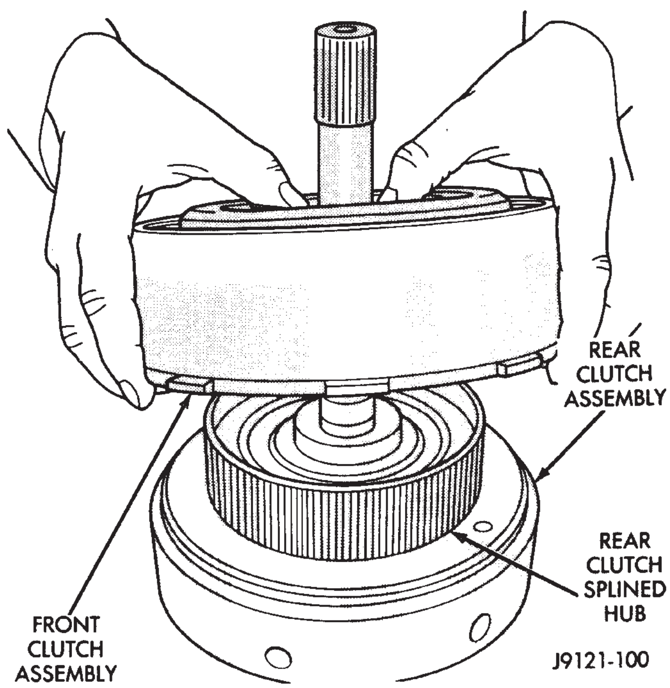

Fig. 144 Assembling Front And Rear Clutches

(8) Position front band lever in case and over servo rod guide. Then install front band lever pin in case and slide it through lever.

(9) Coat threads of front band pin access plug with sealer and install it in case. Tighten plug to 17 N·m (13 ft. lbs.) torque.

(10) Slide front band over front clutch retainer and install front band strut and anchor (Fig. 147).

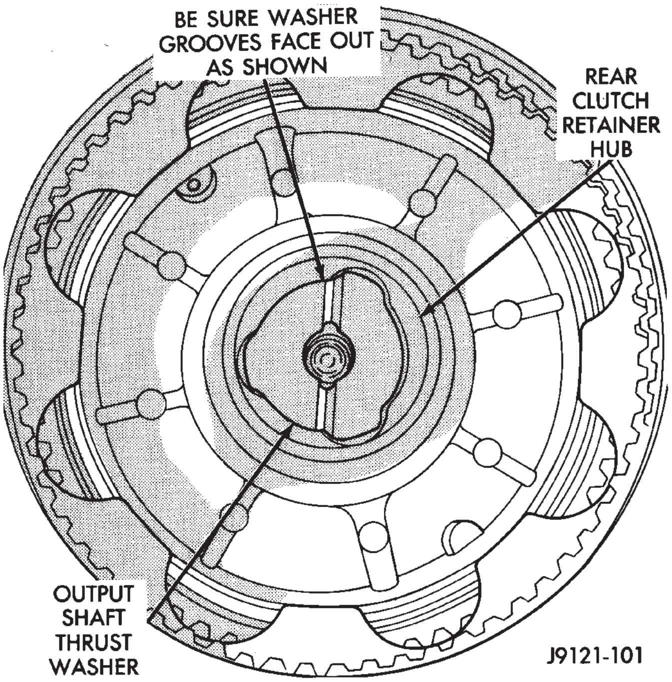

Fig. 145 Intermediate Shaft Thrust Washer Installation

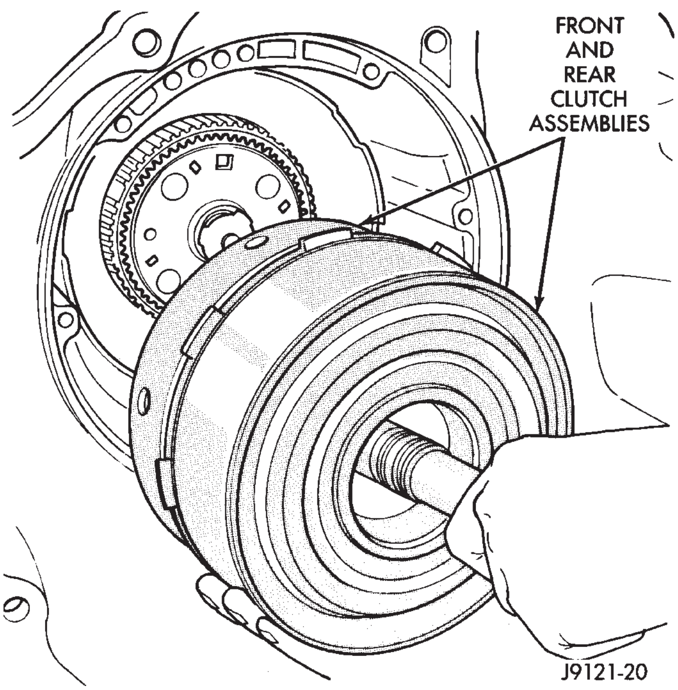

Fig. 146 Front/Rear Clutch Assembly Installation

(11) Tighten front band adjusting screw until band is tight on clutch retainer. This will hold clutches in place while oil pump is being installed. **Verify that front/rear clutch assembly is still properly seated before tightening band.**

OIL PUMP INSTALLATION

(1) Install oil pump Pilot Studs C-3288-B in case (Fig. 148).

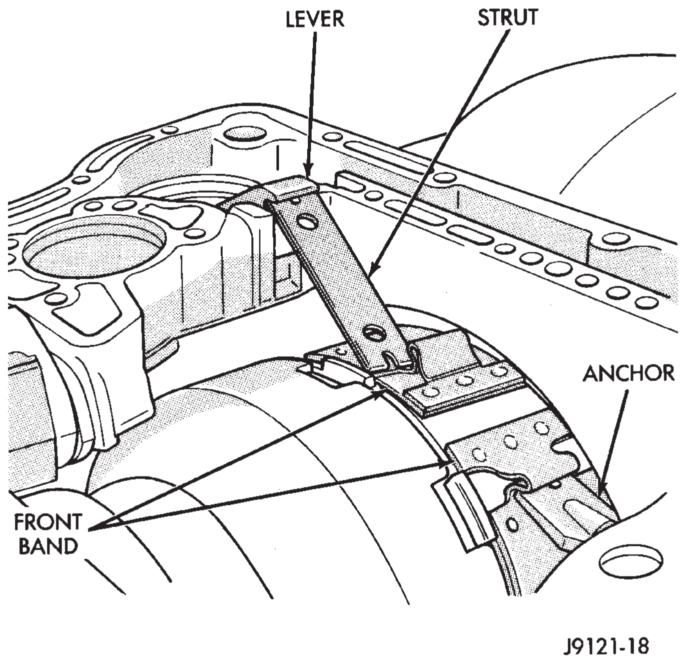

Fig. 147 Front Band And Linkage Installation

(2) Install new oil pump gasket on pilot studs and seat it in case. Be sure gasket is properly aligned with fluid passages in case (Fig. 148).

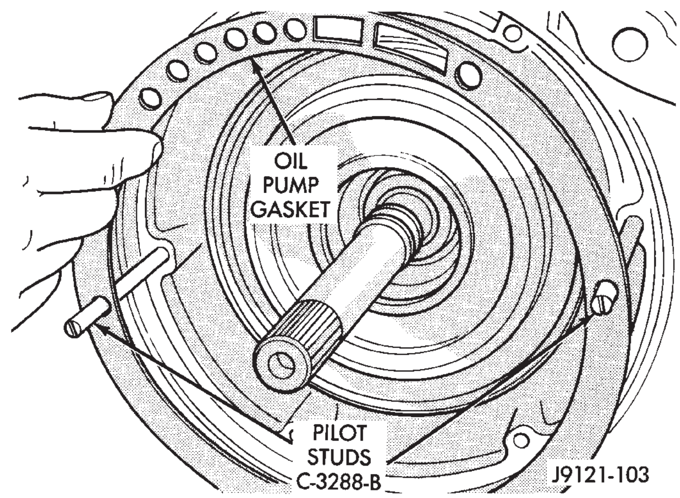

Fig. 148 Oil Pump Gasket And Pilot Stud Tool Installation

(3) Coat front clutch thrust washer with petroleum jelly to hold it in place. Then install washer over reaction shaft hub and seat it on pump (Fig. 149).

CAUTION: The thrust washer bore (I.D.), is chamfered on one side. Make sure the chamfered side is installed so it faces the pump.

(4) Check seal rings on reaction shaft support. Be sure rings are hooked together correctly. Also be sure fiber thrust washer is in position (Fig. 150). Use extra petroleum jelly to hold washer in place if necessary.

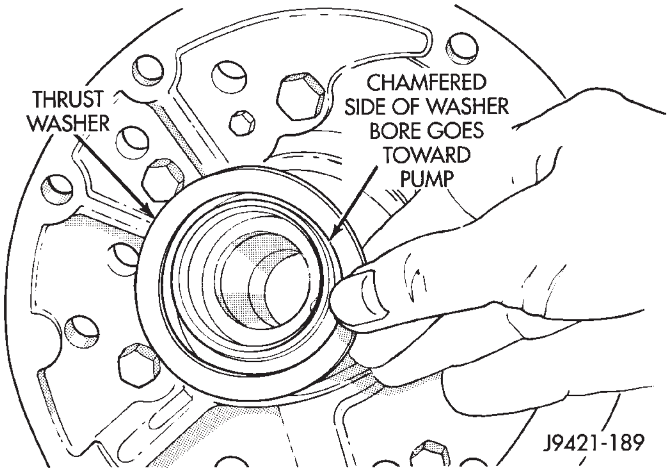

Fig. 149 Front Clutch Thrust Washer Installation

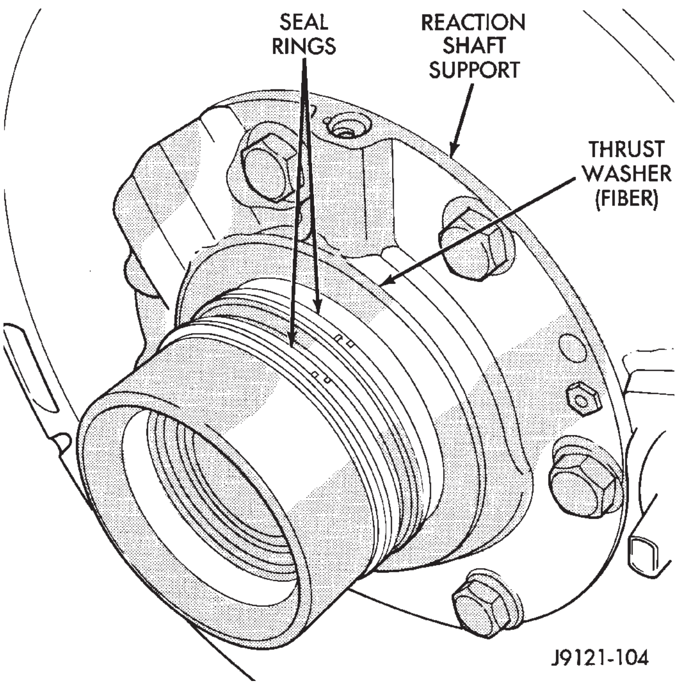

Fig. 150 Reaction Shaft Seal Ring And Thrust Washer Installation

(5) Lubricate oil pump seals with Mopar ATF Plus.

(6) Mount oil pump on pilot studs and slide pump into case opening (Fig. 151). **Work pump into case by hand. Do not use a mallet or similar tools to seat pump.**

(7) Remove pilot studs and install oil pump bolts. Tighten pump bolts alternately and evenly to fully seat pump in case. Then final-tighten pump bolts to 20 N·m (15 ft. lbs.) torque.

(8) Verify correct installation. Rotate input and intermediate shafts and check for bind. If bind exists, components are either misassembled, or not seated. Disassemble and correct as necessary before proceeding.

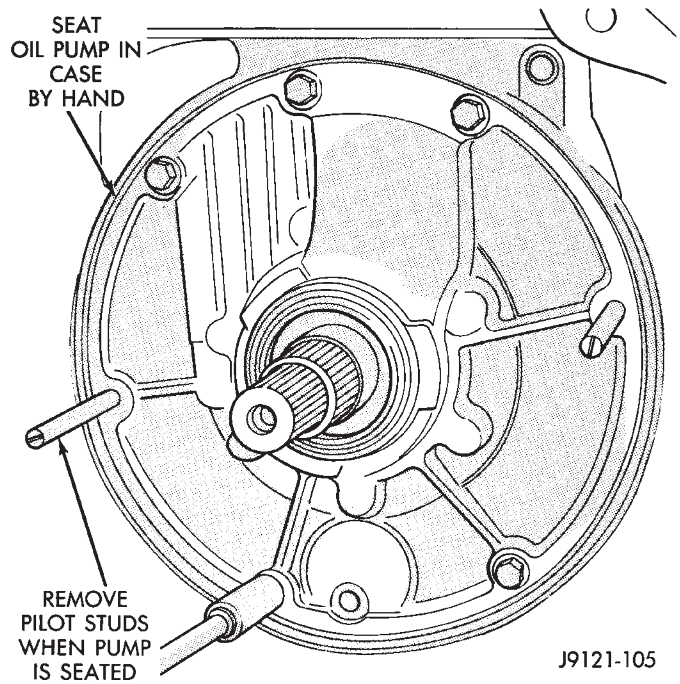

Fig. 151 Oil Pump Installation

OVERDRIVE UNIT AND PISTON INSTALLATION

(1) Install new seals on overdrive piston. Then lubricate seals with Mopar Door Ease, or Ru-Glyde to ease installation.

(2) Install overdrive piston in retainer. **Align locating lugs on piston in locating bores in retainer** (Fig. 152). Use thin plastic strip or feeler gauge to help guide piston outer seal into retainer.

(3) Install spacer on intermediate shaft, if not previously installed.

(4) Install overdrive piston thrust plate (Fig. 153). Use liberal quantity of petroleum jelly to hold thrust plate in position on piston.

(5) Install overdrive piston thrust bearing in direct clutch hub (Fig. 154). Use liberal quantity of petroleum jelly to hold thrust bearing in place. **Note that one side of bearing has dark coated surface. This surface faces overdrive piston. Also be sure raised shoulder on inside diameter of bearing faces forward as well.**

(6) Apply small amount of petroleum jelly to pilot hub of intermediate shaft.

(7) Verify alignment of splines in overdrive unit planetary gear and overrunning clutch. Be sure Alignment Tool 6227-2 is fully seated (Fig. 155). **If planetary gear and overrunning clutch splines become misaligned, overdrive unit cannot be fully installed on intermediate shaft. Overdrive unit will have to be disassembled in order to realign splines.**

(8) Carefully withdraw alignment tool from overdrive unit.

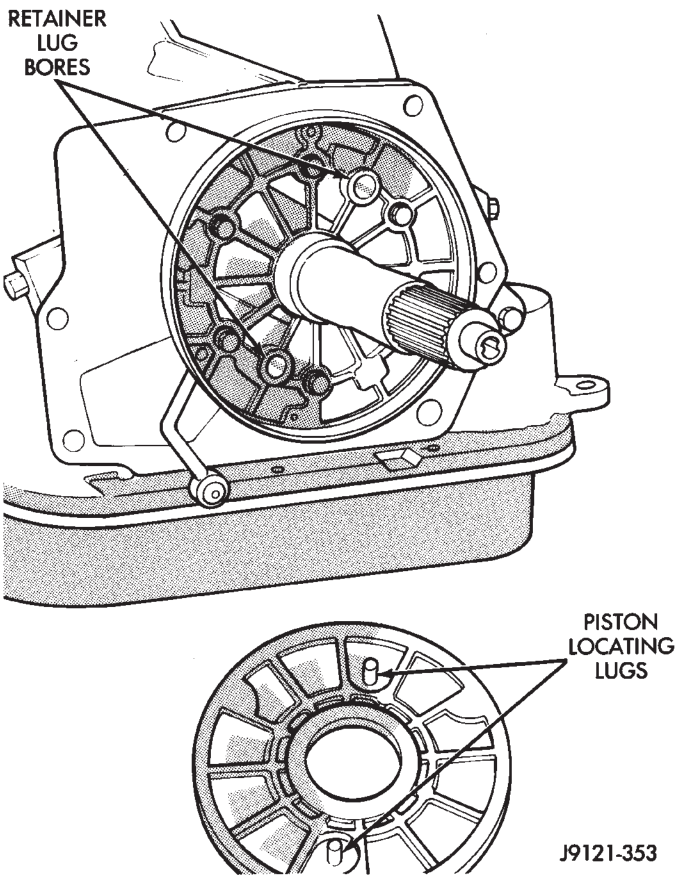

Fig. 152 Overdrive Piston Alignment

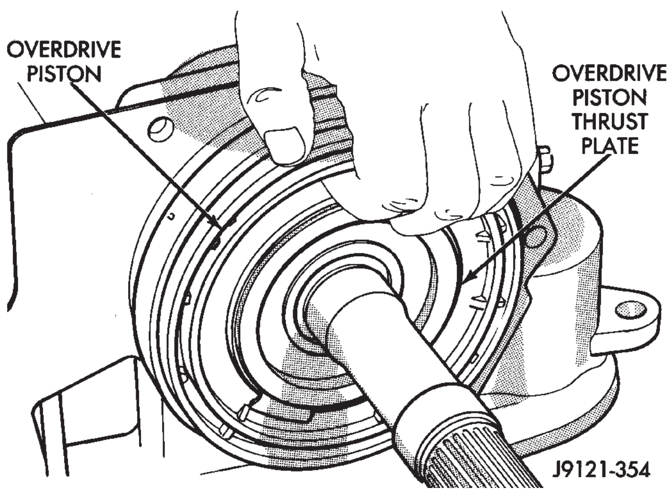

Fig. 153 Installing Overdrive Piston Thrust Plate

(9) Lubricate intermediate shaft splines and bushing surfaces with transmission fluid or petroleum jelly.

(10) Install overdrive unit. Be sure governor tubes are aligned with feed holes in piston retainer boss. Intermediate shaft is snug fit in overdrive planetary gear and overrunning clutch. If overdrive unit will not seat fully, rotate overdrive output shaft slightly to align splines and try again.

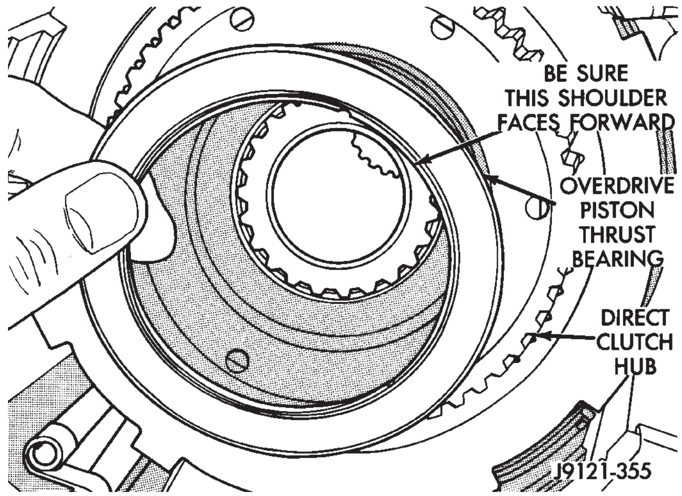

Fig. 154 Installing Overdrive Piston Thrust Bearing

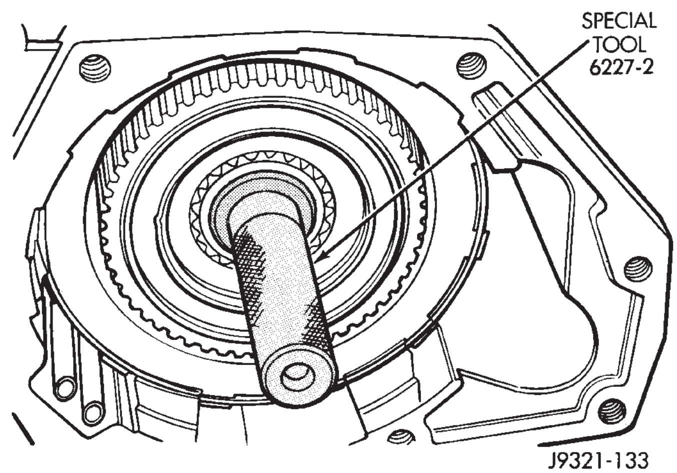

Fig. 155 Checking Alignment Of Overdrive Planetary Gear And Overrunning Clutch Splines

(11) Apply 1-2 drops of Mopar Lock N' Seal (or Loctite 242) to overdrive unit attaching bolts. Then install and tighten bolts to 34 N· (25 ft. lbs.) torque.

INPUT SHAFT END PLAY CHECK

(1) Check input shaft end play as follows.

(2) Attach dial indicator to converter housing (Fig. 156). Position indicator plunger against input shaft and zero indicator.

(3) Move input shaft in and out and record reading.

(4) End play should be 0.86 - 2.13 mm (0.034 - 0.084 in.).

(5) If end play is incorrect, change intermediate shaft thrust washer. The thrust washer controls end play and is available in three thicknesses for adjustment purposes.

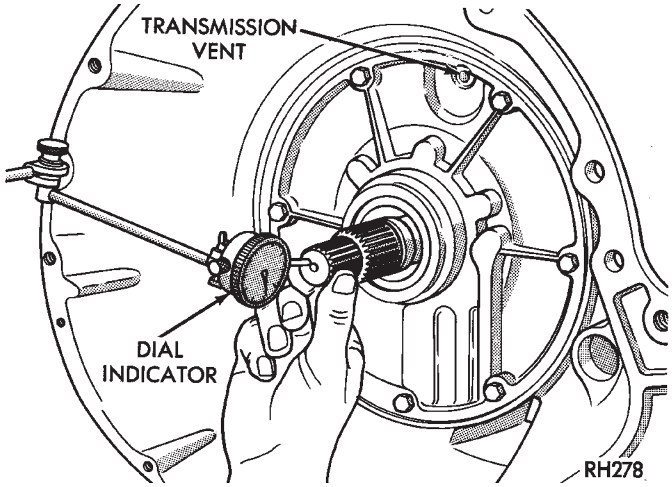

Fig. 156 Checking Input Shaft End Play

BAND ADJUSTMENTS AND INSTALLATION OF ACCUMULATOR, VALVE BODY, OIL PAN, AND TORQUE CONVERTER

(1) Install accumulator inner spring, piston and outer spring (Fig. 157).

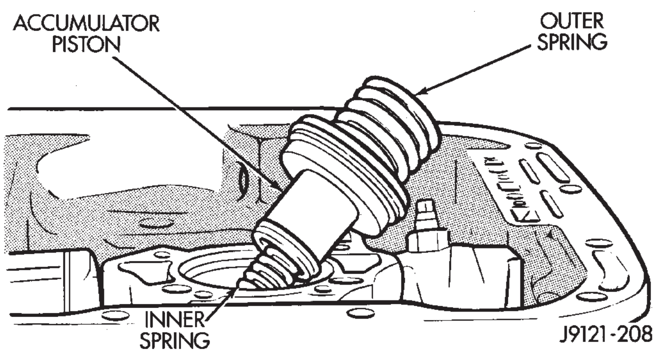

Fig. 157 Installing Accumulator Piston And Springs

(2) Verify that park/neutral position switch has **not** been installed in case. Valve body can not be installed if switch is in position.

(3) Install valve body as follows:

(a) Start park rod into park pawl. If rod will not slide past park pawl, pawl is engaged in park gear. Rotate overdrive output shaft with suitable size 12 point socket; this will free pawl and allow rod to engage.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are fully seated in case.

(c) Install and start all valve body attaching bolts by hand. Then tighten bolts evenly, in a diagonal pattern to 12 N·m (105 in. lbs.) torque. **Do not overtighten valve body bolts. This could result in distortion and cross leakage after installation.**.

(4) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(5) Install seal on park/neutral position switch (Fig. 158). Then install and tighten switch to 34 N·m (25 ft. lbs.).

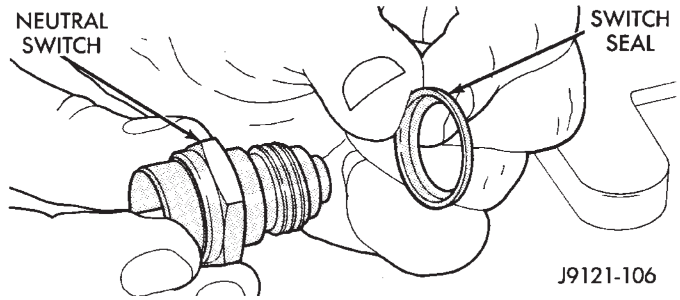

Fig. 158 Park/Neutral Position Switch Seal Position

(6) Adjust front and rear bands as follows:

(a) Loosen locknut on each band adjusting screw 4-5 turns.

(b) Tighten both adjusting screws to 8 N·m (72 in. lbs.).

(c) Back off front band adjusting screw 2-7/8 turns.

(d) Back off rear band adjusting screw 2 turns.

(e) Hold each adjusting screw in position and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(7) Install magnet in oil pan. Magnet seats on small protrusion at corner of pan.

(8) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(9) Install new valve body manual shaft seal in case (Fig. 159). Lubricate seal lip and manual shaft with petroleum jelly. Start seal over shaft and into case. Seat seal with 15/16 inch, deep well socket.

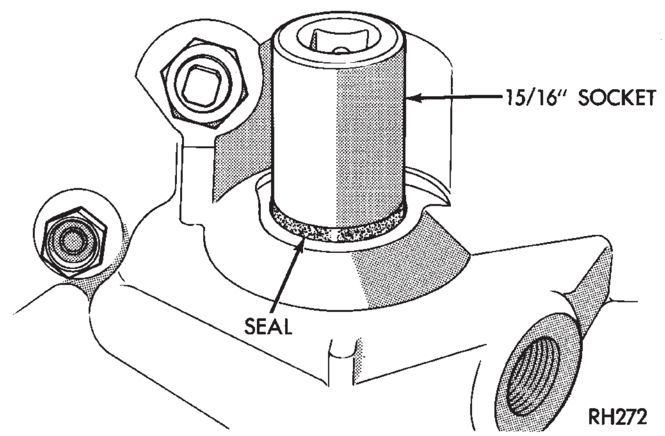

Fig. 159 Manual Lever Shaft Seal Installation

(10) Install throttle valve and shift selector levers on valve body manual lever shaft.

(11) Cap or cover transmission openings (cooler line fittings, filler tube bore, etc.) to prevent dirt entry.

(12) Install and seat torque converter. Use C-clamp or metal strap to hold converter in place for installation. Be sure converter is fully seated before installing clamp.

(13) Mount transmission on jack for installation in vehicle.

(14) Apply small quantity of dielectric grease to terminal pins of solenoid case connector and neutral switch.

CAUTION: The transmission cooler and lines must be reverse flushed if overhaul corrected a malfunction that generated sludge, metal particles, or clutch friction material. The torque converter and drainback valve should also be replaced if contaminated by the same malfunction. Debris and residue not flushed from the cooler and lines will flow back into the transmission and converter. The result could be a repeat failure and shop comeback.

46RH OVERDRIVE UNIT OVERHAUL

INDEX

OVERDRIVE UNIT DISASSEMBLY

(1) Remove overdrive piston thrust plate (Fig. 1). Retain thrust plate. It is a select fit part and can be reused.

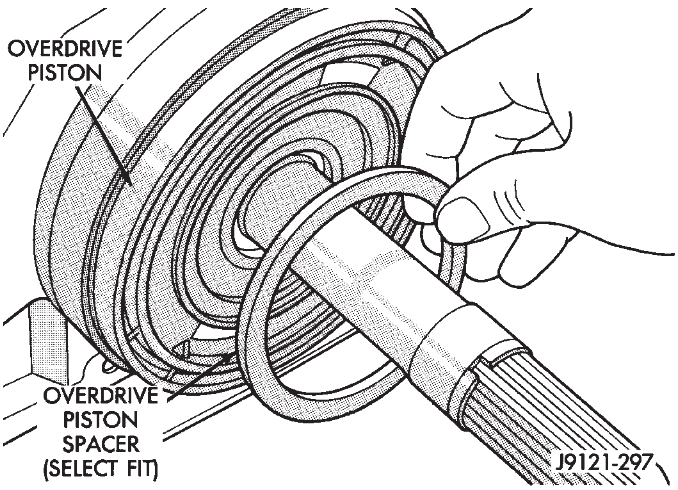

Fig. 1 Overdrive Piston Thrust Plate Removal/ Installation

(2) Remove intermediate shaft spacer (Fig. 2). Retain spacer. It is a select fit part and can be reused.

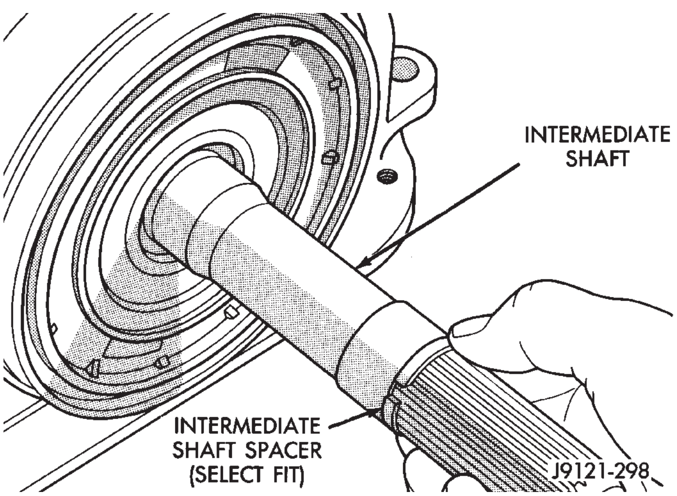

Fig. 2 Intermediate Shaft Spacer Location

(3) Remove overdrive piston from retainer (Fig. 3).

(4) Remove overdrive piston thrust bearing from direct clutch hub (Fig. 4).

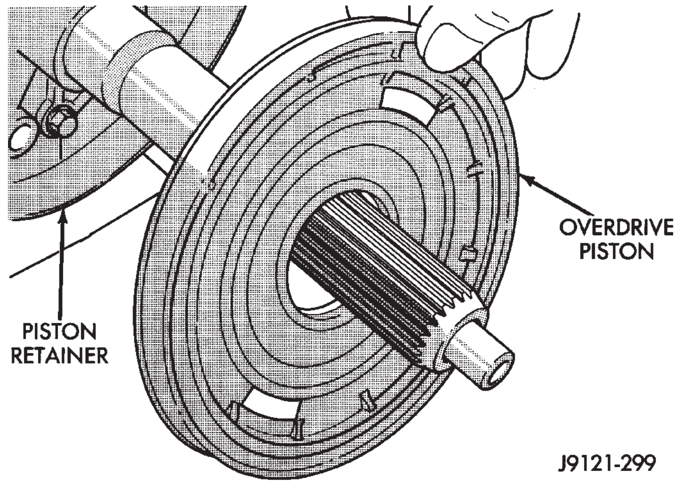

Fig. 3 Overdrive Piston Removal

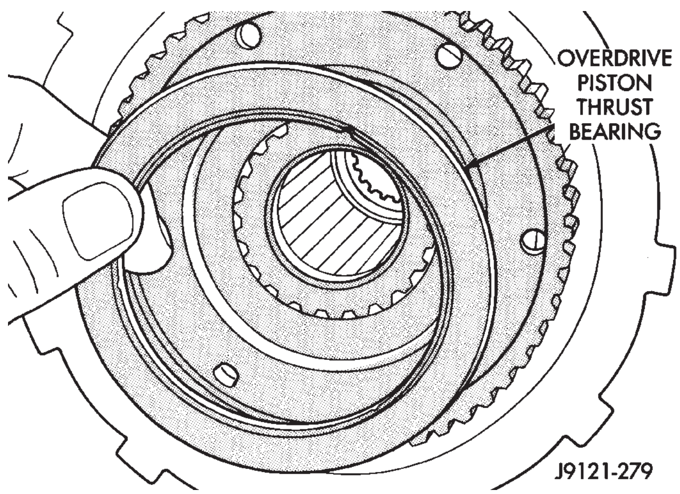

Fig. 4 Overdrive Piston Thrust Bearing Removal

(5) Remove overdrive clutch pack retaining ring (Fig. 5).

(6) Remove overdrive clutch pack (Fig. 6). Note that thickest plate is positioned at rear of clutch pack.

(7) Remove overdrive clutch wave spring (Fig. 7).

(8) Remove overdrive clutch reaction snap ring (Fig. 8). Note that snap ring is located in same groove as wave spring.

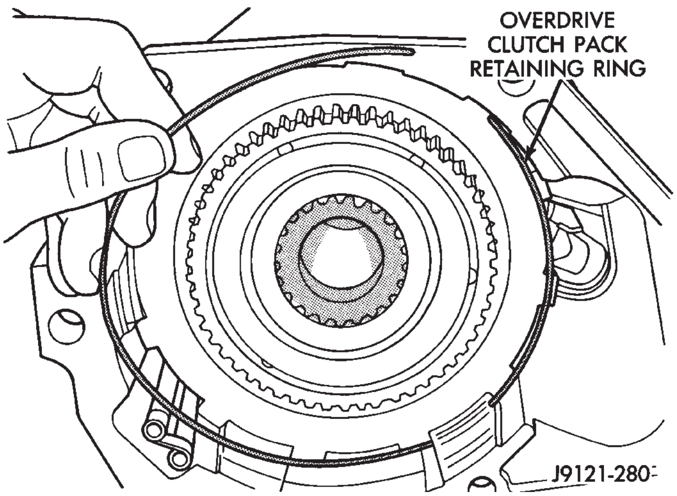

Fig. 5 Overdrive Clutch Pack Retaining Ring Removal

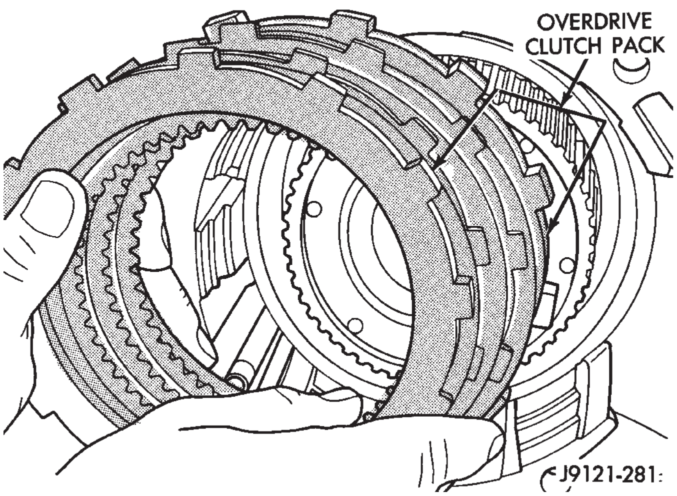

Fig. 6 Overdrive Clutch Pack Removal

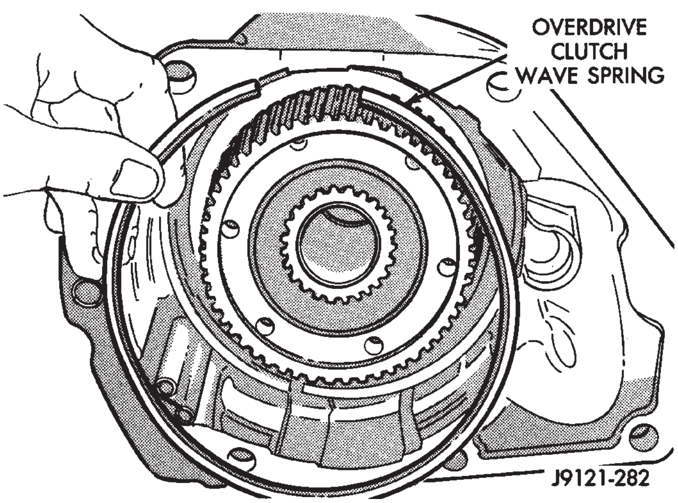

Fig. 7 Overdrive Clutch Wave Spring Removal

(9) Remove access cover and gasket from case (Fig. 9). Cover provides access to output shaft front bearing locating ring.

(10) Expand output shaft bearing snap ring with snap ring pliers. Then push output shaft forward to release shaft front bearing from locating ring (Fig. 10).

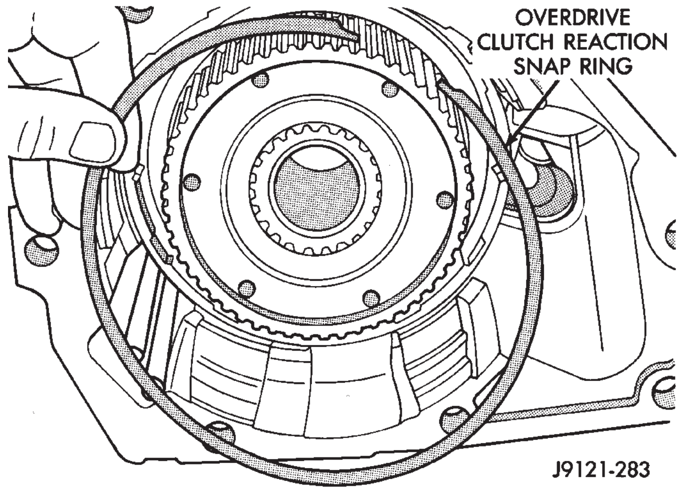

Fig. 8 Overdrive Clutch Reaction Snap Ring Removal

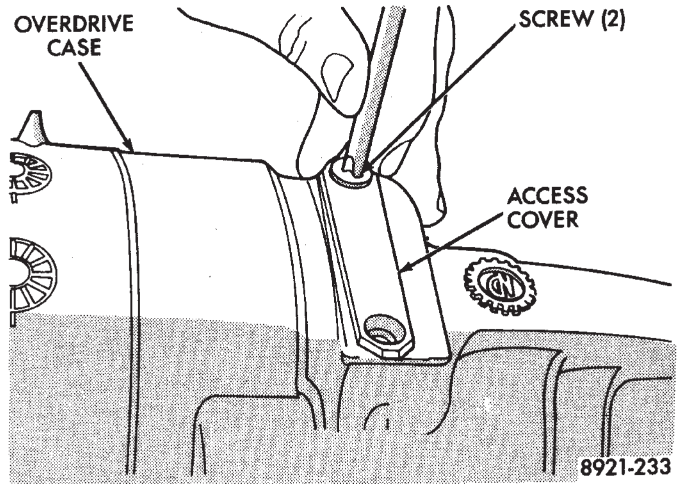

Fig. 9 Locating Ring Access Cover Removal/ Installation

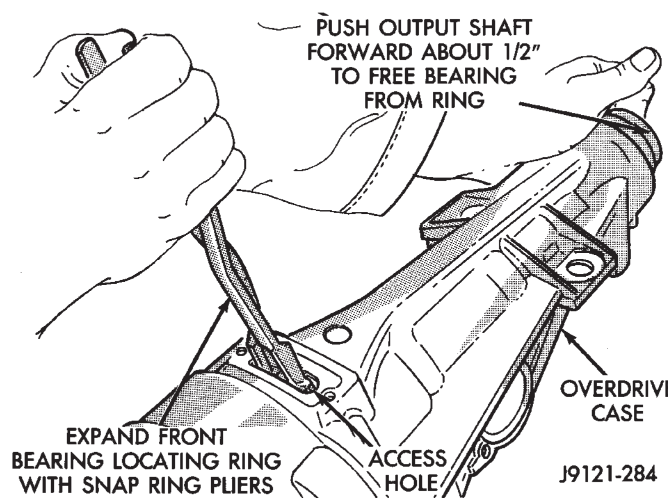

Fig. 10 Releasing Shaft Front Bearing From Locating Ring

(11) Remove geartrain assembly from housing (Fig. 11). Set geartrain aside.

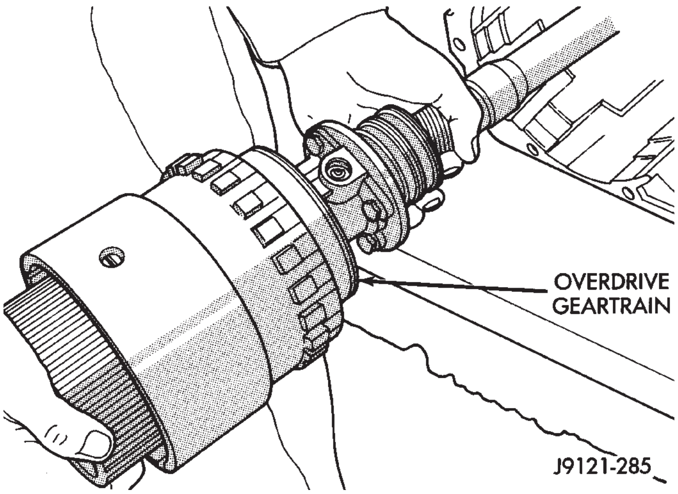

Fig. 11 Overdrive Geartrain Removal

(12) Remove output shaft front bearing locating ring and governor support snap ring (Fig. 12).

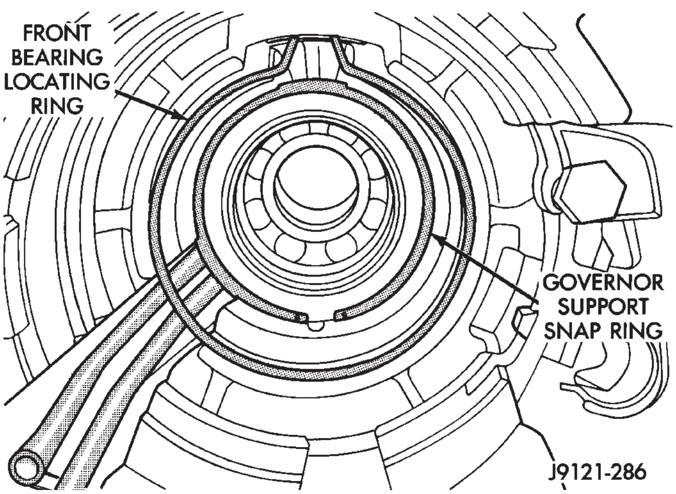

Fig. 12 Front Bearing Locating Ring And Governor Support Snap Ring Location

(13) Remove governor support and tube assembly from case (Fig. 13).

(14) Remove park pawl retaining bolt and reaction plug snap ring (Fig. 14). Compress snap ring only enough to remove it. Snap ring can be distorted if overcompressed.

(15) Remove park pawl shaft, park pawl, pawl spring and reaction plug (Fig. 14).

(16) Remove output shaft rear bearing snap ring (Fig. 15). Remove snap ring with long jaw internal type snap ring pliers. Or, rotate snap ring until one end is adjacent to notch in case. Then unseat ring with extra long flat blade screwdriver.

(17) Remove rear bearing by tapping overdrive case on wood block to dislodge bearing.

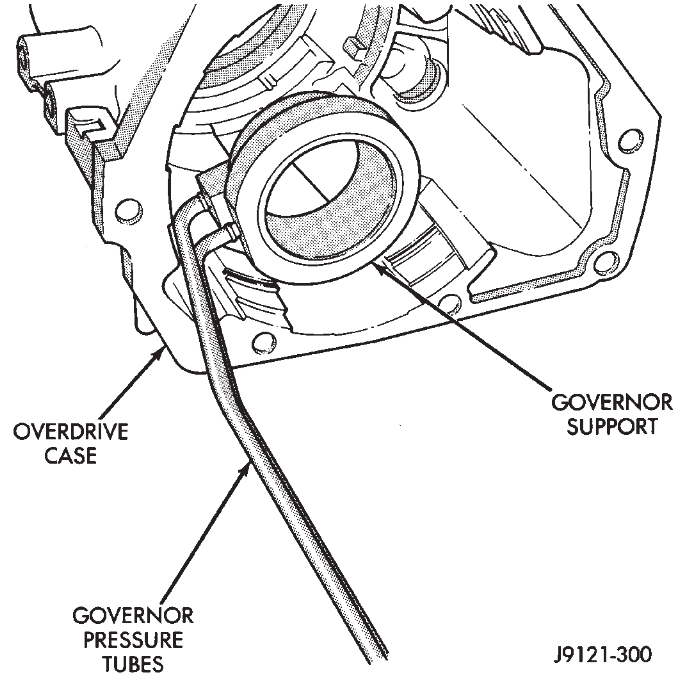

Fig. 13 Governor Support And Tube Assembly Removal

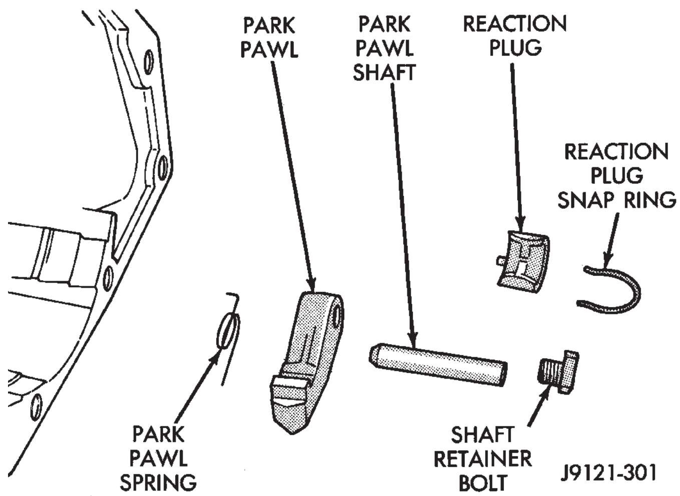

Fig. 14 Park Lock Component Removal

OVERDRIVE GEARTRAIN DISASSEMBLY

(1) Remove E-clip from one end of governor valve shaft and remove shaft and valve (Fig. 16).

(2) Remove governor snap ring (fig. 17).

(3) Remove governor body and drive as assembly (Fig. 18). Set assembly aside for disassembly, inspection, and overhaul. Refer to Governor Overhaul procedures.

(4) Remove governor drive key (Fig. 19).

(5) Remove output shaft front bearing snap ring (Fig. 20).

(6) Remove front bearing from output shaft (Fig. 21).

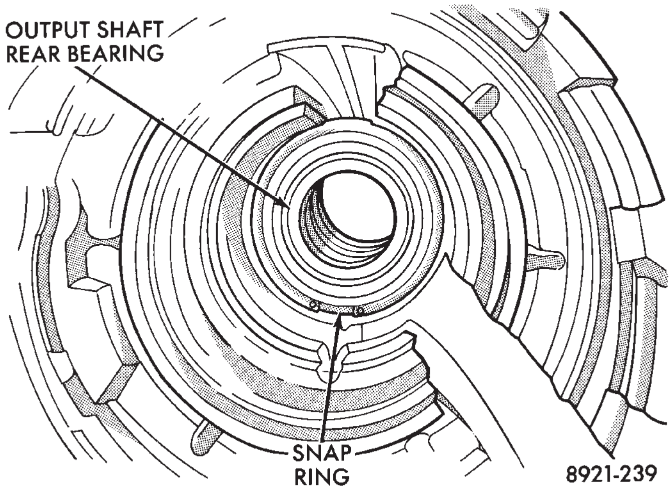

Fig. 15 Output Shaft Rear Bearing And Snap Ring Location

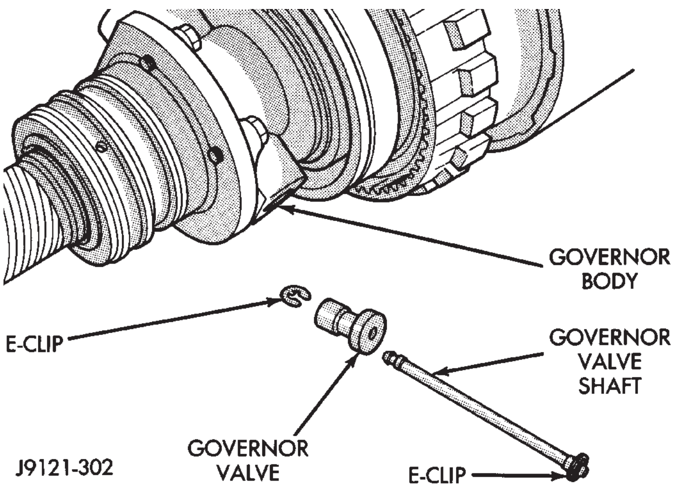

Fig. 16 Governor Valve And Shaft Removal/ Installation

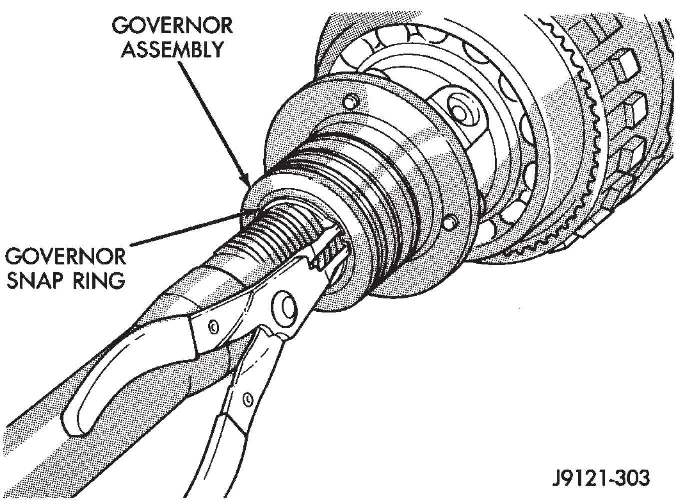

Fig. 17 Governor Snap Ring Removal/Installation

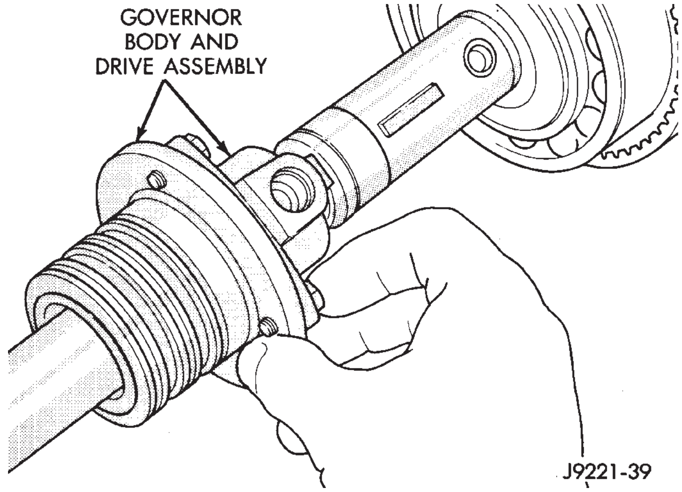

Fig. 18 Governor Body And Drive Assembly Removal/Installation

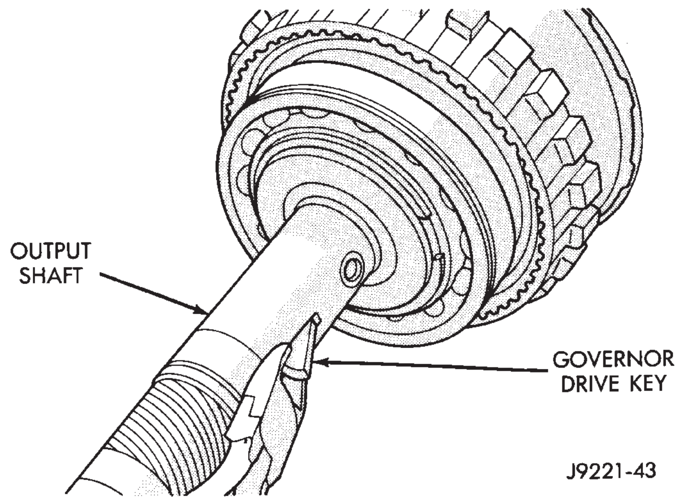

Fig. 19 Governor Drive Key Removal

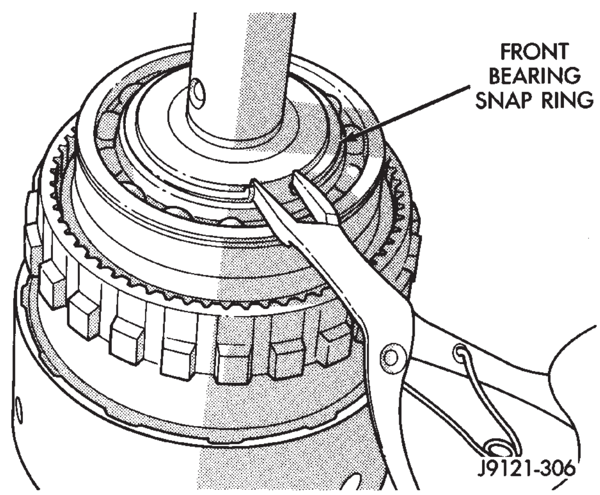

Fig. 20 Front Bearing Snap Ring Removal/ Installation

WARNING: THE NEXT STEP IN GEARTRAIN DISASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS AP-

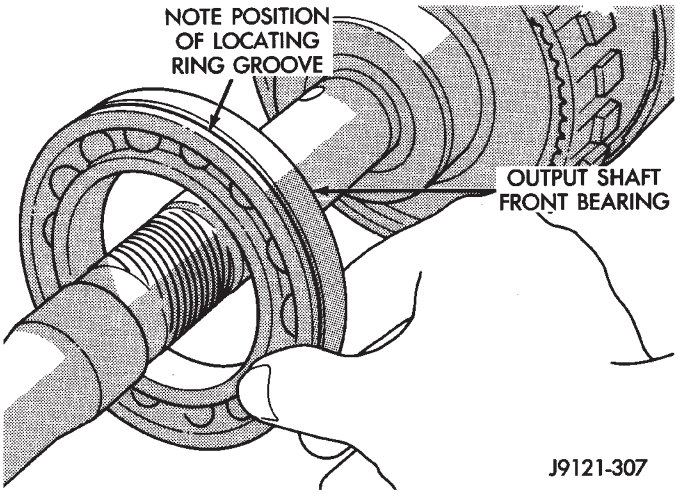

Fig. 21 Output Shaft Front Bearing Removal/ Installation

PROXIMATELY 830 POUNDS. USE SPRING COMPRESSOR TOOL 6227-1 AND A HYDRAULIC SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

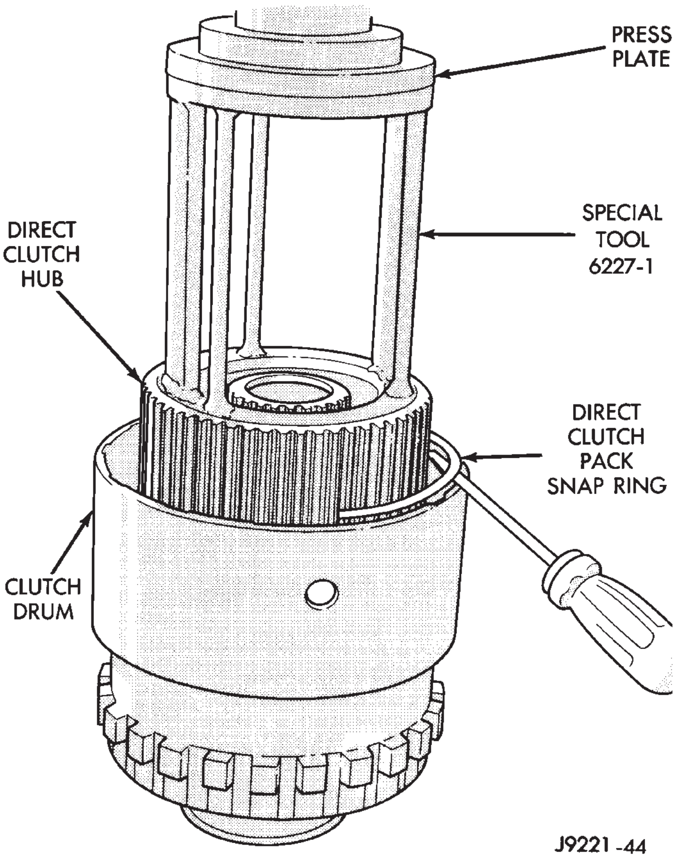

Fig. 22 Direct Clutch Pack Snap Ring Removal

(7) Mount geartrain in shop press

(8) Position Compressor Tool 6227-1 on clutch hub (Fig. 22). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(9) Use bushing remover style tool that is approximately 2-3 in. in diameter at top of Tool 6227-1. Tool will help distribute load and provide needed extra press length.

(10) Apply press pressure slowly. Compress hub and spring far enough to expose clutch hub retaining ring and relieve spring pressure on clutch pack snap ring (Fig. 22).

(11) Remove direct clutch pack snap ring first (Fig. 22).

(12) Remove direct clutch hub retaining ring (Fig. 23).

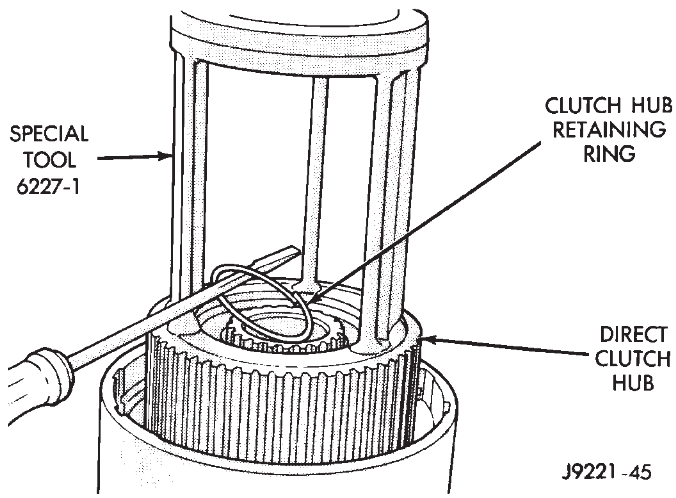

Fig. 23 Direct Clutch Hub Retaining Ring Removal

(13) Release press load on clutch spring **slowly and completely.** Remove press tools and geartrain.

(14) Remove direct clutch pack from hub (Fig. 24).

(15) Remove direct clutch hub and spring (Fig. 25).

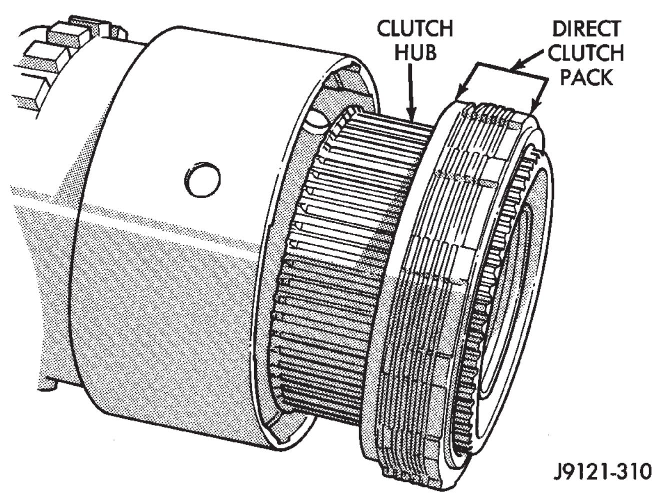

Fig. 24 Direct Clutch Pack Removal

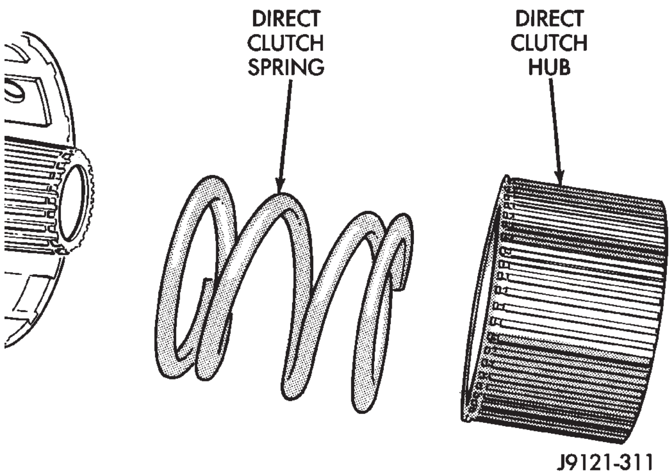

Fig. 25 Direct Clutch Hub And Spring Removal

(16) Remove sun gear and spring plate, planetary thrust bearing and planetary gear (Fig. 26).

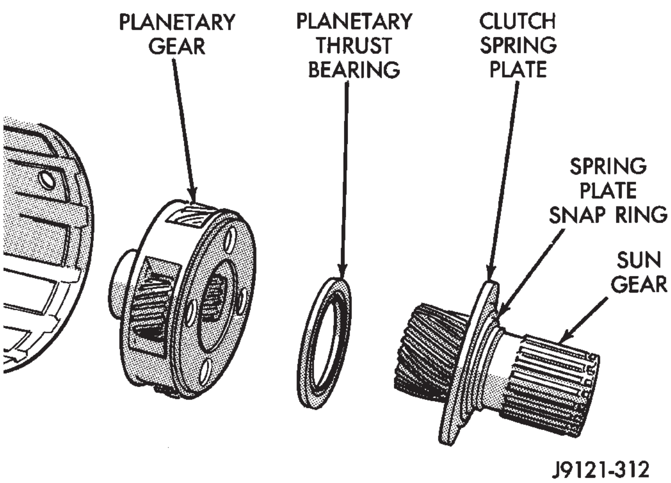

Fig. 26 Sun Gear-Thrust Bearing-Planetary Gear Removal

(17) Remove overrunning clutch assembly with expanding type snap ring pliers (Fig. 27). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

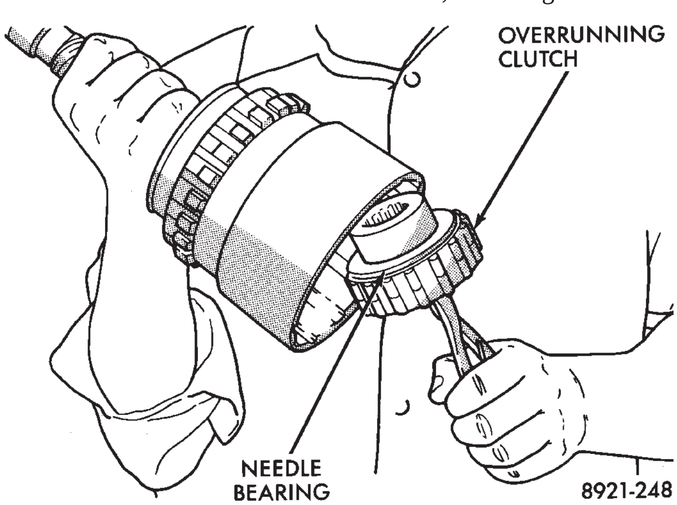

Fig. 27 Overrunning Clutch Assembly Removal

(18) Remove thrust bearing from overrunning clutch hub (Fig. 28).

(19) Remove overrunning clutch from hub (Fig. 28).

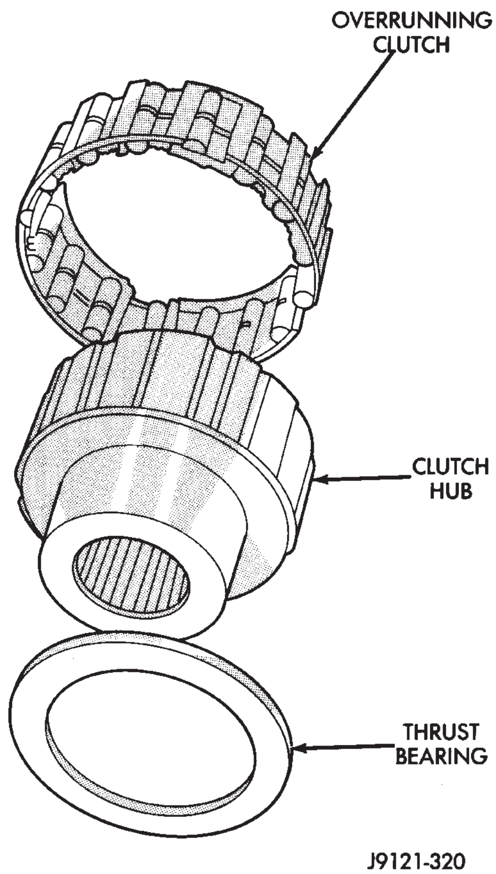

Fig. 28 Overrunning Clutch Components

(20) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 29). Use small center punch or scriber to make alignment marks.

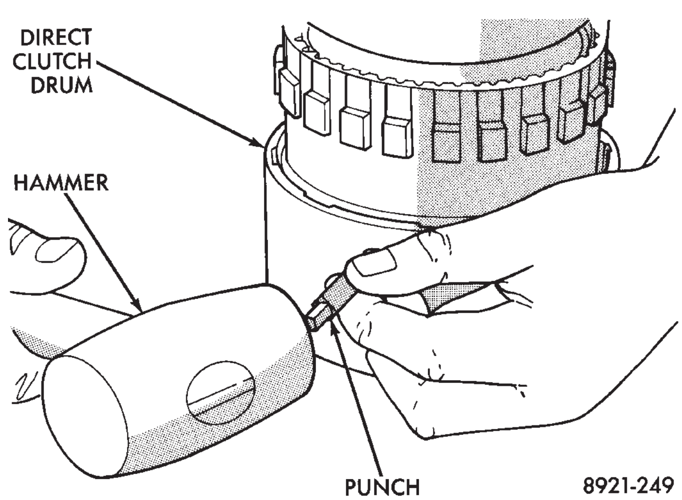

Fig. 29 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

(21) Remove direct clutch drum rear retaining ring (Fig. 30).

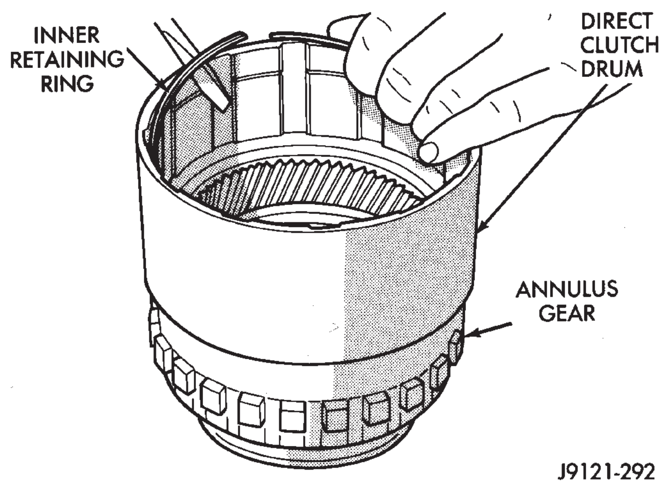

Fig. 30 Clutch Drum Inner Retaining Ring Removal

(22) Remove direct clutch drum outer retaining ring (Fig. 31).

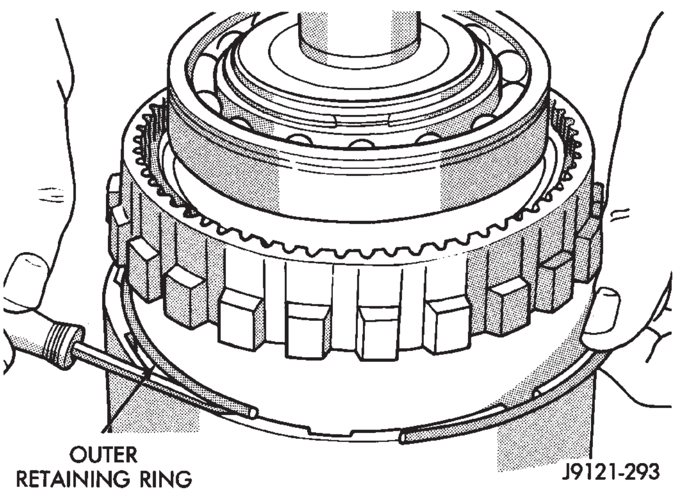

Fig. 31 Clutch Drum Outer Retaining Ring Removal

(23) Mark annulus gear and output shaft for assembly alignment reference (Fig. 32).

(24) Remove annulus gear from output shaft (Fig. 33). Use rawhide or plastic mallet to tap gear off shaft.

(25) Remove output shaft front bearing if not previously removed.

OVERDRIVE COMPONENT CLEANING AND INSPECTION

Clean the geartrain (Fig. 34) and case components (Fig. 35) with solvent. Dry all parts except the bearings with compressed air. Allow bearings to air dry.

Do not use shop towels for wiping parts dry unless the towels are made from a lint-free material. A sufficient quantity of lint (from shop towels, cloths, rags, etc.) could plug the transmission filter and fluid passages.

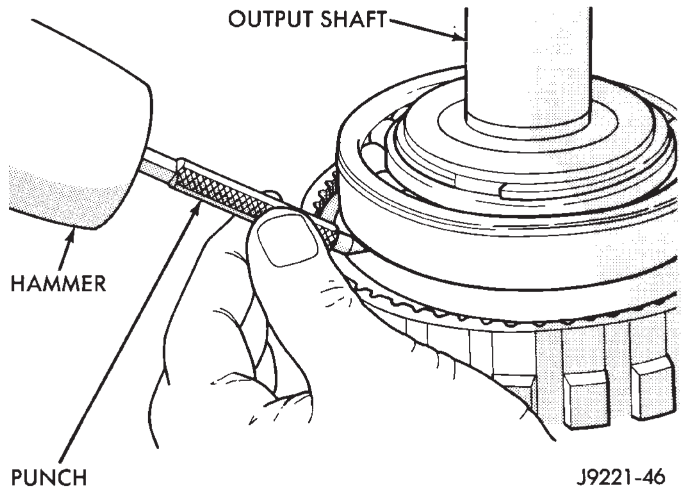

Fig. 32 Marking Annulus Gear And Output Shaft For Assembly Alignment

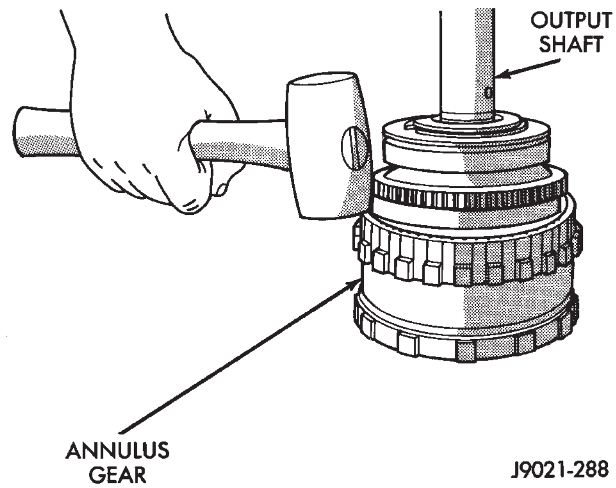

Fig. 33 Annulus Gear Removal

Discard the old case gasket and seals. Do not attempt to salvage these parts. They are not reusable. Replace any of the overdrive unit snap rings if distorted or damaged.

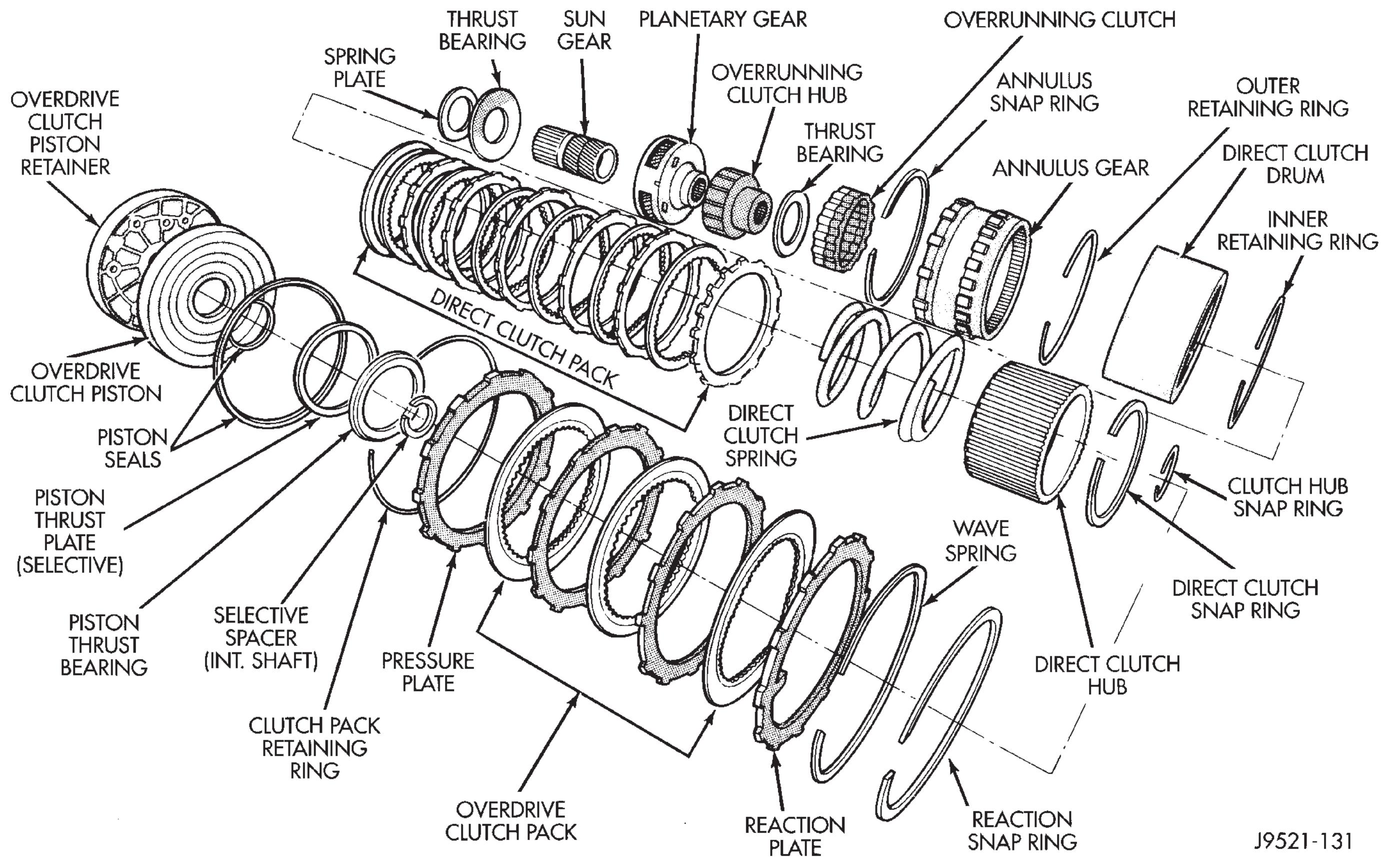

Fig. 34 Overdrive Geartrain Components

Minor nicks or scratches on components can be smoothed with crocus cloth. However, do not attempt to reduce severe scoring on any components with abrasive materials. Replace severely scored components; do not try to salvage them.

Check condition of the park lock components and the overdrive case (Fig. 36).

Replace the case if cracked, scored, or damaged. Replace the park lock pawl, plug, or spring if worn or damaged. Be sure the bullet at the end of the park lock rod is in good condition. Replace the rod if the bullet is worn or the rod itself is bent or distorted. Do not attempt to straighten the rod.

Check the bushings in the overdrive case. Replace the bushings if severely scored or worn. Also replace the case seal if loose, distorted, or damaged.

Examine the overdrive and direct clutch discs and plates (Fig. 34). Replace the discs if the facing is worn, severely scored, or burned and flaking off. Replace the clutch plates if worn, heavily scored, or cracked. Check the lugs on the clutch plates for wear. The plates should slide freely in the drum. Replace the plates or drum if binding occurs.

Check condition of the annulus gear, direct clutch hub, clutch drum and clutch spring (Fig. 34). Replace the gear, hub and drum if worn or damaged. Replace the spring if collapsed, distorted, or cracked.

Be sure the splines and lugs on the gear, drum and hub are in good condition. The clutch plates and discs should slide freely in these components.

Inspect the thrust bearings and spring plate (Fig. 34). Replace the plate if worn or scored. Replace the bearings if rough, noisy, brinneled, or worn.

Inspect the planetary gear assembly and the sun gear and bushings (Fig. 34). If either the sun gear or the bushings are damaged, replace the gear and bushings as an assembly. The gear and bushings are not serviced separately.

The planetary carrier and pinions must be in good condition. Also be sure the pinion pins are secure and in good condition. Replace the carrier if worn or damaged.

Inspect the overrunning clutch and race. The race surface should be smooth and free of scores. Replace the overrunning clutch assembly or the race if either assembly is worn or damaged in any way.

Inspect the output shaft and governor components (Fig. 36). Replace the shaft pilot bushing and inner bushing if damaged. Replace either shaft bearing if rough or noisy. Replace the bearing snap rings if distorted or cracked.

Check the machined surfaces on the output shaft. These surfaces should clean and smooth. Very minor

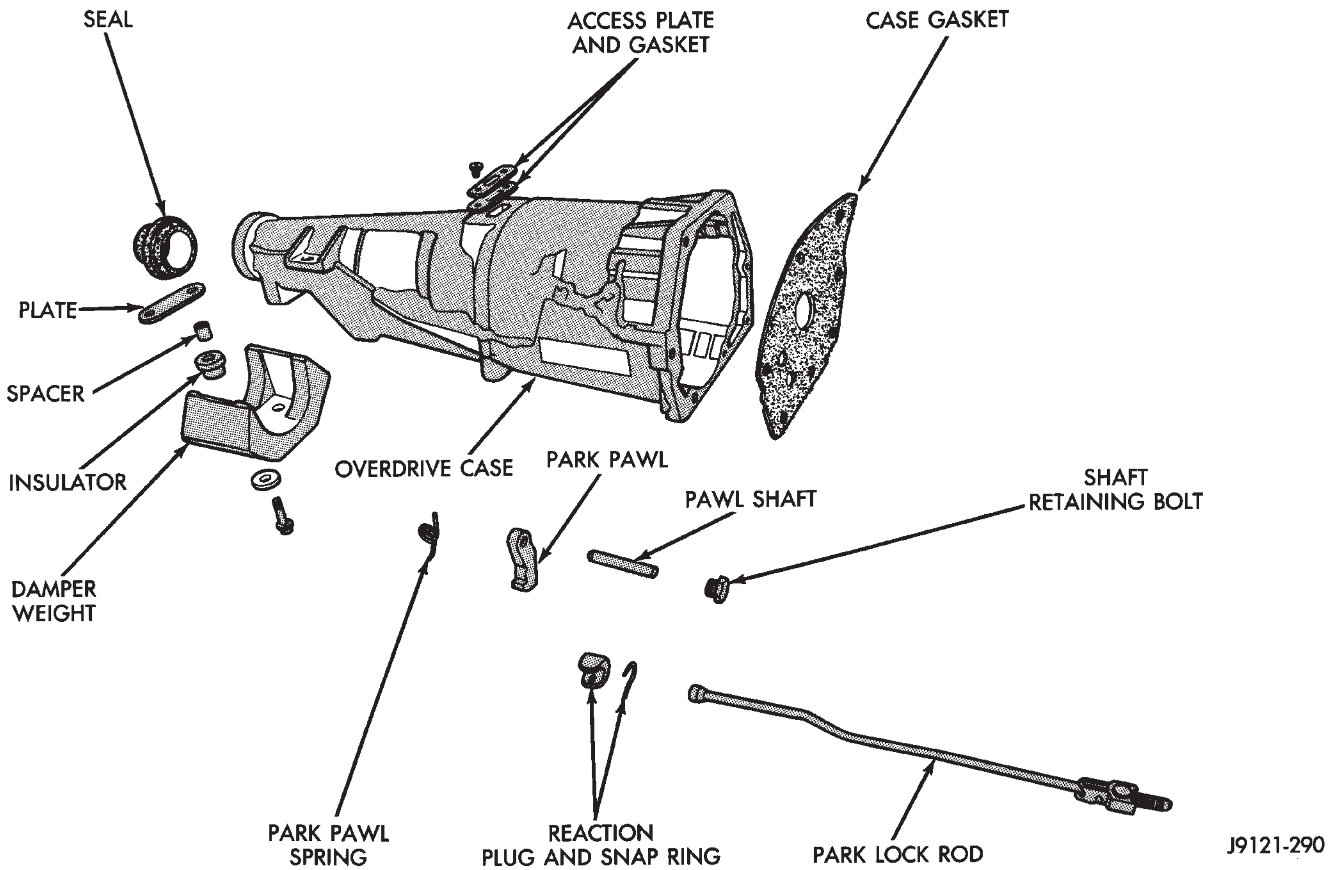

Fig. 35 Overdrive Case And Park Lock Components

nicks or scratches can be smoothed with crocus cloth. Replace the shaft if worn, scored or damaged in any way.

Inspect the output shaft bushings (Fig. 36). The small bushing is the intermediate shaft pilot bushing. The large bushing is the overrunning clutch hub bushing. Replace either bushing if scored, pitted, cracked, or worn.

The bushings can be removed with "blind hole puller tools" such as Snap-On set CG40CB for small bushings and set CG46 for large bushings. New bushings can be installed with tools from an all purpose installer kit such as the Snap-On A257 bushing driver set.

GOVERNOR OVERHAUL

Governor Changes

A 3-stage governor weight assembly is now in production. The assembly consists of an outer weight, a smaller weight spring and inner weight, and a new intermediate weight. The sleeve-like intermediate weight fits inside the outer weight; the inner weight now fits inside the intermediate weight.

A steel outer weight was used in early models. Current production models have an aluminum outer weight. Only the aluminum weight assembly will be supplied for service.

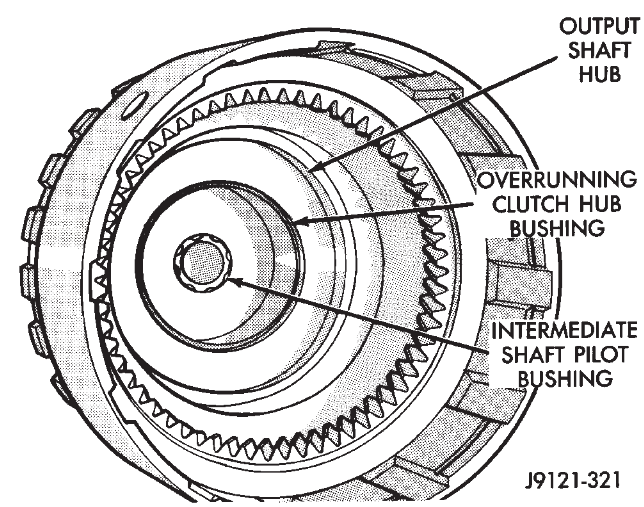

Fig. 36 Output Shaft Bushing Location

The governor body was also changed. A retainer washer was added to help secure the outer weight in the bore; the washer backs up the original snap ring which is still used. The governor body on was also changed. The weight assembly bore is slightly longer on these models. Only the new style governor body will be supplied for service.

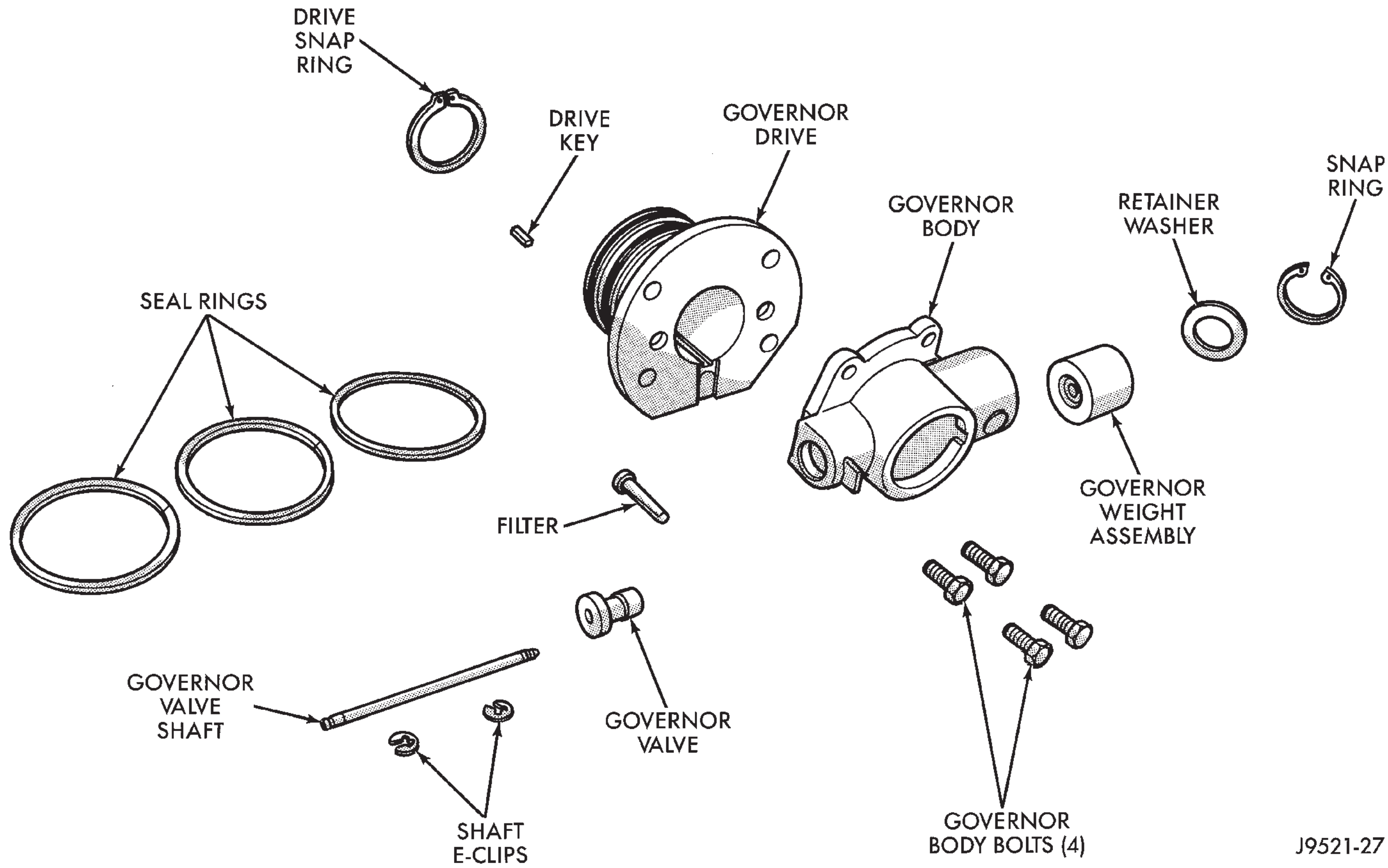

Fig. 37 Governor Components

GOVERNOR DISASSEMBLY

(1) Remove snap ring and washer that retain governor weight assembly in governor body (Fig. 38).

(2) Remove governor weight assembly from governor body.

(3) Note position of governor body on drive for installation reference.

(4) Clamp edge of governor drive in vise equipped with brass protective jaws. Then loosen governor body attaching bolts.

(5) Remove bolts attaching governor body to drive.

(6) Remove governor body (Fig. 39).

(7) Remove filter from governor drive. Note position of filter for assembly reference (Fig. 39).

(8) Disassemble governor weight components:

(a) Remove inner weight and intermediate weight from outer weight.

(b) Position intermediate weight on suitable size socket (Fig. 40).

(c) Push inner weight downward with nut driver tool. Then remove inner weight snap ring with Snap Ring Plier Tool 6823 (Fig. 40).

(d) Remove inner weight and spring from intermediate weight.

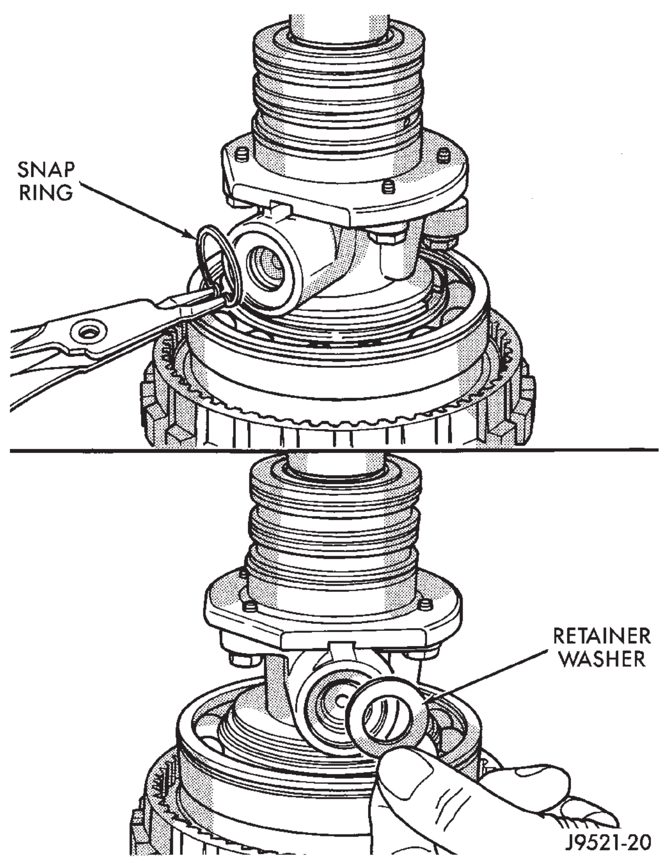

Fig. 38 Retainer Washer And Snap Ring Removal

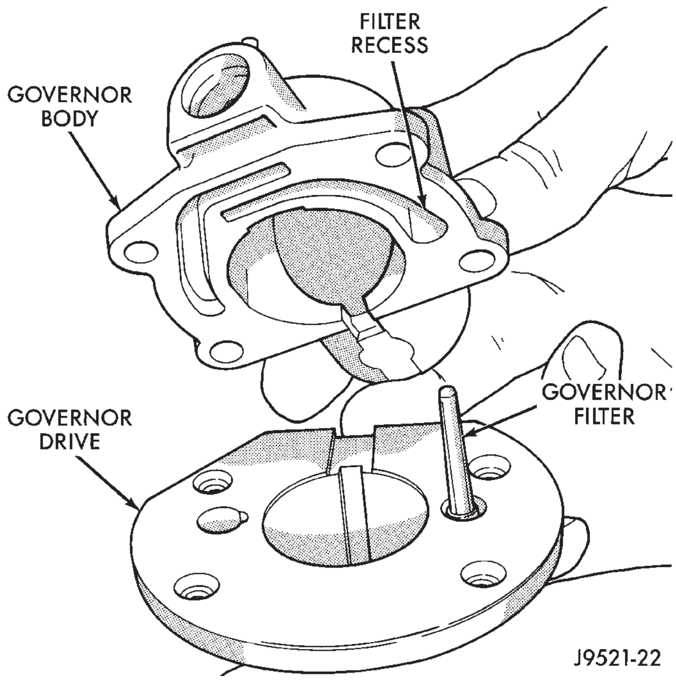

Fig. 39 Governor Body And Filter Position On Drive

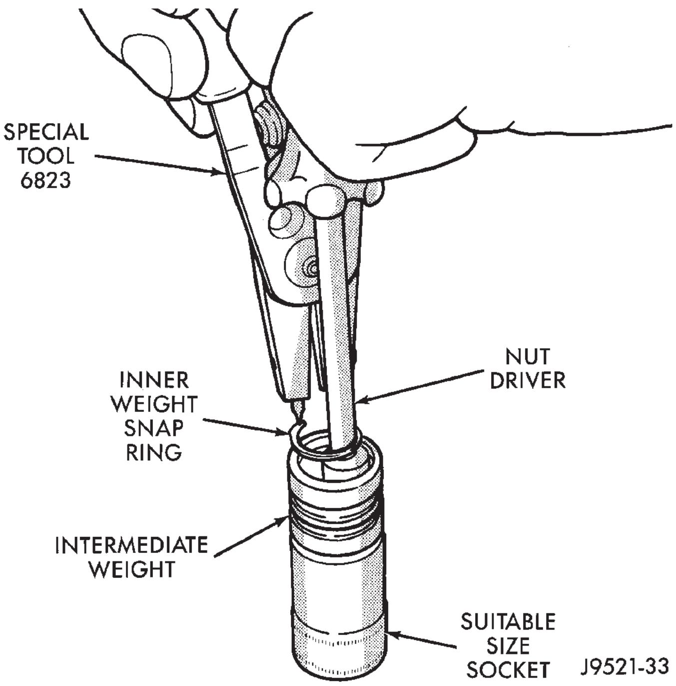

Fig. 40 Inner Weight Snap Ring Removal/Installation

Governor Inspection

Check condition of the governor components. Check operation of the governor valve, weights and shaft. The valves and weights should slide freely in the governor body.

Check condition of the governor drive seal rings. Replace the seal rings only if they exhibit wear or damage. Be sure the seal ring grooves in the drive are in good condition as well.

Inspect the governor support and oil pressure tubes. The tubes must not be pinched, kinked, collapsed, or distorted. Blow them out with compressed air to clear them. The tubes are designed to be a slip fit in the piston retainer boss. Do not modify the tube ends in an effort to make them fit tighter. **Both tubes are an integral part of the support. Do not attempt to remove them. Replace the support and oil tubes as an assembly if either part is damaged.**

Check condition of the governor snap rings. Replace any snap ring that appears bent or distorted, or condition is doubtful.

Inspect the governor body for damage. Replace it if cracked, or if the bores are worn.

GOVERNOR ASSEMBLY

(1) Lubricate governor components with Mopar ATF Plus transmission fluid during assembly.

(2) Install new seal rings on governor drive as follows:

(a) Compress (squeeze) each seal over center before installation (Fig. 41); this provides tighter ring fit on drive.

(b) Carefully work seal into each groove of drive. Avoid overspreading seals during installation to ensure tight fit.

(c) Verify that diagonally cut ring ends are properly interlocked (Fig. 42).

(d) Stagger position of seal ring ends so they are at least 30° apart. Ring ends must not be aligned.

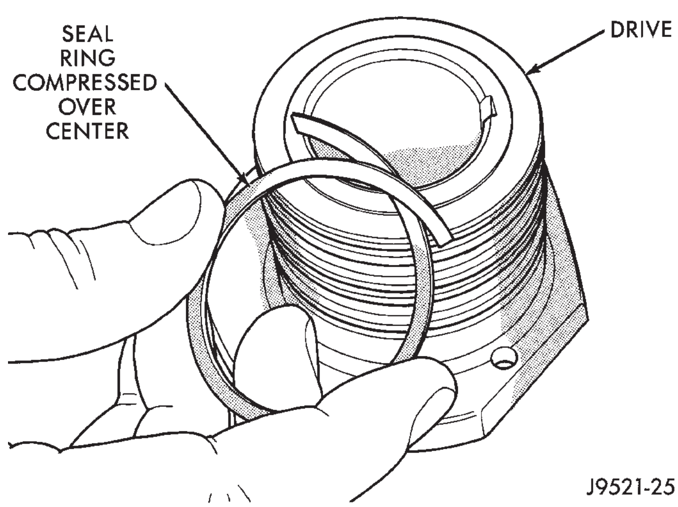

Fig. 41 Compressing Seal Rings

(2) Insert filter in governor drive. Filter goes in hole to right of key slot (Fig. 43).

(3) Align and position governor body on drive. Be sure filter is seated in recess in governor body (Fig. 43).

(4) Apply 1-2 drops of Mopar Lock N' Seal, or Loctite 242 to threads of all four governor body attach-

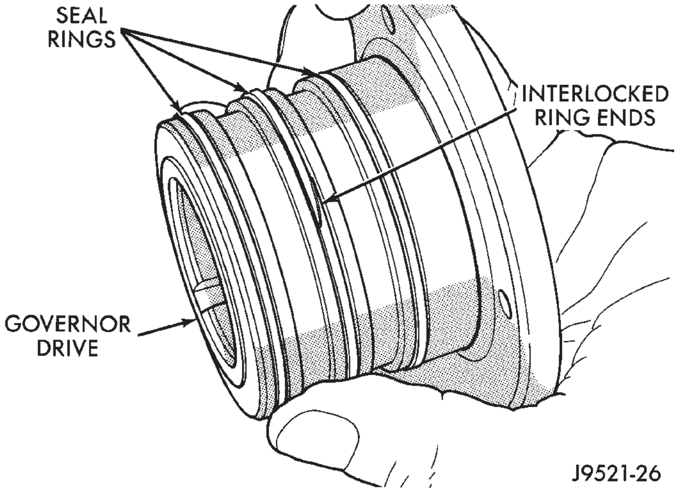

Fig. 42 Governor Drive Seal Rings Installed

ing bolts. Then install and tighten governor body bolts snug but not to specified torque at this time.

(5) Assemble governor weight components (Fig. 44).

(a) Be sure weights are clean; then lubricate them with ATF Plus.

(b) Insert spring and inner weight in intermediate weight. Position intermediate weight on suitable size socket (Fig. 40).

(c) Press inner weight downward with nutdriver and install inner weight snap ring with Tool 6823 (Fig. 40).

(d) **Set weight assembly aside temporarily. Assembly will not be installed until after governor drive is seated on output shaft.**

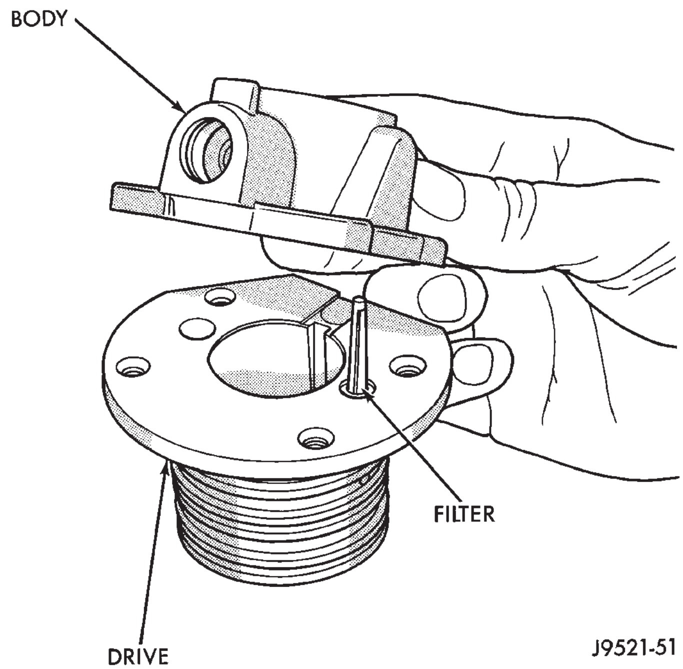

Fig. 43 Governor Body And Filter Installation

(6) Lubricate seal rings, drive hub and governor body bores with Mopar ATF Plus. Then set assembly aside until final installation on output shaft.

DIRECT CLUTCH AND GEARTRAIN ASSEMBLY

(1) Soak direct clutch and overdrive clutch discs in Mopar ATF Plus before installation. Also lubricate geartrain components with ATF Plus during reassembly.

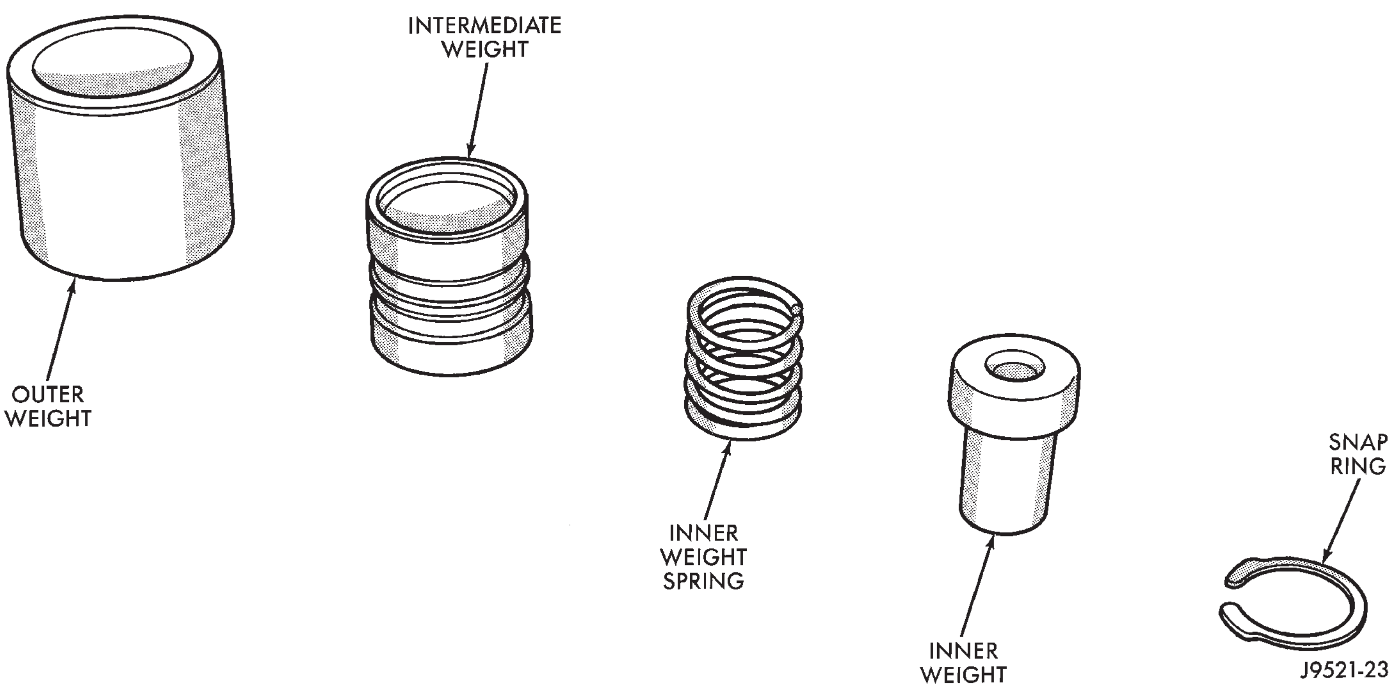

Fig. 44 Governor Weight Components

(2) Install new pilot bushing and clutch hub bushing in output shaft if necessary (Fig. 45). Lubricate new (or old) bushings with petroleum jelly.

(3) Install front bearing and bearing snap ring on output shaft (Fig. 45)

(4) Align and install annulus gear on output shaft (Fig. 45).

(5) Install annulus snap ring (Fig. 45).

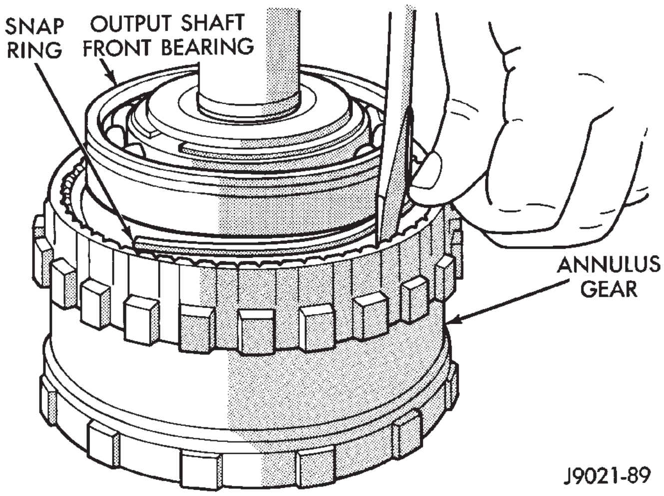

Fig. 45 Annulus Gear And Snap Ring Installation

(6) Align and install clutch drum on annulus gear (Fig. 46). Be sure drum is engaged in annulus gear lugs.

(7) Install clutch drum outer retaining ring (Fig. 46).

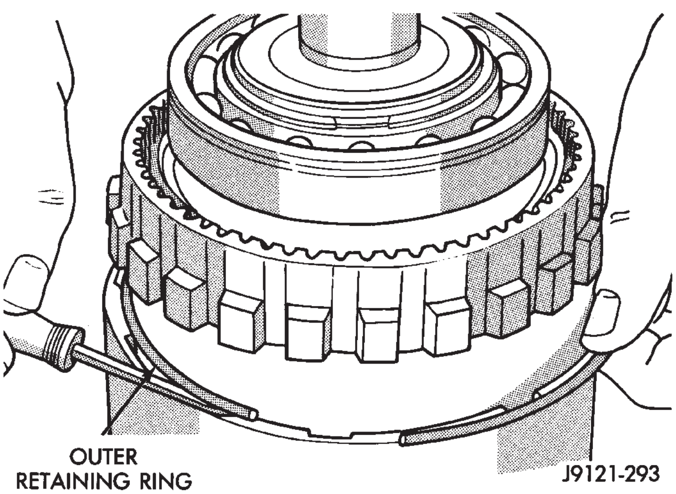

Fig. 46 Clutch Drum And Outer Retaining Ring Installation

(8) Slide clutch drum forward and install inner retaining ring (Fig. 47).

(9) Install overrunning clutch on hub (Fig. 48). **Note that clutch only fits one way. Shoulder on clutch should seat in small recess at edge of hub.**

(10) Install thrust bearing on overrunning clutch hub (Fig. 49). Use petroleum jelly to hold bearing in place during installation. **Bearing fits one way only. Be sure bearing is seated squarely against hub. Reposition bearing if it does not seat squarely.**

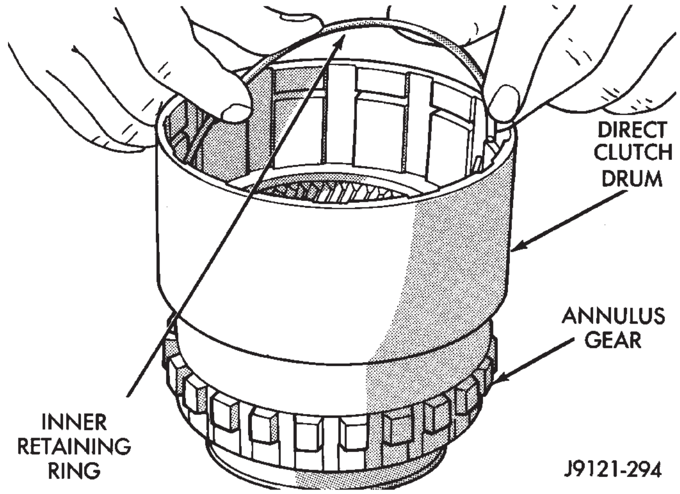

Fig. 47 Clutch Drum Inner Retaining Ring Installation

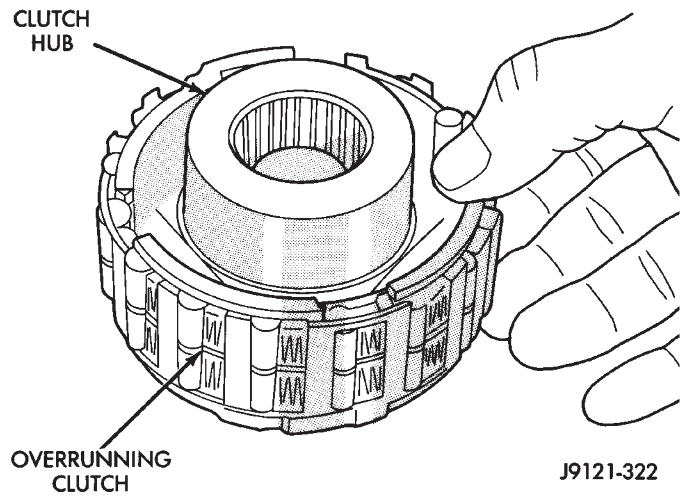

Fig. 48 Assembling Overrunning Clutch And Hub

(11) Install overrunning clutch (Fig. 50). Insert snap ring pliers in hub splines. Expand pliers to grip hub. Then install assembly with counterclockwise, twisting motion.

(12) Install planetary gear in annulus gear (Fig. 51). **Be sure planetary pinions are fully seated in annulus gear before proceeding.**

(13) Install direct clutch spring plate on sun gear. Then secure plate to sun gear with snap ring (Fig. 52). Shoulder side of plate should face outward and toward front.

(14) Coat planetary thrust bearing and bearing contact surface of spring plate with petroleum jelly. This will help hold bearing in place during installation.

(15) Install planetary thrust bearing on sun gear (Fig. 53). Slide bearing onto gear and seat it against

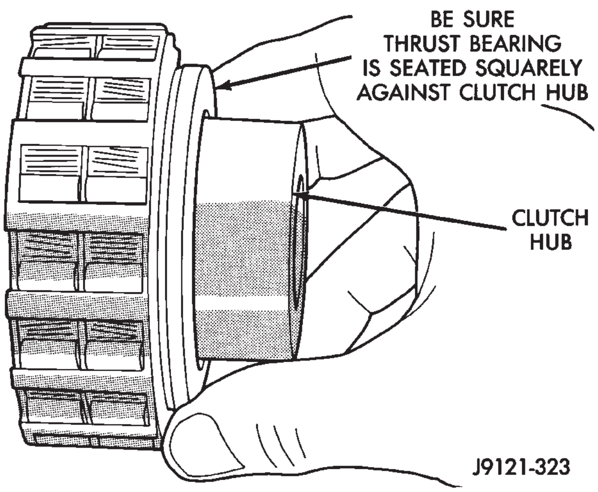

Fig. 49 Overrunning Clutch Thrust Bearing Installation

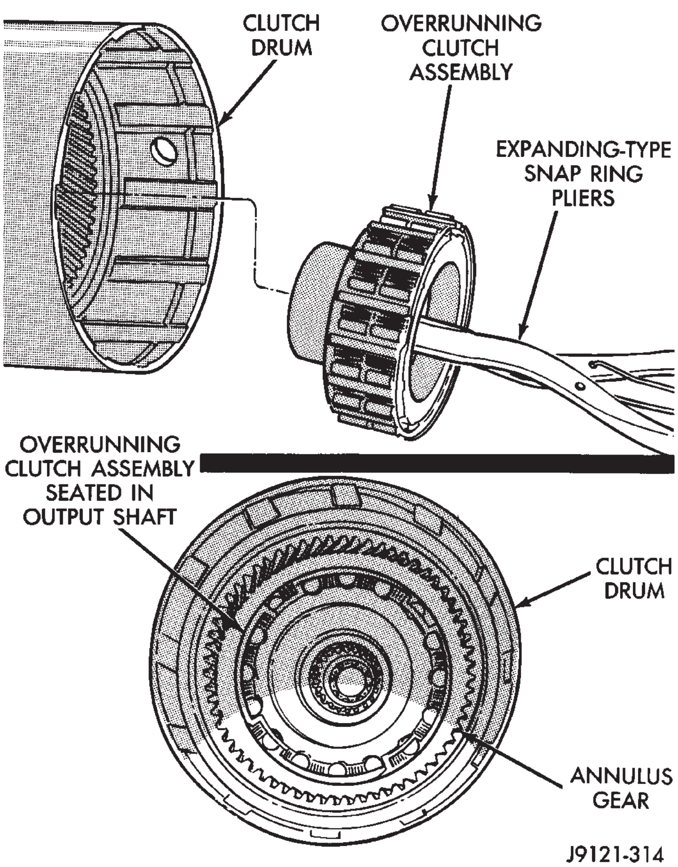

Fig. 50 Overrunning Clutch Installation

spring plate as shown. **Bearing fits one way only. If it does not seat squarely against spring plate, remove and reposition bearing.**

(16) Install assembled sun gear, spring plate and thrust bearing (Fig. 54). Be sure sun gear and thrust bearing are fully seated before proceeding.

(17) Align splines in hubs of planetary gear and overrunning clutch with Alignment Tool 6227-2 (Fig.

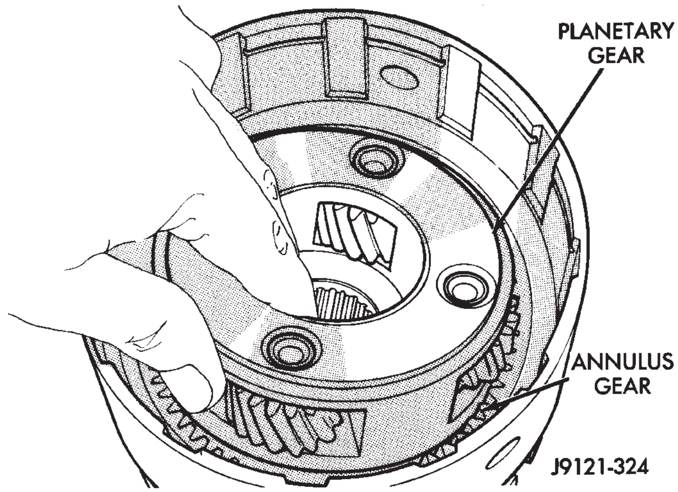

Fig. 51 Planetary Gear Installation

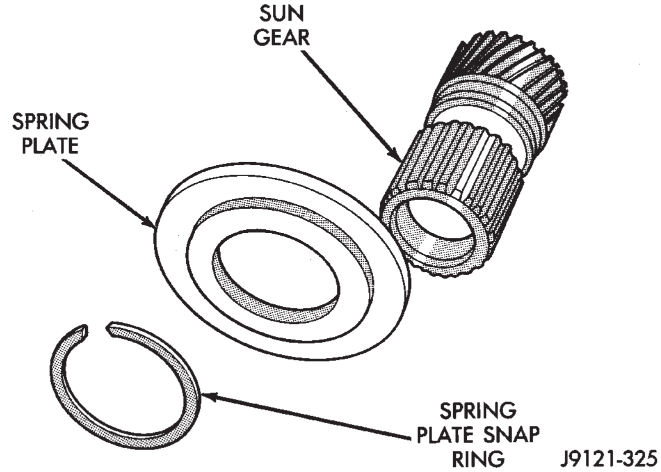

Fig. 52 Sun Gear And Spring Plate Assembly

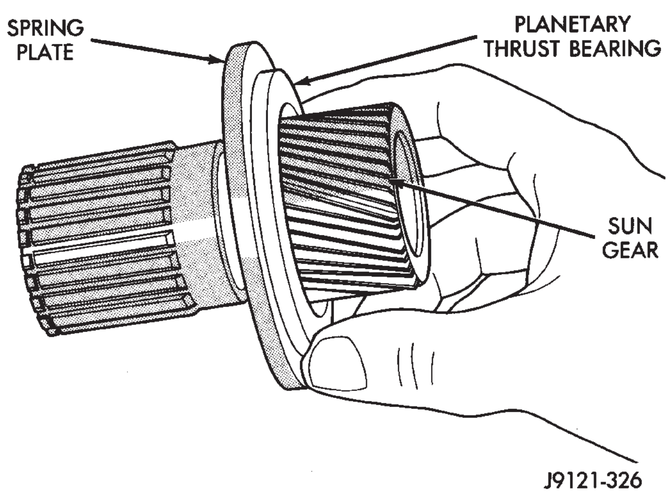

Fig. 53 Planetary Thrust Bearing Installation

55). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

(18) Install direct clutch spring. Be sure spring is properly seated on spring plate (Fig. 55).

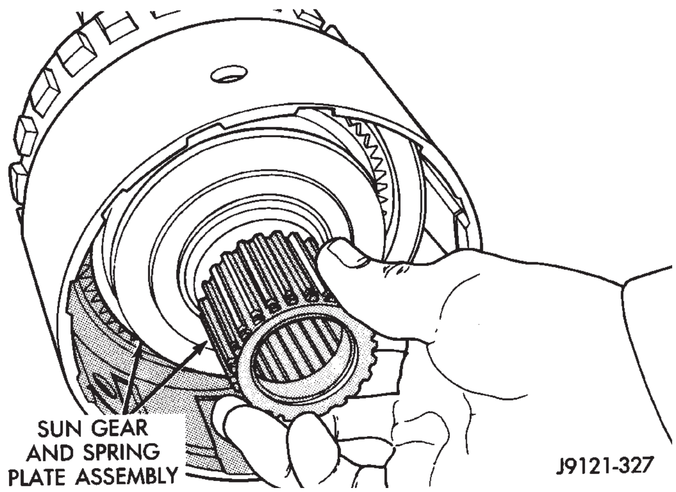

Fig. 54 Sun Gear Installation

(19) Assemble direct clutch pack for installation on hub (Fig. 56).

(20) Install direct clutch reaction plate on clutch hub. **Note that one side of reaction plate is counterbored. Be sure this side faces rearward. Splines at rear of hub are raised slightly and counterbore in plate fits over these splines. Plate should be flush with this end of hub (Fig. 57).**

(21) Install remainder of direct clutch components as follows:

(a) Install first clutch disc on reaction plate followed by a steel plate.

(b) Alternately install remaining clutch discs and steel plates until required number of discs and plates are installed. **46RH requires 8 discs and 7 steel plates (Fig. 56).**

(c) Last clutch pack item installed is clutch pressure plate. Be sure plate is installed with shoulder side of plate facing upward (Fig. 58).

(22) Install clutch hub and clutch pack on direct clutch spring (Fig. 59).

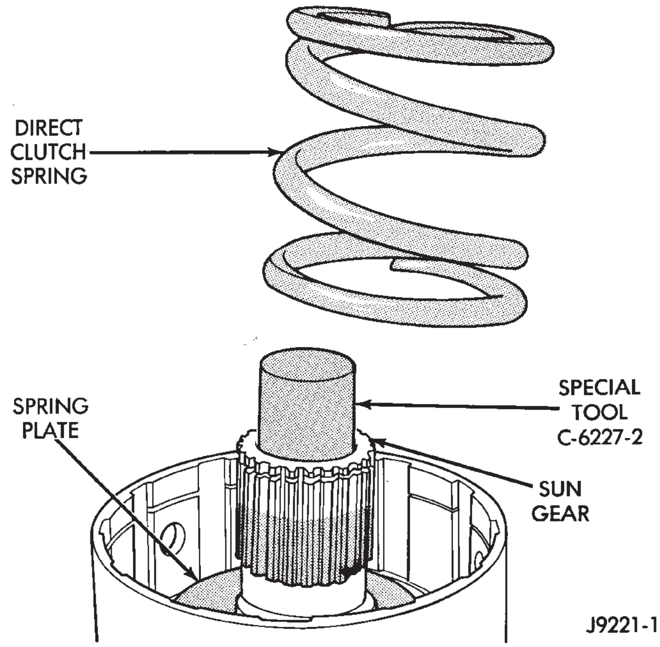

Fig. 55 Direct Clutch Spring Installation

(23) Mount geartrain assembly in shop press (Fig. 60)

WARNING: THE NEXT STEP IN GEARTRAIN ASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH HUB AND SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 800 POUNDS. USE SPRING COMPRESSOR TOOL C-6227-1 AND A HYDRAULIC-TYPE SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

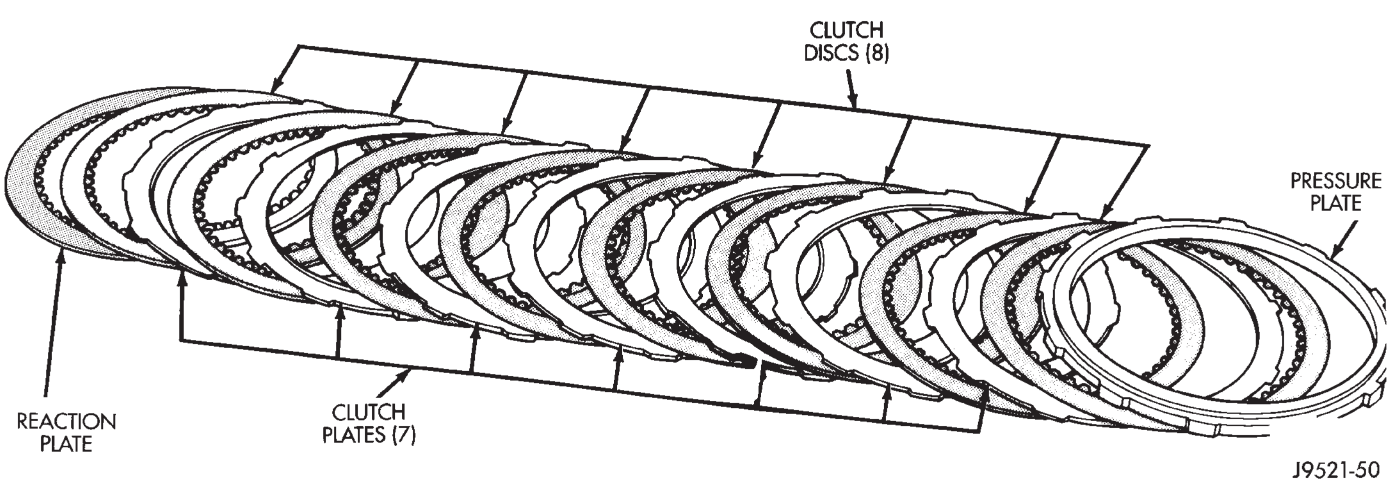

Fig. 56 Direct Clutch Pack Components

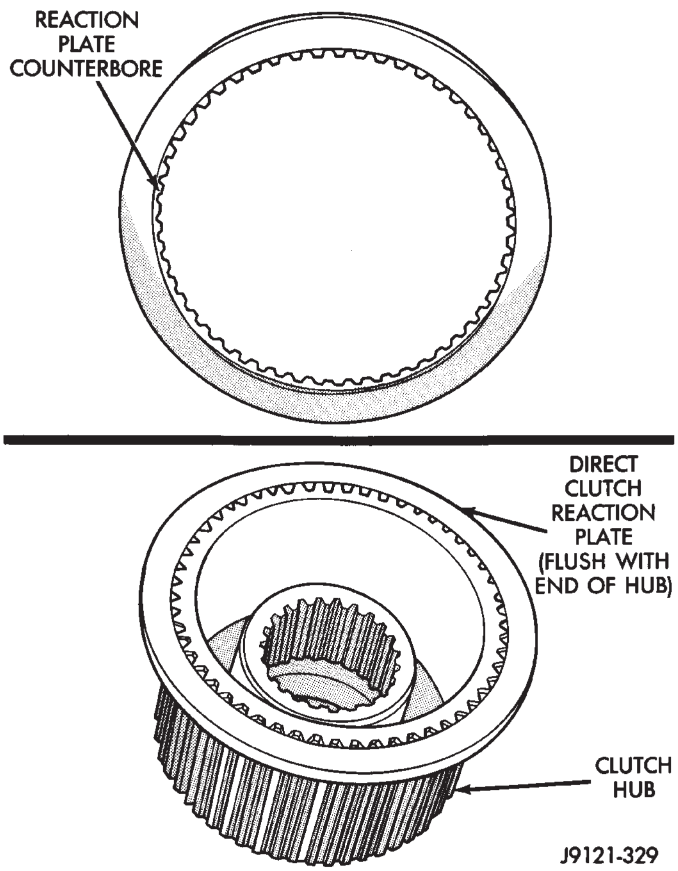

Fig. 57 Correct Position Of Direct Clutch Reaction Plate

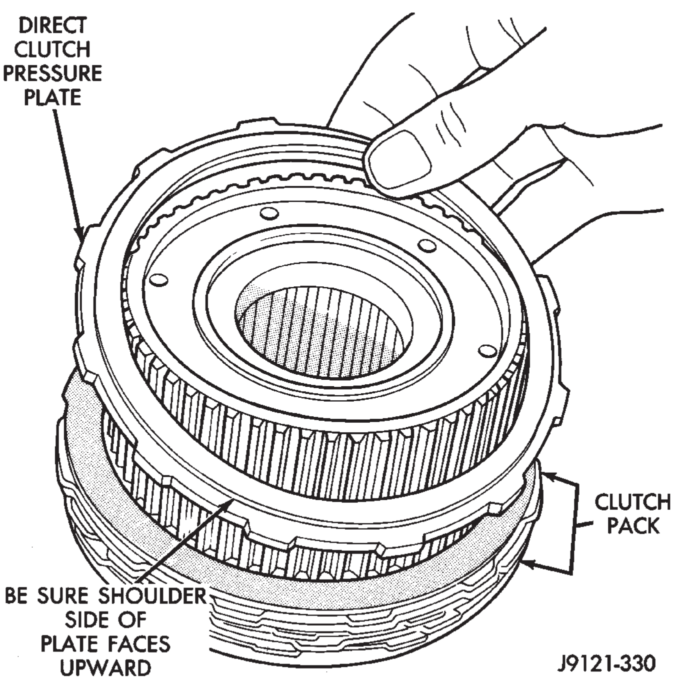

Fig. 58 Correct Position Of Direct Clutch Pressure Plate

(24) Position Compressor Tool 6227-2 on clutch hub (Fig. 60).

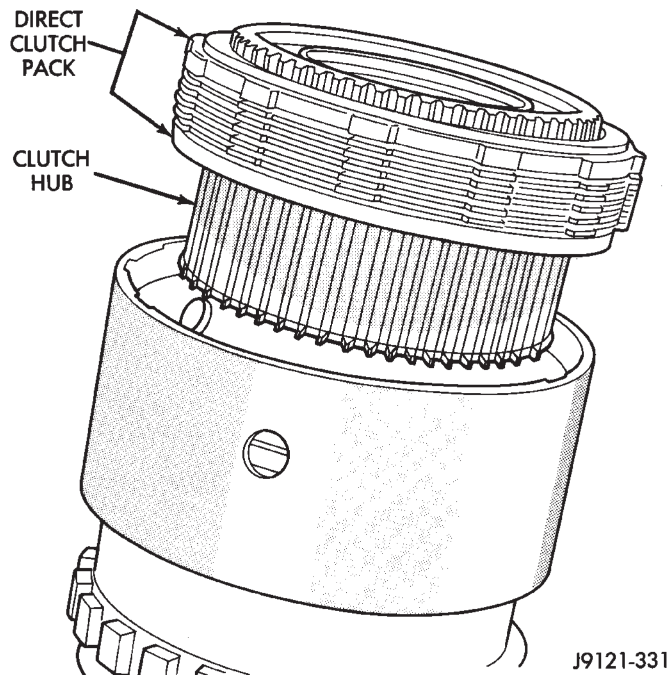

Fig. 59 Installing Assembled Direct Clutch Pack And Hub

(25) Slide direct clutch pack upwards on hub (Fig. 60). Slide pack upward and set it partially on edge of hub and compressor tool as shown in Figure 60.

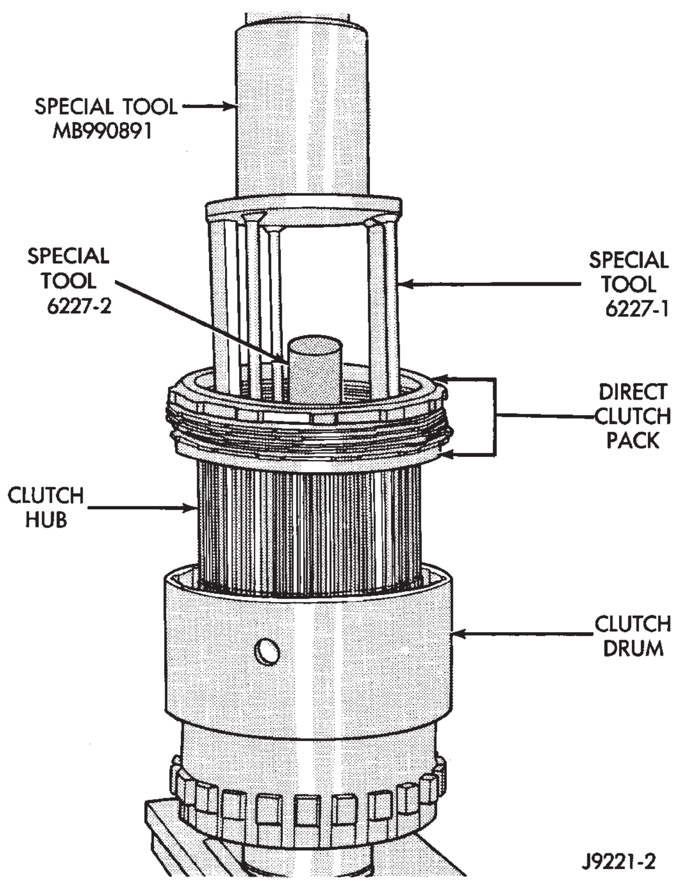

Fig. 60 Mounting Geartrain Assembly In Shop Press

(26) Slowly compress clutch hub and spring (Fig. 61). Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

(27) Realign clutch pack on hub and seat clutch discs and plates in clutch drum (Fig. 61).

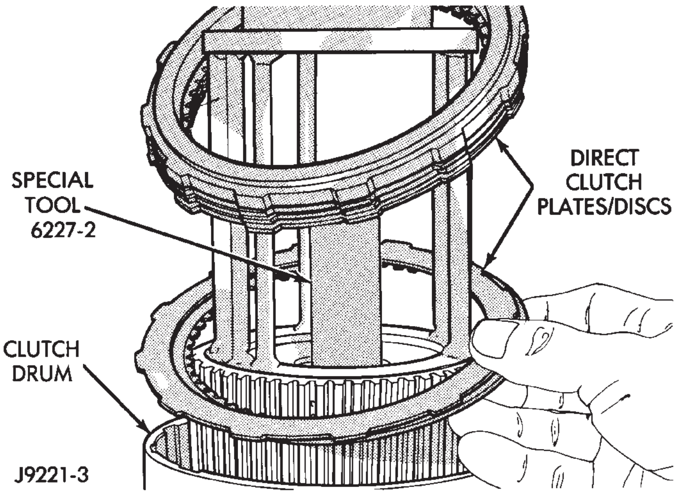

Fig. 61 Seating Clutch Pack In Drum

(28) Install direct clutch pack snap ring (Fig. 62). **Be very sure snap ring is fully seated in clutch drum ring groove.**

(29) Install clutch hub retaining ring (Fig. 63). **Be very sure retaining ring is fully seated in sun gear ring groove.**

(30) Slowly release press ram, remove compressor tools and remove geartrain assembly.

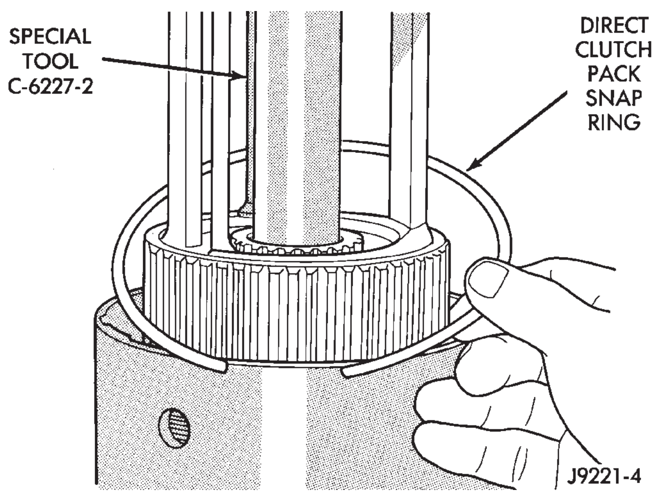

Fig. 62 Direct Clutch Pack Snap Ring Installation

OVERDRIVE GEARTRAIN AND CASE ASSEMBLY

(1) Install front bearing and snap ring on output shaft (Fig. 64). **Be sure locating ring groove in bearing is toward rear of shaft. Otherwise, housing locating ring and bearing ring groove will not align. Remove and reposition bearing if necessary.**

(2) Install governor drive key in output shaft (Fig.

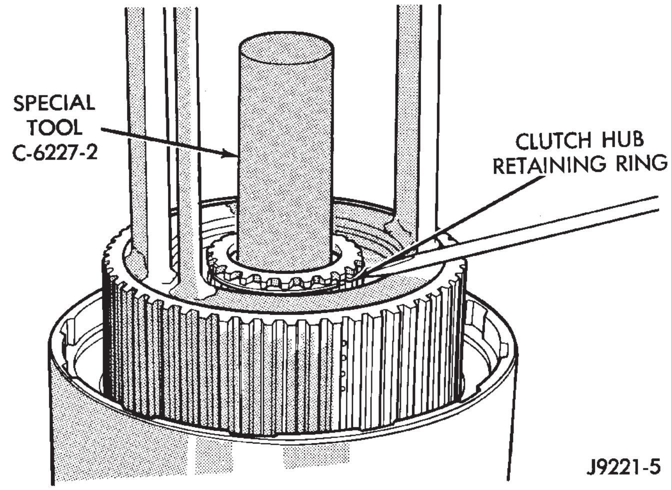

Fig. 63 Clutch Hub Retaining Ring Installation

64). Use petroleum jelly to hold key in place if necessary.

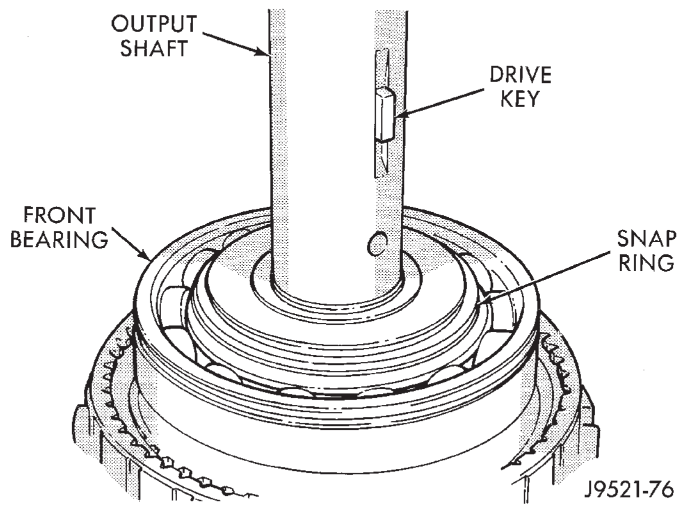

Fig. 64 Front Bearing And Drive Key Installation

(3) Install governor body and drive assembly on output shaft as follows (Fig. 65).

(a) Be sure drive key is fully engaged in shaft drive slot.

(b) Align key with slot in governor drive and slide drive assembly into place. To avoid displacing drive key, reach through weight opening in governor body with fingers and guide key into place.

(4) Install governor weight assembly in governor body (Fig. 66).

(5) Install retainer washer and snap ring that secure governor weight assembly in governor body (Fig. 67).

(6) Verify that governor valve shaft bores in governor body and output shaft are aligned.

(7) Install governor valve in body bore. Large diameter end of valve faces outward. Then install governor valve shaft and secure it with E-clips.

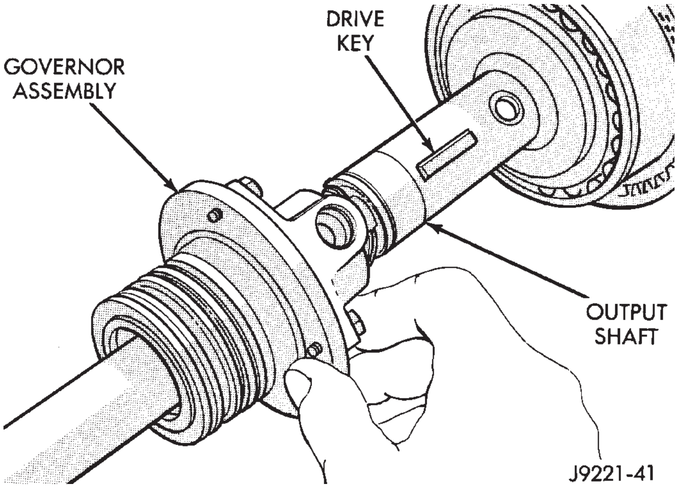

Fig. 65 Governor Assembly Installation

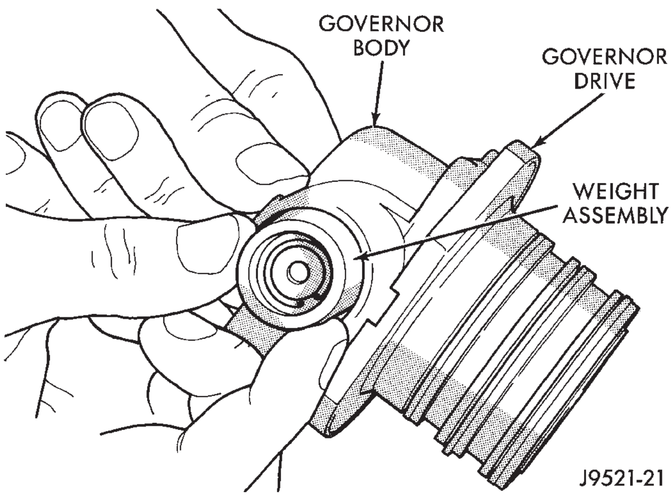

Fig. 66 Installing Governor Weight Assembly

CAUTION: Be very sure the E-clips are fully seated in the valve shaft grooves and that the rounded sides of the clips are facing outward. Otherwise, the clips will pop off the shaft causing a governor failure.

(8) Install governor assembly snap ring (Fig. 68).

(9) Tighten governor body attaching bolts to 11 N·m (8 ft. lbs.) torque.

(10) Install output shaft rear bearing in case and install bearing snap ring. Be sure snap ring is fully seated.

(11) Position park pawl and spring in case and install park pawl shaft (Fig. 14). Verify that spring end is hooked to pawl and straight end of spring

(12) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.

(13) Install park lock reaction plug. **Note that plug has locating pin at rear (Fig. 69). Be sure pin is seated in hole in case before installing snap ring.**

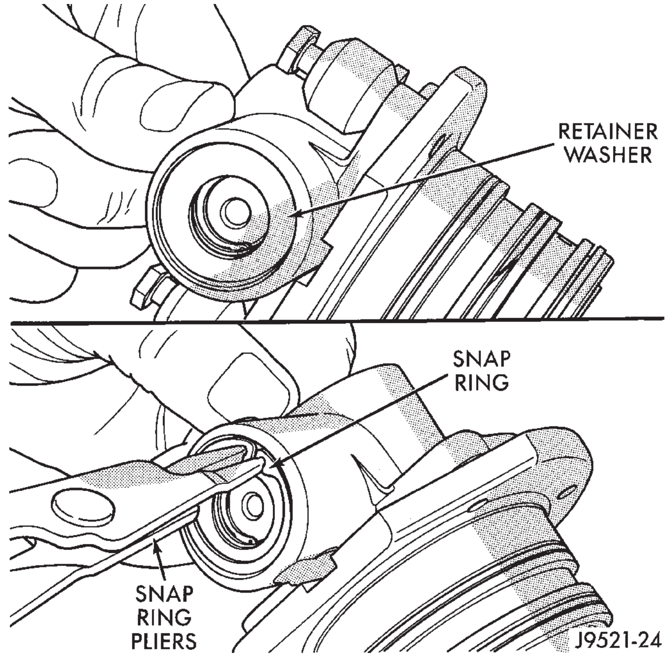

Fig. 67 Governor Weight Retainer Washer And Snap Ring Installation

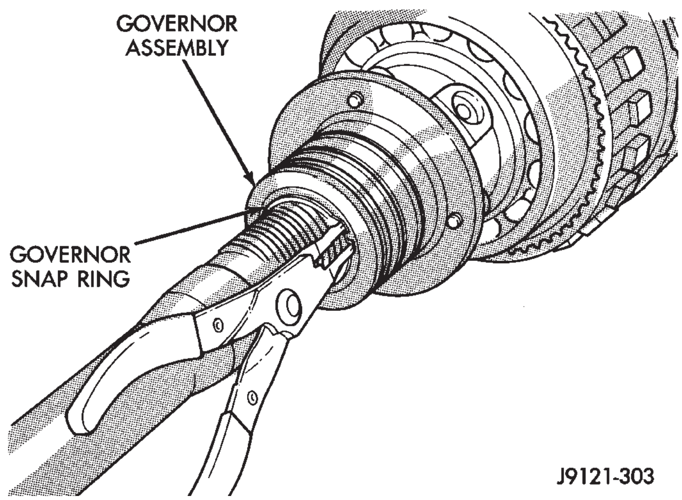

Fig. 68 Governor Snap Ring Installation

(14) Install reaction plug snap ring (Fig. 70). **Compress snap ring only enough for installation; do not distort it.**

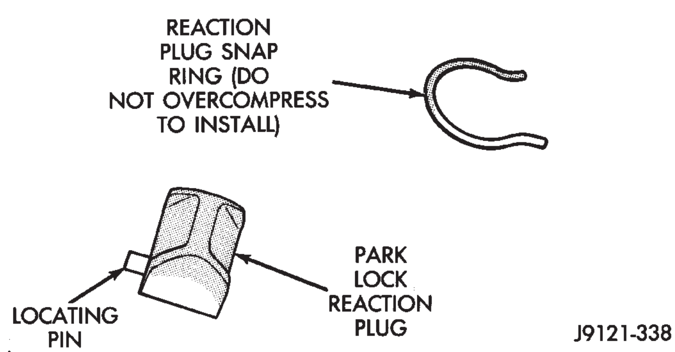

Fig. 69 Reaction Plug Locating Pin And Snap Ring

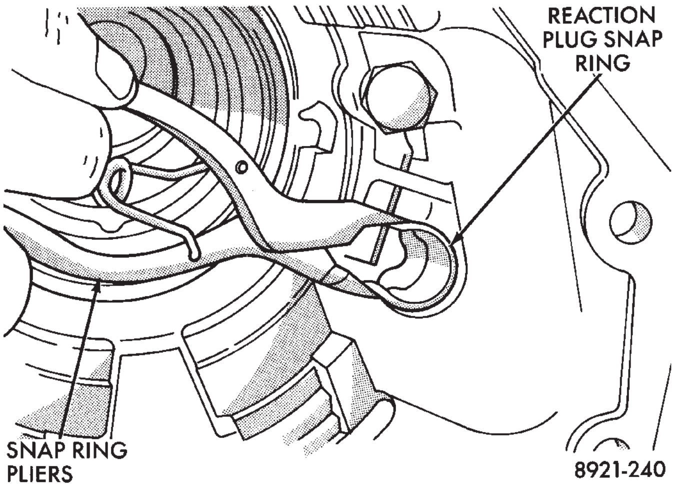

Fig. 70 Reaction Plug And Snap Ring Installation

(15) Install alignment clip on governor tubes (Fig. 71). Slide clip up against shoulder on each tube.

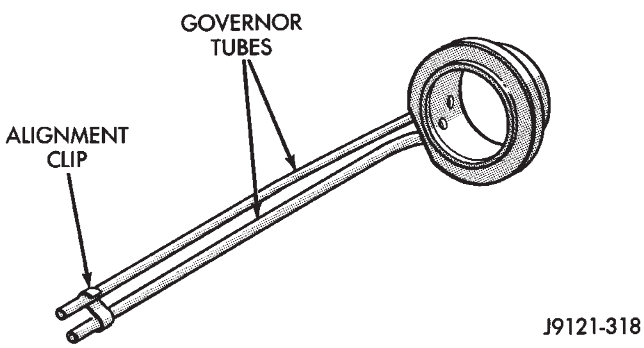

Fig. 71 Positioning Governor Tube Alignment Clip

(16) Install governor support and pressure tubes in case (Fig. 72).

(17) Install governor support snap ring (Fig. 73).

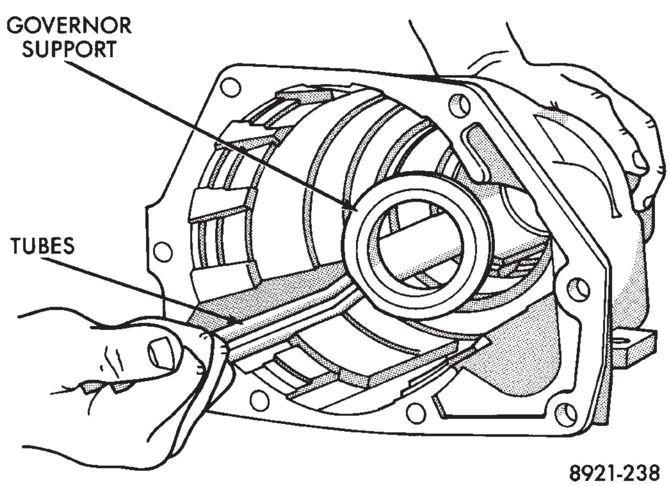

Fig. 72 Installing Governor Support And Pressure Tubes

(18) Install output shaft front bearing locating ring in case (Fig. 74).

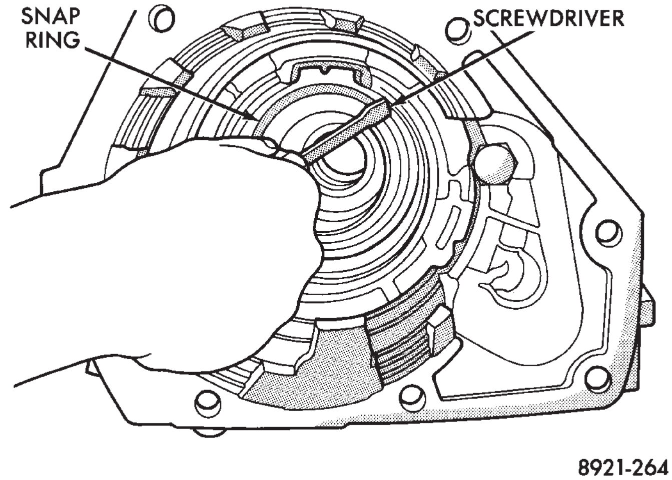

Fig. 73 Installing Governor Support Snap Ring

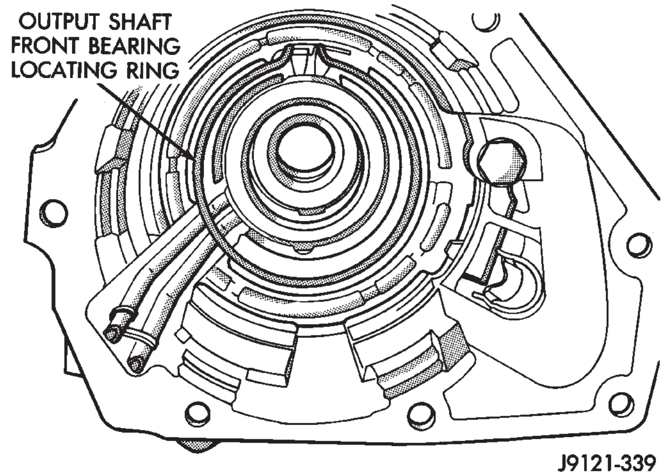

Fig. 74 Front Bearing Locating Ring Installation

(19) Support geartrain on Tool 6227-1 (Fig. 75). Be sure tool is securely seated in clutch hub.

(20) Install overdrive unit case over geartrain (Fig. 75).

(21) Expand front bearing locating ring with snap ring pliers. Then slide case downward until locating ring locks in bearing groove and release snap ring.

(22) Install locating ring access plate and gasket in overdrive unit case (Fig. 9).

OVERDRIVE CLUTCH INSTALLATION AND ADJUSTMENT

(1) Install overdrive clutch components as follows:

(a) Install reaction ring first. Reaction ring is flat with notched ends (Fig. 76).

(b) Install wave spring on top of reaction ring. **Reaction ring and wave ring both fit in same ring groove.** Use screwdriver to seat each ring securely in groove.

(c) Install reaction plate (Fig. 77).

(d) Install first clutch disc followed by first clutch plate.

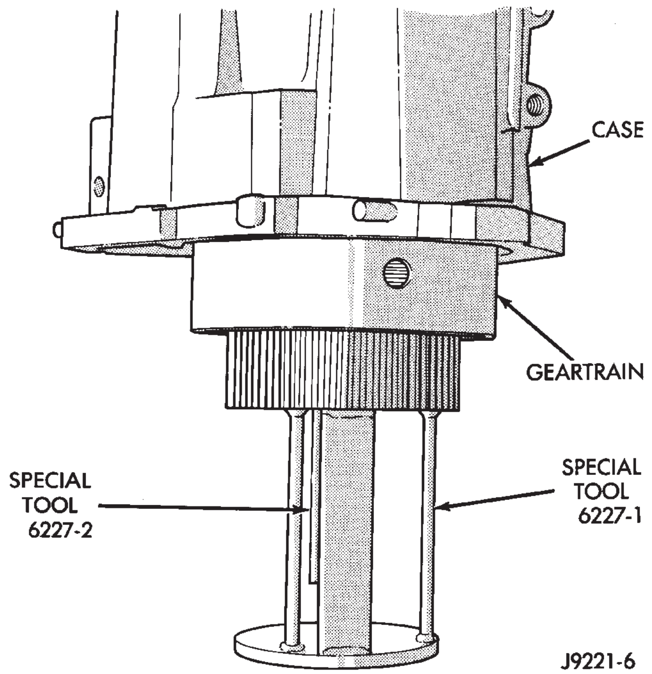

Fig. 75 Installing Overdrive Case On Geartrain

(e) Install remaining clutch discs and plates in same order.

(f) Verify clutch pack. **Four clutch discs, 3 steel plates, 1 reaction plate and 1 pressure plate are required.**

(g) Install clutch pack pressure plate (Fig. 77).

(h) Install clutch pack wire-type retaining ring (Fig. 76).

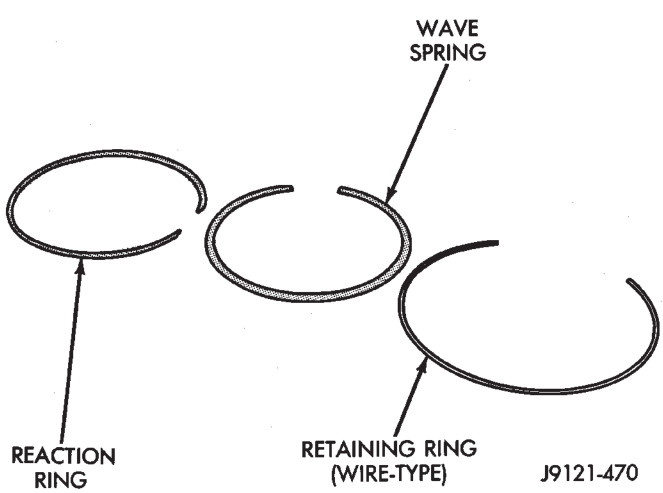

Fig. 76 Overdrive Clutch Ring Identification

(2) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(3) Determine correct thickness **intermediate shaft spacer** as follows:

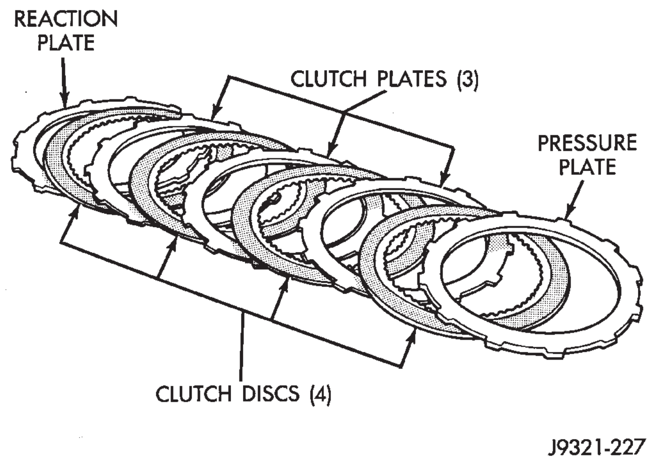

Fig. 77 Overdrive Clutch Pack Components

(a) Insert Special Tool 6312 through sun gear, planetary gear and into pilot bushing in output shaft. Be sure tool bottoms against planetary shoulder.

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 78). Then position Dial Caliper C-4962 over gauge tool.

(c) Extend sliding scale of dial caliper downward through gauge tool slot until scale contacts end of Gauge Alignment Tool 6312. Lock scale in place. Remove dial caliper tool and note distance measured (Fig. 78).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 79).

(e) Remove Gauge Alignment Tool 6312.

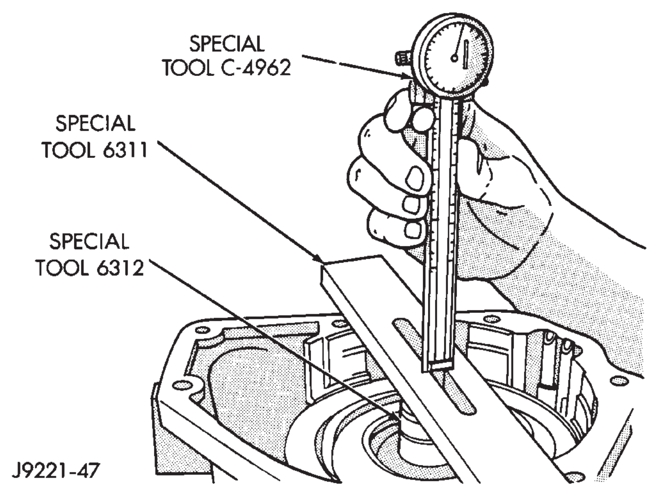

Fig. 78 Shaft End Play Measurement

(4) Determine correct thickness **overdrive piston thrust plate** as follows:

(a) Position Gauge Tool 6311 across face of overdrive case. Then position Dial Caliper C-4962 over gauge tool (Fig. 80).

End Play Measurement (Inches)	Spacer Thickness (Inches)
.7336 - .7505	.158 - .159
.7506 - .7675	.175 - .176
.7676 - .7855	.193 - .194
.7856 - .8011	.211 - .212

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Fig. 79 Intermediate Shaft End Play Spacer Selection

(b) Measure distance to clutch hub thrust bearing seat at four points 90° apart. Then average measurements by adding them and dividing by 4.

(c) Select and install required thrust plate from information in thrust plate chart (Fig. 81).

(5) Leave Alignment Tool 6227-2 in place. Tool will keep planetary and clutch hub splines in alignment until overdrive unit is ready for installation on transmission.

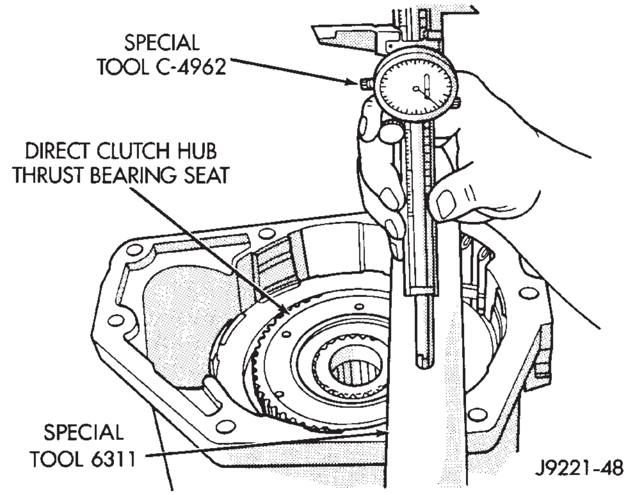

Fig. 80 Overdrive Piston Thrust Plate Measurement

End Play Measurement (Inches)	Spacer Thickness (Inches)
1.7500 - 1.7649	.108 - .110
1.7650 - 1.7799	.123 - .125
1.7800 - 1.7949	.138 - .140
1.7950 - 1.8099	.153 - .155
1.8100 - 1.8249	.168 - .170
1.8250 - 1.8399	.183 - .185
1.8400 - 1.8549	.198 - .200
1.8550 - 1.8699	.213 - .215
1.8700 - 1.8849	.228 - .230
1.8850 - 1.8999	.243 - .245

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Fig. 81 Overdrive Piston Thrust Plate Selection

NP231 TRANSFER CASE

INDEX

GENERAL INFORMATION

The NP231 is a part-time transfer case with a low range reduction gear system (Fig. 1). The NP231 has three operating ranges plus a Neutral position. A low range system provides a reduction ratio for increased low speed torque capability.

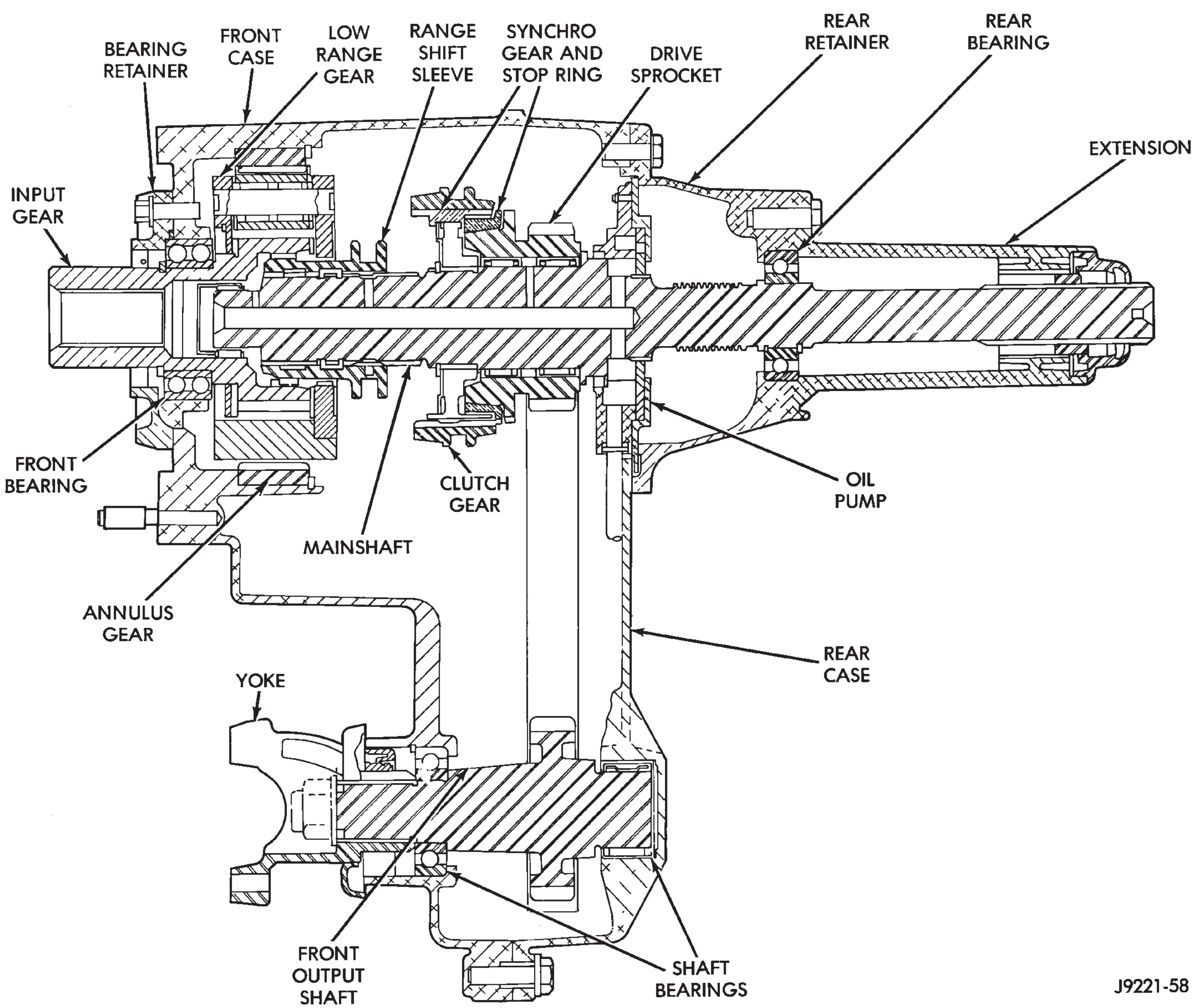

Fig. 1 NP231 Transfer Case

Two versions of the NP231 are used. One version retains the synchronizer components used in previous models. A newer version does not have synchro components.

OPERATING RANGES

Transfer case operating ranges are:
- 2-wheel drive high (2H)
- 4-wheel drive high (4H)
- 4-wheel drive low (4L)

The 2H range is for use on all road surfaces. The 4H and 4L ranges are for off-road use only. Use these ranges on low traction surfaces such as sand, dirt, or snow/ice covered road surfaces only.

SHIFT MECHANISM

Operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod.

A straight line shift pattern is used. Range positions are marked on the shifter knob and bezel cover plate. A synchronizer assembly in the transfer case allows the unit to be shifted between two and four high ranges while in motion.

TRANSFER CASE IDENTIFICATION

A circular ID tag is attached to the rear case of each NP231 transfer case (Fig. 2). The ID tag provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 11-7-94 would represent November 7, 1994.

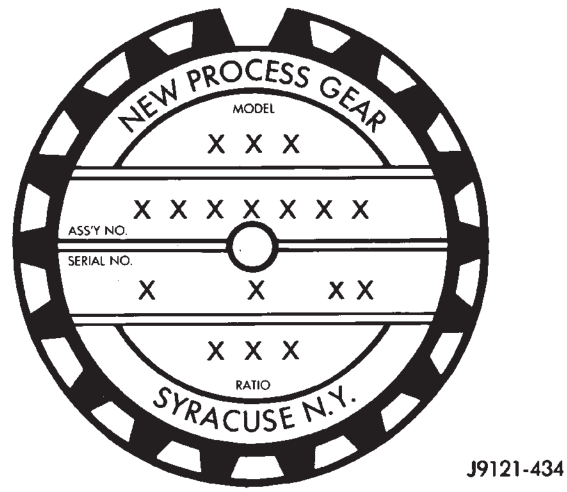

Fig. 2 Transfer Case Identification Tag

RECOMMENDED LUBRICANT

Recommended lubricant for the NP231 is Mopar Dexron II. Do not use any type of anti-friction additives in the NP231 transfer case. Use the recommended lubricant only.

NP231 lubricant capacity is approximately 1.2 liters (2.5 pints). Correct fill level is to the bottom edge of the fill plug hole.

TRANSFER CASE SPECIFICATIONS

The NP231 transfer case torque specifications are provided at the end of Group 21. Recommended lubricants and adjustments are included in the overhaul section.

NP231 SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Vehicle speed too great to permit shifting. (2) If vehicle was operated for extended period in 4H mode on dry paved surface, driveline torque load may cause difficulty. (3) Transfer case external shift linkage binding. (4) Insufficient or incorrect lubricant. (5) Internal components binding, worn or damaged.	(1) Stop vehicle and shift into desired range. Or reduce speed to 3-4 km/h (2-3 mph) before attempting to shift. (2) Stop vehicle, shift transmission to Neutral, shift transfer case to 2H mode and operate vehicle in 2H on dry paved surfaces. (3) Lubricate, repair or replace linkage bushings or tighten loose components as necessary. (4) Drain and refill to edge of fill hole with DEXRON II® or MOPAR-MERCON® Automatic Transmission Fluid. (5) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE MODES	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with DEXRON II® or MOPAR-MERCON® Automatic Transmission Fluid. Check for leaks and repair if necessary. **Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.**
NOISY IN – OR JUMPS OUT OF – FOUR WHEEL DRIVE LOW RANGE	(1) Transfer case not completely engaged in 4L position. (2) Shift linkage out of adjustment. (3) Shift linkage loose or binding. (4) Range fork damaged, inserts worn, or fork is binding on shift rail. (5) Low range gear worn or damaged.	(1) Stop vehicle, shift transfer case to Neutral, then shift back into 4L position. (2) Adjust linkage. (3) Tighten, lubricate or repair linkage as necessary. (4) Disassemble unit and repair as necessary. (5) Disassemble and repair as necessary.
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled. (2) Vent closed or restricted. (3) Output shaft seals damaged or installed incorrectly.	(1) Drain to correct level. (2) Clear or replace vent if necessary. (3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
ABNORMAL TIRE WEAR	(1) Extended operation on dry hard surface (paved) roads in 4H range.	(1) Operate in 2H on hard surface (paved) roads.

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SHIFT LINKAGE ADJUSTMENT

(1) Shift transfer case into 4L position.

(2) Secure shift lever in 4L position.

(3) Raise vehicle.

(4) Loosen lock bolt that secures shift rod in adjusting swivel (Fig. 4).

(5) Make sure shift rod slides freely in adjusting swivel. Lube rod and swivel if necessary.

(6) Verify that transfer case range lever is in 4L detent.

(7) Center pin on adjusting swivel in shift arm and tighten lock bolt to 10 N·m (90 in. lbs.) torque.

(8) Lower vehicle just enough to enter vehicle. Be sure all wheels are off shop floor. Then start engine, shift transmission into gear, and shift transfer case through all ranges to verify correct adjustment.

SPEEDOMETER SERVICE

Rear axle gear ratio and tire size determine speedometer pinion requirements. If the pinion must be replaced, refer to the parts catalogue information for the correct part.

SPEEDOMETER ASSEMBLY REMOVAL

(1) Raise vehicle.

(2) Disconnect wires from vehicle speed sensor.

(3) Remove adapter clamp and screw (Fig. 5).

(4) Remove speed sensor and speedometer adapter as assembly.

(5) Remove speed sensor retaining screw and remove sensor from adapter.

(6) Remove speedometer pinion from adapter.

(7) Inspect sensor and adapter O-rings (Fig. 5). Remove and discard O-rings if worn or damaged.

(8) Inspect terminal pins in speed sensor. Clean pins with Mopar electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or pins are loose, severely corroded, or damaged.

SPEEDOMETER INSTALLATION AND INDEXING

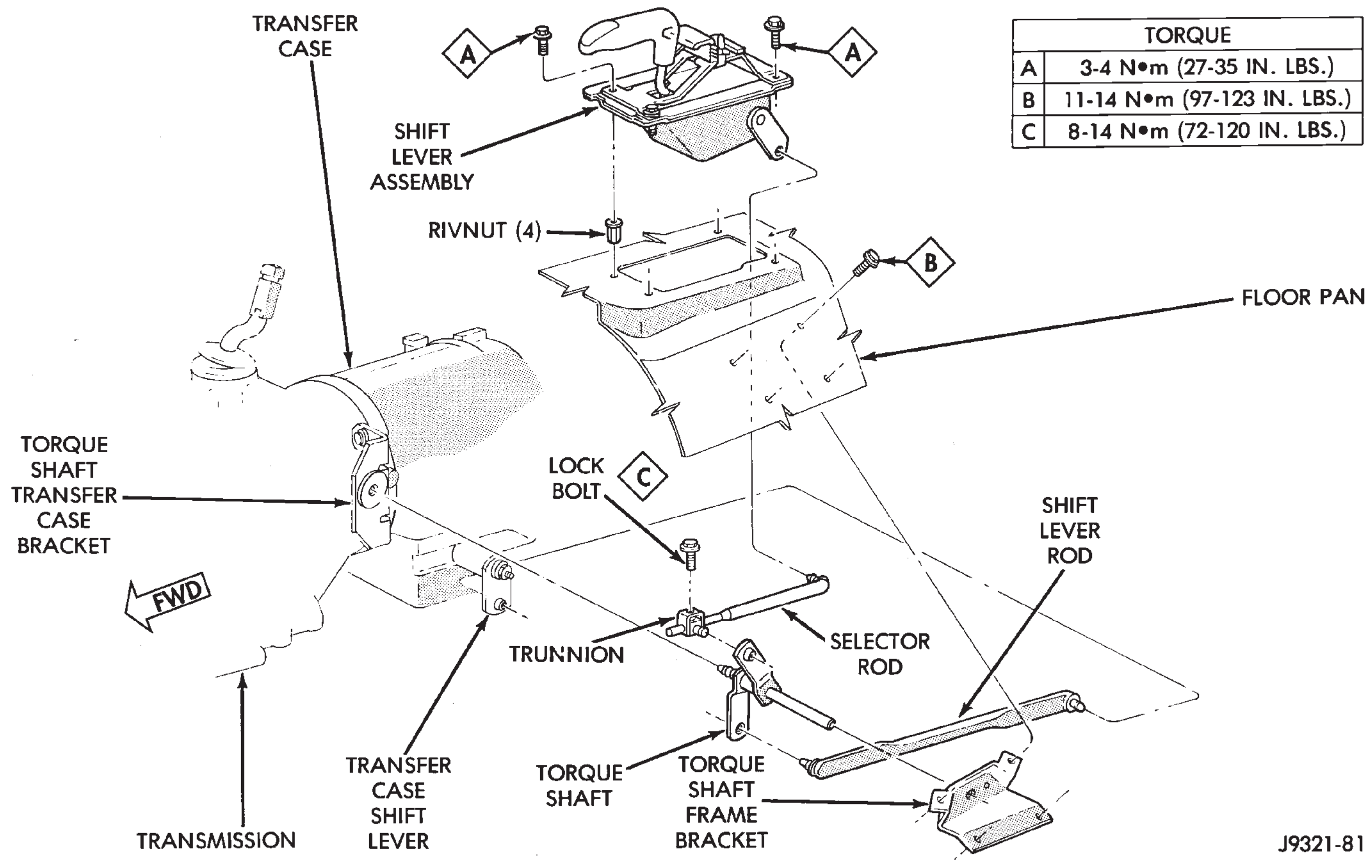
(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.

(2) Install new O-rings on speed sensor and speedometer adapter if necessary.

(3) Lubricate sensor and adapter O-rings with transmission fluid.

(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.

(5) Install speedometer pinion in adapter.



	TORQUE
A	3-4 N•m (27-35 IN. LBS.)
B	11-14 N•m (97-123 IN. LBS.)
C	8-14 N•m (72-120 IN. LBS.)

Fig. 3 Transfer Case Shift Linkage (Manual Transmission)

	TORQUE
A	3-4 N•m (27-35 in. lbs.)
B	11-14 N•m (97-123 in. lbs.)
C	8-14 N•m (72-120 in. lbs.)

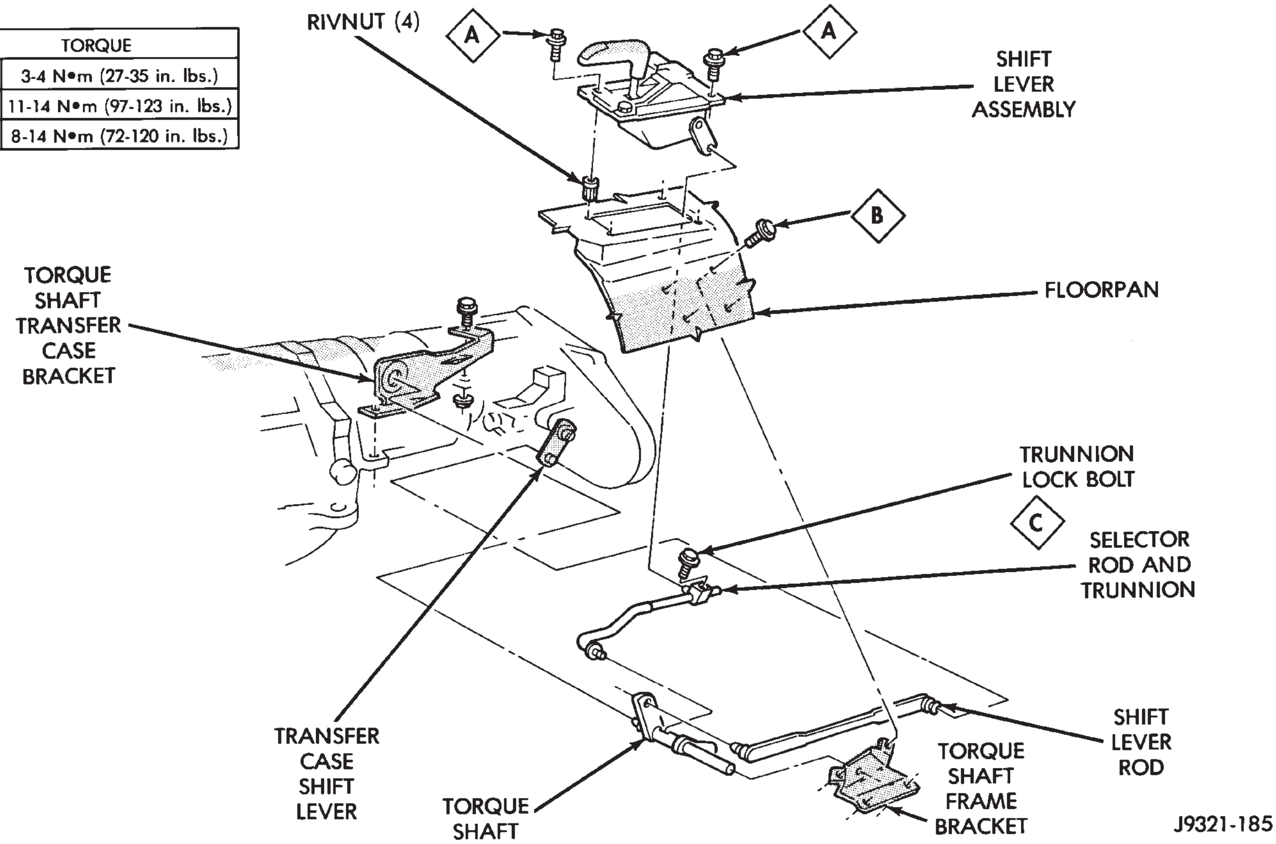


Fig. 4 Transfer Case Shift Linkage (Automatic Transmission)

ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

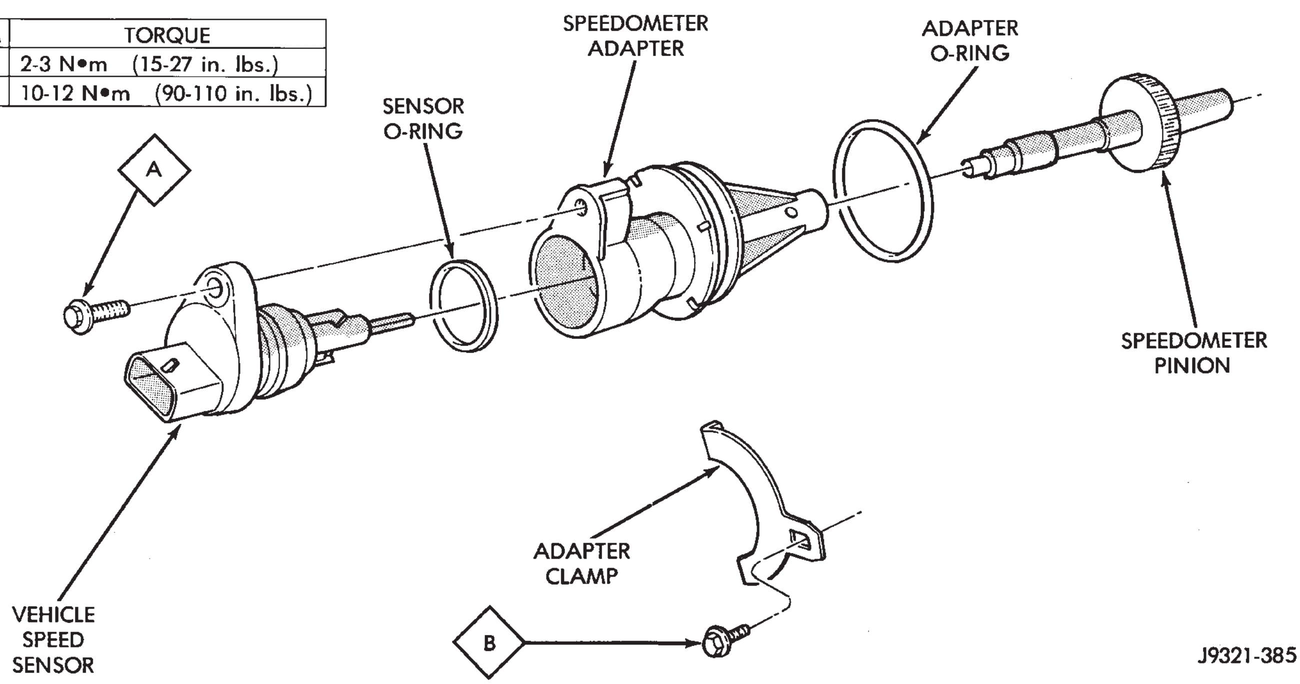


Fig. 5 Speedometer Components

(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.

(7) Note index numbers on adapter body (Fig. 6). These numbers will correspond to number of teeth on pinion.

(8) Install speedometer assembly in housing.

(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.

(12) Lower vehicle and top off transmission fluid level if necessary.

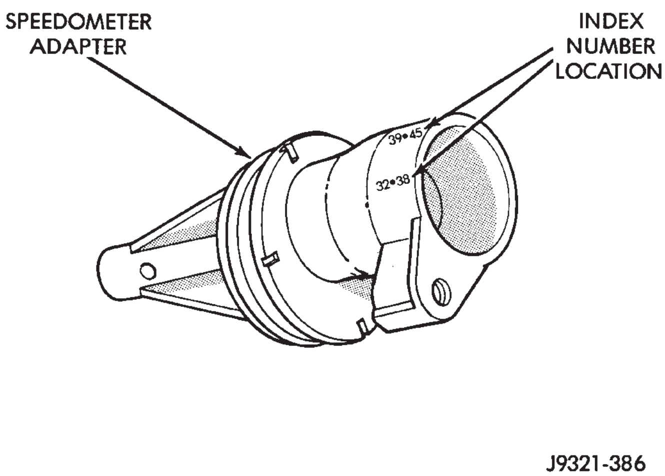


Fig. 6 Location Of Index Numbers On Speedometer Adapter

TRANSFER CASE REMOVAL

(1) Shift transfer case into Neutral.

(2) Raise vehicle.

(3) Drain transfer case lubricant.

(4) Mark front and rear propeller shaft yokes for alignment reference.

(5) Place support stand under transmission.

(6) Remove rear crossmember.

(7) Disconnect front/rear propeller shafts at transfer case.

(8) Disconnect speed sensor and remove speedometer adapter and sensor if necessary.

(9) Disconnect transfer case shift lever from shift lever rod.

(10) Disconnect vent hose and electrical connectors.

(11) Support transfer case with transmission jack.

(12) Remove nuts attaching transfer case to transmission.

(13) Secure transfer case to jack with chains.

(14) Pull transfer case and jack rearward to disengage transfer case.

(15) Remove transfer case from under vehicle.

TRANSFER CASE INSTALLATION

(1) Mount transfer case on a transmission jack. Secure transfer case to jack with chains.

(2) Position transfer case under vehicle.

(3) Align transfer case and transmission shafts and install transfer case on transmission (Fig. 7).

(4) Install and tighten transfer case attaching nuts. Tighten 5/16 nuts to 35 N·m (26 ft. lbs.) torque. Tighten 3/8 nuts to 47 N·m (35 ft. lbs.) torque.

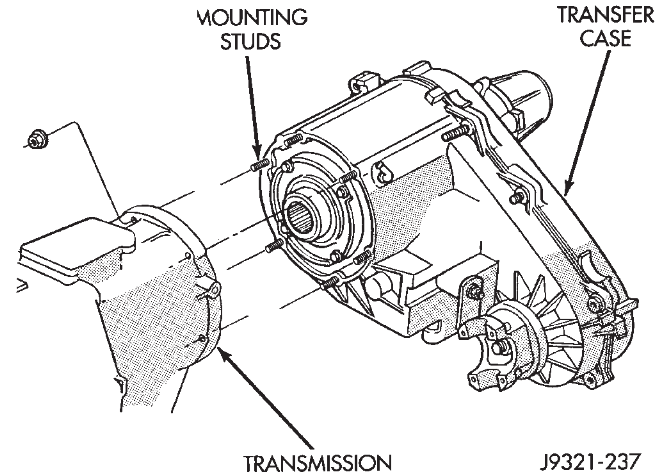


Fig. 7 Transfer Case Attachment

(5) Install speedometer adapter, pinion, and speed sensor.

(6) Connect electrical wires to speed sensor.

(7) Connect vent hose to transfer case vent (Fig. 8).

(8) Align and connect propeller shafts. Tighten shaft attaching bolts to 19 N·m (170 in. lbs.) torque.

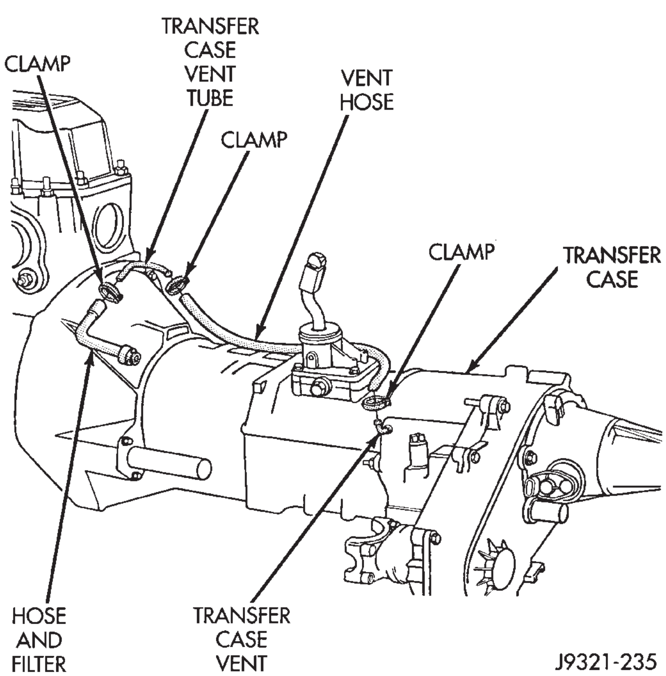


Fig. 8 Transfer Case Vent Hose Routing

(9) Fill transfer case with recommended lubricant. Correct level is to bottom edge of fill plug hole.

(10) Install rear crossmember if removed. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(11) Remove transmission jack and transmission support stand.

(12) Connect transfer case shift lever to shift lever rod.

(13) Check and adjust transfer case shift linkage if necessary.

(14) Lower vehicle.

TRANSFER CASE DISASSEMBLY AND OVERHAUL

Two versions of the NP231 are used in current models. One version retains the synchronizer components used in previous years. A newly introduced version does not have synchro components. The non-synchro version is not equipped with a synchro gear, struts, springs, or stop ring. During overhaul, note which version is being serviced and order needed parts accordingly.

(1) Remove fill and drain plugs. Also remove speedometer adapter and pinion if not previously removed.

(2) Remove front yoke. Discard yoke seal washer and nut. They should not be reused.

(3) Move transfer case range lever rearward to 4L position.

(4) Remove extension housing attaching bolts.

(5) Tap extension housing in clockwise direction to break sealer bead and remove housing (Fig. 1).

CAUTION: To avoid damaging the sealing surfaces of the extension housing and rear retainer, do not pry or wedge the housing off the retainer.

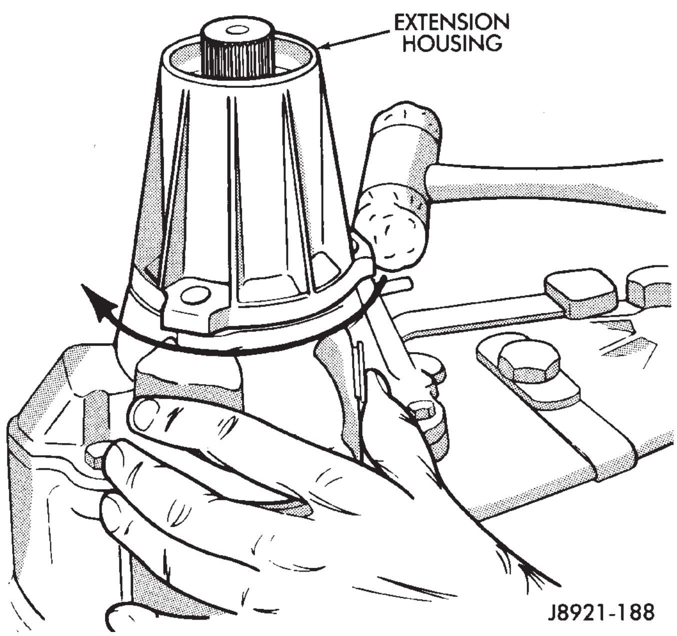


Fig. 1 Extension Housing Removal

(6) Remove rear bearing snap ring (Fig. 2).

(7) Remove rear retainer attaching bolts.

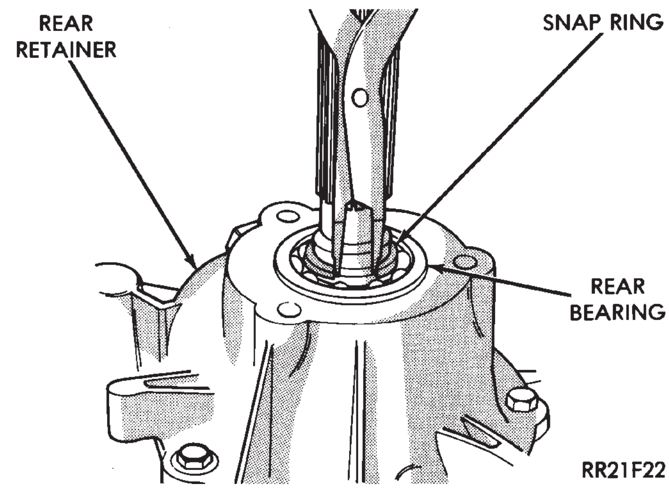


Fig. 2 Rear Bearing Snap Ring Removal

(8) Remove rear retainer. Position screwdriver under each tab on retainer housing (Fig. 3). Then carefully pry retainer upward and off rear case.

CAUTION: Do not pry against the sealing surfaces of the retainer or rear case. The surfaces could be damaged.

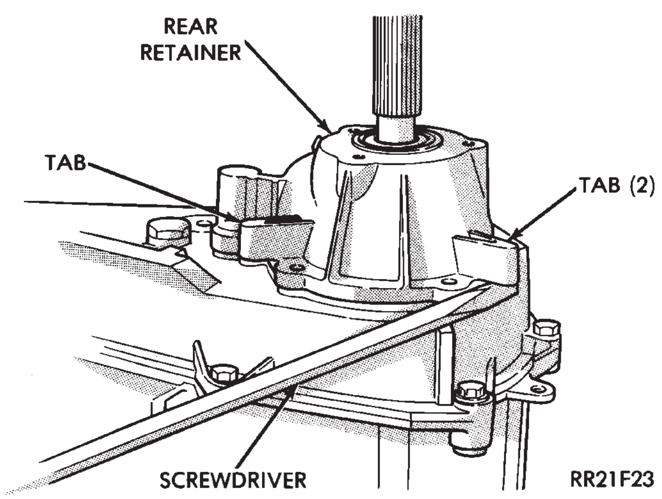


Fig. 3 Rear Retainer Removal

(9) Remove bolts attaching rear case to front case. Retain bolts and washers.

(10) Separate rear case from front case (Fig. 4) Insert screwdrivers into slots cast in case ends. Then gently pry upward to break sealer bead and loosen rear case.

CAUTION: Do not pry against the sealing surfaces of the retainer or rear case. The surfaces could be damaged.

(11) Remove oil pump and rear case as an assembly (Fig. 5).

(12) Slide oil pickup tube screen out of case pocket.

(13) Remove oil pump and pickup tube as assembly (Fig. 6).

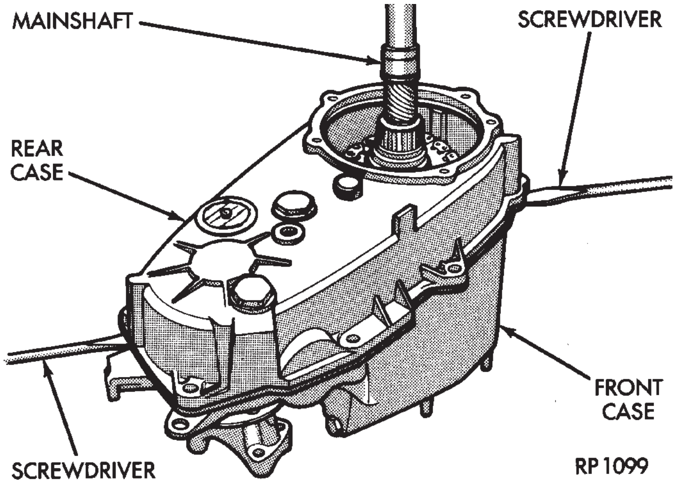


Fig. 4 Loosening Rear Case

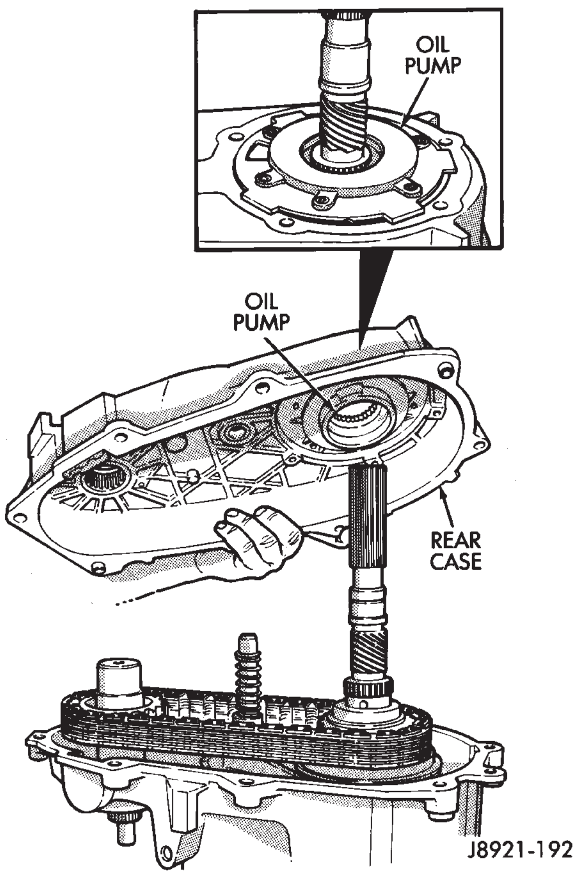


Fig. 5 Rear Case And Oil Pump Removal

(14) Disconnect screen from pickup tube and remove screen (Fig. 7).

(15) Remove pickup tube from oil pump (Fig. 7).

(16) Remove pickup tube O-ring from oil pump (Fig. 8).

(17) Remove mode spring (Fig. 9).

(18) Tap front output shaft upward with rawhide mallet to free it from shaft bearing.

(19) Remove front output shaft and drive chain (Fig. 10).

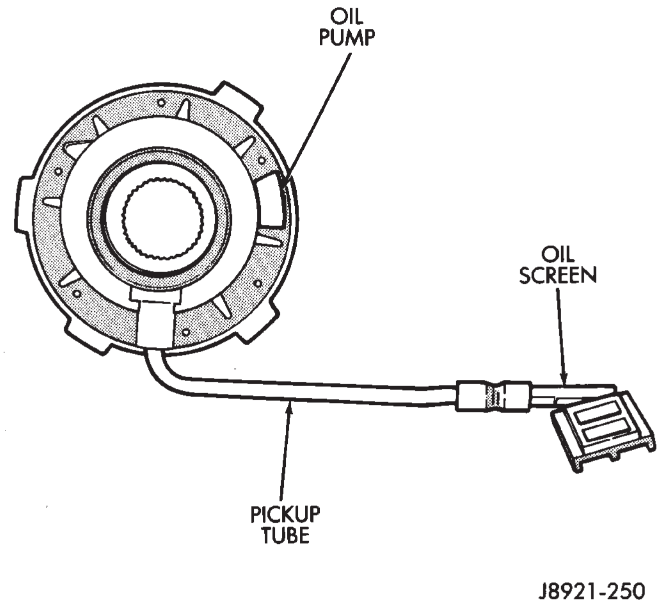


Fig. 6 Oil Pump And Pickup Tube Removal

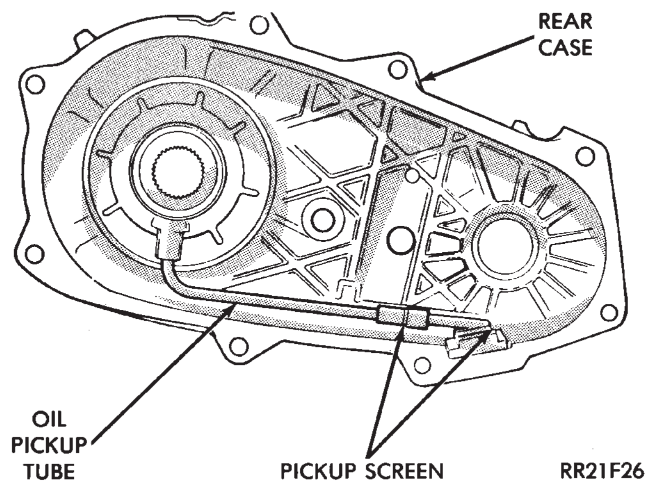


Fig. 7 Removing Oil Screen And Pickup Tube

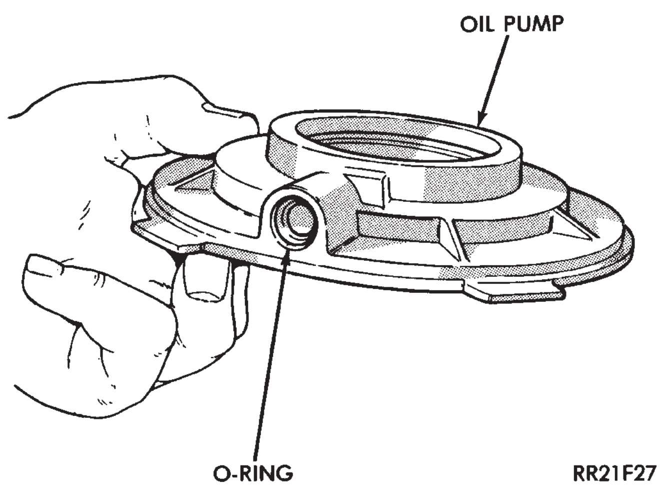


Fig. 8 Pickup Tube O-Ring Location

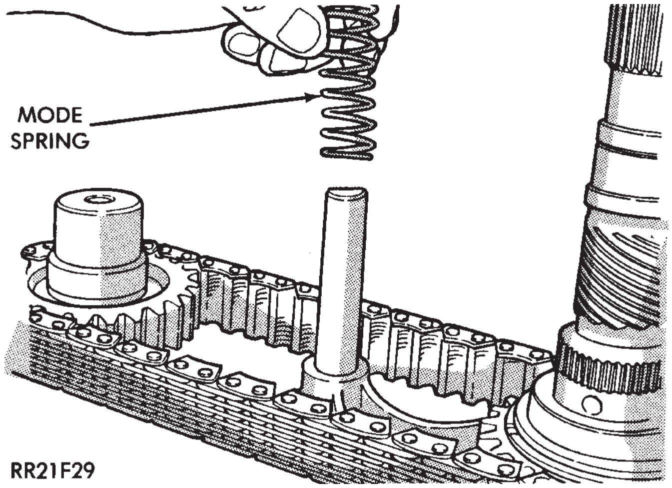


Fig. 9 Mode Spring Removal

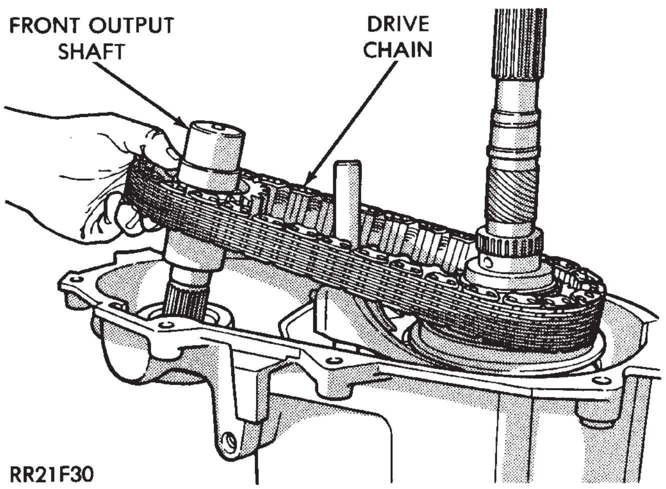


Fig. 10 Front Output Shaft And Drive Chain Removal

(20) Remove mainshaft, mode fork and shift rail as assembly d (Fig. 11).

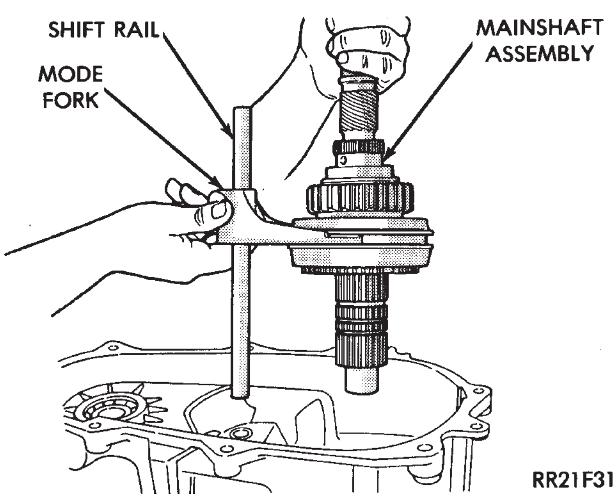


Fig. 11 Removing Mainshaft, Mode Fork And Shift Rail

(21) Remove mode fork and shift rail from synchro sleeve (Fig. 12).

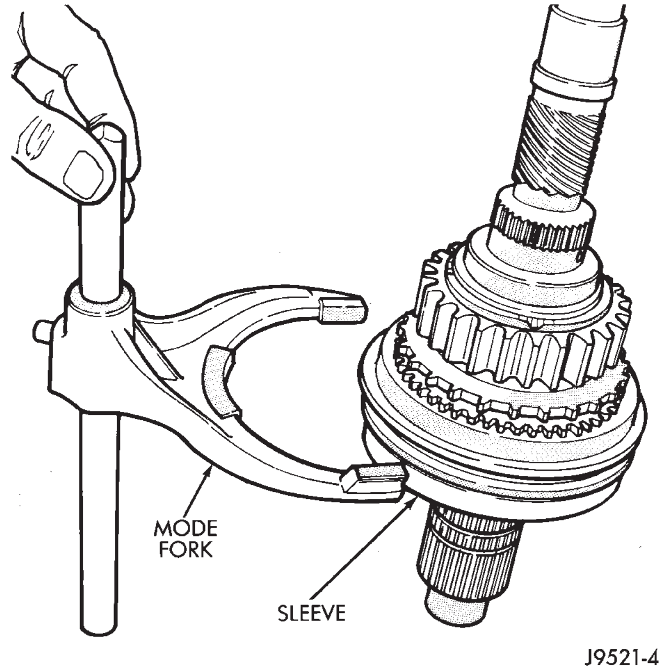


Fig. 12 Removing Mode Fork And Rail From Sleeve

(22) Remove hub snap ring and remove spacer if equipped (Fig. 13).

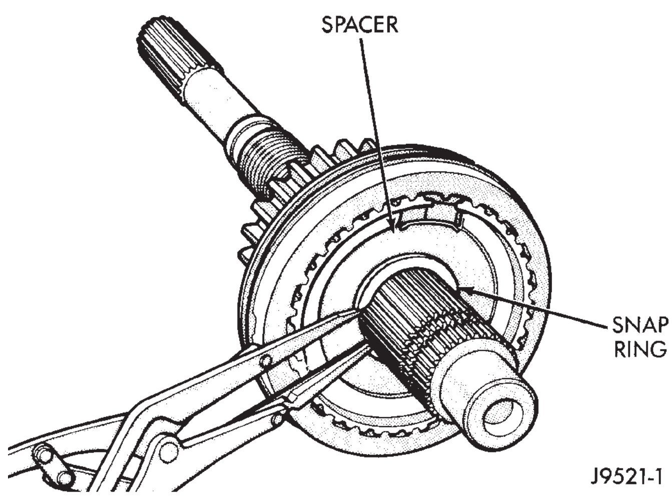


Fig. 13 Hub Snap Ring And Spacer Removal

(23) Remove sleeve from hub (Fig. 14).

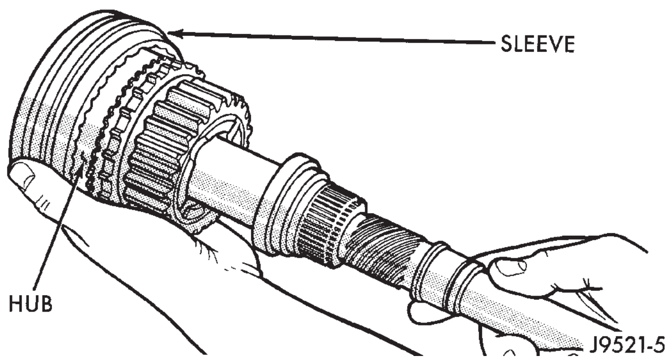


Fig. 14 Removing Sleeve From Hub

(24) Remove hub from mainshaft. On synchro models, also remove synchro stop ring (Fig. 15).

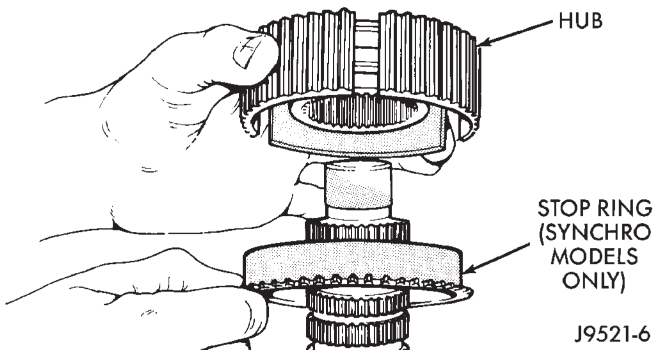


Fig. 15 Hub And Stop Ring Removal

(25) Remove drive sprocket (Fig. 16).

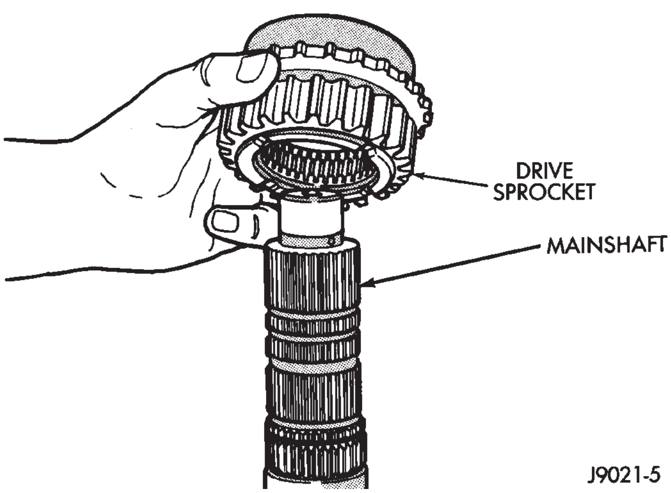


Fig. 16 Drive Sprocket Removal/Installation

(26) Slide range fork pin out of shift sector (Fig. 17).

(27) Remove range fork and shift hub (Fig. 18).

(28) Remove range lever from sector shaft.

(29) Remove shift sector (Fig. 19).

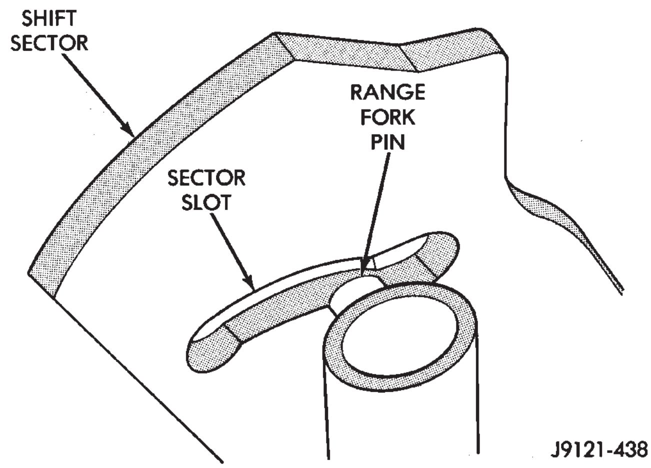


Fig. 17 Disengaging Range Fork

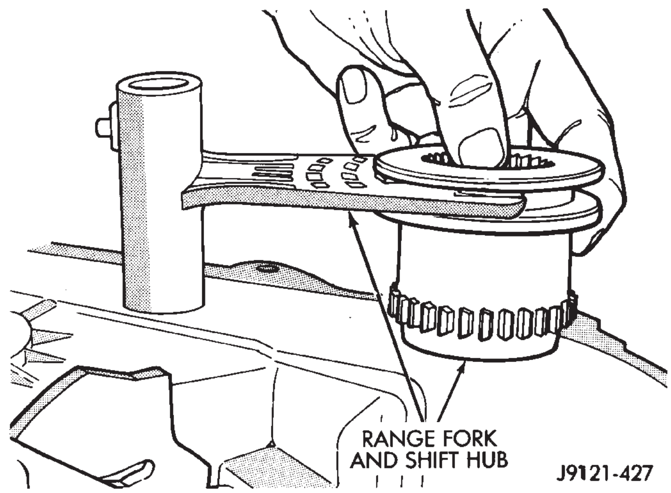


Fig. 18 Range Fork And Hub Removal/Installation

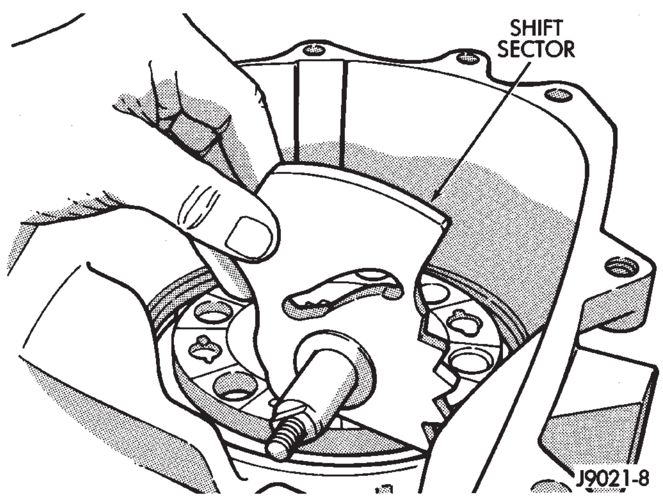


Fig. 19 Shift Sector Removal/Installation

(30) Remove sector shaft bushing and O-ring (Fig. 20).

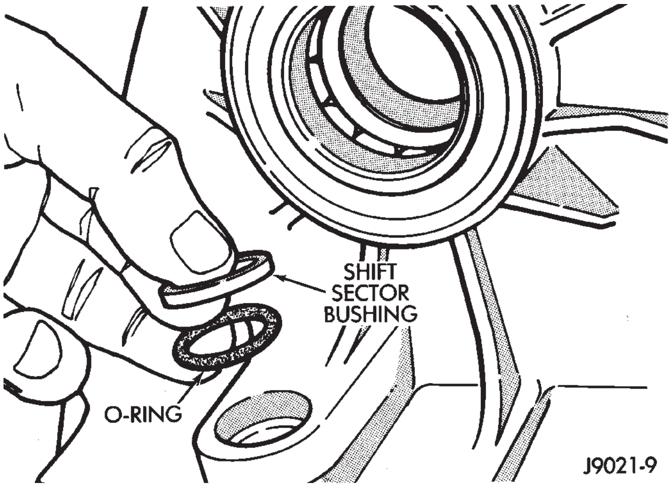


Fig. 20 Removing/Installing Sector Shaft Bushing And O-Ring

(31) Remove shift detent plunger, spring and plug (Fig. 21). Remove O-ring from plug after removal.

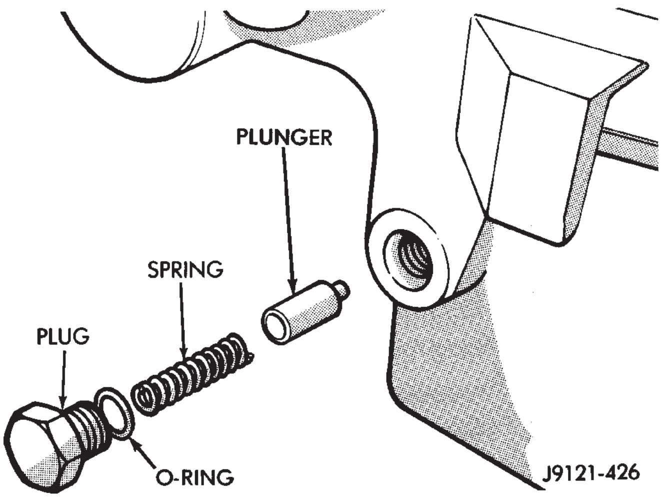


Fig. 21 Detent Component Removal

(32) Turn front case over and remove front bearing retainer bolts (Fig. 22).

(33) Remove front bearing retainer. Position screwdrivers in retainer slots and lift upward to loosen and remove retainer (Fig. 23).

(34) Remove input gear snap ring (Fig. 24).

(35) Press input and low range gear assembly out of input gear bearing with shop press (Fig. 25).

(36) Remove low range gear snap ring (Fig. 26).

(37) Remove retainer, thrust washers and input gear from low range gear (Fig. 27).

(38) Remove oil seals from rear retainer, rear extension housing, oil pump feed housing and case halves.

(39) Remove magnet from pocket in front case.

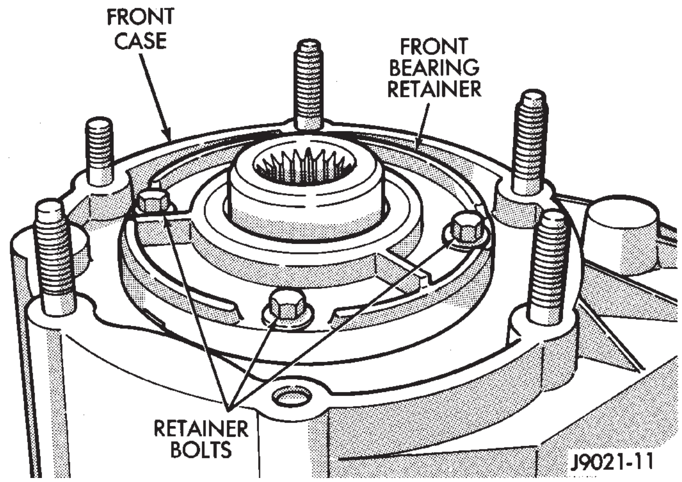


Fig. 22 Front Bearing Retainer Bolt Locations

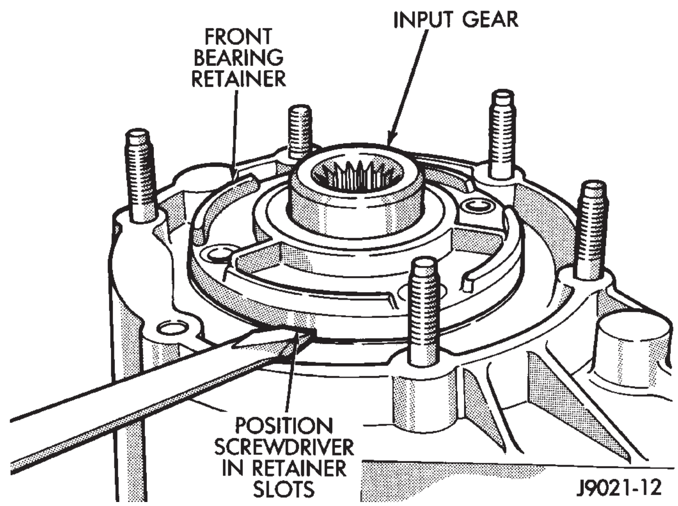


Fig. 23 Removing Front Bearing Retainer

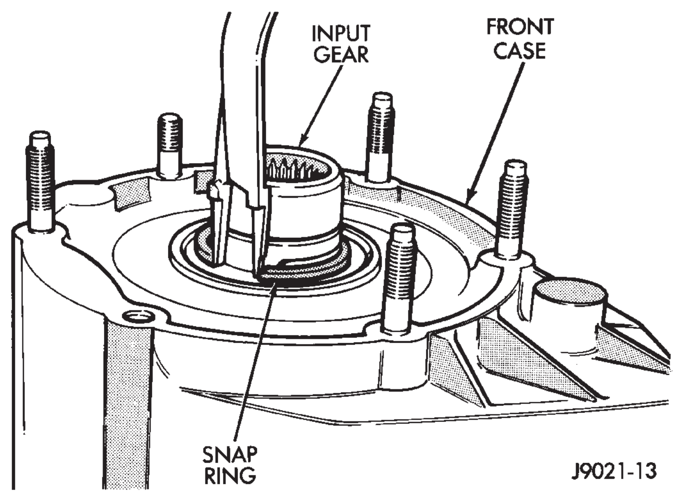


Fig. 24 Removing Input Gear Snap Ring

OVERHAUL CLEANING AND INSPECTION

Clean the transfer case components thoroughly with solvent. Remove all traces of sealer from the case and retainer seal surfaces.

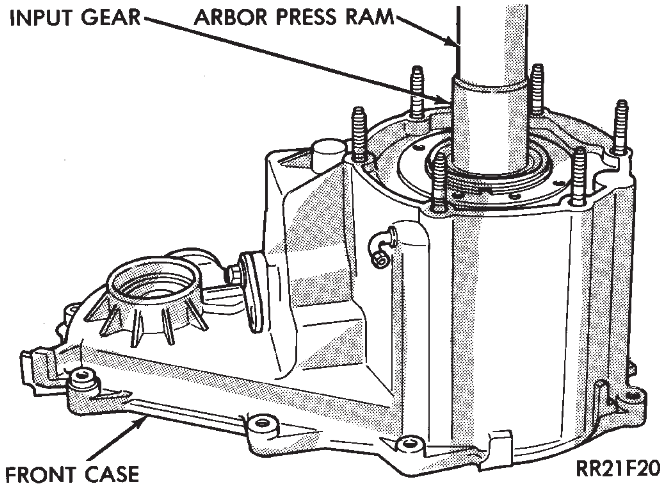


Fig. 25 Removing Input And Low Range Gear Assembly

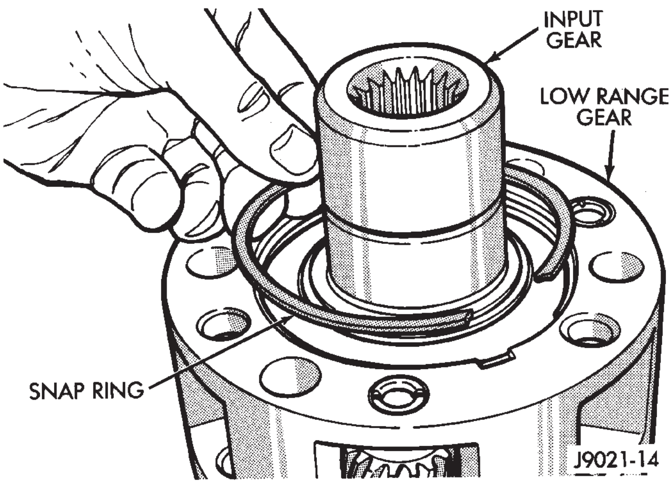


Fig. 26 Removing Low Range Gear Snap Ring

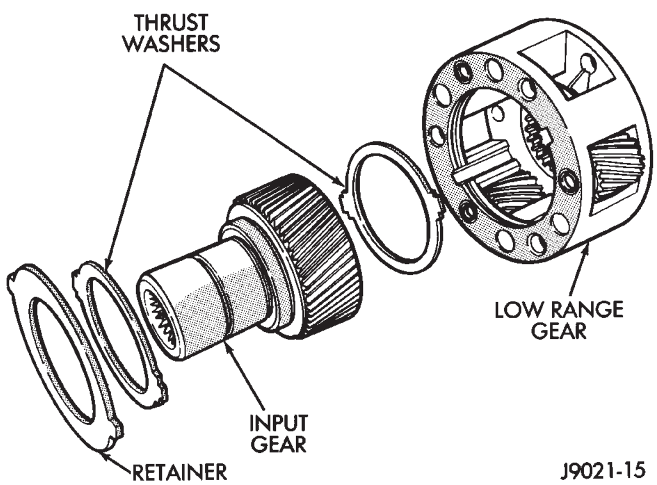


Fig. 27 Input And Low Range Gear Components

Clean the oil pickup screen with solvent. Shake excess solvent from screen and allow it air dry. Use compressed air to remove solvent residue from all oil feed passages and channels in the case halves.

Inspect the splines and bearing surfaces on both shafts. Replace either shaft as necessary if wear, or damage is evident.

Check condition of the shift forks, fork pads and shift rail. Minor scratches/nicks on the rail can be smoothed with 320/400 grit emery cloth. Replace the mode fork pads if worn. Replace the range fork if the pads are worn, missing, or damaged.

On synchro equipped models, inspect the synchro sleeve, hub, struts, springs, and the stop ring. Replace worn, or damaged parts as necessary.

Do not attempt to salvage and reuse snap rings that were bent, or distorted. It is recommended that all snap rings be replaced during overhaul.

Replace the front yoke nut as it should not be reused. Also replace the rubber seal if worn, cut, or torn.

Inspect the low range annulus gear (Fig. 28). **If the gear is damaged, replace the gear and front case as an assembly. Do not attempt to remove the gear.**

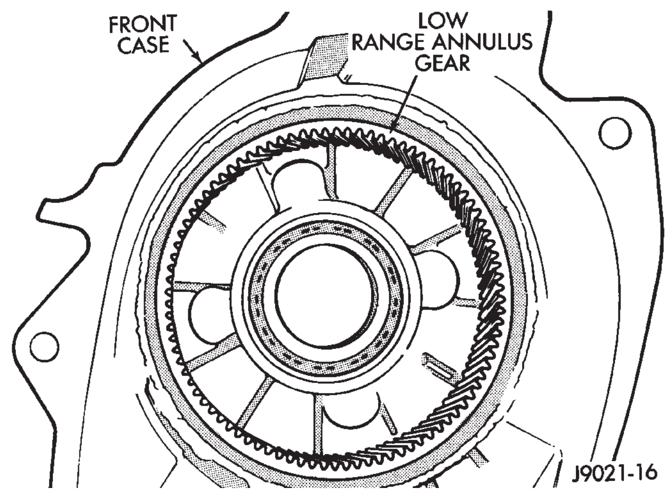


Fig. 28 Low Range Annulus Gear Location

Inspect the case halves, extension housing and retainers for cracks, porosity, or damaged sealing surfaces.

Inspect the drive sprockets and drive chain carefully. Replace the sprockets if worn, chipped, or cracked. Also replace the chain if distorted, binds at any point, or is stretched.

Replace the oil pump if any pump part is worn or damaged. Do not disassemble the pump as parts are not available separately. The pump is only available as an assembly.

Inspect all of the transfer case bearings for wear, roughness, pitting, or galling. Replace worn or damaged bearings as outlined in the transfer case assembly procedures.

Clean the sealing (mating) surfaces of the case halves, retainer and extension with a scraper, a wire brush and 3M All Purpose cleaning solvent. These surfaces must be clean in order for the sealer to adhere properly.

TRANSFER CASE ASSEMBLY

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Be sure replacement bearings do not block these feed holes. In addition, the drive sprocket, synchro hub and sleeve are different for non-synchro and synchro models. Do not interchange these parts. Do not install synchro struts or a stop ring in a non-synchro model; this will cause the drive sprocket to bind on the shaft and hub.

FRONT CASE ASSEMBLY

(1) Lubricate components with automatic transmission fluid (or petroleum jelly where indicated) during assembly.

(2) Remove front output shaft seal from front case with crowfoot style pry tool (Fig. 29).

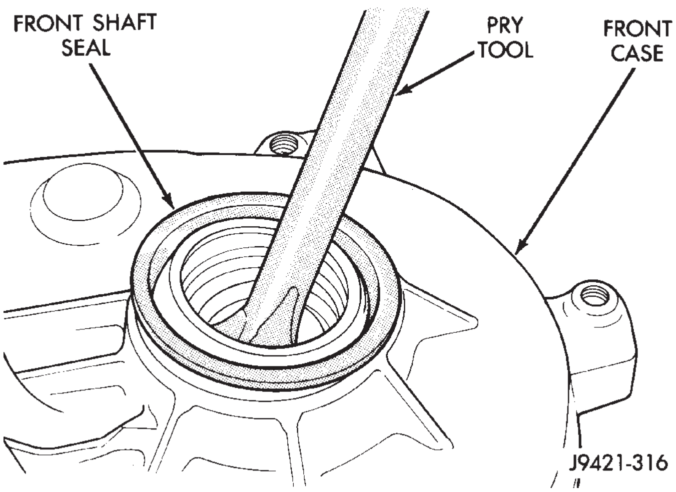


Fig. 29 Front Output Shaft Oil Seal Removal

(3) Remove snap ring retaining front output shaft front bearing in case (Fig. 30).

(4) Tap old front output shaft bearing out of front case with plastic mallet. Install new bearing with Tool Handle C-4171 and Installer Tool 5064 (Fig. 31).

(5) Secure front output shaft bearing in front case with new snap ring (Fig. 30).

(6) Install new front output shaft seal in front case with suitable size socket or installer tool.

(7) If front output shaft rear bearing is to be replaced, install new bearing as follows:

(a) Remove bearing from rear case with Bearing Remover MD-998346 and two suitable size wrenches (Fig. 32).

(b) Seat new bearing in rear case with Tool Handle C-4171 and Bearing Installer 5063 (Fig. 33).

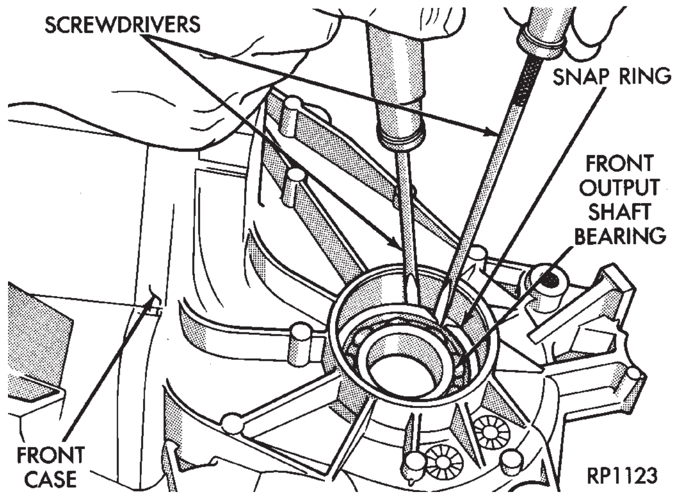


Fig. 30 Removing/Installing Front Output Shaft Bearing Snap Ring

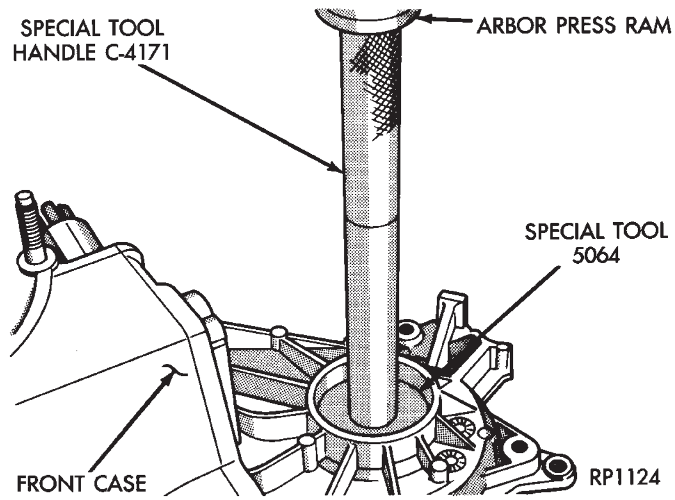


Fig. 31 Installing Front Output Shaft Front Bearing In Case

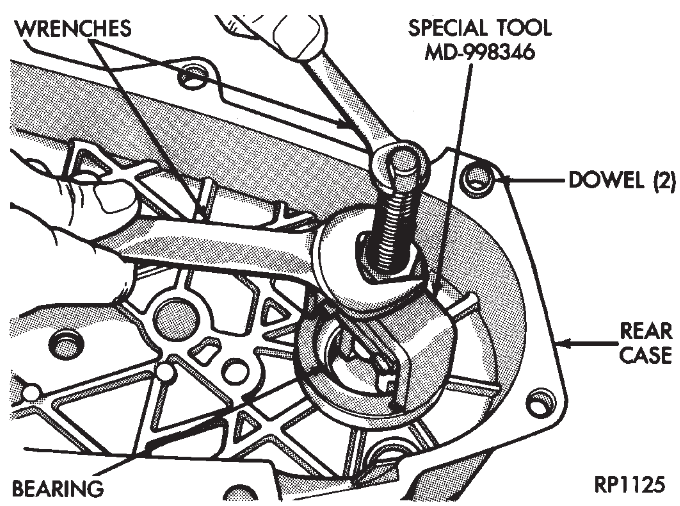


Fig. 32 Front Output Shaft Rear Bearing Removal

(8) Remove input gear bearing from front case with Tool Handle C-4171 and Tool C-4210, 7828, or 5062. Use tool that is best fit in bearing (Fig. 34).

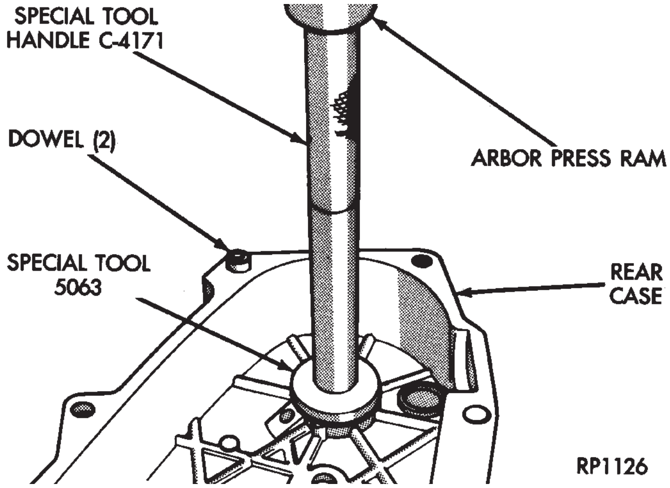


Fig. 33 Front Output Shaft Rear Bearing Installation

(9) Turn front case over.

(10) Start bearing in case by hand. Then seat bearing with Tools C-4171 and C-4210, or 7828 until snap ring seats against case surface (Fig. 35).

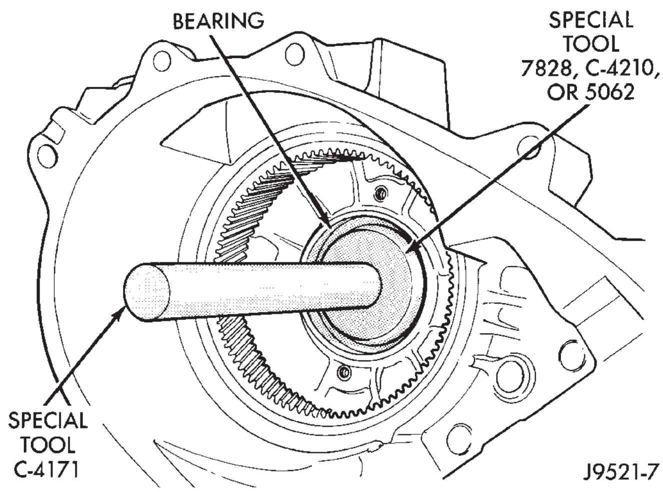


Fig. 34 Input Gear Bearing Removal

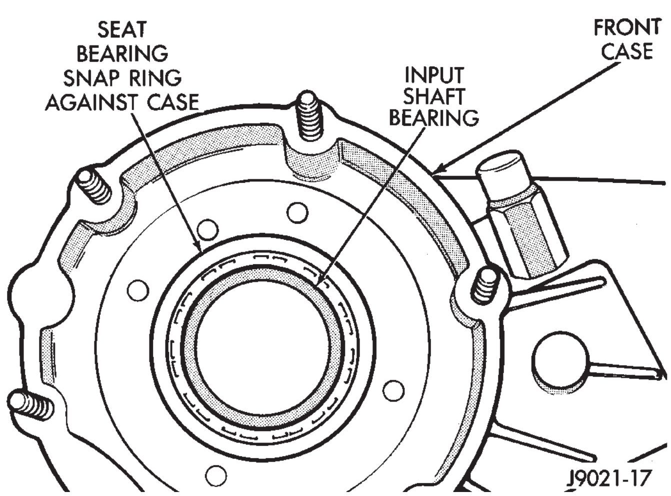


Fig. 35 Input Gear Bearing Installation

INPUT AND LOW RANGE GEAR ASSEMBLY AND INSTALLATION

(1) Remove mainshaft pilot bearing from input gear with Tool MD-998346 as follows:

(a) Turn puller tool bolt until jaws retract enough to fit into bearing (Fig. 36).

(b) Insert puller bolt and jaws into bearing. Then turn puller bolt clockwise so ramp on bolt spreads jaws forcing them under bearing (Fig. 37).

(c) Install puller bridge over puller bolt (Fig. 38). Then install flat washer and nut on bolt.

(d) Hold puller bridge from turning by hand or with locking pliers. Then tighten nut on puller bolt in clockwise direction to draw bearing out of input gear (Fig. 39).

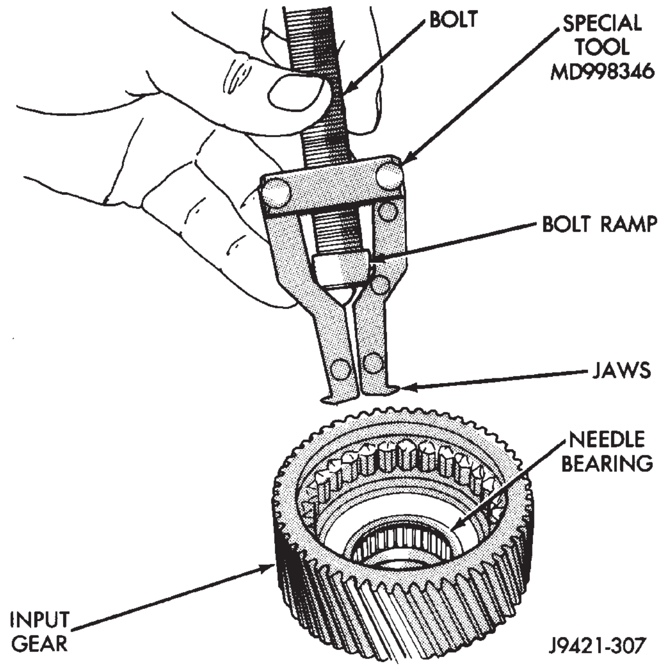


Fig. 36 Puller Jaws In Retracted Position

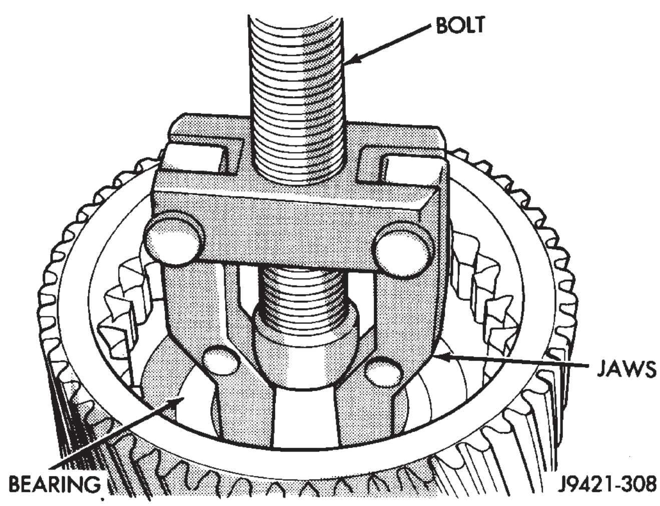


Fig. 37 Puller Bolt And Jaws Seated Under Needle Bearing

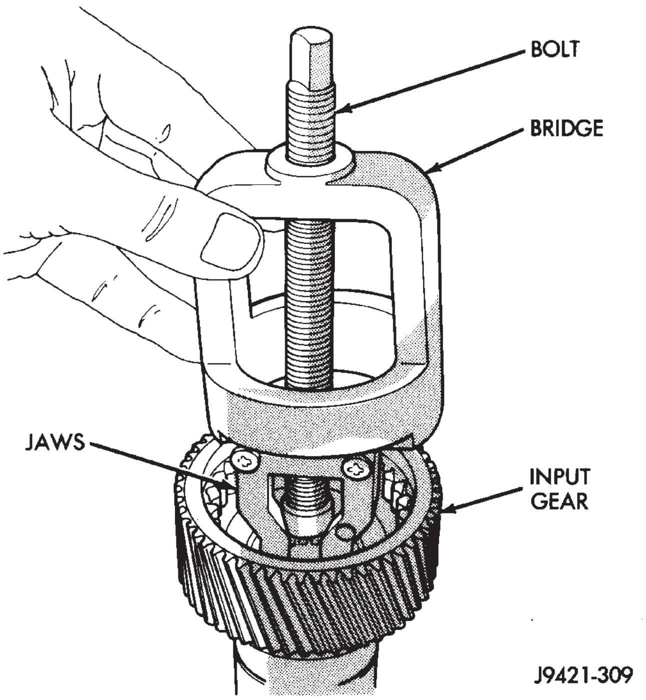


Fig. 38 Installing Puller Bridge

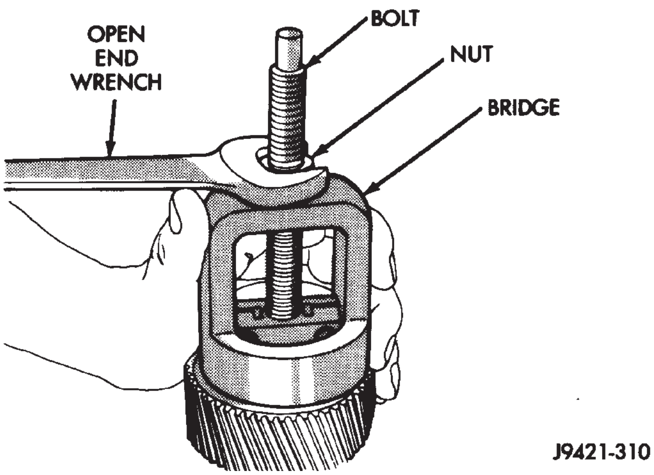


Fig. 39 Removing Mainshaft Pilot Bearing From Input Gear

(2) Install new needle bearing in input gear with Tool Handle C-4171 and Installer 5065 (Fig. 40).

(3) Lubricate and install thrust washers, input gear and retainer in low range gear (Fig. 41). Then install retainer snap ring. **Be sure snap ring is fully seated before proceeding.**

(4) Align and install input/low range gear assembly in case. Use hammer handle to tap low range gear into annulus and input gear into bearing if necessary.

(5) Install input gear snap ring (Fig. 42).

(6) Install new oil seal in input bearing retainer with suitable size installer tool (Fig. 43).

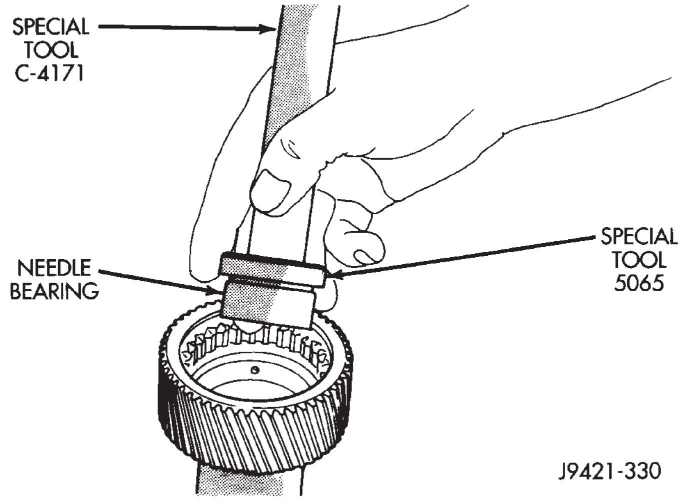


Fig. 40 Installing Mainshaft Pilot Bearing In Input Gear

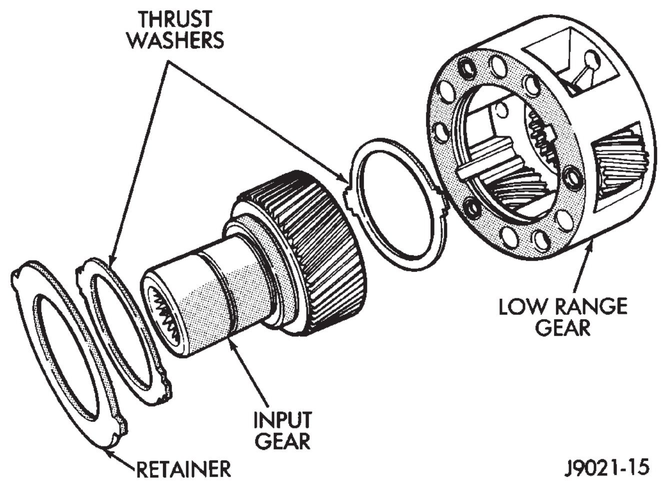


Fig. 41 Input And Low Range Gear Components

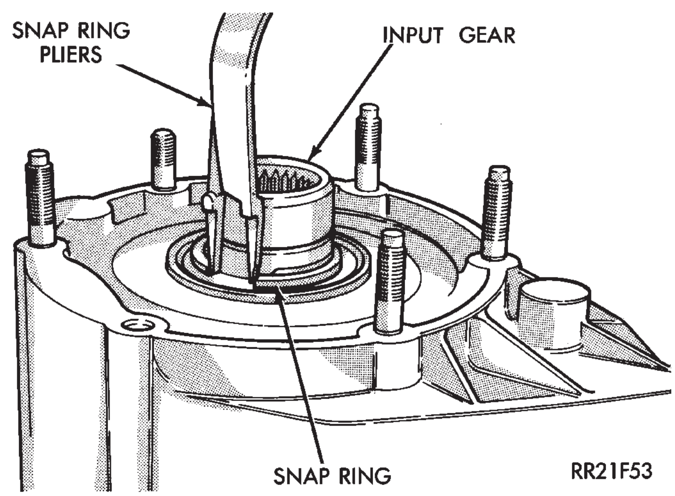


Fig. 42 Installing Input Gear Snap Ring

(7) Apply 3 mm (1/8 in.) wide bead of Mopar Gasket Maker, silicone adhesive/sealer, or Loctite 518 to front bearing retainer seal surface (Fig. 44).

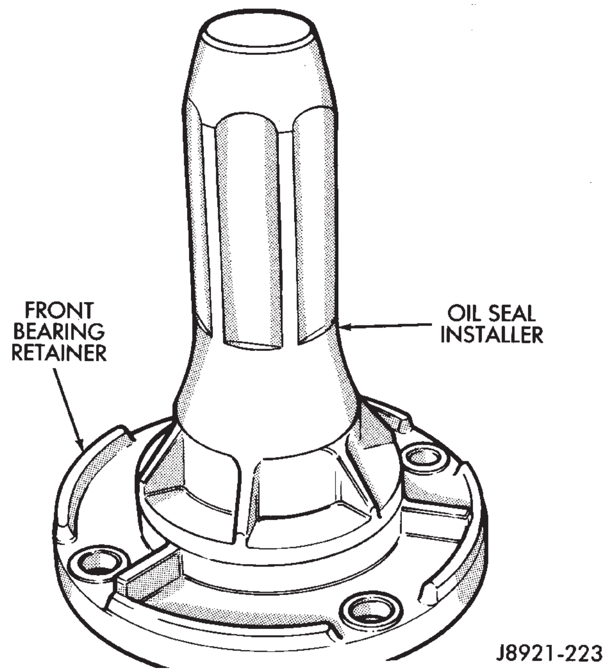


Fig. 43 Installing Input Bearing Retainer Oil Seal

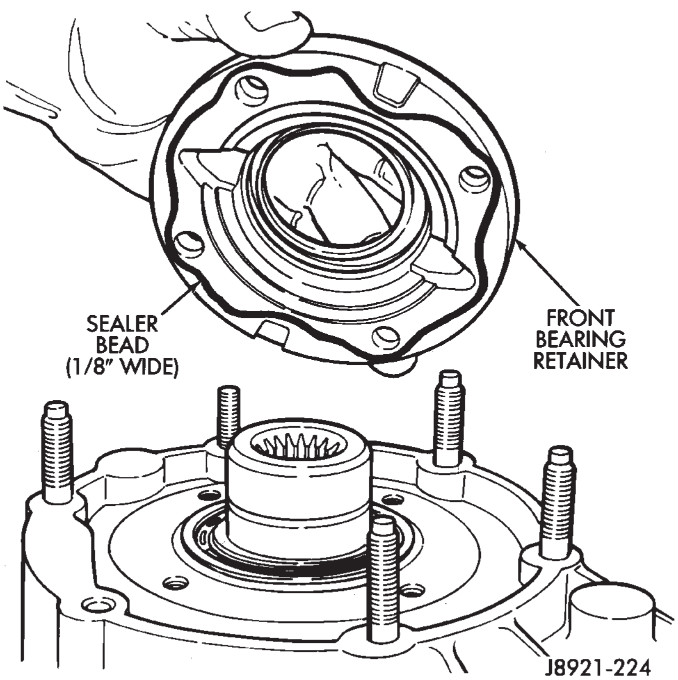


Fig. 44 Applying Sealer Bead To Bearing Retainer

(8) Align oil channel in retainer with oil feed hole in case (Fig. 45).

(9) Install input (front) bearing retainer on front case (Fig. 46). Tighten retainer bolts to 21 N·m (16 ft. lbs.) torque.

SHIFT SECTOR, RANGE FORK AND SLEEVE INSTALLATION

(1) Install new sector shaft O-ring and retainer bushing (Fig. 47).

(2) Install shift sector in the case (Fig. 48).

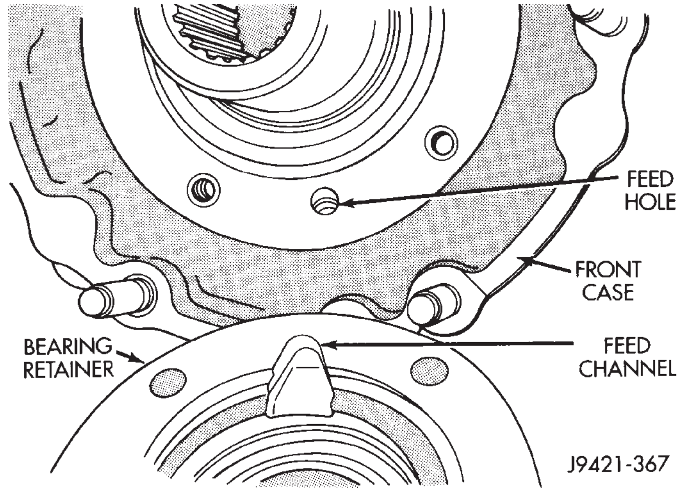


Fig. 45 Aligning Retainer Oil Channel With Feed Hole In Case

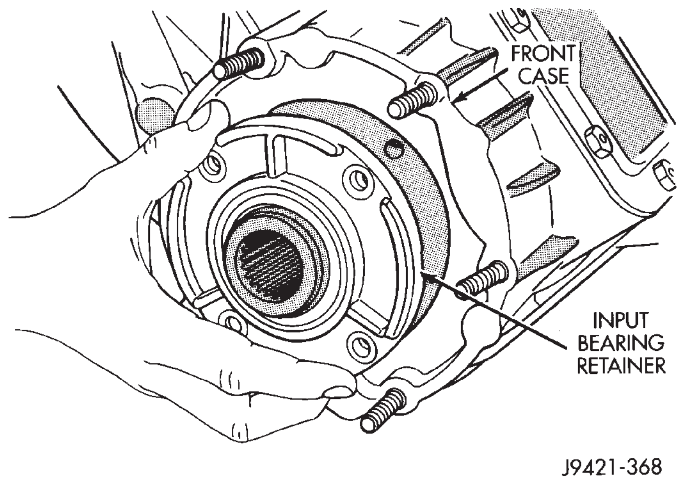


Fig. 46 Bearing Retainer Installation

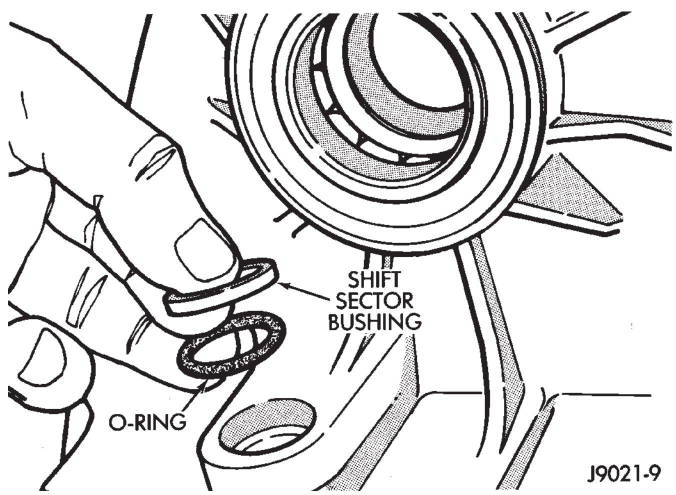


Fig. 47 Installing Sector O-Ring And Retainer Bushing

(3) Install range lever and lever attaching nut on shift sector. Tighten attaching nut to 30 N·m (22 ft. lbs.) torque.

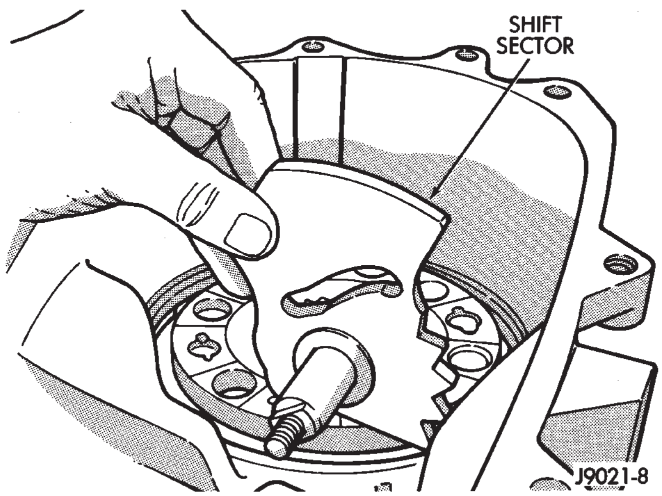


Fig. 48 Shift Sector Installation

(4) Install detent plunger, spring and plug (Fig. 49). Tighten plug to 20 N·m (15 ft. lbs.) torque.

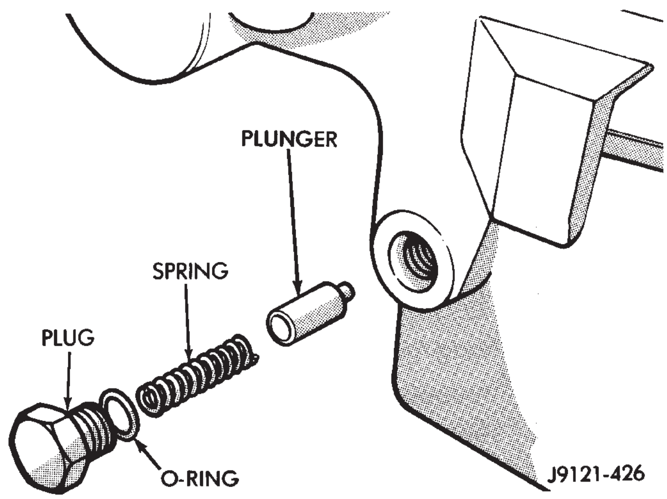


Fig. 49 Installing Detent Plunger, Spring And Plug

(5) Inspect pads on range fork (Fig. 50). Be sure pads are secure and in position. Replace fork as an assembly if pads are worn through, or broken.

(6) Assemble range fork and shift hub (Fig. 51).

(7) Engage range fork pin in shift sector slot (Fig. 52).

(8) Insert shift hub in low range gear. Be sure hub is fully seated.

MAINSHAFT ASSEMBLY

(1) If drive sprocket bearings are to be replaced, remove and install them as follows:

(a) Press both bearings out of sprocket simultaneously with Tool Handle C-4171 and Remover Tool C-4667, or 5066 (Fig. 53).

(b) Before installing new bearings, refer to Figure 54 and note correct bearing position in sprocket. Bearings must also be installed in proper sequence. Install front bearing first and rear bearing last.

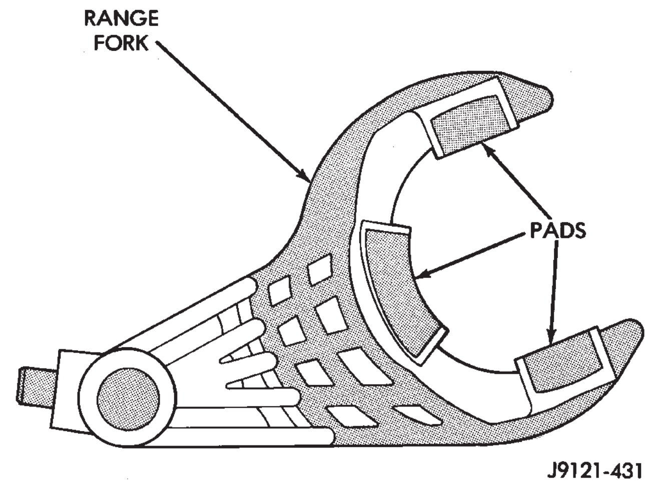


Fig. 50 Range Fork Pad Locations

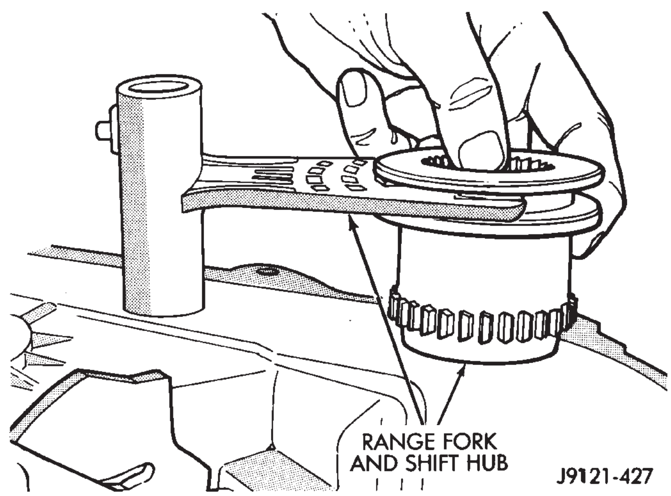


Fig. 51 Assembling Range Fork And Shift Hub

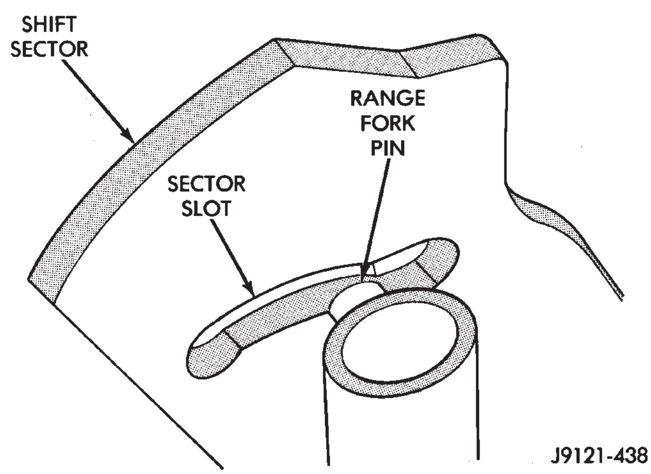


Fig. 52 Seating Range Fork Pin In Shift Sector Slot

CAUTION: Do not press the bearings any farther into the sprocket than indicated in Figure 54. The bearings could block the mainshaft oil feed hole if pressed too deeply into the sprocket.

(c) Install new **front** bearing first. Press bearing flush with edge of sprocket bore (Fig. 55).

(d) Install new **rear** bearing (Fig. 56). Press bearing in until 4.6 mm (3/16 in.) below edge of bore as shown in Figure 46.

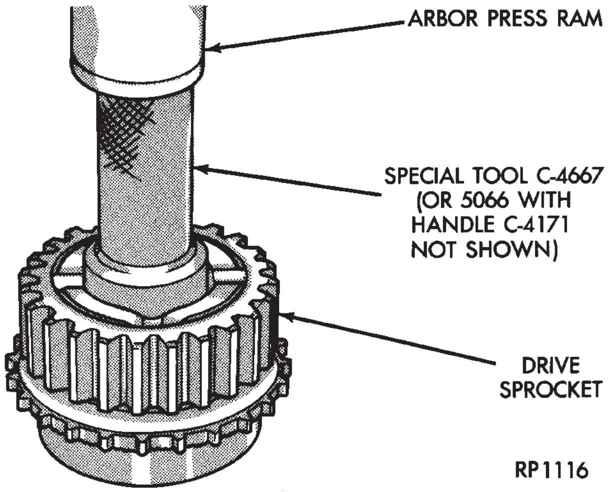


Fig. 53 Drive Sprocket Bearing Removal

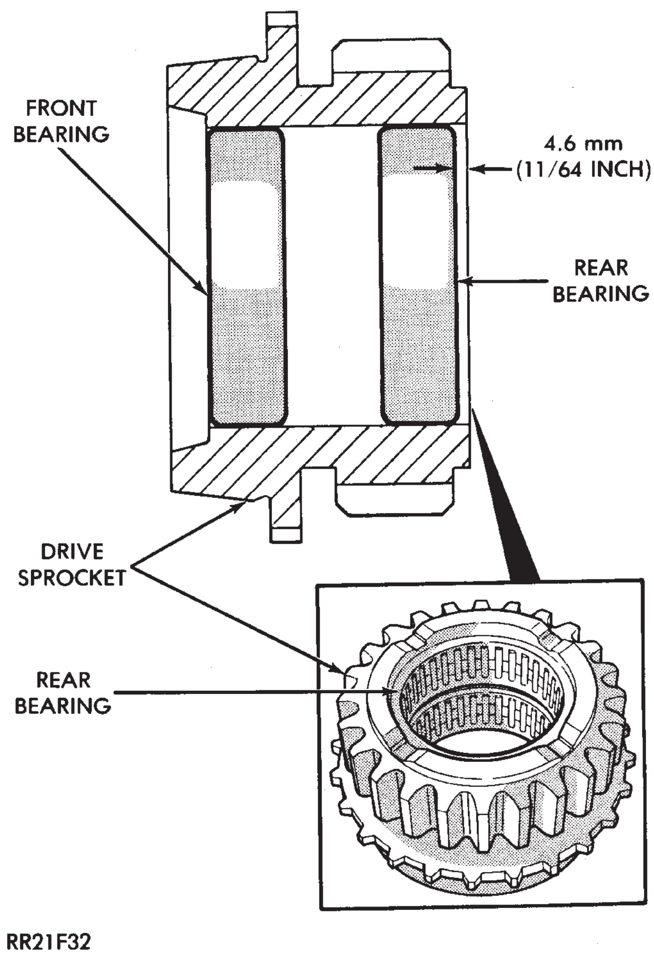


Fig. 54 Correct Bearing Position In Drive Sprocket

(2) On synchro models, install struts and spring(s) in hub (Fig. 57).

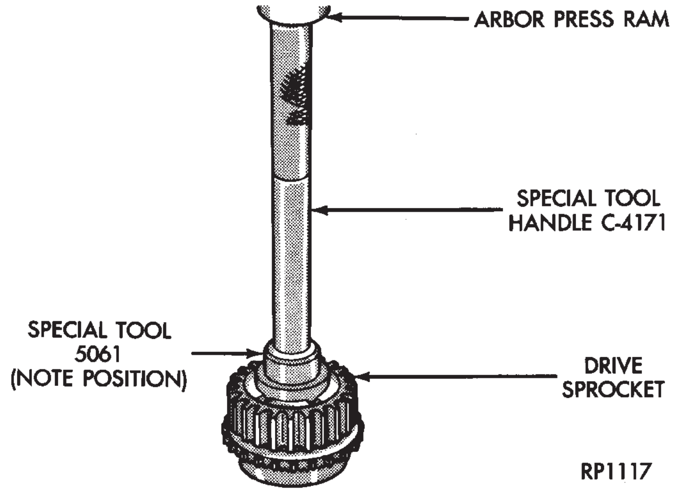


Fig. 55 Drive Sprocket Front Bearing Installation

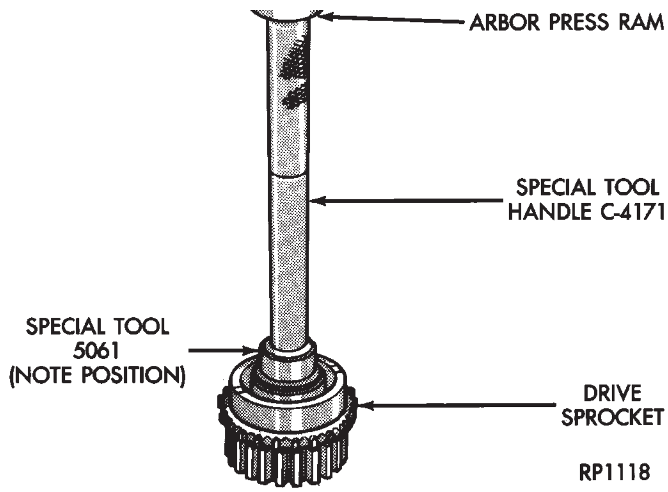


Fig. 56 Drive Sprocket Rear Bearing Installation

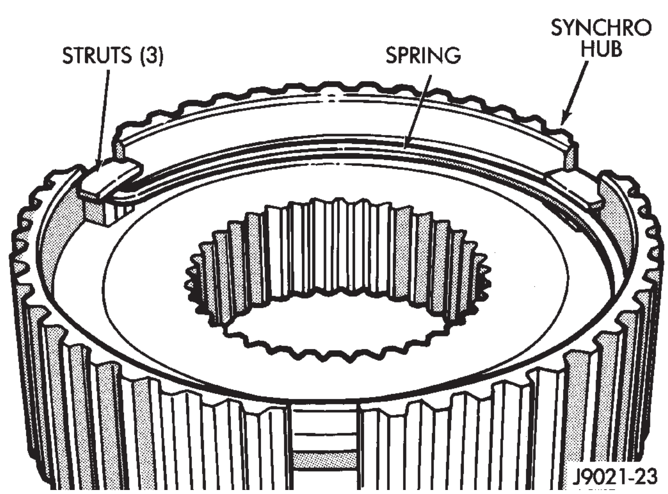


Fig. 57 Installing Synchro Springs And Struts In Hub

(3) Lubricate drive sprocket bearings, stop ring and hub with automatic transmission fluid. Bearings can also be lubricated with petroleum jelly if desired.

(4) Install sprocket, stop ring (synchro models only) and hub on mainshaft (Fig. 58). **Be sure to seat hub struts on stop ring lugs.**

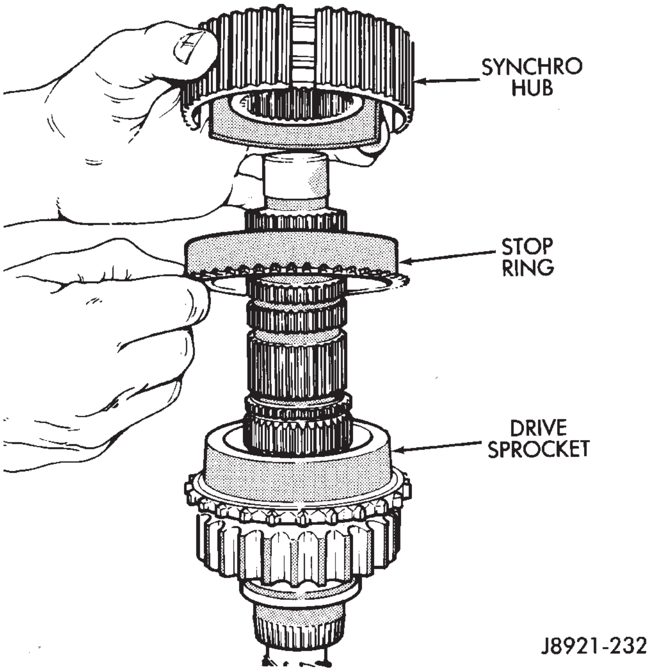


Fig. 58 Sprocket, Stop Ring And Hub Installation

(5) Install spacer washer on hub, if equipped.

(6) Install new hub retaining snap ring (Fig. 59).

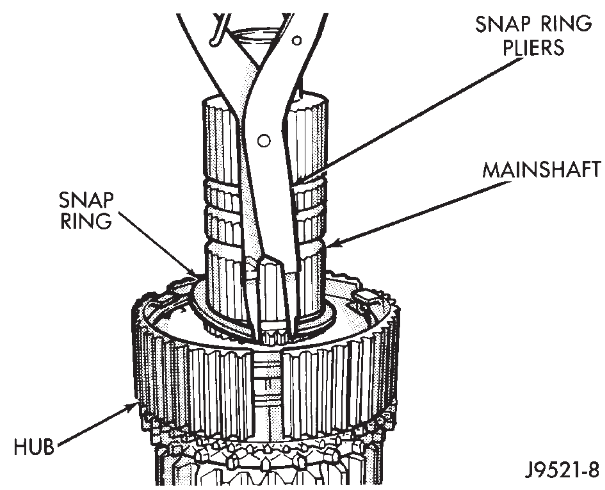


Fig. 59 Hub Retaining Snap Ring Installation

MAINSHAFT AND MODE FORK INSTALLATION

(1) Install sleeve on hub. Be sure sleeve is installed with beveled spline ends facing stop ring and short end of sleeve toward rear of shaft. In addition, on synchro models, be sure a sleeve tooth is aligned with each synchro strut (Fig. 60).

CAUTION: Correct sleeve alignment is important to proper shifting on synchro models. Be sure a sleeve tooth is aligned (centered) over each synchro strut (Fig. 60). Gear clash will occur if the struts and sleeve teeth are misaligned.

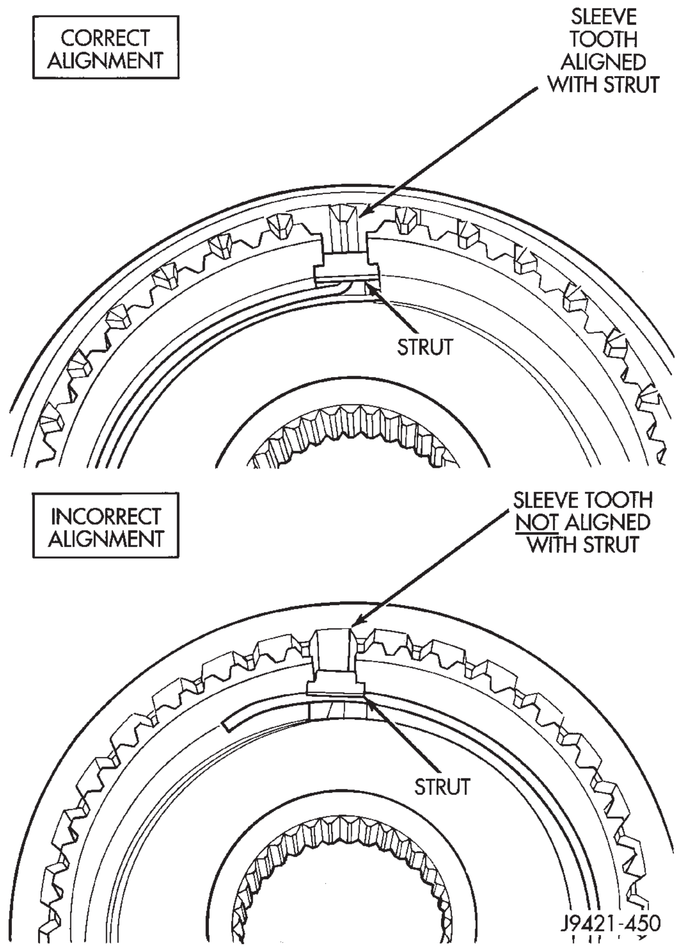


Fig. 60 Correct Synchro Strut And Sleeve Alignment (Synchro Models Only)

(2) Install new pads on mode fork.

(3) Engage mode fork in sleeve (Fig. 61).

(4) Install mode fork-mainshaft assembly in case (Fig. 61). Be sure the mode fork rail is seated in case bore.

(5) Lift mainshaft upward about 2.54 cm (1-inch).

(6) Position front output shaft in drive chain.

(7) Install chain on drive sprocket and start front shaft into front bearing at same time (Fig. 62).

(8) Seat mainshaft and front output shaft (Fig. 54). If front shaft is hard to seat, lift mainshaft slightly to allow front shaft to seat.

(9) Reseat mainshaft in input gear and seat sleeve on hub if necessary.

(10) Install mode spring on shift rail (Fig. 63).

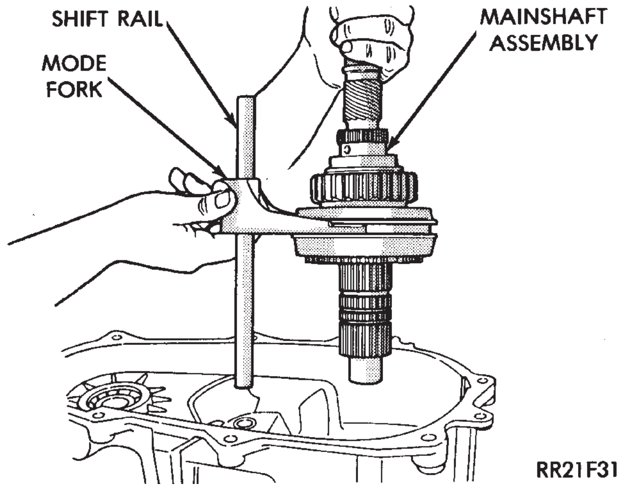


Fig. 61 Installing Mainshaft And Mode Fork Assembly

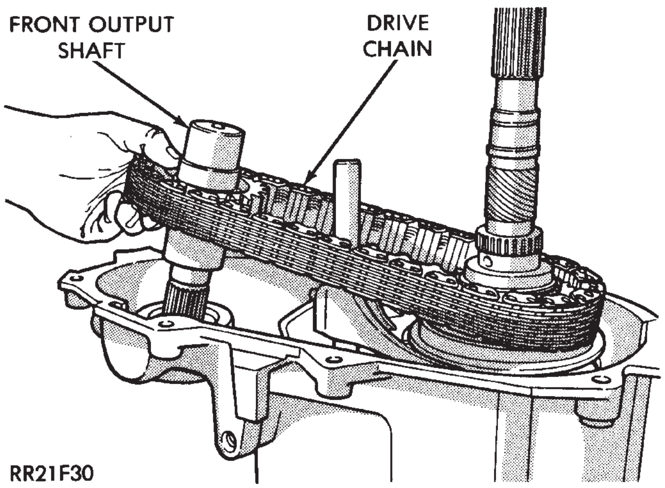


Fig. 62 Installing Drive Chain And Front Output Shaft

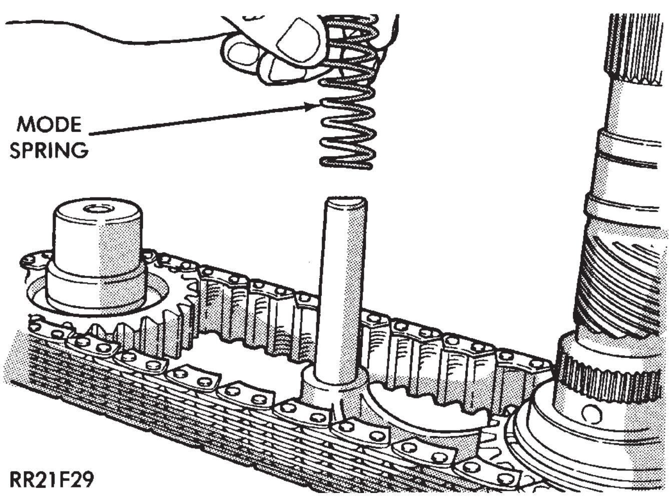


Fig. 63 Installing Mode Spring On Shift Rail

OIL PUMP, REAR CASE, REAR RETAINER AND EXTENSION INSTALLATION

(1) Install new seal in oil pump feed housing with Special Tool 7888 (Fig. 64).

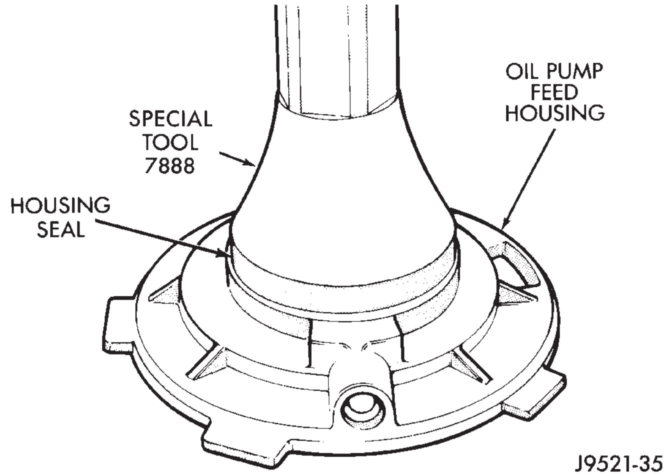


Fig. 64 Oil Pump Seal Installation

(2) Install new pickup tube O-ring in oil pump (Fig. 65).

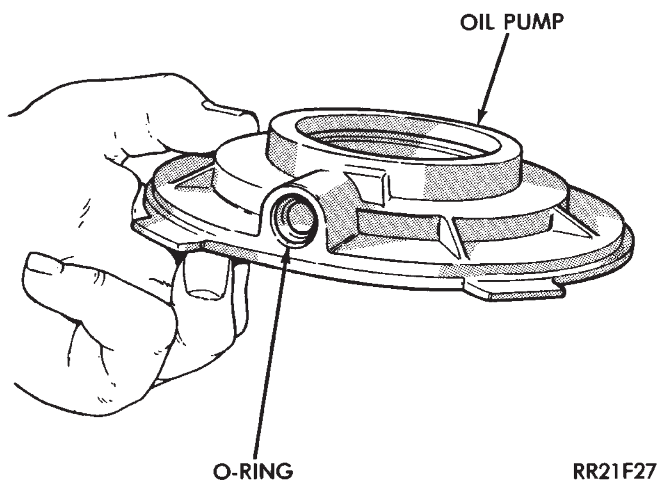


Fig. 65 Pickup Tube O-Ring Installation

(3) Prime oil pump by pouring transmission fluid into pump through pickup tube opening.

(4) Insert pickup tube in oil pump. Then attach oil screen and connecting hose to pickup tube (Fig. 66).

(5) Install assembled pump, pickup tube and screen in rear case. Be sure screen is seated in case slot as shown (Fig. 66).

(6) Install magnet in front case pocket.

(7) Clean sealing surfaces of rear case front case, retainer and extension. Use 3M all purpose cleaner or equivalent product.

(8) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to sealing surface of front case.

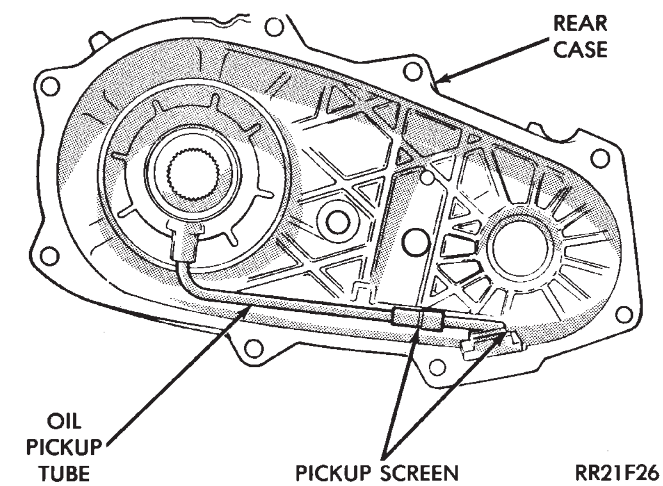


Fig. 66 Pickup Tube, Oil Screen And Pump Installation

(9) Align and install rear case/oil pump assembly on front case (Fig. 67). Be sure case locating dowels are in place and that mainshaft splines are engaged in oil pump inner gear.

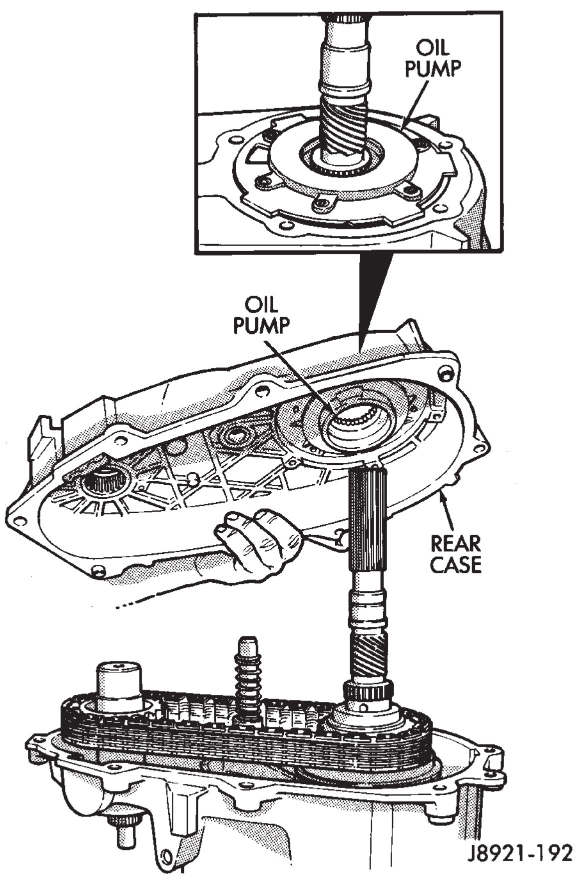


Fig. 67 Installing Rear Case On Front Case

(10) Install and tighten front case-to-rear case attaching bolts to 27-34 N·m (20-25 ft. lbs.) torque. **Be sure to install a washer under each bolt used at case dowel locations.**

(11) Install output bearing in rear retainer. Tap old bearing out of retainer with hammer and brass drift. Then install new bearing with Tool Handle C-4171 and Installer 5064 (Fig. 68).

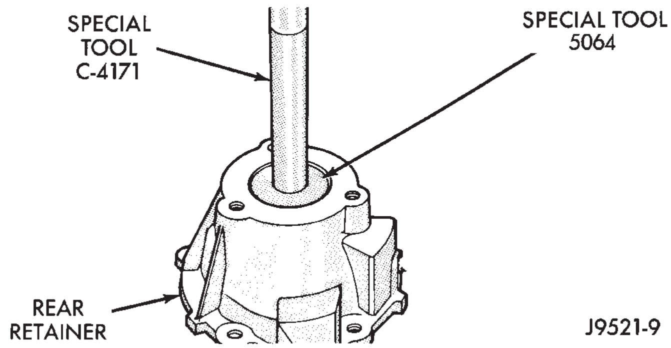


Fig. 68 Installing Mainshaft Rear Bearing In Rear Retainer

(12) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to flange surface of rear retainer.

(13) Align and install rear retainer on rear case. Install and tighten retainer bolts to 27-34 N·m (20-25 ft. lbs.) torque.

(14) Install new output bearing snap ring (Fig. 69). Lift mainshaft slightly to seat snap ring in shaft groove if necessary.

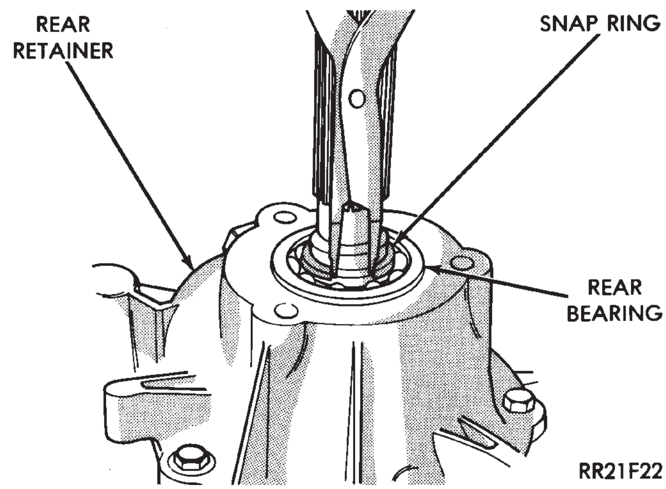


Fig. 69 Installing Output (Rear) Bearing Snap Ring

(15) Remove extension housing seal if not removed previously.

(16) Remove extension housing bushing with Bushing Installer Tools C-4171 and 7889-A (Fig. 70).

(17) Install new extension housing bushing with Installer Tools C-4171 and 5066 (Fig. 71).

(18) Install new seal in extension. Use suitable size socket, or installer tool to seat seal.

(19) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to mounting surface of extension housing.

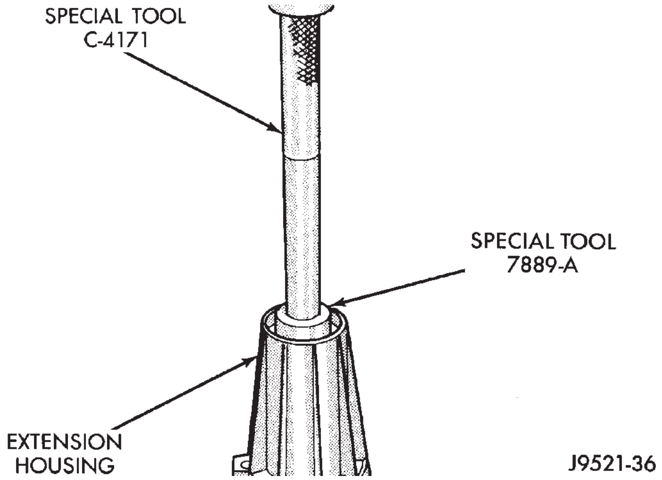


Fig. 70 Extension Housing Bushing Removal

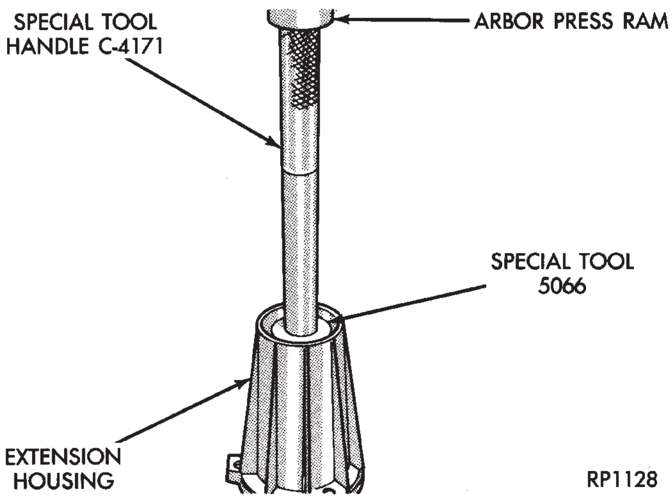


Fig. 71 Extension Housing Bushing Installation

(20) Align and install extension on retainer. Then install and tighten extension bolts to 27-34 N·m (20-25 ft. lbs.) torque.

(21) Install new seal on front output shaft (Fig. 72).

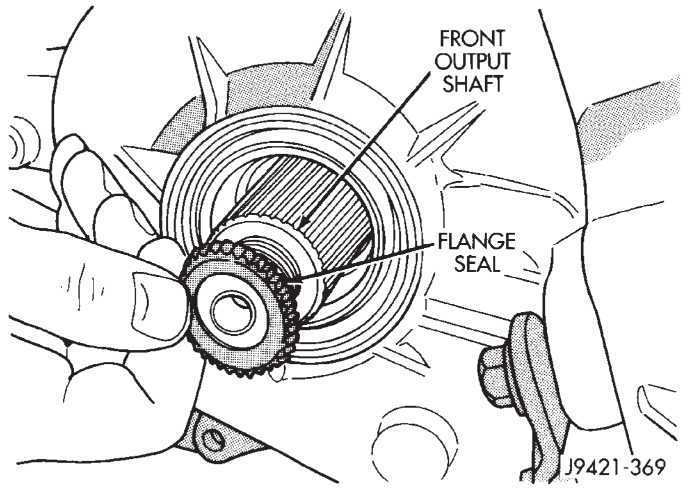


Fig. 72 Front Shaft Seal Installation

(22) Install front yoke on front shaft. Secure yoke with replacement nut. Tighten nut to 149 N·m (110 ft. lbs.) torque.

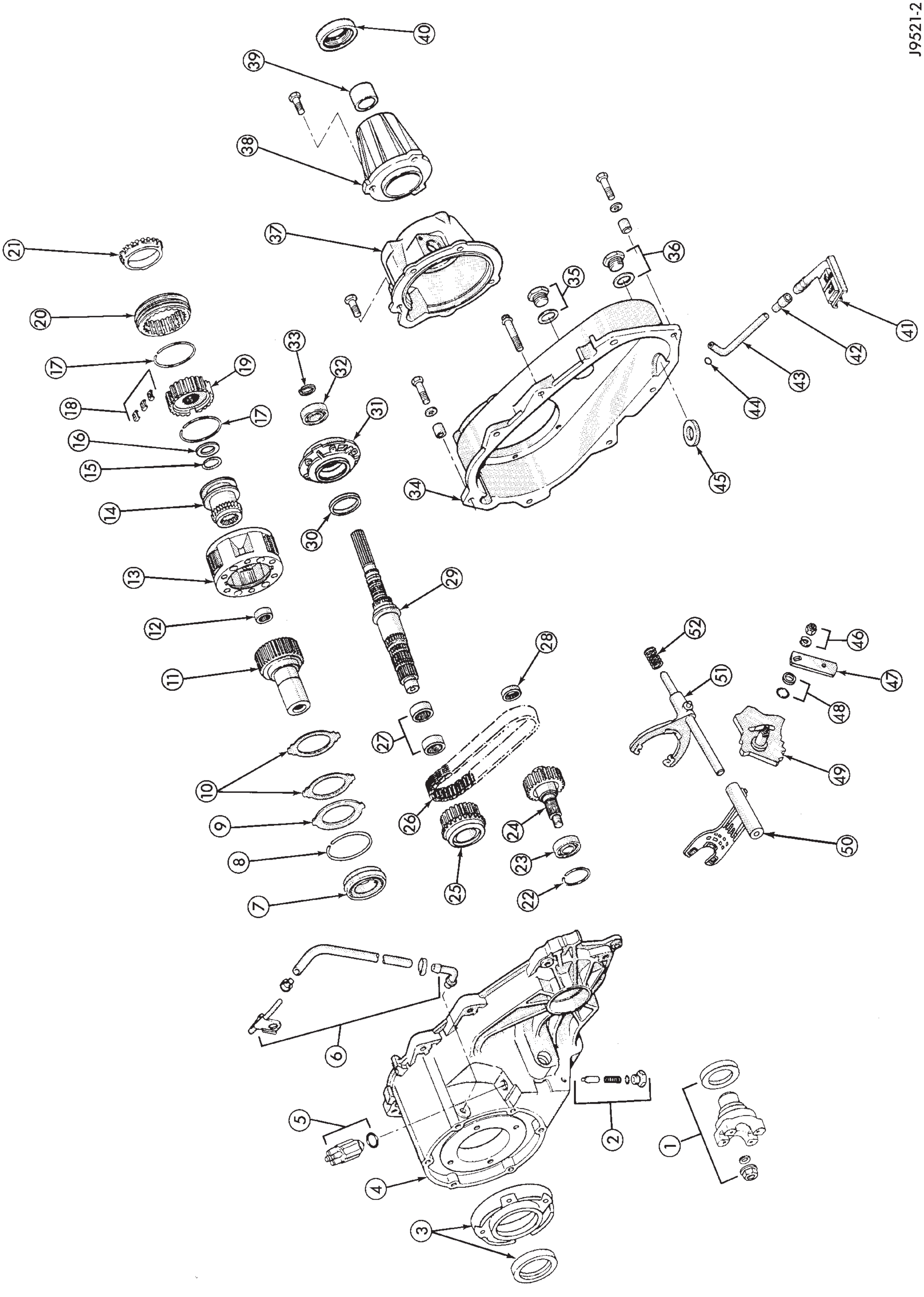
(23) Install replacement gasket on indicator/vacuum switch and install switch in front case. Tighten switch to 27-34 N·m (20-25 ft. lbs.) torque.

(24) Install and tighten drain plug to 47 N·m (35 ft. lbs.) torque.

(25) Install speedometer pinion and adapter and speed sensor.

(26) Fill transfer case with Mopar Dexron II. Correct level is to bottom edge of fill plug hole.

(27) Install and tighten fill plug to 41 N·m (35 ft. lbs.) torque.



NP231 TRANSFER CASE

LEGEND FOR NP231 TRANSFER CASE

1. FRONT YOKE, NUT, SEAL WASHER, AND OIL SEAL
2. SHIFT DETENT PLUG, SPRING AND PIN
3. FRONT RETAINER AND SEAL
4. FRONT CASE
5. 4WD INDICATOR SWITCH
6. VENT ASSEMBLY
7. INPUT GEAR BEARING AND SNAP RING
8. LOW RANGE GEAR SNAP RING
9 INPUT GEAR RETAINER
10. LOW RANGE GEAR THRUST WASHERS
11. INPUT GEAR
12. INPUT GEAR PILOT BEARING
13. LOW RANGE GEAR
14. RANGE FORK SHIFT HUB
15. HUB SNAP RING
16. SPACER WASHER
17. SYNCHRO SPRINGS*
18. SYNCHRO STRUTS*
19. HUB
20. SLEEVE
21. STOP RING*
22. SNAP RING, FRONT BEARING
23. OUTPUT SHAFT FRONT BEARING
24. FRONT OUTPUT SHAFT
25. DRIVE SPROCKET
26. DRIVE CHAIN
27. DRIVE SPROCKET BEARINGS
28. OUTPUT SHAFT REAR BEARING
29. MAINSHAFT
30. OIL SEAL
31. OIL PUMP ASSEMBLY
32. MAINSHAFT REAR BEARING
33. SNAP RING
34. REAR CASE
35. FILL PLUG AND GASKET
36. DRAIN PLUG AND GASKET
37. REAR RETAINER
38. EXTENSION
39. BUSHING
40. OIL SEAL
41. OIL PICKUP SCREEN
42. TUBE CONNECTOR
43. OIL PICKUP TUBE
44. PICKUP TUBE O-RING
45. MAGNET
46. RANGE LEVER NUT AND WASHER
47. RANGE LEVER
48. SECTOR O-RING AND RETAINER BUSHING
49. SECTOR
50. MODE SPRING
51. MODE FORK
52. RANGE FORK

* SYNCHRO EQUIPPED MODELS ONLY.

J9521-3

NP242 TRANSFER CASE

INDEX

GENERAL INFORMATION

The NP242 is a full and part time transfer case with four operating ranges (Fig. 1). The NP242 provides both 2-wheel drive and full time 4-wheel drive operation.

The differential has a locking mechanism for undifferentiated 4-wheel drive in low range. A low range gear reduction system provides increased low speed torque capability.

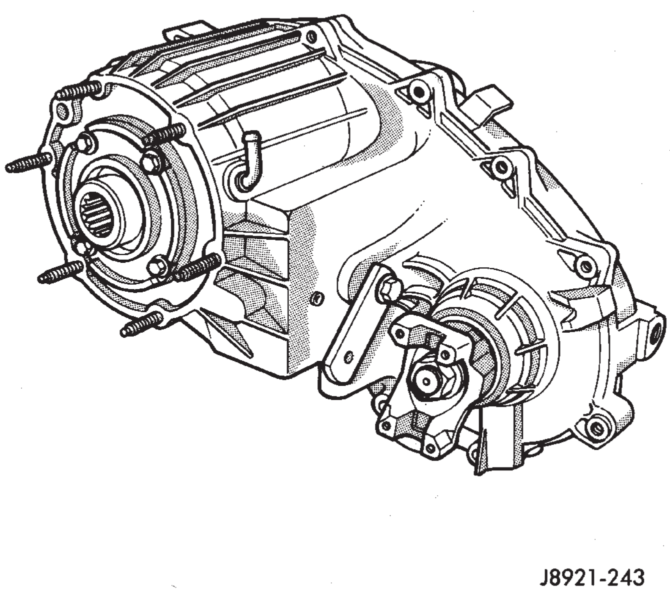


Fig. 1 NP242 Transfer Case

OPERATING RANGES

The NP242 transfer case operating ranges are:
- 2WD (2-wheel drive)
- 4x4 part-time
- 4x4 full time
- 4 Lo (4-wheel drive low).

The 2WD and 4x4 full time ranges are for use on any road surface at any time.

The 4x4 part time and 4 Lo ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is covered by ice and snow.

The low range reduction gear system is operative in 4 Lo range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

SHIFT MECHANISM

Transfer case operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. Range positions are marked on the shifter bezel plate.

TRANSFER CASE IDENTIFICATION

A circular I.D. tag is attached to the rear case of each NP242 transfer case (Fig. 2). The tag provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 7-10-94 would represent July 10, 1994.

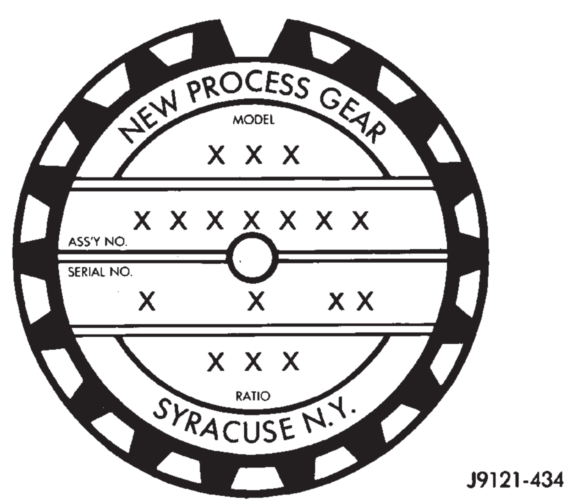


Fig. 2 Transfer Case I.D. Tag

TRANSFER CASE CHANGES

The only service change for 1995 involves the front output seal which is new. The new seal does not have the flange used on prior seals and affects seal installation. The new seal must be seated below the edge of the seal bore in the front case. Refer to the overhaul procedures for seal installation.

TRANSFER CASE LUBRICANT

Mopar Dexron II is the recommended lubricant for the NP242 transfer case. Lubricant capacity is approximately 1.4 liters (1.45 qts.).

TRANSFER CASE FILL LEVEL

Correct fill level for the NP242 transfer case is to the bottom edge of the fill plug hole.

NP242 SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Transfer case external shift linkage binding. (2) Insufficient or incorrect lubricant. (3) Internal components binding, worn or damaged.	(1) Lubricate, repair or replace linkage, or tighten loose components as necessary. (2) Drain and refill to edge of fill hole with DEXRON II® or MOPAR-MERCON® Automatic Transmission Fluid. (3) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE POSITIONS	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with DEXRON II® or MOPAR-MERCON® Automatic Transmission Fluid. Check for leaks and repair if necessary **Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.**
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled. (2) Vent closed or restricted. (3) Output shaft seals damaged or installed incorrectly.	(1) Drain to correct level. (2) Clear or replace vent if necessary. (3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
TRANSFER CASE WILL NOT SHIFT THROUGH 4 X 4 PART-TIME RANGE (Light Remains On).	(1) Incomplete shift due to drivetrain torque load. (2) Incorrect tire pressure(s). (3) Excessive tire wear. (4) Excessive vehicle loading.	(1) Driver must momentarily release the accelerator pedal to complete the shift. (2) Inflate all tires equally to correct pressure. (3) Switch tires — Install the two tires with the most wear (one on the front axle and one on the rear axle). (4) Check vehicle loading — **Do not exceed the vehicle's GVW.**

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SHIFT LINKAGE ADJUSTMENT

(1) Move transfer case shift lever into Neutral position.

(2) Raise vehicle on hoist that will allow all four wheels to rotate freely.

(3) Loosen trunnion lock bolt (Figs. 3 and 4). Loosen bolt enough so selector rod slides freely in trunnion.

(4) Verify that shift lever on transfer case is in Neutral position.

(5) Tighten trunnion lock bolt to 8-14 N·m (72-120 in. lbs.) torque.

(6) Lower vehicle enough for entry into driver seat but keep all wheels off shop floor.

(7) Verify correct linkage adjustment. Start engine, shift transmission into gear and shift transfer case into all ranges. Be sure transfer case is fully engaged in high and low range. Readjust linkage if necessary.

(8) Shut engine off and lower vehicle completely.

SPEEDOMETER SERVICE

Rear axle gear ratio and tire size determine speedometer pinion requirements. If the pinion must be replaced, refer to the parts catalogue information for the correct part.

SPEEDOMETER ASSEMBLY REMOVAL

(1) Raise vehicle.

(2) Disconnect wires from vehicle speed sensor.

(3) Remove adapter clamp and screw (Fig. 5).

(4) Remove speed sensor and speedometer adapter as assembly.

(5) Remove speed sensor retaining screw and remove sensor from adapter.

(6) Remove speedometer pinion from adapter. Replace pinion if worn, cracked, or chipped.

(7) Inspect sensor and adapter O-rings (Fig. 5). Remove and discard O-rings if worn or damaged.

(8) Inspect terminal pins in speed sensor. Clean pins with Mopar electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or pins are loose, severely corroded, or damaged.

SPEEDOMETER INSTALLATION AND INDEXING

(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.

(2) Install new O-rings on speed sensor and speedometer adapter if necessary (Fig. 5).

(3) Lubricate sensor and adapter O-rings with transmission fluid.

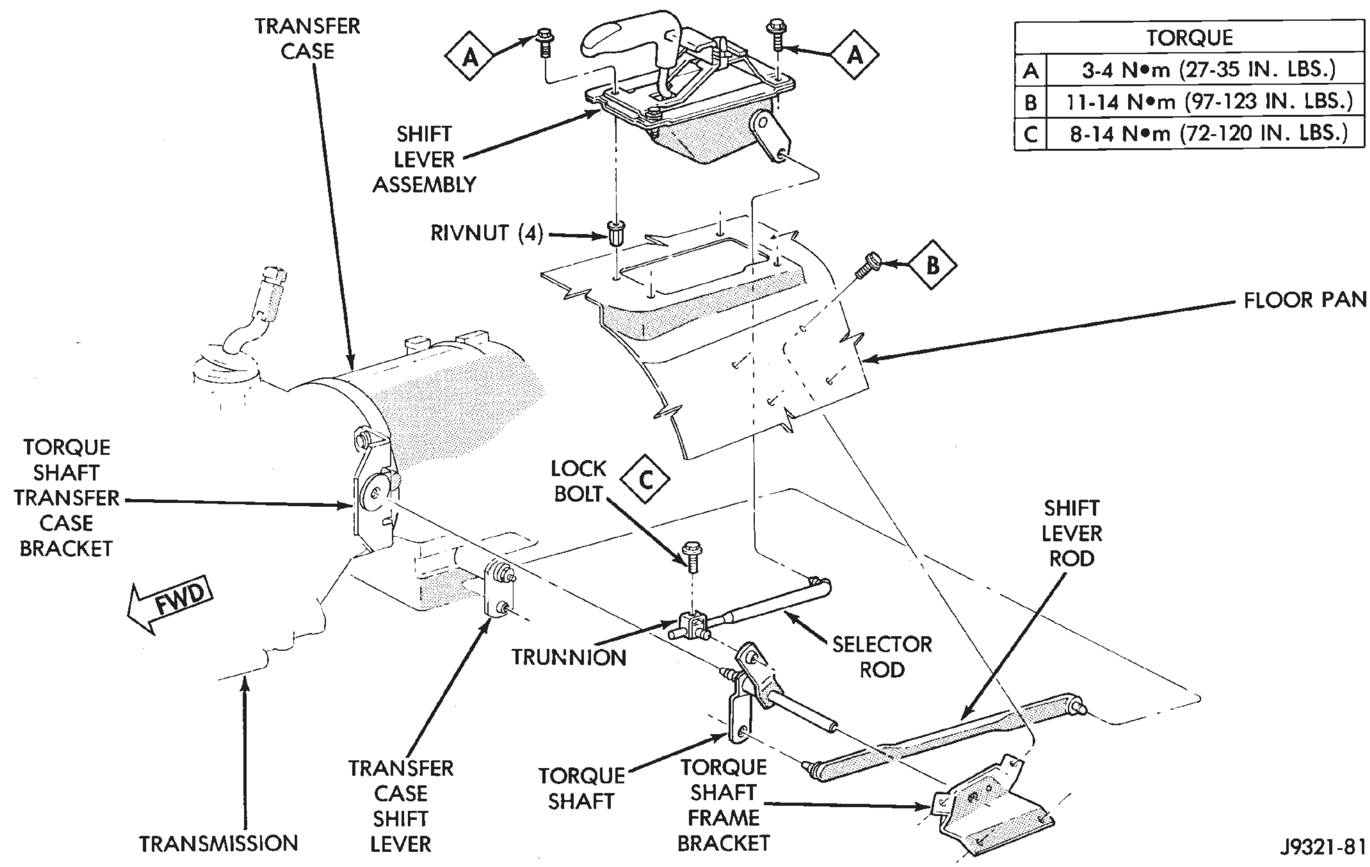


Fig. 3 Transfer Case Shift Linkage (Manual Transmission)

TORQUE	
A	3-4 N•m (27-35 in. lbs.)
B	11-14 N•m (97-123 in. lbs.)
C	8-14 N•m (72-120 in. lbs.)

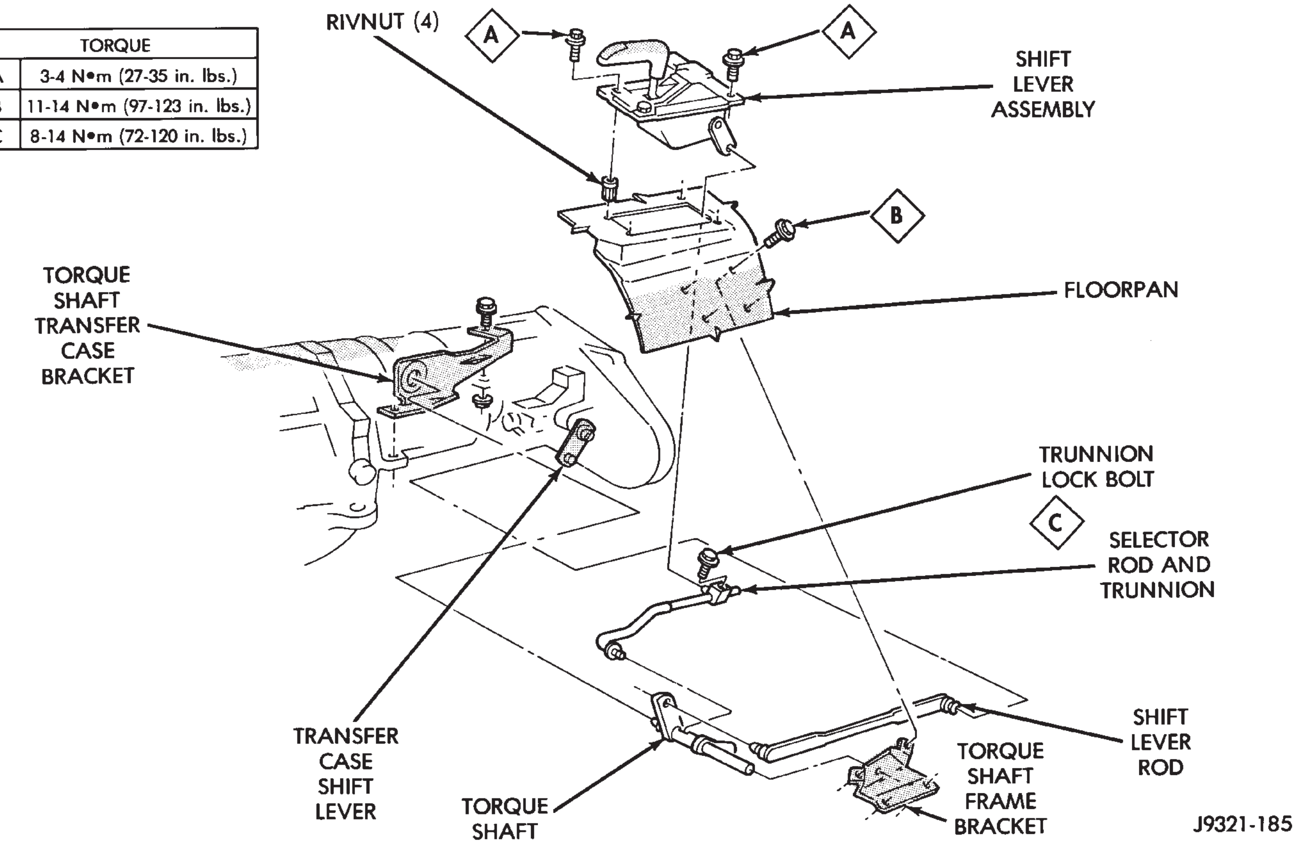


Fig. 4 Transfer Case Shift Linkage (Automatic Transmission)

ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

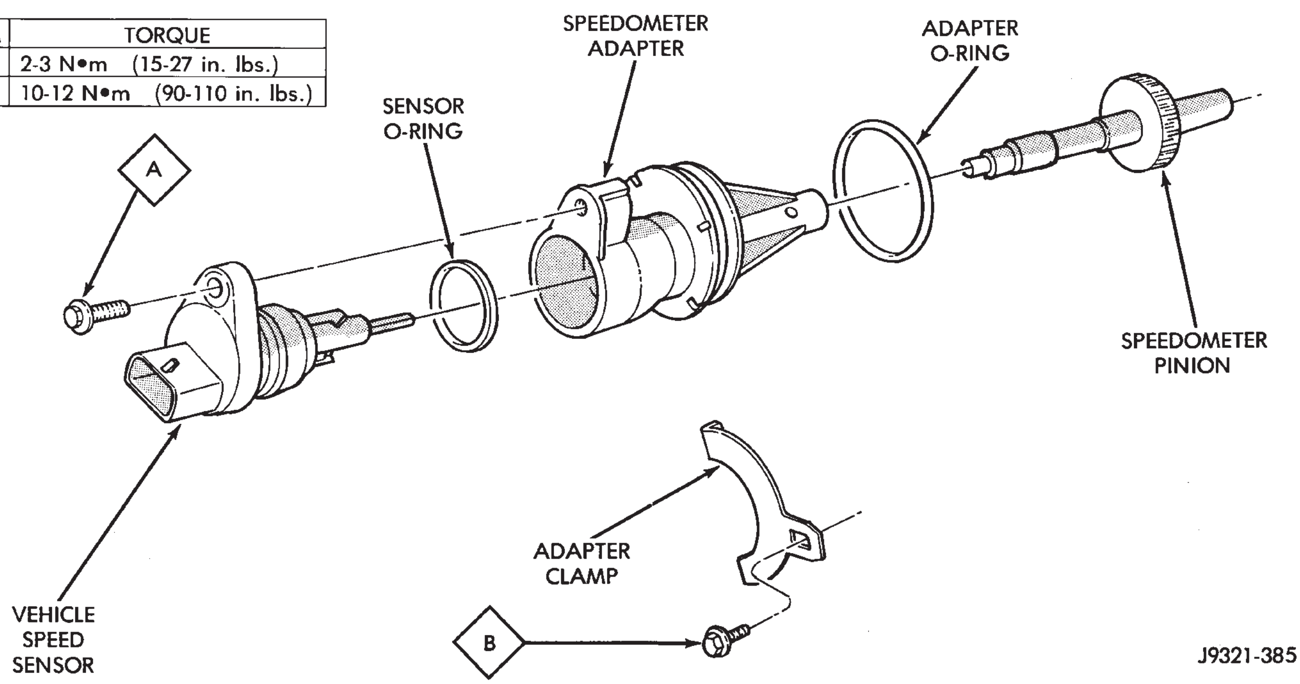


Fig. 5 Speedometer Components

(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.

(5) Install speedometer pinion in adapter.

(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.

(7) Note index numbers on adapter body (Fig. 6). These numbers will correspond to number of teeth on pinion.

(8) Install speedometer assembly in housing.

(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.

(12) Lower vehicle and top off transmission fluid level if necessary.

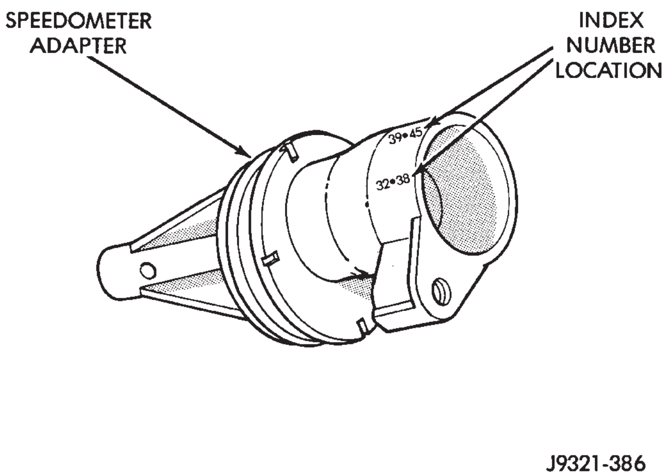


Fig. 6 Location Of Index Numbers On Speedometer Adapter

TRANSFER CASE REMOVAL

(1) Shift transfer case into Neutral.

(2) Raise vehicle.

(3) Drain transfer case lubricant.

(4) Mark front and rear propeller shaft yokes for alignment reference.

(5) Place support stand under transmission.

(6) Remove rear crossmember.

(7) Disconnect front/rear propeller shafts at transfer case.

(8) Disconnect speed sensor and remove speedometer adapter and sensor if necessary.

(9) Disconnect transfer case shift lever from shift lever rod.

(10) Disconnect vent hose and electrical connectors.

(11) Support transfer case with transmission jack.

(12) Remove bolts attaching transfer case to transmission.

(13) Secure transfer case to jack with chains.

(14) Pull transfer case and jack rearward to disengage transfer case.

(15) Remove transfer case from under vehicle.

TRANSFER CASE INSTALLATION

(1) Mount transfer case on a transmission jack. Secure transfer case to jack with chains.

(2) Position transfer case under vehicle.

(3) Align transfer case and transmission shafts and install transfer case on adapter (Fig. 7).

(4) Install and tighten transfer case attaching nuts. Tighten nuts to 35 N·m (26 ft. lbs.) torque if case has 5/16 studs. Tighten nuts to 47 N·m (35 ft. lbs.) torque if case has 3/8 studs.

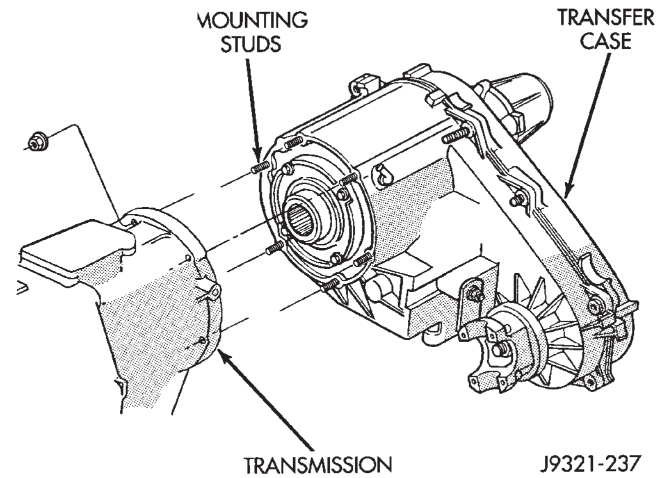


Fig. 7 Transfer Case Attachment

(5) Install speedometer adapter, pinion, and speed sensor.

(6) Connect electrical wires to speed sensor.

(7) Connect vent hose to transfer case vent (Fig. 8).

(8) Align and connect propeller shafts. Tighten shaft attaching bolts to 19 N·m (170 in. lbs.) torque.

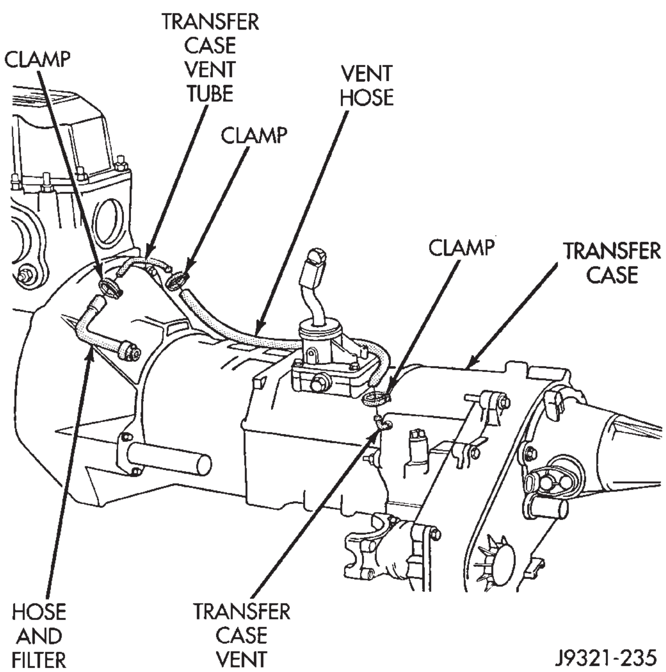


Fig. 8 Transfer Case Vent Hose Routing

(9) Fill transfer case with Dexron II. Correct level is to bottom edge of fill plug hole.

(10) Install rear crossmember if removed. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(11) Remove transmission jack and transmission support stand.

(12) Connect transfer case shift lever to shift lever rod.

(13) Check and adjust transfer case shift linkage if necessary.

(14) Lower vehicle.

TRANSFER CASE DISASSEMBLY AND OVERHAUL

(1) Remove fill and drain plugs.

(2) Remove front yoke. Discard yoke seal washer and nut.

(3) Place transfer case range lever in 4L position.

(4) Remove extension housing attaching bolts.

(5) Tap extension housing in a clockwise direction to break sealer bead and remove housing (Fig. 1).

CAUTION: To avoid damaging the sealing surfaces of the extension housing and rear retainer, do not attempt to pry or wedge the housing off the retainer.

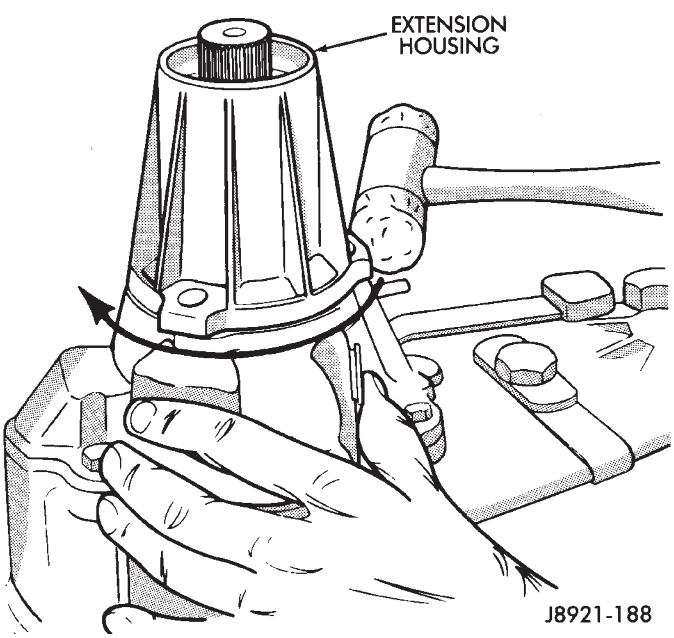


Fig. 1 Extension Housing Removal

(6) Remove rear bearing snap ring from mainshaft (Fig. 2). Discard snap ring.

(7) Remove rear retainer attaching bolts.

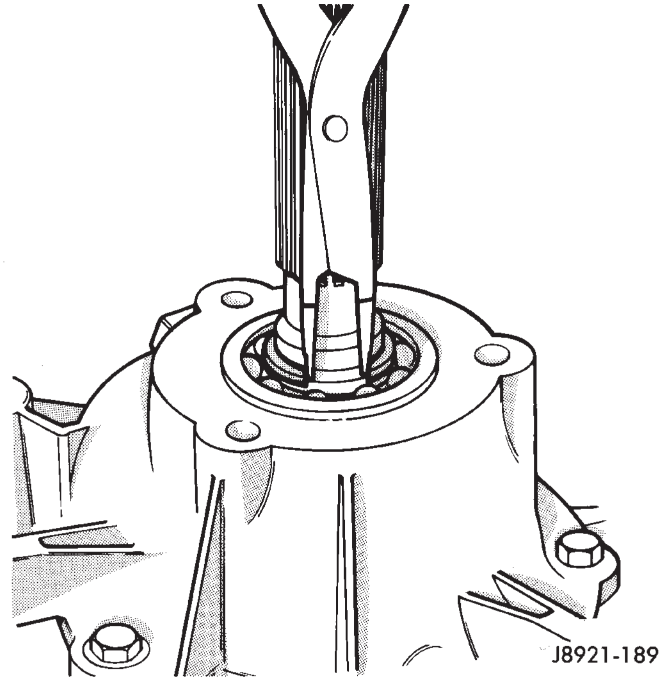


Fig. 2 Removing Rear Bearing Snap Ring

(8) Loosen rear retainer (Fig. 3). Position long screwdriver under each tab at ends of retainer housing and pry retainer upward.

CAUTION: Do not pry against the sealing surfaces of the retainer or rear case. The surfaces could be damaged.

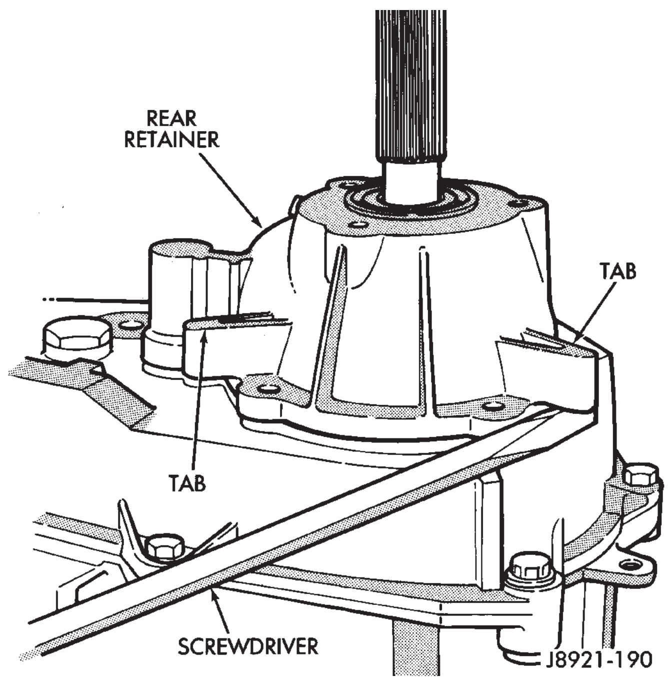


Fig. 3 Loosening Rear Retainer

(9) Lift rear retainer up and off case and mainshaft (Fig. 4).

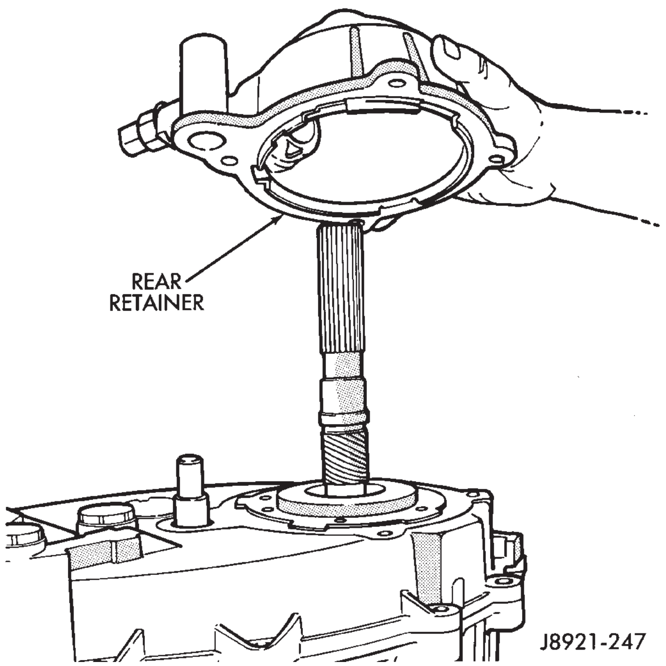


Fig. 4 Rear Retainer Removal

(10) Remove bolts attaching rear case to front case. Retain bolts and the washers.

(11) Loosen rear case with two screwdrivers (Fig. 5). Insert screwdrivers into slots cast in case ends. Then gently pry upward to break sealer bead.

CAUTION: Do not pry against the sealing surfaces of the front case or rear case. The surfaces could be damaged.

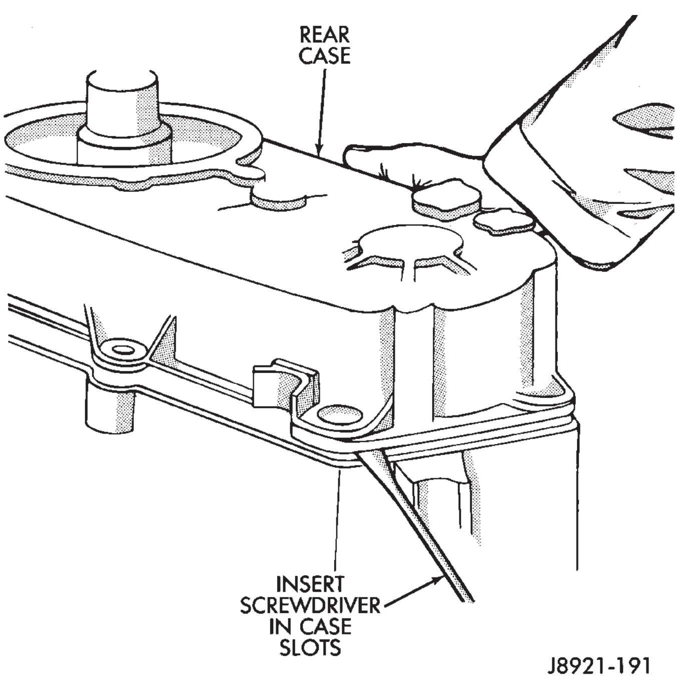


Fig. 5 Loosening Rear Case

(12) Remove rear case and oil pump as assembly (Fig. 6).

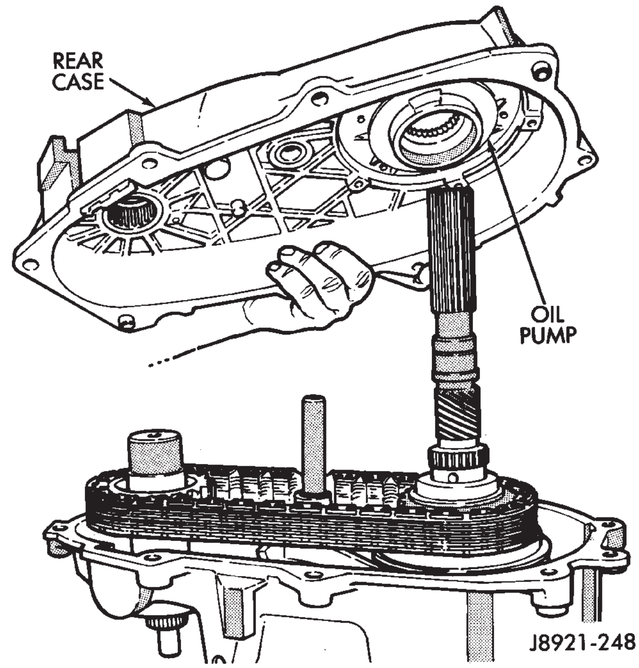


Fig. 6 Rear Case And Oil Pump Removal

(13) Slide oil screen (Fig. 7) out of case pocket.

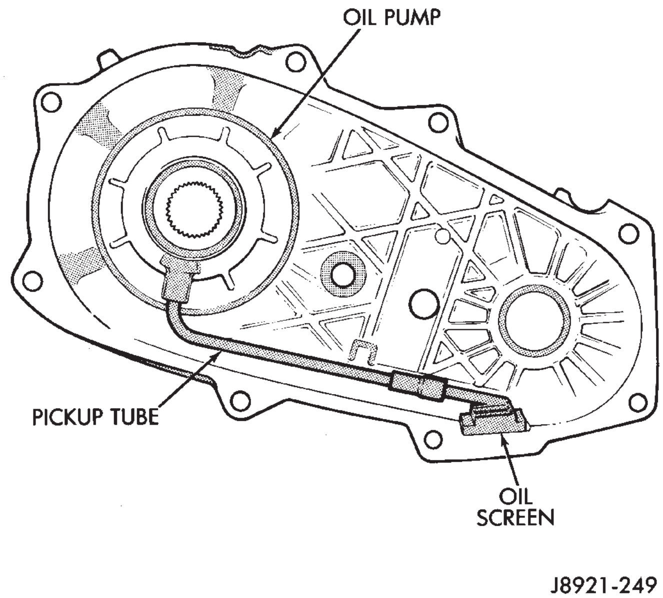


Fig. 7 Unseating Oil Screen

(14) Remove oil pump, pickup tube and oil screen from rear case (Fig. 8).

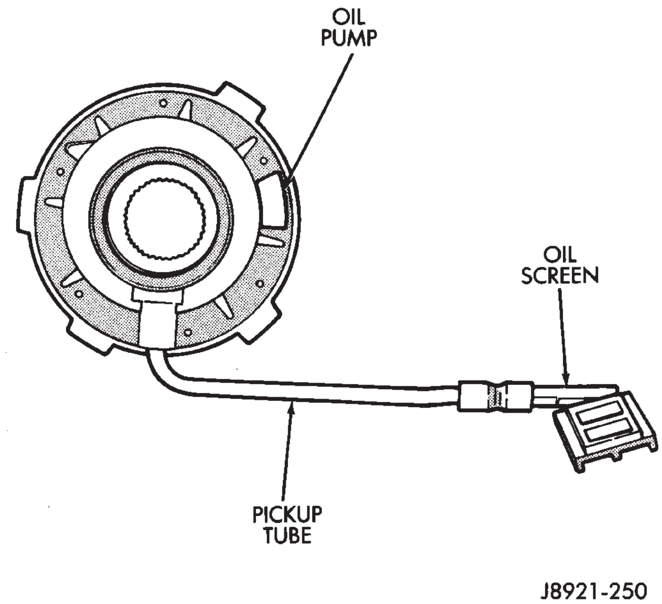


Fig. 8 Oil Pump/Pickup Tube/Screen Removal

(15) Remove pickup tube and screen from pump. **Do not disassemble oil pump; it is not repairable. Pumps are serviced only as an assembly.**

(16) Remove pickup tube O-ring from oil pump (Fig. 9).

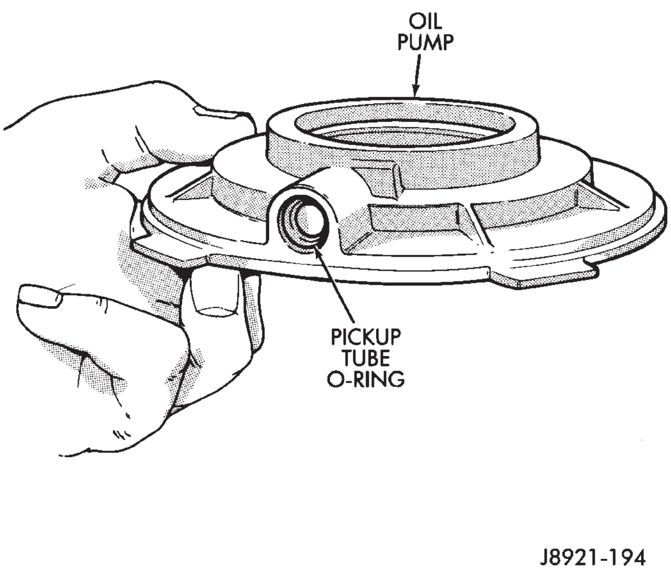


Fig. 9 Pickup Tube O-Ring Removal

(17) Remove and discard oil pump seal.

(18) Remove magnet from front case.

(19) Remove drive sprocket snap ring (Fig. 10).

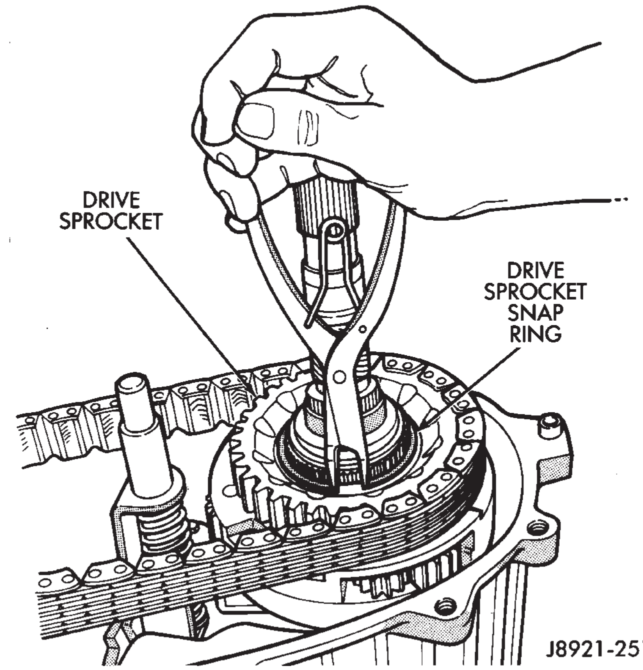


Fig. 10 Drive Sprocket Snap Ring Removal

(20) Remove drive sprocket and chain (Fig. 11).

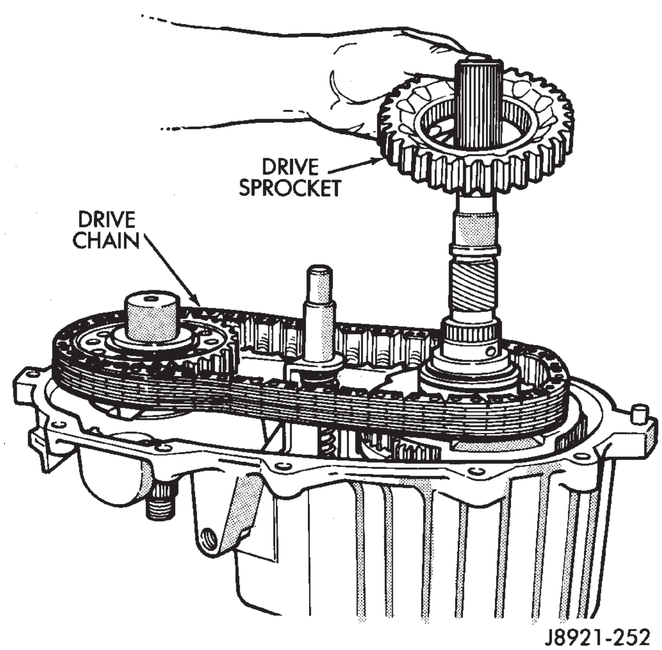


fig. 11 Drive Sprocket And Chain Removal

(21) Remove front output shaft (Fig. 12).

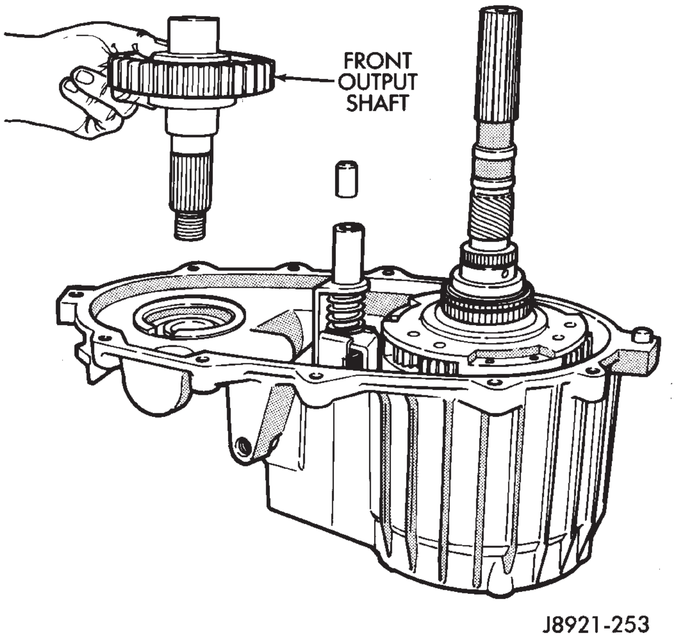


Fig. 12 Removing Front Output Shaft

(22) Remove transfer case shift lever nut and lever.

(23) Remove shift detent plug, spring and pin (Fig. 13)

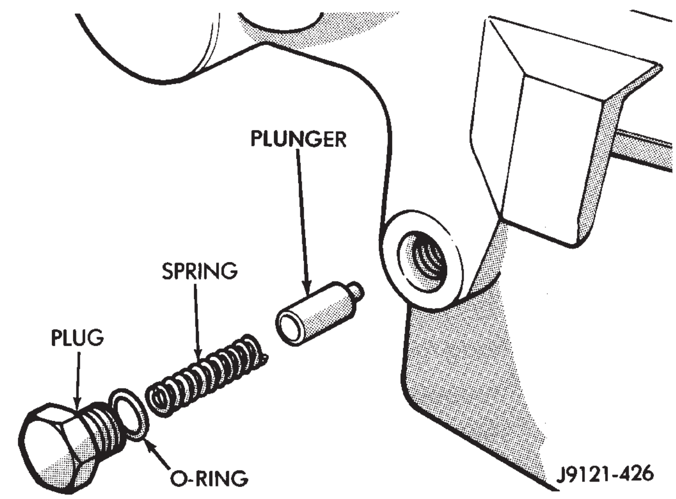


Fig. 13 Detent Component Removal

(24) Remove seal plug from low range fork lockpin access hole. Then move shift sector to align low range fork lockpin with access hole (Fig. 14).

(25) Remove range fork lockpin with size number one easy-out tool. Grip easy-out tool with locking pliers and remove pin with counterclockwise, twist and pull motion (Fig. 14).

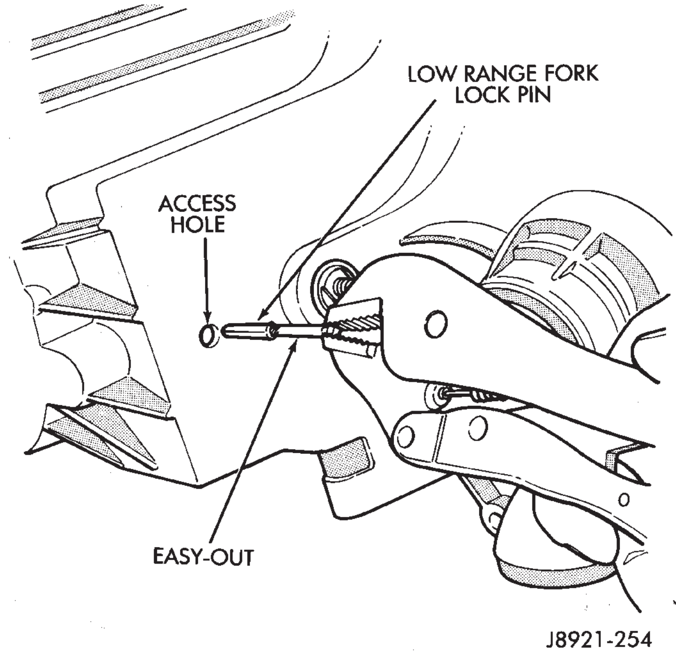


Fig. 14 Low Range Fork Lockpin Removal

(26) Remove shift rail by pulling it straight up and out of fork (Fig. 15).

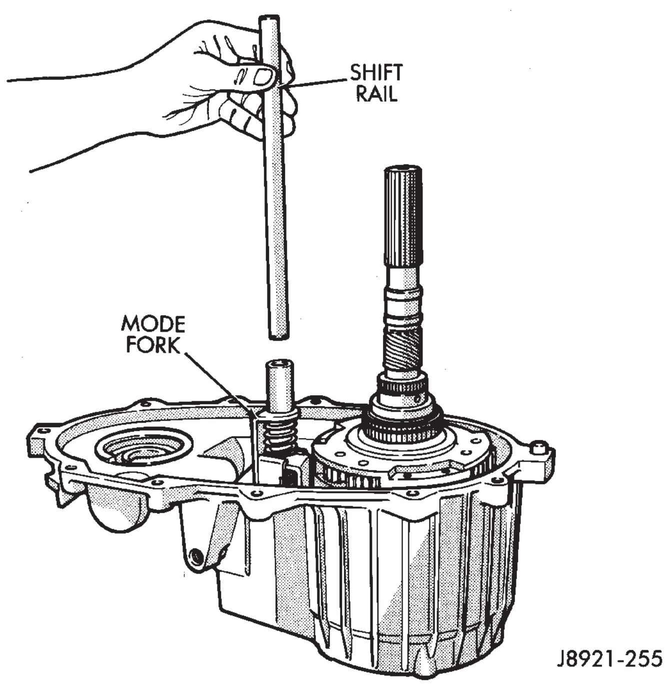


Fig. 15 Shift Rail Removal

(27) Remove mode fork and mainshaft as assembly (Fig. 16).

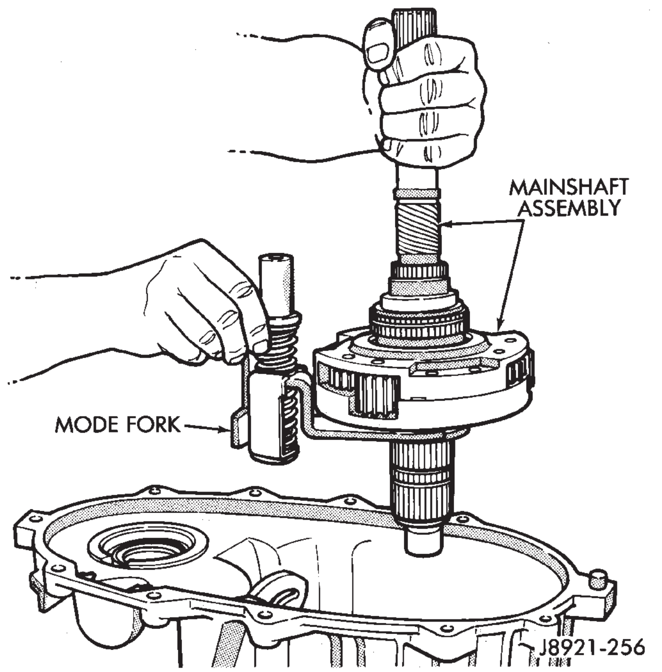


Fig. 16 Mode Fork And Mainshaft Removal

(28) Remove mode shift sleeve and mode fork assembly from mainshaft (Fig. 17). Note position of mode sleeve in fork and remove sleeve.

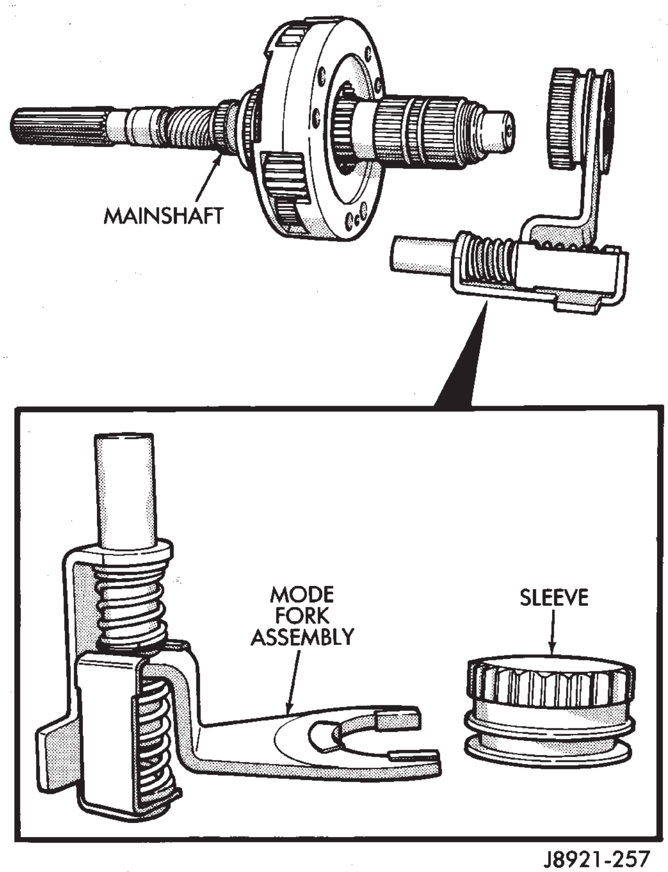


Fig. 17 Mode Fork And Sleeve Removal

(29) Remove intermediate clutch shaft snap ring (Fig. 18).

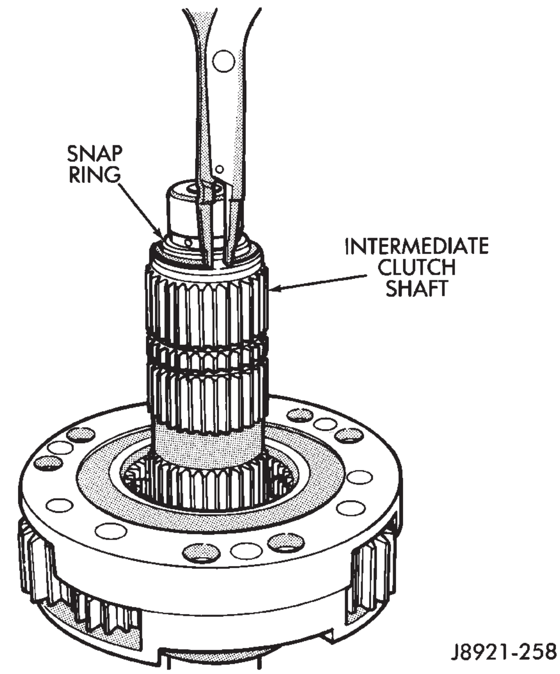


Fig. 18 Intermediate Clutch Shaft Snap Ring Removal

(30) Remove clutch shaft thrust ring (Fig. 19).

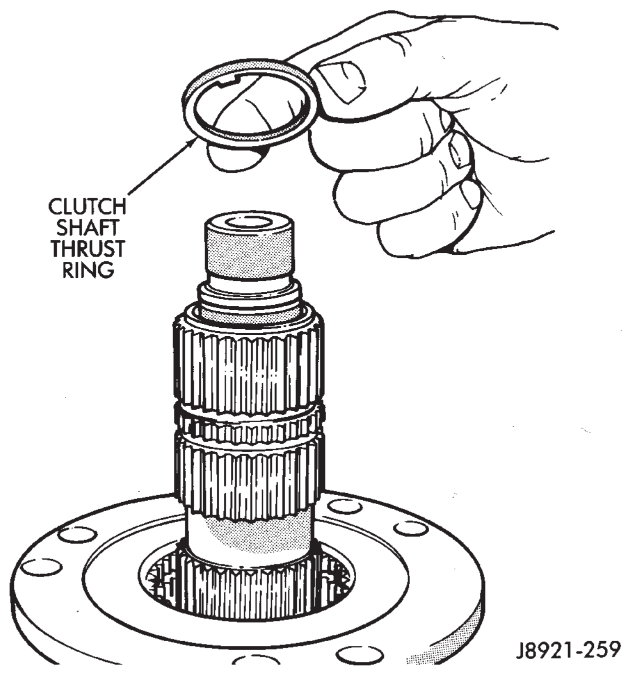


Fig. 19 Clutch Shaft Thrust Ring Removal

(31) Remove intermediate clutch shaft (Fig. 20).

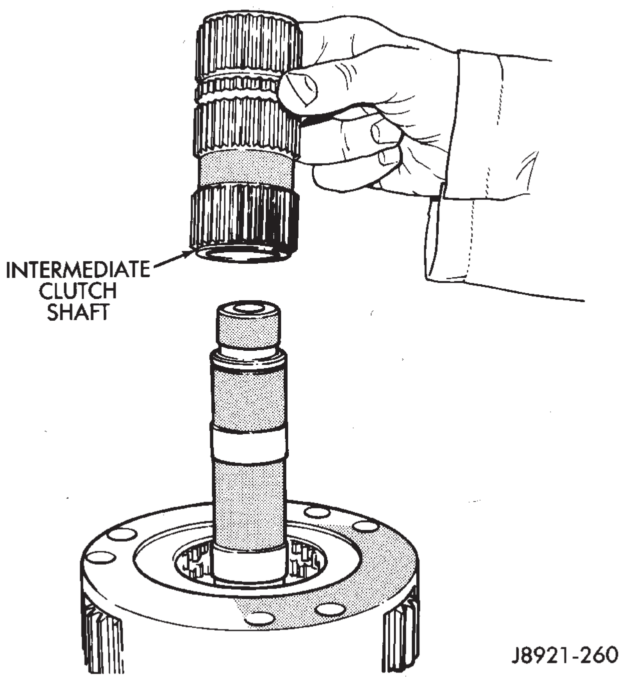


Fig. 20 Intermediate Clutch Shaft Removal

(32) Remove differential snap ring (Fig. 21).

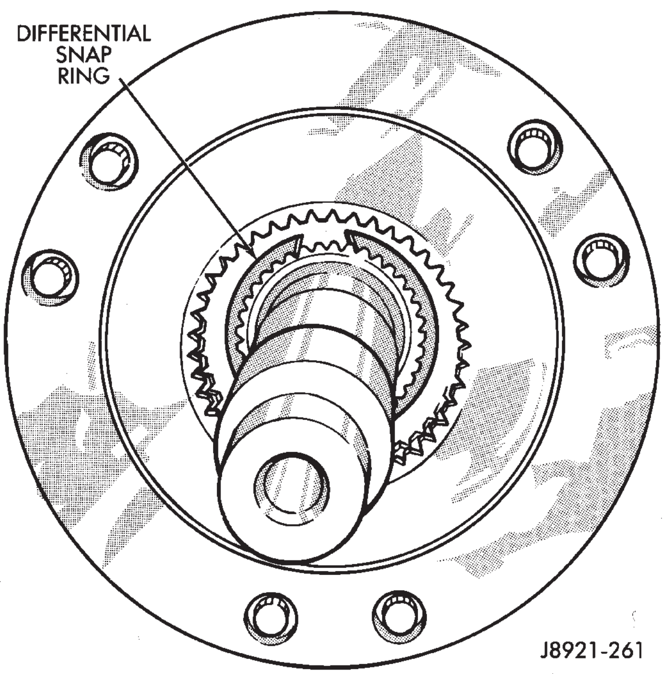


Fig. 21 Differential Snap Ring Removal

(33) Remove differential (Fig. 22).

(34) Remove differential needle bearings and both needle bearing thrust washers from mainshaft.

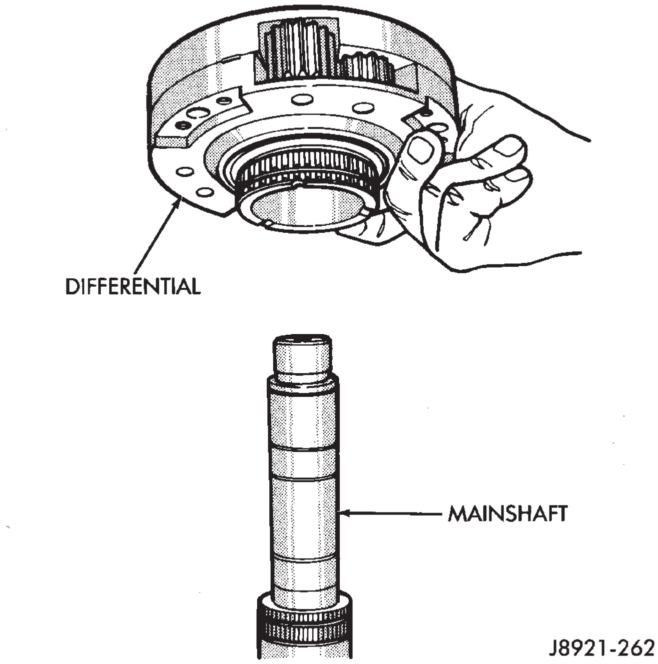


Fig. 22 Differential Removal

(35) Slide low range fork pin out of shift sector slot (Fig. 23)

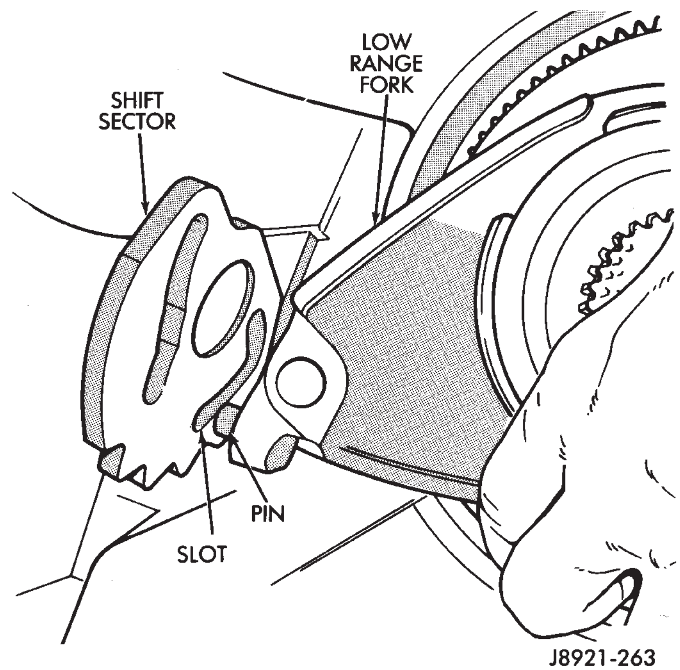


Fig. 23 Disengaging Low Range Fork

(36) Remove low range fork and hub (Fig. 24).

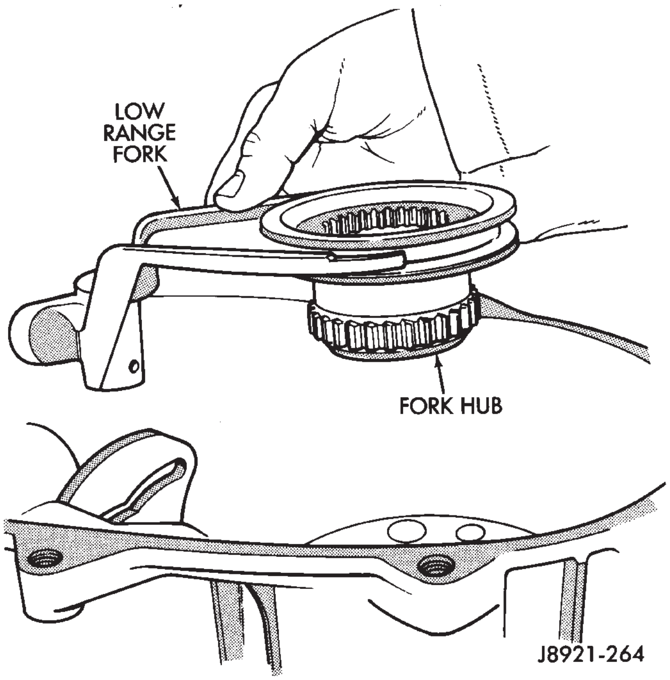


Fig. 24 Low Range Fork And Hub Removal

(37) Remove shift sector (Fig. 25).

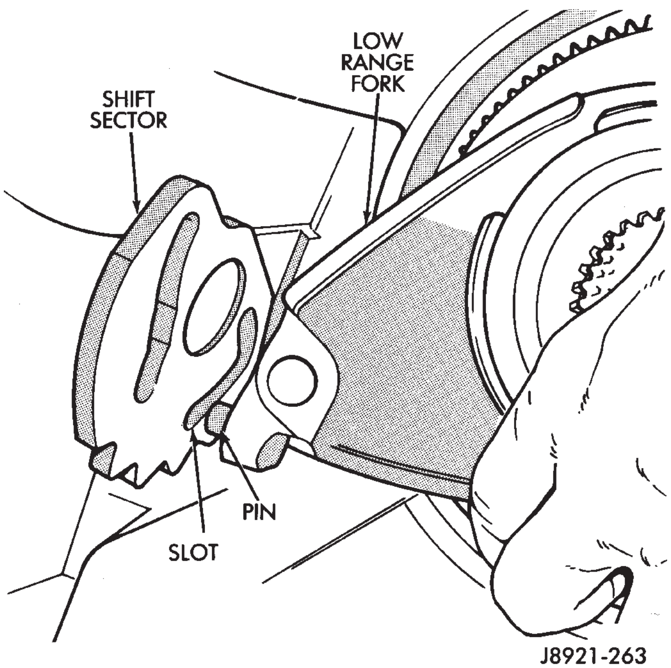


Fig. 25 Shift Sector Position

(38) Remove shift sector bushing and O-ring (Fig. 26).

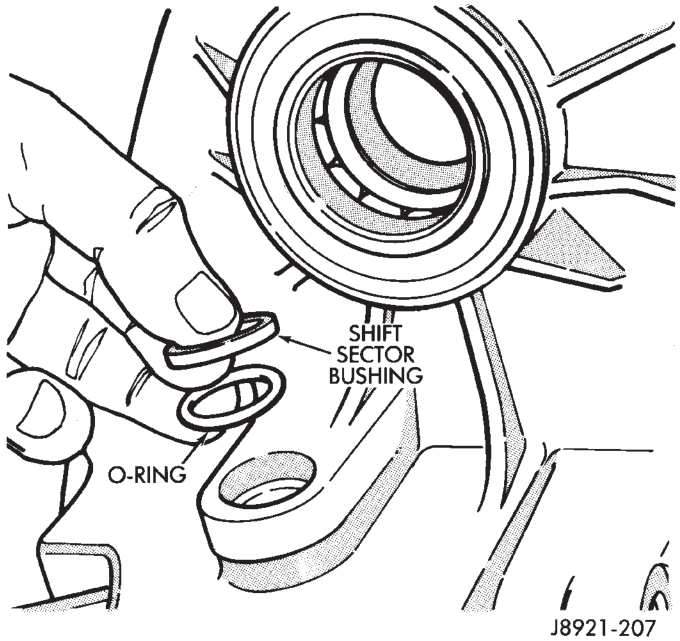


Fig. 26 Sector Bushing And O-Ring Removal

(39) Remove front bearing retainer bolts.

(40) Remove front bearing retainer. Carefully pry retainer loose with screwdriver (Fig. 27). Position screwdriver in slots cast into retainer.

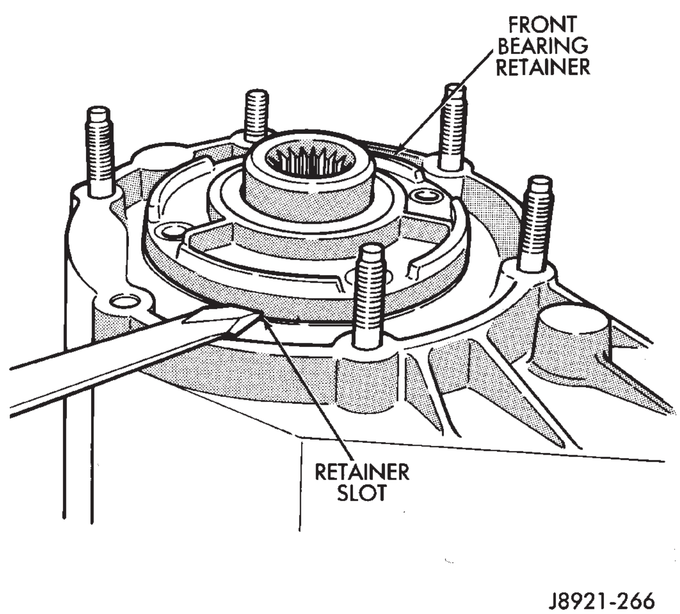


Fig. 27 Front Bearing Retainer Removal

(41) Remove input gear snap ring (Fig. 28).

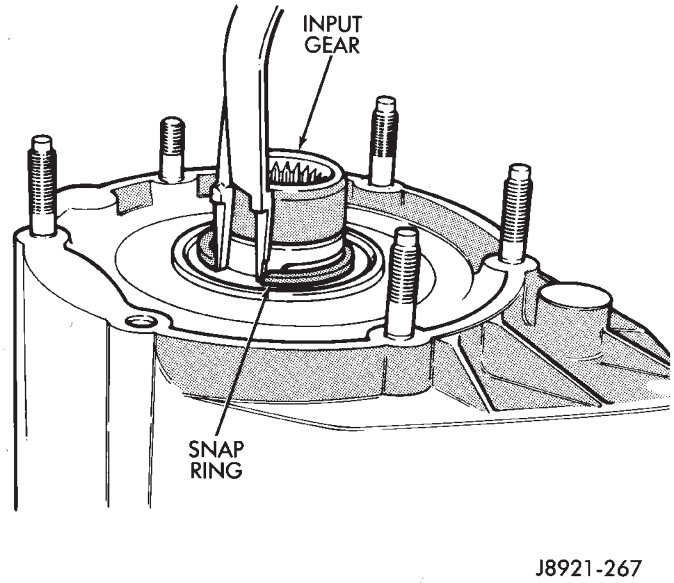


Fig. 28 Input Gear Snap Ring Removal

(42) Remove input/low range gear assembly from bearing with Tool Handle C-4171 and Tool 7829A (Fig. 29).

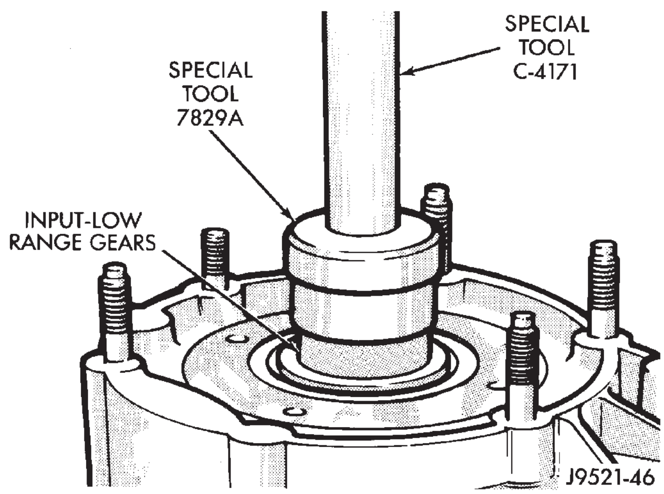


Fig. 29 Input And Low Range Gear Assembly Removal

(43) Remove low range gear snap ring (Fig. 30).

(44) Remove input gear retainer, thrust washers and input gear from low range gear (Fig. 31).

(45) Inspect low range annulus gear (Fig. 32). **Gear is not a serviceable component. If damaged, replace gear and front case as assembly.**

(46) Remove oil seals from following components:

- rear retainer
- extension housing
- oil pump
- case halves

(47) Mark differential case halves for reference.

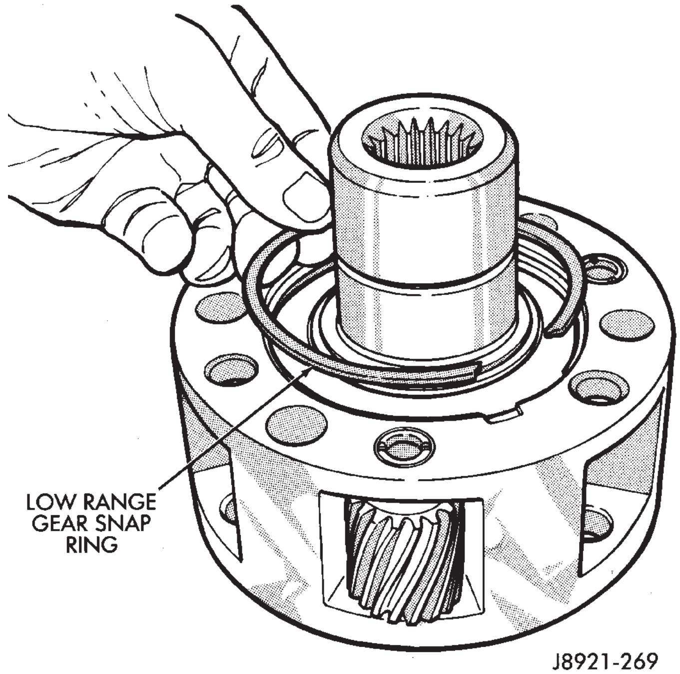


Fig. 30 Low Range Gear Snap Ring Removal/Installation

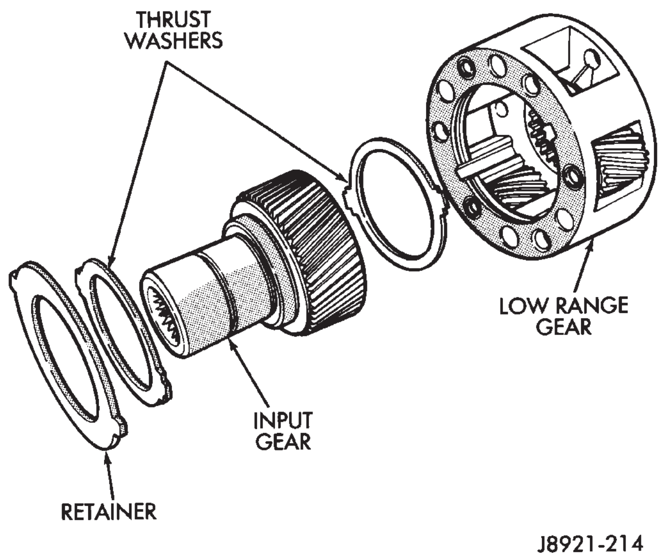


Fig. 31 Low Range Gear Disassembly

(48) Remove differential case bolts and separate top case from bottom case. Use slots in case halves to pry them apart (Fig. 33).

(49) Remove thrust washers and planet gears from case pins (Fig. 34).

(50) Remove mainshaft and sprocket gears from bottom case (Fig. 35). Note gear position for reference before separating them.

OVERHAUL CLEANING AND INSPECTION

Clean the transfer case components thoroughly with solvent. Remove all traces of sealer from the case and retainer seal surfaces.

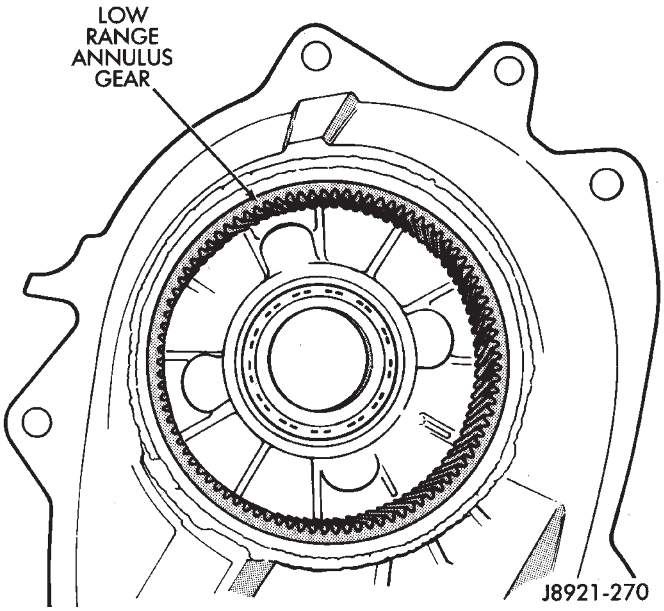


Fig. 32 Inspecting Low Range Annulus Gear

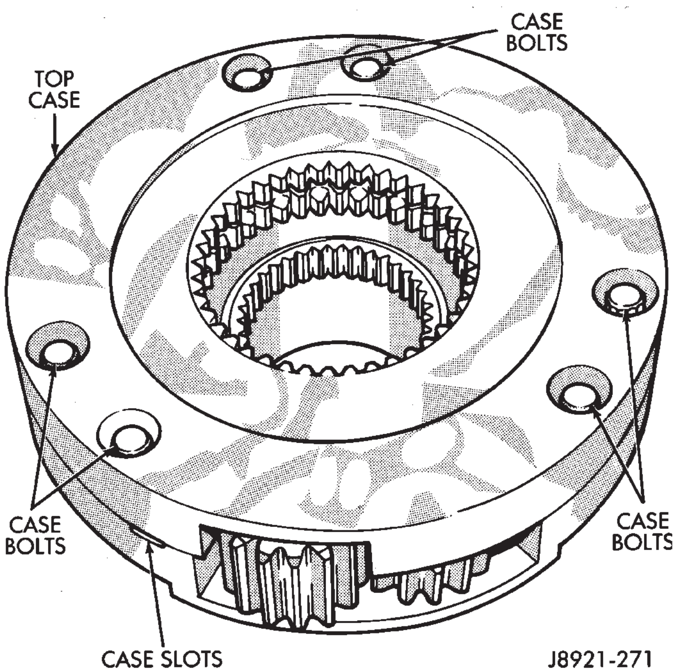


Fig. 33 Separating Differential Case Halves

Clean the oil pickup screen with solvent and allow it to air dry. Use compressed air to remove solvent residue from all oil feed passages and channels in case halves.

Inspect the differential gears, thrust washers and case halves. Replace the mainshaft gear if the gear teeth or the brass ring on the underside of the gear are damaged. Replace the differential as an assembly if the gears, case halves, or the pins in the lower case half are damaged.

Inspect the case halves, extension housing and retainers for cracks, porosity, or damaged sealing surfaces. Inspect the shafts, gears, chain and shift components for wear or damage.

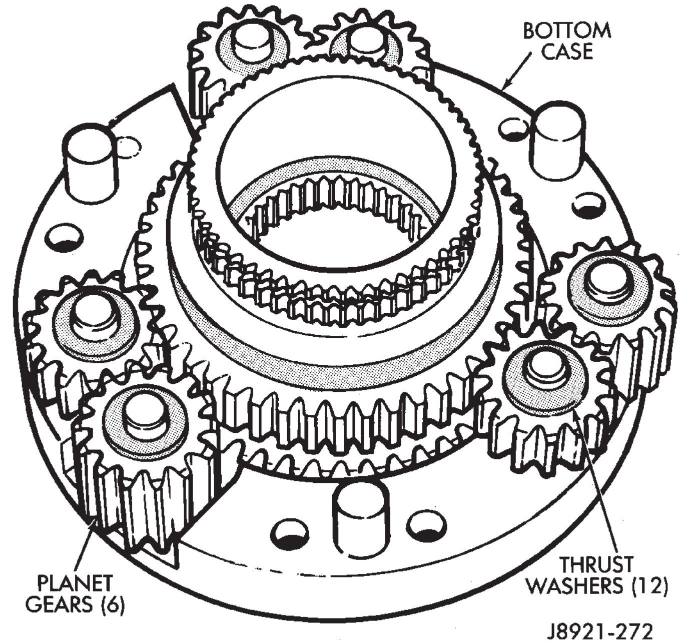


Fig. 34 Planet Gears And Thrust Washer Removal

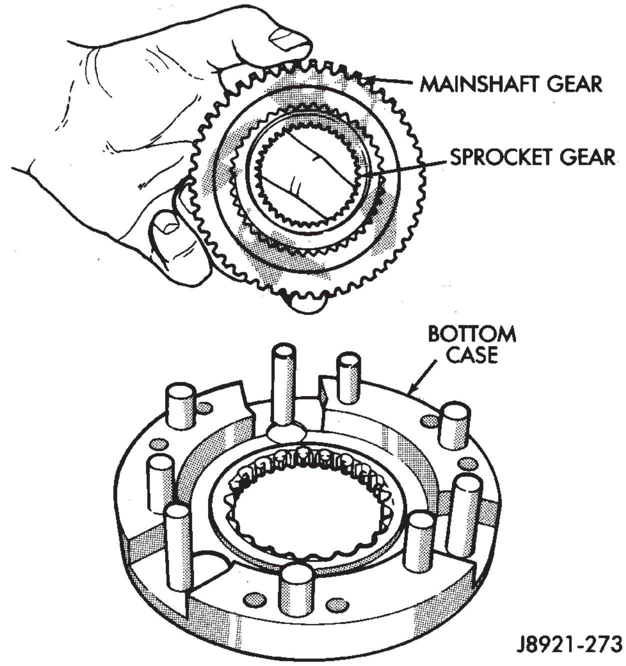


Fig. 35 Mainshaft And Sprocket Gear Removal

Inspect all of the transfer case bearings for wear, roughness, pitting, or galling. Replace worn or damaged bearings as outlined in the assembly section.

TRANSFER CASE ASSEMBLY

(1) Lubricate transfer case components with automatic transmission fluid or petroleum jelly (where indicated) during assembly.

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Be sure replacement bearings do not block these feed holes.

(2) Remove snap ring that retains front output shaft front bearing in case (Fig. 36). Then remove bearing. Use hammer handle, or hammer and brass punch to tap bearing out of case.

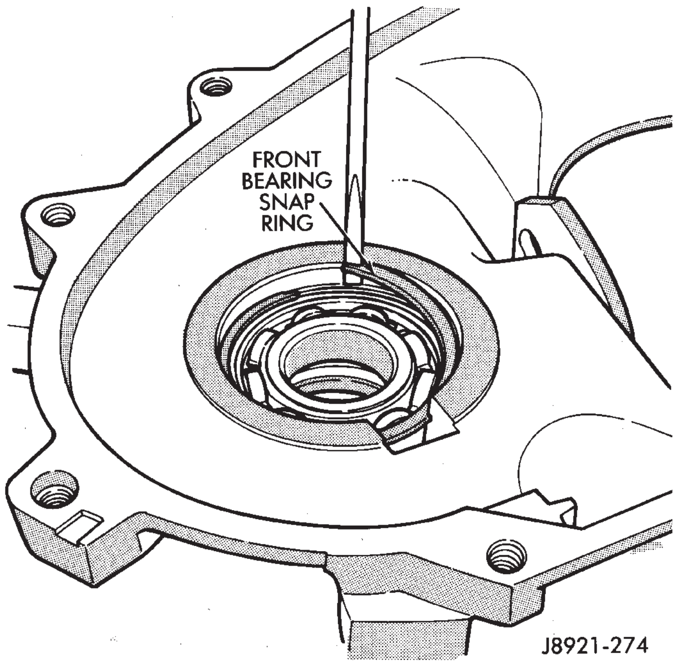


Fig. 36 Front Output Shaft Front Bearing Snap Ring Removal

(3) Install new front output shaft bearing with Tool Handle C-4171 and Installer 8033A (Fig. 37).

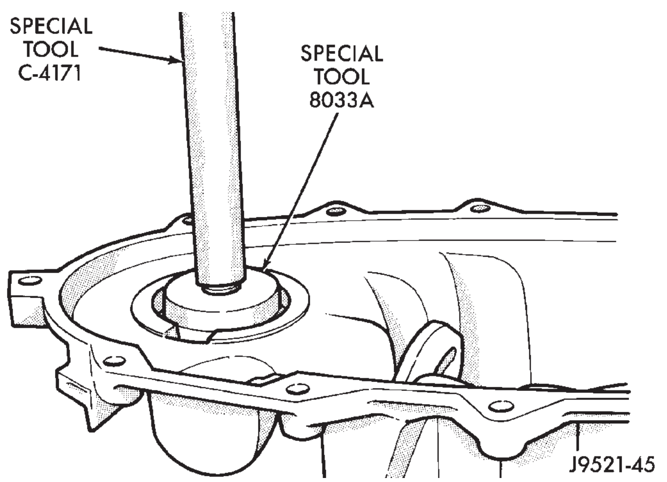


Fig. 37 Front Output Shaft Front Bearing Installation

(4) Install front bearing snap ring (Fig. 36).

(5) Install new front output shaft oil seal with Tool 6888 or suitable size tool as follows:

(a) Tap seal into bore until flush with upper edge of case bore (Fig. 38).

(b) Seat seal 2.03 to 2.5 mm (0.080 to 0.100 in.) **below** top edge of seal bore in front case (Fig. 39). Tool 6888 will seat seal to desired depth. Check seal depth with dial caliper.

CAUTION: Be sure the front output seal is seated below the top edge of the case bore as shown (Fig. 39). The seal could work loose if not seated to the recommended depth.

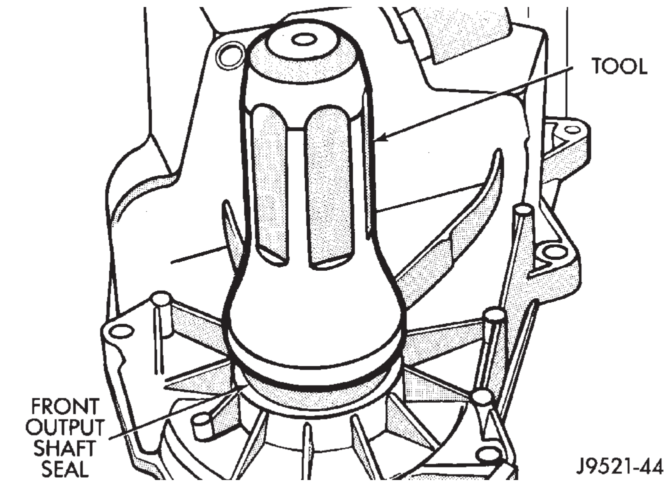


Fig. 38 Starting Front Output Shaft Seal Into Case Bore

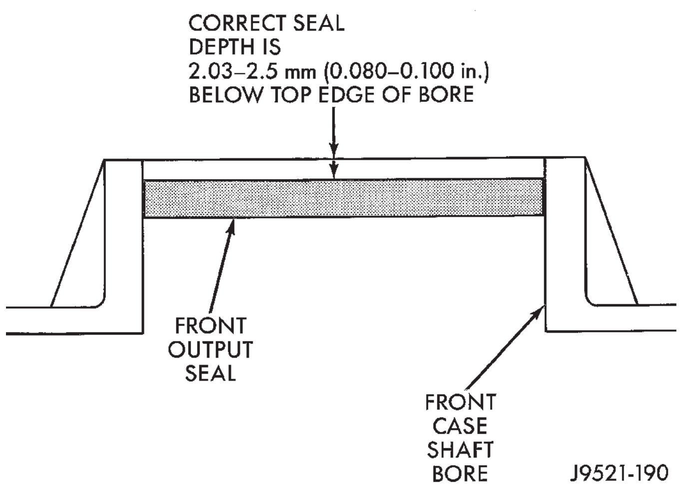


Fig. 39 Front Output Seal Installation Depth

(6) Remove input gear bearing with Tool Handle C-4171 and Remover C-4210 (Fig. 40).

(7) Install snap ring on new input gear bearing.

(8) Install new input gear bearing with shop press and wood block. Install bearing far enough to seat snap ring against case (Fig. 41).

(9) Remove input gear pilot bearing with slide hammer and internal puller (Fig. 42).

(10) Install new pilot bearing with Tool Handle C-4171 and Installer 5065 (Fig. 43).

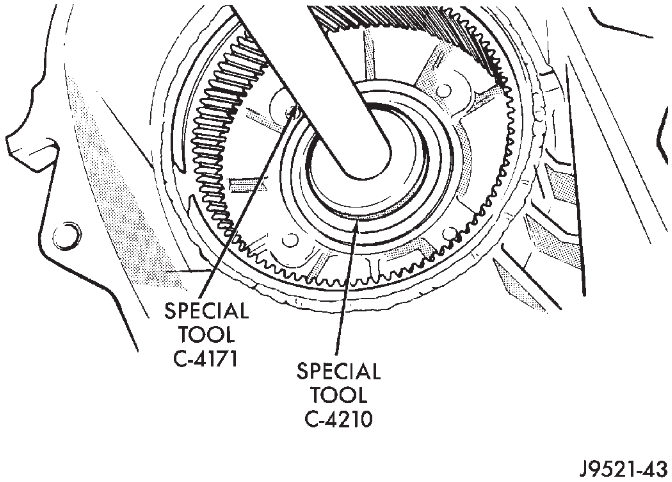


Fig. 40 Input Gear Bearing Removal

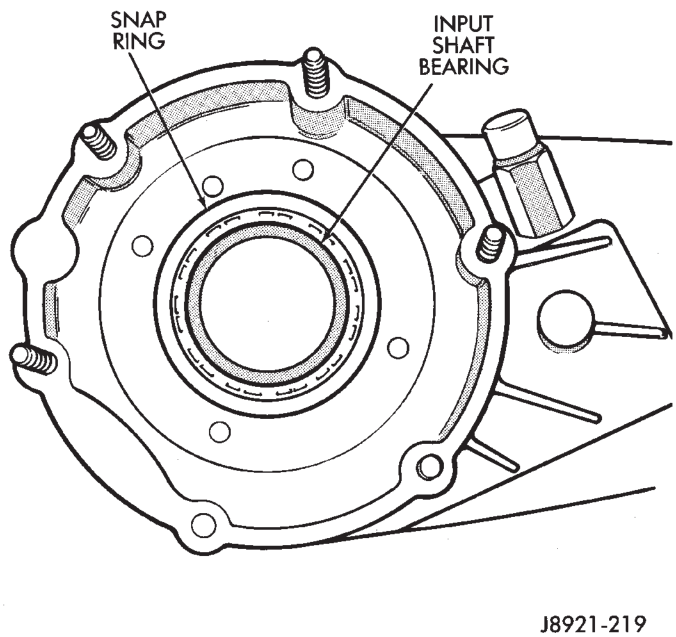


Fig. 41 Seating Input Gear Bearing

(11) Assemble low range gear, input gear thrust washers, input gear and input gear retainer (Fig. 44).

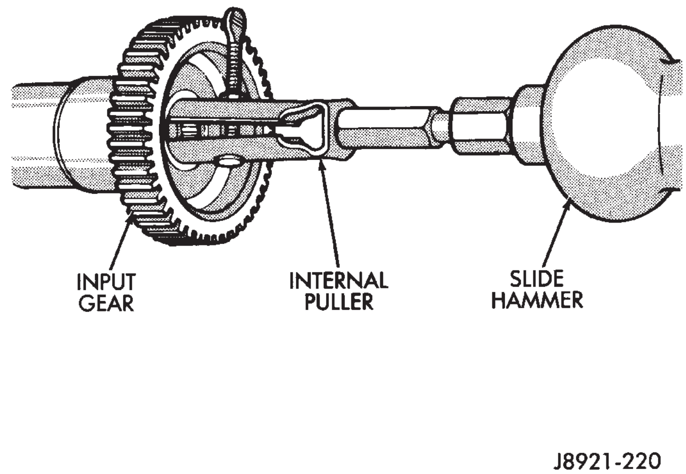


Fig. 42 Input Gear Pilot Bearing Removal

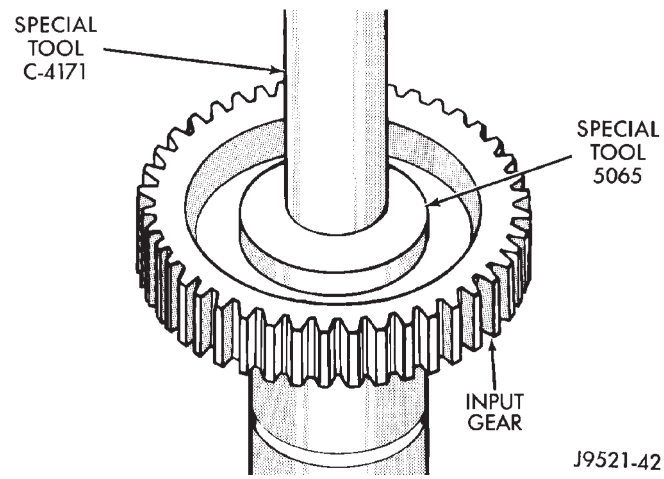


Fig. 43 Input Gear Pilot Bearing Installation

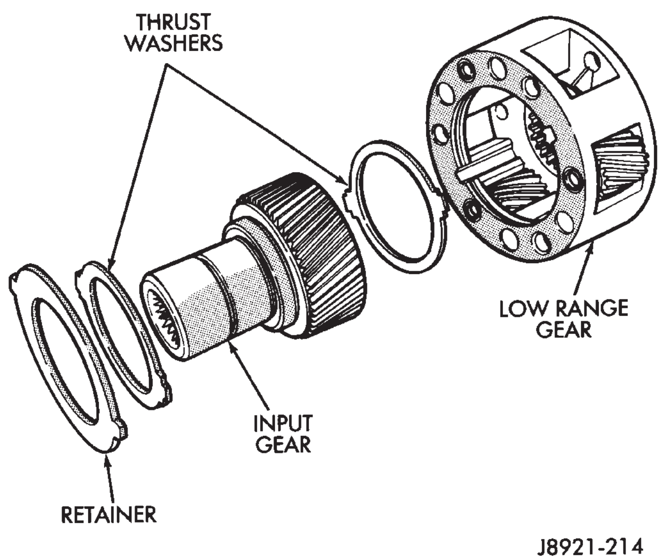


Fig. 44 Low Range And Input Gear Assembly

(12) Install low range gear snap ring (Fig. 45).

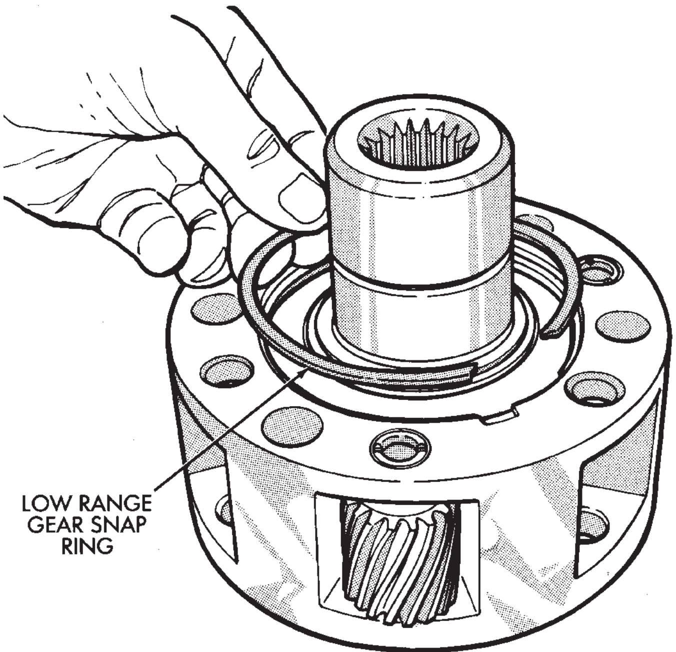


Fig. 45 Install Low Range Gear Snap Ring

(13) Lubricate input gear and low range gears with automatic transmission fluid.

(14) Start input gear shaft into front case bearing.

(15) Press input gear shaft into front bearing.

CAUTION: Be sure the input gear installer tool is the proper size. The wrong size tool could push the input gear pilot bearing too far into the gear bore (Fig. 46). Also, do not press against the end surfaces of the low range gear. The gear case and thrust washers could be damaged.

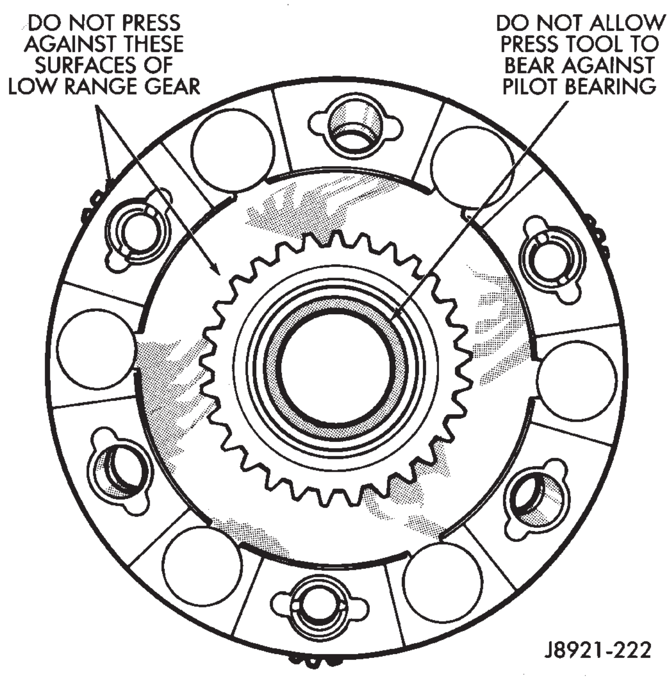


Fig. 46 Input Gear Installation

(16) Install new input gear snap ring (Fig. 47).

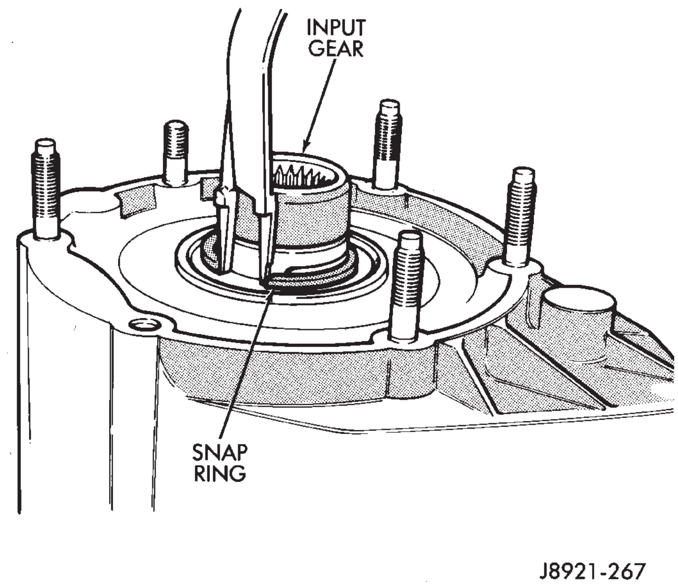


Fig. 47 Input Gear Snap Ring Installation

(17) Install new seal in front bearing retainer with Tool Handle C-4171 and Installer 7884 (Fig. 48).

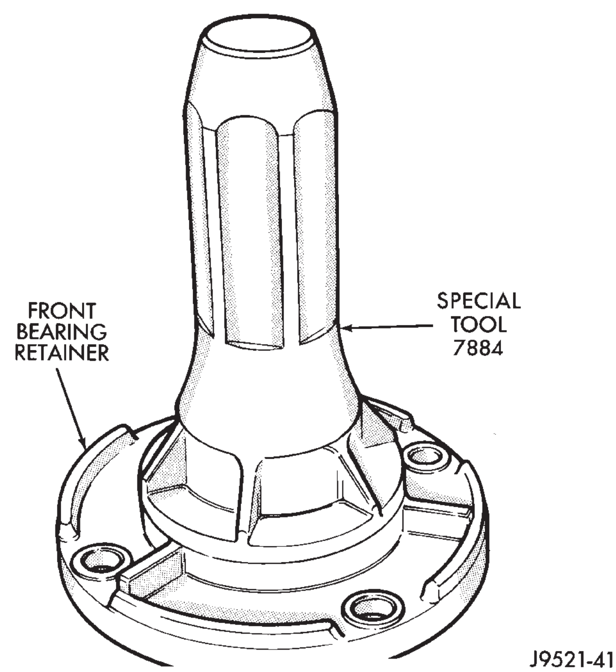


Fig. 48 Front Bearing Retainer Seal Installation

(18) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker. silicone adhesive sealer, or Loctite 518 to seal surface of front bearing retainer.

(19) Install front bearing retainer (Fig. 49). Tighten retainer bolts to 16 ft. lbs. (21 N·m) torque.

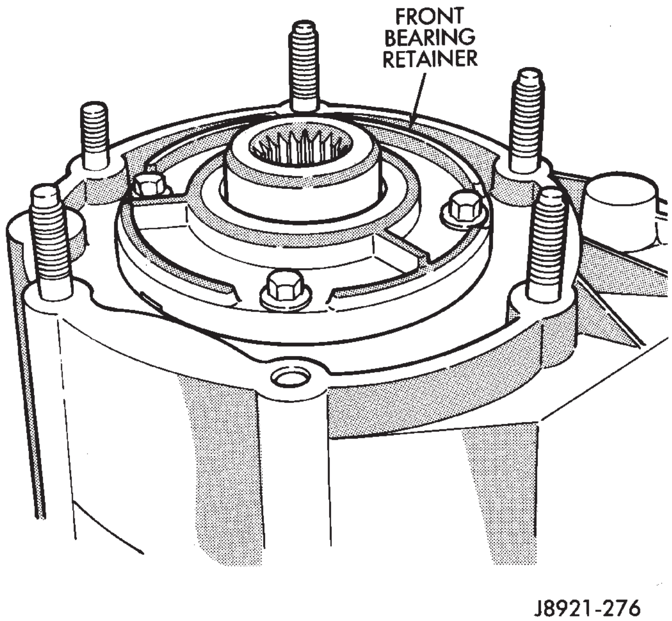


Fig. 49 Installing Front Bearing Retainer

(20) Install new sector shaft O-ring and bushing (Fig. 50).

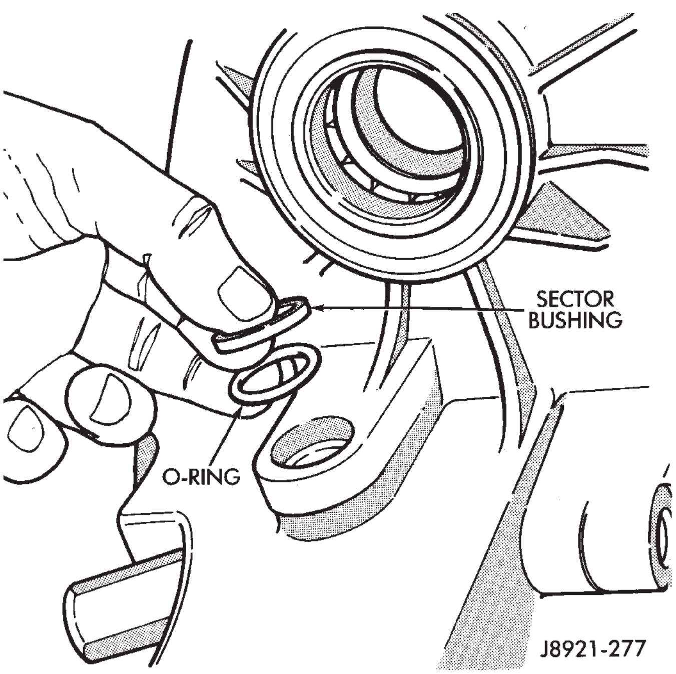


Fig. 50 Sector O-Ring And Bushing Installation

(21) Install shift sector.

(22) Install new pads in low range fork (Fig. 51).

(23) Assemble low range fork and hub (Fig. 51).

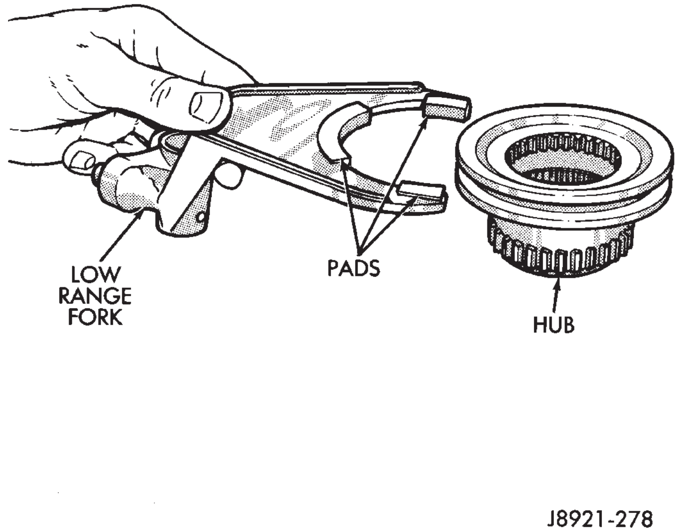


Fig. 51 Assembling Low Range Fork And Hub

(24) Position low range fork and hub in case. Be sure low range fork pin is engaged in shift sector slot (Fig. 52).

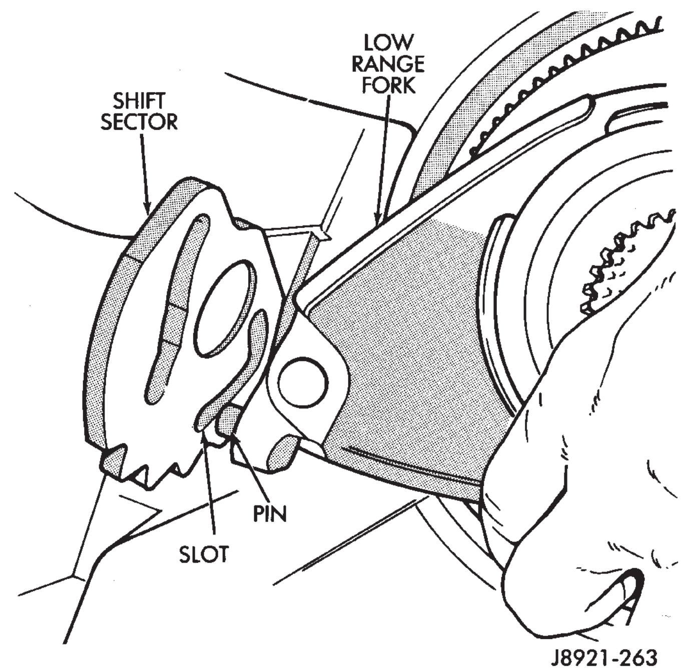


Fig. 52 Positioning Low Range Fork

(25) Lubricate differential components with automatic transmission fluid.

(26) Install sprocket gear in differential bottom case (Fig. 53).

(27) Install differential planet gears and new thrust washers (Fig. 54). **Be sure thrust washers are installed at top and bottom of each planet gear.**

(28) Install differential mainshaft gear (Fig. 54).

(29) Align and position differential top case on bottom case (Fig. 55). Align using scribe marks made at disassembly.

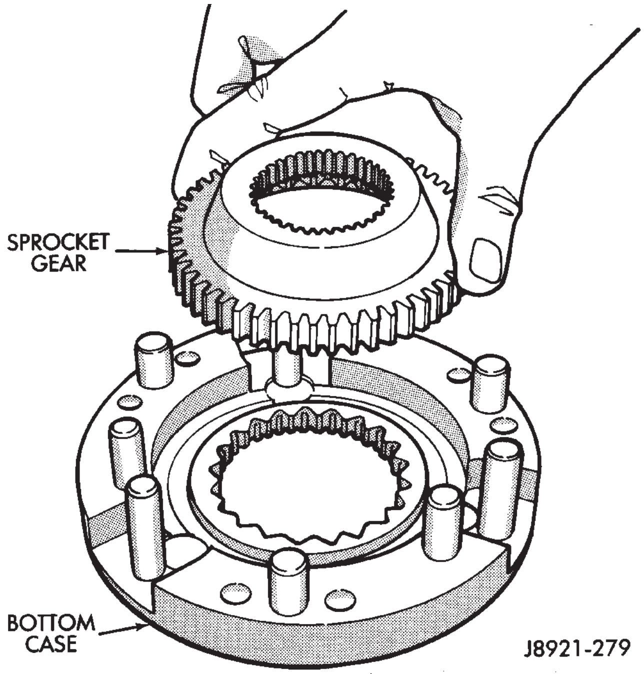


Fig. 53 Installing Differential Sprocket Gear

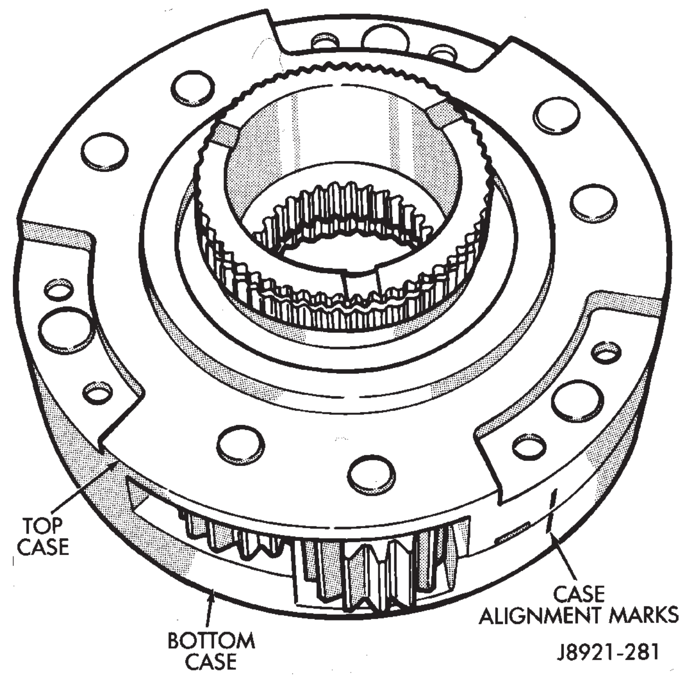


Fig. 55 Differential Case Assembly

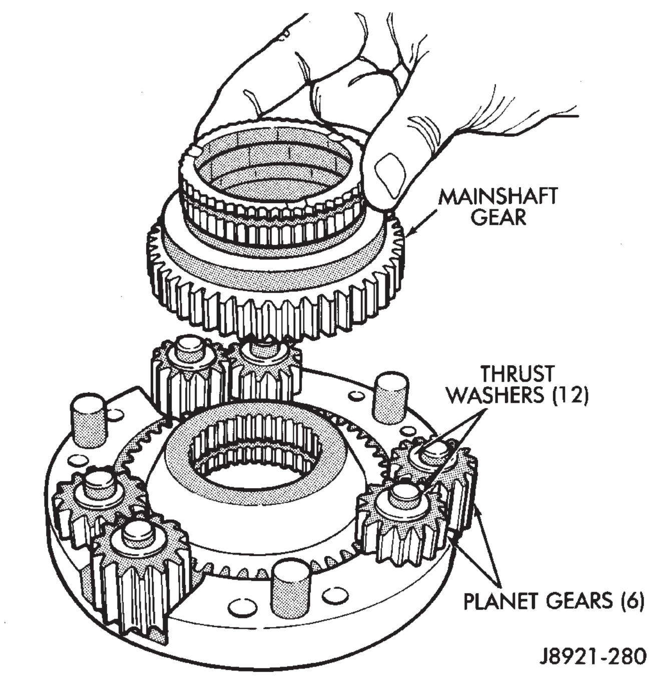


Fig. 54 Installing Mainshaft And Planet Gears

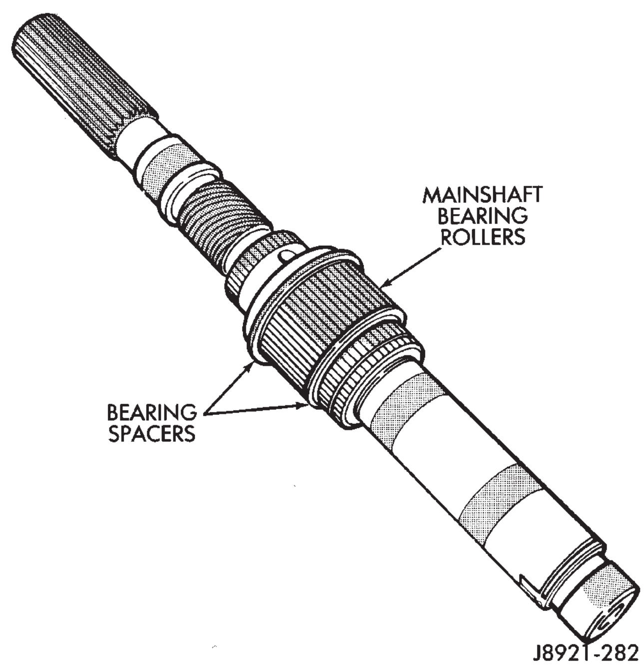


Fig. 56 Installing Mainshaft Bearing Rollers and Spacers

(30) Install and tighten differential case bolts to specified torque.

(31) Install first mainshaft bearing spacer on mainshaft (Fig. 56).

(32) Install bearing rollers on mainshaft (Fig. 56). **Coat bearing rollers with generous quantity of petroleum jelly to hold them in place.**

(33) Install remaining bearing spacer on mainshaft (Fig. 56). Do not displace any bearings while installing spacer.

(34) Install differential (Fig. 57). **Do not displace mainshaft bearings when installing differential.**

(35) Install differential snap ring (Fig. 58).

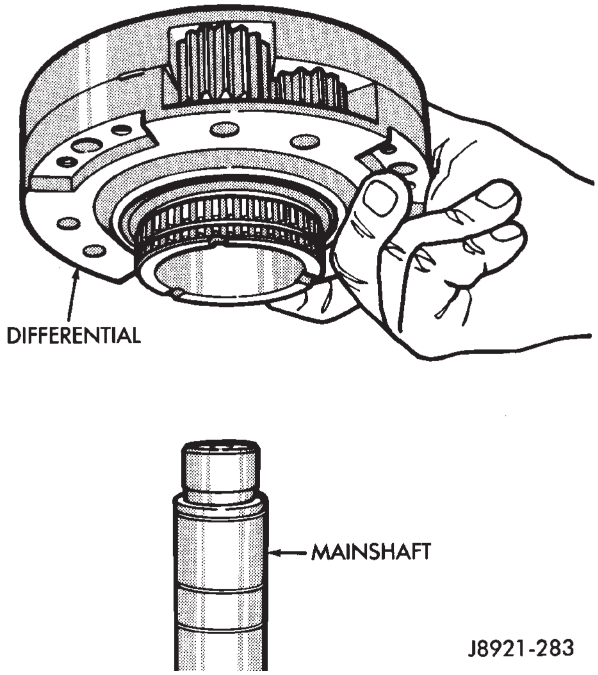


Fig. 57 Differential Installation

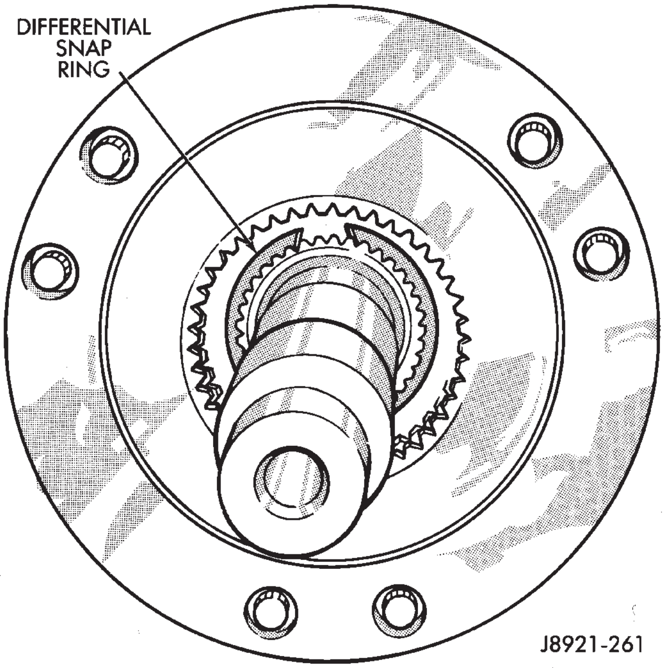


Fig. 58 Installing Differential Snap Ring

(36) Install intermediate clutch shaft (Fig. 59).

(37) Install clutch shaft thrust washer (Fig. 60).

(38) Install clutch shaft snap ring (Fig. 61).

(39) Inspect mode fork assembly (Fig. 62). Replace pads and bushing if necessary. Replace fork tube if bushings inside tube are worn or damaged. Also check springs and slider bracket (Fig. 62). Replace worn, damaged components.

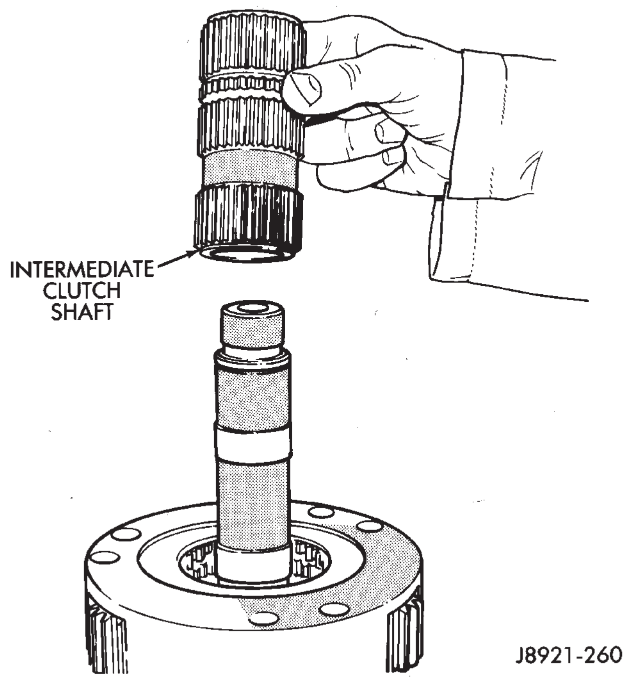


Fig. 59 Installing Intermediate Clutch Shaft

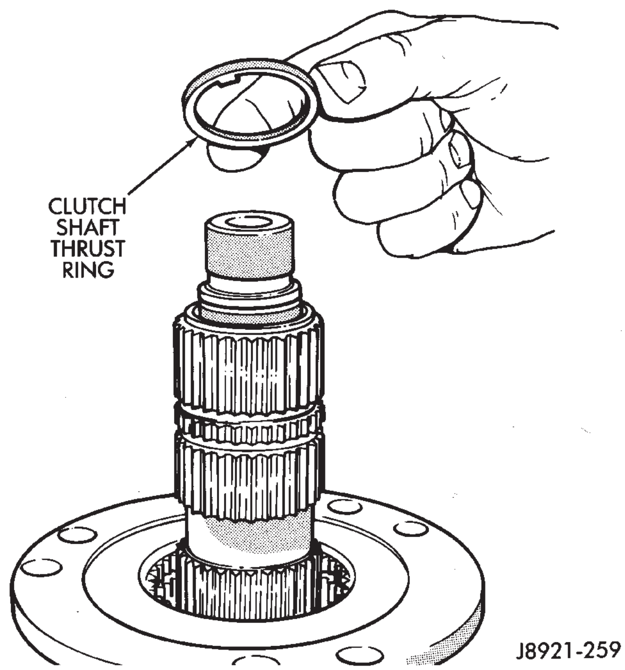


Fig. 60 Installing Clutch Shaft Thrust Washer

(40) Install mode sleeve in mode fork (Fig. 63). Then install assembled sleeve and fork on mainshaft. Be sure mode sleeve splines are engaged in differential splines.

(41) Install mode fork and mainshaft assembly in case (Fig. 64). Rotate mainshaft slightly to engage shaft with low range gears.

(42) Rotate mode fork pin into shift sector slot.

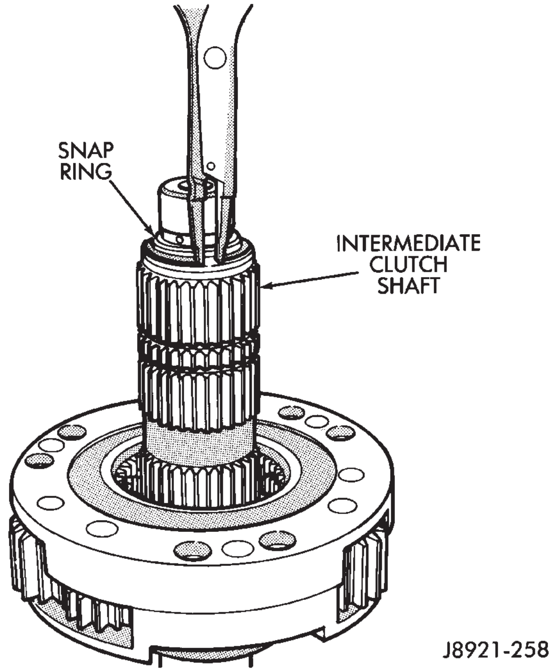


Fig. 61 Installing Clutch Shaft Snap Ring

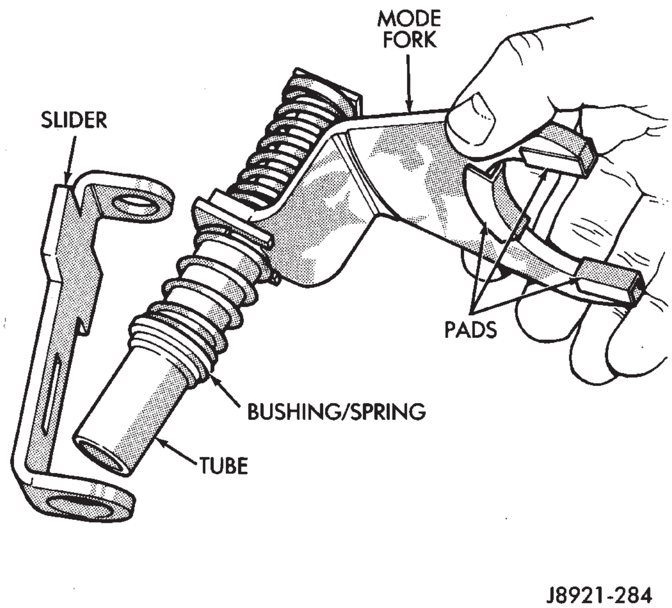


Fig. 62 Mode Fork Assembly Inspection

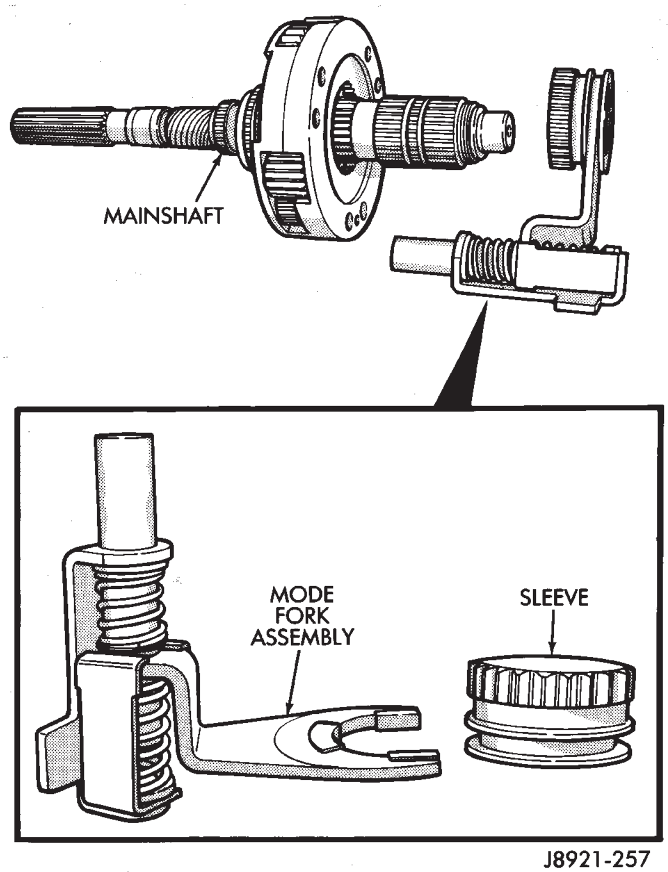


Fig. 63 Installing Mode Fork And Sleeve

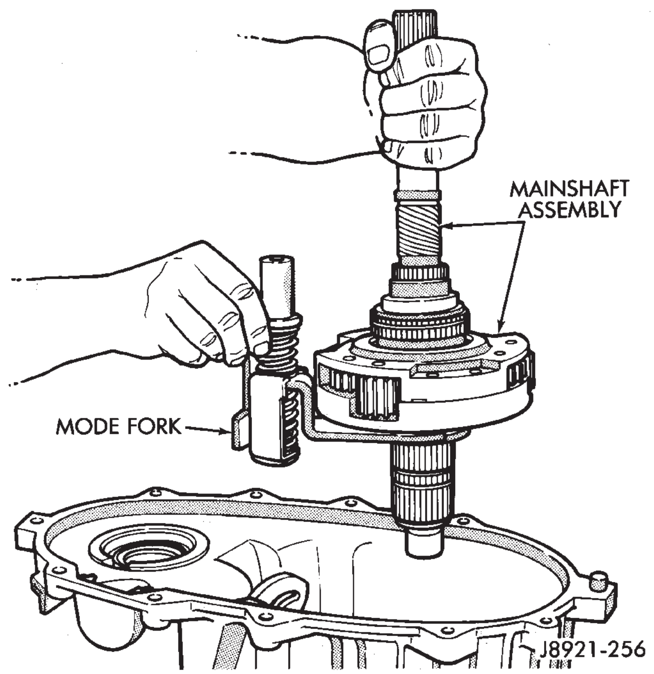


Fig. 64 Assembled Mainshaft And Mode Fork Installation

(43) Install shift rail (Fig. 65). **Be sure rail is seated in both shift forks.**

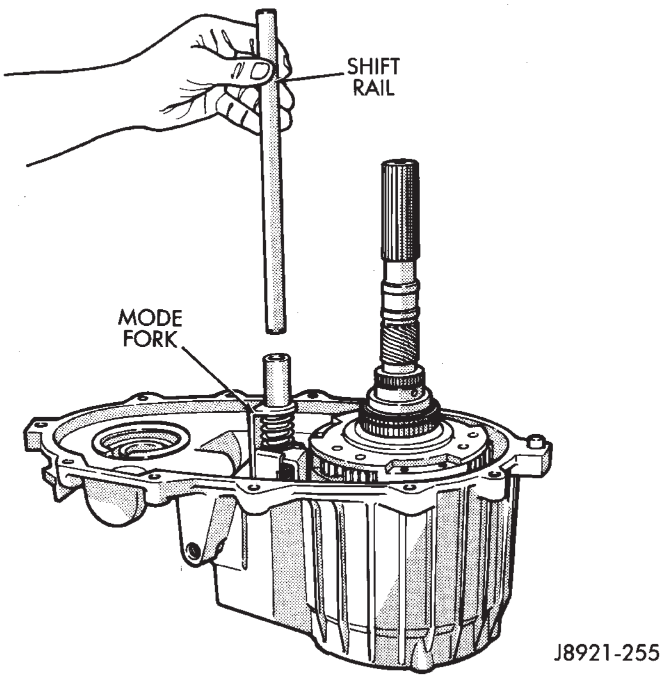


Fig. 65 Shift Rail Installation

(44) Rotate shift sector to align lockpin hole in low range fork with access hole in case.

(45) Insert an easy-out in range fork lockpin to hold it securely for installation (Fig. 66). **Lockpin is slightly tapered on one end. Insert tapered end into fork and rail.**

(46) Insert lockpin through access hole and into shift fork (Fig. 66). Then remove easy-out and seat the pin with pin punch.

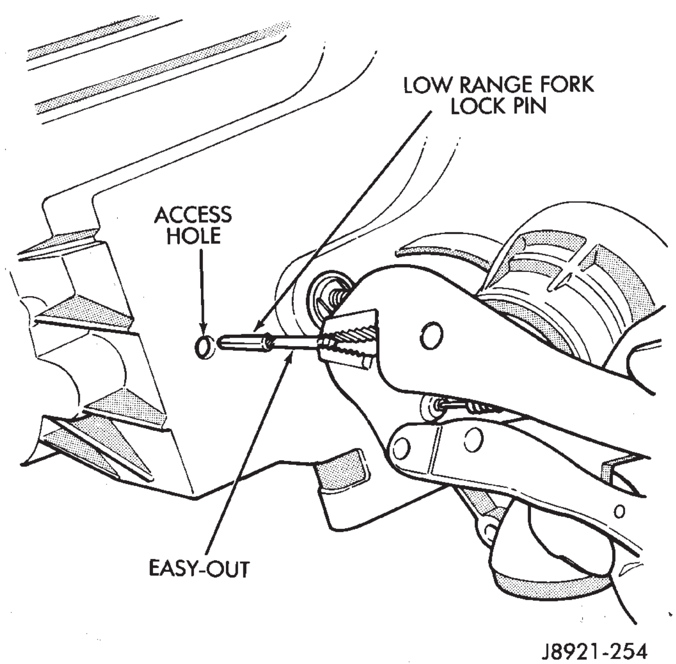


Fig. 66 Installing Low Range Fork Lockpin

(47) Install plug in lockpin access hole.

(48) Install transfer case shift lever and attaching nut. Tighten nut to 30 N·m (22 ft. lbs.) torque.

(49) Install detent plunger, detent spring and detent plug in case (Fig. 67).

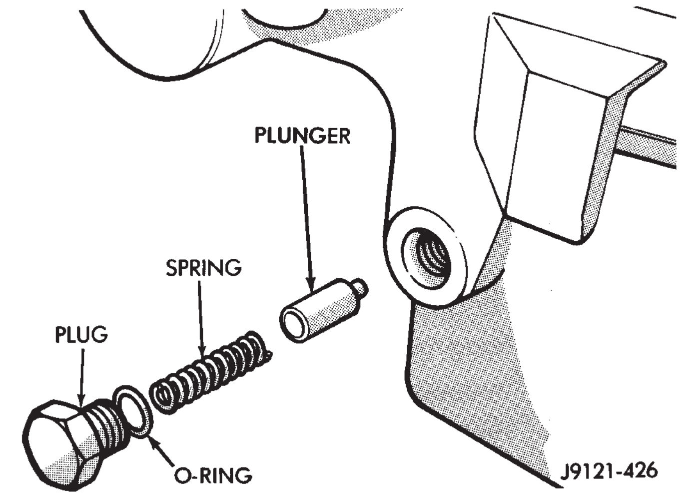


Fig. 67 Detent Pin, Spring And Plug Installation

(50) Install front output shaft (Fig. 68).

(51) Install drive chain (Fig. 68). Engage chain with front output shaft sprocket teeth.

(52) Install drive sprocket (Fig. 68).

(53) Engage drive sprocket teeth with chain. Then engage sprocket splines with mainshaft splines.

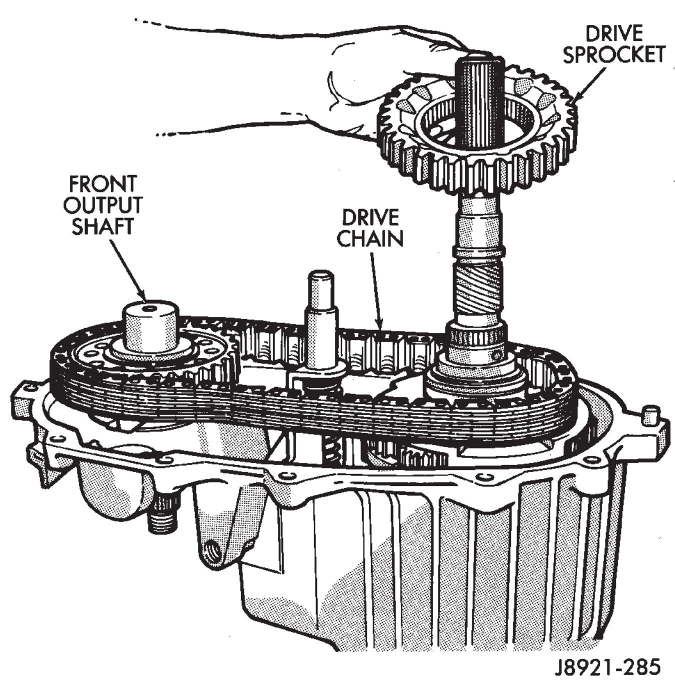


Fig. 68 Drive Chain And Sprocket Installation

(54) Install drive sprocket snap ring (Fig. 69).

(55) Replace front output shaft rear bearing (Fig. 70). Remove bearing with internal puller and slide

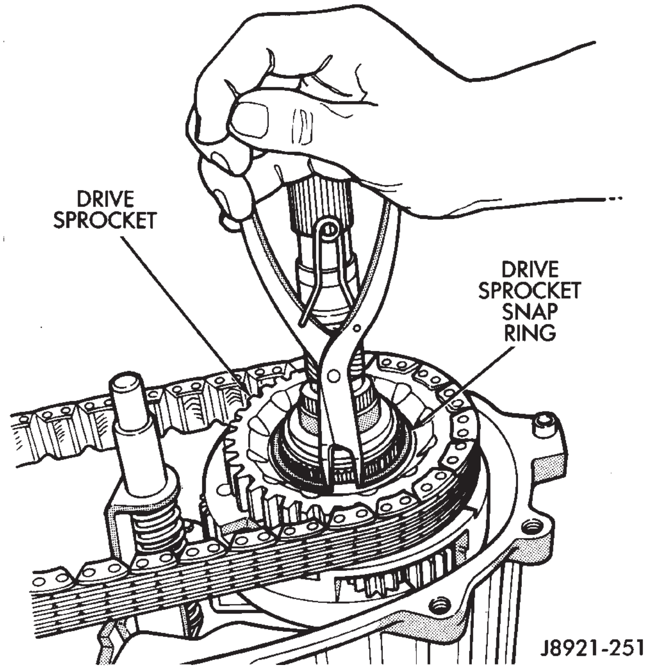


Fig. 69 Drive Sprocket Snap Ring Installation

hammer. Install new bearing with Tool Handle C-4171 and Installer 5066. Lubricate bearing after installation.

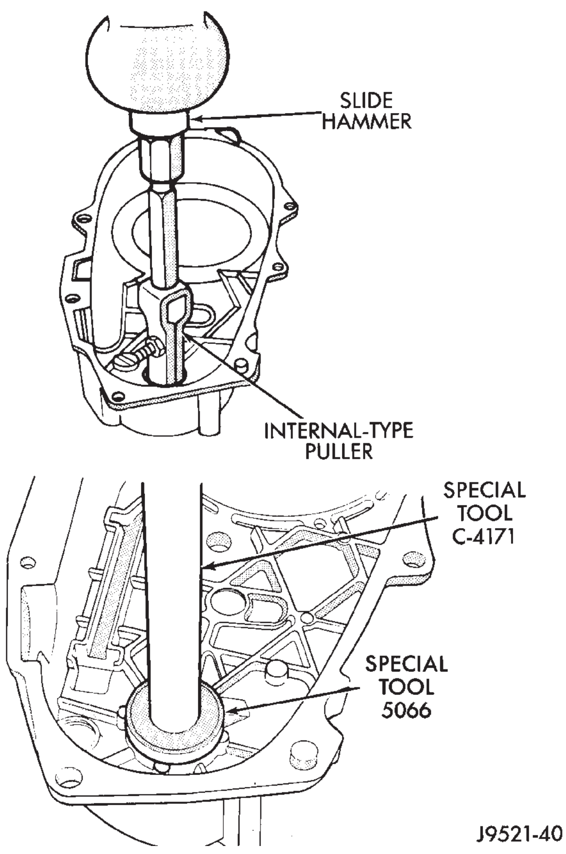


Fig. 70 Front Output Shaft Rear Bearing Installation

(56) Install new seal in oil pump feed housing with Special Tool 7888 (Fig. 71).

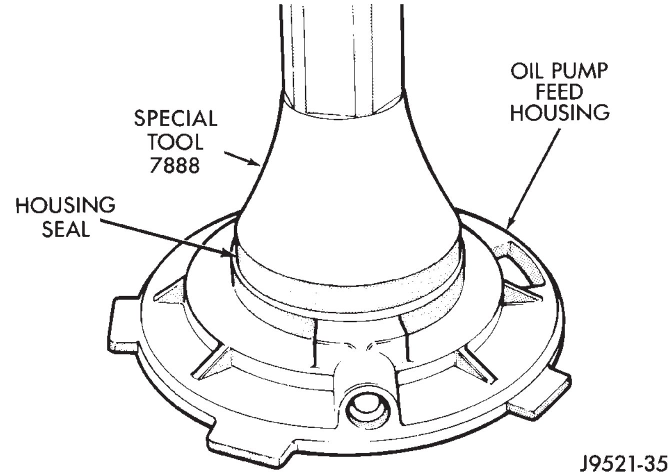


Fig. 71 Oil Pump Seal Installation

(57) Install new pickup tube O-ring in oil pump (Fig. 72).

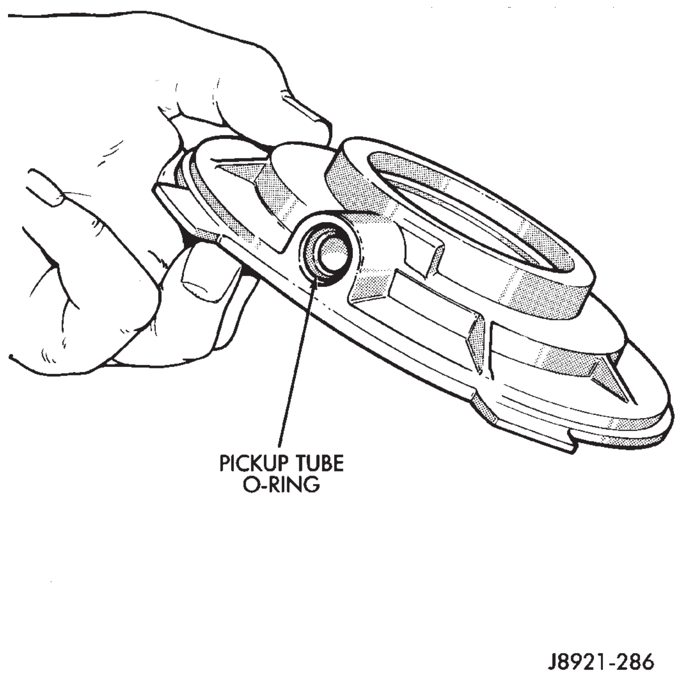


Fig. 72 Pickup Tube O-Ring Installation

(58) Insert oil pickup tube in oil pump and attach oil screen and connecter hose to pickup tube. Then install assembled pump, tube and screen in rear case (Fig. 73). Be sure screen is seated in case slot as shown.

(59) Install magnet in front case pocket (Fig. 74).

(60) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to seal surface of front case.

(61) Align and install rear case on front case. Be sure case locating dowels are in place and that mainshaft splines are engaged in oil pump inner gear.

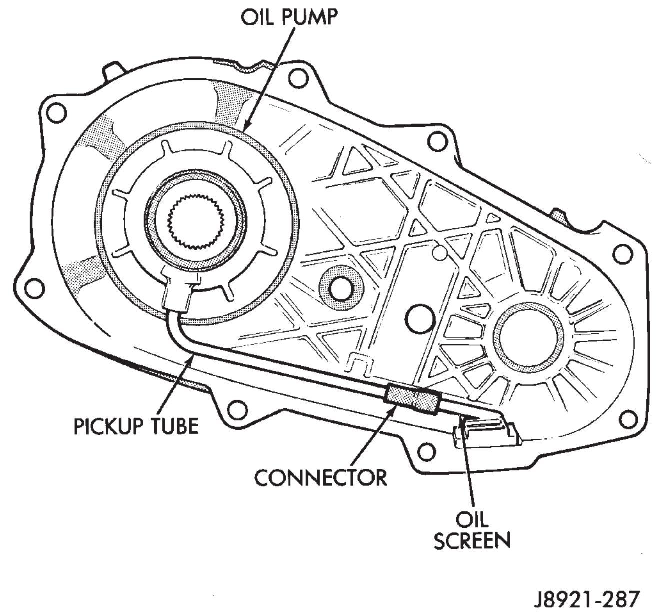


Fig. 73 Oil Screen And Pickup Tube Installation

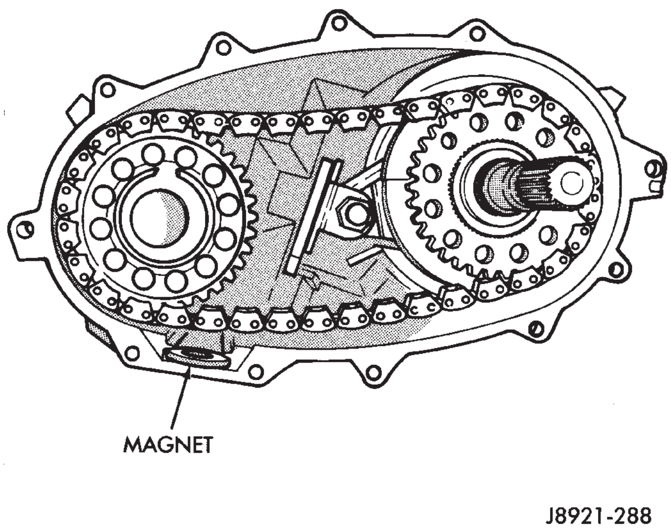


Fig. 74 Installing Case Magnet

(62) Install and tighten front case-to-rear case bolts to 41 N·m (30 ft. lbs.) torque. **Be sure to install a washer under each bolt used at case dowel locations.**

(63) Tap rear retainer bearing out of retainer with hammer and brass drift.

(64) Install bearing in rear retainer with Driver Handle C-4171 and Installer 5064 (Fig. 75).

(65) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to seal surface of rear retainer.

(66) Install locating dowel in rear retainer (if removed) and install retainer on the case. Tighten retainer bolts to 41 N·m (30 ft. lbs.) torque.

(67) Install new rear bearing snap ring (Fig. 76). Lift mainshaft slightly to seat snap ring if necessary.

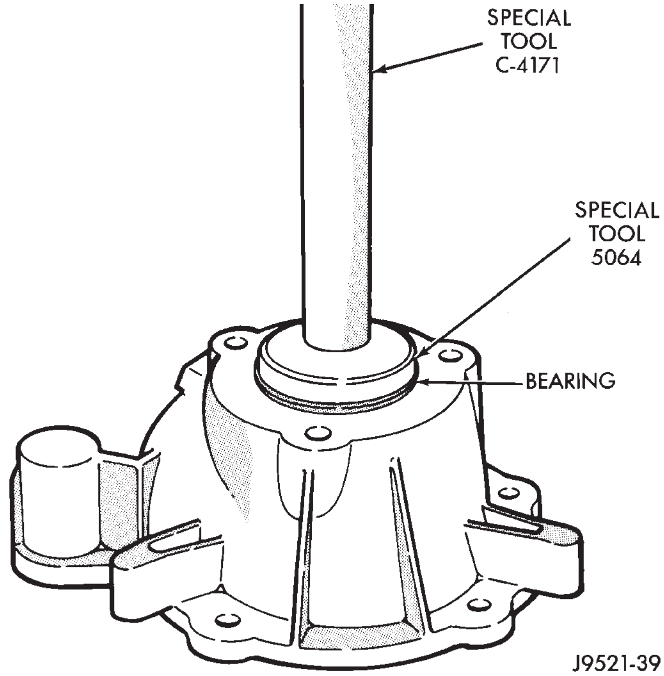


Fig. 75 Installing Rear Bearing In Retainer

(68) Remove extension housing seal if not removed previously.

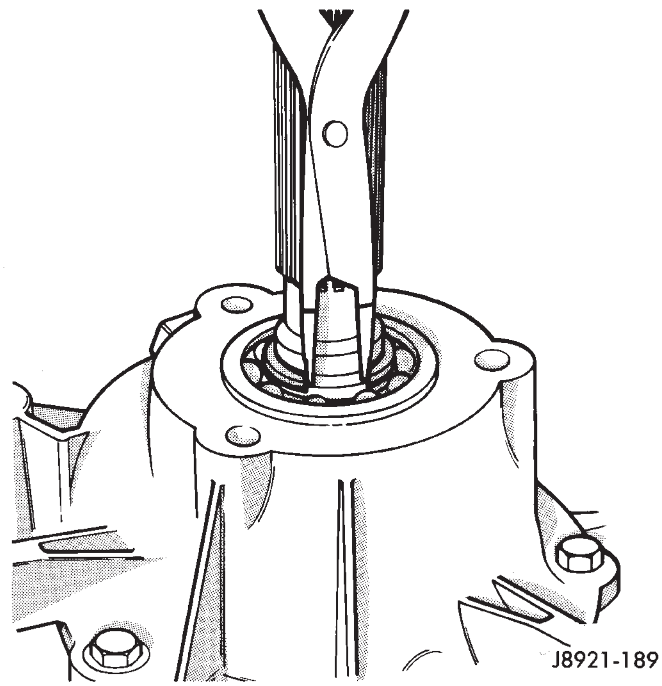


Fig. 76 Rear Bearing Snap Ring Installation

(69) Replace extension housing bushing (Fig. 77).

- Use Tools C-4171 and 7889-A to remove bushing
- Use Tools C-4171 and 5066 to install bushing

(70) Install new extension housing oil seal with Special Tool 7891 (Fig. 78).

(71) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to seal surface of extension housing.

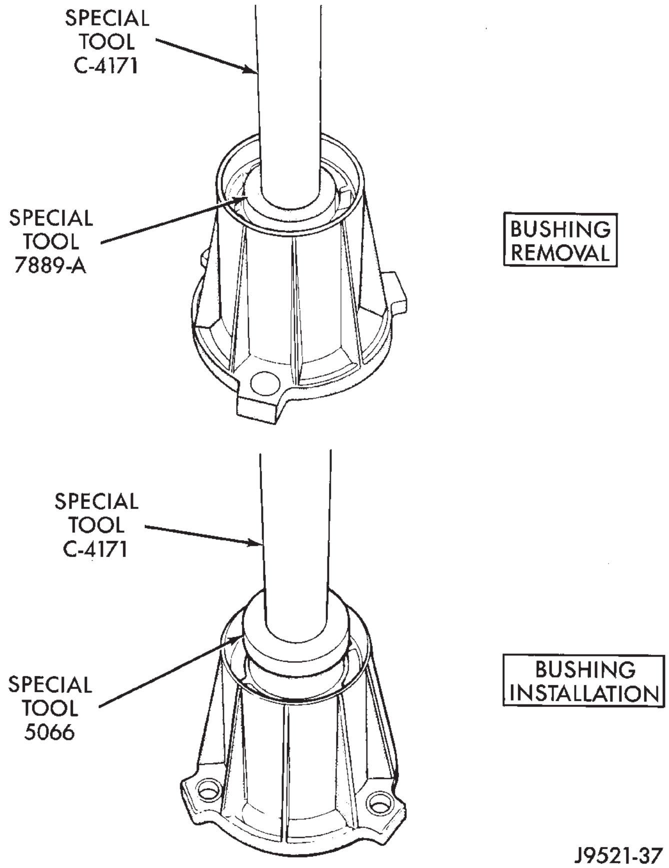


Fig. 77 Extension Housing Bushing Replacement

(72) Install extension housing on case. Tighten housing bolts to 41 N·m (30 ft. lbs.) torque.

(73) Install front yoke. Secure yoke with new seal washer and nut. Tighten nut to 149 N·m (110 ft. lbs.) torque.

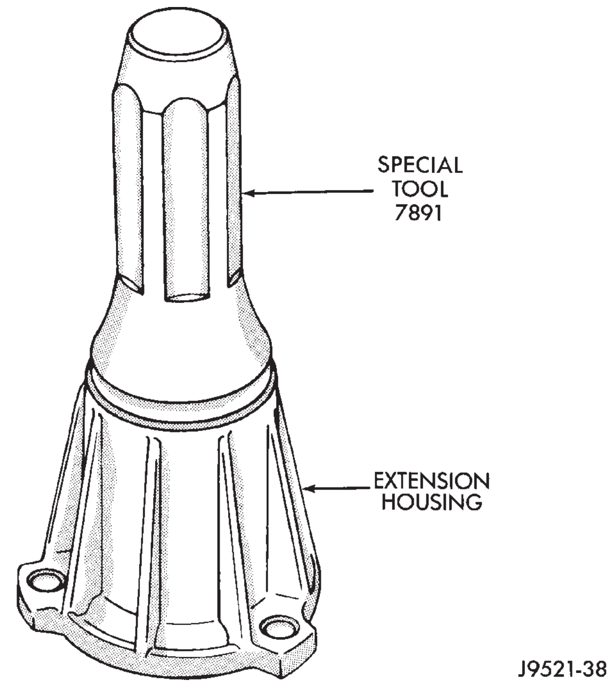


Fig. 78 Seating Extension Housing Seal

(74) Install new gasket on vacuum switch and install switch in case. Tighten switch to 27 N·m (20 ft. lbs.) torque.

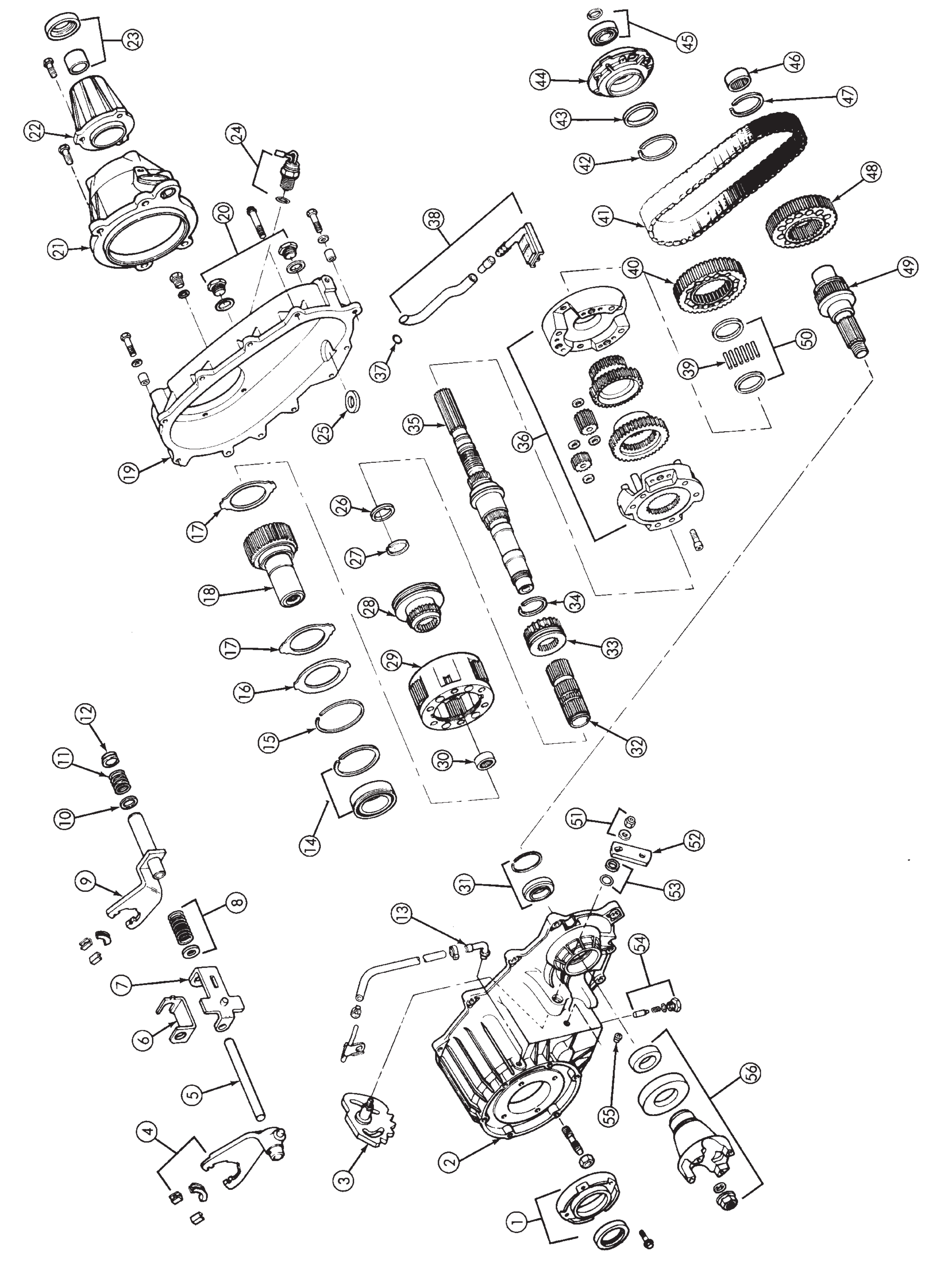
(75) Install speedometer components.

(76) Install and tighten drain plug to 47 N·m (35 ft. lbs.) torque.

(77) After installing transfer case, refill with recommended lubricant.

(78) Tighten fill plug to 47 N·m (35 ft. lbs.) torque.

(79) Adjust transfer case shift linkage.



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NP242 TRANSFER CASE

LEGEND FOR NP242 TRANSFER CASE

1 FRONT BEARING RETAINER AND SEAL
2 FRONT CASE
3 SHIFT SECTOR
4 LOW RANGE FORK AND INSERTS
5 SHIFT RAIL
6 SHIFT BRACKET
7 SLIDER BRACKET
8 BUSHING AND SPRING
9 MODE FORK AND INSERTS
10 BUSHING
11 FORK SPRING
12 BUSHING
13 VENT TUBE ASSEMBLY
14 INPUT GEAR BEARING AND SNAP RING
15 LOW RANGE GEAR SNAP RING
16 RETAINER, LOW RANGE GEAR
17 THRUST WASHER, LOW RANGE GEAR
18 INPUT GEAR
19 REAR CASE
20 DRAIN/FILL PLUGS
21 REAR BEARING RETAINER
22 EXTENSION HOUSING
23 BUSHING AND OIL SEAL
24 SWITCH
25 MAGNET
26 THRUST RING
27 SNAP RING
28 SHIFT SLEEVE
29 LOW RANGE GEAR
30 PILOT BUSHING (INPUT GEAR/MAINSHAFT)
31 FRONT OUTPUT SHAFT FRONT BEARING AND SNAP RING
32 INTERMEDIATE CLUTCH SHAFT
33 SHIFT SLEEVE
34 SNAP RING
35 MAINSHAFT
36 DIFFERENTIAL ASSEMBLY
37 OIL PUMP TUBE O-RING
38 OIL PUMP PICKUP TUBE AND SCREEN
39 MAINSHAFT BEARING ROLLERS
40 DRIVE SPROCKET
41 DRIVE CHAIN
42 SNAP RING
43 OIL PUMP SEAL
44 OIL PUMP
45 REAR BEARING AND SNAP RING
46 FRONT OUTPUT SHAFT REAR BEARING
47 SNAP RING
48 DRIVEN SPROCKET
49 FRONT OUTPUT SHAFT
50 MAINSHAFT BEARING SPACERS
51 SHIFT LEVER WASHER AND NUT
52 SHIFT LEVER
53 SECTOR O-RING AND SEAL
54 DETENT PIN, SPRING AND PLUG
55 SEAL PLUG
56 FRONT YOKE NUT, SEAL WASHER, YOKE, SLINGER AND FRONT OUTPUT SEAL

J9521-192

NP249 TRANSFER CASE

INDEX

GENERAL INFORMATION

The NP249 is an all the time, transfer case with two operating ranges and a neutral position (Fig. 1).

Operating ranges are 4-high and 4-low. The 4-low range is used for extra pulling power in off road situations.

Engine torque is distributed to the front and rear axles through a differential and viscous coupling. The

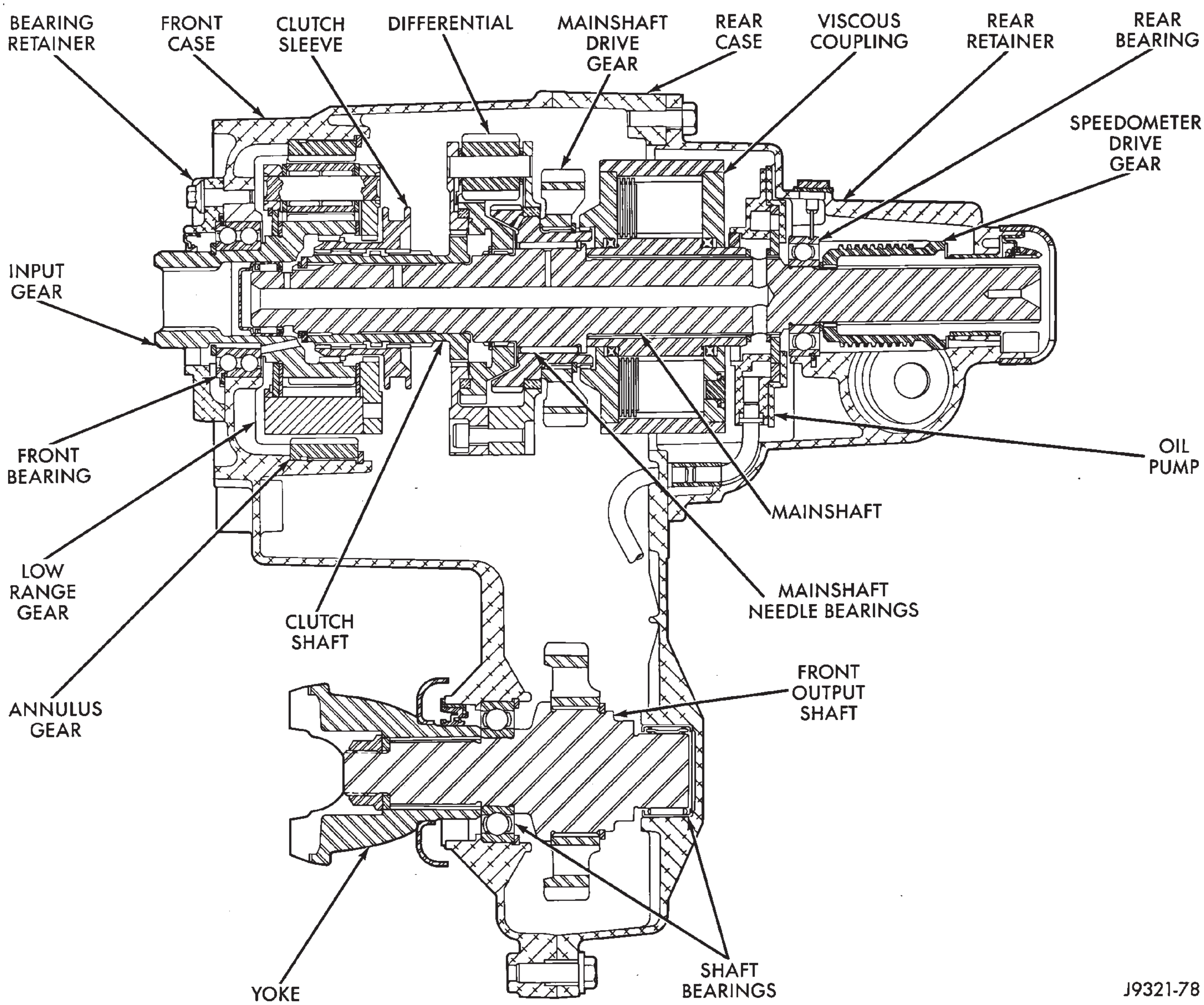

Fig. 1 NP249 Transfer Case

NP249 low range is provided by a gear reduction system for increased low speed, off road torque capability.

SHIFT MECHANISM

Transfer case operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. Range positions are marked on the shifter bezel plate.

TRANSFER CASE IDENTIFICATION

A circular I.D. tag is attached to the rear case of each NP249 transfer case (Fig. 2). The tag provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 8-12-94 would represent August 12, 1994.

RECOMMENDED LUBRICANT AND FILL LEVEL

Mopar Dexron II is the recommended lubricant for the NP249 transfer case. Approximate fluid refill capacity is approximately 1.18 liters (2.50 pints).

Correct fill level is to the bottom edge of the fill plug hole.

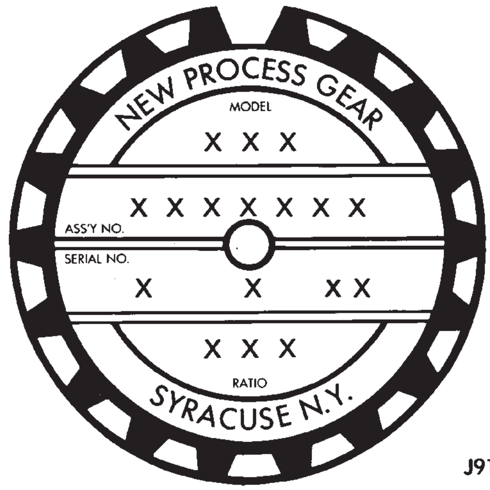

Fig. 2 Transfer Case I.D. Tag

TRANSFER CASE CHANGES

The only service change for 1995 involves the front output seal which is new. The new seal does not have the flange used on prior seals and affects seal installation. The new seal must be seated below the edge of the seal bore in the front case. Refer to the overhaul procedures for seal installation.

SHIFT LINKAGE ADJUSTMENT

(1) Shift transfer case into Neutral position.

NP249 SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Transfer case external shift linkage binding. (2) Insufficient or incorrect lubricant. (3) Internal components binding, worn or damaged.	(1) Lubricate, repair or replace linkage, or tighten loose components as necessary. (2) Drain and refill to edge of fill hole with MOPAR DEXRON II® or ATF Plus, Type 7176 Automatic Transmission Fluid. (3) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE POSITIONS	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with MOPAR DEXRON II® or ATF Plus, Type 7176 Automatic Transmission Fluid. Check for leaks and repair if necessary. **Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.**
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled. (2) Vent closed or restricted. (3) Output shaft seals damaged or installed incorrectly.	(1) Drain to correct level. (2) Clear or replace vent if necessary. (3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.

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(2) Raise vehicle on hoist that will allow all four wheels to rotate freely.

(3) Loosen trunnion lock bolt (Figs. 3 and 4). Loosen bolt enough so selector rod slides freely in trunnion.

(4) Verify that shift lever on transfer case is in Neutral position.

(5) Tighten trunnion lock bolt to 11-20 N·m (96-180 in. lbs.) torque.

(6) Lower vehicle enough for entry into driver seat but keep all wheels off shop floor.

(7) Verify correct linkage adjustment. Start engine, shift transmission into gear and shift transfer case into all ranges. Be sure transfer case is fully engaged in high and low range. Readjust linkage if necessary.

(8) Shut engine off and lower vehicle completely.

SPEEDOMETER SERVICE

Rear axle gear ratio and tire size determine speedometer pinion requirements. If the pinion must be replaced, refer to the parts catalogue information for the correct part.

SPEEDOMETER ASSEMBLY REMOVAL

(1) Raise vehicle.

(2) Disconnect wires from vehicle speed sensor.

(3) Remove adapter clamp and screw (Fig. 5).

(4) Remove speed sensor and speedometer adapter as assembly.

(5) Remove speed sensor retaining screw and remove sensor from adapter.

(6) Remove speedometer pinion from adapter. Replace pinion if chipped, cracked, worn.

(7) Inspect sensor and adapter O-rings (Fig. 5). Remove and discard O-rings if worn or damaged.

(8) Inspect terminal pins in speed sensor. Clean pins with Mopar electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or pins are loose, severely corroded, or damaged.

SPEEDOMETER INSTALLATION AND INDEXING

(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.

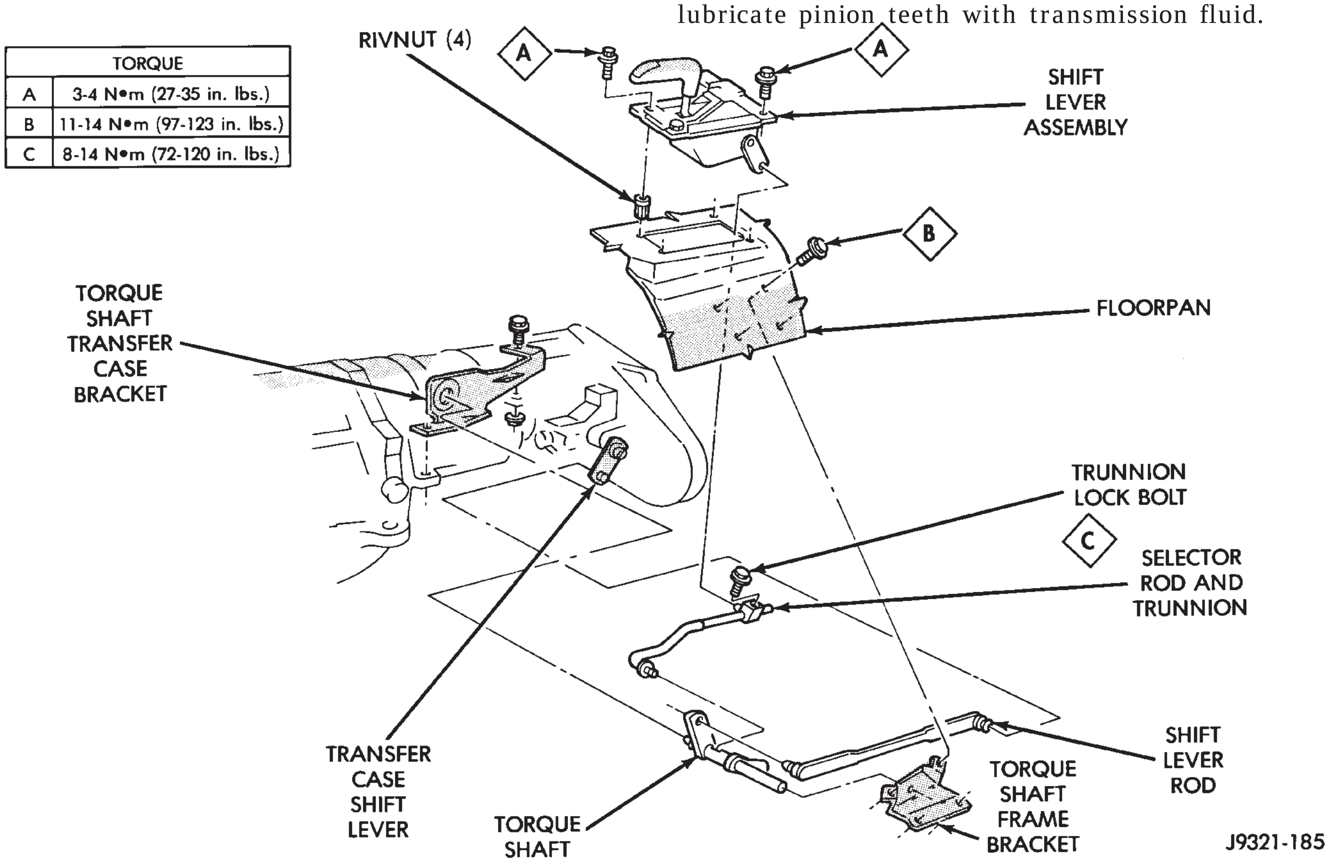
(2) Install new O-rings on speed sensor and speedometer adapter if necessary (Fig. 5).

(3) Lubricate sensor and adapter O-rings with transmission fluid.

(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.

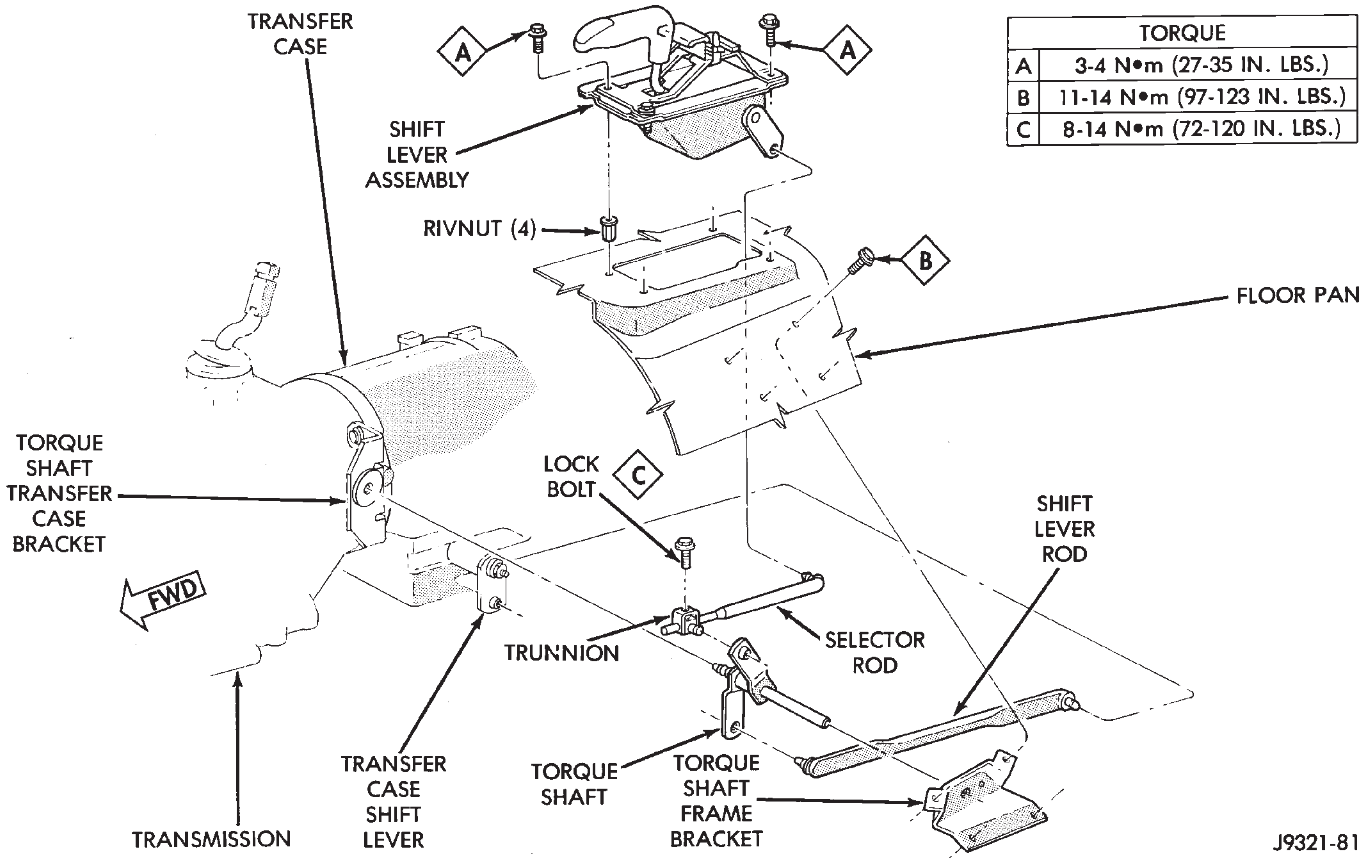
(5) Install speedometer pinion in adapter.

(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.



TORQUE	
A	3-4 N•m (27-35 in. lbs.)
B	11-14 N•m (97-123 in. lbs.)
C	8-14 N•m (72-120 in. lbs.)

Fig. 3 Transfer Case Shift Linkage (Automatic Transmission)



	TORQUE
A	3-4 N•m (27-35 IN. LBS.)
B	11-14 N•m (97-123 IN. LBS.)
C	8-14 N•m (72-120 IN. LBS.)

Fig. 4 Transfer Case Shift Linkage (Manual Transmission)

ITEM	TORQUE
A	2-3 N•m (15-27 in. lbs.)
B	10-12 N•m (90-110 in. lbs.)

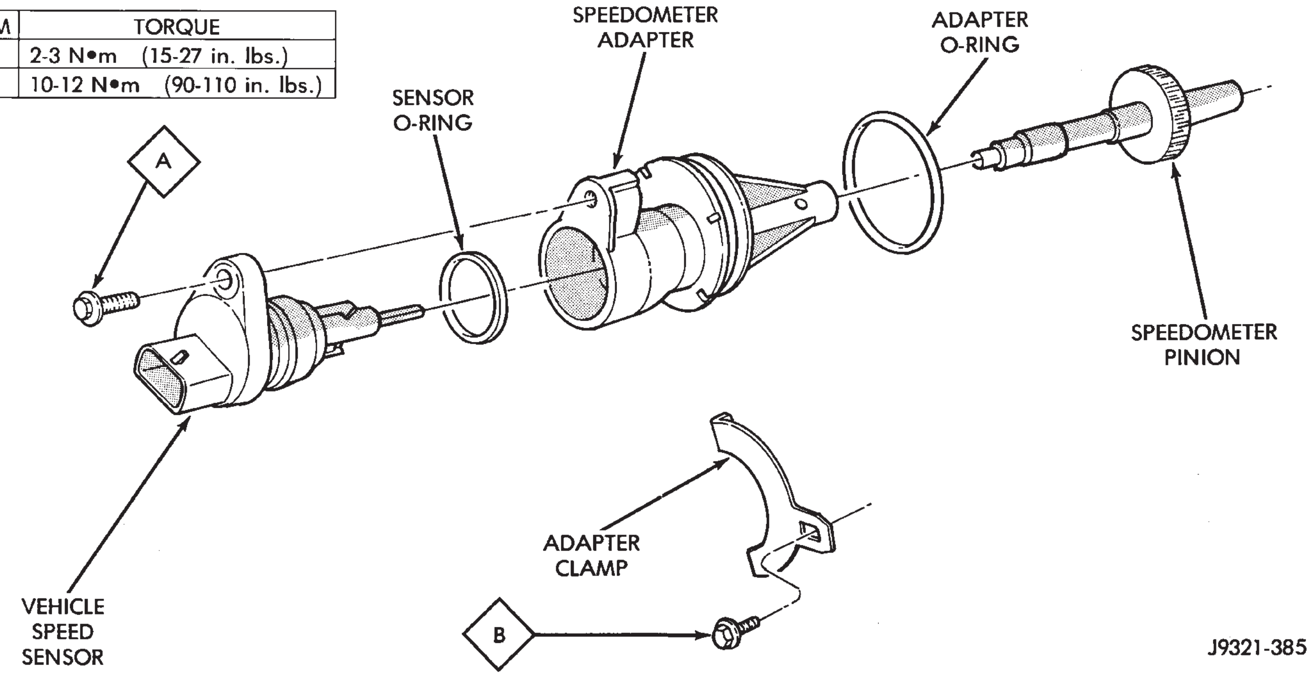


Fig. 5 Speedometer Components

(7) Note index numbers on adapter body (Fig. 6). These numbers will correspond to number of teeth on pinion.

(8) Install speedometer assembly in housing.

(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.

(12) Lower vehicle and top off transmission fluid level if necessary.

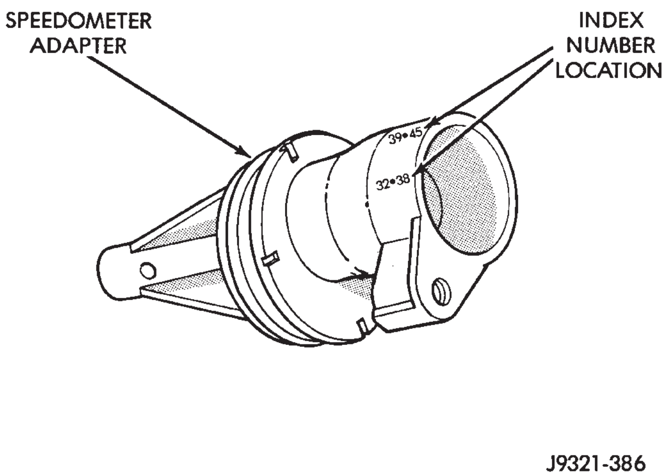


Fig. 6 Location Of Index Numbers On Speedometer Adapter

TRANSFER CASE REMOVAL

(1) Shift transfer case into Neutral.

(2) Raise vehicle.

(3) Drain transfer case lubricant.

(4) Mark front and rear propeller shaft yokes for alignment reference.

(5) Place support stand under transmission.

(6) Remove rear crossmember.

(7) Mark propellers hafts for installation reference. Then disconnect shafts at transfer case.

(8) Disconnect speed sensor and remove speedometer adapter and sensor if necessary.

(9) Disconnect transfer case shift lever from shift lever rod.

(10) Disconnect vent hose and indicator switch. Remove hoses and wires from retainers on transfer case.

(11) Support transfer case with transmission jack.

(12) Remove nuts attaching transfer case to transmission adapter.

(13) Secure transfer case to jack with safety chains.

(14) Pull transfer case and jack rearward to disengage transfer case.

(15) Remove transfer case from under vehicle.

TRANSFER CASE INSTALLATION

(1) Mount transfer case on a transmission jack. Secure transfer case to jack with safety chains.

(2) Position transfer case under vehicle.

(3) Align transfer case and transmission shafts and install transfer case on transmission (Fig. 7).

(4) Install and tighten transfer case attaching nuts (Fig. 7). Tighten 3/8 nuts to 41-47 N·m (30-35 ft. lbs.). Tighten 5/16 nuts to 30-35 N·m (22-26 ft. lbs.).

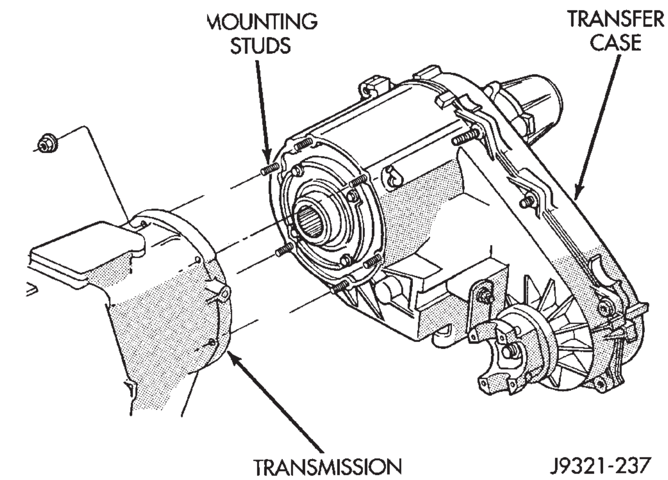


Fig. 7 Transfer Case Attachment

(5) Install speedometer adapter if removed during service (Fig. 8). Then index adapter and install speed sensor in adapter. Refer to In-Vehicle Service section for indexing procedure.

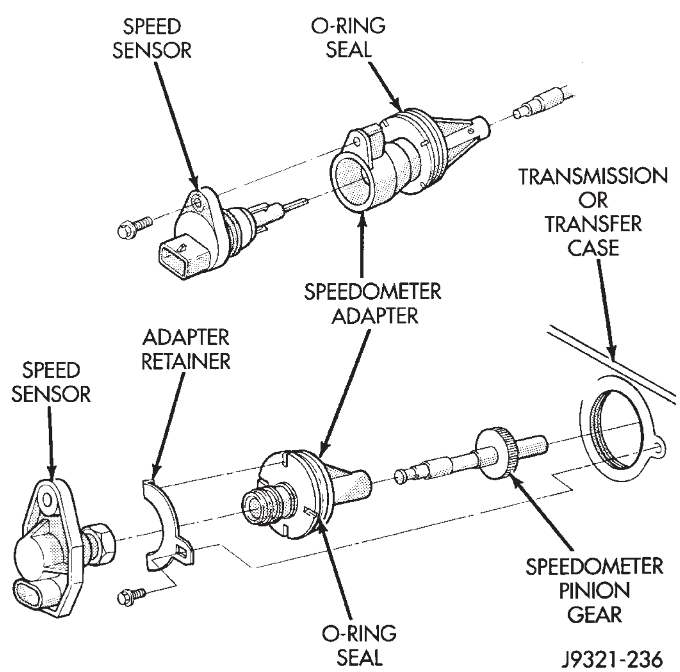


Fig. 8 Speedometer Components

(6) Connect electrical wires to speed sensor and indicator switch.

(7) Connect vent hose to transfer case vent (Fig. 9).

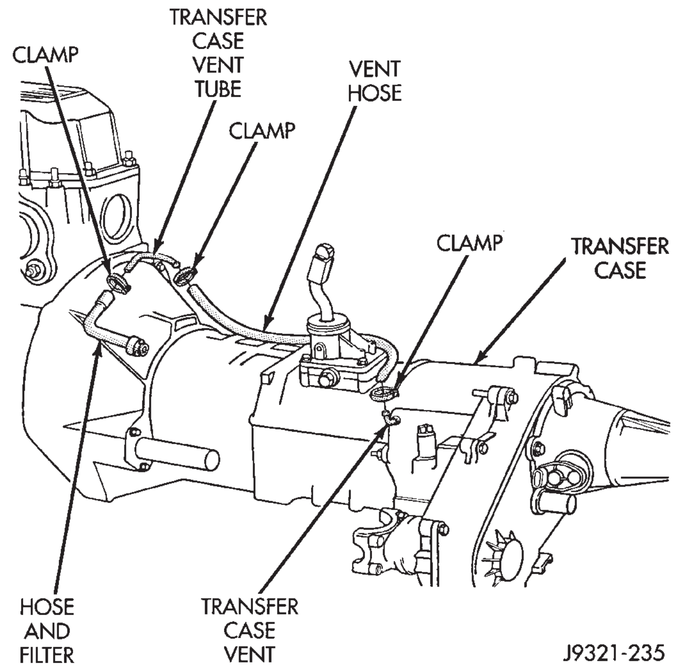


Fig. 9 Transfer Case Vent Hose Routing

(8) Align and connect propeller shafts. Tighten shaft attaching bolts to 19 N·m (170 in. lbs.) torque.

(9) Fill transfer case with Dexron II. Correct level is to bottom edge of fill plug hole.

(10) Install rear crossmember if removed. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(11) Remove transmission jack and transmission support stand.

(12) Connect transfer case shift lever to shift lever rod.

(13) Check and adjust transfer case shift linkage if necessary.

(14) Lower vehicle.

TRANSFER CASE DISASSEMBLY AND OVERHAUL

TRANSFER CASE DISASSEMBLY

(1) Position transfer case on shallow drain pan. Remove drain plug and drain any lubricant remaining in case.

(2) Remove front yoke nut and remove yoke (Fig. 1).

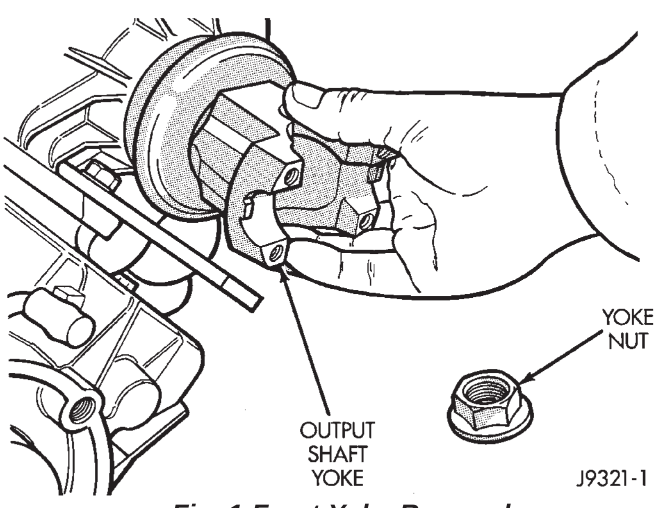


Fig. 1 Front Yoke Removal

(3) Remove yoke seal washer from front output shaft (Fig. 2).

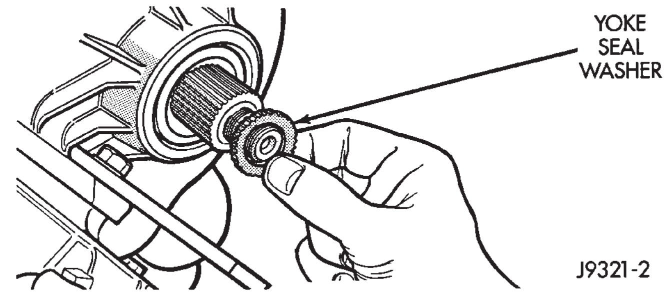


Fig. 2 Yoke Seal Washer Removal

(4) Remove rear retainer bolts (Fig. 3).

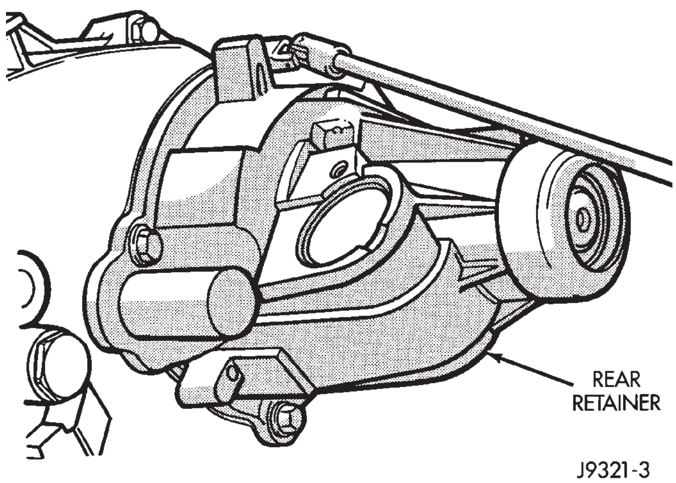


Fig. 3 Rear Retainer Bolt Removal

(5) Remove rear bearing locating ring access cover screws, cover and gasket (Fig. 4).

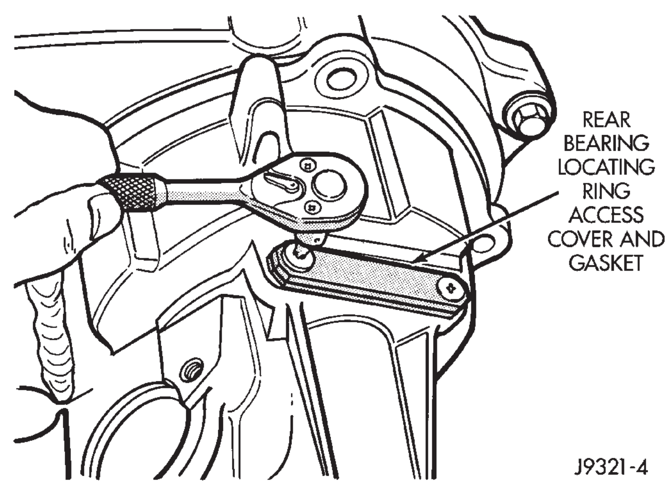


Fig. 4 Locating Ring Access Cover And Gasket Removal

(6) Loosen rear retainer with pry tool to break sealer bead. Pry only against retainer boss as shown (Fig. 5).

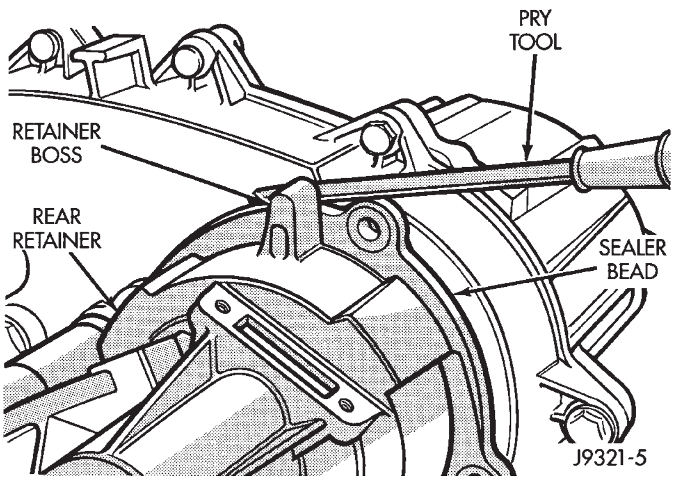


Fig. 5 Loosening Rear Retainer

(7) Remove rear retainer as follows: Spread rear bearing locating ring with snap ring pliers (Fig. 6). Then slide retainer off mainshaft and rear bearing (Fig. 7).

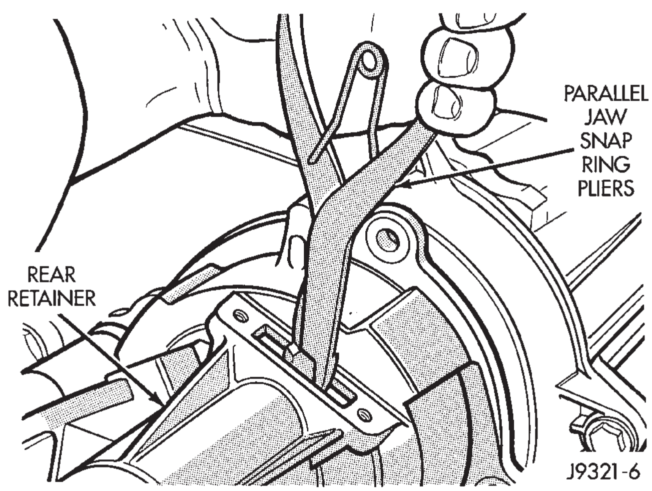


Fig. 6 Disengaging Rear Bearing Locating Ring

(8) Remove speedometer drive gear (Fig. 8).

(9) Remove rear bearing snap ring (Fig. 9).

(10) Remove rear bearing (Fig. 10). Note position of bearing locating ring groove for assembly reference.

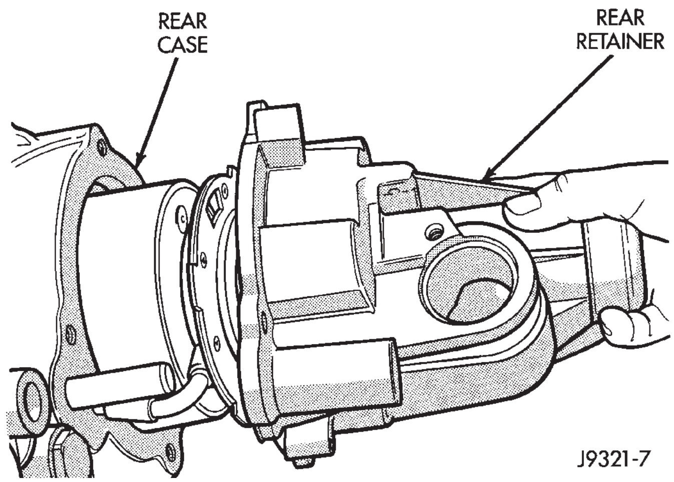


Fig. 7 Rear Retainer Removal

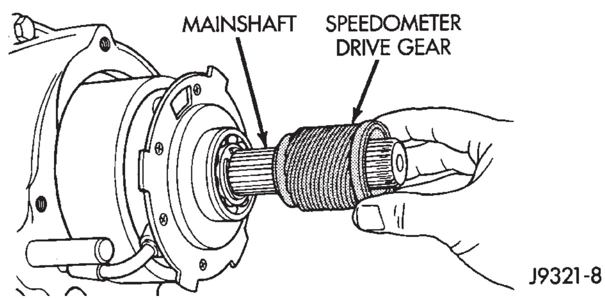


Fig. 8 Speedometer Drive Gear Removal

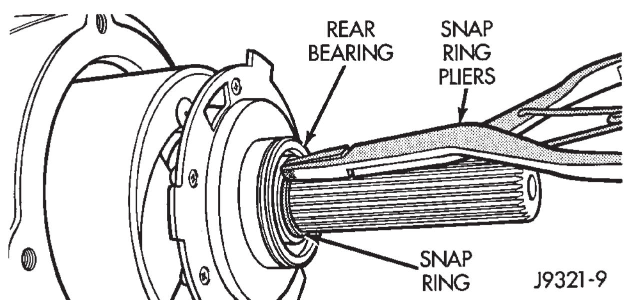


Fig. 9 Rear Bearing Snap Ring Removal

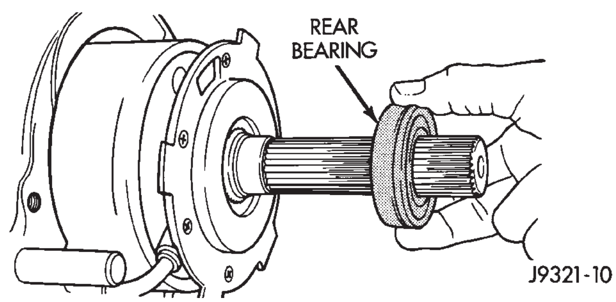


Fig. 10 Rear Bearing Removal

(11) Disengage oil pickup tube from oil pump and remove oil pump assembly (Fig. 11).

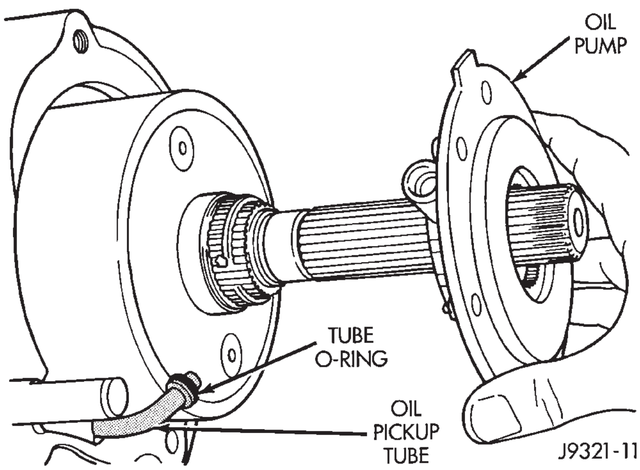


Fig. 11 Oil Pump Removal

(12) Mount transfer case on wood blocks so rear case is facing upward (Fig. 12).

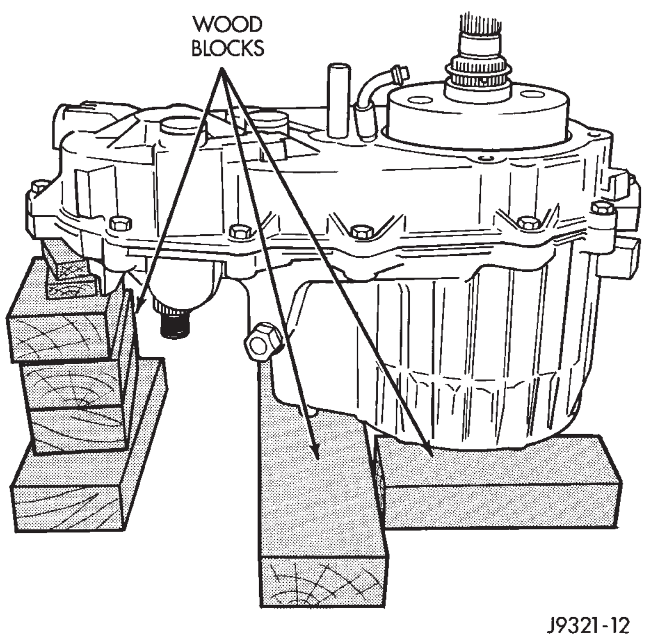


Fig. 12 Supporting Transfer Case On Wood Blocks

(13) Remove bolts attaching rear case to front case. Note that two end bolts are only ones that require washers (Fig. 13). These bolts serve as case-to-case alignment bolts.

(14) Loosen rear case with flat blade screwdriver to break sealer bead. Insert screwdriver blade only into notches provided at each end of case (Fig. 14).

(15) Remove rear case (Fig. 15).

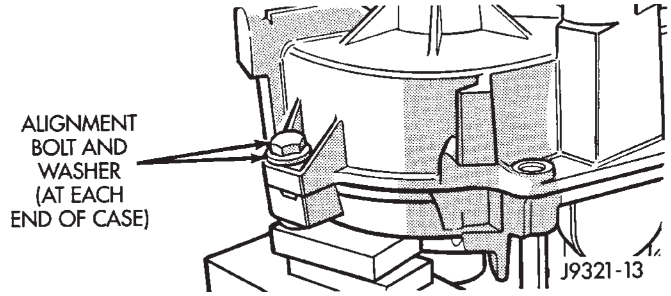


Fig. 13 Rear Case Alignment Bolt Locations

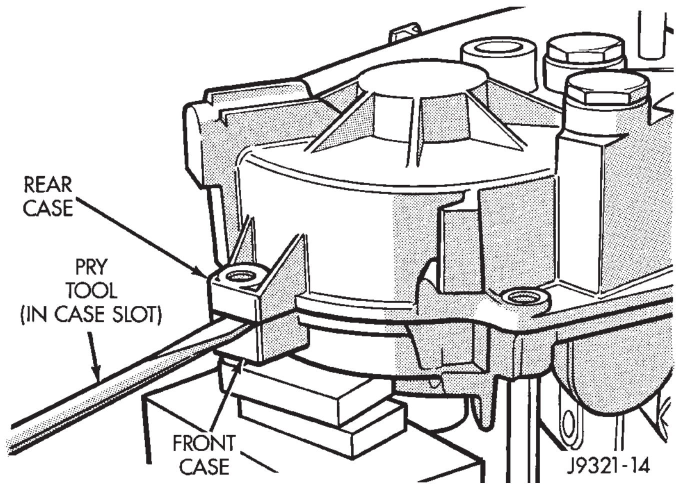


Fig. 14 Loosening Rear Case

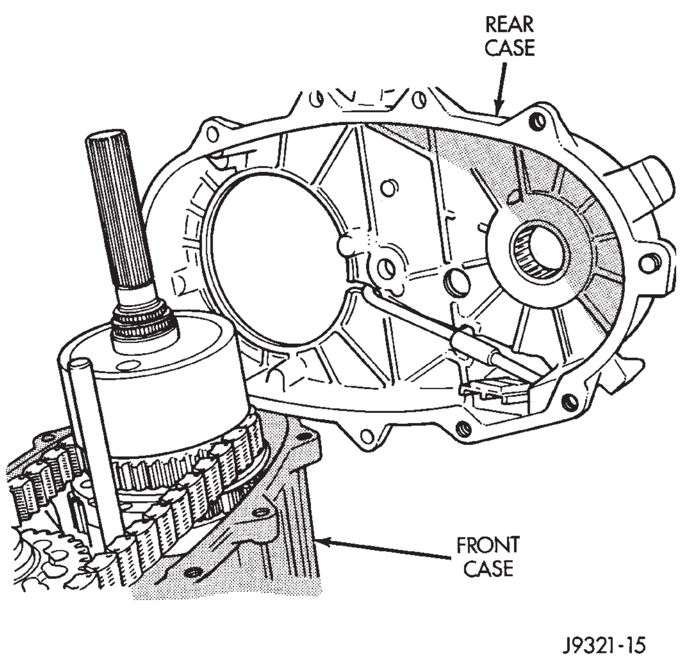


Fig. 15 Rear Case Removal

(16) Remove oil pickup tube from rear case (Fig. 16).

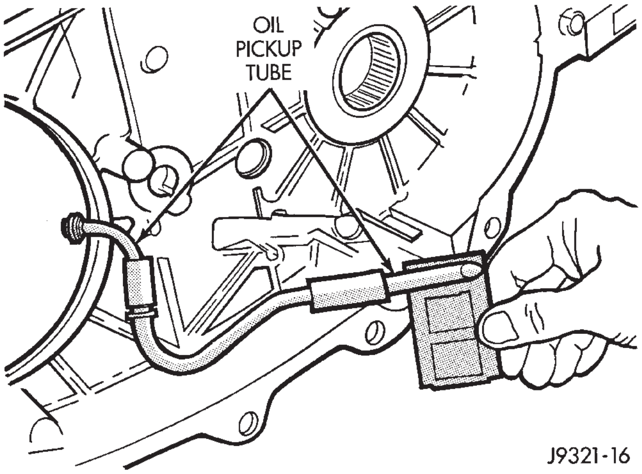


Fig. 16 Oil Pickup Tube Removal

(17) Remove oil pump locating snap ring and viscous coupling snap ring from mainshaft (Fig. 17).

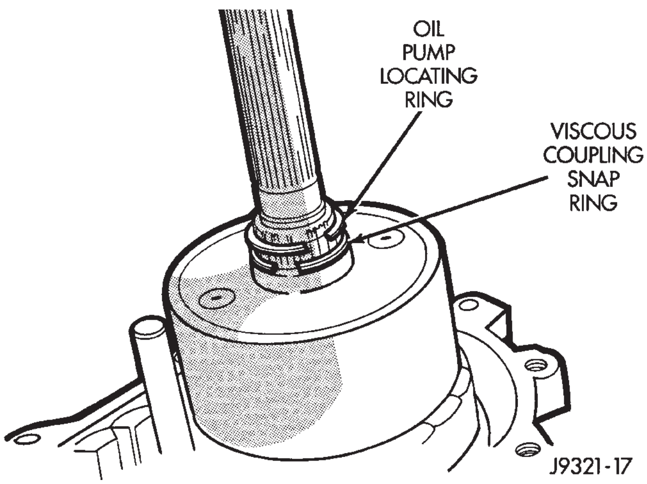


Fig. 17 Oil Pump And Viscous Coupling Snap Ring Locations

(18) Remove viscous coupling from mainshaft (Fig. 18).

(19) Remove drive gear snap ring (Fig. 19).

(20) Disengage drive gear (Fig. 20). Pry gear upward and off mainshaft as shown.

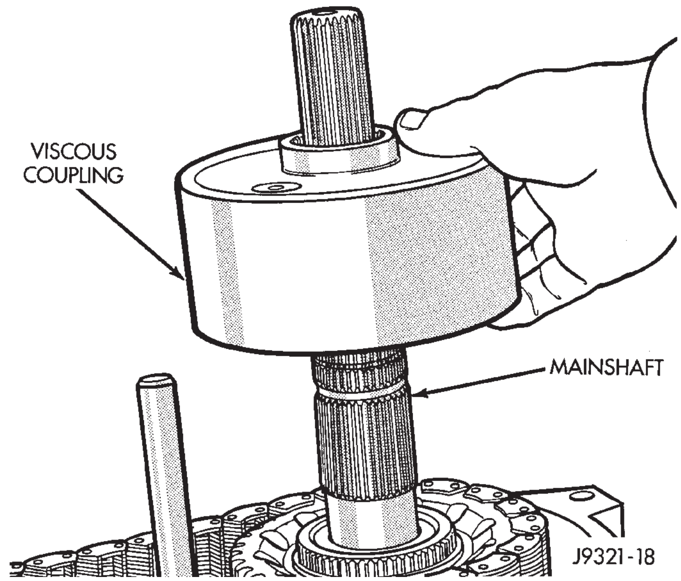


Fig. 18 Viscous Coupling Removal

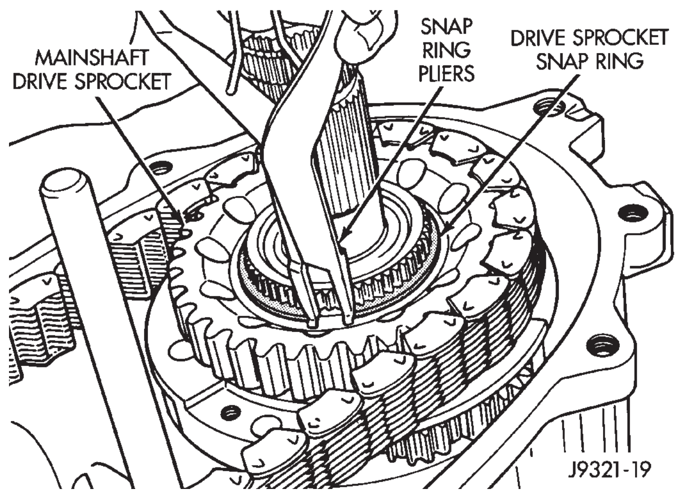


Fig. 19 Drive Gear Snap Ring Removal

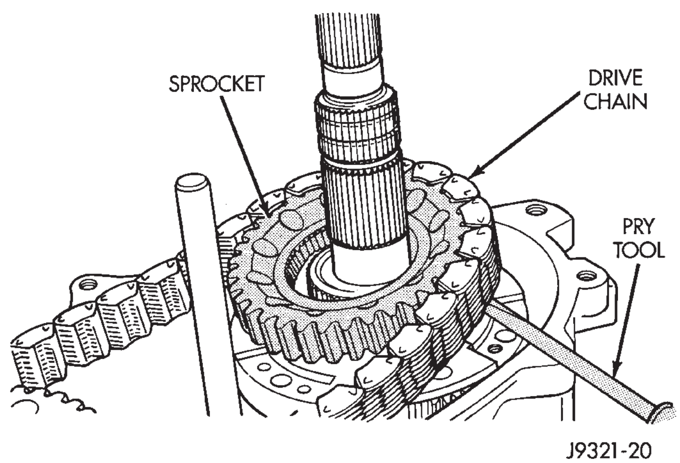


Fig. 20 Disengaging Mainshaft Drive Gear

(21) Remove front output shaft, drive chain and drive gear as assembly (Fig. 21).

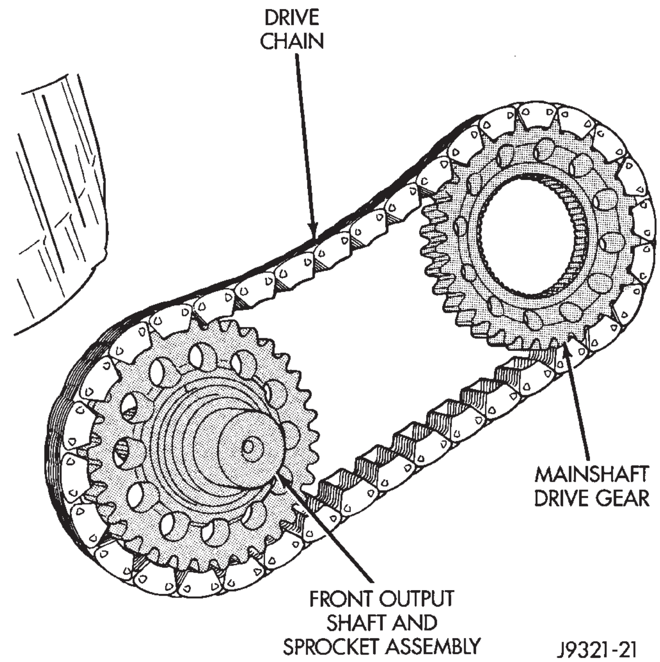


Fig. 21 Front Output Shaft, Drive Gear And Chain Removal

(22) Remove detent plug, plug O-ring, detent spring and detent plunger (Fig. 22).

(23) Remove mainshaft and differential assembly (Fig. 23).

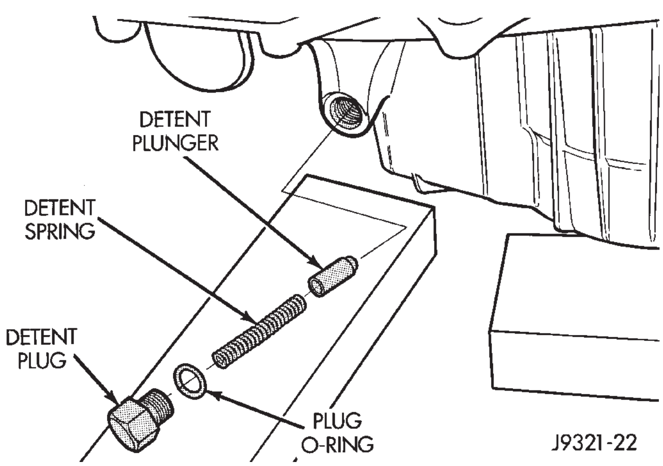


Fig. 22 Detent Plug, Spring And Plunger Removal

(24) Rotate shift sector so sector teeth face upward (Fig. 24).

(25) Remove range fork, rail and clutch sleeve as assembly (Fig. 25). Lift shift rail upward, rotate fork out of shift sector and remove assembly.

(26) Turn front case on side so front bearing retainer is accessible.

(27) Remove front bearing retainer bolts (Fig. 26).

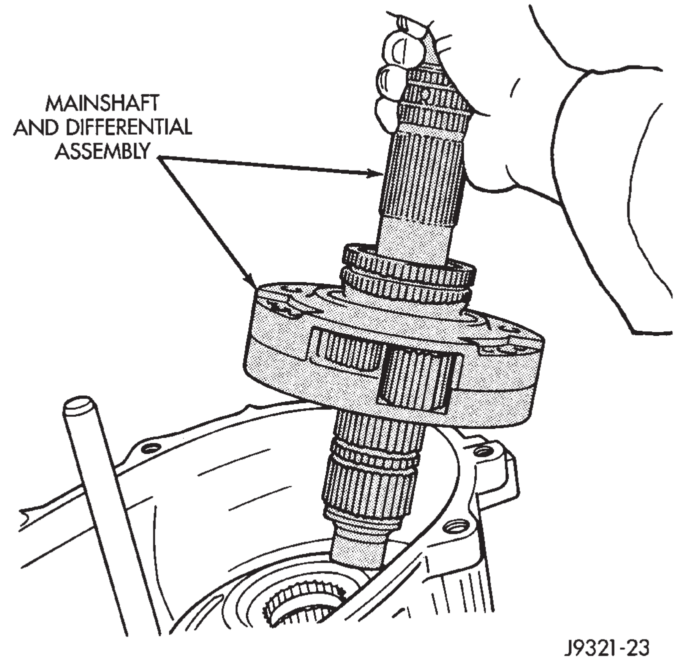


Fig. 23 Mainshaft And Differential Removal

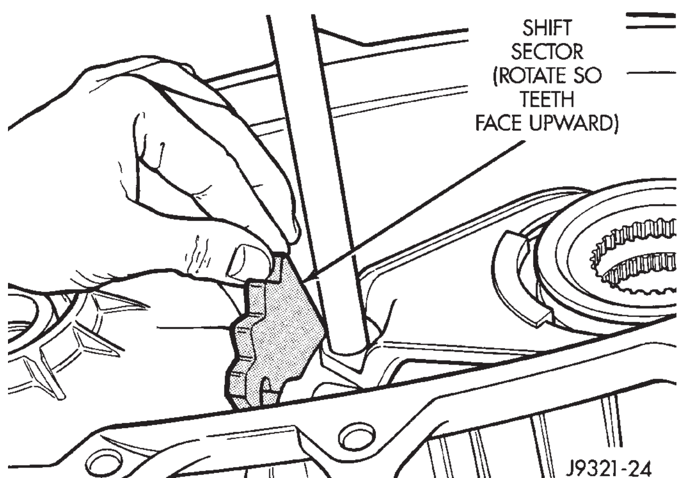


Fig. 24 Rotating Shift Sector

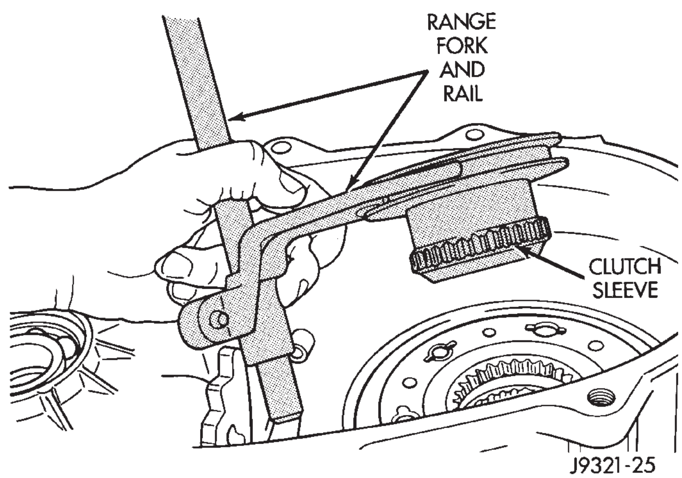


Fig. 25 Range Fork And Clutch Sleeve Removal

(28) Remove front bearing retainer as follows: Loosen retainer with flat blade screwdriver to break

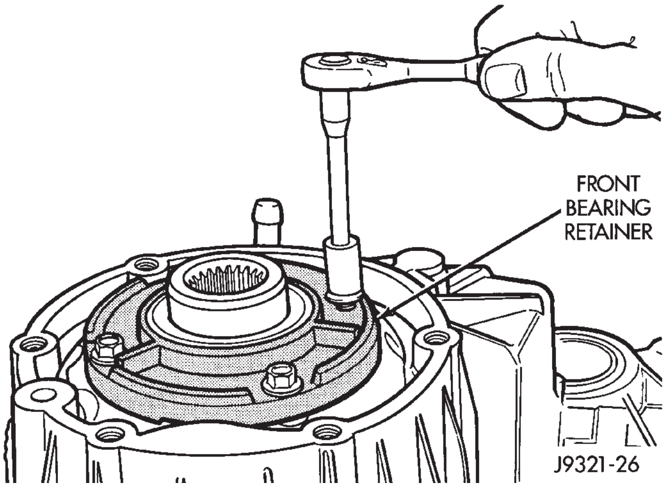


Fig. 26 Front Bearing Retainer Bolt Removal

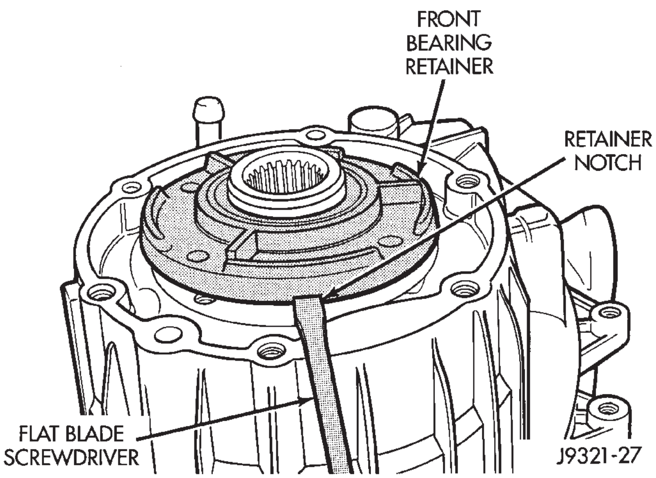


Fig. 27 Front Bearing Retainer Removal

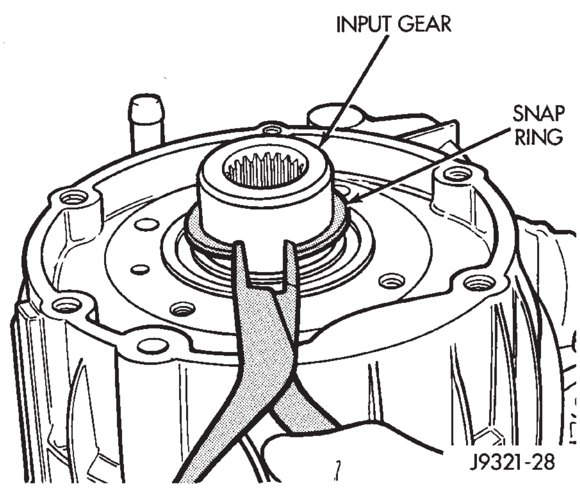


Fig. 28 Input Gear Snap Ring Removal

sealer bead. Then remove retainer from case and gear. **To avoid damaging case and retainer, position screwdriver blade only in slots provided in retainer (Fig. 27).**

(29) Remove snap ring that retains input gear shaft in front bearing (Fig. 28).

(30) Remove input and low range gear assembly (Fig. 29).

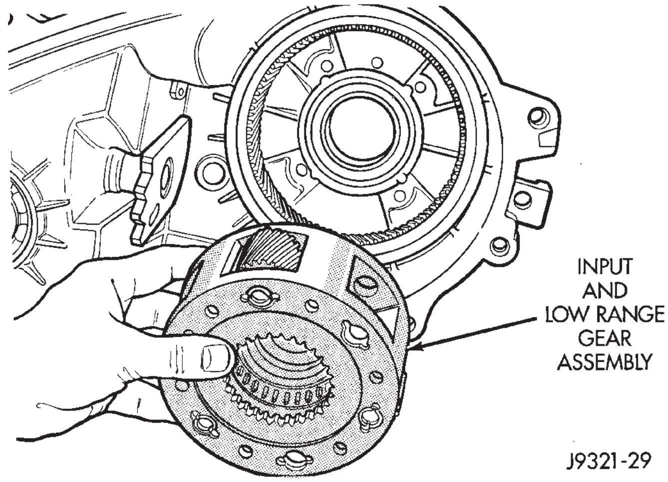


Fig. 29 Input And Low Range Gear Assembly Removal

(31) Remove range lever locknut and remove lever and washer from shift sector shaft (Fig. 30).

(32) Remove shift sector. Rotate and tilt sector as needed to remove it (Fig. 31).

(33) Remove magnet from case.

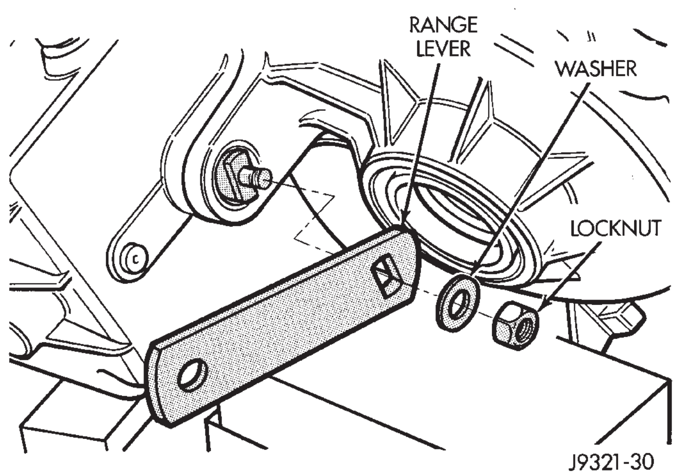


Fig. 30 Range Lever Removal

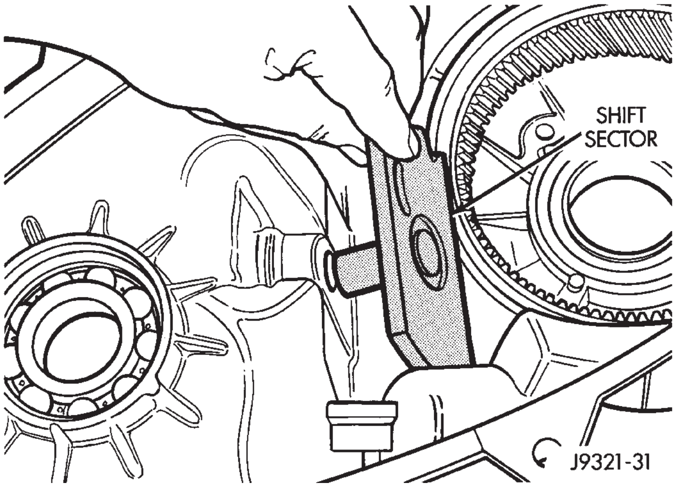


Fig. 31 Shift Sector Removal

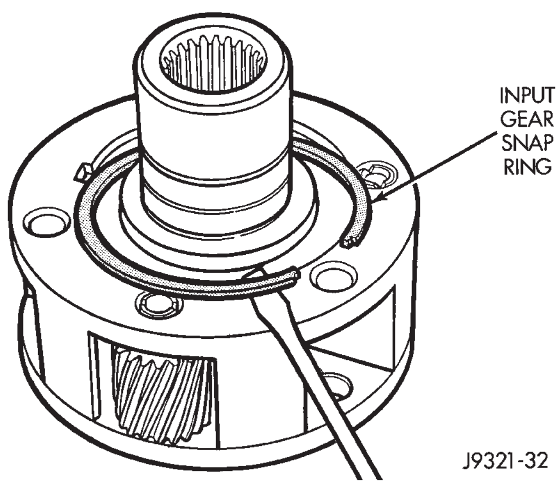


Fig. 32 Input Gear Snap Ring Removal

INPUT AND LOW RANGE GEAR DISASSEMBLY

(1) Remove snap ring that retains input gear in low range gear (Fig. 32).

(2) Remove retainer (Fig. 33).

(3) Remove front tabbed thrust washer (Fig. 34).

(4) Remove input gear (Fig. 35).

(5) Remove rear tabbed thrust washer from low range gear (Fig. 36).

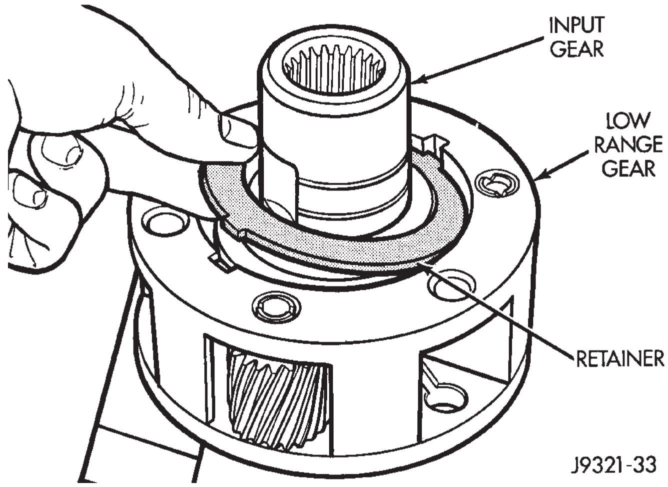


Fig. 33 Input Gear Retainer Removal

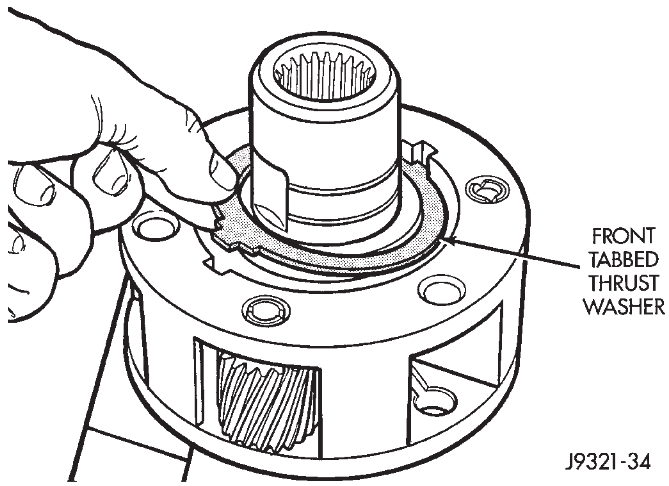


Fig. 34 Front Tabbed Thrust Washer Removal

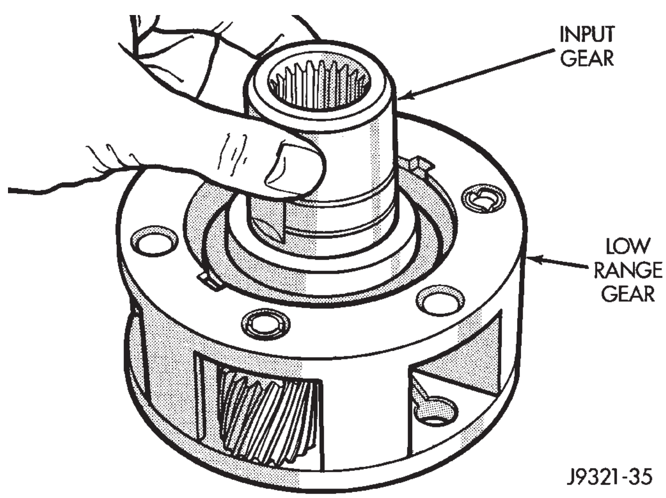


Fig. 35 Input Gear Removal

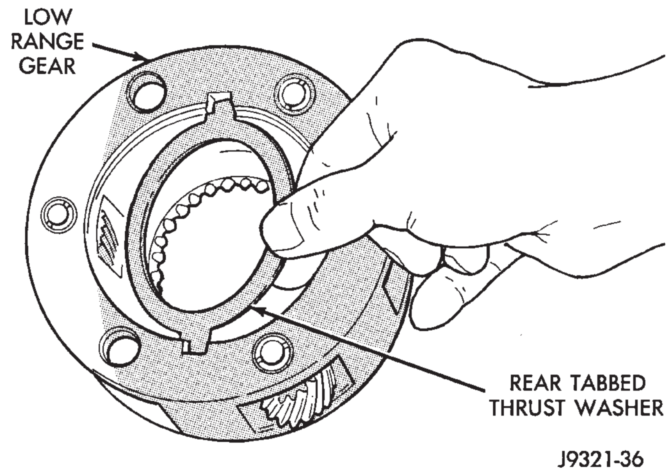


Fig. 36 Rear Tabbed Thrust Washer Removal

MAINSHAFT AND DIFFERENTIAL DISASSEMBLY

(1) Remove clutch shaft snap ring (Fig. 37).

(2) Remove thrust ring (Fig. 38).

(3) Slide clutch shaft off mainshaft (Fig. 39).

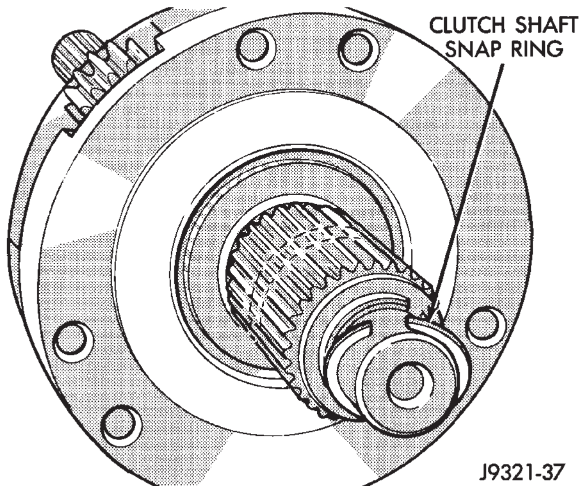


Fig. 37 Clutch Shaft Snap Ring Removal

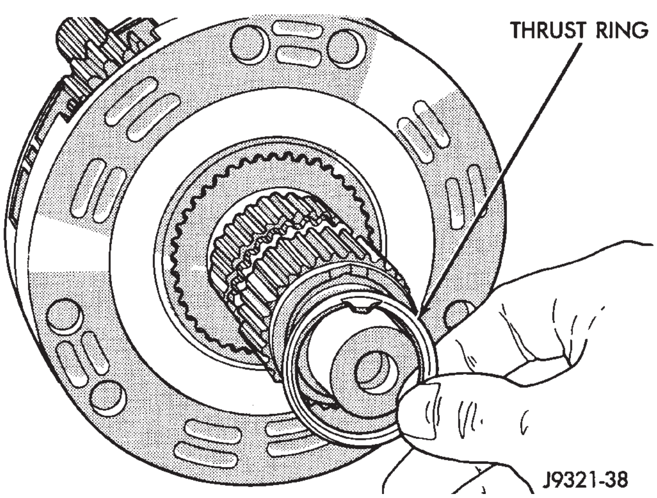


Fig. 38 Thrust Ring Removal

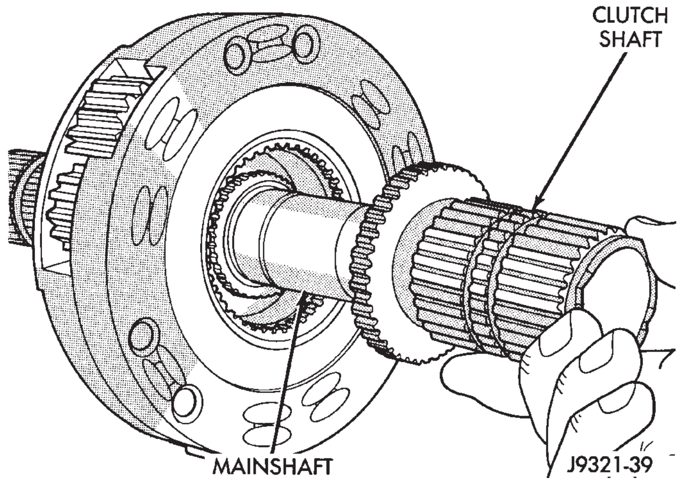


Fig. 39 Clutch Shaft Removal

(4) Disengage snap ring that retains differential on mainshaft (Fig. 40). Work snap ring upward until clear of gear teeth and ring groove.

(5) Retrieve snap ring from shaft and interior of differential with pencil magnet (Fig. 41).

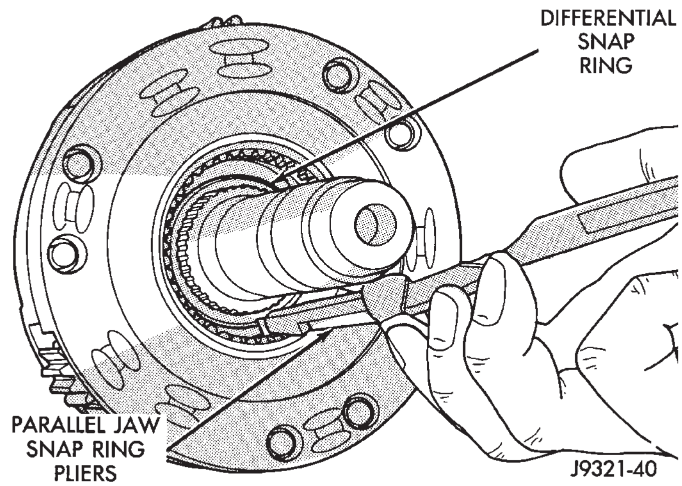


Fig. 40 Disengaging Differential Snap Ring

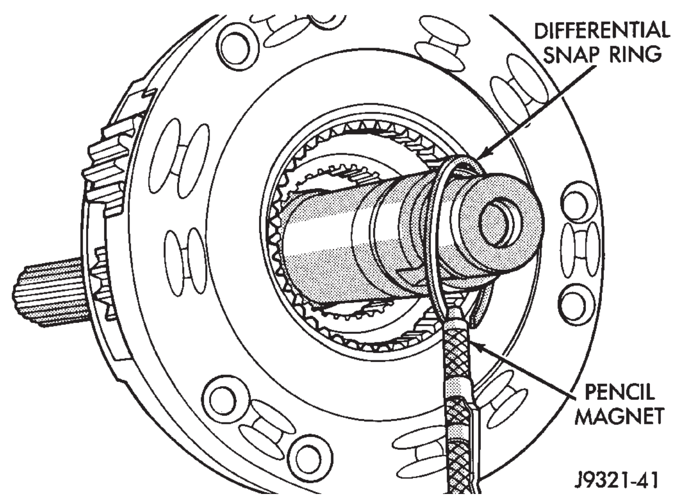


Fig. 41 Differential Snap Ring Removal

(6) Position drain pan or shop towels under differential and mainshaft. Pan or towels will help catch and retain mainshaft needle bearings when differential is removed from shaft.

(7) Slide differential off mainshaft (Fig. 42).

(8) Remove needle bearings and spacers from mainshaft (Fig. 43), or from interior of mainshaft gear. There should be 53 bearings and two spacers. Store bearings and spacers in clean cup or jar to avoid losing them.

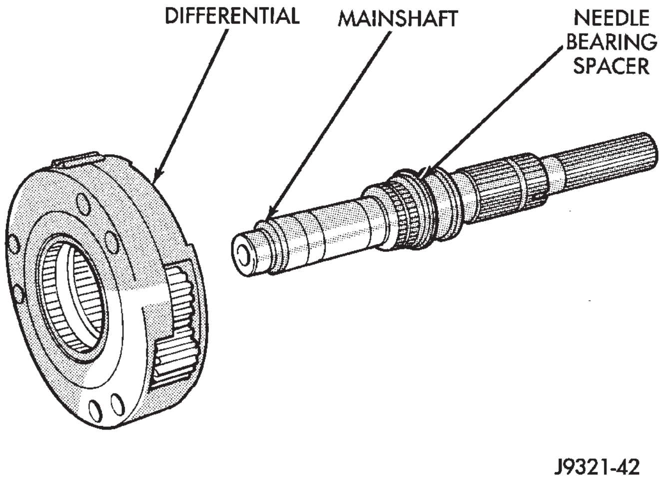


Fig. 42 Removing Differential From Mainshaft

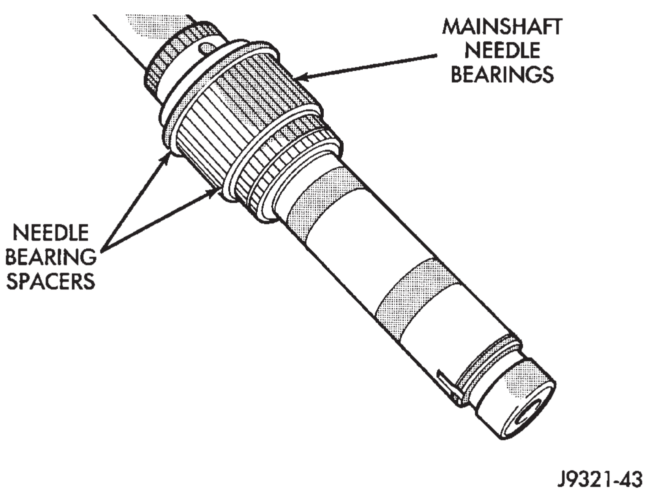


Fig. 43 Mainshaft Needle Bearing And Spacer Position

DIFFERENTIAL DISASSEMBLY

(1) Mark differential carriers with center punch or paint mark for assembly reference (Fig. 44).

(2) Remove differential bolts (Fig. 45). Use thin wall, 12 point socket to remove bolts.

(3) Separate differential carriers (Fig. 46). Use two flat blade screwdrivers inserted in carrier slots to separate.

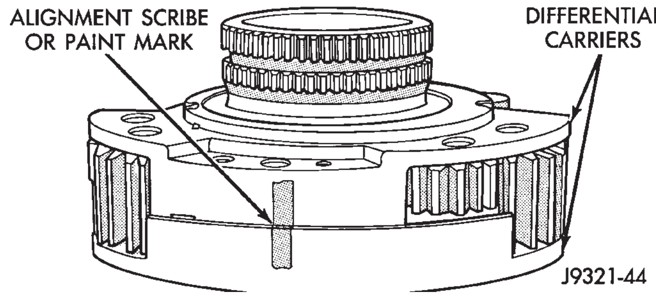


Fig. 44 Marking Differential Carriers

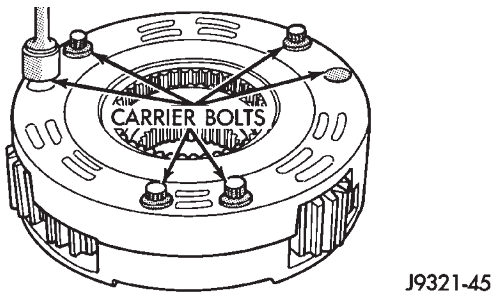


Fig. 45 Differential Bolt Removal

(4) Remove pinion gears and thrust washers (Fig. 47). Three short and three long gears are used. Also note that a thrust washer is used at each end of every pinion gear.

(5) Remove sprocket gear (Fig. 48).

(6) Remove mainshaft gear (Fig. 49).

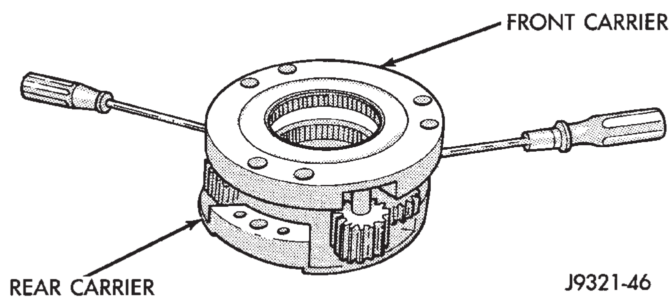


Fig. 46 Separating Differential Carriers

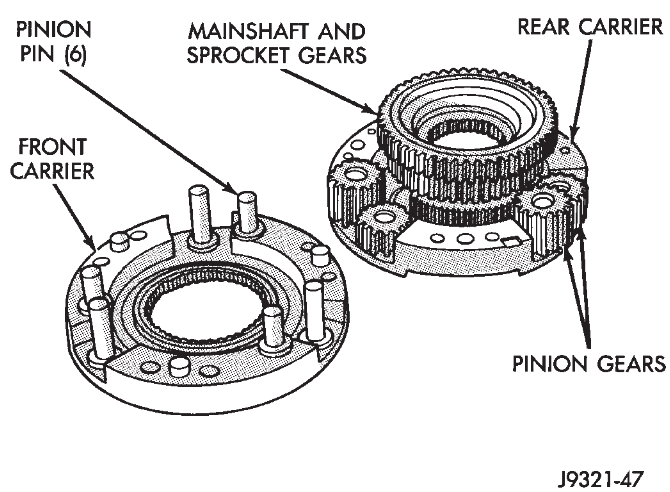


Fig. 47 Pinion Gear Positions

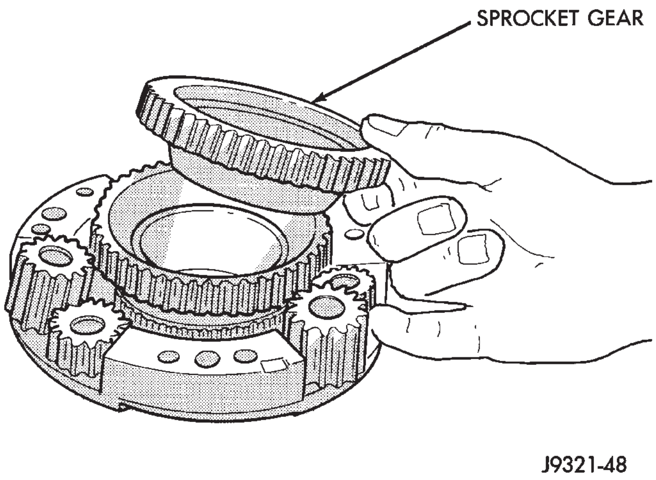


Fig. 48 Sprocket Gear Removal

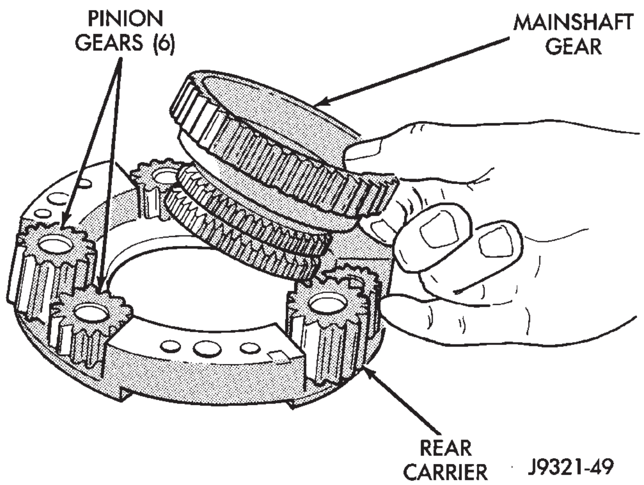


Fig. 49 Mainshaft Gear Removal

COMPONENT CLEANING AND INSPECTION

Clean the transfer case components with parts cleaning solvent. Flush the oil passages in the cases and drivetrain components with solvent. This will help remove dirt and particles from these passages.

Dry the transfer case components with compressed air or allow them to air dry on clean shop towels.

Apply compressed air through all oil passages in the cases and gear components to clear them of any residue.

Mainshaft And Differential

Examine the mainshaft and differential components carefully for evidence of wear or damage.

Replace the thrust washers and pinion gears if worn or damaged.

Replace the differential case halves as an assembly if either case is worn or damaged, or if the gear teeth in the rear half are damaged.

Replace the mainshaft and sprocket gears if the teeth or gear bores are worn or damaged.

Replace the mainshaft bearings if worn, flat spotted, brinnelled, or damaged in any way.

Replace the mainshaft if it exhibits wear or damage to the bearing surfaces, splines or gear teeth.

Input And Low Range Gears

Inspect the low range gear pinions and pinion pins. Replace the low range gear if any of the pins or pinions are worn or damaged.

Inspect the thrust washers, retainer and snap ring. Replace the snap ring if bent, or distorted. Replace the thrust washers and retainer if worn, cracked or damaged in any way.

Examine the input gear carefully. Be sure the gear teeth and bearing surfaces are in good condition. Replace the gear if wear or damage is evident.

Check the input gear pilot bearing. Rotate the bearing and check for roughness or noise. Also check bearing position in the bore. The bearing should be recessed approximately 2.5 mm (0.100 in.) below the top edge of the bore. The bearing should not be seated at the bottom of the bore. Replace the bearing if worn, or roughness is evident. Replace both the gear and bearing if the bearing is a loose fit in the bore.

Gear Cases And Extension

Examine both case halves and the extension carefully. Replace the extension or either case half if wear, cracks, or other damage is evident.

Check condition of the low range annulus gear and the shift rail bushing in the front case (Fig. 50). The low range annulus gear is not a serviceable part. Replace the gear and case as an assembly if the gear is loose, worn, or damaged. The shift rail bushing is a serviceable part and can be replaced if necessary.

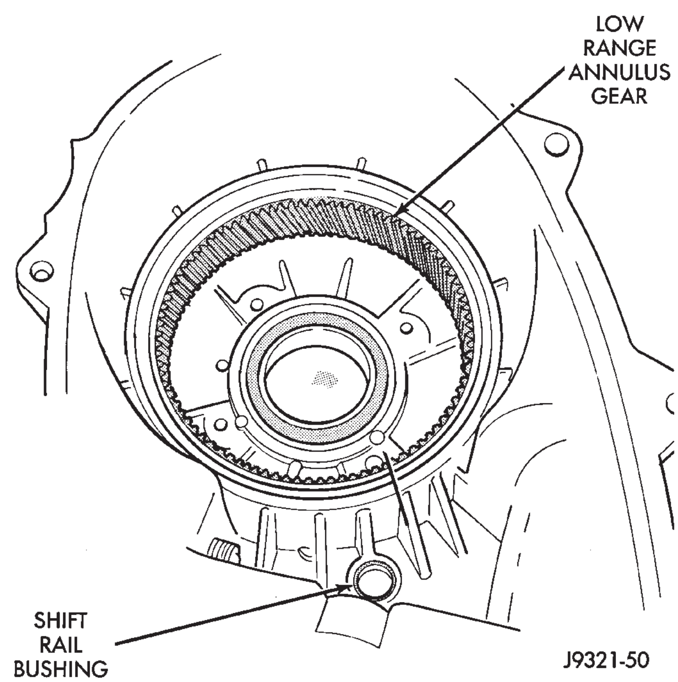


Fig. 50 Low Range Annulus Gear Location

Check the bushing in the rear extension. Replace the bushing if worn or scored. A shop press and universal type bushing driver set can be used for replacement purposes.

Examine the sealing surfaces of both case halves and the extension. Small burrs, or scratches on these surfaces can be reduced with crocus cloth or a fine tooth file.

Examine condition of the shift rail bushing in the front case. If the bushing is worn or damaged, it can be removed with a blind hole type puller. A replacement bushing can be installed with a suitable size driver. Recess the bushing slightly below the edge of the bore but do not seat it all the into the case.

Geartrain

The differential pinion gears and thrust washers are serviceable components and can be replaced if worn or damaged. The differential cases are also serviceable but must be replaced as a set if either case is damaged.

Inspect the mainshaft splines, gear teeth and bearing surfaces carefully for evidence of wear, or damage. Replace the shaft if necessary. do not attempt to salvage it if damaged.

The shift rail and range fork are an assembly. Replace both parts if either is damaged. However, the nylon pads in the fork can be replaced if worn, or cracked.

Inspect the transfer case snap rings closely. Do not attempt to salvage a distorted snap ring by straightening or reshaping it. Replace any snap ring that is distorted, or worn.

Inspect the low range gear, input gear and the gear thrust washers retainer, and snap ring. The low range gear is serviced as an assembly only. Replace the gear if the case or pinions are damaged.

During inspection, also make sure the seal surface of the input gear is in good condition. Minor nicks on this surface can be reduced with crocus cloth. However, replace the gear if the seal surface is severely scored or worn.

The speedometer gear should be replaced if worn, cracked, or if the small spline teeth are worn.

Oil Pump And Viscous Coupling

The oil pump and viscous coupling are not serviceable components. Replace the coupling as an assembly if it is leaking or damaged. Replace the oil pump as an assembly if the gear teeth are worn, or if the pump has become damaged.

Bearings And Seals

The transfer case seals should be replaced during overhaul. Use new seals in the input gear bearing retainer, front case and rear extension. Also replace the yoke seal washer and the detent plug O-ring.

Check condition of each transfer case bearing. Replace any bearing exhibiting signs of roughness, wear, or damage.

Bearing and seal replacement is described in the Transfer Case Bearing And Seal Replacement procedures.

TRANSFER CASE BEARING AND SEAL REPLACEMENT

Replacing Output Shaft Front Bearing And Seal

Remove the seal from the front case with a pry tool. Then remove the snap ring that retains the front bearing in the front case (Fig. 51).

Use a rawhide mallet or drift to remove the old bearing and install the new. Then reinstall the bearing snap ring.

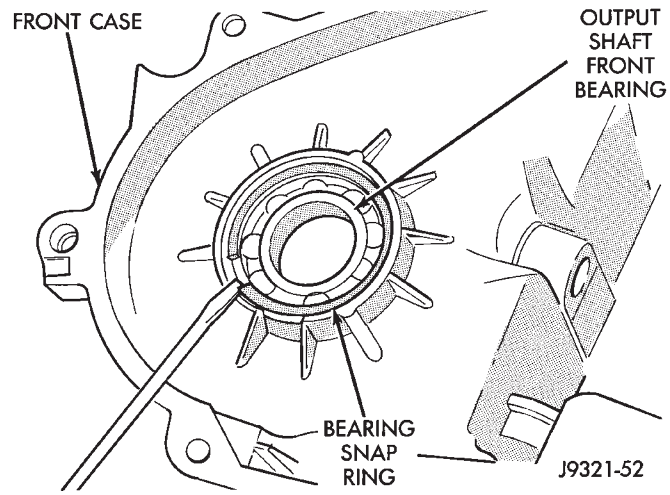


Fig. 51 Output Shaft Front Bearing Snap Ring Removal

Install the new front output shaft seal with Tool 6888 or suitable size tool as follows:

(a) Tap seal into bore until flush with upper edge of case bore (Fig. 52).

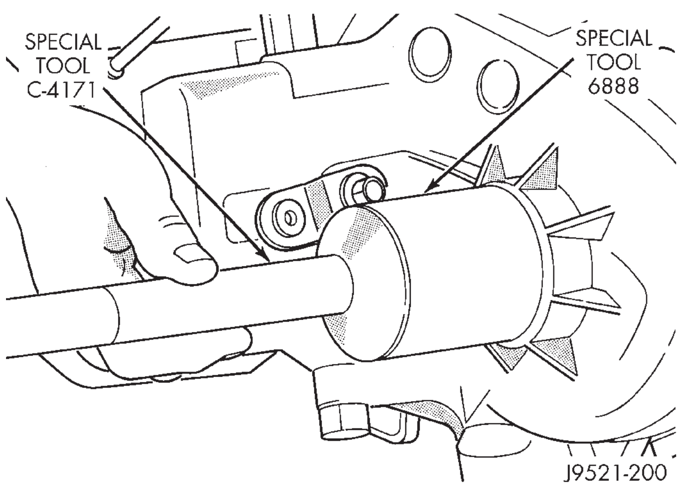


Fig. 52 Starting Front Output Shaft Seal Into Case Bore

(b) Seat seal 2.03 to 2.5 mm (0.080 to 0.100 in.) **below** top edge of seal bore in front case (Fig. 53).

Tool 6888 will seat seal to desired depth. Check seal depth with dial caliper.

CAUTION: Be sure the front output seal is seated below the top edge of the case bore as shown (Fig. 53). The seal could work loose if not seated to the recommended depth.

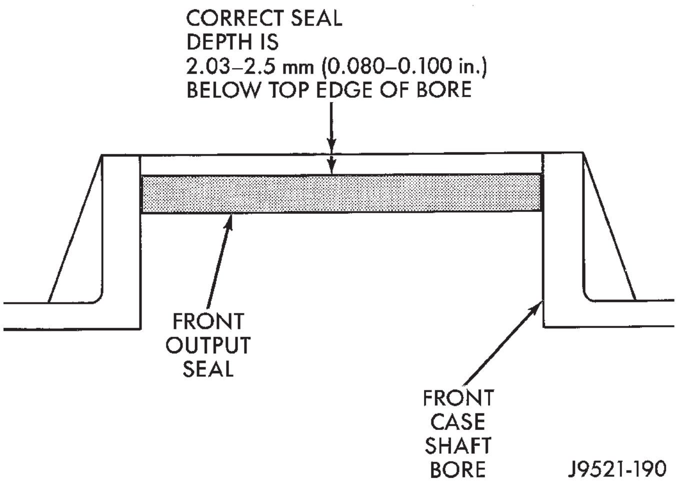


Fig. 53 Front Output Seal Installation Depth

Replacing Front Output Shaft Rear Bearing

Remove the shaft rear bearing from the rear case with Puller 7794A and Slide Hammer 7420 with Adapter 7420-8 (Fig. 54).

Install the new bearing with Tool Handle C-4171 and Bearing Installer 7823 (Fig. 55). **The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 56).**

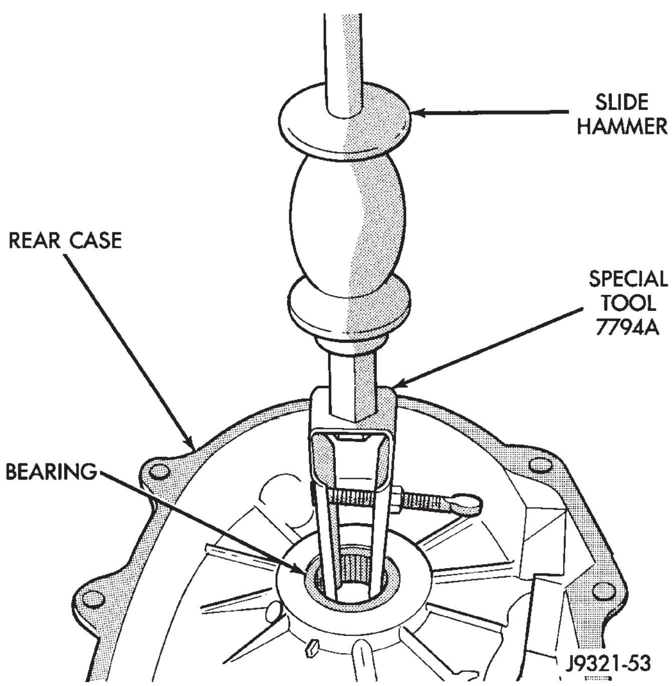


Fig. 54 Front Output Shaft Rear Bearing Removal

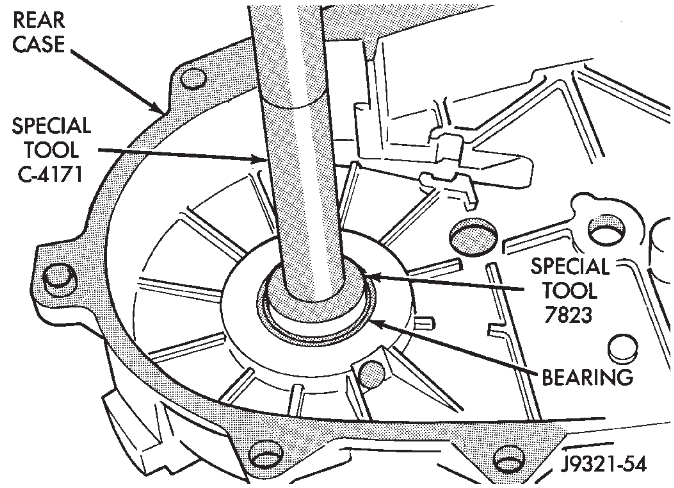


Fig. 55 Front Output Shaft Rear Bearing Installation

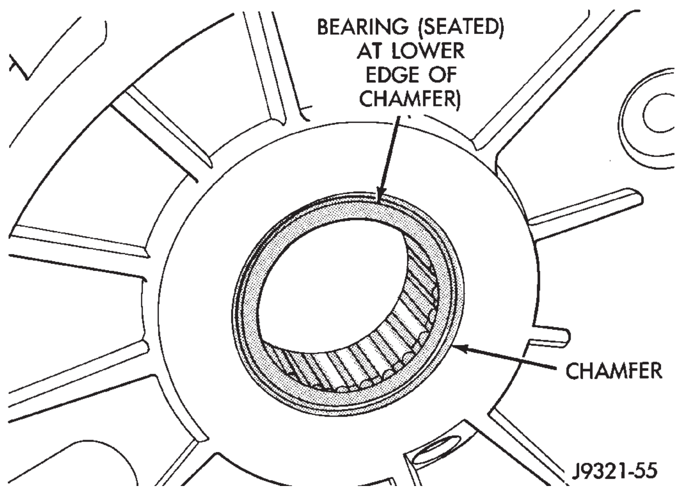


Fig. 56 Rear Bearing Installation Depth

Replacing Front Bearing

Although the same tools are used to remove and install the bearing, the bearing is removed from different directions. Replace the bearing only as described to avoid damaging the front case.

(1) Remove old bearing with Tool Handle C-4171 and Bearing Driver 7823 (Fig. 57). Drive bearing out from case interior as shown.

(2) Install locating ring on new bearing, if necessary (Fig. 58).

(3) Position case so forward end is facing upward (Fig. 58).

(4) Install bearing with Tools C-4171 and 7823 (Fig. 58). Bearing locating ring should be fully seated against case surface.

Replacing Front Bearing Retainer Seal

Remove the old seal with a drift or pry bar. Then install the new seal with Tool 7884 (Fig. 59).

Replacing Input Gear Pilot Bearing

The old bearing can be removed with an internal-type, two-jaw puller similar to MD998346 (Fig. 60).

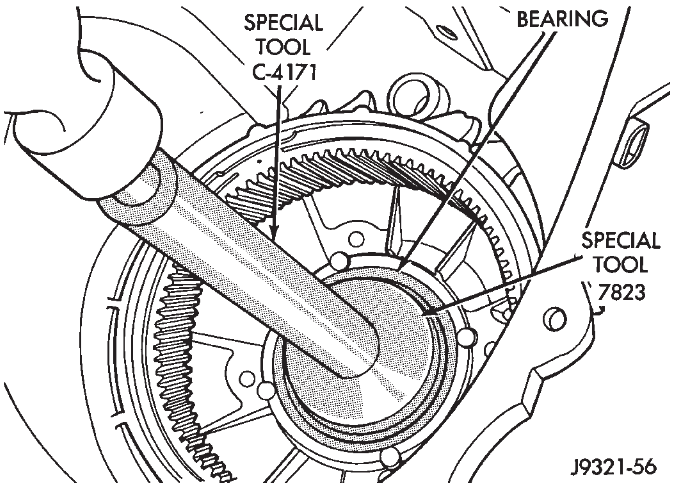


Fig. 57 Front Bearing Removal

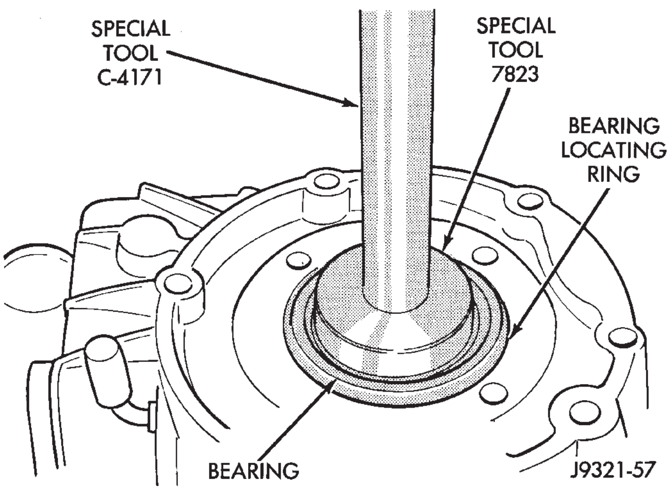


Fig. 58 Front Bearing Installation

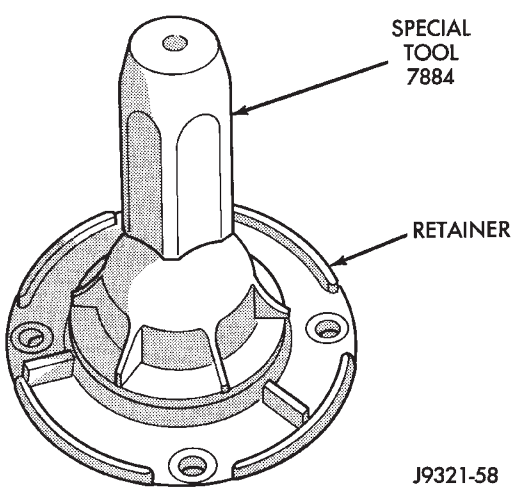


Fig. 59 Installing Seal In Front Bearing Retainer

The new bearing can be installed with tools similar to Driver Handle C-4171 and Installer 5064 (Fig. 61).

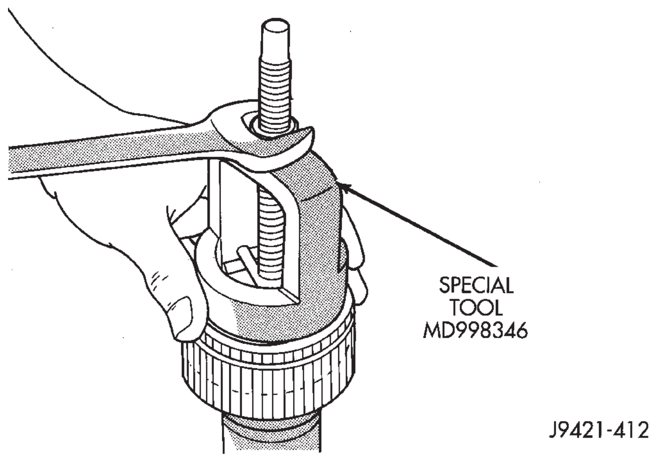


Fig. 60 Removing Input Gear Pilot Bearing

Replacing Rear Retainer Seal And Bushing

The rear retainer seal and bushing are serviceable parts. Both components are accessible once the retainer dust cap has been removed (Fig. 62).

Use a large pair of channel-lock pliers, or blunt punch to remove the dust cap. If a punch is used, work around the entire cap edge to remove it evenly from the retainer.

Remove the seal with a pry bar, drift, or punch. Then use a suitable size installer tool to position the seal in the retainer. The bushing can be replaced with a universal type bushing driver set once the seal has been removed from the retainer.

TRANSFER CASE ASSEMBLY AND ADJUSTMENT

Lubricate the transfer case components with the Mopar Dexron II during assembly operations.

Use petroleum jelly to prelubricate and hold mainshaft needle roller bearings and spacers in place. Petroleum jelly can also be used to lubricate seals, bushings and bearings during assembly.

Gaskets are **not** used in the NP249 transfer case. Instead, the mating surfaces of the case halves, retainer and extension are sealed with Mopar Gasket Maker, silicone adhesive/sealer, or Loctite 518.

PREPARING FRONT CASE FOR ASSEMBLY

(1) Support front case on wood blocks. Position case so sector shaft bore and input gear bearing are accessible.

(2) Lubricate sector shaft, shaft O-ring and shaft bore (in case) with petroleum jelly.

(3) Install sector in case (Fig. 63).

(4) Lubricate shift rail bushing with light coat of petroleum jelly, or transmission fluid. **Do not over-lubricate bushing. Excess lubricant will flow into bottom of bushing bore and prevent shift**

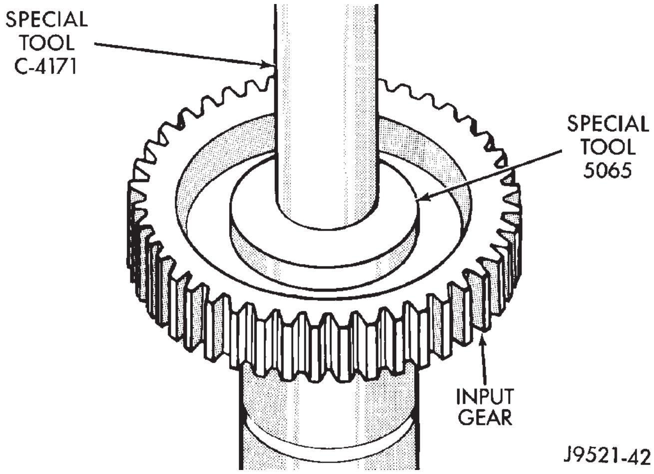


Fig. 61 Installing Input Gear Pilot Bearing

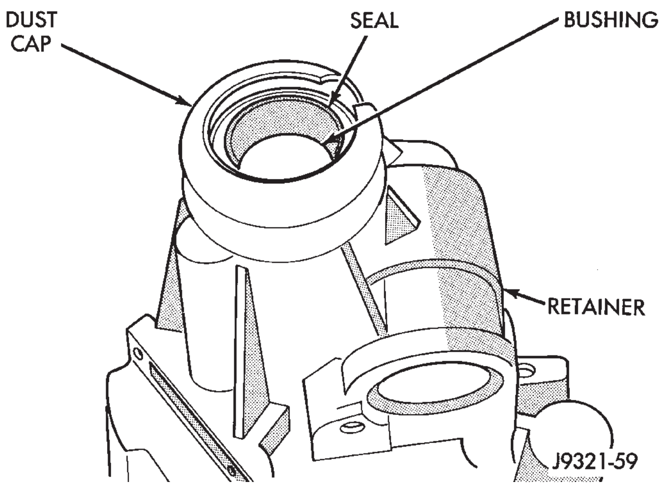


Fig. 62 Rear Retainer Cap, Bushing And Seal Position

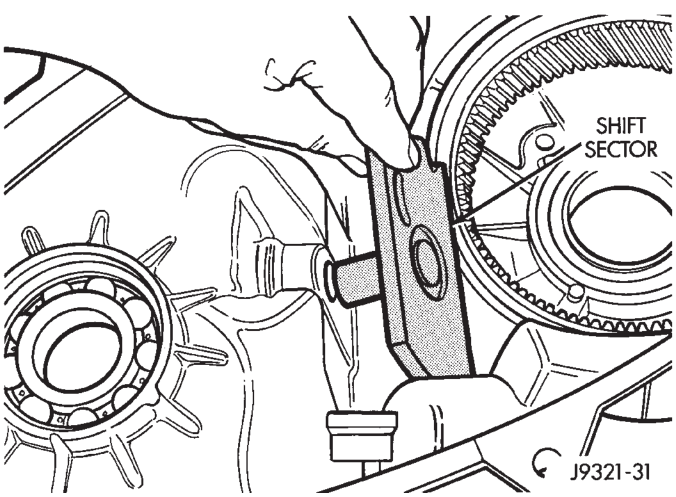


Fig. 63 Shift Sector Installation

rail from fully seating; this can also make it difficult to seat rear case on front case.

(5) Lubricate bearings and seals in front case with recommended lubricant.

(6) Install magnet in case.

INPUT—LOW RANGE GEAR ASSEMBLY AND INSTALLATION

(1) Lubricate gears and thrust washers (Fig. 64) with recommended transmission fluid.

(2) Install first thrust washer in low range gear (Figs. 36 and 64). Be sure washer tabs are properly aligned in gear notches.

(3) Install input gear in low range gear (Fig. 35). Be sure input gear is fully seated.

(4) Install remaining thrust washer in low range gear and on top of input gear (Fig. 34). Be sure washer tabs are properly aligned in gear notches.

(5) Install retainer on input gear and install snap ring.

(6) Align and install low range-input gear assembly in front case (Fig. 65). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

(7) Install snap ring on input gear shaft to secure gear in bearing and case (Fig. 66).

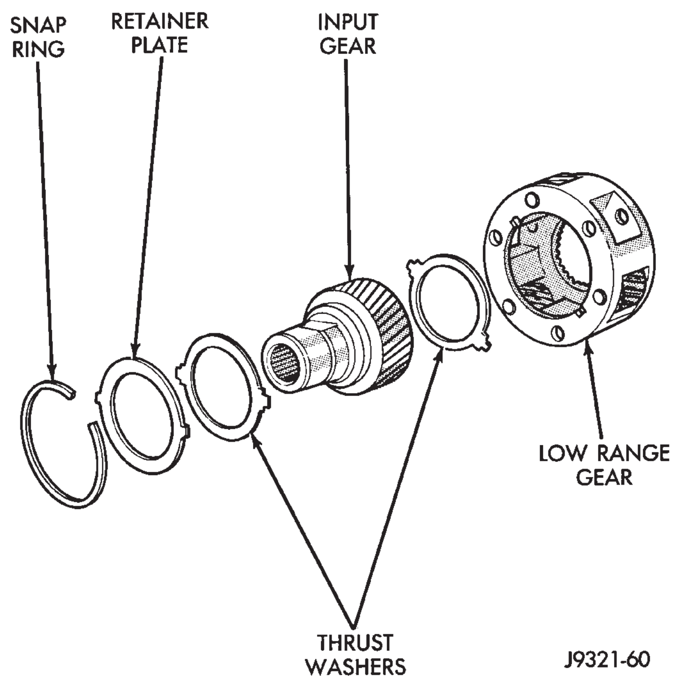


Fig. 64 Input/Low Range Gear Components

RANGE FORK/CLUTCH SLEEVE ASSEMBLY AND INSTALLATION

(1) Install new pads on range fork (Fig. 67).

(2) Lubricate range fork pads with light coat of petroleum jelly.

(3) Install clutch sleeve in range fork (Fig. 67).

(4) Install assembled range fork and clutch sleeve (Fig. 68). Insert range fork pin in sector. Then rotate sector and seat clutch gear in low range gear.

(5) Verify that range fork rail is seated in case bushing and that clutch sleeve is properly engaged in low range gear.

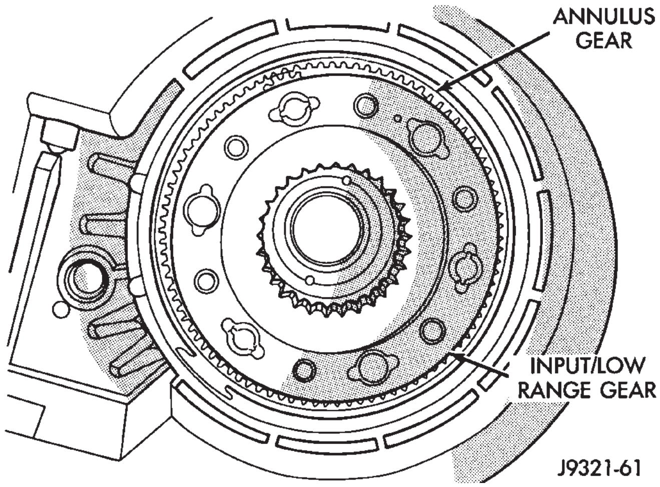


Fig. 65 Input/Low Range Gear Installation

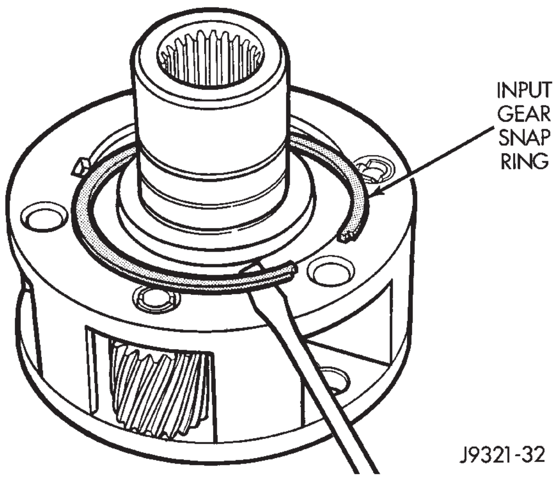


Fig. 66 Input Gear Snap Ring Installation

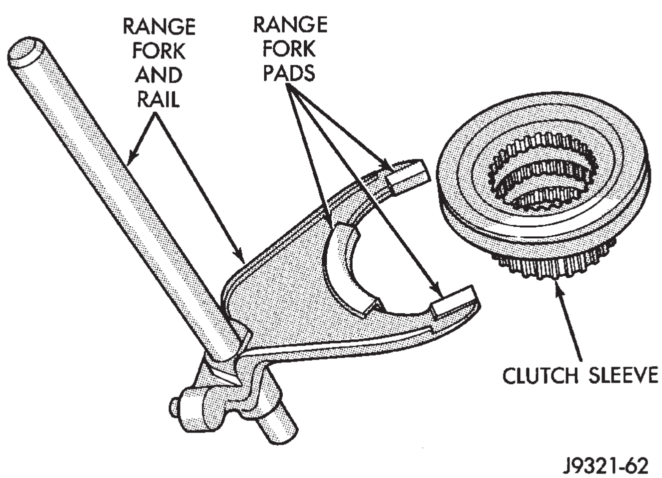


Fig. 67 Assembling Range Fork And Clutch Sleeve

DETENT INSTALLATION

(1) Rotate sector to Neutral position.

(2) Install new O-ring on detent plug (Fig. 69).

(3) Lubricate detent plunger with transmission fluid or light coat of petroleum jelly.

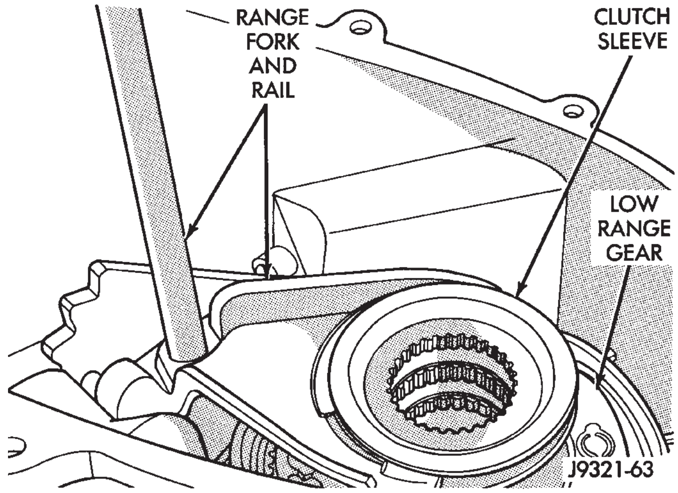


Fig. 68 Range Fork And Clutch Sleeve Installation

(4) Install detent plunger, spring and plug (Fig. 69).

(5) Verify that plunger is properly engaged in sector.

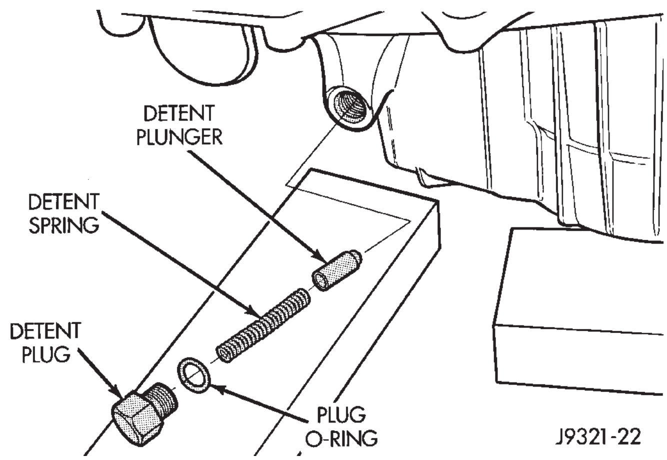


Fig. 69 Shift Detent Components

MAINSHAFT—DIFFERENTIAL ASSEMBLY AND INSTALLATION

(1) Lubricate pins on front carrier (Fig. 70) with transmission fluid or petroleum jelly.

(2) Install first set of thrust washers on front carrier pins (Fig. 70).

(3) Install sprocket gear in front carrier (Fig. 70).

(4) Install mainshaft gear in sprocket gear (Fig. 71).

(5) Install pinion gears on carrier pins (Fig. 72). Be sure short and long gears are installed on correct pins.

(6) Install remaining set of thrust washers on carrier pins and on top of pinion gears (Fig. 72).

(7) Install differential front carrier on rear carrier. Align carriers with paint mark made at disassembly (Fig. 73).

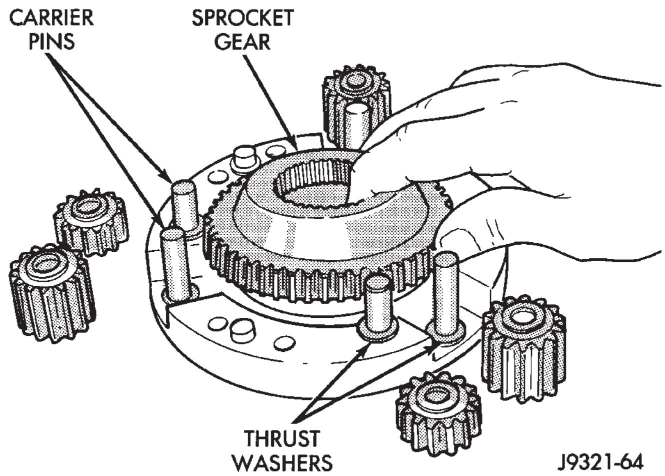


Fig. 70 Sprocket Gear And Thrust Washer Installation

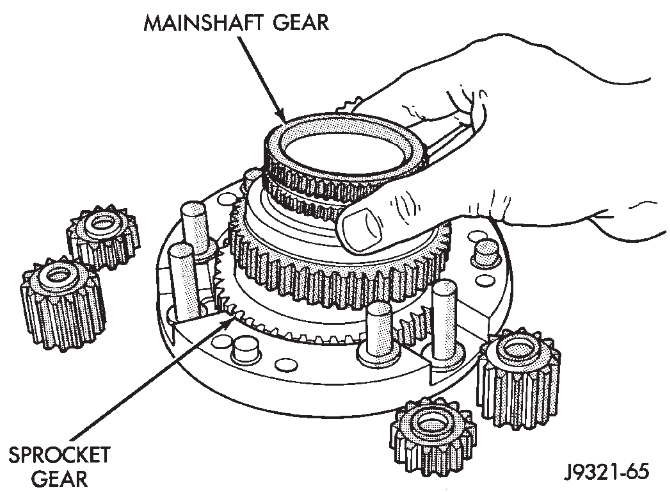


Fig. 71 Installing Mainshaft Gear

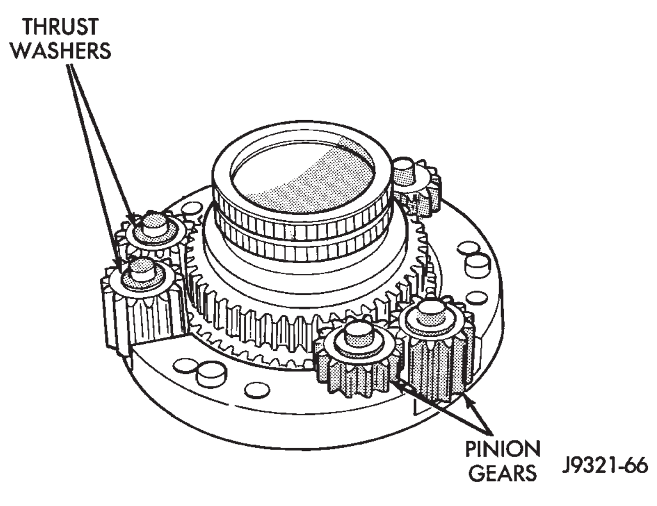


Fig. 72 Pinion Gear And Thrust Washer Installation

(8) Install and tighten differential carrier bolts to 17-27 N·m (150-240 in. lbs.) torque.

(9) Install first needle bearing spacer in bore of mainshaft gear (Fig. 74).

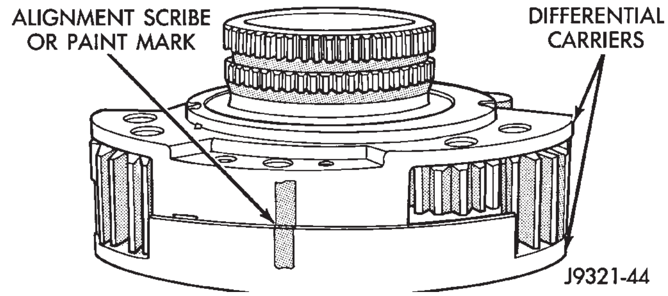


Fig. 73 Differential Carrier Alignment And Assembly

(10) Install remaining needle bearing spacer on mainshaft (Fig. 75). Seat spacer against shaft flange.

(11) Apply liberal quantity of petroleum jelly to needle bearings and to bore of mainshaft gear (Fig. 75). Petroleum jelly will prelubricate and hold bearings in place during assembly.

(12) Install mainshaft needle bearings in bore of mainshaft gear (Fig. 75). A total of 53 bearings are required.

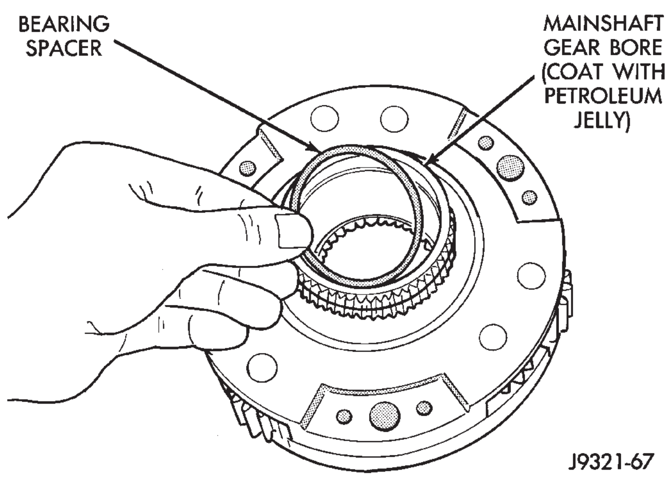


Fig. 74 Installing Bearing Spacer In Mainshaft Gear

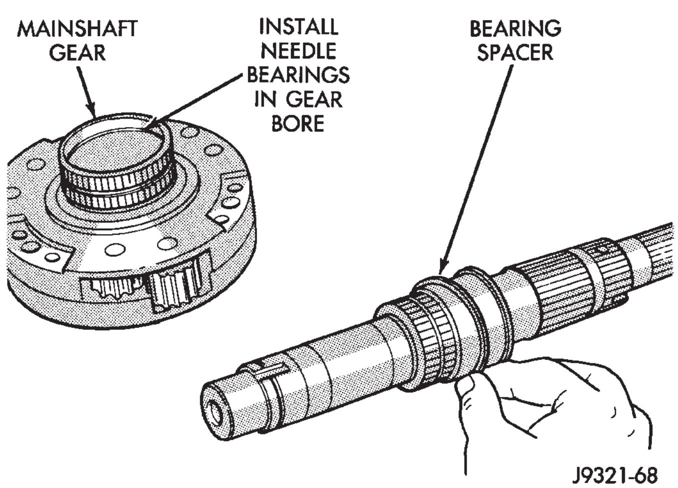


Fig. 75 Installing Bearing Spacer And Needle Bearings

(13) Install mainshaft in differential (Fig. 76). Rotate shaft to verify that bearings were not displaced during assembly. Also be sure that shaft is fully seated in differential.

(14) Install mainshaft snap ring (Fig. 77).

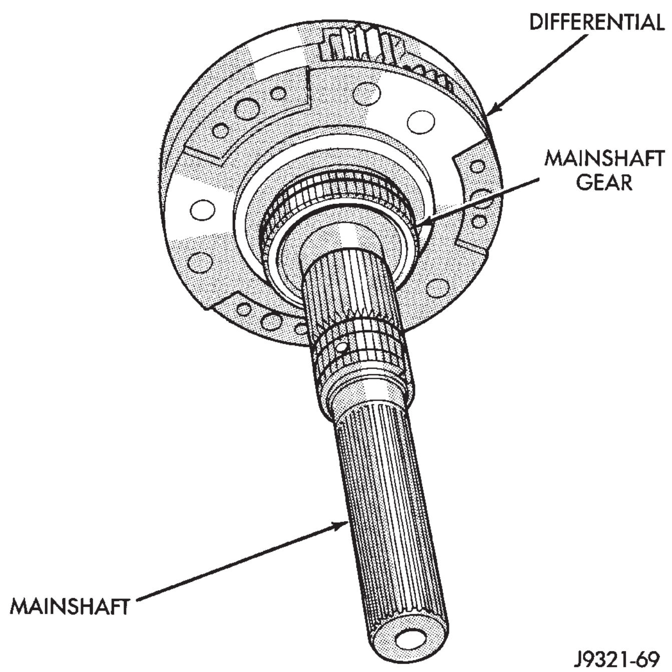


Fig. 76 Installing Mainshaft In Differential

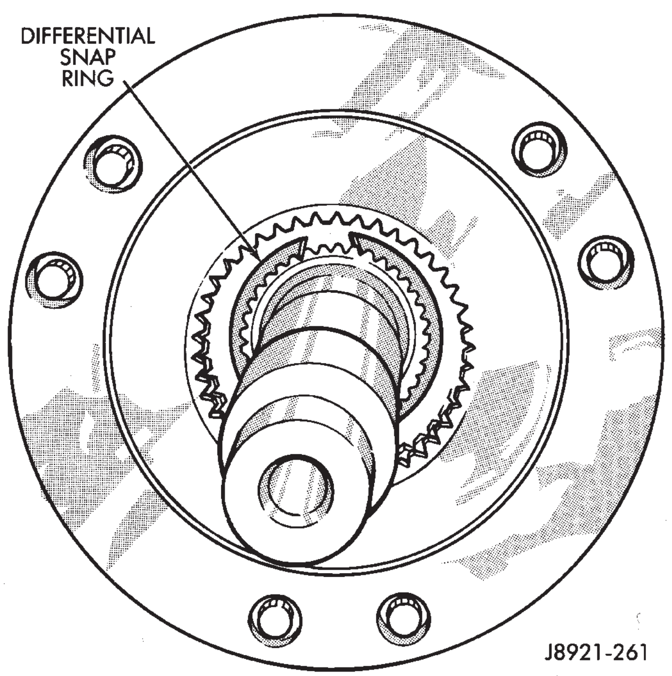


Fig. 77 Differential Snap Ring Installation

(15) Install clutch shaft (Fig. 78).

(16) Install thrust ring on end of mainshaft (Fig. 79). Be sure notch on ring seats in notch in shaft.

(17) Install clutch shaft snap ring (Fig. 80). Be sure snap ring is fully seated in ring groove.

(18) Install assembled mainshaft and differential in low range gear and clutch gears (Fig. 81).

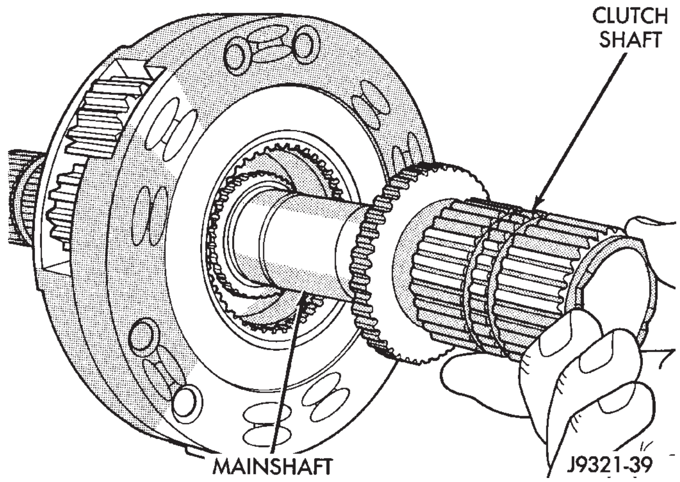


Fig. 78 Clutch Shaft Installation

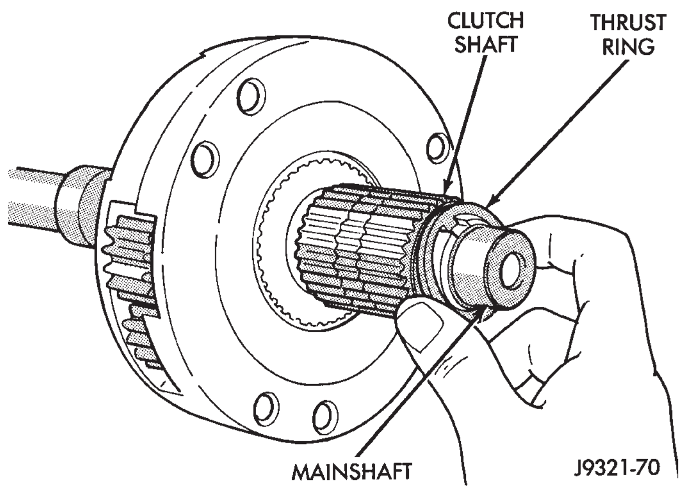


Fig. 79 Clutch Shaft Thrust Ring Installation

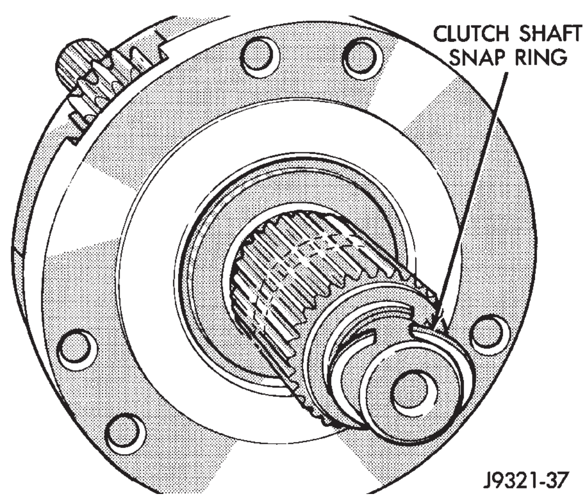


Fig. 80 Clutch Shaft Snap Ring Installation

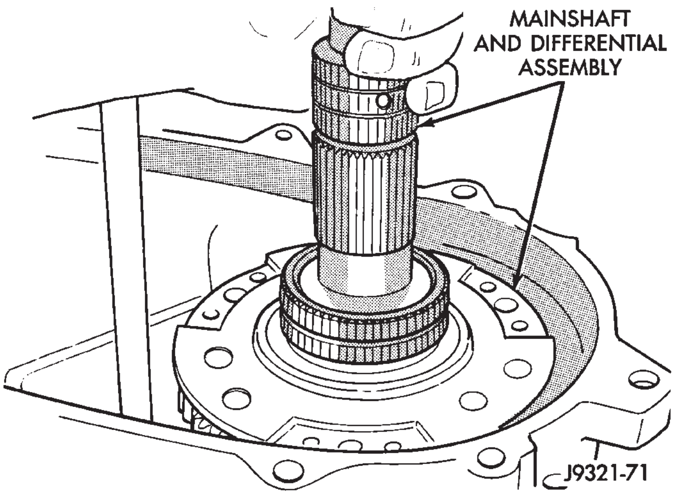


Fig. 81 Installing Mainshaft And Differential Assembly

DRIVE CHAIN—OUTPUT SHAFT—SPROCKET INSTALLATION

(1) Lubricate front output shaft-sprocket assembly, drive chain and drive sprocket with transmission fluid.

(2) Assemble drive chain, drive sprocket and front output shaft (Fig. 82).

(3) Start drive sprocket on mainshaft.

(4) Guide front shaft into bearing and drive sprocket onto mainshaft drive gear (Fig. 82).

(5) Install drive sprocket snap ring (Fig. 83).

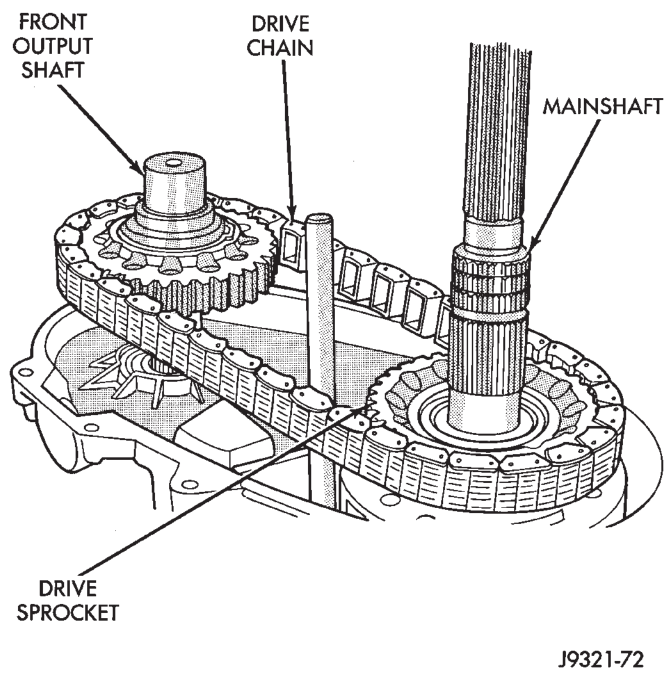


Fig. 82 Installing Drive Chain, Front Output Shaft And Drive Sprocket

VISCOUS COUPLING INSTALLATION

(1) Lubricate mainshaft splines with transmission fluid.

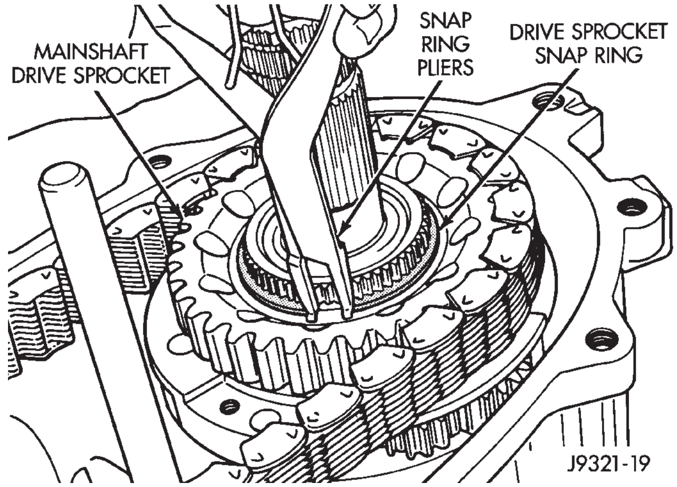


Fig. 83 Installing Drive Sprocket Snap Ring

(2) Install coupling on mainshaft (Fig. 84).

(3) Install coupling retaining snap ring first (Fig. 84). Be sure snap ring is fully seated before proceeding.

(4) Install oil pump locating snap ring on mainshaft (Fig. 84).

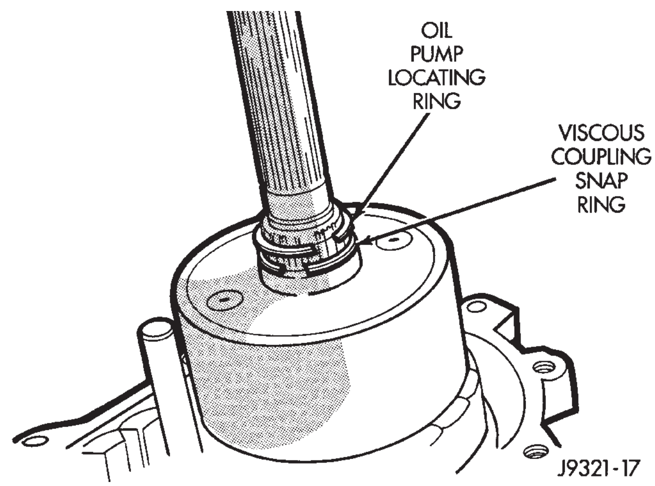


Fig. 84 Viscous Coupling And Oil Pump Ring Installation

REAR CASE INSTALLATION

(1) Clean sealing flanges of front case and rear case with a wax and grease remover.

(2) Install new O-ring on flanged end of oil pickup tube.

(3) Install oil pickup tube in rear case. Be sure tube is seated in case notch as shown (Fig. 85).

(4) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to mounting flange of front case. Work sealer bead around bolt holes as shown (Fig. 86).

(5) Align and install rear case on front case (Fig. 87).

(6) Verify that oil pickup tube is still seated in case notch and tube end is pointed toward mainshaft (Fig. 88).

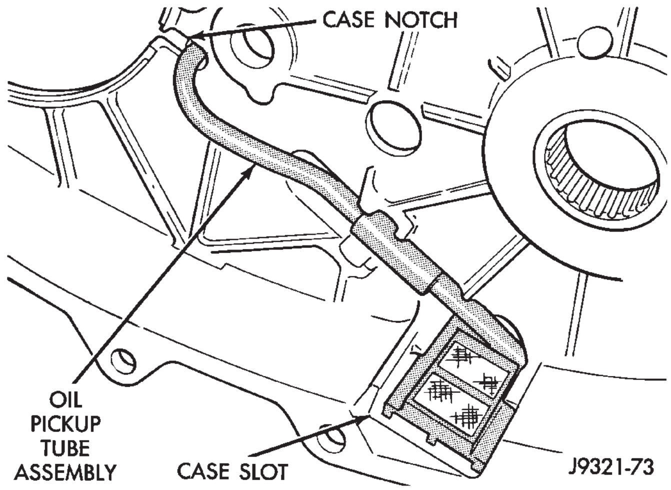


Fig. 85 Oil Pickup Tube Installation

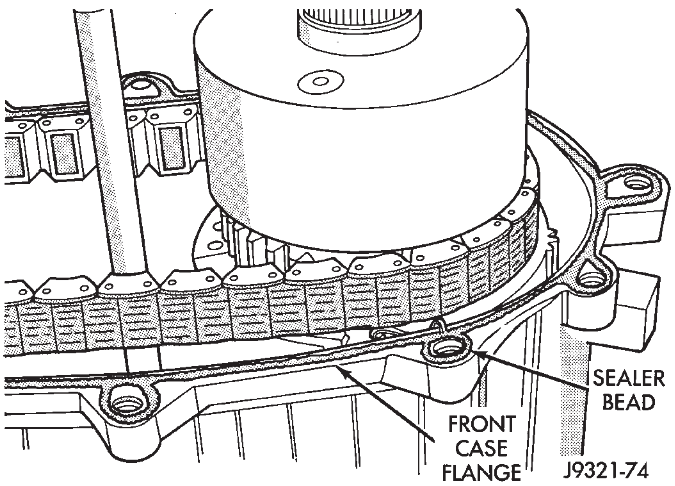


Fig. 86 Applying Sealer To Front Case Flange

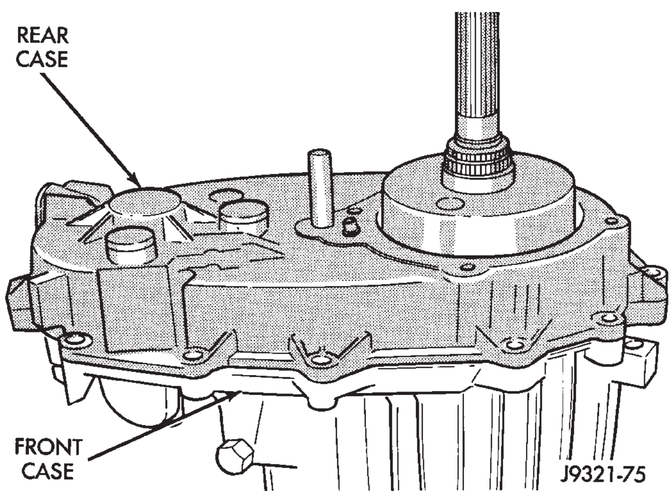


Fig. 87 Rear Case Installation

(7) Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (Fig. 89).

(8) Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

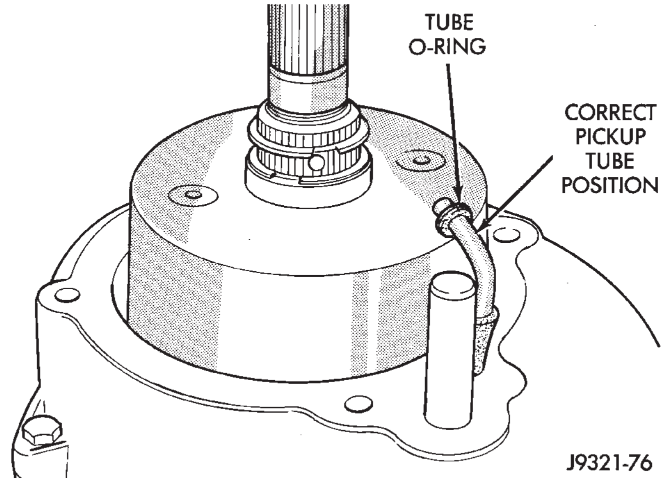


Fig. 88 Checking Position Of Oil Pickup Tube

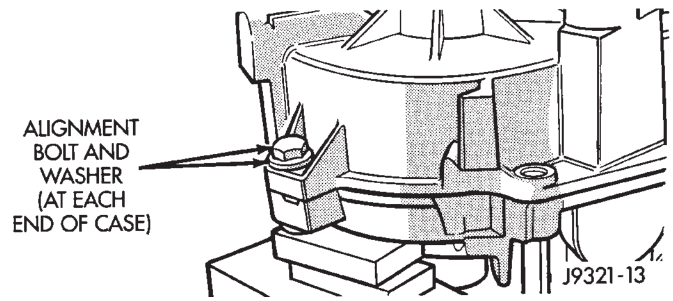


Fig. 89 Alignment Bolt Location

OIL PUMP—REAR BEARING—REAR RETAINER INSTALLATION

(1) Install oil pump (Fig. 90).

(2) Insert oil pickup tube in pump (Fig. 91).

(3) Install rear bearing on mainshaft (Fig. 91). Locating ring groove in bearing goes toward end of mainshaft.

(4) Install rear bearing retaining snap ring (Fig. 92).

(5) Install speedometer drive gear (Fig. 93).

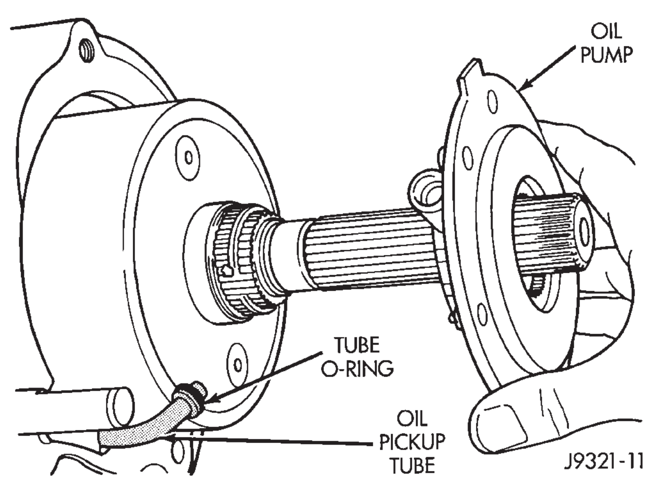


Fig. 90 Installing Oil Pump

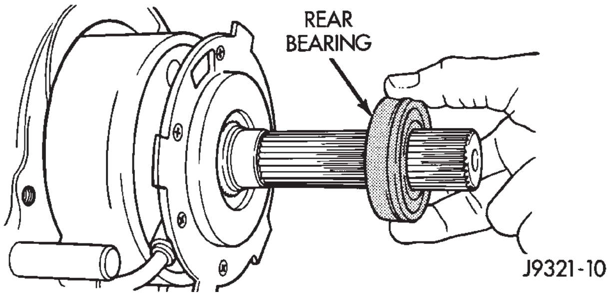


Fig. 91 Rear Bearing Installation

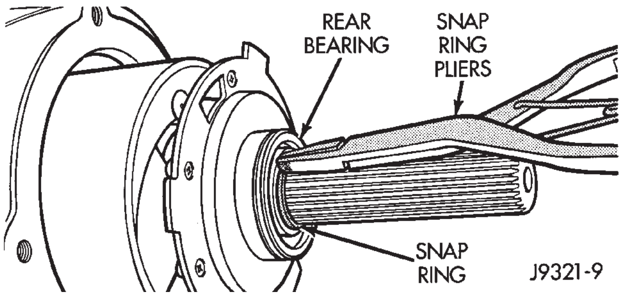


Fig. 92 Rear Bearing Snap Ring Installation

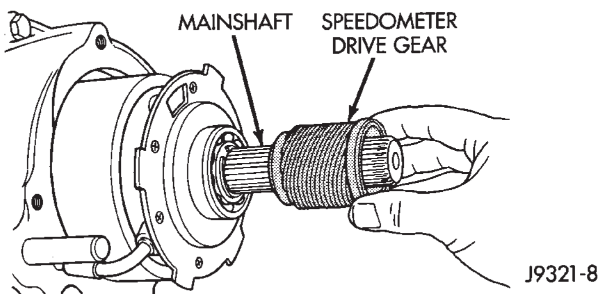


Fig. 93 Speedometer Drive Gear Installation

(6) Install rear bearing locating ring in rear retainer, if ring was removed during overhaul.

(7) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker, silicone adhesive sealer, or Loctite 518 to mounting surface of rear retainer. Allow sealer to set-up slightly before proceeding.

(8) Slide rear retainer onto mainshaft (Fig. 94).

(9) Spread rear bearing locating ring and slide rear retainer into place on rear case (Fig. 95).

(10) Install and tighten rear retainer bolts to 27-34 N·m (20-25 ft. lbs.).

(11) Install locating ring access cover and gasket (Fig. 96). Tighten plate attaching screws to 10 N·m (85 in. lbs.) torque.

FRONT BEARING RETAINER, YOKE AND RANGE LEVER INSTALLATION

(1) Apply 3 mm (1/8 in.) wide bead of Mopar Gasket Maker, silicone adhesive sealer, or Loctite 518 to mating surface of front bearing retainer. Allow sealer to set-up slightly before installing retainer.

(2) Install front bearing retainer (Fig. 97). Tighten retainer bolts to 16-24 N·m (12-18 ft. lbs.) torque.

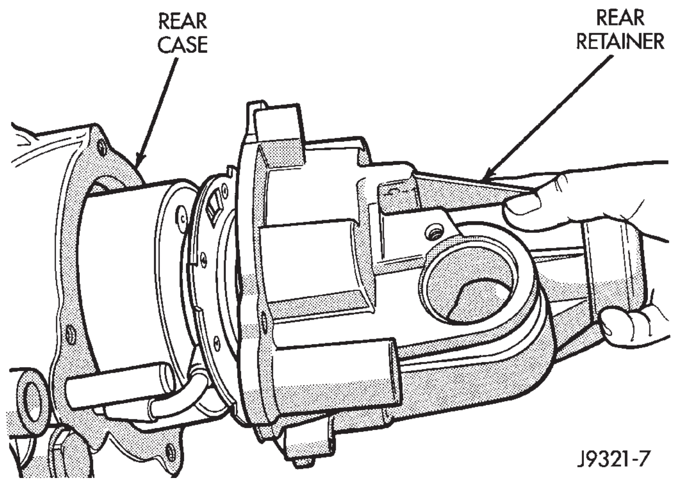


Fig. 94 Rear Retainer Installation

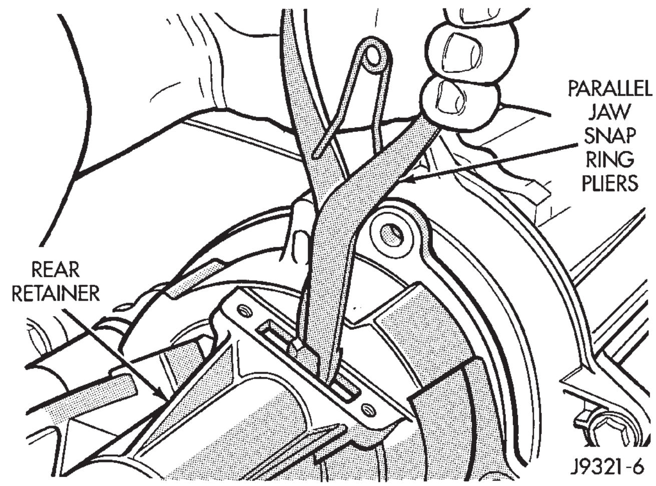


Fig. 95 Engaging Rear Bearing Locating Ring

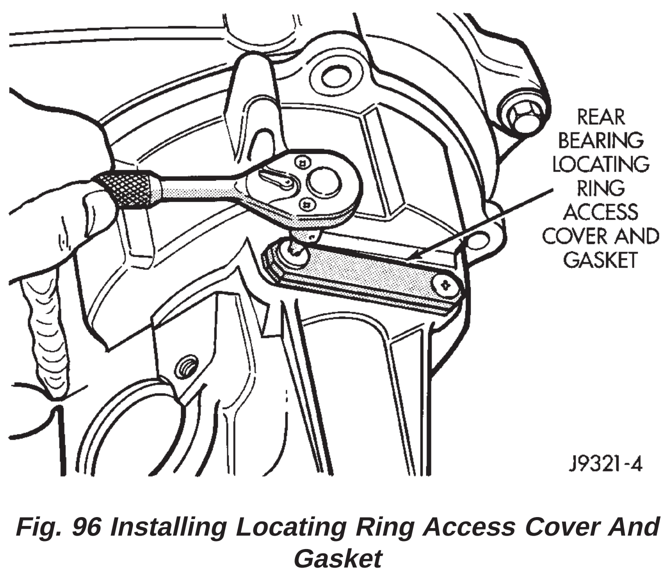


Fig. 96 Installing Locating Ring Access Cover And Gasket

(3) Install new seal washer on front output shaft (Fig. 98).

(4) Install yoke and new yoke nut on front output shaft (Fig. 99).

(5) Tighten yoke nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281, or similar tool to hold yoke while tightening yoke nut.

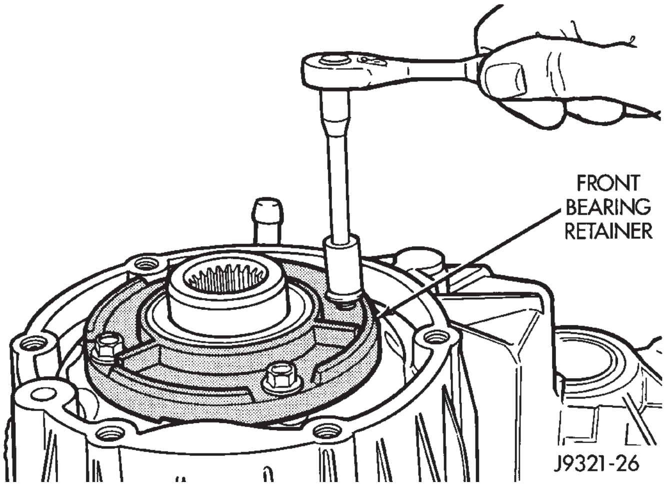


Fig. 97 Front Bearing Retainer Installation

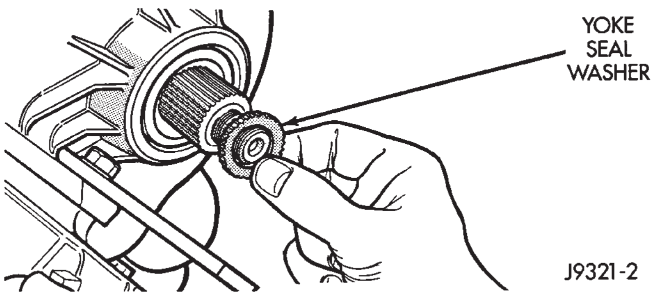


Fig. 98 Yoke Seal Washer Installation

(6) Install range lever, washer and locknut on sector shaft (Fig. 100). Tighten locknut to 27-34 N·m (20-25 ft. lbs.) torque.

(7) Install drain plug. Tighten plug and switch to 41-54 N·m (30-40 ft. lbs.) torque.

(8) Install and tighten indicator switch to 20-34 N·m (15-25 ft. lbs.) torque.

(9) Level transfer case and fill it with Mopar Dexron II. Correct fill level is to bottom edge of fill plug hole.

(10) Install and tighten fill plug to 41-54 N·m (30-40 ft. lbs.) torque.

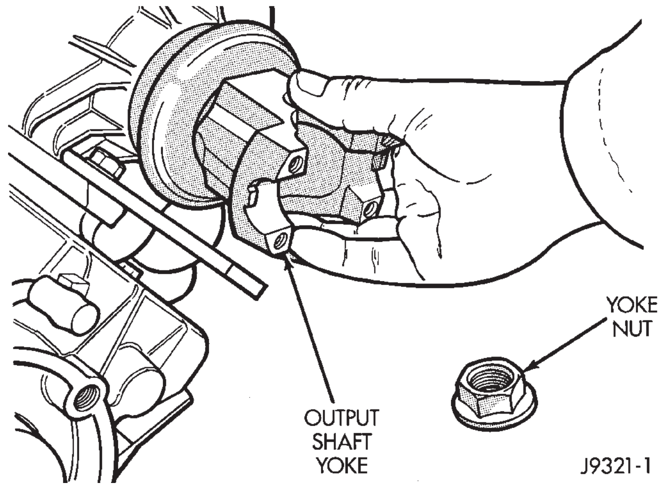


Fig. 99 Output Shaft Yoke Installation

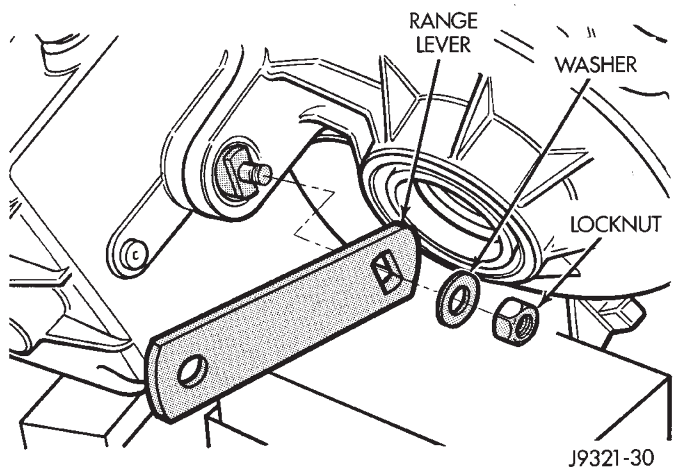
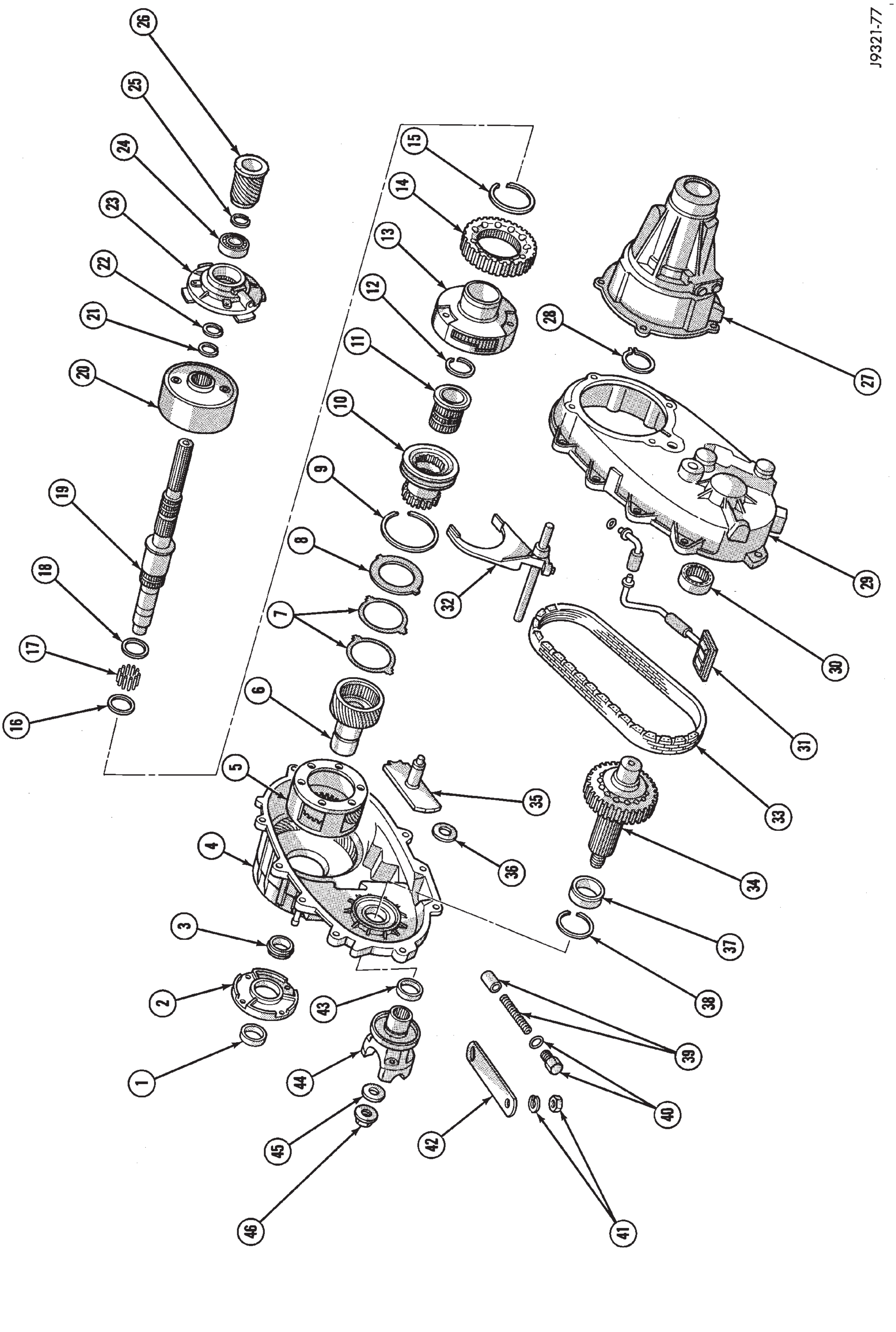


Fig. 100 Range Lever Installation



NP249 TRANSFER CASE

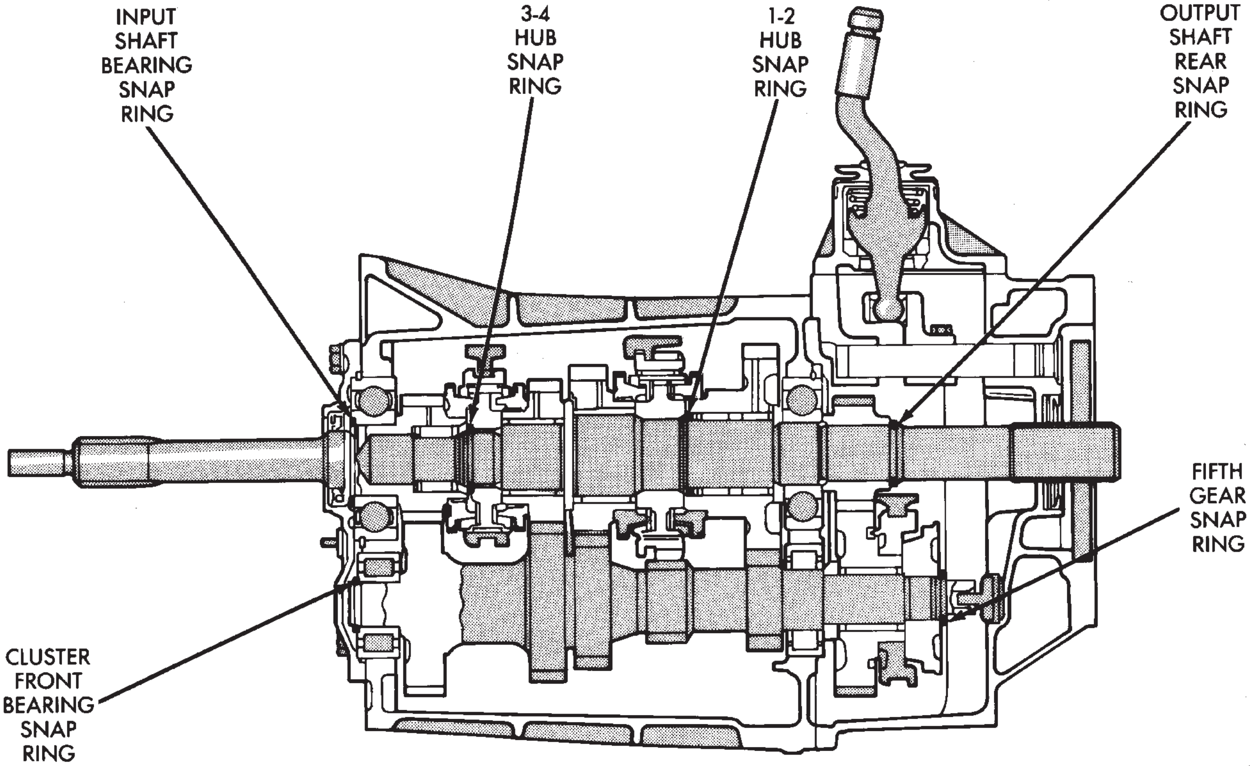
SPECIFICATIONS

LEGEND FOR NP249 TRANSFER CASE

1. Oil Seal
2. Front Bearing Retainer
3. Mainshaft Front Bearing and Locating Ring
4. Front Case (includes low range annulus gear and shift rail bushing)
5. Low Range Gear
6. Input Gear
7. Tabbed Thrust Washer (2)
8. Retainer Plate
9. Input Gear Snap Ring
10. Clutch Sleeve
11. Clutch Shaft
12. Differential Snap Ring
13. Differential Assembly
14. Mainshaft Drive Gear
15. Drive Gear Snap Ring
16. Mainshaft Bearing Spacer
17. Mainshaft Needle Bearings (53)
18. Mainshaft Bearing Spacer
19. Mainshaft
20. Viscous Coupling
21. Viscous Coupling Snap Ring
22. Oil Pump Locating Snap Ring
23. Oil Pump
24. Mainshaft Rear Bearing
25. Rear Bearing Snap Ring
26. Speedometer Drive Gear
27. Rear Retainer Assembly (includes retainer cap, oil seal, bushing, access cover and gasket)
28. Rear Bearing Locating Ring
29. Front Case
30. Front Output Shaft Rear Bearing
31. Oil Pickup Tube Assembly (includes connecting hoses, pickup screen, tubes and O-ring)
32. Range Fork and Shift Rail Assembly (includes range fork pads)
33. Drive Chain
34. Front Output Shaft
35. Shift Sector
36. Case Magnet
37. Front Output Shaft Front Bearing
38. Bearing Snap Ring
39. Detent Plunger and Spring
40. Detent Plug and O-Ring
41. Range Lever Locknut and Washer
42. Range Lever
43. Oil Seal (Front Output Shaft Front Bearing)
44. Output Shaft Yoke
45. Yoke Seal Washer
46. Yoke Nut

J9321-80

AX-15 SELECTIVE SNAP RING CHART



INPUT SHAFT BEARING SNAP RING

I.D. MARK	THICKNESS
A	2.10-2.15 mm
B	2.15-2.20 mm
C	2.20-2.25 mm
D	2.25-2.30 mm
E	2.30-2.35 mm
F	2.35-2.40 mm
G	2.40-2.45 mm

1-2 HUB SNAP RING

I.D. MARK	THICKNESS
B	2.35-2.40 mm
C	2.40-2.45 mm
D	2.45-2.50 mm
E	2.50-2.55 mm
F	2.55-2.60 mm
G	2.60-2.65 mm

CLUSTER FRONT BEARING SNAP RING

I.D. MARK	THICKNESS
A	2.00-2.05 mm
B	2.05-2.10 mm
C	2.10-2.15 mm
D	2.15-2.20 mm
E	2.20-2.25 mm

OUTPUT SHAFT REAR SNAP RING

I.D. MARK	THICKNESS
A	2.75-2.80 mm
B	2.80-2.85 mm
C	2.85-2.90 mm
D	2.90-2.95 mm
E	2.95-3.00 mm
F	3.00-3.05 mm
G	3.05-3.10 mm
H	3.10-3.15 mm
I	3.15-3.20 mm
J	3.20-3.25 mm
K	3.25-3.30 mm
L	3.30-3.35 mm

3-4 HUB SNAP RING

I.D. MARK	THICKNESS
A	1.80-1.85 mm
B	1.85-1.90 mm
C	1.90-1.95 mm
D	1.95-2.00 mm
E	2.00-2.05 mm
F	2.05-2.10 mm
G	2.10-2.15 mm

FIFTH GEAR SNAP RING

I.D. MARK	THICKNESS
A	2.80-2.85 mm
B	2.85-2.90 mm
C	2.90-2.95 mm
D	2.95-3.00 mm
E	3.00-3.05 mm
F	3.05-3.10 mm
G	3.10-3.15 mm
H	3.15-3.20 mm

J8921-1131

AX-15 TORQUE SPECIFICATIONS

Description	Torque
Access Plugs	19 N•m (14 ft. lbs.)
Adapter Housing Bolts	37 N•m (27 ft. lbs.)
Backup Light Switch	37 N•m (27 ft. lbs.)
Drain and Fill Plugs	37 N•m (27 ft. lbs.)
Front Bearing Retainer Bolts	17 N•m (12 ft. lbs.)
Interlock and Detent Ball Plugs	19 N•m (14 ft. lbs.)
Propeller Shaft Clamp Screws	16-23 N•m (140-200 in. lbs.)
Rear Mount-To-Transmission Bolts	33-60 N•m (24-44 ft. lbs.)
Rear Mount Clevis Bolt/Nut	54-75 N•m (40-55 ft. lbs.)
Rear Mount-To-Crossmember Nuts	33-49 N•m (24-36 ft. lbs.)
Restrictor Pins	19 N•m (14 ft. lbs.)
Reverse Shift Arm Bracket Bolts	18 N•m (13 ft. lbs.)
Shift Arm Set Screw	38 N•m (28 ft. lbs.)
Shift Fork Set Screws	20 N•m (15 ft. lbs.)
Shift Knob Nut	20-34 N•m (15-25 ft. lbs.)
Shift Lever Floor Cover Screws	2-3 N•m (17-30 in. lbs.)
Shift Tower Bolts	18 N•m (13 ft. lbs.)
Transfer Case Mounting Nuts	30-41 N•m (22-30 ft. lbs.)

J9321-89

42RE GENERAL SPECIFICATIONS

TRANSMISSION MODEL	42 RE
Oil Pump Clearances (all)	0.089-0.190 mm (0.0035-0.0075 in)
Planetary End Play	0.127-1.22 mm (0.005-0.048 in)
Input Shaft End Play	0.56-2.31 mm (0.022-0.091 in)
Clutch Pack Clearance: Front Clutch (4 Disc) Rear Clutch (4 Disc)	 1.70-3.40 mm (0.067-0.134 in) 0.81-1.40 mm (0.032-0.055 in)
Clutch Disc Usage: Front Clutch Rear Clutch Overdrive Clutch Direct Clutch	 4 4 3 6
Band Adjustments: (backed off form 72 in. lbs.) Front Band Rear Band	 3-5/8 Turns 4 Turns
Recommended (and preferred) Fluid	MOPAR ATF Plus, Type 7176 Automatic Transmission Fluid

J9321-449

42RE THRUST WASHER/SPACER/SNAP RING DIMENSIONS

TRANSMISSION MODEL	42 RE
Front Clutch Thrust Washer (on reaction shaft support hub)	0.061 in.
Rear Clutch Thrust Washer (on clutch retainer)	0.061 in.
Intermediate Shaft Thrust Plate (on shaft pilot hub)	0.060-0.063 in.
Intermediate Shaft Thrust Washer (in rear clutch hub)	Select fit to set overall end play
Rear Clutch Pack Snap Ring	0.060 in. 0.076 in. 0.098 in.
Planetary Geartrain Snap Ring (at front end of intermediate shaft)	Select fit (3 thicknesses available)
Overdrive Piston Thrust Plate	Thrust plate and spacer are select fit components. Refer to size charts and selection procedures in "Overdrive Unit Assembly and Adjustment."
Intermediate Shaft Spacer	

J9321-450

42RE PRESSURE TEST SPECIFICATIONS

Overdrive Clutch	Fourth Gear Only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line Pressure (at accumulator)	Closed Throttle	372-414 kPa (54-60 psi)
Front Servo	Third Gear Only	No more than 21 kPa (3 psi) lower than line pressure.
Rear Servo	1 Range R Range	No more than 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm
Governor	D Range Closed Throttle	Pressure should respond smoothly to changes in mph and return to 0-7 kPa (0-1 1/2 psi) when stopped with transmission in D, 1, 2. **Pressure above 20.6 kPa (3 psi) at standstill will prevent transmission from downshifting.**

J9521-120

42RE TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Cooler Line Fittings (at transmission)	18 N•m (13 ft. lbs.)
Converter Bolts: 10.75 in., 4-lug converter	31 N•m (270 in. lbs.)
Crossmember Bolts/Nuts	68 N•m (50 ft. lbs.)
Driveplate Bolts	75 N•m (55 ft. lbs.)
Front Band Lever Pivot Shaft Access Plug	17 N•m (13 ft. lbs.)
Front Band Adjusting Screw Locknut	34 N•m (25 ft. lbs.)
Park/Neutral Position Switch	34 N•m (25 ft. lbs.)
Oil Filter Screws	4 N•m (35 in. lbs.)
Oil Pan Bolt	17 N•m (13 ft. lbs.)
Oil Pump Bolt	20 N•m (15 ft. lbs.)
Overrunning Clutch Cam Bolts	17 N•m (150 in. lbs.)

DESCRIPTION	TORQUE
Overdrive-to-Transmission Case Bolts	34 N•m (25 ft. lbs.)
Overdrive Piston Retainer Bolts	17 N•m (150 in. lbs.)
Pressure Test Port Plugs	14 N•m (10 ft. lbs.)
Propeller Shaft Clamp Bolts	19 N•m (170 in. lbs.)
Reaction Shaft Support Bolts	20 N•m (15 ft. lbs.)
Rear Band Adjusting Screw Locknut	41 N•m (30 ft. lbs.)
Solenoid Wiring Connector Screw	4 N•m (35 in. lbs.)
Solenoid-to-Transfer Plate Screw	4 N•m (35 in. lbs.)
Speedometer Adapter Bolt	11 N•m (8 ft. lbs.)
Valve Body/Governor Body Screws	4 N•m (35 in. lbs.)
Valve Body-to-Case Bolts	12 N•m (100 in. lbs.)
Transmission speed sensor	27 N•m (20 ft. lbs.)

J9321-451

46RH GENERAL SPECIFICATIONS

TRANSMISSION MODEL	46RH
Oil Pump Tip and Outer Gear-to-Housing Clearances	0.089-0.190 mm (0.0035-0.0075 in.)
Planetary End Play	0.15-1.22 mm (0.006-0.048 in.)
Input Shaft End Play	0.86-2.13 mm (0.034-0.084 in.)
Clutch Pack Clearance:	
Front Clutch - 3 Disc	1.78-3.28 mm (0.070-0.129 in.)
Rear Clutch - 4 Disc	0.64-1.14 mm (0.025-0.045 in.)
Clutch Disc Usage:	
Front Clutch	3
Rear Clutch	4
Overdrive Clutch	4
Direct Clutch	8
Front Clutch Spring Usage	9
Band Adjustments: (backed off from 72 in. lbs.)	
Front Band	2-7/8
Rear Band	2
Recommended Fluid	Mopar ATF Plus, Type 7176 Automatic Transmission Fluid

J9521-195

46RH THRUST WASHER/SPACER/SNAP RING DIMENSIONS

	46RH
Front Clutch Thrust Washer (on reaction shaft support hub)	0.061 in. 0.084 in. 0.102 in.
Rear Clutch Thrust Washer (on clutch retainer)	0.061 in.
Intermediate Shaft Thrust Plate (on shaft pilot hub)	0.060 - 0.063 in.
Output Shaft Thrust Washer (in rear clutch hub)	0.052 - 0.054 in. 0.068 - 0.070 in. 0.083 - 0.085 in.
Rear Clutch Pack Snap Ring	0.060 in. 0.074 in.
Planetary Geartrain Snap Ring (at front end of intermediate shaft)	0.055 - 0.059 in. 0.062 - 0.066 in.
Overdrive Piston Thrust Plate	Thrust plate and spacer are select fit components. Refer to size charts and selection procedures in "Overdrive Unit Assembly and Adjustment."
Intermediate Shaft Spacer	

J9521-119

46RH PRESSURE TEST SPECIFICATIONS

Overdrive Clutch	Fourth Gear Only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line Pressure (at accumulator)	Closed Throttle	372-414 kPa (54-60 psi)
Front Servo	Third Gear Only	No more than 21 kPa (3 psi) lower than line pressure.
Rear Servo	1 Range R Range	No more then 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm.
Governor	D Range Closed Throttle	Pressure should respond smoothly to changes in mph and return to 0-7 kPa (0-1½ psi) when stopped with transmission in D, 1, 2. **Pressure above 7 kPa (1½ psi) at standstill will prevent transmission from downshifting.**

J9321-471

46RH TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Converter Bolts:	
10.0 in., 4-lug converter	74 N·m (55 ft. lbs.)
10.75 in., 4-lug converter	31 N·m (270 in. lbs.)
Crossmember Bolts/Nuts	68 N·m (50 ft. lbs.)
Driveplate Bolts	75 N·m (55 ft. lbs.)
Front Band Reaction Pin Access Plug	17 N·m (13 ft. lbs.)
Front Band Adjusting Screw Locknut	34 N·m (25 ft. lbs.)
Park/Neutral Position Switch	34 N·m (25 ft. lbs.)
Oil Pan Bolt	17 N·m (13 ft. lbs.)
Oil Pump Bolt	20 N·m (15 ft. lbs.)
Overrunning Clutch Cam Bolts	17 N·m (150 in. lbs.)
Overdrive-to-Transmission Case Bolts	34 N·m (25 ft. lbs.)
Overdrive Piston Retainer Bolts	17 N·m (150 in. lbs.)
Pressure Test Port Plugs	14 N·m (10 ft. lbs.)
Propeller Shaft Clamp Bolts	19 N·m (170 in. lbs.)
Reaction Shaft Support Bolts	20 N·m (15 ft. lbs.)
Rear Band Adjusting Screw Locknut	41 N·m (30 ft. lbs.)
Solenoid Wiring Connector Screw	17 N·m (13 ft. lbs.)
Solenoid-to-Transfer Plate Screw	4 N·m (35 in. lbs.)
Speedometer Adapter Bolt	11 N·m (8 ft. lbs.)
Valve Body and Oil Filter Screws	4 N·m (35 in. lbs.)
Valve Body-to-Case Bolts	12 N·m (100 in. lbs.)

J9321-231

NP231/NP242 TORQUE SPECIFICATIONS

Description	Torque
Detent Plug	16-24 N•m (12-18 ft. lbs.)
Differential Case Bolt	17-27 N•m (150-240 in. lbs.)
Drain/Fill Plugs	40-54 N•m (30-40 ft. lbs.)
Extension Housing Bolt	35-46 N•m (26-34 ft. lbs.)
Front Bearing Retainer Bolt	16-27 N•m (12-20 ft. lbs.)
Front Case-To-Rear Case Bolt	35-46 N•m (26-34 ft. lbs.)
Front Yoke Nut	122-176 N•m (90-130 ft. lbs.)
Oil Pump Screw	1.4-1.8 N•m (12-15 in. lbs.)
Range Lever Nut	27-34 N•m (20-25 ft. lbs.)
Rear Retainer Bolt	35-46 N•m (26-34 ft. lbs.)
Transfer Case Mounting Nuts	35-47 N•m (26-35 ft. lbs.)
U-Joint Clamp Bolts	19 N•m (170 in. lbs.)
Vacuum Switch	20-34 N•m (15-25 ft. lbs.)

J9321-95

NP249 TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Crossmember Bolts	41-47 N•m (30-35 ft. lbs.)
Detent Plug	16-24 N•m (12-18 ft. lbs.)
Differential Carrier Bolts	17-27 N•m (150-240 in. lbs.)
Drain and Fill Plugs	41-54 N•m (30-40 ft. lbs.)
Electrical Switch	20-34 N•m (15-25 ft. lbs.)
Front Bearing Retainer Bolts	16-24 N•m (12-18 ft. lbs.)
Front Case-to-Rear Case Bolts	27-34 N•m (20-25 ft. lbs.)
Output Shaft Yoke Nut	122-176 N•m (90-130 ft. lbs.)
Rear Retainer Bolts	27-34 N•m (20-25 ft. lbs.)
Shift Lever Locknut	27-34 N•m (20-25 ft. lbs.)
Shift Rod Trunnion Bolt	11-20 N•m (96-180 in. lbs.)
Transfer Case Mounting Stud Nuts	33-41 N•m (24-30 ft. lbs.)
U-Joint Clamp Bolts	16-22 N•m (12-16 ft. lbs.)

J9321-79

WHEELS AND TIRES

CONTENTS

TIRES

INDEX

GENERAL INFORMATION

Tires are designed 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. These tires have specific load carrying capacities. When correctly inflated, they will operate properly.

Tires used in cool climates, and with light loads will have a longer life than tires used in hot climates with heavy loads. Abrasive road surfaces will accelerate tire wear.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain much greater mileage than careless drivers.

Driving habits that shorten the life of any tire;
- Rapid acceleration and deceleration
- Severe application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles

It is very important to follow the tire rotation interval

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. The speed rating is not always printed on the tire sidewall. The letter **S** indicates that the tire is speed rated up to 112 mph.
- **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.

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life, 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, but reduced speeds are recommended.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They use the same recommended inflation pressures.

SPARE TIRE (TEMPORARY)

The compact spare tire is designed for emergency use only. The original tire should be repaired and reinstalled at the first opportunity. Refer to Owner's Manual for complete details.

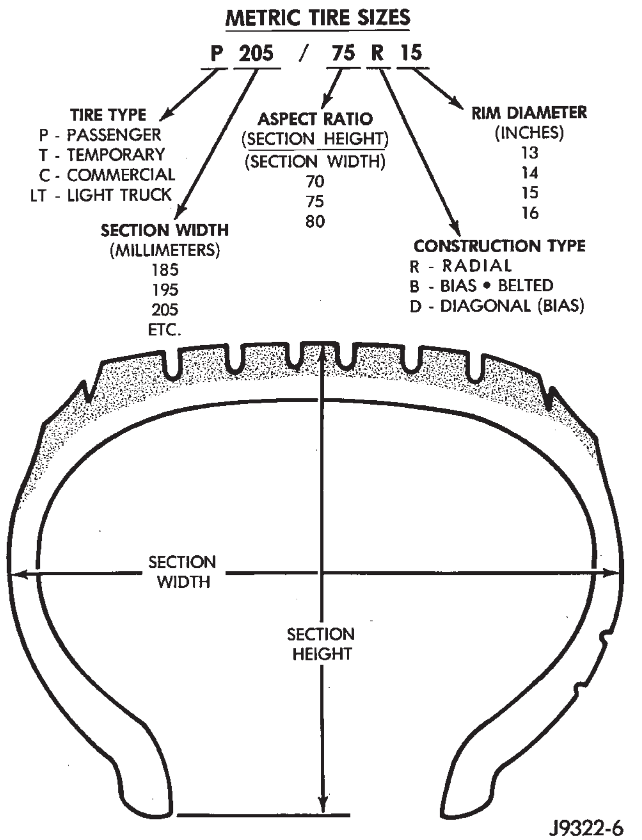


Fig. 1 Tire Size Identification

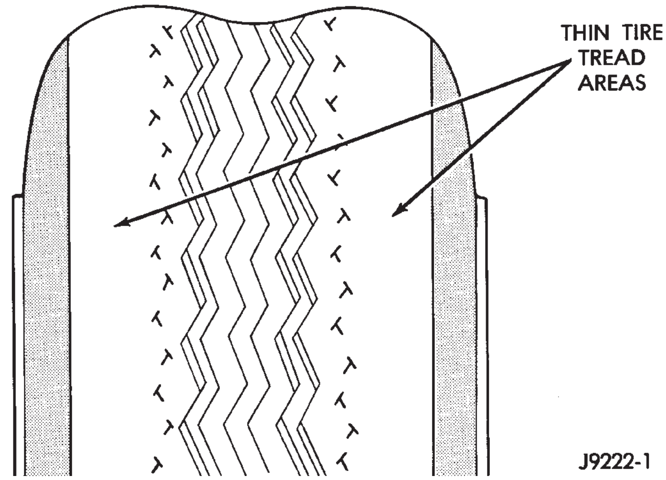


Fig. 2 Under Inflation Wear

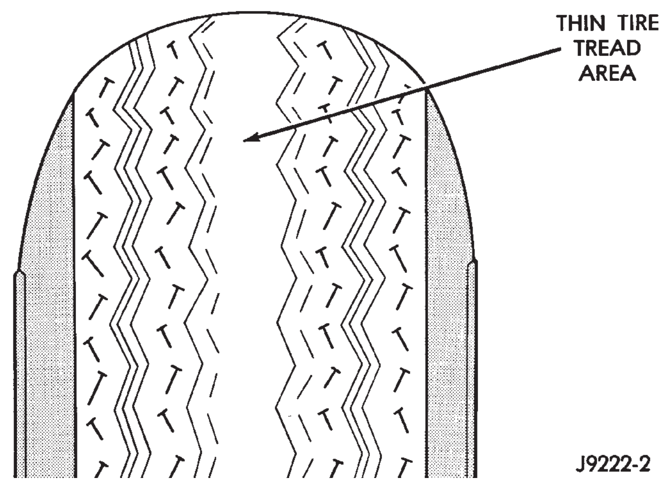


Fig. 3 Over Inflation Wear

TIRE CHAINS

Tire snow chains may be used on certain models. Refer to Owner's Manual for more information.

CLEANING OF TIRES

Steam cleaning may be used for cleaning.

DO NOT use gasoline or wire brush for cleaning.

DO NOT use mineral oil or an oil-based solvent.

PRESSURE GAUGES

High-quality, dial-type, air-pressure gauges are recommended. After checking with the gauge, replace valve cap finger tight.

TIRE INFLATION PRESSURES

Under inflation (Fig. 2) causes rapid shoulder wear and tire flexing.

Over inflation (Fig. 3) causes rapid center wear and loss of the tire's ability to cushion shocks.

Improper inflation can cause;

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Cause the vehicle to drift

Refer to the Owner's Manual for information regarding proper tire inflation pressure.

This pressure has been carefully selected to provide for safe vehicle operation. Tire pressure should be checked **cold** once per month. Tire pressure decreases when the outside temperature drops.

Inflation pressures specified on the placards are always **cold inflation pressure**. Cold inflation pressure is obtained after the vehicle has not been operated for at least 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.

Vehicles loaded to maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND CAN FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

REPLACEMENT TIRES

OEM tires provide a proper balance of many features such as;

- Ride

- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

Original equipment tires should be used when replacement is needed. Failure to use original or equivalent replacement tires, may adversely affect the handling of the vehicle.

Refer to the placard on the vehicle or the Owner's Manual for the correct replacement tire.

The use of oversize tires **is not recommended.** They may cause interference with vehicle suspension and steering travel. This can cause tire damage or failure.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE LOAD CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

ROTATION

Front and rear tires, operate at different loads and perform different steering, driving, and braking functions. For these reasons, the tires wear at unequal rates. They may also develop irregular wear patterns. These effects can be reduced by rotating the tires according to the maintenance schedule in the Owners Manual. This will improve tread life, traction and maintain a smooth quiet ride.

The suggested method of tire rotation is the **same side front to rear** pattern (Fig. 4). Other rotation methods can be used, but may not provide the same tire longevity benefits.

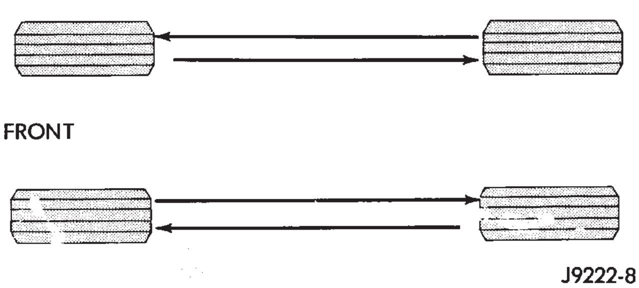


Fig. 4 Tire Rotation Pattern

TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band.

Tire replacement is necessary when indicators appear in two or more grooves (Fig. 5).

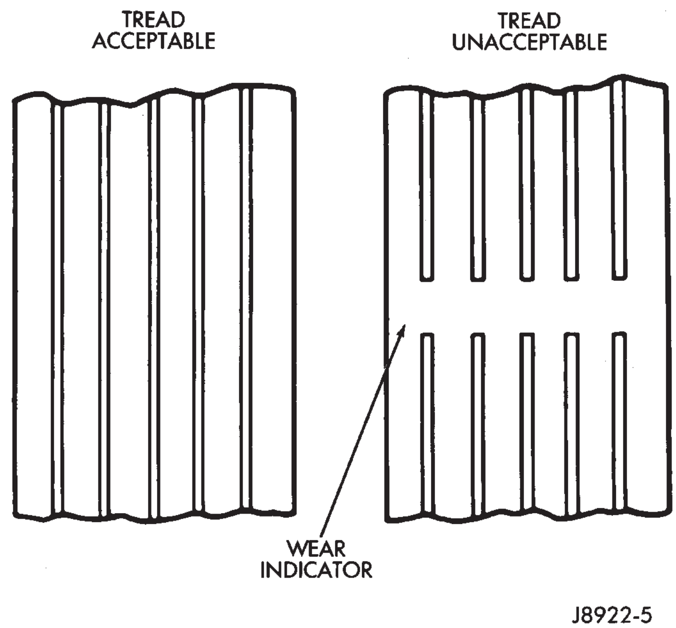


Fig. 5 Tread Wear Indicators

REPAIRING LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the puncture is in the **tread area** (Fig. 6). If outside the tread area the tire should be replaced.

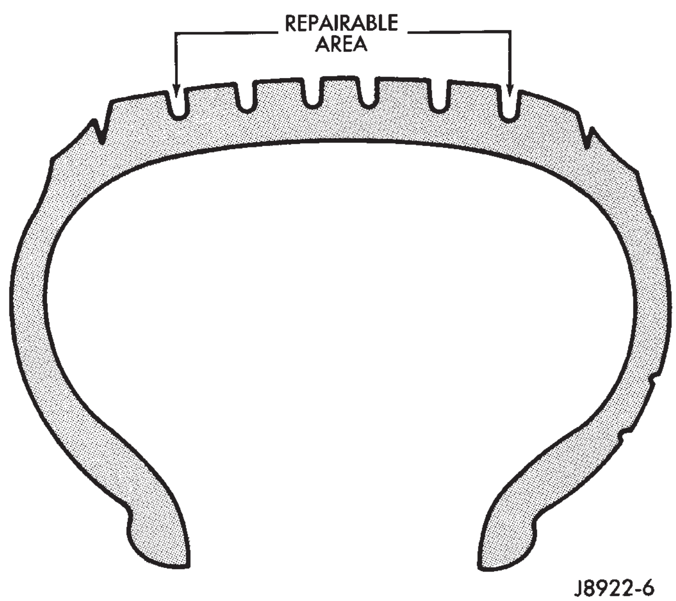


Fig. 6 Tire Repair Area

Deflate tire completely before dismounting tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges.

Before mounting tire on wheel, make sure all rust scale is removed from the rim. Repaint or seal if necessary.

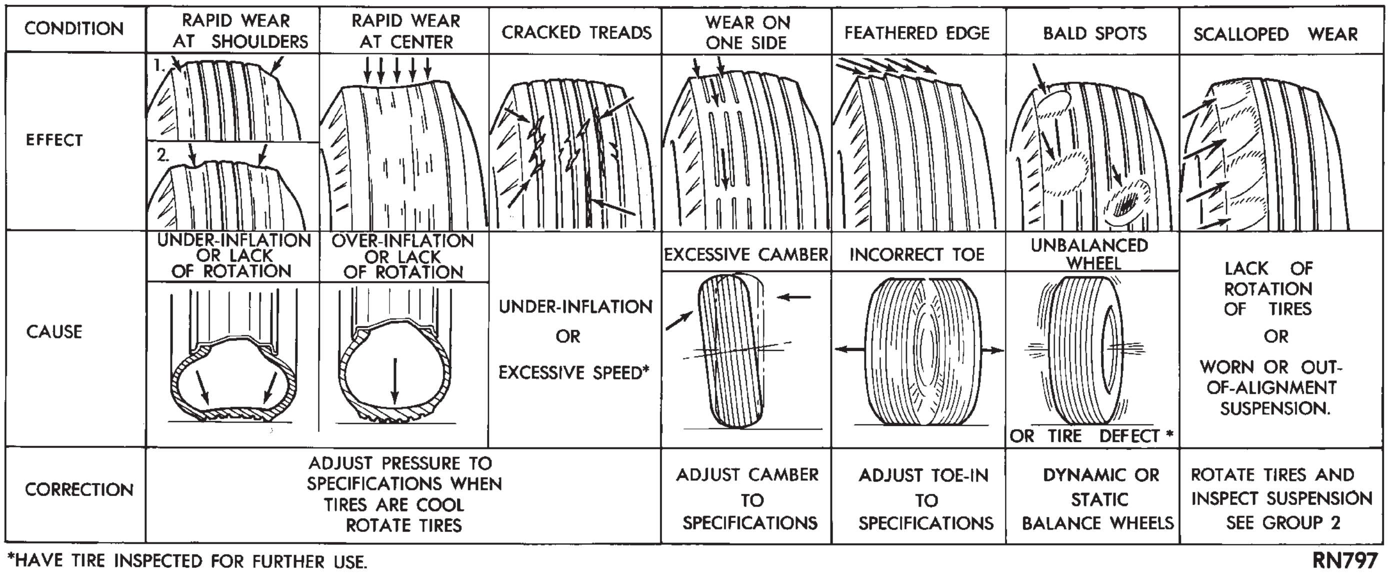


Fig. 7 Abnormal Tire Tread Wear Patterns

TIRE NOISE OR VIBRATION

The radial-ply tire on your vehicle is more sensitive to improper mounting, or imbalance.

To determine if tires are the cause of vibration, drive the vehicle over a smooth road at different speeds. Note the effect of acceleration and deceleration on noise level. Differential and exhaust noise will change in intensity as speed varies. Tire noise will usually remain constant.

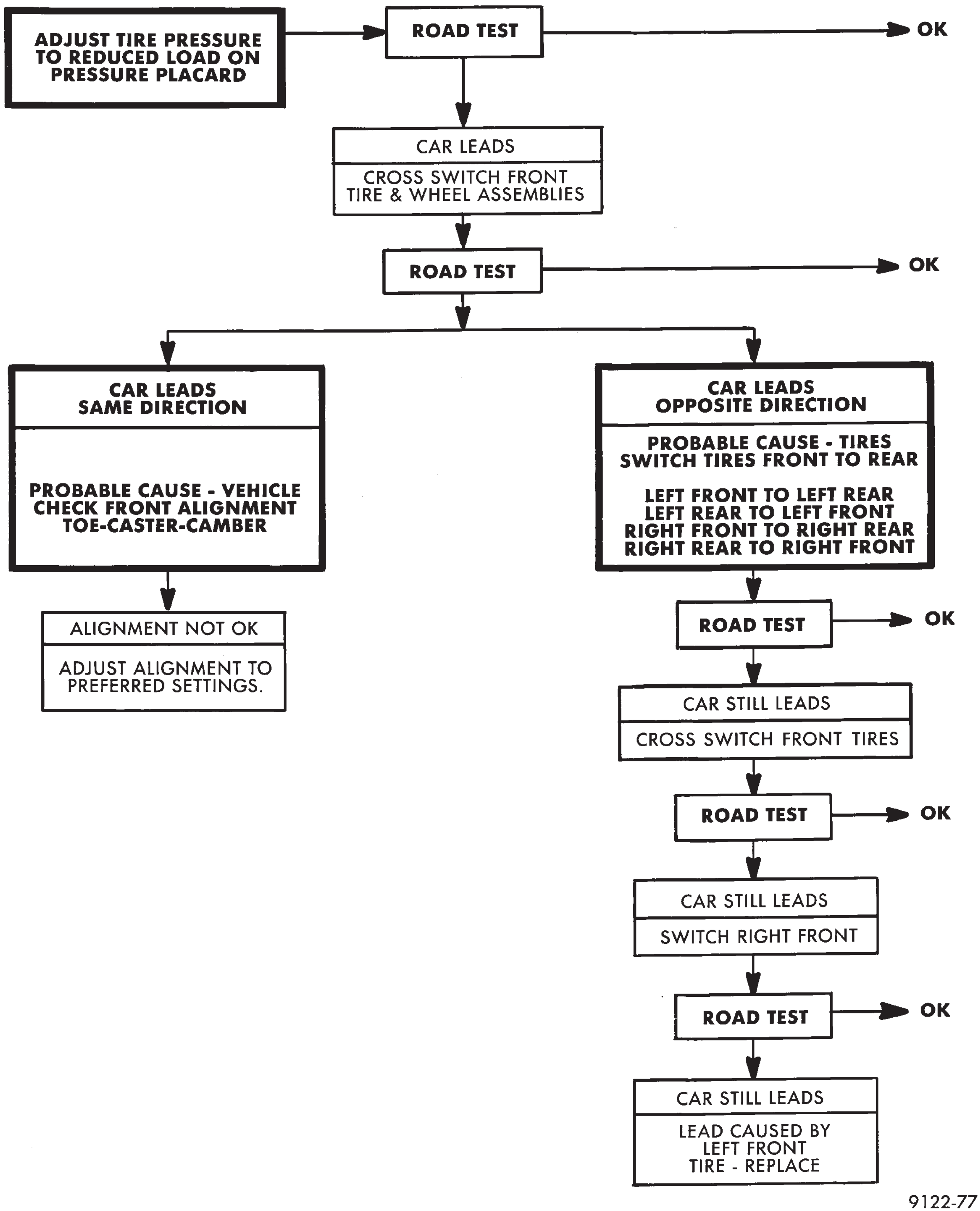
TIRE WEAR PATTERNS

Under inflation will increase wear on the shoulders of the tire. Over inflation will increase wear at the center of the tread.

Excessive camber causes the tire to run at an angle to the road. One side of tread is worn more than the other.

Excessive toe-in or toe-out causes wear on tread edges. There is a feathered effect across the tread (Fig. 7).

LEAD CORRECTION CHART



WHEELS

GENERAL INFORMATION

Original equipment wheels are designed for the specified Maximum Vehicle Capacity.

All models use steel or cast aluminum drop center wheels. The safety rim wheel (Fig. 1) has raised sections between the rim flanges and the rim well.

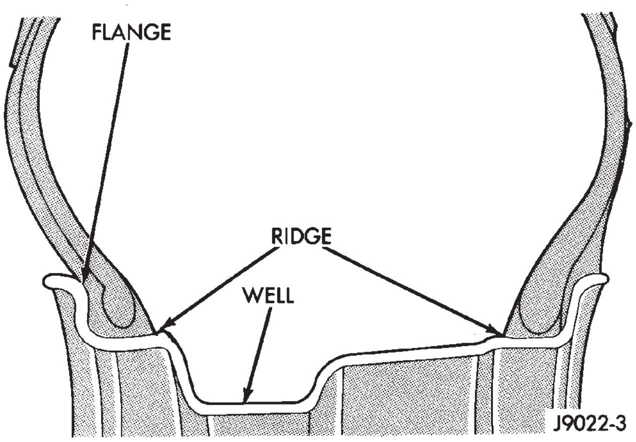


Fig. 1 Wheel Safety Rim

Initial inflation of the tire forces the bead over these raised sections. In case of tire failure, the raised sections 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 and alignment equipment.

WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to 129 N·m (95 ft. lbs.) torque (Fig. 2). **Never use oil or grease on studs or nuts.**

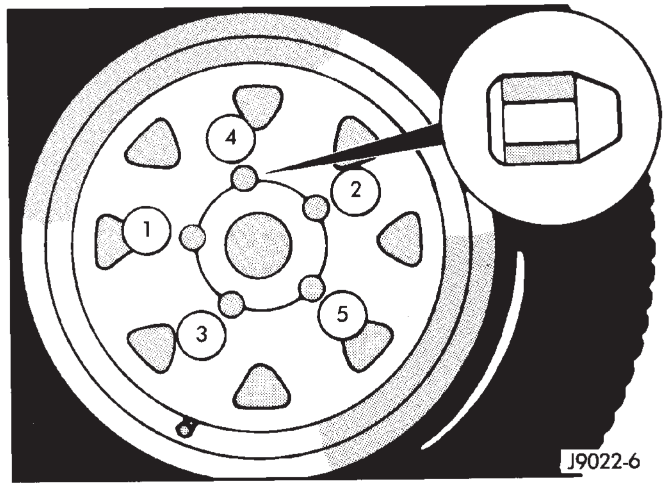


Fig. 2 Lug Nut Tightening Pattern

WHEEL REPLACEMENT

Wheels must be replaced if they have:

- Excessive runout
- Bent or dented
- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:

- Load carrying capacity
- Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

Refer to the Specifications Chart for information regarding above requirements.

WHEEL ORNAMENTATION

WARNING: HANDLE ALL WHEEL ORNAMENTATION WITH EXTREME CARE DURING REMOVAL AND INSTALLATION. SHARP EDGES ON THE COVERS OR CAPS CAN CAUSE PERSONAL INJURY.

TIRE AND WHEEL BALANCE

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. 3, Fig. 4). Off-vehicle balancing is necessary.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, follow these precautions:

• Limited-slip rear axle differential, remove the opposite wheel/tire
• Before balancing the wheels/tires on a vehicle equipped with a transfer case, disconnect the drive shafts

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 at the valve stem location on the wheel rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve

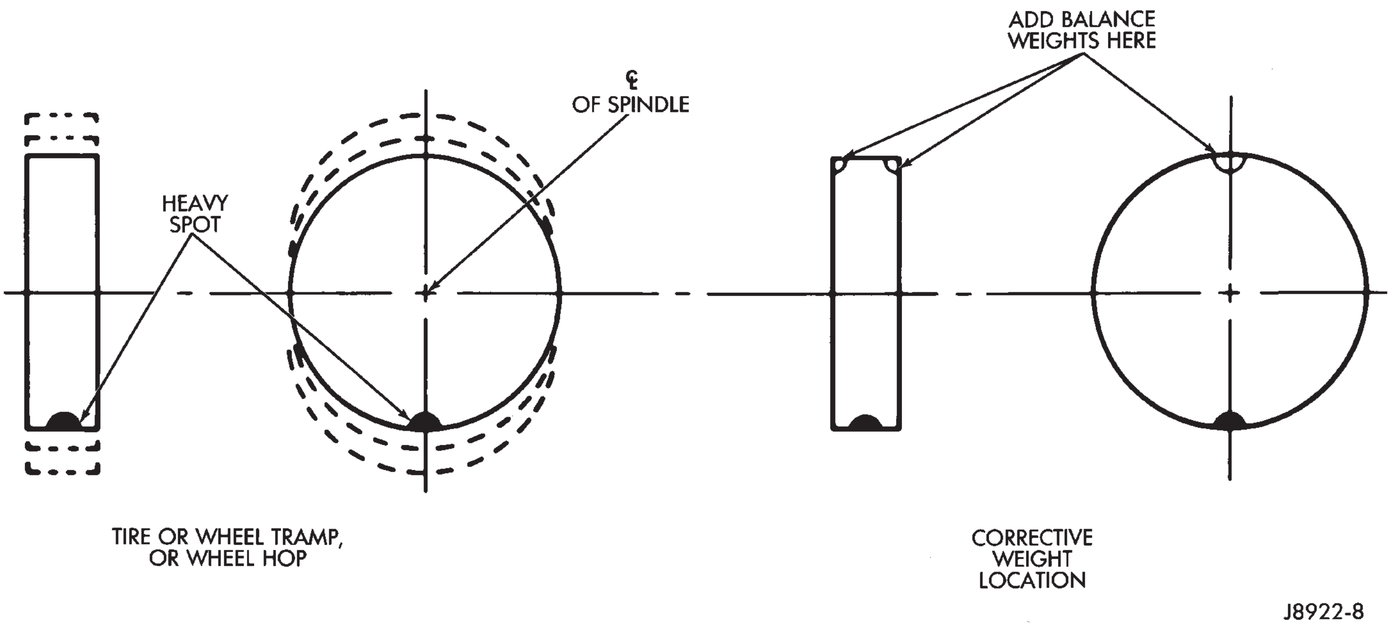


Fig. 3 Static Unbalance & Balance

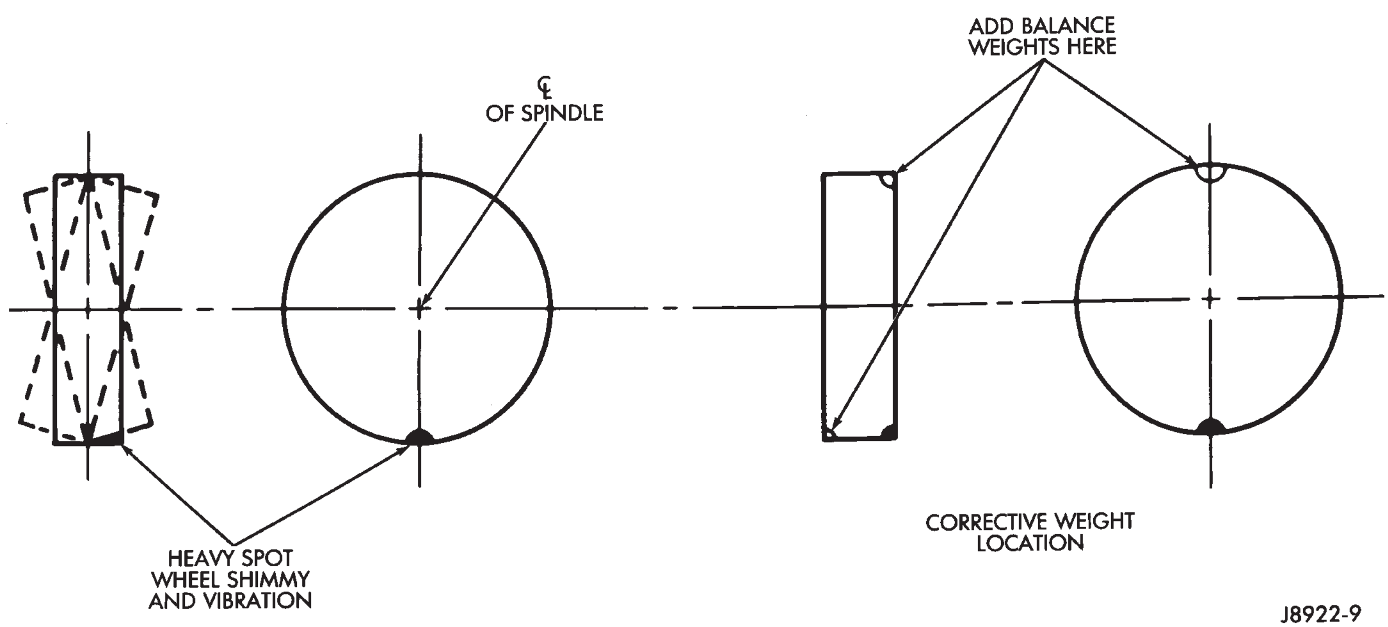


Fig. 4 Dynamic Unbalance & Balance

stem location. This reference will assure 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. 5).

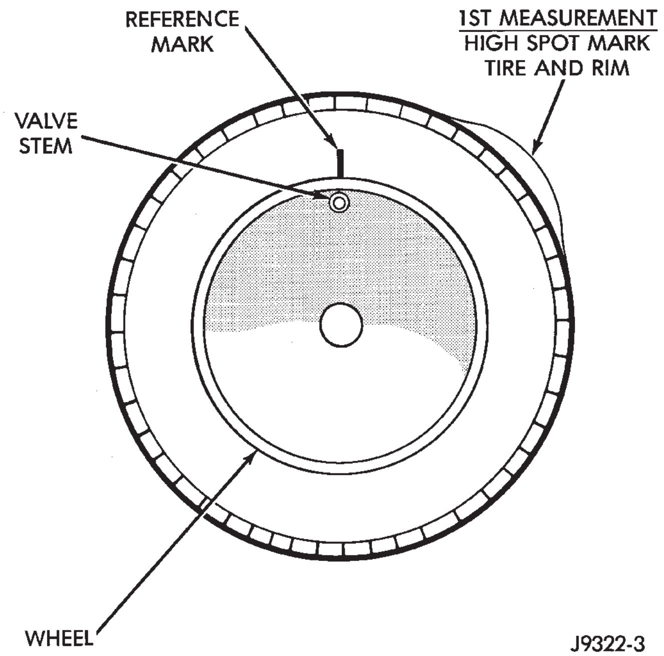


Fig. 5 First Measurement On Tire

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 6).

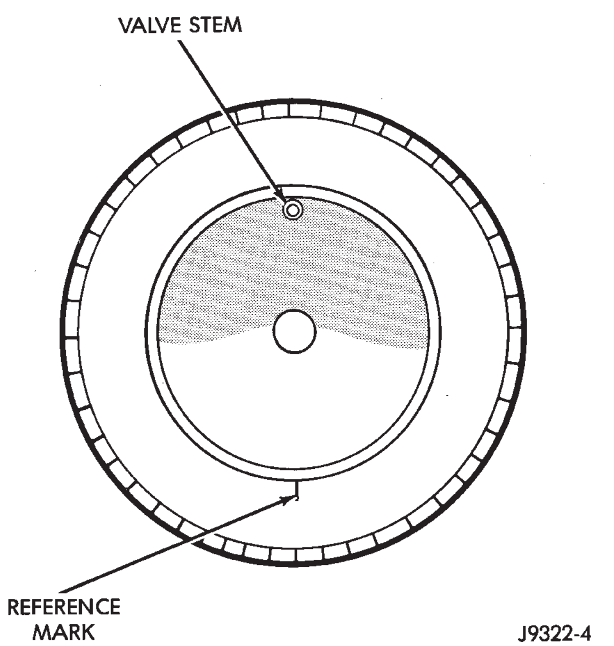


Fig. 6 Remount Tire 180 Degrees

(3) Measure the total indicator runout again. Mark the tire to indicate the high spot.

(4) If runout is still excessive, the following procedures must be done.

- If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 101.6 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 the rim in that direction (Fig. 7). This procedure will normally reduce the runout to an acceptable amount.

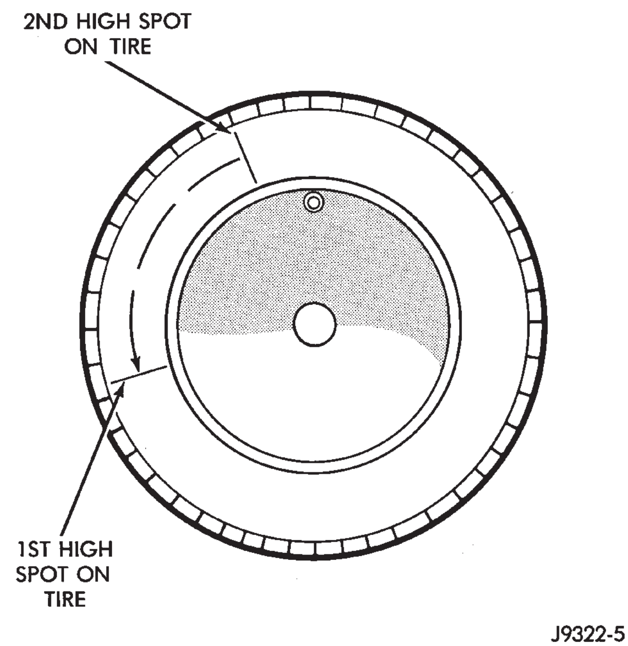


Fig. 7 Remount Tire 90 Degrees In Direction of Arrow

TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel (Fig. 8).

Lateral runout is the **wobble** of the tire or wheel.

Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout 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.

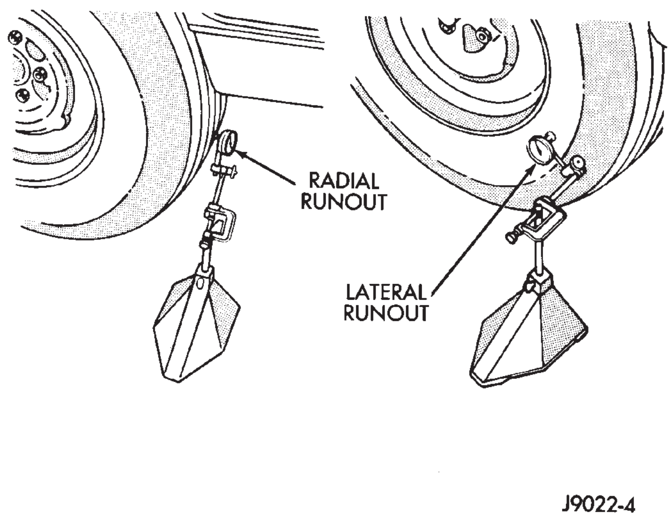


Fig. 8 Checking Tire Runout

Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

Make sure all wheel nuts are properly torqued.

Relocate wheel on the mounting, two studs over from the original position.

Re-tighten wheel nuts until all are properly torqued, to eliminate brake distortion.

Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

METHOD 2 (RELOCATE TIRE ON WHEEL)

Rotating tire on wheel is particularly effective when there is runout in both tire and wheel.

Remove tire from wheel and re-mount wheel on hub in former position.

Check wheel radial runout (Fig. 9).

- STEEL WHEELS: Radial runout 0.040 in., Lateral runout 0.045 in.
- ALUMINUM WHEELS: Radial runout 0.030 in., Lateral runout 0.035 in.

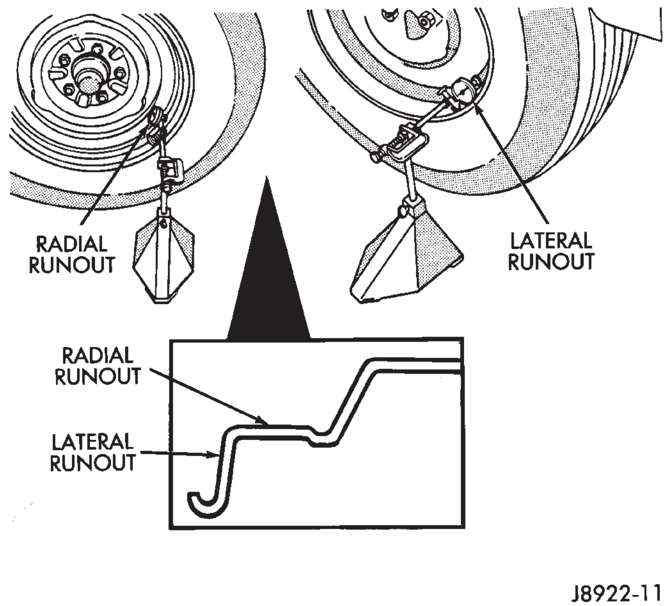


Fig. 9 Checking Wheel Runout

If point of greatest runout is near original chalk mark, remount tire 180 degrees. Recheck runout.

VEHICLE VIBRATION

Vehicle vibration can be caused by:
- Tire/wheel unbalance or excessive runout
- Defective tires with extreme tread wear
- Nylon overlay flat spots (performance tires only)
- Incorrect wheel bearing adjustment (if applicable)
- Loose or worn suspension/steering components
- Certain tire tread patterns
- Incorrect drive shaft angles or excessive drive shaft/yoke runout
- Defective or worn U-joints
- Excessive brake rotor or drum runout
- Loose engine or transmission supports/mounts
- And by engine operated accessories

Refer to the appropriate Groups in this manual for additional information.

VIBRATION TYPES

There are two types of vehicle vibration:
- Mechanical
- Audible.

Mechanical vehicle vibration can be felt through the seats, floor pan and/or steering wheel.

Audible vehicle vibration is heard above normal background noise. The sound can be a droning or drumming noise.

Vibrations are sensitive to change in engine torque, vehicle speed or engine speed.

ENGINE TORQUE SENSITIVE VIBRATION

This vibration can be increased or decreased by:
- Accelerating
- Decelerating
- Coasting
- Maintaining a constant vehicle speed

VEHICLE SPEED SENSITIVE VIBRATION

This vibration condition always occurs at the same vehicle speed regardless of engine torque or engine speed.

ENGINE SPEED (RPM) SENSITIVE VIBRATION

This vibration occurs at varying engine speeds. It can be isolated by increasing or decreasing the engine speed with the transmission in NEUTRAL position.

VIBRATION DIAGNOSIS

A vibration diagnosis should always begin with a 10 mile (16 km) trip (to warm the vehicle and tires). Then a road test to identify the vibration. Corrective action should not be attempted until the vibration type has been identified via a road test.

During the road test, drive the vehicle on a smooth surface. If vibration exists, note and record the following information:
- Identify the vehicle speed range when the vibration occurs
- Identify the type of vibration
- Identify the vibration sensitivity
- Determine if the vibration is affected by changes in vehicle speed, engine speed and engine torque.

When the vibration has been identified, refer to the Vibration Diagnosis chart for causes. Consider correcting only those causes coded in the chart that are related to the vibration condition.

Refer to the following cause codes and descriptions for explanations when referring to the chart.

TRR—Tire and Wheel Radial Runout: Vehicle speed sensitive, mechanical vibration. The runout will not cause vibration below 20 mph (32 km/h).

WH—Wheel Hop: Vehicle speed sensitive, mechanical vibration. The wheel hop generates rapid up-down movement in the steering wheel. The vibration is most noticeable in the 20 - 40 mph (32 - 64 km/h) range. The wheel hop will not cause vibration below 20 mph (32 km/h). Wheel hop is caused by a tire/wheel that has a radial runout of more than 0.045 of-an-inch (1.14 mm). If wheel runout is acceptable and combined runout cannot be reduced by repositioning the tire on wheel, replace tire.

TB—Tire/Wheel Balance: Vehicle speed sensitive, mechanical vibration. Static tire/wheel unbalance will not cause vibration below 30 mph (46 km/h). Dynamic tire/wheel unbalance will not cause vibration below 40 mph (64 km/h).

TLR—Tire/Wheel Lateral runout: Vehicle speed sensitive, mechanical vibration. The runout will not cause vibration below 50 - 55 mph (80 - 88 km/h). Excessive lateral runout will also cause front-end shimmy.

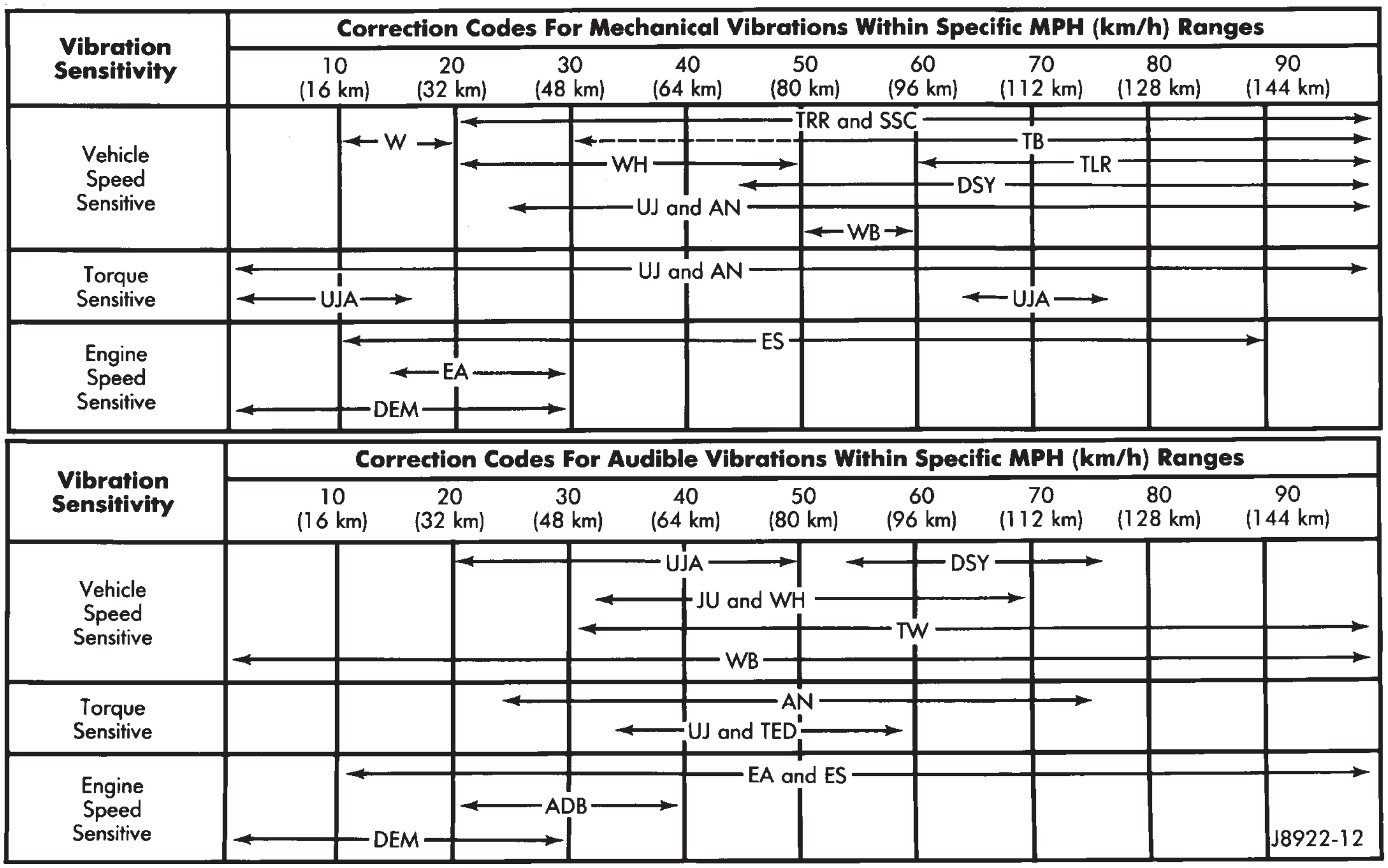
TW—Tire Wear: Vehicle speed sensitive, audible vibration. Abnormal tire wear causes small vibration in the 30 - 55 mph (88 km/h) range. This will produce a whine noise at high speed. The whine will change to a growl noise when the speed is reduced.

W—Tire Waddle: Vehicle speed sensitive, mechanical vibration. Irregular tire uniformity can cause side-to-side motion during speeds up to 15 mph (24 km/h). If the motion is excessive, identify the defective tire and replace it.

UAJ—Universal Joint (Drive Shaft) Angles: Torque/vehicle speed sensitive, mechanical/audible vibration. Incorrect drive shaft angles cause mechanical vibration below 20 mph (32 km/h) and in the 70 mph (112 km/h) range. The incorrect angles can also produce an audible vibration in the 20 - 50 mph (32 - 80 km/h) range. Caster adjustment could be required to correct the angles.

UJ—Universal Joints: Engine torque/vehicle speed sensitive, mechanical/audible vibration. If the

VIBRATION DIAGNOSIS



U-joint is worn it will cause vibration with almost any vehicle speed/engine torque condition.

DSY—Drive Shaft and Yokes: Vehicle speed sensitive, mechanical/audible vibration. The condition will not cause vibration below 35 mph (56 km/h). Excessive runout, unbalance or dents and bends in the shaft will cause the vibration. Identify the actual cause and repair/replace as necessary.

WB—Wheel Bearings: Vehicle speed sensitive, mechanical/audible vibration. Loose wheel bearings cause shimmy-like vibration at 35 mph (56 km/h) and above. Worn bearings will also produce a growl noise at low vehicle speed and a whine noise at high vehicle speed. The wheel bearings must be adjusted or replaced, as applicable.

AN—Axle Noise: Engine torque/vehicle speed sensitive, mechanical/audible vibration. The axle will not cause mechanical vibration unless the axle shaft is bent. Worn or damaged axle pinion shaft or differential gears and bearings will cause noise. Replace the defective component(s) as necessary.

SSC—Suspension and Steering Components: Vehicle speed sensitive, mechanical vibration. Worn suspension/steering components can cause mechanical vibration at speeds above 20 mph (32 km/h). Identify and repair or replace the defective component(s).

EA—Engine Driven Accessories: Engine speed sensitive, mechanical/audible vibration. Vibration can be caused by loose or broken A/C compressor, PS pump, water pump, generator or brackets, etc. Usually more noticeable when the transmission is shifted into the NEUTRAL position and the engine speed (rpm) increased. Inspect the engine driven accessories in the engine compartment. Repair/replace as necessary.

ADB—Accessory Drive Belts: Engine speed sensitive, audible vibration. Worn drive belts can cause a vibration that produces either a droning, fluttering or rumbling noise. Inspect the drive belt(s) and tighten/replace as necessary.

DEM—Damaged Engine or Transmission Support Mounts: Engine speed sensitive, mechanical/audible vibration. If a support mount is worn, noise or vibration will occur. Inspect the support mounts and repair/replace as necessary.

ES—Exhaust System: Engine speed sensitive, mechanical/audible vibration. If loose exhaust components contact the vehicle body they will cause noise and vibration. Inspect the exhaust system for loose, broken and mis-aligned components and repair/replace as necessary.

SPECIFICATIONS

WHEEL LUG NUT

DESCRIPTION	TORQUE
1/2 x 20 with 60° Cone	109 to 150 N·m (80 to 110 ft. lbs.)

J9322-7

WHEEL DESCRIPTION

Description	Bolt Pattern	Offset	Load Rating
15 X 7 Spoke Argent	5 X 4.5"	1.25"	1700 lbs.
16 X 4 Mini Spare	5 X 4.5"	1.75"	1500 lbs.
15 X 7 Full Face Triangle Hole	5 X 4.5"	1.00"	1500 lbs.
15 X 7 Directional Sport Aluminum	5 X 4.5"	1.00"	1500 lbs.
15 X 7 Luxury Alum. Painted Pocket	5 X 4.5"	1.25"	1500 lbs.

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BODY COMPONENTS

CONTENTS

EXTERIOR COMPONENT SERVICE

INDEX

GRILLE AND GRILLE OPENING REINFORCEMENT (GOR)

REMOVAL

(1) Remove screws and grille (Fig. 1) from grille opening reinforcement (GOR).

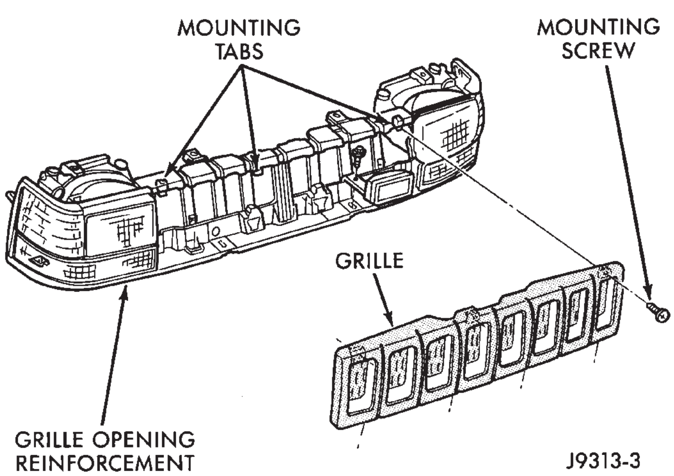


Fig. 1 Grille Removal

(2) Grasp lower edge of headlamp lens. Pull straight back (away) from grille opening reinforcement (GOR). Disengage lower adjuster pivots from lens assembly (Fig. 2).

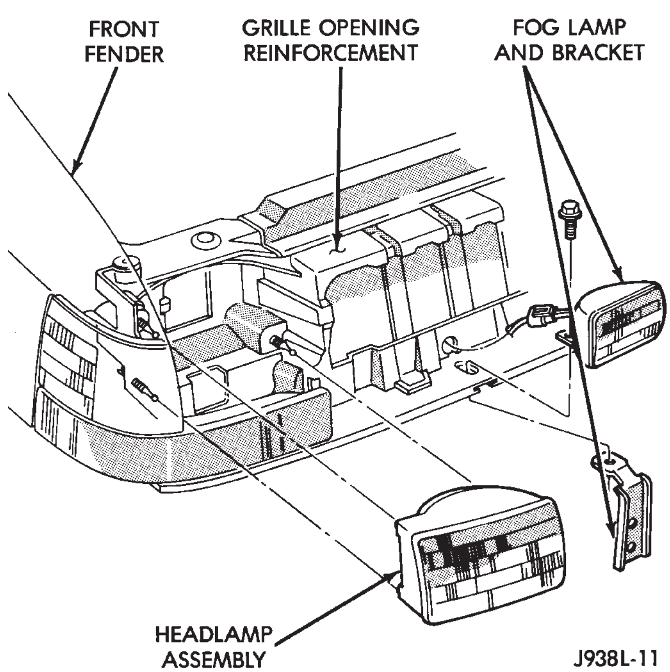


Fig. 2 Headlamp Removal

(3) Grasp upper edge of headlamp lens. Pull straight back (away) from grille opening reinforcement (GOR). Disengage upper adjuster pivot from lens assembly.

(4) Locate and disconnect the 3 wire connector behind headlamp.

(5) Rotate bulb ring counterclockwise. Remove ring and bulb from lens (Fig. 3).

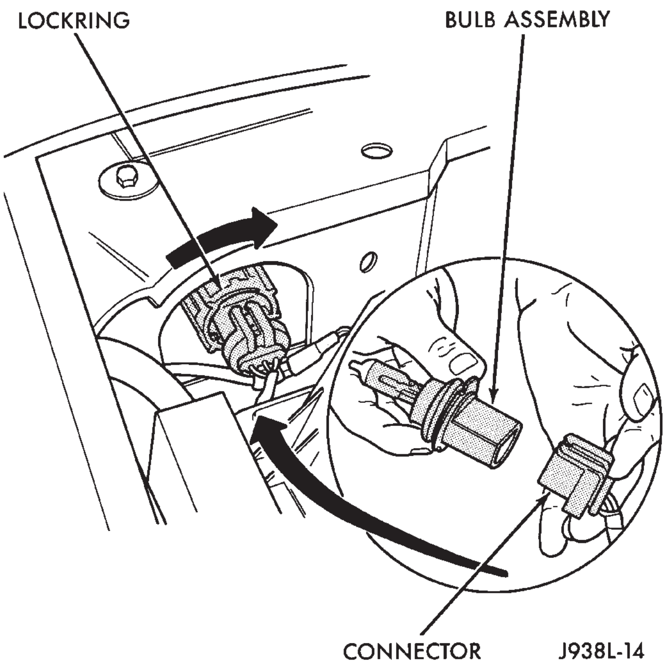


Fig. 3 Headlamp Bulb Removal

(6) Open hood.

(7) Remove side marker lamp upper screw located below radiator side closure panel (Fig. 4).

(8) Remove lower screw located above park/turn signal lamp.

(9) Pull out lamp.

(10) Twist lamp socket clockwise. Disconnect lamp socket from lamp.

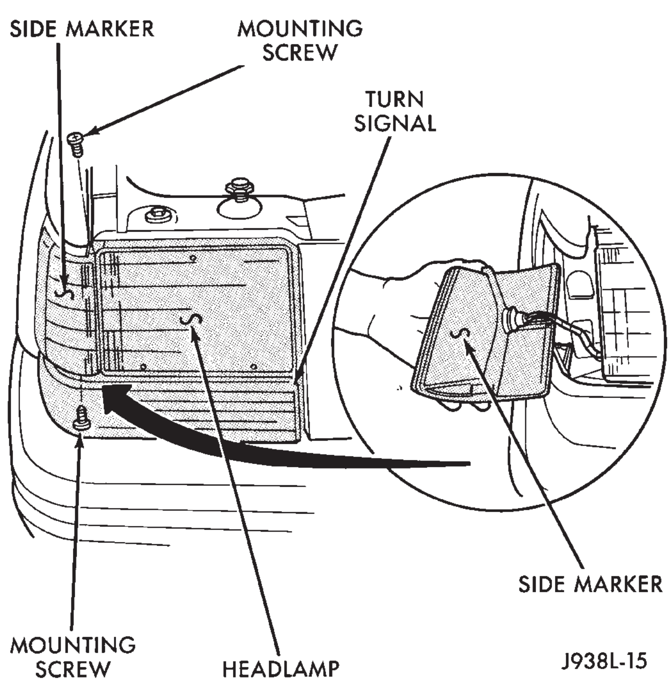


Fig. 4 Side Marker Lamp Removal

(11) Remove upper screws at turn signal lens. Pull lens out to access lamp sockets (Fig. 5).

(12) Remove turn signal and side marker lamp sockets by twisting sockets clockwise.

(13) Remove lens.

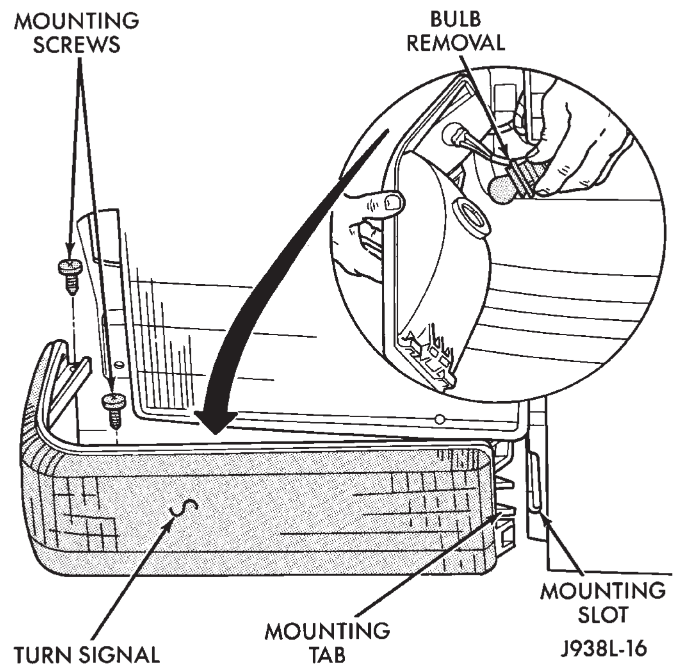


Fig. 5 Turn Signal Lens

(14) Repeat procedure for other side of front end.

(15) Remove license plate bracket if equipped, from bumper fascia/crossmember.

(16) Remove 6 retainers at front fascia (Fig. 6).

(17) Remove 3 plastic rivets at each front wheel well (Fig. 7).

(18) Slide fascia off retainer pegs at side of lower crossmember.

(19) Remove fascia from lower crossmember (Fig. 6).

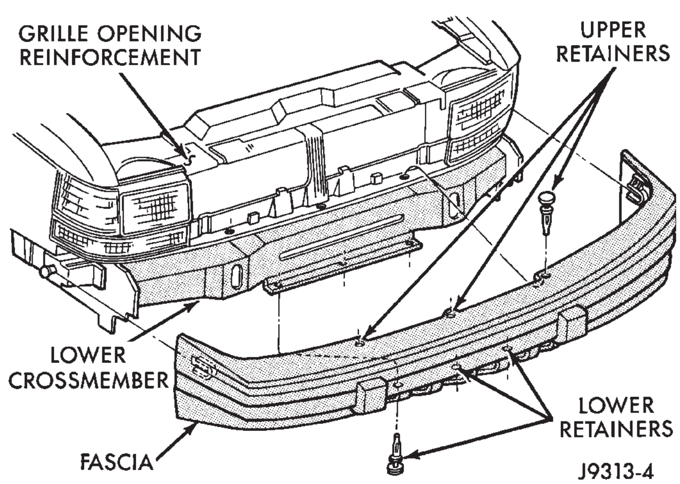


Fig. 6 Lower Fascia Removal

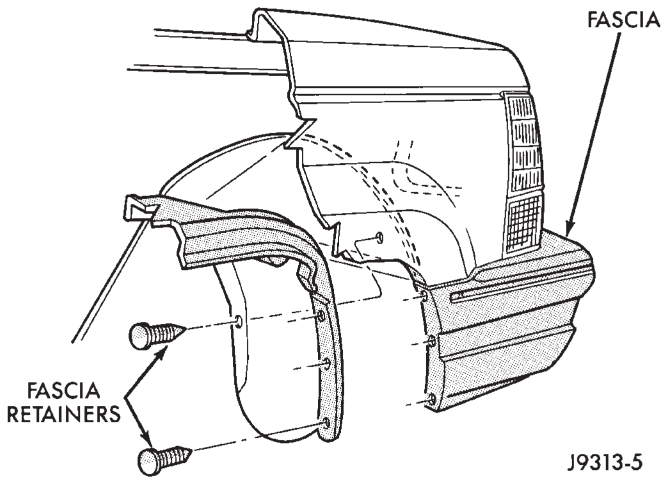


Fig. 7 Wheel Well Retainers

(20) Remove 8 bolts that attach grille opening reinforcement (GOR) to the upper and lower crossmember (Fig. 8).

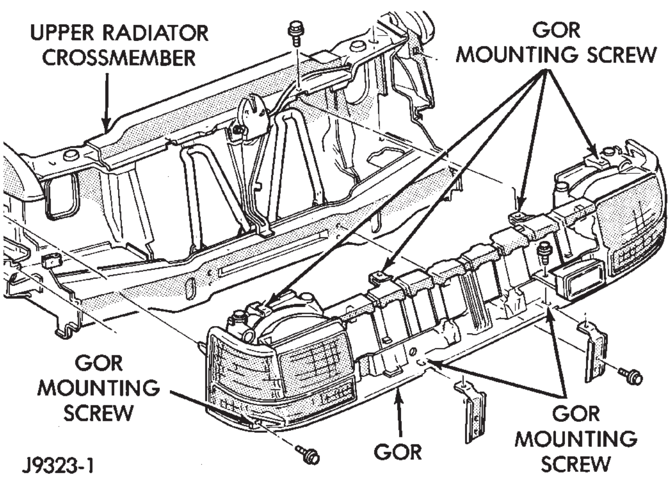


Fig. 8 Grille Opening Reinforcement

(21) Remove grille opening reinforcement.

(22) If necessary, remove air seals located at headlamp wiring inlets (Fig. 9).

INSTALLATION

For installation, reverse removal procedure.

RADIATOR SUPPORT CROSSMEMBER

Refer to Group 7, Cooling Systems for service information.

HOOD

REMOVAL

(1) Raise hood.

(2) Disconnect underhood lamp wire harness connector (Fig. 10), if equipped.

(3) Mark location of the hood hinges and hinge shims (Fig. 11) for installation alignment.

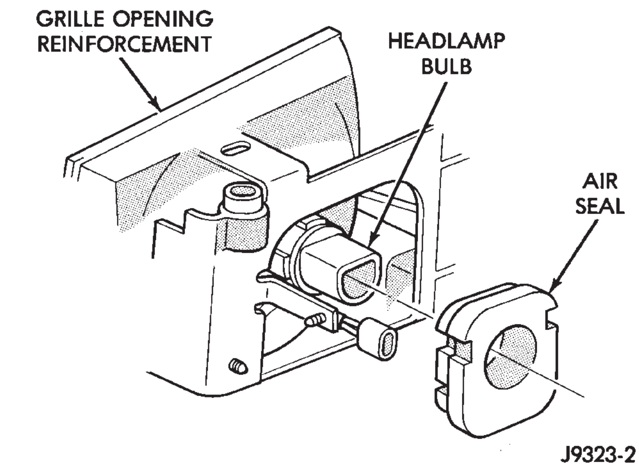


Fig. 9 GOR Air Seals

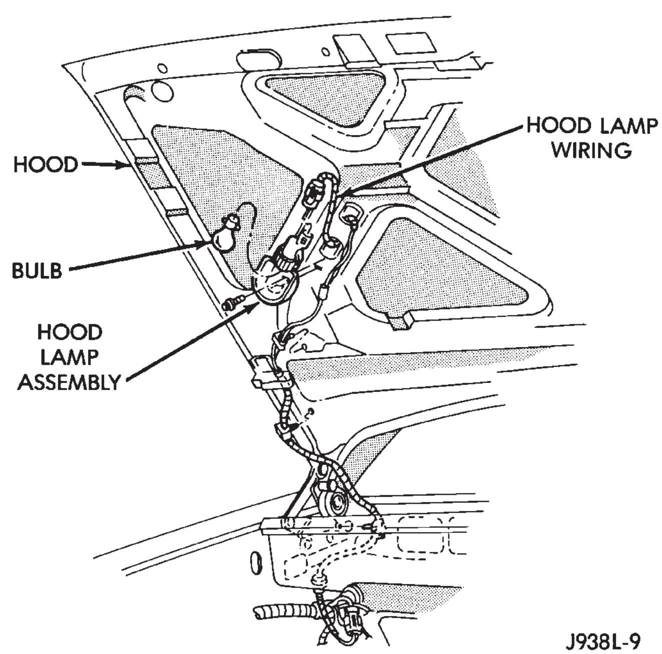


Fig. 10 Underhood Lamp

(4) Remove nuts that attach hinges to hood. Remove hood from vehicle with aid of a helper.

INSTALLATION

(1) Position hood on shims and hinges. Finger-tighten hinge nuts (Fig. 11).

(2) Align hinges and shims (Fig. 11) with installation reference marks. Tighten hinge nuts to 23 N·m (17 ft-lbs) torque.

(3) Test latch release cable and latches for proper operation.

(4) Connect underhood lamp wire harness connector.

(5) Inspect hood for proper alignment and adjust as necessary.

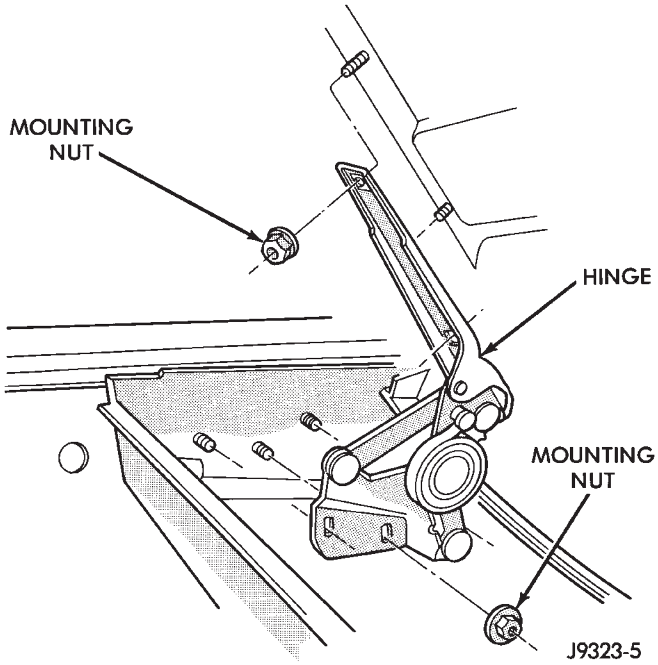


Fig. 11 Hood Hinge

HOOD ADJUSTMENT

The hood attaching holes are enlarged to aid front, back and side-to-side adjustment.

(1) If hood is low in relation to cowl panel, insert shims between hinge and hood.

(2) Adjust hood bumper (Fig. 12) in or out to adjust hood-to-fender height alignment.

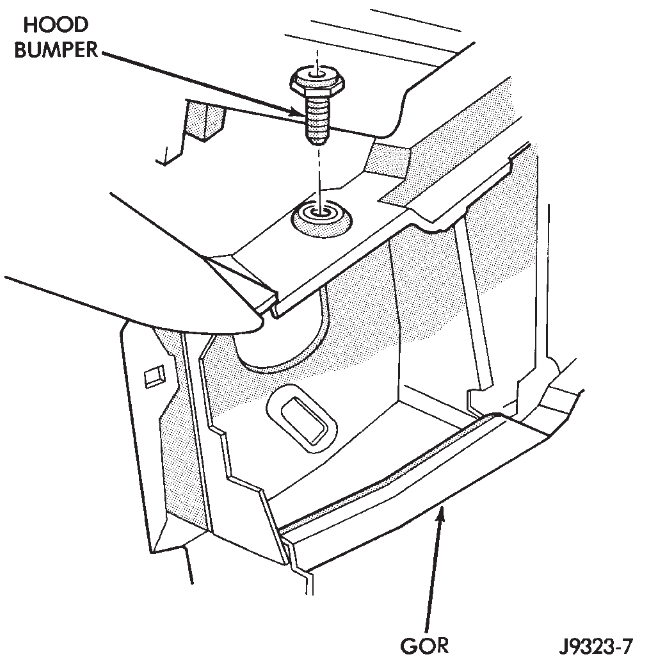


Fig. 12 Hood Bumper

(3) Adjust the hood latch (Fig. 13) as necessary. Tighten the nuts to 11 N·m (8 ft-lbs) torque after adjustment.

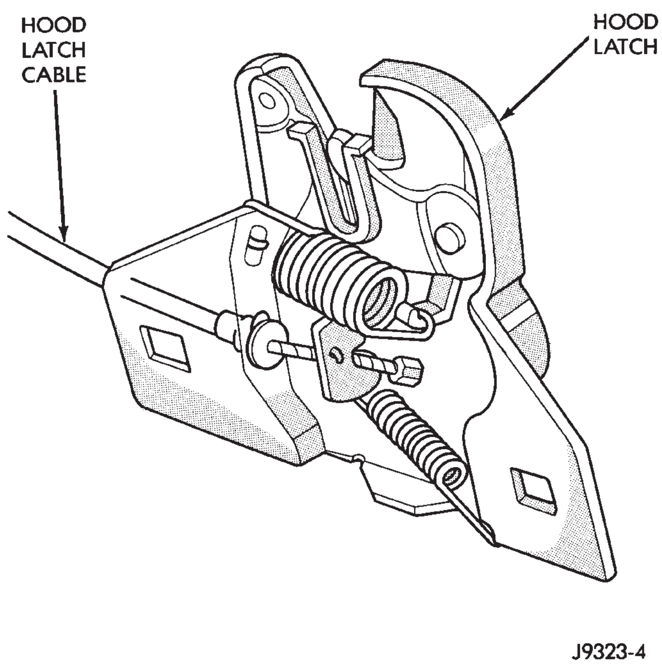


Fig. 13 Hood Latch

(4) Align latch striker (Fig. 14) so that striker enters the latch squarely and without binding.

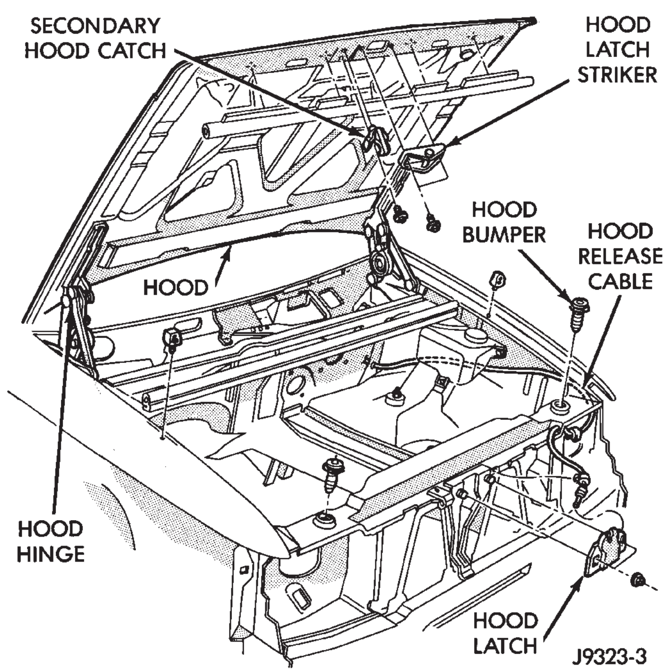


Fig. 14 Hood Striker and Release Cable

HOOD HINGES

REMOVAL

(1) Remove hood from vehicle.

(2) Remove hinge retaining nuts from studs (Fig. 11).

(3) Remove hinge from inner cowl side panel.

INSTALLATION

(1) Position hinge over studs (Fig. 11).

(2) Install hinge retaining nuts on studs. Tighten retaining nuts to 23 N·m (17 ft-lbs) torque.

(3) Install hood.

(4) Adjust hood as necessary. If necessary, refer to adjustment procedure.

HOOD LATCH

REMOVAL

(1) Remove nuts that attach latch to radiator crossmember support (Fig. 14).

(2) Disconnect latch from the hood release cable. Remove latch.

INSTALLATION

(1) Connect latch to latch release cable. Position it on radiator crossmember support (Fig. 14).

(2) Install nuts. Tighten nuts to 11 N·m (8 ft-lbs) torque.

(3) Test operation of latch release cable and latch.

HOOD LATCH STRIKER

REMOVAL

(1) Remove 2 striker retaining bolts.

(2) Remove striker from hood (Fig. 14).

INSTALLATION

(1) Position striker on hood.

(2) Install bolts (Fig. 14). Tighten bolts to 11 N·m (8 ft-lbs) torque.

(3) Test striker/hood alignment by opening and closing hood several times. Adjust striker, if necessary.

LATCH RELEASE CABLE

REMOVAL

(1) Disconnect cable from hood latch (Fig. 13).

(2) Disconnect cable from retaining clips (Fig. 14).

(3) Remove left cowl side (kick) trim panel.

(4) Remove cable bracket attaching screws from cowl side panel (Fig. 15).

(5) Pull cable through dash panel and remove it from under instrument panel.

INSTALLATION

(1) Insert replacement cable end through hole in dash panel (Fig. 15) into engine compartment.

(2) Pull cable forward and seat grommet in dash panel (Fig. 15).

(3) Position cable bracket on cowl side panel and install screws (Fig. 15). Tighten screws to 11 N·m (8 ft-lbs) torque.

(4) Install left cowl side trim panel.

(5) Route cable into retaining clips.

(6) Attach cable to hood latch (Fig. 13).

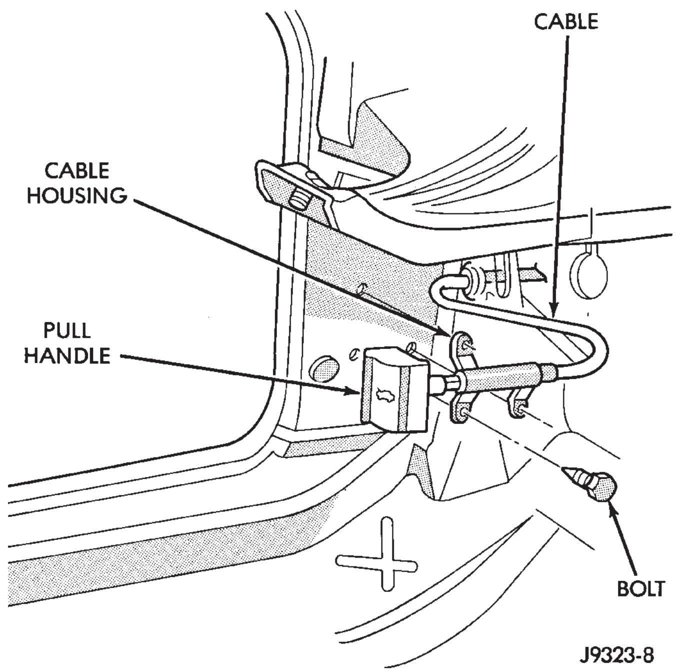


Fig. 15 Hood Release Cable

(7) Test release cable for proper operation.

SAFETY LATCH STRIKER

REMOVAL

(1) Remove latch striker screw from hood (Fig. 14).

(2) Remove striker from hood (Fig. 14).

INSTALLATION

(1) Position striker on hood. Install screw (Fig. 14).

(2) Test safety latch operation.

COWL GRILLE AND SCREEN

REMOVAL

(1) Use a wax pencil to mark position of wiper arms (Fig. 16).

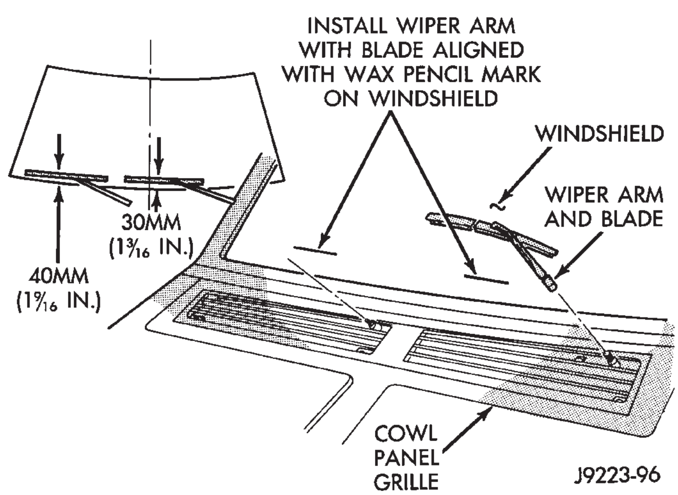


Fig. 16 Wiper Locations On Windshield

(2) Remove windshield wiper arms from pivots (Fig. 16).

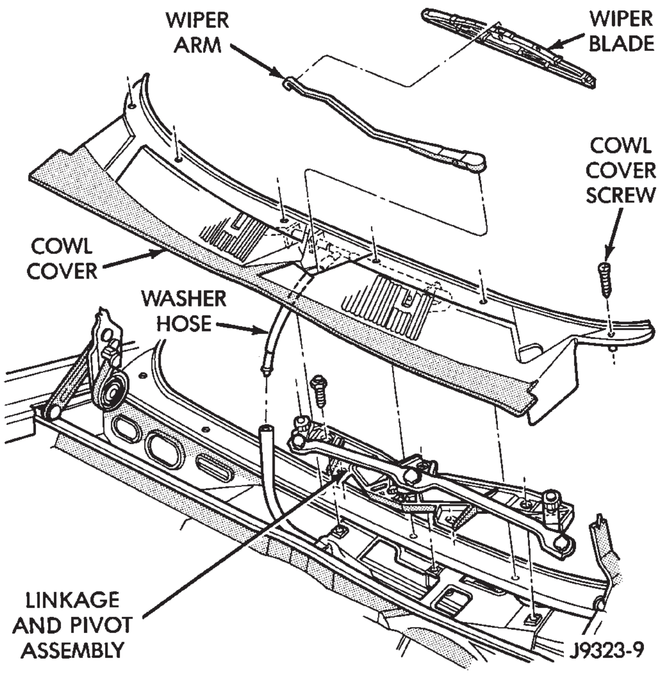


Fig. 17 Cowl Grille Components

(3) Remove 6 screws that attach grille to cowl (Fig. 17).

(4) Remove windshield washer tubes from nozzles (Fig. 18).

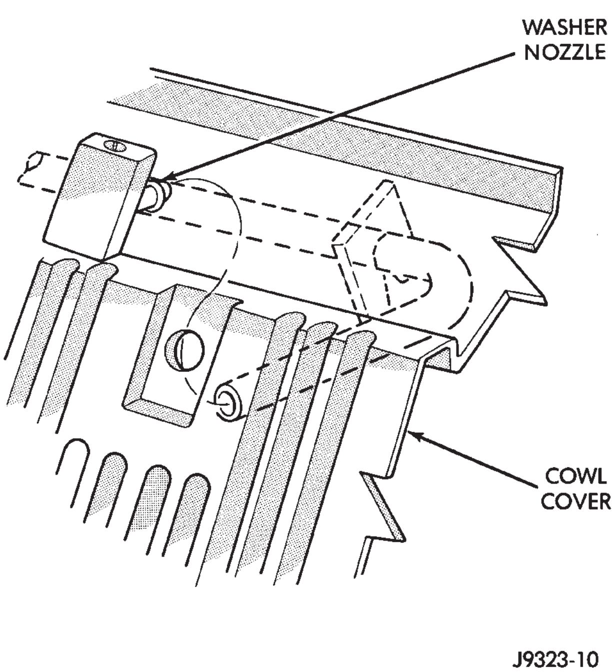


Fig. 18 Washer Fluid Tubes

(5) Remove cowl grille and screen from cowl (Fig. 17).

INSTALLATION

(1) Position cowl grille on cowl. Install windshield washer tubes on nozzles.

(2) Install cowl grille retaining screws.

(3) Install windshield wiper arms on pivots with wipers aligned with wax pencil.

BATTERY TRAY

REMOVAL

(1) Remove 2 bolts and holddown bracket from battery tray (Fig. 19).

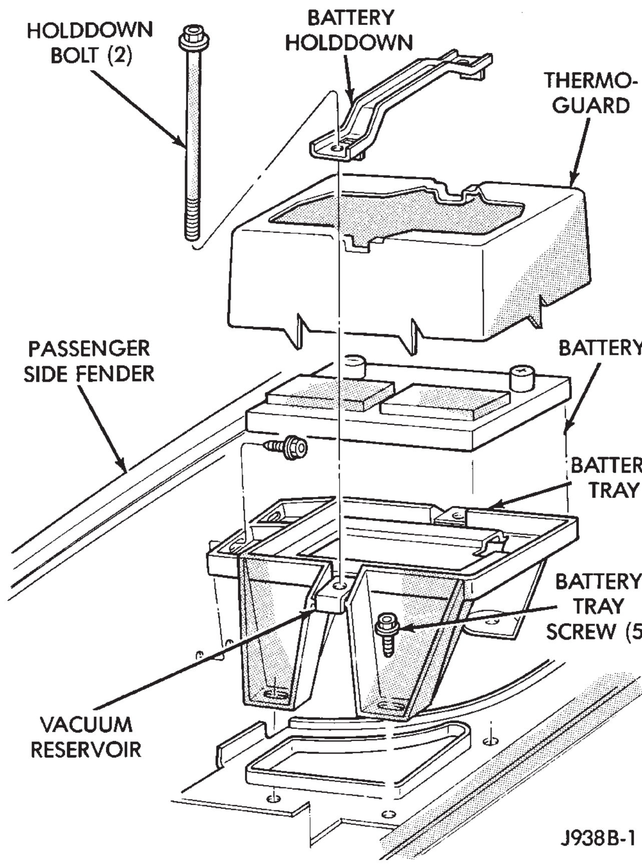


Fig. 19 Battery Tray

(2) Remove battery thermo-guard from battery.

(3) Remove battery from tray.

(4) Remove screws that attach battery tray to inner fender panel.

(5) Remove battery tray. Disconnect vacuum reservoir hoses.

(6) If necessary, remove screws that attach reservoir to bottom of battery tray.

INSTALLATION

(1) If removed, install vacuum reservoir and screws to bottom of tray.

(2) Position battery tray on inner fender panel. Connect vacuum lines to reservoir.

(3) Attach battery tray to inner fender panel with screws (Fig. 19). Tighten screws to 10 N·m (7 ft-lbs) torque.

(4) Install battery in tray.

(5) Position upper holddown bracket over battery.

(6) Install holddown bracket and holddown bolts. Tighten the bolts to 10 N·m (7 ft-lbs) torque.

FRONT FENDER

REMOVAL

(1) Remove headlamp, side marker and turn signal lamp. Refer to Group 8L, Lamps for service information.

(2) Remove front bumper fascia. Refer to Group 13, Frame and Bumpers for service information.

(3) Remove front wheel.

(4) Remove fasteners attaching inner front fender liner to fender and inner fender (Fig. 20).

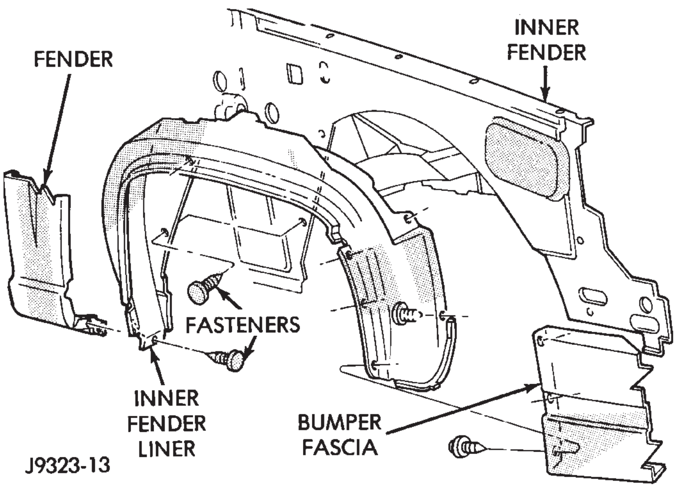


Fig. 20 Inner Fender Liner

(5) Remove inner fender liner.

(6) Right fender only:

• If equipped, remove radio antenna mast, nut, pad and base from fender (Fig. 21 and 22).

(7) From inside wheel well, remove bolts at rear of fender reinforcements (Fig. 23).

(8) Remove bolts at front fender bracket (Fig. 24).

(9) Remove bolts at lower rear of fender at A-pillar (Fig. 24).

(10) Remove upper mounting bolts at top of fender (Fig. 24).

(11) Remove fender from inner fender.

INSTALLATION

(1) Position fender on inner fender panel (Fig. 24).

(2) Install all of fender attaching screws finger-tight.

(3) Align fender with adjacent body panels. Tighten fender bolts to 9 N·m (80 in-lbs) torque.

(4) Install inner fender liner.

(5) Install front wheel.

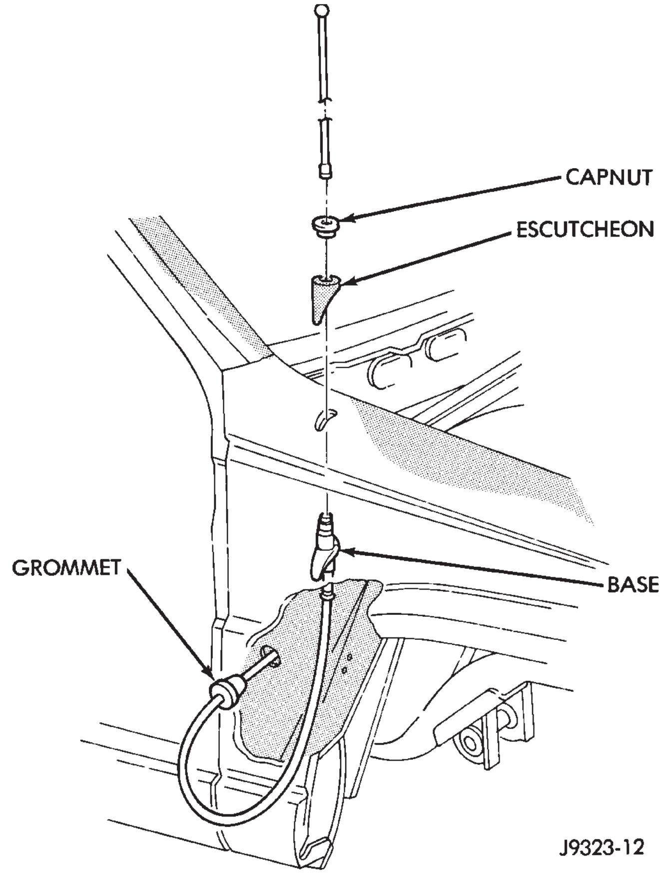


Fig. 21 Radio Antenna

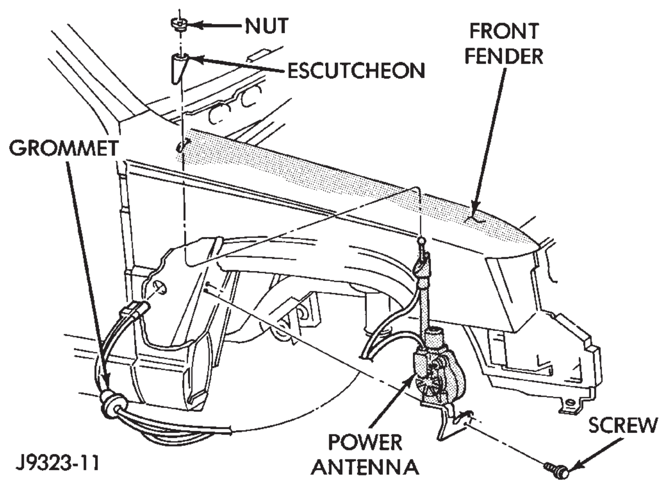


Fig. 22 Power Antenna

(6) Install front bumper fascia. If necessary refer to Group 13, Frame and Bumpers for installation instructions.

(7) Install front headlamp, side marker and turn signal lamp. If necessary refer to Group 8L, Lamps for service information.

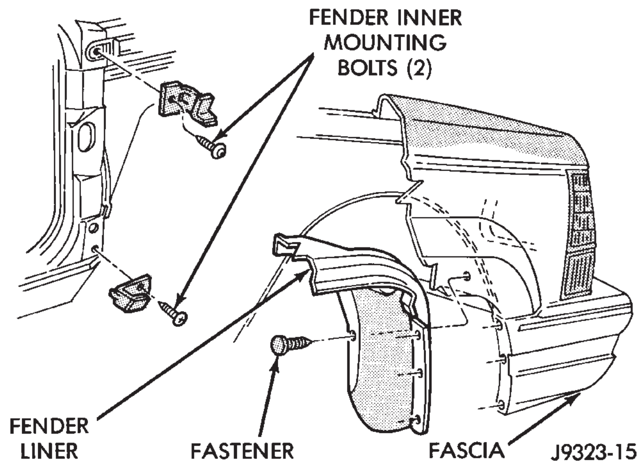


Fig. 23 Inner Fender Mounting

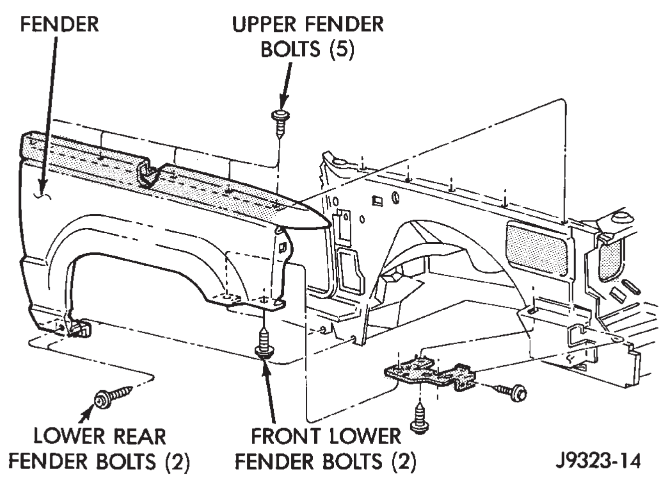


Fig. 24 Fender Mounting

BODY SIDE CLADDING

REMOVAL/FRONT DOOR

(1) Using a trim stick, gently lift up from bottom of cladding. Unsnap molding from retaining clips (Fig. 25).

(2) Lift upward and remove molding.

INSTALLATION/FRONT DOOR

(1) Install molding over top of retaining clips.

(2) Align molding to door edges.

(3) Snap molding down over retaining clips.

REMOVAL/REAR DOOR

(1) Open rear door.

(2) Remove acorn nut at rear dogleg (Fig. 25).

(3) Using a trim stick, gently lift up from bottom of cladding. Unsnap molding from retaining clips.

INSTALLATION/REAR DOOR

(1) Install molding retainer into hole at dogleg.

(2) Install molding over top of retaining clips.

(3) Snap molding down over top of retaining clips.

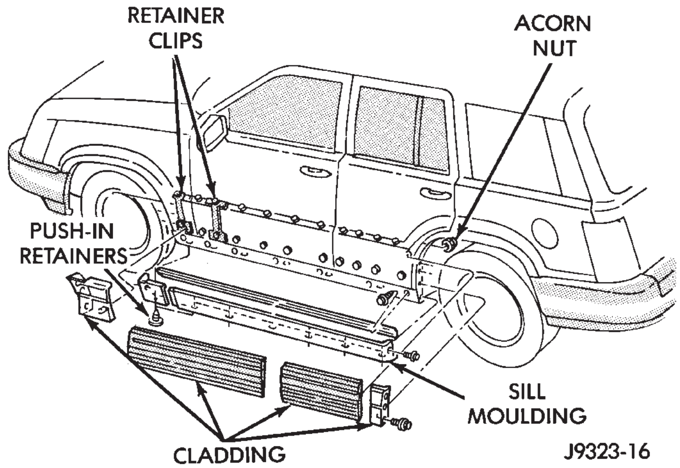


Fig. 25 Body Side Cladding

(4) Install acorn nut onto retainer.

REMOVAL/FENDER-QUARTER PANEL

(1) Remove 3 screws at wheel opening.

(2) Using a trim stick, Gently pry upward from bottom of cladding.

(3) Unsnap cladding from retainers.

INSTALLATION/FENDER-QUARTER PANEL

(1) Install molding over top of retainer clips.

(2) Snap molding down over retaining clips.

(3) Install screws into wheel opening.

BODY STRIPES/DECALS

GENERAL INFORMATION

Body stripes are durable, weather-resistant tape stripes with pressure-sensitive backing. The tape stripe is protected by a carrier until installed on a body panel. Carrier also is an installation alignment aid (Fig. 1).

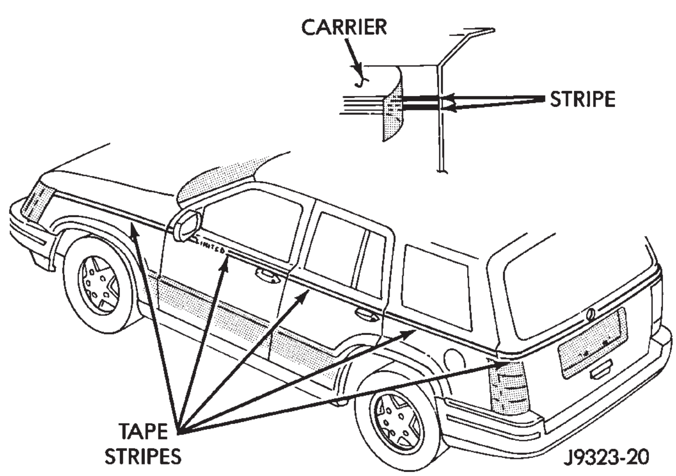


Fig. 1 Tape Stripes

REMOVAL

(1) Remove exterior trim as necessary to clear captured edges of tape stripe being removed

(2) Remove tape stripe using a suitable heat gun or lamp.

This will soften adhesive backing.

(3) Clean adhesive residue from body finish using a suitable adhesive remover.

INSTALLATION

INSTALLATION EQUIPMENT

- Bucket filled with a mild dish soap solution.
- Lint free applicator cloth or sponge.
- Body putty applicator squeegee.
- Heat gun or sun lamp.
- Razor knife.

The painted surface of the body panel to be covered by a tape stripe must be smooth and completely cured before stripe can be applied. If painted surface is not smooth, wet sand with 600 grit wet/dry sand paper until surface is smooth.

Ripples and feather edges will read through stripe if surface is not properly prepared.

(1) With backing still in place, position stripe across panel to receive the stripe. Apply masking at top of stripe to hold it in position.

(2) Mark outside edge of panel on stripe with grease pencil.

(3) Trim stripe to within 17 mm (0.750 in.) of outline marks.

(4) Spread stripe across a smooth flat work surface, stripe side down.

(5) Peel paper backing away from stripe exposing adhesive backing of stripe.

(6) Apply soap solution liberally to adhesive backing of stripe.

(7) Apply soap solution to body panel surface.

(8) Place stripe into position on body panel (Fig. 29). Smooth out wrinkles by pulling lightly on edges of tape stripe until it lays flat on panel surface.

(9) Push air pockets from under tape stripe to perimeter of panel from center of the tape stripe out.

(10) Remove air bubbles from under tape stripe using a body putty squeegee.

CAUTION: Do nut cut into painted surface of body when trimming tape stripe to size.

(11) Trim tape stripe to size using a razor knife. Leave at least 13 mm (0.5 in.) for edges of doors and openings.

CAUTION: Do not overheat tape stripe when performing step 12.

(12) Apply heat to tape stripe to evaporate residual moisture from edges of tape stripe. This will also allow tape stripe to be stretched into concave surfaces.

(13) Edge turn tape stripe around doors or fenders.

(14) Install exterior trim if necessary. Small air or water bubbles under tape stripe can be pierced with a pin and smoothed out.

QUARTER WINDOW APPLIQUE/AIR EXHAUSTER

REMOVAL

(1) Using a trim stick, carefully pry applique from panel (Fig. 2).

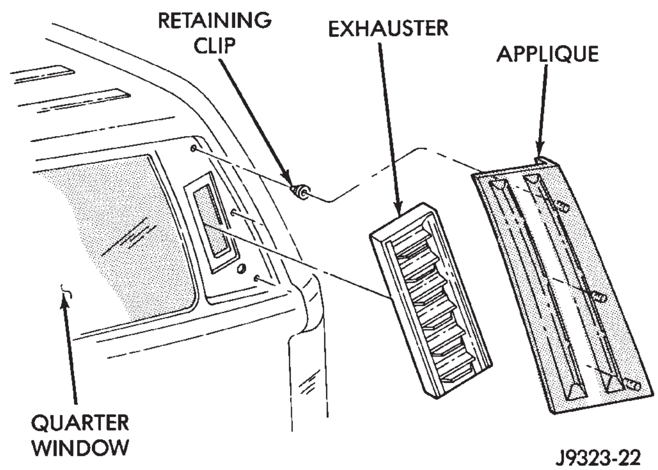


Fig. 2 Quarter Window Applique & Air Exhauster

(2) Carefully pry air exhauster from upper quarter panel using a flat blade screwdriver.

INSTALLATION

(1) Reseal air exhauster using foam tape.

(2) Install air exhauster on panel.

(3) Position applique on panel with retainers aligned (Fig. 2). Press applique firmly in place.

EXTERIOR NAMEPLATES

SERVICE INFORMATION

All of the vehicle exterior nameplates (Fig. 3), are attached to the vehicle panels with adhesive.

REMOVAL/INSTALLATION

(1) Carefully pry nameplate (Fig. 3) from body panel.

(2) Clean panel surface.

(3) Position replacement nameplate on panel and push inward to seat it.

EXTERNAL MIRRORS

REMOVAL

(1) Remove door trim panel.

(2) Remove mirror inside trim cover attaching screw.

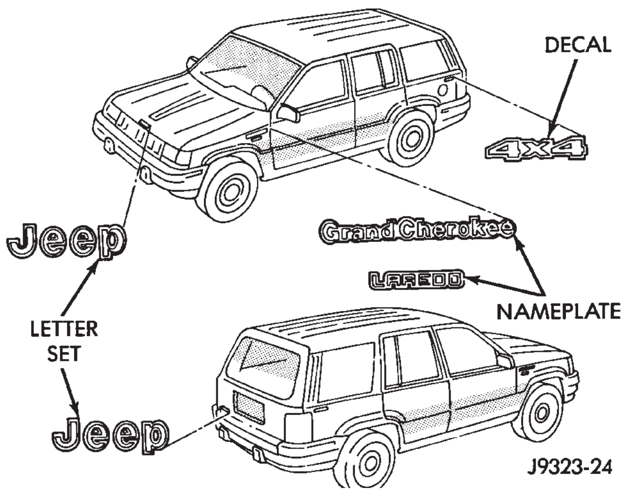


Fig. 3 Exterior Nameplates

(3) For power mirrors, remove inside trim cover.

(4) For remote control mirrors, loosen toggle control setscrew.

(5) For remote control mirrors, remove inside trim cover.

(6) Remove mirror retaining nuts (Fig. 4).

(7) Remove mirror from door. Refer to Group 8, Electrical for additional information involving power mirrors.

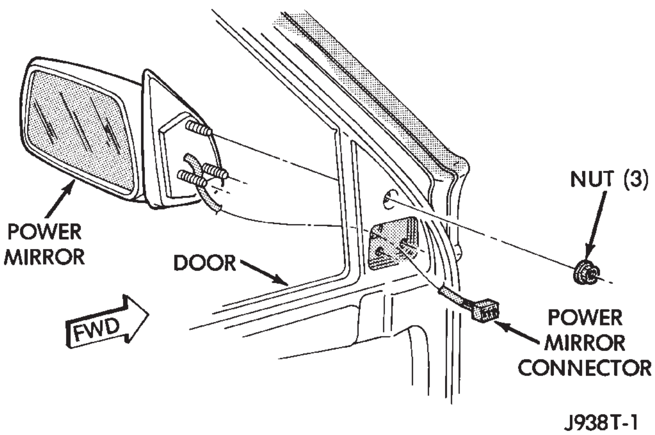


Fig. 4 Exterior Mirror

INSTALLATION

(1) Position mirror on door. Verify that the O-ring seal and gasket are properly positioned.

(2) Install mirror retaining nuts.

(3) For remote mirrors, position inside trim cover over toggle control. Tighten setscrew.

(4) Install inside trim cover.

(5) Install inside trim cover attaching screw and tighten it securely.

(6) Install door trim panel.

LUGGAGE RACK

REMOVAL

(1) Remove slide rail screws (Fig. 5).

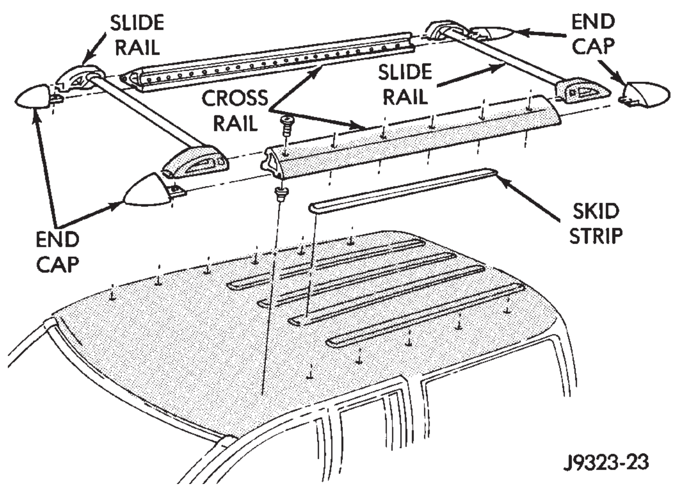


Fig. 5 Luggage Rack

(2) Remove luggage rack from vehicle roof.

The skid strips are attached to roof panel with adhesive.

(3) Loosen each skid strip (Fig. 5) with a heat gun.

(4) Lift one edge of each skid strip with a putty knife and peel it from roof panel. Apply additional heat to any location where a skid strip remains.

(5) Remove original adhesive from roof panel with an all-purpose adhesive removal solution.

INSTALLATION

(1) Install 3M 06379 double-sided tape on skid strips.

(2) Align each skid strip on roof panel.

(3) Verify that each skid strip is properly aligned.

(4) Press each skid strip onto roof panel with a roller.

Apply 3M Drip-Chek Sealant (or an equivalent product) to underside of side rail screw heads.

(5) Position luggage rack on roof.

(6) Install and tighten slide rail screws to 3 N·m (28 in-lbs) torque.

POWER SUNROOF

INDEX

GENERAL INFORMATION

All sunroofs are equipped with drain tubes (Fig. 1 and 2). The drain tubes must be kept open to prevent water from entering passenger compartment.

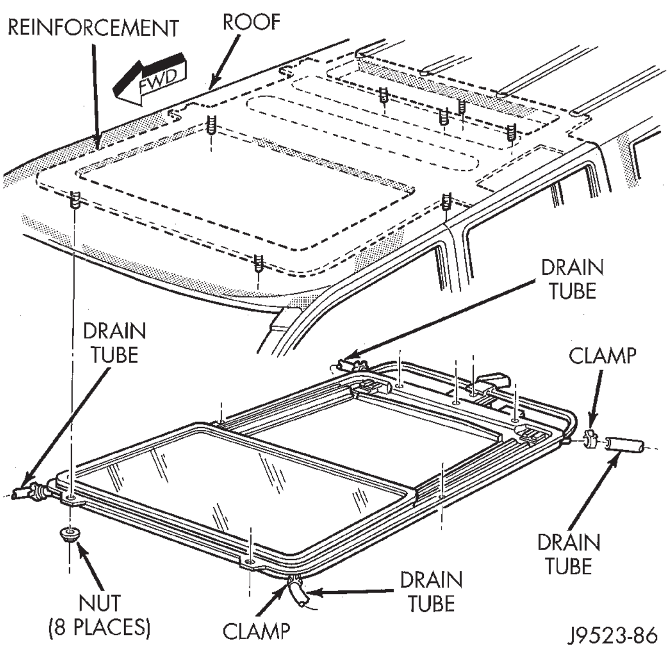


Fig. 1 Drain Tubes

LUBRICATION

(1) Lubricate cables with Lubriplate or equivalent when cables are replaced.

(2) Periodically clean dirt from guide rail covers.

DRAIN TUBES

- Inspect drain holes, located in trough around sunroof opening to verify they are clear. Inspection should be performed once a year or when problems are suspected. If drain hose or tubes are plugged, use compressed air or blunt flexible wire to clear them. If tubes cannot be cleared, they must be repaired.
- The lower ends of rear drain tubes are located in rear quarter panel drop wells. To clear rear drain tubes, remove the plug/adapter and use compressed air or a blunt flexible wire from the lower ends of tubes.

GLASS VERTICAL HEIGHT ADJUSTMENT

GLASS VERTICAL ADJUSTMENT

(1) Open glass to vent position.

(2) Slide upper half of mechanism covers rearward until clips disengage and separate covers from vehicle (Fig. 3).

(3) Close glass panel, separately loosen adjusting bolts (Fig. 3—View A) and individually adjust the corners of the glass.

(4) Adjust front of glass panel to 1.0 mm (0.040 in.) below top surface of roof panel.

(5) Adjust rear of glass to 1.0 mm (0.040 in.) above top surface of roof panel.

(6) Secure adjustment bolts and install covers.

WIND DEFLECTOR

REMOVAL

(1) Open sun roof glass panel.

(2) Remove screws holding wind deflector to sun roof unit side rail (Fig. 4).

(3) Separate wind deflector from vehicle.

INSTALLATION

Reverse preceding operation.

GLASS PANEL

REMOVAL

(1) Position glass to vent position.

(2) Remove wind deflector mechanism covers (Fig. 3)

(3) Position sunshade full rearward.

(4) Loosen nuts holding glass panel to side adjustment brackets (Fig. 3—View B).

(5) Slide glass panel rearward 12mm (0.5in.) and separate glass from sunroof unit.

INSTALLATION

(1) Position glass panel in opening with logo rearward and slide panel forward 12 mm (0.5in.).

(2) Verify that attaching nuts are below top surface of glass adjustment brackets.

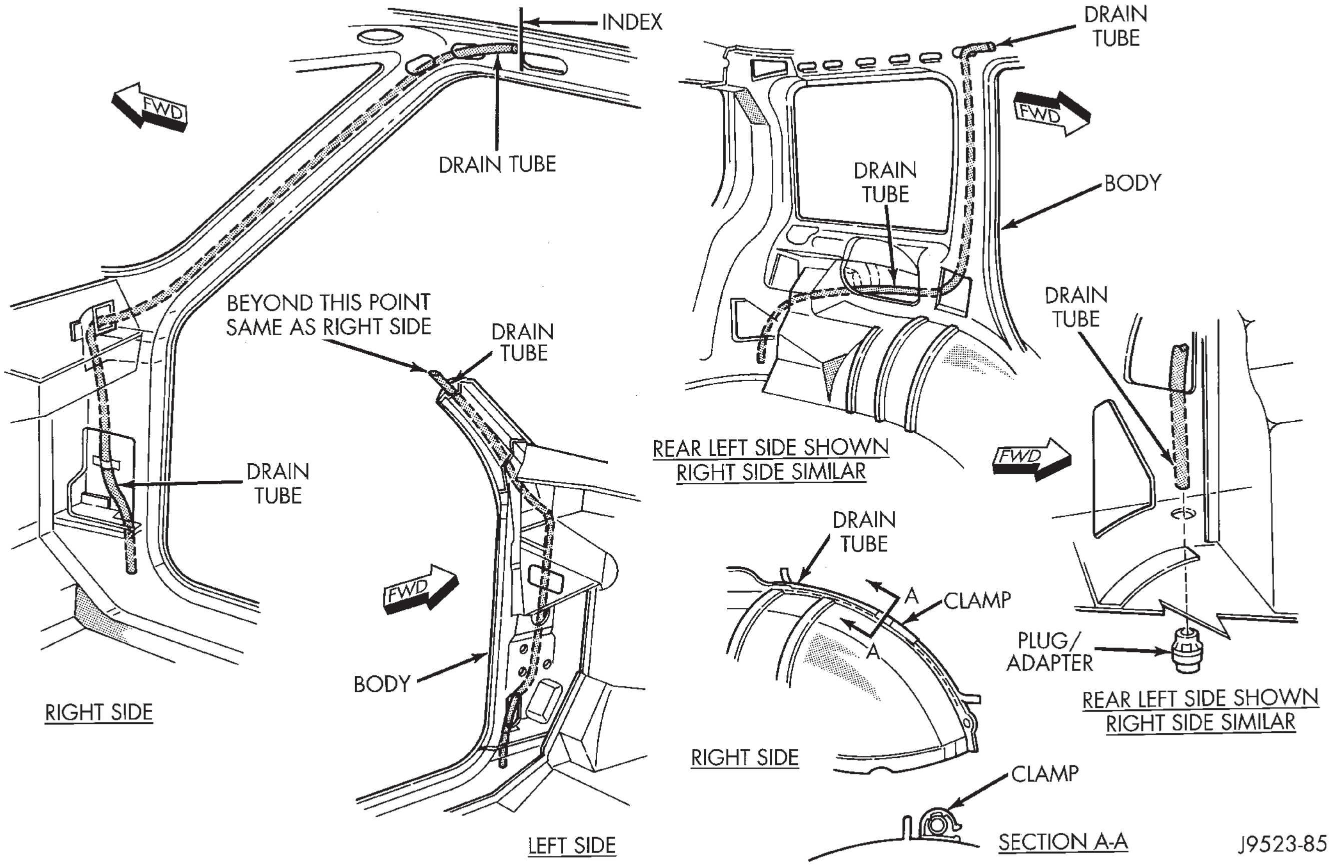


Fig. 2 Drain Tube Locations

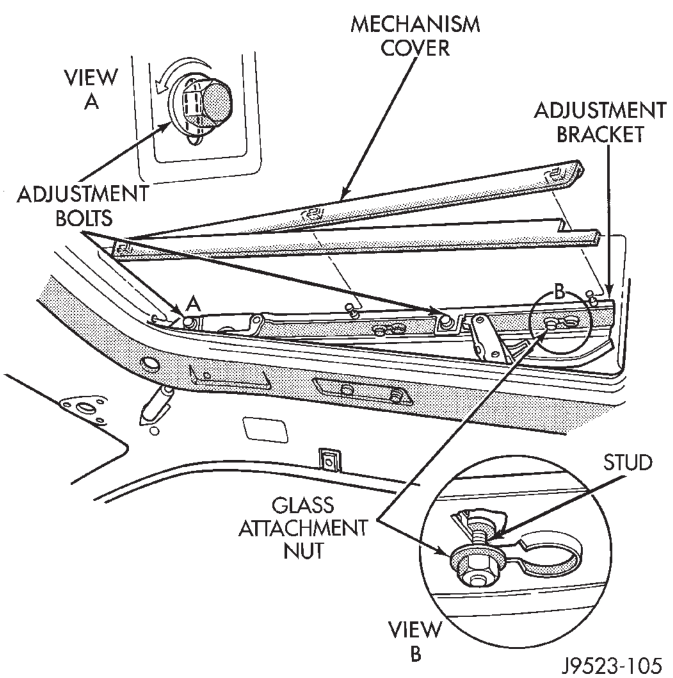


Fig. 3 Glass Adjustment

(3) Close sunroof to center glass panel in roof opening.

(4) Tighten center screws to hold adjustment.

(5) Open glass to vent position and tighten nuts to 8 N·m (70.8 in. lbs.).

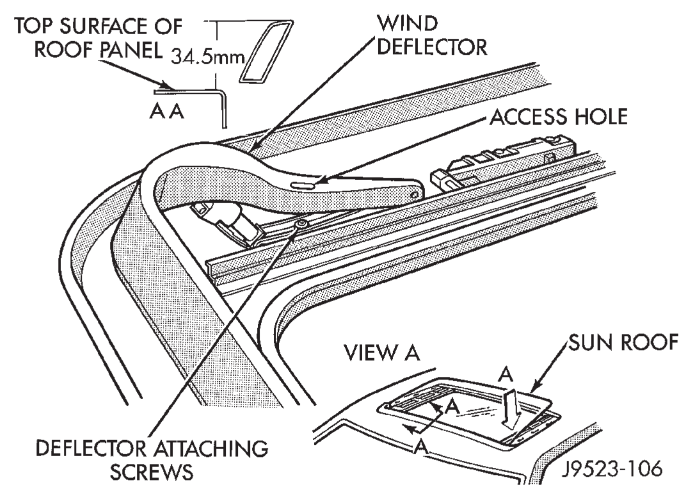


Fig. 4 Deflector Assembly

(6) Close glass and check alignment.

(7) Locate glass to vent position.

(8) Install mechanism covers.

ADJUSTMENT BRACKET

REMOVAL AND INSTALLATION

(1) Remove wind deflector, mechanism covers and glass panel.

(2) Move glass carriage to vent position and remove rearward adjustment bolt from adjustment bracket.

(3) Lift rear of adjustment bracket to highest vertical position and disengage front of bracket from unit (Fig. 5).

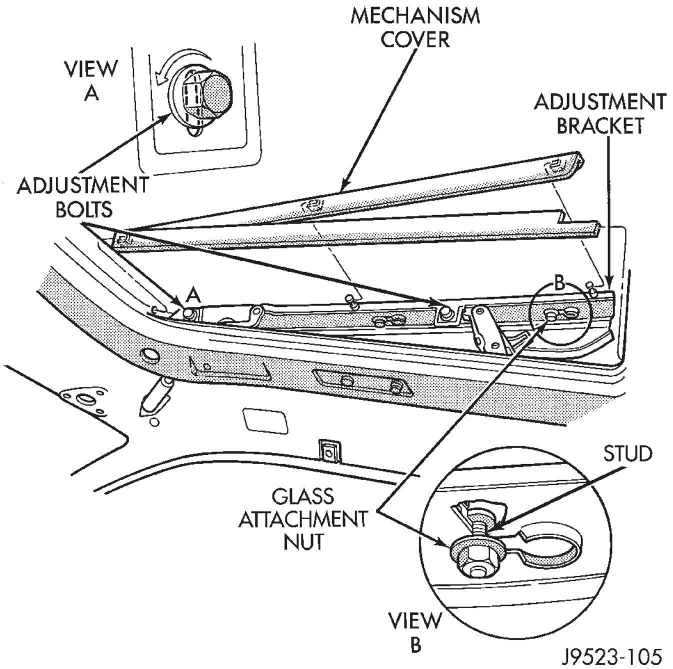


Fig. 5 Adjustment Bracket Removal/Installation

(4) For installation reverse the preceding operation. Adjust glass as necessary.

DRAIN CHANNEL

REMOVAL AND INSTALLATION

(1) Locate glass to vent position.

(2) Remove mechanism covers and glass panel.

(3) Remove screws holding drain channel to support frame.

(4) For installation reverse preceding operation.

DRIVE CABLE LOCATORS

REMOVAL AND INSTALLATION

(1) Position glass 19 mm (0.75 in.) until rearward cable locator is visible.

(2) Remove screws holding drive cable locator to unit.

(3) Remove travel limiting micro switch grommet and disconnect wire connector.

(4) Insert a small screwdriver under rear edge of locator and pry locator from track (Fig. 6).

(5) For installation reverse preceding operation. The small out-board lip underneath cable locator slips under bottom slot on guide track. After locator is seated install screws.

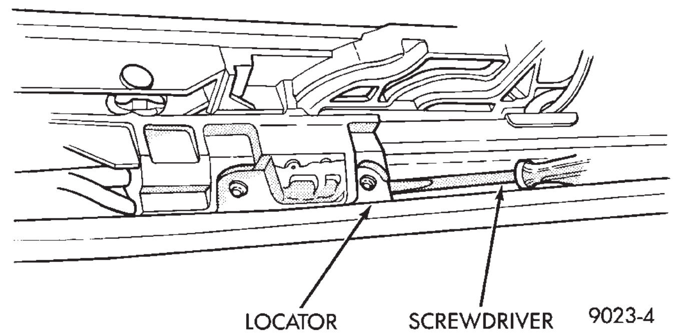


Fig. 6 Removing Cable Drive Locator

MOTOR AND DRIVE GEARS

REMOVAL

(1) Open sunroof to vent position.

(2) Remove headlining.

(3) Remove bolts holding sunroof motor to motor bracket.

(4) Disconnect wire connector.

(5) Separate motor and drive gear from drive cables (Fig. 7).

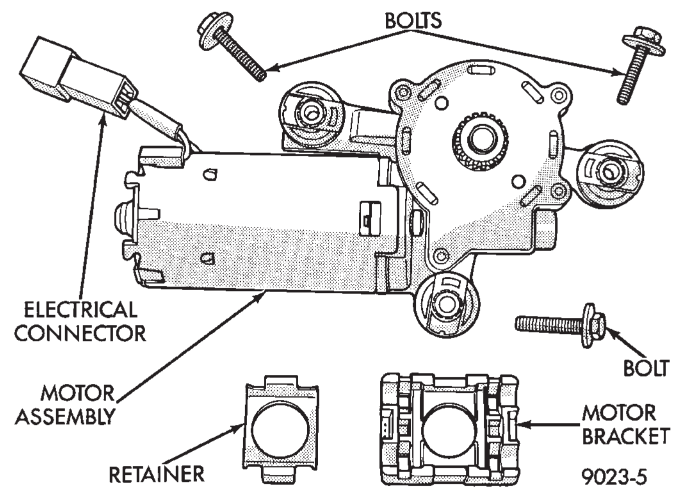


Fig. 7 Sunroof Motor And Drive Gear

INSTALLATION

(1) Verify that sunroof is in vent position. Push mechanism forward on both sides to align drive cables.

(2) Engage drive gears onto drive cables.

(3) Install motor and drive gear screws and tighten to 5 N·m (44in-lbs.).

(4) Install headlining.

DRIVE CABLES

REMOVAL

(1) Open sunroof to vent position.

(2) Remove headlining, wind deflector, mechanism covers, glass panel, side glass adjustment brackets, motor and drive cable locators.

(3) Lift cable out of cable retainer and pull forward. Separate cable from assembly (Fig. 8).

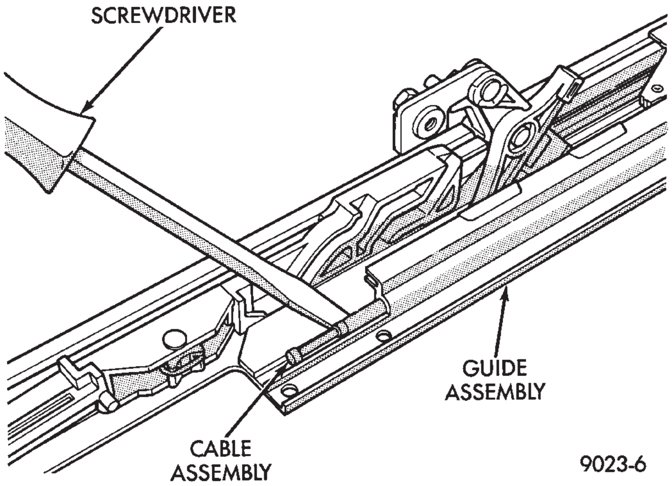


Fig. 8 Drive Cables

INSTALLATION

Verify sunroof is in vent position. Push mechanism forward on both sides to align drive cables. Reverse the preceding operation.

SUNSHADE

REMOVAL AND INSTALLATION

(1) Remove wind deflector, mechanism covers and glass panel.

(2) Position system to full rearward position.

(3) Slide sunshade panel full forward and release the front tabs from track assembly.

(4) Pull front and rear retaining clips inboard and lift sunshade out (Fig. 9).

(5) For installation reverse preceding operation.

GUIDE ASSEMBLY

REMOVAL

(1) Remove wind deflector, mechanism covers, glass panel, drain channel, sunshade and drive cable locator as necessary.

(2) Move glass carriage to vent position.

(3) Remove front slide from guide assembly.

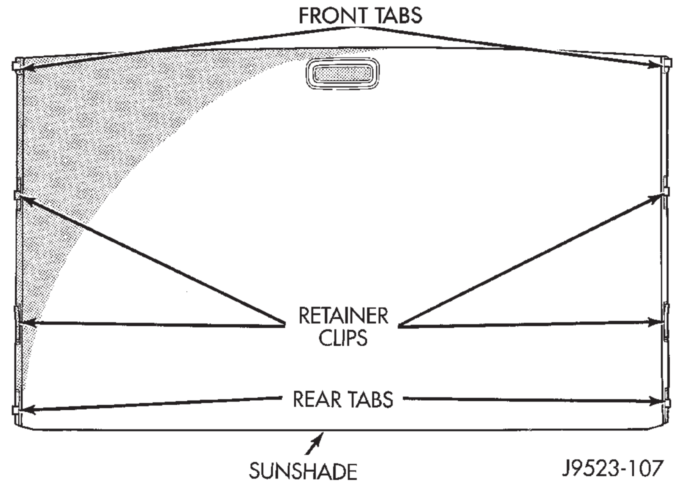


Fig. 9 Sunshade

(4) Remove screws holding front and center guide track to unit.

(5) Pull cable out of groove for cable end.

(6) Pull guide outward to release from housing. Separate rear end of guide from clips. Slide guide out of unit (Fig. 10).

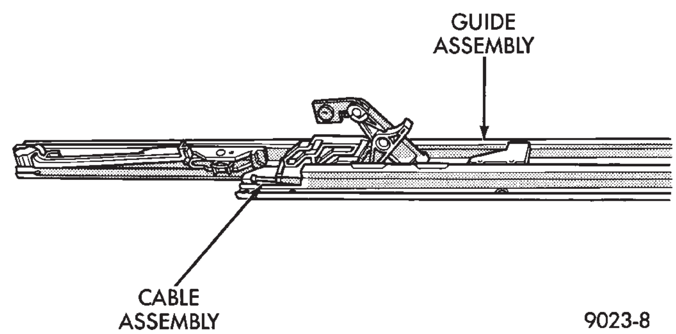


Fig. 10 Guide Assembly

INSTALLATION

(1) Install guide cable into rear of guide assembly.

(2) Install guide assembly at an angle so the rear portion slips under finger clips at rear of module housing.

(3) Place cable in groove of cable holder.

(4) Install screws in track assembly.

(5) Install locators.

(6) Reverse removal operation.

DOORS

INDEX

FRONT DOOR TRIM PANEL

REMOVAL

(1) Remove inside release handle assembly screws (Fig. 1).

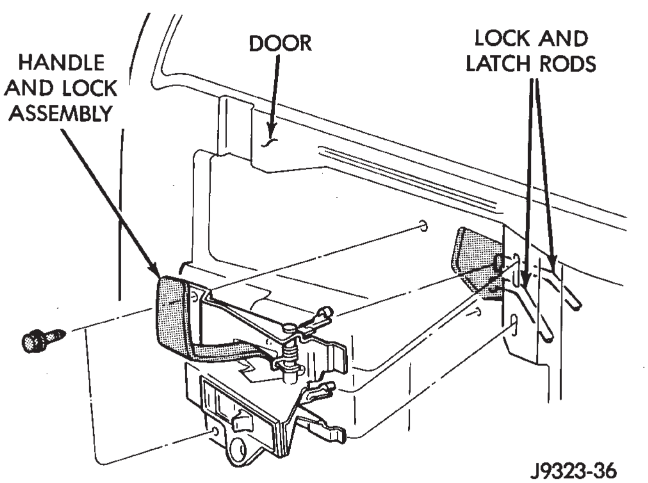


Fig. 1 Front Door Inside Latch Release Handle

(2) Remove screw at armrest (Fig. 2).
(3) Remove screw at window demister slot (Fig. 2).
(4) Remove screw at the upper mirror bezel (Fig. 2).
(5) Detach trim panel perimeter retainers from door inner panel with an appropriate pry tool (Fig. 2).
(6) If equipped, disconnect the wiring connectors from power switch panel.
(7) Remove trim panel from door (Fig. 2).
(8) If necessary, remove waterdams from door.
(9) If necessary, remove power switches from door panel (Fig. 3 and 4).
(10) Disconnect handle latch and lock rods.

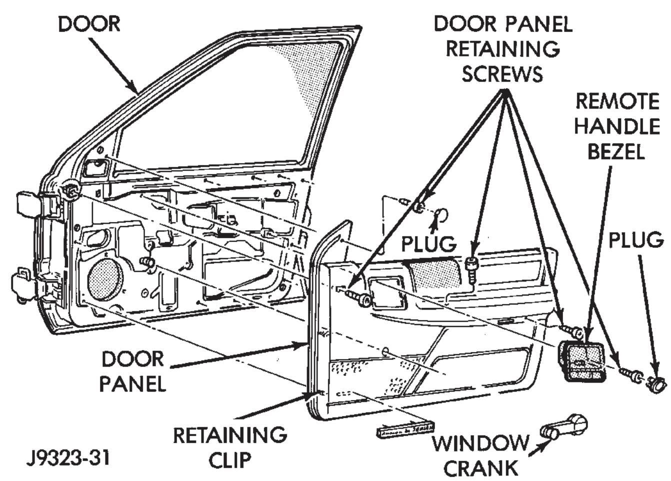


Fig. 2 Door Panel

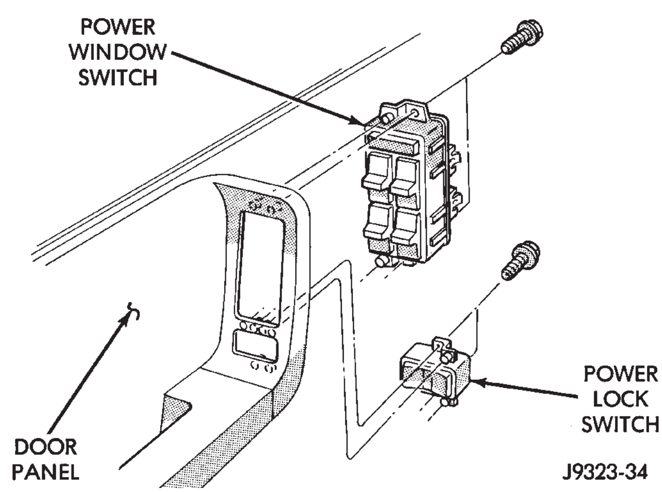


Fig. 3 Left Power Door Switches

(11) Remove window crank handle (Fig. 2).

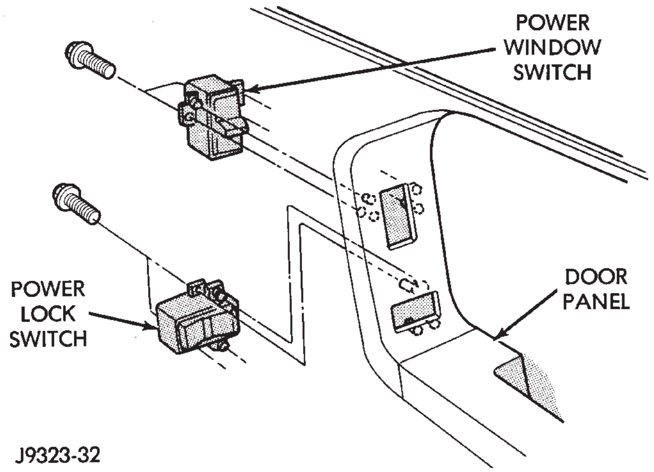


Fig. 4 Right Power Door Switches

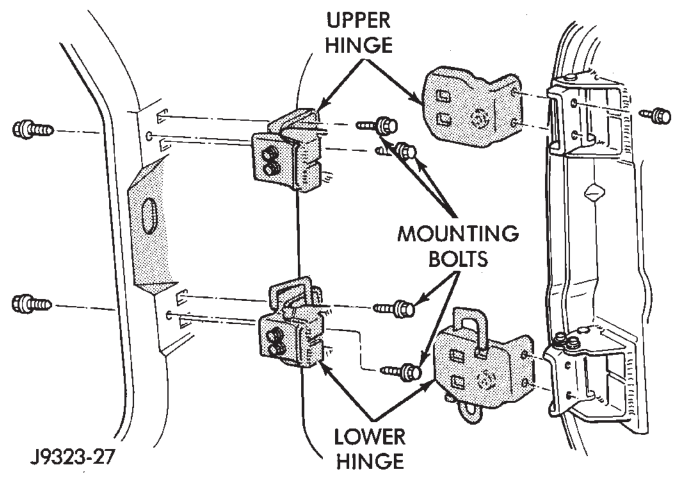


Fig. 5 Door Hinges and Bolts

INSTALLATION

(1) Connect rods to inside handle assembly. Install handle assembly (Fig. 2). Tighten screws to 2 N·m (16 in-lbs) torque.

(2) Apply adhesive/sealant to edges of door waterdam.

(3) Position waterdam on door inner panel. Press it inward to attach it to inner panel.

(4) If removed, install power door switches (Fig. 3 and 4).

(5) Position trim panel on door inner panel. For vehicles equipped with power door locks/windows, connect wire harness connectors. Press nylon retainers inward to attach it to inner panel (Fig. 2).

(6) Install armrest screw. Install demister slot screw. Install mirror bezel screw (Fig. 2). Tighten screws to 4 N·m (34 in-lbs) torque.

(7) Install window crank handle.

DOOR REMOVAL/INSTALLATION

(1) For vehicles equipped with power windows and locks, remove door trim panel. Disconnect power window regulator, power door lock motor and all other wire harness connectors. Slide wire harness out of boot and door.

(2) Mark an outline around door hinges for installation alignment reference.

(3) Remove door hinge, retaining bolts, plates and shims (Fig. 5). Remove door from vehicle.

(4) Identify and retain door hinge plates and shims for correct installation (Fig. 5).

(5) If a replacement front door is being installed, coat door interior with anti-corrosion wax. Also, seal door hem flange with sealant.

(6) Before installing a replacement door, transfer original hardware. If necessary, refer to applicable procedures.

(7) Position door in body opening.

(8) Align door hinges, plates and shims with bolt holes. Install (but do not tighten) hinge bolts (Fig. 5).

(9) Adjust door to reference marks. If necessary, refer to adjustment procedure. Tighten hinge bolts to 35 N·m (26 ft-lbs) torque.

(10) Adjust latch striker as necessary.

(11) If applicable, route and connect harness connectors to door and vehicle body wire harness connectors.

(12) Install door waterdam (if removed), trim panel, armrest and window glass regulator handle. If necessary, refer to trim panel installation procedure.

DOOR ALIGNMENT ADJUSTMENT—MINOR

Minor adjustment for alignment of the door is made by moving the latch striker.

IN AND OUT

(1) Loosen the latch striker.

(2) Tap the latch striker inward if the door character line is outboard of the body character line or tap the latch striker outward if the door character line is inboard of the body character line.

(3) Inspect alignment. If correct, tighten striker with 28 N·m (21 ft. lbs.) torque.

UP AND DOWN

(1) Loosen the latch striker.

(2) Tap the latch striker downward if the door character line is higher than the body character line or tap the latch striker upward if the door character line is lower than the body character line.

(3) Inspect alignment. If correct, tighten striker with 28 N·m (21 ft. lbs.) torque.

FRONT DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel and waterdam. If necessary, refer to removal procedure.

(2) Position window glass to access window track nuts (Fig. 6).

(3) Loosen 2 window track nuts and slide track off of the window (Fig. 6).

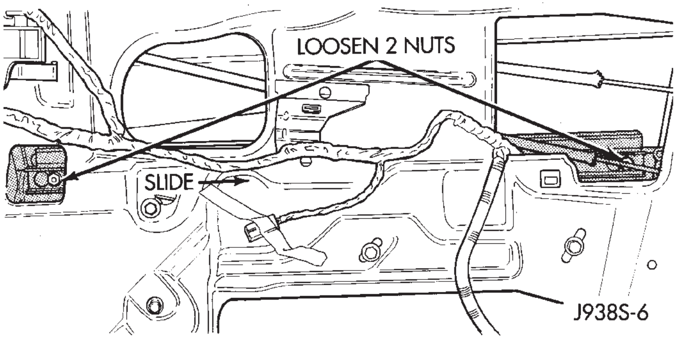


Fig. 6 Front Door Window Track

(4) Remove 4 window regulator retaining screws (Fig. 7).

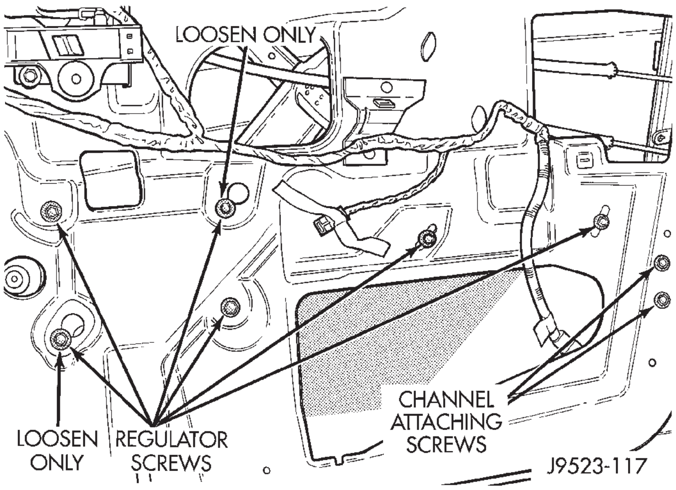


Fig. 7 Front Door Window Regulator

(5) Lift window upward and separate it from regulator. Support window.

(6) Remove window regulator from door.

Reverse removal procedure for installation.

FRONT DOOR WINDOW

REMOVAL

(1) Remove door trim panel and waterdam. If necessary, refer to removal procedure.

(2) Remove beltline molding and weatherstrip seals.

(3) Remove window track retaining nuts (Fig. 6). If necessary, refer to removal procedure.

(4) Lift window glass upward and out of door.

For installation, reverse removal procedure.

REAR DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel and waterdam. If necessary, refer to removal procedure.

(2) Position window glass to access window track nuts (Fig. 8).

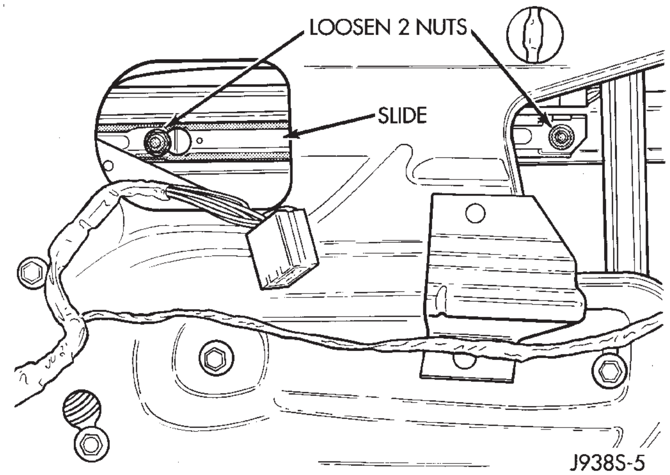


Fig. 8 Rear Door Window Track

(3) Loosen 2 window track nuts and slide track off of window (Fig. 8).

(4) Remove 4 window regulator retaining screws (Fig. 9).

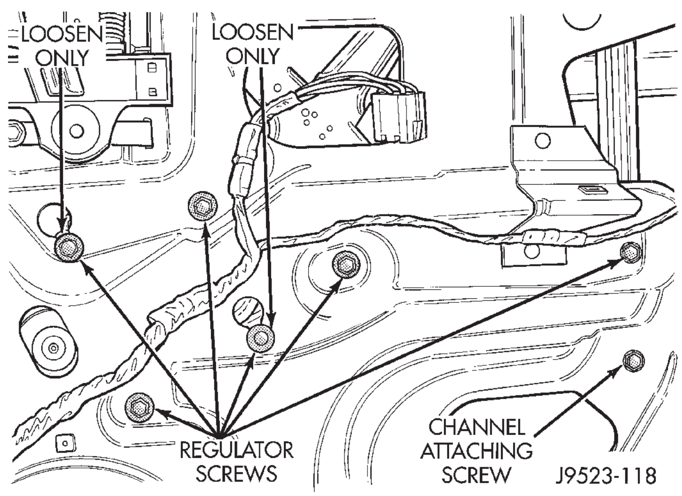


Fig. 9 Rear Door Window Regulator

(5) Lift window upward and separate it from regulator. Support window.

(6) Remove window regulator from door.

Reverse removal procedure for installation.

REAR DOOR WINDOW

REMOVAL

(1) Lower window glass.

(2) Remove trim panel and waterdam from door inner panel. If necessary, refer to removal procedure.

(3) Pry window beltline molding from flange. Remove molding from door.

(4) Remove window weatherstrip seals from door.

(5) Remove window track nuts and slide track off of window (Fig. 8).

(6) Remove division bar upper attaching screw and belt line screw (Fig. 10).

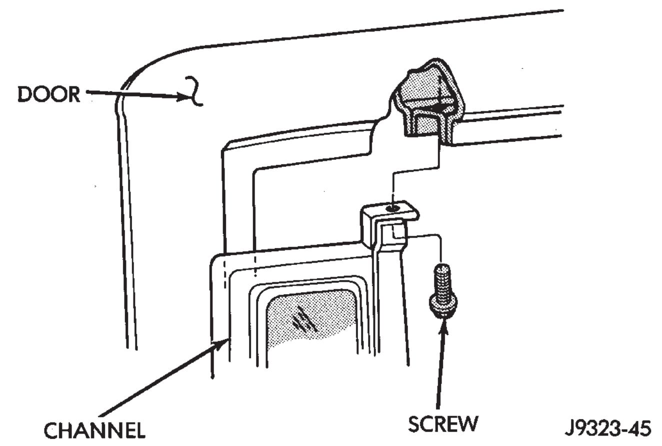


Fig. 10 Stationary Glass Channel

(7) Tilt stationary glass channel assembly forward and remove it from door.

(8) Remove window glass from door.

INSTALLATION

(1) Install window glass in door.

(2) Tighten glass track nuts to 6 N·m (53 in-lbs) torque.

(3) Install stationary glass channel in door.

(4) Install stationary glass channel screws (Fig. 10). Tighten screw to 6 N·m (5 ft-lbs) torque.

(5) Install window glass channel and belt weather-strip seals.

(6) Install window beltline molding.

(7) Install door waterdam and trim panel. If necessary, refer to installation procedure.

DOOR KEY LOCK CYLINDER

REMOVAL

(1) Remove door trim panel and waterdam. If necessary. refer to removal procedure.

(2) Disconnect door latch lock cylinder rod at door latch (Fig. 11).

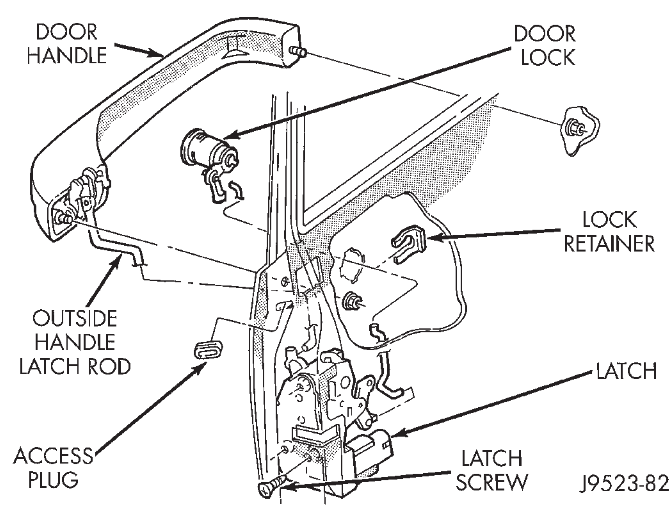


Fig. 11 Key Lock Cylinder & Door Latch

(3) If equipped, disconnect security alarm switch connector from lock cylinder (Fig. 12).

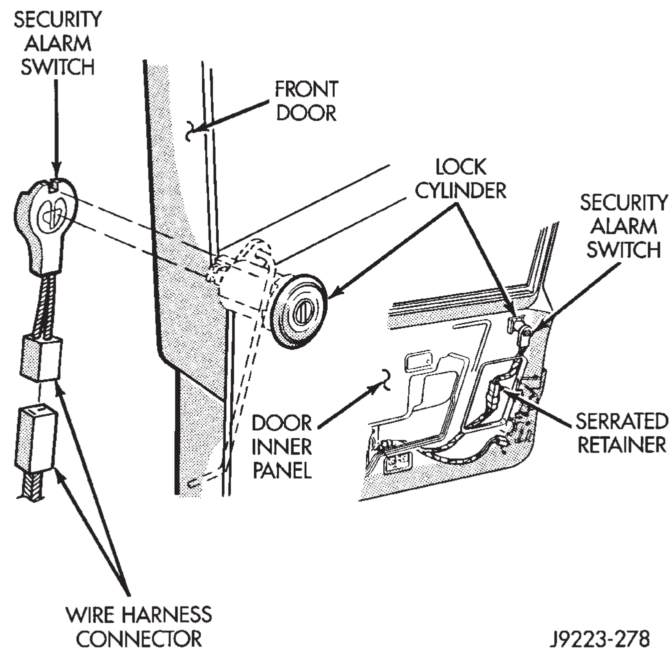


Fig. 12 Security Alarm Switch

(4) Remove key lock cylinder retainer clip. Remove lock cylinder, gasket and clip from door (Fig. 11).

(5) If applicable, remove door latch lock cylinder rod from original lock cylinder. Connect it to replacement lock cylinder.

For installation, reverse removal procedure.

DOOR LATCH ADJUSTMENT

(1) Locate access hole (Fig. 13).

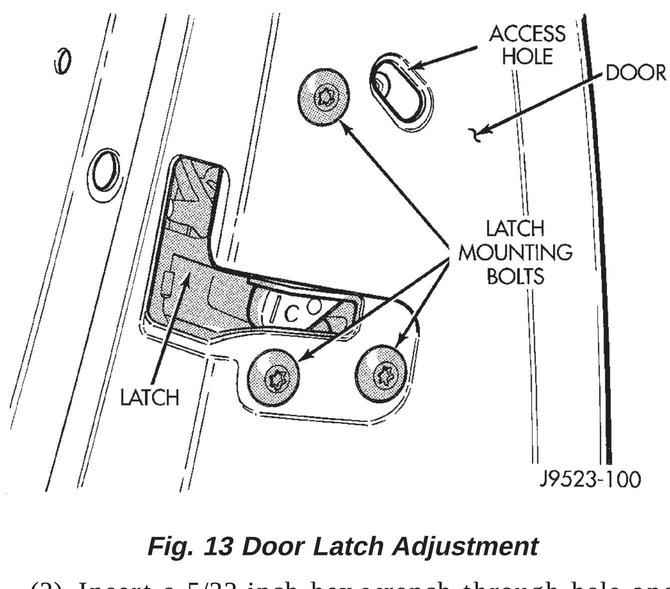


Fig. 13 Door Latch Adjustment

(2) Insert a 5/32-inch hex-wrench through hole and into adjustment screw. Loosen screw.

(3) Operate outside handle button several times to release any restriction because of mis-alignment.

(4) Tighten adjustment screw to 3 N·m (30 in-lbs) torque.

(5) Test handle button and lock cylinder for proper operation.

OUTSIDE DOOR HANDLE

REMOVAL

(1) Remove door trim panel and waterdam. If necessary, refer to removal/installation procedure.

(2) Remove access hole cover and door handle retaining nuts.

(3) Disconnect handle latch rod from latch (Fig. 11).

For installation, reverse removal procedure.

DOOR LATCH

REMOVAL

(1) Remove door trim panel and waterdam. If necessary, refer to removal procedure.

(2) Remove door latch retaining screws (Fig. 14).

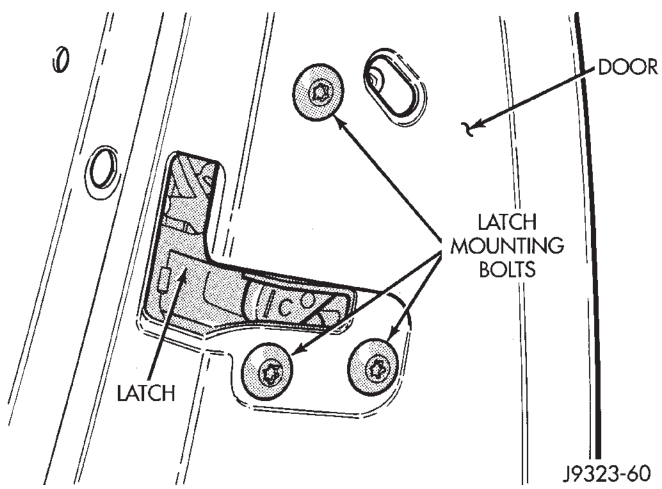


Fig. 14 Door Latch Retaining Screws

(3) Disconnect all rods from door latch (Fig. 15).

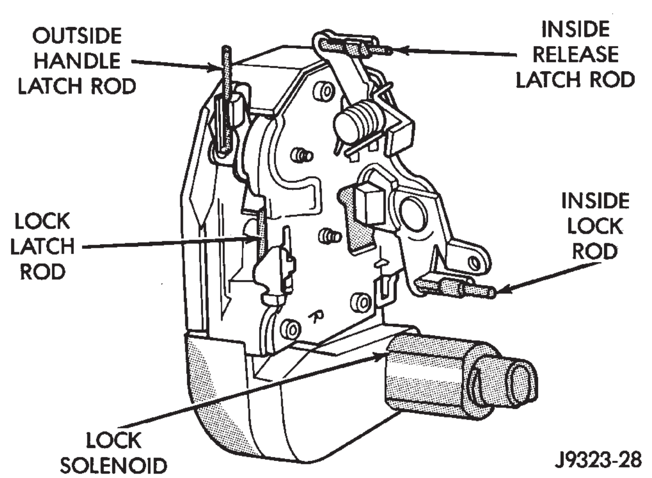


Fig. 15 Door Latch

(4) Disconnect wire connector, if equipped.

(5) Remove door latch from door.

For installation, reverse removal procedure.

DOOR INSIDE LATCH RELEASE AND LOCK RODS

REMOVAL

(1) Remove door trim panel and waterdam. If necessary, refer to removal procedure.

(2) Remove door inside latch release handle screws (Fig. 16 and 17).

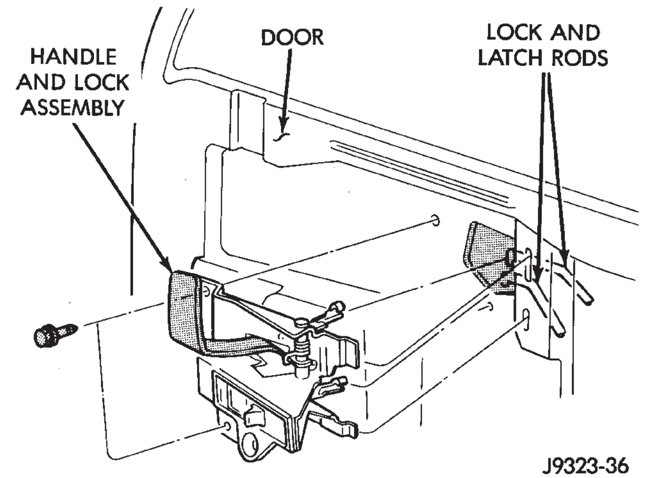


Fig. 16 Front Door Inside Latch Release Handle

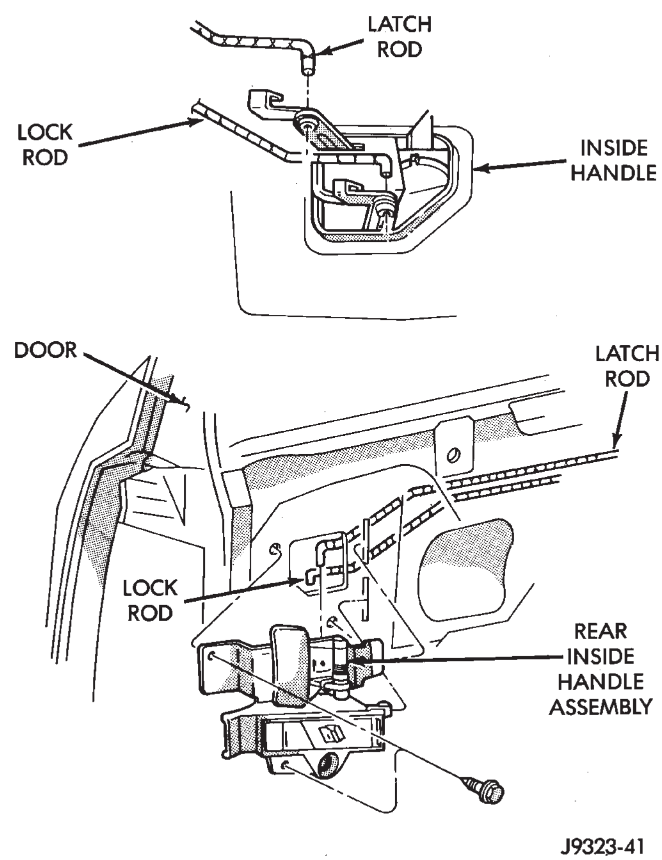


Fig. 17 Rear Door Inside Latch Release Handle

(3) Move door release handle outward. Disconnect handle latch and lock rods.

(4) Remove door inside release handle from door.

For installation, reverse removal procedure.

DOOR WINDOW EXTERIOR MOLDINGS

REMOVAL

(1) Lower window glass completely.

(2) Carefully pull molding from door panel flange and/or retaining clips.

INSTALLATION

(1) When installing window moldings, start at forward end of molding.

(2) Force molding onto door flange. Continue rearward until it is seated on flange.

(3) Mate rear molding with upper molding. Force molding edge inward.

(4) Continue pressing downward to complete installation.

DOOR WINDOW GLASS AND DOOR OPENING SEALS

The window glass seals can be removed by hand.

The door opening seal is attached to edge of door opening in body. The front door secondary seal is attached to A-pillar.

WINDOW GLASS SEAL INSTALLATION

When installing front or rear door window glass weatherstrip seals, open window completely.

(1) To install a front door window channel weatherstrip seal, start at upper, rear corner.

(2) To install a rear door window glass channel weatherstrip seal, start at upper, front corner.

(3) Install seal evenly until it is fully seated in channel.

(4) Position belt weatherstrip seals at window edge. Force them downward until seated on flange.

DOOR OPENING WEATHERSTRIP SEAL INSTALLATION

(1) When installing a door opening weatherstrip seal, start at rear of front seal and front of rear seal using paint dots as location points.

(2) Use adhesive along with push-studs to aid in retaining a weatherstrip seal.

(3) Move upward and around edge of door opening. Seat seal on flange.

LIFTGATE TRIM PANEL

REMOVAL

(1) Remove the CHMSL access panel. Remove the screws that attach liftgate panel to liftgate (Fig. 1).

(2) Use a trim panel removal tool to detach panel retainers from liftgate (Fig. 2).

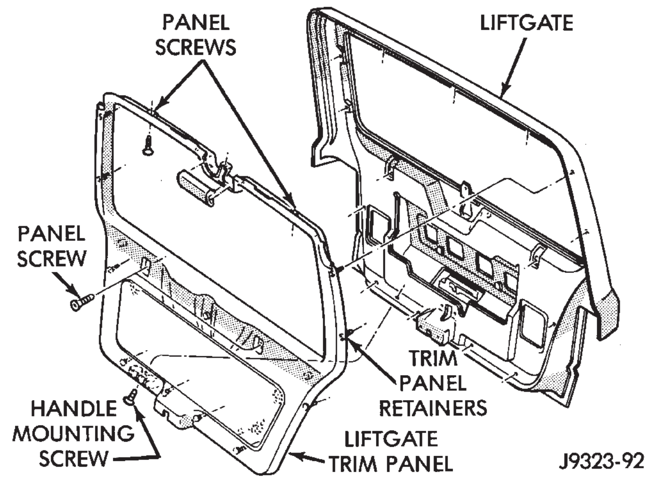


Fig. 1 Liftgate Trim Panel

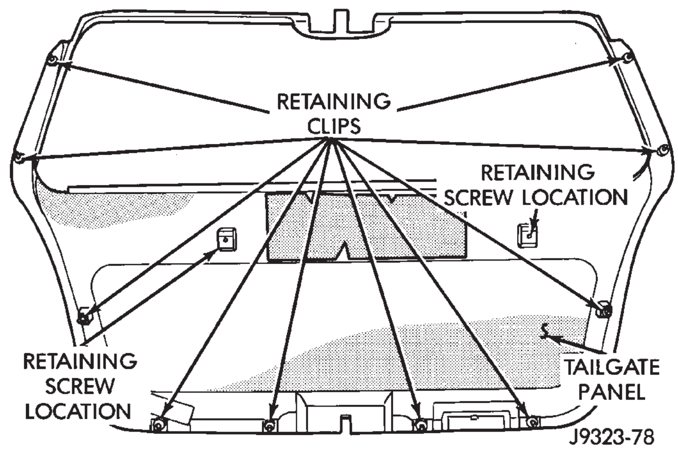


Fig. 2 Liftgate Retainer Location

(3) Remove trim panel from liftgate.

INSTALLATION

(1) Position trim panel on liftgate.

(2) Align trim panel retainers with holes in liftgate inner panel. Force trim panel inward to seat retainers in holes (Fig. 2).

(3) Install screws to attach panel to liftgate (Fig. 1). Tighten screws securely.

LIFTGATE

REMOVAL

WARNING: DO NOT DISCONNECT THE SUPPORT ROD CYLINDERS WITH THE LIFTGATE CLOSED. THE SUPPORT ROD PISTONS ARE OPERATED BY HIGH PRESSURE GAS. THIS PRESSURE COULD CAUSE DAMAGE AND/OR PERSONAL INJURY IF THEY ARE REMOVED WHILE THE PISTONS ARE COMPRESSED.

(1) Open liftgate. Support liftgate for ease of repair.

(2) Remove liftgate trim panel (Fig. 1). If necessary, refer to removal procedure.

(3) Remove retainer clips that secure support rod cylinders to ball studs (Fig. 3).

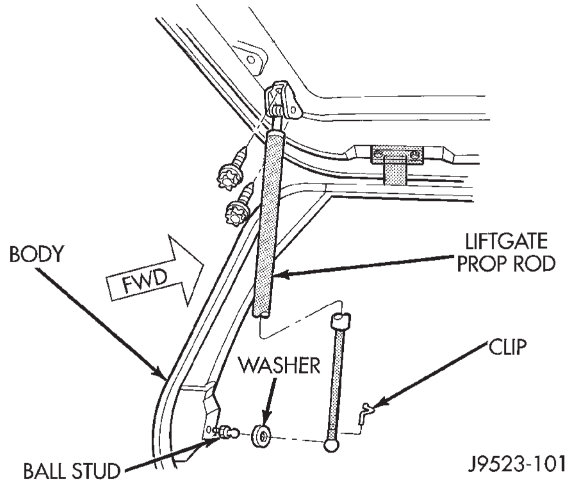


Fig. 3 Liftgate Prop Rod

(4) Remove support rod cylinders from ball studs (Fig. 23).

(5) Remove upper support rod retaining screws (Fig. 23). Remove support rods.

(6) Disconnect wire harnesses and washer hose from liftgate.

(7) Remove hinge screws at liftgate (Fig. 4).

(8) Remove liftgate from vehicle.

For installation, reverse removal procedure. Tighten hinge screws to 28 N·m (21 ft-lbs) torque.

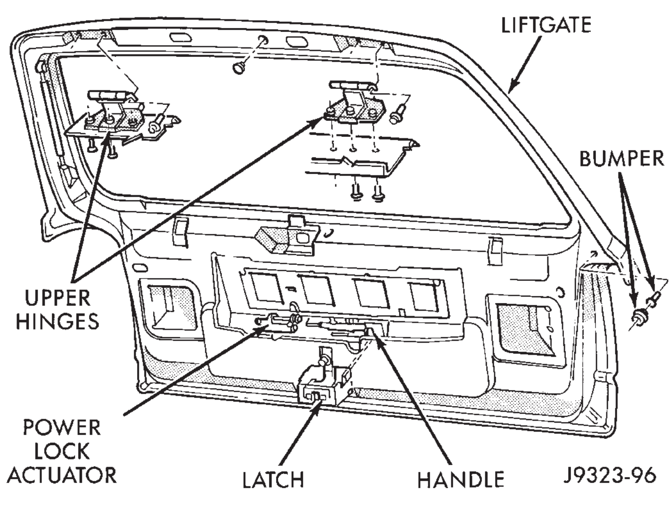


Fig. 4 Liftgate Components

LIFTGATE HINGE

REMOVAL

It is not necessary to remove liftgate to replace one or both hinges. The hinges can be replaced one at a time.

(1) Remove liftgate opening (headliner) upper trim molding (Fig. 5). Disconnect wiring harness to cargo lamp.

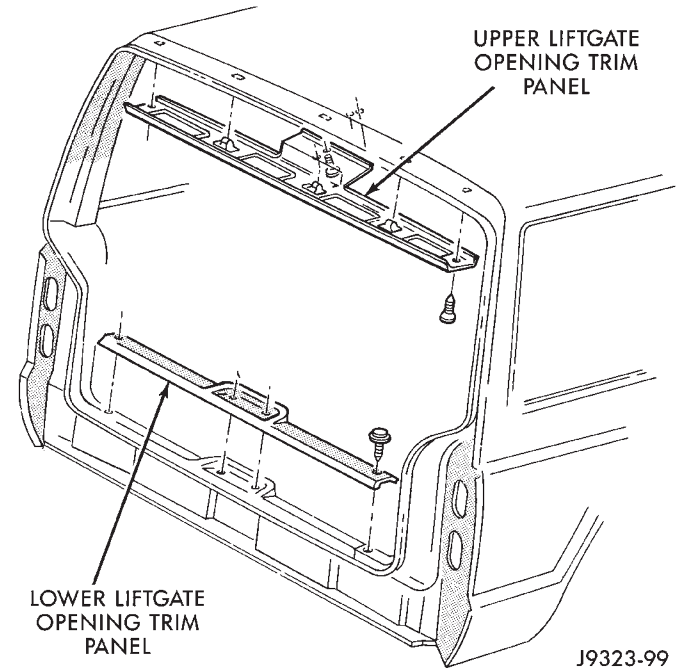


Fig. 5 Liftgate Upper Trim Molding

(2) Remove hinge screws at roof panel (Fig. 4).

(3) Remove hinge screws at liftgate (Fig. 4).

(4) Remove hinge from liftgate (Fig. 4).

INSTALLATION

(1) Position hinge on liftgate and roof panel (Fig. 4). (Use 3M™ Fast and Firm or equivalent on the hinge to body mating surface as a sealant).

(2) Install and tighten hinge screws at roof panel to 28 N·m (21 ft-lbs) torque.

(3) Install hinge screws at liftgate. Tighten screws to 28 N·m (21 ft-lbs) torque.

(4) Install liftgate opening (headliner) upper trim molding (Fig. 5).

LIFTGATE LATCH/LOCK COMPONENTS

REMOVAL

(1) Raise liftgate. Remove liftgate trim panel. If necessary refer to service procedure.

(2) Remove latch screws (Fig. 6).

(3) Disconnect rod from latch (Fig. 6).

(4) Disconnect power lock connector, if equipped (Fig. 7).

(5) Remove latch from liftgate (Fig. 6 and 7).

(6) Remove lock cylinder retainer clip (Fig. 6).

(7) Remove key lock cylinder.

(8) Remove nuts retaining the liftgate handle. Remove the handle (Fig. 6 and 7).

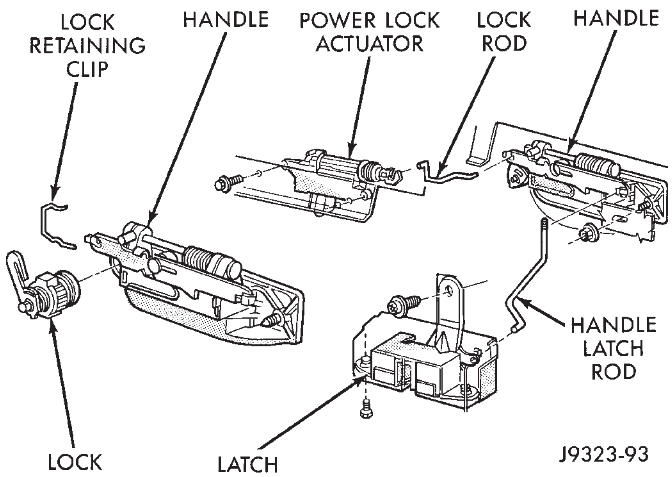


Fig. 6 Liftgate Latch/Lock Component

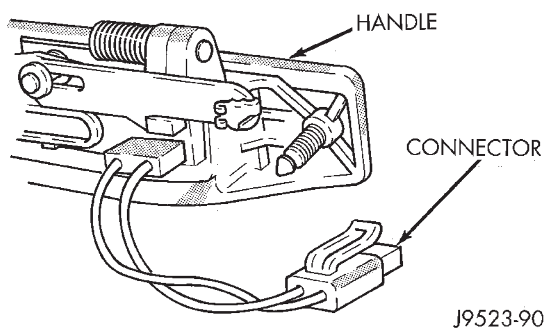


Fig. 7 Power Lock Handle

(9) Remove latch striker nuts from below scuff plate. Access nuts from under bumper fascia/beam. (Fig. 8)

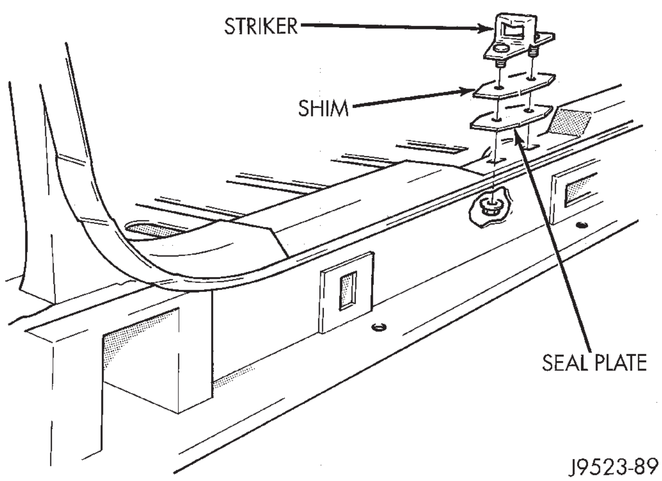


Fig. 8 Liftgate Latch Striker

(10) Remove striker, shim and seal plate (Fig. 8).

For installation of components, reverse removal procedure. Tighten striker nuts to 54 N·m (40 ft. lbs.) and tighten latch screws to 7 N·m (5 ft. lbs.) torque.

LIFTGATE ADJUSTMENT

The position of liftgate can be adjusted upward or downward by use of slots in the hinge. An inward or outward adjustment is achieved by use of slots in the body. If an inward or outward adjustment is needed, use 3M™ Fast and Firm or equivalent on the hinge to body mating surface as a sealant.

LIFTGATE OPENING WEATHERSTRIP SEAL

REMOVAL

(1) Pull seal away from flange around edge of liftgate opening. Remove it from vehicle.

(2) Clean seal flange as necessary.

INSTALLATION

(1) Position weatherstrip seal in opening with left end of seal at opening centerline. Install seal in a clockwise direction.

(2) Seat installed part of seal. Move from left bottom end of seal to top left half of the seal.

(3) Center and butt seal ends together at centerline.

LICENSE PLATE LAMP HOUSING

REMOVAL

(1) Remove liftgate trim panel

(2) Remove lamp housing retaining screws from liftgate (Fig. 9).

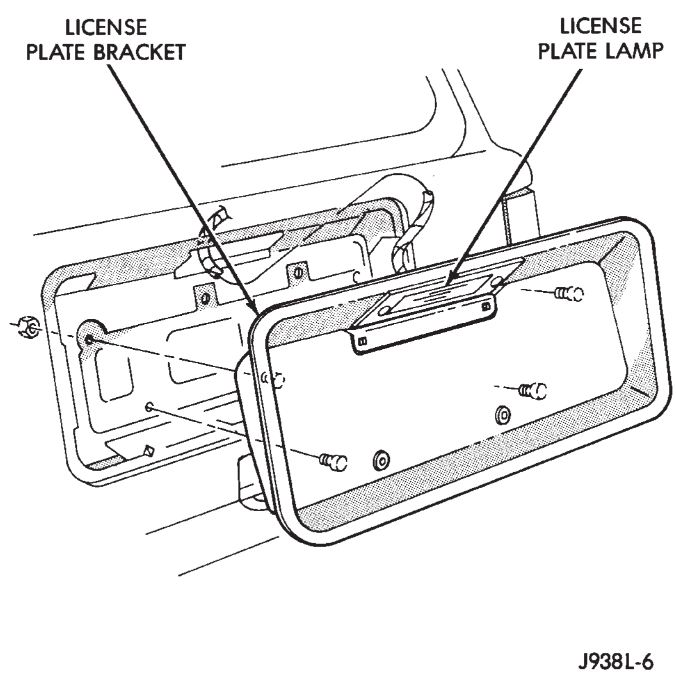


Fig. 9 License Plate Lamp Housing

(3) Disconnect bulb socket from lamp housing.

(4) Disconnect Flip-Up glass switch connector, if equipped.

(5) Remove housing from liftgate.

INSTALLATION

(1) Position lamp housing at liftgate.

(2) Connect bulb socket to lamp housing.

(3) Connect Flip-Up glass switch connector, if equipped.

(4) Install lamp housing retaining screws in liftgate. Tighten screws securely.

(5) Install liftgate trim panel.

LIFTGATE FLIP-UP GLASS

REMOVAL

WARNING: DO NOT DISCONNECT THE PROP ROD CYLINDERS WITH THE LIFTGATE FLIP-UP GLASS CLOSED. THE PROP ROD PISTONS ARE OPERATED BY HIGH PRESSURE GAS. THIS PRESSURE COULD CAUSE DAMAGE AND/OR PERSONAL INJURY IF THEY ARE REMOVED WHILE THE PISTONS ARE COMPRESSED.

(1) Open liftgate flip-up glass. Support glass for ease of repair.

(2) Using a small flat blade or equivalent tool, gently pry open the locking caps on the end of the prop rod. (Fig. 10).

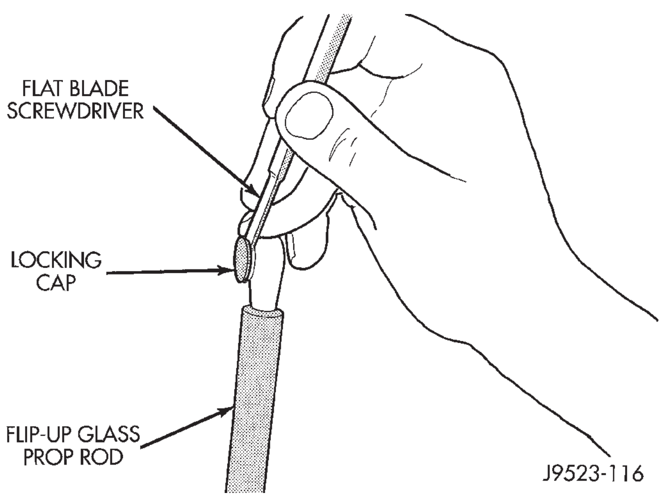


Fig. 10 Prop Rod Removal

(3) Remove prop rod cylinders from ball studs (Fig. 11).

(4) Remove hinge nuts from liftgate (Fig. 12).

(5) Separate flip-up glass from vehicle.

DISASSEMBLY

(1) Remove ball studs from glass panel.

(2) Remove hinge from glass panel.

(3) Remove handle/striker.

ASSEMBLY

(1) Install ball studs onto glass panel. Tighten screws to 6 N·m (60 in. lbs.).

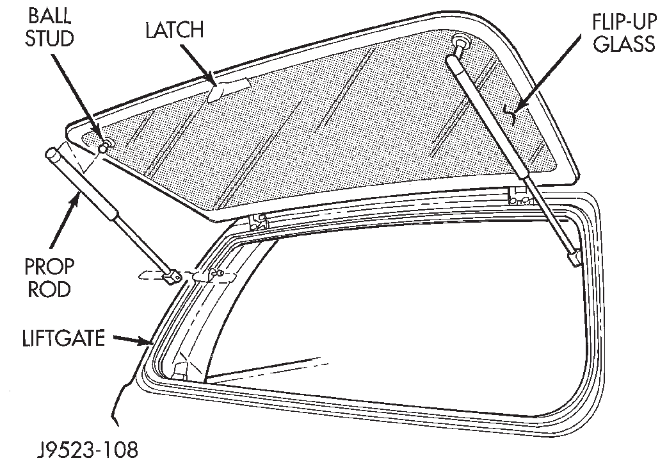


Fig. 11 Prop Rod Removal

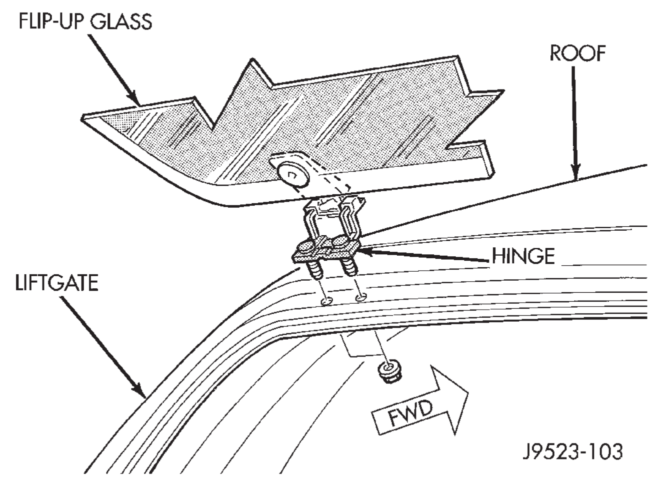


Fig. 12 Hinge Removal

(2) Position hinges on to glass panel and finger tighten screws.

(3) Install handle/striker. Tighten screws to 6 N·m (60 in. lbs.).

INSTALLATION

(1) Position flip-up glass on liftgate.

(2) Install hinge nuts. Tighten nuts to 6 N·m (60 in. lbs.).

(3) Check alignment of glass panel. If panel is aligned correctly, tighten hinge screw to 6 N·m (60 in. lbs.).

(4) Install prop rods onto ball studs (Fig. 11) and compress locking caps to lock prop rods onto ball studs.

LIFTGATE FLIP-UP GLASS LATCH/LOCK COMPONENTS

REMOVAL

(1) Raise liftgate. Remove liftgate trim panel. If necessary refer to service procedure.

(2) Remove latch nuts (Fig. 13).

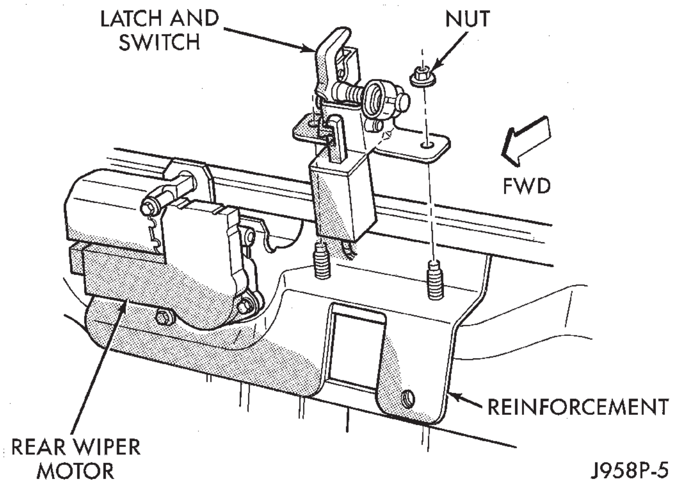


Fig. 13 Flip-Up Glass Latch/Lock Component

(3) Disconnect switch connector.
(4) Remove latch from liftgate.

INSTALLATION

(1) Position latch on vehicle, 2.5 mm forward of seal.
(2) Connect switch connector.
(3) Install latch nuts. Tighten to 11 N·m (100 in. lbs.).
(4) Close flip-up glass panel and verify proper operation.
(5) Install liftgate trim panel.

FLIP-UP GLASS SWITCH

REMOVAL

(1) Remove liftgate trim panel.
(2) Remove license plate lamp housing nuts from liftgate (Fig. 14).

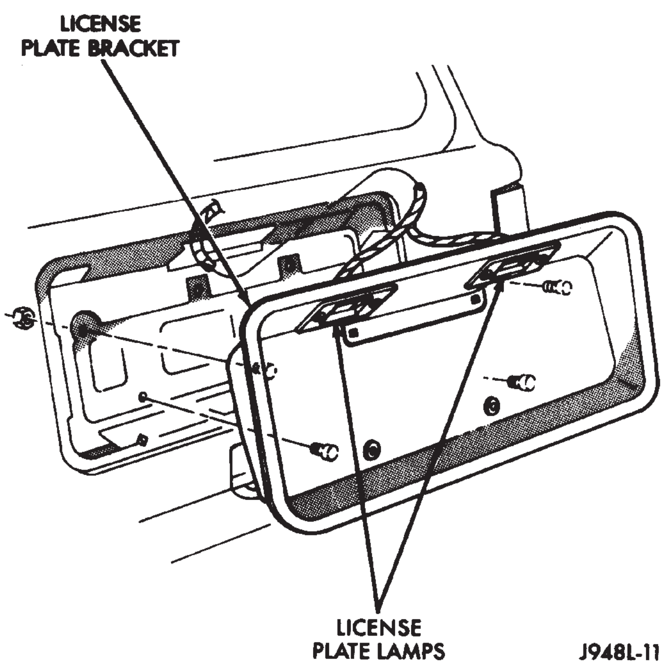


Fig. 14 License Plate Lamp Housing

(3) Squeeze switch locking tabs inward to release switch from license plate lamp housing.
(4) Disconnect switch harness connector.
(5) Separate switch from housing (Fig. 15).

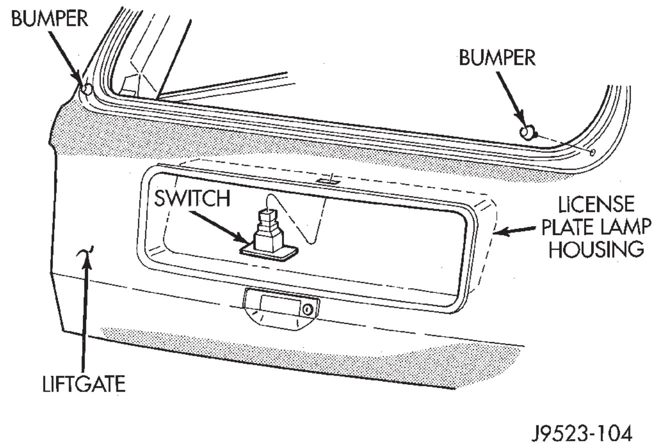


Fig. 15 Switch Removal

INSTALLATION

(1) Position switch into license plate lamp housing and connect switch harness connector.
(2) Snap switch into place.
(3) Install license plate lamp housing.
(4) Install liftgate trim panel.

LIFTGATE FLIP-UP GLASS WEATHERSTRIP SEAL

REMOVAL

(1) Slowly pull seal away from flange around edge of glass opening. Remove it from vehicle.
(2) Clean seal flange as necessary.

INSTALLATION

(1) Position weatherstrip seal with paint dots aligned with window opening corners.
(2) Seat seal firmly around entire liftgate (Fig. 16).
(3) Butt seal ends together and smooth out any remaining length.

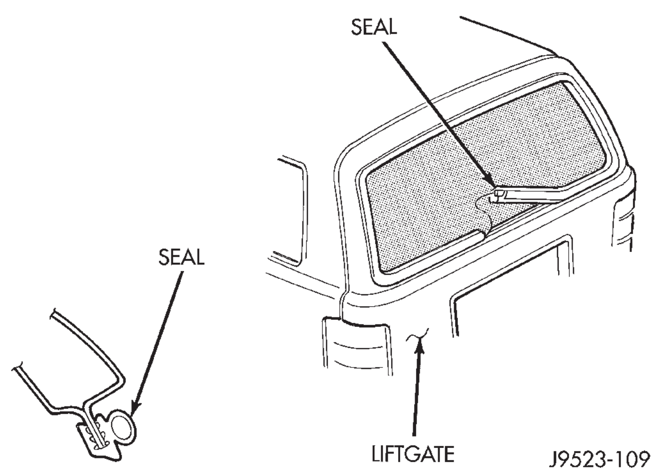


Fig. 16 Liftgate Seal

FIXED WINDOW GLASS

INDEX

SAFETY PRECAUTIONS AND WARNINGS

WARNING: DO NOT USE URETHANE ADHESIVE OR PRIMER IN CLOSED WORK AREA, PERSONAL INJURY CAN RESULT. PROTECT SKIN FROM COMING IN CONTACT WITH URETHANE, PERSONAL INJURY CAN RESULT. WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS, PERSONAL INJURY CAN RESULT.

CAUTION: Protect all painted or trimmed surfaces from coming in contact with urethane or primers, damage will result. Do not damage painted surfaces when removing moldings or cutting urethane around windshield.

WARNING: DO NOT OPERATE VEHICLE FOR AT LEAST 24 HOURS AFTER WINDSHIELD INSTALLATION. WINDSHIELD MAY NOT PERFORM PROPERLY IN THE EVENT OF A COLLISION IF URETHANE ADHESIVE IS NOT SUFFICIENTLY CURED. REFER TO MANUFACTURER OF URETHANE BEING USED FOR CURING TIME SPECIFICATIONS. WHEN INSTALLING GLASS, DO NOT USE URETHANE ADHESIVE AFTER DATE ON PRODUCT HAS EXPIRED. SAFETY AND QUALITY OF REPAIR WOULD BE QUESTIONABLE.

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 windshield to fence is difficult to cut or clean from any surface. If moldings are set in urethane, it would also be unlikely they could be salvaged. Before removing windshield, check availability of windshield and moldings from the parts supplier.

WINDSHIELD REPLACEMENT

The procedure for windshield replacement can also be used to service rear quarter glass and liftgate glass (Fig. 1 and 2).

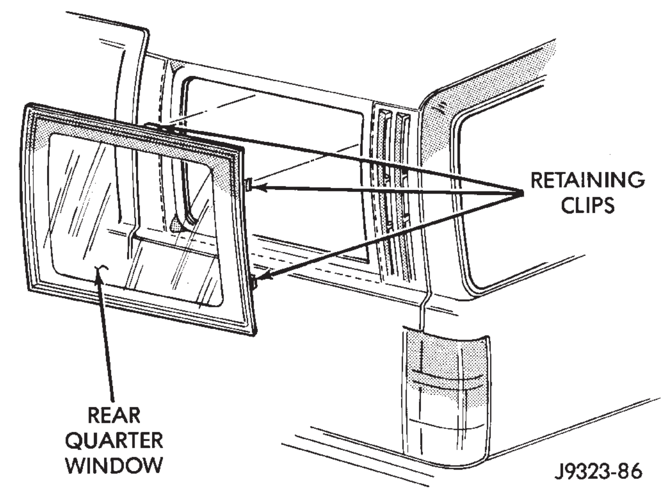


Fig. 1 Rear Quarter Glass

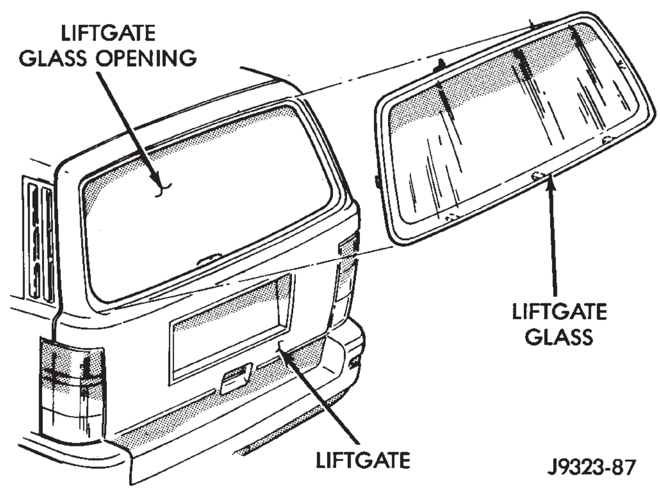


Fig. 2 Liftgate Glass

WINDSHIELD REMOVAL

(1) Remove inside rear view mirror.

(2) Remove cowl cover.

(3) Remove windshield moldings (Fig. 3). Pull outward on molding at the bottom of A-pillars using pliers.

(4) Cut urethane bonding from around windshield using a suitable sharp cold knife. A pneumatic cutting device can be used if available (Fig. 4).

(5) Separate windshield from vehicle.

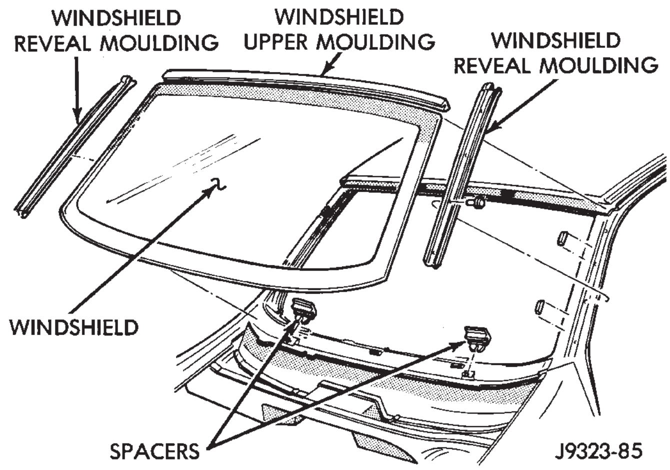


Fig. 3 Windshield Moldings

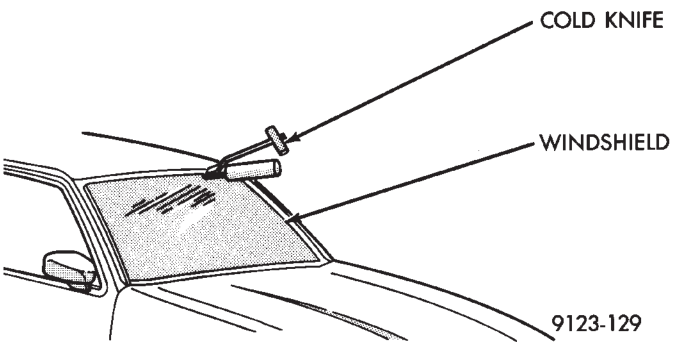


Fig. 4 Cut Urethane Around Windshield—Typical

WINDSHIELD INSTALLATION

CAUTION: Open a window before installing windshield. This will avoid pressurizing the passenger compartment. If a door or trunk lid is slammed before urethane is cured, water leaks can result.

Allow the urethane at least 4 hours to cure before returning the vehicle to use.

The windshield fence should be cleaned of old urethane bonding material. Support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

(1) Place replacement windshield into windshield opening. Position glass in the center of the opening against the support spacers. Mark the glass at the support spacers with a grease pencil or masking tape and ink pen to use as a reference for installation. Remove replacement windshield from windshield opening (Fig. 5).

(2) 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. 6).

(3) Clean inside of windshield with Mopar Glass Cleaner and lint-free cloth.

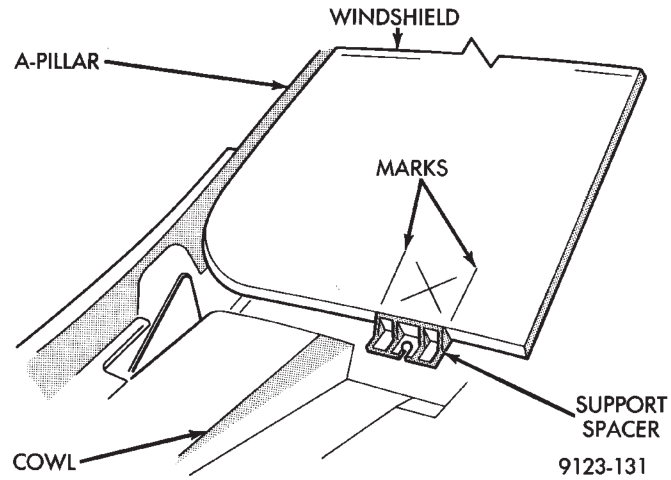


Fig. 5 Center Windshield and Mark at Support Spacers

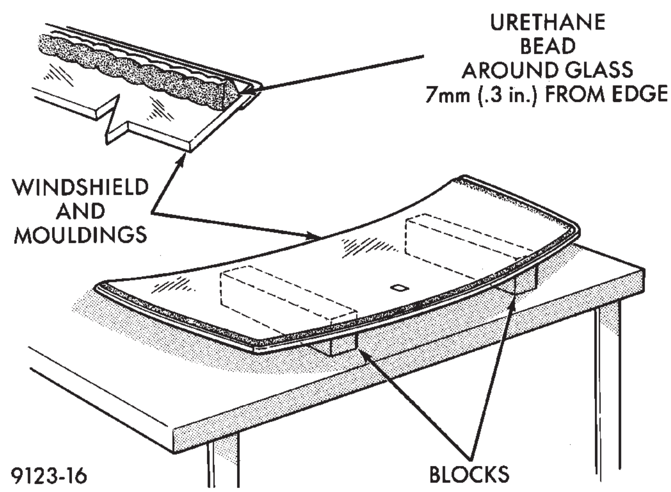


Fig. 6 Work Surface Set up and Molding Installation

(4) Apply clear glass primer 25 mm (1 in.) wide around edge of windshield. Wipe with clean/dry lint-free cloth.

(5) Apply black-out primer 15 mm (.75 in.) wide on top and sides of windshield and 25 mm (1 in.) on bottom of windshield. Allow at least three minutes drying time.

(6) Position windshield spacers on lower fence above support spacers at the edge of the windshield opening (Fig. 7).

(7) Apply a 10 mm (0.4 in.) bead of urethane around perimeter of windshield along the inside of the moldings.

(8) With aid of a helper, position windshield over windshield opening. Align reference marks at bottom of windshield to support spacers.

(9) Slowly lower windshield glass to windshield opening fence. Guide top molding into proper position if necessary. Push windshield inward to fence spacers at bottom and until top molding is flush to roof line (Fig. 8).

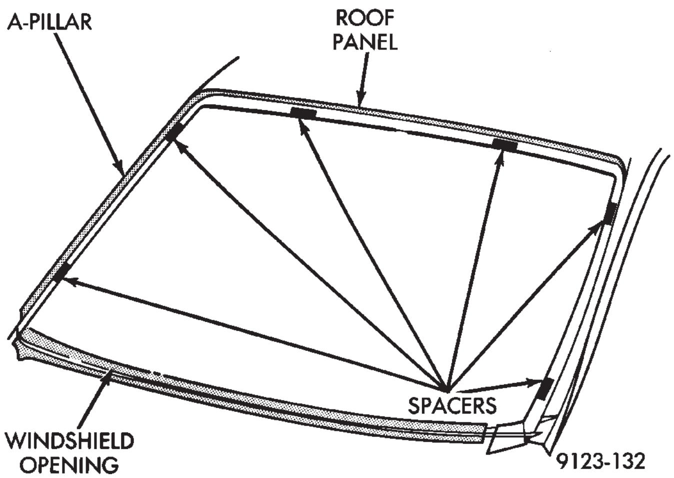


Fig. 7 Position Urethane Compression Spacers

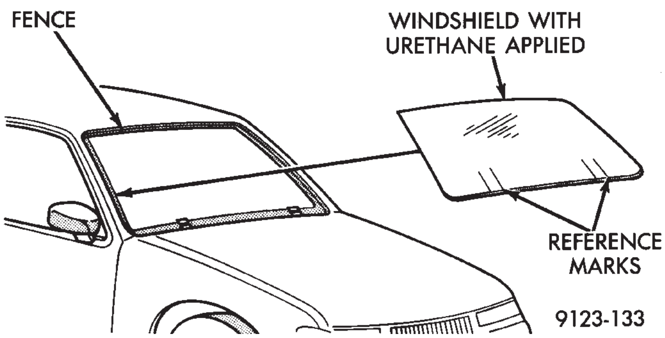


Fig. 8 Lower Windshield Into Position

(10) Clean excess urethane from exterior with Mopar Super Clean or equivalent.

(11) Install windshield molding. 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.

(12) Install cowl cover and wipers.

(13) Install inside rear view mirror.

(14) After urethane has cured, remove tape strips. Water test windshield to verify repair.

FIXED GLASS WATER LEAK DETECTION AND REPAIR

SERVICE INFORMATION

The sources of water leaks around edge of the windshield or a fixed glass can be sealed without removing glass. If glass is firmly bonded and only has a small leak, seal the area with a liquid sealant.

LEAK TEST

Water test glass with a spray only. **Do not use hard streams of water.** Work from the bottom to the top of glass.

SEALING LEAK AREAS

(1) Thoroughly clean and remove all foreign material from leak area. Dry area with compressed air.

(2) Seal leak area with butyl sealant. Allow sealant to cure for at least 1/2 hour. Next, water test glass to ensure that leak area is sealed.

UNDERBODY COMPONENTS

INDEX

SERVICE INFORMATION

In some instances, the components in the following procedures are concealed by other components. Refer to applicable component removal procedure for service access.

TRANSFER CASE SKID PLATE

REMOVAL

(1) Support skid plate.

(2) Remove bolts that attach skid plate to transmission support crossmember and frame sill (Fig. 1).

(3) Remove support and skid plate from vehicle (Fig. 1).

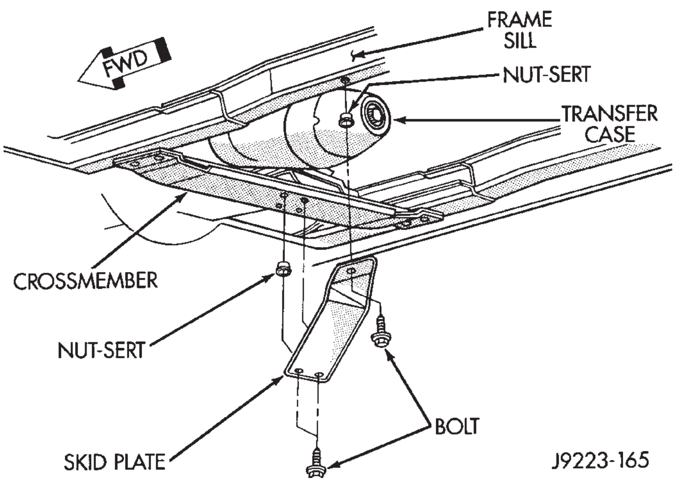


Fig. 1 Transfer Case Skid Plate

INSTALLATION

(1) Position and support skid plate at the frame sill and transmission support crossmember (Fig. 1).

(2) Attach skid plate to frame sill and crossmember with the bolts (Fig. 1). Tighten bolts to 22 N·m (16 ft. lbs) torque.

TRAILER HITCH

REMOVAL

(1) If necessary, remove trailer tow wire harness connector from hitch.

(2) Support hitch.

(3) Remove nuts that attach the towing tube to frame sills (Fig. 2).

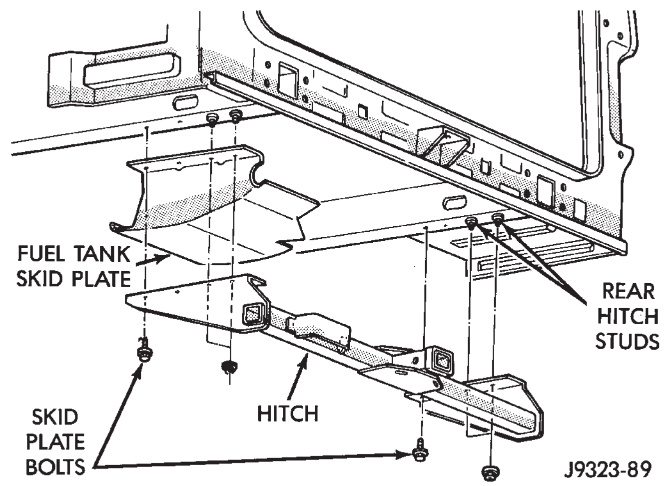


Fig. 2 Equalizer Type Hitch

Reinforcement brackets are retained on frame sills with 4 studs.

(4) Remove bolts from plate bracket and vehicle rear crossmember (Fig. 2). Lower support and hitch.

INSTALLATION

(1) Place hitch on a lifting device. Raise, position hitch at proper location (Fig. 2) and support it.

(2) Loosely install nuts that attach towing tube to vehicle frame sills (Fig. 2).

(3) Position plate bracket and install attaching bolts through vehicle rear crossmember (Fig. 2).

(4) Tighten all attaching bolts/nuts.

(5) Remove support and, if removed, attach trailer wire harness connector to hitch (Fig. 2).

INTERIOR COMPONENTS

INDEX

INSTRUMENT PANEL

REMOVAL

(1) Remove defroster duct bezel from instrument panel.

(2) Remove speaker grilles.

(3) Remove upper instrument panel retaining nuts.

(4) Remove screws retaining lower left side panel at instrument panel. Remove mounting bolt for instrument panel at left side cowl through access hole provided.

(5) Remove ashtray. Remove instrument panel mounting screw located behind ashtray.

(6) Remove instrument panel mounting bolt located on right side cowl.

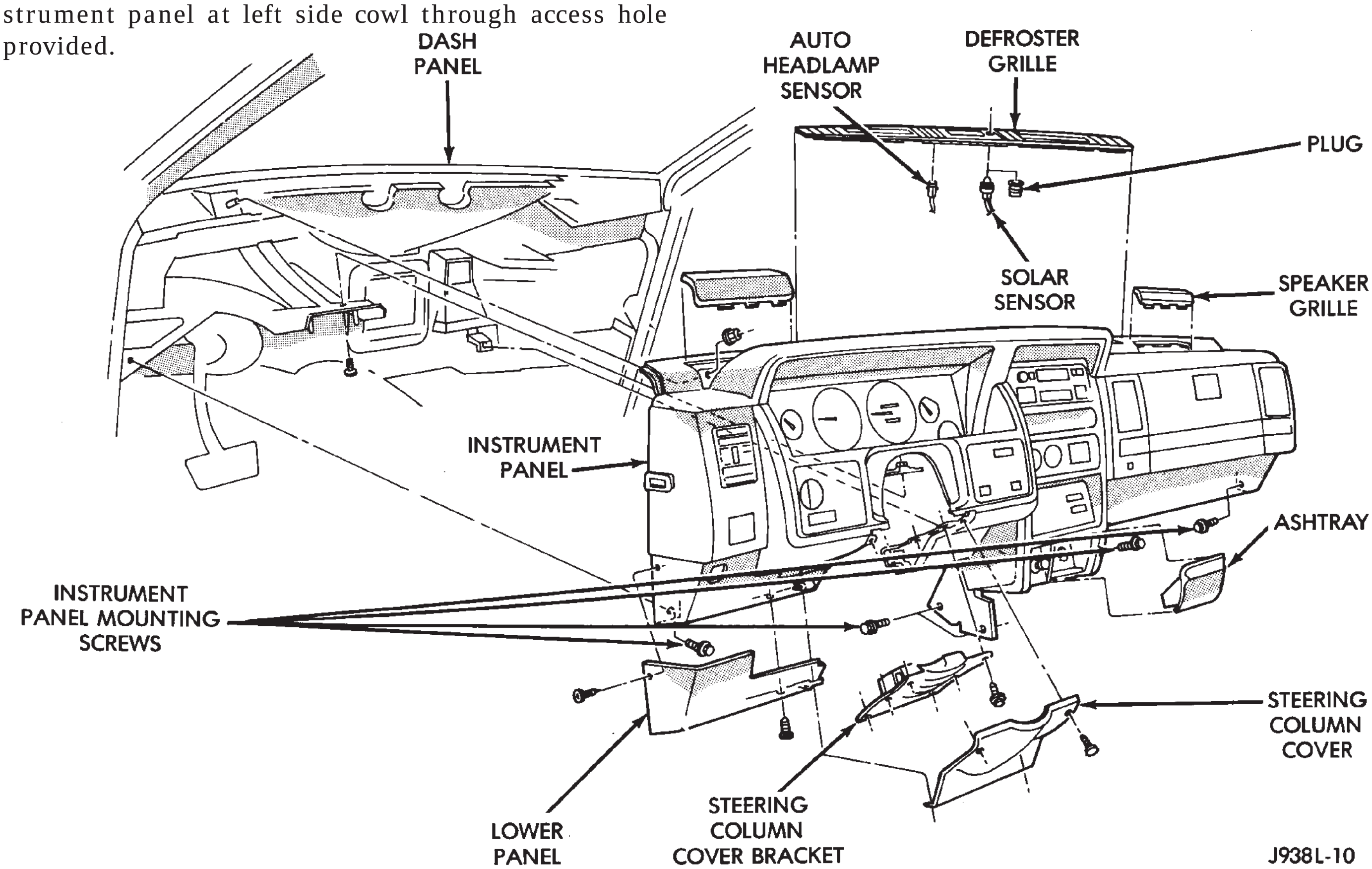


Fig. 1 Instrument Panel

(7) Fold down carpet at left side of the console. Remove mounting screws.

(8) Remove screws at lower column cover and remove cover (Fig. 2).

(9) Remove screws at lower knee bolster and remove bolster (Fig. 2).

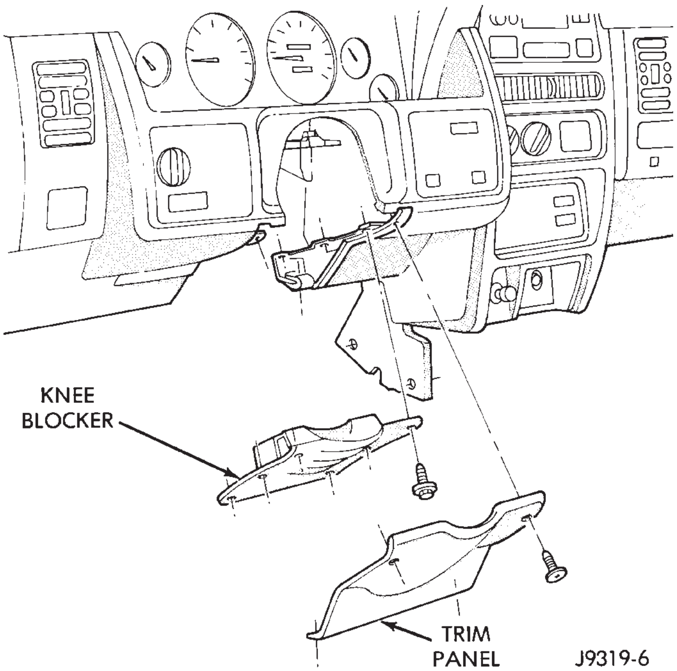


Fig. 2 Knee Bolster

(10) Remove tilt lever and both column covers. Disconnect column wiring.

(11) Remove nuts at column mount. Lower steering column.

(12) Remove instrument panel mounting bolt above center of column.

(13) Disconnect bulkhead connector at left side of dash panel.

(14) Disconnect cluster wiring at lower left side of instrument panel.

(15) Remove right side kick panel access door. Disconnect wiring at kick panel.

(16) Pull back and lower instrument panel. Disconnect A/C vacuum lines and antenna.

(17) Remove Instrument Panel.

For component disassembly refer to related group.

To install reverse removal procedure.

FRONT BUCKET SEATS

REMOVAL

Bucket seat tracks are attached to floor panel with bolts (Fig. 3).

(1) Remove bolts retaining seat.

(2) For power seats, disconnect wire harness connector (Fig. 4).

(3) Remove seat from floor panel.

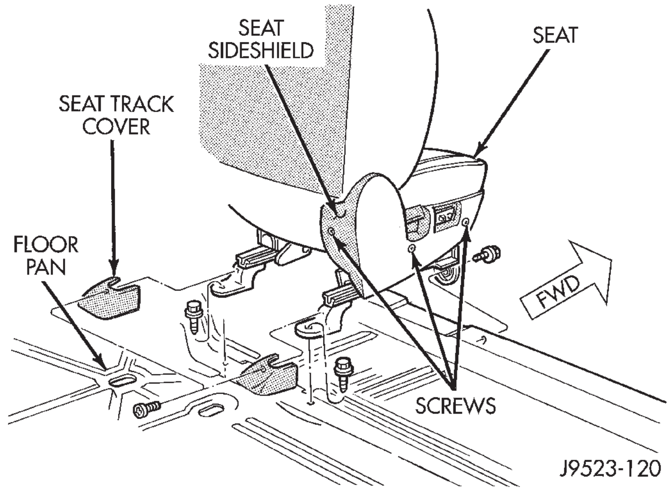


Fig. 3 Front Bucket Seat

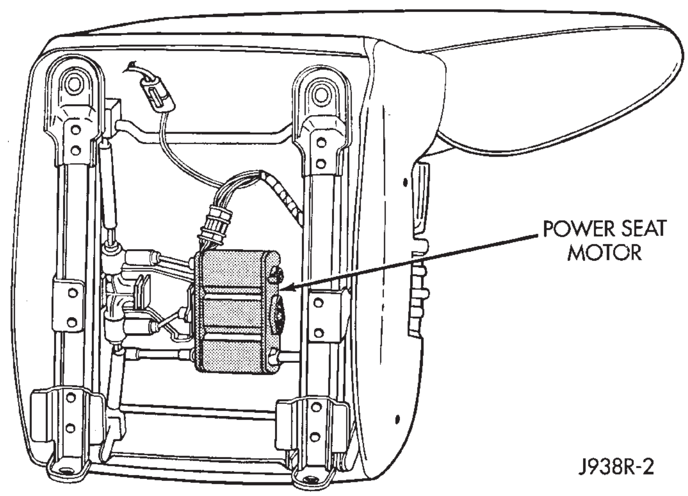


Fig. 4 Power Bucket Seat Wire Harness Connector

INSTALLATION

(1) Position seat on floor panel.

(2) Install and tighten seat retaining bolts to 25 N·m (18 ft. lbs.) torque.

(3) For power seats, connect wire harness connector.

BUCKET SEAT CUSHION AND COVER

REMOVAL

(1) Remove the seat from vehicle (Fig. 3). If necessary, refer to removal procedure.

(2) Remove screws retaining plastic side shield (Fig. 3).

(3) Remove bolts securing seat back to cushion.

(4) Remove nuts securing seat tracks to cushion frame.

(5) Remove cushion frame by opening hogrings and unhooking plastic j-rails from wires.

(6) Separate cover from pad by turning cover inside-out and open hogrings along 3 grooves in pad.

INSTALLATION

Reverse removal procedure.*

* When pad is placed on cushion frame, verify lip of pad lays over outside edge of frame.

BUCKET SEATBACK COVER AND FRAME

REMOVAL

(1) Remove seat from vehicle. If necessary, refer to removal procedure.
(2) Remove plastic sideshield from seat.
(3) Remove seat back from cushion.
(4) If equipped, remove headrest. Twist knob under headrest and pull up and out of cylinders in seatback.
(5) Lay seatback on table with face up.
(6) Unfasten bottom of trim cover. (Some models may have J-retainers or zippers that hold trim cover closed).
(7) Unfasten hogrings at bottom of retaining and remove retaining wires.
(8) Peel cover upward off pad until upper tiedown wire is exposed. Unfasten upper hogrings.
(9) Remove cover from pad.

INSTALLATION

Reverse removal procedure.

BUCKET SEAT TRACK

REPLACEMENT

Bucket seat tracks are not repairable. If the seat track is damaged, replace track as a unit. Refer to Group 8, Electrical for additional service information.

REAR SEAT CUSHION

REMOVAL

(1) Disengage seat cushion at rear by pulling upward on release strap.
(2) Tilt seat cushion forward.
(3) Disengage lower seat cushion hinge by pulling upward and out. Remove cushion from vehicle.

INSTALLATION

(1) Position seat cushion in vehicle.
(2) Insert hinge into lower pivot.
(3) Push downward to engage hinge into pivot.
(4) Rotate cushion downward into seating position.
(5) Lock seat cushion down by pressing firmly on center of cushion until latch engages.

REAR SEAT CUSHION COVER

REMOVAL

(1) Remove seat cushion from vehicle. If necessary, refer to removal procedure.
(2) Using a trim tool, disengage seat cover retainers that hold trim cover to flange of cushion pan.
(3) Remove pad and cover from pan.
(4) Separate cover from pad by turning inside-out and opening hogrings along 3 grooves in pad.

INSTALLATION

Reverse removal procedure.

REAR SEATBACK

REMOVAL

(1) Remove lower seat cushion. Refer to removal procedure.
(2) Remove bolts holding seatback side support brackets (Fig. 5).*

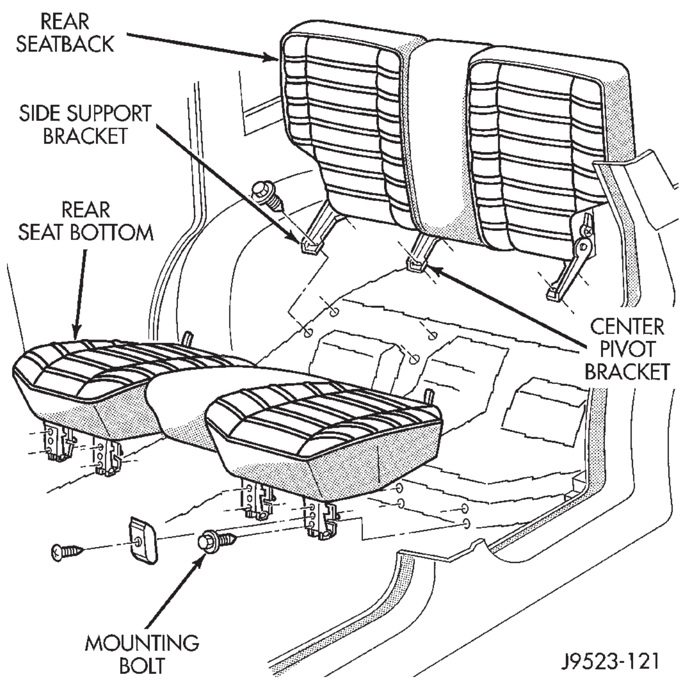


Fig. 5 Rear Seat Mounting

(3) Tilt seatback forward, and slide it outboard to detach it from pin on center pivot bracket.
(4) Remove seatback from vehicle.

* It is not necessary to remove center pivot bracket.

INSTALLATION

(1) Position seatback in vehicle.
(2) Install seatback onto center pivot bracket pin.
(3) Position side support brackets with bolt holes aligned and install side support bracket bolts (Fig. 5). Tighten bolts to 27 N·m (27 ft. lbs.) torque.
(4) Install lower seat cushion. Refer to installation procedure.

REAR SEATBACK COVER

REMOVAL

(1) Remove seatback from vehicle. If necessary, refer to removal procedure.

(2) Remove headrest. Twist knob under headrest and pull up and out of cylinders in seatback.

(3) Unfasten zipper (Fig. 6) on trim cover. and peel cover off pad by turning inside-out.

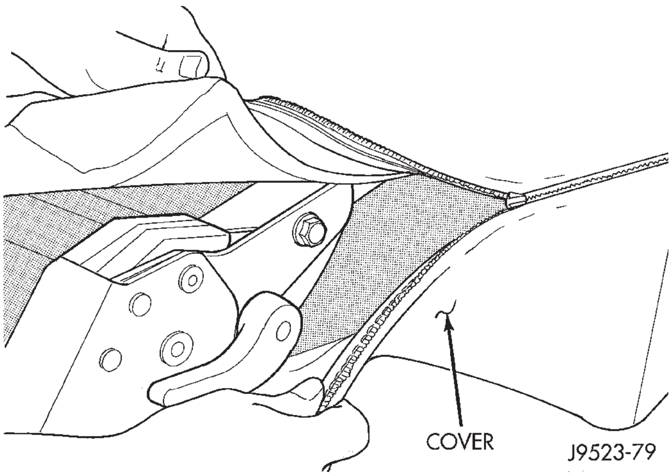


Fig. 6 Seatback Cover Removal

(4) If necessary, headrest cylinders may be removed from seatback frame. Squeeze locking tabs on cylinder and slide cylinder upward and remove from frame bracket.

INSTALLATION

Reverse removal procedure.

REAR SEAT BACK WITH CHILD SEAT

REMOVAL

(1) Disengage seat cushion at rear by pulling upward on release strap.

(2) Tilt seat cushion forward.

(3) Disengage lower seat cushion hinge by pulling upward and out. Remove cushion from vehicle.

(4) Remove bolts holding seatback side support brackets (Fig. 7).

(3) Tilt seatback forward, lift it upward and detach it from center pivot.

(4) Remove seatback from vehicle.

INSTALLATION

(1) Position seatback in vehicle.

(2) Align holes in side support brackets with bolt holes in floor pan. and install side support bracket bolts (Fig. 7). Tighten bolts to 27 N·m (27 ft. lbs.) torque.

(3) Install lower seat cushion.

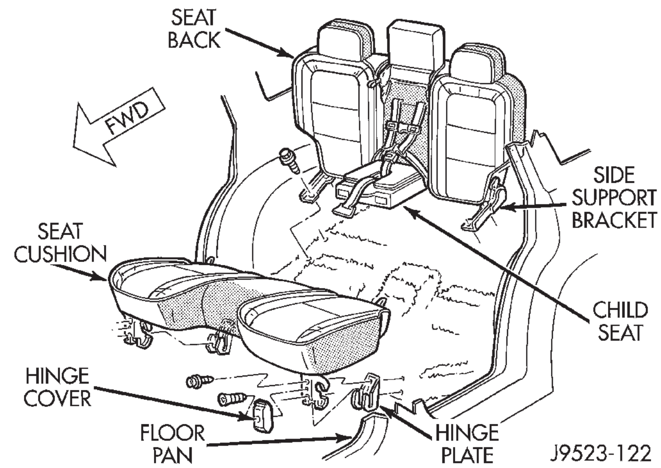


Fig. 7 Seat Back With Child Seat

CHILD SEAT MODULE

The child seat module can be removed with the seat back installed or removed from the vehicle.

REMOVAL

(1) Pull release strap to open child seat and remove lining.

(2) Remove upper and lower child seat back bolts.

(3) Slide the release strap through the retaining loop (Fig. 8).

(4) Remove child seat module from seat back (Fig. 9).

INSTALLATION

(1) Position child seat module in seat back.

(2) Slide the release strap through the retaining loop.

(3) Install the upper and lower child seat back bolts.

(4) Install child seat lining.

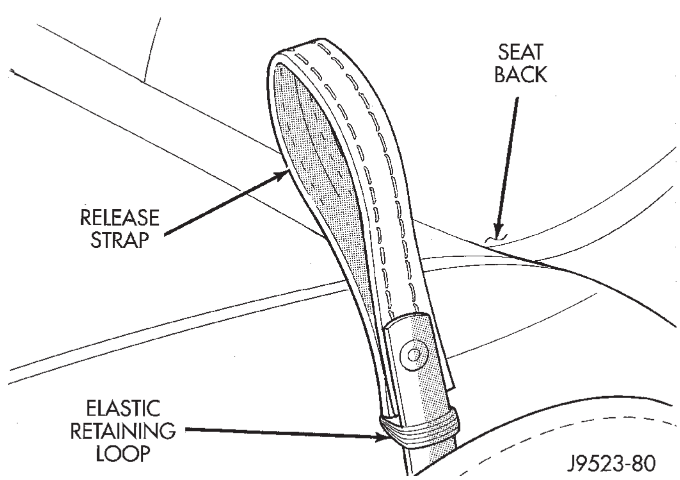


Fig. 8 Child Seat Release Strap/Retaining Loop

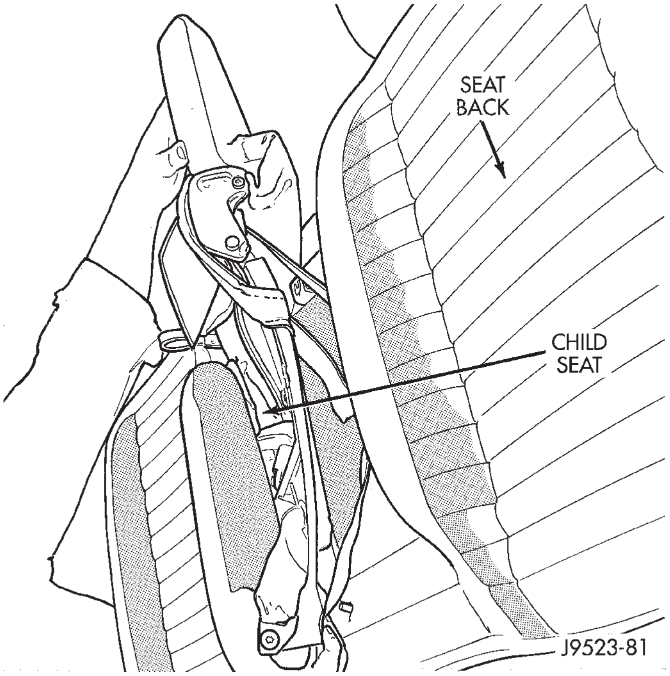


Fig. 9 Child Seat Module Removal/Installation

INTERIOR TRIM PANELS AND SCUFF PLATES

SERVICE INFORMATION

CAUTION: Do not attempt to remove trim panels/moldings without first removing overlapping adjacent panels.

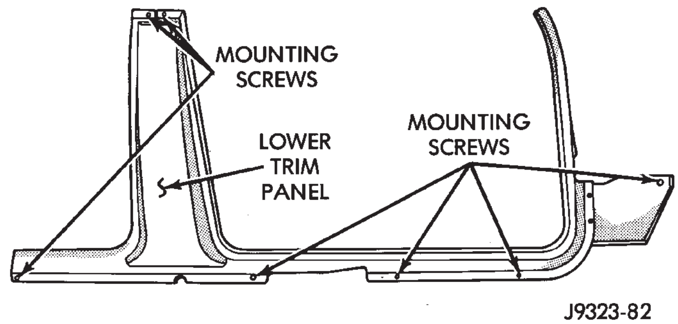


Fig. 1 B-Pillar Trim Panel

To avoid damaging panels, verify that all screws and clips are removed before attempting to remove a trim panel/molding. Trim panels are somewhat flexible but can be damaged if handled improperly.

LOWER B-PILLAR TRIM PANEL

REMOVAL

(1) Remove retaining screws along bottom edge of trim panel (Fig. 1).

(2) Detach and remove the A-pillar upper trim panel (Fig. 2).

(3) Remove upper front seat belt mounting pivot (Fig. 3).

(4) Detach and remove upper B-pillar trim panel.

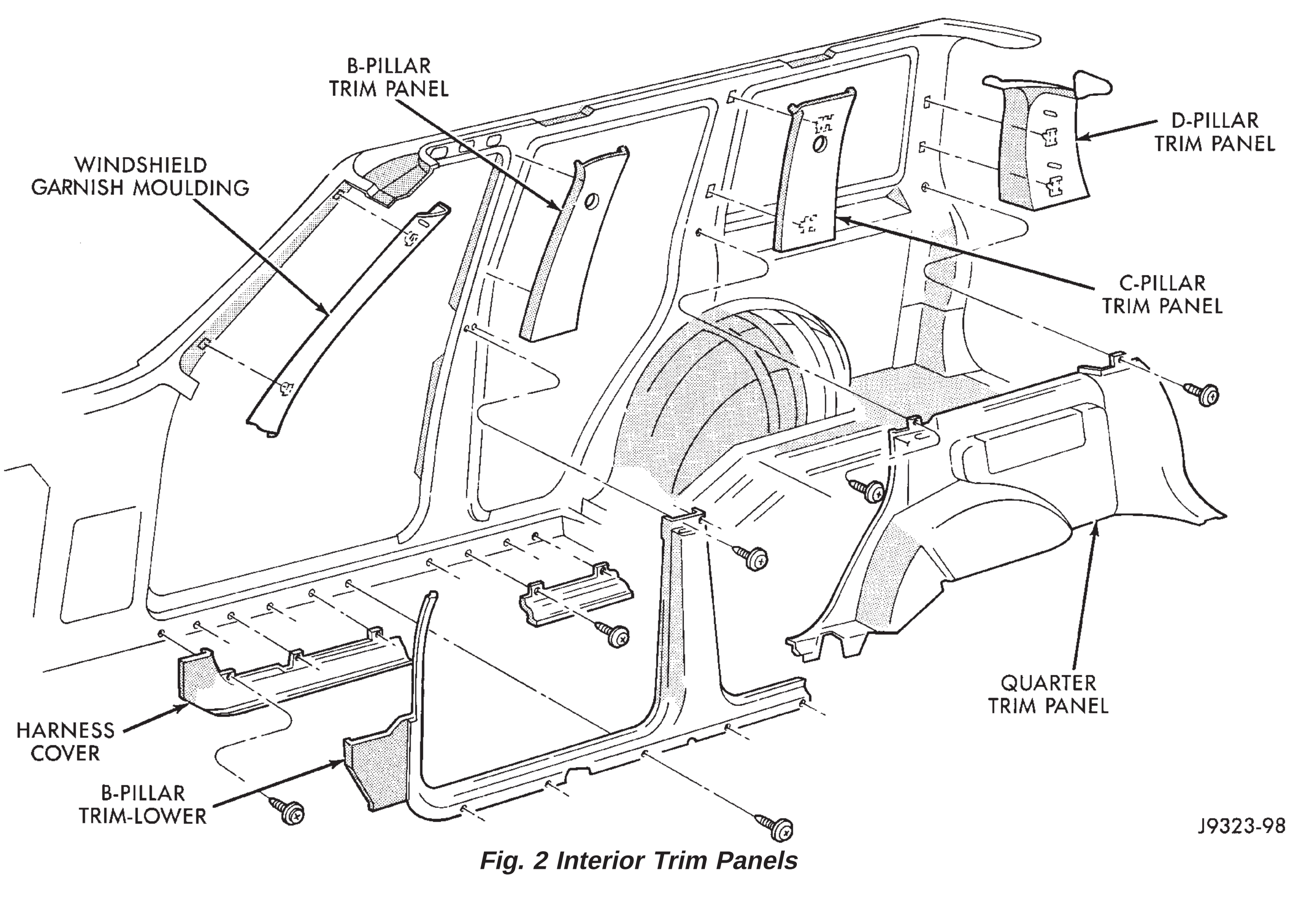


Fig. 2 Interior Trim Panels

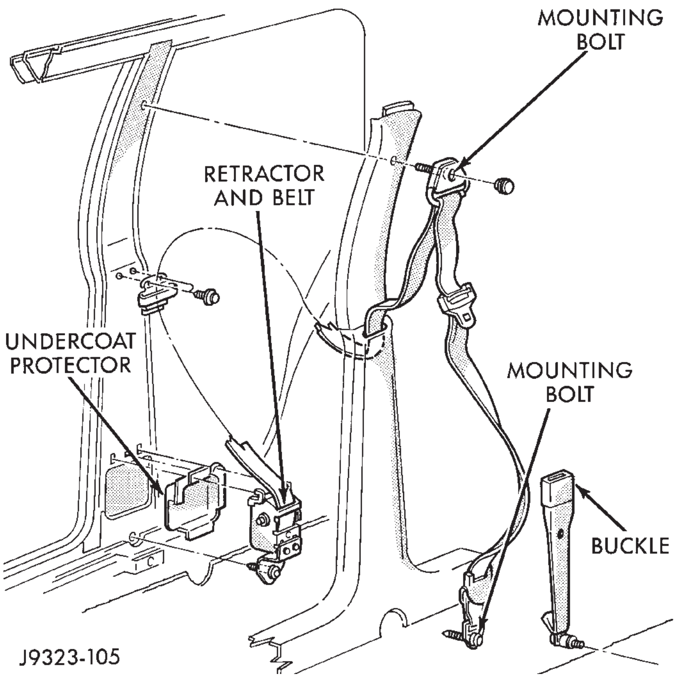


Fig. 3 Front Seat Belt

(5) Remove lower front seat belt mounting bolt (Fig. 3).

(6) Remove mounting screws located behind upper B-pillar trim.

(7) Remove trim panel.

For installation, reverse removal procedure.

WINDSHIELD SIDE MOLDING

REMOVAL

(1) Unsnap clips retaining upper A-pillar trim panel.

(2) Remove trim panel (Fig. 2).

For installation, reverse removal procedure.

QUARTER TRIM PANELS

REMOVAL

(1) Pull rear seat bottom forward and fold down rear seat.

(2) Remove lower retaining screw at rear door opening (Fig. 4 and 5).

(3) Remove tonneau cover (If applicable).

(4) Remove rear seat shoulder belt retaining bolt (Fig. 6).

(5) Detach and remove C-pillar trim panel (Fig. 2).

(6) Remove screws retaining upper liftgate trim panel (Fig. 7).

(7) Disconnect wiring to cargo lamp.

(8) Remove liftgate lower trim panel from liftgate opening (Fig. 7).

(9) Remove quarter trim panel mounting screws (Fig. 4 and 5).

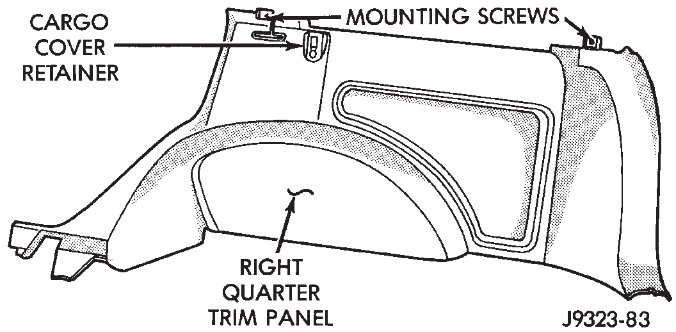


Fig. 4 Right Quarter Trim Panel

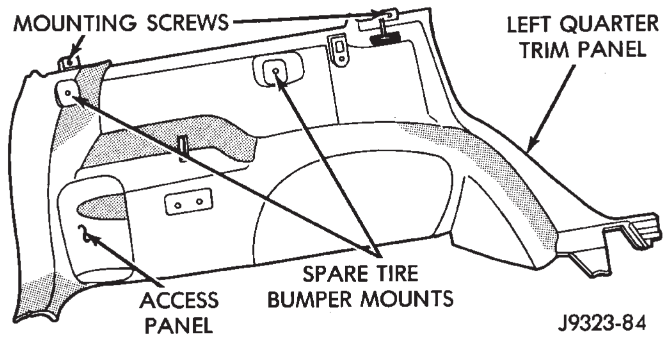


Fig. 5 Left Quarter Trim Panel

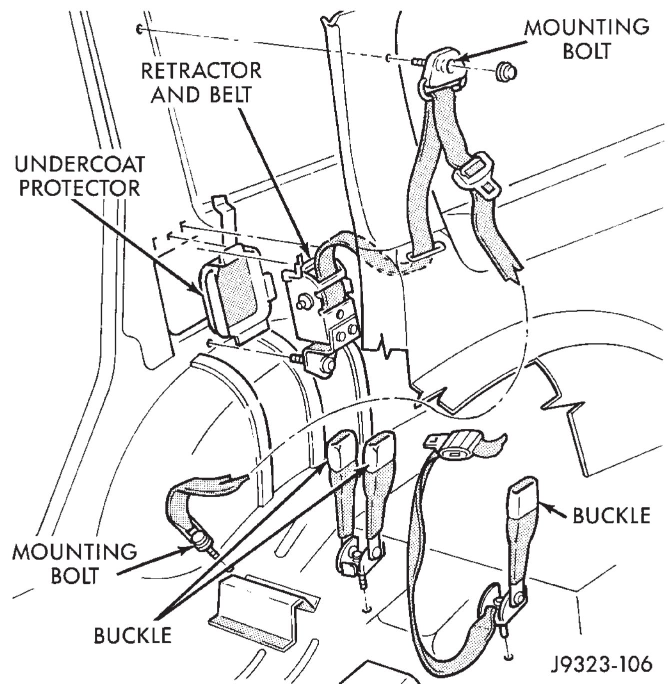


Fig. 6 Rear Seat Shoulder Belt

(10) If necessary, remove spare tire (Fig. 8) and tire stand-offs from left quarter trim panel (Fig. 9).

(11) Remove rear quarter trim panel.

For installation, reverse removal procedure.

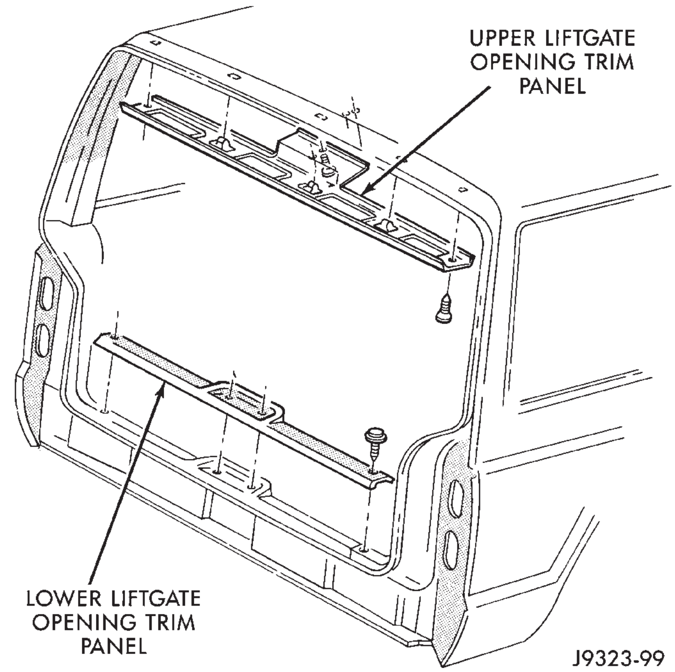


Fig. 7 Liftgate Opening Trim Panels

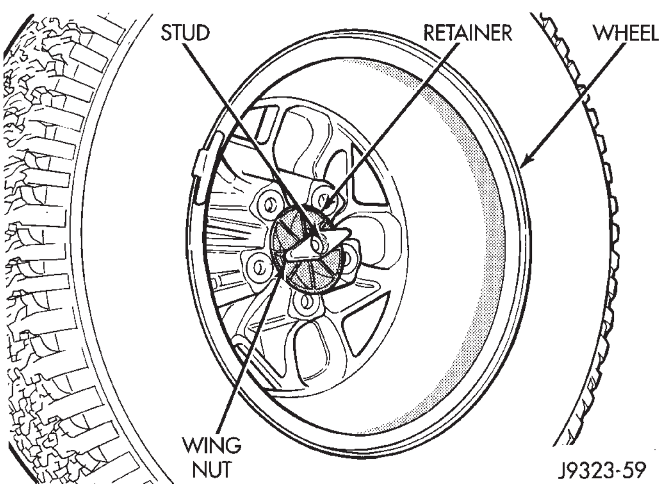


Fig. 8 Spare Tire Mounting

B AND C-PILLAR TRIM COVERS

REMOVAL

(1) Remove shoulder belt retaining bolt (Figs. 3 and 6).

(2) Detach and remove pillar trim panel from pillar (Fig. 10).

INSTALLATION

(1) Position trim cover on pillar. Snap trim panel into place (Fig. 10).

(2) Install shoulder belt retaining bolt.

D-PILLAR TRIM COVER

REMOVAL

(1) Remove liftgate upper trim panel (Fig. 7).

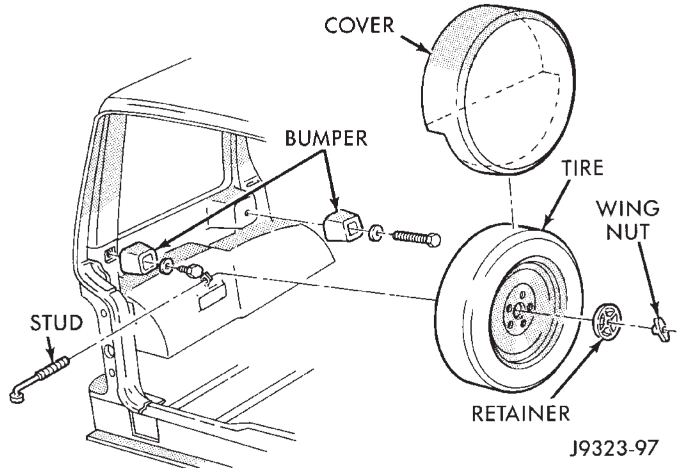


Fig. 9 Tire Stand-Offs—Left Quarter Trim Panel

(2) Detach and remove trim panel from D-pillar (Fig. 10).

INSTALLATION

(1) Position D-pillar trim panel on D-pillar and snap in place (Fig. 10).

(2) Install upper liftgate trim panel (Fig. 7).

OUTER SCUFF PLATES

REMOVAL

The door sill outer scuff plates are attached to the sills with molded-in snap retainers.

Using a flat blade screwdriver, detach scuff plate from sill (Fig. 11).

For installation, reverse removal procedure.

ASSIST HANDLE

REMOVAL

(1) Remove the Torx retaining screws (Fig. 12).

(2) Remove assist handle from roof panel.

INSTALLATION

(1) Position handle on the roof panel and install retaining screws (Fig. 12). Tighten retaining screws to 3 N·m (22 in-lbs) torque.

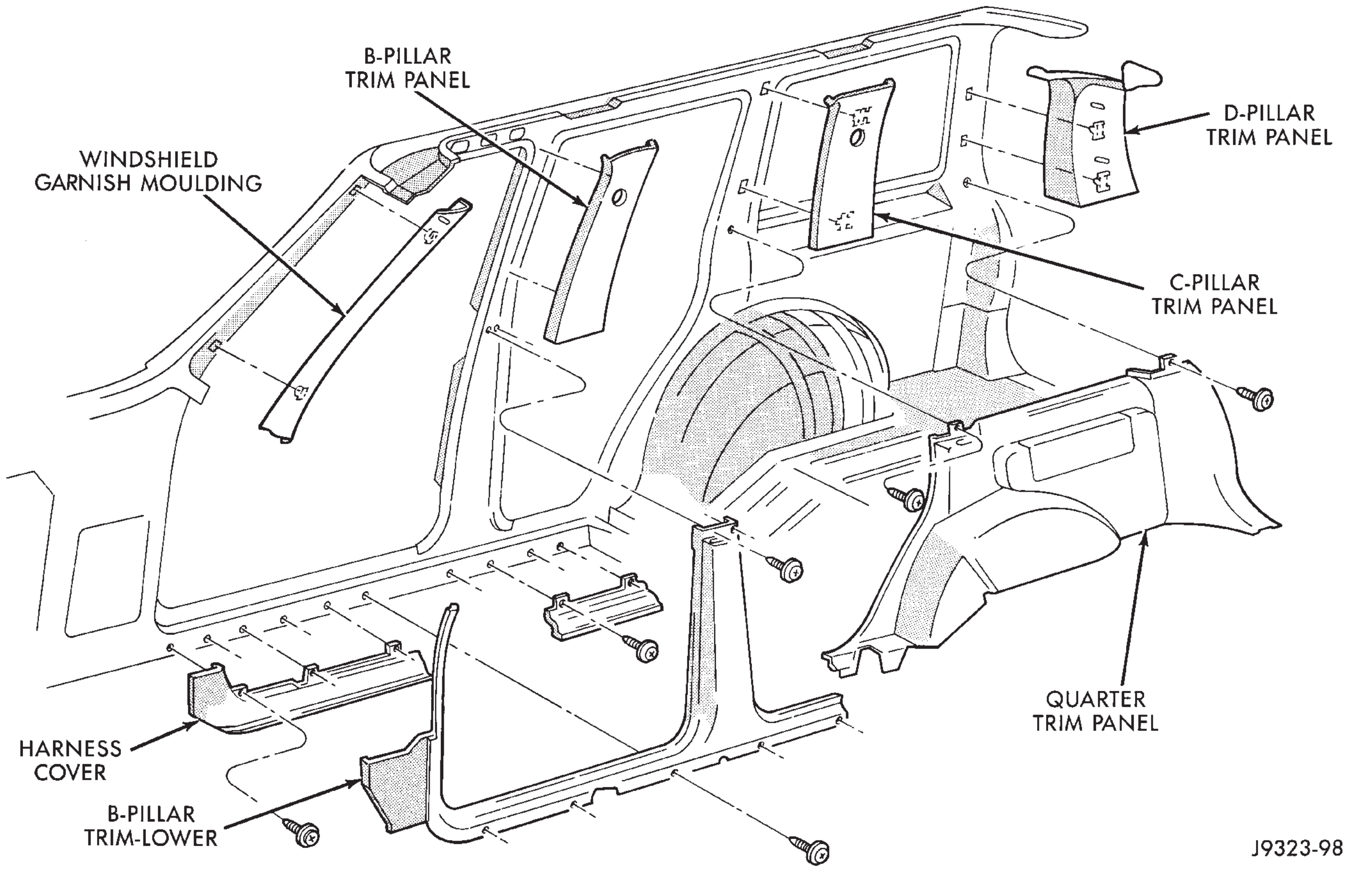


Fig. 10 Interior Trim Panels

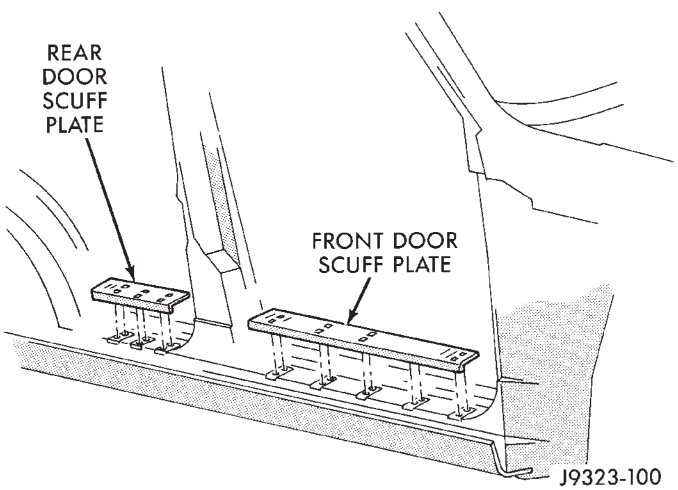


Fig. 11 Scuff Plates

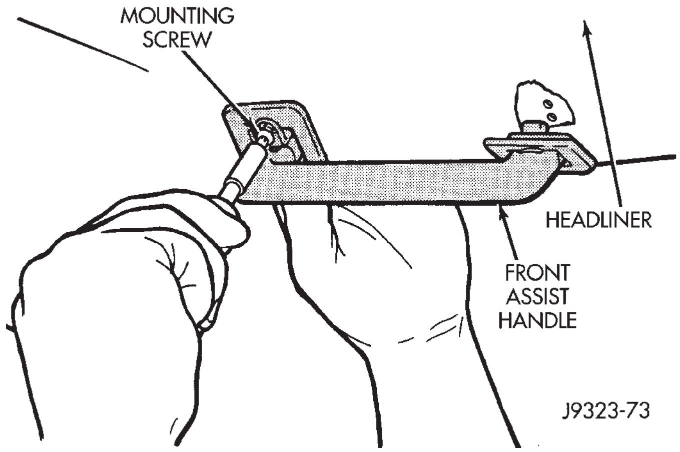


Fig. 12 Assist Handle

FRONT SHOULDER BELT/BUCKLE

REMOVAL

(1) Slide front seats all the way forward for access to buckle anchor bolt.

(2) Disconnect buckle wire harness connector.

(3) Remove anchor bolt cover.

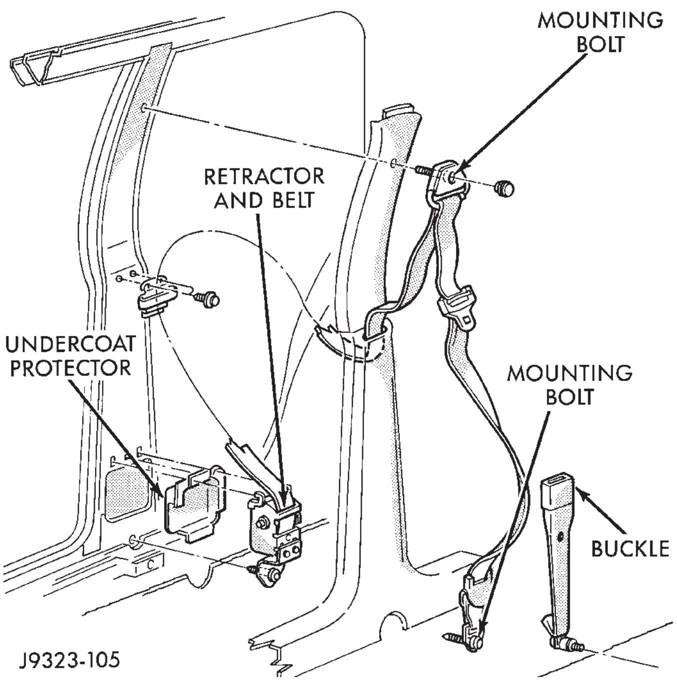


Fig. 1 Front Shoulder Belt/Buckle

(4) Remove buckle anchor bolt with a Torx bit (Fig. 1).

(5) Remove shoulder belt buckle from transmission tunnel.

(6) Remove cap concealing shoulder belt upper anchor bolt (Fig. 1).

(7) Use a Torx bit to remove upper anchor bolt (Fig. 2).

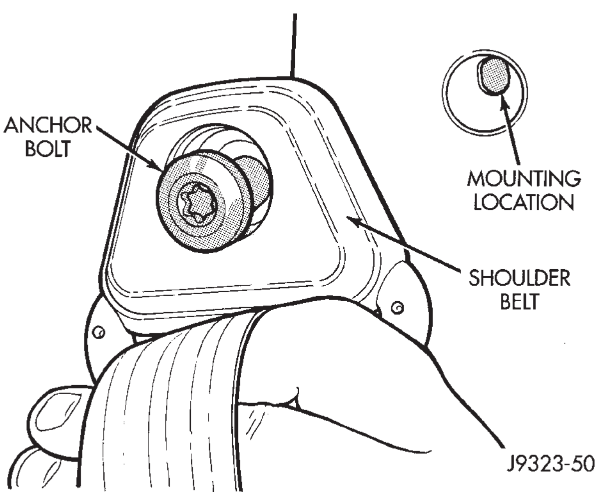


Fig. 2 Upper Seat Belt Mounting

(8) Remove lower A to B trim panel, refer to service procedure. Remove shoulder belt lower retractor anchor bolt with a Torx bit (Fig. 1).

(9) Remove shoulder belt and retractor (Fig. 1).

For installation, reverse removal procedure. Tighten anchor bolts to 37 N·m (27 ft-lbs)

REAR SHOULDER/LAP BELT/BUCKLE

REMOVAL

(1) Pull rear seat release loop and tilt seat bottom forward. Remove seat bottom from lower latch.

(2) Unlatch seat back and tilt forward.

(3) Remove shoulder belt buckle and lap belt/ buckle anchor plate bolts from the floor panel (Fig. 3).

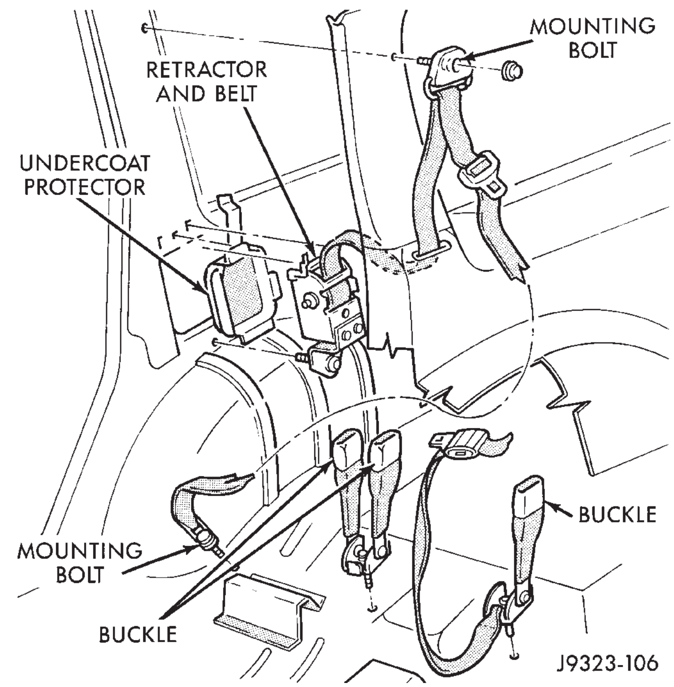


Fig. 3 Rear Seat Shoulder/Lap Belts & Buckles

(4) Remove quarter trim panel.

(5) Remove shoulder belt upper anchor bolt (Fig. 2).

(6) Remove belt retractor anchor bolt from rear quarter rail (Fig. 3).

(7) Remove retractor and shoulder belt from panel (Fig. 3).

For installation, reverse removal procedure. Tighten anchor bolts to 37 N·m (27 ft-lbs)

HEADLINER

REMOVAL

CAUTION: The headliner is a one-piece, molded component. It has limited flexibility and must not be bent. Damage possibly will result.

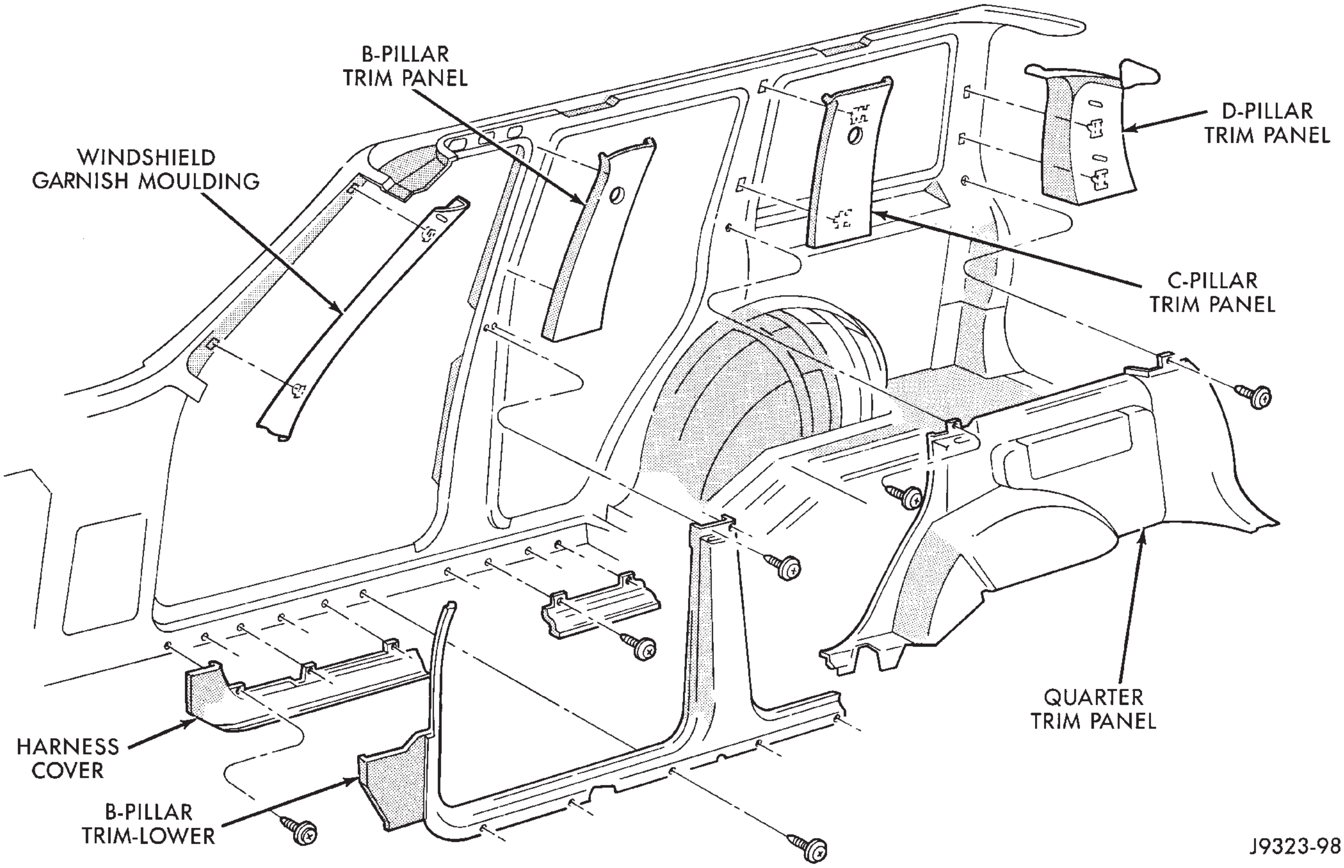


Fig. 1 Trim Moldings

(1) Remove the A,B,C and D-pillar trim moldings from perimeter of headliner (Fig. 1).

(2) Remove upper liftgate trim molding (Fig. 2).

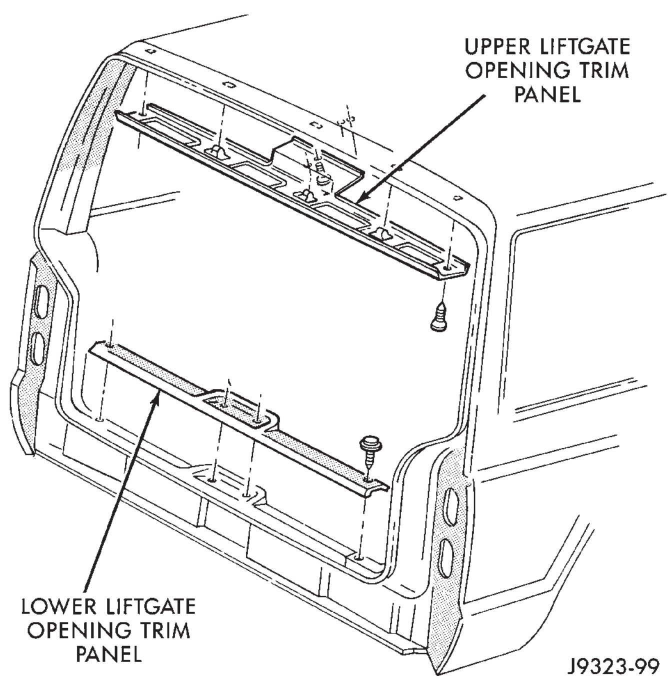


Fig. 2 Liftgate (Headliner) Trim Molding

(3) Remove sunvisors from front of roof panel (Fig. 3). Disconnect vanity lamp wiring (if applicable)

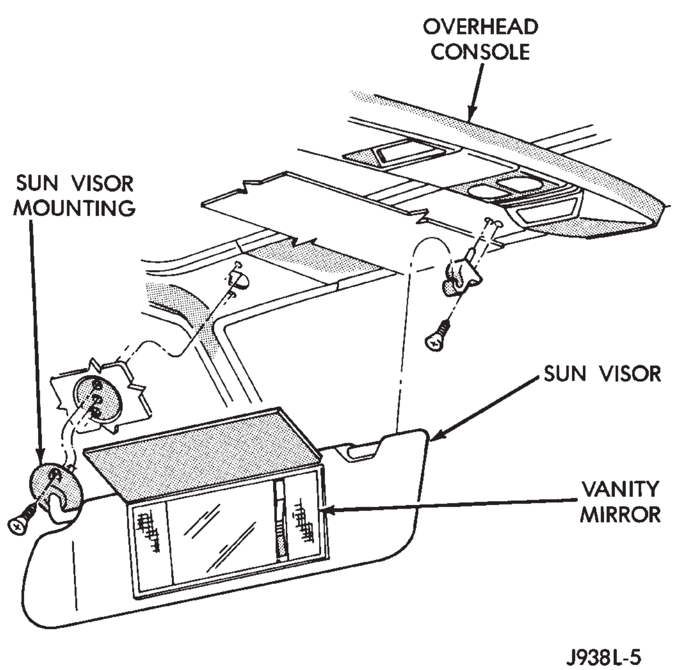


Fig. 3 Sun Visor

(4) Remove assist handles or plugs from side of roof rails (Fig. 4).

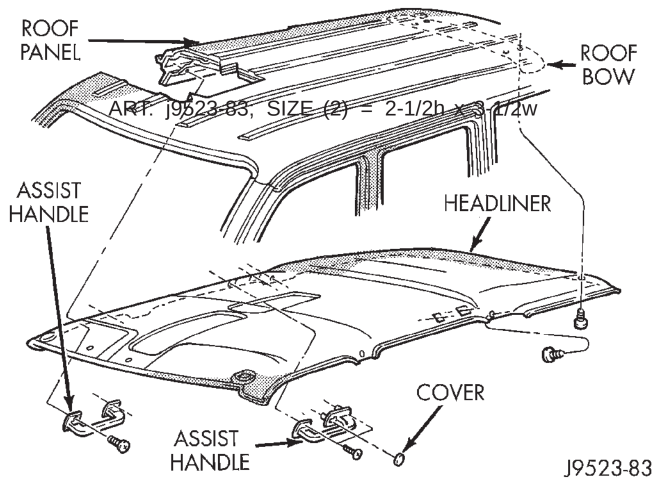


Fig. 4 Assist Handles

(5) Remove dome/reading lamp or overhead console from center of roof panel (Fig. 5).

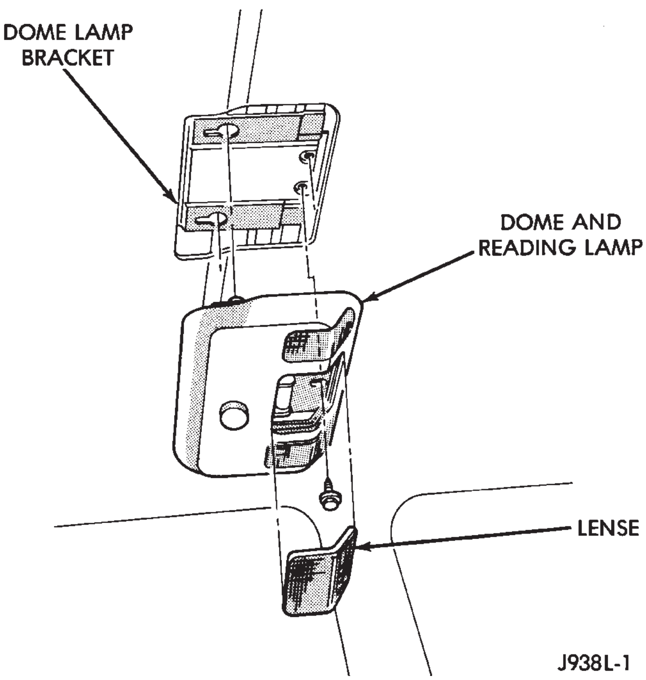


Fig. 5 Dome/Reading Lamp

(6) Remove sunroof pinch welt holding headliner, if equipped (Fig. 6).

(7) With aid of an assistant, remove headliner through liftgate opening.

INSTALLATION

(1) With the aid of an assistant, position headliner in vehicle (Fig. 7, 8 and 9).

(2) Install sunroof pinch welt.

(3) Install dome/reading lamp.

(4) Install sunvisors.

(5) Install assist handles or plugs.

(6) Install A,B,C and D-pillar trim panels.

(6) Install liftgate upper trim panel.

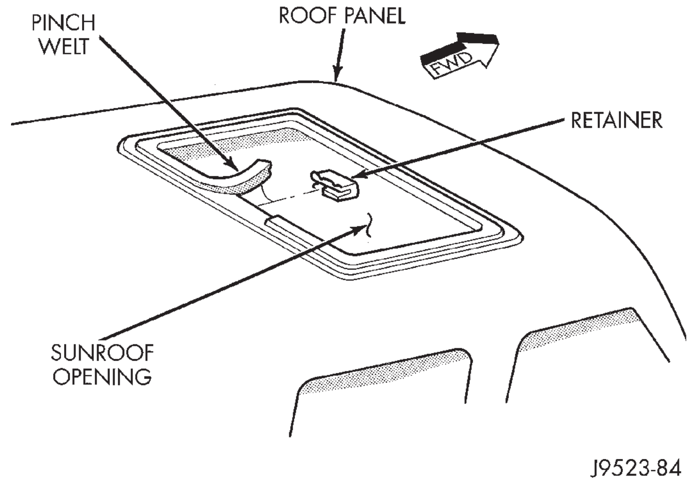


Fig. 6 Sunroof Opening

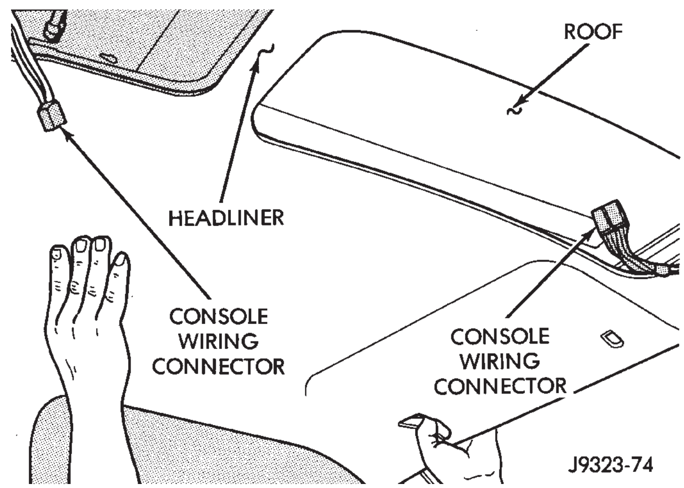


Fig. 7 Headliner Positioning/Front

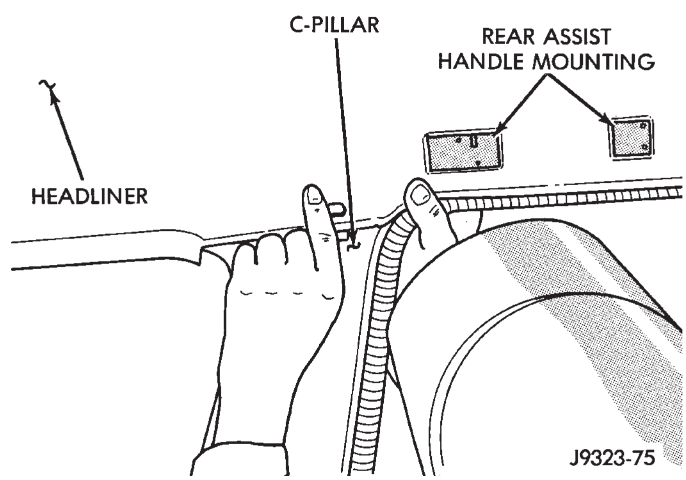


Fig. 8 Headliner Positioning/Side

SUNVISORS

REMOVAL

(1) Remove screws that attach sunvisor arm support bracket to headliner and roof panel (Fig. 3).

(2) Detach sunvisor from support bracket (Fig. 3).

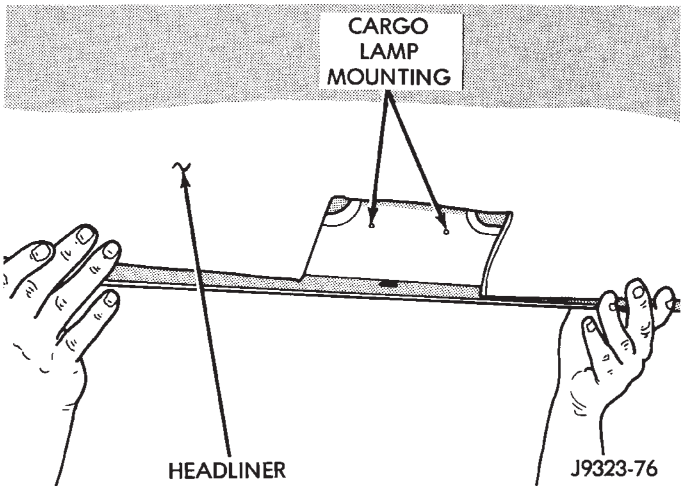


Fig. 9 Headliner Positioning/Rear

(3) Remove sunvisor from vehicle.

(4) Remove retaining screw and support bracket (Fig. 3).

For installation, reverse removal procedure.

FULL FLOOR CONSOLE

REMOVAL

(1) Pull transmission shift lever handle straight up and remove handle.

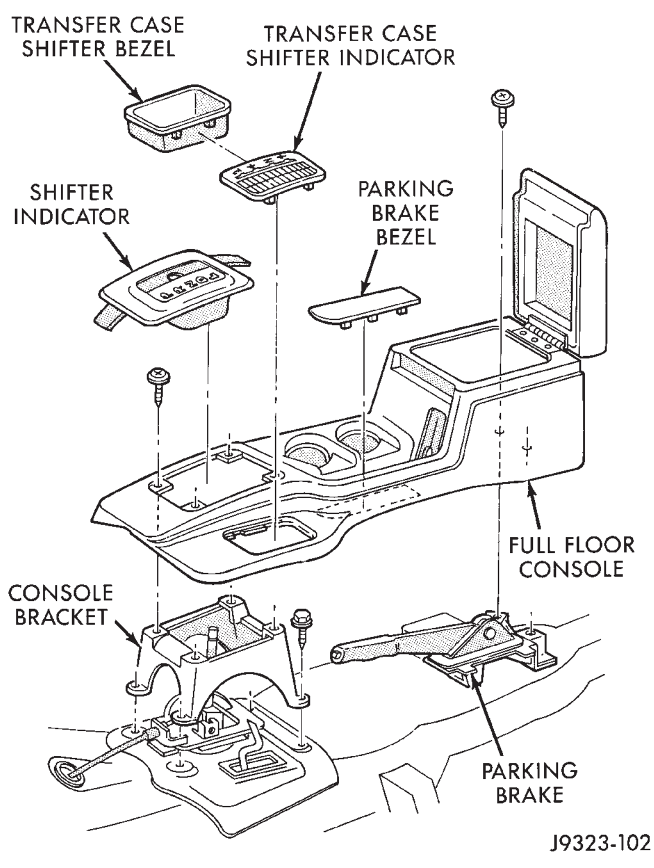


Fig. 1 Full Console Components

(2) Remove transmission and transfer case shift indicator bezels by prying upward to release them. Position flat screwdriver between bezel and console to remove indicator bezel (Fig. 1).

(3) Disconnect lamp sockets from bezels (Fig. 1).

(4) Remove console retaining screws (Fig. 2 and 3).

(5) Remove console from floor (Fig. 4).

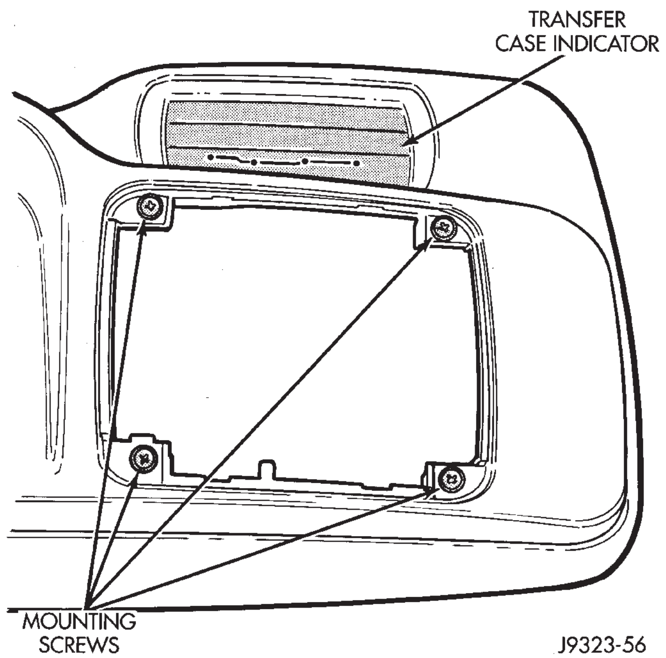


Fig. 2 Console Mounting/Front

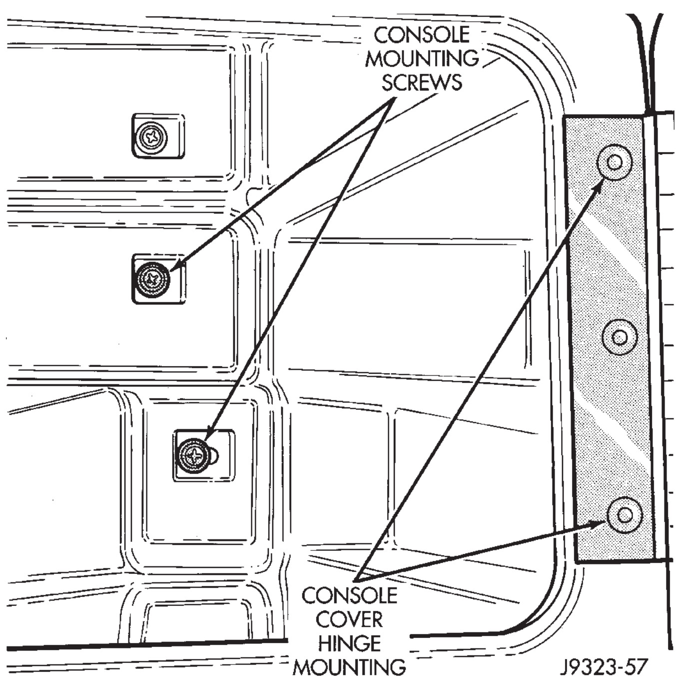


Fig. 3 Console Mounting/Rear

For installation, reverse removal procedure.

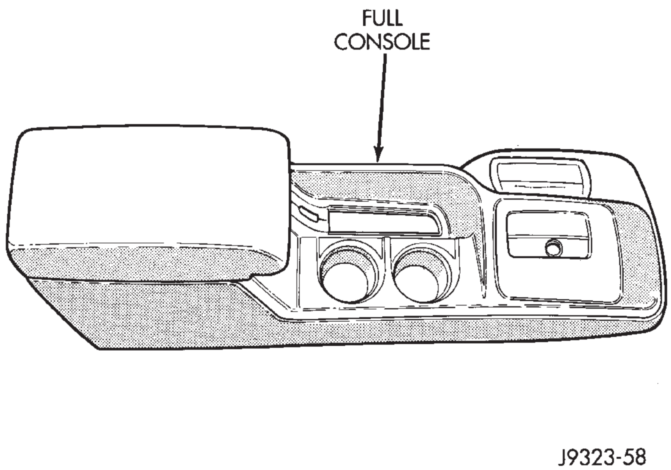


Fig. 4 Full Console

CARPETS AND FLOOR MATS

FRONT CARPET/MAT

REMOVAL

(1) Remove lower B-pillar trim panels.
(2) Remove front and rear seats (as applicable).
(3) As necessary, remove trim panels and moldings.
(4) Remove floor console.
(5) Remove all other interfering components.
(6) Remove carpet and mat from floor panel (Fig. 5).
For installation, reverse removal procedure.

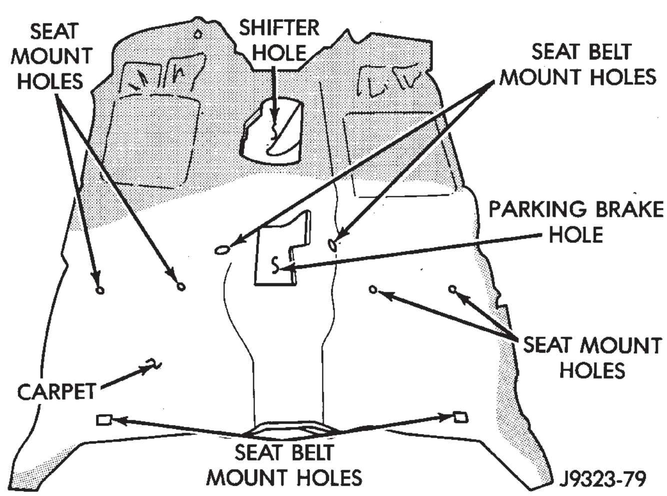


Fig. 5 Front Carpet & Mat

CARGO CARPET/MAT

REMOVAL

(1) Remove quarter trim panels.
(2) Remove retaining screws, and liftgate trim panel.
(3) Drill-out retaining rivet heads and remove cargo tie-down footman loops from carpet (Fig. 6).
(4) Remove rear seats and belts.

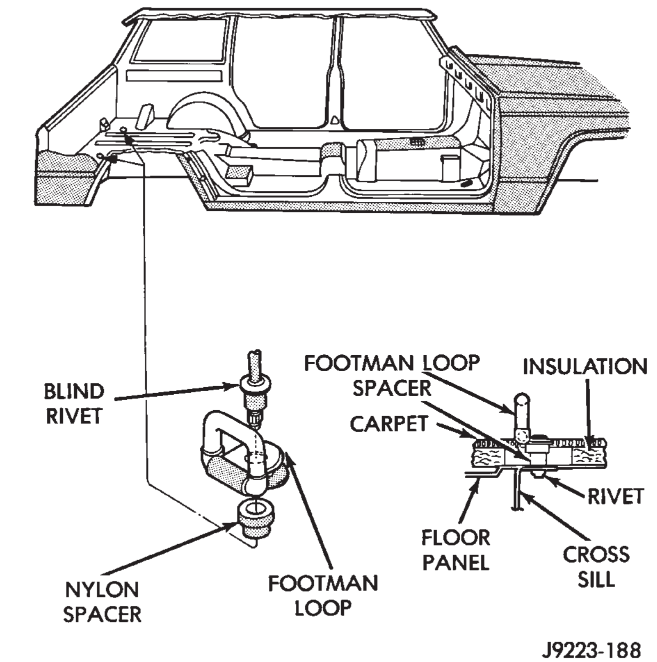


Fig. 6 Cargo Tie-Down Footman Loop

(5) As necessary, remove trim panels and moldings.
(6) Remove all other interfering components.
(7) Remove carpet and mat from floor panel (Fig. 7).

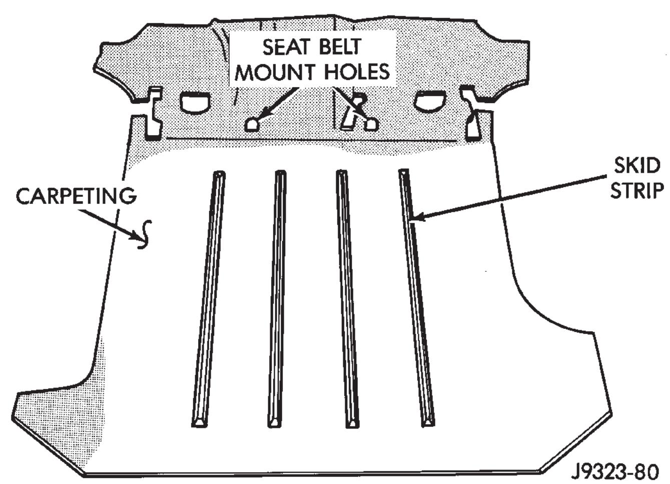


Fig. 7 Rear Carpet & Mat

(8) If necessary, remove skid strips from carpet.
For installation, reverse removal procedure.

FUEL DOOR CABLE

REMOVAL

(1) Remove left lower B-pillar trim panel.
(2) Remove rear seats.
(3) Remove left rear quarter trim panel.
(4) Pull up on side of carpeting along rear door sill.
(5) Disconnect and remove fuel door cable at fuel door lever (Fig. 8).

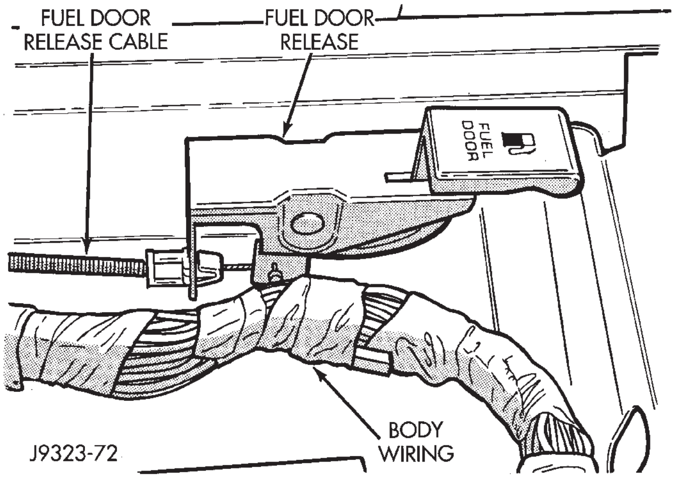


Fig. 8 Fuel Door Lever

(6) Remove cable from routing clips along floor (Fig. 9).

(7) Remove cable from fuel door latch and grommet (Fig. 10).

(8) Remove cable from vehicle.

For installation, reverse removal procedure.

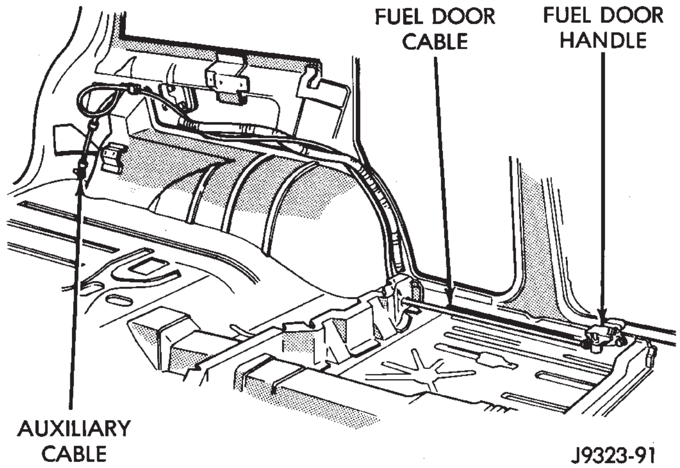


Fig. 9 Fuel Door Cable Routing

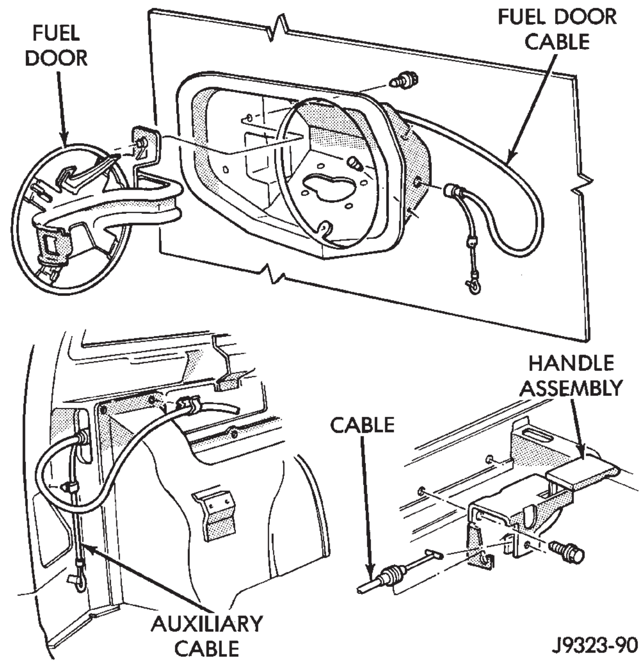


Fig. 10 Fuel Door Components

PAINT

INTRODUCTION

Exterior vehicle body colors are identified on the Body Code plate. The plate is attached to the top, right side of the cowl below the cowl grille. The color code location is described in the manual Introduction.

OEM paint colors are generally available from all of the major paint suppliers. They are supplied in the form of either mixing formulas or factory packaged (pre-mixed) paint.

The exterior colors and corresponding Grand Cherokee paint codes are listed in the following chart.

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 ultra violet light and provides a durable high gloss finish.

WET SANDING,BUFFING AND POLISHING

Minor acid etching, orange peel or smudging in clear coat can be reduced with light wet sanding, hand buffing and polishing. If the finish has been wet sanded in the past, it can not be repeated. Wet sanding operation should be performed by a trained automotive painter.

CAUTION: Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat to shine.

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.

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 (600 grit) wet sanded 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.

AFTERMARKET PAINT AND TRIM REPAIR PRODUCTS

EXTERIOR COLOR NAME	CHRYSLER[1] CODE	PPG	BASF	DuPONT	S-W ACME M-S	AKZO/ SIKKENS
Wildberry P.C.	MMB	4678	22108	B9332	46949	CHA93:MMB
Flame Red C.C.	PR4	4679	23043	B9326	46916	CHA93:PR4
Char-Gold II S.G.	RJ7	35748	25037	B9532	50278	CHA95:RJ7
Lt. Driftwood S.G.	MFA	4569	22110	B9263	46579	CHA92:MFA
Teal P.C.	LP5	4445	21094	B9232	45858	CHA92:LP5
Moss Green P.C.	RJN	47383	25036	B9533	50277	CHA:94RJN
Medium Blue P.C.	RB3	18719	25047	B9528	50263	CHA95:RB3
Black C.C.	DX8	9700	15214	F0204	34858 90-5950	CHA85:DX8
Bright White C.C.	GW7	4037	18238	B8833	37298	CHA88:GW7

CLADDING COLOR NAME	CHRYSLER[1] CODE	PPG	BASF	DuPONT	S-W ACME M-S	AKZO/ SIKKENS
Jewel Blue	MC9	4449	22109	B9241	45868	CHA93:MC9
Char-Gold II S.G.	RJ7	35748	25037	B9532	50278	CHA95:RJ7
Lt. Driftwood S.G.	MFA	4569	22110	B9263	46579	CHA92:MFA
Moss Green P.C.	RJN	47383	25036	B9533	50277	CHA94:RJN
Neutral Dk. Gray	HS5	34349	20215	C8923	40392	CHA90:HS5
Black C.C.	DX8	9700	15214	F0204	34858 90-5950	CHA85:DX8
Bright White C.C.	GW7	4037	18238	B8833	37298	CHA88:GW7

INTERIOR COLOR NAME	CHRYSLER CODE	PPG	BASF	DuPONT	S-W ACME M-S
Med. Quartz	D5	34618/2-1346	19133	C8904	40075
Med./Lt. Quartz (HD5/HW8)	DW	34618/2-1346 51449/2-1384	19133 20166	C8904 C9009	40075/ 42267
Champagne	V4	26504/2-1347	19134	C8905	40076
Champagne/Moss Green (HV4/RJ4)	VJ	26504/2-1347 26797/2-1404	19134	C8905	40076/ 50512
Lt./Dk. Driftwood (LF4/LF8)	FF	27242/2-1462 27243/2-1463	22136 22137	C9273 C9274	45998 45999

[1] Herberts Standox and Spies Hecker use the Chrysler paint code as listed on the Vehicle Code Plate.

J9523-87

HEATING AND AIR CONDITIONING

CONTENTS

GENERAL INFORMATION

This Group deals with manual and automatic temperature control (ATC) systems.

For proper operation of the instrument panel controls (Fig. 1), refer to the Owner's Manual provided with the vehicle.

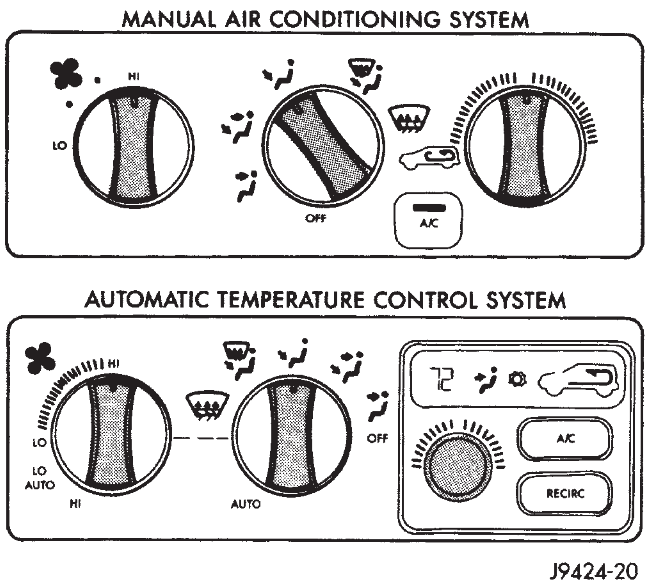


Fig. 1 Manual A/C and ATC Controls

All vehicles are equipped with a Heater A/C unit housing assembly (Fig. 2).

HEATER SYSTEM

All models use a Blend-Air type heater. Outside air enters the through the cowl opening. The air then passes through the plenum chamber, evaporator and then the heater core. Air intake openings must be kept free of obstructions, so sufficient volume of air can enter the system. A temperature control door in the housing directs incoming air through and or around the heater core. The amount of blend air

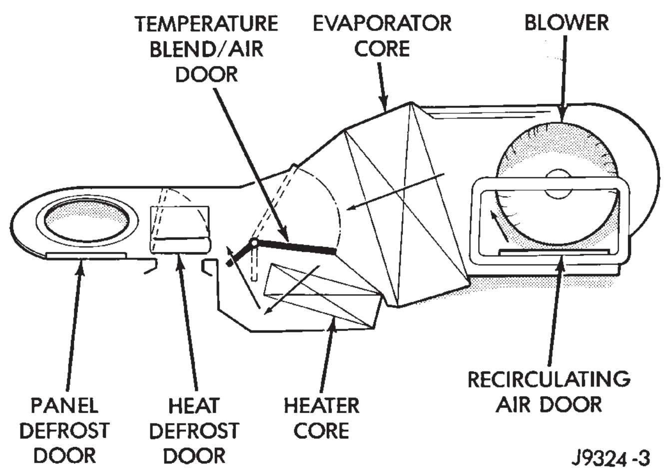


Fig. 2 Blend-Air Heater and A/C System

(heated, non-heated or cooled air) is controlled by the temperature knob on the instrument panel. Direction of the air is controlled by the mode knob on the instrument panel.

The blower switch and resistor block controls the speed of the blower motor. This in turn controls the volume of air flow through the system.

SIDE WINDOW DEMISTERS

The side window demisters direct air from the Heater A/C assembly. The outlets are located on the top left and right edges of the door panels. The Demisters operate when the mode selector is on FLOOR, BI-LEVEL, FLOOR/DEFROST or DEFROST mode.

AIR CONDITIONING SYSTEM

The A/C compressor increases the pressure and temperature of the refrigerant. The heated refrigerant vapor is pumped into the condenser where it cools by giving off heat to air passing over the condenser fins. As the refrigerant cools in the condenser, it condenses into a liquid. Still under high pressure, the liquid refrigerant passes into the fixed orifice tube. The fixed orifice tube meters the flow of refrigerant into the evaporator coil. A low pressure is maintained by the suction side of the compressor. As refrigerant enters the evaporator, it begins to boil by absorbing heat from the air passing over the evaporator coil. Having given up its heat to boil the refrigerant, the air is cooled and passes into the passenger compartment of the vehicle. From the evaporator the vaporized refrigerant enters the accumulator which separates the liquid from the vapor. The vapor and oil are drawn back into the compressor to repeat the cycle.

Ambient air intake can be shut off by closing the recirculating air door. This will cool the air that is already inside the vehicle. This is done by turning the temperature control knob to the RECIRC position. On ATC systems a RECIRC button on the control is used. Depressing the A/C button will allow refrigerant to flow through the evaporator. This cools and dries the plenum air before it is directed through or around the heater core.

The ATC system lets the operator adjust the temperature of the passenger compartment. A computer built into the control panel, regulates the temperature, air flow direction and blower speed. The operator may select an AUTO mode feature in which the computer selects the blower speed and air flow direction. Refer to the Owner's Manual for proper operation.

A/C COMPONENTS

ACCUMULATOR: The Accumulator is mounted in the engine compartment on the right side of the vehicle. The inlet tube of the accumulator attaches directly to the evaporator core outlet tube. Refrigerant enters the accumulator canister through the inlet tube. The liquid oil-laden refrigerant falls to the bottom of the canister which acts as a separator. A desiccant bag mounted in the accumulator absorbs moisture which may be in the refrigerant system (Fig.3).

COMPRESSOR: The 10PA17 Compressor is a fixed displacement compressor. The purpose of the compressor is to compress the low-pressure refrigerant vapor into a high pressure, high temperature vapor. The compressor is serviced as a assembly only.

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 10PA17 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.

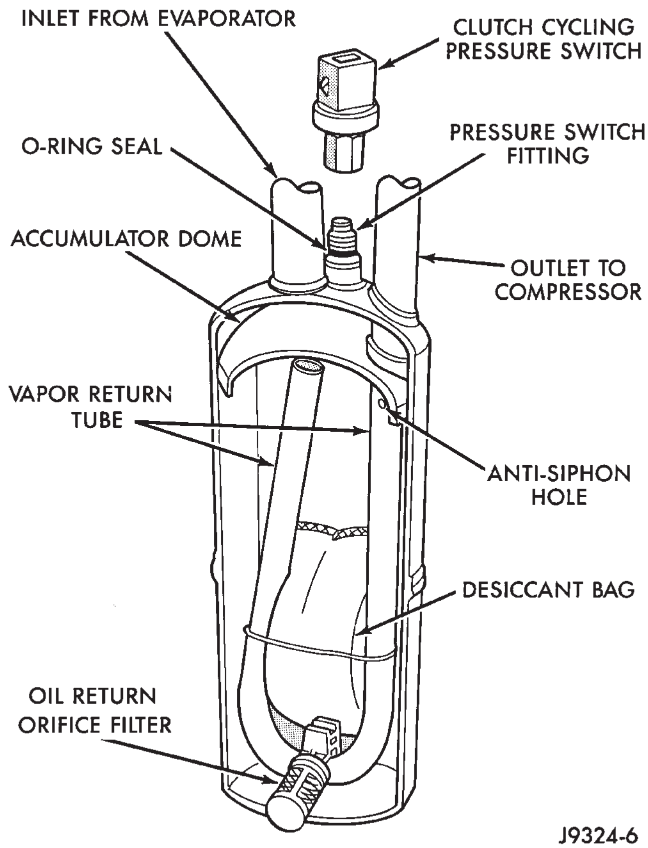


Fig. 3 Accumulator

AIR CONDITIONING CYCLING SWITCH: The switch is mounted on top of the accumulator (Fig. 3). The switch is wired in series with compressor clutch. The switch contacts open and close turning on an off the compressor clutch. This regulates the system pressure. Low ambient temperatures, below approximately -1°C (30°F) will also open the switch contacts. This is due to the pressure/temperature relationship of the refrigerant in the system.

CONDENSER: The condenser is located in front of the engine radiator (Fig.4, 5). Its function is to cool the hot high pressure refrigerant gas. This causes it to condense into high pressure liquid refrigerant.

EVAPORATOR COIL: The coil is located in the A/C housing. Its function is to remove heat and dehumidify the air before it enters the vehicle.

FIXED ORIFICE TUBE: The orifice tube is located in the outlet line of the condenser. The inlet and outlet ends have a screen to filter the refrigerant. O-rings on the orifice tube body prevent the refrigerant from bypassing the orifice. The orifice tube is used to meter the flow of liquid refrigerant into the evaporator core.

HIGH PRESSURE RELIEF VALVE: The valve is located on the compressor manifold (Fig.4, 5). The valve is used to prevent excessive pressure build up. This prevents damage to the compressor and other system components.

HIGH-PRESSURE CUT-OUT SWITCH: The switch is located on the discharge line (Fig.4, 5).The switch is wired in series with compressor clutch. The switch interrupts power to the compressor clutch, when excessive pressure is present.

REFRIGERANT LINES: The lines are used to carry the refrigerant between the various system components. The barrier hose design is used for the air conditioning system on this vehicle. The ends of the A/C hoses are made from light-weight aluminum and use new braze-less fittings.

SPRING LOCK COUPLER: The coupler is used to attach A/C lines and other components. The coupling is held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage prevent the flared end of the female fitting from pulling out of the cage. O-rings are used to seal the coupling. These O-rings are compatible with R-134a refrigerant and must be replaced with O-rings made of the same material. A secondary clip is installed at the factory for added blow-off protection.

SERVICE PORTS: The low pressure service port is attached to the refrigerant line (Fig.4, 5). The high pressure service port is attached to the compressor manifold. These ports are used to attach A/C gauges. After servicing the refrigerant system, always install service port caps.

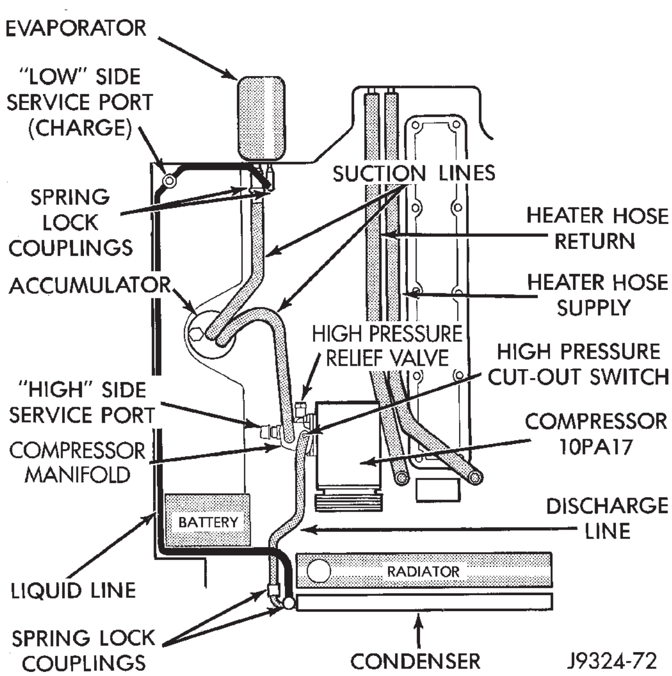


Fig. 4 A/C Components 4.0L Engine

ATC SENSORS

AMBIENT TEMPERATURE SENSOR: The sensor is located in front of the condenser. It is a temperature sensitive resistor which provides a signal to

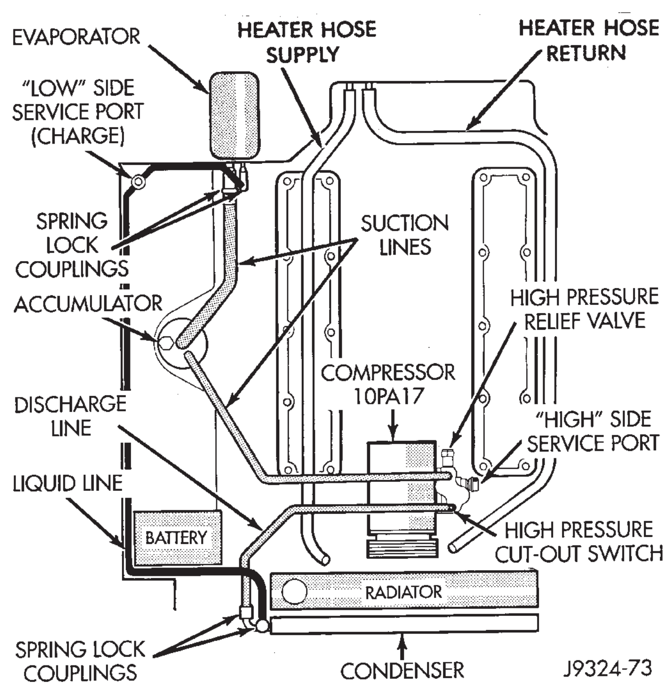


Fig. 5 A/C Components 5.2L Engine

ATC controller. The controller receives the signal from the sensor and determines the outside air temperature. This information is only provided when the vehicle is in motion.

IN-VEHICLE SENSOR: The sensor is located beneath the right center air outlet. It is a temperature sensitive resistor which provides a signal to ATC controller. A small fan is used to draw inside air passed the sensor. The controller receives the signal from the sensor and determines the inside air temperature.

SOLAR SENSOR: The sensor is mounted to the top of the instrument panel defroster grille. The sensor is a photo diode which responds to light intensity. The controller receives the signal from the sensor and determines the sun light intensity.

REFRIGERANT

This system uses R-134a refrigerant. It is a non-toxic, non-flammable, clear color-less liquified gas.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. A small amount of R-12 in a R-134a system will cause compressor failure, refrigerant oil sludge or poor A/C performance.

New service port couplers have been used to ensure that the system is not accidentally filled with the wrong refrigerant (R-12).

R-134a refrigerant requires a special type of compressor oil (ND8 PAG). When adding oil, make sure that it is designed to be used in the R-134a system.

REFRIGERANT EQUIPMENT

WARNING: EYE PROTECTION MUST BE USED WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED BEFORE PROCEEDING WITH THIS OPERATION. PERSONNEL INJURY CAN RESULT.

Chrysler Corporation recommends a (R-134a) recycling device that meets SAE standard J2210 be used when servicing the refrigerant system. Contact an automotive service equipment supplier for refrigerant recycling equipment that is available in your area. Refer to the operating instructions provided with the recycling equipment for proper operation.

MANIFOLD GAUGE SET

A R-134a manifold gauge set (Fig. 6) may be needed in conjunction with the charging and or recovery/recycling device. The service hoses on the gauge set being used should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant from being release into the atmosphere.

LOW PRESSURE GAUGE HOSE

The low pressure hose (BLUE with BLACK STRIP) attaches to the low side service port. This port is located at the right rear of the engine compartment in the condenser-to-evaporator line.

HIGH PRESSURE GAUGE HOSE

The high pressure hose (RED with BLACK STRIP) attaches to the discharge service port. This port is located on the compressor plumbing or manifold.

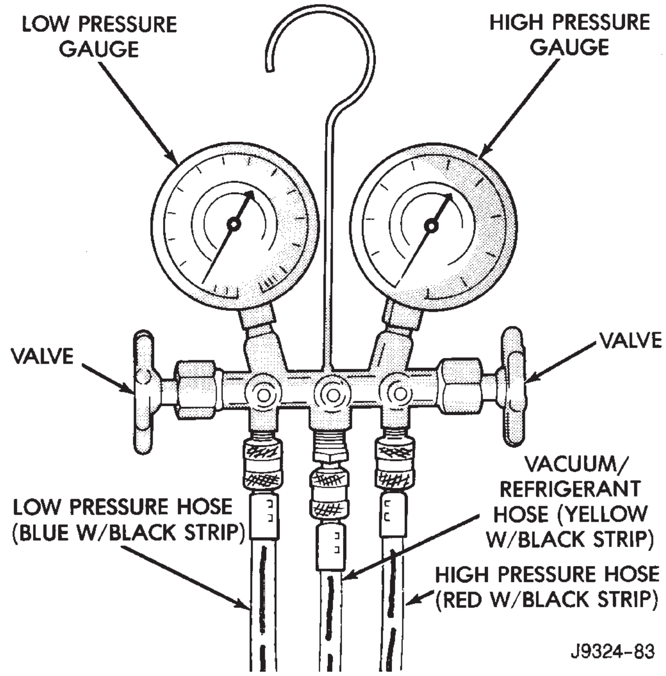


Fig. 6 R-134a Manifold Gauge Set

RECOVERY/RECYCLING/EVACUATION/ CHARGING HOSE

The center manifold hose (YELLOW or WHITE with BLACK STRIP) is used to recover, evacuate and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

Refer to the Recovery/Recycling device operators manual for proper procedures.

WARNINGS, CAUTIONS AND SERVICE PRECAUTIONS

WARNINGS

WARNING: THE AIR CONDITIONING SYSTEM CONTAINS REFRIGERANT UNDER HIGH PRESSURE. SEVERE PERSONAL INJURY MAY RESULT FROM IMPROPER SERVICE PROCEDURES. REPAIRS SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND/OR THROAT. 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.

WARNING: DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC LEAK DETECTOR IS RECOMMENDED.

WARNING: IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE THE WORK AREA BEFORE RESUMING SERVICE. LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

WARNING: THE EVAPORATION RATE OF R-134A 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.

WARNING: 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.

CAUTIONS

CAUTION: Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with equipment being used.

CAUTION: Never add R-12 to a system designed to use R-134a. Damage to the system will result.

CAUTION: R-12 compressor oil can not be mixed with the R-134a compressor oil. They ARE NOT compatible.

CAUTION: DO NOT use R-12 equipment or parts on the R-134a system. Damage to the system will result.

CAUTION: Do not over charge refrigerant system. This will cause excessive compressor head pressure and can cause noise and system failure.

SERVICE PRECAUTIONS

Never open or loosen a connection before the refrigerant has been recovered from the system.

A system which has been opened or one which has discharged through leakage must be evacuated before charging.

DO NOT open the refrigerant system or uncap a replacement component until you are ready to service the system. This will prevent contamination in the system.

Before disconnecting a component from the system, clean the outside of the fittings thoroughly.

When disconnecting a fitting use a wrench on both halves of the fitting. This will prevent twisting of the refrigerant lines or tubes.

Immediately after disconnecting a component from the system, seal the open fittings with a cap or plug.

Before connecting an open fitting always install a new seal. Coat the fitting and seal with clean refrigerant oil before connecting.

Tighten fittings only to the specified torque. The aluminum fittings used in the A/C system will not tolerate over tightening.

Refrigerant oil absorbs moisture from the atmosphere. DO NOT open an oil container until ready to use and install the cap immediately after using. Store the oil only in a clean moisture-free container.

When installing a refrigerant line avoid sharp bends. Position the line away from the exhaust or any sharp edges which may chafe the line.

Keep service tools and the work area clean. Contamination of A/C system through careless work habits must be avoided.

COOLING SYSTEM

To maintain the performance level of the heating/air conditioning system, the engine cooling system must be properly maintained.

The use of a bug screen is not recommended. Any obstructions in front of the radiator or condenser can reduce the performance of the A/C and engine cooling system.

The radiator and condenser uses seals to insure air flow is directed through these components. These seals must be in the proper position to maintain cooling and A/C performance.

WARNINGS AND CAUTIONS

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY.

WARNING: WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL.

WARNING: KEEP OUT OF REACH OF CHILDREN AND PETS.

WARNING: DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY CAN RESULT.

WARNING: DO NOT STORE IN OPEN OR UNMARKED CONTAINERS.

CAUTION: The engine cooling system is designed to develop internal pressure of 97 to 124 kPa (14 to 18 psi). Allow the vehicle 15 minutes to cool down (or until a safe temperature and pressure are attained) before opening the cooling system. Refer to Group 7, Cooling System.

REFRIGERANT TUBING AND FITTINGS PRECAUTIONS

The barrier hose design is used for the air conditioning system on this vehicle. The ends of the A/C hoses are made from light-weight aluminum and use new braze-less fittings.

The A/C hoses use special connectors called QUICK CONNECTS. Never attempt to disconnect a quick connect without discharging the air conditioning system. 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. If O-ring replacement is required be sure to use the correct type of O-ring. Failure to use the correct type of O-ring will cause the connection to leak within a short period of time.

Kinks in refrigerant tubing or sharp bends in refrigerant hose lines will reduce the capacity of the system. 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. The flexible hose lines should be routed so they are at least 80 mm (3 in) from the engine exhaust manifold. Inspect all flexible hose lines to make sure they are in good condition and properly routed. 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.

REFRIGERANT SERVICE AND PERFORMANCE TEST

INDEX

LEAK TESTING REFRIGERANTREVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE LEAK TESTING.

If A/C system is not cooling properly, determine if system is fully charged. Refer to Refrigerant System Diagnosis Chart. If the system is empty evacuate the A/C system and charge system with 0.27 kg (0.6 lbs.) R-134a refrigerant. Refer to Charging Refrigerant System for instructions. To detect a leak in the system, perform the following procedures.

(1) Position the vehicle in a wind free work area. This will aid in detecting small leaks.

(2) Bring A/C system up to operating temperature and pressure. This is done by allowing the engine to run with the A/C on for 5 to 7 minutes.

(3) Open hood 5 minutes prior to leak test. This will dissipate any accumulated refrigerant in the engine compartment.

(4) With the engine not running, use an R-134a Electronic Leak Detector and search for leaks. Move probe slowly along the bottom side of lines and fittings, because R-134a is heavier than air. Fittings, lines, or components that appear to be oily usually indicates a refrigerant leak.

(5) To inspect the evaporator core for leaks. Set the blower at low speed and the selector in FLOOR and RECIRC mode check for leaks at the left and right heater outlets.

RECOVERING REFRIGERANT SYSTEM

REVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE RECOVERING REFRIGERANT SYSTEM.

R-134a refrigerant is a hydrofluorocarbon (HFC) that does not contain chlorine. R-134a refrigerant Recovery/Recycling Station that meets SAE standard J2210 must be used to recover the refrigerant. Refer to the operating instructions provided with the equipment for proper operation.

EVACUATING REFRIGERANT SYSTEMREVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE EVACUATING SYSTEM.

If the A/C system has been open to the atmosphere, it must be evacuated before the system can be charged. Moisture and air mixed with refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Evacuating will boil the moisture out of the system at near room temperature. To evacuate the refrigerant system use following procedure:

(1) Connect a suitable charging station and manifold gauge set to the vehicle.

(2) Open the low and high side valves and start vacuum pump. When suction gauge reads 88 kPa (26 in. Hg) vacuum or greater, close all valves and turn off vacuum pump. If system fails to reach specified vacuum, the system has a leak that must be corrected. If system maintains the specified vacuum for 5 minutes, restart the vacuum pump. Then open the suction and discharge valves and evacuate an additional 10 minutes.

(3) Close all valves. Turn off and disconnect the vacuum pump.

The system is now ready to be charged with refrigerant.

CHARGING REFRIGERANT SYSTEMREVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE CHARGING SYSTEM.

After the system has been tested for leaks and the refrigerant recovered, a refrigerant charge can be injected into the system. Refer to refrigerant capacities for proper amount of refrigerant charge. Charge the system using a Recovery/Recycling/Charging Station approved for R-134a refrigerant. Refer to the instructions provided with the equipment for proper operation.

REFRIGERANT CHARGE CAPACITY

The R-134a system charge capacity is 0.8 kg (1.75 lbs.).

PARTIAL CHARGE METHODREVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE CHARGING SYSTEM.

This method is used to add a partial charge to a system that is low on refrigerant. To perform this procedure the evaporator inlet and outlet tube temperatures are measured. The difference between the evaporator inlet and outlet tube temperatures will determine the amount of charge needed.

The temperature difference is measured with a temperature meter with one or two clamp-on Thermocouple probes.

Before adding a partial charge check for leaks (refer to Refrigerant Leak Testing). If found correct leak.

(1) Attach manifold gauge set.

(2) Attach probes to the inlet and outlet tubes of the evaporator.

(a) If a single thermocouple probe is used, attach probe to the evaporator inlet tube just before the collar of the quick-connect fitting. The probe must makes contact with the bottom surface of the tube.

(b) If dual thermocouple probes are used, attach probe (1) to the evaporator inlet tube and probe (2) to the evaporator outlet tube. Be sure to attach the probes just before the collar of the quick-connect fittings. The probes must make contact with the bottom surface of the tubes.

(3) Open all windows or doors of the passenger compartment. Set the air conditioning controls to A/C, PANEL, RECIRC (temperature knob on full cool) and blower speed on HIGH.

(4) Start the engine and hold at 1,000 RPM. Allow the engine to warm up to normal operating temperature.

(5) The A/C clutch may cycle depending on ambient temperature and the state of charge. If the clutch cycles remove cycling clutch switch connector from switch located on the accumulator. Place a jumper wire between the terminals of the switch connector.

(6) Hold the engine speed at 1,000 RPM.

(7) Allow 3 to 5 minutes for the A/C system to stabilize. Record the temperature difference between the evaporator inlet and outlet tubes.

(a) If a single probe is used, record the temperature of the inlet tube. Then remove the probe from the inlet tube and attach it to the outlet tube just before the quick-connect fitting. The probe must makes contact with the tube. Allow the equipment to stabilize then record the temperature of the outlet tube. Subtract the inlet temperature from the outlet temperature.

(b) If dual probes are used, record the temperature difference between the two.

(8) Refer to the Low Charge Determination chart to determine the additional charge required. If the measured temperature differential (refer to Low Charge Determination chart) is higher than 22°C to 26°C (40°F to 47°F), add 0.4 kg. (14 oz.).

(9) Allow 3 to 5 minutes for the system to stabilize then take a second measurement. Record the temperature difference and refer to the Low Charge Determination chart to determine if an additional charge is required.

(10) Record the compressor discharge pressure. If pressure is higher than the pressure in the Compressor Discharge Pressure chart, the system could be overcharged. If the pressure is equal to or lower than the chart continue with this procedure.

FOR EXAMPLE: The ambient temperature is 21°C (70°F). The evaporator INLET temperature is 12°C (54°F) and the evaporator OUTLET temperature is 10°C (50°F). The difference is OUTLET - INLET = -2°C (-4°F). With a -2°C (-4°F) temperature differential at 21°C (70°F) ambient temperature, the system is fully charged.

(11) Add enough refrigerant to bring system up to a full charge.

(12) Remove the jumper wire from the cycling switch connector and plug connector into switch.

REFRIGERANT OIL

It is important to have the correct amount of oil in the A/C system. This will ensure proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling capacity of the system.

The oil used in the 10PA17 compressor is a polyalkylene glycol synthetic ND8 PAG, wax-free refrigerant oil. Only refrigerant oil of the same type should be used to service the system. Do not use any other oil. The oil container should be kept tightly capped until it is ready for use and then capped after use to prevent contamination. Refrigerant oil will quickly absorb any moisture it comes in contact with.

OIL LEVEL CHECK

It will not be necessary to check oil level in the compressor or to add oil unless there has been an oil loss. This may be due to a rupture or leak from a line, shaft seal, evaporator or condenser. Oil loss at a leak point will be evident by the presence of a wet, shiny surface around the leak.

When an A/C system is assembled at the factory, all components (except the compressor) are refrigerant oil free. After the system has been charged and operated, the oil in the compressor is dispersed through the system. The accumulator, evaporator, condenser and compressor will retain a significant amount of oil.

Refrigerant oil must be added when a accumulator, evaporator, condenser or compressor are replaced. When the compressor is replaced, the oil must be drained from the replaced compressor and measured. Drain all the oil from the new compressor. Add back into the new compressor the amount of oil that was drained out of the old compressor.

LOW CHARGE DETERMINATION

Open the windows and/or doors of the passenger compartment. Set the air conditioning controls to A/C, PANEL, RECIRC (temperature knob on full cool) and blower speed on HIGH. Set the engine speed at 1,000 RPM.

Evaporator Outlet and Inlet Temperature Differential • If Outlet is WARMER than Inlet, temperature differential is plus (+). • If Outlet is COLDER than Inlet, temperature differential is minus (-). See the example in the Refrigerant Charge Check (Alternative Method).					
Added Amount of R134a to Properly Charge A/C System	Ambient Temperature				
	21°C (70°F)	27°C (80°F)	32°C (90°F)	38°C (100°F)	43°C (110°F)
	Differential Temperature				
0.90 lbs. (14 oz.)	+22°C (+40°F)	+23°C (+42°F)	+24°C (+43°F)	+25°C (+45°F)	+26°C (+47°F)
0.75 lbs. (12 oz.)	+12°C (+22°F)	+12°C (+23°F)	+13°C (+24°F)	+15°C (+26°F)	+16°C (+28°F)
0.60 lbs. (10 oz.)	+4°C (+8°F)	+5°C (+9°F)	+6°C (+10°F)	+7°C (+12°F)	+8°C (+13°F)
0.50 lbs. (8 oz.)	0°C (0°F)	+0°C (+1°F)	+1°C (+2°F)	+2°C (+3°F)	+3°C (+4°F)
0.40 lbs. (6 oz.)	-1°C (-2°F)	-1°C (-1°F)	+0°C (-0°F)	0°C (0°F)	0°C (0°F)
Recommended Charge	-2 to -6°C (-3 to -10°F)				

Note: A temperature differential of -2°C to -6°C (-3°F to -10°F) indicates an acceptable charge.

J9324-86

COMPRESSOR DISCHARGE PRESSURE

Ambient Temperature	16°C (60°F)	21°C (70°F)	27°C (80°F)	32°C (90°F)	38°C (100°F)	43°C (110°F)
Compressor Discharge Pressure	1515 kPa (220 psi)	1655 kPa (240 psi)	1790 kPa (260 psi)	2070 kPa (300 psi)	2345 kPa (340 psi)	2690 kPa (390 psi)

J9324-40

The evaporator, condenser and accumulator will retain a significant amount of oil (refer to the Refrigerant Oil Capacities Chart).

A/C PERFORMANCE TEST

The air conditioning system is designed to provide the passenger compartment with low temperature and low humidity air. The evaporator, located in the Heater A/C unit behind the instrument panel, is cooled to temperatures near the freezing point. As warm damp air passes over the fins in the evaporator, the air is cooled and moisture is removed to condense on the fins. During periods of high heat and humidity an A/C system will be more effective in the RECIRC mode. With the control set to RECIRC, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels improve.

A/C REFRIGERANT OIL CAPACITIES

Component	ml	oz
A/C System	230	7.75
Accumulator	120	4
Condenser	30	1
Evaporator Care	60	2
Compressor	(see Oil Level Check)	

J9324-88

If the system has a intermittent operational problems or fault codes, make sure the 16 Way Connector is properly seated (Fig. 1). To check this condition, separate the connector halves and then connect them. Two fault codes that could be stored as a result of this condition are 6 and 7.

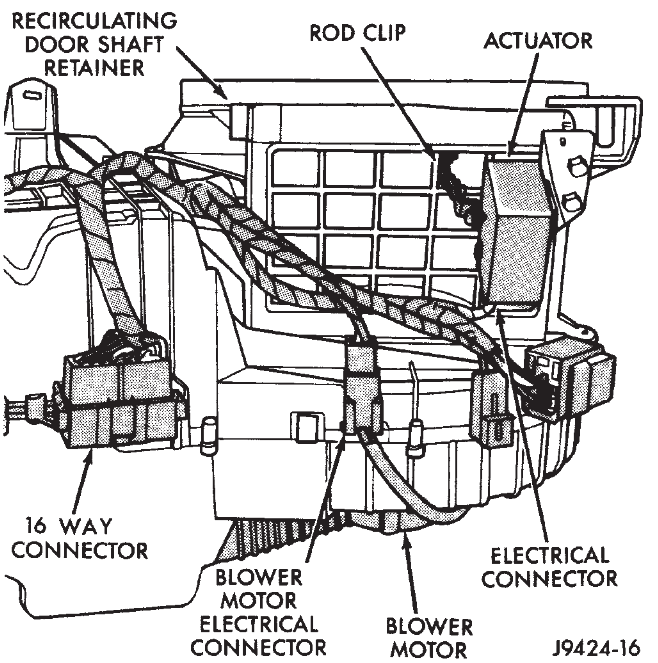


Fig. 1 Location of 16 Way Connector

Review Safety Precautions and Warnings before proceeding with this procedure. Air temperature in test room and in the vehicle must be 21°C (70°F) minimum for this test.

(1) Connect an engine tachometer and R-134a manifold gauge set.

(2) Set control to A/C, PANEL, RECIRC (temperature knob on full cool) and blower on HIGH.

(3) Start engine and hold at 1,000 RPM with A/C clutch engaged.

(4) Engine should be warmed up with windows and/or doors opened.

(5) Insert a thermometer in the left center A/C outlet and operate the engine for 5 minutes.

(6) The A/C clutch may cycle depending on ambient conditions. If clutch cycles, remove the clutch cycling pressure switch connector from the switch located on the accumulator (Fig. 2). Place a jumper wire across the terminals of the clutch cycling pressure switch connector.

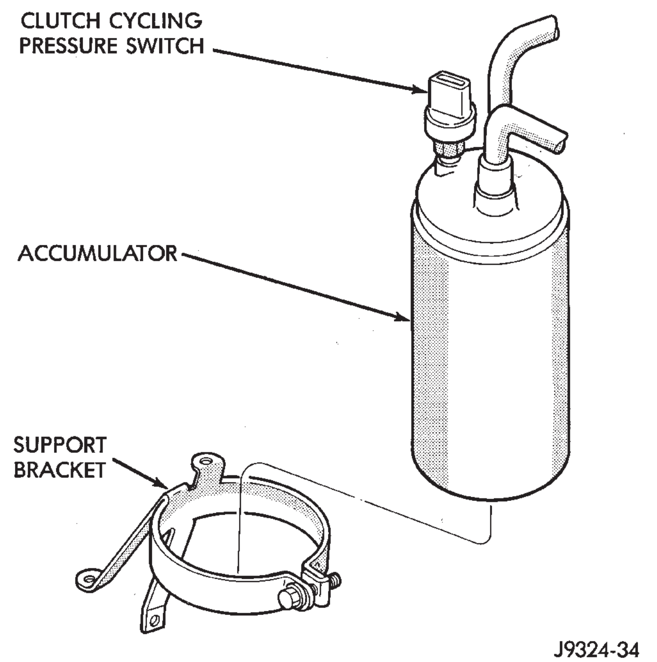


Fig. 2 Clutch Cycling Pressure Switch

(7) With the A/C clutch engaged, record the discharge air temperature and the compressor discharge pressure.

(8) Compare the discharge air temperature to the A/C Performance (Temperature and Pressure) chart. If the discharge air temperature is high, refer to the Refrigerant Service Procedures (Refrigerant Leak Testing and Refrigerant Charge Check).

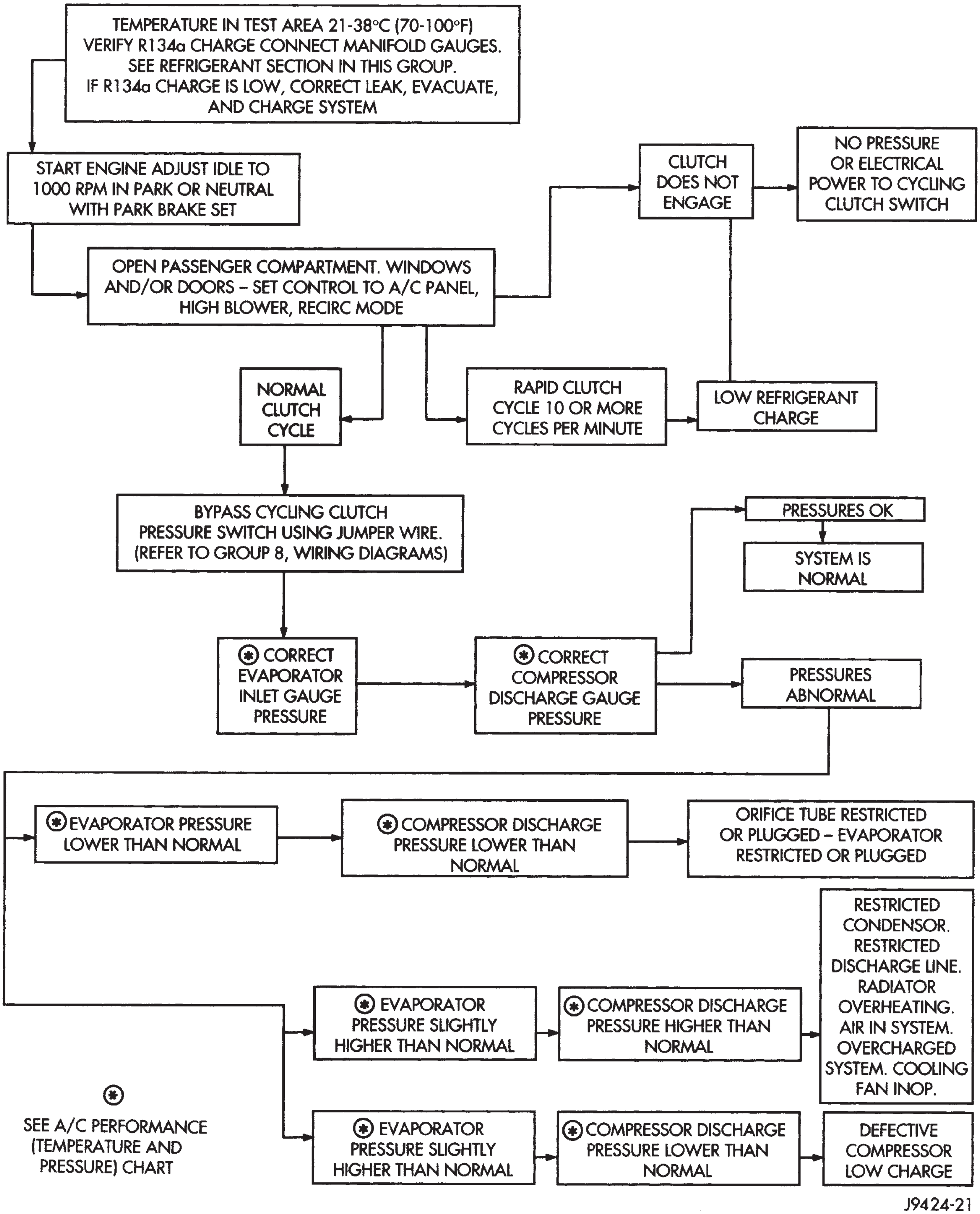
(9) Compare the compressor discharge pressure to the A/C Performance (Temperature and Pressure) chart. If the compressor discharge pressure is high, refer to the Refrigerant Service Procedures (High Compressor Discharge Pressure).

A/C PERFORMANCE (TEMPERATURE AND PRESSURE)

Ambient Temperature	21°C (70°F)	27°C (80°F)	32°C (90°F)	38°C (100°F)	43°C (110°F)
Air Temperature at Center Panel Outlet	-3 to 3°C (27-38°F)	1 to 7°C (33-44°F)	3 to 9°C (37-48°F)	6 to 13°C (43-55°F)	10 to 18°C (50-64°F)
Evaporator Inlet Pressure at Charge Port	179-241 kPa (26-35 psi)	221-283 kPa (32-41 psi)	262-324 kPa (38-47 psi)	303-365 kPa (44-53 psi)	345-414 kPa (50-60 psi)
Compressor Discharge Pressure	1240-1655 kPa (180-240 psi)	1380-1790 kPa (200-260 psi)	1720-2070 kPa (250-300 psi)	1860-2345 kPa (270-340 psi)	2070-2690 kPa (300-390 psi)

J9324-74

REFRIGERANT SYSTEM DIAGNOSIS



HEATER AND AIR CONDITIONING TEST PROCEDURES

HEATER OUTPUT TEST

PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings before performing the following procedures.

Check the radiator coolant level, drive belt tension and engine vacuum line connections. Also check radiator air flow and radiator fan operation. Start engine and allow to warm up to normal operating 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

Engine coolant is provided to the Heater A/C system by 2 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 chart.

TEMPERATURE REFERENCE CHART

Ambient Temperature		Minimum Heater System Floor Outlet Temperature	
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°

9124-4

If the floor outlet air temperature is low, refer to Group 7, Cooling System for coolant temperature specifications. Both heater hoses should be HOT to the touch. The 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 A/C system.

Possible locations or cause of obstructed coolant flow:

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at cooling system connections (refer to Group 7, Cooling System).
- Plugged heater core.

If proper coolant flow is verified and outlet air temperature is still low, a mechanical problem may exist.

Possible location or cause of insufficient heat:

- Obstructed cowl air intake.
- Obstructed Heater A/C system outlets.
- Blend-air door not functioning properly.

VACUUM CONTROL

This control is used with the Heater A/C (manual) system.

Use an adjustable Vacuum Test Gauge (C-3707) and a suitable vacuum pump to test Heater A/C control vacuum. With a finger placed over the end of test hose (Fig. 3), calibrate vacuum control valve on the test gauge to obtain -27 kPa (8 in. Hg.). Release and block the end of the test hose several times to verify vacuum setting.

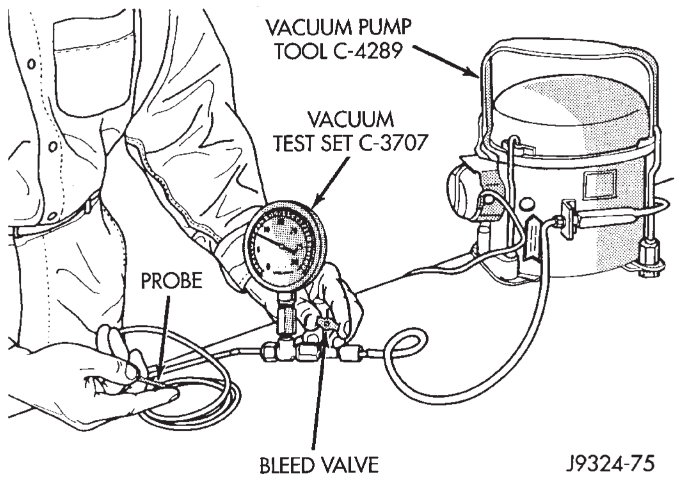


Fig. 3 Adjust Vacuum Test Bleed Valve

ONE-WAY CHECK VALVE VACUUM TEST

(1) In the engine compartment, disconnect the Heater A/C vacuum supply (black) hose. This hose passes through an opening in the dash panel.

(2) Remove the vacuum check valve. This valve is located on the (black) vacuum supply hose at the intake manifold.

(3) Connect test vacuum supply hose to the HEATER SIDE of the valve. In this direction the gauge should return to calibrated setting. If valve leaks vacuum in this direction, valve replacement is necessary.

(4) Connect test vacuum supply hose to the ENGINE VACUUM SIDE of the valve. Vacuum should flow through valve.

HEATER A/C CONTROL VACUUM TEST

(1) Connect the test vacuum probe to the vehicles (black) vacuum supply hose. Position vacuum test gauge so it can be viewed from the passenger compartment.

(2) Position the Heater A/C control mode selector to DEFROST, FLOOR, BI-LEVEL, PANEL or RECIRC (with A/C). Pause after each selection. The test gauge should return to the calibrated setting of -27 kPa (8 in. Hg.) after each selection is made. If the gauge cannot achieve the calibrated setting, a vacuum circuit or component has a leak.

LOCATING VACUUM LEAKS

To locate a vacuum leak, disconnect 7-way vacuum connector behind the Heater A/C control panel. Connect the calibrated vacuum hose probe to each port in the vacuum harness connector (Fig. 4). After each connection is made, the test gauge should return to calibrated setting. If all circuits function properly, replace Heater A/C control. If not, determine the color of the vacuum circuit that is leaking. To determine vacuum line colors, refer to the Vacuum Circuits chart for the Heater A/C (manual) units. Disconnect the vacuum actuator at the other end of the circuit. Instrument panel removal may be necessary to gain access to some components. Block the end of the disconnected vacuum line. The test gauge should return to calibrated setting. If not, that circuit has a leak and must be repaired or replaced. If test gauge returns to calibrated setting, the vacuum actuator must be replaced.

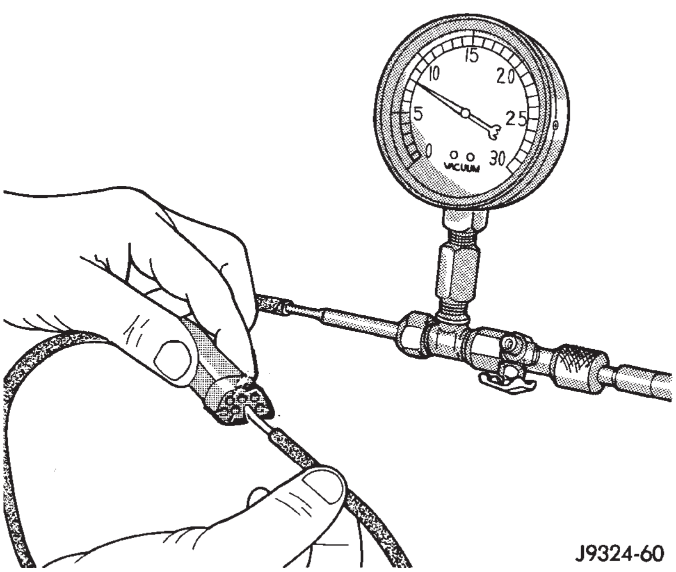


Fig. 4 Vacuum Circuit Test

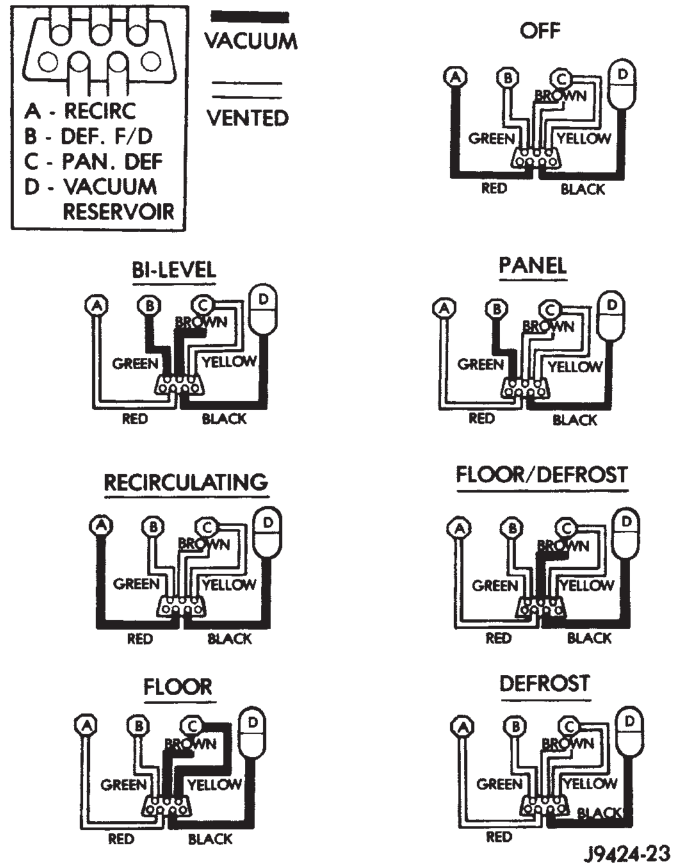
BLOWER MOTOR VIBRATION NOISE DIAGNOSIS

BLOWER MOTOR VIBRATION

Possible cause of blower motor vibration;

• Blower motor assembly loose in heater A/C housing.

VACUUM CIRCUITS



• Blower wheel loose on motor shaft.
• Blower wheel out of balance or bent.
• Blower motor defective.

BLOWER MOTOR NOISE

To verify blower noise, disconnect blower motor connector and operate the heater A/C system. If the noise goes away check the following possible causes.

• Foreign material in the heater A/C housing around the blower wheel.
• Blower wheel rubbing the heater A/C housing.
• Blower motor defective.

BLOWER MOTOR ELECTRICAL DIAGNOSIS

Refer to the Blower Motor Electrical System Diagnosis chart in this section. Also refer to Group 8W, Wiring Diagrams for more information.

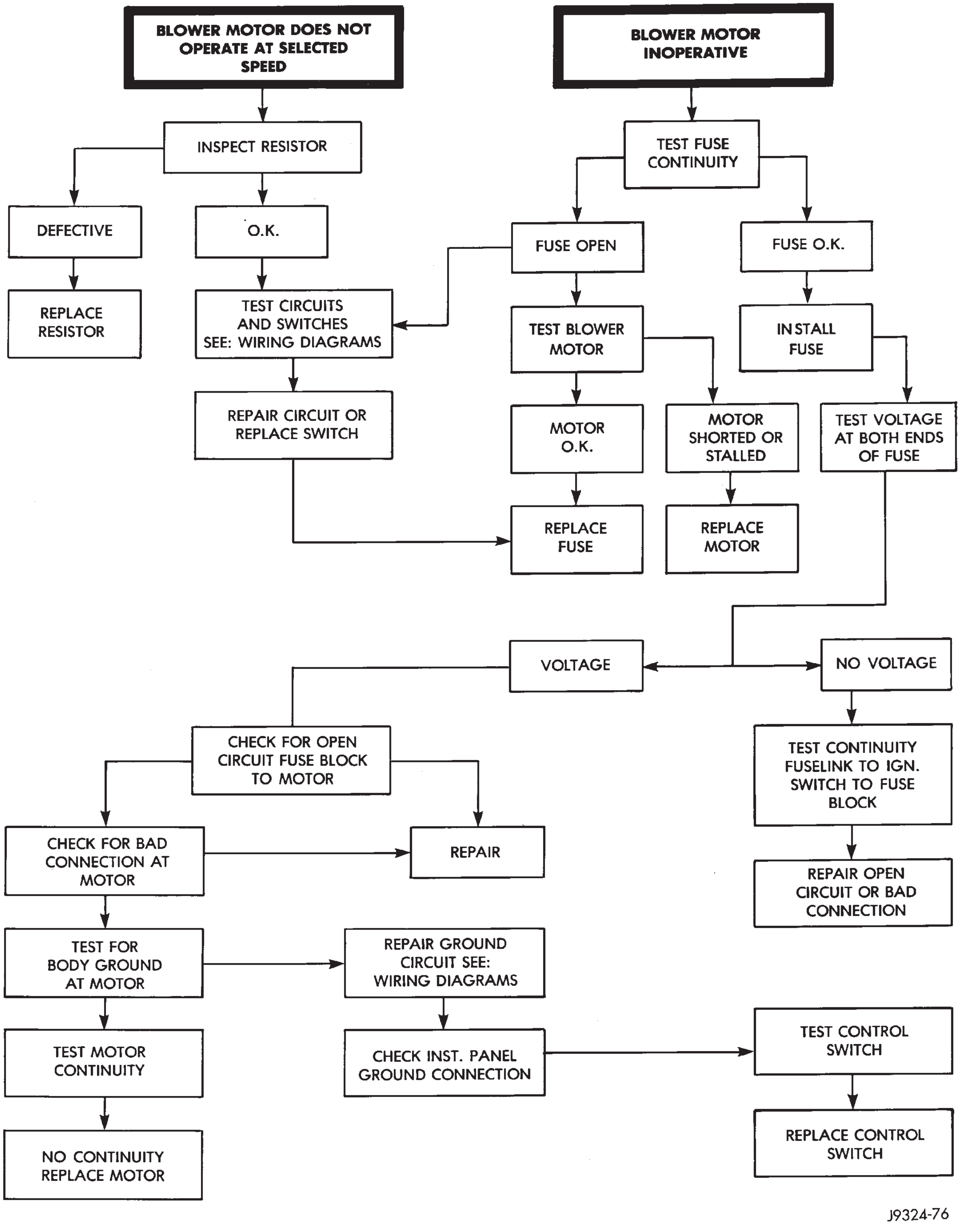
COMPRESSOR CLUTCH

The air conditioning compressor clutch electrical circuit is controlled by the powertrain control module (Fig. 5).

If the compressor clutch does not engage, verify refrigerant charge.

If the compressor clutch still does not engage, check for battery voltage at the low pressure switch

BLOWER MOTOR ELECTRICAL SYSTEM DIAGNOSIS



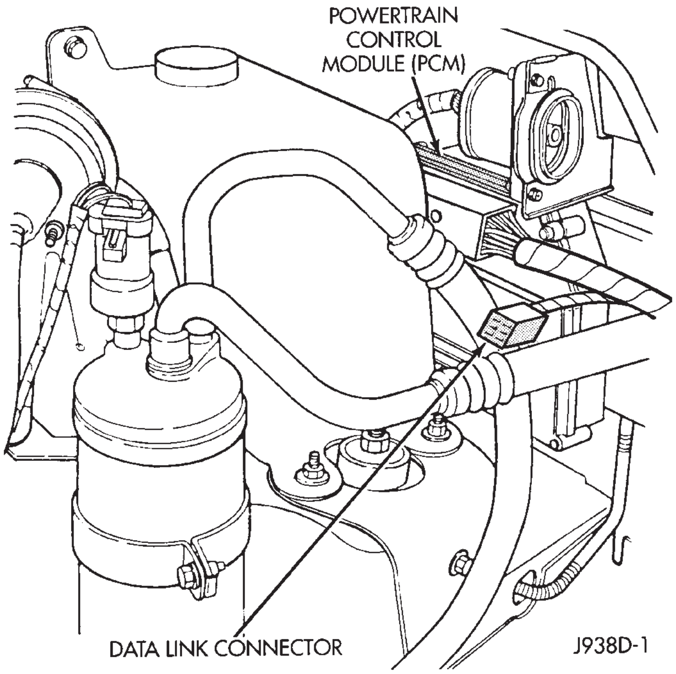


Fig. 5 Powertrain Control Module

located on the accumulator. If voltage is not detected, refer to Group 8W, Wiring Diagrams and the Powertrain Diagnostic Procedures Manual for diagnostic information.

If voltage is detected at the cut-off switch, reconnect switch. Then check for battery voltage between the compressor clutch connector terminals. If voltage is detected, perform A/C Clutch Coil Tests.

CLUTCH COIL TESTS

(1) Verify battery state of charge. Test indicator in battery should be green.

(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 3.7 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.

If coil current reads zero, the coil is open and should be replaced. If the ammeter reading is 4 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.

HIGH PRESSURE RELIEF VALVE

The high pressure relief valve is located on the compressor manifold (Fig. 6). The valve vents only a small amount of refrigerant necessary to reduce system pressure and then reseats itself. This prevents damage to the air conditioning system if excessive pressure develops. Excessive pressure may be caused by condenser air flow blockage, refrigerant overcharge, or air and moisture in the system. The valve is calibrated to vent at a pressure of 3445 to 4135 kPa (500 to 600 psi). If a valve has vented a small amount of refrigerant, it does not necessarily mean the valve is defective.

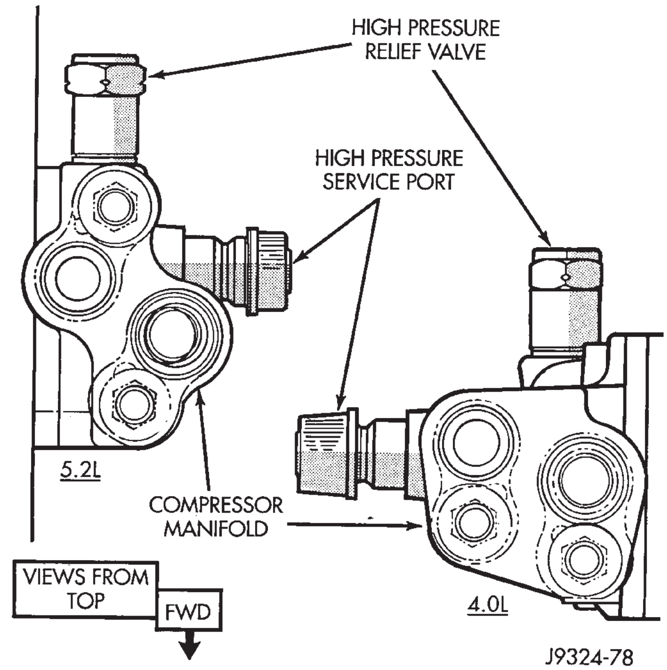


Fig. 6 High Pressure Relief Valve

AIR CONDITIONING CYCLING SWITCH

The switch is mounted on a Schrader-Type valve fitting on the top of accumulator. A valve depressor, is located inside the threaded end of the pressure switch. It presses on the Schrader-Type valve stem as the switch is mounted. This allows the evaporator outlet pressure inside the accumulator to control switch operation. The electrical switch contacts are normally open when the suction evaporator outlet pressure is approximately 172 kPa (25 psi) or lower. They will close when the suction evaporator outlet pressure rises to approximately 296 kPa (43 psi) or above. Lower ambient temperatures, below approximately -1°C (30°F) during cold weather will also open the clutch cycling pressure switch contacts. This is due to the pressure/temperature relationship of the refrigerant in the system. The electrical switch contacts control the electrical circuit to the compressor magnetic clutch coil. When the switch contacts are closed, the clutch coil is energized and the A/C clutch is engaged to drive the compressor.

The cycling switch controls the evaporator coil refrigerant flow. It also prevents evaporator icing and the blockage of airflow.

FIXED ORIFICE TUBE

The fixed orifice tube is located in the liquid line near the condenser. It has filter screens on the inlet and outlet ends of the tube body. The filter screens act as a strainer for the liquid refrigerant flowing through the fixed orifice opening. O-rings, on the tube body, prevent the high pressure liquid refrigerant from bypassing the orifice. Adjustments cannot be made to the fixed orifice tube. If it becomes clogged or damaged, replace the condenser to evaporator tube.

The fixed orifice tube assembly is the restriction between the high and low pressure liquid refrigerant. It meters the flow of liquid refrigerant into the evaporator core. Evaporator temperature is controlled by sensing pressure within the evaporator with a pressure-operated electric switch. The pressure switch controls compressor operation as necessary to prevent evaporator freeze-up.

The condenser to evaporator tube should be replaced whenever a compressor is replaced for lack of performance (internal damage).

HIGH PRESSURE RELIEF VALVE

A pressure relief valve is used to prevent excessive high pressure build up of 3445 to 4135 kPa (500 to 600 psi) and above. This will prevent damage to the compressor and other system components. The pressure relief valve is located on the rear end of the compressor manifold.

HIGH PRESSURE CUT-OUT SWITCH

The high pressure cut-out switch is located at the plumbing connection on the compressor manifold. When the discharge pressure reaches 3100 to 3375 kPa (450 to 490 psi), the switch interrupts the electrical power to the compressor clutch. This will prevent compressor operation when compressor discharge pressure approaches high levels.

ATC-TEMPERATURE AND BLOWER SPEED VARIATIONS

If the outlet air temperature and blower speed varies, the air aspirator hose could either be disconnected or blocked. In order for the in-vehicle temperature sensor to function, the aspirator hose draws air from the passenger compartment.

Check the operation of the aspirator hose and fan by operating the system in the panel air mode. Set the fan on high and in recirculating mode. Place a 50 by 50 mm (2 by 2 inch) square paper over the aspirator grille next to the glove box. The paper should cling to the grille. If the paper does not cling to the grille, proceed with the following steps:

(1) Inspect the aspirator hose routing. The hose is connected to the heating and air conditioning unit just above the carpeting on the transmission tunnel. The hose should be long enough to reach the nipple if it is routed correctly.

(2) Make sure that the hose is not blocked by disconnecting the hose and checking for blockage.

(3) Install the hose on the nipple using a new clamp.

ATC DIAGNOSTICS

The ATC controller is designed with on-board diagnostics. It is capable of troubleshooting input and output circuits of the controller. When a fault is detected and in memory, an “Er” is momentarily displayed, but only once during an ignition cycle. There are three different groups of testing features that this system is capable of:

(1) Fault Codes
(2) Input Circuit Testing
(3) Output Circuit Testing/Actuator Tests

DIAGNOSTICS TEST SELECTOR

The test selector is located in the same location as the temperature control point. It is used to display fault codes, identify test mode and show the value of each circuit being tested.

(1) If the floor (bottom) arrow is showing, the test selector value will be a range of numbers below 0 (Fig. 7).

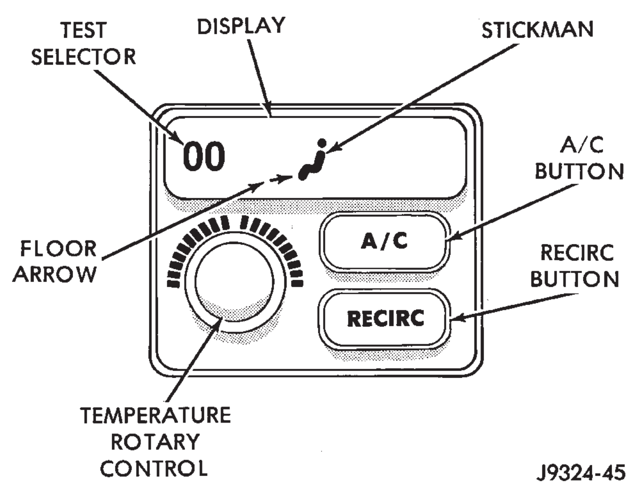


Fig. 7 Test Selector Values Below 0

(2) If the stickman shows no arrows, the test selector value will be a range of numbers between 0 and 99 (Fig. 8).

(3) If the panel (middle) arrow is showing, the test selector value will be a range of numbers between 100 and 199 (Fig. 9).

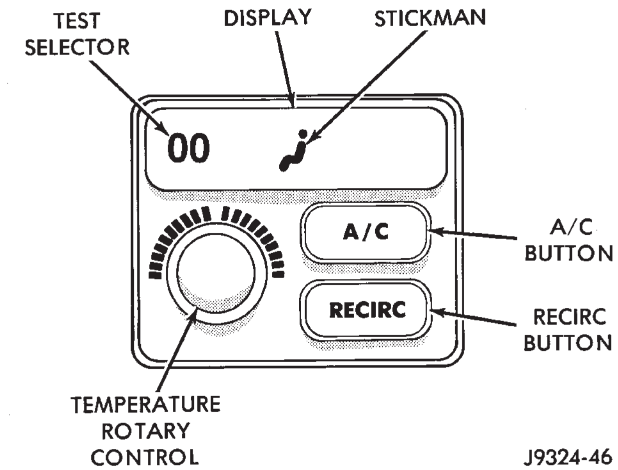


Fig. 8 Test Selector Values Between 0 and 99

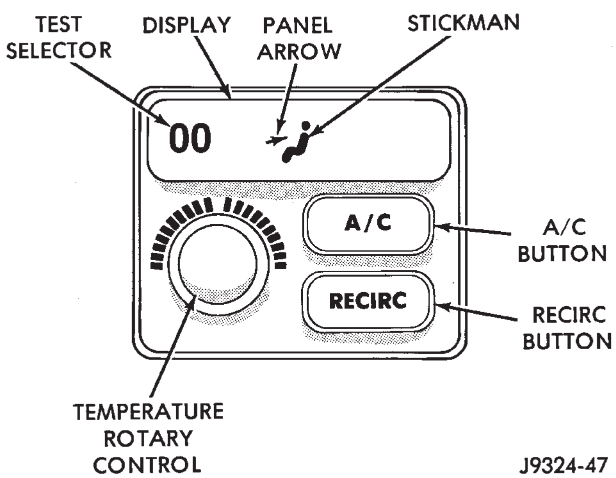


Fig. 9 Test Selector Values Between 100 and 199

(4) If the panel (middle) and defrost (top) arrows are showing, the test selector value will be a range of numbers between 200 and 255 (Fig. 10).

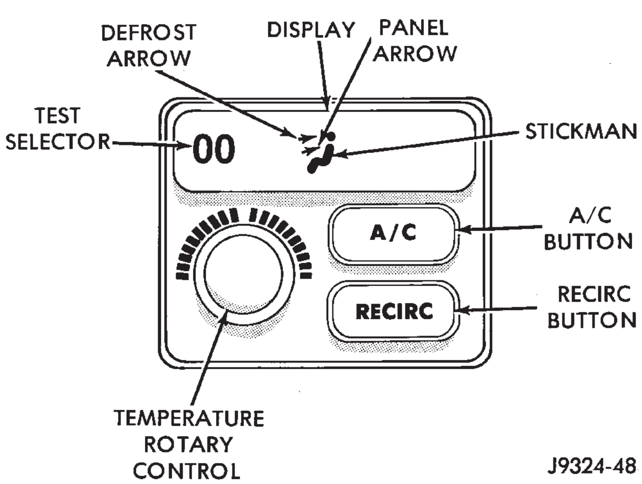


Fig. 10 Test Selector Values Between 200 and 255

During diagnostics you may return to the test selector mode. Simply turning the temperature control one CLICK in either direction. Again the stickman and arrows are not shown in test selector mode. Also, you have the option of monitoring or testing another circuit (Fig. 11).

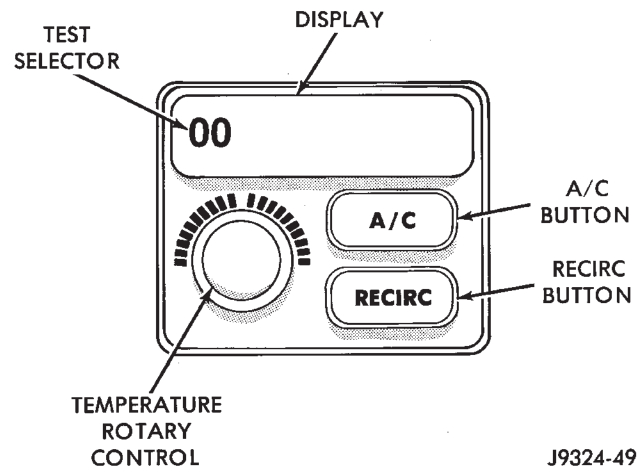


Fig. 11 Return to Test Selector Mode

ENTER DIAGNOSTICS

To enter the diagnostics, perform the following:

(1) Depress the A/C and RECIRC buttons simultaneously and hold. Rotate the control knob clockwise one CLICK.

(2) If you continue to hold the A/C and RECIRC buttons you will see the display completely light up. This is the Segment Test.

(3) After viewing the Segment Test, release the A/C and RECIRC buttons. This will put the test selector at 00, the Select Test level.

At this point a number of tests can be performed. However, the Fault Code Diagnostics should be preformed now.

FAULT CODE DIAGNOSTICS

The codes are two digit numbers that identify which circuit is malfunctioning. There are two different kinds of fault codes.

(1) Current Fault Codes are divided into two categories; input faults and system faults. Current faults means they are present right now.

(2) Historical Fault Codes are referred to as historical faults or faults that are stored in memory. Historical faults are an indication that a circuit failed previously, but is OK right now. A majority of historical fault codes are caused by wiring or connector problems.

CAUTION: A battery disconnect will erase all faults stored in Read Available Memory (RAM). It is recommended that all faults be recorded before they are erased.

While 00 is displayed, push either A/C or RECIRC button. The stickman will appear indicating you have entered the fault section. The numbers displayed will range from 00 to 64.

Fault codes will appear and repeat if there are more than one. Record the fault codes and refer to the Current and Historical Fault Code Charts. If there are no fault codes, the display remains at 00.

If Fault Code 25 or 29 is displayed, the ATC Control Module must be replaced before any further testing is performed.

For more detailed information about a fault code, refer to the Input Circuit Testing or Output Circuit Testing/Actuator Tests.

CLEARING FAULT CODES

Current faults are cleared whenever the problem goes away. To clear the historical faults, press and hold either A/C or RECIRC for 3 seconds. The faults have cleared when 2 horizontal bars appear in the display screen.

INPUT CIRCUIT TESTING

After diagnostics is entered, the status of input circuits can be viewed or monitored. If a failure occurs within an input circuit the controller will display a “?” for unknown values, a “OC” for an open circuit and a “SC” for a shorted circuit.

Use the following steps to view the inputs into the controller:

(1) Enter the diagnostics mode.

(2) Turn the knob until the test you are looking for appears (refer to Circuit Testing chart).

(3) To see the input, press the A/C or RECIRC button. The digits displayed will represent the input seen by the controller.

OUTPUT CIRCUIT TESTING / ACTUATOR TESTS

After diagnostics is entered, you have the ability to view or monitor, override and test the output circuits. If a failure occurs in the output circuit, test by overriding the system. Test it through its full range of operation. When the override control has been activated, the display will be flashing. The control will display feedback information about the circuit being tested.

Use the following steps to view the output commands from the controller:

(1) Enter the diagnostics mode.

(2) Turn the knob until the test you are looking for appears (refer to Circuit Testing chart).

(3) To see the output, press the A/C or RECIRC button. The digits displayed will represent the output from the controller.

(4) To enter the actuator test, press the A/C or RECIRC button. The display will blink, indicating you are in an actuator testing mode. Manual tests are those in which you will have to continuously press the A/C or RECIRC button to control the output. Press the A/C or RECIRC button once to run the automatic tests.

CURRENT FAULTS

Fail Code/Description	Circuit Description
00 = No Faults	
01 = Circuit open	Ambient Temperature Sensor
02 = Circuit open	In-Vehicle Temperature Sensor
03 = Circuit open	Solar Sensor Input Circuit
04 = Circuit open	Front Panel Blower/Fan Control Input
05 = Circuit open	Front Panel Mode Control Input
06 = Circuit open	Blend Air Door Feedback Circuit
07 = Circuit open	Mode Door Feedback Circuit
08 = Feedback too high	Blower/Fan Feedback Circuit
09 = Circuit shorted	Ambient Temperature Sensor
10 = Circuit shorted	In-Vehicle Temperature Sensor
11 = Circuit shorted	Solar Sensor Input Circuit
12 = Circuit shorted	Front Panel Blower/Fan Control Input
13 = Circuit shorted	Front Panel Mode Control Input
14 = Circuit shorted	Blend Air Door Feedback Circuit
15 = Circuit shorted	Mode Door Feedback Circuit
16 = Feedback too low	Blower/Fan Feedback Circuit
17 = Dimming input error	Pulse Width Dimming PWD Input
19 = Door not responding	Mode Door Feedback Circuit
20 = Door not responding	Blend Air Door Actuator Drive Circuit
21 = Door travel range too small	Mode Door Feedback Circuit
22 = Door travel range too large	Mode Door Feedback Circuit
23 = Door travel range too small	Blend Air Door Actuator Drive Circuit
24 = Door travel range too large	Blend Air Door Actuator Drive Circuit
25 = Calibration data error	Calibration and CPU Data
26 = Coolant temp message missing	Collision Detection C2D BUS Inputs
27 = Vehicle speed message missing	Collision Detection C2D BUS Inputs
28 = Engine RPM message missing	Collision Detection C2D BUS Inputs
29 = CPU error	Calibration and CPU Data
30 = Reserved	
31 = Reserved	
32 = Reserved	

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HISTORICAL FAULTS

Fail Code/Description	Circuit Description
33 = Circuit was open	Ambient Temperature Sensor
34 = Circuit was open	In-Vehicle Temperature Sensor
35 = Circuit was open	Solar Sensor Input Circuit
36 = Circuit was open	Front Panel Blower/Fan Control Input
37 = Circuit was open	Front Panel Mode Control Input
38 = Circuit was open	Blend Air Door Feedback Circuit
39 = Circuit was open	Mode Door Feedback Circuit
40 = Feedback was too high	Blower/Fan Feedback Circuit
41 = Circuit was shorted	Ambient Temperature Sensor
42 = Circuit was shorted	In-Vehicle Temperature Sensor
43 = Circuit was shorted	Solar Sensor Input Circuit
44 = Circuit was shorted	Front Panel Blower/Fan Control Input
45 = Circuit was shorted	Front Panel Mode Control Input
46 = Circuit was shorted	Blend Air Door Feedback Circuit
47 = Circuit was shorted	Mode Door Feedback Circuit
48 = Feedback was too low	Blower/Fan Feedback Circuit
49 = Dimming input was in error	Pulse Width Dimming PWD Input
51 = Door was not responding	Mode Door Feedback Circuit
52 = Door was not responding	Blend Air Door Actuator Drive Circuit
53 = Door travel range was too small	Mode Door Feedback Circuit
54 = Door travel range was too large	Mode Door Feedback Circuit
55 = Door travel range was too small	Blend Air Door Actuator Drive Circuit
56 = Door travel range was too large	Blend Air Door Actuator Drive Circuit
57 = Calibration data was in error	Calibration and CPU Data
58 = Coolant temp message was missing	Collision Detection C2D BUS Inputs
59 = Vehicle speed message was missing	Collision Detection C2D BUS Inputs
60 = Engine RPM message was missing	Collision Detection C2D BUS Inputs
61 = CPU was in error	Calibration and CPU Data
62 = Reserved	
63 = Reserved	
64 = Reserved	

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CIRCUIT TESTING

Test No.	Test Item	Test Type	System Tested	Displayed Values
01	Blower Control Switch (A/D)	I	Blower System	"?" "OC" "SC" 00-255
02	Blower Feedback	I	Blower System	"?" 00-255
03	Blower Speed	O/A	Blower System	00-255
04	Hi Blower Relay	O/A	Blower System	00 = OFF 01 = ON
05	Mode Control A/D	I	Mode Door System	"OC" "SC" 00-255
06	Mode Door Feedback	I	Mode Door System	"OC" "SC" 00-255
07	Panel Stop	I	Mode Door System	"?" 00-255 If "?" is displayed, activate Mode 11 to find panel stop position.
08	Defrost Stop	I	Mode Door System	"?" 00-255 If "?" is displayed, activate Mode 11 to find defrost stop position.
09	A/C Request	O/A	A/C System	00 = OFF 01 = ON
10	Mode Door Position	O/A	Mode Door System	00-255 It is possible to command the door position beyond the stops. The motor will try to move there.
11	Mode Motor	O/A	Mode Door System	Pressing A/C or RECIRC button for 3 sec. begins reinitialization. 00 = searching for panel stop 01 = searching for defrost stop 02 = moving toward panel 03 = moving toward defrost 04 = in position 05 = stalled moving toward panel 06 = stalled moving toward defrost 07 = feedback error
12	Mode Motor Drive Lines	O	Mode Door System	00 = stopped (lines low) 01 = toward defrost 02 = toward panel 03 = stopped (lines high)
13	Recirc Door	O/A	Recirc Door System	00 = continuous operation (lines grounded) 01 = fresh 02 = recirc. 03 = stopped (lines open)
14	In-Vehicle Temp. A/D	I	Temperature Inputs	"OC" "SC" 00-255
15	Ambient Sensor A/D	I	Temperature Inputs	"OC" "SC" 00-255
16	Blend Door Feedback	I	Blend Door System	"OC" "SC" 00-255
17	Blend Door Cold Stop	I	Blend Door System	"?" 00-255
18	Blend Door Hot Stop	I	Blend Door System	"?" 00-255

TEST TYPE: I = Input O = Output O/A = Output/Actuator

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CIRCUIT TESTING (CONT.)

Test No.	Test Item	Test Type	System Tested	Displayed Values
19	In-Vehicle Temperature	I	Temperature Inputs	"OC" "SC" -40 to +60 C (-40 to +140 F)
20	Ambient Sensor	I	Temperature Inputs	"OC" "SC" -40 to +60 C (-40 to +140 F)
21	Solar Sensor A/D	I	Sun Intensity Input	"OC" "SC" 00-255
22	Engine Coolant	I	CCD	"?" -40 to +185 C (-40 to +260 F)
23	Vehicle Speed (MPH/KPM)	I	CCD	"?" 00-255
24	Engine RPM (x100)	I	CCD	00-82
25	Blend Door Motor	O/A	Blend Door System	Pressing A/C or RECIRC button for 3 sec. begins reinitialization. 00 = searching for hot stop 01 = searching for cold stop 02 = moving to warmer 03 = moving to cooler 04 = in position 05 = stalled moving to warmer 06 = stalled moving to cooler 07 = feedback error
26	Blend Door Motor	O/A	Blend Door System	00-255 It is possible to command the door position beyond the stops. The motor will try to move there.
27	Blend Door Motor Lines	O/A	Blend Door System	00 = stopped (lines low) 01 = toward cold 02 = toward hot 03 = stopped (lines high)
28	Lights On	I	Headlight Switch	00 = OFF 01 = ON
29	Dimming	I	PWD System	"?" 00-255
30	Dimming Level	O/A	Dimming System	"?" 00-255
31	ROM & EEPROM			00-FF
32	ROM & EEPROM			00-FF
33	ROM & EEPROM			00-FF
34	ROM & EEPROM			00-FF
35	ROM & EEPROM			00-FF
36	ROM & EEPROM			00-FF
37	ROM & EEPROM			00-FF
38	ROM & EEPROM			00-FF

TEST TYPE: I = Input O = Output O/A = Output/Actuator

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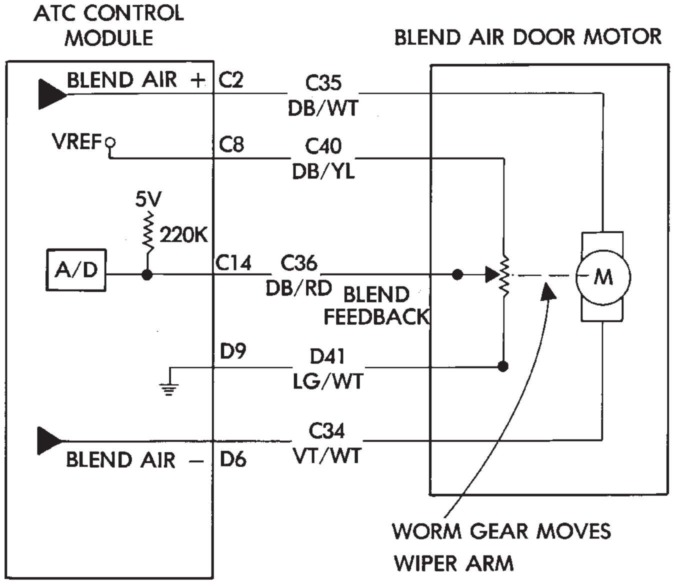
ELECTRICAL CIRCUITS

BLEND AIR DOOR ACTUATOR DRIVE CIRCUIT



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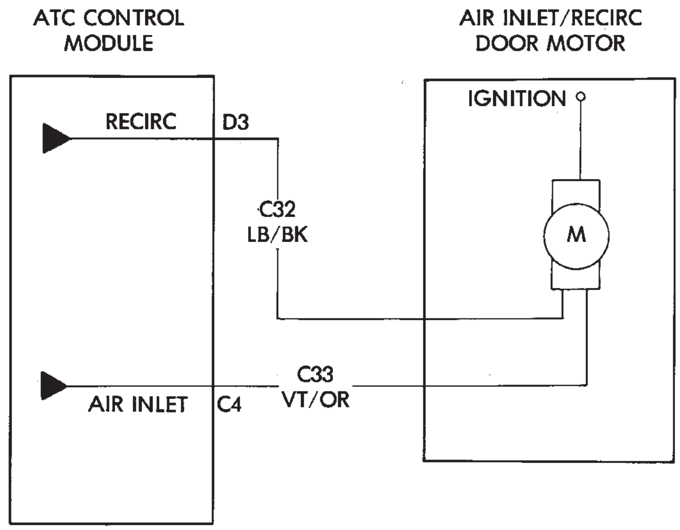
AIR INLET/RECIRC DOOR ACTUATOR DRIVE CIRCUIT



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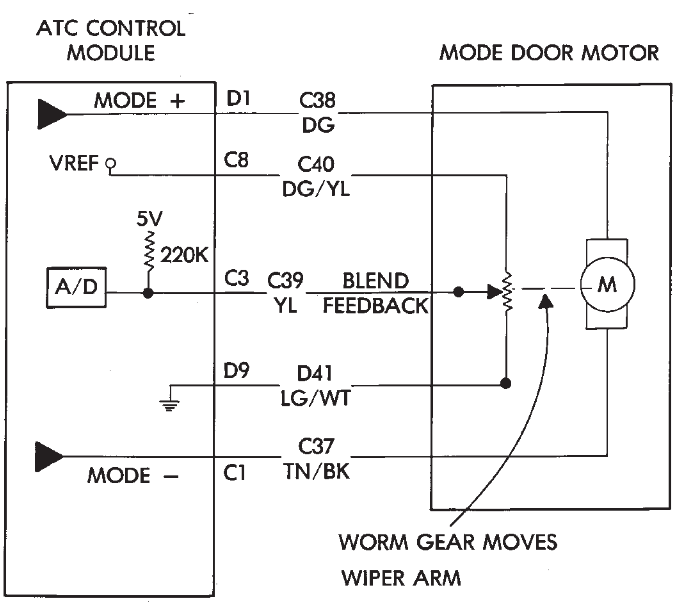
MODE DOOR ACTUATOR DRIVE CIRCUIT



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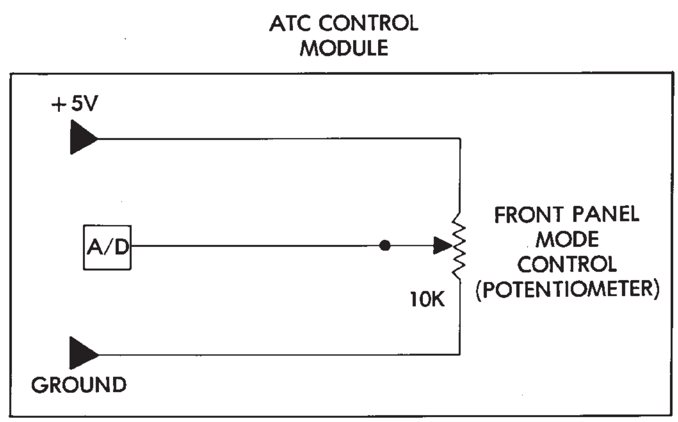
FRONT PANEL MODE CONTROL



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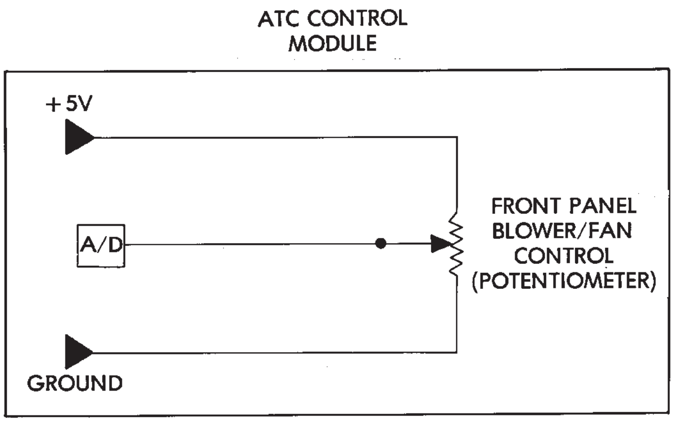
FRONT PANEL BLOWER/FAN CONTROL



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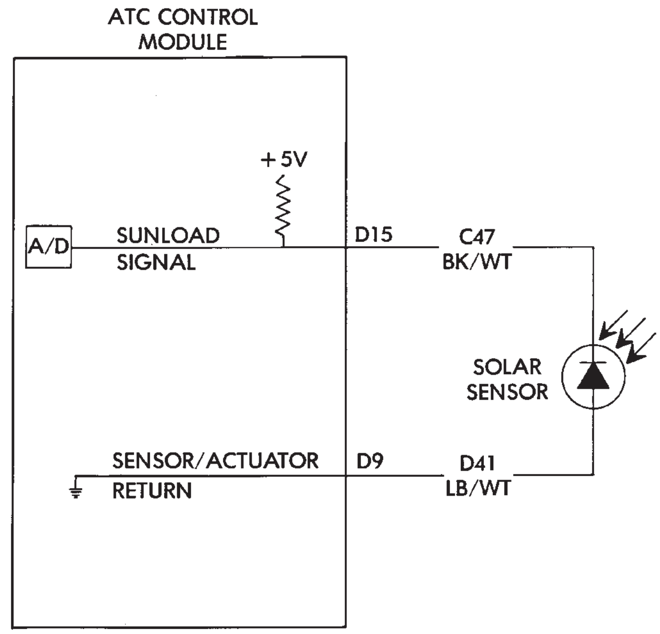
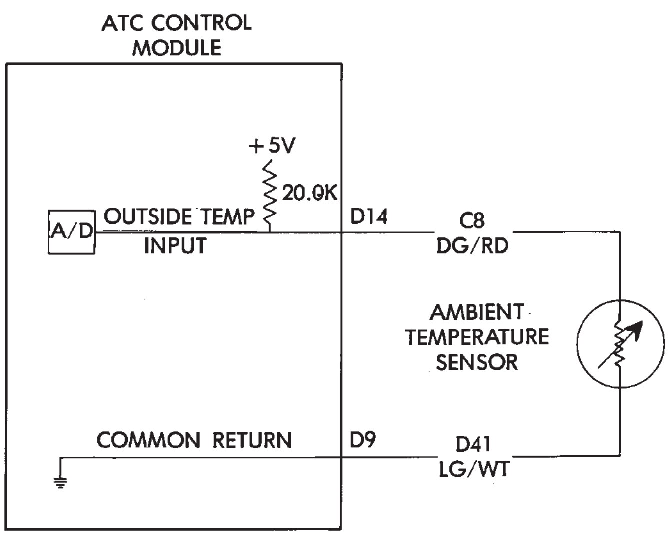
SOLAR SENSOR



J9324-63

AMBIENT TEMPERATURE SENSOR



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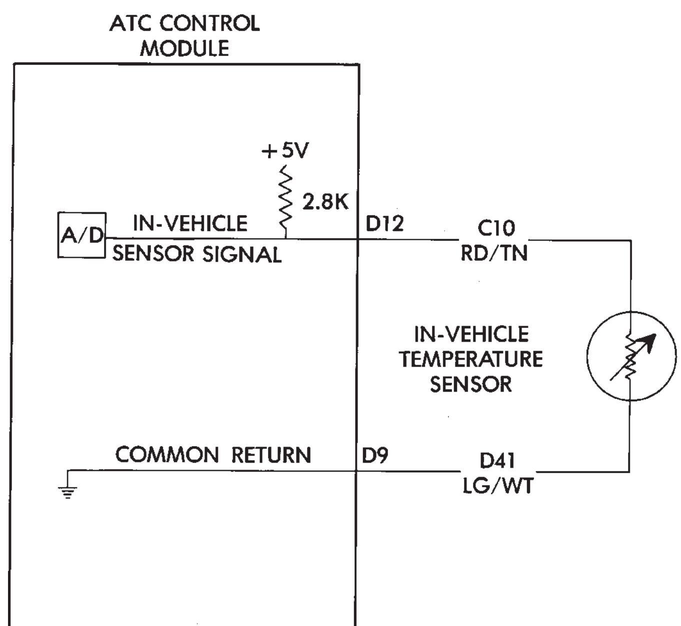
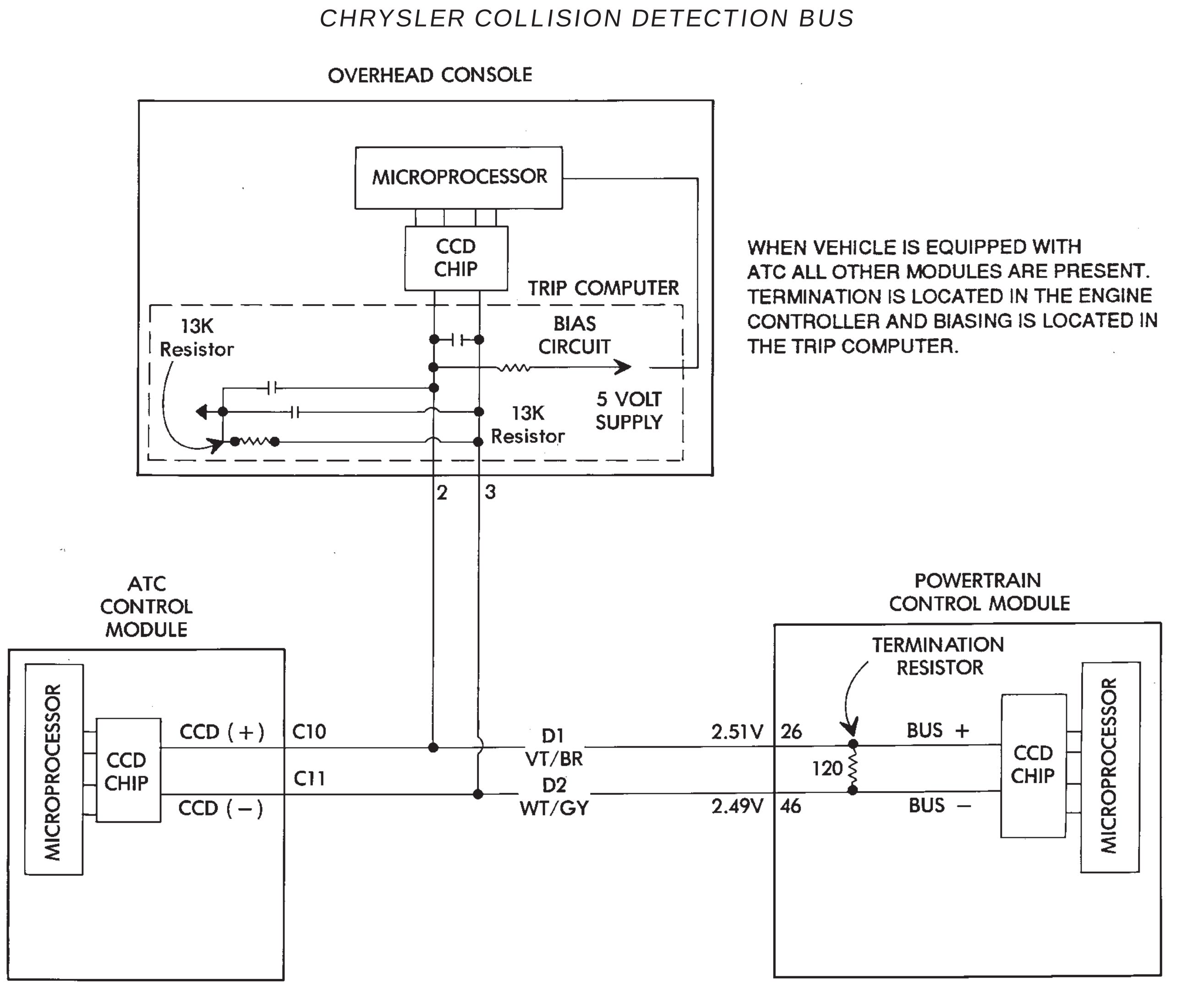
IN-VEHICLE TEMPERATURE SENSOR



J9324-64



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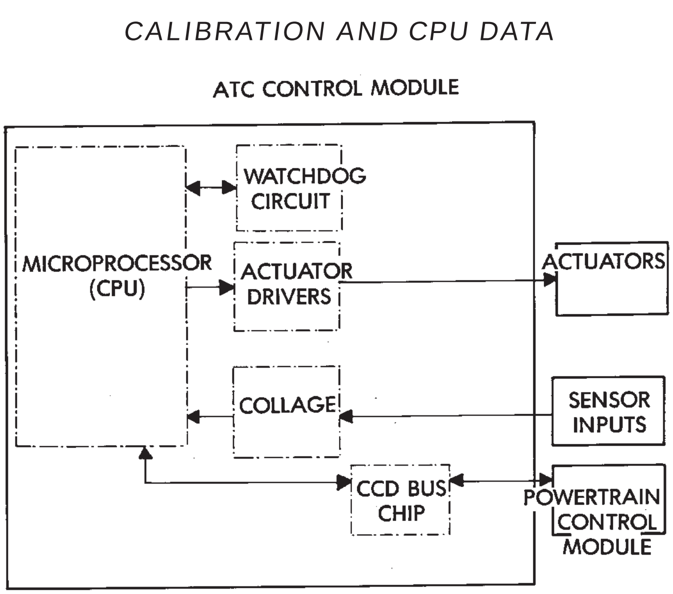

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COMPRESSOR SERVICE

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A/C COMPRESSOR NOISE

Noises that develop during air conditioning operation can often be misleading.

Drive belts are speed sensitive. At different engine speeds belts can make noises which can be mistaken for compressor noise.

First proceed with the following steps:

(1) Select a quiet area for testing. Switch compressor on and off several times to clearly identify compressor noise.

(2) Tighten all compressor mounting bolts to correct torque. Check condition and adjustment of compressor drive belt. Verify refrigerant lines are not contacting other components.

(3) Test vehicle; if noise persists, continue trouble shooting system for source of noise. Refer to the Compressor and Clutch Diagnosis Charts.

COMPRESSOR

REMOVAL

REVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE PROCEEDING WITH THIS PROCEDURE.

The A/C compressor may be removed and repositioned without recovering the refrigerant system. To remove the compressor clutch/coil assembly, engine, cylinder head or generator refrigerant recovery is not necessary.

(1) Disconnect the negative cable from the battery.

(2) Loosen and remove the serpentine belt (refer to Group 7, Cooling System).

(3) Disconnect compressor clutch wire lead.

(4) If the compressor must be removed from the vehicle, recover the refrigerant system into a recovery/ recycle device. Remove refrigerant lines from compressor.

(5) Remove compressor attaching bolts.

(6) Remove compressor. If refrigerant lines were not removed, lift compressor/clutch assembly and tie it to a suitable component.

INSTALLATION

(1) Position compressor on mount.

(2) Install and tighten the bolts to 27 N·m (20 ft. lbs.) torque.

(3) Connect the compressor clutch wire lead.

(4) Install and tighten the serpentine belt (refer to Group 7, Cooling System).

(5) Connect the negative cable to the battery.

(6) If refrigerant lines were removed, install the lines to the manifold an use new O-rings.

(7) Evacuate and charge the system.

COMPRESSOR MANIFOLD

REVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE PROCEEDING WITH THIS PROCEDURE.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover the refrigerant system into a recovery/ recycle device.

(3) Remove A/C lines from the manifold.

(4) Remove compressor manifold bolts.

(5) Remove manifold.

INSTALLATION

(1) Install new seal and position the manifold onto the compressor.

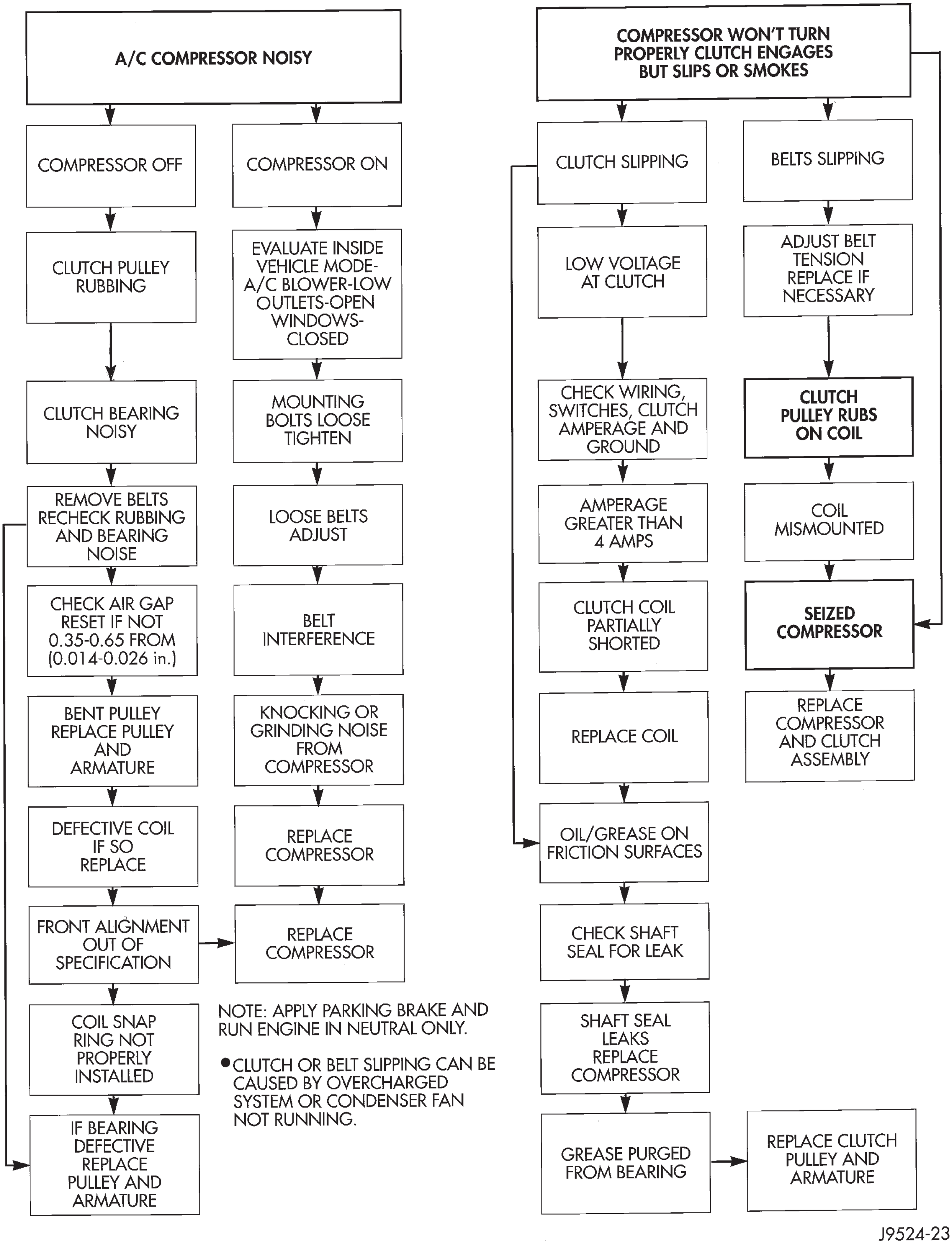
(2) Install compressor manifold bolts and tighten to 25 N·m (19 ft. lbs.) torque.

(3) Install new O-rings on A/C lines and install lines.

(4) Connect the negative cable to the battery.

(5) Evacuate and charge system.

COMPRESSOR AND CLUTCH DIAGNOSIS



COMPRESSOR CLUTCH / COIL ASSEMBLY

REMOVAL

(1) Remove compressor refer to compressor removal procedure.

(2) Remove the compressor shaft bolt (Fig. 1). A band type oil filter removal tool can be placed around the clutch plate to aid in bolt removal.

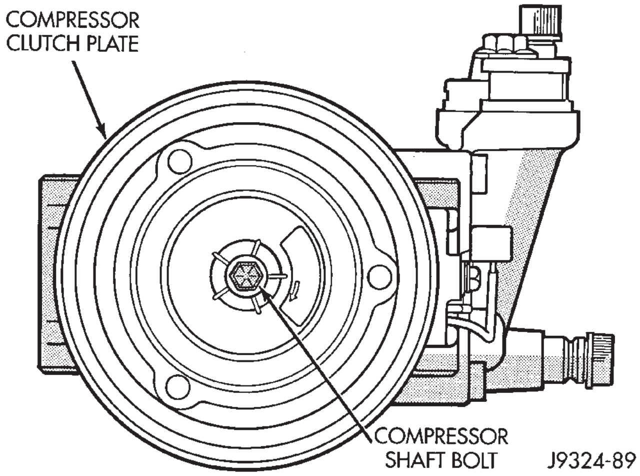


Fig. 1 Compressor Shaft Bolt and Clutch Plate

(3) Tap the clutch plate with a plastic hammer and remove clutch plate and shim (Fig. 2).

CAUTION: Do not use screwdrivers between the clutch plate assembly and pulley to remove front plate. This may damage the front plate assembly.

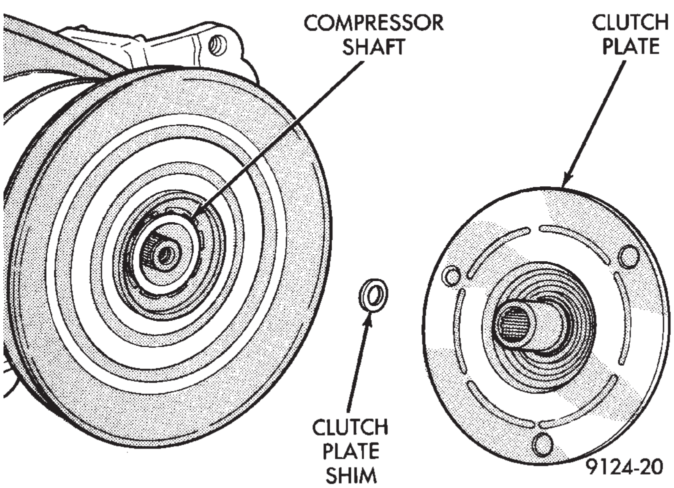


Fig. 2 Clutch Plate and Shim(s)

(4) Remove pulley retaining snap ring with Snap Ring Pliers (C-4574) and slide pulley assembly off of compressor (Fig. 3).

(5) Remove coil wire clip screw and wire harness.

(6) Remove snap ring retaining field coil onto compressor housing (Fig. 4). Slide field coil off of compressor housing.

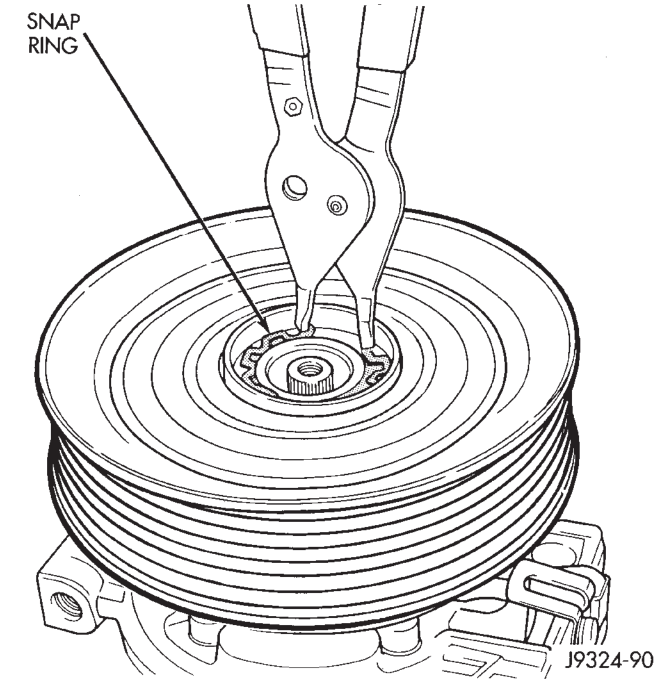


Fig. 3 Removing Pulley Snap Ring

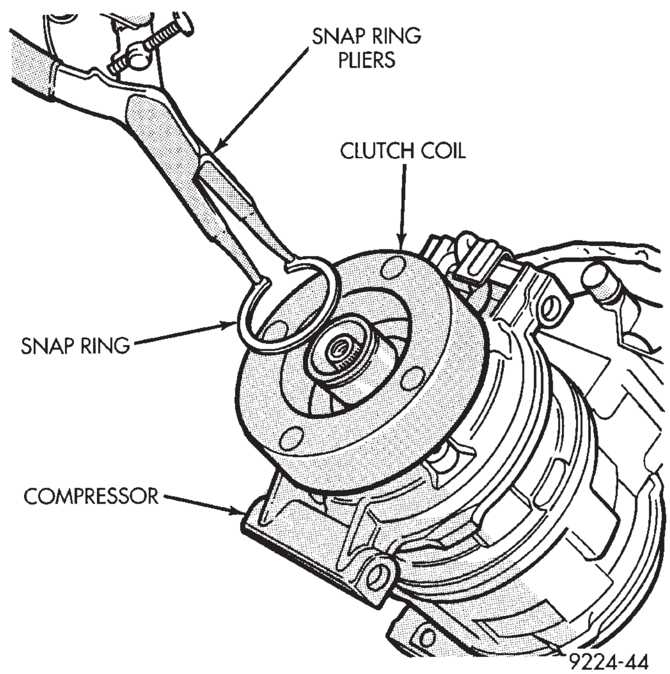


Fig. 4 Clutch Coil Snap Ring

INSPECTION

Examine frictional faces of the clutch pulley and front plate for wear. The pulley and front plate should be replaced if there is excessive wear or scoring.

If friction surfaces are oily, inspect shaft nose area of the compressor for oil. Remove the felt from the front cover. If the felt is saturated with oil, the shaft seal is leaking and the compressor must be replaced.

Check bearing for roughness or excessive leakage of grease. Replace bearing as required.

INSTALLATION

(1) Align pin in back of field coil with hole in compressor end housing and position field coil into place. Make sure that lead wires are properly routed and fasten with the wire clip retaining screw.

(2) Install field coil retaining snap ring with Snap Ring Pliers (C-4574). The bevel side of the snap ring must be outward. Also both eyelets must be to the right or left of the pin on the compressor. Press snap ring to make sure it is properly seated in the groove.

CAUTION: If snap ring is not fully seated it will vibrate out, resulting in a clutch failure and severe damage to the front face of the compressor.

(3) Install pulley assembly to compressor. If necessary, tap gently with a block of wood on the friction surface (Fig. 5).

CAUTION: Do not mar the pulley frictional surface.

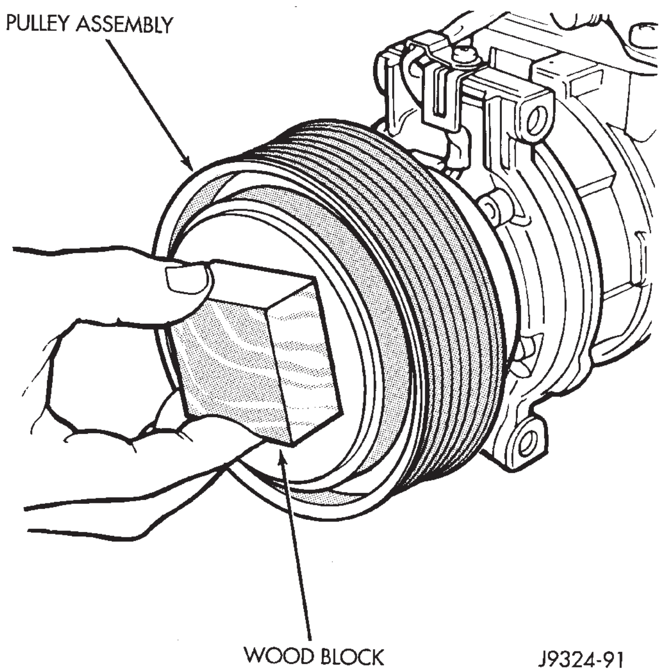


Fig. 5 Installing Pulley Assembly

(4) Install pulley assembly retaining snap ring (bevel side outward) with Snap Ring Pliers (C-4574). Press the snap ring to make sure it is properly seated in the groove.

(5) If the original front plate assembly and pulley assembly are to be reused, the old shim(s) can be used. If not, place a stack of shim(s) equal to the old shim(s) on the shaft against the shoulder.

(6) Install front plate assembly onto shaft.

(7) With the front plate assembly tight against the shim(s), measure the air gap between front plate and pulley face with feeler gauges. The air gap should be between 0.35 and 0.65 mm (.014 and .026 in.) If proper air gap is not obtained, add or subtract shims until desired air gap is obtained.

(8) Install compressor shaft bolt. Tighten bolt to 13 N·m (115 in. lbs.) torque.

Shims may compress after tightening shaft nut. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

(9) Connect the negative cable to the battery.

CLUTCH BREAK-IN

After a new clutch has been installed cycle the A/C clutch 20 times (5 sec. on and 5 sec. off). During this procedure, set the system to the A/C mode, engine RPM at 1500 - 2000 and high blower speed. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher clutch torque capability.

COMPRESSOR HIGH-PRESSURE RELIEF VALVE

REVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE PROCEEDING WITH THIS PROCEDURE.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover refrigerant system into a recovery/recycle device.

(3) Rotate the high pressure relief valve counterclockwise and separate relief valve from the vehicle (Fig. 6).

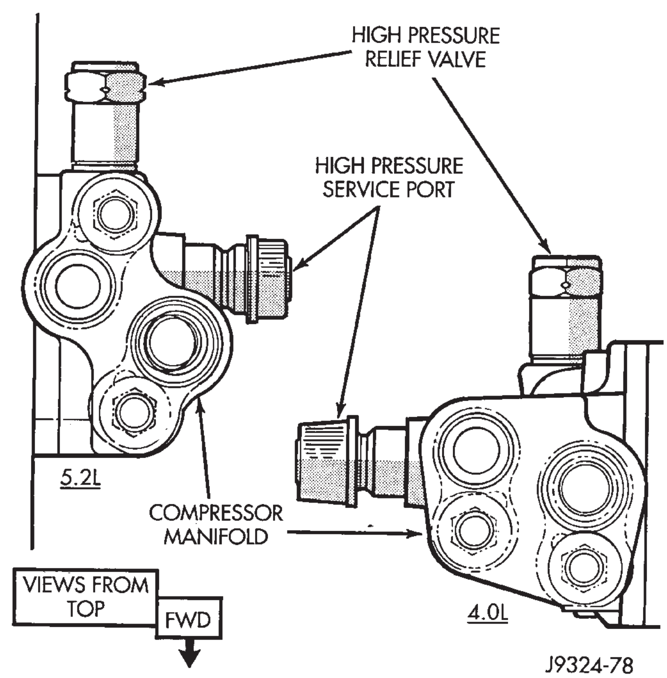


Fig. 6 High Pressure Relief Valve

INSTALLATION

(1) Install the high pressure relief valve.

(2) Evacuate and charge system.

COMPONENT SERVICE

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REFRIGERANT LINES

REVIEW WARNINGS AND CAUTIONS IN THIS GROUP BEFORE PERFORMING THE FOLLOWING PROCEDURE.

REMOVAL

(1) Recover refrigerant system into a recovery/recycle device.

(2) Remove the secondary clip from the coupling. Fit the appropriate Spring Lock Coupling Tool from A/C Tool Kit 6125 (Fig. 1).

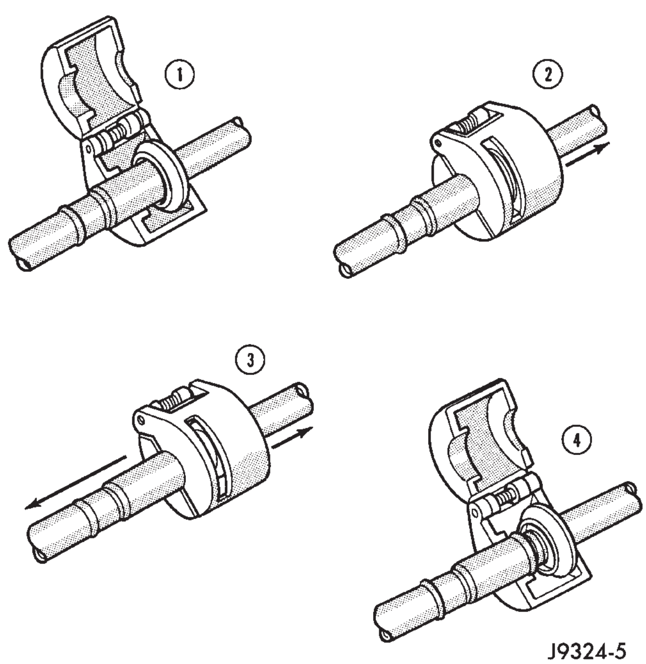

Fig. 1 Spring Lock Coupling Disconnect

(3) Close the tool and push into the open side of the cage to expand garter spring and release female fitting.

The garter spring may not release if the tool is cocked while pushing it into the cage opening.

(4) After garter spring is expanded, pull fittings apart within the tool.

(5) Remove the tool from the disconnected coupling.

(6) Separate the two ends of the coupling.

INSTALL

(1) Check to ensure that the garter spring is in the cage of the male fitting. If the garter spring is missing, install a new spring by pushing it into the cage opening. If the garter spring is damaged, remove it from the cage with a small wire hook (DO NOT use a screwdriver) and install a new spring.

(2) Clean all dirt or foreign material from both pieces of the coupling.

(3) Install new O-rings on the male fitting.

CAUTION: Use only the specified O-rings as they are made of a special material for the R-134a system. The use of any O-ring other than the specified O-ring may allow the connection to leak intermittently during vehicle operation.

(4) Lubricate the male fitting and O-rings and the inside of the female fitting with clean R-134a (SP20 PAG) refrigerant oil.

(5) Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.

(6) Ensure coupling engagement by pulling back on the line.

(7) Install secondary clip on coupling.

CONTROL PANEL

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Remove ash tray.
(3) Remove screws holding center cluster bezel (Fig. 2).

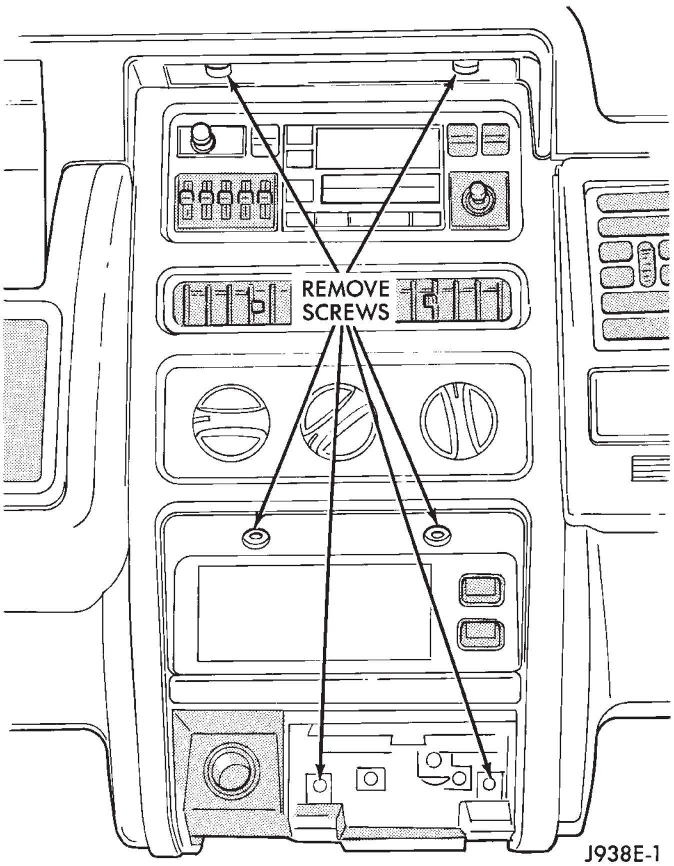

Fig. 2 Remove Center Bezel Retaining Screws

(4) Remove center bezel.
(5) Remove the control panel screws (Fig. 3).
(6) Remove the control panel.

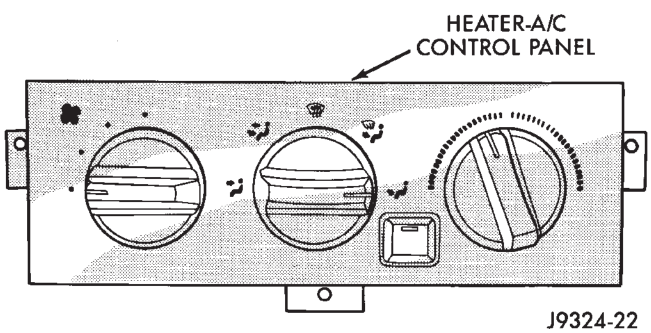

Fig. 3 Heater A/C Control Panel

(7) Disconnect the electrical connector(s).
(8) Disconnect the vacuum connector on Heater A/C (manual) vehicles (Fig. 4).

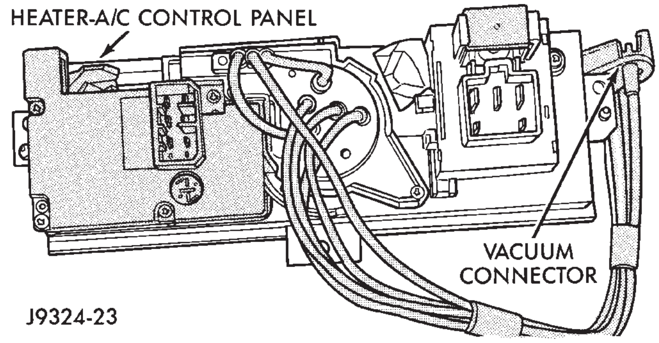

Fig. 4 Vacuum Connector

INSTALLATION

(1) If the vehicle is equipped with Heater A/C (manual), connect the vacuum connector.
(2) Connect electrical connectors.
(3) Install control panel and tighten screws.
(4) Install center bezel.
(5) Install and tighten the center bezel screws.
(6) Install ash tray.
(7) Connect the negative cable to the battery.

BLOWER MOTOR AND WHEEL

The blower motor and wheel are located under the glove box and can be removed from the passenger compartment.

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Disconnect the blower motor cooling tube (Fig. 5).
(3) Remove the blower motor electrical connector from the retainer. Disconnect the electrical connector (Fig. 5).
(4) Remove the blower motor and wheel assembly mounting screws (Fig. 5).
(5) Remove the blower motor and wheel assembly.
(6) Remove the blower motor wheel retainer clip (Fig. 6).
(7) Pull the blower motor wheel off of the blower motor shaft.

INSPECTION

Inspect the blower motor seal for damage.

INSTALLATION

(1) Press the blower motor wheel onto the blower motor shaft. Be sure the flat on the blower motor shaft lines up with the flat inside the wheel.
(2) Install the retainer clip. The ears of the retainer clip must be over the flat surface on the motor shaft.
(3) Be sure the seal is installed on the blower motor housing (Fig. 7).
(4) Install the blower motor and wheel assembly.
(5) Install and tighten blower motor and wheel assembly screws.

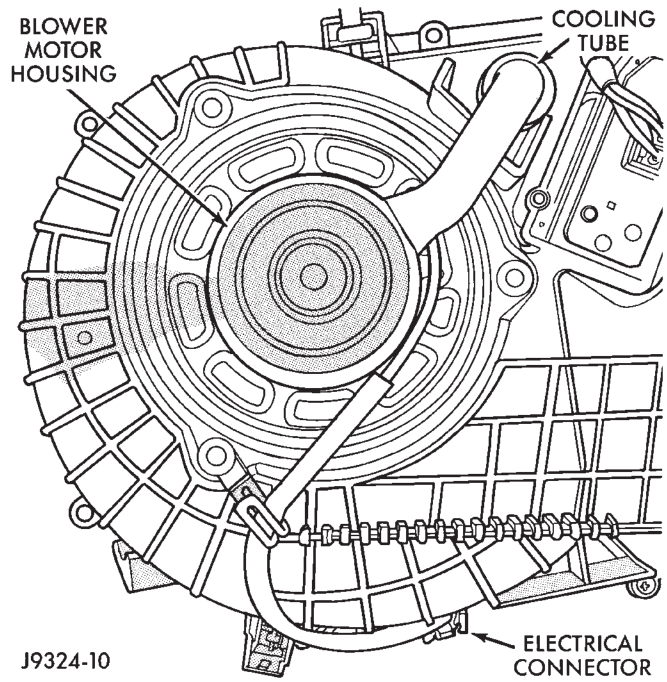

Fig. 5 Blower Motor

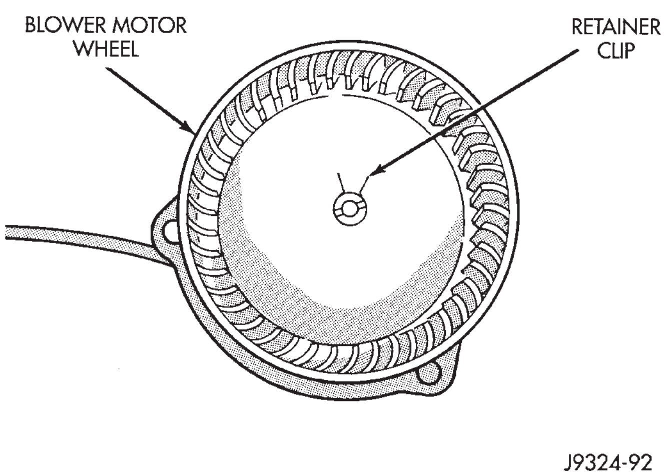

Fig. 6 Blower Motor Wheel

(6) Connect the electrical connector and install into the retainer.

(7) Connect the blower motor cooling tube.

(8) Connect the negative cable to the battery.

BLOWER MOTOR RESISTOR

The blower motor resistor is located under the glove box and can be removed from the passenger compartment.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove the blower motor resistor connector(s).

(3) Remove the resistor retaining screws.

(4) Remove the blower motor resistor (Fig. 8).

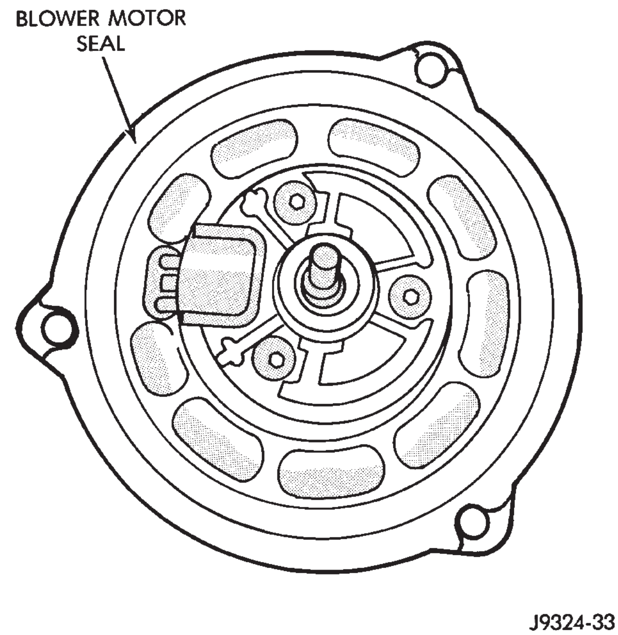

Fig. 7 Blower Motor Seal

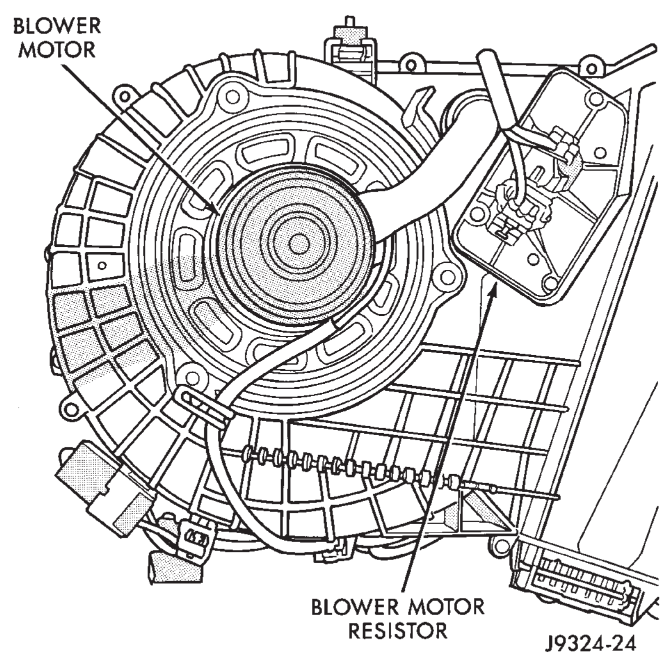

Fig. 8 Blower Motor Resistor (ATC Shown)

INSTALLATION

(1) Install the blower motor resistor. Install and tighten the screws.

(2) Connect the resistor connectors.

(3) Connect the negative cable to the battery.

HEATER—A/C UNIT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover the refrigerant system into a recovery/ recycle device.

(3) Disconnect the A/C hoses from the evaporator lines (Fig. 9).

(4) Drain the cooling system (refer to Group 7, Cooling System).

(5) Disconnect the heater hoses from the heater core lines (Fig. 9).

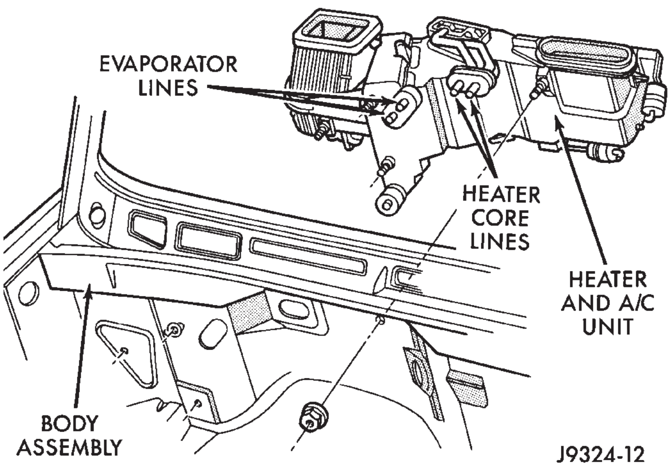

Fig. 9 Heater A/C Unit (Shown from Engine Compartment)

(6) Remove the coolant reserve/overflow bottle (Fig. 10).

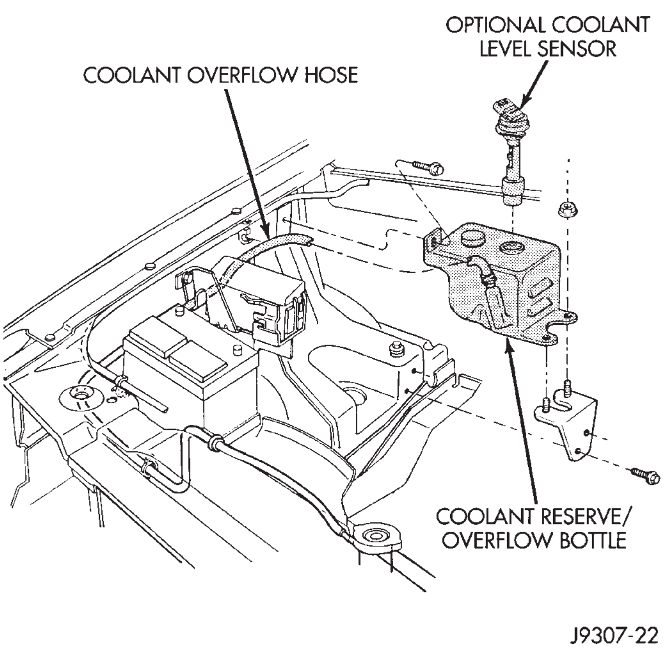

Fig. 10 Coolant Reserve/Overflow Bottle—Typical

(7) DO NOT disconnect the 60-way connector from the powertrain control module (PCM) - (Fig. 11). Remove the PCM and set aside.

(8) Remove the attaching nuts from the studs on the engine compartment side of the dash panel (Fig. 9).

(9) Remove the instrument panel (refer to Group 23, Body).

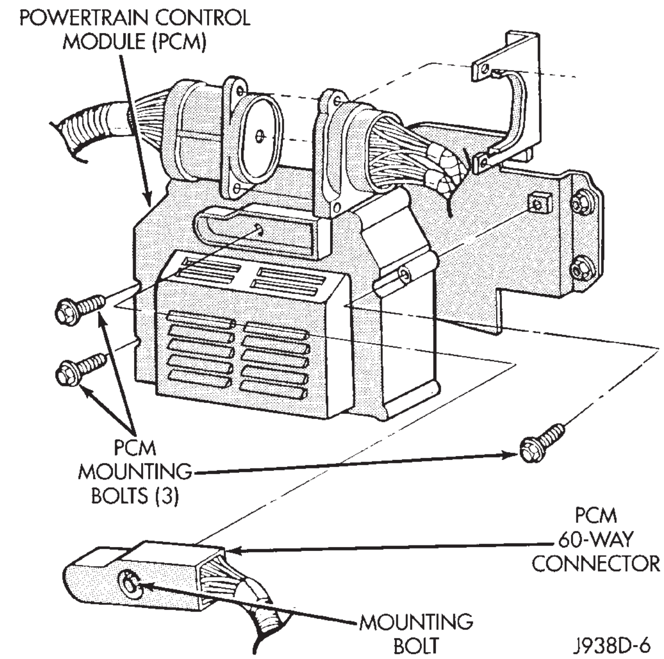

Fig. 11 Powertrain Control Module (PCM)

(10) Remove the defrost duct (Fig. 12).

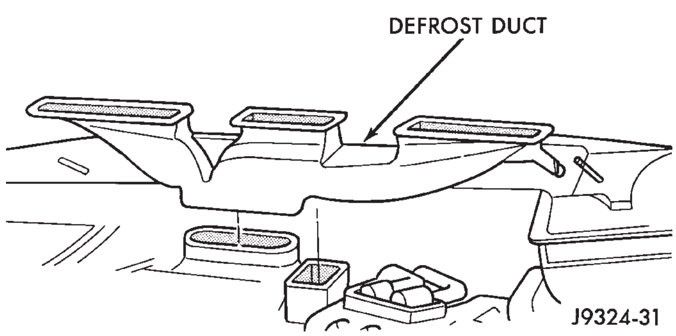

Fig. 12 Defrost Duct

(11) Disconnect the rear floor heat duct from the center adaptor heat duct (Fig. 13).

(12) Disconnect the electrical connections.

(13) Remove the attaching nuts from the studs in the passenger compartment side of the dash panel (Fig. 14).

(14) Remove the Heater A/C unit from the vehicle.

INSTALLATION

(1) Position the Heater A/C unit into the dash panel. Be sure the drain tube is positioned in the dash panel drain hole.

(2) Install the passenger compartment attaching nuts (Fig. 14). Tighten the nuts to 4.5 N·m (40 in. lbs.) torque.

(3) Install the attaching nuts on the engine compartment side of the dash panel (Fig. 9). Tighten the nuts to 7 N·m (60 in. lbs.) torque.

(4) Connect the heater hoses to the heater core lines.

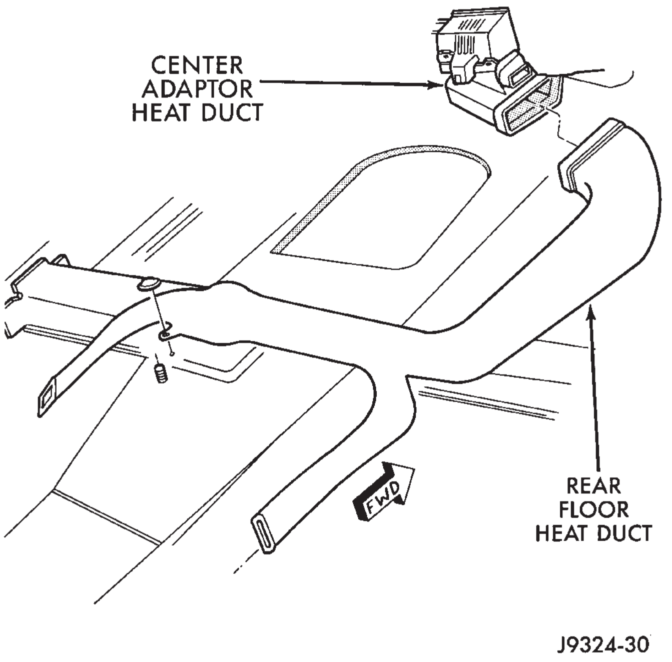

Fig. 13 Rear Floor Heat Duct

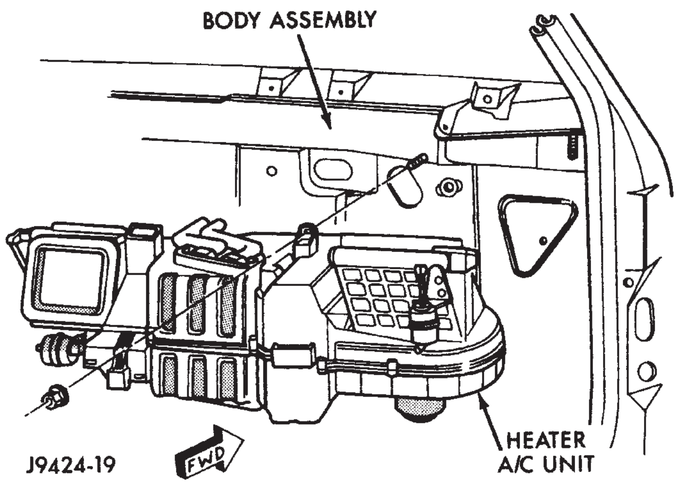

Fig. 14 Heater A/C Unit (Shown from Passenger Compartment)

(5) Connect the A/C hoses to the evaporator lines.

(6) Install the coolant reserve/overflow bottle.

(7) Install the powertrain control module (PCM).

(8) Install the defrost duct.

(9) Connect the rear floor heat duct to the center adaptor heat duct. Check that the carpet is not interfering with any duct outlets.

(10) Connect the electrical connectors.

(11) Install the instrument panel (refer to Group 23, Body).

(12) Fill the cooling system (refer to Group 7, Cooling System).

(13) Connect the negative cable to the battery.

(14) Evacuate and charge the system.

(15) Start the vehicle and check for proper operation of the Heater A/C system.

HEATER CORE

REMOVAL

(1) Remove the Heater A/C unit from the vehicle.

(2) Remove the heater core retaining screws.

(3) Pull the heater core straight out of the housing (Fig. 15).

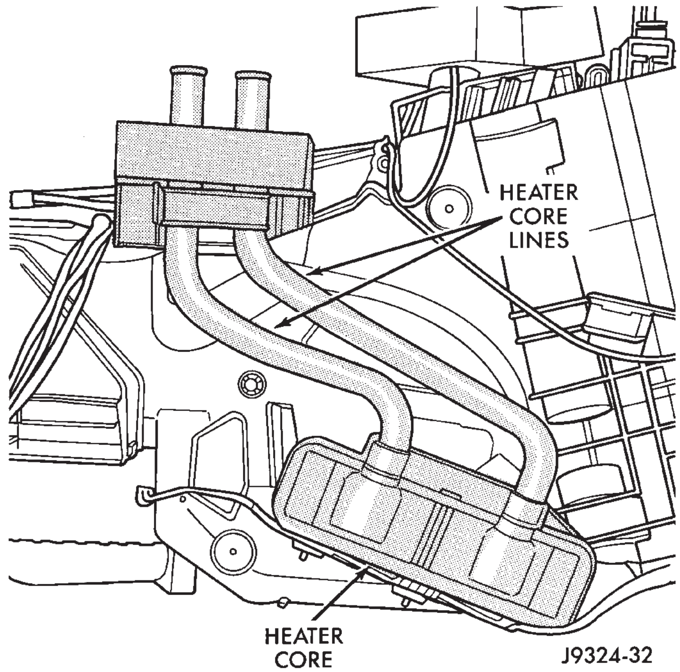

Fig. 15 Heater Core

INSTALLATION

(1) Install the heater core into the housing.

(2) Position the clips over the heater core tubes. Install and tighten the screws.

(3) Install the Heater A/C unit into the vehicle.

EVAPORATOR CORE

REMOVAL

(1) Remove the Heater A/C unit from the vehicle.

(2) Turn the Heater A/C unit upside down.

(3) Remove the retaining screws holding the two halves together. Remove the center adaptor heat duct (Fig. 16) and remove the screw.

(4) Carefully turn the Heater A/C unit over. Remove the top half of the unit (Fig. 17).

(5) Remove the evaporator out of the unit.

INSTALLATION

Add 2 ounces oil to the evaporator if it was replaced.

(1) Position the evaporator in the bottom half of the Heater A/C unit.

(2) Position the top half of the Heater A/C unit in place. Carefully turn the unit over. Install and tighten the retaining screws.

(3) Snap on the center adaptor heat duct.

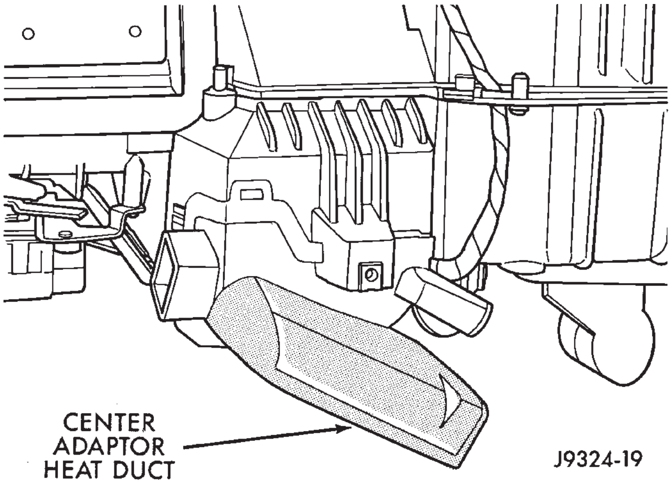

Fig. 16 Center Adaptor Heat Duct

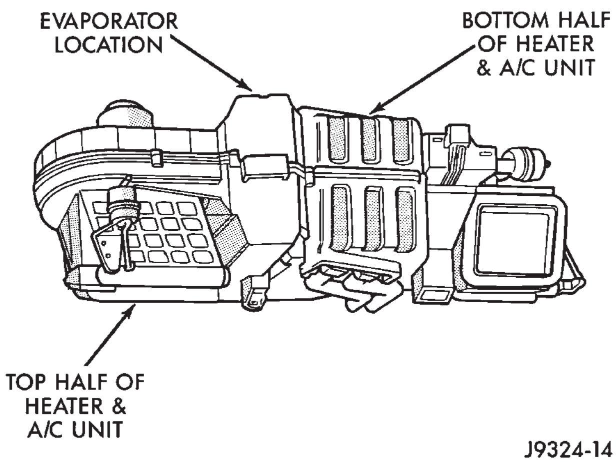

Fig. 17 Evaporator Location in Heater A/C Unit (Upside Down)

(4) Install the Heater A/C unit into the vehicle.

RECIRCULATING AIR DOOR ACTUATOR

REMOVAL

(1) Remove the instrument panel (refer to Group 23, Body).

(2) Disconnect the vacuum line (Fig. 18) or electrical connector (Fig. 19).

(3) Disconnect the actuating rod clip (Figs. 18 and 19).

(4) Remove the actuator retaining screws.

(5) Remove the actuator (Fig. 18 or 19).

INSTALLATION

(1) Position the actuator on the Heater A/C unit. Install and tighten the screws.

(2) Connect the rod and rod clip to the door lever.

(3) Connect the vacuum line (Heater A/C - Manual) or the electrical connector (ATC).

(4) Install the instrument panel (refer to Group 23, Body).

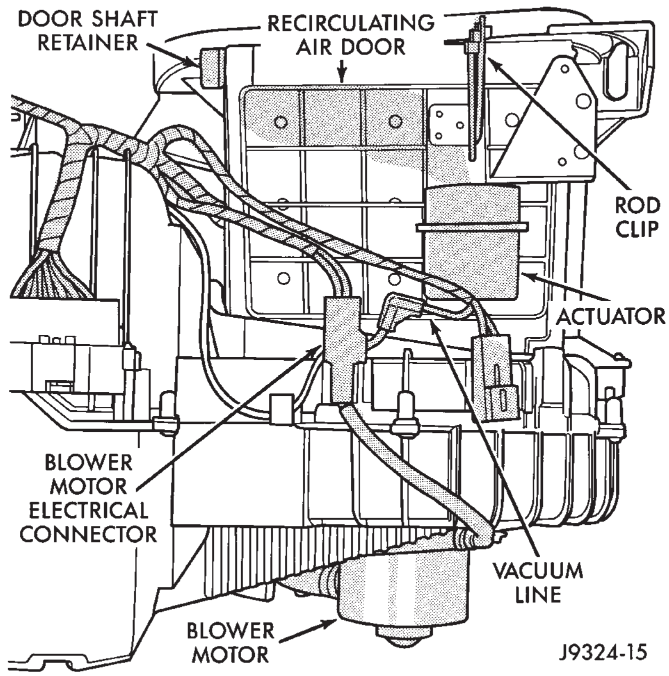

Fig. 18 Recirculating Air Door Actuator (Heater A/C - Manual)

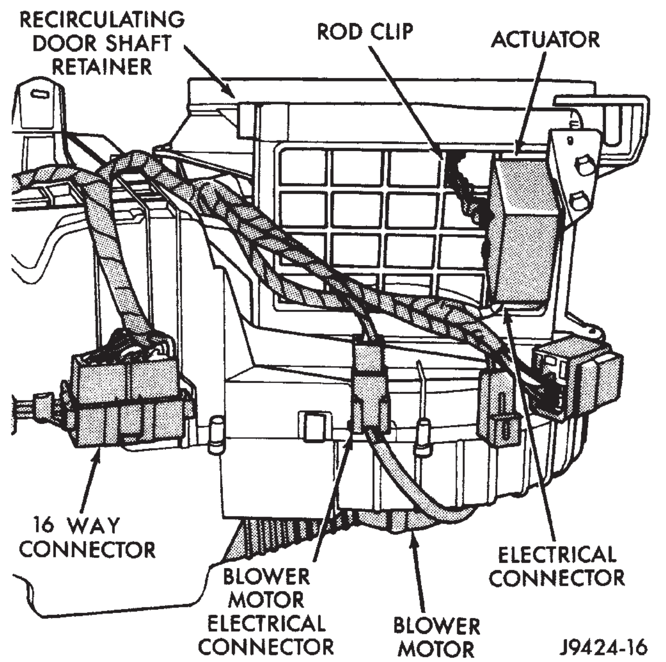

Fig. 19 Recirculating Air Door Actuator (ATC)

RECIRCULATING AIR DOOR

REMOVAL

(1) Remove the Heater A/C unit from the vehicle.

(2) Disconnect the actuating rod clip (Fig. 18 or 19).

(3) Pry the recirculating door shaft retainer from the shaft (Fig. 18 or 19).

(4) Remove the recirculating door through the top opening.

INSTALLATION

(1) Install the recirculating door through the top opening and position in place.

(2) Press the recirculating door shaft retainer onto the shaft.

(3) Connect the rod and rod clip to the door lever.

(4) Install the Heater A/C unit into the vehicle.

TEMPERATURE / BLEND AIR DOOR MOTOR

The temperature/blend air door motor is located under the instrument panel and can be removed from the passenger compartment.

REMOVAL

(1) Disconnect the electrical connector (Fig. 20).

(2) Remove the retaining screws.

(3) Remove the temperature/blend air door motor (Fig. 20).

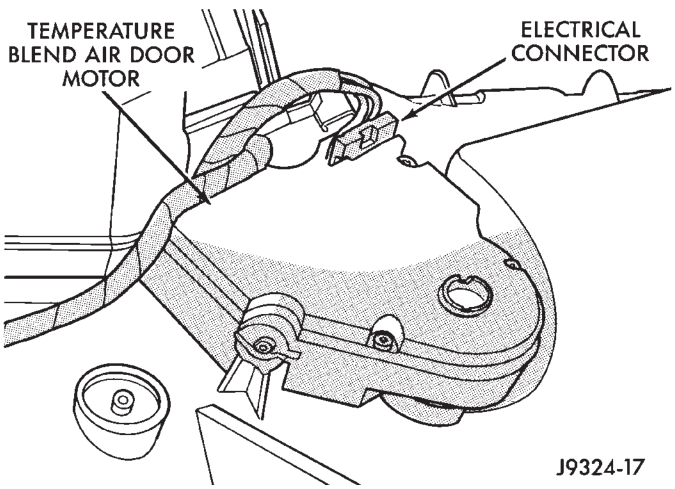

Fig. 20 Temperature/Blend Air Door Motor

INSTALLATION

(1) Position the motor over the door connection.

(2) Install and tighten the retaining screws.

(3) Connect the electrical connector.

TEMPERATURE / BLEND AIR DOOR

REMOVAL

(1) Remove the Heater A/C unit from the vehicle.

(2) Turn the Heater A/C unit upside down.

(3) Remove the retaining screws holding the two halves together. Remove the center adaptor heat duct (Fig. 21) and remove the screw.

(4) Disconnect the electrical connectors.

(5) Remove the bottom half of the Heater A/C unit (Fig. 22).

(6) Remove the door (Fig. 22).

(7) To replace the door-to-motor pivot connection, the motor must be removed.

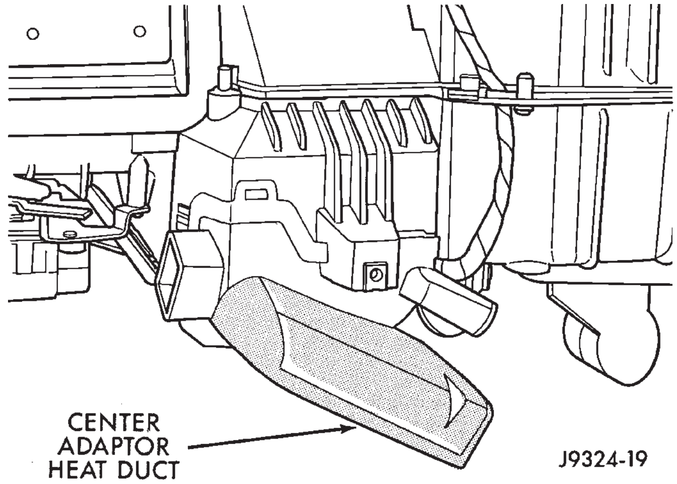

Fig. 21 Center Adaptor Heat Duct

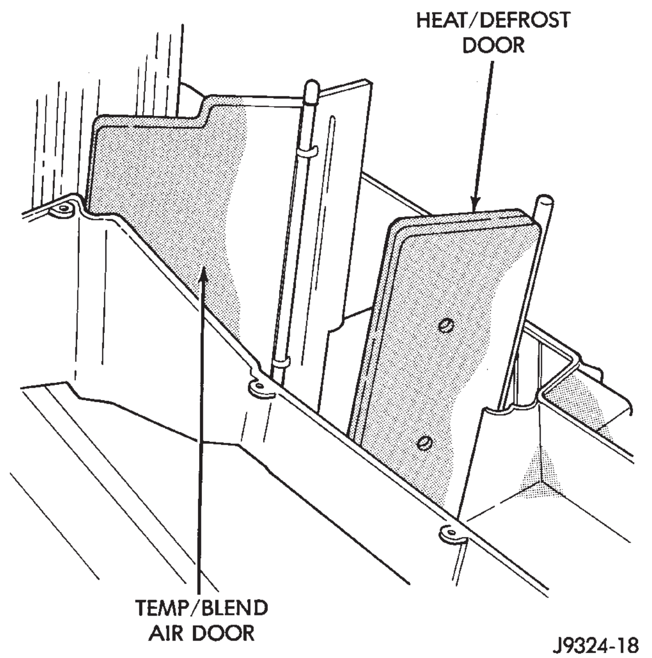

Fig. 22 Temperature/Blend Air Door

INSTALLATION

(1) If removed, install the door-to-motor pivot connection. Position the motor and tighten the screws.

(2) Install the door.

(3) Position the top half of the Heater A/C unit onto the bottom. Be sure the door pivot pins align with the pivot holes.

(4) Carefully turn the Heater A/C unit over. Install and tighten the screws.

(5) Snap on the lower center air duct.

(6) Connect the electrical connectors.

(7) Install the Heater A/C unit into the vehicle.

HEAT / DEFROST DOOR ACTUATOR

This actuator is used only on the Heater A/C (manual) units.

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REMOVAL

(1) Remove the Heater A/C unit from the vehicle.
(2) Turn the Heater A/C unit upside down.
(3) Disconnect the vacuum line (Fig. 23).
(4) Separate the door pivot connection from the door pivot pin (Fig. 23).
(5) Remove the retaining screws.
(6) Remove the heat/defrost door actuator (Fig. 23).

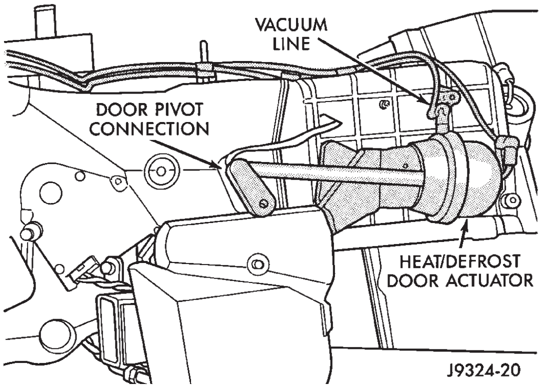


Fig. 23 Heat/Defrost Door Actuator

INSTALLATION

(1) Install the heat/defrost door actuator.
(2) Install and tighten the retaining screws.
(3) Press the door pivot connection onto the door pivot pin.
(4) Connect the vacuum line.
(5) Install the Heater A/C unit into the vehicle.

HEAT / DEFROST - PANEL / DEFROST DOOR MOTOR

This motor is used only on models equipped with the optional Automatic Temperature Control (ATC) system.

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Remove the three screws that secure the upper and lower steering column shrouds to the steering column and remove the shrouds.
(3) Remove the cluster bezel, instrument panel center bezel, instrument panel top cover, steering column opening cover, knee blocker, left instrument panel end cap and left lower instrument panel trim from the instrument panel. Refer to Group 8E - Instrument Panel and Gauges for the procedures.
(4) Remove the two bolts that secure the center instrument panel support bracket to the left side of the floor pan transmission tunnel.
(5) Remove the two bolts that secure the center instrument panel support bracket to the instrument panel.
(6) Remove the center instrument panel support bracket from the vehicle.
(7) Unplug the wire harness connector from the motor (Fig. 24).
(8) Remove the three screws that secure the motor to the bottom of the heater-A/C housing.
(9) Remove the motor from the housing.

INSTALLATION

(1) Position the heat/defrost - panel/defrost door motor to the bottom of the heater-A/C housing.
(2) Install and tighten the three screws that secure the motor to the housing.
(3) Plug in the wire harness connector to the motor.
(4) Position the center instrument panel support bracket to the instrument panel.

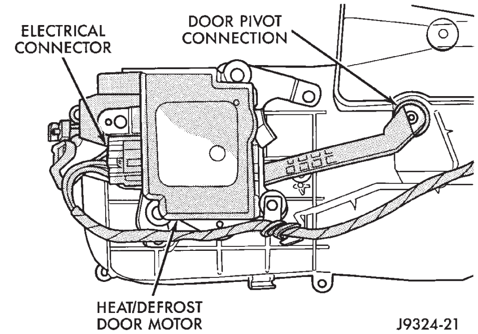


Fig. 24 Heat/Defrost Door Motor

(5) Install and tighten the two bolts that secure the center instrument panel support bracket to the instrument panel.
(6) Install and tighten the two bolts that secure the center instrument panel support bracket to the left side of the floor pan transmission tunnel.
(7) Install the cluster bezel, instrument panel center bezel, instrument panel top cover, steering column opening cover, knee blocker, left instrument panel end cap and left lower instrument panel trim from the instrument panel. Refer to Group 8E - Instrument Panel and Gauges for the procedures.
(8) Install the upper and lower steering column shrouds onto the steering column.
(9) Connect the battery negative cable.

HEAT / DEFROST DOOR

REMOVAL

(1) Remove the Heater A/C unit from the vehicle.
(2) Turn the Heater A/C unit upside down.
(3) Separate the door pivot connection from the door pivot pin.
(4) Disconnect the electrical connector or the vacuum line.
(5) Remove the retaining screws holding the two halves together. Remove the center adaptor heat duct (Fig. 25) and remove the screw.

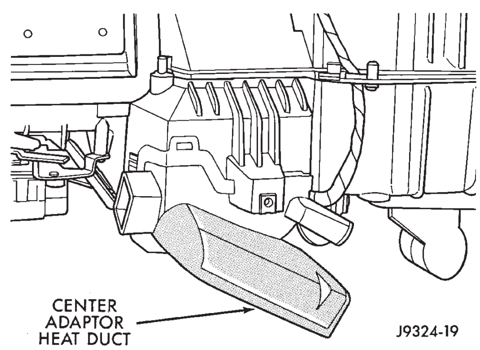


Fig. 25 Center Adaptor Heat Duct

(6) Remove the bottom half of the Heater A/C unit.
(7) Remove the door (Fig. 26).

INSTALLATION

(1) Position the door in the hole.
(2) Press the door pivot connection onto the door pivot pin.
(3) Position the top half of the Heater A/C unit onto the bottom. Be sure the door pivot pins align with the pivot holes.
(4) Carefully turn the Heater A/C unit over. Install and tighten the screws.
(5) Snap on the lower center air duct.
(6) Connect the electrical connectors.
(7) Install the Heater A/C unit into the vehicle.

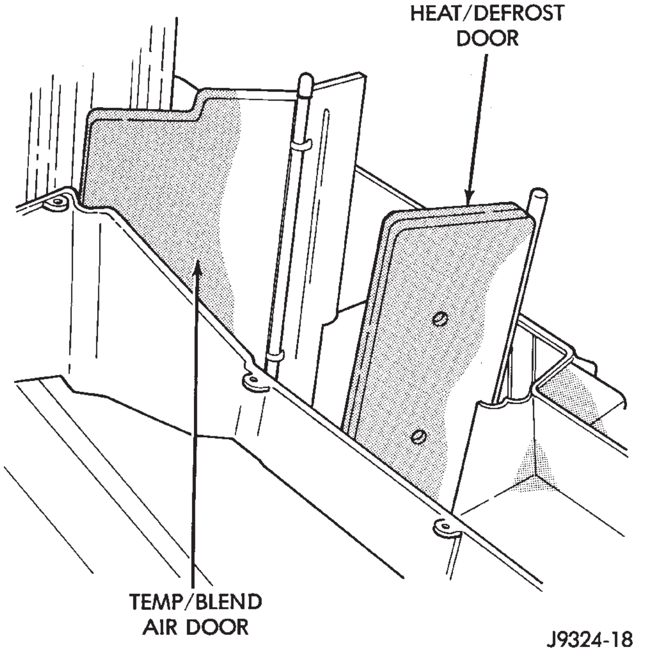


Fig. 26 Heat/Defrost Door

PANEL / DEFROST DOOR ACTUATOR

This actuator is used only on the Heater A/C (manual) units.

REMOVAL

(1) Remove the Heater A/C unit from the vehicle.

(2) Disconnect the vacuum line (Fig. 27).

(3) Separate the door pivot connection from the door pivot pin (Fig. 27).

(4) Remove the retaining screws.

(5) Remove the panel/defrost door actuator (Fig. 27).

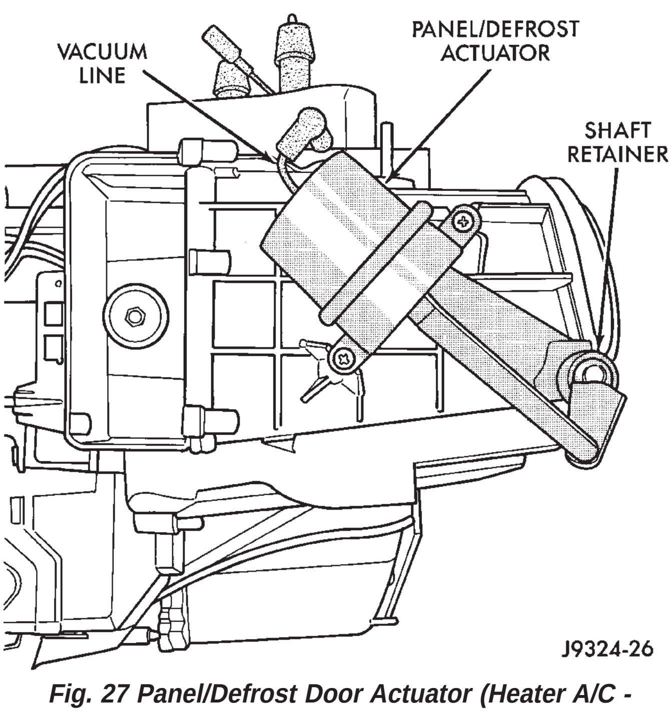


Fig. 27 Panel/Defrost Door Actuator (Heater A/C - Manual)

INSTALLATION

(1) Install the panel/defrost door actuator.

(2) Install and tighten the retaining screws.

(3) Press the door pivot connection onto the door pivot pin.

(4) Connect the vacuum line.

(5) Install the Heater A/C unit into the vehicle.

PANEL / DEFROST DOOR

REMOVAL

(1) Remove the instrument panel (refer to Group 23, Body).

(2) Remove the defrost duct (Fig. 28).

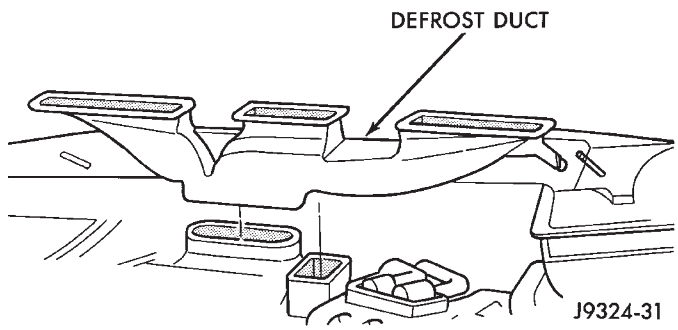


Fig. 28 Defrost Duct

(3) Disconnect the actuating rod (Fig. 27 or 29).

(4) Pry the panel/defrost door shaft retainer from the shaft (Fig. 27 or 29).

(5) Remove the door through the top opening.

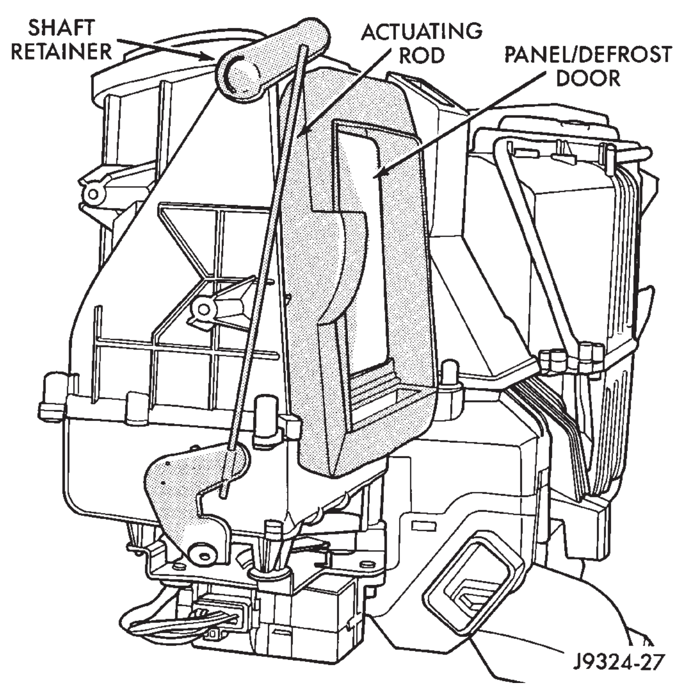


Fig. 29 Panel/Defrost Door (ATC)

INSTALLATION

(1) Install the panel/defrost door through the top opening and position in place.

(2) Press the door shaft retainer onto the shaft.

(3) Connect the rod and rod clip to the door lever.

(4) Install the defrost duct.

(5) Install the instrument panel (refer to Group 23, Body).

SOLAR SENSOR

This sensor is used only on the ATC units. It is amber in color and located right of center in the defrost grille.

REMOVAL

(1) Pop out the defrost grille (Fig. 30).

(2) Remove the solar sensor from the defrost grille (Fig. 30).

(3) Disconnect the solar sensor connector (Fig. 30).

INSTALLATION

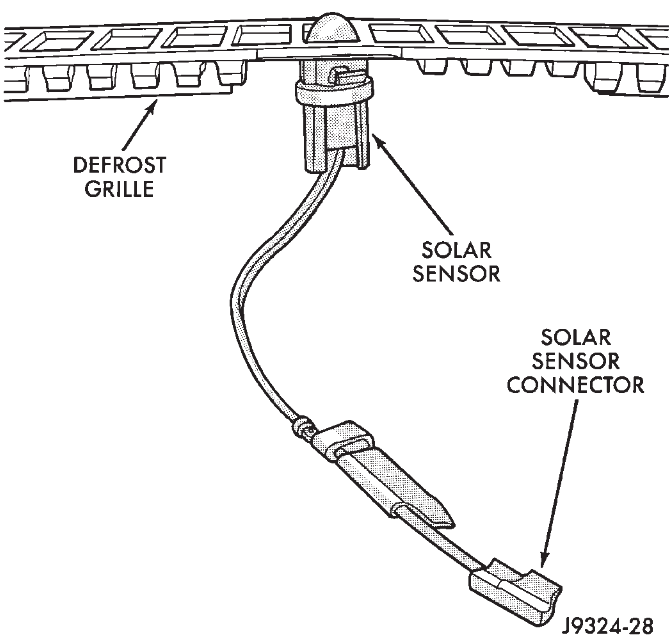


Fig. 30 Solar Sensor

(1) Connect the solar sensor connector.

(2) Install the solar sensor into the defrost grille.

(3) Press the defrost grille into the instrument panel.

IN-VEHICLE TEMPERATURE SENSOR

This sensor is used only on the ATC units.

REMOVAL

(1) Remove the instrument panel (refer to Group 23, Body).

(2) Disconnect the aspirator tube from the sensor assembly and the Heater A/C unit (Fig. 31).

(3) Remove the sensor assembly screws from the instrument panel bracket. Remove the sensor assembly.

(4) Disconnect the in-vehicle temperature sensor from the sensor assembly (Fig. 31).

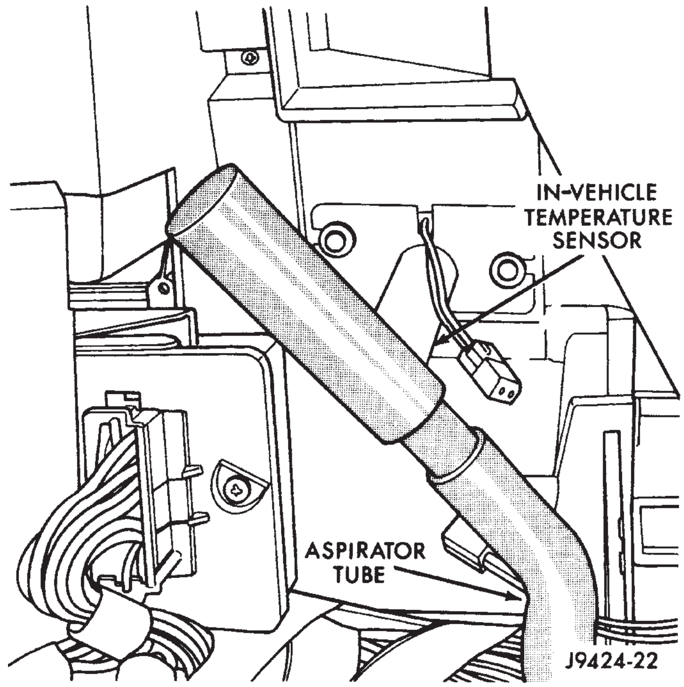


Fig. 31 In-Vehicle Temperature Sensor

INSTALLATION

(1) Connect the in-vehicle temperature sensor to the sensor assembly.

(2) Install the sensor assembly to the instrument panel bracket. Tighten the screws.

(3) Connect the aspirator tube to the sensor assembly and the Heater A/C unit.

(4) Install the instrument panel (refer to Group 23, Body).

AMBIENT AIR TEMPERATURE SENSOR

This sensor supplies information for the ATC system only. On vehicles with overhead consoles this sensor supplies information for the console.

REMOVAL

(1) Remove the grille.

(2) Disconnect the ambient air temperature sensor connector (Fig. 32).

(3) Remove the sensor (Fig. 32).

INSTALLATION

(1) Install the ambient air temperature sensor.

(2) Connect the sensor.

(3) Install the grille.

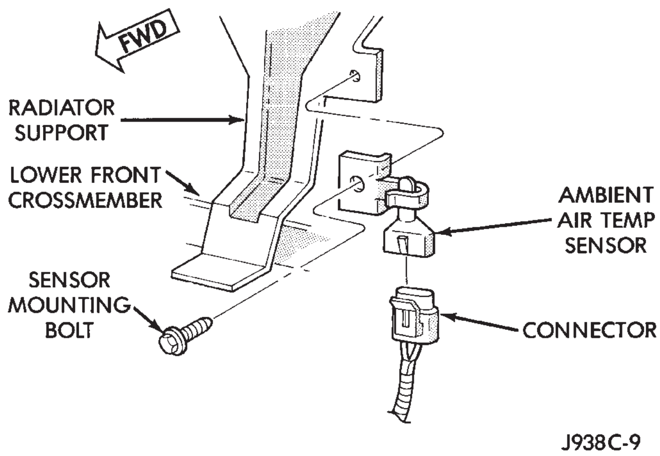


Fig. 32 Ambient Air Temperature Sensor

DEFROSTER DUCT

REMOVAL

(1) Remove the instrument panel (refer to Group 23, Body).

(2) Remove the defroster duct retaining screws.

(3) Remove the defroster duct (Fig. 33).

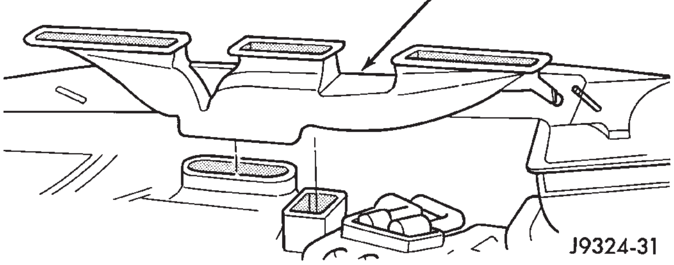


Fig. 33 Defrost Duct

INSTALLATION

(1) Install the defroster duct.

(2) Install and tighten the defroster duct retaining screws.

(3) Install the instrument panel (refer to Group 23, Body).

REAR FLOOR HEAT DUCT

REMOVAL

(1) Remove the center console (refer to Group 23, Body).

(2) Remove the passenger seat (refer to Group 23, Body).

(3) Remove the passenger side door trim (refer to Group 23, Body).

(4) Roll carpet back.

(5) Remove the stud nut (Fig. 34).

(6) Disconnect the rear floor heat duct from the center adaptor heat duct (Fig. 34).

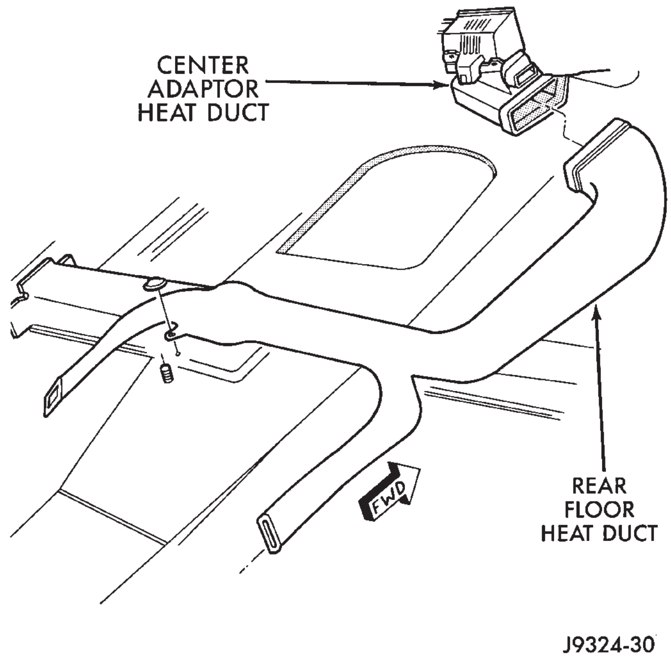


Fig. 34 Rear Floor Heat Duct

INSTALLATION

(1) Connect the rear floor heat duct to the center adaptor heat duct.

(2) Install and tighten the stud nut.

(3) Position carpet over duct and onto the floor.

(4) Install the passenger side door trim (refer to Group 23, Body).

(5) Install the passenger seat (refer to Group 23, Body).

(6) Install the center console (refer to Group 23, Body).

CONDENSER

REVIEW ALL WARNINGS AND CAUTIONS IN THIS GROUP BEFORE REMOVING the Condenser.

CAUTION: When removing the condenser note the location of all radiator and condenser air seals. These seals are used to direct air through the condenser and radiator. They must be install in their original locations to prevent overheating (Fig. 35).

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover refrigerant system into a recovery/recycle device.

(3) Disconnect the A/C hoses from the condenser and plug the openings.

(4) Remove the grille.

(5) Remove the upper brace bolts from the two radiator braces (Fig. 36).

(6) Remove the two crossmember-to-radiator mounting nuts (Fig. 36).

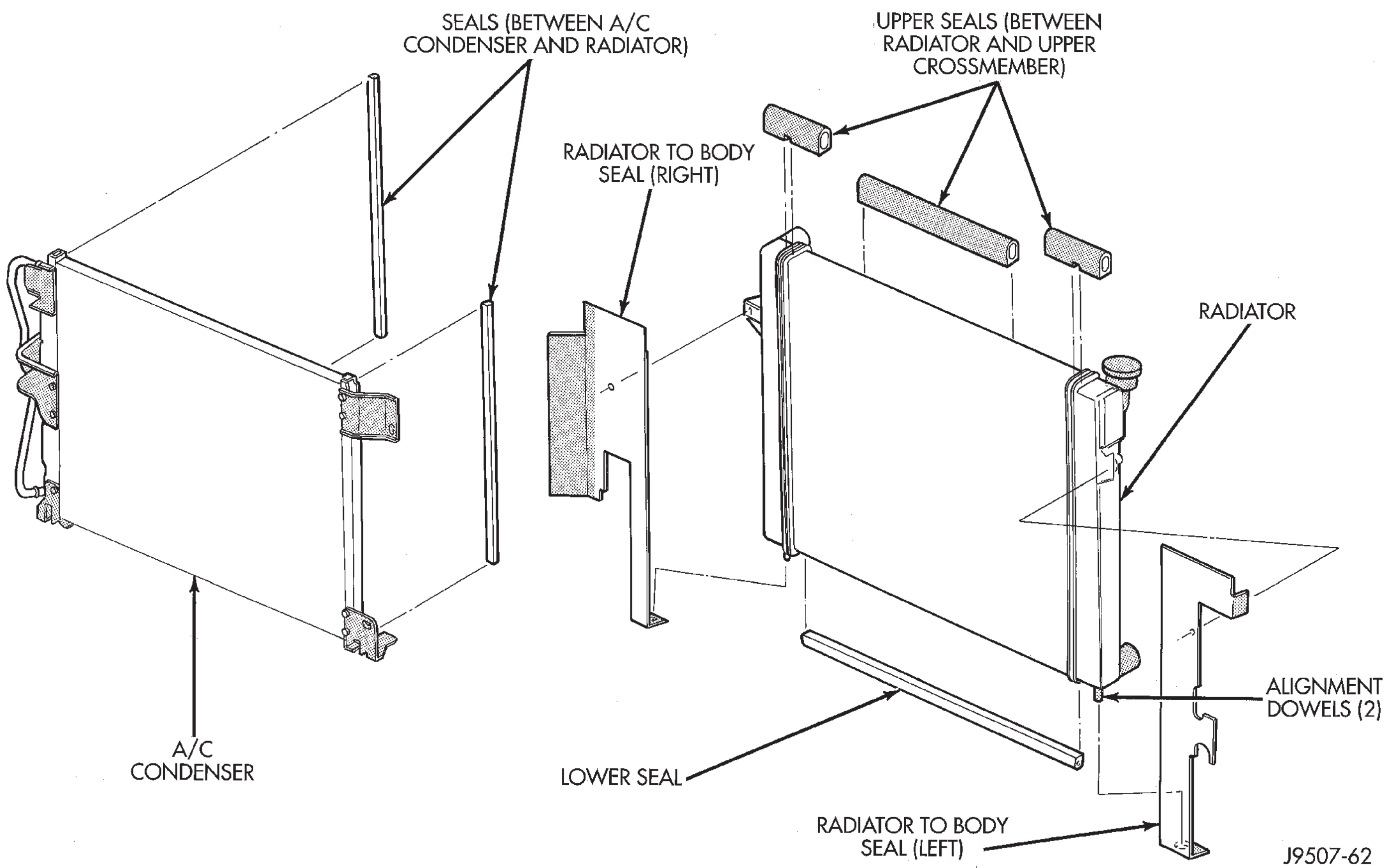


Fig. 35 Air Seals

(7) Through grille opening, remove bolt securing lower part of hood latch support to lower frame crossmember.

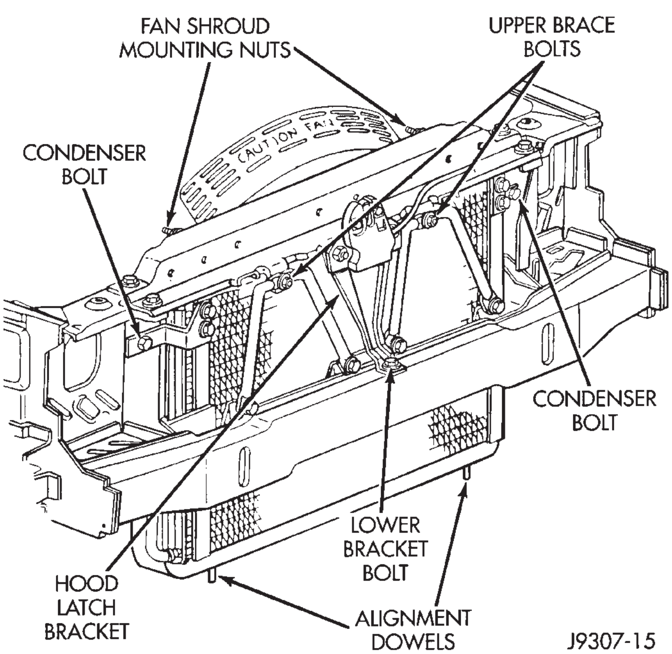


Fig. 36 Radiator—A/C Condenser Mounting

(8) The radiator upper crossmember (Fig. 37) can be adjusted left or right through the use of slotted holes. Before removal, mark the original position of the crossmember.

(9) Remove the remaining bolts securing the radiator upper crossmember to the body. Do not remove the hood latch or hood latch cable from the crossmember. Lift the crossmember straight up and lay to the side (Fig. 37).

(10) Remove the four lower condenser attaching bolts.

(11) Remove the two upper condenser attaching bolts (Fig. 37).

(12) Carefully remove the condenser from the vehicle.

INSTALLATION

Add 1 ounce of refrigerant oil into the condenser if it is replaced.

(1) Carefully position the condenser into the vehicle.

(2) Install and tighten the two upper condenser attaching bolts.

(3) Install and tighten the four lower condenser attaching bolts.

(4) Align the radiator upper crossmember with the scribe marks. Install and tighten the radiator upper crossmember bolts to the body.

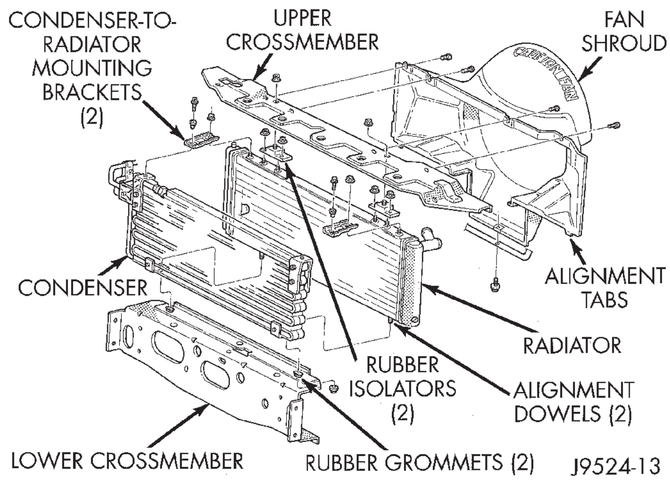


Fig. 37 Radiator Upper Crossmember—Typical

(5) Install and tighten the radiator upper crossmember mounting nuts.

(6) Through grille opening, install and tighten bolt securing lower part of hood latch support to lower frame crossmember.

(7) Install and tighten the two upper bolts holding the radiator brace to the upper radiator crossmember.

(8) Install the grille.

(9) Remove the plugs from the openings. Connect the A/C hoses to the condenser.

(10) Connect the negative cable to the battery.

(11) Evacuate and charge system.

ACCUMULATOR

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover refrigerant system into a recovery/recycle device.

(3) Disconnect hoses from the compressor and evaporator. Plug the openings.

(4) Unplug the harness from the low pressure switch (Fig. 38).

(5) Loosen the support bracket screw (Fig. 38).

(6) Remove the accumulator.

INSTALLATION

Add 4 ounce of refrigerant oil into the accumulator if it is replaced.

(1) Install the accumulator in the support bracket and tighten the screw.

(2) Plug the harness into the low pressure switch.

(3) Remove the plugs from hoses. Install new o-rings and connect the hoses.

(4) Connect the negative cable to the battery.

(5) Evacuate and charge the system.

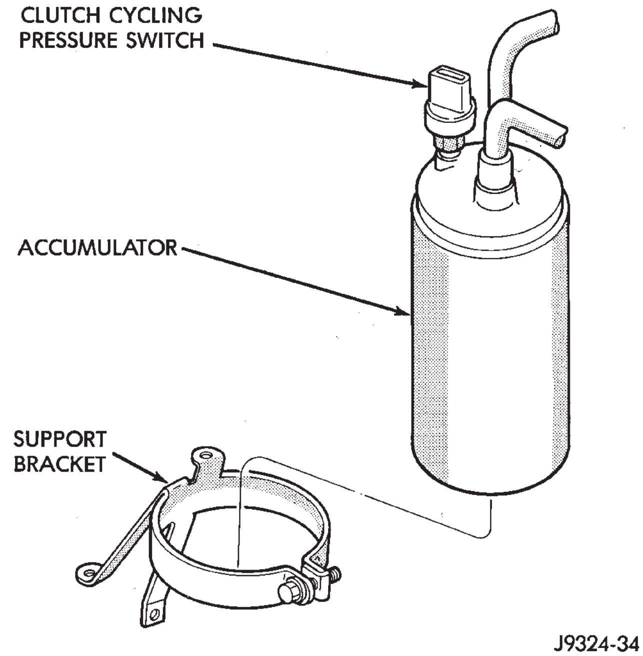


Fig. 38 Accumulator and Bracket

LIQUID LINE

The fixed orifice tube is located in the liquid line near the condenser. The orifice has a filter screens on the inlet and outlet ends of the tube body. If the fixed orifice tube is plugged, the liquid line must be replaced.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover the refrigerant system into a recovery/recycle device.

(3) Disconnect the quick-connect fittings at the evaporator and the condenser.

(4) Remove the liquid line.

INSTALLATION

(1) Install the liquid line.

(2) Connect the quick-connect fittings at the evaporator and the condenser.

(3) Connect the negative cable to the battery.

(4) Evacuate and charge the system.

DISCHARGE LINE

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Recover the A/C system into a recovery/recycle device.

(3) Disconnect the quick-connect fitting at the condenser.

(4) Remove the discharge line-to-compressor manifold bolt. Discard the O-ring.

INSTALLATION

(1) Install new O-rings and install the discharge

line-to-compressor manifold.

(2) Connect the quick-connect fitting at the condenser.

(3) Connect the negative cable to the battery.

(4) Evacuate and charge the system.

HIGH PRESSURE CUT-OUT SWITCH

The high pressure cut-out switch is located on the discharge line connection at the compressor manifold.

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove the connector from the switch.

(3) Unscrew the switch.

INSTALLATION

(1) Install and tighten the switch.

(2) Install the connector onto the switch.

(3) Connect the negative cable to the battery.

VACUUM RESERVOIR

The vacuum reservoir is located under the battery tray.

REMOVAL

(1) Remove the battery (refer to Group 8B, Battery/Starter/Generator Service).

(2) Disconnect the vacuum hose (Fig. 39).

(3) Remove the battery tray and vacuum reservoir assembly (refer to Group 8B, Battery/Starter/Generator Service).

(4) Remove the reservoir attaching screws (Fig. 39). Remove the vacuum reservoir from the battery tray.

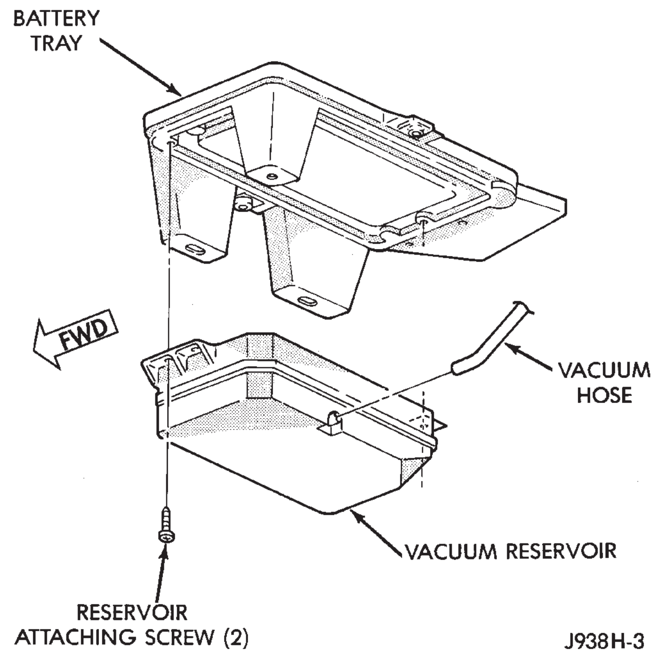


Fig. 39 Vacuum Reservoir

INSTALLATION

(1) Position the vacuum reservoir to the battery tray. Install and tighten the vacuum reservoir screws.

(2) Install the battery tray and vacuum reservoir assembly (refer to Group 8B, Battery/Starter/Generator Service).

(3) Connect the vacuum hose.

(4) Install the battery (refer to Group 8B, Battery/Starter/Generator Service).

TORQUE SPECIFICATIONS

AIR CONDITIONING COMPRESSOR

DESCRIPTION .... TORQUE

Compressor

Mounting Bolts ....27 N·m (20 ft. lbs.)

Manifold Bolts ....25 N·m (19 ft. lbs.)

Shaft Bolt ....13 N·m (115 in. lbs.)

EMISSION CONTROL SYSTEMS

CONTENTS

GENERAL INFORMATION

INDEX

VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

All vehicles are equipped with a combined VECI label. The label is located in the engine compartment (Fig. 1). The label contains the following:

- Engine family and displacement
- Evaporative family
- Emission control system schematic
- Certification application
- Engine timing specifications (if adjustable)
- Idle speeds (if adjustable)
- Spark plug and plug gap

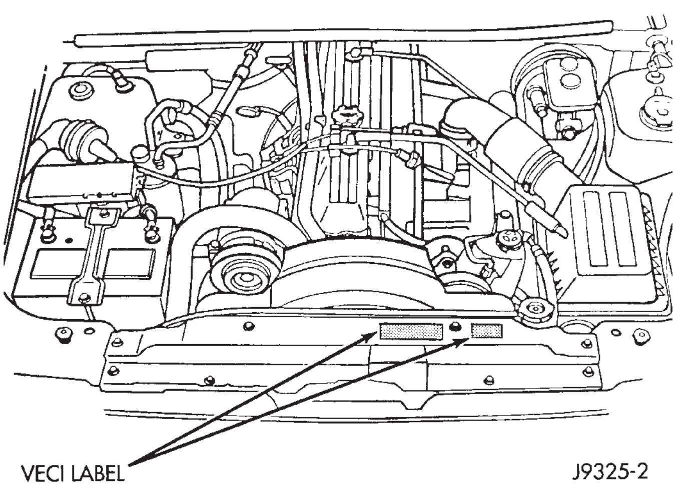


Fig. 1 VECI Label Location—Typical

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

The VECI label illustration (Fig. 2) is used as an example only. Refer to the VECI label located in the engine compartment (Fig. 1) for actual emission information.

VACUUM HOSE ROUTING SCHEMATICS

The vacuum hose routing schematics are used as examples only. If there are any differences between these schematics and the Vehicle Emission Control Information (VECI) label schematics, those shown on the VECI label should be used.

ON-BOARD DIAGNOSTICS

FOR CERTAIN EMISSION SYSTEM COMPONENTS

The powertrain control module (PCM) performs an On-Board Diagnostic (OBD) check for certain emission system components on all vehicles. This is done by setting a diagnostic trouble code (DTC).

A DTC can be obtained in two different ways. One of the ways is by connecting the DRB scan tool to the data link connector. This connector is located in the engine compartment (Fig. 3). Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool. The other way is to cycle the ignition key and observe the malfunction indicator lamp (MIL). The MIL lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 4). This lamp will flash a numeric code. If a numeric code number 32 is observed, a problem has

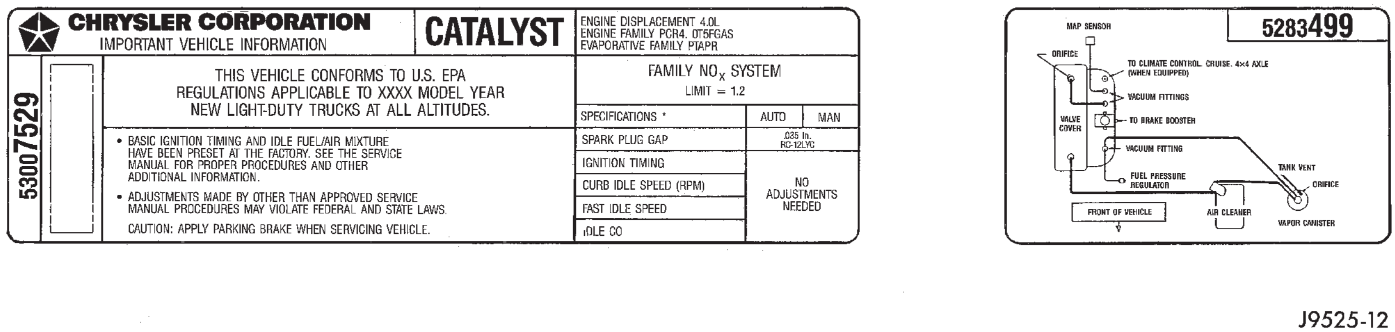


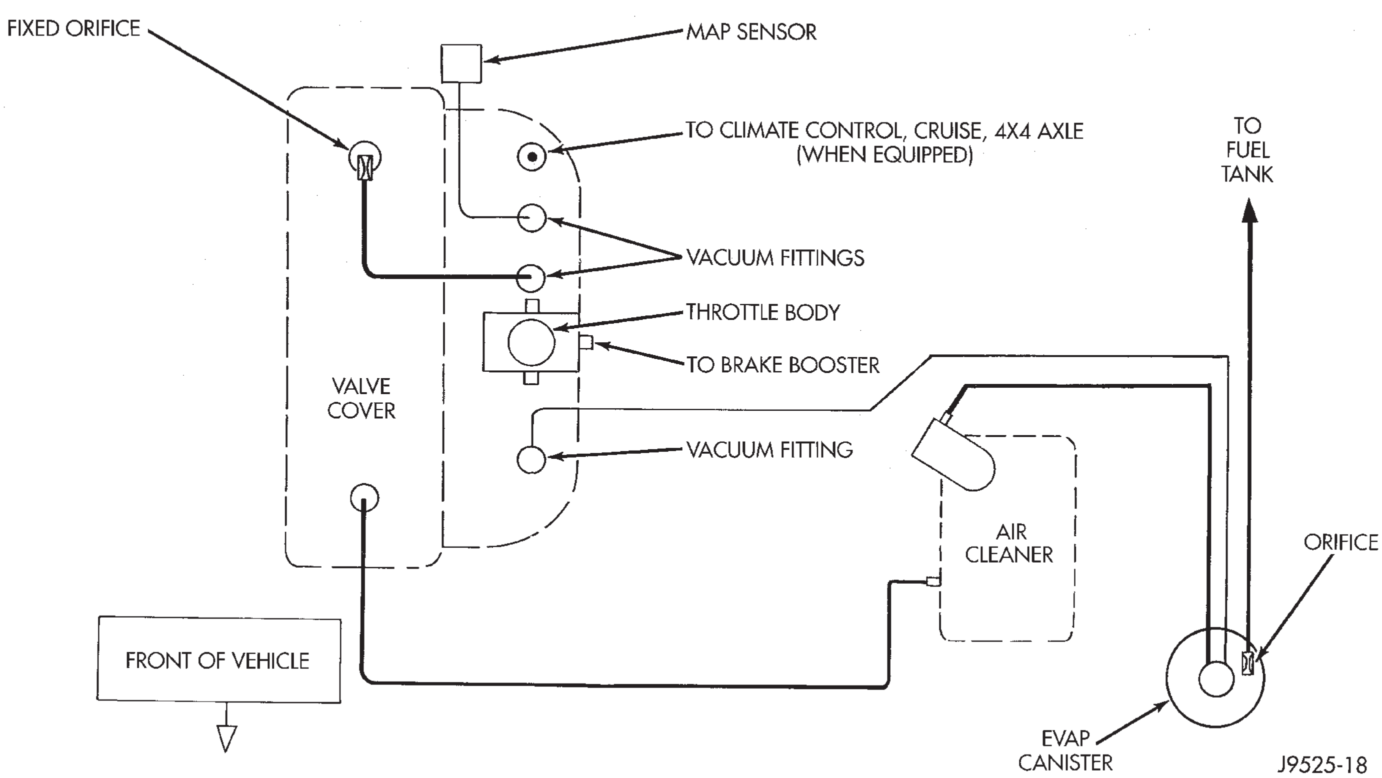
Fig. 2 VECI Label—Typical

been found in the EGR system. If a numeric code number 31 is observed, a problem has been found in the EVAP system.

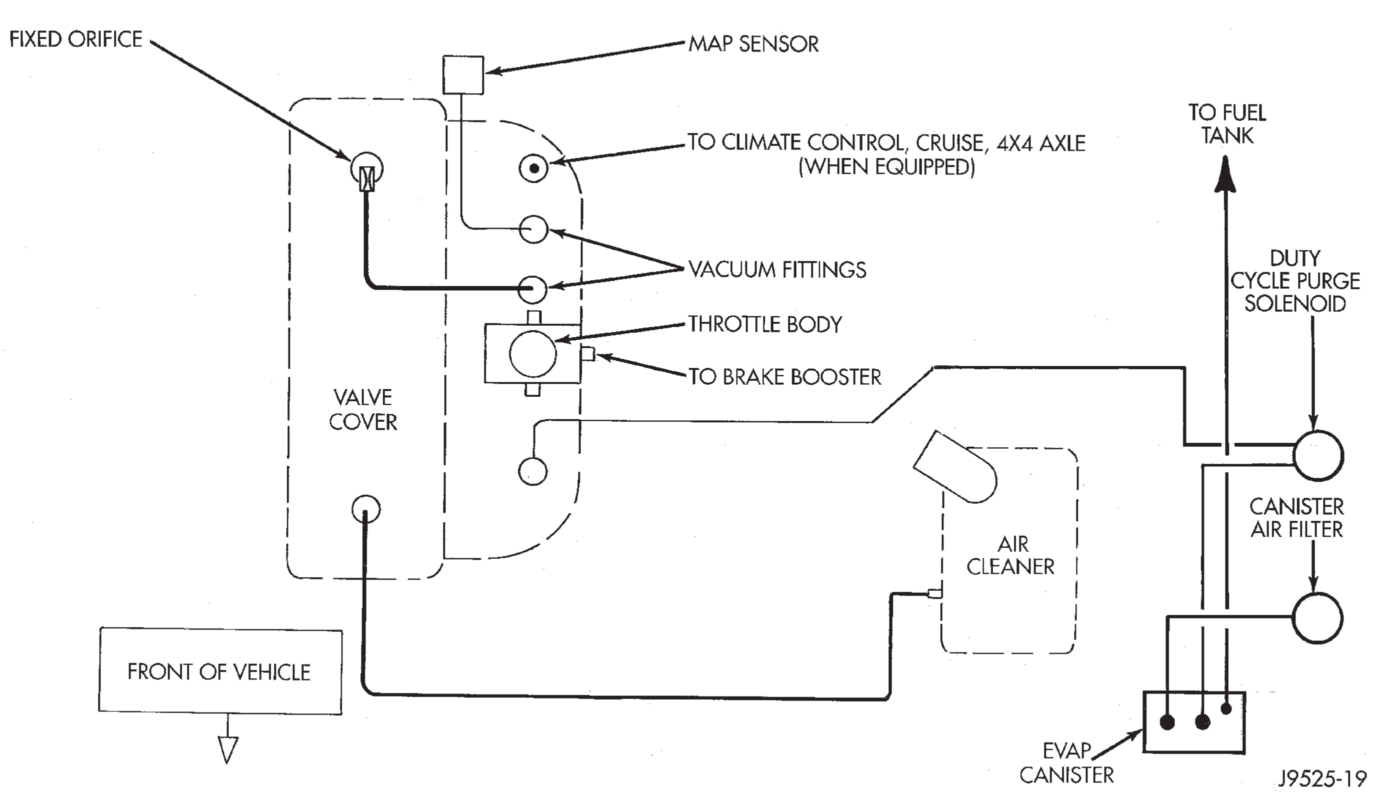
EGR System Check: The OBD check will activate only during selected engine/driving conditions. When the conditions are met, the PCM energizes the EGR valve control solenoid to disable the EGR. The PCM checks for a change in the oxygen sensor signal. If the air-fuel mixture goes lean, the PCM will attempt to enrichen the mixture. The PCM registers a diagnostic trouble code (DTC) if the EGR system has failed or degraded. After registering a DTC, the PCM turns the CHECK ENGINE lamp on. Illumination of this lamp indicates the need for immediate service. Note that the CHECK ENGINE lamp will illuminate initially for approximately two seconds each time the ignition key is turned to the ON position. This is done for a bulb test.

For a complete operational description of all DTC's, for accessing a DTC and for erasing a DTC, refer to On-Board Diagnostics. This can be found in the General Diagnosis sections of Group 14, Fuel System. For numeric flash lamp code charts for emission related components, refer to Diagnostic Trouble Code (DTC). This can also be found in the General Diagnosis sections of Group 14, Fuel System.

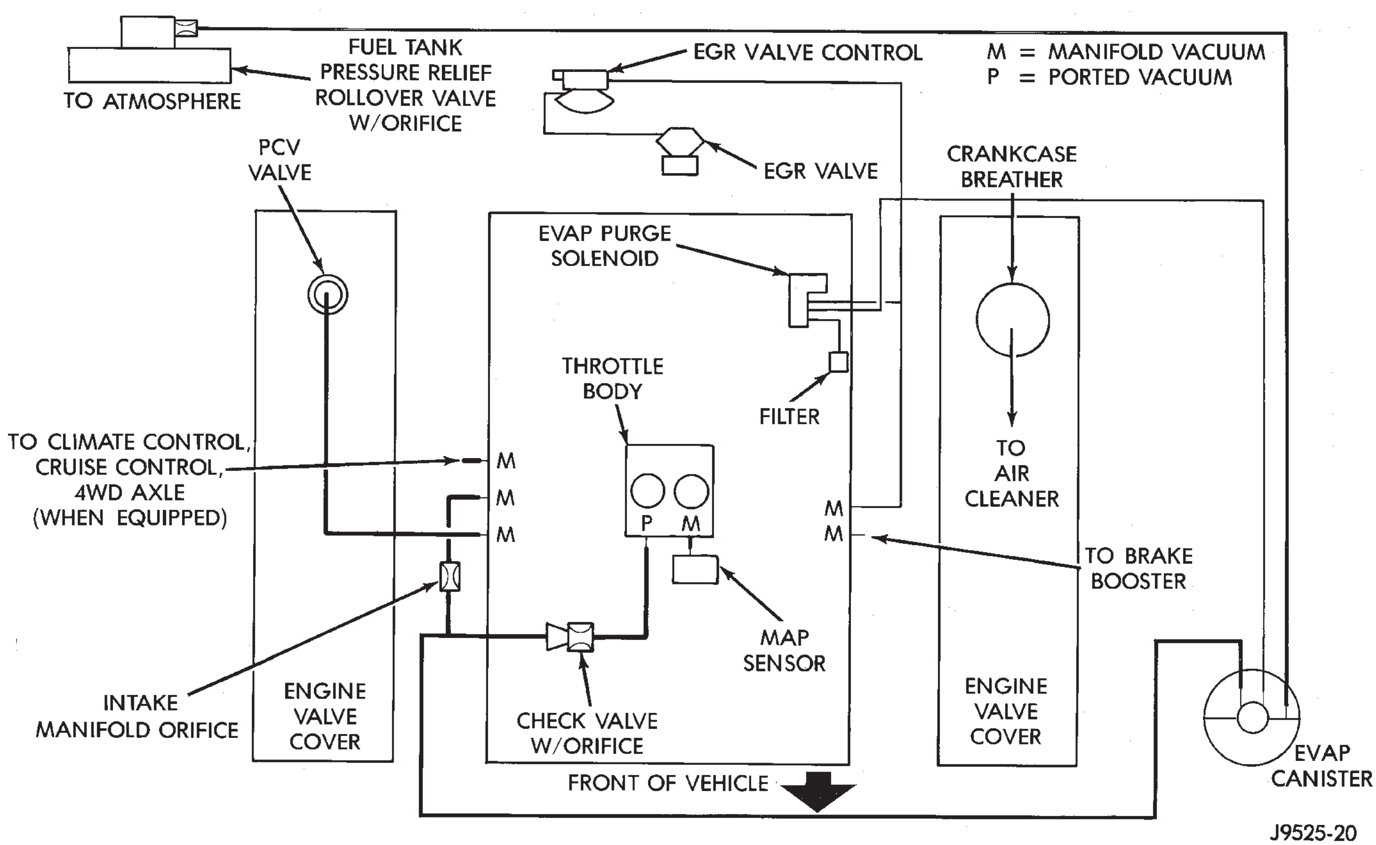
VACUUM ROUTING SCHEMATIC—NON-CALIFORNIA 4.0L ENGINE—TYPICAL



VACUUM ROUTING SCHEMATIC—CALIFORNIA 4.0L ENGINE—TYPICAL



VACUUM ROUTING SCHEMATIC—5.2L V-8 ENGINE—TYPICAL



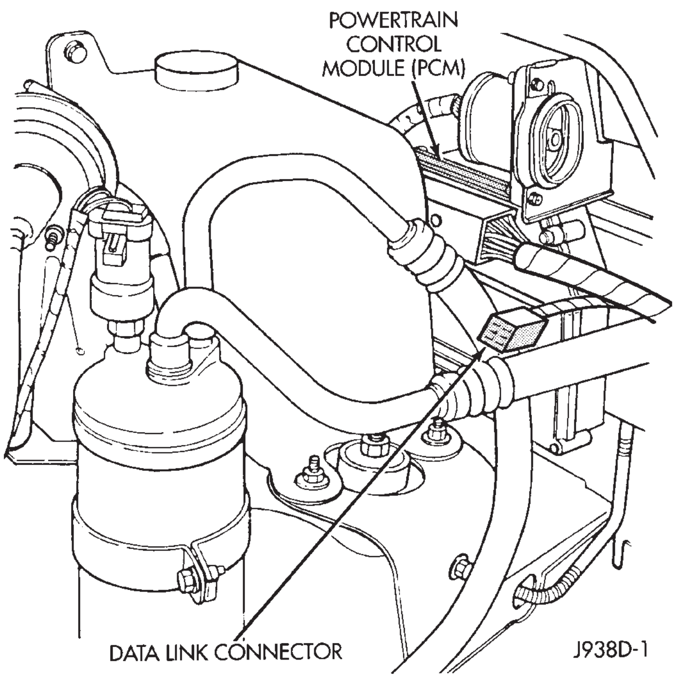


Fig. 3 Data Link Connector—Typical

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

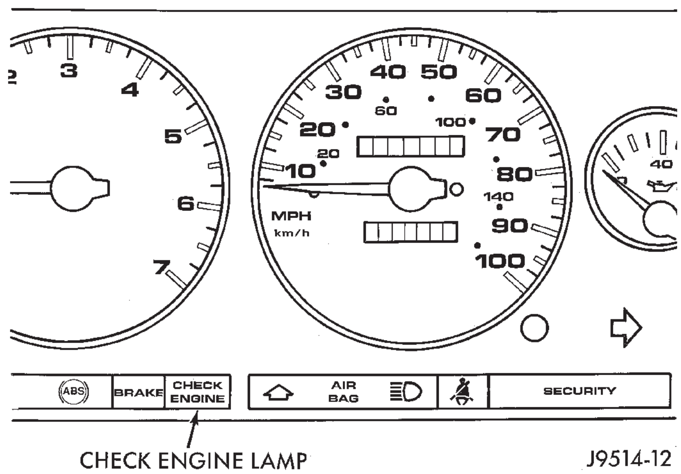


Fig. 4 Check Engine Lamp Location

EVAPORATIVE EMISSION CONTROLS

INDEX

EVAP (EVAPORATION) CONTROL SYSTEM

GENERAL INFORMATION

The function of the EVAP control system is to prevent the emissions of gasoline vapors from the fuel tank into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to a carbon filled EVAP canister. They are temporarily held in the canister until they can be drawn into the intake manifold when the engine is running.

The EVAP canister is a feature on all models for the storage of fuel vapors from the fuel tank. Refer to the following EVAP Canister for information.

Three different EVAP systems are used. These are for:

- The 4.0L six-cylinder engine **without** the California emission package.
- The 4.0L six-cylinder engine **with** the California emission package.
- The 5.2L V-8 engine.

Refer to the following System Operation sections for information.

The hoses used in this system are specially manufactured. If replacement becomes necessary, it is important to use only fuel resistant hose.

EVAP CANISTER

A sealed, maintenance free, EVAP canister is used on all vehicles. Depending on engine and emission packages, two different types of canisters are used. The EVAP canister is located in the left front corner of the vehicle below the left front headlamp (Figs. 1 or 2). The canister is filled with granules of an activated carbon mixture. Fuel vapors entering the canister are absorbed by the charcoal granules.

A separate EVAP canister filter is used on 4.0L 6-cylinder engines equipped with the California Emission Package only. This filter is located in the left front corner of the engine compartment behind the air cleaner housing. On the 5.2L V-8 engine, this filter is located at the end of the vacuum line harness where the connection is made at the EVAP purge solenoid. On the 4.0L engine without the California package, the engine air cleaner housing is used.

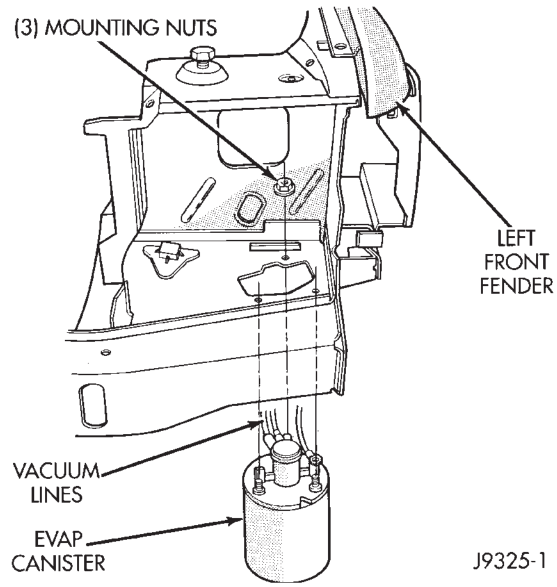


Fig. 1 Canister Location—All Engines—Non-California

SYSTEM OPERATION

4.0L ENGINE WITHOUT CALIFORNIA EMISSION PACKAGE

This is a non-electrical, vacuum operated system.

The EVAP canister is equipped with a vacuum controlled purge shutoff switch (orifice) (Fig. 3) that controls canister purge operation. The switch is open when engine manifold vacuum is applied to it. When the engine is operating, the EVAP canister purge function draws fresh air through the top of the canister. This causes the stored vapors to be drawn out of the canister and into the airstream in the air cleaner housing snorkel (Fig. 3).

The air cleaner contains a venturi in the air cleaner cover used as a purge line vacuum source (Fig. 4). The venturi effect increases the speed of the intake air flowing by the slots in the venturi wall. This creates a low pressure area around the slots. When the purge shutoff switch is open, vapors from the canister are drawn through slots and into the airstream flowing through the venturi (Fig. 4).

The fuel vapors then pass through the intake manifold and into the engine combustion chambers. Here they are consumed during engine combustion.

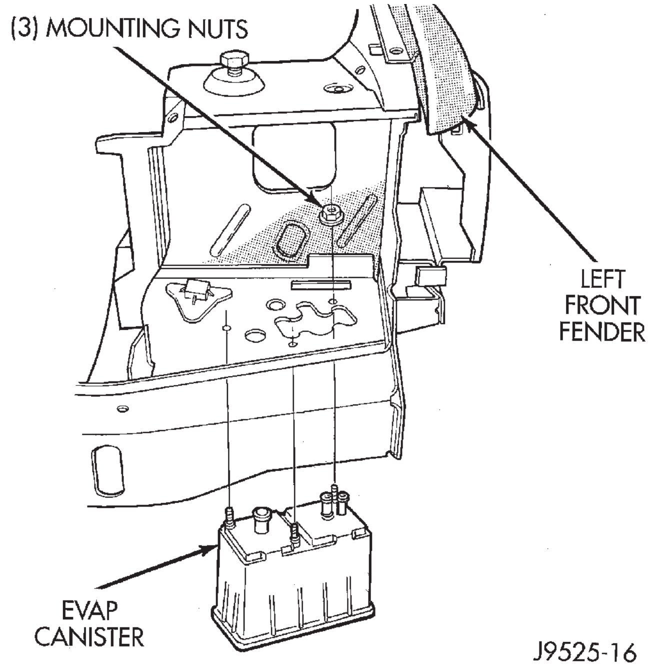


Fig. 2 Canister Location—California Emission Package—4.0L Only

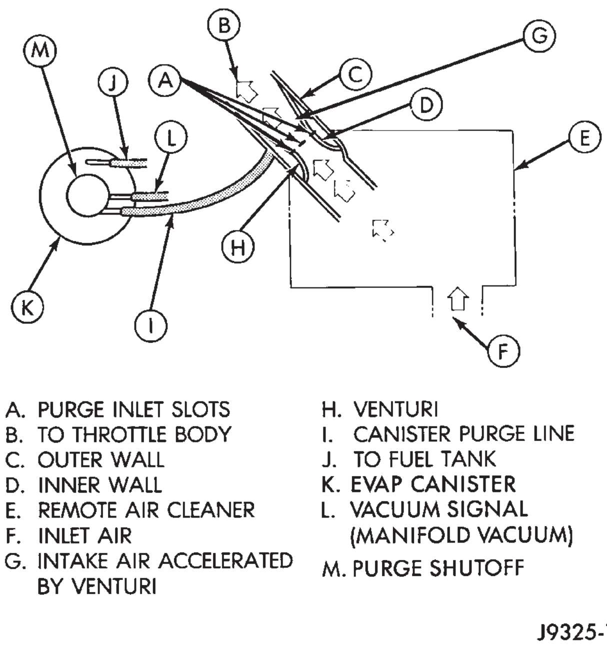


Fig. 3 EVAP System—Non-California 4.0L Engine—Typical

SYSTEM OPERATION

4.0L ENGINE WITH CALIFORNIA EMISSION PACKAGE

This is a combination electrical and vacuum operated system.

The duty cycle EVAP canister purge solenoid (Fig. 5) regulates the rate of vapor flow from the EVAP canister to the intake manifold. The powertrain con-

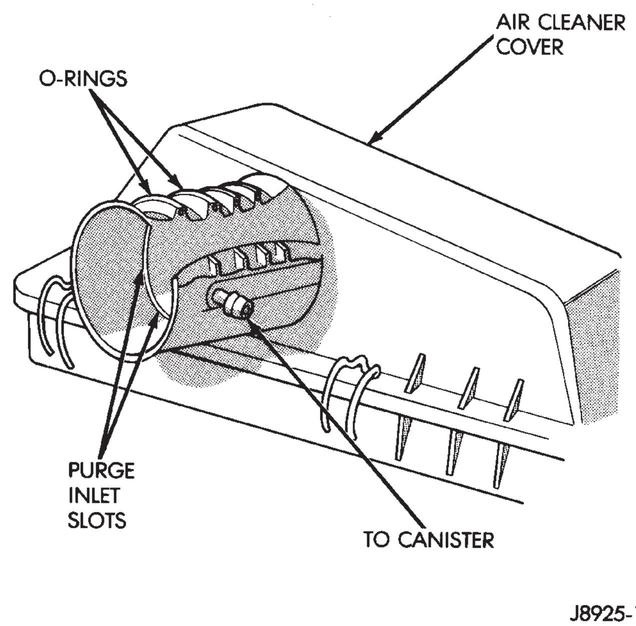


Fig. 4 Air Cleaner Venturi—Non-California 4.0L Engine—Typical

trol module (PCM) operates the purge solenoid by controlling the ground circuit to it.

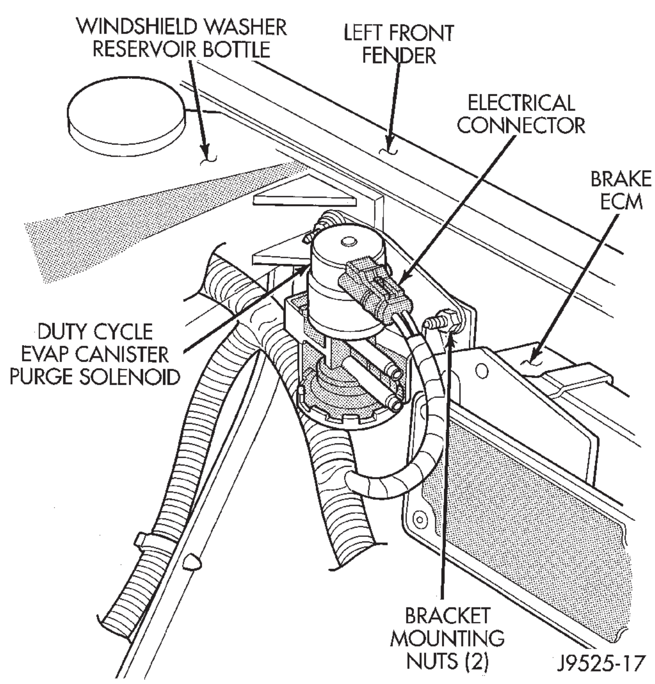


Fig. 5 Purge Solenoid—4.0L Engine—California Emission Package

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized (pulse ground signal not supplied), no vapors are purged.

The engine enters closed loop operation after it reaches a specified temperature and the programmed time delay ends. During closed loop operation, the

PCM energizes and de-energizes the solenoid 5 to 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing the solenoid pulse width. Pulse width is the amount of time the solenoid is energized.

As the solenoid is energized, the fuel vapors then pass through the intake manifold and into the engine combustion chambers. Here they are consumed during engine combustion.

SYSTEM OPERATION

5.2L V-8 ENGINE

This is a combination electrical and vacuum operated system.

Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

Vacuum for the EVAP canister is controlled by the EVAP canister purge solenoid (Fig. 6). The solenoid is operated by the powertrain control module (PCM). The PCM regulates the solenoid by switching the ground circuit on and off based on engine operating conditions. When energized (grounded), the solenoid prevents vacuum from reaching the EVAP canister. When not energized, the solenoid allows vacuum to flow through to the EVAP canister.

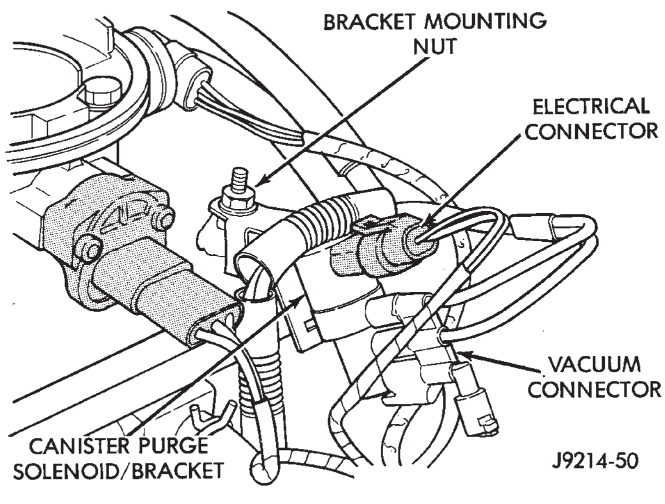


Fig. 6 Purge Solenoid—5.2L Engine—Typical

During warm-up and for a specified time period after hot starts, the PCM grounds the EVAP canister purge solenoid causing it to energize. This will prevent vacuum from reaching the EVAP canister valve. When the engine reaches an operating temperature of approximately 60°C (140°F), the PCM removes the ground to the solenoid. The de-energized solenoid then allows vacuum to flow to the EVAP canister and purge fuel vapors through the intake manifold and into the engine combustion chambers. Here they are consumed during engine combustion.

The EVAP canister purge solenoid will also be energized during certain idle conditions in order to update the fuel delivery calibration.

FUEL TANK FILLER TUBE CAP

The fuel tank filler tube cap (fuel tank cap) incorporates a two-way relief valve that is closed to atmosphere during normal operating conditions. The relief valve used in fuel filler caps of all models is calibrated at a pressure of 10 kPa (1.5 psi) or a vacuum of 6 kPa (1.8 in. Hg). When the pressure or vacuum is relieved, the valve returns to the normally closed position.

CAUTION: The fuel filler cap must be removed prior to disconnecting any fuel system component.

CRANKCASE VENTILATION SYSTEM—4.0L 6-CYLINDER ENGINE

The 4.0L engine is equipped with a Crankcase Ventilation (CCV) system (Fig. 7). The CCV system performs the same function as a conventional PCV system, but does not use a vacuum controlled valve.

A molded vacuum tube connects manifold vacuum to top of cylinder head cover at dash panel end. The vacuum tube contains a fixed orifice (Fig. 7) of a calibrated size. It meters the amount of crankcase vapors drawn out of the engine.

A fresh air supply hose from the air cleaner (Fig. 7) is connected to front of cylinder head (valve) cover. When the engine is operating, fresh air enters the engine and mixes with crankcase vapors. Manifold vacuum draws the vapor/air mixture through the fixed orifice and into the intake manifold. The vapors are then consumed during engine combustion.

POSITIVE CRANKCASE VENTILATION SYSTEM—5.2L V-8 ENGINE

DESCRIPTION/OPERATION

The 5.2L V-8 engine is equipped with a closed positive crankcase ventilation (PCV) system (Fig. 8).

This system consists of a crankcase PCV valve mounted on the cylinder head cover with a hose extending from the valve to the intake manifold.

A closed engine crankcase breather/filter, with a hose connecting it to the air cleaner housing, provides the source of air for system.

The positive crankcase ventilation (PCV) system operates by engine intake manifold vacuum (Fig. 9). Filtered air is routed into the crankcase through the air cleaner hose and crankcase breather/filter. This forces crankcase vapors through the PCV valve. It is then drawn into the intake manifold. Here it becomes part of the calibrated air/fuel mixture to be

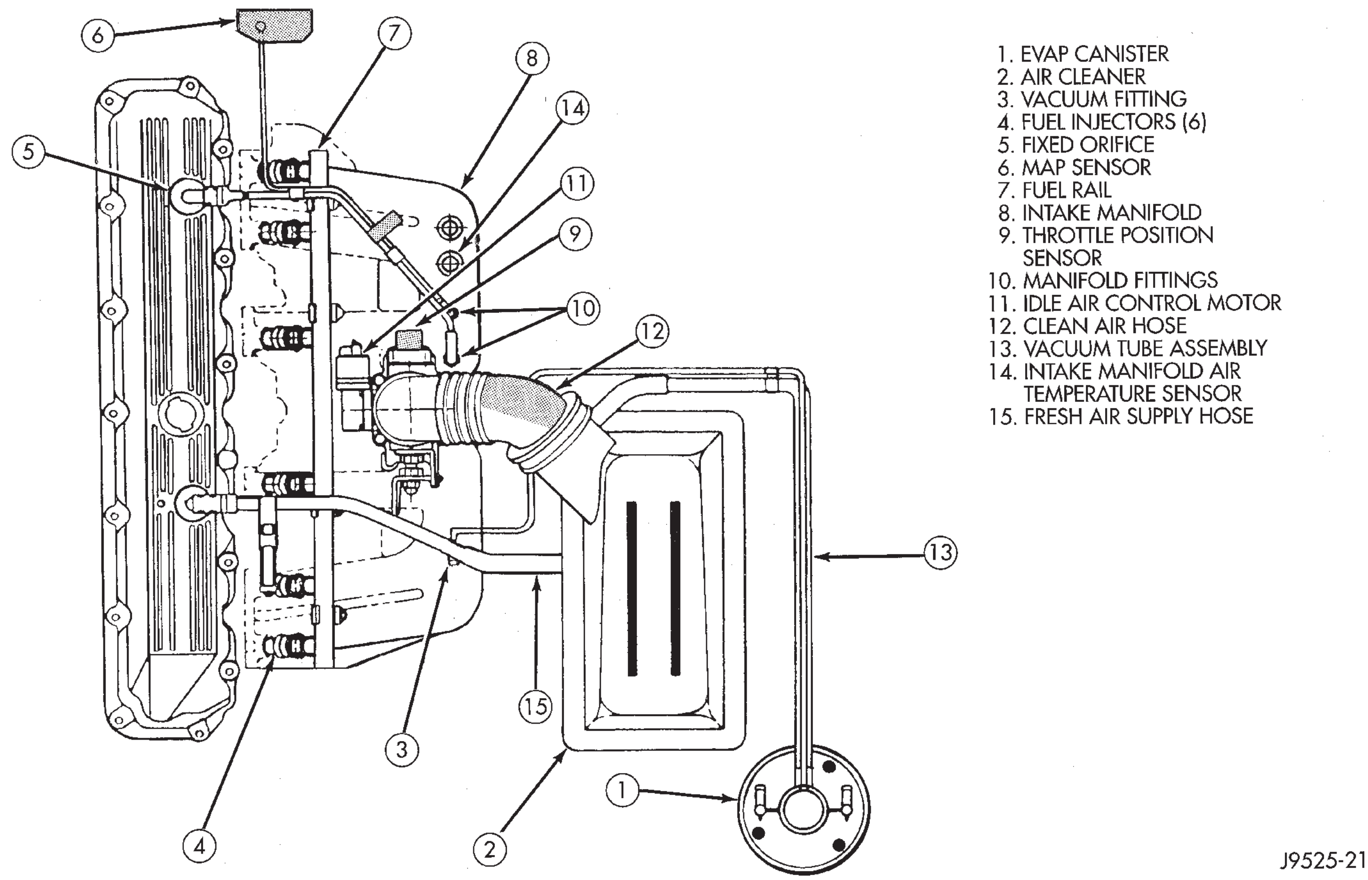


Fig. 7 CCV System—4.0L Engine—Non-California System Shown

consumed in the combustion chamber. The PCV system constantly ventilates the crankcase to help prevent sludge formation and vapors from entering the atmosphere.

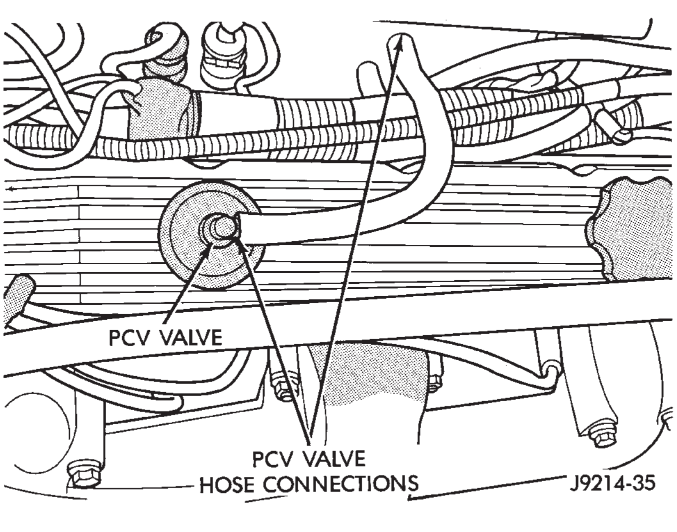


Fig. 8 PCV Valve/Hose—5.2L Engines

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

When the engine is not operating, or during an engine popback, the spring forces the plunger back against the seat. This will prevent vapors from flowing through the valve (Fig. 10).

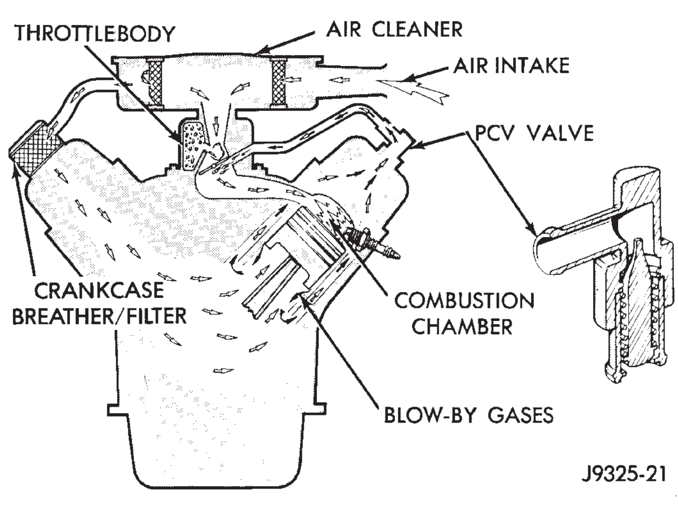


Fig. 9 Typical Closed Crankcase Ventilation System

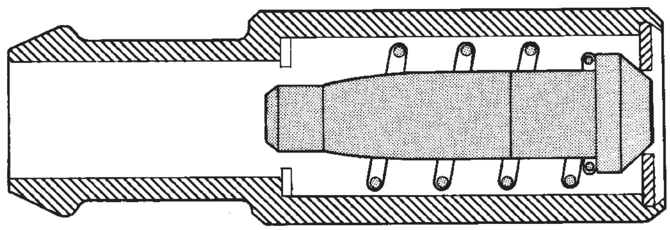


Fig. 10 Engine Off or Engine PopBack—No Vapor Flow

During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve (Fig. 11). In this position there is minimal vapor flow through the valve.

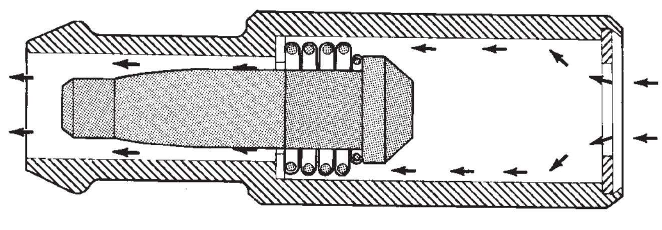


Fig. 11 High Intake Manifold Vacuum—Minimal Vapor Flow

During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve (Fig. 12).

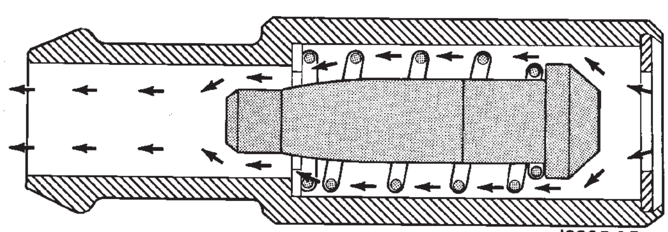


Fig. 12 Moderate Intake Manifold Vacuum—Maximum Vapor Flow

INSPECTION AND SERVICE PROCEDURE

(1) With engine idling, remove the PCV valve from cylinder head cover. If the valve is not plugged, a hissing noise will be heard as air passes through the valve. Also, a strong vacuum should be felt at the valve inlet (Fig. 13).

(2) Install the PCV valve. Remove the crankcase breather/filter. Hold a piece of stiff paper, such as a parts tag, loosely over the opening of crankcase breather/filter at the cylinder head (valve) cover (Fig. 14).

(3) The paper should be drawn against the opening in the cylinder head (valve) cover with noticeable

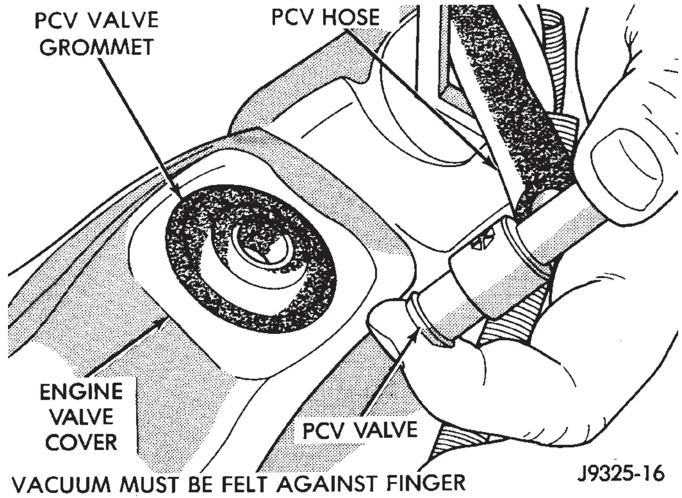


Fig. 13 Check Vacuum at PCV Valve—Typical

force. This will be after allowing approximately one minute for crankcase pressure to reduce.

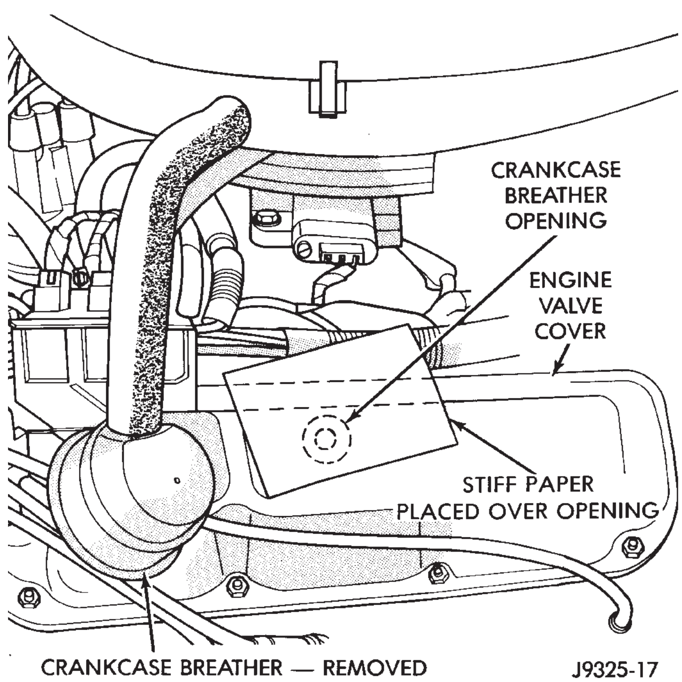


Fig. 14 Check Vacuum at Crankcase Breather Opening—Typical

(4) Turn engine off and remove PCV valve from cylinder head (valve) cover. The valve should rattle when shaken (Fig. 15).

Replace the PCV valve and retest the system if it does not operate as described in the preceding tests. **Do not attempt to clean the old PCV valve.**

(5) If the paper is not held against the opening in cylinder head (valve) cover after new valve is installed, the PCV valve hose may be restricted and must be replaced. The passage in the intake manifold must also be checked and cleaned.

(6) To clean the intake manifold fitting, turn a 1/4 inch drill (by hand) through the fitting to dislodge

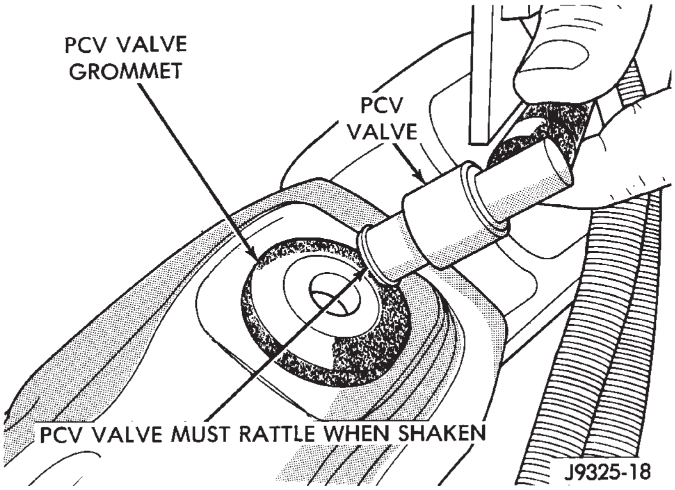


Fig. 15 Shake PCV Valve—Typical

any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

CRANKCASE BREATHER/FILTER—5.2L ENGINES

The crankcase breather/filter is used with the 5.2L V-8 engine only.

The crankcase breather/filter (Fig. 16) is located on the engine valve cover. It must be kept clean and lubricated. At the recommended interval, remove the filter and wash it thoroughly in kerosene, or similar solvent. Lubricate or wet the filter by inverting it and filling with SAE 30 engine oil. Filter must then be thoroughly drained. More frequent service may be necessary for vehicles operated extensively on short run, stop and go, or extended engine idle service.

The filter must be replaced at correct intervals. Refer to Lubrication and Maintenance, Group 0.

PRESSURE RELIEF/ROLLOVER VALVE

These vehicles are equipped with a combination fuel tank pressure relief and rollover valve (Fig. 17). This dual function valve will relieve fuel tank pressure and also prevent fuel flow through the fuel tank vent hoses in the event of an accidental vehicle rollover.

The valve incorporates a pressure relief mechanism (Fig. 18) that releases fuel tank pressure when the pressure increases above the calibrated sealing value. Refer to the Fuel Tank section of Group 14, Fuel Systems for removal and installation procedures.

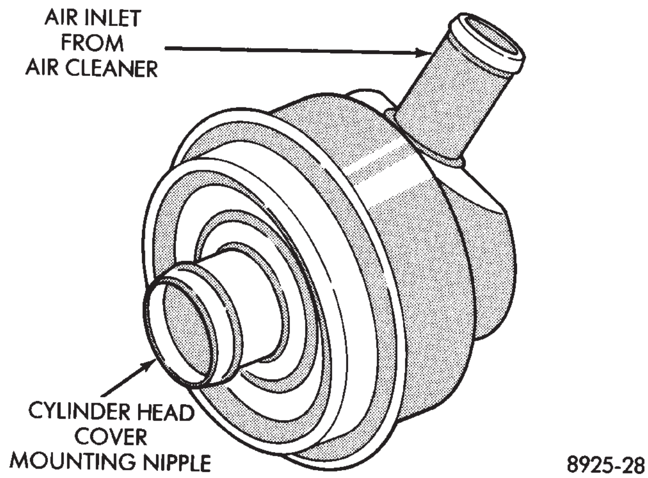


Fig. 16 Typical Crankcase Breather/Filter—5.2L Engine

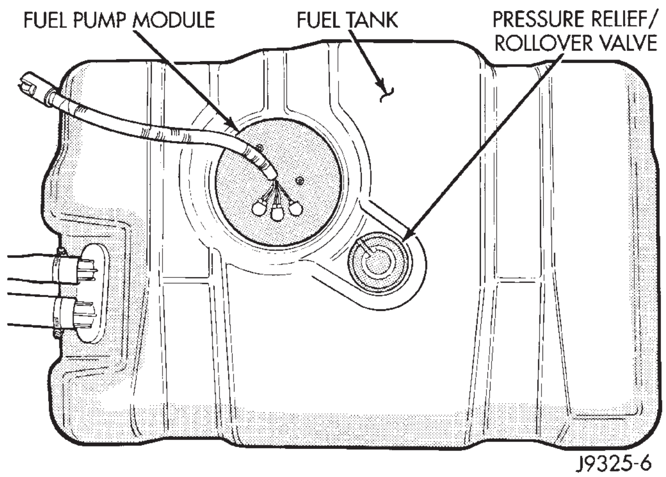


Fig. 17 Pressure Relief/Rollover Valve Location

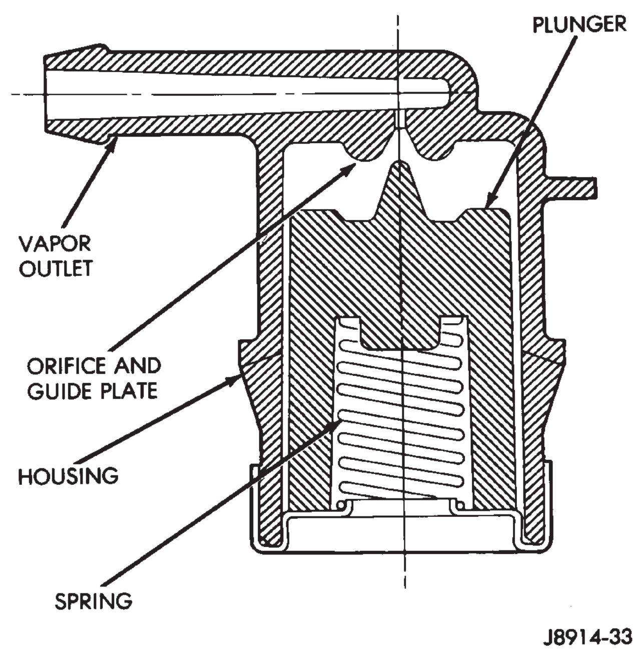


Fig. 18 Pressure Relief/Rollover Valve Operation

EXHAUST EMISSION CONTROLS

INDEX

CATALYTIC CONVERTER

Refer to Group 11, Exhaust System and Intake manifold for information.

EGR (EXHAUST GAS RECIRCULATION) SYSTEM—5.2L ENGINE

GENERAL INFORMATION

The Exhaust Gas Recirculation (EGR) System is used with the 5.2L V-8 engine only.

The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust and helps prevent spark knock. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming fuel/air mixture. This dilution reduces peak flame temperature during combustion.

A malfunctioning EGR system can cause engine spark knock, sags or hesitation, rough idle, engine stalling and poor driveability.

EGR SYSTEM OPERATION

The system consists of:

- An EGR valve assembly (Figs. 1 or 2) mounted to the intake manifold.
- An EGR valve control containing a combination back-pressure transducer and an electric vacuum solenoid (Figs. 1 and 2).
- The powertrain control module (PCM) to control the electric solenoid portion of the valve control.
- An EGR tube (Fig. 3) connecting a passage in the intake manifold (near the EGR valve) to the rear of the right exhaust manifold.
- Hoses to connect the various components.

When the PCM removes the ground signal to the electric solenoid portion of the valve control, EGR system operation starts to occur. The PCM will monitor and determine when to supply and remove this ground signal depending on certain engine temperatures, throttle positions and other engine operating conditions.

If the electrical connector to the EGR valve control (solenoid) is disconnected, or the electrical signal is lost, the EGR valve will operate at all times. This may result in; poor engine performance, rough idle speed and reduced driveability during certain operating conditions.

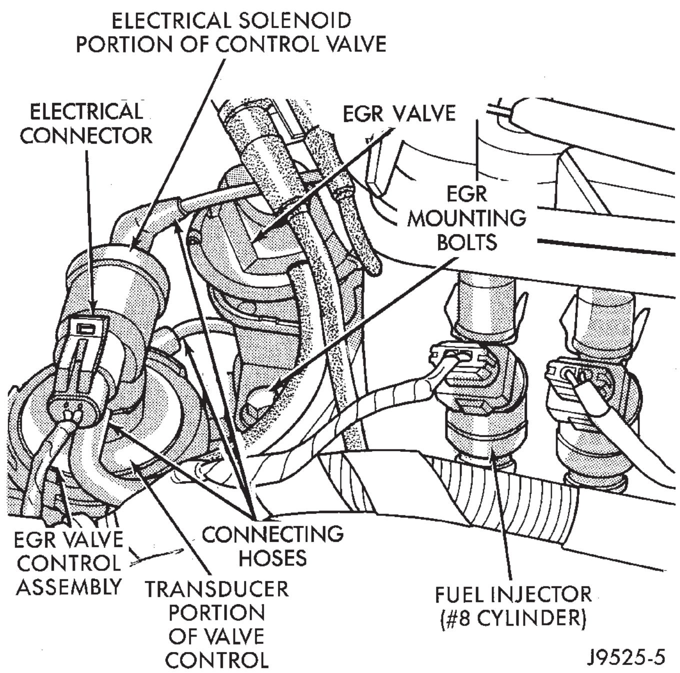


Fig. 1 EGR System Component Location

The EGR valve control also contains an internal pressure-type transducer (Fig. 2). This transducer portion of the valve control is operated by exhaust back-pressure from the EGR valve. Exhaust is delivered to the EGR valve through the metal EGR tube (Fig. 3). This connects it to the rear of the right exhaust manifold. A rubber hose connects the back-pressure fitting on the EGR valve to the back-pressure fitting on the valve control (Fig. 2).

When the ground signal is removed from the electric portion of the valve control (solenoid is not energized), and exhaust gas back-pressure entering the EGR valve inlet is high enough, back-pressure is supplied to the valve control. It then holds the bleed valve in the transducer closed. This allows engine vacuum to flow through the EGR valve control to activate and operate the EGR valve for exhaust gas recirculation. If back-pressure is not strong enough to close the bleed valve in the transducer, the valve control will bleed off engine vacuum preventing EGR valve operation.

The transducer measures and uses this exhaust back-pressure signal from the EGR valve to regulate

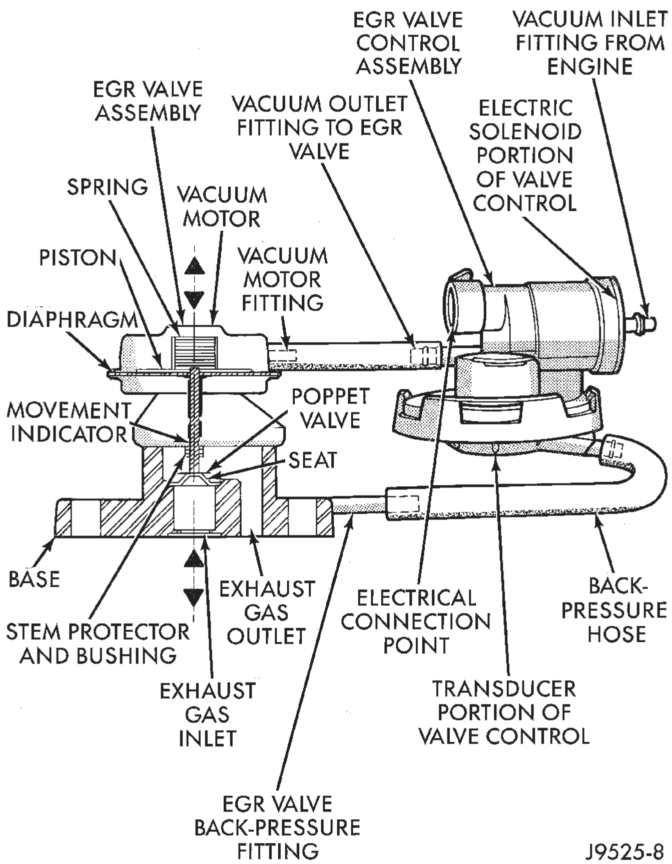


Fig. 2 EGR Valve and EGR Valve Control

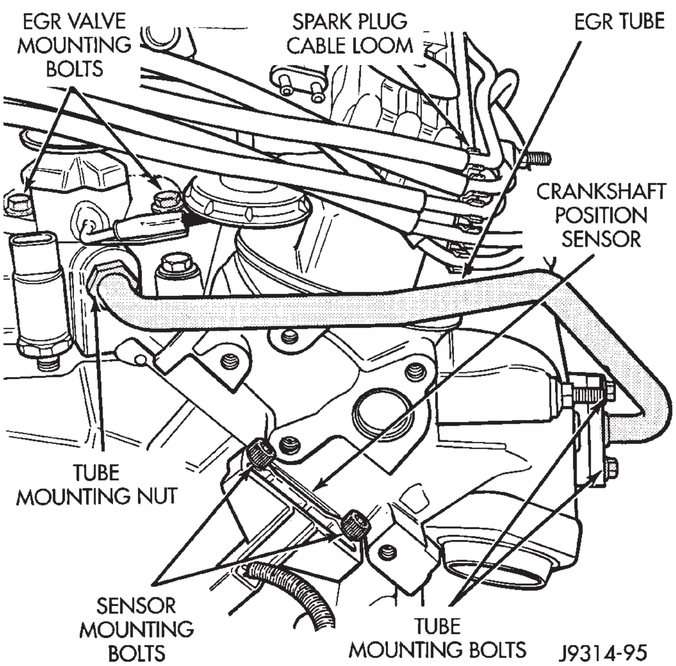


Fig. 3 EGR Tube

and provide the correct amount of exhaust gas recirculation under all conditions.

Exhaust gas recirculation will begin in this order when:

- The powertrain control module (PCM) determines that EGR system operation is necessary.
- The electrical portion of the EGR valve control is not energized (grounded) by the PCM.
- Exhaust back-pressure entering the transducer in the EGR valve control is strong enough to close its bleed valve.
- Engine vacuum is passed through the EGR valve control to the EGR valve.
- The inlet seat (poppet valve) at the bottom of the EGR valve opens to dilute and recirculate exhaust gas back into the intake manifold.

For more information, also refer to Open Loop/Closed Loop Modes of Operation in Group 14, Fuel Systems.

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. 4). 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.

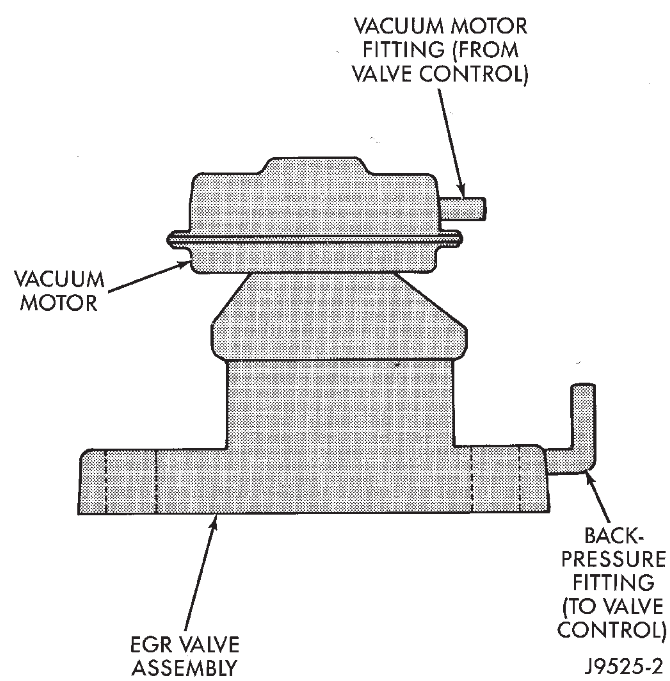


Fig. 4 Typical EGR Valve

(2) Disconnect the rubber hose at the vacuum motor fitting (Fig. 4) on the top of the EGR valve vacuum motor.

(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, and with the engine running at idle speed, the idle speed should drop or the engine may even stall. 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, the 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.

Do not attempt to clean the EGR valve. If the valve shows evidence of heavy carbon build-up near the base, replace it.

EGR SYSTEM TEST

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE TESTING THE EGR SYSTEM.

(1) Warm up the engine and bring to operating temperature before performing the proceeding tests.

(2) Check the condition of all EGR system hoses and tubes for leaks, cracks, kinks and hardening of rubber hoses. Repair and correct these conditions before performing any tests.

(3) Be sure the hoses at both the EGR valve and EGR valve control are connected to the proper fittings. Refer to figure 2.

(4) Be sure the electrical connector is firmly connected at the valve control.

(5) To check EGR system operation, connect the DRB scan tool to the data link connector. The data link connector is located in the engine compartment (Fig. 5). Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool when diagnosing the EGR system.

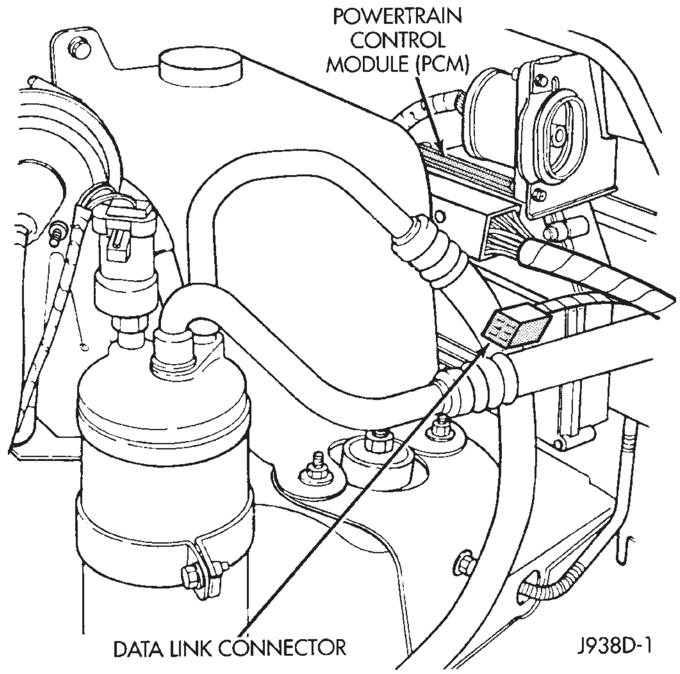


Fig. 5 Data Link Connector—Typical Location

(6) After checking the system with the DRB scan tool, proceed to the following: EGR Valve Leakage Test, or EGR Valve Control Test and repair as necessary.

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. 2) at the base of the EGR valve may be leaking in the closed position. The diaphragm (Fig. 2) within the EGR valve may also be ruptured.

(1) The engine should be off for the following test.

(2) Disconnect the rubber hose from the fitting (Fig. 2) 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 unit. Refer to EGR Valve Removal/Installation in this group.

(f) If vacuum did not fall off, proceed to the next step.

(3) A small metal fitting (back-pressure fitting) is located at the base of the EGR valve (Fig. 2). A rubber back-pressure hose connects it to the back-pres-

sure fitting on the EGR valve control. Disconnect this rubber hose at the EGR valve fitting.

(4) Remove the air intake tube at 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. 2) 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 unit. Refer to EGR Valve Removal/Installation in this group. Do not attempt clean the old EGR valve.

EGR VALVE CONTROL TEST

TESTING ELECTRICAL SOLENOID PORTION OF VALVE CONTROL

This is not to be used as a complete test of the EGR system.

Electrical operation of the valve control 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 (valve control) if necessary.

TESTING VACUUM TRANSDUCER PORTION OF VALVE CONTROL

The first part of this test will determine if the transducer diaphragm at the back-pressure side of the valve control 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 control. This is not to be used as a complete test of the EGR system.

(1) Electrical operation of the valve control should first be checked with the DRB scan tool before proceeding with the vacuum test. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

(2) Disconnect the rubber back-pressure hose from the fitting at the bottom of EGR valve control (Fig. 2).

(3) Connect a hand-held vacuum pump to this fitting.

(4) Apply 10 inches of vacuum to this fitting.

(5) If vacuum falls off, the valve control diaphragm is leaking.

(6) Replace the EGR valve control. Proceed to next step for further testing.

(7) Remove the rubber hose at the vacuum **inlet** fitting (Fig. 2) on the EGR valve control.

(8) Connect a vacuum gauge to this disconnected hose.

(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. 2) on the EGR valve control.

(13) Disconnect the rubber hose at the vacuum **outlet** fitting (Fig. 2) on the EGR valve control.

(14) Connect a vacuum gauge to this fitting.

(15) Disconnect the electrical connector (Fig. 1) at the valve control. This will simulate an open circuit (no ground from the PCM) at the valve control.

(16) Start the engine and bring to operating temperature.

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 control, exhaust back-pressure must be present at valve control. It must be high enough to hold the bleed valve in the transducer portion of the valve control closed.** Have a helper 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.**

As temporary back-pressure is built, full manifold vacuum should be observed at the vacuum control 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 will be erratic. This is also normal.

(17) If full manifold vacuum is not present at the outlet fitting, but was present at the inlet fitting, replace the valve control. Note: The EGR valve, valve control and attaching hoses are serviced as one unit. Refer to EGR Valve Removal/Installation in this group.

OXYGEN (O2S) SENSOR

For description, operation, diagnosis and removal/installation procedures of the O2S sensor, refer to Group 14, Fuel Systems.

COMPONENT REMOVAL/INSTALLATION

INDEX

AIR CLEANER HOUSING

Refer to either of the Component Removal/Installation sections of Group 14, Fuel System for procedures.

AIR CLEANER ELEMENT

Refer to either of the Component Removal/Installation sections of Group 14, Fuel System for procedures.

ENGINE COOLANT TEMPERATURE SENSOR

For description, operation, diagnosis and removal/installation procedures, refer to the 4.0L or 5.2L sections of Group 14, Fuel Systems.

EGR VALVE—5.2L ENGINE

REMOVAL

The EGR valve, EGR valve control (solenoid) and attaching hoses are serviced as one unit on the 5.2L engine.

(1) Disconnect vacuum hoses to EGR valve and EGR valve control. Note position of hoses for easier installation.

(2) Remove EGR mounting bolts (Figs. 1 or 2).

(3) Remove EGR valve and gasket. Discard old gasket. Clean intake manifold mating surface and check for cracks.

INSTALLATION

(1) Place new EGR gasket on intake manifold.

(2) Install EGR valve. Tighten mounting bolts to 23 N·m (200 in. lbs.) torque.

(3) Connect vacuum hoses to EGR valve and EGR valve control.

EGR TUBE—5.2L ENGINE

REMOVAL

(1) Remove the spark plug cable loom and spark plug cables from valve cover mounting stud at rear of right valve cover (Fig. 2). Position spark plug cables to top of valve cover.

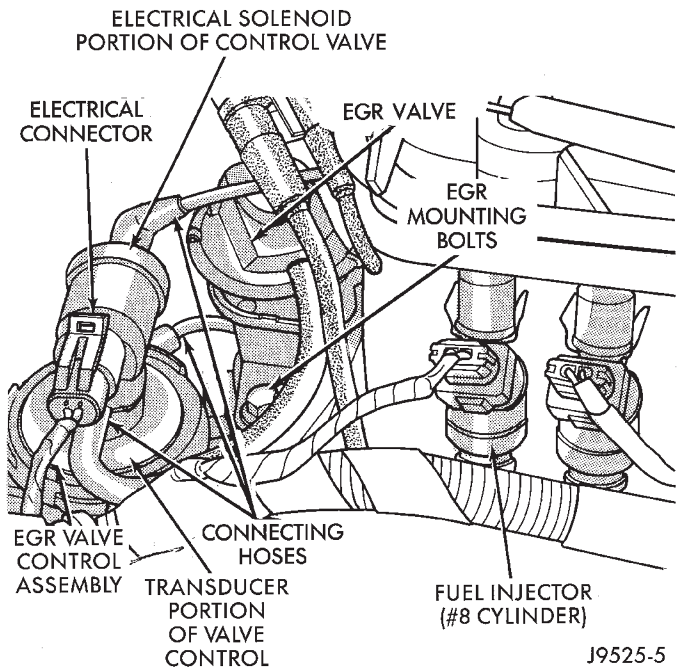


Fig. 1 EGR Valve Location—5.2L Engines

(2) Remove the right exhaust manifold heat shield nuts/bolts and remove heat shield (Fig. 3).

(3) Disconnect 2 hoses at EGR valve. Note position of hoses at EGR valve before removal.

(4) Disconnect electrical connector and hoses at EGR valve control. Note position of hoses before removal.

(5) Remove 2 EGR valve mounting bolts (Fig. 2) and remove EGR valve. Discard old EGR gasket.

(6) Disconnect electrical connector at engine oil pressure sending unit.

(7) To prevent damage to oil pressure sending unit, a special tool, such as number C-4597 must be used (Fig. 4). Remove sending unit from engine.

(8) Loosen EGR tube mounting nut at intake manifold (Fig. 2).

(9) Remove 2 EGR tube mounting bolts at exhaust manifold (Fig. 2) and remove EGR tube. Discard old gasket at exhaust manifold.

(10) Remove EGR tube from vehicle.

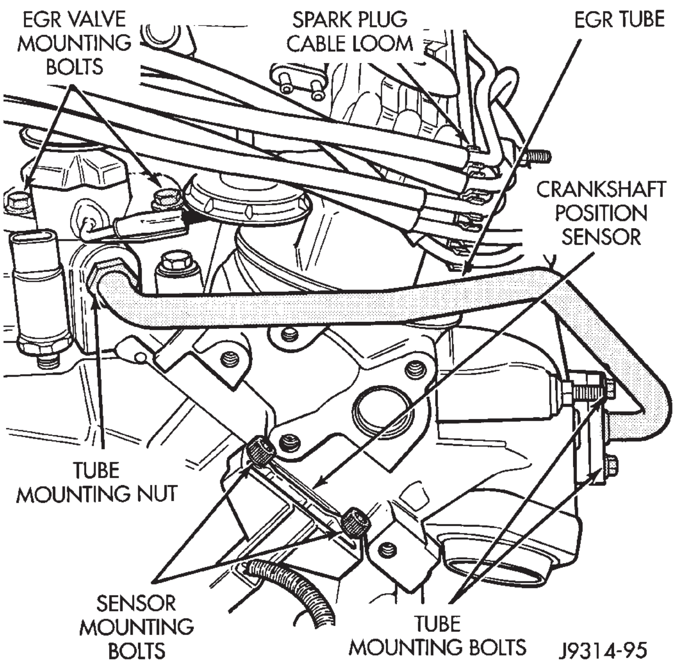


Fig. 2 EGR Valve Mounting Bolts—5.2L Engines

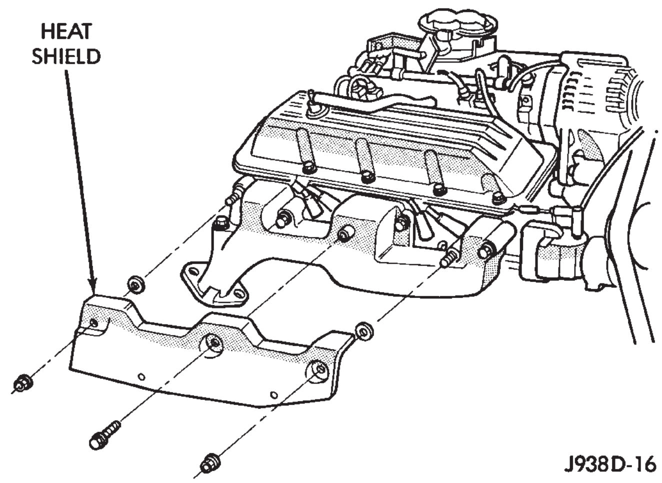


Fig. 3 Exhaust Manifold Heat Shield—5.2L Engine

INSTALLATION

(1) Clean the EGR tube and exhaust manifold (at EGR tube mounting point) of any old gasket material.

(2) Install a new gasket to exhaust manifold end of EGR tube and install EGR tube to both manifolds. Tighten tube mounting nut at intake manifold. Tighten 2 mounting bolts at exhaust manifold to 23 N·m (204 in. lbs.) torque.

(3) Coat the threads of the oil pressure sending unit with thread sealant. Do not allow any of the thread sealant to get into the sending unit opening, or the opening at the engine. Install sending unit to engine and tighten to 14 N·m (130 in. lbs.) torque. Install electrical connector to sending unit.

(4) Clean the intake manifold and EGR valve of any old gasket material.

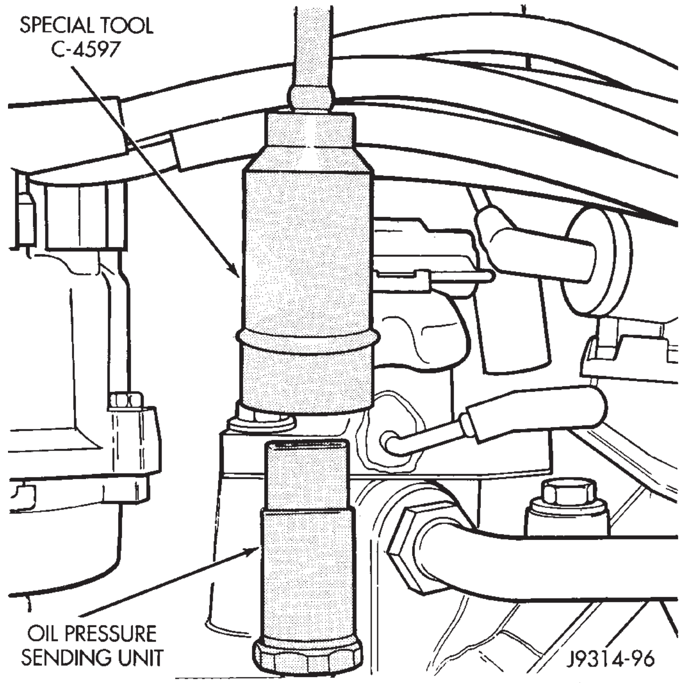


Fig. 4 Oil Pressure Sending Unit—Removal/ Installation—5.2 L Engine

(5) Install a new EGR valve gasket at intake manifold.

(6) Install EGR valve to intake manifold. Tighten 2 EGR bolts to 23 N·m (200 in. lbs.) torque.

(7) Position EGR valve control and install its electrical connector. Connect hoses between EGR valve and EGR valve control.

(8) Install spark plug cable loom and spark plug cables to valve cover mounting stud.

(9) Install heat shield at right exhaust manifold.

EGR VALVE CONTROL

The EGR valve, the EGR valve control (solenoid) and the connecting hoses are serviced as one unit on the 5.2L engine. Refer to EGR Valve Removal/Installation for procedures.

EVAP CANISTER

The EVAP canister is located in the left front corner of vehicle below the left front headlamp (Figs. 5 or 6).

REMOVAL

(1) Remove the grill. Refer to Group 23, Body.

(2) Remove the front bumper/fascia assembly. Refer to Group 23, Body.

(3) Disconnect vacuum lines at canister.

(4) Remove the three canister mounting nuts (Figs. 5 or 6).

(5) Lower the canister through bottom of vehicle.

INSTALLATION

(1) Position canister to body.

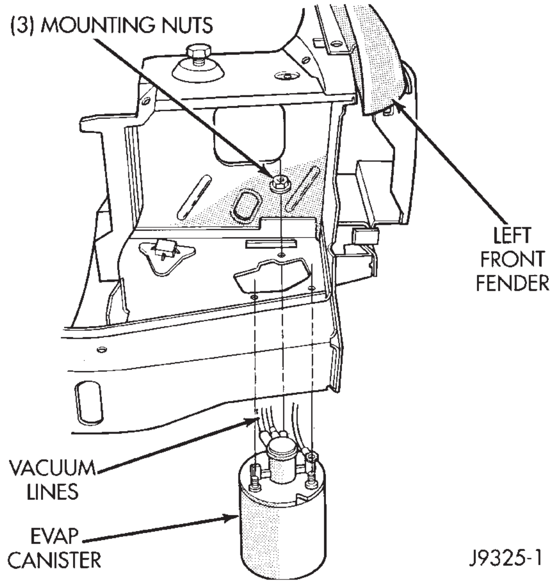


Fig. 5 Canister Location—Non-California

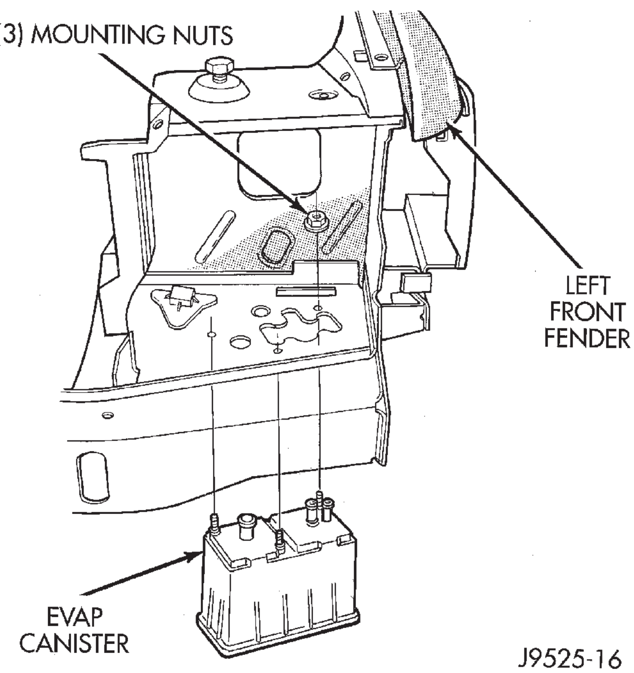


Fig. 6 Canister Location—California Emission Package—4.0L Only

(2) Install canister mounting nuts. Tighten nuts to 6 N·m (55 in. lbs.) torque.

(3) Connect vacuum lines.

(4) Install the front bumper/fascia assembly and grill. Refer to Group 23, Body.

EVAP CANISTER PURGE SOLENOID—DUTY CYCLE

4.0L ENGINE—CALIFORNIA EMISSION PACKAGE ONLY

The solenoid is located near the front of the windshield washer reservoir bottle (Fig. 7).

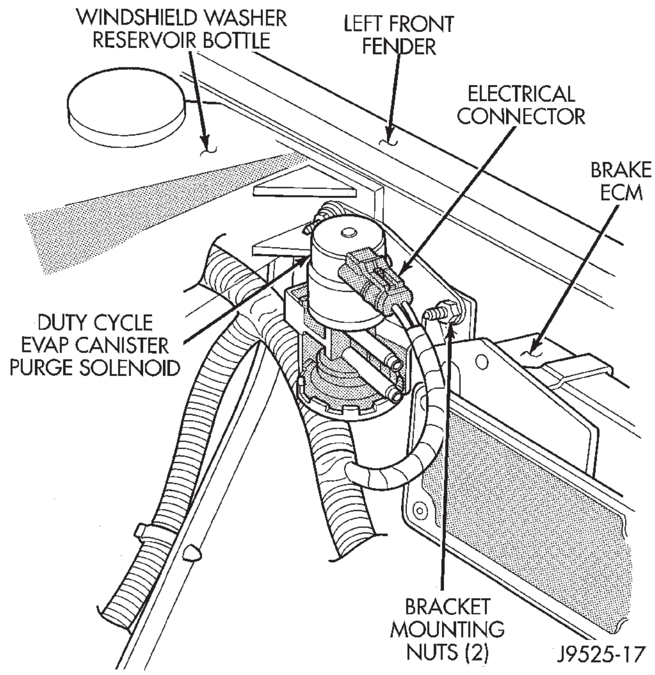


Fig. 7 Purge Solenoid—4.0L Engine—California Emission Package

REMOVAL

(1) Disconnect the electrical connector at the solenoid (Fig. 7).

(2) Disconnect the vacuum lines at the solenoid.

(3) Remove the two bracket mounting nuts and remove solenoid.

INSTALLATION

(1) Position the solenoid to vehicle.

(2) Install and tighten the two bracket mounting nuts.

(3) Connect the vacuum lines to the solenoid.

(4) Connect the electrical connector to the solenoid.

EVAP CANISTER PURGE SOLENOID

REMOVAL—5.2L ENGINE

(1) Remove air duct at throttle body.

(2) Disconnect wiring connector at solenoid (Fig. 8).

(3) Disconnect vacuum harness at solenoid (Fig. 8).

(4) Remove solenoid and its support bracket from intake manifold.

(5) Remove EVAP canister purge solenoid from engine.

INSTALLATION

(1) Install EVAP canister purge solenoid and its mounting bracket to intake manifold.

(2) Connect vacuum harness and wiring connector.

(3) Install air duct to throttle body.

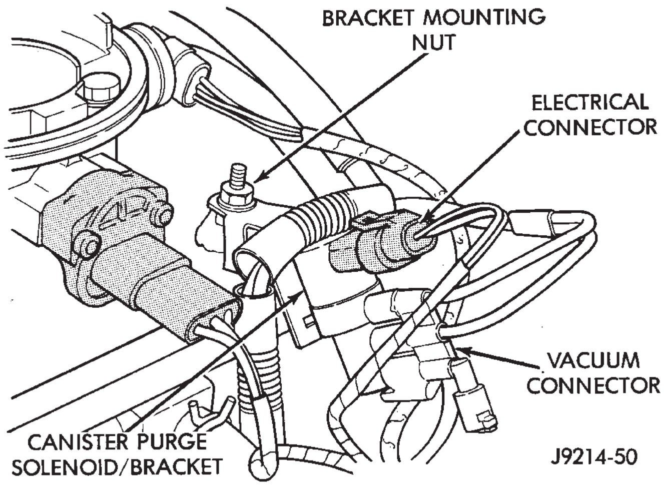


Fig. 8 EVAP Canister Purge Solenoid—5.2L Engine

FUEL TANK FILLER TUBE CAP

If replacement of the fuel tank filler tube cap (fuel tank cap) is necessary, it must be replaced with an identical cap to be sure of correct system operation.

OXYGEN (O2S) SENSOR

For description, operation, diagnosis and removal/installation procedures of the O2S sensor, refer to Group 14, Fuel Systems.

POWERTRAIN CONTROL MODULE (PCM)

For removal and installation procedures, refer to Group 14, Fuel Systems.

PRESSURE RELIEF/ROLLOVER VALVE

For removal and installation procedures, refer to the Fuel Tank section of Group 14, Fuel Systems.

Description	Group-Page

Description — Group-Page